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Ministry of Energy and Water Resources

N. O. P. 37 H

For Natural Gas Treatment Facilities From Natural Gas Discoveries

Environmental Impact Survey

Chapter 1 – Land Environment

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Abstract

Chapter 1 – Description of the environment to which the plan relates

The main purpose of NOP/37 H is to create a planning framework that will enable the gas companies to produce, transport and transmit natural gas to the existing and planned national transmission system from the sources that have been discovered and may be discovered in the future, in offshore wells opposite the Israeli coast.

The purpose of the present phase – Chapters 1 and 2 of the Environmental Impact Survey – is to examine five onshore alternatives for the receiving and treatment facilities:

1. Dor North
2. Ein Ayala
3. Hagit East
4. Hadera Wastewater Treatment Facility
5. Meretz Wastewater Treatment Facility

Additionally, three alternatives are being investigated regarding offshore sites for platforms that will be part of the natural gas treatment array in accordance with the guidelines of the Ministry of Environmental Protection from March 29, 2012, which were approved at a meeting of the National Board and are attached hereto as Appendix A. It should be noted that concomitant with the EIS document that looks at alternative locations from environmental perspectives, an additional document is being prepared that will be submitted in parallel, presenting the engineering, security and other aspects for examining the aforesaid alternatives.

The analysis for the impact of implementing the plan on the plan area and vicinity and its integration with the environment, addresses the following topics:

Land usage / zoning – A survey was conducted of the existing land usages in the area covered by the review of the proposed alternatives for gas treatment systems. Land zoning areas were reviewed vis-à-vis national and district outline plans, detailed plans that have been approved and submitted, and conceptual and plans that are being prepared.

Population concentrations – This section offers population projections in the area of the survey and surrounding the gas treatment facility alternatives. Population concentrations were presented as they are at present, projections for five years as estimated according to approved and submitted plans, and projections for ten years based on conceptual and plans that are being prepared.

Meteorology and air quality – This section presents the meteorological status of each of the treatment facility alternatives and how this status is likely in

influence the dispersion of pollutants emitted into the air. Data used to assess the meteorological status of each alternative were taken from meteorological stations that represent, as closely as possible, the present meteorological status.

In order to describe the current air quality for the various alternatives, data was analyzed and calculated from two sources:

- Air quality data from existing monitoring stations of the Sharon-Carmel Regional Association;
- Calculation of pollutant concentrations in the environment by running the AERMOD modeling system. Data on current emissions as obtained from the Environmental Protection Ministry were input into the model, along with future emissions from approved plans as will be specified below.

Data on contaminant concentrations received from monitoring stations and modeling calculations were compared to the environmental target values appearing in the Regulations for Air Quality Values – 2011, of the Ministry of Environmental Protection (Clean Air Regulations, Air Quality Values – Temporary Provisions, 5771-2011).

Air pollutants that were investigated according to the Environmental Protection Ministry's guidelines for the EIS:

- Sodium dioxide (SO2)
- Nitrogen oxides (NOX)
- Benzene

Appearance – This section presents the visual analysis of the proposed gas treatment facility alternatives. The analysis includes presentation of the visual basin, analyzes the visibility of the proposed plan from prominent points in the area where people can be found, such as residential areas, roadways, sites used for visiting and touring, and so on.

Seismology – This section of the Survey deals with the seismological risks to which the onshore gas facilities discussed in the proposed plan are liable to be exposed. This section brings a review of all the seismic risks and a detailed assessment of the feasibility and level of risk for each one based on existing knowledge for each of the onshore gas facilities, coastal entrance arrays, and along the pipeline that connects the coastal entrance array, the facilities and the national transmission system. This section also includes general geological background, and details of the seismotectonic model used to characterize the regional seismogenic sources and which was the basis for calculating peak ground acceleration (PGA) at the sites of the different alternatives. Also presented are the different seismic risks examined for each alternative, including the criteria used to make these assessments. The end of the section presents seismic risk data for each of the proposed arrays.

Hydrogeology and soil – In this section the survey presents a review of the relevant elements on the surface and below ground in the area of the treatment arrays, the purpose of which is to present the hydrological and hydrogeological conditions in the plan area in order to examine and assess the alternatives from these perspectives. Furthermore the survey refers to the guidelines and maps attached to the relevant national outline plans. The survey provides a basis for comparing the different alternative locations, assessing the impact of facility construction on the environment, and proposes guidelines for reducing possible damage to groundwater in later parts of the survey.

Hazardous materials – This section is based on agreements coordinated with the Ministry of Environmental Protection – Hazardous Materials Department on July 31, 2011, regarding how to assess risks and separation distances for natural gas according to the underlying assumptions presented in this section.

The separation distances report presented in this section will serve as a basis for examining the treatment arrays presented in Chapter 2 in terms of risks.

Nature, landscape and heritage treasures – This section presents the plan area in terms of the parameters specified below. The survey was prepared for the treatment facility site alternatives at a distance of up to one km from the exploration area, and about 150 m from the building line boundaries for the pipeline alignment to a distance of some 300 m west of the shoreline:

1. **Landscape units** – looking at the plan environment from landscape perspectives (which are specified as part of the visual analysis). Additionally, an ecological examination was conducted, which included analyzing the continuity of ecological corridors and habitats within the plan area and vicinity.
2. **Flora** – this section looks at plant growth in the survey area based on a review of habitats, a field survey, and a review of the literature. Furthermore, endangered and rare species found in the plan area and/or vicinity are also presented.
3. **Fauna** – animals are presented in the survey based on a field survey and review of the literature. The information presented includes a table that specifies animals that were observed or that are likely to be found in the plan area – data is based on the Red Book of Invertebrates, the Nature and Parks Authority and the Ministry of Environmental Protection edited.
4. **Heritage and historic sites** – heritage and historic sites in the vicinity of the alternatives were examined based on existing information the list of recognized antiquities sites given by the Antiquities Authorities updated as of 2011, and responses to the plan from the Antiquities Authority and the Council for the Preservation of Heritage Sites.

Oceanographic and meteorological conditions – This section features a survey of the sedimentological aspects that are relevant to the onshore environment, mainly in the area of the coastal entrance array. The remaining requirements of this chapter as outlined in the Survey Guidelines will be addressed as part of the EIS for the marine environment, which is currently being written.

Noise – In order to estimate the acoustic climate that characterizes the plan area in general, and the noise for potential noise recipients in particular, background noise measurements were made under current conditions.

Noise measurements under current conditions constitute a basis for comparison with noise levels as calculated for future conditions and for defining the extent of the change in noise in the wake of the plan under consideration. Noise under current conditions includes all of the existing fixed noise sources in the area of noise recipients and sensitive areas that are likely to be affected by the plan.

In order to characterize the noise levels for the Dor North, Emek Hefer – Meretz Wastewater Treatment Facility and Hagit East alternatives, two series of noise measurements were conducted – one during the day and the other at night.

Environmental noise measurements were conducted for periods of about 10 minutes at each site, for both daytime and nighttime noise measurements.

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Chapter A
Description of the Plan Environment

1. Chapter 1 – Description of the plan environment

1.1 General – status and main characteristics of the planning process

The main purpose of NOP 37/H is to create a planning infrastructure that will enable the gas companies to extract, transport and inject natural gas into the existing and planned national transmission system from sources that have been discovered and from future sources, insofar as may be found, in offshore wells off the coast of Israel.

The planning process for NOP 37/H comprises a number of stages. The preliminary planning stages are detailed below:

Stage A – a theoretical examination was made of nine possible technological alternatives, detailed in the Stage A document, based on engineering and technological feasibility. The document also presented a general and engineering background, a description of the gas treatment chain, a review of the nine main technological alternatives, and an analysis and initial evaluation of them in terms of the different aspects.

Stage B – identification of location options and selection of the preferred options, by means of presenting threshold conditions, formulating criteria for evaluation and ranking of the options, identifying and examining location options for the selected technological alternatives, and deciding on the selected options. On conclusion of this process, 12 onshore alternatives were chosen for the location of the onshore treatment facility, and three offshore location alternatives for examining the location of the offshore treatment platform.

Stage C – in accordance with the decision of the National Board of May 1, 2012, Stage C consists of two phases:

1. Planning-environmental document – examined 12 alternate onshore locations. On completion of this stage, five location alternatives were chosen for further examination in environmental impact surveys:
    a. Dor North
    b. Ein Ayala
    c. Hagit East
    d. Hadera Wastewater Treatment Facility
    e. Meretz Wastewater Treatment Facility
2. Sections A-B in the environmental impact survey – in the present stage – Sections A-B of the survey – five onshore location alternatives and three offshore location alternatives were examined for the gas treatment system, in accordance with the guidelines of the Ministry of Environmental Protection from March 29, 2012, approved at the National Board meeting

and attached as Appendix A. It should be noted that in parallel to the environmental impact survey document that examines the location options mainly in terms of environmental criteria, another document was drawn up and will be presented at the same time, relating to engineering, security, and other aspects for examining the above options.

Components of the treatment array – components of the gas treatment array and its requirements are detailed at length in the previous stages of the work and in Chapter 2 below. The gas treatment array has been divided into the offshore zone and the onshore zone, according to the location of the system components. **This document examines the technological alternatives for full onshore treatment, in order to determine the maximum impact of the treatment facility on the onshore environment in each of the alternatives.** For details and an explanation of the offshore and onshore environmental arrays, see Section 2.1 in Chapter 2.

Figure 1 below shows the location alternatives for the gas treatment array examined in this document, against the background of a general orientation map.

Section A of the survey presents the existing situation at the alternative sites for the treatment array, and presents the information in the onshore zone according to the order of the array:

- Alternatives for the landfall crossing array
- Alternatives for the pipeline corridor to the onshore treatment facility
- The exploration zone alternative
- Alternatives for the corridor from the onshore facility to the transmission system

Section B examines the alternatives on the basis of the information presented in the previous section, and ranks them according to order of preference by the criteria examined.

A document is currently being drawn up that examines the impact of a full offshore natural gas treatment facility (hereinafter: the "Marine Survey"). The Marine Survey will examine the marine section of the offshore treatment array and will present the existing information for the selected offshore alternatives. This document will be submitted following submission of the present document.

**Note: due to the complexity of the options matrix and the desire to limit repetitive text in the description of the pipeline route options, which overlap between a number of alternative treatment sites, there are references in the body of the text to sections with identical descriptions and examination of the alternative.*

Figure 1.1.1 Gas treatment array alternatives

1.2 Background maps

The description of the surrounding area of the alternatives focuses on the areas of the treatment array alternatives, their immediate surroundings, and more distant areas that could be affected by implementation of the plan. These data represent a basis for assessing the environmental impacts of implementation of the alternatives detailed in this document.

1.2.1 Treatment facility, onshore block valve, and other onshore infrastructures

1.2.1.1 Topographical map 1:10,000

Attached is Figure 1.1.1.1 – topographical maps including settlements, buildings and facilities, existing gas, electricity and fuel lines in the area.

For the Dor array – Folio 1

Hadera – Neurim array – Folios 2 and 3

1.2.1.2 Maps on a scale of 1:2500

Maps on a scale of 1:2500 are in preparation, and will be submitted later as a supplement to the survey.

1.2.1.3 Aerial photographs on a scale of 1:5000

Attached is Figure 1.1.1.3 – updated aerial photograph as of 2010.

The facility pipeline and overall array are presented on the scale of 1:25,000 – Folio 1

Treatment facility alternatives are presented on a scale of 1:5000

Dor array alternatives – Folio 2

Hadera – Neurim array alternatives – Folio3

1.2.2 Offshore infrastructures*

Maps for this section will be presented in the framework of the Marine Survey, currently in preparation.

Figure 1.1.1.1: Topographic map on a scale of 1:25,000

Figure 1.1.1.3: Aerial photograph on a scale of 1:5000

1.3 Existing land uses and planned land zoning

1.3.1 Land zoning / uses

In this section, we will review the planned land zoning and existing uses along the transmission array and onshore treatment. The survey area is as follows:

- Area of the landfall crossing array
- 150 m beyond the building lines of the pipeline area
- 1 km around the treatment facility

A. Land zoning that has been approved or is in preparation is presented in Section 1.2.2 below.

B. Land uses were surveyed according to updated aerial photographs, the data layer of the Survey of Israel's national GIS, data layers of National Outline Plans, the National Parks and Nature Authority, information given by the authorities, and tours of the area.

Diagrams of land uses on aerial photographs on a scale of 1:10,000 are presented in Figures 1.2.1–1/2 below.

Figure 1.2.1-1 – Dor array

Figure 1.2.1-2 – Hadera – Neurim array

Land uses in the survey below are described in tables according to the selected alternative, and in each table according to the component in the alternative.

1.3.1.1 Dor North

Existing land uses

Below are details of the land uses in the area of the proposed plan, see Figure 1.2.1-1 below.

Table 1.3.1.1: Existing land uses for the Dor North alternative

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Landfall crossing array			
Dor	Bathing beach	An undeclared and unregulated bathing beach	In the area of the landfall crossing array
	Fishponds	Fishponds belonging to Moshav Dor	In the area of the landfall crossing array
	Paths and hiking trails	Israel Bicycle Trail – planned	In the eastern part of the area of the landfall crossing array
Gas pipeline to the treatment facility			
From Dor Beach	Agriculture	Cultivated fields and fishponds	In the alignment area and the survey area to the west of the landfall crossing array, and east of Road 2
	Roads and railway lines	1. Haifa-Tel Aviv railway line 2. Road 2 3. Dirt tracks and agricultural paths in the agricultural areas	4. In the alignment area and the survey area, between Zichron Junction and Dor 6. In the alignment area and the survey area, between Zichron Junction and Dor 2. In the alignment area and the survey area
	Nature reserves and national parks	Nature reserve – Kurkari Hof HaCarmel	In the alignment area and the survey area in the region of Maayan Zvi Reservoir
	Wastewater treatment facility and reservoir	Maayan Zvi wastewater treatment facility and reservoir	In the survey area
	Infrastructures	Gas – Dor-Hagit INGL line	Close to the proposed route from the area of Maayan Zvi wastewater treatment facility up to the exploration area
Treatment facility			
Dor North	Residential	Residential homes in Moshav Dor	Approx. 800 m to the west
	Nature reserves and national parks	1. Nature reserve – Kurkari Hof HaCarmel	1. Approx. 600 m to the west 2. Approx. 500 m to the north-west

Alternative	Use	Description	Location and minimum distance from the plan boundaries
		2. Nature reserve – Horvat Drachmon	
	Roads and railways	1. Road 7011 2. Road 2 3. Dirt roads and agricultural paths 4. Railway line	4. Tangential to the exploration area to the north 6. Approx. 600 m to the west 2. Within the exploration area and the survey area 1. Approx. 700 m to the west of the exploration area
	Paths and hiking trails	Regional bicycle path	Approx. 750 m to the north-west
	Agriculture	Cultivated areas, fishponds and greenhouses	In the area of the exploration area and its surroundings in the survey area
	Infrastructures	1. Electricity – voltage/high-voltage lines 2. Gas – INGL line from the Dor Beach area to Hagit power station	1. Tangential to the exploration area to the north / approx. 900 m to the east 2. Tangential to the western border of the exploration area
	Wastewater treatment facility	Wastewater treatment facility	Approx. 800 m to the south-west
	Irrigation reservoir	Treated effluent and flood catchment reservoirs	Next to the exploration area to the south
	Cemetery	Dor Cemetery	Approx. 400 m to the north-west
	Research institute	Dor Fish Farming Research Station	Approx. 400 m west of the exploration area
Pipeline from the treatment facility			
The flow of gas eastward and to the Hagit power station will pass along the route of the existing Dor – Hagit gas pipeline and does not require an additional pipeline route to be identified			

1.3.1.2 Ein Ayala

Existing land uses

Below are details of the land uses in the area of the proposed plan, see Figure 1.2.1-1 below.

Table 1.3.1.2: Existing land uses for the Ein Ayala alternative

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Landfall crossing array			
Dor	The uses in the landfall crossing array at Dor are detailed in Table 1.2.1.1 above		
Gas pipeline to the treatment facility			
From Dor Beach	Agriculture	Cultivated fields, greenhouses and fishponds	In the alignment area and the survey area, in the western, central and eastern part of the route
	Roads and railway lines	1. Haifa-Tel Aviv railway line 2. Road 2 3. Road 7011 4. Road 4 5. Dirt tracks and agricultural paths in the agricultural areas	4. In the alignment area and the survey area, between Zichron Yaacov Junction and Dor 6. In the alignment area and the survey area, between Zichron Yaacov Junction and Dor 2. Tangential and parallel to the route 1. Tangential and parallel to the route north of Fureidis 1. In the alignment area and the survey area
	Nature reserves and national parks	Nature reserve – Kurkari Hof HaCarmel	In the alignment area and the survey area in the region of Maayan Zvi Reservoir
	Wastewater treatment facility and reservoir	Maayan Zvi wastewater treatment facility and reservoir	In the survey area
	Infrastructures	1. Gas – Dor-Hagit INGL line 2. Voltage line – 161 kW	1. Close to the proposed route from the area of Maayan Zvi wastewater treatment facility up to the exploration area 2. In the alignment area and the survey area to the west of Fureidis
	Forest	Mixed natural woodland and oaks	In the survey area in the eastern part of the route
Treatment facility			

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Ein Ayala	Residential and public institutions	1. Fureidis – residential, Fureidis comprehensive school 2. Ein Ayala	1. Approx. 900 m to the south 2. Approx. 900 m to the north-west
	Mining and quarrying sites	1. Ein Ayala quarry 2. Shefaya C quarry	1. Overlaps the exploration area 2. Approx. 800 n to the south-west
	Roads and railways	1. Road 4 2. Dirt roads and agricultural paths	1. Approx. 150 m to the west 2. In the exploration area and survey area
	Agriculture	Cultivated areas and greenhouses	Next to the alternative to the south and west of Road 4
	Infrastructures	1. Electricity – voltage lines 2. Gas and fuel pipeline strips	1. In the area of the alternative and approx. 500 m to the west 2. To the west and north of the exploration area, at a minimum distance of 70 m
	Wild waste site	Unregulated garbage tip	Approx. 750 m to the south
	Woodland and fallow area	Areas of scrub, garigue and natural woodland on the Carmel slope	Tangential to the exploration area and spreading east – the Carmel hillsides
Pipeline from the treatment facility			
The flow of gas eastward and to the Hagit power station will pass along the route of the existing Dor – Hagit gas pipeline and does not require an additional pipeline route to be identified			

1.3.1.3 Hagit East

Existing land uses

Below are details of the land uses in the area of the proposed plan, see Figure 1.2.1-1 below.

Table 1.3.1.3: Existing land uses for the Hagit East alternative

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Landfall crossing array			
Dor	The uses in the landfall crossing array at Dor Beach are detailed in Table 1.2.1.1 above		
Gas pipeline to the treatment facility (in addition to the uses detailed in Table 1.2.1.2 above)			
Northern alternative	Forest	Natural and planted woodland	In the review area and the survey area, mainly from Ein Ayala to Bat Shlomo
	Agricultural land	1. Cultivated fields, orchards and field crops 2. Agricultural buildings at Ofer	1. From the western part of the alignment to the area of Hagit power station 2. In the review area, in the southern part of Moshav Ofer
	Roads and railway lines	1. The Israel National Trail 2. Bicycle paths – part of the Carmel trails 3. Bicycle path – Hagit single	1. In the alignment area and the survey area to the west of Ofer 2. In the alignment area and the survey area. From Ofer the bicycle has overlaps the pipeline route eastward to the area of Bat Shlomo, and from there branches out to the south and north 3. In the eastern part of the alignment
	Military area	Firing range	In the area of the alternative and the survey area in the eastern part of the alignment
	Infrastructures	1. Gas – Dor-Hagit INGL line 2. Voltage lines – 161 / 400 kW	1. Close to the proposed route from the area of Maayan Zvi wastewater treatment facility up to the exploration area at Hagit 2. The route crosses 161 kW voltage lines to the west of Fureidis and north of Bat Shlomo. The route crosses a 400 kW line in its eastern section close to Hagit power station

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Garigue woodland and fallow and grazing areas	Areas of scrub, garigue and natural woodland in the central and eastern section of the alignment	The alignment area and the survey area
	Roads	Dirt roads and agricultural paths	In the survey area
The southern alternative	Forest	Natural and planted woodland	In the review area and the survey area, mainly from Ein Ayala to Bat Shlomo
	Quarry	Shefaya C quarry and mining area	In the review area
	Agricultural	Cultivated fields, orchards, vineyards and field crops	From the western part of the alignment to the area of Hagit power station
	Roads and railway lines	1. The Israel National Trail 2. Israel Bicycle Trail (planned)	1. In the alignment area and the survey area near Shefaya C 2. In the alignment area and the survey area. North of Bat Shlomo close to the pipeline route for approx. 2 km to the north-east
	Dry waste disposal site	Shefaya B dry waste disposal site, including offices and parking areas, and disposal of waste	In the review area
	Infrastructures	1. Gas – Dor-Hagit INGL line 2. Voltage lines – 161 / 400 kW	1. Close to the proposed route from the northern area to Bat Shlomo and up to Hagit power station 2. To the east of Ein Ayala quarry, the route crosses to 161 kW voltage lines. An area of two voltage lines, 161 and 400 kW, is crossed twice by the pipeline route from the south-west and north of Bat Shlomo
	Military area	Firing range	In the area of the alternative and the survey area in the eastern part of the alignment
	Garigue woodland and fallow and grazing areas	Areas of scrub, garigue and natural woodland in the central and eastern section of the alignment	The alignment area and the survey area
	Roads	Dirt roads and agricultural paths	In the alignment area and the survey area along the entire alignment
Treatment facility			

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Hagit East	Military areas and facilities belonging to the security system	1. Elyakim army base 2. Firing area	1. Approx. 700 m to the east 2. Approx. 600 m to the north-west
	Nature reserves and national parks and rivers	1. Nachal Tut nature reserve 2. Nachal Maharal nature reserve	1. Approx. 100 m to the south 2. Approx. 900 m to the north
	Roads	1. Roads 6/70 and interchange (Ein Tut interchange) 2. Dirt roads and agricultural paths	1. Approx. 250 m to the south-east 2. In the exploration area and the survey area
	Paths and hiking trails	Bicycle path – Hagit single	In the exploration area and the survey area
	Agricultural land	Agricultural buildings and cultivated land	On the western side of the exploration area
	Infrastructure facilities	1. Hagit power station 2. Switching station 3. High voltage lines and ultrahigh voltage line 4. Gas and fuel pipeline strip	1. Tangential to the exploration area to the west 2. Tangential to the exploration area to the west 3. In the exploration area and the survey area from north-west and north-east 4. Approx. 450 m to the north-west
	Woodland and fallow and grazing areas	Areas of scrub, garigue and natural woodland on the slopes of the Carmel	In and around the area of the alternative
	Planting	KKL-JNF planting area	Approx. 200 m to the north and west of the exploration area
Pipeline from the treatment facility			
The gas pipeline reaches the Hagit power station and the eastern transmission system, and does not require an additional pipeline to be laid.			

1.3.1.4 Hadera Wastewater Treatment Facility

Existing land uses

Below are details of the land uses in the area of the proposed plan, see Figure 1.2.1-2 below.

Table 1.3.1.4: Existing land uses for the Hadera Wastewater Treatment Facility alternative

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Landfall crossing array			
Nachal Hadera	Bathing beach	Undeclared and unorganized bathing beach	In the area of the landfall crossing array
	Paths and hiking trails	The Israel Trail	In the area of the landfall crossing array
	Infrastructure facilities	Orot Rabin power station and desalination plant	Adjacent to and north of the landfall crossing array
	Vegetation and fallow areas	Fallow field, area of coastal vegetation	In the area of the landfall crossing array
	Roads	Dirt roads and access path to Nachal Hadera park	In the area of the landfall crossing array
	Public park	Nachal Hadera park	Adjacent to and north of the landfall crossing array
	Infrastructures	Gas – natural gas pipeline to American Paper Mills	In the offshore area of the landfall crossing array
Michmoret	Bathing beach	Beach facilities and undeclared bathing beach	In the area of the landfall crossing array
	Paths and hiking trails	The Israel Trail	In the area of the landfall crossing array
	Vegetation and fallow areas	Fallow field, area of coastal vegetation	In the area of the landfall crossing array
	Roads	Dirt roads to the beach and reserve area	In the area of the landfall crossing array
	Nature reserves, national parks and streams	National park and nature reserves, fenced beach and sea	In the offshore and beach area of the landfall crossing array
	Residential	Residence in the Kfar Hamayim neighborhood of Michmoret	Adjacent to and south of the landfall crossing array. One single building in the survey area
Nachal Alexander	Bathing beach	Undeclared and unregulated bathing beach	In the area of the landfall crossing array
	Nature reserves and national parks and streams	Nachal Alexander National Park, natural areas, a number of abandoned buildings	In the offshore and beach area of the landfall crossing array

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	vegetation and fallow areas	Fallow field, area of coastal vegetation	In the area of the landfall crossing array
	Roads	Peripheral road belonging to the naval academy, dirt roads to the beach area and the national park	In the area of the landfall crossing array
	Infrastructures	Sewage pumping station	In the northern part of the landfall crossing array
Gas pipeline to the treatment facility			
From Nachal Hadera	Roads	1. Road 2 2. Road 4 3. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route, in the alignment area and the survey area 2. Crossed by the pipeline route, in the alignment area and the survey area 3. Access road and parking for Nachal Hadera Park, dirt roads and agricultural paths along the entire length of the alignment
	Residential and public institutions	1. Around 10 residences in the north of the Heftziba neighborhood of Hadera 2. Synagogue	1. In the review area 2. In Givat Olga in the review area
	Heritage sites	A number of buildings and parking lot in the Israel Electric Co. heritage site and training center, Heftziba Farm	In the review area
	Paths and hiking trails	Israel Bicycle Trail (planned)	In the alignment area and the survey area near Nachal Hadera
	Agricultural land	Cultivated land with field crops and fishponds	To the east of Road 2, along the alignment and survey area
	Vegetation and fallow areas	Fallow sandy fields with typical vegetation, woodland and uncultivated plots	Along the alignment and in the survey area
	Infrastructures	Gas – natural gas pipeline to American Paper Mills and PEI line	In the alignment area and the survey area near Nachal Hadera
	Industrial area	2 – 4 buildings in the northern part of Hadera industrial area	In the review area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Streams	Nachal Hadera	The alignment crosses Nachal Hadera and passes along it east of Road 4
Michmoret	Roads and railways	1. Road 2 2. Road 4 3. Dirt roads and agricultural paths 4. Railway line	1. Crossed 3 times by the pipeline route and parallel to it in the Michmoret – Hadera area, in the alignment area and survey area. 2. Crossed by the pipeline route, in the alignment area and survey area 3. Dirt roads and agricultural paths all along the alignment 4. Tel Aviv-Haifa railway line close to the review area to the east near Hadera Forest
	Kiosk	AWIS kiosk	North of Olga intersection in the survey area
	Residential and public institutions	1. Around 10 residences in the north of the Heftziba neighborhood of Hadera 2. 4 – 6 residences in the eastern part of Givat Olga 3. 2 – 4 buildings and parking lot in Hillel Yaffe Hospital 4. Synagogue	1. In the review area 2. In the review area 3. In the review area 4. In Givat Olga in the review area
	Heritage sites	A number of buildings and parking at the Heftziba Farm heritage site in Hadera	In the review area
	Paths and hiking trails	1. Israel Bicycle Trail (planned) 2. Israel Trail	1. In the exploration area and survey area, near Nachal Hadera 2. In the alignment area and survey area near Givat Olga
	Agricultural land	Cultivated areas of field crops and fishponds	To the east of Road 2, mainly in the area of Nachal Hadera
	Vegetation and fallow and grazing areas	Fallow sandy and other fields with typical vegetation, and cultivated plots	Along the alignment and in the survey area
	Waste disposal site	Abandoned quarry, waste disposal site and high groundwater lake	In the alignment area and the review area to the west of Hadera Forest

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Infrastructures	1. Gas – natural gas pipeline to American Paper Mills 2. PEI line	1. In the alignment area and survey area near Nachal Hadera 2. In the alignment area and survey area near Olga intersection and Nachal Hadera
	Industrial area	2 – 4 buildings in the northern part of Hadera industrial area	In the review area
	Sports/recreation	Givat Olga football field and neighborhood pitch in Givat Olga	In the review area
	Forest	Western forest areas in Hadera Forest	In the review area
	Filling station complex	Filling station and food complex	In the review area close to Olga intersection
	Infrastructure facilities	Cellular antennas	To the north of Olga intersection in the alignment area and survey area
	Nature reserves and national parks	Hof Gador National Park	In the review area
	Streams	Nachal Hadera	The route crosses Nachal Hadera and passes along its length east of Road 4
From Nachal Alexander	Roads and railways	1. Road 2 2. Road 4 3. Railway line, Haifa-Tel Aviv 4. Dirt roads and agricultural paths	1. Crossed 3 times by the pipeline route and parallel to it in the Michmoret – Hadera area, in the alignment area and survey area. 2. Crossed by the pipeline route, in the alignment area and survey area 3. In the alignment area and the survey area. The route crosses the railway line and continues along it near Emek Hefer industrial area 4. Dirt roads and agricultural paths all along the alignment
	Residential and public institutions	1. Around 10 residences in the north of the Heftziba neighborhood of Hadera 2. 4 – 6 residences in the eastern part of Givat Olga 3. 2 – 4 buildings and parking lot in Hillel Yaffe Hospital	1. In the review area 2. In the review area 3. In the review area 4. In the review area, Givat Olga

Alternative	Use	Description	Location and minimum distance from the plan boundaries
		4. Synagogue	
	Heritage sites	A number of buildings and parking at the Heftziba Farm heritage site in Hadera	In the review area
	Kiosk	AWIS kiosk	North of Olga intersection in the survey area
	Paths and hiking trails	1. Israel Bicycle Trail (planned) 2. Regional bicycle paths along Nachal Alexander 3. Israel Trail	1. In the alignment area and survey area, near Nachal Hadera 2. In the review area 3. In the alignment area and survey area near Nachal Alexander Park and Givat Olga
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards, and fishponds	To the east of Road 2, in the area of Emek Hefer industrial area and Nachal Hadera
	Vegetation and meadows	Sandy and other fallow fields with typical vegetation, uncultivated plots	Along the route and in the survey area
	Abandoned quarry, waste disposal site and high groundwater lake	In the alignment area and review area to the west of Hadera Forest	Waste disposal site
	Infrastructures	1. Gas – natural gas pipeline to American Paper Mills 2. PEI line	1. In the alignment area and survey area near Nachal Hadera 2. In the alignment area and survey area near Olga intersection and Nachal Hadera
	Industrial area	2 – 4 buildings in the northern part of Hadera industrial area	In the review area
	Sports/recreation	Givat Olga football field and neighborhood pitch in Givat Olga	In the review area
	Forest	Western forest areas in Hadera Forest	In the review area
	Filling station complex	Filling station and food complex	In the review area close to Olga intersection
	Infrastructure facilities	Cellular antennas	To the north of Olga intersection in the alignment area and survey area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Nature reserves and national parks	Sharon Park	In the alignment area and review area
	Fallow field	Fallow field including paths and waste disposal	To the west of Emek Hefer industrial area, in the review area
	Agricultural farm	Seakura aquaculture farm	In the survey area
	Streams	Nachal Hadera and Nachal Alexander	The route crosses Nachal Hadera and passes along it east of Road 4, and crosses Nachal Alexander in its western section
The treatment facility			
Hadera Wastewater Treatment Facility	Residential and public institutions	1. Residential, mixed 1-, 2- and 3-stories 2. Kindergartens in residential neighborhoods 3. Synagogues in residential neighborhoods 4. Family Health Center in the western residential neighborhood	1. 700 m to the west and 800 m to the south of the exploration area 2. 700 m to the west and 900 m to the south 3. 900 m to the south 4. 900 m to the west
	Public institutions and function halls in the industrial area	Center for Professional Diagnosis and Rehabilitation, Sharon Carmel Towns Association for Environmental Quality and Pisga Center, function halls in the southern part of the industrial area	600 m to the west
	Commercial areas	1. Home Center commercial area in the industrial area 2. Mega Bul and car sales complex	1. 450 m to the south-west 2. 900 m to the west
	Industrial areas and factories	Hadera industrial area, including factories, workshops, filling stations and industrial areas, and also commercial uses, function halls and institutions detailed above	50 m to the west and south-west of the exploration area
	Streams	Nachal Hadera	Next to the alternative to the west
	Roads and railway lines	1. Road 4 2. Road 65	1. 100 m to the north 2. 700 m to the north-west

Alternative	Use	Description	Location and minimum distance from the plan boundaries
		3. Dirt roads and agricultural paths 4. Railway line	3. In the exploration area and survey area 4. 400 m to the east
	Paths and hiking trails	Israel Bicycle Trail (planned)	In the exploration area and in the survey area
	Agricultural land, fishponds and cultivated areas	Agricultural buildings and cultivated fields	In the exploration area and in the survey area
	Infrastructure facilities	1. Gas: - Hadera block valve station – PRMS facility - Gas pipeline 2. 161 kW voltage lines 3. Fuel – transmission pipe and PEI facility	1. Gas: - In the exploration area - Close to the exploration area to the west 2. In the exploration area and survey area 3. 600 m to the west
	Wastewater treatment facilities	Hadera wastewater treatment facility	Next to the exploration area to the south east
	Filling station complex	Filling station, restaurant and garage complex	400 m to the north
	Staging area	Staging area and earth heaps	Next to the exploration area to the south
	Fallow areas	Sandy area with moderate and leafy vegetation	150 m to the north
Pipeline from the treatment facility			
Northern alternative	Agricultural land	Henhouses, packing houses, agricultural buildings, cultivated field crop areas, orchards, and fishponds	Along the route in the alignment area and survey area
	Roads	1. Road 65 2. Hadera access road from Hadera East Junction 3. Road 650 4. Road 6403 5. Road 574 6. Road 581 7. Dirt roads and agricultural paths	1. In the alignment area and survey area. Crossed twice in the area of Hadera East Junction and north to Talmei Elazar, and accompanies the route of the road 2. In the alignment area and the survey area. Crossed by the route in the area of the junction 3. Crossed by the pipeline route, in the alignment area and the survey area 4. In the alignment area and survey area. The route crosses the road

Alternative	Use	Description	Location and minimum distance from the plan boundaries
			and continues along its length in the area of Ein Shemer 5. In the alignment area and survey area. The pipeline route crosses the road and continues along its length from Nirbata junction to Metzer 6. In the review area near Kalaniot junction 7. Dirt roads and agricultural paths all along the route
	Junkyard	To the north of Road 65	In the alignment area and survey area close to Talmei Elazar
	Public institutions	Sha'ar Menashe Mental Health Institute. 3 – 5 buildings and employee accommodation complex	In the review area
	Complex at Nirbata junction	A commercial complex	In the review area
	National parks and nature reserves	Kalaniot nature reserve	In the review area
	Abandoned quarry, waste disposal site and high groundwater lake	In the alignment area and review area to the west of Hadera Forest	Waste disposal site
	Streams	Nachal Hadera	The route is close to the stream mainly in the review area
Southern alternative	Agricultural land	Greenhouses, agricultural buildings, cultivated land, and fishponds	Along to the route in the alignment area and the survey area
	Waste disposal site	Abandoned quarry, waste disposal site and high groundwater lake	In the alignment area and the review area to the west of Hadera Forest
	Roads	1. Road 65 2. Hadera access road from Hadera East junction 3. Road 6 4. Road 581 5. Dirt roads and agricultural paths	1. In the survey area. In the area of Hadera East junction 2. In the alignment area and survey area. Crossed by the route in the area of the junction 3. In the eastern part of the route in the review area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
			4. In the alignment area and survey area. Crossed by the pipeline route north west of Maor 5. Dirt roads and agricultural paths all along the route
	Industrial areas and factories	Granot industrial area	In the alignment area and survey area
	Paths and hiking trails	Israel Trail in the area of Beit Zeta swamp	In the alignment area and survey area
	Residential	Approx. 40 houses in the northern section of Maor	In the review area
	Streams	Nachal Hadera	The route accompanies the stream in the alignment area and review area
	Filling station	Filling station near Metzer junction	In the review area

1.3.1.5 Meretz Wastewater Treatment Facility

Existing land uses

Below are details of the land uses in the area of the proposed plan, see Figure 1.2.1-2 below.

Table 1.3.1.5.1: Existing land uses for the Meretz Wastewater Treatment Facility alternative

Alternative	Use	Description	Location and minimum distance from the plan boundaries
Landfall crossing array			
The uses in the landfall crossing array at Nachal Hadera, Michmoret and Nachal Alexander are detailed in table 1.2.1.4 above			
Neurim	Training area	Israel Police training area	In the area of the landfall crossing array
	Public institutions	Neurim Youth Village complex	Outside the area of the landfall crossing array and adjacent to it to the north
	Police facility	Police facility	Outside the area of the landfall crossing array and adjacent to it to the south
	Paths and hiking trails	Israel Trail	In the area of the landfall crossing array
	Bathing beach	The bathing beach is not organized or declared	In the area of the landfall crossing array
Gas pipeline to the treatment facility			
From Nachal Hadera northern alternative	Roads	1. Road 2 2. Road 4 3. Road 581 4. Railway line, Tel Aviv – Haifa 5. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route between Hadera and Michmoret, in the alignment area and survey area 2. In the alignment area and survey area, crossed to the north of Emek Hefer industrial area 3. In the alignment area and survey area, crossed to the north of Maabarot wastewater treatment facility 4. In the alignment area and survey area. The pipeline route crosses the track to the south of Hadera 5. Access road and parking for Nachal Hadera Park, dirt roads and agricultural paths all along the alignment
	Residences and public institutions	1. 4-6 residences in the eastern part of Givat Olga	1. In the review area 2. In the review area 3. In the review area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
		2. 2-4 buildings and parking in the area of Hillel Yaffe hospital 3. 6 – 8 houses in the south of Kfar Brandeis neighborhood of Hadera + isolated building to the south 4. Synagogue	4. In Givat Olga, in the review area
	Paths and hiking trails	Israel Trail	In the alignment area and the survey area near Givat Olga
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area, mainly near Emek Hefer
	Kiosk	AWIS kiosk	To the north of Olga junction in the survey area
	Vegetation and fallow land	Fallow sandy fields with characteristic vegetation, uncultivated plots	Along the route and in the survey area, mainly in the northern-central section of the alignment
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the north of Ichilov 2. In the alignment area and survey area near Olga junction
	Sport / recreation	Givat Olga football field and neighborhood pitch in Givat Olga	In the review area
	Forest	Western forest areas of Hadera Forest	In the review area
	Filling station complex	Filling station and food complex	In the review area close to Olga junction and in the alignment and survey area to the south of Hadera in the northern route to Hadera Forest pool
	Infrastructure facilities	Cellular antennas	To the north of Olga junction in the alignment area and survey area
	Spare parts building and lot	Car parts lot	In the alignment area and survey area
	National parks and nature reserves	Sharon Park	In the survey area in the southern route to Hadera Forest pool

Alternative	Use	Description	Location and minimum distance from the plan boundaries
From Nachal Alexander southern alternative	Roads and railways	1. Road 2 2. Road 4 3. Road 5720 4. Railway line, Tel Aviv – Haifa 5. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route between Hadera and Michmoret, in the alignment area and survey area 2. In the alignment area and survey area, crossed near Hefer junction 3. In the survey area near Hefer junction 4. In the alignment area and survey area. The alignment crosses the track and continues along it by Emek Hefer industrial area 5. Access road and parking for Nachal Hadera Park, dirt roads and agricultural paths all along the alignment
	Residences and public institutions	1. 4-6 residences in the eastern part of Givat Olga 2. 2-4 buildings and parking in the area of Hillel Yaffe hospital 3. Synagogue	1. In the review area 2. In the review area 3. In Givat Olga, in the review area
	Paths and hiking trails	1. Israel Trail 2. Red trail 7149 3. Regional bicycle trails around Nachal Alexander	1. In the alignment area and the survey area near Givat Olga and Sharon Park 2. In the review area along Nachal Alexander 3. In the alignment area and the survey area
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area, mainly near Emek Hefer
	Vegetation and fallow land	Fallow sandy fields with characteristic vegetation, uncultivated plots	Along the route and in the survey area, mainly in the northern-central section of the alignment
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the south of Hogla 2. In the alignment area and survey area near Olga junction and to the west of Emek Hefer industrial area
	Kiosk	AWIS kiosk	To the north of Olga junction in the survey area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Sport / recreation	Givat Olga football field and neighborhood pitch in Givat Olga	In the review area
	Forest	Western forest areas of Hadera Forest	In the review area
	Filling station complex	Filling station and food complex	In the review area close to Olga junction
	Infrastructure facilities	Cellular antennas	To the north of Olga junction in the alignment area and survey area
	National parks and nature reserves	Sharon Park	In the survey area in the eastern part of the park
	Fallow field	Fallow field, including roads and waste disposal	To the west of Emek Hefer industrial area, in the review area
from Michmoret northern alternative	Roads	1. Road 2 2. Road 4 3. Road 581 4. Railway line, Tel Aviv – Haifa 5. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route to the north of Michmoret, in the alignment area and survey area 2. In the alignment area and survey area, crossed to the north of Emek Hefer industrial area 3. In the alignment area and survey area, crossed to the north of Maabarot wastewater treatment facility 4. In the alignment area and survey area. The pipeline route crosses the track to the south of Hadera 5. Dirt roads and agricultural paths all along the alignment
	Residences and public institutions	6 – 8 houses in the south of Kfar Brandeis neighborhood of Hadera + isolated building to the south	In the review area
	Paths and hiking trails	The Israel Trail	In the alignment area and survey area to the south of Hadera Forest
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area along the route
	Vegetation and fallow land	Fallow sandy fields with characteristic vegetation, uncultivated plots	Along the route and in the survey area, mainly in the western section of the alignment

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the north of Elyakhin 2. In the alignment area and survey area to the south of Hadera Forest
	Forest	Western forest areas of Hadera Forest	In the review area
	Filling station complex	Filling station and food complex	In the alignment and survey area to the south of Hadera in the northern route to Hadera Forest pool
	Spare parts building and lot	Car parts lot	In the alignment area and survey area
	National parks and nature reserves	1. Gador Beach 2. Sharon Park	1. In the survey area in the northern route to Hadera Forest pool 2. In the survey area in the southern route to Hadera Forest pool
From Michmoret southern alternative	Roads and railways	1. Road 2 2. Road 4 3. Road 5720 4. Railway line, Tel Aviv – Haifa 5. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route to the north of Michmoret, in the alignment area and survey area 2. In the alignment area and survey area, crossed near Hefer junction 3. In the survey area near Hefer junction 4. In the alignment area and survey area. The alignment crosses the track and continues along it by Emek Hefer industrial area 5. Access road and parking for Nachal Hadera Park, dirt roads and agricultural paths all along the alignment
	Paths and hiking trails	1. Israel Trail 2. Red trail 7149 3. Regional bicycle trails around Nachal Alexander	1. In the alignment area and the survey area near Sharon Park 2. In the survey area along Nachal Alexander 3. In the alignment area and the survey area
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area along the route

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Vegetation and fallow land	Fallow sandy fields with characteristic vegetation, uncultivated plots	Along the route and in the survey area, mainly in the western section of the alignment
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the south of Hogla 2. In the alignment area and survey area near Olga junction and to the west of Emek Hefer industrial area
	National parks and nature reserves	Nachal Alexander National Park	In the survey area in the eastern part of the park
	Fallow field	Fallow field, including roads and waste disposal	To the west of Emek Hefer industrial area, in the review area
From Nachal Alexander northern alternative	Roads	1. Road 2 2. Road 4 3. Road 581 4. Railway line, Tel Aviv – Haifa 5. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route near Nachal Alexander, in the alignment area and survey area 2. In the alignment area and survey area, crossed to the north of Emek Hefer industrial area 3. In the alignment area and survey area, crossed to the north of Maabarot wastewater treatment facility 4. In the alignment area and survey area. The pipeline route crosses the track and follows it in Nachal Alexander and to the south of Hadera Forest 5. Dirt roads and agricultural paths all along the alignment
	Residences	6 – 8 houses in the south of Kfar Brandeis neighborhood of Hadera + isolated building to the south	In the review area
	Paths and hiking trails	1. Israel Trail 2. Regional bicycle trails around Nachal Alexander	1. In the alignment area and the survey area to the south of Hadera Forest and in Nachal Alexander 2. In the survey area, in the western section of the alignment
	Agricultural land	Agricultural buildings, greenhouses, cultivated	In the alignment area and the survey area along the route

Alternative	Use	Description	Location and minimum distance from the plan boundaries
		areas of field crops and orchards	
	Vegetation and fallow land	Fallow sandy fields with characteristic vegetation, uncultivated plots	Along the route and in the survey area, mainly in the western section of the alignment
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the north of Elyakhin 2. In the alignment area and survey area to the south of Hadera Forest and west of Emek Hefer industrial area
	Forest	Western forest areas of Hadera Forest	In the review area
	Filling station complex	Filling station and food complex	In the alignment and survey area to the south of Hadera in the northern route to Hadera Forest pool
	Spare parts building and lot	Car parts lot	In the alignment area and survey area
	Agricultural farm	Seakura aquaculture farm	In the survey area
	National parks and nature reserves	Nachal Alexander National Park	In the alignment area and the review area
	Streams	Nachal Alexander	In the alignment area and the review area, the stream is crossed a number of times, mainly in the western part of the alignment
From Nachal Alexander southern alternative	Roads and railways	1. Road 2 2. Road 4 3. Road 5720 4. Railway line, Tel Aviv – Haifa 5. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route near Nachal Alexander, in the alignment area and survey area 2. In the alignment area and survey area, crossed near Hefer junction 3. In the survey area near Hefer junction 4. In the alignment area and survey area. The route crosses the track to the south of Emek Hefer industrial area 5. Dirt roads and agricultural paths all along the alignment

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Paths and hiking trails	1. Israel Trail 2. Red trail 7149 3. Regional bicycle trails around Nachal Alexander	1. In the alignment area and the survey area near Nachal Alexander 2. In the survey area along Nachal Alexander 3. In the alignment area and the survey area
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area along the route
	Vegetation and fallow land	Fallow sandy fields with characteristic vegetation, uncultivated plots	Along the route and in the survey area, mainly in the western section of the alignment
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the south of Hogla 2. In the alignment area and survey area to the south of Emek Hefer industrial area
	Agricultural farm	Seakura aquaculture farm	In the survey area
	National parks and nature reserves	Nachal Alexander National Park	In the alignment area and the review area
Neurim	Roads and railways	1. Road 2 2. Road 4 3. Road 5710 4. Road 5720 5. Railway line, Tel Aviv – Haifa 6. Parking lot, dirt roads and agricultural paths	1. Crossed by the pipeline route to the south of Neurim Youth Village, in the alignment area and survey area 2. In the alignment area and survey area, crossed near Hefer junction 3. In the alignment area and survey area, crossed to the north of Bitan Aharon 4. In the alignment area and survey area near Hefer junction 5. In the alignment area and survey area. The route crosses the track to the south of Maabarot wastewater treatment facility 5. Dirt roads and agricultural paths all along the alignment
	Residences	5 – 7 houses in the north of Bitan Aharon	In the review area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	National parks and nature reserves	Bitan Aharon Nature Reserve	In the alignment area and the survey area
	Infrastructures	1. 161 kW voltage lines 2. PEI line	1. In the alignment area and survey area to the south of Hogla 2. In the alignment area and survey area to the west of Maabarot Hefer wastewater treatment facility
	Wastewater treatment facility	Maabarot wastewater treatment facility	Adjacent to the alignment area and in the survey area
	Paths and hiking trails	1. Black trail 7142 2. Red trail 7149 3. Regional bicycle trails around Nachal Alexander	1. In the alignment area and survey area near Nachal Alexander 2. In the survey area along Nachal Alexander 3. In the alignment area and the survey area
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area along the route
The treatment facility			
Meretz Wastewater Treatment facility	Streams	1. Nachal Alexander 2. Nachal Ometz 3. Nachal Bachan	1. Approx. 300 m to the south-west 2. In the exploration area 3. Approx. 150 m to the south
	Roads	1. Road 581 2. Dirt roads and agricultural paths	1. Approx. 700 m to the north 2. In the exploration area and the survey area
	Paths and hiking trails	Israel Bicycle Trail (planned)	In the exploration area and adjacent to the east
	Agricultural land, fishponds and cultivated areas	1. Cultivated and agricultural fields 2. Agricultural buildings / henhouses 3. Fishponds to the east and the south	1. In the exploration area and the survey area 2. Approx. 300 m to the north 3. Approx. 300 m to the south
	Infrastructures	High-voltage lines	In the area of the alternative and the survey area
	Wastewater treatment facilities	Meretz wastewater treatment facility	In the exploration area

Alternative	Use	Description	Location and minimum distance from the plan boundaries
	Reservoirs	Gat treated effluent reservoir	Adjacent to the alternative to the south-east
Pipeline from the treatment facility			
From Meretz Wastewater Treatment Facility	Paths and hiking trails	Israel Bicycle Trail (planned)	In the exploration area and adjacent to the east
	Residences	Residential buildings to the south-west of Ma'apil	Adjacent to the survey area to the east
	Agricultural land	Agricultural buildings, greenhouses, cultivated areas of field crops and orchards	In the alignment area and the survey area along the route
	Roads	1. Road 5803 2. Road 581 3. Road 6 4. Dirt roads and agricultural paths	1. Accompanied by the pipeline route to the east of Kibbutz Ma'apil up to Road 581, in the alignment area and the survey area 2. In the survey area, from the junction with Road 5803 eastward 3. At the eastern end of the route in the survey area 4. Dirt roads and agricultural paths all along the route

Figure 1.3.1: Land uses in Dor array

Figure 1.3.2: Land uses in Hadera – Neurim array

1.3.2 Land zoning

The proposed treatment arrays were examined against:

a. National outline plans[1], national infrastructure plans
b. District outline plans
c. Approved and deposited detailed plans
d. Master plans and plans in preparation

The survey area is approximately 1 km around the exploration area for the treatment facility, and 100 m around the pipeline corridor alignment. The review of the landfall crossing point also includes attention to the offshore area approximately 300 m to the west of the coastline.

All the land-use schemes include NOP 37 zoning. The index of diagrams for this section is detailed below:

Subject	Plan	Figure no.
National Outline Plans		
Infrastructures	NOPs 32, 23, 16, 15, 14, 10, 3, and 34/B/2/5	1.2.2-a1
Environment	NOPs 8, 2, nature reserve, parks and forests plans layers from Nature and Parks Authority and KKL (2011), 34/B/3/4	1.2.2-a2
Mediterranean coast outline plan	NOP 13	1.2.2-a3
Combined outline plan for construction, development and conservation	NOP 35, texture scheme	1.2.2-a4
	NOP 35, environment scheme	1.2.2-a5
National infrastructure plans		
Road 9	NIP 4	1.2.2-a1
Cogeneration power station at Hadera Paper Mills	NIP 20 L20	1.2.2-a1
Eastern railway line	NIP 22	1.2.2-a1
Separation of levels	NIP 14/25, 20/25, and 23/26	1.2.2-a1
Road 2 Zichron – Herzliya	NIP 31	1.2.2-a1
Road 65 upgrade	NIP 38	1.2.2-a1
Electrification of railway line	NIP 18	1.2.2-a1

[1] A review of NOPs 34/B/3-4 was made as part of the hydrological and geo-hydrological analysis, see Section 1.7.

District outline plans		
District outline plan, zoning	DOP 6 and DOP 21/3	1.2.2-b1
District outline plan, infrastructures	DOP 6 and DOP 21/3	1.2.2-b2
District outline plan, environment	DOP 6 and DOP 21/3	1.2.2-b3
Compilation of detailed plans		
Approved plans		1.2.2-c1
Conceptual plans, master plans and plans in preparation		1.2.2-d1

Dor array

1.3.2.1 Dor North

1.3.2.1.1 Landfall crossing array

a. National outline plans

Infrastructures

There are no infrastructures in the area of the landfall crossing array.

NOP 13 – the landfall area crosses a number of zoning uses according to the NOP, as detailed: **coastal reserve, bathing beach**, at the northern end of the landfall corridor and **ponds for agricultural use.**

NOP 35 – the area begins in the area of a **coastal fabric** intended to conserve the open beaches and the rural-coastal hinterland. It is intended to remain open for the greater part, in such a way as to assure public access to the beach and passage along it. Planning and development in the fabric will have a landscape and functional connection to the sea, the seashore and the hinterland open space, and will ensure limited and cautious incorporation of the values of the fabric. The western part of the landfall crossing is in an area of **nature reserves and parks** that does not appear in NOP 8 – in accordance with Section 9.7 of the plan provisions, in this area provisions with regard to purposes and uses permitted in NOP 8 will apply. In the diagram of environmental guidelines, the plan applies to an area of **high landscape and environmental sensitivity**.

b. District outline plans

DOP 6 – according to the zoning diagram, the landfall crossing array is in the area of **provisions for changes to NOP 13 "Haifa and Tirat HaCarmel shores"** and in an area of **agricultural / open rural landscape** – according to Section 7.18.2, in this area engineering infrastructure that is adapted in terms of landscape and environment will be permitted. The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan overlaps a **161 kW electricity line.**

c. Approved and deposited detailed plans

In the area of the proposed landfall crossing at Dor Beach there is one land zoning plan in the approved and deposited plans:

Plan MSHמשח/2 of Moshav Dor, approved for validation on July 4, 1985, whose main zoning is agricultural land, tourism and recreation.

d. Conceptual plans, master plans and plans in preparation

Based on the national GIS layer and the information given to the planning team, there are no plans in the preparation stage in the area or vicinity of the alternative.

1.3.2.1.2 Pipeline route to the treatment facility

The pipeline route crosses the zoning areas as detailed below:

a. National outline plans

Infrastructures

NOP 3 – Road 2 – **existing highway**

NOP 23–route of **existing railway line**

NOP 37/A – the route overlaps the area of an **existing transmission line and block valve station**, Dor-Hagit

In addition, the route crosses the area of NIP 18 for electrification of the railway line.

Environment

National parks and nature reserves – the area of **an approved nature reserve,** Kurkari HaCarmel, according to the data layer of parks and nature reserves from the Nature and National parks Authority.

NOP 22 – area of **coastal park forest**

NOP 13 – the route passes an area of **ponds for agricultural use and agricultural area**

NOP 35 – the route is in an area of **coastal fabric** and an area of **high landscape and environmental sensitivity and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, the landfall crossing array is in the area of **agricultural / open rural landscape** – according to Section 7.18.2, in this area engineering infrastructure that is adapted in terms of landscape and environment will be permitted, **an area of forest and afforestation crossing a national railway line, and highway and landscape road**. The infrastructures diagram of the environmental guidelines of DOP 6 shows that the pipeline route passes through an area of **sites for identification of reservoirs, the site of an existing wastewater treatment facility, the site of sensitive drainage strips, and a 161 kW electricity line.**

c. Approved and deposited detailed plans

The survey area of the proposed pipeline route crosses the area of the detailed and deposited plans detailed in Table 1.2.2.1.2 below.

Table 1.3.2.1.2: Land zoning in detailed plans in the pipeline route to Dor North

Plan no.	Validity (date)	Purpose of the plan	Main zoning
MSH/2	July 4, 1985	Moshav Dor	Agricultural land, tourism and recreation
HC/21F	January 17, 2005	Regional wastewater treatment facility, Maayan Zvi	Engineering facility
MSH/7	July 4, 1985	Arranging agricultural allotment for Kibbutz Maayan Zvi	Agricultural land
MSH/8	July 4, 1985	Arranging agricultural allotment for Kibbutz Nachsholim	Agricultural land
HPAG/D/1167	April 2, 2008	Widening railway line corridor Atlit – Binyamina	Transport (railway line)

d. Conceptual plans, master plans and plans in preparation

According to the Carmel Coast Forest site plan. The route crosses the area of a nature reserve.

1.3.2.1.3 Treatment facility

a. National outline plans

Infrastructures

NOP 3 – the site is in a block enclosed by major roads defined in NOP 3 as **highway** – Road 2, and main road – Road 4. Road 70 connects the two main roads, passing to the south of the site at a considerable distance. The plan for upgrading Road 2 in the framework of NIP 31 passes to the south of the alternative, at a distance of approximately 1 km.

NOP 23 – according to NOP 23, to the west of the site and Road 2 **an existing railway line** is marked. A plan for track separation included in NIP 14/25 is located to the south of the alternative, at a distance of 400 m. According to NIP 18 – the exploration area borders in its northern section on a track section for electrification that includes a restriction on construction and development of 10 m on either side. The railway transformer station (RTS) is planned at a distance of around 670 m to the east of the area.

NOP 37 – the route of the **existing onshore gas transmission** system passes to the west and north close to the site of the alternative, according to NOP 37C. The route of the existing offshore gas transmission system passes to the west of the site at a distance of 4.5 km, according to NOP 37/A/2.

Environment

NOP 8 – in the exploration area of the alternative, there are no components of NOP 8 nature reserves in national parks, but only in its vicinity, as follows: nature reserves: approved nature reserve – Kurkari HaCarmel east to the west of the area at a distance of around 500 m. A proposed and approved nature reserve, which is the continuation of the Kurkari HaCarmel reserve, is marked to the north-west of the area at a distance of 300 m and more. The declared nature reserve Horvat Drachmon is marked at a distance of 600 m to the north-west of the area.

NOP 22 – according to NOP 22, an area of **coastal park forest –** Carmel coast is marked to the west of the area at a distance of 500 m, and in part there is a detailed plan for a forest. Other forests on NOP 22 and declared forest reserves are found to the east of the area, at a considerable distance.

NOP 35 –according to the fabric scheme of the NOP, the site area and its environs are located in the **coastal fabric** of the Carmel coastal plain, whose purpose is to preserve the open beaches and the rural-coastal hinterland. It is intended to remain open for the greater part, in such a way as to assure public access to the beach and passage along it. Planning and development in the fabric will have a landscape and functional connection to the sea, the seashore and the hinterland open space, and will ensure limited and cautious incorporation of the values of the fabric. In the diagram of environmental guidelines, it appears that the site area and its surroundings overlap an area of **high landscape and environmental sensitivity and area for conservation of water resources**

b. District outline plans

DOP 6 – the site and surrounding area are in an area of **agricultural / open rural landscape**. The infrastructures diagram of DOP 6 shows the following: **a 161 kW electricity line** is marked in the southern part of the exploration area of the alternative, and passes along its northern border. Other electricity lines pass near to the alternative. From the environmental guidelines diagram of DOP 6 it appears that the proposed site is in an area of **sensitive drainage strips.**

c. Approved plans

The land zoning in approved plans is detailed in Table 1.2.2.1.3 below. The plans detailed and presented in Figure 1.2.2-c1 are located in the exploration area and its immediate surroundings up to approximately 1000 m from the borders of the exploration area.

Table 1.3.2.1.3: Land zoning in detailed plans for the Dor North alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
MSH/2	July 4, 1985	Moshav Dor	Agricultural land, tourism and recreation	In the entire exploration area
HC/21F	January 17, 2005	Regional wastewater treatment facility, Maayan Zvi	Engineering facility	Bordering on the exploration area in the south
MSH/7	July 4, 1985	Arranging agricultural allotment for Kibbutz Maayan Zvi	Agricultural land	Bordering on the exploration area in the south
S/391	May 5, 1984	Local outline plan for Fureidis	Overall planning, in the area – agricultural land	In the exploration area in a limited part in the south-west and to the south-west of the area
MSH/8	July 4, 1985	Arranging agricultural allotment for Kibbutz Nachsholim	Agricultural land	To the exploration area
HC/206/A	April 2, 2001	Plan for Horvat Drachmon nature reserve	Open spaces – nature reserve	To the north-west of the exploration area at a distance of 600 m
HPAG/D/1167	April 2, 2008	Widening railway line corridor Atlit – Binyamina	Transport (railway line)	At a distance of 750 m to the west of the area
HC/28/E	September 7, 1999	Moshav Dor expansion	Residential	At a distance of 800 m to the west of the area
HC/5	June 3, 1982	Plan for Kibbutz Nachsholim	Residential	At a distance of 900 m and more to the north-west of the area

d. Conceptual plans, master plans and plans in preparation

According to the Fureidis master plan the exploration area and the survey area overlap existing agricultural land.

1.3.2.1.4 Pipeline route to the treatment facility
The treated gas will flow eastward and to the Hagit power station along the existing Dor – Hagit gas pipeline and does not require the identification of an additional pipeline route.

1.3.2.2 Ein Ayala

1.3.2.2.1 Landfall crossing array
See Section 1.2.2.1.1 above.

1.3.2.2.2 Pipeline route to the treatment facility
In addition to the zoning as detailed in Section 1.2.2.1.2 above, the pipeline route crosses the following zoning areas:

a. National outline plans

Infrastructures

NOP 3 – Road 2 – **existing highway**, Road 4 **– existing and planned main road** in the area of Fureidis.

NOP 10 – 161 kW **ultra-high voltage line**

NOP 14 – in the area of the chalk, cement and limestone **quarry** – Ein Ayala

NOP 34/B/5 – in the area of an approved/existing **drinking water pipe** and Mekorot facility

NOP 37/C – the route overlaps the area of an **existing transmission line and block valve station**, Dor-Hagit

In addition, the route crosses the area of NIP 18 for electrification of the railway line.

Environment

National parks and nature reserves – the area of **an approved nature reserve,** Kurkari HaCarmel, according to the data layer of parks and nature reserves from the Nature and National parks Authority.

NOP 22 – area of **coastal park forest**

NOP 13 – the route passes an area of **ponds for agricultural use and agricultural area**

NOP 35 –the route is in an area of **coastal fabric, integrated conservation fabric,** and in an area of **high landscape and environmental sensitivity and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, the landfall crossing array is in an area of **agricultural / open rural landscape** – according to Section 7.18.2, in this area engineering infrastructure that is adapted in terms of landscape and environment will be permitted, **an open space / protected agriculture area –** according to Section 7.16.2, in this area only engineering infrastructure adapted to the environmental and landscape restrictions will be permitted, **an open urban area and quarry area** are in the review area. In addition, the route crosses **a scenic road**. The infrastructures diagram of the environmental guidelines of DOP 6 shows that the pipeline route passes through an area of **sensitive drainage strips, and a 161 kW electricity line.**

c. Approved and deposited detailed plans

In addition to the plans detailed in Section 1.2.2.1.2 above, the survey area of the proposed pipeline route crosses the area of the detailed and deposited plans detailed in Table 1.2.2.2.2 below. The plans are presented in Figure 1.2.2-c1.

Table 1.3.2.2.2: Land zoning in detailed plans in the pipeline route to Ein Ayala

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HC/78A	November 26, 1982	Zoning an area for a lime quarry for continued quarrying	Mining and quarrying
HC/78B	October 17, 1985	Ein Ayala Quarry plan	Mining and quarrying
MSH/8	July 4, 1985	Arranging agricultural allotment for Kibbutz Nachsholim	Agricultural land
MSH/11	July 4, 1985	Moshav Ein Ayala plan	Agricultural land

d. Conceptual plans, master plans and plans in preparation

According to the Fureidis master plan, the pipeline route crosses the Fureidis northern employment area.

1.3.2.2.3 Treatment facility

a. National outline plans

Infrastructures

NOP 3 – the site is next to Road 4, defined in NOP 3 as a **main road**, from which there is access to the active quarry. Road 2 – Highway, and Road 70 – main road, are at a considerable distance from the quarry.

NOP 14 – Ein Ayala Quarry is included in NOP 14 as an area for **mining and quarrying**. The preparation of NOP 14b is currently being advanced, as an update to the approved NOP 14. According to a decision by the committee of editors of December 26, 2011, the expansion being promoted in detailed plan HC/78C will be marked in NOP 14B, for rehabilitation of the quarry. At the same time, it was decided that it is this alternative is found suitable for a gas treatment facility, it is clarified that there is no essential need for the raw material, and that the main consideration is the rehabilitation.

NOP 37 – the route of the existing onshore gas transmission system– NOP 37C, connecting Dor to Hagit, passes to the west and north close to the site of the alternative. The route of the existing offshore gas transmission system passes to the west of the site at a distance of 6 km.

<u>Environment</u>

NOP 22 – in the northern part of the site and in the vicinity of the site are an **existing man-made forest** according to NOP 22, and an **existing park forest**. At the same time, the plans for expanding the quarry includes a change of zoning to forest, see the section on detailed plans below.

NOP 35 – according to the fabric scheme of the NOP, the site area and its environs are located in a **combined conservation fabric** – whose purpose is to bring together a continuum of natural values, agriculture, landscape, settlement and heritage, creating a green Avenue from north to south and open buffer zones along the main river beds in the center. The fabric is intended to achieve a maximum combination of the characteristic values with limited development in the center of the country, and cautious development in the peripheral areas. To the west of the site, at a distance of 200 m or more, the area of the Carmel coastal plain is included in the coastal fabric, and the town of Fureidis is included in the area of urban fabric. In the diagram of environmental guidelines, it appears that the site area and its surroundings are in an area of **high landscape and environmental sensitivity and area for conservation of water resources**. The natural gas pipeline passes close to the western and northern borders of the site. The pipeline passes in a generally west to east direction.

b. <u>District outline plans</u>

DOP 6 – the site is in an area zoned for a **quarrying site**, and in its northern section, for **forest and afforestation.** The infrastructures diagram of DOP 6 shows the following: the site area and its surroundings are in an area zoned for mining and quarrying, and in its impact area (500 m). **An existing main Hazmat corridor** passes to the west of the site at a distance of 100 m, parallel to

Road 4, and turns eastward, parallel to the natural gas transmission pipeline. A 161 kW electricity line is marked to the west of the site, at a distance of some 500 m.

c. Approved and deposited plans

The land zoning in approved plans is detailed in Table 1.2.2.2.3 below. The detailed plans are located in the exploration area and its immediate surroundings up to approximately 1000 m from the borders of the exploration area.

Table 1.3.2.2.3: Land zoning in detailed plans for the Ein Ayala alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
HC/78A	November 26, 1982	Zoning an area for a lime quarry for continued quarrying	Mining and quarrying	In the area of the site
HC/78B	October 17, 1985	Ein Ayala Quarry plan	Mining and quarrying	In the area of the site
C/400	January 10, 1963	Galilee outline plan for Haifa district	Forest	To the south-east of the site at a distance of 800 m
S/1384 HC//156/I	March 7, 2012	Construction of new residential area – 811 housing units	Residential	To the south-east of the site at a distance of 900 m
MSH/8	July 4, 1985	Arranging agricultural allotment for Kibbutz Nachsholim	Agricultural land	To the west of the exploration area at a distance of 150 m
HC/249	June 26, 2003	Plan for Shefaya C Quarry	Mining and quarrying	To the south-east of the site at a distance of 750 m
S/391	May 5, 1984	Local outline plan for Fureidis	Overall planning in the plan area – industry, workshops and open space, sport and recreation	To the south of the site at a distance of 800 m

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
2/537/1	March 17, 2004	Public-housing registration plan	Residential	To the south of the site at a distance of 950 m
MSH/2	July 4, 1985	Moshav Dor	Agricultural land	To the west of the site at a distance of 450 m
S/MK/1087	May 9, 2007	Moving public building areas	Public institutions – Fureidis Cultural Center	To the south of the site at a distance of 900 m
MSH/11	July 4, 1985	Plan for Moshav Ein Ayala	Agricultural land	To the north of the site at a distance of 600 m
HC/22/B	June 8, 1999	Moshav Ein Ayala expansion	Residential	To the north-west of the site at a distance of 650 m

d. Conceptual plans, master plans and plans in preparation

HC/78C – Ein Ayala expansion plan. The plan expands the existing site to the north, and adds an area of around 22 dunams to the approved quarry area. The plan zones some 120 dunams of the approved quarry area for quarrying and rehabilitation. The quarry expansion is in an existing planted forest area according to NOP 22, an open / protected agriculture area in DOP 6, and within 100 m of the gas pipeline (an area for quarrying without explosives).

Fureidis master plan –the plan assimilates the desired development trends of the town, including developing an employment area in the northern part of the town. Accordingly and in parallel, a **detailed plan for this employment area** is being advanced. According to the information received at this stage, the plan is not included in the safety zone of the site. This plan was submitted to the district committee a few years ago. Today the Ministry of the Interior has begun drawing up a new outline plan.

Carmel Coast Forest plan – the plan allocates areas of forest and agriculture in the survey area.

1.3.2.2.4 Pipeline route from the treatment facility
The gas will flow to the Hagit power station through the existing Dor – Hagit gas pipeline, according to NOP 37/C, and does not require an additional pipeline route to be laid.

1.3.2.3 Hagit East

1.3.2.3.1 Landfall crossing array
See Section 1.2.2.1.1 above.

1.3.2.3.2 Pipeline route to the treatment facility
In addition to the zoning as detailed in Section 1.2.2.2.2 above, the pipeline route crosses the following zoning areas:

1.3.2.3.2.1 Northern alternative

a. National outline plans

Infrastructures

NOP 10 – 161 kW **ultra-high voltage line**

NOP 14 – in the area of the chalk, cement and limestone **quarry** – Ein Ayala

Environment

National parks and nature reserves – the area of **an approved nature reserve,** Kurkari HaCarmel, according to the data layer of parks and nature reserves from the Nature and National parks Authority.

NOP 22 – in the area of **coastal park forest, existing planted forest, and existing park forest** of the Carmel coast and Nachal Tut, **natural forest for conservation, proposed forest and park forest nature reserve**. In addition, plans for a forest and afforestation are in the area of the pipeline alignment, see detailed plans below.

NOP 13 the route passes an area of **ponds for agricultural use and agricultural area**

NOP 35 – the route is in an area of **coastal fabric and integrated conservation fabric,** and in an **area of high landscape and environmental sensitivity, firing zone, and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, the alignment is in an area of **agricultural / open rural landscape and open space / protected agriculture area –** according to Sections 7.18.2 and

7.16.2, in these areas engineering infrastructure that is adapted in terms of landscape and environment will be permitted; a **forestry and afforestation** area, **an open urban area (Fureidis), open rural area (Ofer) and quarry site** are in the review area. The route also crosses **a scenic road and approved 400 kW electricity corridor**. In addition, the infrastructures diagram of the environmental guidelines of DOP 6 shows that the pipeline route passes through an area of **sensitive drainage strips, and area for conservation of water resources of very high sensitivity, an approved strip for consolidating infrastructures, an existing main Hazmat corridor, and a 161 kW electricity line.**

c. Approved and deposited detailed plans

In addition to the plans detailed in Section 1.2.2.2.1 above, the survey area of the proposed pipeline route crosses the area of the detailed and deposited plans detailed in Table 1.2.2.3.2.1 below.

Table 1.3.2.3.2.1: Land zoning in detailed plans in the pipeline route to Hagit East, northern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HC/156/D	October 15, 2002	Arrangement of the existing and new construction in Moshav Ofer	Residential
C/400	January 10, 1963	Galilee outline plan for Haifa district	Agricultural land

d. Conceptual plans, master plans and plans in preparation

According to the Carmel coast forest plan, in the alignment area there is agricultural land in addition to the zoning detailed above.

1.3.2.3.2.2 Southern alternative

a. National outline plans

Infrastructures

NOP 10 – 161 kW **ultra-high voltage line**

NOP 14 – in the area of the chalk, cement and limestone **quarry** – Ein Ayala

Environment

National parks and nature reserves – the area of **an approved nature reserve,** Kurkari HaCarmel, according to the data layer of parks and nature reserves from the Nature and National Parks Authority.

NOP 22 – in the area of **coastal park forest, existing planted forest, and existing park forest** of the Carmel coast and Nachal Tut, **natural forest for conservation, proposed forest and park forest nature reserve**. In addition, plans for a forest and afforestation are in the area of the pipeline alignment, see detailed plans below.

NOP 13 – the route passes an area of **ponds for agricultural use and agricultural area**

NOP 35 – the route is in an area of **coastal fabric and integrated conservation fabric,** and in an **area of high landscape and environmental sensitivity, firing zone, and area for conservation of water resources** and crosses a **main electricity line.**

b. District outline plans

DOP 6 – according to the zoning diagram, the alignment is in an area of **agricultural / open rural landscape and open space / protected agriculture area** – according to Sections 7.16.2 and 7.18.2, in these areas engineering infrastructure that is adapted in terms of landscape and environment will be permitted; a **forestry and afforestation** area, **an open urban area (Fureidis), open rural area (Bat-Shlomo) and quarry site** are in the review area. The route also crosses **a scenic road and an approved 400 kW electricity corridor**. In addition, the infrastructures diagram of the environmental guidelines of DOP 6 shows that the pipeline route passes through an area of **sensitive drainage strips, and area for conservation of water resources of very high sensitivity, an approved strip for consolidating infrastructures, an existing main Hazmat corridor, and a 161 kW electricity line.**

c. Approved and deposited detailed plans

In addition to the plans detailed in Section 1.2.2.2.2 above, the survey area of the proposed pipeline route crosses the area of the detailed and deposited plans detailed in Table 1.2.2.3.2.2 below.

Table 1.3.2.3.2.2: Land zoning in detailed plans in the pipeline route to Hagit East, southern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HC/249	June 26, 2003	Zoning an area for quarrying, creating an access road, developing the quarry area and rehabilitation in the Shefaya C Quarry	Mining and quarrying
MSH/43/HC	November 10, 1996	Plan for the Bat-Shlomo agricultural community	Residential
C/400	January 10, 1963	Galilee outline plan for Haifa district	Agricultural land

d. Conceptual plans, master plans and plans in preparation

The Carmel coast forest site plan, which allocates mainly open space uses, does not add additional zoning to the zoning detailed above.

1.3.2.3.3 The treatment facility

a. National outline plans

Infrastructures

NOP 3 – the site is at a distance of 300 m from Road 70, which is defined as a main road, and to the west of Road 6, defined as a highway at a distance of 600 m from the site. The access road to the site is through the access road to the power station exiting from Road 70.

NOP 10 – a main electricity lines corridor passes along the north-west and section of the site, and in addition a passage is marked for main electricity lines to the north of the site. **Hagit power station** is to the west, and adjacent to the exploration area.

NOP 34/B/5 – in the eastern part of the exploration area a **drinking water pipe** and in the survey area (to the north of the exploration area).

NOP 37– according to NOP 37C, the Hagit alternative is located at the junction of the **existing Dor – Hagit** onshore route, and continues to the north-east in NOP 37B, between the approved Nesher – Hagit onshore route in NOP 37 B/8. The route of the existing offshore gas transmission system passes to the west of the eastern site at a distance of 14 km.

Environment

NOP 8 – in the exploration area of the alternative there are no components of NOP 8 and of national parks. Approximately 100 m to the south of the site, **a declared and approved nature reserve** is marked, Nachal Tut. A nature reserve for Nachal Daliya and additional nature reserves are marked at a considerable distance from the site of the alternative.

NOP 22 – forest areas defined in NOP 22 as **natural forest for conservation and proposed park forest** at Nachal Tut are in the area and vicinity of the site.

NOP 35 – according to the fabric scheme of the NOP, the area and environs of the alternative are located in a **combined conservation fabric** whose purpose is to bring together a continuum of natural values, agriculture, landscape, settlement and heritage, creating a green avenue from north to south and open buffer zones along the main river beds in the center. The fabric is intended to achieve a maximum combination of the characteristic values with limited development in the center of the country, and cautious development in the peripheral areas.

To the south of the site, along Nachal Tut, the NOP marks reserves and parks. In the diagram of environmental guidelines, it appears that the site area and its surroundings are in an area of **high landscape and environmental sensitivity and area for conservation of water resources**.

b. <u>District outline plans</u>

DOP 6 -the site is in an area zoned as **open area / protected agriculture** intended for preserving areas as open spaces as a means of protecting concentrations of natural resources, landscape, heritage and agriculture. To determine guidelines for conservation, cultivation, and/or rehabilitation of open areas and protect them from development because of their natural, landscape, environmental or cultural qualities, and address the need for recreation in the heart of nature, with a national, district and regional view.

In addition, the exploration area is in an area zoned for **forest and afforestation**, and adjacent to an **engineering facility.** The infrastructures diagram of DOP 6 shows the following: the exploration site is marked as a **power station, infrastructure consolidation strip** in the northern section, **an approved strip for 400 kW electricity lines, a 400 W electricity line, and a 161 kW electricity line**, and the route the natural gas transmission pipeline passes to the east.

The infrastructures diagram of DOP 6 shows that the proposed site is in an **area for conservation of water resources with very high sensitivity and in the area of sensitive drainage strips.**

c. <u>Approved plans</u>

The land zoning in approved plans is detailed in Table 1.2.2.3.3 below. The detailed plans are located in the exploration area and its immediate surroundings up to approximately 1000 m from the borders of the exploration area.

<u>1.3.2.3.3: Land zoning in detailed plans for the Hagit East alternative</u>

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
MSH/43/HC	November 10, 1996	Plan for Bat-Shlomo agricultural community	Residential	Adjacent to the exploration area (the adjacent zoning for the alternative is for agriculture)
C/400	January 10, 1963	Galilee outline plan for Haifa district	Agricultural land	On the western border of the western site
HC/200	March 25, 1999	Nature reserve plan	Nature Reserve – Nachal Tut	To the south of the exploration areas
C/4252	December 4, 1983	Arrangement plan for the area of Kibbutz Ramot Menashe	Agricultural land, road	At a distance of 600 m or more to the south of the exploration areas
C/12635	May 3, 2007	Detailed plan for forest according to NOP 22	Nature reserve	To the south of the exploration areas
C/4889	July 5, 1987	Plan for Kibbutz Ein Hashofet	Agricultural land	To the south of the eastern exploration area at a distance of 600 m

d. Conceptual plans, master plans and plans in preparation

Forest plans – according to information given to the planning team, detailed plans are currently being promoted for KKL-JNF forests in the area of the alternatives.

1.3.2.3.4 Pipeline route from the treatment facility

The route comes close to the Hagit power station and the eastern gas transmission pipeline, and does not include laying an additional route in this plan.

Hadera – Neurim array

1.3.2.4 Hadera Wastewater Treatment Facility

1.3.2.4.1 Landfall crossing array

1.3.2.4.1.1 Nachal Hadera alternative

a. National outline plans

Infrastructures

NOP 10 – the plan is adjacent to the south to the Orot Rabin **power station.**

NOP 34/B/2 – within **an area of offshore infrastructures, proposed pipeline, and existing desalination plant.**

NOP 34/B/5 – within a **drinking water pipe and sea outlet for desalination concentrate**

NOP 37/D – the plan overlaps the route of **an existing transmission pipe.**

Environment

NOP 8 – the northern end of the plan overlaps the area of a **proposed national park** – Caesarea Dunes

NOP 22 – the plan overlaps an area of **riverbank planting**, Nachal Hadera

NOP 13 – the landfall crossing array overlaps sites of **bathing beach, public open space, and settlement area**

NOP 35 – the fabrics diagram shows that the plan overlaps the following zones: **coastal fabric, urban fabric, and the site of nature reserves and parks that does not appear in NOP 8.** According to Section 9.7 of the plan instructions, in this area the instructions with regard to the purposes and uses permitted in NOP 8 will apply.

According to the environmental guidelines diagram, the area overlaps an area of **high landscape and environmental sensitivity and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, the landfall crossing array is in an area of **forest and afforestation, an area of urban development and urban-coastal development, urban open space, open space/protected agriculture, and national park.** From the infrastructures diagram of the NOP 6 environmental guidelines it appears that the plan is in a **sensitive drainage strip**. To the north, the Orot Rabin power station is adjacent.

c. Approved and deposited detailed plans

According to the data layer received from the Israel Lands Administration, there are no land zonings in the detailed and approved plans in the area of the alternative.

d. Conceptual plans, master plans and plans in preparation

According to the Hadera outline plan (deposited), in the survey area are areas zoned for bathing beach, public park, and residential area at the eastern end.

1.3.2.4.1.2 Michmoret alternative

a. National outline plans

Infrastructures

NOP 34/B/2/2 – in the area is **a proposed pipeline and proposed marine area.**

Environment

National parks and nature reserves – according to NOP 8, there is no zoning in the area of the plan. According to the national parks and nature reserves layer from the Nature and National Parks Authority, at the entry point there are the following zoned areas:

- **Declared nature reserve**, Yam Gador
- At the northern end of the landfall crossing array, Hof Gador **declared nature reserve**
- **Proposed national park**, Sharon Park
- **Proposed national park**, Hof Gador

NOP 13 – the plan overlaps the following zones: **bathing beach, tourism and recreation area, valid national park and declared nature reserve**

NOP 35 – the fabrics diagram shows that the plan overlaps the following zones: **coastal fabric, scenic complex** – according to Section 9.1.3 of the plan instructions, the passage of infrastructure lines will be permitted only after the planning institution has examined alternatives for these lines to pass outside the area of the scenic complex, been persuaded of the need for them to pass through it, and determined the landscape and environmental treatment required as relevant, and an area of **nature reserves and parks** that does not appear in NOP 8.

According to the environmental guidelines diagram, the area overlaps an area of **high landscape and environmental sensitivity and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, the landfall crossing array is in an area of **nature reserve and national park, open space/protected agriculture, and center of rural-coastal tourism development.**

c. Approved and deposited detailed plans

In the landfall crossing area proposed at Michmoret there is one planned for land zonings in approved and deposited plans:

Plan HD/1420 for Hof Gador Nature Reserve, approved for validation on May 30, 2010, with main zoning for open areas.

d. Conceptual plans, master plans and plans in preparation

According to the Hadera outline plan, in the survey area are areas zoned for national park, nature reserve and rural accommodation.

1.3.2.4.1.3 Nachal Alexander alternative

a. National outline plans

Infrastructures

According to the national outline plans, there is no infrastructure zoning in national outline plans at the landfall crossing site.

Environment

National parks and nature reserves – according to NOP 8 and the national parks and nature reserves layer from Nature and National Parks Authority, at the entry point there are the following zoned areas:

- **Declared national park**, Nachal Alexander
- **Proposed national park**, Yam Michmoret

NOP 13 – the plan overlaps the following zones: **bathing beach, agricultural area, valid national park and declared nature reserve.**

NOP 35 – the fabrics diagram shows that the plan overlaps the following zones: **coastal fabric** – whose purpose is to preserve the open beaches and rural-coastal hinterland. Intended to remain largely open so as to ensure public access to the beach and passage along it. Planning and development in the fabric will be made with a scenic and functional connection to the sea, the beach and the open hinterland, and will assure their limited and cautious incorporation in the values of the fabric. **Scenic complex** – according to Section 9.1.3 of the plan instructions, the passage of infrastructure lines will be permitted only after the planning institution has examined alternatives for these lines to pass outside the area of the scenic complex, been persuaded of the need for them to pass through it, and determined the landscape and environmental treatment required as relevant, and an area of **nature reserves and parks.** According to the environmental

guidelines diagram, the area overlaps an area of **high landscape and environmental sensitivity and area for conservation of water resources.**

b. District outline plans

DOP 3/21 – according to the zoning diagram, the landfall crossing array is in an area of **marine reserve, bathing beach, national park, landscape reserves, institute, scenic route, and leisure and recreation area.**

c. Approved and deposited detailed plans

The landfall crossing area at Nachal Alexander overlaps a number of land zonings in detailed and deposited plans, detailed in Table 1.2.2.4.1.3 below.

Table 1.3.2.4.1.3 : Land zoning in detailed plans in the area of the landfall crossing array at Nachal Alexander

Plan no.	Validity (date)	Purpose of the plan	Main zoning
IH/38/1	January 30, 1980	Cancelling roads, determining areas and building instructions for Mevo'ot Yam Nautical School	Institutions
IH/91/3	May 17, 1998	Plan for development of Nachal Alexander National Park area	Open spaces
IH/91/3/a	March 10, 1994	Change in zoning for proposed road	Area for roads
MSM/16/IH	May 11, 1987	Detailed plan for registration purposes for Michmoret	Residential
IH/91	November 19, 1970	Zoning land for Nachal Alexander National Park	Open spaces

d. Conceptual plans, master plans and plans in preparation

According to the Nachal Alexander plan IH/191 (deposited), there is zoning for a national park in the survey area.

1.3.2.4.2 Pipeline route to the treatment facility

1.3.2.4.2.1 Pipeline route from Nachal Alexander

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – **existing highway** – Road 2, and **existing main road** – Road 4

NOP 14 – the route crosses a **sand mining site**, Hadera Dunes

NOP 23 – the route of a **railway track planned unit**

NOP 34/B/5 – in the area of a **drinking water pipe** and in the area of **a planning strip and optional strips for planning 24" – 107" diameter water pipe**

NOP 37/D – the route overlaps in part to the area of **an existing transmission line**

In addition, the pipeline crosses the area of NIP 31 for Road 2 in the Zichron – Havatzelet section.

Environment

NOP 22 – in the area of **coastal park forest and riverbank** in Nachal Hadera. In addition, the survey area partly overlaps natural forest for conservation.

NOP 13 – the pipeline route overlaps areas zoned for **public open space and settlement area.**

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric**. The survey area partly overlaps coastal fabric. The route partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines the route is in an **area of high landscape and environmental sensitivity, and area for conservation of water resources**

b. <u>District outline plans</u>

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area and an urban-coastal development area, urban open space, open space / protected agriculture area, metropolitan / regional park, highway, scenic route, and alternative stream route for examination.** The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of **sensitive drainage strips, and area for conservation of water resources of very high sensitivity,** the route crosses a **Hazmat corridor for examining the feasibility of transfer.** In the survey area there is a mine, a 161 kW electricity line, and the route of a national railway line.

c. <u>Approved and deposited detailed plans</u>

The survey area of the proposed pipeline route crosses the area of the detailed and deposited plans detailed in Table 1.2.2.4.2.1 below.

<u>Table 1.3.2.4.2.1: Land zoning in detailed plans in the pipeline route to Hadera wastewater treatment facility from Nachal Alexander</u>

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/MK/920B	January 12, 1999	Increasing public areas	Public institutions
25/30/2	May 13, 1997	Determining a valid plan for "public housing" for implementing measurements and registration in land registers	Residential
C/400	January 10, 1993	Galilee Outline Plan	Agricultural area
MSH/26	October 17, 1985	Kibbutz Gan Shmuel land arrangement plan	Agricultural area
C/842A	July 18, 1985	Passage for electricity lines	Area for roads

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **proposed pipeline.**

According to the Hadera outline plan (deposited), the pipeline route passes through the area of a national park, public open space, residential area, employment area, public educational buildings and institutions, and agricultural area.

1.3.2.4.2.2 Pipeline route from Michmoret

A number of zones are in the review area and the alignment area, as detailed below:

a. National outline plans

Infrastructures

NOP 3 –the route passes along an **existing highway** – Road 2, and crosses an **existing main road** – Road 4

NOP 14 – the route crosses a **sand mining site**, Hadera Dunes

NOP 23 – the route of a **railway track planned unit**

NOP 34/b/2/2 – in the area of a **proposed pipeline**

NOP 34/B/5 – in the area of a **drinking water pipe** and in the area of **a planning strip and optional strips for planning a 24" – 107" diameter water pipe**

NOP 37/D – the route overlaps in part to the area of **an existing transmission line**

In addition, the pipeline crosses the area of NIP 31 for Road 2 in the Zichron – Havatzelet section, and NIP 4 to Road 9.

Environment

NOP 8 – in the area of a **proposed national park**, Sharon Park

NOP 22 –**riverbank planting,** Nachal Hadera

NOP 13 – the pipeline route overlaps areas zoned for **public open space and settlement area.**

NOP 35 – the route is in an area of **coastal fabric, urban fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines the route is in an **area of high landscape and environmental sensitivity, and area for conservation of water resources**

b. <u>District outline plans</u>

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area and an urban-coastal development area, urban open space, open space / protected agriculture area, metropolitan / regional park, highway, scenic route, and alternative stream route for examination.** The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of **sensitive drainage strips, and area for conservation of water resources of very high sensitivity,** the route crosses an **existing Hazmat corridor and for examining the feasibility of transfer.** In the survey area there is a mine, a 161 kW electricity line, and the route of a national railway line.

c. <u>Approved and deposited detailed plans</u>

According to Figure 1.2.2-c1, the survey area overlaps the following detailed plans:

Table 1.3.2.4.1: Land zoning in detailed plans in the pipeline route to Hadera wastewater treatment facility from Michmoret

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/1420	May 30, 2010	Zoning an area for a national park and nature reserve	Open spaces
NIP 3 6/4	July 10, 2005	Road 9 – transverse road connecting Road 6 to the east with Road 2 to the west, between Hadera and Sharon Park to the north of the road alignment and the settlements of Emek Hefer and Nachal Alexander National Park to the south of the road	Area for roads
HD/1362/A	April 28, 2010	Rehabilitation of mine by burying dry waste	
HD/BM/793A	February 11, 1993	Change in zoning	Residential
HD/905	October 17, 1991	Miscellaneous plans – Givat Olga interchange	Area for roads
HD/1300	November 26, 2009	Business Park – Hadera Forest	Commercial and offices
21/30/2	April 27, 1994	Determining a valid plan for "public housing" for implementing measurements and registration	
HD/763	September 15, 1985	Determining residential areas	Residential
HD/BM/938	April 30, 1994	Constructing a water tower and pool for supplying water to Hadera West	Residential
HD/490B	September 26, 1984	Plan for Hillel Yaffe hospital	Public institutions
HD/MK/490C	May 7, 1998	Changing location of private open area and public building area	Public institutions

HD/BM/900	April 30, 1994	Planning and arrangement of a residential neighborhood, public buildings, commerce, and future planning area	Residential
25/30/2	May 13, 1997	Determining a valid plan for "public housing" for implementing measurements and registration in land registers	Residential
C/400	January 10, 1993	Galilee Outline Plan	Agricultural area
MSH/26	October 17, 1985	Kibbutz Gan Shmuel land arrangement plan	Agricultural area
C/842 A	July 18, 1985	Passage for electricity lines	Area for roads

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **proposed pipeline.**

According to the Hadera outline plan (deposited), the pipeline route passes through an area of rural accommodation, forest, national park, public open space, residential area, employment area, public educational buildings and institutions, and agricultural area.

1.3.2.4.2.3 Pipeline route from Nachal Alexander

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – the route passes along an existing highway – Road 2, and crosses an existing main road – Road 4

NOP 14 – the route crosses sand mining sites, Michmoret and Hadera Dunes

NOP 23 – the route is parallel to a planned multi-track railway line and railway track planned unit. This track is also included in NIP 18 – for electrification of the track.

NOP 34/B/5 – in the area of a **drinking water pipe** and in the area of **a planning strip and optional strips for planning a 24" – 107" diameter water pipe**

NOP 37/D – the route overlaps in part to the area of an existing transmission line

In addition, the pipeline crosses the area of NIP 31 for Road 2 in the Zichron – Havatzelet section, and NIP 4 to Road 9.

Environment

NOP 8 – in the area of a proposed national park, Sharon Park

NOP 22 – riverbank planting, Nachal Hadera

NOP 13 – the pipeline route overlaps areas zoned for public open space and settlement area.

NOP 35 – the route is in an area of coastal fabric, urban fabric and integrated conservation fabric. The route partly overlaps a scenic complex and reserves and parks area. According to the environmental guidelines the route is in an area of high landscape and environmental sensitivity, and area for conservation of water resources

b. <u>District outline plans</u>

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area and an urban-coastal development area, urban open space, open space / protected agriculture area, metropolitan / regional park, highway, scenic route, national park, and alternative stream route for examination.** The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of **sensitive drainage strips, and area for conservation of water resources of very high sensitivity,** the route crosses an **existing Hazmat corridor and for examining the feasibility of transfer.** In the survey area there is a mining site, a 161 kW electricity line, and the route of a national railway line.

DOP 3/21 – according to the zoning diagram the route crosses an area of **landscape reserve, a stream and environs area, national park, agricultural /open rural landscape area, forest, and employment area.** Also, **a highway, suburban highway, and railway line.**

c. <u>Approved and deposited detailed plans</u>

According to the data layer of detailed plans provided by the Israel Lands Administration, the survey area overlaps the following detailed plans:

Table 1.3.2.4.2: Land zoning in detailed plans in the pipeline route to Hadera wastewater treatment facility from Nachal Alexander

Plan no.	Validity (date)	Purpose of the plan	Main zoning
IH/91/3	May 17, 1998	Plan to develop Nachal Alexander National Park	Open spaces
IH/91	November 19, 1970	Zoning land for Nachal Alexander National Park	Open spaces
MSM/16/IH	May 11, 1987	Detailed plan for Michmoret registration	Residential
MSM/7/IH	May 11, 1987	Detailed plan for registration of Kfar Vitkin and environs	Agricultural and grazing area
NIP 3 6/4	July 10, 2005	Road 9 – transverse road connecting Road 6 to the east with Road 2 to the west, between Hadera and Sharon Park to the north of the road alignment and the settlements of Emek Hefer and Nachal Alexander National Park to the south of the road	Area for roads
HD/1362/A	April 28, 2010	Rehabilitation of mine by burying dry waste	
HD/BM/793A	February 11, 1993	Change in zoning	Residential
HD/905	October 17, 1991	Miscellaneous plans – Givat Olga interchange	Area for roads
HD/1300	November 26, 2009	Business Park – Hadera Forest	Commercial and offices
21/30/2	April 27, 1994	Determining a valid plan for "public housing" for implementing measurements and registration	
HD/763	September 15, 1985	Determining residential areas	Residential
HD/BM/938	April 30, 1994	Constructing a water tower and pool for supplying water to Hadera West	Residential

HD/490B	September 26, 1984	Plan for Hillel Yaffe hospital	Public institutions
HD/MK/490C	May 7, 1998	Changing location of private open area and public building area	Public institutions
HD/BM/900	April 30, 1994	Planning and arrangement of a residential neighborhood, public buildings, commerce, and future planning area	Residential
25/30/2	May 13, 1997	Determining a valid plan for "public housing" for implementing measurements and registration in land registers	Residential
C/400	January 10, 1993	Galilee Outline Plan	Agricultural area
MSH/26	October 17, 1985	Kibbutz Gan Shmuel land arrangement plan	Agricultural area
C/842 A	July 18, 1985	Passage for electricity lines	Area for roads
IH/122	August 16, 1979	Zoning public areas for Kfar Vitkin – Hofit	Agricultural and grazing area

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **proposed pipeline.**

According to deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an area for conservation of nature and landscape values, a national park, a site of values for conservation and cultivation, and a strip and extensive area of agriculture, leisure and recreation. According to the Hadera outline plan (deposited), the pipeline route passes through an area of forest, national park, public open space, residential area, employment area, public educational buildings and institutions, and agricultural area.

1.3.2.4.3 Treatment facility

a. National outline plans

Infrastructures

NOP 3 – the exploration area is between Road 4, defined as a **highway**, to the west, and Road 65, defined as a **main road,** to the north. The alternative is at a distance of around 150 m from Road 65.

NOP 10 – a passage is marked for main electricity lines, and areas for main electricity lines to the north and west of the alternative, parallel to Road 65 and Road 652.

NOP 23 – a planned multi-track railway line is marked in the eastern part of the exploration area, and to the east of its an existing track is marked. The eastern track, included in NIP 22, is marked at a distance of some 550 m to the east of the exploration area of the alternative. Level separation in NIP 25/20 is located at a distance of 370 m to the east of the area.

NOP 34/B/5 – in the exploration area is an **existing main pumping station and planning strip and a water pipe with a diameter of 24" – 107"** in the survey area.

NOP 37 – an approved offshore strip (according to NOP 37 A/2) passes to the west of the alternative and at a distance of some 9 km. An onshore strip connecting the offshore transmission system to American Paper Mills according to NOP 37 D and NOP 37 D/1 passes close to the area. The approved onshore strip (NOP 37 B/8), which represents the main corridor passing to the east of the proposed site and at a distance of 10 km from it.

*A desalination plant proposed in the framework of **NOP 34/B/2/2** is situated next to the exploration area, see details in the section on conceptual plans, master plans, and plans in preparation.

Environment

There is no zoning for national parks, nature reserves and forest and afforestation in the exploration area.

NOP 35 – according to the fabric scheme of the NOP, the north-eastern section of the alternative is located in an area of **combined conservation fabric, and the south-western section is in an area of urban fabric**. Within the area a **railway line** is marked, and to the north of it a **main electricity line** passes. Another **railway line** passes through the western section of the area. In the diagram of environmental guidelines, it appears that the site area and its surroundings are in an area of **high landscape and environmental sensitivity and area for conservation of water resources**.

b. <u>District outline plans</u>

DOP 6–the eastern part of the area is in an area defined as **metropolitan / regional park**, and the western part is in an area defined as **special industrial area, attached to an engineering facility**.

The infrastructures diagram of DOP 6 shows the following: on the border of the exploration area **a 161 kW electricity line and an approved substation** are marked. A 400 kW electricity line passes to the north of the alternative along Road 65. An approved Hazmat line passes to the west of the exploration area along Road 4.

The environmental guidelines diagram of DOP 6 shows that the proposed site is adjacent to **a proposed wastewater treatment facility**, adjacent to **a strip sensitive to drainage of Nachal Hadera, and a conservation area for water resources of very high sensitivity.** In addition, in and around the area of the alternative there are **water bores**, which are to the south of an impounding and injection area.

c. Approved and deposited plans

The land zoning in approved and deposited plans is detailed in Table 1.2.2.4.3 below. The plans detailed and presented in the diagram are located in the exploration area and its immediate surroundings up to approximately 1000 m from the borders of the exploration area.

Table 1.3.2.4.3: Land zoning in detailed plans for the Hadera wastewater treatment facility alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
NIP 20		Power station (American Paper Mill), industrial area		Borders on the alternative to the south-west
HD/MK/812		Industrial area, storage and commercial services area and area for public buildings. In the industrial area there are permitted uses for factories, storage and cooling areas, office buildings and commercial services related directly to the place, function halls, restaurants, discotheques, public institutions to serve people working in the area and schools connected to the area, engineering facilities and more. In the storage and commercial services area there are permitted commercial uses connected to the nature of the area. In the public building area construction of daycare centers is permitted	Industrial area	Borders to the west
HD/MK/812D	Validity published in Gazette May 7, 1998	Change to building line	Industry and workshops	Approx. 300 m from area
HD/MK/1105	Validity published in Gazette July 26, 1999	Change to building line	Industry and workshops	
HD/MK/812D	Validity published in Gazette June 11, 2002	Change to building line	Industry	Approx. 300 m from area
HD/MK/812F	Validity published in Gazette May 7, 1998	Change to building line	Industry and workshops	Approx. 600 m to the west

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
HD/MK/812G	Validity published in Gazette May 7, 1998	Change to building line	Industry and workshops	Borders on the area to the west
HD/659	Validity published in Gazette July 26, 1999	Change to building line	Industry and workshops	Approx. 800 m to the west
HD/BM/900	Validity published in Gazette April 30, 1994	Planning and arrangement of residential neighborhood	Residential	650 m and more to the south-west
HD/248D	Validity published in Gazette January 5, 1986	Industrial area	Industry and workshops	Approx. 400 m to the south
HD/991	Validity published in Gazette March 21, 2002	Construction of 125 housing units	Residential	Approx. 800 m to the south
HD/848	Validity published in Gazette July 21, 1994	Determining housing areas	Residential	Approx. 800 m to the south-east
HD/699	Validity published in Gazette November 20, 1980	Determining housing areas	Residential	Approx. 800 m to the south-east
HD/808	Validity published in Gazette January 31, 1991	Determining housing areas	Residential	Approx. 900 m to the south
MSH/26	Validity published in Gazette October 17, 1985	Kibbutz Gan Shmuel land arrangement plan	Agricultural area	The entire area of the alternative in the eastern section
C/400	Validity published in Gazette	Galilee Outline Plan	Agricultural area	Borders on the alternative to the north

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
	January 10, 1993			
C/C/1121/HD/ 1330/M/348	Validity published in Gazette June 23, 2008	Water pipeline corridor	Water pipes	Approx. 150 m to the north of the area
C/845B	Validity published in Gazette May 3, 1998	Railway line plan	Railway line	Approx. 150 m to the north
HPAG/1342	Validity published in Gazette March 7, 2010	Plan for filling station and auxiliary uses	Filling station	Approx. 330 m to the north
C/842A	Validity published in Gazette July 18, 1985	Passage for electricity lines	Area for roads	Approx. 800 m and more

d. Conceptual plans, master plans and plans in preparation

Plan for desalination plant – NOP 34/B/2/2 – the purpose of the plan is to construct a desalination plant for the Palestinian Authority. The route of the proposed pipeline passes through the eastern section of the exploration area of the alternative. The proposed facility is located adjacent to the exploration area at a distance of 80 m to the south-east.

Hadera Outline Plan – HD/2020. The northern area of the alternative is outside the plan area (other than a very limited area bordering on the stream). The southern area is within the area intended for industry in the plan, and adjacent to an engineering facility (Hadera Wastewater Treatment Facility) and to the gas facility. The western section borders on the Nachal Hadera strip.

Hadera Park plan – a plan that mainly zones areas for commerce, sport and recreation, and in the northern section also for agriculture. The plan is located outside the exploration areas of the site, and at a considerable distance from their borders.

1.3.2.4.4 Pipeline route from the treatment facility

1.3.2.4.4.1 Northern alternative

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – the route crosses an **existing main road** – Road 65, and **an existing and proposed regional road** – Roads 574/6403. The alignment ends next to Road 6.

NOP 10 – 400 and 161 kW **ultra-high voltage lines.**

NOP 23 – the route of a **single existing and planned** railway line.

NOP 34/B/5 – in the area of a **drinking water pipe, planned main pumping station**, and in the area of a **planning strip and optional strip for planning a water pipe with a diameter of 24" – 107".**

NOP 37B – the route connects at its eastern end to the approved transmission route.

In addition, the route is within the area of NIP 38 for upgrading Road 65.

Environment

National parks and nature reserves – a declared nature reserve, Givat Hakalaniot, is in the survey area.

NOP 22 – Nachal Hadera **riverbank planting.** In the survey area, at the eastern end, is an **existing planted forest**, Metzer Forest.

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric.** It crosses a regional road, Road 650. According to the environmental guidelines diagram, the route is in an **area of high landscape and environmental sensitivity, and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, most of the route is in an area of **agricultural / open rural landscape** in which engineering infrastructure that is adapted in terms of landscape will be permitted, and also in the area of the following zones: **metropolitan / regional park, forestry and afforestation, open / protected agriculture area, approved400 kW electricity line and corridor, national railway line and for examining route, main road, national park, and**

open rural area. The infrastructures diagram of the environmental guidelines of DOP 6 shows that the proposed route is in an area of **sensitive drainage strips of Nachal Hadera, an area for conservation of water resources of very high sensitivity, and an approved strip for consolidating infrastructures**, and crosses a **national water pipe, and 161 kW ultra-high voltage line – existing and for cancellation / moving / burying.** In addition, in and around the area of the alternative are **water bores with protective radiuses A and B.** The alternative ends at a **natural gas transmission system** in the east.

c. <u>Approved and deposited detailed plans</u>

According to the data layer for approved and deposited detailed plans received from the Israel Lands Administration, the survey area overlaps the plans detailed below:

Table 1.3.2.4.3.1: Land zoning in detailed plans in the pipeline route from Hadera Wastewater Treatment Facility , northern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/1020	November 11, 1998	Building an intersection on Road 65 for Hadera East	Area for roads
MSH/26	October 17, 1985	Kibbutz Gan Shmuel land arrangement plan	Agricultural area
C/1311/HD/ 1330/M/348	June 23, 2008	Determining a strip for the passage of water pipes	Engineering facilities
C/400	January 10, 1993	Galilee Outline Plan	Agricultural area
S/364	November 3, 1987	Change in the zoning from agricultural to orchard automation services	Industry and workshops
MSH/25	December 5, 1985	Registration of lands, Talmei Elazar	Agricultural and grazing area
MSH/44	April 17, 1997	Registration of lands, Pardes Hanna agricultural school	Agricultural and grazing area
M/83A	May 28, 1998	Change to outline plan for Gan Hashomron	Residential
MSH/32	March 31, 1986	Registration of lands, Ein Shemer and environs	Agricultural and grazing area
M/241	July 27, 1997	Determining the site of the government hospital at Sha'ar Menashe	Institutions
MSH/30	October 25, 1987	Registering lands and determining the zoning for Kibbutz Ma'anit and environs	Agricultural and grazing area
M/167	October 20, 1994	Zoning an area for a nature reserve	Open spaces
MSH/31	March 31, 1987	Registering lands of Kibbutz Metzer and determining zoning	Residential

d. Conceptual plans, master plans and plans in preparation

According to the outline plan for Pardes Hanna, Karkur and Hadera, the pipeline route passes through an agricultural area, an area of special instructions at Nachal Hadera, and a public open space.

1.3.2.4.4.2 Southern alternative

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – the route crosses an **existing main road** – Road 65, **an existing and proposed regional road** – Road 574 and Road 444 respectively, and highway – Road 6.

NOP 10 – 400 and 161 kW ultra-high voltage lines.

NOP 23 – the route of a single existing and planned railway line.

NOP 34/B/5 – in the area of a **drinking water pipe, planned main pumping station**, and in the area of a **strip for planning a water pipe with a diameter of 24" – 107".**

NOP 37B – the route connects at its eastern end to the approved transmission route.

In addition, the route is within the area of NIP 38 for upgrading Road 65 and NIP 22 for the eastern railway track.

Environment

National parks and nature reserves – a declared nature reserve, Givat Hakalaniot, is in the survey area.

NOP 22 – Nachal Hadera **riverbank planting.** In the survey area, at the eastern end is an **existing planted forest**, Metzer Forest.

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric.** It crosses a regional road, Road 650. According to the environmental guidelines diagram, the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, most of the route is in an area of **agricultural / open rural landscape and open / protected agriculture area** in

which engineering infrastructure that is adapted in terms of landscape will be permitted. It is also in the area of the following zones: **metropolitan / regional park, forestry and afforestation, approved400 kW electricity line and corridor, national railway line and for examining route, main road, national park, and open rural area, transport center.** The environmental guidelines diagram of DOP 6 shows that the proposed route is in an area of **sensitive drainage strips of Nachal Hadera, an area for conservation of water resources of very high sensitivity, and an approved strip for consolidating infrastructures**, and crosses a **national water pipe, and 161 kW ultra-high voltage line – existing and for cancellation / moving / burying.** In addition, in and around the area of the alternative are **water bores.** The alternative ends at a **natural gas transmission system** in the east.

c. Approved and deposited detailed plans

According to the data layer from the Israel Lands Administration given to the planning team, the survey area overlaps the plans detailed below:

Table 1.3.2.4.4: Land zoning in detailed plans in the pipeline route from Hadera Wastewater Treatment Facility , southern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/1020	November 11, 1998	Building an intersection on Road 65 for Hadera East	Area for roads
HD/654A	July 24, 1980	Allocation of land, change in zoning from agricultural to packing house	Agricultural and grazing area
M/88	February 21, 1991	Zoning an area for industry	Industry and workshops
MSH/26	October 17, 1985	Kibbutz Gan Shmuel land arrangement plan	Agricultural area
C/1311/HD/ 1330/M/348	June 23, 2008	Determining a strip for the passage of water pipes	Engineering facilities
MSH/25	December 5, 1985	Registration of lands, Talmei Elazar	Agricultural and grazing area
MSH/32	March 31, 1986	Registration of lands, Ein Shemer and environs	Agricultural and grazing area
M/193A/BM	November 15, 1992	Maor expansion	Residential
MSH/30	October 25, 1987	Registering lands and determining the zoning for Kibbutz Ma'anit and environs	Agricultural and grazing area
MSH/31	March 31, 1987	Registering lands of Kibbutz Metzer and determining zoning	Residential

d. Conceptual plans, master plans and plans in preparation

According to the Hadera outline plan (deposited), the pipeline route passes through an agricultural area, an area of special instructions at Nachal Hadera, Zeta nature reserve, and a public open space.

1.3.2.5 Meretz Wastewater Treatment Facility

1.3.2.5.1 Landfall crossing array

See Section 1.2.2.4.1 above

1.3.2.5.1.1 Neurim alternative

a. National outline plans

Infrastructures

There are no areas zoned for infrastructure in national outline plans at the landfall crossing point.

Environment

National parks and nature reserves – according to NOP 8 there is a **proposed national park** – Hof Neurim – in the survey area.

NOP 13 – the plan overlaps the following zones: **bathing beach, area for public institutions, and valid national park.**

NOP 35 – the fabrics diagram shows that the plan overlaps the following zones: **coastal fabric** – intended to preserve the open beaches and rural-coastal hinterland. Intended to remain largely open so as to guarantee public access to the beach and passage along it. Planning and development of the fabric will relate in terms of view and function to the sea, the shore, and the open hinterland, and will ensure limited and cautious integration in the values of the fabric. Also **an area of nature reserves and parks.** According to the environmental guidelines diagram, the area overlaps an area of **high landscape and environmental sensitivity and area for conservation of water resources**

b. <u>District outline plans</u>

DOP 3/21 – according to the zoning diagram, the landfall crossing array is in the area of a **bathing beach, national park, and institution.**

c. <u>Approved and deposited detailed plans</u>

In the area of the landfall crossing, overlaps plan IH/54/1, published for validation on June 26, 1969, for planning an educational and vocational institution at Neurim, with main zoning for institutions.

d. <u>Conceptual plans, master plans and plans in preparation</u>

Based on the national GIS layer and information given to the planning team, there are no plans in stages of preparation and/or master plans in and around the area of the alternative.

1.3.2.5.2 Pipeline route to the treatment facility

1.3.2.5.2.1 Pipeline route from Hadera

1.3.2.5.2.1.1 Northern alternative

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – **existing highway** – Road 2, **existing main road** – Road 4. In addition: the route runs along a **proposed highway** – Road 9, and crosses an existing regional road – Road 581.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 14 – the route crosses two **sand mining sites**, Hadera Dunes and Michmoret

NOP 23 – the pipeline route accompanies and crosses the route of **single existing and planned railway line** and a **planned multi-track railway line** also included in NIP 18 for electrification of the track.

NOP 34/B/5 – in the area of a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe**

In addition, the pipeline crosses the area of NIP 31 for Road 2 in the Zichron – Havatzelet section, and NIP 4 for Road 9.

Environment

NOP 8 – the route passes through the area of a **proposed national park** – Sharon and Michmoret Park, and the area of **a proposed forest pond nature reserve.** The southern route passes through a **declared national park** – Nachal Alexander.

NOP 22 – in the area of **coastal park forest and natural forest for conservation**.

NOP 13 – the pipeline route overlaps areas zoned for **public open space and settlement area.**

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric**. The survey area partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources.**

b. <u>District outline plans</u>

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area and an urban-coastal development area, urban open space, agricultural area / open rural landscape, open space / protected agriculture area, national park, highway, scenic route, and commemoration site** in the more southerly route – Road 9**.** The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of **mining sites**. The route crosses an existing **Hazmat corridor and for examining the feasibility of transfer**, a **161 kW ultra-high voltage line**, and the route of a **national railway line**.

DOP 3/21 – according to the zoning diagram the route passes through a **river and environs area, agricultural area / open rural landscape**. The more southerly alternative close to the route of Road 9 is in the review area in a forest. The infrastructures diagram shows that the route passes through **an area for identifying treated effluent reservoirs.**

c. <u>Approved and deposited detailed plans</u>

According to the data layer from the Israel Lands Administration given to the planning team, the survey area overlaps the following detailed plans:

Table 1.3.2.5.1: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Hadera, northern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/MK/920B	January 12, 1999	Increasing public areas	Public institutions
NIP 3 6/4	July 10, 2005	Road 9 – transverse road connecting Road 6 to the east with Road 2 to the west, between Hadera and Sharon Park to the north of the road alignment and the settlements of Emek Hefer and Nachal Alexander National Park to the south of the road	Area for roads
HD/1362/A	April 28, 2010	Rehabilitation of mine by burying dry waste	
HD/BM/793A	February 11, 1993	Change in zoning	Residential
HD/1061	April 5, 1998	Planning a residential neighborhood to the south of Givat Olga	Residential
HD/905	October 17, 1991	Miscellaneous plans – Givat Olga interchange	Area for roads
HD/1300	November 26, 2009	Business Park – Hadera Forest	Commercial and offices
21/30/2	April 27, 1994	Determining a valid plan for "public housing" for implementing measurements and registration	
HD/763	September 15, 1985	Determining residential areas	Residential
HD/BM/938	April 30, 1994	Constructing a water tower and pool for supplying water to Hadera West	Residential
HD/490B	September 26, 1984	Plan for Hillel Yaffe hospital	Public institutions

HD/MK/490C	May 7, 1998	Changing location of private open area and public building area	Public institutions
HD/BM/900	April 30, 1994	Planning and arrangement of a residential neighborhood, public buildings, commerce, and future planning area	Residential
HD/811*	January 31, 1991	Determining a residential area near the Kfar Brandeis neighborhood of Hadera	Residential
HD/1157*	December 25, 2008	Precision and zoning of forest sites	Open areas
HD/1082*	July 23, 1998	Constructing a filling station with roadside services and a commercial area	Area for roads
MSH/12/IH	November 20, 1986	Registering lands for Kibbutz Givat Haim and the surrounding area	Agricultural and grazing land
IH/75	January 17, 1963	Planting orchards, cancelling and opening roads	Agricultural and grazing land
MSM/11/IH	December 18, 1986	Registering and zoning lands for Ein Horesh and surrounding area	Agricultural and grazing land

* On the northern alignment to Hadera Forest Pond

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **proposed pipeline.**

According to the Hadera outline plan, the pipeline route passes through the area of a forest, national park, public open space, residential area, employment area, public health buildings and institutions, nature reserve, and agricultural area. According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an extensive agriculture, leisure and recreation area.

1.3.2.5.2.1.2 Southern alternative

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – **existing highway** – Road 2, **existing main road** – Road 4, and **proposed highway**.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 14 – the route crosses two **sand mining sites**, Hadera Dunes and Michmoret

NOP 23 – the pipeline route accompanies and crosses a **planned multi-track railway line** and the route of **single existing and planned railway line,** also included in NIP 18 for electrification of the track. In the framework of the NIP, a railway transformer station is planned in the survey area.

NOP 34/B/5 – in the area of a **drinking water pipeline** and in the area of a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe.**

In addition, the pipeline crosses the area of NIP 31 for Road 2 in the Zichron – Havatzelet section, and NIP 4 for Road 9.

Environment

NOP 8 – the route passes through the area of a **proposed national park** – Sharon and Michmoret Park, and the area of **a proposed forest pond nature reserve.** The southern route passes through a **declared national park** – Nachal Alexander.

NOP 22 – in the area of **coastal park forest and natural forest for conservation**.

NOP 13 – the pipeline route overlaps areas zoned for **public open space and settlement area.**

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources**

b. <u>District outline plans</u>

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area and an urban-coastal development area, urban open space, national park, highway.** The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of **mining**

sites. The route crosses an existing **Hazmat corridor and for examining the feasibility of transfer**, and the route of a **national railway line**.

DOP 3/21 – according to the zoning diagram the route passes through a **river and environs area, agricultural area / open rural landscape**, and a **forest area**. In the review area there is also an open rural area. The infrastructures diagram shows that the route crosses **a site of water impounding, injection, and utilization of surface water**, two **161 kW ultra-high voltage lines, a scenic route, and a railway line.**

c. Approved and deposited detailed plans

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the detailed plans in the table below:

Table 1.3.2.5.2: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Nachal Hadera, southern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/MK/920B	January 12, 1999	Increasing public areas	Public institutions
NIP 3 6/4	July 10, 2005	Road 9 – transverse road connecting Road 6 to the east with Road 2 to the west, between Hadera and Sharon Park to the north of the road alignment and the settlements of Emek Hefer and Nachal Alexander National Park to the south of the road	Area for roads
HD/1362/A	April 28, 2010	Rehabilitation of mine by burying dry waste	
HD/BM/793A	February 11, 1993	Change in zoning	Residential
HD/1061	April 5, 1998	Planning a residential neighborhood to the south of Givat Olga	Residential
HD/905	October 17, 1991	Miscellaneous plans – Givat Olga interchange	Area for roads
HD/1300	November 26, 2009	Business Park – Hadera Forest	Commercial and offices
21/30/2	April 27, 1994	Determining a valid plan for "public housing" for implementing measurements and registration	
HD/763	September 15, 1985	Determining residential areas	Residential
HD/BM/938	April 30, 1994	Constructing a water tower and pool for supplying water to Hadera West	Residential
HD/490B	September 26, 1984	Plan for Hillel Yaffe hospital	Public institutions

HD/MK/490C	May 7, 1998	Changing location of private open area and public building area	Public institutions
HD/BM/900	April 30, 1994	Planning and arrangement of a residential neighborhood, public buildings, commerce, and future planning area	Residential
IH/91	November 19, 1970	Zoning an area for Nachal Alexander National Park	Open spaces
MSH/16/IH	May 11, 1987	Michmoret detailed plan for registration purposes	Residential
MSM/7/IH	May 11, 1987	Kfar Vitkin and environs detailed plan for registration purposes	Agricultural and grazing area
MSM/6/IH	November 20, 1986	Kibbutz Ha'ogen and environs land registration and zoning	Agricultural and grazing area
MSM/14/IH	November 20, 1986	Kfar Hogla land registration and zoning	Agricultural and grazing area
MSM/13/IH	November 20, 1986	Kibbutz Givat Haim Meuchad and registration in zoning	Agricultural and grazing area
MSM/11/IH	December 18, 1986	Ein Horesh and environs land registration and zoning	Agricultural and grazing area

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **a reservoir and proposed pipeline.**

According to the Hadera outline plan, the pipeline route passes through the area of a forest, national park, public open space, residential area, employment area, public health buildings and institutions. According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an area for conservation of nature and landscape resources, national park, extensive agriculture, leisure and recreation area and strip, and area of agriculture, public institutions, and intensive leisure and recreation.

1.3.2.5.2.2 Pipeline route from Michmoret

1.3.2.5.2.2.1 Northern alternative (Road 9)

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – **existing highway** – Road 2, **existing main road** – Road 4. In addition: the route runs along a **proposed highway** – Road 9, and crosses an existing regional road – Road 581.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 14 – the route crosses a **sand mining site**, Michmoret, in the sub-alternative of the southern route.

NOP 23 – the pipeline route accompanies and crosses a **planned multi-track railway line** and the route of **a single existing railway line,** which is included in NIP 18 for electrification of the track.

NOP 34/B/5 – in the area of a **water pool with a volume of over 5,000 m³ – planned**, and in the area of a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe.**

In addition, the pipeline crosses the area of NIP 4 for Road 9.

Environment

NOP 8 – the route passes through the area of a **declared and proposed national**, and the area of **a proposed forest pond nature reserve.**

NOP 22 – in the area of **coastal park forest**, and in the northern sub-alternative also the area of **natural forest for conservation**.

NOP 13 – the pipeline route overlaps areas zoned for **tourism and recreation, public open space, valid national park, and agricultural area.**

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources.**

b. District outline plans

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area, agricultural area / open rural landscape, open space / protected agriculture area, national park, highway, scenic route, and commemoration site** in the more southerly sub-route – Road 9**.**

The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of a **mining site** in the southern sub-route. The route crosses an existing **Hazmat corridor and for examining the feasibility of transfer**, a **161 kW ultra-high voltage line**, and the route of a **national railway line**.

DOP 3/21 – according to the zoning diagram the route passes through a **river and environs area, and agricultural area / open rural landscape**. The more southerly sub-alternative close to the route of Road 9 also overlaps a landscape reserve and forest area. The infrastructures diagram shows that the route passes through **an area for identifying treated effluent reservoirs.**

c. Approved and deposited detailed plans

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the detailed plans in the table below:

Table 1.3.2.5.3: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Michmoret, northern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
HD/1020	November 11, 1998	Building an interchange for Road 65 in Hadera East	Area for roads
NIP 3 6/4	July 10, 2005	Road 9 – transverse road connecting Road 6 to the east with Road 2 to the west, between Hadera and Sharon Park to the north of the road alignment and the settlements of Emek Hefer and Nachal Alexander National Park to the south of the road	Area for roads
HD/811*	January 31, 1991	Determining a residential area near the Kfar Brandeis neighborhood of Hadera	Residential
HD/1157*	December 25, 2008	Precision and zoning of forest sites	Open areas
HD/1082*	July 23, 1998	Constructing a filling station with roadside services and a commercial area	Area for roads
MSH/12/IH	November 20, 1986	Registering lands for Kibbutz Givat Haim and the surrounding area	Agricultural and grazing land
IH/75	January 17, 1963	Planting orchards, cancelling and opening roads	Agricultural and grazing land
MSM/11/IH	December 18, 1986	Registering and zoning lands for Ein Horesh and surrounding area	Agricultural and grazing land

* On the northern alignment to Hadera Forest Pond

d. <u>Conceptual plans, master plans and plans in preparation</u>

NOP 34/B/2/2 – in the area of **proposed pipeline.**

According to the Hadera outline plan, the pipeline route passes through the area of a forest, national park, rural accommodations, residential area, public open space, nature reserve, and agricultural area. According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an extensive agriculture, leisure and recreation area.

1.3.2.5.2.2.2 Southern alternative

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – **existing highway** – Road 2, **existing main road** – Road 4, and **proposed highway**.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 14 – the route crosses a **sand mining site**, Michmoret

NOP 23 – the pipeline route accompanies and crosses a **planned multi-track railway line and route of single existing and planned railway line,** included in NIP 18 for electrification of the track. In the framework of the NIP, a railway transformer station is planned in the survey area.

NOP 34/B/5 – in the area of a **water pool with a volume of 5,000 m³ – planned**, and in the area of a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe.**

In addition, the pipeline crosses the area of NIP 4 for Road 9.

Environment

NOP 8 – the route passes through the area of a **proposed national park** – Sharon and Michmoret Park, and a **declared national park** – Nachal Alexander.

NOP 22 – in the area of **coastal park forest and natural forest for conservation**.

NOP 13 – the pipeline route overlaps areas zoned for **tourism and recreation, public open space, valid national park, and agricultural area.**

NOP 35 – the route is in an area of **urban fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources**

b. District outline plans

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, open space / protected agriculture, national park, and highway.**

The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in an area of a **mining site**. The route crosses an existing **Hazmat corridor and for examining the feasibility of transfer**, and the route of a **national railway line**.

DOP 3/21 – according to the zoning diagram the route passes through a **river and environs area**. In addition, the route passes through an area of **national park, forest, an industry, workshops and employment area, open rural area, and agricultural area / rural open landscape.** The infrastructures diagram shows that the route passes through an **area for location of treated effluent reservoirs** and crosses **161 kW ultra-high voltage lines.**

c. Approved and deposited detailed plans

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the detailed plans in the table below:

Table 1.3.2.5.4: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Michmoret, southern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
IH/91/3	May 17, 1998	Plan for developing the area of Nachal Alexander national park	Open space
IH/91	November 19, 1970	Zoning an area for Nachal Alexander National Park	Open spaces
MSH/16/IH	May 11, 1987	Michmoret detailed plan for registration purposes	Residential
IH/122	August 16, 1979	Zoning public areas for Kfar Vitkin – Hofit	Agricultural and grazing area
MSM/7/IH	May 11, 1987	Kfar Vitkin and environs detailed plan for registration purposes	Agricultural and grazing area
MSM/6/IH	November 20, 1986	Kibbutz Ha'ogen and environs land registration and zoning	Agricultural and grazing area
MSM/14/IH	November 20, 1986	Kfar Hogla land registration and zoning	Agricultural and grazing area
MSM/13/IH	November 20, 1986	Kibbutz Givat Haim Meuchad and registration in zoning	Agricultural and grazing area
MSM/11/IH	December 18, 1986	Ein Horesh and environs land registration and zoning	Agricultural and grazing area

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **a reservoir and proposed pipeline.**

According to the Hadera outline plan, the pipeline route passes through an area of rural accommodations, forest, national park, and public open space. According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an area of national park, an area for conservation of nature and landscape resources, an extensive agriculture, leisure and recreation area and strip, and area of agriculture, public institutions, and intensive leisure and recreation.

1.3.2.5.2.3 Pipeline route from Nachal Alexander

1.3.2.5.2.3.1 Northern alternative

a. National outline plans

Infrastructures

NOP 3 – **existing highway** – Road 2, **existing main road** – Road 4, and crosses an existing highway – Road 20, in place of which the National Planning Committee has decided to expand the existing Road 2. In addition, the route runs along a **proposed highway** – Road 9, and crosses an **existing regional road** – Road 581.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 14 – the route crosses a **sand mining site**.

NOP 23 – the pipeline route accompanies and crosses **a single existing railway line** and a **planned multi-track railway line,** which is included in NIP 18 for electrification of the track.

NOP 34/B/5 – in the area of a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe.**

In addition, the pipeline crosses the area of NIP 4 for Road 9.

Environment

NOP 8 – the route passes through the area of a **declared and proposed national**, and the area of **a proposed forest pond nature reserve.**

NOP 22 – in the area of **coastal park forest**, and in an area of **natural forest for conservation** (in the route to the north of the forest pond).

NOP 13 – the pipeline route overlaps areas zoned for **tourism and recreation, public open space, valid national park, declared nature reserve, and agricultural area.**

NOP 35 – the route is in an area of **coastal fabric, urban fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources.**

b. <u>District outline plans</u>

DOP 6 – according to the zoning diagram, the route crosses an area of **forest and afforestation, an urban development area, agricultural area / open rural landscape, open space / protected agriculture area, national park, highway, scenic route, and commemoration site** in the more southerly sub-route – Road 9**.** The infrastructures diagram of the environmental guidelines of DOP 6 shows that the plan is in the area of a **161 kW ultra-high voltage line**, and the route of a **national railway line**. In addition, a **mining site** in the route to the south of the

forest pond, an in the area of an existing **Hazmat corridor** in the route to the north of the pond.

DOP 3/21 – according to the zoning diagram the route passes through a **river and environs area, national park, nature reserve, forest, workshops and employment area, and agricultural area / open rural landscape**. The infrastructures diagram shows that the route passes through **an area for locating treated effluent reservoirs.**

c. Approved and deposited detailed plans

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the detailed plans in the table below:

Table 1.3.2.5.5: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Nachal Alexander, northern alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning
IH/91/3	May 17, 1998	Plan for developing the area of Nachal Alexander national park	Open space
IH/91	November 19, 1970	Zoning an area for Nachal Alexander National Park	Open spaces
MSH/16/IH	May 11, 1987	Michmoret detailed plan for registration purposes	Residential
IH/122	August 16, 1979	Zoning public areas for Kfar Vitkin – Hofit	Agricultural and grazing area
MSM/7/IH	May 11, 1987	Kfar Vitkin and environs detailed plan for registration purposes	Agricultural and grazing area
HD/1157*	December 25, 2008	Precision and zoning of forest sites	Open areas
NIP 3 6/4	July 10, 2005	Road 9 – transverse road connecting Road 6 to the east with Road 2 to the west, between Hadera and Sharon Park to the north of the road alignment and the settlements of Emek Hefer and Nachal Alexander National Park to the south of the road	Area for roads
HD/1082*	July 23, 1998	Constructing a filling station with roadside services and a commercial area	Area for roads
HD/811*	January 31, 1991	Determining a residential area near the Kfar Brandeis neighborhood of Hadera	Residential
MSH/12/IH	November 20, 1986	Registering lands for Kibbutz Givat Haim and the surrounding area	Agricultural and grazing land
IH/75	January 17, 1963	Planting orchards, cancelling and opening roads	Agricultural and grazing land

MSM/11/IH	December 18, 1986	Registering and zoning lands for Ein Horesh and surrounding area	Agricultural and grazing land

* On the northern alignment to Hadera Forest Pond

d. Conceptual plans, master plans and plans in preparation

NOP 34/B/2/2 – in the area of **reservoir and proposed pipeline.**

According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an area of national park, an area for conservation of nature and landscape resources, an extensive agriculture, leisure and recreation area and strip, and area of values for conservation and cultivation. According to the Hadera outline plan, the pipeline route passes through an area of forest, national park, public open space, residential area, public open space, nature reserve, and agricultural area.

1.3.2.5.2.3.2 Southern alternative

a. National outline plans

Infrastructures

NOP 3 – the route crosses a **main road**– Road 2 and Road 4, and crosses an existing **highway** – Road 20,in place of which the National Planning Committee has decided to expand the existing Road 2.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 23 – the pipeline route accompanies and crosses a **planned multi-track railway line and route of single existing and planned railway line,** included in NIP 18 for electrification of the track. In the framework of the NIP, a railway transformer station is planned in the survey area.

NOP 34/B/5 – in the area of a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe.**

Environment

NOP 8 – the route passes through the area of a **declared national park** – Nachal Alexander.

NOP 22 –**natural forest for conservation**, on the banks of Nachal Alexander.

NOP 13 – in the area of a **declared nature reserve, bathing beach, and valid national park.**

NOP 35 – the route is in an area of **coastal fabric, urban fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources.**

b. <u>District outline plans</u>

DOP 3/21 – according to the zoning diagram most of the route is in a **river and environs area**. In addition, the route passes through an area of **national park, landscape reserve, open rural area, and agricultural area / rural open landscape.** The infrastructures diagram shows that the route passes through an **area for location of treated effluent reservoirs** and crosses **161 kW ultra-high voltage lines.**

c. <u>Approved and deposited detailed plans</u>

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the detailed plans in the table below:

<u>Table 1.3.2.5.6: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Nachal Alexander, southern alternative</u>

Plan no.	Validity (date)	Purpose of the plan	Main zoning
IH/91/3	May 17, 1998	Plan for developing the area of Nachal Alexander national park	Open space
IH/91	November 19, 1970	Zoning an area for Nachal Alexander National Park	Open spaces
MSH/16/IH	May 11, 1987	Michmoret detailed plan for registration purposes	Residential
IH/122	August 16, 1979	Zoning public areas for Kfar Vitkin – Hofit	Agricultural and grazing area
MSM/7/IH	May 11, 1987	Kfar Vitkin and environs detailed plan for registration purposes	Agricultural and grazing area
MSM/6/IH	November 20, 1986	Kibbutz Ha'ogen and environs land registration and zoning	Agricultural and grazing area
MSM/14/IH	November 20, 1986	Kfar Hogla land registration and zoning	Agricultural and grazing area
MSM/13/IH	November 20, 1986	Kibbutz Givat Haim Meuchad and registration in zoning	Agricultural and grazing area
MSM/11/IH	December 18, 1986	Ein Horesh and environs land registration and zoning	Agricultural and grazing area

d. Conceptual plans, master plans and plans in preparation

According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an area of national park, an area for conservation of nature and landscape resources, an extensive agriculture, leisure and recreation area and strip, a site of values for conservation and cultivation, and area of agriculture, public institutions, and intensive leisure and recreation.

1.3.2.5.2.4 Pipeline route from Neurim

a. National outline plans

Infrastructures

NOP 3 – the route crosses an **existing main road**– Road 2 and Road 4, and crosses an existing **highway** – Road 20, in place of which the National Planning Committee has decided to expand the existing Road 2.

NOP 10 – the route crosses **161 kW ultra-high voltage lines**

NOP 23 – the pipeline route accompanies and crosses a **planned multi-track railway line and route of single existing and planned railway line,** included in NIP 18 for electrification of the track. In the framework of the NIP, a railway transformer station is planned in the survey area.

NOP 34/B/5 – in the area of a **drinking water pipeline** and a **planning strip and an optional strip for planning a 24" – 107" diameter water pipe.**

Environment

NOP 8 – in the area of a **declared national park** – Nachal Alexander, **a proposed national park** – Hof Neurim, and **declared national park** – Bitan Aharon.

NOP 22 –**natural forest for conservation**, on the banks of Nachal Alexander, and **proposed cultivated forest**.

NOP 13 – in an area of **public institutions, bathing beach, and valid national park.**

NOP 35 – the route is in an area of **coastal fabric and integrated conservation fabric**. The route partly overlaps a **scenic complex and reserves and parks area.** According to the environmental guidelines diagram the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources.**

b. <u>District outline plans</u>

DOP 3/21 – according to the zoning diagram most of the route is in a **river and environs area and agricultural area / rural open landscape**. In addition, the route passes through an area of **national park, landscape reserve, bathing beach, and open rural area.** The infrastructures diagram shows that the route passes through **a site of water impounding, injection, and utilization of surface water, a site of impounding and injection of treated effluent, and a wastewater treatment facility,** and crosses **a water pipeline and main treated effluent pipeline.**

c. <u>Approved and deposited detailed plans</u>

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the detailed plans in the table below:

Table1.3.2.5.7: Land zoning in detailed plans in the pipeline route to Meretz wastewater treatment facility from Neurim

Plan no.	Validity (date)	Purpose of the plan	Main zoning
IH/54/1	June 26, 1969	Planning an educational and vocational institute at Neurim	Institutions
IH/141	January 2, 1992	Detailed plan for Moshav Bitan Aharon	Agriculture and grazing area
IH/132	March 25, 1982	Changing zoning in Moshav Herut	Agriculture and grazing area
IH/86	July 28, 1966	Zoning nature reserve	Open spaces
MSM/24/IH	May 11, 1987	Givat Shapira detailed plan for registration and zoning	Agriculture and grazing area
MSM/138/IH	March 22, 1996	Moshav Beit Yanai detailed plan for registration and zoning	Agricultural and grazing area
IH/111	July 11, 1994	Zoning from agricultural area to area for sewage facilities	Engineering facilities
MSM/8/IH	May 11, 1987	Preparing a detailed plan for registration purposes at Kfar Haim	Residential
MSM/4/IH/HZ	November 20, 1986	Registering land and determining the zoning for Kibbutz Ma'abarot, Mishmar Ha'emek and Ha'ogen	Agricultural and grazing area
IH/69/5	March 28, 1994	Changing from agricultural land to residential area at Ma'abarot	Agricultural and grazing area
MSM/7/IH	May 11, 1987	Kfar Vitkin and environs detailed plan for registration purposes	Agricultural and grazing area
MSM/14/IH	November 20, 1986	Kfar Hogla land registration and zoning	Agricultural and grazing area
MSM/13/IH	November 20, 1986	Kibbutz Givat Haim Meuchad and registration in zoning	Agricultural and grazing area

MSM/11/IH	December 18, 1986	Ein Horesh and environs land registration and zoning	Agricultural and grazing area

d. Conceptual plans, master plans and plans in preparation

According to the deposited plan IH/191 for Nachal Alexander, the pipeline route passes through an area for conservation of nature and landscape resources, an extensive agriculture, leisure and recreation area and strip, public institutions, and intensive leisure and recreation.

1.3.2.5.3 Treatment facility

a. National outline plans

NOP 37 – an approved offshore strip in the Ashdod-Dor alignment according to NOP 37 A/2 to the west and at a distance of some 11 km. An approved onshore strip according to NOP 37 B (and NOP 37 B/8) passes to the east of the alternative at a distance of 4.2 km.

Environment

NOP 22 – natural forest for conservation in the survey area.

NOP 35 – according to the fabric scheme of the NOP, the alternative is located in an area of **combined conservation fabric, and an area of landscape complex** in which, according to Section 9.1.3, only purposes for tourism services or infrastructure lines will be approved. From the environmental guidelines diagram it appears that the site area and its surroundings are in an area of **high landscape and environmental sensitivity**.

b. District outline plans

DOP 3/21 – the route is in an area bounded to the north by an area intended for **agriculture and a river area and environs**. Close to the alternative, a wastewater treatment facility is marked. The infrastructures diagram of DOP 3/21 shows the following: in the environs of the alternative **a wastewater treatment** facility is marked, and **a site of impounding and injection of treated effluent, and existing and proposed main treated effluent pipelines.** An area for location of treated wastewater reservoirs is marked to the east of the exploration area. A main / national water pipeline is marked to the south of the area, as well as a number of sites for impounding, utilization and injection of surface water. Road 581 is marked to the north of the alternative.

c. Approved and deposited plans

The land zoning in approved plans is detailed in table 1.2.2.5.3 below. The plans detailed and presented in the diagram are located in the exploration area and its immediate surroundings up to approximately 1000 m from the borders of the exploration area.

Table 1.3.2.5.3: Land zoning in detailed plans for the Hadera wastewater treatment facility alternative

Plan no.	Validity (date)	Purpose of the plan	Main zoning	Location of plan relative to site
IH/74	February 27, 1964	Allocating agricultural area for cultivation and planting and opening an access road to the plots	Agricultural and grazing land	Approx. 780 m north
MSM/11/IH	December 18, 1986	Registering and zoning lands for Ein Horesh and surrounding area. Reallocation of plots and delineation of roads.	Agricultural and grazing land	In the area of the alternative
IH/79	November 12, 1964	Reallocation of plots	Agricultural and grazing land	Approx. 600 m to the north
IH/66/3	April 25, 1969	Change in zoning and allocation	Open spaces	In the area of the alternative
IH/66	April 18, 1963	Delineation of roads and changes in land zoning	Agricultural and grazing land	Approx. 780 m to the north-east
MSM/18/IH	November 20, 1986	Plan for purposes of arrangement and registration of Kibbutz Hama'apil	Agricultural and grazing land	Borders to the south-east
C/400	January 10, 1993	Galilee Outline Plan	Agricultural area	In the northern part of the exploration area
MSM/10/IH	October 25, 1987	Plan for purposes of arrangement and registration of Moshav Beit Halevi	Agricultural and grazing land	Approx. 600 m to the south

d. Conceptual plans, master plans and plans in preparation

According to the deposited plan IH/191 for Nachal Alexander, the exploration area overlaps an extensively distributed agriculture, leisure and recreation area, and a water or treated effluent reservoir. In addition, in the survey area is an area of fishponds, a strip for agriculture, leisure and recreation, and an area for conservation of nature and landscape resources.

1.3.2.5.4 Pipeline route from the treatment facility

The route crosses a number of zones, as detailed below:

a. National outline plans

Infrastructures

NOP 3 – the route passes along an **existing regional road** – Road 568, and crosses an existing regional road, Road 444, and **an existing highway** –Road 6.

NOP 10 – 400 kW ultra-high voltage line.

NOP 23 – the route of a **single existing railway line and planned railway line** as part of NIP 22 for the eastern track.

NOP 34/B/5 – in the survey area there is a **drinking water pipe and 108" pipe.**

NOP 37B – passes along an approved route eastward and connects at its eastern end to the **eastward transmission system**.

Environment – there is no zoning for nature reserves and forests in the area of the alternative.

NOP 35 – the route is in an area of **urban fabric, integrated conservation fabric and landscape complex**. According to the environmental guidelines diagram, the route is in an area of **high landscape and environmental sensitivity, and area for conservation of water resources.**

b. District outline plans

DOP 3/21 – the main part of the route is in an area bounded to the north by an **agriculture /open rural landscape area**. The infrastructures diagram of DOP 3/21 shows the following: the route crosses a **main treated effluent pipeline, optional treated effluent pipeline, main water pipeline, and ultra-high voltage line.**

c. Approved and deposited detailed plans

According to the data layer given to the planning team by the Israel Lands Administration, the survey area overlaps the plans detailed in the table below:

Table 1.3.2.5.4: Land zoning in detailed plans in the pipeline route from Meretz Wastewater Treatment Facility

Plan no.	Validity (date)	Purpose of the plan	Main zoning
MSM/18/IH	November 20, 1986	Registering and zoning Kibbutz Hama'apil lands	Agricultural and grazing area
IH/60	April 26, 1962	Planning for Kibbutz Hama'apil	Residential
MSM/17/IH	January 29, 1989	Determining zoning and areas in Achituv	Agricultural and grazing area
MSM/113IH	April 18, 1990	Registry and zoning lands for Moshav Ometz and environs	Agricultural and grazing area
MH/119	January 5, 2004	Zoning for a regional road connecting segments to Road 6	Agricultural and grazing area
MSM/2	December 24, 1985	Detailed plan for registration and zoning of agricultural lands at Gan Shmuel, Barkai, Lehavot Haviva and Magal	Agricultural and grazing area
MSM/3	March 31, 1986	Detailed plans for registration and zoning lands at Bahan and Magal	Agricultural and grazing area

d. Conceptual plans, master plans and plans in preparation

According to the deposited plan IH/191 for Nachal Alexander the pipeline route passes through an area zoned for fishponds.

1.3.2-a1: Infrastructures

Figure 1.3.2-a2: Environment

Figure 1.3..2-a3: NOP 13

Figure 1.3.2-a4: NOP 35, fabrics scheme

Figure 1.3.2-a5: NOP 35, environment scheme

Figure 1.3.2-b1: DOP 6 and DOP 3/21, zoning

Figure 1.3.2-b2: DOP 6 and DOP 3/21, infrastructures

Figure 1.3.2-b3: DOP 6 and DOP 3/21, environment

Figure 1.3.2-c1: Approved detailed plans

Figure 1.3.2-d1: Conceptual plans, master plans and plans in preparation

1.3 Population Concentration

General – The survey comprises the pipeline sites and coastal entrance array and 600 meters surrounding the exploration area for the onshore treatment facility, under the various alternatives. Different population concentrations were calculated on the basis of information published on the Internet, data published by government ministries, an environmental impact survey for NOP 37/H dated May 2010, and calculations performed by the survey team in regard to the population in accordance with land uses and zoning areas, as specified in the context of the survey of alternatives presented below.

The values on which the calculations of population concentrations in land uses/zoning areas common to all of the alternatives, are detailed below:

Residential – Each residential unit within the survey area was calculated at 3.2 people – according to the data of the Central Bureau of Statistics.

Wastewater Treatment Institute – Approximately 5 permanent employees onsite.

Casual population – National Reserves and Parks – About 50 people per day, on average (regardless of the area of the reserve or the park that overlaps the survey area), assuming about 20,000 visitors per year at each site in accessible areas, and about 10 people per day in less accessible parks and reserves.

Population forecasts:

The demographic forecast for 5 years was based on existing conditions, plus approved and deposited plans applicable to the survey area. Population concentrations in these zoning areas were calculated according to the definitions in the relevant plan instructions. A figure of the approved and deposited plans is presented in Figure 1.2.2-1c.

A 10-year demographic forecast was drawn up on the basis of the 5-year forecast with the addition of plans in preparation – including outline plans and with consideration for development trends and land use density. **It should be emphasized that plans currently under preparation may still undergo changes, *inter alia* due to the plan on which the present survey is based, and may therefore impact and change the forecasts presented below.**

In many cases the forecasts and the evaluations in this section were stringent as regards the calculated and estimated population considerations, in order to evaluate the plan's impact as regards the worst case scenario.

The section "Population Distribution" within the range of 600 meters surrounding the site was drawn up only for the exploration area of the treatment facility, without regard to pipeline arrays and shoreline entry systems.

Dor Array

1.3.1 Dor North

1.3.1.1 Population data – current / planned status

The survey area in this alternative comprises a number of uses and zoning areas as specified below:

Current status

Residential and vulnerable uses – there are no vulnerable and residential uses within the survey area.

Population in industrial and employment areas – 10 employees at the fishery research station at Dor.

Casual population at leisure sites – about 30 dunams of bathing beaches, extensive at Dor and calculated as 10 people per dunam, a total of **300 people. About 10 hikers** per day at the Kurkarei HaCarmel Natural Reserve, about 500 meters to the southwest of the exploration area.

Demographic forecast for 5 years – no change as compared with the current status based on approved and deposited plans within the survey area.

Demographic forecast for 10 years – no change as compared with the current status based on approved and deposited plans and on plans in preparation within the survey area.

Population data are presented in Table 1.3.1.1 below:

Table 1.3.1.1: Population Data at Dor North

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
Coastal entrance array				
Dor	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	-
	C. Casual population	300	300	300
Gas Pipeline leading to the treatment facility				

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
From the Dor Shore	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	-
	C. Casual population	-	-	-
Treatment facility				
Dor North	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	10	10	10
	C. Casual population	10	10	10
Piping leading from the treatment facility				
Gas flow eastwards and to the Hagit Power Station will be carried out through the existing Dor-Hagit pipeline alignment and does not require finding an additional pipeline alignment.				

1.3.1.2 Population distribution

Current status

In this alternative, there is a sparse population surrounding the onshore treatment facility exploration area. There are small population concentrations to the northwest and to the west of the exploration area.

Table 1.3.1.2: Population distribution in rings and sectors at Dor North, current status

Distance from exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	0	0	0	**0**

100-200	0	0	0	0	**0**
200-300	0	0	0	0	**0**
300-400	0	0	0	0	**0**
400-500	0	0	10	0	**10**
500-600	10	0	0	0	**10**

There is no difference between the distribution presented in the current status and the distribution in the demographic forecast for 5/10 years.

1.3.2 Ein Ayala

1.3.2.1 Population data – current / planned status

The survey area in this alternative comprises a number of uses and zoning areas as specified below:

Current status

Residential and vulnerable uses – there are no vulnerable and residential uses within the survey area.

Population in industrial and employment areas – **about 20-30 permanent employees** at a quarry.

Casual population at leisure sites – about 30 dunams of bathing beaches, extensive at Dor and calculated as 10 people per dunam, a total of **300 people. About 10 hikers** per day at the Kurkarei HaCarmel Natural Reserve.

Demographic forecast for 5 years – no change as compared with the current status based on approved and deposited plans within the survey area.

Demographic forecast for 10 years – according to information given the planning team for the Fureidis master plan, an employment area is planned to the north of Fureidis. Planned within the site are a workshop and employment area and multistory buildings, as well as an area for parking trucks, covering a total area of about 50 dunams. On the basis of these data, the density of employed people was estimated at about 60m^2 per employed person. The distance from the exploration area is approximately 550 meters, with an overlap of up to 3 dunams and about 5 **employed people**. About 30 dunams overlap the pipeline survey alignment, with an estimated density of **about 50 employed people**.

The population data are presented in Table 1.3.2.1 below:

Table 1.3.2.1: Population data at Ein Ayala, current status

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
Coastal entrance array				
Dor	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	-
	C. Casual population	300	300	300
Gas pipeline leading to the treatment facility				
From the Dor Shore	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	55
	C. Casual population	10	10	10
Treatment facility				
Dor North	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	30	30	80
	C. Casual population	-	-	5
Piping leading from the treatment facility				
Gas flow eastwards and to the Hagit Power Station will be carried out through the existing Dor-Hagit pipeline alignment and does not require finding an additional pipeline alignment.				

1.3.2.2 Population distribution

Current status

In this alternative, there is a sparse population surrounding the onshore treatment facility exploration area. It should be noted that in the event that this alternative is selected, quarrying work at the site will be terminated.

Within the exploration area, there is an existing quarry employing 20-30 permanent employees and they are not included in the examination of the population distribution surrounding the facility.

Table 1.3.2.2: Population distribution in rings and sectors at Ein Ayala, current status

Distance from Exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	0	0	0	**0**
100-200	0	0	0	0	**0**
200-300	0	0	0	0	**0**
300-400	0	0	0	0	**0**
400-500	0	0	0	0	**0**
500-600	0	0	0	0	**0**

There is no change in the forecast for 5 years as compared with the current status. The following is the demographic forecast for 10 years:

Table 1.3.2.3: Population distribution in rings and sectors at Ein Ayala,, demographic forecast for 10 Years

Distance from Exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	0	0	0	**0**
100-200	0	0	0	0	**0**
200-300	0	0	0	0	**0**

300-400	0	0	0	0	**0**
400-500	0	0	0	0	**0**
500-600	0	50	0	0	**50**

1.3.3 Hagit East

1.3.3.1 Population data – current / planned status

The survey area in this alternative comprises a number of uses and zoning areas as specified below:

Current status

Residential and vulnerable uses – an agricultural farm that comprises residential buildings and employees within the exploration area of **up to 5 people.** 3-5 residential buildings at Bat Shlomo, **about 15 people.**

Population in industrial and employment areas

- The Hagit Power Station – The Electric Corporation did not provide the planning team with any data. The estimation is that there are 30-40 employees.
- A dry waste disposal site at Shfeya B, **about 5 employees**.
- An army station comprising one to two people.

Casual population at leisure sites

- About 30 dunams of bathing beaches, extensive at Dor and calculated as 10 people per dunam, a total of **300 people.**
- **About 10 hikers** per day at the Kurkarei HaCarmel Natural Reserve and the Nahal Tut Nature Reserve, about 100 meters south of the exploration area.

Demographic forecast for 5 years – apart from the closing down of the waste disposal site and Shfeya B, there is no change as compared with the current status based on approved and deposited plans within the survey area.

Demographic forecast for 10 years – an overlap of about 33m^2 from the Fureidis industrial zone with **about 55 employed people**.

Population data are presented in Table 1.3.3.1 below:

Table 1.3.3.1: Population Data at Hagit East

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
Coastal entrance array				
Dor	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	-
	C. Casual population	300	300	300
Gas pipeline leading to the treatment facility				
North Alternative	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	55
	C. Casual population	10	10	10
South Alternative	A. Residential population and vulnerable uses	15	15	15
	B. Permanent population at employment centers	5	-	55
	C. Casual population	10	10	10
Treatment facility				
Dor North	A. Residential population and vulnerable uses	5	5	5
	B. Permanent population at employment centers	About 40	About 40	About 40
	C. Casual population	15	15	15
Piping leading from the treatment facility				
The gas pipeline reaches the Hagit Power Station and the east transmission system and does not require finding an additional pipeline alignment.				

1.3.3.2 Population distribution around the treatment facility site

Current status

Within the area of this alternative, there are population concentrations as detailed below:

- Within the exploration at the agricultural farm, which includes residential buildings, up to 5 people.
- At the Hagit Power Station to the west and adjacent to the exploration area, about 40 employees.
- 2 people at a military station about 400 meters to the northeast of the exploration area.

Table 1.3.3.2: Population distribution in rings and sectors at Hagit East, current status

Distance from Exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	15	40	0	**65**
100-200	0	0	0	0	**0**
200-300	0	0	0	0	**0**
300-400	2	0	0	0	**2**
400-500	0	0	0	0	**0**
500-600	0	0	0	0	**65**

There is no change in the forecast for 5/10 years as compared with the current status.

Hadera-Neurim Alignment

1.3.4 Hadera Wastewater Treatment Facility

1.3.4.1 Population data – current / planned status

The survey area in this alternative comprises a number of uses and zoning areas as specified below:

Current status

Residential buildings – the number of buildings within the Heftziba neighborhood of Hadera (**30 people**), Maor (**30 people**) and Olga (**15 people**). A single residential house within the entry site to the Michmoret beach.

Public institutions and buildings – a number of buildings and a parking lot within the survey area at the Sha'ar Menashe Mental Health Center, which is estimated to include **about 50 people**. Within the survey area there are a number of partial buildings belonging to the Hillel Yaffe Medical Center housing, according to a calculation of 15m^2 per person (patients and hospital staff), an estimated population of **about 30-40 people**. A synagogue in Givat Olga, with **about 20 people.**

Population in industrial and employment areas

- At the Hadera industrial zone, there are more than 250 businesses over an area of approximately 1,05o dunams (according to the site administration). The industrial zone area within the survey area is about 655 dunams (about 150 businesses within the survey area). According to calculations made by the Ministry of Industry, Trade and Labor[i] and the experience accumulated with employment areas in various other regions of Israel, it is estimated that **the area per employed person within the Hadera industrial zone is about 60m^2.**

  The calculation comprises land surface calculations per employed person for the various types of industry and craft, and the growth trends of the population, the shortage in lands for development, and the development of diverse and advanced types of employment. It should be noted that the calculation is a stringent calculation for the entire survey area, which assumes that non-built land coverage is "offset" against multistory buildings. **The permanent population within the employment area is estimated at about 11,100.**

- An agricultural site/packing house at Gan Shmuel close to Granot, with **about 30 employed people** within each site.
- A mariculture farm at Michmoret – up to **10 employed people**.
- Hadera Wastewater Treatment Facility (**up to 5 employees**).
- Residential building for employees at Sha'ar Menashe, **about 20 employees**.

Casual population at leisure sites

- The commercial area within the Hadera industrial zone is estimated at **about 400 people**.
- The site of gas stations and restaurants close to Nahal Hadera and Olga Junction is estimated to include **about 100 people**.

- Heftziba farm – a number of buildings are located within the survey area. The number of people is estimated at **about 30**.
- Hadera bathing beaches (about 30 dunams), Michmoret (about 20 dunams) and Nahal Alexander (about 25 dunams), where the number of people visiting was estimated in accordance with a key of about 25 people per dunams**, a total of 750, 500 and 625 respectively.**
- Givat HaKalaniot Nature Reserve – **about 10 visitors per day.**
- HaSharon-Gador Park and Nahal Alexander Park – **about 50 visitors per day** per site.

Demographic forecast for 5 years – an addition to the current status according to approved and deposited plans within the survey area is detailed below:

Residential buildings – the addition of approximately 60 residential units at Maor, **about 190 people**.

Public buildings – about 20 dunams according to Plan HD/MC/920b - for a school. About 20m^2 were calculated per person, with a total of about **1,000 pupils and teachers.**

Population within industrial and employment areas:

- Area of a dry waste burial site, Plan HD/1362/a – **about 5 employed people**.
- Business park to the north of the Hadera Forest – about 65 dunams allocated for high-tech industry buildings and offices, based on Plan HD/1300. Higher population density is expected in this area than in the industrial zone, about 30m^2 per employed person, with a total of **about 2,200 employed people**.

Demographic forecast for 10 years – based on Figure 1.2.2-1d, for plans in preparation, within the survey area the following uses will be added:

Residential buildings – based on the Hadera outline plan – about 100 dunams in the Heftziba area, with a density of about 7 residential units per dunam (**about 2,240 people**). About 10 dunams to the south of the Orot Rabin Power Station and about 40 dunams to the west of the coastal road, with a density of about 15 residential units per dunam, **about 480 and 1,920 people** respectively.

Population within industrial and employment areas:

- Hadera industrial zone – according to the Hadera outline plan about 335 dunams, mainly for the use of electricity, gas and water facilities. When population growth trends and shortage of land for development are taken into consideration, it is expected that the number of employed people per meter squared within the industrial zone will increase, but since the areas added to

the industrial area are mostly for infrastructure and are not population-dense areas, the calculation for the entire industrial zone has been retained at about 60m² per employed person and a total of **about 5,600 employed people**.

- Employment park of approximately 130 dunams adjacent to Nahal Hadera – high-tech and offices, based on the Hadera outline plan with a density of approximately 30m² per employed person and **about 4,400 employed people**.
- Transportation center – 55 dunams adjacent to the Granot plant. Density was calculated on the basis of the industrial zone (60m² per employed person) giving a total of **about 900 employed people**.

Casual population – about 120 dunams as part of rural accommodations in the Michmoret region, based on the Hadera outline plan. An area of 30m² per visitor was calculated with a built land coverage area of approximately 10%, a total of **about 400 visitors**.

Population data are presented in Table 1.3.4.1 below:

Table 1.3.4.1: Population data at Hadera Wastewater Treatment Facility

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
Coastal entrance array				
Nahal Hadera	A. Residential population and vulnerable uses	-	-	480
	B. Permanent population at employment centers	-	-	-
	C. Casual population	700	700	700
Michmoret	A. Residential population and vulnerable uses	4	4	4
	B. Permanent population at employment centers	-	-	-
	C. Casual population	550	550	950
Nahal Alexander	A. Residential population and vulnerable uses	-	-	-

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
	B. Permanent population at employment centers	-	-	-
	C. Casual population	675	675	675
Gas Pipeline leading to the Treatment Facility				
From Nahal Hadera	A. Residential population and vulnerable uses	32	1,030	2,750
	B. Permanent population at employment centers	-	-	5,600
	C. Casual population	30	30	30
From Michmoret	A. Residential population and vulnerable uses	115	115	4,270
	B. Permanent population at employment centers	-	2,200	7,800
	C. Casual population	80	80	80
From Nahal Alexander	A. Residential population and vulnerable uses	125	125	4,280
	B. Permanent population at employment centers	-	2,200	7,800
	C. Casual population	130	130	130
Treatment Facility*				
Hadera Wastewater Treatment Facility	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	11,200	11,200	16,700
	C. Casual population	500	500	500
Piping leading from the Treatment Facility				

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
North Alternative	A. Residential population and vulnerable uses	50	50	50
	B. Permanent population at employment centers	50	50	50
	C. Casual population	-	-	-
South Alternative	A. Residential population and vulnerable uses	125	315	315
	B. Permanent population at employment centers	30	30	30
	C. Casual population	-	-	-

* The location of the alternative at the east part of the exploration area places the facility at a distance from the industrial zone. The closest regions to the east part are intended for infrastructure facilities and are expected to be populated by no more than a few dozen-hundreds of employed people.

1.3.4.2 Population distribution around the treatment facility site

Current status

This alternative is close to population concentrations as follows:

- To the west, the Hadera industrial zone, which also comprises a commercial center. The analysis of the population in rings was performed on the basis of an assumed 50m² per employed person and a population of 400 people within the commercial site in the industrial zone area, which is located at a distance of about 450 meters to the southwest of the exploration area, as detailed in Section 1.3.4.1 above.
- At a distance of about 400 meters from the northwest, about 100 people on the site of a gas station and restaurant.
- From the south, the Hadera Wastewater Treatment Facility, including about 5 employed people.

Table 1.3.4-1: Population distribution in rings and sectors at Hadera Wastewater Treatment Facility, current status

Distance from Exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	5	250	0	**255**
100-200	0	0	1,340	0	**1,340**
200-300	0	0	1,670	0	**1,670**
300-400	0	0	2,000	0	**2,000**
400-500	100	0	3,070	0	**3,170**
500-600	0	0	3,160	0	**3,160**

There is no change in the forecast for 5 years as compared with the current status.

Demographic forecast for 10 years

As compared with the current status, an additional industrial zone will be added to the west of the survey area and adjacent to the existing wastewater treatment facility, which is mainly intended for electricity, gas and water infrastructures and as detailed below:

- Within the survey area, about 100 dunams of industrial zone for infrastructures.
- An additional area of about 235 dunams to the south of the survey area.

Table 1.3.4-2: Population distribution in rings and sectors at Hadera Wastewater Treatment Facility, demographic forecast for 10 years

Distance from Exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	500	250	0	**750**
100-200	0	1,000	1,340	0	**2,340**
200-300	0	1,100	1,670	0	**2,770**
300-400	0	830	2,000	0	**2,830**

400-500	100	420	3,070	0	**3,570**
500-600	0	90	3,160	0	**3,250**

1.3.5 Meretz Wastewater Treatment Facility

1.3.5.1 Population data – current / planned status

The survey area in this alternative comprises a number of uses and zoning areas as specified below:

Current status:

Residential buildings – a number of buildings at Bitan Aharon, in the Kfar Brandeis neighborhood at Hadera and at Olga, about **15 people per site**. A farm and an isolated residential building to the south of the Kfar Brandeis neighborhood. A single residential building at Michmoret.

Public institutions and buildings – a number of buildings within the survey area at the Sha'ar Menashe Mental Health Center, estimated to include **about 50 people**. In addition, there are a number of partial buildings belonging to the Hillel Yaffe Medical Center housing, according to a calculation of 15m^2 per person (patients and hospital staff), an estimated population of **about 30-40 people**.

Population in industrial and employment areas

- Mariculture farm at Michmoret – up to **10 employed people**.
- Ma'abarot and Meretz Wastewater Treatment Facility, up to **5 employees** per facility with offices adjacent to the Meretz reservoir with about 5 additional employees.

Casual population at leisure sites

- On the sites of gas stations and restaurants adjacent to the Olga Junction and to the south of Hadera within the north alignment to the forest pool, an estimated **100 people per site**.
- Hadera bathing beaches (about 30 dunams), Michmoret (about 20 dunams) and Nahal Alexander (about 25 dunams), where the number of people visiting was estimated in accordance with a key of about 25 people per dunam, **a total of 750, 500 and 625 respectively.**
- The Bitan Aharon Nature Reserve, **about 10 visitors per day.**

Demographic forecast for 5 years – an addition to the current status according to approved and deposited plans within the survey area is detailed below:

Public buildings – about 20 dunams according to Plan HD/MC/920b for a school. About 20m² were calculated per person, with a total of about **1,000 pupils and teachers.**

Population within industrial and employment areas:

- Dry waste burial site, Plan HD/1362/a – **about 5 employed people**.
- Business park to the north of the Hadera Forest – about 65 dunams allocated for high-tech industry buildings and offices, based on Plan HD/1300. Higher population density is expected in this area than in the industrial zone, about 30m² per employed person, with a total of **about 2,200 employed people**.

Demographic forecast for 10 years – based on Figure 1.2.2-1d, for plans in preparation, within the survey area the following uses will be added:

Residential buildings – based on the Hadera outline plan – about 10 dunams to the south of the Orot Rabin Power Station and about 40 dunams to the west of the coast road, with a density of about 15 residential units per dunam, **about 480 and 1,920 people** respectively (according to the plan regulations).

Population within industrial and employment areas: An employment park of approximately 130 dunams adjacent to Nahal Hadera – high-tech and offices, based on the Hadera outline plan with a density of approximately 30m² per employed person and **about 4,400 employed people**.

Casual population – about 120 dunams as part of rural accommodations in the Michmoret region, based on the Hadera outline plan. An area of 30m² per visitor was calculated with a built land coverage area of approximately 10%, a total of **about 400 visitors**.

Population data are presented in Table 1.3.5.1 below:

Table 1.3.5.1: Population data at Meretz Wastewater Treatment Facility

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
Coastal entrance array				
Nahal Hadera, Michmoret and Nahal Alexander alternatives, see details in Table 1.3.4.1 above.				
Neurim	A. Residential population and vulnerable uses	-	-	-

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
	B. Permanent population at employment centers	-	-	-
	C. Casual population	280	280	280
Gas pipeline leading to the treatment facility				
From Nahal Hadera - North Alternative	A. Residential population and vulnerable uses	50	1,050	2,970
	B. Permanent population at employment centers	-	2,200	2,200
	C. Casual population	200/300 in the north alignment to the forest pool	200/300 in the north alignment to the forest pool	200/300 in the north alignment to the forest pool
From Nahal Hadera - South Alternative	A. Residential population and vulnerable uses	15	1,020	2,940
	B. Permanent population at employment centers	-	2,200	6,600
	C. Casual population	150	150	150
From Michmoret - North Alternative	A. Residential population and vulnerable uses	20	15	15
	B. Permanent population at employment centers	-	-	-
	C. Casual population	100/200 in the north alignment to the forest pool	100/200 in the north alignment to the forest pool	100/200 in the north alignment to the forest pool
From Michmoret -	A. Residential population and vulnerable uses	-	-	-

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
South Alternative	B. Permanent population at employment centers	-	-	-
	C. Casual population	100	100	500
From Nahal Alexander - North Alternative	A. Residential population and vulnerable uses	20	15	15
	B. Permanent population at employment centers	10	10	10
	C. Casual population	150/250 in the north alignment to the forest pool	150/250 in the north alignment to the forest pool	150/250 in the north alignment to the forest pool
From Nahal Alexander - South Alternative	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	10	10	20
	C. Casual population	50	50	50
From Neurim	A. Residential population and vulnerable uses	15	15	15
	B. Permanent population at employment centers	5	5	5
	C. Casual population	10	10	10
Treatment facility				
Meretz Wastewater Treatment Facility	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	10	10	10
	C. Casual population	-	-	-
Piping leading from the treatment facility				

Alternative	Type of Population	Current status	Forecast for 5 years	Forecast for 10 years
Piping leading from the Treatment Facility	A. Residential population and vulnerable uses	-	-	-
	B. Permanent population at employment centers	-	-	-
	C. Casual population	-	-	-

1.3.5.2 Population distribution around the treatment facility site

Current status

In this alternative, there is a sparse population surrounding the onshore treatment facility exploration area.

- The Meretz Wastewater Treatment Facility comprising 5 employees is located within the area of this alternative (the population concentration within the exploration area is not presented in the table below).
- Offices adjacent to the Meretz reservoir with up to 5 additional employees to the east of the exploration area.

Table 1.3.5.2: Population distribution in rings and sectors at Meretz Wastewater Treatment Facility, current status

Distance from Exploration Area (meters)	North Sector	South Sector	West Sector	East Sector	Total
0-100	0	0	0	5	**5**
100-200	0	0	0	0	**0**
200-300	0	0	0	0	**0**
300-400	0	0	0	0	**0**
400-500	0	0	0	0	**0**
500-600	0	0	0	0	**0**

There is no difference between the distribution presented in the current status and the distribution in the demographic forecast for 5/10 years.

In Summary

Dor North – the exploration area is surrounded by open agricultural areas that are sparse in population. To the northwest and to the west there are small population centers.

Ein Ayala – the exploration area is surrounded by open spaces and agricultural areas that are sparse in population. There is a small concentration of a population of employed people within the exploration area.

Hagit – there is a small population concentration within the exploration area as well as to the south and to the west at the Hagit Power Station. In addition, there is a military station with minimum presence located about 400 meters from the exploration area.

Hadera Wastewater Treatment Facility – the exploration area is adjacent to an industrial zone with a high concentration of employed people and casual populations. This concentration is expected to increase in the coming years with the expansion of the industrial zone, and the trends of population growth and the development of existing industrial zones.

Meretz Wastewater Treatment Facility – the exploration area is surrounded with open agricultural areas that are sparse in population. To the east of the alternative and within the area of the wastewater treatment facility, there is a small population concentration.

Table 1.3.2-b below summarizes the cumulative populations in rings in the various alternatives under the current status. Changes in the demographic forecasts for 5 and 10 years, based on the methodology presented above, are in the Ein Ayala site and the Hadera Wastewater Treatment Facility site where an expansion of the industrial zone is planned, while no changes are expected in the other alternatives.

Table 1.3.2-b: Population in the range of 0-600 at the proposed alternative sites

Distance from Exploration	Dor North	Ein Ayala	Hagit East	Hadera Wastewater Treatment Facility	Meretz Wastewater

Area (meters)		Current status	Forecast for 10 Years		Current status	Forecast for 10 Years	Treatment Facility
0-100	0	0	0	65	**255**	**750**	**5**
0-200	0	0	0	0	**1,600**	**3,090**	**5**
0-300	0	0	0	0	**3,270**	**5,860**	**5**
0-400	0	0	0	2	**5,270**	**8,690**	**5**
0-500	10	0	0	0	**8,440**	**12,260**	**5**
0-600	20	0	5	65	**11,600**	**15,500**	**5**

1.4 Meteorology and the State of Air Quality

1.4.1 General

This chapter discusses the meteorological conditions prevailing in the area of each of the alternatives, and how these conditions may impact the way in which pollutants released into the air are spread. The Ein Ayala and Dor North alternatives are considered in this chapter as a single alternative on account of their geographic proximity.

In order to evaluate the meteorological conditions of each alternative, use was made of data provided by meteorological stations that represent as closely as possible the meteorological conditions of the alternatives. This approach was approved by the Ministry of Environmental Protection. The meteorological data files were provided by Dr. Ilan Setter, who is a professional meteorologist.

The following is a list of the meteorological stations that were used to characterize each of the alternatives:

Ein Ayala and Dor North alternative

- Ein Carmel Station: The meteorological station is located to the north of Ein Carmel, at coordinates 196450/731820 and is about 7.6 kilometers from the Dor North alternative, and about 5.4 kilometers from the Ein Ayala alternative. Station data were used to characterize general meteorological conditions and temperature. Duration of the data period obtained is 5 years, from 2007 to 2011. Meteorological data for this station were received from the Meteorological Service.
- Haifa Meteorological Station: This station is located at the Technion at coordinates 202380/742150. Solar radiation data were obtained from this station.

Hadera Wastewater Treatment Facility alternative

- Hadera Station: This station, up to the year 2010, was located on the roof of the Hadera municipality building (coordinates 704800/192300) and from the year 2010 it was transferred to the Hadera Cities Association's building (coordinates 706000/192000) – a distance of about 1 kilometer from the Hadera Wastewater Treatment Facility alternative. The Hadera meteorological station is about 2.9 kilometers from the Hadera alternative. Station data were used to characterize the meteorological conditions within the alternative area. Duration of the data period obtained is 5 years, from 2007 to 2011. Data for this station were received from the Hadera Cities Association.

- Hadera Port Station: Data from this station (coordinates 189100/708800) were used to characterize the temperature in the area of the alternative. Data for this station were received from the Meteorological Service.

Meretz Wastewater Treatment Facility Alternative

- HaMa'apil Station: This station is located in Emek Hefer to the south of Kibbutz HaMa'apil at coordinates 697200/198100 and is about 1.3 kilometers from the Meretz Wastewater Treatment Facility alternative. Station data were used to characterize the meteorological conditions prevailing in the area. Duration of the data period obtained is 5 years, from 2007 to 2011. Data from this station were received from the Hadera Cities Association.
- Ein HaHoresh Station: Data for this station (coordinates 194300/699300) were used to characterize the temperature within the alternative's area. Data for this station were received from the Meteorological Service.

Hagit East Site alternative

- Elyakim Station: This station is located in the southwest part of Kibbutz Elyakim at coordinates 726500/206500 and at a distance of approximately 2.5 kilometers from the Hagit site alternative. Data from this station were used to characterize the meteorological conditions within the alternative's area. Duration of the data period obtained is 5 years, from 2007 to 2011. Data for this station were received from the Hadera Cities Association.
- Ein HaShofet Station: Data for this station (coordinates 209300/723200) were used to characterize the temperature within the alternative's area. Data for this station were received from the Meteorological Service.

The wind roses, presented below, describe wind speeds and directions, and for each of the alternatives in general for the entire five years (2007-2011). In addition, wind roses are presented that depict the atmospheric stability at each of the alternatives. The wind roses presented in Appendix B describe in detail the directions and speeds of the winds and the atmospheric stability for all seasons and throughout the times of the day and night. On the basis of the wind direction, their speed and the stability conditions in each of the alternatives, we can establish how meteorological conditions are liable to impact the spread of pollutants. The conclusions for each of the alternatives are presented in Section 1.4.3 (Special Meteorological Conditions).

Atmospheric stability conditions

Atmospheric stability conditions are conditions that establish, to a great extent, the way in which pollutants that impact the condition of the air quality are spread. Stability conditions are determined in accordance with the temperature differences

between adjacent layers of air, where the temperature difference is impacted by the sun's radiation, the extent of the cloud coverage and the winds. It is customary to divide the stability conditions into 6 categories A-F, according to Pasquill-Gifford[ii]:

A - very unstable C - unstable E - slightly unstable

B - unstable D - neutral F - stable

According to the meteorological stability conditions, wind direction and intensity, it is possible to establish the special meteorological conditions that would make it difficult for pollutants to spread in the atmosphere (see Section 1.4.3 "Special Meteorological Conditions").

1.4.2 Basic Meteorological Data

Ein Ayala and Dor North alternative

The Ein Carmel meteorological station is located in the north of the coastal strip near Atlit, and located within the east region of the coastal plain strip. This climatic region is characterized as a Mediterranean region. The main characteristic of the coastal plain climate is a relatively small seasonal and daily temperature range, as compared with the rest of Israel. The reason for this is the moderating impact of the sea and the breezes that are present in this area throughout the year. The further one goes inland, the greater the temperature difference. In the Ein Carmel area, the absolute maximum temperature was recorded in May and reached 43.5°C, and the minimum temperature was recorded in January and reached 1°C. The temperature difference between the average monthly maximum and the average monthly minimum is 30.6°C (Figure 1.4.2-1).

Figure 1.4.2-1: Temperature Data from Ein Carmel Station[iii]

Month	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Daily Average	17.5	18.0	20.2	23.5	25.9	27.9	29.8	30.3	29.6	27.5	24.1	19.6
Minimum Daily Average	10.0	9.5	10.6	13.0	15.9	19.4	22.3	22.7	21.0	18.1	14.6	11.7
Daily Average	13.7	13.8	15.4	18.2	20.9	23.7	26.1	26.5	25.3	22.8	19.4	15.7
Average Daily Fluctuation	7.5	8.5	9.6	10.5	10.0	8.5	7.5	7.6	8.6	9.4	9.5	7.9

Maximum Monthly Average	22.6	24.7	29.5	34.7	35.6	33.7	32.3	31.8	34.2	34.7	30.1	25.1
Minimum Monthly Average	5.0	5.4	6.0	7.9	11.3	15.6	18.9	20.1	17.6	13.8	9.7	7.2
Absolute Maximum	27.1	29.8	37.9	40.6	43.5	42.7	39.1	34.5	40.8	39.7	34.5	29.6
Date of Maximum	12/1/2003	29/2/2004	23/3/2008	23/4/2008	21/5/1970	8/6/2002	9/7/1978	14/8/1968 28/8/1972	29/9/2006	8/10/1994	1/11/1966	2/12/2010
Absolute Minimum	1.0	2.0	2.2	5.5	6.9	11.5	15.0	16.5	14.2	9.6	5.8	-1.0
Date of Minimum	3/1/1973	21/2/2008	3/3/1976	6/4/1972	1/5/1978	4/6/1974	10/7/1972	3/8/1977	30/9/1974	31/10/1977	26/11/1995	27/12/1972

Inspection period for the absolute extreme values 1966-1979; 1993-2011

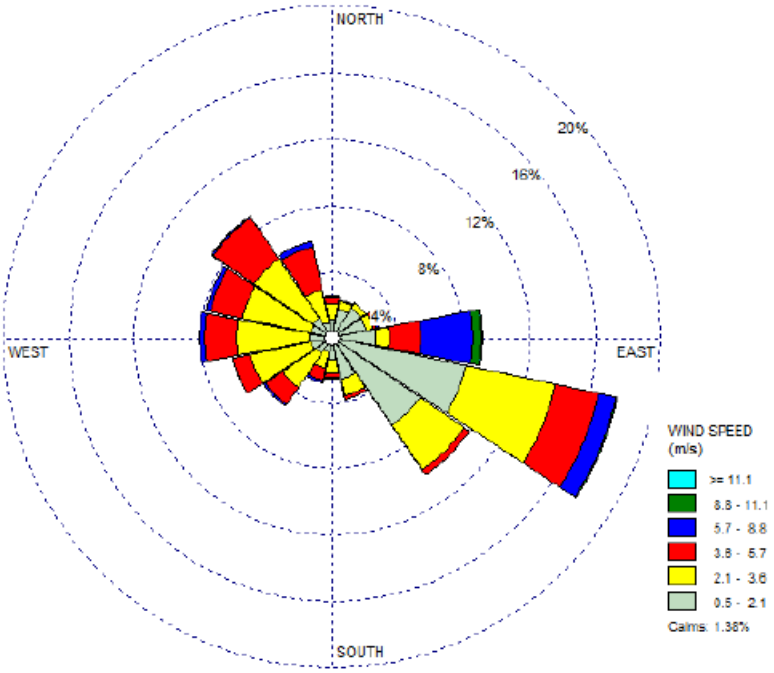
Land winds (wind roses)

Figure 1.4.2-2 depicts the multiannual average of wind directions and intensities during the period 2007-2011. Perusal of this figure may show:

The most frequent direction in which the wind blows is from the east-southeast (18%) with a main low wind speed (0.5-2.1 m/s) with a frequency of up to 10% from this direction. From the other directions, the frequency of the winds arriving is up to 10% (from any direction) whereas the north by east-northeast and the west-southwest by east-southeast directions, the frequency of the winds is low (up to 4% from each direction).

The wind speed prevailing in this area is 0.5-2.1 m/s at a rate of 44.8% from the total wind speed values measured during these years from this direction.

Figure 1.4.2-2: Multiannual Wind Rose for the Ein Carmel Area for the years 2007-2011[2]

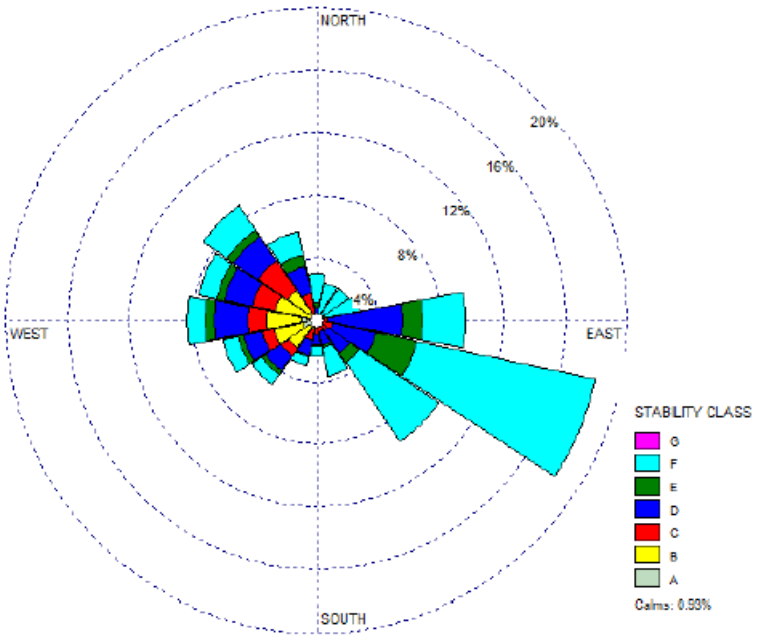


Atmospheric stability

According to the frequency of the atmospheric stability during the period 2007-2011, as measured at the Ein Carmel meteorological station, Figure 1.4.2-3, it may be seen that the main stability conditions during these years were Category F conditions, and mainly arrived from the east-southeast direction, at a rate of 11.6% and from the southeast direction at a rate of 6%. The extent of F stability conditions from all directions is higher than all other stability conditions, and is 39.5%.

[2]Based on data received from the Meteorological Service.

Figure 1.4.2-3: Multiannual Meteorological Stability Compass for the Ein Carmel Area for the Years 2007-2011[3]



Hadera Wastewater Treatment Facility

Hadera is located in the north area of the coastal plain strip. This area is also characterized as a Mediterranean area, and because of the moderating impact of the sea and the breezes that are present in the area throughout the year, the area has a daily and seasonal temperature range that is smaller relative to other areas of Israel.

The meteorological station at the Hadera port was used to represent the changes in temperature within the alternative's area.

Figure 1.4.2-4 depicts the temperature changes throughout the months of the year. According to these data, it may be seen that the absolute maximum temperature was recorded in the month of June and was as high as 41.3°C, while the minimum absolute temperatures were recorded during the months of January and February and were as low as 3.2°C. The temperature difference between the average monthly maximum and the average monthly minimum is 26.5°C.

Figure 1.4.2-4: Temperature Data for the Hadera Port Station[iv]

Month	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Daily Average	17.4	17.6	19.0	21.4	23.2	25.6	27.8	28.5	27.8	26.0	23.4	19.4

[3]Based on data received from the Meteorological Service.

Month	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Minimum Daily Average	10.5	10.8	12.4	14.9	18.0	21.5	24.1	24.8	23.1	19.9	15.8	12.4
Daily Average	14.0	14.2	15.7	18.1	20.6	23.6	26.0	26.6	25.4	22.9	19.6	15.9
Average Daily Fluctuation	6.9	6.8	6.6	6.5	5.2	4.1	3.7	3.7	4.7	6.1	7.6	7.0
Maximum Monthly Average	22.8	24.4	29.0	33.2	33.2	29.6	29.5	29.5	31.5	33.1	29.6	24.3
Minimum Monthly Average	6.7	7.2	8.2	10.2	13.8	18.5	22.1	22.8	20.0	15.7	11.6	8.2
Absolute Maximum	25.8	31.4	36.9	38.4	39.0	41.3	31.6	30.8	38.6	40.0	38.0	30.0
Date of Maximum	12/1/2003 10/1/2010 30/1/2010	29/2/2004	23/3/2008	23/4/2008	23/5/1999	8/6/2002	30/7/2002	19/8/2010 20/8/2010	29/9/1999 29/9/2006	13/10/1998	4/11/1991	4/12/2010
Absolute Minimum	3.2	3.2	3.6	5.1	10.7	14.4	19.4	20.5	15.7	13.2	7.3	4.1
Date of Minimum	12/1/1998	26/2/1992	8/3/1997	11/4/1997	6/5/1990	2/6/1991	1/7/1992	28/8/1997	28/9/1992	31/10/1996	26/11/1992	17/12/2004

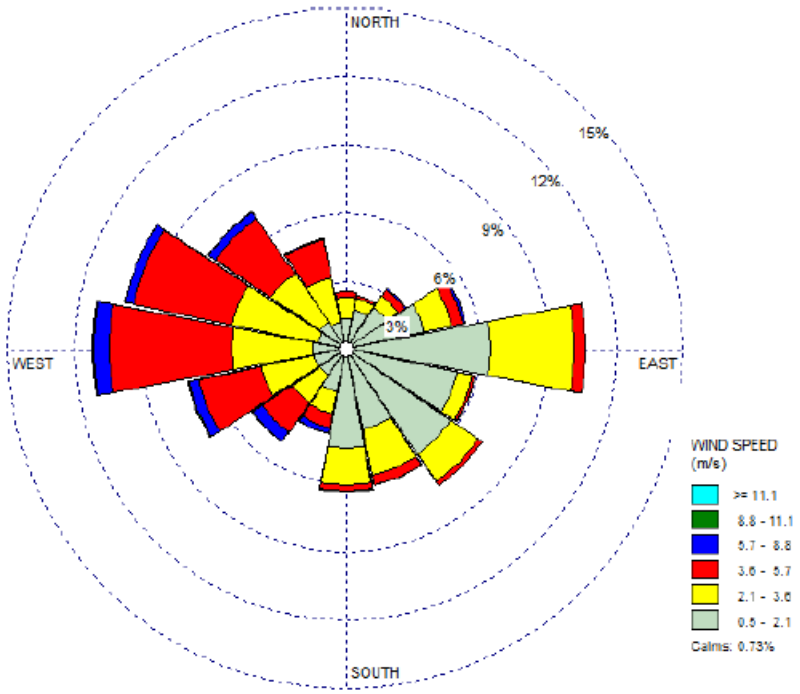
Inspection period for the absolute extreme values 1990-2011

Land winds (wind roses)

Figure 1.4.2-5 depicts the multiannual average of wind directions and intensities during the period 2007-2011. Perusal of this figure may show:

The most frequent direction in which the wind blows is from the west, the west-northwest, and the east at a rate of 11% to 10.5% (from each of the directions in this range) with a main wind speed of 3.6-5.7 m/s from the direction of the west and the west-northwest, and a main wind speed of 0.5-2.1 m/s from the east. The main wind speeds are 0.5-2.1 m/s at a rate of 44.5% of all directions for the Hadera area.

Figure 1.4.2-5: Multiannual Meteorological Stability Compass for the Hadera Area for the Years 2007-2011[4]

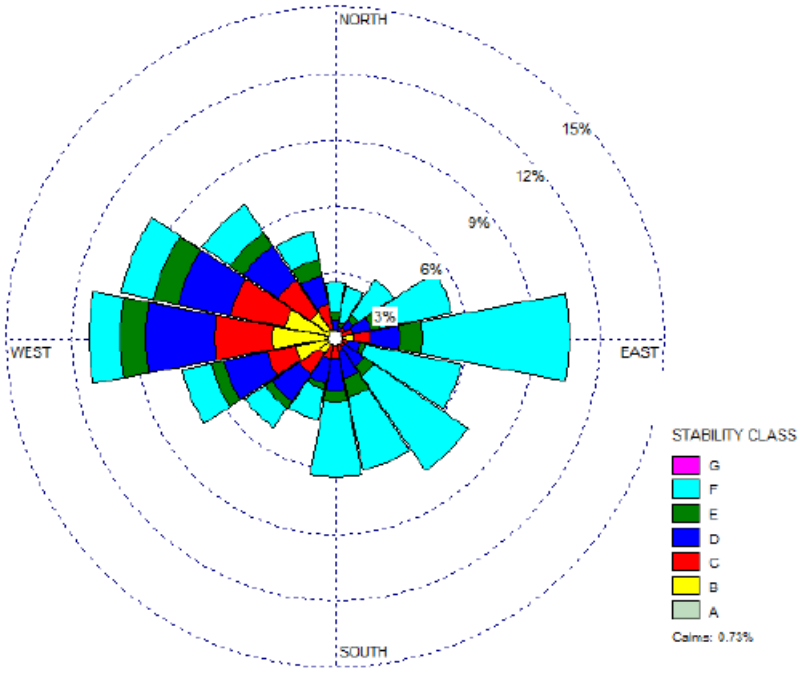


Atmospheric stability

According to the frequency of the atmospheric stability during the period 2007-2011, as measured at the Hadera meteorological station, Figure 1.4.2-6, it may be seen that the Category F stability conditions during these years are mostly in the east direction, at a rate of 6.6%. The extent of F stability conditions is highest among all stability conditions in directions, and is 40.8%.

[4]Based on data received from the Hadera Cities Association.

Figure 1.4.2-6: Multiannual Meteorological Stability Compass for the Hadera Area for the Years 2007-2011[5]



Meretz Wastewater Treatment Facility Alternative

The area of this alternative is located at a more inside region of Israel than the Hadera, Ein Ayala and Dor North alternatives, and for this reason the range of temperatures between the hot and cold months is greater.

The temperature data for the Meretz Wastewater Treatment Facility alternative were characterized by the Ein Horesh meteorological station (Figure 1.4.2-7). According to these data, it was found that the maximum absolute temperature was recorded in the month of May and reached a temperature of 43.1°C, and the absolute minimum temperatures were recorded in the month of February and were as low as -4.2°C. The temperature difference between the average monthly maximum and the average monthly minimum is 34.4°C.

Figure 1.4.2-7: Temperature Data for the Ein HaHoresh Station[v]

Month	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Daily Average	17.8	18.5	20.8	24.1	26.9	29.2	31.1	31.5	30.7	28.4	24.5	19.9

[5]Based on data received from the Hadera Cities Association.

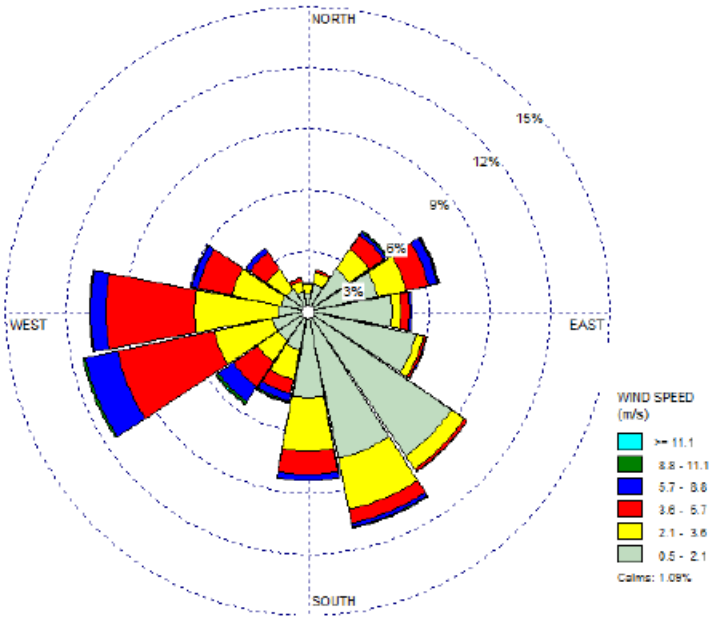
Month	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Minimum Daily Average	6.5	6.6	7.8	10.4	13.5	16.9	19.8	20.2	17.8	14.6	10.8	8.1
Daily Average	12.2	12.5	14.3	17.2	20.2	23.0	25.4	25.9	24.2	21.5	17.6	14.0
Average Daily Fluctuation	11.3	11.9	13.0	13.7	13.4	12.3	11.3	11.3	12.9	13.8	13.7	11.8
Maximum Monthly Average	23.3	25.4	30.8	35.5	36.1	35.2	34.2	33.3	35.8	35.7	31.0	25.7
Minimum Monthly Average	1.3	1.7	2.4	4.7	7.7	12.4	15.8	17.1	13.6	10.1	5.4	2.8
Absolute Maximum	29.8	32.7	38.4	40.9	43.1	43.0	38.6	36.5	43.8	40.8	36.6	33.5
Date of Maximum	15/1/1960	29/2/2004	23/3/2008	23/4/2008	15/5/1988	2/6/1969	2/7/1995	14/8/1968	13/9/1994	20/10/2010	2/11/1959	7/12/1952
Absolute Minimum	-2.4	-4.2	-3.0	0.5	4.0	8.2	12.6	12.5	8.2	5.3	0.2	-0.5
Date of Minimum	5/1/1989	7/2/1950	2/3/1976	11/4/1997	1/5/1978	2/6/1991	22/7/1985	3/8/1982	28/9/1992	23/10/1984	30/11/1999	17/12/2006

Land winds (wind roses)

Figure 1.4.2-8 depicts the multiannual average of wind directions and intensities during the period 2007-2011. Perusal of this figure may show:

The most frequent wind directions come from two main areas: west the west-southwest at a rate of about 11% in each of these directions and from south to southeast at a rate of 8% - 11% from each of the directions in the range. The wind speed from the west direction and from the west-southwest (main speed of 3.6-5.7 m/s) is higher than that arriving from the south to southeast (main speed of 0.5-2.1 m/s). The main wind speed for this area was 0.5-2.1 m/s at a rate of 49% of all directions.

Figure 1.4.2-8: Multiannual Meteorological Stability Compass for the HaMa'apil Area for the Years 2007-2011[6]

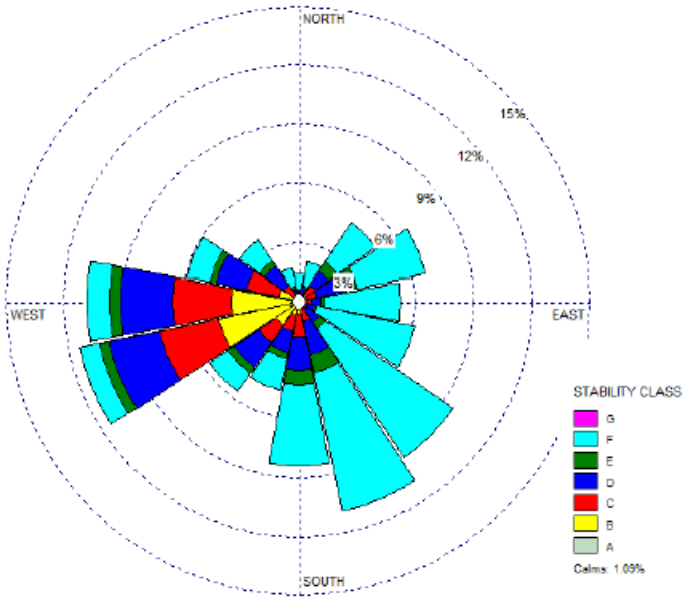


Atmospheric stability

According to Figure 1.4.2-9 which describes the atmospheric stability during the period 2007-2011 in the HaMa'apil area, we see that the main atmospheric stability of Category F arrives from the south and the east-southeast directions at a rate of 9.5% and 10.8%, respectively. The main atmospheric stability from all directions if from Category F and it amounts to a rate of 44.5%.

[6]Based on data received from the Hadera Cities Association.

Figure 1.4.2-9: Multiannual Meteorological Stability Compass for the HaMa'apil Area for the Years 2007-2011[7]



Hagit East Site Alternative

The Hagit alternative's area is located at a more inside region of Israel than the Hadera, Ein Ayala and Dor North alternatives, and for this reason the range of temperatures between the hot and cold months is greater.

The temperature data for the Hagit site alternative were characterized by the Ein HaShofet meteorological station (Figure 1.4.2-10).

According to these data, it was found that the maximum absolute temperature was recorded in the month of May and reached a temperature of 40.8°C, and the absolute minimum temperature was recorded in the month of January and was as low as 0°C. The temperature difference between the average monthly maximum and the average monthly minimum is 32.1°C.

[7]Based on data received from the Hadera Cities Association.

Figure 1.4.2-10: Temperature Data for the Ein HaShofet Station[vi]

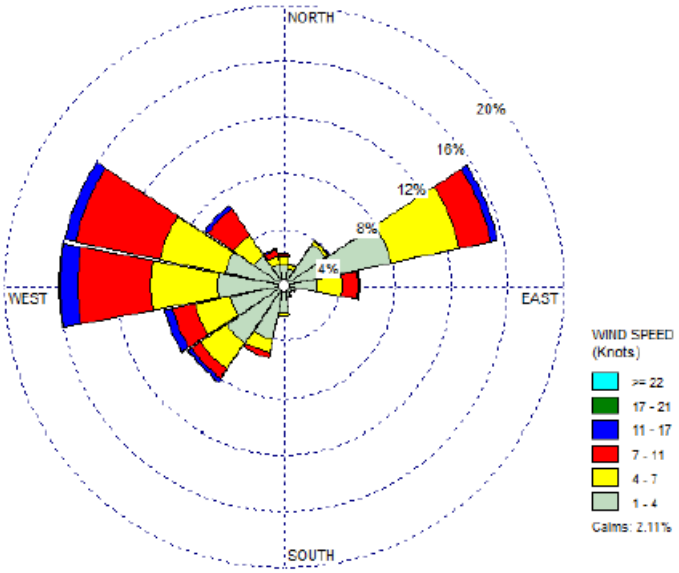
Month	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Daily Average	15.0	15.9	18.9	22.9	26.9	29.0	30.6	30.8	29.9	27.4	22.5	17.2
Minimum Daily Average	8.3	8.6	10.5	12.8	16.0	19.1	21.5	22.0	21.0	18.7	14.1	10.3
Daily Average	11.7	12.2	14.7	17.9	21.5	24.0	26.1	26.4	25.4	23.0	18.3	13.7
Average Daily Fluctuation	6.7	7.3	8.4	10.1	10.9	9.9	9.1	8.8	8.9	8.7	8.4	6.9
Maximum Monthly Average	19.7	22.1	27.4	33.2	36.8	36.4	35.0	34.0	35.8	34.8	28.2	22.3
Minimum Monthly Average	3.8	4.7	6.1	8.4	12.1	16.5	19.8	20.6	18.9	13.8	9.4	5.8
Absolute Maximum	23.4	27.1	34.9	38.3	40.8	42.6	40.7	40.0	40.1	37.7	32.1	27.4
Date of Maximum	12/1/2003	29/2/2004	31/3/2001	23/4/2008	27/5/2001	9/6/2002	31/7/2002	8/9/1998	30/9/2002	1/10/2002	1/11/2003	1/12/2010
Absolute Minimum	0.0	0.4	2.2	2.5	10.0	14.4	18.2	18.8	16.6	11.2	5.6	1.3
Date of Minimum	12/1/1998	7/2/1997	8/3/1997	11/4/1997	5/5/2005	2/6/1997	12/7/1998	29/8/1997	30/9/1997	30/10/2003 21/10/2005	19/11/2001	17/12/2004

Land winds (wind roses)

Figure 1.4.2-11 depicts the multiannual average of wind directions and intensities during the period 2007-2011 at the Elyakim station area. Perusal of this figure may show:

The most frequent wind directions come from two main areas: west the west-northwest and from the east-northeast with a main rate of 15% from each of the directions. The main wind speeds from these directions were 3.6-5.7 m/s from the west and west-northwest directions, and 0.5-2.1 m/s from the east-northeast direction. The main wind speeds are 0.5-2.1 m/s at a rate of 47% from all directions.

Figure 1.4.2-11: Multiannual Meteorological Stability Compass for the Elyakim Area for the Years 2007-2011[8]

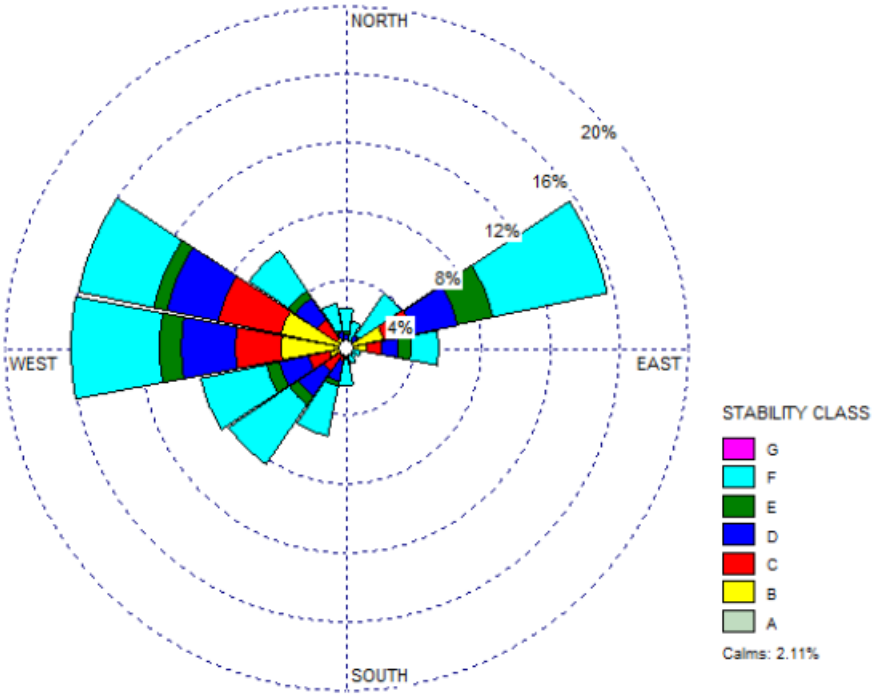


Atmospheric stability

According to Figure 1.4.2-12 which describes the atmospheric stability during the period 2007-2011 in the Elyakim area, we see that the main atmospheric stability of Category F arrives from the east-northeast and from the west and west-northwest directions at a rate of 15% from each of these directions. The main atmospheric stability from all directions if from Category F and it amounts to a rate of 42.4%.

[8]Based on data received from the Hadera Cities Association.

Figure 1.4.2-12: Multiannual Meteorological Stability Compass for the Elyakim Area for the Years 2007-2011[9]



1.4.3 Special meteorological conditions

Ein Ayala and Dor North alternative

According to the wind rose in Figure 1.4.2-2, the atmospheric stability wind rose in Figure 1.4.2-3 and Appendix B, it may be shown that during the autumn season and during the night hours, the main winds arriving from the east-southeast directions are weak winds with stable stability conditions that are liable to cause problematic dispersion conditions for the environment in the west-northwest direction of the Ein Ayala and Dor North alternatives.

Hadera Wastewater Treatment Facility alternative

According to the wind rose in Figure 1.4.2-5, the atmospheric stability wind rose in Figure 1.4.2-6 and Appendix B, it may be shown that during the autumn season and during the night hours, from the easterly direction there are mainly weak winds with stable stability conditions that are liable to cause problematic dispersion conditions for the environment in the westerly direction of the Hadera alternative.

Meretz Wastewater Treatment Facility alternative

[9]Based on data received from the Hadera Cities Association.

According to the wind rose in Figure 1.4.2-8, the atmospheric stability wind rose in Figure 1.4.2-9 and Appendix B, it may be shown that during the autumn season and during the night hours, the winds arriving from the southeast and east-southeast directions are mainly weak winds with stable stability conditions that are liable to cause problematic dispersion conditions for the environment in the northwest and west-northwest directions of the Meretz Wastewater Treatment Facility alternative.

Hagit East Site alternative

According to the wind rose in Figure 1.4.2-11, the atmospheric stability wind rose in Figure 1.4.2-12 and Appendix B, it may be seen that from the east-northeast direction, the winds arriving are mainly weak winds with stable stability conditions that are liable to cause problematic dispersion conditions to the environment in the west-southwest direction of the Meretz Wastewater Treatment Facility alternative.

1.4.4 The Present Condition of Air Quality and Future Forecast

1.4.4.1 Introduction (Note: the methodology for performance of this section was separately coordinated with the Air Quality division of the Ministry of Environmental Protection)

Monitoring stations

In order to describe the present condition of air quality for the various alternatives, the analysis and calculation of data were based on two sources:

- Air quality data from existing monitoring stations belonging to the Sharon-Carmel Cities Association.
- Calculation of pollutant concentrations in the environment by means of running the AERMOD model. Existing discharge data as received from the Ministry of Environmental Protection were fed into the model, as well as future discharge data from approved plans as detailed below.

The data of pollutant concentrations as received from the monitoring stations and from the calculations generated by running the model were compared with the environmental and target values that are given in the air quality values regulations published by the Ministry of Environmental Protection in 2011 (the 2011 Clean Air Regulations, Air Quality Values Temporary Order).

Air pollutants examined

The following are the air pollutants examined according to the instructions of the Ministry of Environmental Protection for the environmental impact survey:

- Sulfur dioxides (SO_2)

- Nitrous oxides (NO_x)
- Benzene

Environmental values and target values

The results of running the model and the results of the measurements carried out by the monitoring stations were compared with the environmental and target values provided by the 2011 Air Quality Values Regulations issued by the Ministry of Environmental Protection (2011 Clean Air Regulations, Air Quality Values Temporary Order). Tables 1.4.4-1 - 1.4.4-2 specify the threshold values for the pollutants sulfur dioxide, nitrous oxides and benzene.

Table 1.4.4-1: Target Values for the Pollutants Sulfur Dioxide, Nitrous Oxides and Benzene

Pollutant	Chemical Formula	Maximum Average Concentration in mcg/m³	Given Time Period
Sulfur Dioxide	SO_2	**500**	10 minutes
		20	24 hours
Benzene	C_6H_6	**3.9**	24 hours
		1.3	1 year

Table 1.4.4-2: Environmental Values for the Pollutants Sulfur Dioxide, Nitrous Oxides and Benzene

Pollutant	Chemical Formula	Maximum Average Concentration in mcg/m³	Given Time Period
Sulfur Dioxide	SO_2	**350**	1 hour
		125	24 hours
		60	1 year
Nitrous Oxide	NO_x	**940**	30 minutes
		560	24 hours
Benzene	C_6H_6	**5**	1 year

Survey area

The pollutant monitoring stations to which the model run results were compared belong to the Hadera Cities Association (Carmel-Sharon). The air pollutants to be examined from the monitoring stations are sulfur dioxides and nitrous oxide, according to the data from the year 2010. Appendix C presents the results of the model run on top of isoplate maps and lattice maps. Figure 1.4.4-1 describes the geographical location of the monitoring stations on top of the map, and the alternatives survey area. Table 1.4.4-3 specifies the names of the monitoring stations and gives the coordinates of each station.

Figure 1.4.4-1: Location of Monitoring Stations and the Survey Areas

Legend:

●	Air Pollutant Monitoring Station
▭	10-km radius
	Dor North, exploration area
	Hagit East, exploration area
	Hadera Wastewater Treatment Facility, exploration area
	Ein Ayala, exploration area
	Emek Hefer - Meretz Wastewater Treatment Facility, exploration area

Table Table 1.4.4-3: List of Monitoring Stations belonging to the Hadera Cities Association

Monitoring Station	Coordinates	
	X	Y
Beit Eliezer	194.5	704.5
Hadera	192	706
Barkai	202.4	709
Netanya	187.2	694.8
Elyakim	206.5	726.5
Zikhron Ya'akov	195.9	719.9
Pardes Hanna	196.8	708.1
Elyakhin	192.6	701.7
Menashe	193	708.6
Givat Ada	200.6	713.8
Gan Shmuel	196.6	7-5.3
HaMa'apil	198.1	697.7
Magal	203.4	699.2
Kerem Maharal	199.1	728.4
Daliyat al-Carmel	206.9	731.9
Amikam	202.2	719.1
Kafr Kara	204.5	713.2
Ein HaShofet	209.3	723.3

Background sources

The pollutant sources input into the model are divided into two: focal discharge sources and discharge sources from vehicles.

A. Focal sources

The focal discharge sources include discharge sources from chimney stacks as obtained from the Ministry of Environmental Protection, and future discharge sources planned as part of approved plans. In the event that a future discharge source replaces an existing discharge source, only the future discharge source was taken into consideration.

Following conversations with representatives of the Ministry of Environmental Protection and the Hadera Cities Association, the approved future discharge source data obtained according to the various alternatives are presented below:

<u>Dor North and Ein Ayala alternatives</u>

Updates were received regarding the Hagit site, where Steam Unit No. 9 is to be added in future. According to the Planning Division manager at the Haifa District Office of the Ministry of Environmental Protection, it was confirmed verbally that this is the only future discharge approved for this area.

<u>Hadera Wastewater Treatment Facility alternative</u>

An update was received from the IEC regarding future discharges from Orot Rabin Power Station stacks.

According to the Planning Division manager at the Haifa District Office of the Ministry of Environmental Protection, it is possible that there may be a change in future as regards discharges in accordance with future plans approved for the area, but no additional data have been received yet.

No additional data have yet been received from the Ministry of Environmental Protection in regard to future discharges according to approved plans.

Therefore, the future discharges from approved plans that were input into the model are:

- The Hagit Power Stations (addition of Steam Unit No. 9) in addition to the data relating to the present conditions that were received from the Ministry of Environmental Protection.
- Future discharge data received from the IEC in regard to the Orot Rabin Power Station.

<u>Hagit alternative</u>

An update regarding the Hagit site was received from the IEC. According to the Planning Division manager at the Haifa District Office of the Ministry of Environmental Protection, and following a conversation with the Air Quality coordinator and North District manager at the Ministry of Environmental

Protection, confirmation was received verbally that this is the only approved future discharge in this area.

B. Vehicular discharge sources

Discharge sources from vehicles that were taken into consideration are from both national and regional roads. The calculation of discharge sources was performed in accordance with the following formula:

Q=COEF*N*L/3600

Q - Discharge in g/second

N - Maximum number of vehicles moving on the road in both directions per hour, based on the count of vehicle movements provided by the Central Bureau of Statistics reports generator

L - Length of the road

COEF - Weighted discharge coefficient for all types of vehicles

This coefficient weighs the road incline, the average speed of vehicles and the type of vehicle (private car, taxis, vans, minibuses, trucks, buses and motorcycles). Table number 1.4.4-4 specifies the distribution of the types of vehicles. This table is based on information provided by the Central Bureau of Statistics.

Table 1.4.4-4: Percent Mileage of all types of Vehicles

Type of Vehicle	% Mileage
Private	64.6
Taxi	3.4
Van	0.3
Minibus	1.5
Truck	26.5
Bus	1.9
Motorcycle	1.8

Calculations of discharge rates from vehicles were made for each and every segment along each of the roads. A road segment was usually defined as the road section from one junction to the next, or from a junction to an interchange.

Evaluation of pollutant discharge rates for each and every segment during non-peak load hours was made by means of data provided by the counting generator of the Central Bureau of Statistics for "traffic volume by road, segment and time of day (average) per hour for all days of the week." These data were used to calculate the

discharge coefficients for every hour in the course of each 24-hour period for all days of the week.

Model run scenarios

The model was run for the following scenarios:

Nitrous oxides:

Scenario 1: In this scenario, focal discharge sources and vehicle discharge sources were input.

Scenario 2: In this scenario, only focal discharge sources were input.

The two above-described scenarios were implemented as regards the pollutant nitrous oxide. The model run according to the first scenario presents results of very high pollutant concentrations that are even not realistic in areas adjacent to the roads. For this reason, a second scenario was also applied in which the model did not take into account the discharges from vehicles, and it was possible to present maximum concentration results.

Sulfur dioxide:

For the calculations of this pollutant, only focal discharge sources were input. The discharge of sulfur dioxides from vehicles is very low and for this reason was not input into the model.

Benzene:

In order to calculate this pollutant, only discharge sources from vehicles were input since no discharge data were received from focal sources.

Calculation of averaging times

The AERMOD dispersion model calculates environmental concentrations at minimum averaging times of one hour. For environmental values and target values expressed in an averaging period of less than an hour, the concentrations were calculated using short-term averaging times of one hour, and were adjusted to the desired averaging times by means of a formula developed by D. Bruce Turner[vii]:

$Cs=Cc(tc/ts)0.2$

Cs - Corrected concentration for an average time "S," microgram/m^3

Cc - Concentration calculated by the model, microgram/m^3

tc - Average time of concentrations calculated by the model, minutes

ts - Average time required, minutes

The results of the model run are detailed below and compared to the threshold values in each of the alternatives.

1.4.4.2 Results of Model Run

1.4.4.2.1 Dor North and Ein Ayala alternatives

The Model's Input Data

The meteorological data used for the model run were taken from the Ein Carmel meteorological station. The station is located in an area of banana groves to the northeast of the locality, at coordinates 731820N/196450E at a height of 25 m above the ground.

In order to construct a profile of the planetary boundary layer (PBL), data were established for the meteorological parameters and the soil data: the roughness of the surface of the soil, the Bowen ratio and the Albedo ratio. The station is located on the outskirts of a cultivated area (frequently irrigated) and was divided into a single sector (0°-360°). Therefore, the following characteristics were defined (the characteristics were adapted to a dry area with a long season of no rainfall):

Albedo ratio: 0.28

Bowen ratio: 1.625

Surface roughness (in meters): 0.0725

Solar radiation data were taken from the station located at the Technion in Haifa, located at coordinates 202380/742150.

Elevation data were taken from the Beit Dagan meteorological station, at coordinates 182060/657320.

Definition of receptors

In the context of the model run, 1530 receptors were defined as specified below (Figure 1.4.4-2):

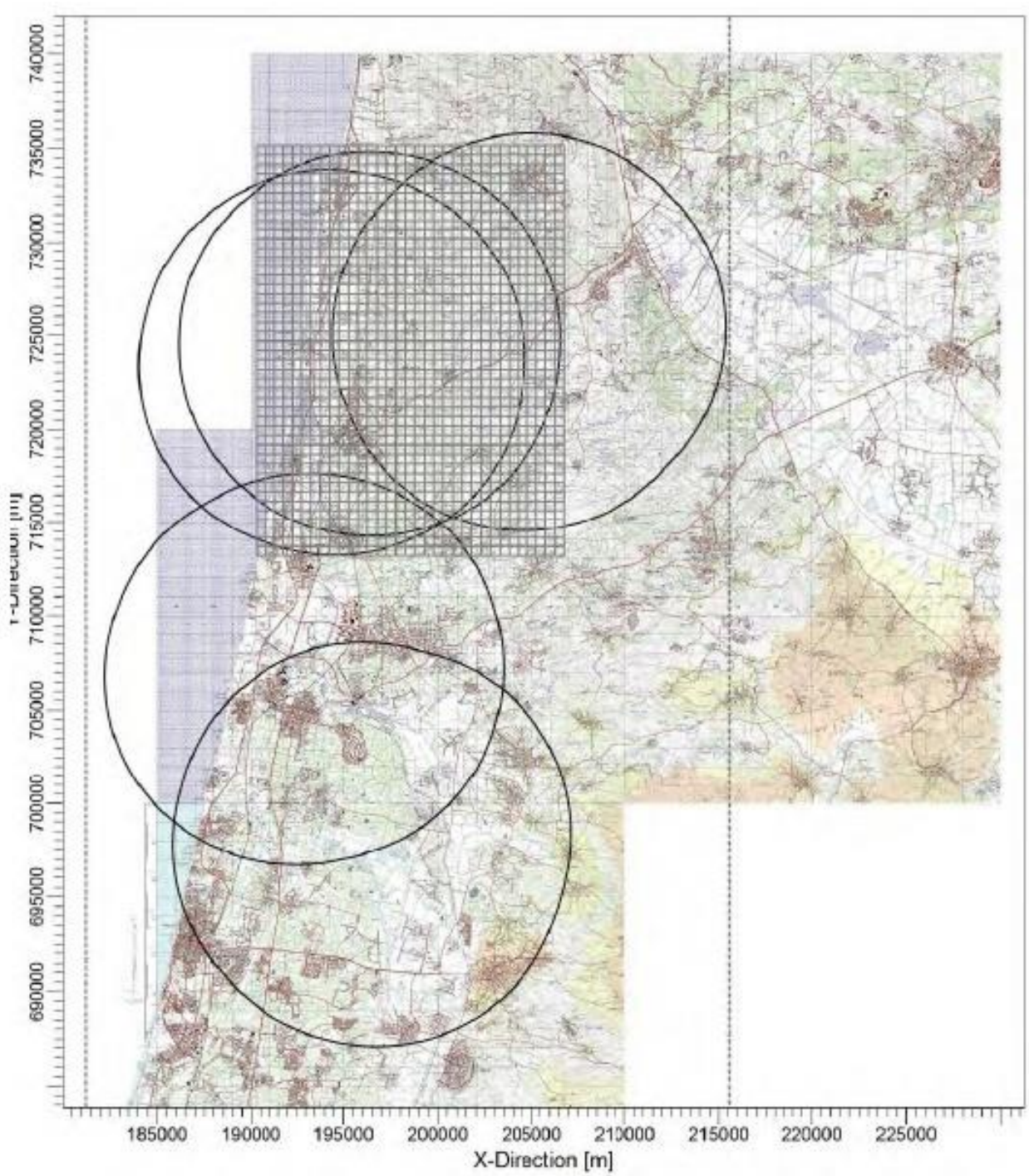
A network of receptors extending over 22 km from north to south and 16.5 km from east to west was selected (the sea was not taken as part of the receptor network). The distance between receptors was 500 meters.

In addition, a number of individual receptors were also selected, as specified in Table 1.4.4-5.

Table 1.4.4-5: Location of Individual Receptors:

Receptor Number	Receptor Location	X	Y
1.	Elyakim	206500	726500
2.	Zikhron Ya'akov	195900	719900
3.	Kerem Maharal	199100	728400
4.	Daliyat al-Carmel	206900	731900
5.	Amikam	202200	719100
6.	Atlit	194890.4	732582.6
7.	Ein Ayala	195176.7	725988.3
8.	Fureidis	195825.7	722762.7
9.	Binyamina	195186.3	714002
10.	Bat Shlomo	200597.3	722915.4
11.	**Ramot Menashe**	**205502.5**	**722562.3**

Figure 1.4.4-2: Location of Receptor Network for the Ein Ayala and Dor North Alternatives on the Background of the Areas of the Alternatives



Background Sources

Table No. 1.4.4-6 specifies the focal discharge sources that were input into the model.

Table 1.4.4-6: Focal Discharge Sources

Site Name	X	Y	Height meters	Diameters meters	Temperature (°C)	Speed m/s	SO2 kg/hour	NOx kg/hour
Hagit Power Station IEC	204210	724780	70	6.25	145.5	25.6	0	34.9
Hagit Power Station IEC	204210	724780	70	6.25	147.5	24.1	4.2	0
Hagit Power Station IEC	204210	724780	70	6.25	147.5	24.1	0	37.85
Hagit Power Station IEC	204350	724820	70	6.25	144	23.7	3.65	0
Hagit Power Station IEC	204350	724820	70	6.25	144	23.7	0	36.55
Hagit Power Station IEC	204350	724820	70	6.25	148.5	26.7	3.15	0
Hagit Power Station IEC	204350	724820	70	6.25	148.5	26.7	0	40.7
Hagit Power Station IEC	204050	724822	70	6	120	24.8	3.15	55.65
Hagit Power Station IEC*	2040505	724822	70	7.5	104	16.1	33	110
Vitamed Ltd.	195824	713449	15	0.5	122	2.3	0	0.1
Carmel Chemicals	195590	733633	20	1.25	183	2.13	6.6	1.06
Carmel Chemicals	195590	733633	20	0.75	197	4.43	5.27	1.52
Kal-Kar Ein Carmel	196711	731744	12	0.6	189.25	6.8625	5.375	2.3425
Kal-Kar Ein Carmel	196711	731744	12	0.55	193.5	4.84	2.9075	1.13

*Addition of future steam unit (Unit 9) –data received from IEC

Discharge sources from vehicles

Roads that were taken into consideration when calculating the discharge sources from vehicles for the Ein Ayala and Dor alternatives are: Roads 2, 4, 6, 7 and 652. Table number 1.4.4-7 specifies the characteristics of the roads (geometry and mileage). The roads' incline was taken to be 0% and the speed of the vehicles was taken as 90 km/h except for Road 6, where the speed taken was 100 km/h.

Table 1.4.4-7: Characteristics of Roads (Geometry and Mileage) for the Ein Ayala and Dor North Alternative

Road No.	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
6	Iron Interchange-Ein Tut Interchange	9	0.015	2600	12	0.027
652	Binyamina - Ada Junction	0.9	0.0072	900	0.4	0.143
652	Renanim - Binyamina Junction	5.6	0.0072	1057	2.96	0.0067
652	Ramat Beit Zvi - Renanim	0.6	0.0072	1767	0.53	0.0012
652	Entrance to old Zikhron - Ramat Beit Zvi	2.2	0.0072	1082	1.19	0.0027
652	Shfaya Junction - Entrance to old Zikhron	0.54	0.0072	412	0.11	0.00025
70	Entrance to old Zikhron - Elyakim Interchange	12.5	0.0144	2501	15.6	0.035
70	Zikhron Interchange - Fureidis Junction	2	0.0144	1976	1.97	0.0045
70	Fureidis Junction - Entrance to old Zikhron	2.4	0.0144	2787	3.34	0.0076
2	Caesarea Interchange - Zikhron Interchange	14	0.0144	3900	27.3	0.062
2	Zikhron Interchange - Atlit Junction	14	0.0144	1575	11	0.025

Road No.	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
4	Binyamina Junction - Fureidis Junction	8.7	0.0144	1763	7.66	0.0175
4	Fureidis Junction - Atlit Junction	13.4	0.0072	1053	7	0.016

<u>Results of Model Run</u>

Tables 1.4.4-8-11 describe the results of the model run in accordance with the scenarios explained above. Also, the values deviating from the standard are emphasized.

Table 1.4.4-8: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources and Vehicle Contribution) - Dor North and Ein Ayala Alternatives

Serial No.	Location	X Coordinate	Y Coordinate	Standard Max. Half-hourly Concentration mcg/m³	Environment 940 Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Environment 940 Percentage of Half-hourly Environmental Value %	Max. 24-hour Concen-tration mcg/m³	Environment 560 Percentage of 24-hour Environmental Value %	Second Max. 24-hour Concentration mcg/m³	Environment 560 Percentage of 24-hour Environmental Value %
1.	Elyakim	206500	726500	**1497.4**	**159.3**	**1249.5**	**132.9**	89.7	16.0	87.5	15.6
2.	Zikhron Yaakov	195900	719900	330.9	35.2	322.5	34.3	24.3	4.3	22.8	4.1
3.	KeremMaharal	199100	728400	334.0	35.5	334.0	35.5	41.5	7.4	39.3	7.0
4.	Daliyat al-Carmel	206900	731900	256.8	27.3	251.0	26.7	18.4	3.3	14.5	2.6
5.	Amikam	202200	719100	**1301.8**	**138.5**	**1118.4**	**119.0**	125.8	22.5	122.7	21.9
6.	Atlit	194890.4	732582.6	**4871.7**	**518.3**	**4201.6**	**447.0**	207.4	37.0	194.2	34.7
7.	Ein Ayala	195176.7	725988.3	**1274.9**	**135.6**	931.1	99.1	87.6	15.7	85.0	15.2
8.	Fureidis	195825.7	722762.7	451.5	48.0	437.0	46.5	49.7	8.9	4.4	7.5
9.	Binyamina	195186.3	714002	**1061.9**	**113.0**	**1061.9**	**113.0**	72.8	13.0	70.2	12.5
10.	Bat Shlomo	200597.3	722915.4	**1327.0**	**141.2**	**1279.3**	**136.1**	114.1	20.4	95.5	17.1
11.	Ramot Menashe	205502.5	722562.3	533.5	56.8	457.1	48.6	32.2	5.7	29.4	5.3

Table 1.4.4-9: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources Only) - Dor North and Ein Ayala Alternatives

Serial No.	Location	X Coordinate	Y Coordinate	Max. Half-hourly Concentration mcg/m³	Standard Environment 940 Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Standard Environment 940 Percentage of Half-hourly Environmental Value %	Maximum 24-hour Concentration mcg/m³	Standard Environment 560 Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Standard Environment 560 Percentage of 24-hour Environmental Value %
	Maximum	204282.1	731172.6	343.7	36.6	343.7	36.6	14	7.3	22	5.9
1.	Elyakim	206500	726500	43.5	4.6	42.4	4.5	3.7	0.7	3.2	0.6
2.	Zikhron Yaakov	195900	719900	23.2	2.5	14.5	1.5	0.9	0.2	0.6	0.1
3.	KeremMaharal	199100	728400	31.2	3.3	30.5	3.2	2.9	0.5	2.1	0.4
4.	Daliyat al-Carmel	206900	731900	256.8	27.3	251.0	26.7	18.4	3.3	14.3	2.5
5.	Amikam	202200	719100	34.2	3.6	31.9	3.4	1.7	0.3	1.5	0.3
6.	Atlit	194890.4	732582.6	27.8	3.0	25.5	2.7	4.1	0.7	4.1	0.7
7.	Ein Ayala	195176.7	725988.3	24.1	2.6	20.1	2.1	2.7	0.5	2.5	0.5
8.	Fureidis	195825.7	722762.7	35.9	3.8	27.1	2.9	1.6	0.3	1.5	0.3
9.	Binyamina	195186.3	714002	15.3	1.6	12.8	1.4	1.0	0.2	0.9	0.2
10.	Bat Shlomo	200597.3	722915.4	28.1	3.0	25.6	2.7	1.6	0.3	1.5	0.3
11.	Ramot Menashe	205502.5	722562.3	51.7	5.5	43.2	4.6	6.3	1.1	5.9	1.1

Table 1.4.4-10: Results of the Model Run for the Benzene Pollutant - Dor North and Ein Ayala Alternatives

Serial No.	Location	X Coordinate	Y Coordinate	Standard Maximum 24-hour Concentration mcg/m³	Target 3.9 Percentage of 24-hour Target Value %	Second Maximum 24-hour Concentration mcg/m³	Target 3.9 Percentage of 24-hour Target Value %	Maximum Annual Concentration mcg/m³	Target 1.3 Percentage of Annual Target Value %	Environment 5 Percentage of Annual Environmental Value %
	Maximum	204282.1	731172.6	**11.27**	**289**	**9.48**	**243**	**2.70**	**207.9**	54.0
1.	Elyakim	206500	726500	0.20	5.2	0.20	5.1	0.04	2.8	0.7
2.	Zikhron Yaakov	195900	719900	0.06	1.4	0.05	1.3	0.01	0.7	0.2
3.	KeremMaharal	199100	728400	0.09	2.4	0.09	2.3	0.01	1.1	0.3
4.	Daliyat al-Carmel	206900	731900	0.01	0.3	0.01	0.1	0.00	0.0	0.0
5.	Amikam	202200	719100	0.29	7.4	0.28	7.2	0.08	6.5	1.7
6.	Atlit	194890.4	732582.6	0.47	12.0	0.44	11.4	0.09	6.7	1.7
7.	Ein Ayala	195176.7	725988.3	0.20	5.1	0.19	5.0	0.05	3.9	1.0
8.	Fureidis	195825.7	722762.7	0.11	2.9	0.10	2.5	0.02	1.8	0.5
9.	Binyamina	195186.3	714002	0.17	4.3	0.16	4.1	0.03	1.9	0.5
10.	Bat Shlomo	200597.3	722915.4	0.26	6.7	0.22	5.6	0.05	3.6	0.9
11.	Ramot Menashe	205502.5	722562.3	0.07	1.9	0.06	1.6	0.01	0.8	0.2

Table 1.4.4-11: Results of the Model Run for the Sulfur Dioxide SO_2 Pollutant - Dor North and Ein Ayala Alternatives

				Standard	Target - 500		Target - 500		Environment 350		Environment 350		Environment 350		Environment 125	Target 20		Environment 125	Target 20		Environment 60
Serial No.	**Location**	**X Coordinate**	**Y Coordinate**	**Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Target Value %**	**Second Concentration – Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Environ-mental Value %**	**Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environ-mental Value %**	**Second Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Hourly Percentile 99.9 mcg/m³**	**Percentage of Hourly Environmental Value %**	**Max. 24-hour Concentration mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Second Concentration 24 hours - mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Maximum Annual Concentration mcg/m³**	**Percentage of Annual Environmental Value %**
	Maximum	196782.1	731672.6	**643.7**	**128.7**	**625.7**	**125.1**	**449.9**	**128.5**	**437.3**	**124.9**	337.9	96.5	60.9	48.7	**304.4**	58.4	46.7	**292.0**	12.4	20.7
1.	Elyakim	206500	726500	9.5	1.9	9.2	1.8	6.6	1.9	6.4	1.8	3.0	0.9	0.6	0.4	2.8	0.5	0.4	2.5	0.1	0.2
2.	Zikhron Yaakov	195900	719900	15.0	3.0	12.3	2.5	10.5	3.0	8.6	2.4	2.2	0.6	0.5	0.4	2.6	0.4	0.3	2.1	0.0	0.0
3.	KeremMaharal	199100	728400	54.5	10.9	54.1	10.8	38.1	10.9	37.8	10.8	32.1	9.2	5.0	4.0	25.0	4.8	3.8	24.0	0.3	0.5
4.	Daliyat al-Carmel	206900	731900	47.3	9.5	47.1	9.4	33.0	9.4	32.9	9.4	19.7	5.6	2.6	2.1	13.2	2.0	1.6	10.0	0.1	0.2
5.	Amikam	202200	719100	35.5	7.1	35.4	7.1	24.8	7.1	24.7	7.1	17.7	5.1	2.4	1.9	12.1	1.8	1.4	8.8	0.1	0.2
6.	Atlit	194890.4	732582.6	64.8	13.0	62.3	12.5	45.3	12.9	43.5	12.4	31.0	8.9	8.9	7.1	44.6	7.9	6.3	39.4	0.7	1.2
7.	Ein Ayala	195176.7	725988.3	32.4	6.5	32.3	6.5	22.6	6.5	22.6	6.5	16.0	4.6	3.3	2.6	16.3	2.6	2.1	12.9	0.1	0.2
8.	Fureidis	195825.7	722762.7	81.4	16.3	78.2	15.6	56.9	16.3	54.6	15.6	40.0	11.4	3.5	2.8	17.5	3.2	2.6	16.2	0.2	0.3
9.	Binyamina	195186.3	714002	18.4	3.7	18.3	3.7	12.8	3.7	12.8	3.6	9.9	2.8	1.3	1.1	6.6	1.3	1.0	6.5	0.0	0.1
10.	Bat Shlomo	200597.3	722915.4	54.0	10.8	52.9	10.6	37.8	10.8	37.0	10.6	24.7	7.1	2.5	2.0	12.3	2.2	1.8	10.9	0.1	0.2
11.	Ramot Menashe	205502.5	722562.3	16.1	3.2	11.8	2.4	11.2	3.2	8.2	2.4	4.3	1.2	1.0	0.8	5.2	1.0	0.8	5.1	0.1	0.2

Concentrations at Monitoring Stations

Tables 1.4.4 –12/13 present the concentrations of the nitrous oxides and sulfur dioxide at monitoring stations.

Table 1.4.4-12: Concentrations of Nitrous Oxide Pollutant for the year 2010 at the Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Elyakim	206500	726500	**259.5**	**48.9**
Zikhron Yaakov	195900	719900	**791.6**	**47**
KeremMaharal	199100	728400	**334.7**	**35.7**
Daliyat al-Carmel	206900	731900	**325.3**	**30**
Amikam	202200	719100	**389**	**33.8**

Table 1.4.4-13: Concentrations of Sulfur Dioxide Pollutant for the year 2010 at the Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Elyakim	206500	726500	**177.8**	**18.3**
Zikhron Yaakov	195900	719900	**104**	**13**
KeremMaharal	199100	728400	**75.8**	**13**
Daliyat al-Carmel	206900	731900	**191**	**18**
Amikam	202200	719100	**259**	**13**

Discussion of Results:

The results of running the model for the Ein Ayala and Dor North alternative lead to the following conclusions:

Nitrous oxides:

According to the explanation of the model run scenarios presented in Section 1.4.4.1, the nitrous oxides pollutant was run in two scenarios:

Scenario 1: Model run for the discharges from vehicles and focal discharges.

Scenario 2: Model run for focal discharges only.

The running of the model according to Scenario 1 yielded high results beyond the threshold values in the receptors located close to the roads. Deviant readings were in the following locations: Elyakim, Amikam, Atlit, Ein Ayala, Binyamina, Bat Shlomo in both maximum half-hour values and the second values. Moreover, where maximum values were found, the high values received were non-realistic.

In order to neutralize the impact of the roads and to examine the maximum model results, the nitrous oxides pollutant was additionally run for focal discharges only.

Results of the model run according to the second scenario indicated that the concentrations of the nitrous oxides pollutant conform to the environmental values and the target values at all averaging times.

Moreover, it can be seen in the concentration measurements taken at the monitoring station of the Hadera Cities Association that the nitrous oxide concentrations conform to both the half-hourly and 24-hour standards.

<u>Sulfur dioxide</u>:

It was found that the concentrations of sulfur dioxide deviate from the environment and target values only at a maximum point at a rate of 29% and 25% of the target values in an averaging time of 10 minutes in the maximum results and in the second results, respectively, and in the hourly environment value at rates of 28.5% and 25% in the maximum results and the second result, respectively. In the maximum 24-hour concentration and the secondary 24-hour concentration, the results do not conform to the target value and exceed it by a rate of 204% and 192%, respectively.

In other locations examined, the results of the model conform to the environment and target values.

Moreover, as can be seen in the measurements of concentrations taken at the monitoring stations of the Hadera Cities Association, the concentrations of sulfur dioxide conform to both the hourly and 24-hourly standards.

<u>Benzene</u>:

It was found that the maximum and secondary benzene concentrations at the maximum location do not conform to the target values, and exceed them by 189% and 143%, respectively. Moreover, the maximum annual concentration does not conform to the target value, and exceeds it by 108%. In the rest of the locations, no deviations were found.

1.4.4.2.2 Hadera Wastewater Treatment Facility Alternative

Model Input Data

Meteorological data used for the model run were taken from the meteorological station located in Hadera at coordinates 704800/192300.

In order to construct a profile of the planetary boundary layer (PBL), the following values were established for the meteorological parameters and the soil data: the roughness of the surface of the soil, the Bowen ratio and the Albedo ratio. The area was divided into a single sector (0°-360°) and the following are its characteristics:

Albedo ratio: 0.2075

Bowen ratio: 1.625

Surface roughness (in meters): 1 m

The station is located within an urban area.

Definition of receptors

In the context of the model run, 1462 receptors were defined as specified below (Figure 1.4.4-3):

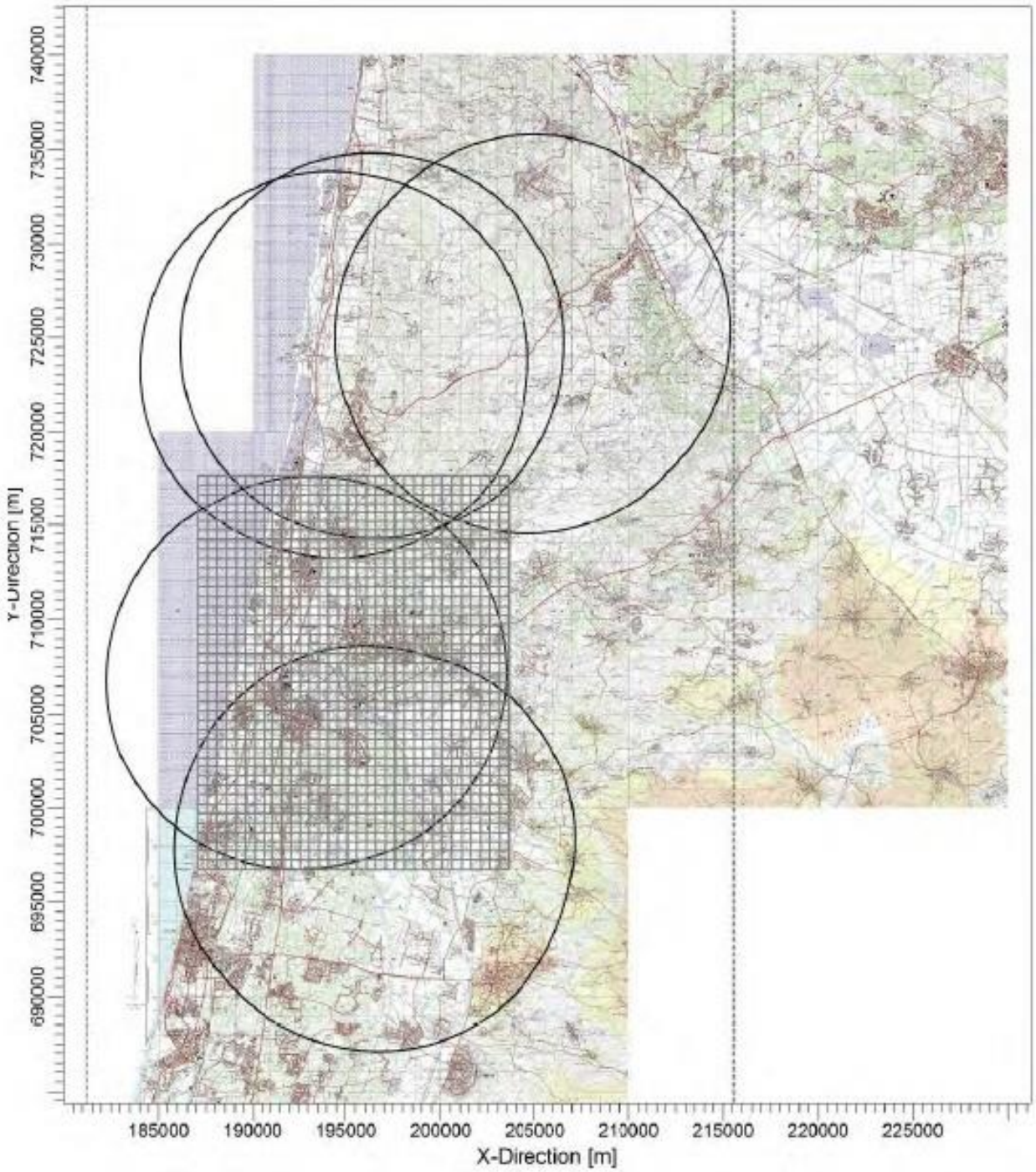
A network of receptors extending over 21 km from north to south and 16.5 km from east to west was selected. The distance between receptors was 500 meters.

In addition, a number of individual receptors were also selected, as specified in Table 1.4.4-14.

Table 1.4.4-14: Location of Individual Receptors:

Receptor Number	Receptor Location	X	Y
1.	Beit Eliezer	194500	704500
2.	Hadera	192300	704800
3.	Hadera - Association Building	192000	706000
4.	Barkai	202400	709000
5.	Pardes Hanna	196800	708100
6.	Elyakhin	192600	701700
7.	Menashe	193000	708600
8.	Givat Ada	200600	713800
9.	Gan Shmuel	196600	705300
10.	Binyamina	195241.4	714096
11.	Or Akiva	192601.5	712837.9

Figure 1.4.4-3: Location of Receptor Network for the Hadera Alternative on the Background of the Areas of the Alternatives



Background sources

Table No. 1.4.4-15 specifies the focal discharge sources that were input into the model.

Table 1.4.4-15: Focal Discharge Sources

Site Name	X	Y	Height meters	Diameters meters	Temperature (°C)	Speed m/s	SO2 kg/hour	NOx kg/hour
Ytong Alliance -	197977	709895	10	0.9	197.8	4.6	7.4	3.454
Tire Company (1992) Ltd.	192895	707467	20	1.78	208.2	2.82	18.4	7.3856
Alliance - Tire Company (1992) Ltd.	192895	707467	20	1	16.5	10.2	16.5	7.1125
"Ein Shemer" Rubber Factory	202298	708001	10	0.3	188	6.2	1.24	0.31
"Ein Shemer" Rubber Factory	202298	708001	10	0.33	181	7.31	1.97	0.51
Amber - Mixture Institute	196558	705906	20	0.75	185	7.3	8.3	3.215
Gan Shmuel Food Ltd.	196466	706461	10	0.78	191	3.2	3.95	1.65
Gan Shmuel Food Ltd.	196466	706461	24	0.95	235.5	8.105	12.65	5.13
Gan Shmuel Food Ltd.	192329	706461	24	0.85	208	7.335	11.5	5.23
Hadera Paper	192329	706692	100	2.1	130.9	12.9	0.1	15.3
Hadera Paper	192329	706692	60	2	159.5	11.1	0.2	9.5
Biopet Ltd.	191342	696744	12	0.29	184	3.77	0.57	0.25
HodHefer Ltd.	190391	700962	10	0.46	198.1	9.25	5.1	1.47
HodHefer Ltd.	190391	700962	15	0.56	201.9	10.3	7.7	2.83
TivTaam HaCarmel Ltd.	190985	700977	25	0.5	211	4.8	2.15	0.9
Materna Laboratories Ltd.	191343	696744	10	0.43	219	6.1	2.35	0.9
Materna Laboratories Ltd.	191343	696744	10	0.37	195	7.4	2.58	0.76

Site Name	X	Y	Height meters	Diameters meters	Temperature (°C)	Speed m/s	SO2 kg/hour	NOx kg/hour
Pachmas Industries	194591	698912	12	0.5	204	4.96	1.7	0.5
Pachmas Industries	194591	698912	12	0.5	252.2	5.06	2.03	0.64
Prigat International Ltd.	194016	700362	20	0.7	210.4	8.2	6.8955	2.881
Prigat International Ltd.	194016	700362	20	0.9	240.85	11.3	17.487	7.5785
Prigat International Ltd.	194016	700362	20	1.05	268	9.4	15.463	6.019
Caesarstone Sdot Yam Ltd.	191120	711575	20	0.8	78	10.29	0	0.086
Gan Shmuel Food Ltd.	196466	706461	15	0.36	229	9.1	0.89	0.14
IEC Orot Rabin Power Station Hadera**	189537	708401	250	7	128	31.6	65.88	94
IEC Orot Rabin Power Station Hadera**	189500	708242	250	7	128	31.6	65.88	94
IEC Orot Rabin Power Station Hadera**	189660	708885	250	7.64	53	30.1	381	381

**The data are future data derived from approved plans. Data were received from the IEC, Unit for the Prevention of Hazards and Environmental Licensing – Statutory Planning and Environmental Quality Division – Planning, Development and Technology Department.

Roads that were taken into consideration when calculating the discharge sources from vehicles for the Hadera alternative (in addition to the overlapping roads in the Ein Ayala and Dor North alternatives) are: Roads 2, 4, 65, 650, 651, 652, 581. Table number 1.4.4-16 specifies the characteristics of the roads (geometry and mileage). The roads' incline was taken to be 0% and the speed of the vehicles was taken as 90 km/h.

Table 1.4.4-16: Characteristics of Roads (Geometry and Mileage) for the Hadera Alternative

Road Number	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
651	Ytong Junction - Pardes Hanna Junction	2.2	0.0072	1923	2.11	0.005
651	Pardes Hanna Junction - Pal-Yam Junction	2.8	0.0144	1923	2.7	0.006
652	Ytong Junction - Ada Junction	3.6	0.0072	1187	2.134	0.005
652	Tel Zvi - Ytong Junction	1.1	0.0072	1598	0.82	0.002
652	Hanna Junction - Tel Zvi	1.7	0.0072	1268	1.077	0.002
650	Entire Road	3.2	0.0072	778	1.24	0.003
581	Kalanit Junction - Baqa al-Gharbiyye Junction	3	0.0072	1464	2.2	0.005
581	Baqa al-Gharbiyye Junction - Magal Junction	3.4	0.0144	1464	2.5	0.0057
581	HaRo'eh Junction - Magal Junction	11.1	0.0072	1330	7.38	0.017
65	Menashe Junction – Mishmar HaGevul Junction	0.9	0.0144	2359	1.06	0.0024
65	Hanna Junction - Menashe Junction	6.4	0.0144	3502	11.2	0.025

Road Number	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
65	Alon Junction - Hanna Junction	1.2	0.0144	2914	1.75	0.004
65	Nahal Hadera Junction - Alon Junction	1.2	0.0144	3381	2.03	0.004
65	Nahal Hadera Junction - Caesarea Interchange	1.6	0.0144	1938	1.55	0.0035
4	Or Akiva - Binyamina Junction	1.6	0.0144	2319	1.77	0.004
4	Nahal Hadera Junction - Or Akiva	4.4	0.0144	2313	5.08	0.012
4	Haroshet Junction - Nahal Hadera Junction	1.3	0.0144	2411	1.56	0.0036
4	Hadera Junction - Haroshet Junction	1.9	0.0144	2204	2.09	0.005
4	HaRo'eh Junction - Hadera Junction	7.7	0.0144	2335	9	0.02
2	Olga Interchange - Caesarea Interchange	3	0.0144	5748	8.62	0.02
2	Yanai Interchange - Olga Interchange	7.7	0.0144	6307	24.3	0.055

Results of Model Run

Tables 1.4.4-17-1.4.4-20 describe the results of the model run in accordance with the scenarios explained at the beginning of the chapter.

Table 1.4.4-17: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources and Vehicle Contribution) - Hadera Alternative

Serial No.	Location	Standard X Coordinate	Y Coordinate	Max. Half-hourly Concentration mcg/m³	Environment 940 Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Environment 940 Percentage of Half-hourly Environmental Value %	Max. 24-hour Concentration mcg/m³	Environment 560 Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Environment 560 Percentage of 24-hour Environmental Value %
4.	Beit Eliezer	194500	704500	549.9	58.5	549.9	58.5	38.6	6.9	37.6	6.7
6.	Hadera	192300	704800	578.0	61.5	578.0	61.5	45.2	8.1	42.7	7.6
2.	Hadera - Association Building	192000	706000	**1079.6**	**114.9**	**1079.6**	**114.9**	61.3	10.9	55.8	10.0
1.	Barkai	202400	709000	861.3	91.6	861.3	91.6	69.2	12.4	62.0	11.1
1.	Pardes Hanna	196800	708100	341.0	36.3	341.0	36.3	31.3	5.6	28.8	5.1
2.	Elyakhin	192600	701700	562.3	59.8	562.3	59.8	34.5	6.2	33.7	6.0
2.	Menashe	193000	708600	**1286.2**	**136.8**	**1286.2**	**136.8**	69.0	12.3	65.1	11.6
2.	Givat Ada	200600	713800	148.9	15.8	148.9	15.8	11.9	2.1	11.6	2.1
2.	Gan Shmuel	196600	705300	730.0	77.7	730.0	77.7	47.7	8.5	43.0	7.7
46.	Binyamina	195241.4	714096	**975.7**	**103.8**	**975.7**	**103.8**	100.2	17.9	89.2	15.9
44.	Or Akiva	192601.5	712837.9	**1469.4**	**156.3**	**1469.4**	**156.3**	73.6	13.1	69.8	12.5
46.	Caesarea	191156.1	713379.9	848.3	90.2	848.3	90.2	59.1	10.5	58.0	10.4
42.	Givat Haim	193826.9	700397.4	553.8	58.9	553.8	58.9	51.3	9.2	45.6	8.1
41.	Sdeh Yitzhak	199556.4	701270.3	259.2	27.6	259.2	27.6	22.2	4.0	16.8	3.0
41.	Sha'ar Menashe	201693.7	706238.8	573.8	61.0	573.8	61.0	45.4	8.1	29.1	5.2

Table 1.4.4-18: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources Only) - Hadera Alternative

Serial No.	Location	X Coordinate	Y Coordinate	Max. Half-hourly Concentration mcg/m³	Standard Environment 940 Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Environment 940 Percentage of Half-hourly Environmental Value %	Max. 24-hour Concentration mcg/m³	Environment 560 Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Environment 560 Percentage of 24-hour Environmental Value %
		Maximum	193592	707700.9	**1012.7**	**107.7**	**949.9**	**101.0**	94.1	16.8	76.5
4.	Beit Eliezer	194500	704500	80.4	80.4	8.6	8.1	8.8	1.6	6.8	1.2
6.	Hadera	192300	704800	82.5	82.5	8.8	8.7	7.5	1.3	6.9	1.2
2.	Hadera - Association Building	192000	706000	119.4	119.4	12.7	12.7	17.3	3.1	14.3	2.6
1.	Barkai	202400	709000	25.8	25.8	2.7	2.7	4.6	0.8	4.0	0.7
1.	Pardes Hanna	196800	708100	47.9	47.9	5.1	5.1	7.3	1.3	7.2	1.3
2.	Elyakhin	192600	701700	71.8	71.8	7.6	6.7	5.8	1.0	5.6	1.0
2.	Menashe	193000	708600	146.7	146.7	15.6	15.6	26.8	4.8	24.2	4.3
2.	Givat Ada	200600	713800	50.8	50.8	5.4	5.4	4.5	0.8	3.4	0.6
2.	Gan Shmuel	196600	705300	71.0	71.0	7.6	7.4	7.3	1.3	6.0	1.1
46.	Binyamina	195241.4	714096	52.4	52.4	5.6	5.4	4.6	0.8	4.3	0.8
44.	Or Akiva	192601.5	712837.9	62.4	62.4	6.6	6.3	7.9	1.4	7.7	1.4
46.	Caesarea	191156.1	713379.9	56.5	56.5	6.0	5.8	7.0	1.3	6.3	1.1
42.	Givat Haim	193826.9	700397.4	110.3	110.3	11.7	11.2	50.2	9.0	45.1	8.1
41.	Sdeh Yitzhak	199556.4	701270.3	52.8	52.8	5.6	5.4	3.8	0.7	3.5	0.6
41.	Sha'ar Menashe	201693.7	706238.8	38.5	38.5	4.1	4.0	3.7	0.7	3.6	0.6

Table 1.4.4-19: Results of the Model Run for the Benzene Pollutant - Hadera Alternative

		Standard			Target 3.9		Target 3.9		Target 1.3	Environment 5
Serial No.	**Location**	**X Coordinate**	**Y Coordinate**	**Max. 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Second Max. 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Max. Annual Concentration mcg/m³**	**Percentage of Annual Target Value %**	**Percentage of Annual Environmental Value %**
	Maximum	192592	717700.9	**4.06**	**104.2**	3.57	91.6	1.22	94.1	24.5
1.	Beit Eliezer	194500	704500	0.09	2.2	0.08	2.0	0.01	0.9	0.2
2.	Hadera	192300	704800	0.11	2.7	0.10	2.5	0.02	1.5	0.4
3.	Hadera - Association Building	192000	706000	0.14	3.6	0.13	3.2	0.03	2.2	0.6
4.	Barkai	202400	709000	0.10	2.6	0.08	1.9	0.01	0.7	0.2
5.	Pardes Hanna	196800	708100	0.07	1.7	0.06	1.6	0.02	1.3	0.3
6.	Elyakhin	192600	701700	0.08	2.1	0.08	2.0	0.01	0.9	0.2
7.	Menashe	193000	708600	0.16	4.0	0.15	3.8	0.03	2.3	0.6
8.	Givat Ada	200600	713800	0.02	0.5	0.02	0.5	0.00	0.2	0.1
9.	Gan Shmuel	196600	705300	0.10	2.6	0.09	2.4	0.01	1.1	0.3
10.	Binyamina	195241.4	714096	0.22	5.7	0.18	4.6	0.05	3.5	0.9
11.	Or Akiva	192601.5	712837.9	0.17	4.5	0.16	4.2	0.03	2.5	0.7
12.	Caesarea	191156.1	713379.9	0.14	3.6	0.14	3.6	0.03	2.2	0.6
13.	Givat Haim	193826.9	700397.4	0.10	2.5	0.08	2.2	0.02	1.5	0.4
14.	Sdeh Yitzhak	199556.4	701270.3	0.05	1.3	0.03	0.8	0.01	0.5	0.1
15.	Sha'ar Menashe	201693.7	706238.8	0.05	1.2	0.04	1.1	0.01	0.5	0.1

Table 1.4.4-20: Results of the Model Run for the Sulfur Dioxide SO_2 Pollutant - Hadera Alternative

		Standard			Target - 500		Target - 500		Environment 350		Environment 350		Environment 350		Environment 125	Target 20		Environment 125	Target 20		Environment 60
Serial No.	Location	X Coordinate	Y Coordinate	Max. 10-minute Concentration mcg/m³	Percentage of 10-minute Target Value %	Second Concentration – Max. 10-minute Concentration mcg/m³	Percentage of 10-minute Environmental Value %	Max. Hourly Concentration mcg/m³	Percentage of Hourly Environmental Value %	Second Max. Hourly Concentration mcg/m³	Percentage of Hourly Environmental Value %	Hourly Percentile 99.9 mcg/m³	Percentage of Hourly Environmental Value %	Max. 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %	Percentage of 24-hour Target Value %	Second Concentration 24 hours - mcg/m³	Percentage of 24-hour Environmental Value %	Percentage of 24-hour Target Value %	Maximum Annual Concentration mcg/m³	Percentage of Annual Environmental Value %
	Maximum	193592	707701	**2927.6**	**585.5**	**2745.9**	**549.2**	**2045.9**	**584.5**	**1918.9**	**548.3**	**441.5**	**126.2**	**216.0613**	**172.8**	**1080.3**	**176.2**	**141.0**	**881.1**	16.6	27.7
1.	Beit Eliezer	194500	704500	232.4	46.5	219.3	43.9	162.4	46.4	153.2	43.8	82.4	23.5	18.4	14.7	92.2	14.1	11.3	70.3	2.2	3.7
2.	Hadera	192300	704800	238.3	47.7	236.0	47.2	166.5	47.6	165.0	47.1	111.6	31.9	15.6	12.5	78.1	14.7	11.8	73.5	2.7	4.5
3.	Hadera*	192000	706000	344.7	68.9	344.4	68.9	240.9	68.8	240.7	68.8	188.4	53.8	38.2	30.6	191.2	32.9	26.3	164.4	4.0	6.7
4.	Barkai	202400	709000	76.3	15.3	76.2	15.2	53.3	15.2	53.2	15.2	51.5	14.7	13.3	10.7	66.6	13.1	10.5	65.4	1.8	3.0
5.	Pardes Hanna	196800	708100	143.9	28.8	143.1	28.6	100.6	28.7	100.0	28.6	84.1	24.0	17.0	13.6	84.9	16.9	13.5	84.3	3.1	5.2
6.	Elyakhin	192600	701700	207.7	41.5	182.2	36.4	145.1	41.5	127.3	36.4	45.5	13.0	13.5	10.8	67.5	12.8	10.2	63.8	2.5	4.1
7.	Menashe	193000	708600	425.7	85.1	424.6	84.9	297.5	85.0	296.8	84.8	278.1	79.5	59.0	47.2	295.0	52.8	42.3	264.1	7.3	12.1
8.	Givat Ada	200600	713800	155.0	31.0	154.9	31.0	108.3	31.0	108.2	30.9	68.0	19.4	11.0	8.8	55.0	9.2	7.3	45.8	0.8	1.4
9.	Gan Shmuel	196600	705300	205.2	41.0	202.1	40.4	143.4	41.0	141.3	40.4	75.1	21.4	18.7	15.0	93.7	15.2	12.2	76.0	2.7	4.5
10.	Binyamina	195241.4	714096	151.9	30.4	147.3	29.5	106.1	30.3	103.0	29.4	71.3	20.4	11.5	9.2	57.4	10.8	8.6	53.8	1.7	2.8
11.	Or Akiva	192601.5	712837.9	180.6	36.1	171.6	34.3	126.2	36.1	120.0	34.3	81.2	23.2	19.2	15.3	95.9	17.3	13.8	86.4	2.5	4.2
12.	Caesarea	191156.1	713379.9	163.5	32.7	158.0	31.6	114.3	32.6	110.4	31.6	78.2	22.3	15.5	12.4	77.6	13.9	11.1	69.6	2.2	3.7
13.	Givat Haim	193826.9	700397.4	331.9	66.4	317.7	63.5	231.9	66.3	222.0	63.4	180.2	51.5	121.0	96.8	**605.1**	108.6	86.8	**542.8**	8.4	14.1
14.	Sdeh Yitzhak	199556.4	701270.3	152.7	30.5	147.6	29.5	106.7	30.5	103.2	29.5	39.1	11.2	7.8	6.2	39.0	7.7	6.2	38.6	1.1	1.8
15.	Sha'ar Menashe	201693.7	706238.8	111.4	22.3	110.1	22.0	77.9	22.2	77.0	22.0	43.9	12.5	7.9	6.3	39.4	7.7	6.2	38.7	1.2	2.0

*Association Building

Concentrations at Monitoring Stations

Tables 1.4.4-21 - 1.4.4-22 present the concentrations of the nitrous oxides and sulfur dioxide at monitoring stations.

Table 1.4.4-21: Concentrations of Nitrous Oxide Pollutant for the year 2010 at Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Beit Eliezer	194500	704500	526	156
Hadera	192300	704800	522.7	152.3
Barkai	202400	709000	413	176.7
Pardes Hanna	196800	708100	468	86.5
Elyakhin	192600	701700	353.5	67.7
Menashe	193000	708600	492.6	75
Givat Ada	200600	713800	376	52.6
Gan Shmuel	196600	705300	406	88.4

Table 1.4.4-22: Concentrations of Sulfur Dioxide Pollutant for the year 2010 at Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Beit Eliezer	194500	704500	355.7	44.85
Hadera	192300	704800	204	34
Barkai	202400	709000	243.3	23.5
Pardes Hanna	196800	708100	361	67.8
Elyakhin	192600	701700	196.2	21
Menashe	193000	708600	377.4	23
Givat Ada	200600	713800	287.7	28.8
Gan Shmuel	196600	705300	329.6	47

Discussion of results:

Results of running the model for the Hadera alternative lead to the following conclusions:

Nitrous oxides:

According to the explanation of the model run scenarios presented in Section 1.4.4.1, the nitrous oxides pollutant was run in two scenarios:

Scenario 1: Model run for the discharges from vehicles and focal discharges.

Scenario 2: Model run for focal discharges only.

The running of the model according to Scenario 1 yielded high results beyond the threshold values in the receptors located close to the roads.

Deviant readings were in the following locations: Hadera - Association Building, Menashe, and Or Akiva in both maximum half-hour values and the second values. Moreover, where maximum values were found, the high values received were non-realistic. Therefore, in order to neutralize the impact of the roads and to examine the maximum model results, the nitrous oxides pollutant was additionally run for focal discharges only.

The results of the model run according to the second scenario indicated that the concentrations of the nitrous oxides pollutant exceed the maximum half-hourly environmental values at the maximum point by about 8%, and secondary environmental values by about 1%. In the rest of the locations examined, the concentrations conformed to all environmental target values.

Moreover, it can be seen in the concentration measurements taken at the monitoring station of the Hadera Cities Association that the nitrous oxide concentrations conform to both the half-hourly and 24-hour standards.

Sulfur dioxide:

It was found that the concentrations of sulfur dioxide deviate from the target value only at the maximum point when the averaging is done over 10 minutes (by 485% at the maximum and 492% at the secondary one), from the hourly environment value (by 484% at the maximum, and 448% at the secondary one) and at the hourly 99.9% percentile by 26%, from the 24-hour environmental value (by 73% at the maximum and 41% at the secondary one) and from the 24-hour target value (by 908% for the maximum and 781% at the secondary one) from the environmental value. Moreover, deviations were found in the locations: Givat Haim in the 24-hour target values, both the maximum (a deviation of 505%) and secondary ones (a deviation of 443%).

In the rest of the locations examined, the model results conform to the environmental target values.

The results of the model run were mostly lower than the measured results obtained via the monitoring stations. Moreover, as may be seen in the concentration measurements taken at the monitoring stations of the Hadera Cities Association, the concentrations of sulfur dioxide do not conform to the 24-hour target values.

According to the isoplate map (see Appendix C), we see that the location of the area where the maximum deviation was found, both of the nitrous oxide pollutant and of the sulfur dioxide pollutant, was an area around which focal discharge sources are located.

Benzene:

It was found that in the maximum location, only the maximum 24-hour benzene concentrations deviate by 4% from the target value. The rest of the concentrations in the locations calculated by means of the model were found to be far lower than the threshold values, for these areas are distant from the roads.

1.4.4.2.3 Meretz Wastewater Treatment Facility alternative

Model's Input Data

Meteorological data used for the model run were taken from the HaMa'apil meteorological station. The station located at Emek Hefer at the coordinates 697200N/198100E at a height of 24 m above sea level, south of Kibbutz HaMa'apil near the fish ponds.

In order to construct a profile of the planetary boundary layer (PBL), the area was divided into the following sectors:

Sectors 0-90 and 270-360, which are mainly impacted by the fish ponds.

Sector 90-270, characterized by fields and low crops.

Table No. 1.4.4-23 presents the parameters of the boundary layer according to sectors.

Table 1.4.4-23: Parameters of the Planetary Boundary Layer according to sector

Wind Direction	Albedo	Bowen Ratio	Roughness Length
0-90	0.14	0.6	0.03
90-270	0.28	1.625	0.07
90-360	0.14	0.6	0.03

Definition of receptors

In the context of the model run, 1848 receptors were defined as specified below (Figure 1.4.4-4):

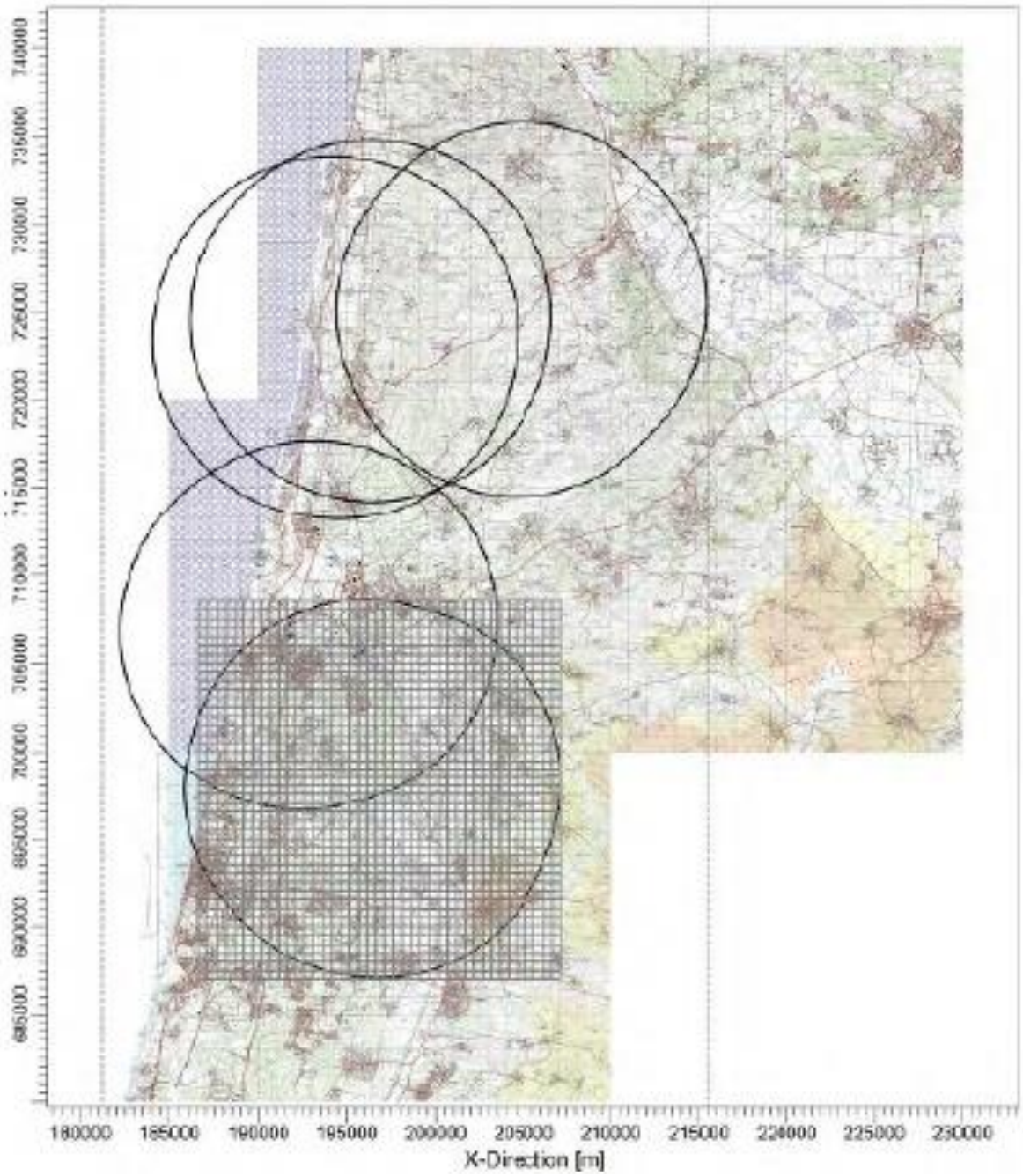
A network of receptors extending over 21.5 km from north to south and 20 km from east to west was selected. The distance between receptors was 500 meters.

In addition, a number of individual receptors were also selected, as specified in Table 1.4.4-24.

Table 1.4.4-24: Location of Individual Receptors:

Receptor Number	Receptor Location	X	Y
1.	Beit Eliezer	194500	704500
2.	Hadera	192300	704800
3.	Hadera - Association Building	192000	706000
4.	Netanya	187200	694800
5.	Pardes Hanna	196800	708100
6.	Elyakhin	192600	701700
7.	Gan Shmuel	196600	705300
8.	HaMa'apil	198100	697700
9.	Magal	203400	699200
10.	Givatayim	193926.9	700397.4
11.	Sde Yitzhak	299556.4	701270.3
12.	Sha'ar Menashe	201693.7	706238.8
13.	Bat Hefer	201505.3	693485.3
14.	Kfar Yonah	193670.3	691385.3
15.	Pardesiya	191608	690179.9
16.	Netanya	187601.3	693984.4
17.	Jatt	203947.8	700644.7

Figure 1.4.4-4: Location of Receptor Network for the Meretz Wastewater Treatment Facility Alternative on the Background of the Areas of the Alternatives



Background sources

Table No. 1.4.4-25 specifies the focal discharge sources that were input into the model.

Table 1.4.4-25: Focal Discharge Sources

Site Name	X	Y	Height meters	Diameters meters	Temperature (°C)	Speed m/s	SO2 kg/hour	NOx kg/hour
Ytong	197977	709895	10	0.9	197.8	4.6	7.4	3.454
Alliance - Tire Company (1992) Ltd.	192895	707467	20	1.78	208.2	2.82	18.4	7.3856
Alliance - Tire Company (1992) Ltd.	192895	707467	20	1	16.5	10.2	16.5	7.1125
Amber - Mixture Institute	196558	705906	20	0.75	185	7.3	8.3	3.215
Gan Shmuel Food Ltd.	196466	706461	10	0.78	191	3.2	3.95	1.65
Gan Shmuel Food Ltd.	196466	706461	24	0.95	235.5	8.105	12.65	5.13
Gan Shmuel Food Ltd.	192329	706461	24	0.85	208	7.335	11.5	5.23
Hadera Paper	192329	706692	100	2.1	130.9	12.9	0.1	15.3
Hadera Paper	192329	706692	60	2	159.5	11.1	0.2	9.5
Biopet Ltd.	191342	696744	12	0.29	184	3.77	0.57	0.25
HodHefer Ltd.	190391	700962	10	0.46	198.1	9.25	5.1	1.47
HodHefer Ltd.	190391	700962	15	0.56	201.9	10.3	7.7	2.83
HaOgenPlast	192880	696200	5	0.54	219	6.34	4.08	1.26
TivTaam HaCarmel Ltd.	190985	700977	25	0.5	211	4.8	2.15	0.9
Tambour Hefer et al Ecology	196901	691045	15	0.34	520.4	16.2	0.0114	1.171
Tambour Hefer et al Ecology	196901	691045	15	0.25	505.6	14.9	0.0028	0.6209
Tambour Hefer et al Ecology	196901	691045	15	0.48	525.5	9.6	0.0007	1.336

Site Name	X	Y	Height meters	Diameters meters	Temperature (°C)	Speed m/s	SO2 kg/hour	NOx kg/hour
Tempo Beer Industries Ltd.	186815	686674	20	0.6	127	2.9	2.91	0.99
Tempo Beer Industries Ltd.	186815	686674	20	1	153.5	3.3	7.71	3.155
Tempo Beer Industries Ltd.	186815	686674	20	0.58	157.5	3.3	2.67	0.965
Tempo Beer Industries Ltd.	186815	686674	20	1	165	2.8	5.82	2.75
Materna Laboratories Ltd.	191343	696744	10	0.43	219	6.1	2.35	0.9
Materna Laboratories Ltd.	191343	696744	10	0.37	195	7.4	2.58	0.76
Pachmas Industries	194591	698912	12	0.5	204	4.96	1.7	0.5
Pachmas Industries	194591	698912	12	0.5	252.2	5.06	2.03	0.64
Plantex Ltd.	188734	692072	15	0.75	188	6.62	8.12	2.61
Plantex Ltd.	188734	692072	15	0.6	197	9.49	8.12	2.38
Prigat International Ltd.	194016	700362	20	0.7	210.4	8.2	6.8955	2.881
Prigat International Ltd.	194016	700362	20	0.9	240.85	11.3	17.487	7.5785
Prigat International Ltd.	194016	700362	20	1.05	268	9.4	15.463	6.019
E. Shnapp& Co. Works Ltd.	188800	691800	8	0.5	28	7	0	0.02
Gan Shmuel Food Ltd.	196466	706461	15	0.36	229	9.1	0.89	0.14

Discharge Sources from Vehicles

The roads that were taken into consideration when calculating the discharge sources from vehicles for the Meretz Wastewater Treatment Facility alternative (in addition to the overlapping roads of the Hadera alternative) are: Roads 2, 4, 6, 57, 574. Table number 1.4.4-26 specifies the characteristics of the roads (geometry and mileage). The roads' incline was taken to be 0% and the speed of the vehicles was taken as 90 km/h, except for Road 6 where the speed was taken to be 100 km/h.

Table 1.4.4-26: Characteristics of Roads (Geometry and Mileage) for the Meretz Wastewater Treatment Facility Alternative

Road Number	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
6	Nizanei Oz Interchange – Baqa Jatt Interchange	11	0.015	4329	23.8	0.055
6	Baqa Jatt Interchange - Iron Interchange	8	0.015	4071	16.3	0.038
4	HaSharon Junction - HaRo'eh Junction	7.9	0.0144	3045	12.02	0.027
4	Dror Junction - HaSharon Junction	7.4	0.0144	3220	11.9	0.027
2	Netanya Interchange - Yanai Interchange	7.2	0.0144	5390	19.4	0.044
574	Bohan Junction - Baqa al-Gharbiyye Junction	6.4	0.0072	1101	3.52	0.008
574	Narvata Junction – Mishmar	3.4	0.0144	1219	2.07	0.0047

Road Number	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
	HaGevul Junction					
574	Narvata Junction - Baqa al-Gharbiyye Junction	5.4	0.0072	2158	5.82	0.013
57	Nizanei Oz Junction - Nizanei Oz Interchange	1.6	0.0144	1526	1.22	0.027
57	Yinov Junction - Nizanei Oz Junction	4	0.0144	2314	4.62	0.01
57	HaSharon Junction - Yinov Junction	5.1	0.0144	3372	8.6	0.02
57	Industrial Zone - HaSharon Junction	2.8	0.0144	3298	4.61	0.01
57	Netanya Junction - Industrial Zone	0.7	0.0144	3593	1.26	0.00287

Results of Model Run

Tables 1.4.4-27-1.4.4-30 describe the results of the model run in accordance with the scenarios explained at the beginning of the chapter. Moreover, deviations from the standards specified above are emphasized.

Table 1.4.4-27: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources and Vehicle Contribution) - Meretz Wastewater Treatment Facility Alternative

Serial No.	Location	X	Y	Max. Half-hourly Concentration mcg/m³	Standard Environment 940 Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Standard Environment 940 Percentage of Half-hourly Environmental Value %	Maximum 24-hour Concentration mcg/m³	Standard Environment 560 Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Standard Environment 560 Percentage of 24-hour Environmental Value %
4.	Beit Eliezer	194500	704500	**1389.0**	**147.8**	**1360.0**	**144.7**	157.4	28.1	133.7	23.9
6.	Hadera	192300	704800	**2816.8**	**299.7**	**2278.0**	**242.3**	222.9	39.8	192.8	34.4
2.	Hadera - Association	192000	706000	**7304.8**	**777.1**	**5996.6**	**637.9**	325.3	58.1	278.3	49.7
1.	Netanya	187200	694800	**4371.9**	**465.1**	**4042.6**	**430.1**	390.7	69.8	381.4	68.1
1.	Pardes Hanna	196800	708100	**1060.8**	**112.8**	**1027.3**	**109.3**	164.0	29.3	155.8	27.8
2.	Elyakhin	192600	701700	**2788.5**	**296.7**	**2150.2**	**228.7**	149.0	26.6	135.6	24.2
2.	Gan Shmuel	196600	705300	**2108.1**	**224.3**	**2027.1**	**215.7**	147.4	26.3	145.8	26.0
2.	HaMa'apil	198100	697700	**1851.4**	**197.0**	**1768.4**	**188.1**	157.6	28.1	140.9	25.2
2.	Magal	203400	699200	**1642.9**	**174.8**	**948.8**	**100.9**	67.8	12.1	65.1	11.6
46.	Givatayim	193926.9	700397.4	**2484.0**	**264.3**	**2255.1**	**239.9**	229.7	41.0	216.8	38.7
44.	Sde Yitzhak	299556.4	701270.3	**2222.8**	**236.5**	**1989.6**	**211.7**	213.0	38.0	202.8	36.2
46.	Sha'ar Menashe	201693.7	706238.8	**4133.9**	**439.8**	**4048.2**	**430.7**	378.1	67.5	326.3	58.3
42.	Bat Hefer	201505.3	693485.3	**3862.6**	**410.9**	**3807.0**	**405.0**	182.1	32.5	175.3	31.3
41.	Kfar Yonah	193670.3	691385.3	**1848.1**	**196.6**	**1831.5**	**194.8**	274.3154.8	49.0	257.4	46.0
41.	Pardesiya	191608	690179.9	**2568.2**	**273.2**	**2290.4**	**243.7**	560.6	27.6	149.9	26.8
42.	Netanya	187601.3	693984.4	**2532.2**	**269.4**	**2532.1**	**269.4**	40.4	100.1	552.8	98.7
42.	Jatt	203947.8	700644.7	592.4	63.0	424.1	45.1	40.4	7.2	38.6	6.9

Table 1.4.4-28: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources Only) - Meretz Wastewater Treatment Facility Alternative

		Standard			Environment 940		Environment 940		Environment 560		Environment 560
Serial No.	Location	X	Y	Max. Half-hourly Concentration mcg/m³	Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Percentage of Half-hourly Environmental Value %	Maximum 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %
	Maximum	193637.6	708013.8	**1159.0**	**123.3**	**1138.0**	**121.1**	97.8	17.5	85.3	15.2
1.	Beit Eliezer	194500	704500	51.5	5.5	48.5	5.2	3.8	0.7	3.7	0.7
2.	Hadera	192300	704800	110.7	11.8	70.0	7.4	5.7	1.0	5.2	0.9
3.	Hadera - Association	192000	706000	199.4	21.2	95.6	10.2	8.7	1.5	5.9	1.1
4.	Netanya	187200	694800	58.8	6.3	29.4	3.1	3.9	0.7	3.2	0.6
5.	Pardes Hanna	196800	708100	94.5	10.1	93.7	10.0	17.4	3.1	13.0	2.3
6.	Elyakhin	192600	701700	128.4	13.7	115.1	12.2	6.9	1.2	6.5	1.2
7.	Gan Shmuel	196600	705300	48.2	5.1	46.4	4.9	4.0	0.7	3.7	0.7
8.	HaMa'apil	198100	697700	50.7	5.4	50.7	5.4	3.9	0.7	3.2	0.6
9.	Magal	203400	699200	45.5	4.8	43.9	4.7	4.1	0.7	3.9	0.7
10.	Givatayim	193926.9	700397.4	78.1	8.3	76.9	8.2	10.9	2.0	9.6	1.7
11.	Sdeh Yitzhak	299556.4	701270.3	82.5	8.8	81.7	8.7	5.9	1.1	5.0	0.9
12.	Sha'ar Menashe	201693.7	706238.8	77.9	8.3	51.3	5.5	5.0	0.9	3.1	0.5
13.	Bat Hefer	201505.3	693485.3	36.9	3.9	34.3	3.6	2.8	0.5	2.4	0.4
14.	Kfar Yonah	193670.3	691385.3	50.3	5.4	50.2	5.3	3.7	0.7	3.1	0.6
15.	Pardesiya	191608	690179.9	45.1	4.8	44.8	4.8	4.3	0.8	3.3	0.6
16.	Netanya	187601.3	693984.4	52.0	5.5	36.4	3.9	4.3	0.8	3.3	0.6
17.	Jatt	203947.8	700644.7	90.1	9.6	84.7	9.0	5.1	0.9	3.7	0.7

Table 1.4.4-29: Results of the Model Run for the Benzene Pollutant (Vehicle Sources) - Meretz Wastewater Treatment Facility Alternative

		Standard			Target 3.9		Target 3.9		Target 1.3	Environment 5
Serial No.	**Location**	**X**	**Y**	**Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Second Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Maximum Annual Concentration mcg/m³**	**Percentage of Annual Target Value %**	**Percentage of Annual Environmental Value %**
	Maximum	187637.6	699013.8	8.4	**216.1**	8.0	206.3	2.3	**178.0**	46.3
1.	Beit Eliezer	194500	704500	0.4	9.3	0.3	7.9	0.1	5.3	1.4
2.	Hadera	192300	704800	0.5	13.0	0.4	11.3	0.1	7.3	1.9
3.	Hadera - Association	192000	706000	0.7	19.1	0.6	16.4	0.1	9.4	2.4
4.	Netanya	187200	694800	0.9	23.5	0.9	22.4	0.2	13.1	3.4
5.	Pardes Hanna	196800	708100	0.4	9.7	0.4	9.2	0.1	5.0	1.3
6.	Elyakhin	192600	701700	0.3	8.7	0.3	7.9	0.1	4.9	1.3
7.	Gan Shmuel	196600	705300	0.3	8.7	0.3	8.7	0.1	6.3	1.6
8.	HaMa'apil	198100	697700	0.4	9.3	0.3	8.3	0.1	5.3	1.4
9.	Magal	203400	699200	0.2	4.0	0.2	4.0	0.0	2.5	0.7
10.	Givatayim	193926.9	700397.4	0.5	13.4	0.5	12.7	0.1	10.4	2.7
11.	Sdeh Yitzhak	299556.4	701270.3	0.5	12.6	0.5	11.9	0.1	7.5	2.0
12.	Sha'ar Menashe	201693.7	706238.8	0.9	22.6	0.8	19.4	0.1	11.5	3.0
13.	Bat Hefer	201505.3	693485.3	0.4	10.9	0.4	10.4	0.1	4.2	1.1
14.	Kfar Yonah	193670.3	691385.3	0.6	16.0	0.6	15.1	0.1	6.5	1.7
15.	Pardesiya	191608	690179.9	0.3	8.9	0.3	8.8	0.1	5.0	1.3
16.	Netanya	187601.3	693984.4	1.3	32.9	1.3	32.4	0.3	20.0	5.2
17.	Jatt	203947.8	700644.7	0.1	2.3	0.1	2.3	0.0	1.4	0.4

Table 1.4.4-30: Results of the Model Run for the Sulfur Dioxide SO_2 Pollutant - Meretz Wastewater Treatment Facility Alternative

				Standard	Target - 500		Target - 500		Environment 350		Environment 350		Environment 350		Environment 125	Target 20		Environment 125	Target 20		Environment 60
Serial No.	**Location**	**X**	**Y**	**Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Target Value %**	**Second Concentration – Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Environmental Value %**	**Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Second Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Hourly Percentile 99.9 mcg/m³**	**Percentage of Hourly Environmental Value %**	**Max. 24-hour Concentration mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Second Concentration 24 hours - mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Max. Annual Concentration mcg/m³**	**Percentage of Annual Environmental Value %**
	Maximum	193137.6	708513.8	**3350.4**	**670.1**	**3289.9**	**658.0**	**2341.3**	**669.0**	**2299.1**	**656.9**	**1655.8**	**473.1**	**227.6**	**182.1**	**1138.1**	**198.5**	**158.8**	**992.3**	24.4	40.7
1.	Beit Eliezer	194500	704500	151.7	30.3	140.8	28.2	106.0	30.3	98.4	28.1	60.1	17.2	9.2	7.4	46.2	8.7	7.0	43.7	1.3	2.2
2.	Hadera	192300	704800	319.9	64.0	206.2	41.2	223.6	63.9	144.1	41.2	83.4	23.8	12.6	10.1	62.8	10.9	8.7	54.7	1.7	2.8
3.	Hadera - Association	192000	706000	578.3	**115.7**	276.9	55.4	404.1	**115.5**	193.5	55.3	68.6	19.6	19.2	15.3	95.9	12.5	10.0	62.7	1.4	2.4
4.	Netanya	187200	694800	179.0	35.8	89.7	17.9	125.1	35.7	62.7	17.9	43.4	12.4	9.4	7.5	46.9	8.8	7.1	44.2	0.9	1.6
5.	Pardes Hanna	196800	708100	310.6	62.1	307.3	61.5	217.0	62.0	214.8	61.4	182.8	52.2	40.8	32.6	**203.8**	30.8	24.6	**153.9**	4.3	7.1
6.	Elyakhin	192600	701700	371.5	74.3	333.0	66.6	259.6	74.2	232.7	66.5	91.0	26.0	16.5	13.2	82.6	16.2	13.0	80.9	2.7	4.4
7.	Gan Shmuel	196600	705300	147.8	29.6	142.3	28.5	103.3	29.5	99.5	28.4	72.0	20.6	9.1	7.3	45.4	8.6	6.9	43.0	1.1	1.8
8.	HaMa'apil	198100	697700	146.7	29.3	146.7	29.3	102.5	29.3	102.5	29.3	56.9	16.3	9.3	7.4	46.5	7.5	6.0	37.6	0.8	1.3
9.	Magal	203400	699200	142.0	28.4	137.3	27.5	99.2	28.4	96.0	27.4	78.9	22.6	9.8	7.8	48.9	9.0	7.2	45.2	0.9	1.5
10.	Givatayim	193926.9	700397.4	234.6	46.9	231.2	46.2	164.0	46.8	161.6	46.2	104.7	29.9	26.4	21.1	**131.9**	23.1	18.5	**115.4**	2.3	3.8
11.	Sdeh Yitzhak	299556.4	701270.3	238.5	47.7	236.2	47.2	166.7	47.6	165.0	47.2	72.2	20.6	13.6	10.9	68.2	11.7	9.3	58.3	1.0	1.7
12.	Sha'ar Menashe	201693.7	706238.8	226.3	45.3	149.3	29.9	158.2	45.2	104.3	29.8	64.3	18.4	11.7	9.4	58.6	7.1	5.7	35.6	1.0	1.6

				Standard	Target - 500		Target - 500		Environment 350		Environment 350		Environment 350		Environment 125	Target 20		Environment 125	Target 20		Environment 60
Serial No.	**Location**	**X**	**Y**	**Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Target Value %**	**Second Concentration – Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Environmental Value %**	**Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Second Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Hourly Percentile 99.9 mcg/m³**	**Percentage of Hourly Environmental Value %**	**Max. 24-hour Concentration mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Second Concentration 24 hours - mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Max. Annual Concentration mcg/m³**	**Percentage of Annual Environmental Value %**
13.	Bat Hefer	201505.3	693485.3	114.5	22.9	114.4	22.9	80.0	22.9	80.0	22.9	44.3	12.7	7.2	5.8	36.2	7.0	5.6	34.8	0.7	1.1
14.	Kfar Yonah	193670.3	691385.3	204.2	40.8	203.7	40.7	142.7	40.8	142.3	40.7	84.4	24.1	9.4	7.5	47.0	8.7	7.0	43.5	0.8	1.3
15.	Pardesiya	191608	690179.9	181.6	36.3	181.3	36.3	126.9	36.3	126.7	36.2	92.3	26.4	13.9	11.1	69.3	10.7	8.6	53.5	0.9	1.5
16.	Netanya	187601.3	693984.4	158.8	31.8	107.3	21.5	111.0	31.7	75.0	21.4	49.6	14.2	11.1	8.9	55.6	8.9	7.1	44.3	1.3	2.2
17.	Jatt	203947.8	700644.7	266.6	53.3	255.0	51.0	186.3	53.2	178.2	50.9	112.4	32.1	11.2	8.9	55.9	8.6	6.9	43.1	0.7	1.2

*Association Building84.4

Concentrations at Monitoring Stations

Tables 1.4.4-31/32 present the concentrations of the nitrous oxides and sulfur dioxide at monitoring stations.

Table 1.4.4-31: Concentrations of Nitrous Oxide Pollutant for the year 2010 at the Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Hadera - Association	192000	706000	522.7	152.3
Netanya	187200	694800	413	97.8
Pardes Hanna	196800	708100	468	86.5
Elyakhin	192600	701700	353.5	67.7
Gan Shmuel	196600	705300	406	88.4
HaMa'apil	198100	697700	319.6	71.4
Magal	203400	699200	428.7	64

Table 1.4.4-32: Concentrations of Sulfur Dioxide Pollutant for the year 2010 at the Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Hadera - Association	192000	706000	204	34
Netanya	187200	694800	70.6	10
Pardes Hanna	196800	708100	361	67.8
Elyakhin	192600	701700	196.2	21
Gan Shmuel	196600	705300	329.6	47
HaMa'apil	198100	697700	225	36.6
Magal	203400	699200	269.4	28.8

Discussion of results:

Results of running the model for the Meretz Wastewater Treatment Facility alternative lead to the following conclusions:

Nitrous oxides:

According to the explanation of the model run scenarios presented in Section 1.4.4.1, the nitrous oxides pollutant was run in two scenarios:

Scenario 1: Model run for the discharges from vehicles and focal discharges.

Scenario 2: Model run for focal discharges only.

The running of the model according to Scenario 1 yielded high results beyond the threshold values in all the receptors except for the one in Jatt for the half-hour value. Moreover, where maximum values were found, the high values received were non-realistic. Therefore, the model was run additionally for the nitrous oxides pollutant for focal points only. In order to neutralize the impact of the roads and to examine the maximum model results, the nitrous oxides pollutant was additionally run for focal discharges only.

Results of the model run according to the second scenario indicated that the concentrations of the nitrous oxides pollutant exceed the maximum half-hourly environmental values at the maximum point by about 23%, and secondary environmental values by about 21%. In the rest of the locations examined, the concentrations conformed to all environmental target values.

Moreover, it can be seen in the concentration measurements taken at the monitoring station of the Hadera Cities Association that the nitrous oxide concentrations conform to both the half-hourly and 24-hour standards.

Sulfur dioxide:

It was found that the concentrations of sulfur dioxide deviate from the target value only at the maximum point when the averaging is done over 10 minutes (by 570% at the maximum and 558% at the secondary one), from the hourly environment value (by 569% at the maximum, and 557% at the secondary one) and at the hourly 99.9% percentile by 373%, from the 24-hour environmental value (by 82% at the maximum and 58% at the secondary one) and from the 24-hour target value (by 938% for the maximum and 892% at the secondary one) from the environmental value. Moreover, deviations were found in the Hadera Cities Association at the maximum concentration from the target value at an averaging time of 10 minutes by 16%, in the maximum concentration from the hourly environmental value at the Hadera Cities Association by 15.5%, in Pardes Hanna from the maximum 24-hour target value by 104% and the secondary value by 153.9%, and in Givat Haim from the 24-hour maximum target value at 32% and the secondary value at 15.4%.

In the rest of the locations examined, the model results conform to the environmental target values.

Moreover, as may be seen in the concentration measurements taken at the monitoring stations of the Hadera Cities Association, the concentrations of sulfur dioxide do not conform to the target values and the 24-hour values at the stations: Hadera, Pardes Hanna, Elyakhin, Gan Shmuel, HaMa'apil and Magal.

Benzene:

It was found that at the maximum location, the maximum and secondary benzene concentrations do not conform to the target values and deviate from them by 116% and 106% and the annual target value also deviates by 78%.

1.4.4.2.4 Hagit Site alternative

Model's Input Data

The meteorological data used for the model run were taken from the Elyakim meteorological station. The Elyakim station is located at coordinates 697200N/198100E at a height of 235 m above sea level.

The station is located in the southwest part of the kibbutz.

In order to construct a profile of the planetary boundary layer (PBL), the area was divided into the following sectors:

Sectors 0-90 and 120-150, characterized by a combination of low buildings and vegetation.

Sector 90-120, characterized by kibbutz buildings and vegetation.

Sector 150-360, characterized by low crops (cultivated fields).

Table No. 1.4.4-33 presents the parameters of the boundary layer according to sectors.

Table 1.4.4-33: Parameters of the Planetary Boundary Layer according to Sectors

Wind Direction	Albedo	Bowen Ratio	Roughness Length
0-90	0.25	2	0.3
90-120	0.2075	2.5	0.4
120-150	0.25	2	0.3
150-360	0.25	1.625	0.0725

Definition of receptors

In the context of the model run, 1849 receptors were defined as specified below (Figure 1.4.4-5):

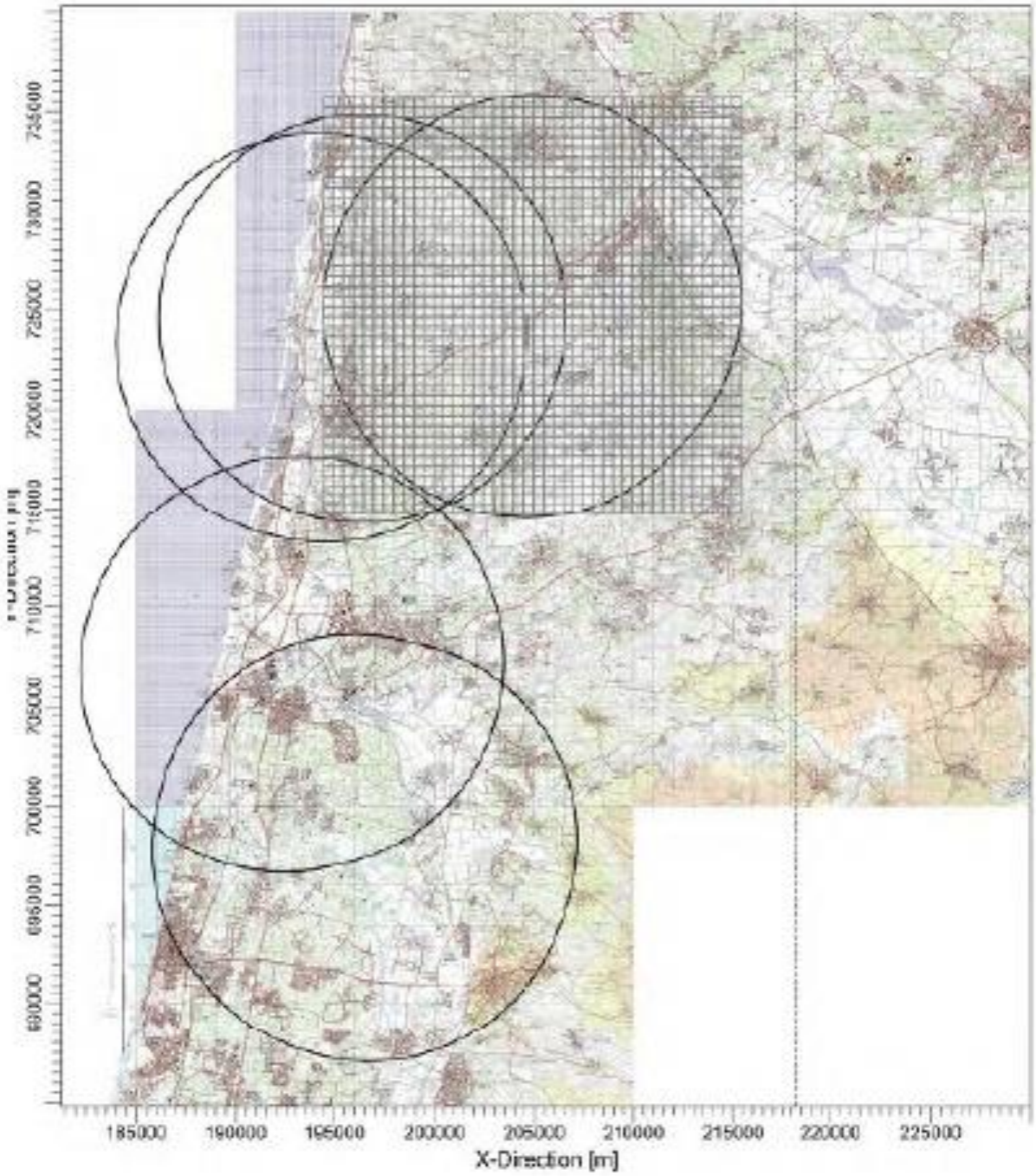
A network of receptors extending over 21 km from north to south and 21 km from east to west was selected. The distance between receptors was 500 meters.

In addition, a number of individual receptors were also selected, as specified in Table 1.4.4-34.

Table 1.4.4-34: Location of Individual Receptors:

Receptor Number	Receptor Location	X	Y
2.	Elyakim	206500	726500
1.	Zikhron Yaakov	195900	719900
3.	KeremMaharal	199100	728400
4.	Daliyat al-Carmel	206900	731900
5.	Amikam	202200	719100
6.	Ein HaShofet	209300	723300
7.	Yokneam	211097.2	728547.6
8.	El-Fureidis	195776.4	722762.6
9.	Bat Shlomo	200557.6	722938.6
21.	Even Yitzhak	207558.1	717994.4
22.	Givat Nili	204047.3	717167
21.	Mishmar HaEmek	213757.7	724164.9

Figure 1.4.4-5: Location of Receptor Network for the Hagit Site Alternative on the Background of the Areas of the Alternatives



Background Sources

Table No. 1.4.4-35 specifies the focal discharge sources that were input into the model.

Table 1.4.4-35: Focal Discharge Sources

Site Name	X	Y	Height meters	Diameters meters	Temperature (°C)	Speed m/s	SO2 kg/hour	NOx kg/hour
Kal-Kar Ein Carmel	196711	731744	12	0.6	189.25	6.8625	5.4	2.3
Kal-Kar Ein Carmel	196711	731744	12	0.55	193.5	4.84	2.9	1.13
Zohar Dalia	207752	721887	20	0.75	146	2.275	3.025	0.675
Zohar Dalia	207752	721887	20	0.75	159	2.9	3.5	1.1
Zohar Dalia	207752	721887	12	0.29	198	4.43	0	0.02
Pro-Metal Technologies Ltd.	210091	729538	12	0.34	162	6.5	0.805	0.416
T.G.L. S.P. Industries Ltd.	210091	729538	15	0.5	161.4	2.1	0.9	0.3
T.G.L. S.P. Industries Ltd.	210091	729538	20	0.5	181.9	3.1	1.644	0.5
Shfaya Quarry	198000	721000	30	0.37	77	12.45	0.003	0.037
Osem-Nakid North	209491	729105	15	0.33	153	4.3	0	0.01
Osem-Nakid North	209492	729106	15	0.5	200	5.4	0	0.07
Zohar Dalia	207752	721887	30	0.22	48.5	15.93	2.63	0
Hagit Power Station IEC	204210	724780	70	6.25	145.5	25.6	0	34.9
Hagit Power Station IEC	204210	724780	70	6.25	147.5	24.1	4.2	0
Hagit Power Station IEC	204210	724780	70	6.25	147.5	24.1	0	37.85
Hagit Power Station IEC	204350	724820	70	6.25	144	23.7	3.65	0
Hagit Power Station IEC	204350	724820	70	6.25	144	23.7	0	36.55
Hagit Power Station IEC	204350	724820	70	6.25	148.5	26.7	3.15	0
Hagit Power Station IEC	204350	724820	70	6.25	148.5	26.7	0	40.7
Hagit Power Station IEC	204050	724822	70	6	120	24.8	3.15	55.65
Hagit Power Station IEC*	2040505	724822	70	7.5	104	16.1	33	110

*The addition of a future steam unit (Unit 9) - the data were obtained from the IEC.

Discharge Sources from Vehicles

The roads that were taken into consideration when calculating the discharge sources from vehicles for the Hagit Site alternative (in addition to the overlapping roads of the Ein Ayala and Dor North alternative) are: Roads 2, 4, 6, 57, 574. Table number 1.4.4-36 specifies the characteristics of the roads (geometry and mileage). The roads' incline was taken to be 0% and the speed of the vehicles was taken as 90 km/h, except for Road 6 where the speed was taken to be 100 km/h.

Table 1.4.4-36: Characteristics of Roads (Geometry and Mileage) for the Hagit Site Alternative

Road Number	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
6	Iron Interchange - HaTut Junction	22	0.015	2400	26.4	0.06
772	Entire Road	5.2	0.0144	3627	9.43	0.01
672	Elyakim Junction - Daliyat al-Carmel	9.5	0.0072	609	2.9	0.0033
672	Even Yitzhak - Elyakim Junction	10.9	0.0072	1121	6.1	0.0076
66	Megiddo – Mishmar HaEmek	7.1	0.0144	1385	4.9	0.0036
66	Mishmar HaEmek - HaTishbi Junction	7.6	0.0144	1385	5.26	0.0038
70	HaTishbi Junction - HaAmakim Junction	6.1	0.0144	3767	11.5	0.015
70	Yokneam Junction -	0.6	0.0288	5231	1.57	0.002

Road Number	Segment Name	Length of Segment (km)	Width of Segment (km)	Maximum Number of Vehicles per Hour	NO_x Discharge (g/second)	Benzene Discharge (g/second)
70	HaTishbi Junction Elyakim Junction - Entry to Yokneam West	4.8	0.0144	4595	19	0.015

<u>Results of Model Run</u>

Tables 1.4.4-37-1.4.4-40 describe the results of the model run in accordance with the scenarios explained at the beginning of the chapter.

Table 1.4.4-37: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources and Vehicle Contribution) - Hagit Site Alternative

Standard					Environment 940		Environment 940		Environment 560		Environment 560
Serial No.	**Location**	**X**	**Y**	**Max. Half-hourly Concentration mcg/m³**	**Percentage of Half-hourly Environmental Value %**	**Second Max. Half-hourly Concentration mcg/m³**	**Percentage of Half-hourly Environmental Value %**	**Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Second Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Environmental Value %**
4.	Elyakim	206500	726500	578.8	61.6	548.7	58.4	55.3	9.9	53.1	9.5
6.	Zikhron Yaakov	195900	719900	803.9	85.5	787.5	83.8	49.3	8.8	44.7	8.0
2.	Kerem Maharal	199100	728400	403.5	42.9	342.1	36.4	27.0	4.8	24.5	4.4
1.	Daliyat al-Carmel	206900	731900	469.2	49.9	380.8	40.5	45.1	8.0	44.8	8.0
1.	Amikam	202200	719100	**984.0**	**104.7**	**983.2**	**104.6**	75.9	13.5	57.9	10.3
2.	Ein HaShofet	209300	723300	355.3	37.8	225.8	24.0	15.5	2.8	14.2	2.5
2.	Yokneam	211097.2	728547.6	**1784.0**	**189.8**	**1676.9**	**178.4**	173.2	30.9	156.7	28.0

				Standard				Environment 940		Environment 940		Environment 560		Environment 560
2.	El-Fureidis	195776.4	722762.6	**1009.2**	**107.4**	788.6	83.9	57.5	10.3	57.2	10.2
2.	Bat Shlomo	200557.6	722938.6	**1345.2**	**143.1**	**1298.7**	**138.2**	128.9	23.0	128.8	23.0
46.	Even Yitzhak	207558.1	717994.4	**2123.4**	**225.9**	**2123.4**	**225.9**	174.0	31.1	169.8	30.3
44.	Givat Nili	204047.3	717167	**1071.2**	**114.0**	741.6	78.9	56.0	10.0	46.4	8.3
46.	Mishmar HaEmek	213757.7	724164.9	**2384.3**	**253.6**	**1934.1**	**205.8**	117.3	20.9	107.7	19.2

Table 1.4.4-38: Results of the Model Run for the Nitrous Oxides NO_x Pollutant (Focal Sources Only) - Hagit Site Alternative

	Standard				Environment 940		Environment 940		Environment 560		Environment 560
Serial No.	Location	X	Y	Max. Half-hourly Concentration mcg/m³	Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Percentage of Half-hourly Environmental Value %	Maximum 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %
	Maximum	206958.66	731186.4	471.2	50.1	457.0	48.6	57.0	10.2	52.5	9.4
4.	Elyakim	206500	726500	29.2	3.1	29.0	3.1	6.1	1.1	4.0	0.7
6.	Zikhron Yaakov	195900	719900	16.9	1.8	14.7	1.6	2.7	0.5	2.2	0.4
2.	Kerem Maharal	199100	728400	17.0	1.8	17.0	1.8	1.2	0.2	0.9	0.2
1.	Daliyat al-Carmel	206900	731900	297.5	31.7	297.1	31.6	42.4	7.6	37.6	6.7
1.	Amikam	202200	719100	15.3	1.6	15.1	1.6	1.4	0.3	1.4	0.3
2.	Ein HaShofet	209300	723300	75.4	8.0	71.8	7.6	10.1	1.8	8.5	1.5

Standard					Environment 940		Environment 940		Environment 560		Environment 560
Serial No.	Location	X	Y	Max. Half-hourly Concentration mcg/m³	Percentage of Half-hourly Environmental Value %	Second Max. Half-hourly Concentration mcg/m³	Percentage of Half-hourly Environmental Value %	Maximum 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %	Second Maximum 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %
2.	Yokneam	211097.2	728547.6	15.7	1.7	15.4	1.6	1.9	0.3	1.6	0.3
2.	El-Fureidis	195776.4	722762.6	13.5	1.4	13.5	1.4	3.1	0.5	2.5	0.4
2.	Bat Shlomo	200557.6	722938.6	20.9	2.2	20.9	2.2	4.9	0.9	3.5	0.6
46.	Even Yitzhak	207558.1	717994.4	17.2	1.8	15.5	1.7	1.8	0.3	1.5	0.3
44.	Givat Nili	204047.3	717167	12.3	1.3	12.1	1.3	1.4	0.2	1.3	0.2
46.	Mishmar HaEmek	213757.7	724164.9	14.7	1.6	13.6	1.4	1.7	0.3	1.6	0.3

Table 1.4.4-39: Results of the Model Run for the Benzene Pollutant - Hagit Site Alternative

	Standard				Target 3.9		Target 3.9		Target 1.3	Environment 5
Serial No.	**Location**	**X**	**Y**	**Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Second Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Maximum Annual Concentration mcg/m³**	**Percentage of Annual Target Value %**	**Percentage of Annual Environmental Value %**
	Maximum	208958.7	728686.4	**6.4**	**163.4**	**5.8**	**148.3**	1.6	**121.8**	31.7
1.	Elyakim	206500	726500	0.1	2.6	0.1	2.5	0.0	2.4	0.6
2.	Zikhron Yaakov	195900	719900	0.1	1.9	0.1	1.8	0.0	0.60.4	0.2
3.	Kerem Maharal	199100	728400	0.0	1.2	0.0	1.2	0.0	0.7	0.1
4.	Daliyat al-Carmel	206900	731900	0.1	1.8	0.1	1.6	0.0	1.4	0.2
5.	Amikam	202200	719100	0.1	3.7	0.1	3.2	0.0	0.2	0.4
6.	Ein HaShofet	209300	723300	0.0	0.8	0.0	0.7	0.0	0.2	0.1
7.	Yokneam	211097.2	728547.6	0.3	6.9	0.3	6.4	0.1	4.0	1.1
8.	El-Fureidis	195776.4	722762.6	0.1	3.4	0.1	3.4	0.0	2.6	0.7

	Standard				Target 3.9		Target 3.9		Target 1.3	Environment 5
Serial No.	**Location**	**X**	**Y**	**Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Second Maximum 24-hour Concentration mcg/m³**	**Percentage of 24-hour Target Value %**	**Maximum Annual Concentration mcg/m³**	**Percentage of Annual Target Value %**	**Percentage of Annual Environmental Value %**
9.	Bat Shlomo	200557.6	722938.6	0.3	7.4	0.2	6.2	0.0	2.4	0.6
10.	Even Yitzhak	207558.1	717994.4	0.4	10.1	0.4	9.9	0.0	1.7	0.4
11.	Givat Nili	204047.3	717167	0.1	3.3	0.1	2.7	0.0	1.7	0.4
12.	Mishmar HaEmek	213757.7	724164.9	0.3	6.4	0.2	6.1	0.0	2.9	0.8

Table 1.4.4-40: Results of the Model Run for the Sulfur Dioxide SO_2 Pollutant - Hagit Site Alternative

	Standard				Target - 500		Target - 500		Environment 350		Environment 350		Environment 350		Environment 125	Target 20		Environment 125	Target 20		Environment 60
Serial No.	**Location**	**X**	**Y**	**Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Target Value %**	**Second Concentration – Max. 10-minute Concentration mcg/m³**	**Percentage of 10-minute Environmental Value %**	**Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Second Max. Hourly Concentration mcg/m³**	**Percentage of Hourly Environmental Value %**	**Hourly Percentile 99.9 mcg/m³**	**Percentage of Hourly Environmental Value %**	**Max. 24-hour Concentration mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Second Concentration 24 hours - mcg/m³**	**Percentage of 24-hour Environmental Value %**	**Percentage of 24-hour Target Value %**	**Max. Annual Concentration mcg/m³**	**Percentage of Annual Environmental Value %**
	Maximum	196958.7	731686.4	**1392.0**	**278.4**	**1349.4**	**269.9**	**972.8**	**277.9**	**943.0**	**269.4**	**715.4**	**204.4**	**134.6**	**107.7**	**673.2**	103.1	82.5	**515.3**	9.9	16.5
1.	Elyakim	206500	726500	109.4	21.9	106.9	21.4	76.4	21.8	74.7	21.3	49.8	14.2	6.2	4.9	30.8	6.0	4.8	29.8	0.3	0.6
2.	Zikhron Yaakov	195900	719900	16.9	3.4	16.8	3.4	11.8	3.4	11.7	3.4	10.0	2.9	2.1	1.7	10.4	2.1	1.7	10.3	0.1	0.2
3.	KeremMaharal	199100	728400	49.7	**9.9**	40.3	8.1	34.7	**9.9**	28.1	8.0	11.6	3.3	1.8	1.5	9.1	1.5	1.2	7.7	0.1	0.2
4.	Daliyat al-Carmel	206900	731900	60.4	12.1	60.3	12.1	42.2	12.1	42.1	12.0	38.8	11.1	6.5	5.2	32.3	5.7	4.5	28.4	0.5	0.8
5.	Amikam	202200	719100	30.6	6.1	27.2	5.4	21.4	6.1	19.0	5.4	17.4	5.0	5.2	4.2	26.1	4.5	3.6	22.7	0.4	0.7
6.	Ein HaShofet	209300	723300	146.5	29.3	145.9	29.2	102.3	29.2	102.0	29.1	59.7	17.1	8.3	6.6	41.3	7.7	6.1	38.4	0.8	1.3
7.	Yokneam	211097.2	728547.6	42.0	8.4	38.7	7.7	29.4	8.4	27.1	7.7	20.0	5.7	3.6	2.9	17.9	3.2	2.6	16.2	0.5	0.8
8.	El-Fureidis	195776.4	722762.6	23.6	4.7	23.5	4.7	16.5	4.7	16.4	4.7	10.8	3.1	1.9	1.5	9.3	1.7	1.3	8.4	0.2	0.3
9.	Bat Shlomo	200557.6	722938.6	56.4	11.3	51.7	10.3	39.4	10.3	36.1	10.3	23.4	6.7	3.2	2.6	16.0	2.8	2.2	13.8	0.3	0.5

Serial No.	Location	X	Y	Max. 10-minute Concentration mcg/m³	Percentage of 10-minute Target Value %	Second Concentration – Max. 10-minute Concentration mcg/m³	Percentage of 10-minute Environmental Value %	Max. Hourly Concentration mcg/m³	Percentage of Hourly Environmental Value %	Second Max. Hourly Concentration mcg/m³	Percentage of Hourly Environmental Value %	Hourly Percentile 99.9 mcg/m³	Percentage of Hourly Environmental Value %	Max. 24-hour Concentration mcg/m³	Percentage of 24-hour Environmental Value %	Percentage of 24-hour Target Value %	Second Concentration 24 hours - mcg/m³	Percentage of 24-hour Environmental Value %	Percentage of 24-hour Target Value %	Max. Annual Concentration mcg/m³	Percentage of Annual Environmental Value %
	Standard				Target - 500		Target - 500		Environment 350		Environment 350		Environment 350		Environment 125	Target 20		Environment 125	Target 20		Environment 60
10.	Even Yitzhak	207558.1	717994.4	31.3	6.3	30.6	6.1	21.9	6.3	21.4	6.1	10.1	2.9	3.0	2.4	15.2	1.9	1.5	9.3	0.0	0.1
11.	Givat Nili	204047.3	717167	26.0	5.2	25.1	5.0	18.2	5.2	17.5	5.0	9.2	2.6	2.6	2.0	12.8	2.3	1.8	11.3	0.1	0.1
12.	Mishmar HaEmek	213757.7	724164.9	27.1	5.4	25.5	5.1	18.9	5.4	17.8	5.1	15.1	4.3	2.8	2.2	13.9	2.7	2.1	13.3	0.3	0.5

Concentrations at monitoring stations

Tables 1.4.4-41/42 present the concentrations of the nitrous oxides and sulfur dioxide at monitoring stations.

Table 1.4.4-41: Concentrations of Nitrous Oxide Pollutant for the year 2010 at the Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Elyakim	206500	726500	259.5	48.9
Zikhron Yaakov	195900	719900	791.6	47
Kerem Maharal	199100	728400	334.7	35.7
Daliyat al-Carmel	206900	731900	325.3	30
Amikam	202200	719100	389	33.8
Ein HaShofet	209300	723300	214	47

Table 1.4.4-42: Concentrations of Sulfur Dioxide Pollutant for the year 2010 at the Monitoring Stations

Monitoring Station	X	Y	Maximum Half-hour Concentration (mcg/m³)	24-hour Average (mcg/m³)
Elyakim	206500	726500	177.8	18.3
Zikhron Yaakov	195900	719900	104	13
KeremMaharal	199100	728400	75.8	13
Daliyat al-Carmel	206900	731900	191	18
Amikam	202200	719100	259	13
Ein HaShofet	209300	723300	175.3	13

Discussion of results:

The results of running the model for the Hagit Site alternative lead to the following conclusions:

Nitrous oxides:

According to the explanation of the model run scenarios presented in Section 1.4.4.1, the nitrous oxides pollutant was run in two scenarios:

Scenario 1: Model run for the discharges from vehicles and focal discharges.

Scenario 2: Model run for focal discharges only.

The running of the model according to Scenario 1 yielded high results beyond the half-hourly threshold values in the following locations: Amikam, Yokneam, al-Fureidis, Bat Shlomo, Even Yitzhak, Givat Nili and Mishmar HaEmek. Moreover, where maximum values were found, the high values received were non-realistic. Therefore, in order to neutralize the impact of the roads and to examine the maximum model results, the nitrous oxides pollutant was additionally run for focal discharges only.

The results of the model run according to the second scenario indicated that the concentrations of the nitrous oxides pollutant conform to all environmental and target values.

Moreover, it can be seen in the concentration measurements taken at the monitoring station of the Hadera Cities Association that the nitrous oxide concentrations conform to both the half-hourly and 24-hour standards.

Sulfur dioxide:

It was found that the concentrations of sulfur dioxide deviate from the target value only at the maximum point when the averaging is done over 10 minutes (by 178% at the maximum and 170% at the secondary one), from the hourly environment value (by 8% at the maximum, and no deviation found at the secondary one) and from the 24-hour target value (by 573% at the maximum and 415% at the secondary one).

Moreover, as may be seen in the concentration measurements taken at the monitoring stations of the Hadera Cities Association, the concentrations of sulfur dioxide conform to the half-hourly and the 24-hourly standards.

Benzene:

It was found that at the maximum location, the maximum and secondary benzene concentrations deviate from the 24-hour target values (maximum at 63% and the secondary at 48%). The deviation in the maximum annual concentration was found as well at a rate of 22% from the annual target value.

1.4.5 Conditions of air pollutant dispersion

The conditions of air pollutant dispersion, including isoplates and lattice maps, are enclosed as Appendix C below.

1.5 Appearance

**Note: In this chapter, the numbering of the subject sections is different as compared with the numbering in the survey guidelines, even though all of the information required in the instructions is present in the chapter. At the beginning of the chapter the test methodology is explained, in accordance with the required parameters stipulated in the survey guidelines, and in Sections 1.5.1-3 describe the various alternatives in relation to these parameters.*

General

In order to evaluate the landscape imprint of the gas treatment facility of its environment and with the aim of comparing between alternatives from the point of view of appearance, the analysis was conducted in two layers: The first, presented in this section, examines the visual basin of the site and the landscape units surrounding it, in its present condition – before construction of the proposed treatment facility. The second layer, presented in Chapter B of the survey, examines the visual basin of the site and the changes that have taken place in it, in view of the construction of the proposed site. The analysis was conducted in accordance with the instructions of the Environmental Impact Survey guidelines enclosed as Appendix A, and is accompanied by a figure (Figure No. 1.5.0), which presents the methodology for conducting the landscape-visual analysis for the alternatives for the gas treatment sites, and the way that the guideline sections have been met.

The description and analysis of the visual basin of the proposed site under existing conditions in Chapter A comprises an examination of the following elements: land uses in the environment of the proposed site, population concentrations and locations of localities, nature and landscape values, adjacent centers and sites, industrial buildings and facilities, roads, infrastructure facilities and more.

The visual analysis also includes a description of the landscape units that comprise the site and that surround it. The background for the analysis of the landscape units is based on the nature and landscape surveys conducted by the Open Landscape Institute (OLI)[10] and on the basis of an analysis of the landscape units and landscape divisions conducted by Motti Kaplan[11].

Accompanying the visual analysis of the proposed sites are drawings of landscape units, and representative cross-sections as well as photographs taken during in situ surveys. See Figures 1.5.1-1.5.2 A-E.

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[10] Open Landscape Institute, Nature and Landscape Surveys, Society for the Preservation of Nature

[11] Methodology for the evaluation of sensitivity and values of open spaces - Motti Kaplan, Menahem Zlutsky - Ministry of Environmental Protection

Definition of the landscape analysis reference area for each site – the combination between the visual basin analysis and the landscape units assisted in defining the site's visual reference area, which will be made in Chapter B of the survey. The reference area was established in accordance with considerations of distance from the site, topography, land coverage and additional characteristics.

1.5.1 Dor North

The Dor North site is located within the Carmel coastal plain within agricultural areas belonging to the Hof HaCarmel Regional Council. A limited region of the exploration area of the alternative is included within the Fureidis local council region.

1.5.1.1 Visual Basin

The visual basin of the site comprises the following elements:

- **Topography and landscape units:** The Dor North alternative is located within the Carmel coastal plain landscape division in the Carmelim Plain unit to the south of the east kurkar range (see Figure 1.5.1-a). The Hof HaCarmel Plain unit is a narrow level strip that lies between the western foothills of the Carmel range to the west, and the kurkar ranges along the seashore. Its eastern margins are split from north to south with Road 4. The proposed site is located at a height of about 10 meters above sea level. The area of the site is included within the drainage basin of the Dalia Stream, and the characteristic soil in the area is an alluvial, silty soil. The entire area is cultivated and the most common of the agricultural branch is banana groves. However, there are also orchards, avocado plantations, vineyards, field crops, and greenhouses in the area, as well as water reservoirs and sewage. According to the landscape surveys, the landscape unit of the Carmel coastal plain has an intermediate landscape value.

  The Carmel coastal plain constitutes the east landscape unit relative to the landscape units in its environment: to the west of it there is the east kurkar range - the HaBonim kurkar range, which lies in a general north-south direction, at an elevation ranging between 5-36 m above sea level, along which Road 2 passes. To the west of the east range is a landscape unit characterized by the Carmelim shore plain sands, and which comprises the following subunits from east to west: the middle trough, the middle kurkar range, the HaBonim sandflat. In parallel with the shoreline, there are the shore strips: the Neve Yam and the Bay Beach. From the peak point of the kurkar cliff and down to the beach, there is a kilometer where the topography gently slopes down to

sea level. The entire region is bisected by streams originating in the Carmel range and flowing down to the sea.

About a kilometer to the southeast of the alternative, the Carmel range bisects Wadi Milek and the transverse Road 70 passes through it.

- **Localities and population concentrations:** The visual basin of the alternative comprises four localities –Dor and Kibbutz Nachsholim to the west of the kurkar cliff and Road 4; Zikhron Yaakov and Fureidis on the Carmel range – from the southeast and from the east, respectively. Further to the north is Ein Ayala.
- **Routes and roads:** The exploration area for the facility, which lies over an area of almost 300 dunams, lies between the longitudinal Roads 2 and 4, and the transverse Roads 70 and 7011. Within the area of the alternative, Road 4 is located along the east boundary of the coastal plain, in the foothills of the range. Road 2 in this area is delineated by the west boundary of the plain – at the peak of the kurkar cliff. The transverse Roads 70 and 7011 bisect the plain to the north and south of the alternative. The intersection between Road 2 and Road 70 passes over a raised interchange, about a kilometer-and-a-half to the southwest of the proposed site. Along the intersection between Road 4 and Road 7011, boulevards of high cypresses have been planted.

  The railroad within the area of the alternative passes to the west of the kurkar range and Road 2. About 7 kilometers to the south of the alternative, there is a grade separation above the railway tracks. The elevation of Road 4 above the railway track may significantly increase the visibility of the site for those travelling towards the north.
- **Nature and landscape values:** The area of the alternative is located to the east of the shoreline at a distance of approximately 1.6 km. In addition, the following nature reservations are located to the west of the region of the alternative: the Kurkarei Hof HaCarmel reserve, which is located to the north and to the east of the alternative on both sides of Road 2; the Hirbet Darkemon reserve – in the vicinity of the proposed site, located on the south part of the kurkar range, and includes the site of Hirbet Darkemon which comprises: quarries, building remains, waterholes, burial caves, sarcophagi and segments of quarried road. This site is defined according to the landscape survey as having landscape sensitivity and is a natural resource of sensitivity and great importance. Today, these reserves and sites are undeveloped and do not include active visiting sites. The Tel Dor site is an important archaeological site with conceptual plans for development. The site is located in the vicinity of Kibbutz Nachsholim and is relatively distant from the area of the alternative.

The Carmel range, located to the east of the alternative, comprises a number of sites such as the Hirbet Tayasim and archaeological sites, but these do not constitute active visiting sites. The Zikhron Yaakov nature reserve is located in the foothills of the range, in the southeast direction. This reserve comprises short walking paths that mainly serve residents of the region. In the west area of the range, in the area where the old Mivtachim convalescence home in Zikhron Yaakov is located (has not been in use for a number of years now), there is a position for the takeoff of gliders and paragliders. This takeoff position is not defined as an official site and is only used by experienced paragliders.

- **Additional uses:** The alternative is located in the heart of agricultural areas, directly adjacent to a brackish water reservoir bounded by a 5-meter high embankment, and by a wastewater treatment facility.

<u>Visibility analysis:</u>

On the basis of an analysis of the central elements in the visual basin of the proposed site, the following is a visibility analysis:

The location of the alternative in the wide plain adjacent to the beach, on the one hand, and to the west foothills of the Carmel range on the other hand, leads this area cell to be characterized by very high visibility. All areas of the Carmel coastal plain are spread out and clearly visible from residential buildings in Fureidis and the northern neighborhoods of Zikhron Yaakov (Givat Eden), which are located in the foothills of the range, at a distance of about 1.5 km and 2 km from the site, respectively. At the same time, within the strip of the coastal plain, we get a local topography that is created by the rise of kurkar ranges within the open areas, leading to a situation in which the area of the proposed site is not fully exposed and is even hidden for some of the area's localities (such as Moshav Dor and Kibbutz Nachsholim), mainly those that are located to the west of the kurkar range. The visibility obtained in localities located within the landscape unit of the Carmel coastal plain, such as Ein Ayala, is also limited since the surface cover of the area is mainly agriculture comprising banana groves, avocado, orchards and even cypress boulevards that are used as windbreakers for these crops, as well as greenhouses. These all create a certain visual barrier and ameliorate the visibility in the direction of the surface cell. Because of the relative elevation obtained along the kurkar range, visibility is obtained from the south part of the range towards the areas of the Carmel coastal plain (in the Hirbet Darkemon site region) as well as from Road 2 (the coastal road) mainly for travelers heading north, since the road passes on top of the kurkar range. However, the road segment that is closest to the site is excavated in the range and does not allow visibility towards the site. The site is not visible from Road 70 (Fureidis Junction -

Zikhron Yaakov Interchange) and is hidden behind the wastewater treatment facility in that direction. Visibility towards the site area is also obtained from the access road to the kibbutz and the leisure village, and the coastal tourist center at Nachsholim.

1.5.1.2 Cross-sections and aspects

Cross-sections and aspects for the Dor North alternative are presented in Figure No. 1.5.2-a.

1.5.1.3 Pipeline alignment and the block valve station

Below is an analysis of the landscape characteristics and the landscape units within the block valve station area, and along the alignment of the proposed pipeline.

The Block Valve Station - Entrance Array to the Shore

In this alternative, the block valve station is located within the area of the coastal strip of the Carmel coastal plain to the south of Dor, in the landscape unit of the Carmelim coastal plain. This surface cell is characterized by sandy areas, both active and inactive fish pools, and gravelly outcroppings. Moreover, this area is a disturbed area which comprises the region of the agricultural buildings that are used probably as an operational area for fishing. The region is used as an important activity area for waterfowl and thicket birds, the sandy beach serves as a nesting side for sea turtles, and during the winter season waterfowl may be observed there. The location of the block valve station is within the operational area of the fishing pools, which is less sensitive to its environment. Moreover, since the block valve station is planned to be located within a limited area in the subsoil (just like all other proposed block valve stations) and its main landscape impact will be expressed in practice in the construction of a peripheral fence and in night lighting within the sandy area, its landscape significance is extremely minor relative to its environment.

Proposed pipeline alignment

The proposed pipeline alignment passes through a region of sandy areas and mainly agricultural areas within the landscape units of the Carmelim coastal plain and the Carmel coastal plain. From the facility, the treated gas will pass through the existing INGL pipeline alignment, and for this reason there will be no further disruption of the area for the purpose of arranging the alignment. It should be noted that from a landscape point of view, it is possible to restore the agricultural landscape to its previous condition and the required reconstruction process is relatively simple.

1.5.2 Ein Ayala

The Ein Ayala site is located within the disrupted quarrying area of the active quarry "Ein Ayala," which spreads over about 150 dunams. The quarry, which is located in the southwestern foothills of the Carmel range, within the jurisdiction of the Hof HaCarmel Regional Council, serves for the production of sand for mortar used by the construction industry. Within the site, a detailed plan HK/78c is being promoted which comprises the spur of the quarrying area and rehabilitation of the quarry. Nevertheless, it was decided that in the event that the alternative referring to the quarried site should be found appropriate for the gas treatment facility, then the raw material is not vitally necessary and the central consideration is rehabilitation of the site.

1.5.2.1 Visual basin

The visual basin of the site comprises the following elements:

- **Topography and landscape units:** The Ein Ayala alternative is located on the margins of the Mount Carmel landscape division, within the area of the low Carmel landscape unit, which borders to the west on the Carmel coastal plain (Carmelim plain – described in the Dor North alternative), see Figure No. 1.5.1-b. The site is located within the area of the Ein Ayala quarry, which is located in the western foothills of the Carmel range, close to the intersection with the Hof HaCarmel coastal strip. The western cliff of the range is more moderate relative to the eastern cliffs, and seems to have been formed by marine abrasion. The low Carmel landscape unit is a plateau area spread at an elevation between 200-300 m, with rocky landscape and deep streams that bisect it from east to west, accompanied by karstic phenomena and dolomite and calcium outcroppings. This region is characterized by hard limestone rocks and terra rossa type soil. Within the environs of the quarry, the ridge foothills are accompanied by natural forest vegetation that is characteristic of the Mediterranean habitat.

  The alternative is located within the area of the Ein Ayala quarry, within the existing excavation pit. The external wall of the quarry towers to a height of about 100 meters above sea level, while the western span of the quarry is located at a height of about 50 meters above sea level. At the center of the quarry there is an additional "wall" in the east-west direction which creates a quarried area that is hidden from the landscape. The western edges of the quarry abut the flat expanses of the coastal plain and spread out at its foot. To the west of the quarry, the topography is higher than the height of the eastern wall, and reaches a peak at a height of about 140 meters. To the north of the spur within which the quarry is located, there is a channel hidden within the

topography. To the south of the quarry there is another channel, above which there is a higher spur covered with forest. Road 4, separating between the Carmel coastal plain, passes at the foot of the quarry and is characterized by agricultural areas of feed crops and plantations. The Carmel range spurs descend to the north and to the south of the site, and includes localities such as Fureidis, Kerem Maharal and more. Within the level area too, there are agricultural localities where some residential areas face the east and overlook the quarry.

- **Localities and population concentrations:** Fureidis is located at a distance of about 900 meters to the south of the quarry, on an adjacent spur. Ein Ayala is located on the plain to its west at a distance of about 900 meters as well. More distant, to the west of Road 4, are the localities of HaBonim, Nachsholim and Dor.
- **Routes and roads:** The longitudinal Road 4 abuts the area of the quarry facilities that are located a little to the north of the quarry site, and passes at a distance of about 300 meters from the site itself. At a distance of about 2.5 kilometers westwards are longitudinal Road 2 and the railroad track. Southwest of the track, at a distance of a kilometer and more, are the transverse roads 70 and 7011.
- **Nature and landscape values:** The area of the alternative is located within the Carmel range and at a relatively large distance, about 4 kilometers to the east of the shoreline. Apart from this are the following nature reserves in the region of the alternative: the Kurkarei Hof HaCarmel reserve located to the north and to the east of the alternative, on both sides of Road 2; the Hirbet Darkemon reserve located to the northeast of the alternative (see the details of the Dor North alternative above), beyond road 7011. These reserves are not developed in practice and do not comprise any active visiting sites.

  In the north spur from the quarry is Hirbet Shimri – the remains of a structure from the Ottoman period, surrounded by a number of large caves. The area of the ruins and the forest areas that abut the alternative are not defined as reserves or as visiting sites. Nevertheless, within the areas surrounding the quarry are various paths, jeep tracks and bicycle tracks – mainly in the vicinity of Hirbet Shimri to the north and along Road 4.
- **Additional uses:** The main uses found in the region of the quarry are agricultural areas. Within the area of the quarry itself, there are no additional infrastructure facilities except for the quarry area. In the south part of the quarry there is a heaping site of soil surpluses remaining from infrastructure works that have been carried out in the region.

- **Future planning and development:** The locality of Fureidis is expected to expand in an easterly direction, based on plan No. S/1384/HK/156i, intended for the expansion of the locality's residential areas. The Fureidis master plan designates areas in the north of the locality for the development of an employment region. The plan is in its early planning stages and has not yet been approved by the planning institutions.

Visibility analysis:

On the basis of an analysis of the central elements of the visual basin of the proposed site, the following is a visibility analysis:

Because of the location of the alternative within the quarry area in the western foothills of the Carmel range, close to the encounter with the level area of the coastal plain, this surface cell is characterized by high visibility from the direction of the Carmel coastal plain to the west. Nevertheless, along Road 4 which passes along the foothills of the range and the quarry, there are cypress and eucalyptus boulevards that have been planted as windbreakers for the agricultural areas of the Carmel coastal plain. These create a physical and visual barrier for those travelling along Road 4 in the direction of the active quarry, and for those observing it close up.

The site is mainly visible to those travelling along Road 2 (the coastal road), to those residing in the south parts of Ein Ayala, and to a limited extent also from the coastal region, and from the localities Dor and Nachsholim, despite their distance (more than 3 km). Moreover, despite the intensive agricultural cultivation in this region, most of the agricultural crops are low-standing and therefore do not aide in concealing the quarry. Take into account that the quarry is destined to expand and its landscape imprint is expected to increase.

The facility itself is located within the area of the Ein Ayala quarry, within the existing excavation pit. The structure of the quarry itself – an excavated area within the Carmel range – serves as a significant landscape barrier, since the natural walls of the mountain partially conceal the area being quarried, so that the excavation pit itself is almost invisible in its environment. At present, what is visible from the west direction is the upper part of the excavation wall (the lower part is concealed by trees), heaps of fill intended for the reconstruction of the disturbed area to the south of the site (heaps created by past works carried out in the quarry and in adjacent projects) as well as the area of the facilities that is close to Road 4.

In addition to the above, in the current status, the quarry is sharply visible and salient within the landscape of its environment because of its great contrast with the natural characteristics of the Carmel range – the bright white quarry walls versus the green slopes of the Carmel range.

1.5.2.2 Cross-sections and aspects

The cross-sections and aspects of the Ein Ayala alternative are presented in Figure No. 1.5.2-b.

1.5.2.3 Pipeline alignment and block valve station

Below is an analysis of the landscape characteristics and landscape units within the block valve station area, and along the alignment of the proposed pipeline.

Block valve station – coastal entrance array

See a description in Section 1.5.3 above, for the Dor North alternative.

Proposed pipeline alignment

The proposed pipeline alignment passes through an environment of mainly agricultural areas within the landscape units of the Carmelim coastal plain and the HaCarmel coastal plain. From the facility, the treated gas will pass through the existing INGL pipeline alignment, and for this reason there will be no further disruption of the area for the purpose of arranging the alignment. It should be noted that from a landscape point of view, it is possible to restore the agricultural landscape to its previous condition and the required reconstruction process is relatively simple.

1.5.3 Hagit East

The Hagit alternative is located within a nature area of herbaceous dwarf shrubs along the southeast slopes of the Carmel range – the Ramot Menashe boundary, in the vicinity of the Hagit Power Station. The proposed site area is locked between the power station to the east and Road 6. The site area, which spreads over about 250 dunams, is located within the jurisdiction of the Hof HaCarmel Regional Council.

1.5.3.1 Visual basin

The visual basin of the site comprises the following elements:

- **Topography and landscape units:** The Hagit East alternative is located on the margins of the Mount Carmel landscape division, on the edges of the south Carmel escarpments landscape unit, and on the boundary of the Bamat Menashe landscape unit, which is included within the landscape unit of Ramot Menashe (see Figure No. 1.5.1-c).

  The south Carmel escarpments is an escarpment unit that descends from the direction of the low Carmel –northwest, in the direction of Ramat Menashe, which is located to the southeast, along the boundary of the Dalia Stream and the Menashe Stream. The unit descends from an elevation of about 200 m to

an elevation of about 100 m. The typical rock face in this area is comprised of chalk with layers of marl. The escarpments are accompanied by natural forest growth at the streambeds (oak, pispacia, Greek strawberry tree) and cultivated agricultural areas around Bat Shlomo.

The Bamat Menashe unit is characterized by a group of hills towering over the streams of Dalia and Menashe, while the hills opposite the streams are characterized by gradual slopes. In the area adjacent to the road and to the Hagit site, the surface is mainly a level plateau area at an elevation between 60-170 m above sea level. The typical rock face is chalk and clays, and the soil is of the humus-carbonate soil. The vegetation in the area is mostly pine trees – a forest planted by man, dwarf shrubs and bushes and hydrophilic vegetation within the streambeds. Agricultural areas, mainly plantations, lie over the area of the mountain plateau. To the south of the exploration area and Road 70, some of the area is defined according to NOP 35 as a landscape array.

The proposed site is located in the region adjacent to the Hagit Power Station, at an elevation of about 170-180 m on top of a level and relatively straight spur that is bisected by a secondary channel. At the foot of the proposed site are streambeds that include natural springs such as Ein Tut.

The south part of the alternative is located along an elevation line lower by about 15 m than the spurs that lie to the north of it and is relatively level. From the south boundary of the alternative is the beginning of the sloping of the topography towards the Tut Stream, which is located to the south and along Road 70. About 2.5 kilometers to the north of the alternative is the beginning of a rise in the topographical slope towards the Carmel range.

- **Localities and population concentrations:** The area of the alternative is located about 1.8 kilometers to the north of Kibbutz Ramot Menashe, about a kilometer to the southwest of Elyakim, and about 700 meters from the firing ranges and facilities of the Elyakim military base.
- **Routes and roads:** At a distance of about 250 meters to the south and to the east of the proposed site is transverse Road 70 and longitudinal Road 6. The Ein Tut interchange, which connects between these two roads, is located at a distance of about 300 meters to the south of this alternative.
- **Nature and landscape values:** The Hagit alternative is located within an environment with considerable ecological value because of the variety of the flora and fauna in the area and its environs. The alternative is located in an environment of streambeds, nature reserves and forest areas as follows: according to NOP 34/B/3, a secondary drainage artery that flows into the Tut

Stream is located to the south of the site. In the area of the Tut Stream to the south of the site is the Nahal Tut nature reserve. The Rosh Nahal Maharal nature reserve and the Nahal Haruvim nature reserve are located a kilometer and more to the north of the alternative, beyond the Elyakim firing ranges. The Nahal Dalia nature reserve and additional nature reserves are located at a considerable distance to the south of the alternative. **At present a jeep track** passes to the west and the north of the site and continues also to the east and the south – beyond the Hagit Power Station. To the north and the west of the power station, is a path for vehicles, mainly passing within the firing range. The Israel Bicycle Trail is planned to pass along 1.5 km to the west of the alternative. To the south of the Hagit Power Station is an organized seating area belonging to the JNF.

The alternative area abuts in its northwest corner with a declared antiquities site, Nahal Hagit and Ein Hagit, in which there are remains from the Paleolithic and Chalcolithic periods and clay shards from the Iron Age and Byzantine period. Close to the 182 m elevation point and to the west are the remains of a settlement from the Iron Age (the 8-7 century BCE), and additional remains from the Roman period. The site is not developed and is not defined as a visiting site.

According to the nature and landscapes surveys of the OLI, the area of the proposed site is partially located within an area considered to be of very high importance for landscape conservation, and partly considered to be of high importance. As regards the sequence of open areas, the area of the site is located in proximity to an existing facility and to a central road, and therefore is not located in an area with high sensitivity in a continuous sequence. The Bamot Menashe area is characterized by the survey as an area with high nature resources and landscape value.

- **Additional uses:** Construction of the Hagit Power Station, which abuts the site to the west, included extensive earthworks. Although the area was treated from a landscape point of view, the works did leave their imprint on the area and led to a change in the face of the region. To the northwest of the proposed site is an IEC switching station.

  Within the alternative's area, to the north and the south of the site proposed for the location of the treatment facilities, are agricultural buildings: poultry sheds to the south and an agricultural farm to the north. Apart from that, most of the area surrounding the alternative is used for agriculture.

  To the north of the alternative are training areas used by the security forces.

- **Future planning and development:** The plan for the employment region Mevo Carmel - C/8415 located in the vicinity of the Kibbutz Ramot Menashe is at a considerable distance from the site and is being developed at present.

Visibility analysis:

On the basis of an analysis of the central elements of the visual basin of the proposed site, the following is a visibility analysis:

The location of the alternative along the south Carmel escarpments with natural characteristics on the one hand and adjacent to a large and relatively prominent infrastructure facility within the landscape environment on the other hand, lead this surface cell to be characterized by high visibility – although a considerable part of the visibility of the surface cell stems from the existence of the infrastructure facility and not from the surface cell itself. Despite the attempt made when erecting the power station to keep it away from the road with the aim of concealing it from a landscape point of view, the site is still prominent from a distance, especially the three stacks which rise up from it, and is opposed to its natural environment and its qualities. From the site we see the Har Hurshan reserve, the Ramot Menashe landscapes and Road 6 and the Ein Tut Interchange which pass near it to the east. For those travelling along Road 70 (Fureidis - Yokneam), there is high visibility for the site in both directions, especially in view of the changes in road alignment and its considerable elevation on its connection with Road 6. For those travelling in an easterly direction, the visibility is obtained from an even greater distance. The area of the site is mainly visible from the localities at the west edges of Ramot Menashe, such as Kibbutz Ramat Menashe.

From the west, because of the south escarpments of the Carmel and because of its location flush with the Hagit Power Station, the site area is almost not prominent today. To the north of the site is the line of a local range (along which a vehicle road passes through the firing range) and from which we see the existing Hagit site and a considerable part of the proposed site area.

1.5.3.2 Cross-sections and aspects

The cross-sections and aspects of the Ein Ayala alternative are presented in Figure No. 1.5.2-c.

1.5.3.3 Pipeline alignment and block valve station

Below is an analysis of the landscape characteristics and the landscape units within the block valve station area, and along the alignment of the proposed pipeline.

Block valve station – Coastal entrance array

See a description in Section 1.5.3 above, for the Dor North alternative.

Proposed pipeline alignment

For the Hagit alternative, two options are proposed for the piping alignment corridors: north alignment – in parallel with the existing INGL line, and the south alignment within the agricultural areas of Moshava Bat Shlomo. In the two alternatives, the alignment extends from the block valve station, passes in the environs of agricultural areas within the landscape units of the Carmelim coastal plain and the Carmel coastal plain. After crossing Road 4, the pipeline alignment splits and passes within the range of the landscape units: low Carmel, Ramot Menashe and south Carmel escarpments. These landscape units are characterized by a natural forest and by dwarf shrubs and thickets. However, it should be noted that the north alternative alignment passes within a region characterized by dense and higher quality natural vegetation of pine plantations, an ancient natural forest of oak and carob trees. This as compared with the south alignment, which mainly passes through agricultural and dwarf shrub areas.

From a landscape point of view, the restoration of agricultural soil is not complex; the restoration of herbaceous natural soil is more complex than that of agricultural soil, but is possible. In a natural area of high-quality, dense forest, the landscape damage is great and full restoration is impossible.

1.5.4 Hadera Wastewater Treatment Facility alternative

The Hadera Wastewater Treatment Facility site is located in the floodplains of Nahal Hadera, close to the Hadera Wastewater Treatment Facility, within the agricultural areas of the Menashe Regional Council. Part of the exploration area region of the alternative is included within the jurisdiction of the city of Hadera.

1.5.4.1 Visual basin

The visual basin of the site comprises the following elements:

- **Topography and landscape units:** The Hadera Wastewater Treatment Facility alternative is located within the area of the North Sharon division in the landscape units of Nahal Hadera and Hamrat Pardes Hanna (see Figure No. 1.5.1-d). The proposed site is located within the area adjacent to the Hadera Wastewater Treatment Facility, at an elevation of about 10-15 m above sea level, within the area of the plain which constitutes in part the floodplain of the Hadera stream. To the northeast of the alternative, a remnant of a third kurkar ridge, Tel Zomra, towers to a height of about 25 m above sea level. To the south of the site, there are residential areas of the city of Hadera built on a ridge to a height of 45 meters above sea level, from which the sloping of the

topography towards Nahal Hadera begins; Nahal Hadera is at an elevation of 5 meters above sea level.

The wastewater treatment facility and the fields surrounding it are located within the floodplain of the stream, between the sands (to the north) and the remnants of a kurkar ridge, and are spread at an elevation of about 10 meters above sea level. The floodplain incorporates agricultural features, such as: fish pools, agricultural buildings, orchards and rows of cypresses and eucalyptuses. The rocks and the soil characteristic of this area are alluvial, stabilized sands for the quarry and edges of kurkar ranges. The typical vegetation of the marl soils is that of sarcopotrium, spiny broom, and halfa grass. In the alluvial soil the typical vegetation is Syrian mesquite, mustard, common beetroot, khelia, cynodondactylon, and corn buttercup and more.

The Nahal Hadera landscape unit abuts the following units along its south part: the built part of the city of Hadera included in the Hamra Hadera unit and the Hulot Hadera unit, some of which were cultivated in the past is located to the west of Road 4, and a considerable part of it is intended for the development of residential areas and tourism. To the south of these units at a considerable distance are the landscape units of the Hadera forest and its environs and the third ridge. To the north of the site, are the Caesarea and Hadera sands and the Orot Rabin Power Station.

- **Localities and population concentrations:** The proposed site is located on the north edges of the city of Hadera, in proximity to the north industrial zone of the city. The residential areas close to the alternative are located in the northeast neighborhoods of the city at a distance of about 900 m and more, and in the west neighborhoods of the city that are located at a distance of about 750 m westwards beyond the industrial zone. The alternative area is located about 1.8 km and more to the west of Kibbutz Gan Shmuel.
- **Routes and roads:** Close to the alternative from the north is Road 65. The road passes within a level area in a general east-west direction. Road 4 passes to the west of the site at a distance of about 1,000 m and more. In this segment, Road 4 crosses Nahal Hadera via a bridge. In future, the Nahal Hadera Interchange is to be constructed at the crossroads, and this will be more elevated and will be diverted towards the east. Construction of the interchange may increase the site's visibility for those travelling towards the north. The longitudinal Road 2 passes to the west of the proposed alternative area and is excavated within the kurkar range (at a distance of 2 km and more). The shore railroad passes to the east of the exploration area at a distance of about 500 m.

- **Nature and landscape values:** The area of the alternative is located to the east of the shoreline, at a distance of about 3 km. The Hadera streambed in this segment, which is defined in NOP 34/B/3 as a main artery and a strip for planning (passing to the south of the proposed site), has lost most of its natural features and qualities, most of the stream passes alongside the industrial zone in an orderly and even artificial way through channels, and the water flowing in it is wastewater at various levels of treatment, even though there are plans for its rehabilitation.

  Tel Zomra is an archaeological site located to the northeast of the exploration area. The site is a remnant of a third kurkar range towering over its environment and providing a 360-degree observation point. According to the North Sharon survey of the OLI, the archaeological site is defined as having a high landscape sensitivity and value. The site includes burial caves, the remains of a church, and structural foundations.

  In the vicinity of the proposed alternative (about 1.6 km to the west) along Nahal Hadera, some of the Heftziba farm has been preserved, which is a remnant of the first settlement period in the Sharon. The farm has undergone restoration and development by the IEC, and today serves as a national training center, as an historical visiting site and as a nature park. The Nahal Hadera segment that passes within the area of the farm has been restored and currently serves as the largest cormorant colony in Israel – and consequently, constitutes a destination for tourists and birdwatchers.

  In the vicinity of the exploration area, the Israel Bicycle Trail is being planned.

  As regards the value of nature and landscape, the alternative is located within an intermediate value range estimated in the ranking of the sequence of open areas as medium or less. The region within the exploration area closest to the Hadera north industrial zone, is characterized by a lower sensitivity, and the further one advances in the north and east direction, the greater the sensitivity and the value of the area. Nahal Hadera in this area does not constitute a quality resource/natural value and has lost most of its natural characteristics. Nevertheless, it should be noted that the stream remains, despite the many hazards surrounding it, an axis of open area along the coastal plain up to the sea, and there are various plans in existence for its restoration.

- **Additional uses:** The alternative is located within an agricultural area adjacent to a wastewater treatment facility. The north industrial zone of Hadera, which has a distinct industrial character, is located to the southwest of the site.

- **Future planning and development:** In the vicinity of the Hadera Wastewater Treatment Facility to the south, on the basis of Plan NOP/34/B/2/2, a plan is being advanced for a desalination facility for the Palestinian Authority, which has not yet been approved by the planning institutions. Moreover, also being advanced are a number of plans for the city of Hadera and for the stream area in which it is proposed to develop leisure and recreation areas along the stream, but mainly along its western parts to the west of Road 4.

Visibility analysis:

On the basis of an analysis of the central elements of the visual basin of the proposed site, the following is a visibility analysis:

On the one hand, this area is important as regards its landscape – the agricultural areas constitute a central element in the landscape of the culture, shaped by Zionist settlement in the Sharon. The importance of these areas increases in view of their contribution to the unbroken sequence of open areas that has remained between the expanding localities of the coastal plain. Moreover, despite the visual and environmental hazards surrounding the corridor of the stream, the area has potential to serve as a landscape access that conserves unique landscapes of a perennial stream, orchards and plantation, kurkar hills and finally, the beach. On the other hand, the location of the alternative within the floodplains of Nahal Hadera in a cultivated agricultural area and in proximity with an infrastructure facility and an intensive industrial zone made the surface cell essentially disconnected, despite its relatively proximate location to a large and crowded city. Moreover, the intensive agricultural surface cover found within the environs of the proposed site, and especially the cypress and eucalyptus boulevards in the agricultural areas and along Road 65, together with Tel Zomra, which towers high in this area, may serve as physical visual barriers to the visibility in the direction of the site area from the north and northeast directions. At the same time, the local topography of the sloping region, the gradual lowering of the kurkar hills and the local ranges in the direction of the Hadera stream bed and its surrounding plains, allow high visibility from the direction of the higher points – local spurs and ranges, among them residential areas of the northeast neighborhoods of the city of Hadera and the Tel Zomra region, which offer a 360-degree observation of the area.

1.5.4.2 Cross-sections and aspects

The cross-sections and aspects of the Hadera Wastewater Treatment Facility alternative are presented in Figure No. 1.5.2-d.

1.5.4.3 Pipeline alignment and block valve station

Below is an analysis of the landscape characteristics and landscape units within the block valve station area, and along the alignment of the proposed pipeline.

Block valve station – Coastal entrance array

In this alternative, three possible locations are proposed for the block valve stations: Hadera, Michmoret and Nahal Alexander.

In the Hadera alternative, the block valve station is located within the plain of open spaces between the Orot Rabin Power Station and the Olga neighborhood in the city of Hadera, and the beach to the west and Road 2 to the east. The station is located within the shore strip Holot Hadera – which is included within the area of the Holot landscape division. This surface cell is characterized by sand areas, partially stabilized with typical shore vegetation, in proximity to the Nahal Hadera estuary, along which an artificial park has been created – eucalyptus trees have been planted in this location spreading out to the sand areas to the south and leading to a stabilization of the sand and changes in habitat. The park promenade constitutes an active visitor center. The stream estuary is located in the vicinity of the Orot Rabin Power Station. In the east part, there is a second kurkar range on which a unique forest part configuration is developing. The location of the proposed block valve station is to the south of Nahal Hadera and to the east of the visitor area and the park's parking lot, in an area that is relatively concealed from its environment, within a fold of land of the sand dunes characteristic of this region.

In the Michmoret alternative, the block valve station is located in an open area between Michmoret and the Olga neighborhood in the city of Hadera, and the shore to the west and Road 2 to the east, which constitute part of the Park HaSharon space within the Holot Hadera landscape unit. This space is characterized by a combination of different habitats, including partially stabilized sand areas, loam soils, a shore escarpment – a loam escarpment within the area of the Tel Gador nature reserve and the park forest landscapes. In the context of the North Sharon survey, the areas of most of the sand regions within the examination area have been estimated as having very high value, except for patches of built areas and disturbed regions. Despite the region's high sensitivity, it is possible to see that there are disturbed areas with point-wise lower sensitivity. The location proposed for the block valve station is in the southern part of the explorations area, which is adjacent to Michmoret where the surface has been obviously disturbed as a result of the entrance of vehicles.

In the Nahal Alexander alternative, the proposed surface cell is located in the space of the areas between Michmoret and Mevo'ot Yam, and Nahal Alexander within the Holot Hadera landscape unit. This region constitutes an active visitor center both

because of the beautiful coastal strip and the natural bays located there, and because of the Nahal Alexander nature reserve and the marine turtle feeding center. This area is characterized by a combination of sandy habitats and moist habitats. In the context of the North Sharon survey, most of the areas within the examination region were evaluated as having very high value, except for patches of built areas and disturbed regions with low value. The location of the block valve station is in the northern part of the region, which is characterized by stabilized sands and by a relatively low value, wherein it is proposed to locate it within a fold of ground and within the local vegetation shrubbery, at a point that is relatively far and is not prominently visible to visitors at the beach and the reserve.

In all three alternatives, since the block valve station is planned to be located within a limited area in the subsoil, and most of its landscape impact will be expressed in actual fact by the positioning of a peripheral fence and night lighting within the sandy area, its landscape significance therefore is extremely minor relative to its environment.

Proposed pipeline alignment

Three alternatives are proposed for the Hadera Wastewater Treatment Facility site's pipeline alignment from the block valve station up to the facility, in accordance with the location of the block valve station.

In the Nahal Hadera alternative, from the Hadera block valve station up to the facility, the proposed pipeline alignment passes within an area of sand dunes, mostly stabilized, in proximity to Nahal Hadera – within the area of the Holot Hadera landscape unit.

From the block valve station in the Michmoret and Nahal Alexander alternatives and up to the facility, the proposed pipeline alignment mostly passes within an environment of sand dunes, mostly stabilized, in parallel with Road 2 within the area of the landscape divisions: Holot and North Sharon, and the landscape units: Holot Hadera, Hamra Hadera and Nahal Alexander. This alignment unites with the Nahal Hadera alignment in proximity to Road 2. In the Nahal Alexander alternative, the alignment first passes in parallel to the Nahal Alexander strip.

From the region of the facility, the alignment passes, in both alternatives, within the North Sharon landscape division, in the Nahal Hadera and Hamra Pardes Hanna units. These landscape units are characterized as the floodplains of Nahal Hadera (which has lost its natural qualities along most of its length) and loam soils – these areas currently serve mainly for agricultural activity of orchards and field crops. In its easternmost part, towards the connection to the onshore conduction system at the Gezer-Hagit line, the pipeline alignment passes through the landscape unit Ma'aleh

Nahal Hadera. It should be noted that in this alternative, the alignment of the proposed pipeline along most of its length, passes through a level area that is cultivated and saturated with agricultural unpaved paths. From a landscape point of view, the rehabilitation of agricultural soil is not complex and the agricultural landscape can be restored to its prior condition.

1.5.5 Meretz Wastewater Treatment Facility alternative

The Meretz Wastewater Treatment Facility site is located in a level area close to the Meretz Wastewater Treatment Facility, within the agricultural areas of the Emek Hefer Regional Council.

1.5.5.1 Visual basin

The visual basin of the site comprises the following elements:

- **Topography and landscape units:** The Meretz Wastewater Treatment Facility alternative is located within the North Sharon division in the landscape units of Hamra Hadera and Nahal Alexander (see Figure 1.5.1-e). The proposed site is located within a flat plain area, within which there is intensive agricultural activity, mostly of plantations, orchards and field crops, and there are also water and fish pools in its vicinity. The plain area of the Sharon is blocked in the east by the foothills of the Shomron, and the three kurkar ranges along the seashore. To the south of the site is the Nahal Alexander bed, which is located in the vicinity of the Meretz Wastewater Treatment Facility.

  The Hamra Hadera landscape unit, located in the northern part of the exploration area, is in a level plain characterized by loam soils. The typical vegetation is the community of centaurea procurrens and halfa grass, which create an herbaceous low shrubbery dominated by perennial plants, geophytes and microphytes. In the cultivated areas there is a segetal variant of this community, the false chamomile. The remains of a forest that covered the loam soils appear in limited areas but not within the explorations area.

  The Nahal Alexander landscape unit is located in the southern part of the exploration area and is characterized by a level surface that spreads along the foothills of the north Shomron, at an elevation between 50-80 m above sea level. The rock face and soil in this area is heavy clayey gromusol. Typical vegetation is that of dwarf shrub shrubbery remains, clayey soils and segetal vegetation – but as noted above, most of the area is cultivated.

Within the exploration area is a relatively flat local topography in proximity with Nahal Alexander. The proposed site is located at an elevation of about 20 m above sea level, but in its close vicinity there are some small slopes of low hills on which some of the adjacent localities are situated.

- **Localities and population concentrations:** The proposed site is located in the vicinity of rural localities included within the Emek Hefer Regional Council: Kibbutz Ein HaHoresh to the northwest at a distance of about 1.9 km; Kibbutz HaMa'apil and Moshav Ahituv to the northeast at a distance of about 1.2 and 2 km, respectively; Moshav Ometz at a distance greater than 2 km, to the east. Additional rural localities within the area of the Emek Hefer Regional Council are located in the more distant environs of the exploration area.
- **Routes and roads:** There are no main roads or railroad tracks within the area of the alternative or its proximate environment. Regional Road 581 passes to the north of the alternative at a distance of about 1 km.
- **Nature and landscape values:** The entire site and its environs constitute a continuous and large agricultural area defined as a landscape assembly according to NOP 35. Nahal Alexander and its tributary, Nahal Ometz, pass to the south and southwest of the exploration area. In this section of Nahal Alexander, wastewater flows in the streambed and is conducted within an organized channel.

  At the same time, to the east of the alternative, extensive restoration and development operations have been carried out for the stream strip. In the restored areas, the stream serves as an excursion and leisure area for the region's residents. Along the stream strip is a path for both pedestrians and bicyclists, and some of the paths also connect the stream to adjacent rural localities. Nahal Alexander is defined as a main drainage artery and as a strip slated for planning in NOP/34/B/3. In addition, the Israel Bicycle Trail is planned to pass in close proximity to the exploration area to the east.

  The Breichot Ein HaHoresh nature reserve is located in a spring area close to Nahal Alexander, to the southwest of the exploration area. In this region there were swamps until mid-20th century, and after these were reclaimed, fish pools and water reservoirs were built in the area. After the pools' operations were terminated, the location has become the habitat of a variety of water plants and also constitutes a habitat for dozens of raptors and waterfowl, as well as mammals and reptiles. During the migration season, thousands of birds visit the pools, among them a number of rare species as well. In winter, the pools collect rainwater and drain the entire region. Today, the Breichot Ein HaHoresh are proposed for inclusion as a nature reserve.

Tel Nurit – an antiquities site located within the exploration area of the alternative, which contains the remains of localities from various periods. This site does not constitute an active visiting site.

- **Additional uses:** The alternative is located within an agricultural area adjacent to a wastewater treatment facility. The wastewater treatment facility pool is surrounded by an artificial embankment just a few meters high.

  The cemetery of Kibbutz HaMa'apil is located at a distance of about 1 km from the exploration area.

<u>Visibility analysis:</u>

On the basis of an analysis of the central elements of the visual basin of the proposed site, the following is a visibility analysis:

The surface cell proposed for this alternative is located within a large agricultural space that is important as an open agricultural landscape. Its landscape significance increases because of the large development pressures exerted on the HaSharon area, and it constitutes one of the central open spaces in which continuity has been preserved with all of its agricultural elements. In proximity to the proposed site there is a wastewater treatment facility. Even though it is salient on the background of the open spaces, the wastewater treatment facility is mostly invisible to its environment because of the intensive agricultural elements of plantations, orchards and cypress boulevards that constitute a physical and visual barrier and ameliorate the visibility of the wastewater treatment facility and its environment to a great extent, both for travelers along the roads and for adjacent localities.

Within the exploration area is a relatively flat local topography, but in its direct proximity there is a small sloping of low hills on which some of the localities are located. The main visibility for the wastewater treatment facility and its environment is from the adjacent localities – Ein HaHoresh, Hoglah, Ometz and HaMa'apil on the slopes of the hills overlooking the facility. Nevertheless, the relative distance of the alternative from rural localities and from the roads in the area helps in general to limit the visibility of the site area.

1.5.5.2 Cross-sections and aspects

The cross-sections and aspects of the Hadera Wastewater Treatment Facility alternative are presented in Figure No. 1.5.2-e.

1.5.5.3 Pipeline alignment and block valve station

Below is an analysis of the landscape characteristics and the landscape units within the block valve station area, and along the alignment of the proposed pipeline.

Block valve station – coastal entrance array

In this alternative, four possible locations are proposed for the block valve stations: Nahal Hadera, Michmoret (Tel Gador reserve), Nahal Alexander and Neurim. All of the alternatives are located within the Holot landscape division.

The alternatives of Hadera, Michmoret and Nahal Alexander – see details in Section 1.5.3 for the Hadera Wastewater Treatment Facility.

In the Neurim alternative, the proposed surface cell is located within a built space that overlies the coastal escarpment in the area of Beit Yanai and Havatzelet HaSharon, within the Holot Netanya landscape unit. This escarpment is a kurkar and upright loam escarpment in which various processes of collapse and buckling are taking place. Most of the area of this alternative is a disturbed area which serves as a training facility for the Home Front Command.

In all four alternatives, the location found for the placement of the facility is within a disturbed area and/or a less sensitive area in its environment: these are areas of acacia saligna and/or disturbed areas from the point of view of the landscape and the ecology.

Moreover, since the block valve station in the four alternatives is planned to be located in a limited area of the subsoil (just like all other proposed block valve stations) and most of its landscape impact will be expressed in practice in the positioning of a peripheral fence and in nighttime illumination of the sandy area, its landscape significance is extremely minor relative to its environment.

Proposed pipeline alignment

From the block valve station up to the facility, the alignment of the pipeline for all 4 alternatives, Hadera, Michmoret, Nahal Alexander or Neurim, passes within the landscape divisions: Holot and North Sharon. The following is a description of the landscape units through which the alignment is to pass, and their characteristics:

The alignment begins with the coastal strip, which is characterized by sandy areas and kurkar ridges, within the landscape units: Holot Hadera (in the Michmoret and Nahal Alexander alternatives) and Holot Netanya (in the Neurim alternative). Following this, the proposed pipeline alignment passes through the agricultural areas of the Emek Hefer Regional Council, most of which are characterized by loam soils and agriculture involving plantations, orchards and field crops within the landscape units: Hamra Hadera (for the Michmoret alternative) and Hamra Netanya (for the Neurim alternative). In the Nahal Alexander alternative, the alignment passes in parallel to the stream's corridor within the Nahal Alexander landscape unit. After the facility, the alignment of the pipeline unites and continue eastwards within the agricultural area towards the western slopes of the Shomron mountains, within the landscape units: Ma'ale Nahal Hadera and the North Trough. It should be noted that

most of the proposed alignment in the four alternatives passes through an area that is essentially agricultural and along or in proximity with existing unpaved roads.

From a landscape point of view, the restoration of agricultural soil is not complex and it is possible to restore the agricultural landscape to its previous condition. The restoration of a stream (in the Nahal Alexander alternative) is also possible, but a greater sensitivity is required in order to minimize the damage to the stream and to avoid damaging Hirbet Samara (in the narrow part of the stream).

Figure 1.5.1-a: Landscape Units of the Dor North Alternative

Figure 1.5.1-b: Landscape Units of the Ein Ayala Alternative

Figure 1.5.1-c: Landscape Units of the Hagit East Alternative

Figure 1.5.1-d: Landscape Units of the Hadera Wastewater Treatment Facility Alternative

Figure 1.5.1-e: Landscape Units of the Meretz Wastewater Treatment Facility Alternative

Figure 1.5.2-a: Visual Analysis Dor North

Figure 1.5.2-b: Visual Analysis Ein Ayala

Figure 1.5.2-c: Visual Analysis Hagit East

Figure 1.5.2-d: Visual Analysis Hadera Wastewater Treatment Facility

Figure 1.5.2-e: Visual Analysis Meretz Wastewater Treatment Facility

1.6 Seismology

**Note: In this chapter, the numbering of the subject sections is different as compared with the numbering in the survey guidelines, even though all of the information required in the instructions is present in the chapter. Sections 1.6.1-3 below deal with the geological background, while Sections 1.6.4-8 deal with an analysis of the seismic risks (which are detailed in the guidelines of the survey - Sections 1.6.1-6, enclosed as Appendix A), as detailed below:*

This part of the survey deals with the seismic risks to which the onshore gas facilities planned within the context of NOP 37/H may be exposed. The chapter presents a survey of the array of seismic risks and a detailed evaluation of the feasibility and level of each one of these risks on the basis of existing information in each of the onshore gas facilities, at the coastal entrance arrays and along the pipeline that connects the coastal entrance arrays, the facilities and the national transmission system. The following sections present a general geological background (Section 1.6.1), the details of the seismotectonic model utilized to characterize the regional seismogenic sources and which constitutes the basis for calculating peak ground accelerations (PGA) at the alternative sites (Section 1.6.2), and a presentation of the various seismic risks that were examined for each alternative including the criteria used for its evaluation (Section 1.6.3). Further on an analysis of the seismic risks for each alternative is also presented (Sections 1.6.4 to 1.6.8).

Figures for this section appear at its end.

1.6.1 Geological background

The alternatives surveyed in the context of this document for the possible location of onshore gas facilities (including the coastal entrance arrays) are located in the central and north part of the coastal plain and/or along its margins (the Meretz Wastewater Treatment Facility, the Hadera Wastewater Treatment Facility, Dor North and Ein Ayala) and in the Ramot Menashe region (Hagit) (Figure 1.6.1-1). The geological descriptions presented below refer to these areas.

The sedimentary coverage in the west of Israel gradually thickens from the mountain spine of Israel as it moves westwards, towards the east basin of the Mediterranean Sea (Figure 1.6.1-2). The Sharon coastal plain includes clayey rocks of the Pliocene Yafo Formation are located directly over the pelagic rocks of the of the Mount Scopus Group HaSnunit (for example the Caesarea-2, Caesarea-3, Netanya-1, Hadasim-1 drillings) while in the Carmel coastal plain, the terrestrial sediments of the Pleistocene kurkar group directly overlie carbonate rocks from the Cenomanian era which belong to the Judea Group (for example the Atlit-1, Atlit-2 drillings). Exposed

sediments in the surface of the coastal plain are included in the kurkar group from the Quaternary era and comprise the following units:

- **Kurkar ranges (Pleistocene-Holocene):** Carbonate sandstone (kurkar) from a marine or Aeolian origin, clay-red silty soil (marl), silt, clay, unconsolidated sand and conglomerate. All these appear in a strip up to 5 km wide along the coastal plain and the continental shelf. The width of the kurkar ranges proximate to the shoreline reaches 180-200 meters.
- **Alluvium from the Holocene Era (younger than 11,000 years):** Includes sand, soil, gravel, clay and loess, most of the sediments originate from streams and the thickness is 5-30 meters. The alluvium and clayey soils (loam) cover extensive areas in the coastal plain, usually overlaying calcareous sandstone (kurkar).
- **Sand dunes from the Holocene Era (younger than 6,000 years):** Appear in a strip that runs parallel to the coast with a thickness of up to 20 meters, over alluvium or calcareous sandstone.

The morphology of the coastal plain on land and on the continental shelf is characterized by elongated kurkar ranges spreading in a north-south direction (Figure 1.6.1-3), mainly comprising carbonate sandstones (kurkar) interchanging with red clayey soil (loam) of up to 100,000 years of age[viii].

1.6.1.1 Subsoil structure and the increase of soil accelerations

The increase of soil vibrations during an earthquake stems from a reduction in the speed of the seismic waves when they rise from the harder rocks that are located in the depths of the ground to the softer rocks and soils nearer to the surface. When the change in speed is not gradual and there is a sharp passage between the hard, rocky subsoil and the soft layer of soil, the phenomenon of amplification increases considerably as seismic energy becomes trapped in the upper layer. Seismic waves that are refracted from the surface downwards are subject to interference with the waves returned from the hard subsoil upwards, so that resonance is created with typical frequency and amplitude[ix]. In areas where there is a soft soil/rocky cover overlying rigid subsoil, a strong seismic reflector is created in the roof of the hard subsoil. In the west of Israel, such a reflector is liable to be created under the following geological conditions (Figure 1.6.1-2):

- In the margins of the mountain spine, in an area where there are soils and soft sandstones belonging to the kurkar group directly overlying strong limestone and dolomite rocks belonging to the Judea and Avdat groups and/or hard chalk rocks belonging to the Mount Scopus group. The chalk rocks overlying the hard limestone layers are also liable to cause amplification[x].

- Along the east edges of the coastal plain, in areas where the soft clay of the Yafo Formation is underneath the sandstones of the kurkar group and this overlies rigid limestone or chalk (the Judea Group, the Mount Scopus Group or the Avdat Group). Nevertheless, the deeper this reflector goes, the weaker the intensity of the resonance created over it, until a state is reached where it is no longer considered abnormal.
- In the coastal plain, in places where under the soil cover or the soft sand cover we find very hard layers of calcareous sandstone ("kurkar"), and on condition that they are thick enough to create amplification in the medium above them. Usually, the depth of this reflector does not exceed a few dozen meters, and in any event is limited within the kurkar group with a maximum thickness of about 200 meters (Gewirtzman and Zaslavsky, 2009).

1.6.2 Seismotectonic model

A seismotectonic model is a model that characterizes seismogenic sources according to their geometry and their distance from a given site, adding the history of the seismic activity to each source: the magnitude of earthquakes and the times of their recurrence. Moreover, the model takes into account an evaluation of the attenuation of soil motions (as a consequence of the distance of the site being examined from the focal points of the earthquakes and the characteristics of the medium through which the waves pass). The model defines reference events and is used for the purpose of calculating soil accelerations that may be expected for the defined reference events. The products of the model are a spectrum of responses of the site to be used for statutory planning purposes and/or for the purpose of engineering design.

In this work, a pseudo-deterministic analysis of the seismic risk is performed of the alternatives for onshore locations of the gas facilities. The analysis includes a deterministic characterization of earthquakes according to main seismic sources in combination with a probabilistic element based on the equations of earthquake recurrence times (as described in Section 1.6.2.3). Accordingly, the expected soil accelerations were calculated for the various alternative sites following an earthquake on each of the main faults at different recurrence times. The results of the model are presented for each alternative in Sections 1.6.4-1.6.8 and are compared to the values of the probabilistic analysis provided by Keller et al[xi].

1.6.2.1 Regional tectonic environment and sources of seismic risk for the various alternatives

Israel is located on the Sinai sub-plate (Figure 1.6.2-1), which is located at the junction area of the African (Nubian) plate, the Arabian plate and the Anatolian block (part of the Eurasian plate). This sub-plate is a young tectonic element created through

Cenozoic splitting processes. These processes isolated the east of the Mediterranean and the Levant basin as part of the creation of the margins of the ancient continent of Gondwana, a process that began in the Early Mesozoic[xii]. The boundaries of the Sinai sub-plate are the Dead Sea Transform (DST) to the east, which constitutes a tectonic boundary between the Arabian plate and the Sinai sub-plate, the Cyprus arc to the north, and the rift of the Suez bay to the west. These elements constitute the main sources of earthquakes in the east of the Levant (Figure 1.6.2-1). The west border of the Sinai sub-plate has no clear structural and/or seismic expression, and is only defined conceptually[xiii].

The faults included in the seismotectonic model are the main seismogenic sources in a radius of 200 km from the region of the alternatives, in accordance with accepted practice for considerations of soil acceleration attenuation. The dominant faults in the tectonic array of the Dead Sea Transform are the Yammouneh, Roum, Rechaya-Emek HaYarden, Jericho and Arava faults (Figure 1.6.2-2). The parts of the transform located to the south and north of these faults are not expected to exert any significant impact on the region of the alternatives. In addition, the regional tectonic array includes the Carmel and Gilboa faults. The Cyprus arc is located beyond the 200 km radius surrounding the region of the alternatives, but it was included in the model since earthquakes of large magnitudes found in the reference events presented in the model are liable to occur on the arc, and constitute a contributory factor in seismic risks. In addition, in view of it being a significant seismic factor, it was found that it should be included in the model in view of the fact that the range of error that includes the low-borderline accelerations received in the earthquake scenarios on the arc is great, or that there may be significant errors in the assumptions of the model. The total array of faults included in the seismotectonic model are described in the following sections.

1.6.2.1.1 Cyprus arc

The Cyprus arc constitutes a tectonic boundary between the Anatolian plate to the north and the Sinai sub-plate and Nubian plate to the south (Figure 1.6.2-1). The relative movement of the plates along the arc is in the NE-SW direction and the rate of its deflection is 7-8 mm per year between the Anatolian plate and the Sinai sub-plate, with a combined horizontal converging deflection trend and 8-9 mm per year between the Anatolian plate and the Nubian sub-plate in a converging trend. Based on seismological evidence[xiv], there are claims that the western boundary of the Sinai sub-plate continues westwards to the west of Eratosthenes Seamount, and connects to the Cyprus arc.

Wdowinski et al. (2006)[xv] divide the Cyprus arc into three main segments based on the geometry of the arc (with references from marine seismic surveys), and on

solutions of earthquake foci: (1) the east segment is parallel to the relative direction of movement between the Anatolian plate and the Sinai sub-plate (northeast - southwest) so that the main active structures along this segment are horizontal movement faults. (2) A central segment to the southeast of Cyprus that is characterized by a collision in the northeast–southwest direction between the Anatolian plate and the Sinai sub-plate. (3) A western segment with a vertical direction towards the reduction of the Nubian sub-plate under the Anatolian plate, and accordingly the main movement on it is that of convergence (Figure 1.6.2-1/b). The boundary between the central segment and the west segment is a transform fault in the northeast–southwest direction (PF in Figure 1.6.2-1/b) which gives rise to medium-large strike-slip earthquakes, such as the 1996 Paphos quake with a magnitude of MW=6.8 and the 1998 Adana quake with a magnitude of MW=6.2. These quakes were relatively deep (30-40 km)[xvi,xvii]. The assumptions regarding the geometry of the fault segments described above include a dip of 150 and a rupture depth of 30 km. The estimations[xviii] indicate that the western segment is capable of generating a quake with a magnitude of MW=8.0 (based on a rupture length of 130 km) and the central and east segments are capable of generating a quake with a magnitude of MW=7.8 (based on a rupture length of 100 km). Combining the rupture along all segments is liable to give rise to a quake with a maximum magnitude of MW=8.4[xix].

1.6.2.1.2 Dead Sea Transform

The Dead Sea Transform (DST) is the main seismogenic source in the east of the Sinai sub-plate (Figures 1.6.2-1/2). This is a left fault system which constitutes a plate boundary between the Arabian plate and the African plate (the Sinai sub-plate). The Dead Sea Transform spreads out in an approximate north-south direction over about 1000 kilometers from the Red Sea and the Aqaba Bay in the south to Turkey in the north (Anatolia). Seismic activity along the transform is mainly concentrated in deep depressions and in the branchings of faults (Figures 1.6.2-2), along the Lebanese shear belt and along the western side of the transform (Salamon et al., 1996).

The DST is subdivided into segments that are distinguished from each other according to the alignment of their spread, the seismic activity discernible along them and their structural style. These segments are separated by large tectonic depressions such as the Dead Sea, the Sea of Galilee and the Hula basins[xx]. The next sections present those segments along the DST that are relevant for the seismotectonic model.

Seismic activity

The DST has a long history of significantly large earthquakes along almost its entire length (Figures 1.6.2-1/2). This history is integrated within the descriptions of such earthquakes and their impacts in the eastern Mediterranean basin since the very

dawn of written history. Earthquakes along the DST have left a rich geological record and they are picked up by recording devices over the past decades. Regional and local catalogues of earthquakes have been developed by various researchers[xxi,xxii,xxiii,xxiv] and are based on geological, historical and modern (instrumental) documentation. Since the beginning of the 20th century, 11 strong earthquakes ($M_L \geq 5$) have been documented along the center and north of the transform (from the Dead Sea area northwards), the largest of which ($M_L = 6.2$; 1927) occurred on the Jericho fault.

Jericho fault

The Jericho fault is a left horizontal deflection fault (strike slip) in the south-central part of the Dead Sea Transform. It spreads from the Dead Sea basin through the Jordan Valley up to the Sea of Galilee (also known as the Jordan Valley fault; Figure 1.6.2-2). There is no continuous geophysical and/or morphological/geological expression for the exact alignment of the Jericho fault. To the north of the Dead Sea, it is identified at ground level by Sagy and Nahmias[xxv]. A number of researchers[xxvi,xxvii] ascribe the clear scar that shows in the bathometry of the west of the Dead Sea to the alignment of this fault. The expression of this fault is limited to the south region of the Dead Sea only, except for the site of the Mor faults that were identified with the center of the horizontal motion in the region[xxviii].

The most recent strong earthquake in our region, in 1927, is ascribed to the Jericho fault, at a magnitude of M_L=6.2 (according to the data provided by the geophysical institute). Moreover, new outcrops along the alignment indicate a history of earthquakes during the Late Pleistocene and the Holocene (Sagy and Nahmias, 2010). Historical documentation for the south part of the Dead Sea Transform indicates that in this area, one moderate-strong earthquake takes place once in every hundred years on the average[xxix], whereas the largest events ($M \geq 7$) took place to the south of the Dead Sea basin along the Arava fault.

The horizontal slip rates typical of the Jericho fault are estimated at about 4.9-5.1 mm per year during the last 47,000 years in the Jordan Valley, in accordance with the deflection of drainage systems[xxx], and 3.5 mm per year over the last 30,000 years in the south part of the fault (Bartov and Sagy, 2004). Examples of the movement rates estimated using geodesic means (GPS) include 3.7±0.4 mm per year[xxxi], and 7.5±0.8 mm per year[xxxii] in the Dead Sea area itself.

The seismic regime along the Jericho fault is characterized by long recurrence times for strong earthquakes, in addition to a significant component of seismic slippage[xxxiii]. Begin et al. (2005) claimed also that the seismic regime along the Jericho fault has been stable over the past tens of thousands of years and therefore the seeming difference between geological and geodesic rates published stems from measuring errors and from methodological limitations. A comprehensive analysis of the

earthquake data along the Jericho faults and calculation of recurrence times were carried out by Hamiel et al. (2009)[xxxiv] and was used in the present work to establish the magnitudes of the reference events for this fault (Table 1.6.2-1).

Arava fault

The Arava fault spreads along the Arava Valley up to the east of the Dead Sea basin. The alignment of this fault to the east of the Dead Sea basin is under contention. Garfunkel et al. (1981) claim that this fault is visible in the sediments found at ground level in the region of its junction with the Amatzia fault (the south of the Dead Sea south basin). The fault is marked in various publications to the east of the basin at various levels of precision on the basis of subsoil information and depending on the tectonic model used by the researchers. In the last hundred years, no earthquakes of a magnitude M ≥ 5 have occurred along this fault (Figure 1.6.2-1/a).

Lebanese restraining band

North of the Hula basin, around latitude 33N-34.5N, the Dead Sea Transform curves by about 25 degrees towards the east. This change in the alignment of the fault and its continued curving along its central part create a pressure region that is expressed in a sharp topography (for example, the Mount Lebanon range), a region that is also called the Lebanese restraining band. Accordingly, we may divide the Dead Sea Transform into a north segment and a south segment that are separated by the Lebanese restraining band.

The length of this restraining band is about 170 km and within it the Dead Sea Transform is split into five main faults (Figure 1.6.2-3): the Yammouneh fault, the Roum fault, the Tripoli-Beirut fault, the Rechaya fault and the Serghaya fault, wherein only the Yammouneh fault crosses the entire Lebanese restraining band[xxxv,xxxvi,xxxvii]. The faults liable to generate an earthquake that may damage the integrity of the marine gas facilities are Yammouneh, Roum, Rechaya and the Tripoli-Beirut faults, and for this reason these faults were included in the model and their description is presented below.

<u>Yammouneh fault</u>

The Yammouneh fault is a left strike-slip fault with a clear topographic trace along 160 km. This fault incorporates the main relative motion of the Africa and Arabia plates, one against the other, within the Lebanese restraining band (Figures 1.6.2-2/3). The rate of the fault's horizontal motion during the Late Pleistocene era until today is about 5.1+1.3 mm per year[xxxviii]. Nemer et al. (2008)[xxxix] estimate for this fault a maximum moment magnitude of M_w=7.3-7.5. The last strong quake on the Yammouneh fault took place on May 20, 1202 and its magnitude has been estimated at about M_w=7.5[xl]. The rupture of the surface as a consequence of the quake was seen

in the Yammouneh basin, in the Vadum Iacob and in the Beit Saida Valley along the Jordanian fault, spreading over a total length of about 145 km (Nemer et al., 2008 and the sources within it). Gomez et al. (2007)[xli] estimate that the low rate of seismic activity at present along the Yammouneh fault is no indication that it is inactive, but rather to the contrary – that the Yammouneh fault is a locked fault that is destined to release the strains collected within it in a strong and significant quake.

This model took two possible scenarios into account. The one, according to which the south tip of the Yammouneh fault is located at the north-west corner of the Hula Valley (as drawn by Daeron et al., 2004) and its length is about 187 km; and the second scenario, according to which the south tip of the Yammouneh fault is located at the Kinorot Valley and in fact also comprises the fault of the Sea of Galilee's western edges (as drawn by Ecolog, 2010). According to this alignment, the length of the fault is about 230 km. This scenario is based on the estimated spread of the surface rupture in the 1202 quake from the Yammouneh basin in the north to the Sea of Galilee in the south.

Roum fault

The Roum fault spreads out from the northwest part of the Hula basin in the north-northwest direction up to Jbaa, where it is replaced by folding formations (Figures 1.6.2-2/3). From among the various faults of the Lebanese band, the Roum fault is the only one with a direction that is similar to the general direction of the Dead Sea transform that lies to the south of the Lebanese band. As a consequence, and contrary to what has been claimed above in regard to the Yammouneh fault, there are those who claim that most of the strains of the Lebanese restraining band are concentrated on the Roum fault[xlii,xliii]. The Roum fault is a left strike-slip fault with normal deflection trends in its northern part. According to the last strong quake that took place on the Roum fault on January 1, 1837, the maximum magnitude of a quake on this fault is estimated at approximately M_S=7.1 (Nemer and Meghraoui, 2006).

Rechaya faults and Jordan Valley fault

The Rechaya fault spreads from Rechaya in the north to the Hula Valley in the south. Its orientation is north-northeast and its length is about 40 km. The Jordan Valley fault spreads from the Hula Valley in the north to the Sea of Galilee in the south (Figures 1.6.2-2/3). Its orientation is to the north and its length is about 38 km. Because of uncertainty regarding the alignment that connects between these faults (for example, see Daeron et al., 2004) two possible scenarios were examined: the first scenario examines a separate activation of each fault, while the second scenario examines a joint activation of both these faults.

Tripoli-Beirut fault

This fault is also known as the Tripoli-Roum fault, the Mount Lebanon Thrust and the Offshore Monocline. This fault is a reverse fault that is mostly spread under the sea and along the shores of Lebanon (Figures 1.6.2-2/3).[xliv] Elias et al., (2007) claim that the length of the fault is at least ~100 km. In Figure 1.6.2-2 the onshore extension of this fault is drawn out conceptually in accordance with Daeron et al., 2004. Nemer and Meghraoui (2006) and Elias et al., (2007) ascribe the historical earthquake of July 9, 551 CE to this fault, which caused a tsunami along the eastern shores of the Mediterranean basin. Nemer and Meghraoui, (2006) estimate the magnitude of this quake on the basis of Byzantine documentation at about M_S=7.1-7.3. Elias et al., (2007) estimate, on the basis of the Wells and Coppersmith, (1994) equations, its magnitude at about M_W=7.4-7.6. In addition, they note that according to the typical earthquake model, the time of recurrence of an earthquake such as that which occurred in the year 551 is ~1500 years, so that we are, in fact, now at the end of a seismic cycle. There is uncertainty as to whether the Tripoli-Beirut fault is the continuation of the Roum fault or not[xlv]. A geophysical mapping of the bottom of the sea[xlvi] which describes the reverse fault along the shores of Lebanon does not support the theory that this fault is the marine extension of the Roum fault.

The Tripoli-Beirut fault is described in this work in view of its importance and its location within a radius of 200 km from the area of the alternatives, but since there is no sufficient information regarding the time of recurrence of earthquakes along this fault (and it goes without saying that there is no equation in the sources that discuss it), no PGA calculations were made for it in the sites of the various alternatives.

1.6.2.1.3 <u>Carmel and Gilboa faults</u>

The Carmel-Tirtza fault system (or Carmel-Pariya) branches on the west side of the Dead Sea Transform and extends to the northwest to it, into the Mediterranean basin (Figure 1.6.2-2). This system comprises the Carmel fault and the Gilboa fault and its total length is approximately 66 km. The system seems to follow the ancient plain of weakness in the earth's crust that is active since the Paleozoic era[xlvii]. Since the late Pliocene-early Pleistocene, with the shift into the present regime of the tectonic activity in the area, the transform on the Carmel fault has a character that combines a left moving horizontal motion with tension. This shifting transfers a left horizontal motion from the Dead Sea Transform towards the Levant basin in the northwest[xlviii] and is responsible for the present morphological and tectonic character of the fault; including a shift from east to west from a scattered fault model (that comprises many sub-faults spread over an extensive area) to a concentrated fault model (that comprises a single central fault that dominates the area with a limited number of small sub-faults) as demonstrated by Hofstetter et al. (1996)[xlix].

Along the northeast boundary of the Carmel range, the morphological expression of the fault is in a prominent rock escarpment facing the northeast. The marine extension of the Carmel fault has no expression on the surface but is clearly visible in seismic sections[l,li]. The Gilboa fault abuts on the north and the east a stress area of 10 km between it and the south section of the Carmel fault and seems to convey the motion from the Dead Sea Transform to the Carmel fault through this area of tension[lii]. The extent of the horizontal deflection of the Carmel fault is estimated at about 4-10 km (for example by Freund, 1970[liii]). Estimations of the slip rates for the Carmel fault according to various sources is in the range of 0 to 2 mm per year for the current pace (geodesy; for example Wdowinski et al., 2004), and 0.3 to 2.9 mm per year for geological timespans (for example Rotstein et al., 1993[liv]). The central assumption for the estimation of the given rates is that only commencing from a slip rate of a number of tenths of millimeters per year will the fault lead to a clear geomorphological expression. The northeast escarpment of the Carmel mountain constitutes a tangible morphological expression of the existence of an active fault, and therefore supports the slip rate at a number of tenths of millimeters or more.

Seismic activity

The depth of the seismogenic crust along this fault system is about 12-20 km according to Hofstetter et al. (1996) and 9-17 km according to Shamir (2007)[lv]. Hofstetter et al. (1996) note that the seismic activity within the Carmel-Tirtza system is concentrated along the traces of faults laid out in a northwest-southeast direction or in local grabens. The number of events increases as one draws nearer the Dead Sea Transforms.

The southeast boundary of the Carmel-Tirtza region is defined by a series of earthquake foci along the Gilboa fault and its extension in the northwest. Shamir (2007) notes a prominent group of foci in the Jenin-Ta'anakh region within the Gilboa-Carmel fault region. In the area to the south of the Gilboa fault, the seismic activity is not concentrated around a single fault in the surface, but is characterized by a wide deformation area as proposed by Rotstein et al. (1993). In the northwest region of the fault area, the edges of the Jezreel Valley and the Zebulun Valley, there is no clear lineation of earthquake foci.

Hofstetter et al. (1996) conclude that the earthquake that took place on August 24, 1984 (M_L=5.3) in the Jezreel Valley (in the vicinity of Kfar Baruch) occurred on the fault belonging to the Carmel-Gilboa fault system. This earthquake was the strongest to be recorded in the north of Israel outside the Dead Sea Transform since the very beginning of instrumental records in Israel. Nevertheless, the extent of the motion in each component on the Carmel fault is still under contention (for example Scattner et

al., 2006) and in view of the lack of clarity regarding the extent of its current seismic activity, it is defined as "suspected as active"[lvi].

In the work of Shamir (2007), that includes a repeat location of 256 earthquakes at a level of M_L>1 that took place in the north of Israel since 1984, there is a clear decline in the frequency of the foci of earthquakes to the southwest of the Jezreel Valley and in a northwesterly direction, so that the part of the fault in the Zebulun Valley region and close to the Haifa Bay shows a seismic gap during the measurement period.

1.6.2.2 Attenuation Relationships

Whenever an earthquake occurs, the motion of the soil declines with the distance from the source of the quake. This decline is characterized by empirical attenuation relationships that characterize the peak accelerations (PGA) and the spectral accelerations obtained in the roof of the rock layer at the site (without any augmentation/attenuation of the layers above the rock roof and at the basis of the structure) as a function of the distance from the source of the quake and the magnitude of the quake. The attenuation equations include parameters related to the speed of the shear waves in the rock as well as the value of the peak acceleration depending on the hardness of the rocks in the medium that lies between the source of the quake and the site for which the acceleration is being calculated.

In recent years, new attenuation relationships known as Next Generation Attenuation (NGA) have been developed, for example by Abrahamson and Silva (2008)[lvii]. The advantage of "new generation" relationships is that they are based on a larger database which is significantly greater than that used to develop the "old generation" attenuation relationships, for example by Boore et al. (1997)[lviii]. Also, they weigh more tectonic, geological and statistical parameters as compared with the "old generation" relationships, such as the depth of the rupture during an earthquake and the speed of the shear waves in the soil. The NGAs also include a more precise distinction between normal faults and horizontal faults.

1.6.2.2.1 <u>The Use of Attenuation Relationships for the Purpose of Calculating the PGA</u>

The attenuation relationships of Abrahamson and Silva (2008), Campbell and Bozorginia (2008)[lix] and Boore and Atkinson (2008)[lx] ("A&S 2008, C&B 2008 and B&A 2008, respectively) have been selected for the present analysis out of the NGAs. These relationships were selected because they are based on an analysis of earthquakes in tectonically active areas with a shallow crust, mainly in the western US and in the Mediterranean basin. The attenuation relationship provided by Campbell and Bozorgnia (2008) is also used as the basis for the new spectral maps drawn up in the context of Amendment Sheet 5 of Israeli Standard 413 (Keller et al., 2011).

For each fault, the minimum distance from each alternative was calculated and then the PGA values were calculated for each one of the reference events based on recurrence periods of 475, 975 and 2475 years according to the explanation given in Section 1.6.3. The final PGA value for a fault within the area of each alternative was established by calculating an average of the values obtained from the attenuation relationships presented for each reference event. The PGA calculations were made by means of the Attenuation Relationship Plotter 1.2.3. For each alternative, a PGA value is presented in accordance with the maximum acceleration caused by the seismogenic sources detailed in Section 1.6.2.1. for each of the reference times. This value is used for control purposes and for comparison with the values of soil acceleration taken from Keller et al. (2011), and as described in Section 1.6.3.1.

1.6.2.3 Rates of Motion and Recurrence Times

The typical magnitude for each fault as well as data regarding the motion rates on each fault were collected from the scientific literature (as detailed above in the sections describing the seismogenic sources), and based on these data the recurrence periods of earthquakes and their magnitudes were calculated for the reference events.

The most comprehensive work done in this area was conducted by Hamiel et al. (2009), who present a compilation and analysis of a paleoseismological, historical and instrumental database that comprises data for a period of tens of thousands of years. The compilation and the analysis address three separate regions: the south of the Arava, the Dead Sea Rift, and the Jordan Valley. The database for these areas is unprecedented in its scope, especially in the timespan to which it refers: it includes data from the late Pleistocene until the present (about 60,000 years). Accordingly, this database makes it possible to present probability data regarding the recurrence times of earthquakes at a good level of reliability, which exceeds the standard common in world literature.

Additional works that dealt with an analysis of data based on a seismic database obtained through instrumental measurements I conducted in the area of Lebanon for the Yammouneh and Roum faults[lxi] and for the Yammouneh and Rechaya faults[lxii]. Similar work was conducted by Hofstetter et al. (1996), who analyzed the seismic activity that took place along the Carmel-Tirtza fault system during the period 1984-1994. Their analysis included 550 earthquakes ($1.0 \leq M_L \leq 5.3$) that took place during this period along the system, and produced a quantitative estimation of the recurrence times of earthquakes on the Carmel and Gilboa faults.

The equations correlating the magnitude of a quake to its recurrence period are usually formulated in a linear fashion: $\log N = a\text{-}bM_W$. Where N represents the frequency of the occurrence of an earthquake with a moment magnitude of M_W or

stronger and a, b are constants. Table 1.6.2-1 presents the equations that were used to calculate the recurrence periods of earthquakes on the faults included in this model.

Table1.6.2-1: Recurrence Times of Earthquakes as a Function of Magnitude

Seismogenic source:	Equation:	Reference:
Cypriot arc	$\text{Log } N = 1.12+0.35M_W - 0.13M_W^2$	Kythreoti and Pilakoutas (2000)[lxiii]
Yammouneh and Roum faults	$\text{Log } N = 3.02 - 0.73M_W$	Elnashai and El-Houry (2004)
Rechaya fault	$\text{Log } N = 1.25 - 0.67M_W$	Huijer et al. (2011)
Jericho fault	$\text{Log } N = 3.67 - 0.97M_W$	Hamiel et al. (2009)
Arava fault	$\text{Log } N = 3.3 - M_W$	Hamiel et al. (2009)
Carmel and Gilboa faults	$\text{Log } N = 2.5 - 0.89M_W$	Hofstetter et al. (1996)

The expected accelerations in accordance with the various recurrence times are presented for each alternative in the section relevant to it.

1.6.3 Seismic risks examined for the alternatives

1.6.3.1 Horizontal soil accelerations accepted for the rocky subsoil

The horizontal soil accelerations expected for the rocky subsoil are given in accordance with various reference events. A reference event is the soil vibrations (Peak Ground Acceleration: PGA, g) expected at a site during a specific recurrence period. The longer the recurrence period, the more severe the reference event (higher PGA).

The horizontal soil accelerations expected for the rocky subsoil within the area of each alternative were evaluated on the basis of the data accompanying Amendment Sheet 5 of Israeli Standard 413 (Keller et al., 2011). For each alternative - for the coordinates that demarcate the center of the alternative. On the basis of these data, note was made of the maximum horizontal soil accelerations expected for earthquakes with recurrence periods of 475 years, 975 years and 2475 years, that parallel the probabilities of occurrence of 10%, 5% and 2% over a period of 50 years, respectively. These soil accelerations are compared with soil accelerations that were calculated for each alternative according to the reference events, in accordance with the geological and seismological information presented for each of the seismogenic sources, according to the seismotectonic model described in Section 1.6.2. For pipeline segments, the possible range of accelerations is noted as well as the trend in their change within the area and along the alignment.

The source of the differences between PGA values calculated by the model and those that appear in IS 413 are the differences in the basic assumptions and the calculation methods, of which the main ones are:

A. Magnitude of reference events used as input for calculating accelerations: Magnitudes used in the standard were taken from the work of Shamir et al. (2001)[lxiv], which extracted the magnitudes from the statistical frequency relationships characterizing ***regional seismogenic sources***. In the present work the magnitudes were extracted from the frequency ratios characteristic of ***linear seismogenic sources***, i.e. faults. Usually, the magnitudes according to Shamir et al. (2001) are smaller than those calculated via the present model.

B. Attenuation Equations: In order to calculate the PGA values, Keller et al. (2011) using the attenuation equation of Campbell and Bozorgnia (2008) (C & B, 2008). The PGA calculations in the present model are based on the average of the results obtained from the three equations (Section 1.6.2.2) which include the C & B (2008). The values obtained by using the equation of C & B (2008) are usually the highest.

C. PGA Calculation Approach: Calculation of the accelerations in a standard based on a statistical model (Probabilistic Seismic Hazard Analysis - PSHA), which summarizes the contribution of all seismic sources, while the present model emphasizes the contribution of the significant seismic source for each alternative. In this way, the calculation presented here adopts the Maximum Credible Earthquake (MCE) approach which is usually used for vital infrastructure facilities.[lxv]

A comparison between PGA values indicates that there are differences of 4-35% between the values obtained from the standard data and those obtained by the model presented in the present work, wherein the standard is usually more stringent. In order to express this amplitude in values, a comparison between the response spectrum based on the PGA values in the model and the response spectrum based on the PGA values obtained from the standard data is presented.

1.6.3.2 Probability that there are active geological faults within the plan area

The existence of active faults or faults suspected as active was examined on the basis of a map of active/suspected as active faults (Bartov et al., 2009). According to IS 413 (Section 202.1, Amendment Sheet No. 3) the minimum distance of a structure from an active fault or a fault that is suspected as active allowed is 15 meters, and there are building limitations applicable to a range of 200 meters from a fault that is active or suspected as active in areas where the seismic coefficient is $Z > 0.15$.

1.6.3.3 Survey of the phenomena of increased seismic vibrations arising from infrastructure or topographic conditions

A committee of experts established by the Israeli Standards Institute determined that a site response survey should be conducted in areas where the soil is classified as F (IS 413, Amendment Sheet No. 3, (2009), Section 202.2.1-c). One of the criteria for the classification of a soil as F is when structures from importance group A (Table 1.6.3-1) are located within an area that is suspected of unusual subsoil amplification. Another criterion is "a soil that is liable to reach failure or to collapse under the influence of seismic stress, such as a soil that is liable to liquefy and sensitive clays." The facilities planned in the context of NOP 37/H serve buildings that are classified in importance group A according to Table 4 of IS 413. Out of the five alternatives, only the Dor alternative is in an area that is suspected of having unusual amplification according to IS 413, and therefore it seems that according to this criterion it is only for this area that a site response survey is required in the next planning stages. The information used for performing the survey is insufficient for the purpose of classifying the soil at the sites of the alternatives as type F soil. The present work actually presents site response surveys for all five alternatives, but without using any direct geotechnical data (such as shear wave speeds) from the subsoil of each alternative as a basis.

Table 1.6.3-1: Importance Coefficients of Structures (Table 4 taken from IS 413, Amendment 3)

Group	Type of Structure	Importance Coefficient
A	Buildings of high public importance, which are supposed to operate with their systems at the time of an earthquake and afterwards: power station buildings, hospitals, fire stations, police stations, telephone switchboards, first aid stations (including entrances and passageways, as well as service buildings and water containers serving them)	1.50
B	Buildings of public importance, which are supposed to allow people to escape without danger to their lives, such as: schools, daycare centers, theaters, houses of prayer, event halls, public buildings, prisons and buildings where gatherings of people are expected, including high occupancy buildings (250 people and	1.25

Group	Type of Structure	Importance Coefficient
	above), whether or not they are zoned as such by the certified authority	
C	All other buildings not included in groups A and B	1.00

Calculating the Response Spectrum

The response spectrum for planning (Figure 1.6.3-1) constitutes input for the evaluation of the loads acting on the structure during an earthquake. The response spectrum represents the impact of soil conditions at a site on the level of acceleration (amplification/attenuation as regards PGA) and its spectral composition. The amplification calculations presented in this report were performed using a system of equations provided by the standard, in which values are substituted that represent the soil classification at the site (in the absence of specific information about its qualities). The acceleration values in the hard rock roof (PGA) were chosen in accordance with the results of the seismotectonic model as compared with the standard data (Keller et al., 2011). In order to establish the typical response spectrum for the area of each of the alternatives, a soil profile was selected to represent each side on the basis of an analysis of existing geological information.

The classification of soil for seismic planning at the site may be weighted as detailed in Table 1.6.3-2 (IS 413, based on the American standard, ASCE 7-05). The soil at a site is classified from A to F on the basis of a weighting of the parameters of the various layers and their thicknesses in the upper 30 meters of the subsoil. Without any direct geotechnical information, the classification of soil is carried out on a qualitative basis, taking into consideration geological (outcrops, thickness), geotechnical regional data (Table 1.6.3-3) and works on a regional and national scale that were performed in this area (Katz et al., 2008; Zaslavsky et al., 2002; 2003; 2009).

Table 1.6.3-2: Classification of Soils (According to IS 413, based on American Standard ASCE 7-05)

Type of soil at the site	Description	Velocity of shear wave in upper 30 meters (m/s)	Resistance using standard penetration test (SPT)	Undrained shear strength (kilopascals)
A	Hard rock	> 1500	-	-
B	Rock	760-1500	-	-

Type of soil at the site	Description	Velocity of shear wave in upper 30 meters (m/s)	Resistance using standard penetration test (SPT)	Undrained shear strength (kilopascals)
C	Very dense soil or soft rock	360-760	> 50	> 100
D	Hard soil	180-360	15-50	50-100
E	Soft clay	< 180	< 15	< 50
F	(Details in IS 413)			

Table 1.6.3-3: Velocity of Shear Waves (Vs) for Rocks from the Senonian to the Holocene Period[lxvi]

Lithological unit	Vs (m/s)
Silt, terrestrial clay (Holocene)	160-250
Sand and sandy loam (Kurkar Gr., Pleistocene)	200-350
Sandstone, gravel, conglomerate (Kurkar Gr., Pleistocene))	350-550
Calcareous sandstone (Kurkar Gr.)	700-750
Clay, marl (Saqiye Gr., Yafo Fm.)	600-750
Marl, chalk (Oligocene, Eocene, Senonian)	800-1000

The horizontal spectral acceleration coefficients S_S and S_1 for short cycle time and for a cycle time of one second, respectively, for various reference events (recurrence times) were calculated by Keller et al., (2011). Based on these values, the site coefficients were established for both short and long cycle times, F_a and F_v, respectively (Tables 2 and 3 in IS 413). F_a and F_v are the site coefficients and their corresponding values were noted for each alternative. For the sake of comparison, the expected amplification values were also noted in accordance to the works of Zaslavsky et al. (2002 and 2003[lxvii]).

The response spectrum is calculated on the basis of a reference event for which the probability of occurrence (or the occurrence of an even stronger event) is 5% over 50 years, i.e. an earthquake with a recurrence period of 975 years, as required by IS 413 for structures belonging to importance group A (Table 1.6.3-1) (IS 413, Amendment Sheet 5, Section 202.1.1).

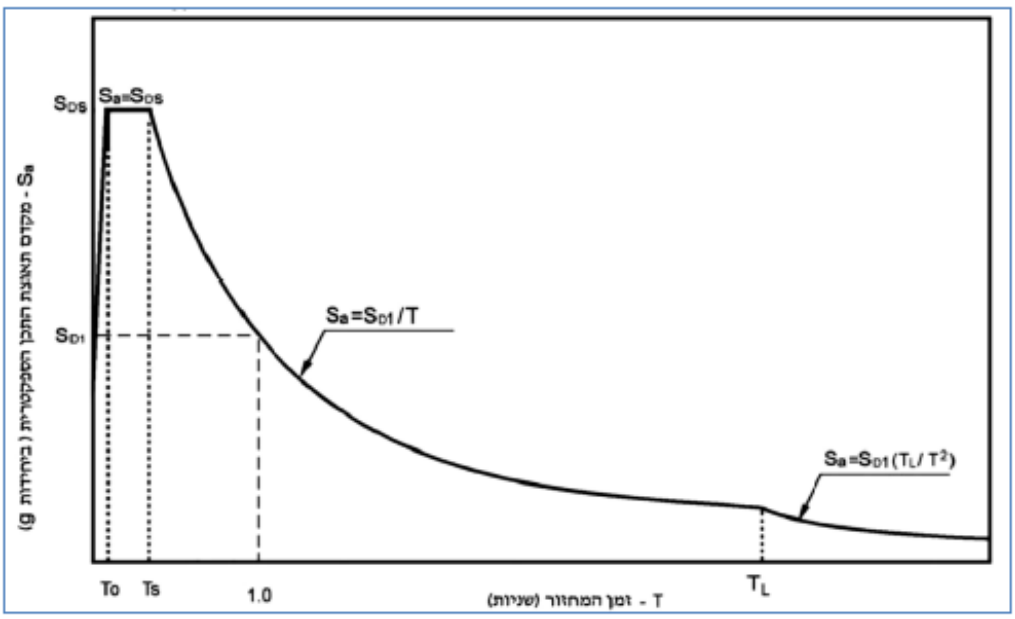
The spectral acceleration coefficients under the impact of the soil conditions prevailing at a site, S_{DS} and S_{D1} (Figure 1.6.3-1), for both long and short cycle times, are established in accordance with the type of soil at the site, and accordingly, for the values of S_S and S_1 and the values F_a and F_v, respectively:

$$S_{DS} = F_a S_s \quad (1)$$

$$S_{D1} = F_v S_1 \quad (2)$$

The acceleration coefficient, S_a, is established according to the basic cycle time of the structure, T. The response spectrum is established by dividing into four zones of cycle time (Figure 1.6.3-1) as detailed in IS 413 (202.3).

<u>Figure 1.6.3-1: Schematic Figure of the Response Spectrum to Design (taken from IS 413)</u>



Legend: X Axis - T - Cycle Time (seconds); Y Axis - S_a - Acceleration Coefficient of the Spectrum to Design (in units of g)

1.6.3.4 Probability of soil failure phenomena as a result of soil sliding

The movement of soil or rock downslope is characterized by 4 main types of failure: slide, flow, creep and fall, whose character is mainly determined by the relationship between the strength of the moving material and the forces acting on it[lxviii]. The sensitivity of the infrastructure to the sliding of the slope was evaluated in accordance with the works of Katz et al. (Katz and Almog, 2006 and Katz et al., 2008[lxix]). According to their approach, the sensitivity depends on the type of rock, on the geological formation (the incline of the base rock) and on the incline of the slope. An incline of less than 5° is defined as a negligible slope that is insensitive to a failure of the slope for all types of rocks. The area of each alternative was examined with the help of

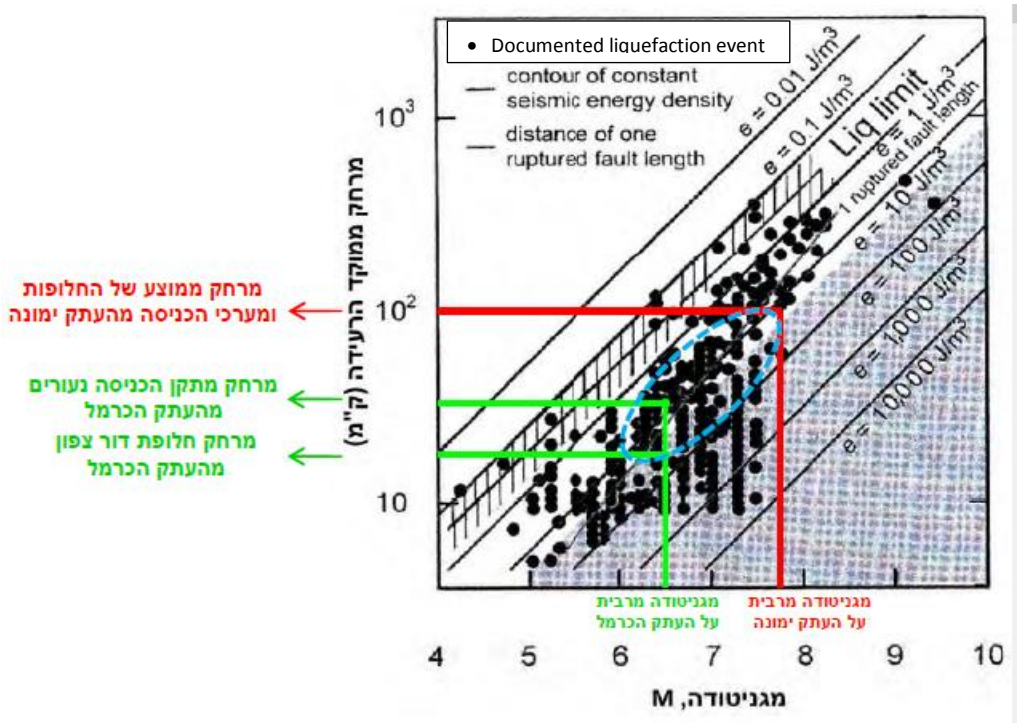
topographic maps and geological information relating to the type of rock and the layering structure, and it was determined accordingly if there are areas which are vulnerable to slope failure.

1.6.3.5 Probability of soil failure phenomena as a result of liquefaction

Liquefaction is a process in which granular water-saturated sediment loses its strength and behaves as a liquid during a seismic shock. Liquefaction takes place naturally when there is a combination of porous and unconsolidated rock, groundwater proximate to the surface and strong soil accelerations that are caused during an earthquake. During a quake, there is a sudden increase in the pressure of the liquids present in the voids between rock layers, and the sediment with the unconsolidated element that until that moment was supported by particles now becomes liquefied and loses its strength. The sediment density (for example sand), the soil acceleration and the duration of the quake, are the main factors that determine if a sediment becomes liquefied during an earthquake[lxx]. Thus, the characteristics of the rocky subsoil, the extent of the saturation of sediments with water, the level of the earthquake and the distance of the site from the earthquake focus, are all very important. Figure 1.6.3-2 presents an experimental correlation between the two latter factors and documented liquefaction events. For the purposes of demonstration, the figure presents a range of data that are typical to the seismic sources in the model. The blue ellipse comprises the parametric space for the alternatives of the treatment facilities and the shore arrays in the graph presented.

Soil liquefaction potential also exists in areas where there are horizons of either sandy or sandy-clayey sediments and the groundwater level is at an elevation shallower than 20 meters below the surface (Salamon et al., 2008). For each alternative, the infrastructure on which it is planned was described and the groundwater level in the area was evaluated on the basis of existing information and as detailed in Chapter 1.7 of this document. It was accordingly established if the potential for soil liquefaction within the area of the alternative exists.

Figure 1.6.3-2: Liquefaction as a Function of the Experimental Correlation between the Magnitude of an Earthquake and the Distance from its Focus[lxxi]



Legend: X Axis - Magnitude, M; Y Axis - Distance from the earthquake focus (km). Red writing, X Axis: Maximum magnitude on the Yammouneh fault; Y Axis - Average distance of alternatives and entry arrays from the Yammouneh fault. Green writing, X Axis: Maximum magnitude on the Carmel fault; Y Axis - Distance of the Neurim entry facility from the Carmel fault, Distance of the Dor north alternative from the Carmel fault.

1.6.3.6 Appearance of a Tsunami

A tsunami is a series of waves with a very long wave length (up to hundreds of kilometers) that develop following a disturbance that takes place within a marine medium, such as: an underwater earthquake, a landslide, a volcanic eruption, the fall of a meteorite, a nuclear explosion at sea, etc. The powerful shore waves of the tsunami are created by an interaction between the wave front and the bottom of the sea, wherein the decrease in water depth is proportional to the increase in the height of the wave. The damage caused by flooding during a tsunami can be attributed to the encroaching seawater onto land as well as the sweeping and motion of sediment and broken objects, and the damage caused to structures located in proximity to the shore. In addition, the retreat stage of the wave may also be destructive because the significant lowering of sea level is liable to cause heavy damages to vessels. Shore facilities are liable to sustain damages following intensive sweeping of sediments into the sea[lxxii]. A tsunami reaching the shore can be as high as dozens of meters. According to simulations conducted by Salamon et al. (2009)[lxxiii] a tsunami flooding along the shores of Israel is liable to damage areas located up to 500 meters from the shoreline. In the vicinity of streams that flow into the sea, the tsunami is liable to cover the streams' floodplain and penetrate several kilometers upstream.

Dor Array

1.6.4 Dor North

The Dor alternative, the Dor entry array and the pipelines surrounding them are located in the Carmel coastal plain, along which there are two kurkar ridges: the coastal ridge and the east ridge (over which Road 2 is built) (Figure 1.6.1-3). The kurkar body is lithologically continuous in the subsoil between these ranges. The calcareous sandstones that make up the ridges were directly deposited on the rocks of the Judea group, which constitute the Carmel range. "Troughs" have formed between the ranges – local sedimentary basins that accumulate soft sediments.

1.6.4.1 Coastal entry array

The Dor entry array is located on the west kurkar range, which is partially abraded and covered with a thin layer (about 5 meters) of sand in the vicinity of the shore and a layer of alluvium to the east of the shore (Figure 1.6.1-3). The thickness of the kurkar layers is 30-40 meters, and at their base are silt and clay layers with a thickness of up to 10 meters[lxxiv]. An exposed kurkar range (submerged) is also located about 130-170 meters to the west of the shoreline (Figure 1.6.4-1).

1.6.4.1.1 Creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413

The horizontal soil accelerations expected in the Dor entry array are presented in Table 1.6.4-1.

Table 1.6.4-1: Magnitude Values Calculated for Reference Events and Soil Acceleration Values for each Reference Event at the Dor Entry Array

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.05	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	2.2*	0.09	2.2*	0.09	2.2*	0.09
Roum	Horizontal	2.6*	0.05	2.6*	0.05	2.6*	0.05
Rechaya	Horizontal	6.6	0.04	7.2	0.05	7.2	0.05

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Carmel	Normal	5.8	0.07	6.1	0.08	6.5*	0.11
Gilboa	Normal	5.8	0.03	6.1	0.04	6.6	0.06
Keller et al., 2011			6.62		6.44		6.41

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.4.1.2 Rupture of the surface on top of active geological faults

The closest active fault to the area of the Dor entry array is the Isfiya fault, which is about 15 km distant from the area of the array (Figure 1.6.1-1). The edge faults of the Dead Sea Rift, which constitute a significant seismic rift in the region, are about 60 km distant from the area of the array. According to IS 413 there is no limitation on development and construction in the area of the Dor entry array in everything that relates to an active fault and the rupture of the surface.

1.6.4.1.3 Amplification of soil vibrations due to geological and topographic conditions

The Dor entry array is located on a kurkar range covered in its west part with a thin layer (about 5 meters) of soft sediments (sand). We may therefore expect a slight amplification in the entry array area. The maximum amplification factor, A, according to Zaslavsky et al. (2002) in the area of the Dor entrance array is A=2-3 (Figure 1.6.4-2).

1.6.4.1.4 Damage to the stability of slopes and landslides

The slope gradient in the Dor entry array area does not exceed 5° and according to the map delineating the vulnerability of slopes to failure, the array is located in an area with negligible vulnerability. Thus, no damage to the stability of the slope and/or landslide is expected within the area of the alternative following a seismic event.

1.6.4.1.5 Probability of soil failure phenomena as a result of liquefaction

The Dor entry array is located on a rocky and sandy sub-base. Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 0-1 meters below the surface. Because of said conditions, there is a potential for liquefaction within the onshore area of the array, as well as its offshore area. According to Salamon et al. (2008) the onshore part of the entry array in the Dor north alternative is located in regions where the vulnerability to liquefaction is medium (onshore) and low (to

the east of the coast) (Figure 1.6.4-3). Figure 1.6.3-2 shows that for a maximum magnitude on the Yammouneh fault and Carmel fault and a distance similar to the distance from the entry array to the coast to these faults, liquefaction events have been documented. Thus, it is not possible to deny the possibility of liquefaction within the area of the entrance array to the shore.

1.6.4.1.6 Appearance of a Tsunami

The Dor entry array is located on the shoreline. A tsunami flooding the shores of Israel is liable to hit areas located up to 500 meters to the east of the shoreline (Salamon et al., 2009). There is therefore a potential for a tsunami strike within the area of the entry array.

1.6.4.2 Pipeline alignment leading to the treatment facility

1.6.4.2.1 Formation of accelerations and the exertion of horizontal forces on structures and infrastructures according to Israeli Standard 413

The horizontal soil acceleration values expected along the alignment of the pipeline leading to the treatment facility in the Dor area are in the range of the expected acceleration values within the Dor coastal entry array and the expected acceleration values in the alternative of the Dor North treatment facility (Tables 1.6.4-1, 1.6.4-2, respectively). The maximum acceleration values expected along this segment according to Keller et al. (2011) are in the range of 0.15g and 0.16g in the west of the segment and in its east, respectively.

1.6.4.2.2 Rupture of the surface on top of active geological faults

The alignment of the pipeline leading to the Dor treatment facility passes within an area where there are no active faults (Figure 1.6.1-1; Sections 1.6.4.1.2, 1.6.4.3.2) and therefore according to IS 413 there is no limitation on the development and construction along it in everything relating to active faulting and rupture of the surface.

1.6.4.2.3 Amplification of soil vibrations due to geological and topographic conditions

The pipeline alignment leading to the Dor treatment facility is located on ridges built up by hard sediments and troughs full of soft sediments (sand, silt and clays) with a total thickness of up to 15 meters, which overlay calcareous sandstones. Therefore, we may expect amplification along the pipeline alignment within the fill areas. The amplification factor according to Zaslavsky et al. (2002) along the pipeline alignment is A=1-5 (Figure 1.6.4-2).

1.6.4.2.4 Damage to the stability of slopes and landslides

The slope gradient within the area of the pipeline alignment leading to the Dor treatment facility does not exceed 5°, and therefore no damage to the stability of the slope and/or landslide is expected along the pipeline alignment following a seismic event.

1.6.4.2.5 Probability of soil failure phenomena as a result of liquefaction

The pipeline alignment leading to the Dor treatment facility is located on a silty-clayey and rocky sub-base. Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 1-20 meters below the surface. Because of said conditions, there is a low potential for liquefaction in the western part of the pipeline alignment. According to Salamon et al. (2008) the pipeline alignment leading to the Dor treatment facility is located in regions where the vulnerability to liquefaction is low to very low (Figure 1.6.4-3). Figure 1.6.3-2 shows that for a maximum magnitude on the Yammouneh fault and Carmel fault and a distance similar to the distance from the pipeline alignment to these faults, liquefaction events have been documented. Thus, it is not possible to deny the possibility of liquefaction within the area of the pipeline leading to the treatment facility.

1.6.4.2.6 Appearance of a tsunami

The pipeline alignment is planned to connect to the coastal entry array at a distance of 300 meters to the east of the shoreline. According to a simulation conducted by Salamon et al., (2009) a tsunami flooding the shores of Israel is liable to hit areas located up to 500 meters to the east of the shoreline. There is therefore potential for tsunami damage to the western end of the pipeline alignment leading to the Dor treatment facility.

1.6.4.3 Treatment facility

The Dor treatment facility alternative ("Dor alternative") is located on the east trough, which is bounded to the east by the Carmel structure and to the west by the east kurkar ridge. The location of the alternative, as seen in a cross-section in the east-west direction, is presented in Figure 1.6.4-4. According to this figure, the soft sediments in the surface and in the subsoil of the Dor alternative site include about 15 meters of silt and clay from onshore origins (Michaelson, 1970) dated to the Holocene-Upper Pleistocene Era[lxxv]. These sediments are layered over a hard rock that comprises 18 meters of calcareous sandstone (kurkar) dated to the Upper Pleistocene (60-100,000 years; Sivan and Porat, 2004) overlying limestone rocks belonging to the Talmei Yaffe formation and dated to the Albian era (Michaelson, 1970).

1.6.4.3.1 The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413

The values of the horizontal soil accelerations expected in the Dor entry array are presented in Table 1.6.4-2. The values marked in red were used as input for calculating the response spectrum.

Table 1.6.4-2: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at Dor North

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.05	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.09	7.8*	0.09	7.8*	0.09
Roum	Horizontal	7.2*	0.05	7.3*	0.05	7.2*	0.05
Rechaya	Horizontal	6.6	0.04	7.2	0.06	7.2	0.06
Carmel	Normal	5.8	0.08	6.1	**0.09**	6.5*	0.12
Gilboa	Normal	5.8	0.04	6.1	0.04	6.6	0.06
Keller et al., 2011			0.09		**0.12**		0.16

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.4.3.2 Rupture of the surface on top of active geological faults

The closest active fault to the area of the Dor North alternative is the Isfiya fault, which is about 13 km distant from the area of the array (Figure 1.6.1-1). The edge faults of the Dead Sea Rift, which constitute a significant seismic rift in the region, are about 60 km distant from the area of the array. According to IS 413 there is no limitation on development and construction in the area of the Dor North alternative in everything that relates to an active fault and the rupture of the surface.

1.6.4.3.3 Amplification of soil vibrations due to geological and topographic conditions

The Dor alternative is located on a local sedimentary basin in which there are soft sediments – silt and clay – about 15 meters thick, overlying calcareous sandstone. In

shallow drillings carried out along the planned alignment of the Dor-Hagit gas line[lxxvi], it was found that a soil section in the area of the Dor site contains brown, fatty clays up to a depth of at least 10 meters, sometimes with chalk particles and organic material. We assume that this lithology is continuous in general down to a depth that reaches the roof of the kurkar unit. The geological map describes the soft sediments in the Dor alternative area as alluvium, which is classified by Katz et al. (2008) as D type soil (in accordance with IS 413). According to Zaslavsky et al. (2009), the speed of the shear waves in Holocene era clays is about 160-250 m/s, i.e. on the boundary of the D-E classification. Since the alluvium is composed of young clay (volcanic) and we do not have any direct geotechnical information available, the soil should be classified as D or E in accordance with IS 413.

In making the amplification calculations, we should address the rocks present up to 30 meters below the surface. In the Dor alternative there are calcareous sandstones from the Pleistocene era below the clayey layer. Zaslavsky et al. (2009) note that the velocities of the shear waves are in the range of 700-750 m/s for calcareous sandstones of this age, and we should accordingly classify this unit as C type soil (according to IS 413).

When all the data are weighted, the conclusion is that the site factors at the Dor alternative are F_a=1.6 and F_a=2.5 for soils of types D and E (respectively) for structures with short cycle times, and F_v=2.4 and F_v=3.5 for soils of types D and E (respectively) for structures with long cycle times. The maximum amplification coefficient according to Zaslavsky et al. (2002) in the Dor alternative area is A=4-6 (Figure 1.6.4-2). The spectral design accelerations for type D and type E soils in the Dor North alternative for an earthquake recurring in a 975-year cycle, with a restraining factor of 5%, are presented in Figure 1.6.4-5.

1.6.4.3.4 Damage to the stability of slopes and landslides

The slope gradient in the Dor alternative and its environs does not exceed 5° and according to the map delineating the vulnerability of slopes to failure, the array is located in an area with negligible vulnerability. Thus, no damage to the stability of the slope and/or landslide is expected within the area of the alternative following a seismic event.

1.6.4.3.5 Probability of soil failure phenomena as a result of liquefaction

The Dor North alternative is located on a silty-clayey sub-base. Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 20 meters below the surface. Because of said conditions, there is no potential for liquefaction within the area of the plan. According to Salamon et al. (2008) the Dor North alternative is located within a region where the vulnerability to liquefaction is negligible (Figure 1.6.4-3).

1.6.4.3.6 Appearance of a tsunami

The Dor North alternative is located about 1.5 km from the shoreline. According to a simulation conducted by Salamon et al., (2009) a tsunami flooding the shores of Israel (not including the area of streams that flow into the sea) is liable to damage areas located up to 500 meters to the east of the shoreline. There is therefore no potential for tsunami damage within the area of the Dor North alternative.

1.6.4.4 Pipeline alignment from the treatment facility

Transmission of the treated gas to the east and to the Hagit Power Station will be carried out through the existing Dor-Hagit gas pipeline alignment and does not require locating an additional pipeline alignment.

1.6.5 Ein Ayala

The Ein Ayala treatment facility alternative ("Ein Ayala alternative"), is located on the western margins of the Carmel ridge. The pipeline alignment leading to this facility (the alignment connecting between the Dor alternative and the Ein Ayala alternative) is mostly planned within the Carmel coastal plain (Figure 1.6.1-1; Section 1.6.4) and some of it on the margins of the Carmel range.

1.6.5.1 Coastal entry array

The entry array planned for the Ein Ayala alternative is the Dor entry array, see Section 1.6.4.1.

1.6.5.2 Pipeline alignment leading to the treatment facility

1.6.5.2.1 Formation of accelerations and the exertion of horizontal forces on structures and infrastructures according to Israeli Standard 413

The horizontal soil acceleration values expected along the alignment of the pipeline leading to the treatment facility in the Ein Ayala alternative area are in the range of the expected acceleration values within the Ein Ayala alternative and the expected acceleration values in the alternative of the Dor North treatment facility (Tables 1.6.5-1, 1.6.4-2, respectively). The maximum acceleration values expected along this segment according to Keller et al. (2011) are in the range of 0.15g and 0.17g in the west of the segment and in its east, respectively.

1.6.5.2.2 Rupture of the surface on top of active geological faults

The alignment of the pipeline leading to the Ein Ayala treatment facility passes within an area where there are no active faults (Figure 1.6.1-1; Sections 1.6.4.3, 1.6.5.3) and therefore according to IS 413 there is no limitation on the development and

construction along it in everything relating to active faulting and rupture of the surface.

1.6.5.2.3 Amplification of soil vibrations due to geological and topographic conditions

The eastern part of the pipeline alignment leading to the Ein Ayala treatment facility is mostly located on soft sediments (silt and clay) with a total thickness of up to 15 meters, which overlay calcareous sandstone (see Figure 1.6.4-4). Therefore, we may expect amplification along the east part of the pipeline alignment. The maximum amplification factor according to Zaslavsky et al. (2002) along this part of the alignment is A=1-5 (Figure 1.6.4-2). The western part of the alignment (between the coastal entrance array at Dor and the Dor treatment facility) is described in Section 1.6.4.2.3.

1.6.5.2.4 Damage to the stability of slopes and landslides

The slope gradient in most of the area of the pipeline alignment leading to the Ein Ayala treatment facility does not exceed 5°, and according to the map delineating the vulnerability of slopes to failure the array is located within an area where the vulnerability is negligible. Thus, we do not expect any damage to the stability of the slope and/or landslide along the alignment of the pipeline following a seismic event. At the east end, where the pipeline alignment hooks up to the treatment facility, the topographic conditions are similar to the conditions within the area of the treatment facility, see discussion in Section 1.6.5.3.4.

1.6.5.2.5 The probability of soil failure phenomena as a result of liquefaction

The pipeline alignment in the section between the Dor treatment facility and the Ein Ayala treatment facility mainly overlies a silty-clayey sub-base, and at its eastern end a rocky sub-base. Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 20 meters and more below the surface. Because of these conditions, there is no potential for liquefaction in this section of the pipeline alignment. According to Salamon et al. (2008) the western part of this section is located in an area where the vulnerability to liquefaction is low (Figure 1.6.4-3). The western part of the pipeline alignment leading to the Ein Ayala facility (in the section between the Dor entry array and the Dor treatment facility) is described in Section 1.6.4.2.5.

1.6.5.2.6 Appearance of a tsunami

The pipeline alignment in the section between the Dor treatment facility and the Ein Ayala treatment facility is planned to be located at a distance of 2-3.5 km east of the shoreline, at an elevation of 7-60 meters and there is thus no potential for a tsunami

strike along it (Salamon et al., 2009). Regarding the pipeline alignment in the segment between the Dor entry array and the Dor treatment facility, see Section 1.6.4.2.6.

1.6.5.3 Treatment facility

The Ein Ayala alternative is located on the slopes of the Carmel ridge (see Figures 1.6.1-1;1.6.1-2; 1.6.1-3) at an elevation of 40-60 meters, on a hard rocky subsoil that includes limestone belonging to the Talmei Yaffe formation from the Albian era, with a few limestone rocks belonging to the Isfiya formation and the Tuf Maharal from the Cenomanian era (Figure 1.6.5-1). A thin layer (dozens of centimeters) of terra-rosa and rendzina soils covers the hard rocky terrain.

1.6.5.3.1 The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413

The values of the horizontal soil accelerations expected in the Ein Ayala alternative are presented in Table 1.6.5-1. The values marked in red were used as input for calculating the response spectrum.

Table 1.6.5-1: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at Ein Ayala

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.05	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.09	7.8*	0.09	7.8*	0.09
Roum	Horizontal	7.2*	0.05	7.3*	0.05	7.2*	0.05
Rechaya	Horizontal	6.6	0.04	7.2	0.06	7.2	0.06
Carmel	Normal	5.8	0.09	6.1	**0.10**	6.5*	0.13
Gilboa	Normal	5.8	0.04	6.1	0.04	6.6	0.06
Keller et al., 2011			0.09		**0.12**		0.17

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.5.3.2 Rupture of the surface on top of active geological faults

The closest active fault to the area of the Ein Ayala alternative is the Isfiya fault, which is about 11 km distant from the area of the array (Figure 1.6.1-1). The edge faults of the Dead Sea Rift, which constitute a significant seismic rift in the region, are about 50 km distant from the area of the array. According to IS 413 there is no limitation on development and construction in the area of the Ein Ayala alternative in everything that relates to an active fault and the rupture of the surface.

1.6.5.3.3 Amplification of soil vibrations due to geological and topographic conditions

The Ein Ayala alternative is located on a rock terrain where the chalk is exposed according to the geological map (Figure 1.6.5-1) and for this reason, there is no deviant attenuation suspected. The exposed chalk belongs to the Talmei Yaffe formation from the Albian era. Katz et al. (2008) classify all the Judea group rocks in the north of Israel (Carmel, Galilee) as type A soil. However, the chalky Menucha formation rocks, which are more similar in their type to the Talmei Yaffe formation rocks, are classified by Katz et al. (2008) as B type soil. Therefore, without additional geotechnical information, the soil classification is either soil A or soil B according to IS 413).The spectral design accelerations for the rocky subsoil in the area of the Ein Ayala alternative for an earthquake with a recurrence period of 975 years and a restraining factor of 5% are presented in Figure 1.6.5-2.

1.6.5.3.4 Damage to the stability of slopes and landslides

The slope gradient in the Ein Ayala alternative and its environs according to a 1:50,000 topographical map is 10-15°. For this gradient and a chalk subsoil, the level of sensitivity to a rock slide is III and to a rotational slide is IV. The conditions for a slope failure for sensitivity levels III and IV are soil accelerations higher than 0.40g and 0.35g, respectively. Thus, the natural conditions in the area of the alternative do not foster the development of soil slides.

In a survey conducted within the area of the alternative, it was found to include artificial topographic gradients arising from the activity of a quarry within the site. The incline of artificial gradients may be as much as 90° at a number of places. Moreover, the excavation has exposed at the site a number of layers with an orientation (original) of 45° in the direction of the exposed rock (Figure 1.6.5-3a). Also found in the area were soft conglomerate units with an effluvial/flooding nature or artificial nature and they too are oriented in the direction of the rock face (Figure 1.6.5-3b).

For a gradient exceeding 40° with a chalk subsoil, the sensitivity level for rock slides is IX and for a rotational slide is X (Katz et al., 2008). The slope failure conditions for these levels of sensitivity are soil accelerations exceeding 0.10g and 0.05g,

respectively. Since the soil accelerations expected within the area of the alternative are 0.09-0.17g (in accordance with various reference events), there is a potential for rockslide and landslide within the area of the alternative following a seismic event. One should note that the chalk rocks in the exposed rocky areas observed present intensive cracking, and accordingly the mass of the rock is approximately granular. Therefore, slope failure in the exposed excavation areas is also expected in response to accelerations that are lower than the accelerations that were noted above. Since the conditions encouraging landslide are not uniform throughout the site, it is necessary to individually examine the slopes adjacent to the planned location of the gas facilities and piping in the event that this alternative is chosen.

1.6.5.3.5 The probability of soil failure phenomena as a result of liquefaction

The Ein Ayala alternative is located on a chalky-rocky sub-base and the groundwater is found within the Judea group aquifer at an estimated level of about 100 meters below the surface. Because of said conditions, there is no potential for liquefaction within the area of this alternative.

1.6.5.3.6 Appearance of a tsunami

The Ein Ayala alternative is located at an elevation of 40-60 meters and is therefore not expected to be subjected to a tsunami within its area.

1.6.5.4 Pipeline alignment from the treatment facility

Transmission of the treated gas to the east and to the Hagit Power Station will be carried out through the existing Dor-Hagit gas pipeline alignment and does not require locating an additional pipeline alignment.

1.6.6 Hagit East

The Hagit East treatment facility alternative is planned at the edges of the Menashe (Ramat Menashe) syncline which is bounded within the Carmel anticline ("Daliyat al Carmel") and the Um m al-Fahm anticline (Figure 1.6.1-1) and constitute part of the parallel synclines and anticlines of the Syrian arc. The eastern part of the pipeline alignment leading to this alternative (the alignment connecting between the Ein Dor alternative and the Hagit alternative)is planned on top of the Carmel range and at the edges of the Menashe syncline.

1.6.6.1 Coastal entry array

The entrance array planned to serve the Hagit alternative is the Dor entry array, see Section 1.6.4.1.

1.6.6.2 The pipeline alignment leading to the treatment facility

The description below refers to the two alignment alternatives (north and south).

1.6.6.2.1 The formation of accelerations and the exertion of horizontal forces on structures and infrastructures according to Israeli Standard 413

The horizontal soil acceleration values expected along the alignment of the pipeline leading to the Hagit treatment facility are in the range of the expected acceleration values for the Ein Ayala alternative and the expected acceleration values in the Hagit alternative (Tables 1.6.5-1, 1.6.6-1, respectively). The maximum acceleration values expected along this segment according to Keller et al. (2011) are in the range of 0.17g and 0.22g in the west of the segment and in its east, respectively.

1.6.6.2.2 Rupture of the surface on top of active geological faults

The alignment of the pipeline leading to the Hagit treatment facility passes within an area where there are no active faults (Figure 1.6.1-1; Sections 1.6.5.3, 1.6.6.3) and therefore according to IS 413 there is no limitation on the development and construction along it in everything relating to active faulting and rupture of the surface.

1.6.6.2.3 Amplification of soil vibrations due to geological and topographic conditions

The pipeline alignment leading to the Hagit treatment facility is mostly located on hard sediments (Figure 1.6.1-1) and therefore no amplification is expected along the pipeline alignment. In the streams that have an alluvial fill (the central part of the south alternative and the east part of the north alternative; Figure 1.6.1-3) have a potential for the amplification of soil vibrations.

1.6.6.2.4 Damage to the stability of slopes and landslides

The slope gradient within most of the area of the pipeline alignment leading to the Hagit treatment facility does not exceed 5° and according to the map delineating the vulnerability of slopes to failure the array is located within an area with negligible sensitivity. In a few locations, the alignment of the pipeline passes through areas where the gradient of the slopes is 5-20°. For this incline and a chalk subsoil, soil accelerations higher than 0.30g are required to damage the stability of the slope. Since the soil accelerations expected within the area of the alternative are lower than the acceleration required for failure, no damage to the stability of the slope and/or landslides are expected along the alignment of the pipeline as a result of a seismic event.

1.6.6.2.5 The probability of soil failure phenomena as a result of liquefaction

The pipeline alignment leading to the Hagit treatment facility mostly overlies rocky subsoil but some of it overlies an alluvial subsoil. The groundwater level changes within the area of the alternative from the surface downwards, but because of the nature of the sub-base (subsoil) in general there is no potential for liquefaction along the pipeline alignment. At the same time, in areas where the alignment passes over fill material, one should examine the nature of that material and the groundwater level in its environment, test that are beneath the mapping resolution of the present work.

1.6.6.2.6 Appearance of a tsunami

The pipeline alignment is planned at an elevation of 30-180 meters and therefore no tsunami is expected to impact its length.

1.6.6.3 Treatment facility

The Hagit East treatment facility alternative ("Hagit alternative") is located on the edges of the Menashe syncline, which is part of the parallel syncline and anticline system of the Syria arc, which is bounded between the Carmel anticline and the Umm al-Fahm anticline (Figure 1.6.1-1). The alternative is located at an elevation of 170-180 meters, on top of a hard rocky subsoil which comprises chalky rocks and flint concentrations belonging to the Adulam formation from the Eocene era (Figure 1.6.6-1).A thin layer (up to dozens of centimeters) of brown forest soils and redzina covers the hard rocky terrain in various places.

1.6.6.3.1 The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413

The values of the horizontal soil accelerations expected in the Hagit alternative are presented in Table 1.6.6-1. The values marked in red were used as input for calculating the response spectrum.

Table 1.6.6-1: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at Hagit East

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.06	6.9	0.06	7.3	0.07
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Yammouneh	Horizontal, normal at the south end	7.8*	0.10	7.8*	0.10	7.8*	0.10
Roum	Horizontal	7.2*	0.05	7.2*	0.05	7.2*	0.05
Rechaya	Horizontal	6.6	0.05	7.2	0.07	7.2	0.07
Carmel	Normal	5.8	0.17	6.1	**0.19**	6.5*	0.23
Gilboa	Normal	5.8	0.05	6.1	0.06	6.6	0.08
Keller et al., 2011			0.11		**0.15**		0.22

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.6.3.2 Rupture of the surface on top of active geological faults

The closest active fault to the area of the Hagit alternative is the Carmel fault, which is about 6.5 km distant from the area of the array (Figure 1.6.1-1). The edge faults of the Dead Sea Rift, which constitute a significant seismic rift in the region, are about 50 km distant from the area of the array. According to IS 413 there is no limitation on development and construction in the area of the Hagit alternative in everything that relates to an active fault and the rupture of the surface.

1.6.6.3.3 Amplification of soil vibrations due to geological and topographic conditions

The Hagit alternative is located at a hard rocky site where chalk and flint are exposed according to the geological map (Figure 1.6.6-1) and there is therefore no suspicion for deviant amplification. The exposed chalk and flint belong to the Adulam formation from the Eocene era and their classification without any additional geotechnical information is therefore soil A, in accordance with IS 413 (see also Katz et al., 2008).The spectral design accelerations for a rocky subsoil of this type within the Hagit alternative area for an earthquake recurring in a 975-year cycle, with a restraining factor of 5%, are presented in Figure 1.6.6-2.

1.6.6.3.4 Damage to the stability of slopes and landslides

The slope gradient in the Hagit alternative and its environs does not exceed 10°. Since the subsoil within the area of the alternative is comprised of chalk and marl, the level of sensitivity to a rotational slide is III. The condition for a slope failure in the sensitivity level III is soil accelerations exceeding 0.40g. Since the expected soil acceleration within the area of the alternative is lower than the acceleration required

for failure (Section 1.6.6.3.1) no damage to the stability of the slope and/or landslide is expected within the area of the alternative following a seismic event.

1.6.6.3.5 The probability of soil failure phenomena as a result of liquefaction

The Hagit alternative is located on rocky-chalky subsoil and the groundwater in this area is within the aquitard of the Avdat group. The groundwater level changes within the area of the alternative from surface level downwards, but because of the rocky subsoil there is no potential for liquefaction within the area of the alternative.

1.6.6.3.6 Appearance of a tsunami

The Hagit alternative is located at an elevation of 170-180 meters and therefore no tsunami is expected to impact its area.

1.6.6.4 Pipeline alignment from the treatment facility

The alternative is adjacent to the Hagit Power Station and the east alignment and no additional pipeline alignment is planned from the treatment facility in the context of this plan.

Hadera-Neurim Array

1.6.7 Hadera Wastewater Treatment Facility

The Hadera Wastewater Treatment Facility alternative, the Hadera, Michmoret and Nahal Alexander entry arrays and the pipelines that connect them are all located in the north of the Sharon coastal plain. There are three kurkar ranges within this area (Figure 1.6.1-3): the coastal ridge, the central ridge (over which Road 2 passes) and the east ridge (which is located to the east of Road 4). The ridges are made up of hard calcareous sandstone and there are layers of marl between them whose thickness is only a few meters (smaller < 5 meters). The total thickness of the ranges is 70-120 meters. The ranges are not continuous on the surface but there is lithological continuity between them in the subsoil[lxxvii,lxxviii].

1.6.7.1 Coastal entry arrays

Nahal Hadera entry array – is planned on the west kurkar range (the coastal range), with a top layer of up to 10 meters of sand and/or red loam.

Michmoret entry array – is planned on the west kurkar range (the coastal range), with a top layer of up to 10 meters of sand and/or red loam. The kurkar range is exposed also to the west of the shoreline along 3 strips: one strip which is 15 meters thick and is located at a distance of 60 meters from the shoreline, and 100-150 meter thick strips located at a distance of 100 and 600 meters from the shoreline (Figure 1.6.7-1).

Nahal Alexander entry array – is planned to the north of the Nahal Alexander estuary, on the west kurkar range (the coastal range) with a top layer of up to 10 meters of sand, silt and pebbles (shells). The kurkar range is also exposed west of the shoreline along two strips 100-150 meters thick located at a distance of 0-200 meters from the shoreline (abutting the shore in the north of the entrance array area) and 700 meters (Figure 1.6.7-1).

1.6.7.1.1 <u>The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413</u>

The horizontal soil accelerations expected in the Hadera, Michmoret and Nahal Alexander entry arrays are presented in Table 1.6.7-1.

Table1.6.7-1: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at the Nahal Hadera, Michmoret and Nahal Alexander Entry Arrays

Nahal Hadera Coastal Entry Array

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.04	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.08	7.8*	0.08	7.8*	0.08
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.04	7.2	0.05	7.2	0.05
Carmel	Normal	5.8	0.04	6.1	0.05	2.1*	0.07
Gilboa	Normal	5.8	0.03	6.1	0.04	6.6	0.05
Keller et al., 2011			6.62		6.62		6.46

Michmoret Coastal Entry Array

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.04	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.08	7.8*	0.08	7.8*	0.08
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.03	7.2	0.05	7.2	0.05
Carmel	Normal	5.8	0.04	6.1	0.05	2.1*	0.07
Gilboa	Normal	5.8	0.03	6.1	0.03	6.6	0.05
Keller et al., 2011			6.62		6.62		6.46

Nahal Alexander Coastal Entry Array

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.04	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.07	7.8*	0.07	7.8*	0.07
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.03	7.2	0.04	7.2	0.04
Carmel	Normal	5.8	0.04	6.1	0.04	2.1*	0.06
Gilboa	Normal	5.8	0.03	6.1	0.03	6.6	0.05
Keller et al., 2011			6.62		6.62		6.44

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.7.1.2 Rupture of the surface on top of active geological faults

The Hadera, Michmoret and Nahal Alexander entry arrays are planned within an area where there are no active faults (Figure 1.6.1-1; Section 1.6.7.3.2, 1.6.8.3.2) and therefore according to IS 413 there is no limitation on development and construction in the area of the entry arrays in everything that relates to an active fault and rupture of the surface.

1.6.7.1.3 Amplification of soil vibrations due to geological and topographic conditions

The Hadera, Michmoret and Nahal Alexander entry arrays are planned on a kurkar range partially covered with a layer of soft sediments (sands, loam, silt) with a thickness of up to 10 meters. We may therefore expect a slight amplification in the entry arrays areas. The maximum amplification factor according to Zaslavsky et al. (2003) in the area of the Hadera entry array is A=2-3 and in the area of the Michmoret and Nahal Alexander entry arrays is A=1-2 (Figure 1.6.4-2).

1.6.7.1.4 Damage to the stability of slopes and landslides

The slope gradient in the Hadera and Nahal Alexander entry arrays does not exceed 5° and therefore no damage to the stability of the slope and/or landslide is expected within the area of the arrays following a seismic event. The Michmoret entry array is

planned in the area where the coastal cliff is located (in the north part of the area), and this has quite a steep gradient (higher than 40°). For this gradient, a soil acceleration of at least 0.05g is required in order to damage the stability of the slope. The accelerations expected in the Michmoret entry array area are higher than this value (Table 1.6.7-1) and therefore we may expect rock slides in the north area of the array during an earthquake event.

1.6.7.1.5 The Probability of Soil Failure Phenomena as a result of Liquefaction

The Hadera, Michmoret and Nahal Alexander entry arrays are located on a rocky and silty-sandy sub-base. Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 0-10 meters below the surface. Because of said conditions, there is a potential for liquefaction within the onshore areas of the arrays, as well as their offshore areas. According to Salamon et al. (2008) the entry arrays are located in regions where the sensitivity to liquefaction is intermediate and low. Figure 1.6.3-2 shows that for a maximum magnitude on the Yammouneh fault and the Carmel fault and a distance similar to the distance from the entry arrays to the coast from these faults, liquefaction events have been documented. Thus, it is not possible to deny the possibility of liquefaction within the area of the entry arrays to the shore.

1.6.7.1.6 Appearance of a tsunami

The entry arrays are located on the shoreline. According to a simulation conducted by Salamon et al., (2009), a tsunami flooding the shores of Israel is liable to damage areas located up to 500 meters from the shoreline. We may also expect a tsunami to damage the entry arrays' area. At the eastern part of the Michmoret entry array, on the coastal cliff that ascends up to a height of 10 meters above the coast, no tsunami damage is expected except in an extreme case.

1.6.7.2 Pipeline alignment leading to the treatment facility

Infrastructure conditions along the alignment of the pipelines are similar to those described for the coastal entry facilities (Chapter 1.6.7.1) and for the Hadera Wastewater Treatment Facility (Chapter 1.6.7.3), or fall somewhere in the range between them. Correspondingly, the level of seismic risk associated with each risk factor except for tsunami (see below) is similar to that described for the facilities on the coast and the treatment facility, and/or is located in the range between them. The maximum expected acceleration values along these segments according to Keller et al., (2011) are in the range of 0.11g and 0.13g in the west and east of the segment, respectively.

1.6.7.2.1 Appearance of a tsunami

Thanks to their distance from the shoreline (about 500 meters) and the topographic elevation in which they are located, no tsunami damage is expected to the pipelines

that are planned to connect with the Hadera and Michmoret entry array. The alignment of the pipeline planned to connect with the Nahal Alexander entry array is planned along the stream up to about 3 km upstream to the east of the coast. According to a simulation conducted by Salamon et al., (2009) for an extreme tsunami scenario at the Yarkon Stream, a flooding may penetrate about 3 km upstream, which is located at this distance from the coast at a topographic height of approximately 8 meters. The pipeline alignment is planned to pass over topography at a height of 6-14 meters. Simulations for tsunami flooding in the Nahal Alexander area have not been conducted yet, but by analogy to the Yarkon area, it is possible that the threshold conditions for a potential tsunami strike in the west area of the pipeline alignment from the Nahal Alexander entry array to the Hadera Wastewater Treatment Facility alternative exist.

1.6.7.3 Treatment facility

The Hadera Wastewater Treatment Facility alternative is located on the banks of Nahal Hadera, along the west edges of the east kurkar range and on the "trough," delimited between the two ranges (Figure 1.6.1-3; Figure 1.6.7-2). Within the trough there are soft sediment layers that comprise alternating sand, silt and clay layers from a terrestrial origin (Acre, 1999). The total thickness of the soft sediments within the Hadera Wastewater Treatment Facility alternative lies in the range of 0-45 meters and the layers overlie a calcareous sandstone (kurkar) with a thickness of 40-60 meters in the area of the alternative (Figure 1.6.7-2). The kurkar is exposed on the surface in the east part of the alternative (its maximum thickness is located on a hill at a height point of 26 meters) and is sometimes covered by a thin layer (up to dozens of centimeters) of pre-redzina and loam soils. The calcareous sandstone as well as the soft sedimentary fill belong to a kurkar group dated to the Holocene-Pleistocene. At a depth of 60-80 meters under the soil, we find a kurkar layer on top of clay, marl and chalk that belong to the Sakia group from the Eocene era.

1.6.7.3.1 <u>The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413</u>

The values of the horizontal soil accelerations expected at the Hadera Wastewater Treatment Facility alternative are presented in Table 1.6.7-2. The values marked in red were used as input for calculating the response spectrum.

Table 1.6.7-2: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at the Hadera Wastewater Treatment Facility

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.05	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.08	7.8*	**0.08**	7.8*	0.08
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.04	7.2	0.05	7.2	0.05
Carmel	Normal	5.8	0.05	6.1	0.06	2.1*	0.08
Gilboa	Normal	5.8	0.03	6.1	0.04	6.6	0.06
Keller et al., 2011			0.08		**0.10**		0.13

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.7.3.2 Rupture of the surface on top of active geological faults

The closest active fault to the area of the Hadera alternative is the Akeda fault, which is about 22 km distant from the area of the array (Figure 1.6.1-1). The edge faults of the Dead Sea Rift, which constitute a significant seismic rift in the region, are about 60 km distant from the area of the array. According to IS 413 there is no limitation on development and construction in the area of the Dor North alternative in everything that relates to an active fault and the rupture of the surface.

1.6.7.3.3 Amplification of soil vibrations due to geological and topographic conditions

The Hadera Wastewater Treatment Facility alternative is located on the edges of a local sedimentary basin in which there are soft sediments including sand, silt and clays at a thickness of 0-45 meters. The sands and the clays belong to a kurkar group dated to the Holocene-Pleistocene era and classified by Katz et al. (2008) as D type soil (in accordance with IS 413). According to Zaslavsky et al. (2009), the velocity of the shear waves in Holocene era clays is about 160-250 m/s, i.e. on the boundary of the D-E classification. In the Caesarea-3 drilling located approximately 3.5 km to the north of the Hadera Wastewater Treatment Facility Alternative, shear wave velocities

of 140-180 m/s were measured for quaternary sand and it is therefore recommended to classify the soft fill within the Hadera alternative site as type E soil.

The calcareous sandstone (exposed in the surface of the east part of the alternative) is classified by Katz et al. (2008) as soil type C (in accordance with IS 413). This classification corresponds to the shear wave velocities noted by Zaslavsky et al. (2009) for the calcareous sandstone in the kurkar group (700-750 m/s), and to the velocities measured for the parallel unit in the Caesarea-1 and Caesarea-2 drillings (700-740 m/s). Therefore, the classification of the soil without direct geotechnical information is either type D or B, in accordance with IS 413 in the west part and C in the east part of the alternative (in the kurkar range area).

When all the data are weighted, the conclusion is that the site factors at the Dor alternative are F_a=1.2, F_a=1.6 and F_a=2.4 for soils of types C, D and E (respectively) for structures with short cycle times; and F_v=1.7, F_v=2.2 and F_v=3.5 for soils of types C, D and E (respectively) for structures with long cycle times. The maximum amplification coefficient, A, according to Zaslavsky et al. (2003) in the Hadera Wastewater Treatment Facility alternative area is A=1-3 (Figure 1.6.4-2). The spectral design accelerations for type D and type E soils in the Hadera Wastewater Treatment Facility alternative for an earthquake recurring in a 975-year cycle, with a restraining factor of 5%, are presented in Figure 1.6.7-3.

1.6.7.3.4 Damage to the stability of slopes and landslides

The slope gradient in the Hadera alternative and its environs does not exceed 5° and according to the map delineating the vulnerability of slopes to failure, the array is located in an area with negligible vulnerability. Thus, no damage to the stability of the slope and/or landslide is expected within the area of the alternative following a seismic event.

1.6.7.3.5 The probability of soil failure phenomena as a result of liquefaction

The Hadera alternative is located on a local sedimentary basin. The soft fill includes sands, silty sands and clays. The sandy units (sand and silt) are not exposed on the surface, but rather located at a depth of 8-10 meters under the surface and their total thickness amounts to 0-35 meters. Moreover, in this area the groundwater is located within the coastal aquifer and its level within the area of the alternative is about 10 meters below the surface. Sometimes water is collected on the surface so that the shallowest soil/rock units are in a state of saturation. This leads to the possibility of sandy units' saturation. The expected soil acceleration in the area of this alternative is 0.08-0.13g for various reference events. Because of said conditions, there is a potential for liquefaction within the area of the Hadera alternative. Figure 1.6.3-2 shows that for the maximum magnitude of the Yammouneh fault and the Carmel fault and a similar distance to that between the treatment facility and these faults,

liquefaction events have been documented. For this reason, we cannot rule out the possibility of liquefaction within the treatment facility area.

1.6.7.3.6 Appearance of a tsunami

The Hadera alternative is located about 1.5 km from the shoreline, close to the Nahal Hadera alignment. According to a simulation conducted by Salamon et al., (2009) for an extreme tsunami scenario at the Yarkon Stream, a flooding may penetrate about 3 km upstream, which is located at this distance from the coast at a topographic height of approximately 8 meters. The west area of the Hadera alternative is located about 3.5 km up Nahal Hadera at a topographic height of about 9 meters. Simulations for a tsunami flooding scenario in the Nahal Hadera area have not been conducted yet, but by analogy to the Yarkon area, it is possible that the threshold conditions for a potential tsunami strike in the area of the Hadera Wastewater Treatment Facility alternative exist.

1.6.7.4 Pipeline alignment from the treatment facility

The description below refers to the two alignment alternatives of the pipeline extending from the treatment facility (north and south).

1.6.7.4.1 The formation of accelerations and the exertion of horizontal forces on structures and infrastructures according to Israeli Standard 413

The horizontal soil acceleration values expected along the alignment of the pipeline extending from the Hadera Wastewater Treatment Facility are presented in Table 1.6.7-3.

Table1.6.7-3: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event for the East Edge of the Pipeline extending from the Hadera Wastewater Treatment Facility

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.06	6.9	0.06	7.3	0.07
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.09	7.8*	0.09	7.8*	0.09
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.04	7.2	0.05	7.2	0.05
Carmel	Normal	5.8	0.07	6.1	0.08	6.5*	0.11

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Gilboa	Normal	5.8	0.04	6.1	0.05	6.6	0.07
Keller et al., 2011			0.09		0.11		0.14

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.7.4.2 Rupture of the surface on top of active geological faults

The pipeline alignment extending from the Hadera Wastewater Treatment Facility is planned in an area where no active faults exist (Figure 1.6.1-1; Section 1.6.7.3.2). Therefore, according to IS 413 there is no limitation on development and construction along the pipeline alignment in anything that relates to an active fault and the rupture of the surface.

1.6.7.4.3 Amplification of soil vibrations due to geological and topographic conditions

The alignment of the piping extending from the Hadera Wastewater Treatment Facility is planned to pass over ridges comprising hard sediments and troughs with soft sediments (sand, silt and clays in the south alternative; similar sediments + red loam in the north alternative). The thickness of the soft sediments is in the range of 0-60 meters and the extent of expected amplification along the pipeline alignment changes according to such thickness. The maximum amplification factor according to Zaslavsky et al. (2003) along the pipeline alignment extending eastwards from the Hadera treatment facility is A=1-5 (Figure 1.6.4-2).

1.6.7.4.4 Damage to the stability of slopes and landslides

The slope gradient in the area of the pipeline alignment extending from the Hadera Wastewater Treatment Facility does not exceed 5° and therefore no damage to the stability of the slope and/or landslide is expected along the pipeline's alignment following a seismic event.

1.6.7.4.5 The probability of soil failure phenomena as a result of liquefaction

The pipeline alignment extending from the Hadera Wastewater Treatment Facility is located over a bed of sand, silt, clay and loam of varying thicknesses. Moreover, in this area the groundwater is located within the coastal aquifer and its level is on the surface along Nahal Hadera, and about 10 meters and more under the surface in the rest of the area. Because of the conditions described, there is potential for liquefaction along the pipeline alignment, especially along the south pipeline, most of which is

aligned along Nahal Hadera (Figure 1.6.4-3). According to Salamon et al. (2008) the pipeline alignment extending from the Hadera Wastewater Treatment Facility is located in an area where the sensitivity to liquefaction is extremely low (Figure 1.6.4-3). In Figure 1.6.3-2, we can see that for the maximum magnitude of the Yammouneh fault and the Carmel fault, and a similar distance to that of the pipeline alignment from these faults, liquefaction events have been documented. For this reason, we cannot rule out the possibility of liquefaction within the coastal entry array area.

1.6.7.4.6 Appearance of a tsunami

Because of its distance from the shore and its topographic elevation, no tsunami strike damage is expected in the alignment of the pipeline extending from the treatment facility eastwards, except for the part of the pipeline that passes within the area of Nahal Hadera in the vicinity of the treatment facility area as specified above.

1.6.8 Meretz Wastewater Treatment Facility

The Meretz Wastewater Treatment Facility alternative, the Hadera, Michmoret and Nahal Alexander entry arrays and the pipelines that connect them are all located in the north of the Sharon coastal plain. There are three kurkar ranges within this area (Figure 1.6.1-3): the coastal ridge, the central ridge (over which Road 2 passes) and the east ridge (which is located to the east of Road 4). The ridges are made up of hard calcareous sandstone and there are layers of marl between them whose thickness is only a few meters (smaller < 5 meters). The total thickness of the ranges is 70-120 meters. The ranges are not continuous on the surface but there is lithological continuity between them in the subsoil (Acre, 1999; Tolmetch, 1980).

1.6.8.1 Coastal entry arrays

The entrance arrays planned for connection to the Meretz Wastewater Treatment Facility are the Hadera, Michmoret, Nahal Alexander and Neurim arrays. The evaluation of seismic risks for the 3 first arrays is listed in Section 1.6.7.2. The Neurim entrance array is located on the west kurkar range covered with a thin layer (up to 10 meters but usually thinner than that) of sand and/or loam.

1.6.8.1.1 The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413

The horizontal soil accelerations expected at the Neurim entry arrays are presented in Table 1.6.8-1.

Table 1.6.8-1: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at the Neurim Entry Arrays

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.04	6.9	0.05	7.3	0.06
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.07	7.8*	0.07	7.8*	0.07
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.03	7.2	0.04	7.2	0.04
Carmel	Normal	5.8	0.03	6.1	0.04	2.1*	0.06

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Gilboa	Normal	5.8	0.02	6.1	0.03	6.6	0.05
Keller et al., 2011			6.62		6.62		6.44

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.8.1.2 Rupture of the surface on top of active geological faults

The Neurim entry array is planned within an area where there are no active faults (Figure 1.6.1-1; see details in Section 1.6.8.3.2 below) and therefore according to IS 413 there is no limitation on development and construction in the area of the entry arrays in everything that relates to an active fault and the rupture of the surface.

1.6.8.1.3 Amplification of soil vibrations due to geological and topographic conditions

The Neurim entry array is planned on a kurkar range partially covered with a layer of soft sediments (sands, loam) with a thickness of up to 10 meters. We may therefore expect a slight amplification in the fill areas located in the entry array area. The maximum amplification factor according to Zaslavsky et al. (2003) in the area of the entry array is A=2-3 (Figure 1.6.4-2).

1.6.8.1.4 Damage to the stability of slopes and landslides

The Neurim entry array is planned in the area where the coastal cliff is located and this has quite a steep gradient (higher than 40°). For this gradient, a soil acceleration of at least 0.05g is required in order to damage the stability of the slope. The accelerations expected in the Neurim entry array area are higher than this value (Table 1.6.8-1) and therefore we may expect rock slides along the shore within the array area during an earthquake event.

1.6.8.1.5 The probability of soil failure phenomena as a result of liquefaction

The Neurim entry array is located on a rocky and sandy sub-base. Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 0-15 meters below the surface. Because of said conditions, there is a potential for liquefaction within the onshore areas of the array, as well as its offshore areas. According to Salamon et al. (2008) the Neurim entry array is located in areas with intermediate sensitivity to liquefaction (both onshore and offshore) and very low (at the head of the coastal cliff). Figure 1.6.3-2 shows that for a maximum magnitude on the Yammouneh fault and the Carmel fault and a distance similar to the distance from

the entry arrays to the coast from these faults, liquefaction events have been documented. Thus, it is not possible to deny the possibility of liquefaction within the area of the entry array to the shore.

1.6.8.1.6 Appearance of a tsunami

The Neurim entry array is located on the shoreline. According to a simulation conducted by Salamon et al., (2009), a tsunami flooding the shores of Israel is liable to damage areas located up to 500 meters from the shoreline and therefore we may also expect a tsunami to damage the entry array area.

1.6.8.2 Pipeline alignment leading to the treatment facility

The infrastructure conditions along the alignment of the pipelines are similar to those described for the coastal entry facilities (Sections 1.6.7.1, 1.6.8.1) and for the Hadera Wastewater Treatment Facility (Chapter 1.6.7.3) and the Meretz Wastewater Treatment Facility (Section 1.6.8.3) or fall somewhere in the range between them. Correspondingly, the level of seismic risk associated with each risk factor except for tsunami (see below) is similar to that described for the facilities on the coast and the treatment facility, and/or is located in the range between them. The maximum expected acceleration values along these segments according to Keller et al., (2011) are in the range of 0.11g and 0.12g in the west and east of the segment, respectively.

1.6.8.2.1 Appearance of a tsunami

The pipeline alignment is planned to connect to the Neurim entry array at an elevation of (approximately) 23 meters and therefore no tsunami strike is expected to impact its length.

1.6.8.3 Treatment facility

The Meretz Wastewater Treatment Facility alternative ("Meretz Wastewater Treatment Facility alternative") is located in the Sharon coastal plain on the banks of Nahal Ometz (Wadi Mubala). The alternative is located to the east of the kurkar ranges (Figure 1.6.1-3) on a soft rocky subsoil that comprises a layer of clay and silt which we can see on the surface, and its thickness is 0-20 meters and sand and silt layers located under the clay layer and exposed in the surface in the east area of the alternative. The total thickness of the sand and silt layers is 50-55 meters. At the base of the soft sub-base, we find calcareous sandstones (kurkar) and pebbles. The total thickness of the sandstone unit, which becomes thinner as one moves westwards, is about 15 meters (Acre, 1999; Figure 1.6.8-1). The sandstone and the soft units belong to the Rehovot formation dated to the Holocene-Pleistocene era. At the base of the section we find silt and clay from a marine origin that probably belong to the Sakia group (the Yafo-Beit Guvrin formations) dated to the Pliocene-Miocene.

1.6.8.3.1 The creation of acceleration and the application of horizontal forces to structures and infrastructure in accordance with Israeli Standard 413

The values of the horizontal soil accelerations expected at the Meretz Wastewater Treatment Facility alternative are presented in Table 1.6.8-2. The values marked in red were used as input for calculating the response spectrum.

Table 1.6.8-2: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event at the Meretz Wastewater Treatment Facility

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Arava	Horizontal	6.5	0.05	6.9	0.06	7.3	0.07
Yammouneh	Horizontal, normal at the south end	7.8*	0.08	7.8*	**0.08**	7.8*	0.08
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.04	7.2	0.05	7.2	0.05
Carmel	Normal	5.8	0.05	6.1	0.05	6.5*	0.08
Gilboa	Normal	5.8	0.03	6.1	0.04	6.6	0.06
Keller et al., 2011			0.08		**0.09**		0.12

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.8.3.2 Rupture of the surface on top of active geological faults

The closest active fault to the area of the Meretz Wastewater Treatment Facility alternative is the Akeda fault, which is about 23 km distant from the area of the array (Figure 1.6.1-1). The edge faults of the Dead Sea Rift, which constitute a significant seismic rift in the region, are about 50 km distant from the area of the array. According to IS 413 there is no limitation on development and construction in the area of the Dor North alternative in everything that relates to an active fault and the rupture of the surface.

1.6.8.3.3 Amplification of soil vibrations due to geological and topographic conditions

The soft fill within the area of the Meretz Wastewater Treatment Facility alternative comprises sand, silt and clays at a thickness of 50-70 meters. The sands and the clays in this area are classified by Katz et al. (2008) as D type soil (in accordance with IS 413). According to Zaslavsky et al. (2009), the velocity of the shear waves in Holocene era clays is about 160-250 m/s, i.e. on the boundary of the D-E classification. Since the age of the units is young (Holocene) and there is no direct geotechnical information available, the soil should be classified as either type D or E in accordance with IS 413.

When all the data are weighted, the conclusion is that the site factors at the Dor alternative are F_a=1.6 and F_a=2.5 for soils of types D and E (respectively) for structures with short cycle times; and F_v=2.4 and F_v=3.5 for soils of types D and E (respectively) for structures with long cycle times. The maximum amplification coefficient, A, according to Zaslavsky et al. (2003) in the Meretz Wastewater Treatment Facility alternative area is A=2-4 (Figure 1.6.4-2). The spectral design accelerations for type D and type E soils in the Meretz Wastewater Treatment Facility alternative for an earthquake recurring in a 975-year cycle, with a restraining factor of 5%, are presented in Figure 1.6.8-2.

1.6.8.3.4 Damage to the stability of slopes and landslides

The slope gradient in the Meretz Wastewater Treatment Facility alternative and its environs does not exceed 5° and according to the map delineating the vulnerability of slopes to failure, the array is located in an area with negligible vulnerability. Thus, no damage to the stability of the slope and/or landslide is expected within the area of the alternative following a seismic event.

1.6.8.3.5 The probability of soil failure phenomena as a result of liquefaction

The Meretz Wastewater Treatment Facility alternative is located on a soft sedimentary bedding comprising sand and clay. The sandy units (including silt) are exposed on the surface, and they are located at a depth shallower by 20 meters in the east part of the alternative. In its west part, a layer of silt and/or clay covers the sand units at a thickness of about 20 meters (Figure 1.6.8-1). Moreover, in this area the groundwater is located within the coastal aquifer and its level is about 1-8 meters below the surface. The expected soil acceleration in the area of this alternative is 0.08-0.12g for the various reference events. Because of said conditions, there is a potential for liquefaction within the east area of the alternative. Figure 1.6.3-2 shows that for the maximum magnitude of the Yammouneh fault and the Carmel fault and a similar distance to that between the treatment facility and these faults, liquefaction events

have been documented. For this reason, we cannot rule out the possibility of liquefaction within the treatment facility area.

1.6.8.3.6 Appearance of a tsunami

The Meretz Wastewater Treatment Facility alternative is located about 8.5 km from the shoreline. For this reason and because of its topographic elevation, a tsunami is not expected to impact its area.

1.6.8.4 Pipeline alignment from the treatment facility

1.6.8.4.1 The formation of accelerations and the exertion of horizontal forces on structures and infrastructures according to Israeli Standard 413

The horizontal soil acceleration values expected along the alignment of the pipeline extending from the Meretz Wastewater Treatment Facility are presented in Table 1.6.8-3.

Table 1.6.8-3: Magnitude Values Calculated for the Reference Events and Soil Acceleration Values for each Reference Event for the East Edge of the Pipeline extending from the Meretz Wastewater Treatment Facility

Fault	Motion Mechanism	Recurrence Periods and Corresponding Maximum Accelerations					
		M 475y	PGA	M 975y	PGA	M 2475y	PGA
Cypriot arc	Reverse	6.9	0.01	7.1	0.02	7.4	0.02
Jericho	Horizontal	6.5	0.06	6.9	0.06	7.3	0.07
Arava	Horizontal	6.0	0.01	6.3	0.01	6.7	0.02
Yammouneh	Horizontal, normal at the south end	7.8*	0.09	7.8*	0.09	7.8*	0.09
Roum	Horizontal	7.2*	0.04	7.2*	0.04	7.2*	0.04
Rechaya	Horizontal	6.6	0.04	7.2	0.05	7.2	0.05
Carmel	Normal	5.8	0.05	6.1	0.06	6.5*	0.09
Gilboa	Normal	5.8	0.03	6.1	0.04	6.6	0.06
Keller et al., 2011			0.08		0.10		0.13

*Maximum magnitude. In these cases the magnitude calculated for the reference event is higher than the maximum magnitude estimated for the fault, and for this reason the soil acceleration calculations were carried out in accordance with an attenuation of the maximum magnitude.

1.6.8.4.2 Rupture of the surface on top of active geological faults

The pipeline alignment extending from the Meretz Wastewater Treatment Facility is planned in an area where no active faults exist (Figure 1.6.1-1; Section 1.6.8.3.2). Therefore, according to IS 413 there is no limitation on development and construction along the pipeline alignment in anything that relates to an active fault and the rupture of the surface.

1.6.8.4.3 Amplification of soil vibrations due to geological and topographic conditions

The alignment of the piping extending from the Meretz Wastewater Treatment Facility is planned to pass over ridges comprising hard sediments and troughs with soft sediments (sand, silt and clays). The thickness of the soft sediments is in the range of 0-60 meters and the extent of expected amplification along the pipeline alignment changes according to such thickness. The maximum amplification factor according to Zaslavsky et al. (2003) along the pipeline alignment extending eastwards from the Meretz Wastewater Treatment Facility is A=2-3 (Figure 1.6.4-2).

1.6.8.4.4 Damage to the stability of slopes and landslides

The slope gradient in the area of the pipeline alignment extending from the Meretz Wastewater Treatment Facility does not exceed 5° and therefore no damage to the stability of the slope and/or landslide is expected along the pipeline's alignment following a seismic event.

1.6.8.4.5 The probability of soil failure phenomena as a result of liquefaction

The pipeline alignment extending from the Meretz Wastewater Treatment Facility is located over a bed of sand, silt and clay of varying thicknesses. Moreover, in this area the groundwater is located within the coastal aquifer and its level is 8-25 meters below the surface. Because of the conditions described, there is potential for liquefaction along the pipeline alignment. According to Salamon et al. (2008) the west part of the pipeline alignment extending from the Meretz Wastewater Treatment Facility is located in an area where the sensitivity to liquefaction is extremely low (Figure 1.6.4-3). In Figure 1.6.3-2, we can see that for the maximum magnitude of the Yammouneh fault and the Carmel fault, and a similar distance to that of the pipeline alignment from these faults, liquefaction events have been documented. For this reason, we cannot rule out the possibility of liquefaction within the coastal entry array area.

1.6.8.4.6 Appearance of a tsunami

Because of its distance from the shore and its topographic elevation, no tsunami strike damage is expected in the alignment of the pipeline extending from the treatment facility eastwards.

Figure 1.6.1-1: The Alternatives of the Onshore and Coastal Array on the Background of a Geographical-Geological Orientation Map

Figure 1.6.1-2: Schematic Section

Figure 1.6.1-3: The Alternatives of Onshore Array on the background of a Geological Map

Figure 1.6.2-1: The Alternatives on the Background of the Dispersion of Quake Foci and a Bathometric Map

Figure 1.6.2-2: The Alternatives on the Background of the Dispersion of Quake Foci

Figure 1.6.2-3: The Lebanese Shear Band

Figure 1.6.4-1: The Entrance Array to the Dor Shore

Figure 1.6.4-2: The Alternatives of the Onshore Array on the Background of a Map of Maximum Attenuation

Figure 1.6.4-3: Alternatives of the Onshore Array on the Background of a Liquefaction Sensitivity Map

Figure 1.6.4-4: A Geological Section Depicting the Units in the Subsoil in the Dor North Alternative Area

Figure 1.6.4-5: The Spectral Design Accelerations for Type D and Type E Soils within the Area of the Dor North Alternative

Figure 1.6.5-1: The Ein Ayala Alternative on the Background of a Geological Map

Figure 1.6.5-2: The Spectral Design Accelerations for the Rocky Sub-base in the Area of the Ein Ayala Alternative

Figure 1.6.5-3: Layers and Units of the Ein Ayala Alternative

Figure 1.6.6-1: The Hagit Alternative on the Background of a Geological Map

Figure 1.6.6-2: Spectral Design Accelerations for the Rocky Sub-base within the Hagit Alternative Area

Figure 1.6.7-1: The Entrance Array to Michmoret Beach and Nahal Alexander on the Background of an Aerial Photograph

Figure 1.6.7-2: Geological Section Depicting the Units in the Subsoil in the Hadera Wastewater Treatment Facility Alternative Area

Figure 1.6.7-3: Spectral Design Accelerations for Type C, D and E Soils within the Hadera Wastewater Treatment Facility Alternative

Figure 1.6.8-1: Geological Section Depicting the Units in the Subsoil within the Meretz Wastewater Treatment Facility Alternative Area

Figure 1.6.8-2: Spectral Design Accelerations for Type D and Type E Soils within the Meretz Wastewater Treatment Facility Alternative Area

1.7 Hydrogeology and Soil

**Note: In this chapter the topical section numbering differs from the numbering of the Survey guidelines, though all of the required guideline information is present in the chapter. The chapter starts with an explanation of the testing methodology, in accordance with the Survey guidelines' required parameters, while Sections 1.7.1-1.7.5 describe the various alternatives for these parameters.*

This chapter presents an overview of the relevant surface and subsurface elements in the alternative's area, the coastal entry array and the pipeline route. The aim is to provide a picture of the current hydrologic and hydrogeologic status of the work area, for use in assessing and evaluating the alternatives. In accordance with the guidelines received from the Ministry of Environmental Protection (Sections 1.7.1-1.7.4 of the guidelines), the following elements were surveyed: the natural and man-made drainage system, wells and protection zones, groundwater contamination, engineering and hydraulic properties of the soil, and the surface/subsurface hydrologic system and its sensitivity to surface contamination. Embedded in the Survey are references to the illustrations required for presentation of the data. The Survey data are based on the soil group map, topographical and geological maps, aerial photographs, information on wells and their protection zones (from the Ministry of Health), geological cross-sections, water quality data from the Hydrologic Service, and data on precipitation and flow from hydrometric stations. The Survey also refers to the instructions and maps appended to the relevant national route plans, noted below. The survey provides a basis for comparison between the various location alternatives, for assessing the environmental impact of the facilities' construction, and for proposing instructions for minimizing any potential harm to the groundwater, in the framework of the survey's following chapters.

This chapter of the Survey is divided into three topics:

A. Soil and drainage

This section presents an overview of the current status of the work area, based on an investigation of 4 hydrological parameters: drainage basin, precipitation data, soil type, and soil penetrability, against the background of the NOP 34/B/3 maps. After the parameters are assessed, the design flow rate for runoff is calculated. There are several methods and formulas for calculating peak storm flow rates. Each has advantages and disadvantages. The choice of an appropriate calculation method for a given instance depends on a number of factors, such as:

- The quantity of data needed for the calculation

- The precision and reliability of the data available to the engineer
- The type (zoning) of the drainage basin area
- The size of the drainage basin area
- The surface cover composition of the drainage basin area.

After taking the above factors into account, and with attention to the size of the drainage basins (very small basins of up to 1-2 sq. k.), it was decided to calculate the peak storm flow rate for purposes of the aforementioned report via the rational method and per a statistical hydrological model that was developed by C. Gatker and S. Pollack (2005).

The criteria according to which the alternatives were ranked were: proximity to streams, presence of an existing drainage system nearby, and the size of the drainage basin. Also, soil penetrability values were used to determine the nature of the hydraulic barrier between the surface and the groundwater.

For the coastal entry points, the assessment criterion is the presence of the site under investigation within a national route plan area or stream flood zone.

B. Hydrogeology

This section describes the current subsurface situation at the alternative under assessment, with an emphasis on the following hydrogeological parameters:

- Local subsurface cross-section
- Nature of the regional aquifer
- Groundwater quality
- Groundwater elevation
- Produced water and reinjection
- Wells and protection zone data

Quantification of the relative effect of each parameter on the work area's hydrologic sensitivity will be done via a linear model, as part of the alternative assessments in Chapter 2 of the Survey.

For the coastal entry points the criteria for comparing the alternatives are groundwater level, soil type and flow directions.

For the pipeline route, the criteria to be used when comparing the alternatives are the presence of wells along the route, overlap of potable water well protection zones, and relation to aquifer.

C. Hydrological sensitivity

In addition to the hydrological parameters noted in the previous section, and for purposes of assessing the various alternatives' relative hydrological sensitivity, weight was also given to three maps, anchored in route plans and legislation, that describe the aquifers' hydrological sensitivity to contamination, on a national scale:

- The Water Resource Conservation Area featured in NOP 35 – Construction, Development and Conservation (Chapter 10.2) – providing planning instructions for groundwater conservation in areas designated conservation areas.
- The Fuel Contamination Danger Zones Map (Water Authority, 1992) – The map divides the country into five surface contamination sensitivity ratings. The map is used to define danger zones in the Water Regulations (Prevention of Water Pollution) 5764-2004.
- The Groundwater Vulnerability Zones Map featured in NOP 34/B/4 – Surface Water Pooling, Reinjection, Enrichment and Protection of Groundwater – Divides the country into zones on the basis of four groundwater vulnerability ratings.

A weighting of the work area hydrological sensitivity, according to local parameters and the national maps, is provided in Chapter 2 of the Survey, as part of the alternatives assessment.

Dor Array

1.7.1 Dor North

The Dor North alternative is located on the Hof HaCarmel coastal plain, in a structural and topographical valley between kurkar ridges (*marzeva*), within the drainage basin of Nahal Dalia, belonging to the Carmel Drainage Authority. The alternative lies 2 kilometers from the Mediterranean coast and its elevation in relation to sea level is 10 meters (Figure 1.1.1.1). Between the area and the beach lies a north-south kurkar ridge whose elevation reaches over 30 meters above sea level (Figure 1.6.1-3). To the west are fish farms, to the southwest is the Nir Etzion wastewater treatment facility, while to the south and east the area is surrounded by agricultural fields. The nearest hydrometric station is the Dalia-Bat Shlomo Station (No. 12130).

1.7.1.1 Coastal entry array

The location of the Dor North coastal entry point is described in Figure 1.6.4-1. The point extends from west to east across non-cohesive sand, a kurkar ridge and a

valley containing a layer of silt, beneath which lies the coastal aquifer (Figure 1.6.4-4).

A. Soil and drainage

Within the site are fish farms near the coastal highway; Nahal Dalia flows on its southeastern side. A bridge stands at the point where the stream intersects Zichron Yaakov Interchange, southeast of the site.

B. Hydrogeology

The groundwater elevation in the entry point area ranges from 0 to 0.5 meters above sea level. The anticipated groundwater flow direction is from east to west.

C. Hydrologic sensitivity

The entry point's hydrologic sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The entry point area is not designated a water resource conservation area (Figure 1.7.1.1-1)
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The point falls within Area B, which is designated a *primary aquifer in which damage can be repaired* or a *secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) ranking for vulnerability (Figure 1.7.1.1-3).

1.7.1.2 Pipeline route to the treatment facility

A. Soil and drainage

The pipeline route to the Dor North alternative (Figure 1.7.1.2), which lies 2 km northeast of the entry point, intersects an internal channel located in the southeastern part of the alternative. There are no streams or flood zones along the pipeline route.

B. Hydrogeology

The pipeline route leads northward after intersecting the Coastal Road, in the Dor C drilling area and the Dor B fish farm (Figure 1.7.1.2). No protection zones overlap with the pipeline route. Most of the pipeline is in alluvial units, with a small portion in a kurkar ridge (Figure 1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – Half of the pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The alternative falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) ranking for vulnerability (Figure 1.7.1.1-3).

1.7.1.3 Treatment facility

A. Soil and drainage

1. Hydrological data

a. Drainage basin

The drainage basin extends to the north of the site. Due to its low-lying location, in a local depression, the rainwater that flows from the east via a water conduit that intersects Highway 4 in the direction of the site and that drains into a local drainage channel that connects with the protection drainage channels (Figure 1.7.1.3-1). We can see that a number of fish farms are situated on the western side of the site. On the southwestern side there are several protection drainage channels. An area surrounding the basin features orchards and numerous agricultural crops.

b. Area rainfall data

The Geva Carmel monitoring station (No. 60) is located near the site and was chosen as a representative station. This station has been active for 14 years, providing a sufficiently lengthy observation period to ensure stable statistical parameters for assessing the intensity of low-probability rainfall.

Table 1.7.1.1**: Geva Carmel Station (No. 60) – Rainfall Intensity over Different Time Periods**

עוצמות גשם(מ"מ/שעה) לפרקי זמן שונים (דקות)										הסתברות
5	10	15	20	30	45	60	90	120	180	
270.7	179.5	158.8	155.3	128.3	97.5	77.9	70.6	47.4	29.9	1%
232.0	156.3	136.8	131.4	108.1	81.9	65.1	57.2	38.9	24.5	2%
184.9	127.3	109.6	103.0	84.1	63.5	50.0	41.9	29.0	18.2	5%
152.9	107.6	91.2	83.8	68.1	51.2	39.7	32.3	22.7	14.2	10%
123.0	88.6	73.9	66.3	53.4	40.0	30.4	23.8	17.0	10.6	20%

Rainfall Intensity (mm/hour) over Different Time Periods Probability

c. Soil classifications

Per the soil groups map, most of the soil in the planning area that served as a basis for hydrologic assessments is of types A (A1, A2, A3, A4), B (B1) and H (H1, H4, H7) (Figure 1.7.1.3-2).

Breakdown as follows:

- **A1, A2** – terra rossa
- **A3**, **A4** – terra rossa and rendzina
- **B1** – brown rendzina
- **H1** – brown gromosol
- **H4** – hydromorphic gromosol
- **H7** – colluvial soil

d. Permeability

The basin extends over brown gromosol soil (H1); this kind of soil quickly becomes impermeable to water, has a low permeability rate, and a high runoff coefficient C=0.5.

2. Calculating rate of flow – via the rational method

We will make use of a model for calculating the maximum flow rate that was developed by C. Gatker and S. Pollak. This method is used for calculations pertaining to areas larger than 5.0 sq. km. Thus a flow rate is calculated for a 5.0 sq. m. area and for the drainage basin area (2.5 sq. km.) per area ratio.

Table 1.7.1.2: Calculation per statistical hydrological model for 5.0 sq. km

Station	Basin area (sq. km.) A	Gradient	Statistical parameters			Peak flow rate (m^3/second) Different probabilities			
			Avg.	Cv	Cs	10%	5%	2%	1%
Dalia Bat Shlomo	5	0.06	0.6	0.45	-0.48	13.4	17.8	23.9	28.7

Table 1.7.1.3: Calculation per area ratio

Basin no.	Basin area (sq. km.) A	Peak flow rate (m^3/second)			
		10%	5%	2%	1%
1	5	13.4	17.8	23.9	28.7
2	2.5	9.5	13.2	16.9	20.3

B. Hydrogeology

Subsurface Cross Section 8 of Hof HaCarmel (Michelson, 1970), presented in Figure 1.6.4-4, is based on the wells adjacent to the alternative. In accordance with the lithological cross section we may define two hydrogeological units under the area:

At the top of the cross section there is a layer composed of silt and clay, from the surface to a depth of 20 meters. This layer constitutes an aquiclude that separates the ground from the groundwater. Water leaks from the fish ponds and from the agricultural fields in the area may cause phreatic horizons to develop.

Under this layer we can discern the Pleistocene coastal aquifer, made of kurkar (sandy kurkar and chalky sandstone) 20-30 meters thick. The piezometric groundwater level of the coastal aquifer in the area is 4 meters above sea level, and the water salinity is 400 mg/L (Hydrological Service, 2011).

In the area no wells were found, but in the direction of the subsurface flow (westward) several private wells were found that appear to produce water for agriculture (Figure 1.7.1.2).

C. Hydrological sensitivity

The alternative area's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The area is designated as a water resource preservation zone (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The alternative falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) ranking for vulnerability (Figure 1.7.1.1-3).

Pipeline route from the treatment facility

The treated gas will be transmitted from the treatment facility via the existing Dor-Hagit gas route; there is no need to locate an additional pipeline route.

1.7.2 Ein Ayala

The Ein Ayala alternative is located in a stone quarry north of Fureidis, at the foot of a mostly artificial cliff that constitutes the boundary of the western slopes of Mount Carmel. The alternative is 4 kilometers from the Mediterranean coast and its elevation is 30 meters above sea level (Figure 1.1.1.1). The area is surrounded by thickets to the east and by agricultural fields to the north and south (Figure 1.1.1.3). The alternative lies in the Nahal Dalia drainage basin, which belongs to the Carmel Drainage Authority; the closest hydrometric station is Dalia Bat Shlomo (No. 12130).

1.7.2.1 Coastal entry array

See Section 1.7.1.1

1.7.2.2 Pipeline route to the treatment facility

For the pipeline segment between the entry point to the Dor alternative, see Section 1.7.1.2.

1. Hydrological data

A. Soil and drainage

There are no stream or flood zones along the pipeline route.

B. Hydrogeology

The pipeline route passes near the Ma'agan Michael Ytong well and within the radius of the Hof HaCarmel Well 2 (Figure 1.7.1.2). Most of the pipeline passes along alluvial units, with a small portion passing along a kurkar ridge (Figure 1.6.1.3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – 80% of the pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The alternative falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) ranking for vulnerability (Figure 1.7.1.1-3).

1.7.2.3 Treatment facility

A. Soil and drainage

a. Drainage basin

The drainage basin extends west of the watershed line northeast of the site. The site surrounds a local elevation point. Rainwater flows from east to west, and drains via existing drainage channels (Figure 1.7.2.3-1).

b. Area rainfall data

A monitoring station located near the site was chosen as a representative station – the Geva Carmel Station (No. 60); see Section 1.7.1.3.

c. Soil classification

Per the Soil Groups map, Figure 1.7.1.3-2, the soil composition is similar to that of the Dor North exploration area – see Section 1.7.1.3.

d. Permeability

The drainage basin extends over soil of the terra rossa and rendzina type (A4). This kind of soil has a high permeability rate and a low runoff coefficient C=0.16 (Figure 1.7.1.3-2).

2. Flow rate calculation – via the rational method

Per the rational method, the peak flow rate from storm rainfall is calculated using the following formula:

Q=C*I*A/3.6

Q = Peak flow rate (m^3/second)

C = Flow rate coefficient. Expresses the nature and attributes of the drainage basin (dimensionless)

I = Design storm intensity (mm/hour)

A = Drainage basin area attributed to the calculation point (sq km)

As is known, the flow rate coefficient is affected by many factors, such as soil attributes, land uses, vegetation, gradient, drainage area, and more. As yet there are no official guidelines for determining the flow rate coefficient. The flow rate coefficients obtained from other countries are not necessarily consistent with Israeli conditions.

Israeli publications on determining runoff coefficients generally relate only to high probability events.

A 10 minute concentration period was taken for the calculation.

Concentration of calculation results per the rational formula

Basin no.	**Basin area (sq. km) A**	**Concentration period Minutes Tc**	**Rainfall intensity mm/hour**			**Flow rate coefficient C**	**Peak flow rate (m^3/hour), different probabilities**		
			10%	**5%**	**2%**		**10%**	**5%**	**2%**
1	0.065	10	108	127	156	0.16	0.31	0.37	0.45

A - Drainage basin area

Tic - Concentration time

I - Rainfall intensity

C - Flow rate coefficient

Q - Design flow rate

B. Hydrogeology

The geological map shows that the area lies directly above the calcareous-chalky Talmei Yaffe formation of the Yehuda Group (Figure 1.6.5.1). In this area, Yehuda Group rock descends westward below the surface and, accordingly, the aquifer's containment line is located to the east of the area. Hydrological sensitivity is therefore assessed in relation to the Yehuda Group aquifer which, as noted, lies with no hydrological barrier under the area. The groundwater elevation in the area is 4 meters above sea level and water salinity is 400 mg/l (Hydrological Service, 2011). In the field unit defined for the survey, no wells were found; but 130 meters from the area's southwestern boundary lies Hof HaCarmel Well 2, which penetrates the Yehuda Group aquifer, whose Protection Radius B encompasses the area (Figure 1.7.1.2). The well has not been used since 2002; during the first half of 2010 Mekorot indicated that there are plans to reactivate it (Environmental Impact Survey for Tamar and Dalit Wells, 2010). The restrictions on construction in the well protection areas are set forth in the Public Health Regulations (1995).

C. Hydrological sensitivity

The alternative area's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The area is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The alternative falls within Area A, which is designated a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) ranking for vulnerability (Figure 1.7.1.1-3).

1.7.2.4 Pipeline route from the treatment facility

The treated gas will be transmitted from the treatment facility via the existing Dor-Hagit gas route, with no need to locate an additional pipeline route.

1.7.3 Hagit East

The Hagit alternative is located near the IEC's Hagit power station, north of Nahal Tut which divides the northern Carmel from the Menashe Syncline, in the Nahal Dalia drainage basin belonging to the Carmel Drainage Authority. The alternative is 11 kilometers from the Mediterranean coast and its surface elevation in relation to sea level ranges from 130 to 200 meters (Figure 1.1.1.1). The area is surrounded by open land, some of it pasture. The nearest hydrometric station is Dalia Bat Shlomo (No. 12130).

1.7.3.1 Coastal entry point

See Section 1.7.1.1

1.7.3.2 Pipeline route to the treatment facility

1.7.3.2.1 Northern alternative

A. Soil and drainage

After leaving the treatment facility, the pipeline continues 11 km northeast until it connects with the treatment facility near the Hagit power station. The pipeline route does not pass through stream or flood zones.

B. Hydrogeology

The pipeline route passes near the Ma'agan Michael Ytong and lies within the protective radius of the Hof HaCarmel 2 well (Figure 1.7.1.2). Half of the pipeline route is located above a cross-section of the chalky Mount Scopus Group, while the other half is above units of the Yehuda Group and an alluvial group (Figure 1.6.1-3). Before the pipeline from the treatment facility is connected to the Gezer-Hagit gas line, the pipeline will be submerged in aquitard units from the Avdat Group over an area of several hundred meters, at the head of the subsurface drainage basin of the Nahal Tut streams. The groundwater elevation in this unit reaches the surface in some places (Bar, 2004).

C. Hydrological sensitivity

The pipeline's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The entire pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area where the pipeline route lies on Yehuda Group rocks (a third of the route) is designated as Area A – a *primary aquifer in which damage is irreparable* . The rest of the route falls within Area B – a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – Half of the route has an A or A1 (highest) rating for vulnerability, while the other half has a B rating (Figure 1.7.1.1-3).

1.7.3.2.2 Southern alternative

A. Soil and drainage

Two kilometers from the Dor North alternative, from the northeast, a spur splits off from the pipeline via the southern alternative; after 5 km the lines reunite until the linkup with the Hagit-Gezer national gas supply pipeline. The pipeline route does not pass through stream or flood zones.

B. Hydrogeology

The pipeline route passes near the Ma'agan Michael Ytong well and within the protection radius of the Hof HaCarmel 2 well (Figure 1.7.1.2). Two-thirds of the route lie above a cross-section of the chalky Mount Scopus Group and alluvial units, while one-third lies above units of the Yehuda Group (Figure 1.6.1-3). In the Bat Shlomo area, over a distance of 2 kilometers, the route passes within aquitard units of the Avdat Group along the slope of the Nahal Tut drainage basin, and, for a distance of several hundred meters, connecting with the Gezer-Hagit gas line, at the head of the Nahal Tut subsurface drainage basin. The groundwater elevation in this unit reaches the surface in places.

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The entire pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area where the pipeline route lies on Yehuda Group rocks (a third of the route) is designated as Area A – a *primary aquifer in which damage can be repaired.* The remaining two-thirds of the route fall within Area B – a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – Half of the route has an A or A1 (highest) rating for vulnerability, while the other half has a B rating (Figure 1.7.1.1-3).

1.7.3.3 Treatment facility

A. Soil and drainage

1. Hydrological data

a. Drainage basin

There are two drainage basins at the Hagit East site:

Area A1 – located on the site's northern side and extends parallel to the watershed line. The basin drains into a local wadi which flows in a southwesterly direction.

Area A2 – located on the site's southeastern side and drains in the direction of Nahal Ein Tut, which flows parallel to Highway 70.

There is an elevation point at the site that causes rainwater to accumulate in the site's southern portion (Figure 1.7.2.2-1). The basins are in a dry pit area, an abandoned area that lies unused.

b. Area rainfall data

The Even Yitzhak (Gilad) monitoring station (No. 22) is located near the site and was chosen as a representative station. This station has been active for 46 years, providing a sufficiently lengthy observation period to ensure stable statistical parameters for assessing the intensity of low-probability rainfall.

Table 1.7.3.1: Even Yitzhak (Gilad) Station (No. 22) – Rainfall Intensity over Different Time Periods

Rainfall Intensity (mm/hour) over Different Time Periods										Probability
עוצמות גשם(מ"מ/שעה) לפרקי זמן שונים (דקות)										הסתברות
5	10	15	20	30	45	60	90	120	180	
235.3	192.5	160.2	138.4	90.8	56.9	44.7	30.3	25.8	20.7	1%
208.0	162.9	134.9	115.4	78.1	50.5	39.6	27.0	22.8	18.0	2%
173.1	128.6	105.6	88.9	62.4	42.3	32.9	23.0	19.0	14.7	5%
148.3	105.6	86.1	71.8	51.9	36.4	28.2	19.9	16.3	12.3	10%
123.0	85.2	68.9	56.7	42.0	30.4	23.5	16.9	13.6	9.9	20%

c. Soil classifications

According to the group map (Figure 1.7.3.3-2), most of the soil in the planning area that served as a basis for hydrological assessments is of types A (A2, A3, A7), and B (B2, B3 B4).

Breakdown as follows:

- **A2, A7** – terra rossa
- **A3** – terra rossa and rendzina
- **B2, B3** – brown rendzina
- **B4** – brown rendzina and light rendzina.

d. Permeability

The drainage basin extends over soil of the brown rendzina type (B2). This kind of soil quickly becomes impermeable to water, has a low penetration rate and a high runoff coefficient C=0.32.

2. Flow rate calculation – via the rational method

Per the rational method, the peak flow rate from storm rainfall is calculated using the following formula:

Q=C*I*A/3.6

Q = Peak flow rate (m^3/second)

C = Flow rate coefficient. Expresses the nature and attributes of the drainage basin (dimensionless)

I = Design storm intensity (mm/hour) per Table 1.7.3.3

A = Drainage basin area attributed to the calculation point (sq km)

As is known, the flow rate coefficient is affected by many factors, such as soil attributes, land uses, vegetation, gradient, drainage area, and more. As yet there are no official guidelines for determining the flow rate coefficient. The flow rate coefficients obtained from other countries are not necessarily consistent with Israeli conditions.

Israeli publications on determining runoff coefficients generally relate only to high probability events.

A 10 minute concentration period was taken for the calculation.

<u>Table 1.7.3.2: Calculation results per the rational formula</u>

Basin no.	**Basin area (sq. km) A**	**Concentration time Minutes Tc**	**Rainfall intensity mm/hour I**			**Flow rate coefficient C**	**Peak flow rate (m^3/hour), different probabilities**		
			10%	**5%**	**2%**		**10%**	**5%**	**2%**
1	0.37	10	106	129	163	0.32	3.49	4.24	5.36
2	0.09	10	106	129	163	0.32	0.85	1.03	1.3

A - Drainage basin area
Tc - Concentration time
I - Rainfall intensity
C - Flow rate coefficient
Q - Design flow rate

B. Hydrogeology

At the surface in the exploration area is a narrow soil layer of up to 10 cm in the ranges and hills and up to 50 cm in the valleys that separates the aquifer rock from the surface and constitutes a poor hydraulic barrier for the upper aquifer (Bar, 2004). Under this layer, beneath the area, one can discern, in the soil cross section (Figure 1.7.3.3-3) three hydrogeologic units:

1. At the top of the cross section is a 30-50 meter layer composed of calcite, chalk and marlstone that constitutes the Eoscene Avdat Group aquitard. This unit thins out as one moves northwest, until it disappears in the area that lies northwest of the Hagit power station. This area is characterized by many subsurface solution cavities that conduct the rainwater that seeps into the soil to the nearby springs. The springs fed by this aquifer are local phreatic springs, meaning that their flow is seasonal. The springs indicate that the elevation of the phreatic groundwater converges with the surface elevation. This layer's overall hydraulic conductivity is moderate. The salinity of the water in the upper aquifer that flows into the springs is less than 100 mg/L (Bar, 2004).
2. Beneath this layer one can discern the Mount Scopus Group aquiclude, composed of calcite and marlstone 30-40 meters thick.
3. The Yehuda Group aquifer lies 70 meters below the surface and, as noted, is separated from the Avdat Group aquitard by the Mount Scopus Group aquiclude.

When calculating hydrological sensitivity, we referred solely to the upper aquifer (the Avdat aquitard).

In the field unit designated for survey, no wells were found; 800 meters east of the area is Menashe Well 1 (Figure 1.7.1.2).

C. Hydrological sensitivity

The area's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The area is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The alternative falls within Area B, designated as a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).

- *Groundwater Vulnerability Zones* (NOP 34/B/4) – Half of the route has a B rating for vulnerability (Figure 1.7.1.1-3).

1.7.3.4 Pipeline route from the treatment facility

The route comes close to the Hagit power station and eastern gas transmission pipeline route, and does not include the laying of an additional route in this plan.

Hadera-Ne'urim Array

1.7.4 Hadera wastewater treatment plant

The Hadera WTP alternative is located south of Highway 65, near the urban industrial area, within and adjacent to the Nahal Hadera drainage basin, 4 km from the coast. The alternative's elevation relative to sea level ranges from 10 meters near the Nahal Hadera channels to 26 meters at Tel Zomera. The area is surrounded by fish farms and agricultural fields, as well as industrial plants and a wastewater treatment plant. The area is traversed by several water channels that connect the fish ponds. The alternative's eastern side is adjacent to and within the Nahal Hadera flood zone per NOP 34/B3, which belongs to the Sharon Drainage Authority. The closest hydrometric station is the Hadera-Gan Shmuel Station (No. 14120).

1.7.4.1 Coastal entry array

1.7.4.1.1 Nahal Hadera

A. Soil and drainage

The site is adjacent to and within the flood areas of Nahal Hadera per NOP 34/B3, which flows through the site while connecting with the Mediterranean Sea (Figure 1.7.4.1.1). On the site's northeastern side one can see the Caesarea Interchange. At the point where the stream intersects Highway 2 there is a bridge.

B. Hydrogeology

The point is situated on Aeolian sand (Figure 1.6.1-3) and the groundwater elevation is 0 meters above sea level. Due to the operation of the nearby Nahalei Menashe reinjection site (Figure 1.7.1.2), there is a hydrological crater nearby that could cause groundwater to flow from west to east.

C. Hydrological sensitivity

The entry point's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The entry area is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area falls within Area A, designated as a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.1.2 Michmoret

A. Soil and drainage

The site is on the coast; there are no streams in the vicinity.

B. Hydrogeology

The point is situated on Aeolian sand (Figure 1.6.1-3) and the groundwater elevation is 0-0.5 meters above sea level. The anticipated flow direction is from east to west.

C. Hydrological sensitivity

The entry point's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The entry area is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area falls within Area A, designated as a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.1.3 Nahal Alexander

A. Soil and drainage

The site lies near and within the flood zone of Nahal Alexander per NOP 34/B/3, which flows through the site while connecting with the Mediterranean Sea (1.7.4.1.2). On the site's southeastern side one can see the Yanai Interchange. Where the stream intersects Highway 2 there is a bridge.

B. Hydrogeology

The point is situated on Aeolian sand (Figure 1.6.1-3) and the groundwater elevation is 0-0.5 meters above sea level. The anticipated flow direction is from east to west.

C. Hydrological sensitivity

The entry point's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The entry area is designated as a water resource conservation area (Figure 1.7.1.1-1).

- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area falls within Area A, designated as a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.2 Pipeline route to the treatment facility

1.7.4.2.1 Route from Hadera

A. Soil and drainage

A kilometer east of the Hadera entry point, the pipeline intersects Highway 2 and continues another 1.5 kilometers to the intersection of Nahal Hadera and Highway 4. A bridge is situated at the site. The pipeline passes within the Hadera wastewater treatment plant and intersects Nahal Hadera. The pipeline route passes through a Nahal Hadera flood zone per NOP 34/B3.

B. Hydrogeology

Most of the pipeline route to the treatment facility passes through a sandy cross section, with a small part passing through a kurkar ridge (Figure 1.6.1-3). The pipeline corridor passes through an area of 6 wells (Nahal Hadera study 101-104, Hadera Heftsiba 53/1 and Hadera Bichar Lanir 3), with special authorization required for the latter from the Water Authority and the Ministry of Health, for construction within a 500 meter area (Figure 1.7.1.2), as it had been drilled before the Public Health Ordinance protection areas went into effect.

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – A third of the pipeline route falls within Area A, designated as a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while two thirds fall within Area B, a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* .
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.2.2 Route from Michmoret

A. Soil and drainage

The pipeline route along the Coastal Road does not cross stream areas but does pass near a quarry south of Hadera, where the groundwater table is exposed.

B. Hydrogeology

The additional segment beyond the route from Hadera passes near three wells (Hadera B 50, Hadera B 51/1, and Hadera 52/1) (Figure 1.7.1.2). Most of the pipeline passes above sand dunes, while a small portion of it passes above an alluvial unit and kurkar ridge (Figure 1.6.1-3). In the pipeline segment that extends along the Coastal Road, the groundwater elevation is close to the surface, as may be seen at the quarry to the east of the road.

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – A small portion of the pipeline route falls within Area A, designated as a *Primary aquifer in which Damage is irreparable* (Figure 1.7.1.1-2), while most of the route falls within Area B, a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* .
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.2.3 <u>The route from Nahal Alexander</u>

The route from the Nahal Alexander entry array moves eastward near the stream and turns northeast toward the Coastal Road; after 3 km it connects with the pipeline coming from the Michmoret entry array. To follow are the hydrological and hydrogeological properties, **in addition to the attributes noted in 1.7.4.2.3**.

A. Soil and drainage

The pipeline passes within the flood zone of Nahal Alexander per NOP 34/B3 (parallel to Nahal Alexander).

B. Hydrogeology

The additional segment for connection to the Nahal Alexander alternative passes near Herev Le'et Well 50/1, and most of it passes above a cross section of Aeolian sand (Figures 1.6.1-3 and 1.7.1.2).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – A small portion of the pipeline route falls within Area A, designated as a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while most of the route falls within Area B, a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* .
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.3 Treatment facility

A. Soil and drainage

A. Hydrological data

a. Drainage basin

There is no runoff drainage basin. The precipitation that reaches the area drains into Nahal Hadera which passes locally parallel to Highway 65, and flows in the southeastern portion of the wastewater treatment plant. Where the stream intersects Highway 4 there is a bridge. One must take into account the flow rate of the stream, which is a central stream at this site (Figure 1.7.4.3-1).

The Hadera Wastewater Purification Facility alternative lies on farmland; its western side is surrounded by fish ponds and most of its area is surrounded by a variety of agricultural crops.

b. Area rainfall data

The Ein Horesh monitoring station (No. 26) is located near the site and was chosen as a representative station. This station has been active for 45 years, providing a sufficiently lengthy observation period to ensure stable statistical parameters for assessing the intensity of low-probability rainfall.

Table 1.7.4: Ein Horesh Station (No. 26) – Rainfall Intensity over Different Time Periods

עוצמות גשם(מ"מ/שעה) לפרקי זמן שונים (דקות)										הסתברות
5	10	15	20	30	45	60	90	120	180	
187.2	121.8	102.2	94.2	79.8	57.7	46.2	35.0	28.5	22.5	1%
169.6	112.3	92.7	84.2	70.7	51.7	41.9	31.1	25.2	19.3	2%
146.9	99.5	80.7	71.3	58.8	44.0	36.0	26.3	20.9	15.3	5%
129.2	89.3	71.5	62.1	50.5	38.2	31.4	22.6	17.7	12.6	10%
110.5	78.3	62.0	52.7	42.2	32.2	26.6	18.9	14.5	10.0	20%

Rainfall Intensity (mm/hour) over Different Time Periods	Probability

c. Soil classifications

According to the group map, most of the soil in the planning area that served as a basis for hydrologic assessments is of types E (E1, E2, E3, E4), V (V1, V2, V4, V5) and H (H5) (Figure 1.7.4.3-2).

Breakdown as follows:

- **E1, E3, E4** – red loam
- **E2** – pararendzina
- **V1, V2, V4, V5** – shifting sand
- **H5** – brown gromosol

d. Permeability

Nahal Hadera passes through soil of the brown gromosol type (H5), which has a high permeability rate and a low runoff coefficient C=0.16.

B. Hydrogeology

Within the field unit cross section along Strip 1 in the Menashe streams area presented in Figure 1.6.7-2, one can see that below most of the area there is a 50 meter cross section composed of exchanges of continental clay, sand and muddy sand. This layer fills a kurkar "drainpipe" several tens of meters thick that constitutes the area's coastal aquifer. On the geologic map one can see that most of the area lies on the continental sediment of Nahal Hadera, but its northeastern portion lies directly on kurkar layers of high hydraulic conductivity, with no barrier between the surface and the aquifer (Figure 1.6.1-3). The thickness of the coastal aquifer beneath the alternative reaches, at its peak, 70 meters, while the area's

groundwater elevation is 2 meters below sea level. Water salinity is 200 mg/L (Hydrological Service, 2011).

The area falls within Protection Radius B of Nahalei Menashe Well 5 and within Protection Radius C of Gan Shmuel Demira Well B. Hadera Well 53/2 falls within the alternative area (Figure 1.7.1.2).

C. Hydrological sensitivity

The area's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The area is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area falls within Area A, designated as a *Primary aquifer in which Damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has a B rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.4 Pipeline route from the treatment facility

1.7.4.4.1 Northern alternative

A. Soil and drainage

Two kilometers east of the Hadera alternative the pipeline splits into northern and southern alternatives of the pipeline from the treatment facility. The northern alternative for the pipeline route passes a local wadi (which drains into Nahal Hadera) and connects with the Hagit-Gezer national pipeline 12 km farther along.

B. Hydrogeology

The pipeline route passes 11 wells, within Protection Radius C of 4 additional wells, and within Protection Radius B of one well (Figure 1.7.1.2). The entire pipeline route lies above a clay to clay-sandy (red loam) cross section (Figure 1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – Except for a small area in its eastern portion, the pipeline route falls within Area B, a

Primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable (Figure 1.7.1.1-2).

- *Groundwater Vulnerability Zones* (NOP 34/B/4) – Except for a small area in its eastern portion which has a low (C) vulnerability rating), the area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.4.4.2 Southern alternative

A. Soil and drainage

The pipeline intersects with Nahal Hadera at three places before it connects with the Hagit-Gezer national gas supply pipeline. The pipeline route passes along Nahal Hadera in a flood zone per NOP 34/B3.

B. Hydrogeology

The pipeline route passes 10 wells and through Protection Radius B of one well (Ma'anit 5A) (Figure 1.7.1.2). The entire pipeline route lies above a clay cross section (Figure 1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – Except for a small area in its eastern portion, the pipeline route falls within Area B, a *Primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – Except for a small area in its eastern portion which has a low (C) vulnerability rating), the area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.5 Meretz wastewater treatment plant

The Meretz Wastewater treatment plant alternative is located between Highway 4 and Highway 6, between Kibbutz HaMa'apil and Ein HaHoresh, a kilometer south of Highway 581. The area is 9 kilometers away from the Mediterranean coast and its elevation relative to sea level ranges from 16 to 30 meters. The alternative is surrounded by agricultural fields and lies north and west of the Meretz Wastewater treatment plant and the Emek Hefer sludge treatment facility. The alternative's southwestern segment is adjacent to and within the Nahal Ometz flood zone, a secondary tributary of Nahal Alexander, which lies within the impact zone per NOP

34/B 3, and belongs to the Sharon Drainage Authority. The nearest hydrometric station is the Alexander-Eliashiv Station (No. 15120).

1.7.5.1 Coastal entry array

For a description of the Nahal Hadera, Michmoret and Nahal Alexander coastal entry arrays, see Section 1.7.4.1.

1.7.5.1.1 Neurim

A. Soil and drainage

One can see that the site is on the coast, there are no streams in the vicinity. The site is near the Coastal Road.

B. Hydrogeology

The point is situated on Aeolian sand (Figure 1.6.1-3) and the groundwater elevation is 0-0.5 meters above sea level. The anticipated flow direction is from east to west.

C. Hydrological sensitivity

The entry point's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area falls within Area A, a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2).
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.5.2 Pipeline route to the treatment facility

1.7.5.2.1 The route from Hadera

The segment that connects the Hadera alternative to the entry point at Michmoret was described in 1.7.4.2.2. The attributes of the additional segment are noted below:

Northern alternative

The segment that connects the Hadera alternative with the Michmoret entry point was described in 1.7.4.2.2. The attributes of the additional segment are noted below:

A. Soil and drainage

The pipeline passes near Birket Ata, which drains runoff. The pipeline route does not traverse stream areas.

B. Hydrogeology

The pipeline route passes along 20 wells and Zita wells 1 and 2 B protection zones (Figure 1.7.1.2). Most of the route passes above clay-sandy units, while a small portion passes above sand and kurkar (Figure 1.6.1-3).

C. Hydrological sensitivity

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – A third of the pipeline route falls within Area A, a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while two thirds fall within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable .*
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

<u>Southern alternative</u>

A. Soil and drainage

The pipeline passes along the track of Nahal Alexander within a flood area per NOP 34/B3; after 5 km it unites with a pipeline originating at the Neurim point. The pipeline continues along nearly the entire route of Nahal Alexander, within the flood area per NOP34/B3 until it reaches the southern portion of the Meretz WTP after 11 km. The line passes within the southern part of the Meretz WTP.

B. Hydrogeology

The pipeline route from the landing point in Hadera passes within the area of 10 wells (Figure 1.7.1.2). Most of the pipeline passes within a clay-containing alluvial cross section, while a small portion passes through kurkar and sand (Figure 1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route's western half is designated as a water resource conservation area (Figure 1.7.1.1-1).

- *Fuel Contamination Danger Zones* (Water Authority, 1992) – 20% of the pipeline route falls within Area A, a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while 80% falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable .*
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.5.2.2 Route from Michmoret

Northern alternative

For the eastern portion see 1.7.5.2.1.1

A. Soil and drainage

The additional line segment that connects to the Michmoret entry point does not traverse stream areas.

B. Hydrogeology

The route passes near Hadera Well B/50 (Figure 1.7.1.2). The pipeline passes within a kurkar and Aeolian sand cross section (1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – Half of the pipeline route falls within Area A, designated as a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while half falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable .*
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

Southern alternative

See Sections 1.7.5.1.1 and 1.7.5.2.2.1.

1.7.5.2.3 Route from Nahal Alexander

Northern alternative

See Sections 1.7.5.2.2.1, 1.7.5.2.2.2 and, below, 1.7.5.2.3.2.

Southern alternative

A. Soil and drainage

The pipeline passes along the route of Nahal Alexander within a flood area per NOP 34/B3; after 5 km it unites with a pipeline originating from the Neurim point. The pipeline continues nearly the entire route of Nahal Alexander, within the flood area per NOP34/B3 until it reaches the southern portion of the Meretz WTP after 11 km. The line passes within the southern part of the Meretz WTP.

B. Hydrogeology

The pipeline route from the entry point in Hadera passes within the area of 10 wells (Figure 1.7.1.2). Most of the pipeline passes within a clay-containing alluvial cross section, while a small portion passes through kurkar and sand (Figure 1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route's western half is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – 20% of the pipeline route falls within Area A, a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while 80% falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable .*
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.5.2.4 Route from Neurim

A. Soil and drainage

In its eastern portion the route intersects with the Nahal Avigayil channel, which flows to Nahal Alexander (Figure 1.1.1.1.1).

B. Hydrogeology

The pipeline route from the Neurim entry point passes within the area of 8 wells and in the protection zones of 2 additional wells (Bitan Aharon B and Ein HaHoresh F) (Figure 1.7.1.2). Most of the route passes within a clay-containing alluvial cross section, while a small portion passes through kurkar and red loam (1.6.1-3).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The pipeline route's western half is designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – 10% of the pipeline route falls within Area A, a *primary aquifer in which damage is irreparable* (Figure 1.7.1.1-2), while 90% falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable .*
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.5.3 Treatment facility

A. Soil and drainage

1. Hydrological data

A. Drainage basin

The drainage basin demarcates the northern portion of the Meretz WTP; the rainwater that flows from the northwest traverses Highway 581 via water conduits and concentrates within the basin area, which drains in the direction of Nahal Ometz (Figure 1.7.5.3.1). The basin is surrounded by large expanses of agricultural areas and fields (Figure 1.1.1.1.3).

B. Area rainfall data

The Ein Horesh monitoring station (No. 26) is located near the site and was chosen as a representative station. This station has been active for 45 years, providing a sufficiently lengthy observation period to ensure stable statistical parameters for assessing the intensity of low-probability rainfall.

Table 1.7.5.1: Ein Horesh Station (No. 26) – Rainfall Intensity over Different Time Periods

Rainfall Intensity (mm/hour) over Different Time Periods										Probability
עוצמות גשם)מ"מ/שעה(לפרקי זמן שונים)דקות(										הסתברות
5	10	15	20	30	45	60	90	120	180	
187.2	121.8	102.2	94.2	79.8	57.7	46.2	35.0	28.5	22.5	1%
169.6	112.3	92.7	84.2	70.7	51.7	41.9	31.1	25.2	19.3	2%
146.9	99.5	80.7	71.3	58.8	44.0	36.0	26.3	20.9	15.3	5%
129.2	89.3	71.5	62.1	50.5	38.2	31.4	22.6	17.7	12.6	10%
110.5	78.3	62.0	52.7	42.2	32.2	26.6	18.9	14.5	10.0	20%

C. Soil classifications

Per the Soil Groups Map, most of the soil in the planning area that served as a basis for hydrologic assessments is of types E (E1, E3,) and H (H1, H3, H5) (Figure 1.7.5.3-2).

Breakdown as follows:

- **E1, E3** – red loam
- **H1, H3, H5** – brown gromosol

D. Permeability

The drainage basin extends over read loam (E1, E3) type soil. This kind of soil has a moderate to low permeability rate (quickly becomes impermeable to water) and a high runoff coefficient C=0.28-0.38.

2. Flow rate calculation – via a statistical hydrological and area ratio model

Use was made of a model for calculating the maximum flow rate that was developed by C. Gatker and S. Pollak. This method is used for calculations pertaining to areas larger than 5.0 sq. km. Thus a flow rate is calculated for a 5.0 sq. m. area and for the drainage basin area (2 sq. km.) per area ratio.

Table 1.7.5.2: Calculation per statistical hydrological model for 5.0 sq. km

Station	Basin area (sq. km.) A	Gradient	Statistical parameters			Peak flow rate (m^3/second) Different probabilities			
			Avg.	Cv	Cs	10%	5%	2%	1%
Alexander – Eliashiv	5	0.17	0.1	0. 5	-0.3	4	6.4	9.9	13

Table 1.7.5.3: Calculation per area ratio

Basin no.	Basin area (sq. km.) A	Peak flow rate (m^3/second)			
		10%	5%	2%	1%
1	5	4	6.4	9.9	13
2	2	2.53	4.05	6.26	8.22

B. Hydrogeology

The cross section along Strip 49 of the Coastal Aquifer (Acker 1999), presented in Figure 1.6.8-1, is based on the wells adjacent to the Givat Haim 49/5 and Ein HaHoresh alternative compound. In accordance with the lithological cross section, two hydrogeological units may be defined in subsurface:

1. At the top of the cross section is a layer composed of clay or silt of continental origin, from the surface to a depth of 20 meters; beneath it is a 10 meter layer of mud to muddy sand. These layers constitute an aquiclude that divides the surface from the groundwater.
2. Below this layer one can discern alternating layers of sand and kurkar that make up the Pleistocene coastal aquifer, to a depth of 100 meters below sea level. The aquifer in this area is divided by horizontal clay layers into sub-aquifers that are hydraulically linked. The aquifer in the area is used mainly for agriculture via tens of private wells. The groundwater elevation is 15 meters and water salinity is 180 mg/L (Hydrological Service, 2011). The aquifer's hydraulic conductivity is high.

In the field unit designated for survey 5 wells were found, with two additional wells located on the alternative border. No protection zones were found to overlap with the alternative area (Figure 1.7.1.2).

C. Hydrological sensitivity

The alternative area's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The area is not designated as a water resource conservation area (Figure 1.7.1.1-1).
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The area falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable.*

- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

1.7.5.4 Pipeline route from the treatment facility

A. Soil and drainage

The pipeline passes within the northwestern portion of the Meretz WTP, intersecting Nahal Ometz (a secondary tributary of Nahal Alexander) and Nahal Alexander within the Nahal Alexander flood zone per NOP 34/B3.

B. Hydrogeology

The pipeline route from the treatment facility, from the Meretz alternative, passes within the area of 3 wells and in Protection Zone B of Ma'apil C (Figure 1.7.1.2).

C. Hydrological sensitivity

The pipeline route's hydrological sensitivity was assessed vis-à-vis the existing sensitivity maps:

- *Water Resource Conservation Area* (NOP 35) – The two western thirds of pipeline route are designated as a water resource conservation area (Figure 1.7.1.1-1), while the eastern third is not.
- *Fuel Contamination Danger Zones* (Water Authority, 1992) – The pipeline route falls within Area B, which is designated a *primary aquifer in which damage can be repaired or a secondary aquifer in which damage is irreparable.*
- *Groundwater Vulnerability Zones* (NOP 34/B/4) – The area has an A (highest) rating for vulnerability (Figure 1.7.1.1-3).

Figure 1.7.1.1-1: Onshore Array Alternatives against the Background of *Resource Conservation Areas* (NOP 35)

Figure 1.7.1.1-2: Onshore Array Alternatives against the Background of *Fuel Contamination Danger Zones*

Figure 1.7.1.1-3: Onshore Array Alternatives against the Background of *Groundwater Vulnerability Zones* (NOP 34/B/4)

Figure 1.7.1.2: Onshore Array Alternatives, Location of Wells, Protection Radii and Cross Sections, Aerial Photographs

Figure 1.7.1.3-1: Dor Alternative Natural and Artificial Runoff Drainage against the Background of NOP 34/B/3 Map

Figure 1.7.1.3-2: Dor North Alternative and Ein Ayala Land Map, against the Background of NOP 34/B/3 Map

Figure 1.7.2.3-1: Ein Ayala Natural and Artificial Runoff Drainage, against the Background of the NOP 34/B/3 Map

Figure 1.7.3.3-1: Hagit Alternative Natural and Artificial Runoff Drainage, against the Background of the NOP 34/B/3 Map

Figure 1.7.3.3-2: Hagit Alternative Land Map

Figure 1.7.3.3-3: Subsurface Cross Section in the Hagit Alternative Area (Bar, 2004)

Figure 1.7.4.1.1: Hadera Coastal Entry Point, against the Background of the NOP 34/B/3 Map

Figure 1.7.4.1.2: Nahal Alexander Coastal Entry Point, against the Background of the NOP 34/B/3 Map

Figure 1.7.4.3-1: Hadera WTP Alternative Natural and Artificial Runoff Drainage, against the Background of NOP 34/B/3

Figure 1.7.4.3-2: Hadera WTP Alternative Land Map

Figure 1.7.5.3-1: Meretz WTP Alternative Natural and Artificial Runoff Drainage, against the Background of the NOP 34/B/3 Map

Figure 1.7.5.3-2: Meretz WTP Alternative Land Map

1.8 Hazardous materials

This section is based on points of agreement reached with the Ministry of Environmental Protection, Hazardous Waste Division on July 31, 2011, and appended as Appendix E, for purposes of assessing natural gas risks and separation distances, as follows:

- For a leak from a hole 1" in diameter in the upper portion of the pipe (gaseous phase), where the duration of the leak is not limited by valves. For purposes of flammability range calculation, stable meteorological conditions were presupposed.
- The range will be calculated up to LEL 60% (lower explosive limit).
- It was agreed that the risk zone would be calculated at an overpressure of 1.5 psi
- Calculation method – TNT equivalent and direct ALOHA calculation.
- In all cases, the calculation will be for a pipe at 110 bar for a length of 10 km.

The results are presented in Table 1.8-1:

Table 1.7.5-1: Leak risk assessment results

Alternative	Range overpressure of 1.5 (meters) using the TNT equivalent model	Range for pressure level of 1.5 psi (meters using the ALOHA method
24" pipeline	609	585
36" pipeline	612	609

Conclusion: risk zone – 600 m.

To follow are the basic assessment guidelines and methodology:

A. Basic guidelines for risk assessment:

- 1" diameter hole in the upper part of a 24/36 zoll [inch] gas pipe.
- Internal pipe pressure – 110 bar.
- Temperature of gas in the pipe – 0°C.
- Meteorological conditions:
    - Clear night, 10°C, wind velocity 1.5 m/sec, inversion at elevation of 300 m, stable atmosphere

- The gas is released in gaseous phase and disperses in an open area.
- Dispersion model – light gas (Gaussian distribution)

Risk assessments:

B. <u>Risk assessment for 24" pipeline</u>

B.1. <u>Risk assessment for 24" natural gas pipe at a pressure of 110 bar – leakage Figure from hole of 1" diameter with no interruption of flow, cloud liable to explode at a concentration of up to 60% LEL:</u>

<u>Calculation of source intensity and threat zone range via ALOHA:</u>

Source intensity from a hole 1" in diameter remains fixed and close to the maximum throughout the leak period:

Explosion threat zones using ALOHA:

B.2. <u>Calculation via TNT equivalent model</u>

In principle, the working assumption is that the exploding material is the material that is within the flammable range. Per the points of agreement reached at the July 31, 2011 meeting, it was decided that the working assumption would be that the exploding material is within a range of up to 60% LEL – the default for flammable pockets in the ALOHA program.

The distance from 60% of the lower explosive limit as calculated via ALOHA is 861 m at a wind velocity of 1.5 m/sec (characteristic of atmospheric stability); time to reach 60% of LEL is 861/1.5 = 574 seconds, or 9.6 minutes. The quantity of material that would leak during this period of time, at a leakage rate of 582 kg/minute, is 5568 kg.

The distance to the upper explosive limit is 334 m. The amount of time to reach the UEL in stable atmospheric conditions is 334/1.5 = 222.67 seconds, or 3.71 minutes.

The quantity of material at a leakage rate of 582 kg per minute from the source to the upper explosive limit (i.e., the amount of material that will not take part in an explosion because there is not enough oxygen to support the explosive reaction) is 2160 kg. The amount of material leaked at a rate of 582 kg per

minute, within the range between the upper explosive limit and 60% of the lower explosive limit, will be 5568-2160 = 3409 kg.

This is the quantity of material that will be taken as the quantity of the exploding material using the TNT equivalent model.

The threat zones from the explosion epicenter for this quantity of material are presented in the following chart:

Table 1.7.5.1: Threat zones from the explosion epicenter, 24" pipeline

Material	Material explosion temperature	Material mass	m(TNT)	Heavy damage range for building	Repairable damage range for buildings (overpressure of 2 psi	Range for overpressure of 1.5 psi	Shatter range, massive glass panel (overpressure of 2 psi)	Range, 10% glass panel shatter
Units	j/kg	Kg	Kg	(meter)	(meter)	(meter)	(meter)	(meter)
Methane	5.02E+07	3408	3918	61	136	178	221	389

If we add 1/2 of the distance to 60% of the lower explosive limit, on the assumption that this is half of the cloud 861/2 = 431 m, then we get the following threat zones:

Table 1.8-3: Threat zones from the explosion epicenter to the lower explosive limit, 24" pipeline

Material	Material explosion temperature	Material mass	m(TNT)	Heavy damage range for building	Repairable damage range for buildings (overpressure of 2 psi	Range for overpressure of 1psi	Shatter range, massive glass panel (overpressure of 1.5 psi)	Range, 10% glass panel shatter
Units	j/kg	Kg	Kg	(meter)	(meter)	(meter)	(meter)	(meter)
Methane	5.02E+07	3408	3918	492	567	609	652	820

The range for overpressure of 1.5 psi via this method is 609 m.

C. Risk assessment for 36" pipeline

C.1. Risk assessment for 36" natural gas pipeline at a pressure of 110 bar – leakage Figure from hole of 1" diameter with no interruption of flow, cloud liable to explode at a concentration of up to 60% LEL:

Calculation of source intensity and threat zone via ALOHA:

Source intensity from a hole 1" in diameter remains fixed and close to the maximum throughout the leak period:

Explosion threat zones using ALOHA:

C.2. Calculation via TNT equivalent model

In principle, the working assumption is that the exploding material is the material that is within the flammable range. Per the points of agreement reached at the July 31, 2011 meeting, it was decided that the working assumption would be that the exploding material is within a range of up to 60% LEL – the default for flammable pockets in the ALOHA program.

The distance from 60% of the lower explosive limit as calculated via ALOHA is 865 m at a wind velocity of 1.5 m/sec (characteristic of atmospheric stability); time to reach 60% of LEL is 865/1.5 = 577 seconds, or 9.62 minutes. The quantity of material that would leak during this period of time, at a leakage rate of 587 kg/minute is 5645 kg.

The distance to the upper explosive limit is 335 m. The amount of time to reach the UEL in stable atmospheric conditions is 335/1.5 = 223.33 seconds, or 3.72 minutes.

The quantity of material at a leakage rate of 587 kg per minute from the source to the upper explosive limit (i.e., the amount of material that will not take part in an explosion because there is not enough oxygen to support the explosive reaction) is 2185 kg. The amount of material leaked at a rate of 587 kg per minute, within the range between the upper explosive limit and 60% of the lower explosive limit, will be 5645-2185 = 3460 kg.

This is the quantity of material that will be taken as the quantity of the exploding material using the TNT equivalent model.

The threat zones from the explosion epicenter for this quantity of material are presented in the following chart:

Table 1.7.5.2: Threat zones from the explosion epicenter, 36" pipeline

Material	Material explosion temperature	Material mass	m(TNT)	Heavy damage range for building	Repairable damage range for buildings (overpressure of 2 psi	Range for overpressure of 1.5 psi	Shatter range, massive glass panel (overpressure of 1 psi)	Range, 10% glass panel shatter
Units	j/kg	Kg	Kg	(meter)	(meter)	(meter)	(meter)	(meter)
Methane	5.02E+07	3460	3977	61	137	179	222	391

If we add 1/2 of the distance to 60% of the lower explosive limit, on the assumption that this is half of the cloud 865/2 = 433 m, then we get the following threat zones:

Table 1.7.5.3: Threat zones from the explosion epicenter to the lower explosive limit, 36" pipeline

Material	Material explosion temperature	Material mass	m(TNT)	Heavy damage range for building	Repairable damage range for buildings (overpressure of 1 psi	Range for overpressure of 1.5 psi	Shatter range, massive glass panel (overpressure of 2 psi)	Range, 10% glass panel shatter
Units	j/kg	Kg	Kg	(meter)	(meter)	(meter)	(meter)	(meter)
Methane	5.02E+07	3460	3977	494	570	612	655	824

The range for overpressure of 1.5 psi via this method is 612 m.

D. Risk assessment for H_2S

1. Environmental protection Figure:

   For a hole 1" in diameter in a 36" pipe in which methane flows at a pressure of 110 bar, a source intensity of 587 kg per minute was calculated.

   Assuming H_sS content of 8 ppm in the gas, as noted in the report describing the gas specifications for sale from the Tamar well, and taking into account the molecular weights of the methane and the H_2, the source intensity of the H_2S will be 8.79 grams per minute.

   Explanation:

   Molecular weight of methane – 18 g/mol.

   Molecular weight of H_2S – 34 g/mol.

587 kg of methane constitute 587,000/18 = 32,611 moles of methane.

8 ppm of this is, approximately, 8/1000000*32,611 = 0.260 mol, weighing 34*0.260 = 8.84 g.

The threat zone for this source intensity for AEGL2 per hour is 27 ppm – 41 m:

1.9 Nature, Landscape and Heritage Values

The analysis of nature, landscape and heritage values includes reference to the following sections:

A. **Landscape units** – landscape units, arrays and landscape characteristics of the area are presented **in Section 1.5 above**. In this chapter we present an ecological analysis including an analysis of adjacent ecological corridors (Figure 1.9 –A) and habitats in the area of the plan and its surroundings.

B. **Flora** – this section analyses the flora layout in the area of the survey according to the survey of habitats, field survey and literature review. In addition red and rare species in the plan layout and / or its surroundings are presented. Habitats and natural values are presented in Figure 1.9.

C. **Fauna** – presentation of the various animal species within the survey area was performed according to a field survey and a literature review. The presented information contains a table specifying the observed species, or species that are likely to be present in the plan area – Data according to the Red Book of Vertebrates in Israel, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)[79, 80, 81].The information includes the risk level of the animal species according to the following risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002)[82]:

   EX = Extinct – "completely extinct", **RE** = Regionally extinct – "extinct in our region", **CR** = Critically endangered – "under severe danger of extinction", **EN** – Endangered – "under danger of extinction", **VU** = Vulnerable – "its future is in danger",**NT** = Near threatened – "low risk", **LC** = Least concern – "not endangered", **DD** – Data deficiency – "missing information"

D. **Heritage sites and historical sites –** Heritage sites and historical sites in the alternate area were examined according to the existing information, the archaeological antiquities layer submitted by the Israel Antiquities Authority and updated to 2011, and in the reference from the Israel Antiquities Authority (attached as Appendix D) and The Council for Conservation of Heritage Sites in Israel (coordination both, verbal and in writing). The survey was performed for sites at a distance of up to 1 kilometer from the boundaries of the search area, and approximately 150 meters from the building lines of the pipeline route to a distance of 300 meters west of the coastline. Since the archaeological survey of Israel was not complete, and since there are many archaeological sites that are covered with eroded earth

and cannot be revealed without archaeological excavation – the data should be considered as the entirety of the archaeological remains in the region.

Dor Array

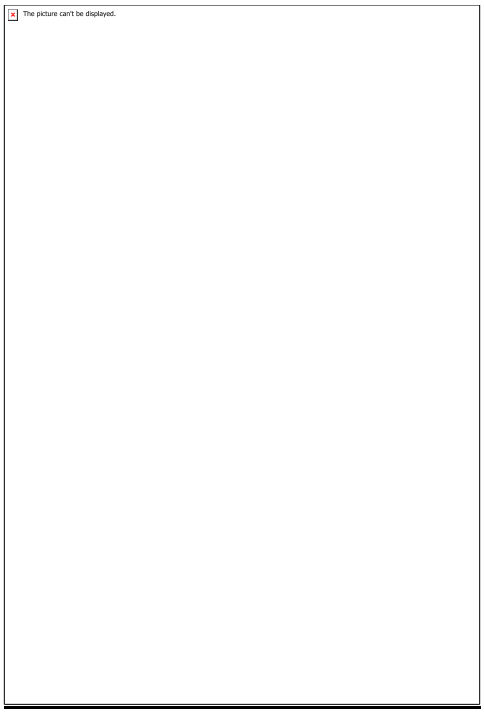
1.9.1 Dor North

1.9.1.1 Coastal entry array

General

Ecological values of the plan area – the survey area for the onshore receiving station is located in the open areas south of Moshav Dor. The area is characterized by a combination of sandy soil habitats, high moisture habitats including fish ponds, briny areas, winter pools and exposed kurkar where several types of flora develop. The area is utilized as an important activity area for water fowl and thickets birds, and it is a known breeding area for the common tern, little tern and yellow-legged gull (at the Dor islands). The sandy beach is a breeding site for sea turtles and during the winter marine birds are observed there. The unique conditions in the habitats in this area create a variety of ecological niches enabling types of endangered plants that require the unique conditions. In the course of the natural values survey for Dor – Jissr A Zarka (Open Landscape Institute)[83] the areas included in this survey area were graded at a high value level (3) – dry ponds, very high (4) – active ponds, Extremely high (5) – the beach (Figure 1.9.1.3)

Figure 1.1.9-3: Alternatives based on land values (source: Hof HaCarmel survey, Open Landscape Institute)



A. Landscape units

Ecological corridors and discontinuation of habitats

The pipeline route passes through a national ecological corridor (Figure A – 1.9)

1. The coastal corridor – passes along coastal areas and the kurkar ridge

The pipeline route is a buried line, therefore discontinuation of habitats and ecological corridors is unexpected. Some disruption is expected to the fauna's free movement in the work sections in the course of the construction.

B. Flora

Habitats and flora communities in the plan areas

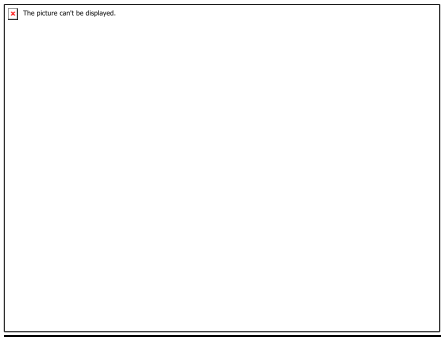
The survey area is high ecological value which includes the area of beach sand dunes, active and non - active fish ponds, and kurkar outcroppings. The disrupted areas include an area of farm houses used as a facility for fishing. The following is a description of the characteristics of the various area units (Figure B – 1.9)

Beach sand dunes (DO 1)

The sand dunes strip includes a sterile strip where no flora develops and a very narrow strip (~ 10 m) of exposed sand where a pattern of dunes is created as a

result of the development of sand stopping growth. The most common plants in the sand strip are sea rocket (cakile maritima) – three corner jack (elytrigia juncea). Additional species : pancratium maritimum, prickly glasswort, prickly dropseed grass, chrysopsis, silvery birds' foot trefoil, as well as viewing of the plant sea holly defined as a red species.

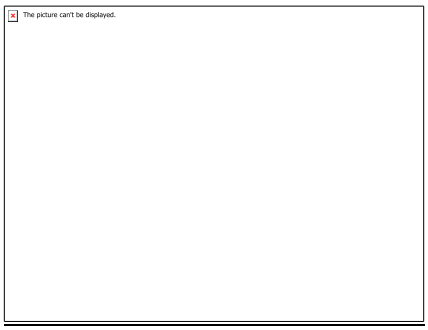
Figure 1B – 1.9.1.1: Sand strip and western pond



Active fish ponds (DO 2)

Adjacent to the beach strip on the west side there is an active fish pond (given its high water level). At the pond's edges there is thicket vegetation where the most common plants are tamarisk, common reed, and red raspberry, accompanied by stranglevine, false yellowhead, camelthornbus, convolvulaceae. On its south side on a kurkar outcropping and soil, at the bottom of which an endangered species was observed (red species) ipomoea. Another rare plant observed is the swamp sea lavender.

Figure 2B – 1.9.1.1: Western pond with high water level



Dry fish ponds (DO 3)

These are located in the locked guttering areas between the eastern and western kurkar ridges. The fish ponds are active intermittently and a variety of moist habitats exists in them, according to the nature of the agricultural activity and flow. The habitats include: saltmarshes, ponds, marsh remnants, and banks thicket growth. The variety of habitats constitutes the basis for fauna activity for many species, mostly birds and mammals, and allow for development of typical flora, including unique plants such as sea plantain, perennial glasswort, saltmarsh morning glory. At the time of the survey the eastern ponds were not active, the most common plants are a combination of saltmarsh flora such as hastate orach, large spiked glasswort and a number of sagittal species such as white conyza and curly conyza, yellow fleabane, common reed and in the ponds perimeters a thicket of tamarisk, common reed, and holy bramble.

Figure 3B – 1.9.1.1: Dry ponds to the east

The picture can't be displayed.

Agricultural structure (DO 4)

Operating area for fish ponds. A disrupted area where sagittal and ruderal vegetation is found such as yellow fleabane, curly conyza, common camelthorn.

Figure 4B – 1.9.1.1: Operating area and open uncultivated area

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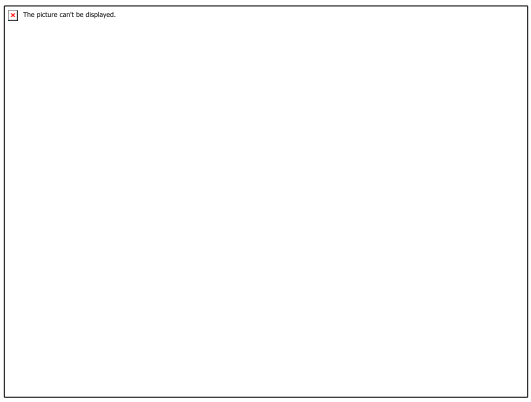
Uncultivated area (DO 5)

A kurkar outcropping which may have been used in the past for agriculture. Combination of kurkar flora and deserted areas growth: pistacia lentiscus, hairy breadgrass, hispid viper's bugloss, thin safflower, dwarf mesquite, common camelthorn, and yellow fleabane. At the edge of the plot a drainage canal where saltmarsh flora grows: such as Dutch rush, common reed, bulrush, stranglevine, and in low points there is development of tightly growing tamarisk.

Figure 6B – 1.9.1.1: Uncultivated area, kurkar flora and high moisture flora in drainage canal



Rare plant species and red plant species in the survey area

In the area of the plan and its vicinity 5 unique species were documented; most of the observations were on the western sides.

Table B – 1.9.1.1: Rare plant species and red plant species at the entrance point at Dor

Name of species	Status	Habitat
Perennial glasswort	Rare	Saltmarsh
Sea plantain	Rare	Saltmarsh
Saltmarsh morning glory	Red	Moist
Limonio comune	Rare	Saltmarsh
Calcatreppola delle sabbie	Red	Sand

C. Fauna

Observations and activity sites – the survey area constitutes an open area where moist habitats, interchange with moist habitats, marsh land and water reservoirs. These habitats support a relatively wide variety of vertebrates, among which are a range water fowl. Fish ponds, water reservoirs and other bodies of water constitute a stopping and rest site for the thousands of birds who are passing through Israel during migration season. In addition, these habitats are rich with a variety of species who summer and nest here, such as the little tern. The sandy beaches in the plan constitute sea turtles nesting sites. The following is a list of animal species specifying either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002).

Table C – 1.9.1.1 Animals observed at the Dor coastal entry array

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Gray heron	CR	Herpestes	LC
Black crowned night heron		Wildcat	VU
Little egret	LC	European badger	LC
Spur winged lapwing	LC	Golden jackal	LC
Hooded crow	LC	Red fox	LC
European Herring Gull		Jungle cat	VU
Slenderbilled Gull		House mouse	LC
Little tern	NT	**Amphibians**	
Common tern	NT	Common toad	VU
Osprey		Marsh frog	LC
White throated kingfisher	NT	Middle East tree frog	VU
Curlew sandpiper		**Reptiles**	
Corn bunting	LC	Loggerhead sea turtle	CR
Kentish Plover	CR	Schreiber's fringe-fingered lizard	CR
Lesser black backed gull		Vipera palaestinae	LC

Name of species	Status	Name of species	Status
Eurasian stone curlew	NT	Caspian turtle	LC
Black winged stilt	VU	Stellagama	LC
Eurasian oyster catcher		Large whip snake	LC

D. . Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.1.1, as follows:

Table D - 1.9.1.1 : Declared archaeological antiquities sites at the Dor coastal entry array

System component	Site name	Number	Location and minimal distance from the plan borders
Dor Coastal entry array	Dor, underwater site	27733 / 0	Inside the pipeline route at the coastal entry
	Dalia river, underwater site	4403 / 0	Inside the coastal entry array
	Dalia river, underwater site, east	27628 / 0	Inside the coastal entry array
	Dalia river, underwater site, North	27666 / 0	Inside the coastal entry array
	Dor, underwater site	4336 / 0	Inside the coastal entry array
	Dor (South)	25268 / 0	Inside the coastal entry array
	K – 60 triangulation pt.	1447 / 0	Inside the coastal entry array

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.1.2 Pipeline route to the treatment plant

The source of the material presented in this chapter is in a field survey performed in July 2012. This season does not allow for optimal impression of the

variety of flora in the various habitats, and particularly in reference to therophytes. In addition to the field survey, some data from the literature is presented. Literature sources are specified in the list of references [84, 85, 86, 87]

A. Landscape units

Ecological corridors and discontinuation of habitats

The pipeline route passes through a national ecological corridor (Figure A – 1.9)

The coastal corridor – passes along coastal areas and the kurkar ridge

The pipeline route is a buried line, therefore discontinuation of habitats and ecological corridors is unexpected. Some disruption is expected to the fauna's free movement in the work sections in the course of the construction.

B. Flora

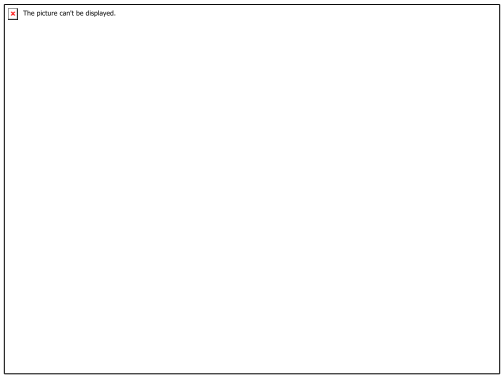
Habitats and flora communities in the plan areas

The transmission route goes from the Dor receiving station located south of Moshav Dor all the way to the alternative gas station – a distance of approximately 2.5 km. The following is a description of the characteristics of the main habitats (Figure B – 1.9):

Fish ponds

These are located in the locked guttering areas between the eastern and western kurkar ridges. The fish ponds are active intermittently and a variety of moist habitats exists in them, according to the nature of the agricultural activity and flow. The habitats include: saltmarshes, ponds, marsh remnants, and thicket growth. The variety of habitats constitutes the basis for fauna activity for many species, mostly birds and mammals, and allow for development of typical flora, including unique plants such as sea plantain, perennial glasswort, saltmarsh morning-glory. At the time of the survey the eastern ponds were not active, the most common plants were a combination of saltmarsh flora such as hastate orach, large-spiked glasswort and a number of sagittal species such as white conyza and curly conyza, yellow fleabane, common reed and in the ponds perimeters a thicket of tamarisk, common reed, and holy bramble.

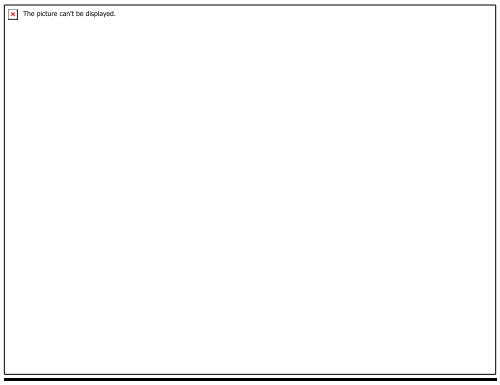
Figure 1B – 1.9.1.2: Eastern fish ponds



The eastern kurkar ridge

The pipeline route crosses the ridge south of Moshav Dor. A number of variants of plant communities appear in the plan area, creating a mosaic controlled by the lentisk, thatching grass and hispid viper's-bugloss. In the northern area there is a large quarry between the railways and Road 4 – Dor shaft – where high levels of groundwater were exposed and these allow for the development of moist habitats controlled by common reed, tamarisk and holy bramble where rare species have been observed. The quarrying activities have led to a change of the flora variability where side by side with the typical species and some rare species such as narrow leaves lotus and Sardinian flax, some invasive species can be seen such as pine, blue-leaved whattle, eucalyptus and withania somnifera. In the southern part, where the ridge was not damaged by quarrying, a grassy knoll is developing controlled by thatching grass and hispid viper's-bugloss, where geophytes concentrations can be found, such as common anemone, squill, and winter crocus.

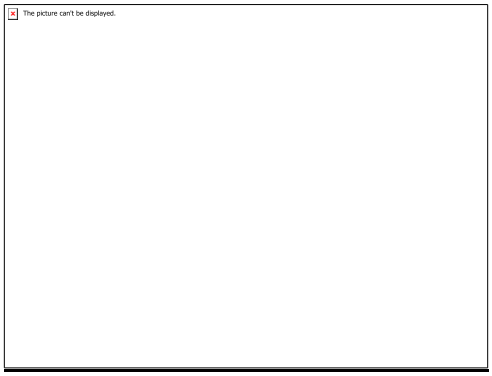
Figure 2B – 1.9.1.2: The kurkar ridge at the quarry site border (Dor shaft)



Agriculture

The cultivation includes seasonal crops and orchards of different types. Generally in all the agricultural areas some sagittal and ruderal vegetation is found. In uncultivated areas we see pioneer species and weeds taking over such as: fennel, thin safflower, holy thistle, dwarf mesquite, common caper, hoary mustard, yellow fleabane, and common reed.

Figure 3B – 1.9.1.2: Agricultural areas east of Moshav Dor



Rare plant species and red plant species in the survey area

Table 1B –1.9.11.9.1.2– Rare plant species and red plant species at route area

Name of species	Status	Habitat
Narrow leaves lotus	Red	Moist
Perennial glasswort	Rare	Saltmarsh
Crocus aleppicus baker	Rare	Kurkar
Sea plantain	Rare	Saltmarsh
Saltmarsh morning glory	Red	Moist
Stork's bill	Red	Kurkar, rock exposures
Lesser flowering narcissus	Red	Kurkar
Limonio comune	Rare	Saltmarsh
Calcatreppola delle sabbie	Red	Sand
Holly leaved naiad	Rare	Moist
Sardinian flax	Red	Moist

Characteristics of areas along the route

Characteristics of areas along the route are detailed in the following table, see Figure B – 1.9

Table 2B – 1.9.11.9.1.2: Characteristics of areas along the route towards Dor north

No.	Coverage	Description	Sensitivity
A1	Fish ponds	Non-active fish ponds, dominant plants are common reeds, tamarisk, sea rush side by side with uncultivated land species : golden samphire, common camelthorn, parapholis incurve, hispid viper's-bugloss, piptatherum miliaceu, procumbent centaurythist. Red species: perennial glasswort, at the pond edges saltmarsh morning glory, and calcatreppola delle sabbie	Medium - high
A2	Kurkar growth	Eastern kurkar ridge. Bush type growth such as : pistacia lentiscus, cascara buckthorn, procumbent centaurythist, hispid viper's bugloss, conehead thyme, and tamarisk. Rare species: narrow leaves lotus, holly leaved naiad, Sardinian flax, crocus aleppicus baker and lesser flowering narcissus.	Medium – high mostly in the northern area
A4	Agriculture	Various agricultural crops including orchards and field crops. Various sagittal plants and trees lines (cypress, eucalyptus). Various moist habitat plants are likely in the water canals draining the areas.	Low
A5	Agriculture and facilities	The effluents reservoir of the Maayan Tzvi Wastewater Treatment Plant and the fish ponds of the Fisheries Research Institute. Vegetation thicket at the edges of the sites. Dominant species : tamarisk and common reed. Widespread : sea sowthistle, yellow fleabane, bristly oxtongue. The reservoir is used as a rest site for water fowl such as pelicans.	Low

C. Fauna

Habitats along the pipeline route support a large variety of animal species. These are areas with relatively high sensitivity which constitute a unique habitat for the fauna, such as guttering areas at the coastal area (fish ponds) and moist habitats. Following is a description of the characteristics of fauna in the various habitats:

Dor guttering area and kurkar ridge

Observations and activity sites – fish ponds on the eastern side of the route constitute an activity site for various migrating and wintering birds with an emphasis on water fowl and marine birds, and a number of mammals species active in thickets and marshland habitats. The following is a list of animal types observed in this habitat:

The following is a list of animal types observed at the entrance point in Dor north (based on: surveys by Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)).

Table C – 1.9.1.2: Animals observed in plan area – pipeline to Dor alternative

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Gray heron	CR	Herpestes	LC
Blackcrowned night heron		Wildcat	VU
Little egret	LC	European badger	LC
Spurwinged lapwing	LC	Golden jackal	LC
Hooded crow	LC	Red fox	LC
European herring gull		Jungle cat	VU
Slenderbilled gull		House mouse	LC
Little tern	NT		
Common tern	NT		
Osprey			
Whitethroated kingfisher	NT		

Cultivated areas

In these areas the variety of fauna is law, and it mainly includes species adjusted to human activity in the area – such as red fox, golden jackal, field mouse, and house mouse. Other species make occasional use of the area, mostly for passage and search for food : birds of prey, herons and crows.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table D - 1. 9.1.2, as follows:

Table D - 1.9.1.2 : Declared archaeological antiquities sites along the pipeline route to the treatment facility in Dor north

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Maayan Tzvi	5930 / 0	Inside the pipeline route and survey area
	Hirbet Tefet (north)	6887 / 0	Inside the pipeline route and survey area
	Hirbet Tefet (east)	39285 / 0	Inside the pipeline route and survey area
	Hirbet Darkemon (south)	25267 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.1.3 Treatment facility

General

Ecological value of the plan area – the survey area is located at an agricultural region adjacent to the Maayan Tzvi water treatment facility and constitutes a part of the Hof HaCarmel plain. Intensive agricultural activity is performed in the survey area which includes: citrus orchards, field crops and greenhouses. High quality areas are located outside of the survey area and these include: Moist habitats – marshland, fountains, ponds, saltmarshes – kurkar ridges and coastal sands along the shore. In the course of the survey on natural values for Dor – Jissr a Zarka (Open Landscape

Institute) the agricultural areas included in this survey area were graded at a medium value level (Figure 1.9.1.3).

Figure 1.9.1.3: General view – agricultural areas, drainage canal

The picture can't be displayed.

Figure 1.9.1.3: Dor alternative based on land values (Source: Hof HaCarmel survey, Open Landscape Institute)

The picture can't be displayed.

A. Landscape units

Ecological corridors and discontinuation of habitats

The survey area is located outside of the national corridor passing from the east along the length of the Carmel Ridge, and on the west along the coastal strip, kurkar ridge and guttering areas. No ecological axis, such as a river, crosses the plan area (Figure A – 1.9). It is reasonable to assume that in a similar manner to the other agricultural areas, there is movement and crossing of areas by animals in the course of their activities. In this aspect, discontinuation of sensitive habitats is not expected.

B. Flora

Habitats and flora communities in the plan areas

The survey area is a variable agricultural area. No natural habitats exist in the plan area. The dominant flora is sagittal and ruderal vegetation and can be found mostly at the edges of cultivated plots and along the organized and treated drainage canals. Rare and red plants species are not found in the plan area.

The following is a description of the characteristics of the various area units (Figure B – 1.9):

Agriculture

The entire plan area

Flora communities: Dwarf mesquite - dwarf chicory

Common species: wild carrot, torilis arvensis, dog's tooth, heliotropium suaveolens

Drainage canal

The drainage canal is well organized and treated, passing between cultivated plots.

Flora communities: common cocklebur, sea club-rush, lesser bulrush, dog's tooth

Rare and red plants species

Rare and red plants species were not documented and not observed In the survey area.

C. Fauna

Observations and activity sites – the survey area constitutes an open area with moist habitats, together with marshlands and bodies of water. These habitats support a relatively wide variety of vertebrates, among which are riches of water

fowl. The fish ponds, water reservoirs and other bodies of water constitute a stopping and rest site for the thousands of birds who are passing through Israel during migration season. In addition, these habitats are rich with a variety of species who summer and nest here. The area is designated for agriculture, therefore its importance for water fowl is not as high. In addition, the intensive activity does not allow for development of the vegetation thicket used by mammals and reptiles as a habitat and activity area. The variety of the animals in the plan area is typical to agricultural areas and includes for the most part common species. The following is a list of animal species specifying either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002)

Table C –1.9.1.3: Animals observed in the plan area (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)

Name of species	Status	Name of species	Status
Birds		**Reptiles**	
Sparrow	LC	Large whip snake	LC
Laughing dove	LC	Mediterranean house gecko	LC
Common myna	Invader	Stellagama	LC
Hooded crow	LC	Vipera palaestinae	LC
Spurwinged lapwing	LC	**Amphibians**	
Eurasian collared dove	LC	Common toad	VU
Cattle egret	LC	marsh frog	LC
		Middle East tree frog	VU
Mammals			
Indian crested porcupine	LC	Southern white breasted hedgehog	LC
Red fox	LC	House mouse	LC
Golden jackal	LC	Jungle cat	VU
European badger	LC	Herpestes	LC

D. Heritage sites and historical sites

The declared archaeological antiquities sites located within this survey perimeter are listed below:

Table D - 1.9.1.3: Declared archaeological antiquities sites located at the Dor North alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Treatment facility	Adalan	1558 / 0	Approx. 100 meter to the north
	Hirbet Darkemon, (south)	25267 / 0	Approx. 150 meter to the west
	Al Fureidis (west)	25649 / 0	Approx. 500 meter to the south - east
	Hirbet Darkemon (east)	25266 / 0	Approx. 500 meter to the south - west
	Hirbet Darkemon (south / west)	25924 / 0	Approx. 600 meter to the west
	Hirbet Darkemon	1517 / 0	Approx. 650 meter to the north - west
	Dor	4213 / 0	Approx. 650 meter to the south - west
	Bab el tantura	24131 / 0	Approx. 650 meter to the north - west
	Hirbet Tefet (east)	39285 / 0	Approx. 700 meter to the south - west
	Hirbet Tefet (north)	6887 / 0	Approx. 800 meter to the south - west
	Maayan Tzvi (east)	25915 / 0	Approx. 800 meter to the south - west
	Nachsholim	14748 / 0	Approx. 900 meter to the north - west
	Maayan Tzvi	5930 / 0	Approx. 900 meter to the south - west
	Hirbet Darkemon, (north)	24133 / 0	Approx. 1 km to the north - west

System component	Site name	Number	Location and minimal distance from the plan borders
	Nachsholim 2	40203 / 0	Approx. 1 km to the west
	Al Fureidis (north)	25650 / 0	Approx. 1 km to the south - east

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

Pipeline route from the treatment facility

Gas will be transmitted to the east and to the Hagit power plant through the existing Dor - Hagit gas route and does not require the location of an additional pipeline route.

1.9.2 Ein Ayala

1.9.2.1 Coastal entry array

See Section 1.9.1.1. above.

1.9.2.2 Pipeline route to the treatment facility

General

The source of the material presented in this chapter is in a field survey performed in July 2012. This season does not allow for optimal impression of the variety of flora in the various habitats, and particularly in reference to therophytes. In addition to the field survey, some data from the literature is presented. Literature sources are specified in the list of references.

A. Landscape units

Ecological corridors and discontinuation of habitats

The pipeline route passes through a national ecological corridor (Figure A – 1.9).

The coastal corridor – passes along the coastal areas and the kurkar ridge.

The pipeline route is a buried line, therefore discontinuation of habitats and ecological corridors is unexpected. Some disruption is expected to the fauna's free movement in the work sections in the course of construction.

B. Flora

Habitats and flora communities in the plan area

The transmission route is between the Dor receiving station located south of Moshav Dor and to the gas station alternative, a distance of approximately 7 km. The

route is partially overlapping the pipeline route to Dor north. The following is a description of the characteristics of the main habitats, **in addition to those described in Section 1.9.1.1. above** (Figure B – 1.9)

Eastern kurkar ridge

Dominant species: pistacia lentiscus, Israeli thyme.

Accompanying species: crown daisy, crown anemone, sea squill

Flora density: approximately 40%

Protected species: crown anemone, Persian cyclamen, Israeli thyme, sea lavender

Red and rare plant types

The red and rare plant types in the route area are described in Table 1B – 1.9.1.2 above

Characteristics of areas along the route

See Table 2B – 1.9.1.2 above (Figure B – 1.9)

C. Fauna

Observations and activity sites – The habitats along the pipeline route support a large variety of animal species. Areas of high sensitivity constituting a unique habitat for various animals are the areas of the Dor guttering at the coastal areas (fish ponds) and moist habitats including fountains and rivers in the Carmel region. The following are the characteristics of animal species in the various habitats:

Dor guttering

The fish ponds on the eastern part of the route constitute an activity area for various migratory and wintering birds species with an emphasis on water fowl, marine birds and mammal active in the thickets and marshes areas. The following is a list of animal species specifying species observed in this habitat:

Table C –1.9.2.2: Animals observed at the Dor guttering area

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Gray heron	RE	Herpestes	LC
Blackcrowned night heron	LC	Wild cat	VU
Little egret	LC	European badger	LC
Spurwinged lapwing	LC	Golden jackal	LC

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Hooded crow	LC	Red fox	LC
European herring gull		Jungle cat	VU
Slenderbilled gull			
Little tern	NT		
Common tern	NT		
Osprey			

Cultivated areas

In these areas the variety of fauna is low, and it mainly includes species adjusted to human activity in the area – such as red fox, golden jackal, field mouse, and house mouse. Other species make occasional use of the area, mostly for passage and search for food: birds of prey, herons and crows.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.2.2, as follows:

Table D- 1.9.2.2 : Declared archaeological antiquities sites along the pipeline route to the treatment facility at Ein Ayala

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Maayan Tzvi	5930 / 0	Inside the pipeline route and survey area
	Hirbet Tefet (north)	6887 / 0	Inside the pipeline route and survey area
	Hirbet Tefet (east)	39285 / 0	Inside the pipeline route and survey area
	Hirbet Darkemon (south)	25267 / 0	Inside the survey area

System component	Site name	Number	Location and minimal distance from the plan borders
	Adalan	1588 / 0	Inside the survey area

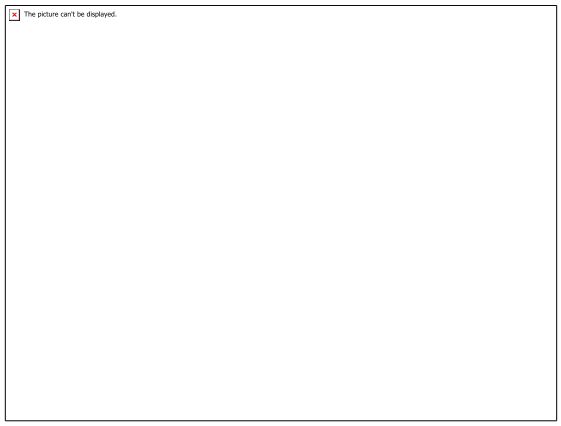
The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.2.3 Treatment facility

General

The survey area is located at the western hills region of the Carmel ridge. The area is characterized by interchanging rocks of kurkar and chalk on top of which are various formations of Mediterranean forest where the carob tree – pistacia lentiscus community is widespread side by side with cultivated areas and man-made forests controlled by pine species (Jerusalem, Canary, cyprus and seed). The high levels of the forest preservation and the high number of species (according to the Ministry of Environmental Protection, approximately 610 were documented in the area) furnish the areas in the plan region a very high ecological value. The survey area itself is an active quarry and therefore its ecological value is low. Figure 1.9.2.3 presents a general view of the survey area.

Figure 1.9.2.3: General view of the survey area



A. Landscape units

Ecological corridors and discontinuation of habitats

The survey area is located at the margins of a wide national corridor passing along the length of the Carmel ridge. The width of the corridor is approximately 35 km (Figure A – 1.9). A number of elements exist in the corridor area, with emphasis on a

paved roads system which cuts through the continuum. However, the area is a relatively undeveloped region, with a high number of natural habitats; therefore, it is important to preserve the continuum continuity and connect and bridge between the disconnected areas. The current quarry site created a disturbance in the area, however, its proximity to Road 4, and to the development areas in the Hof HaCarmel plain reduce its environmental impact.

B. Flora

Habitats and flora communities

The survey area is an active quarry site where no natural habitats exist. In the open areas around the quarry there is a combination of cultivated areas, planted forests and natural forest formations. The natural formations include forest of Palestine oak and carob tree controlled by Palestine oak and pistacia lentiscus and carob tree and pistacia lentiscus. In some widespread areas invasion of Jerusalem pine into the natural forest is observed.

The following is a description of the characteristics of the various area units (Figure B – 1.9).

Mediterranean forest

A spot of Mediterranean forest at a high level of preservation on the west side of the survey area, actually constitutes a part of the western slope that was left in order to cover the quarry pit. It provides a variety of rocky flora side by side with the Mediterranean forest formation.

Plant communities : carob tree and Palestine oak.

Prevalent species : Prickly burnet, pistacia lentiscus, Israeli thyme, spiny broom, teucrium divaricatum, thin safflower, hairy bread-grass, and pine.

Quarry site

Limited flora on the high rocky flats where the activity was stopped, entrance of pine and pioneer and scrub plants such as yellow fleabane, thin safflower, and prickly burnet.

Red and rare plant species

In the survey area no red and rare plant types and species were documented in the scope of this work and in the scope of previous works. In the Mediterranean forest areas and the Carmel area, 26 unique species were documents (Data: the Ministry of Environmental Protection).

Table B – 1.9.2.3: Red and rare plant species in the Carmel area

Plant name	Plant name
Blue sedge	Nit grass
Bee orchid	Iris vartanii
Orchard grass	Sticky vetchling
Madonna lily	Small fruited spurnge
Laurestine	Annual pink
Glandular celsia	Elegance sweet-clover
Italian sweetclover	Rape of cistus
Common centaury	Madder
Lavatera bryoniifolia	Damascus bellflower
Broomrape	Punctate orchid
Phoenician rose	Rumex cassius
Zohary's woundwort	Aegilops speltoides
Blumea bovei	

C. Fauna

Observations and activity sites – the plan area constitutes an open area where Mediterranean forest habitats exist. It is likely that in the Mediterranean forest areas the number of species is quite high, and most of them are not active on the quarry site. However, there is some likelihood of finding them on the margins. Among large mammals, the wild boar is common in the area, and it may be that the European roe deer released in the Ramat Hanadiv area will be found at the margins. Following is a list of animal species specifying either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002):

The following is a list of animal species specifying species observed at the Ein Ayala alternative (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP).

Table C – 1.9.2.3 Fauna observed at the Ein Ayala area

Name of species	Status	Name of species	Status
Birds		**Reptiles**	

Name of species	Status	Name of species	Status
Garrulus	LC	Large whip snake	LC
Laughing dove	LC	Mediterranean house gecko	LC
Eurasian collared dove	LC	Stellagama	LC
Hooded crow	LC	Vipera palaestinae	LC
Rock partridge	NT	European legless lizard	LC
lesser kestrel		**Amphibians**	
Eurasian scopes owl		Common toad	VU
Syrian little owl		Marsh frog	LC
Syrian woodpecker		Middle East tree frog	VU
Mammals			
Red fox	LC	House mouse	LC
Golden jackal	LC	Stripped hyena	VU
European badger	LC	Cape hare	LC
Herpestes	LC	European roe deer	CR
Eurasian field mouse		southern whitebreasted hedgehog	LC
Wild boar	LC	Indian crested porcupine	LC

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.2.2, as follows:

Table D - 1.9.2 : Declared archaeological antiquities sites located in the vicinity of Ein Ayala

System component	Site name	Number	Location and minimal distance from the plan borders
Treatment facility	Hirbet Shia	1738 / 0	Approx. 50 meter to the south - east
	Wadi Maasidi	1739 / 0	Approx. 100 meter to the north
	Uhm el Tus (north – west)	24106 / 0	Approx. 400 meter to the south and Inside the pipeline route and survey area
	Hirbet Tahunat El Hawa	24096 / 0	Approx. 500 meter to the south - east
	Hirbet Tusim	1737 / 0	Approx. 800 meter to the south

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.2.4 Pipeline route from the treatment facility

Flowing the gas to the east and to the Hagit power plant will be performed through the existing Dor - Hagit gas route and does not require the location of additional pipeline route.

1.9.3 Hagit East

General

The source of the material presented in this chapter is a field survey performed in July 2012. This season does not allow for optimal impression of the variety of flora in the various habitats, particularly in reference to therophytes. In addition to the field survey, some data from the literature is presented. Literature sources are specified in the list of references.

1.9.3.1 Coastal entry array

See Section 1.9.1.1. above.

1.9.3.2 Pipeline route from the treatment facility

1.9.3.2.1 Northern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

The pipeline route passes through two national ecological corridors (Figure A – 1.9)

1. The coastal corridor – passes along the coastal areas and the kurkar ridge

2. The Carmel ridge corridor – passes along the Carmel mountain, from Road 4 to the Kishon river area and north of there.

The pipeline route is a buried line, therefore discontinuation of habitats and ecological corridors is unexpected. Some disruption is expected to the fauna's free movement in the work sections in the course of the construction.

B. Flora

Habitats and flora communities in the plan areas

The gas flow pipeline route goes from the Dor receiving station located at the area of Maayan Tzvi water treatment facility to the alternative gas treatment facility at Hagit and overlaps on its western side with the gas flow pipeline route to the alternative gas treatment facility at Ein Ayala. The following is a description of the characteristics of the main habitats in addition to the habitats described in section 1.9.2.1 (Figure B – 1.9).

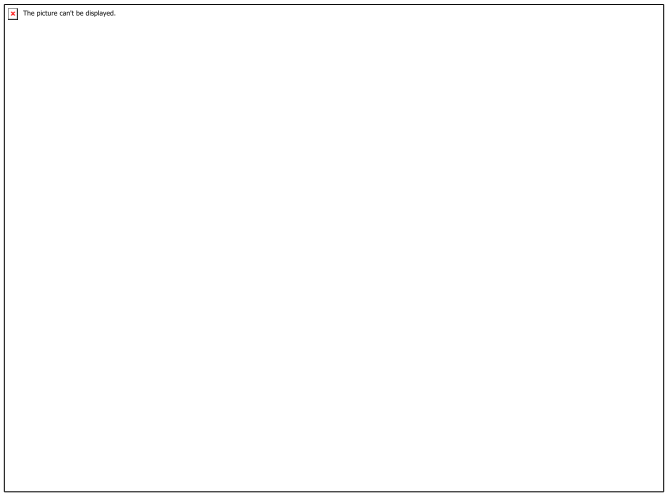
Agriculture

Cultivated areas are located in both the coastal area and the valleys, including the pipeline route area. The cultivation includes seasonal crops and various types of orchards. In the entire cultivated areas sagittal and ruderal vegetation is found. In the uncultivated areas there is control of pioneering species and scrub species such as fennel, thin safflower, holy thistle, dwarf mesquite, common caper, hoary mustard, alba reseda, crucianella macrostachya, yellow fleabane, and tall viper's bugloss. In cultivated areas on the Carmel ridge components of Mediterranean forest can be found, among them some noticeable trees such as Mount Tabor oak, common carob, and spiny hawthorn. These can be found mainly in the uncultivated areas between the plots and field edges. See Figure B – 1.9.1.2 – 3 above.

Man-made forest

In vast areas along the route coniferous forests have been planted where the ruling species are pine (Jerusalem, Canary, and cyprus). This habitat is present mostly in the western parts of the Carmel, from Road 4 and to the areas south of Moshav Ofer. In the eastern part of the route young plants of Mount Tabor oak can be found. Inside the forest perimeter various components of the natural forest can be found according to the density of the trees. Most common among the trees are Palestine oak, carob tree, rock rose. In the sub-forest a layer of bushes and shrubs develops, such as pistacia lentiscus, teucrium divaricatum, prickly asparagus, common caper. Among the geophytes much growth can be found of Persian cyclamen and common narcissus, which at time may create impressive concentrations.

Figure 1B – 1.9.3.2: Forest controlled by Canary pine



Mediterranean forest

The natural forest is divided into a number of types according to the ruling species, plant density and level of disturbance. The forest along the pipeline route is composed of a number of clusters of dominant species; the dominant trees (in a relatively low appearance) in most of the forest communities are Palestine oak, followed by Mount Tabor oak and terebinth. Other common accompanying species are carob tree, pistacia lentiscus, officinal styrax, and broad-leaved phillyrea. Along the route forest formations are composed of various combinations of the above-mentioned plants and the density changes between situations of open and suppressed forest of approximately 20% coverage, up to fully-developed and complex forest with coverage of up to 100%. In the sub-forest layer bushes, shrubs and vines of many types may be found such as spiny broom, rhamnus palaestina boiss, virgin's bower, common madder, and Mediterranean smilax.

Figure 1B – 1.9.3.2: Forest areas developing on the slopes

The picture can't be displayed.

The park forest

A formation based on tress with a single and relatively tall appearance. The dominant species are Mount Tabor oak, Palestine oak, and carob tree. Some individual trees with impressive appearance may be found. Among the trees many shrubs and perennials may be found such as pistacia lentiscus, wild marjoram, teucrium divaricatum, azarole, crown anemone, toothed orchid, cat-thyme germander, prickly burnet and spiny broom.

Figure 3B – 1.9.3.2: Park forest of Mount Tabor oak

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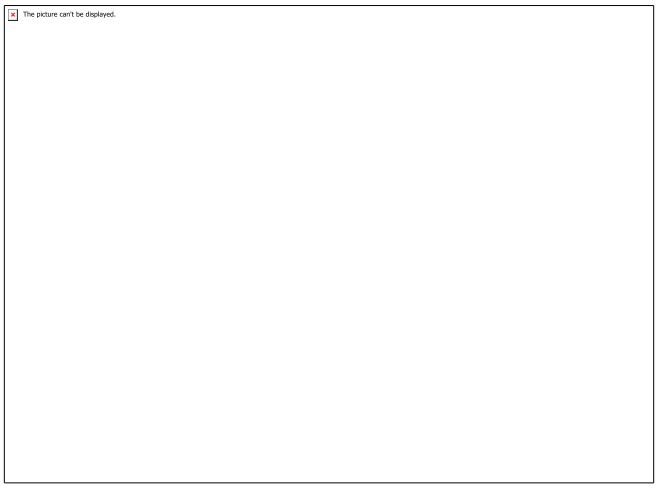
Rocky garrigue and dwarf-shrub steppe formation

This formation is common in the areas south of Hirbet Nagus – tight garrigue areas developing on a partly rocky infrastructure. The dominant flora community: prickly burnet - spiny broom. accompanying species bulbous barley, azarole, red-stemmed figwort, wild marjoram, cat-thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble St. John's wort, splendid bindweed, bitumen trefoil, golden drop, bitumen trefoil, lesser bindweed, crown flower.

Unique species: in this unit some geophytes may be found, among them orchids and bee flowers.

Figure 4B – 1.9.3.2: Garrigue on the eastern part of the route



Grassy steppe

Steppe areas, and particularly at the southeastern part of the survey area, constitute a continuance of the continuum of Ramot Menashe. There is a very high number of species including rare species and flowering clusters. Most of the steppe area also has grazing. The dominant community is the grains community and mostly bulbous barley – common oat. Among the perennials the tumble St. John's Wort – lesser bindweed community is common. Common species include: Lesser bindweed, prickly burnet, hairy bread-grass, silver thistle, field eryngo, dwarf chicory, hispid viper's-bugloss, crepis aspera, star hawkbit, lolium subulatum, bird'sfoot trefoil, crown flower, and medicago rotate. In disturbed areas inside the unit area the dominant species are hoary mustard, and common fennel. Unique species include red-stemmed figwort (endemic), Syrian cornflower thistle (endemic), blue lupine (flowering), raphanus aucheri (uncommon), azarole, Carmel bee orchid, saccata orchid, pink butterfly orchid, and sun's eye tulip. Some rare species observed in steppe areas in the survey spaces are iris vartanii, kanutia bidens, and cerinthe palaestina.

Figure 5B – 1.9.3.2 Grassy steppe

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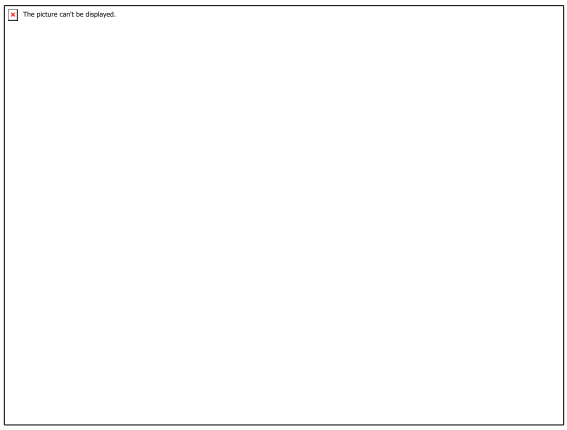
Existing gas pipeline

The northern section of the current route passes close to the existing gas pipeline leading from Dor area to the Hagit power plant. Along this route various levels of rehabilitation can be observed, including establishing of local flora and entry of invasive species. Generally it seems that the highest sensitivity exists in the Mediterranean forest and forestation areas. In this area renewal of the flora may take a long time, and there is no certainty that the current dominant community of the trees and Mediterranean forest will return. In these areas, rehabilitation along the existing line includes appearance of spiny broom, prickly burnet, thin safflower, holy thistle and tobacco tree, which is considered an invasive species in this system.

Rehabilitation of species is faster in the grassy steppe areas and in some areas a growth of grassy flora can be observed on the pipeline strip. However, in these areas, too, some focal points of invasive plants may be seen controlled by scrub species such as common fennel, holy thistle, common caper, cotton thistle and spotted golden thistle.

Figure 6B – 1.9.3.2: Existing gas pipeline on the west side inside the forest and Mediterranean forest area



Red and rare species in the route area

The following is a list of red and rare species in the pipeline route area (based on existing observations), regarding which there is a probability of existence in the proposed route area, or a possibility of indirect impact (spring plants).

Table 1B – 1.9.3.2: Red and rare plant species in the pipeline route area to Hagit, northern alternative

Species name	Status	Habitat
Iris vartanii	Rare	Steppe
Kanutia bidens	Rare	Steppe
Tall germander	Red	Steppe
Lysimachia dubia	Red	Moist
Narrow leaves trefoil	Red	Moist
Cerinthe palaestina	Rare (endemic)	Steppe
Grey-leafed elm	Red	Moist
perennial glasswort	Rare	Saltmarsh
Aleppo crocus	Rare	Kurkar
Sea Plantain	Rare	Saltmarsh
Saltmarsh morning glory	Red	Moist
Erodium subintegrifolium	Red	Kurkar, rocky ridges

Species name	Status	Habitat
Late flowering narcissus	Red	Kurkar
Swamp sea lavender	Rare	Saltmarsh
Sea holly	Red	Sand
Holly-leaved naiad	Rare	Moist
Coastal flax	Red	Moist
Mt. Tabor larkspur	Rare	Rocky steppe

Characteristics of areas along the route

The suggested route was divided into secondary area units based on the nature of coverage and uses. The following are the characteristics of the habitats and flora in each unit (Figure B – 1.9):

Table 2B – 1.9.3.32: Characteristics of areas along the route to Hagit East

No.	Coverage	Description	Sensitivity
A1	Fish ponds	Inactive ponds. The dominant flora is common reed, tamarisk and maritime rush together with uncultivated land growth such as yellow fleabane, common camelthorn, holy bramble, curly conyza, white conyza, parapholis incurve, piptatherum miliaceum, hispid viper's bugloss, procumbent centaury thist and red species: perennial glasswort and on the edges of the ponds: saltmarsh morning glory and sea holly.	Medium - high
A2	Kurkar flora	The eastern kurkar ridge, bushy flora such as pistacia lentiscus, rhamnus palaestina boiss, hispid viper's bugloss, hairy breadgrass, Israeli yhyme, tamarisk and common reed. Rare species: narrow leaves trefoil, holly leaved naiad, coastal flax, Aleppo crocus, and late flowering narcissus.	Medium – high (mostly in the northern part)

No.	Coverage	Description	Sensitivity
A3	Man-made forest	A planted forest of various species of pine (Cyprus, Jerusalem, Canary), between them there are spots of natural Mediterranean forest Palestine oak – carob tree, Terebinth, Mount Tabor oak. Common species: prickly asparagus, African Fleabane, pistacia lentiscus, teucrium divaricatum, three-lobed sage, various types of geophytes such as Persian cyclamen and common narcissus create large concentrations.	High
A4	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Various sagittal growth and tree lines (such as Cyprus and eucalyptus). In the water canals draining the area various types of moist habitat flora is possible.	Low
A5	Agriculture and facilities	The effluents reservoir of the Maayan Tzvi treatment plant, and the fishing research station. Growth at the sites edges controlled by tamarisk and common reed. Common plants include sea sowthistle, yellow fleabane, and bristly oxtongue	Low
A17	Park forest	Forests controlled by Mount Tabor oak, carob tree and terebinth accompanied by pistacia lentiscus, rhamnus palaestina boiss, and a variety of sub-forest grassy flora.	High
A18	Brush	Tight garrigue growth developing on partly rocky infrastructure Dominant species: Prickly burnet - spiny broom Accompanying species: bulbous barley, prickly azarole, red-stemmed figwort, wild marjoram, cat thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble	High

No.	Coverage	Description	Sensitivity
		St. John's wort, splendid bindweed, bitumen trefoil, and golden drop	
A19	Brush	Tight garrigue growth developing on partly rocky infrastructure Dominant species: Prickly burnet - spiny broom Accompanying species: Bulbous barley, prickly azarole, red-stemmed figwort, wild marjoram, cat thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble St. John's wort, splendid bindweed, bitumen trefoil, and golden drop	High
A20	Brush	Tight garrigue growth developing on partly rocky infrastructure Dominant species: prickly burnet - spiny broom Accompanying species: bulbous barley, prickly azarole, red-stemmed figwort, wild marjoram, cat thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble St. John's wort, splendid bindweed, bitumen trefoil, and golden drop	High
A21	Grassy steppe	Steppe areas where grazing takes place. Dominant community is the grains community mostly: bulbous barley - common oat. Among the perennials the common community is of tumble St. John's wort -splendid bindweed. Common species include: splendid bindweed, prickly burnet, hairy breadgrass, silver thistle, field eryngo and dwarf chicory	High
A22	Man-made forest	A planted forest of various species of pine (Cyprus, Jerusalem, Canary), between them	Medium – high

No.	Coverage	Description	Sensitivity
		there are spots of natural Mediterranean forest Palestine oak – carob tree, terebinth, Mount Tabor oak. Common species: prickly asparagus, African fleabane, pistacia lentiscus, teucrium divaricatum, three lobed sage, various types of geophytes such as Persian cyclamen and common narcissus create large concentrations.	
A23	Grassy steppe	Steppe areas where grazing takes place. the dominant community is the grains community mostly: bulbous barley - common oat. Among the perennials the common community is of tumble St. John's wort -splendid bindweed. Common species include: splendid bindweed, prickly burnet, hairy breadgrass, silver thistle, field eryngo and dwarf chicory	High
A24	Agriculture and non-cultivated	Various types of agricultural crops including citrus orchards and field crops. Various sagittal growth and tree lines (such as Cyprus and eucalyptus). Between the plots some non-cultivated flora such as common fennel, thin safflower, common caper, holy thistle, cotton thistle, and various types of weeds.	Low - medium
A25	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Between the crops non-cultivated growth such as common fennel and thin safflower and various types of weeds alongside with Mediterranean forest and garrigue growth such as pistacia lentiscus, spiny broom, rhamnus palaestina boiss, and three-lobed sage.	Low - medium
A26	Grassy steppe	Areas where grazing takes place. The dominant community is the grains	High

No.	Coverage	Description	Sensitivity
		community mostly: bulbous barley - common oat. Among the perennials the common community is tumble St. John's wort - splendid bindweed. Common species include: splendid bindweed, prickly burnet, hairy breadgrass, silver thistle, field eryngo and dwarf chicory	
A27	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Between the crops non-cultivated growth such as common fennel and thin safflower and various types of weeds alongside with Mediterranean forest and garrigue growth such as pistacia lentiscus, spiny broom, rhamnus palaestina boiss, and three-lobed sage.	Low - medium
A28	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Between the crops non-cultivated growth such as common fennel and thin safflower and various types of weeds alongside with Mediterranean forest and garrigue growth such as pistacia lentiscus, spiny broom, rhamnus palaestina boiss, and three-lobed sage.	Low - medium
A28	Rocky steppe	Grassy steppe areas with renewal of shrubs and bushes leading to a formation of garrigue. Plan community: prickly burnet - spiny broom Common species: bitumen trefoil, bulbous barley, cat thyme germander, lesser bindweed, crown flower	High
A29	Mediterranean forest	Tight forest controlled by Palestine oak, officinal styrax and Mount Tabor oak. At the edge of the unit large and impressive Mount	High

No.	Coverage	Description	Sensitivity
		Tabor oak can be seen. Accompanying species: carob tree, pistacia lentiscus, spiny broom, and broad-leaved phillyrea. In spotted areas some proliferation of pine trees may be seen.	
A30	Mediterranean forest	Spots of garrigue and Mediterranean forest: Palestine oak - carob tree. Accompanying trees: Mount Tabor oak, officinal styrax, rhamnus palaestina boiss, and broad-leaved phillyrea. Accompanying species: spiny broom, pistacia lentiscus, prickly burnet, some (rare) concentrations of Mt. Tabor larkspur and crown anemone.	High
A31	Man-made forest	A planted forest of various species of pine (Cyprus, Jerusalem, Canary), between them there are spots of natural Mediterranean forest Palestine oak – carob tree, terebinth, Mount Tabor oak. Common species: prickly asparagus, African fleabane, pistacia lentiscus, teucrium divaricatum, three-lobed sage, various types of geophytes such as Persian cyclamen and common narcissus create large concentrations.	High
A32	Rocky steppe	Rocky steppe with few trees – Palestine oak, carob tree, terebinth	High
A33	Man-made forest	A planted forest of various species of pine (Cyprus, Jerusalem, Canary), between them there are spots of natural Mediterranean forest Palestine oak – carob tree, terebinth, Mount Tabor oak. Common species: prickly Asparagus, African fleabane, pistacia lentiscus, teucrium divaricatum, three-lobed sage, various types of geophytes such as Persian cyclamen and common narcissus create large concentrations.	High

No.	Coverage	Description	Sensitivity
A34	Thicket Mediterranean forest	Mediterranean forest controlled by Palestine oak -carob tree	High
A35	Agriculture	Olive tree orchard. On the margins Mediterranean forest trees and Mediterranean forest growth.	Low
A36	Thicket Mediterranean forest	Partially limited Mediterranean forest controlled by Palestine oak – broad-leaved phillyrea	High
A37	Mediterranean forest	Palestine oak -carob tree. Accompanying trees: Mount Tabor oak, officinal styrax, rhamnus palaestina boiss, and broad-leaved phillyrea. Accompanying species: spiny broom, pistacia lentiscus, prickly burnet, some (rare) concentrations of Mt. Tabor larkspur and crown anemone.	High
A39	Grassy steppe disturbed	An area where it seems that agriculture used to take place in the past. Various grassy growth controlled by uncultivated species: Holy thistle, common fennel, thin safflower, three-lobed sage. At the edge of the unit a Mediterranean forest area with large and impressive Mount Tabor oak trees.	Medium
A40	Park forest	Forests controlled by Mount Tabor oak – Palestine oak accompanied by: terebinth, broad-leaved phillyrea, and pistacia lentiscus.	High

C. **Fauna**

Observations and activity areas – The habitats along the pipeline route support a large variety for animal species. Some areas that are highly sensitive constitute a unique fauna habitat, including the Dor guttering areas along the coast line (and fish ponds) and moist habitat including springs and rivers in the Carmel area. The following is a description of the fauna in the various habitats:

Dor guttering areas

See details in Section 1.9.2.2. C above.

Cultivated areas

See details in Section 1.9.2.2. C above.

Forests and Mediterranean forests

In habitats on the Carmel mountain ridge there are animal species whose preferred habitat is thicket. The largest mammal is the wild boar, and in some areas a number of European roe deer may be active (this species was extinct from the area) – these were released in the course of the "Returning Species" project at the area of Ramat Hanadiv. Animal species are active throughout the entire area and no specific site can be noted along the route where the activity may be concentrated. Species observed in the area:

Table 1C – 1.9.3.2: Fauna in forested and Mediterranean forests habitats

Species	Status	Species	Status
Birds		**Mammals**	
Bush robin	NT	Wild boar	LC
Woodchat shrike	NT	Rock hyrax	LC
Eurasian woodcock		European badger	LC
Alectoris	NT	Golden jackal	LC
Snake eagle	LC	Red fox	LC
Western jackdaw		Common hare	LC

Steppes and garrigue

These habitats are located on the eastern side of the route, around the Hagit power plant. This is the main habitat of the Palestine mountain gazelle in the Carmel region. Activities of the gazelle was documented over the years by Nature and Parks Authority personnel, including in the entire steppe regions (see Figure B – 1.9)

Table 2C – 1.9.3.2: Fauna in steppe and garrigue habitats

Species	Status	Species	Status
Birds		Iduna pallida	
White stork	-	Common blackbird	LC
Common buzzard	NT	Eurasian reed warbler	
Snake eagle	LC	Great spotted cuckoo	
Lesser kestrel	EN	Cetti's warbler	
Common kestrel	LC	Graceful prinia	LC
Glareola	CR	Crested lark	LC
Garrulus	LC	Wood warbler	
Great egret	LC	Red rump swallow	
Alectoris		Barn swallow	LC
Longlegged buzzard		Sardinian warbler	
Roller		Spurwinged lapwing	LC
Hooded crow	LC	Yellow wagtail	
Garrulus	LC	Eurasian stone curlew	LC
White-throated kingfisher		Great tit	LC
Common redstart		Corn bunting	
Sootyheaded bulbul	LC	Cattle egret	LC
Mammals		**Reptiles**	
Palestine mountain gazelle	VU	Montpellier snake	LC
Wolf	VU	Rüppell's snake-eyed skink	VU
Hyena	VU	Günther's cylindrical skink	VU
Red fox	LC	Mediterranean chameleon	LC
Golden Jackal	LC	Kotschy's gecko	LC

Species	Status	Species	Status
European badger	LC	Phoenicolacerta laevis	LC
Herpestes	LC	Stellagama	LC
Wild boar		Bridled skink	LC
Common Hare		Ocellated skink	LC
Weasel	VU	Palaestina Viper	LC
Caracal	VU	Sinai fan-fingered gecko	LC
Jungle cat	VU	Spurthighed tortoise	VU
		Rhinotyphlops simoni	

Springs and rivers

These habitats are not located inside the pipeline alignment, however, due to the unique hydrological nature of the area, and due to their proximity to the route, it is possible, in principle, that some impact may occur, particularly in the water flow aspects and their flow pathways. These habitats carry populations of the fish species Yarkon bream, an endangered species. In addition, these habitats support large populations of amphibians who are also under threat and risk.

Table 3C – 1.9.3.2 : Amphibians in moist habitats

Amphibians	
Southern banded newt	CR
European green toad	EN
Middle East tree frog	VU
Marsh frog	NT

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.3.2.1, as follows:

Table D - 1.9.3.2.1 : Declared archaeological antiquities sites along pipeline route to the treatment facility at Hagit East, Northern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
The pipeline route to the treatment facility	Maayan Tzvi	5930 / 0	Inside the pipeline route and survey area
	Hirbet Teffet (north)	6887 / 0	Inside the pipeline route and survey area
	Hirbet Teffet (east)	39285 / 0	Inside the pipeline route and survey area
	Hirbet Darkemon (south)	25267 / 0	Inside the survey area
	Adallan	1588 / 0	Inside the survey area
	Wadi Maacidi	1739 / 0	Inside the pipeline route and survey area
	Uhm el Tus (north west)	24106 / 0	Inside the survey area
	Hirbet Hanna (south west)?	7170 / 0	Inside the survey area
	Triangulation point 560 – N South	7172 / 0	Inside the survey area
	Triangulation point 560 – N North	7155 / 0	Inside the survey area
	Hirbet Katina	2152 / 0	Inside the pipeline route and survey area
	Bir Katina	7158 / 0	Inside the pipeline route and survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.3.2.2 Southern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.3.2.1 above.

B. Flora

Habitats and flora communities inside the survey area and species of red and rare plants

The characterizations of the habitats and flora communities inside the survey area and species of red and rare plans are presented in Section 1.9.3.2.1 above.

Characterizations of the areas along the route

Characterizations of the areas along the route are presented in Section 1.9.3.2.1 above. The following is a description of habitats and area conditions in the additional section:

Table 2B – 1.9.3.2 : Characteristics of areas along the route to Hagit East

No.	**Coverage**	**Description**	**Sensitivity**
A1	Fish ponds	Inactive ponds. The dominant flora is common reed, tamarisk and maritime rush together with uncultivated land growth such as yellow fleabane, common camelthorn, holy bramble, curly conyza, white conyza, parapholis incurve, piptatherum miliaceum, hispid viper's bugloss, procumbent centaurythist and red species: perennial glasswort and on the edges of the ponds: saltmarsh morning glory and sea holly.	Medium - high
A2	Kurkar flora	The eastern kurkar ridge, bushy flora such as pistacia lentiscus, rhamnus palaestina boiss, hispid viper's bugloss, hairy breadgrass, Israeli thyme, tamarisk and common reed. Rare species: narrow leaves trefoil, holly-leaved naiad, coastal flax, Aleppo crocus, and late flowering narcissus.	Medium – high (mostly in the northern part)
A3	Man-made forest	A planted forest of various species of pine (Cyprus, Jerusalem, Canary), between which are spots of natural Mediterranean forest Palestine oak – carob tree, terebinth, Mount Tabor oak. Common species: prickly asparagus, African fleabane, pistacia lentiscus, teucrium divaricatum, three-lobed sage, various types of geophytes such as Persian cyclamen and common narcissus create large concentrations.	High

No.	**Coverage**	**Description**	**Sensitivity**
A4	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Various sagittal growth and tree lines (such as Cyprus and eucalyptus). In the water canals draining the area various types of moist habitat flora are possible.	Low
A5	Agriculture and facilities	The effluents reservoir of the Maayan Tzvi treatment plant, and the fishing research station. Growth at the sites edges controlled by tamarisk and common reed. Common plants include sea sowthistle, yellow fleabane, and bristly oxtongue	Low
A17	Park forest	Forests controlled by Mount Tabor oak, carob tree and terebinth accompanied by pistacia lentiscus, rhamnus palaestina boiss, and a variety of sub forest grassy flora.	High
A18	Brush	Tight garrigue growth developing on partly rocky infrastructure Dominant species: Prickly burnet - spiny broom Accompanying species: Bulbous barley, prickly - azarole, red-stemmed figwort, wild marjoram, cat thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble St. John's wort, splendid bindweed, bitumen trefoil, and golden drop.	High
A19	Brush	Tight garrigue growth developing on partly rocky infrastructure Dominant species: Prickly burnet - spiny broom Accompanying species: Bulbous barley, prickly - azarole, red-stemmed figwort, wild marjoram, cat thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble St. John's wort, splendid bindweed, bitumen trefoil, and golden drop.	High

No.	**Coverage**	**Description**	**Sensitivity**
A20	Brush	Tight garrigue growth developing on partly rocky infrastructure Dominant species: prickly burnet - spiny broom Accompanying species: bulbous barley, prickly - azarole, red-stemmed figwort, wild marjoram, cat thyme germander, tall spiny restharrow, common oat, purple clover, common caper, Persian cyclamen, tumble St. John's wort, splendid bindweed, bitumen trefoil, and golden drop	High
A21	Grassy steppe	Steppe areas where grazing takes place. The dominant community is the grains community mostly: bulbous barley - common oat. Among the perennials the common community is of tumble St. John's wort - splendid bindweed. Common species include: Splendid bindweed, prickly burnet, hairy breadgrass, silver thistle, field eryngo and dwarf chicory.	High
A22	Man-made forest	A planted forest of various species of pine (Cyprus, Jerusalem, Canary), between them there are spots of natural Mediterranean forest Palestine oak – Carob tree, terebinth, Mount Tabor oak. Common species: prickly asparagus, African fleabane, pistacia lentiscus, teucrium divaricatum, three-lobed sage, various types of geophytes such as Persian cyclamen and common narcissus create large concentrations.	Medium – high
A23	Grassy steppe	Steppe areas where grazing takes place. Dominant community is the grains community mostly: Bulbous barley - common oat. Among the perennials the common community is of tumble St. John's wort - splendid bindweed. Common species include: Splendid bindweed, prickly burnet, hairy breadgrass, silver thistle, field eryngo and dwarf chicory	High

No.	**Coverage**	**Description**	**Sensitivity**
A24	Agriculture and non-cultivated	Various types of agricultural crops including citrus orchards and field crops. Various sagittal growth and tree lines (such as Cyprus and eucalyptus). Between the plots some non - cultivated flora such as common fennel, thin safflower, common caper, holy thistle, cotton thistle, and various types of weeds.	Low - medium
A25	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Between the crops non-cultivated growth such as common fennel and thin safflower and various types of weeds alongside with Mediterranean forest and garrigue growth such as pistacia lentiscus, spiny broom, rhamnus palaestina boiss, and three-lobed sage.	Low - medium
A26	Grassy steppe	Steppe areas where grazing takes place. Dominant community is the grains community mostly: bulbous barley - common oat. Among the perennials the common community is of tumble St. John's wort - Splendid bindweed. Common species include: splendid bindweed, prickly burnet, hairy breadgrass, silver thistle, field eryngo and dwarf chicory.	High
A27	Agriculture	Various types of agricultural crops including citrus orchards and field crops. Between the crops non-cultivated growth such as common fennel and thin safflower and various types of weeds alongside with Mediterranean forest and garrigue growth such as pistacia lentiscus, spiny broom, rhamnus palaestina boiss, and three-lobed sage.	Low - medium

C. <u>Fauna</u>

See Section 1.9.3.2.1 above

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.3.2.1, as follows:

Table D - 1.9.3.2.1 : Declared archaeological antiquities sites along the pipeline route to the treatment facility at Hagit East, southern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
The pipeline route to the treatment facility	Maayan Tzvi	5930 / 0	Inside the pipeline route and survey area
	Hirbet Teffet (north)	6887 / 0	Inside the pipeline route and survey area
	Hirbet Teffet (east)	39285 / 0	Inside the pipeline route and survey area
	Hirbet Darkemon (south)	25267 / 0	Inside the survey area
	Adallan	1588 / 0	Inside the survey area
	Hirbet Tahunat Al hawa	24096 / 0	Inside the survey area
	Uhm el Tus (north west)	24106 / 0	Inside the survey area
	Hirbet Shia	1738 / 0	Inside the survey area
	Hirbet al-Salimania	1809 / 0	Inside the survey area
	Hirbet Kaffa (south – west)?	7184 / 0	Inside the pipeline route and survey area
	Hirbet Kaffa	7173 / 0	Inside the survey area
	Hirbet Hanna (south west)?	7170 / 0	Inside the survey area
	Triangulation point 560 – N South	7172 / 0	Inside the survey area
	Triangulation point 560 – N North	7155 / 0	Inside the survey area

System component	Site name	Number	Location and minimal distance from the plan borders
	Hirbet Katina	2152 / 0	Inside the pipeline route and survey area
	Bir Katina	7158 / 0	Inside the pipeline route and survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.3.3 Treatment facility

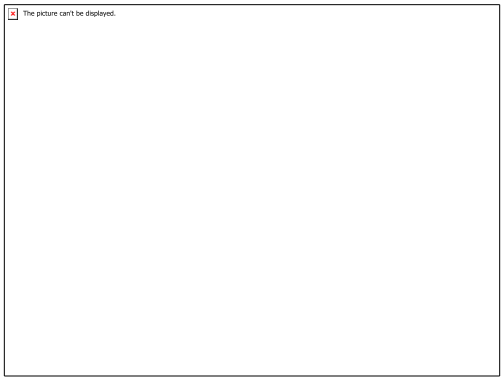
General

Ecological evaluation of the survey area – the survey area spreads east of the Hagit power plant. The area is part of the steppes region typical to the southern Carmel and Ramot Menashe (Figure 1.9.3.3), The habitats and flora formations include grassy steppes, steppes of prickly burnet and wild marjoram, spiny broom garrigue (bushes), springs and rivers, man-made forests, agricultural areas and infrastructure areas. In most of the survey area there are grazing grounds for cattle, which appears to be done in a gradual manner by fencing various areas and letting cattle during different seasons. As noted, the plan area is characterized by high prevalence of steppes areas, from which the most common is grassy steppes. In addition, there are a number of springs located inside the survey area (Ein Hagit, Ein Tut), which create high moisture drainage channels draining into the Nahal Tut. The plan area is a high ecology value area, due to both the unique flora formations, including the steppes formation and the high moisture habitats (Nahal Tut and its tributaries) as well as its regional importance as a connecting area between the Carmel and the high lands.

Nahal Tut

Nahal Tut and Ein Tut are located south of the survey area. The river and springs constitute an important and unique habitat for high moisture organisms. In the river there is a population of the fish species Yarkon bream, which is an endemic and endangered species(acanthobrama telavivensis), as well as the southern banded newt, for which the bodies of water constitute a permanent residence and enables the development of tadpoles into adults. Typical vegetation includes species such as white willow, grey-leafed elm (rare species), river oleander, holy bramble, and common water - crowfoot (rare), creating together thicket landscapes and activity areas for birds and mammals.

Figure 1.9.3.3: Steppes areas inside the survey area – general view

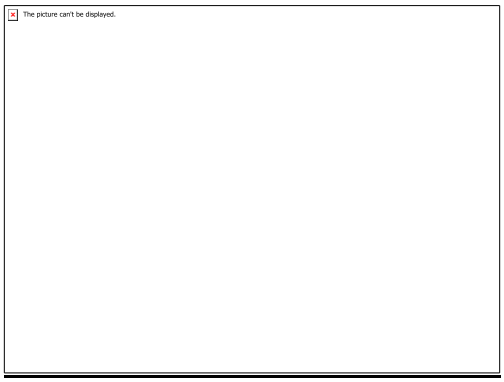


A. <u>Landscape units</u>

Ecological corridors and discontinuation of habitats

The survey area is located in the vicinity of a national ecological corridor connecting the Carmel ridge and Ramot Menashe. This is, in fact, the most important area in the corridor due to the variability of habitats and the open continuum (see Figure A 1.9). Most of the eastern cell unit is not inside the corridor area. Although the survey area is located adjacent to the wall of the current existing infrastructure facility, at the local level the area is used as a movement and passage area for animals, with an emphasis on the gazelle population (Figure 1A – 1.9.3.3). Nahal Tut south of the plan constitutes a very important local corridor. Ecological passage over Road 70 is located approximately 1.5 km south west of the survey area. This is the only passage along Road 70 and it connects the areas of Elyakim – Bat Shlomo with the Menashe steppes on the south. This passage was set up due to the need to connect the gazelle populations and it can be used by all animals active in the area.

<u>Figure 1.9.3.1: Locations of gazelle observation points (source: Rosenberg 2011)</u>[88]



B. Flora

Habitats and flora communities

The most common flora formation in the survey area is of grassy steppes. A rich variety of flora exists in this area. According to observations by the Nature and Parks Authority 232 plant species were documented in the Hagit power plant area. In the survey area it is possible to find areas different in their plant species composition and state of preservation, according to land use and level of violations. As a general rule, the larger the distance from the power plant to the open areas, the greater the area's value in terms of plant variety. The following is a description of the characteristics of habitats in the survey area (Figure B – 1.9).

Grassy steppe – disturbed

Areas attached to the power plant on the east are physically separated by a fence, a gardened strip and by plant communities: common fennel - Jaffa scabious.

Common species: cotton-thistle, holy thistle, blanche globe – thistle, hoary mustard, Syrian thistle, wild carrot and crown daisy.

Grassy steppe

Steppe areas where grazing takes place. The plots are fenced as part of the grazing, apparently in the past some stone clearance and piling activities were performed.

Plant communities : bulbous barley – tabor barley, bulbous barley - common oat

Common species: ovate goat-grass, crown flower, scabiosa palaestina, thin safflower, hoary mustard, dwarf chicory, alba reseda, lesser quaking – grass, great hedge – nettle, rigid flax and heptaptera anisoptera.

Invasive species: hoary mustard, dwarf mesquite.

Agricultural structures

Chicken coops and an agriculture farm in the alternative survey area.

Flora communities: Sagittal and ruderal vegetation

Common species: dwarf mesquite, hoary mustard

Grassy steppe – grazing pressure

In the steppe areas between cultivated areas in the survey area. Intensive grazing is evident which has led to vegetation trampling in the area cells.

Flora community: blanche globe – thistle - bulbous barley

Common species: yellow fleabane, lolium subulatum, hispid viper's-bugloss, dwarf chicory, Syrian thistle and common oat.

Red and rare flora species

The plan area is a natural area with a high species variety. In the scope of the survey no red species were identified, however some of these are known from the vicinity. The following are unique species identified in the scope of this survey and in the scope of previous projects:

Table B – 1.9.3.3: Unique plant species in the area of alternative Hagit East

Species name	Status	Habitat
Iris vartanii	Rare	Steppe
Kanutia bidens	Rare	Steppe
Tall germander	Red	Steppe
Lysimachia dubia	Red	Moist
Syrian cornflower thistle	Endemic	Steppe
Cerinthe palaestina	Rare, endemic	Steppe
Cotton thistle	Endemic	Ruderal
Crocus hyemalis	Endemic	Steppe
Red-stemmed figwort	Endemic	Steppe
Tall viper's-bugloss	Endemic	Steppe
Common water - crowfoot	Protected	Moist
Grey-leafed elm	Rare	Moist

C. Fauna

Observations and locations of activity – The plan area and surroundings constitute a habitat for a large variety of animals from different orders. For the Palestine mountain gazelle the southern part of the Carmel between Elyakim camp and Bat Shlomo constitutes a very important activity area where the largest population is concentrated. The size of this population according to annual counts is estimated at 60 animals (Rosenberg, 2011). In the scope of a field survey performed activity signs were observed (animal droppings) in the steppes areas. In addition, there is activity and movement of endangered mammals such as wolf and hyena. The area of Nahal Tut and its tributaries, in which the plan area is located, constitutes a habitat for various amphibians and fish species which are endangered and it is import to preserve them and their habitat. Southern banded newt (*Triturus vittatus*) can be

found in all the moist habitats in the area and there is a high probability of its existence in the springs and tributaries around the power plant as well (Ein Katina, Ein Tut and Nahal Hagit). Nahal Tut has the fish species Yarkon bream, which is an endangered species. The survey area constitutes an activity area and food source for a large number of birds of prey: falcons and buzzards, and invertebrates such as the Tomares butterfly (Tomares nesimachus), which lays its eggs on the milk-vetch plant growing in the area. The following is a list of species known from the plan area and its surroundings:

Table 1.9.3.1: Animals observed at the Hagit east alternative area

Species	Status	Species	Status
Birds			
White stork	-	Common blackbird	LC
Common buzzard	NT	Eurasian reed warbler	
Snake eagle	LC	Great spotted cuckoo	
Lesser kestrel	EN	Cetti's warbler	
Common kestrel	LC	Graceful prinia	LC
Glareola	CR	Crested lark	LC
Garrulus	LC	Wood warbler	
Great egret	LC	Redrump swallow	
Alectoris		Barn swallow	LC
Long-legged buzzard		Sardinian warbler	
Roller		Spurwinged lapwing	LC
Hooded crow	LC	Yellow wagtail	
Garrulus	LC	Eurasian stone curlew	LC
White-throated kingfisher		Great tit	LC
Common redstart		Corn bunting	
Sooty-headed bulbul	LC	Cattle egret	LC
		Iduna pallida	

Species	Status	Species	Status
Mammals		**Amphibians**	
Palestine mountain gazelle	VU	Southern banded newt	CR
Wolf	VU	European green toad	EN
Hyena	VU	Middle East tree frog	VU
Red fox	LC	Marsh frog	NT
Golden jackal	LC	**Reptiles**	
European badger	LC	Montpellier snake	LC
Herpestes	LC	Rüppell's snake-eyed skink	VU
Wild boar		Günther's cylindrical skink	VU
Common hare		Mediterranean chameleon	LC
Weasel	VU	Kotschy's gecko	LC
Caracal	VU	Phoenicolacerta laevis	LC
Jungle cat	VU	Stellagama	LC
		Bridled skink	LC
		Ocellated skink	LC
		Palaestina viper	LC
		Sinai fan-fingered gecko	LC
		Caspian turtle	LC
		Rhinotyphlops simoni	LC
		Spur-thighed tortoise	VU

D. <u>Heritage sites and historical sites</u>

Declared archaeological antiquities sites are presented in following table:

Table D - 1.9.3 : Declared archaeological antiquities sites located at the Hagit East alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Treatment facility	Hirbet Yoach (west – south – west)	7162 / 0	Inside the survey area
	Hanit river and Ein Hanit	6300 / 0	Touching the survey area to the west
	Boded river (north – west)	40065 / 0	Approx. 50 m to the east
	Boded river (south)	15038 / 0	Approx. 150 m to the south – east
	Triangulation point 566 – N (south – east)	7176 / 0	Approx. 200 m to the south – east
	Triangulation point 978 – R (north west)	7174 / 0	Approx. 300 m to the north
	Nahal Tut (east)	35960 / 0	Approx. 350 m to the south – east
	Hirbet Katina	2152 / 0	Approx. 400 m to the west
	Hirbet Yoach (east)	40064 / 0	Approx. 500 m to the east
	Triangulation point 568 – N (north – east)	7192 / 0	Approx. 500 m to the south
	Ein Al Safsafa	14902 / 0	Approx. 500 m to the west
	Triangulation point 565 – N	7175 / 0	Approx. 550 m to the south – west
	Triangulation point 977 – R (south)	7161 / 0	Approx. 550 m to the west
	Triangulation point 676 – E (north west)	7177 / 0	Approx. 600 m to the south – east
	Ein Boded (south)	40066 / 0	

System component	Site name	Number	Location and minimal distance from the plan borders
	Hirbet Yoach (south – east)	7164 / 0	Approx. 700 m to the south – east
	Triangulation point 588 – N (west)	7146 / 0	Approx. 750 m to the north
	Hirbet al-Menashia (south – west)	7147 / 0	
	Ein Boded	40068 / 0	Approx. 800 m to the east

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.3.4 Pipeline route from the treatment facility

The route reaches the Hagit power plant and the eastern gas pipeline route does not require laying an additional route.

Hadera – Neurim Array

1.9.4 Hadera treatment facility

1.9.4.1 Coastal entry array

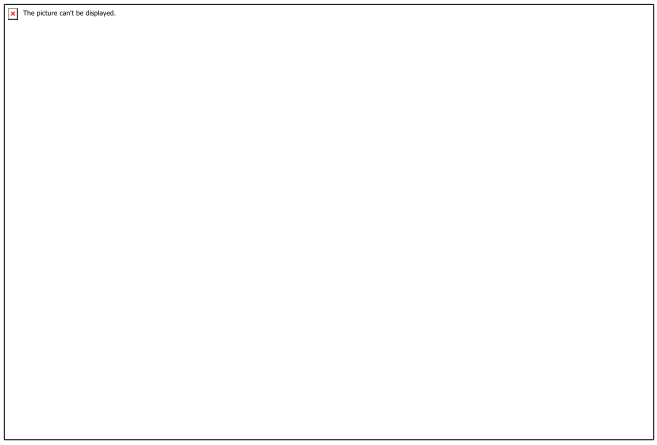
1.9.4.1.1 Nahal Hadera

General

Ecological value of the plan area – the survey area for the onshore receiving station is located in the open spaces between the Orot Rabin power plant and the Olga neighborhood in Hadera, and between the shore to the west and Road 2 to the east. The area is characterized by a combination of sandy habitats including a number of formations: semi-stabilized sands, exposed sands, and stabilized sands. In the eastern part there is a second kurkar ridge on which a unique forest park formation is developing. In the sandy areas close to the south bank of the Nahal Hadera a large man–made park was built. Eucalyptus trees were planted in the area, spreading to sandy areas in the south, causing stabilization of the sand and a change in the habitat. The sands in the plan area constitute a unique and important habitat for sand-loving creatures such as the greater Egyptian gerbil and wedge-snouted skink, and in areas of stabilized sands also Tristram's jird. In the scope of the northern

Sharon region survey the sand areas were evaluated as high value and very high value (Figure 1.9.4.1.1).

Figure 1.9.4.1.1: Nahal Hadera alternative based on land values (source: Hof HaCarmel survey, Open Landscape Institute)



A. Landscape units

Ecological corridors and discontinuation of habitats

The onshore receiving station is located inside the national ecological corridor (Figure A – 1.9):

1. The coastal corridor passes along the coastal areas and the kurkar ridges.

2. The Nahal Hadera corridor – a west-to-east corridor, starting at the shore and along Nahal Hadera to the east.

The corridor in the plan area is blocked on the north by the Orot Rabin power plant and Road 2, therefore, the plan location does not create discontinuation of the continuum. In addition, the actual area of the onshore station is significantly smaller than the survey area, and most of it is buried in the ground, therefore, it is not expected to create a disturbance on the ground.

B. Flora

Habitats and flora communities in the plan area

The plan area is a high value area including the shoreline sand area. A natural habitat of semi-stabilized and stabilized sand exists in most of the space in which no disturbance occurs. Two stabilized sand spots exist in the survey area where the presence of a number of invasive species can be seen. On the local scale these are spots with relatively low ecological sensitivity. In addition, there is a developed and built area in the northwest corner, which is also of low sensitivity. The following is a description of the various area unit characteristics (Figure B – 1.9):

Exposed sands (HD 1)

The sands strip includes a sterile shoreline strip where no plants develop and a belt of exposed sands where a dune pattern is formed as a result of sand stopping vegetation. Dominant plants in the sand strip are sea cudweed - three corner jack. Additional species: pancratium maritimum, prickly glasswort, prickly dropseed grass, chrysopsis, silvery birds' foot trefoil, and sea rocket (cakile maritima).

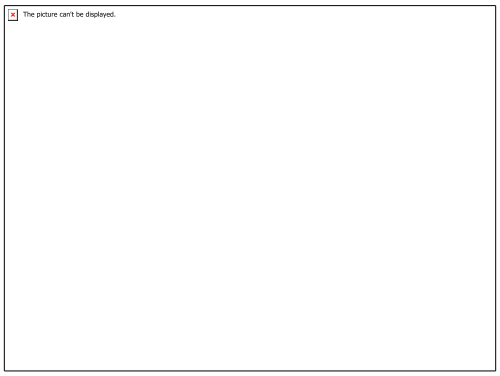
Figure 1B – 1.9.4.1.1: Exposed sand area (sea cudweed)

The picture can't be displayed.

Semi-stabilized sand (HD 3)

The main sandy area in the perimeter of the survey. Undisturbed sands controlled by artemisia monosperma - white broom, with low beach appearance. Accompanying species: one-sided bindweed, chrysopsis, evening primrose, three corner jack.

Figure 2B – 1.9.4.1.1: Semi-exposed sand area (artemisia monosperma - white broom)



Stabilized sands (HD 2, HD 4)

Spots / low spots of stabilized sands with a thick coverage of trees and bushes. In HD 2 the dominant species are: common reed accompanied by chrysopsis, Sydney golden wattle and holy thistle. In small areas a local coverage of grasses is developing. In HD 4 there is a high percentages of trees, such as: tamarisk, Sydney golden wattle, bead tree and pine. In addition common species are: white broom, leafless ephedra, chrysopsis and shrubby saltbush.

Figure 3B – 1.9.4.1.1: Stabilized sands HD 2

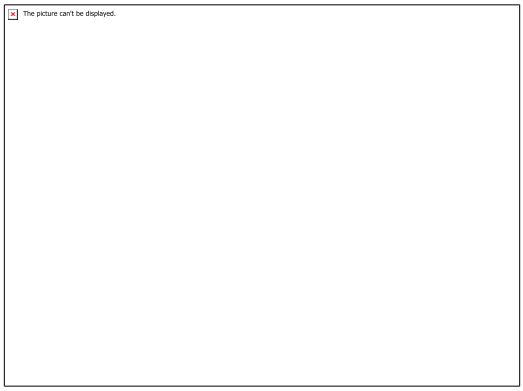
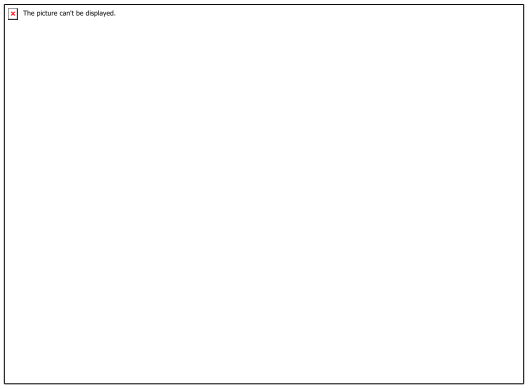


Figure 4B – 1.9.4.1.1: Stabilized sands HD 4



Red and rare plant types

In the survey area no red and rare plant types and species were observed or documented.

C. Fauna

Observations and activity sites – As part of a tour of the area many activity signs were observed in the sand area, including footprints and burrows. The area is part of the habitat of the greater Egyptian gerbil and footprints of red fox and house mouse were observed. Among the reptiles this is an area of known activity for the Schreiber's fringe-fingered lizard, and wedge-snouted skink. In addition, the entire coastal area constitutes a potentially egg laying area for sea turtles. Among the birds, the area constitutes a nesting area for ground birds such as Eurasian stone curlew and rock partridge and thicket birds such as warblers. The following is a list of animal species either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002).

Table 1.9.4.1: Animal species in the area of Nahal Hadera alternative

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Eurasian stone curlew	NT	Herpestes	LC
Lanner falcon	VU	Wildcat	VU
Little egret	LC	Greater Egyptian gerbil	
Spur-winged lapwing	LC	Red fox	LC

Name of species	Status	Name of species	Status
Hooded crow	LC	House mouse	LC
Black kite			
Rock partridge	LC	**Reptiles**	
		Loggerhead sea turtle	CR
		Schreiber's fringe fingered lizard	CR
		Palaestina viper	LC
		Wedge-snouted skink	NT
		Stellagama	LC
		Short-fingered gecko	LC
		Loggerhead sea turtle	CR

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.1.1, as follows:

Table D-1.9.4.1.1: Declared archaeological antiquities sites located at the coastal entrance array at Nahal Hadera

System component	Site name	Number	Location and minimal distance from the plan borders
Coastal entry array	Caesarea, underwater site	4405 / 0	Within the coastal entry array area
	Caesarea sands (south) (south – west)	26145 / 0	Within the coastal entry array area

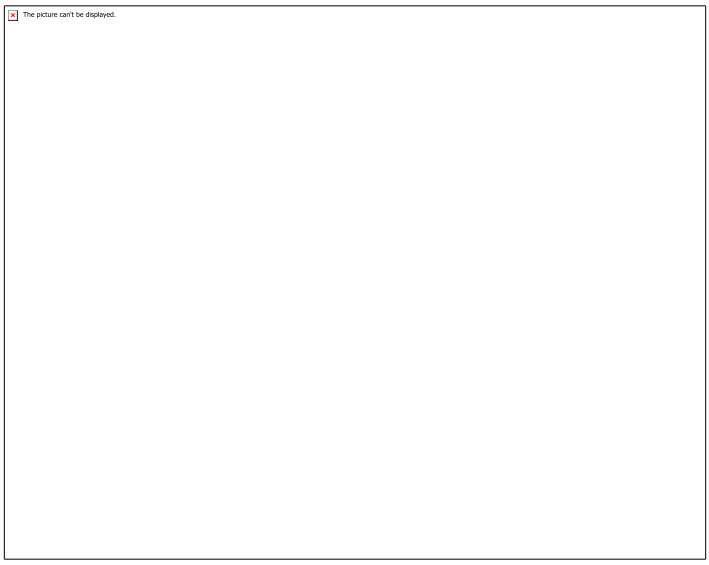
The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.1.2 Michmoret

General

The survey area for the onshore receiving station is located at the open areas between Moshav Michmoret and the Olga neighborhood in the city of Hadera and between the shoreline to the west and Road 2 to the east, which constitute part of the Sharon park space. The area is characterized by a combination of sandy habitats including a number of formations – semi-stabilized sands, exposed sands, stabilized sands, loam soils, coastal ridge and developing park forest landscapes on sandy regosol. In the eastern part there is a second kurkar ridge where a unique park forest formation is developing. In the sandy areas, the various flora belts create a noticeable variety of conditions for various organisms and together create a unique and important habitat for sand-loving animal species such as the greater Egyptian gerbil and the wedge-snouted skink. The Sharon park is also the northernmost point for the Tristram's jird, and in the stabilized sands are also common jird. In the scope of the northern Sharon region survey most of the sand areas were evaluated as very high value, excluding built areas and fertilized soils (Figure 1.9.4.1.2).

Figure 1.9.4.1.2: Alternative based on land values (Source: Hof HaCarmel survey, Open Landscape Institute)



A. Landscape units

Ecological corridors and discontinuation of habitats

The onshore receiving station is located inside the national ecological corridor (Figure A – 1.9):

1. The coastal corridor passes along the coastal areas and the kurkar ridges.

The corridor in the plan area is blocked on the south by Michmoret, thus the plan location does not create discontinuation of the continuum. In addition, the actual area of the onshore station is significantly smaller than the survey area, and most of it is buried in the ground, therefore, it is not expected to create a disturbance on the ground.

B. Flora

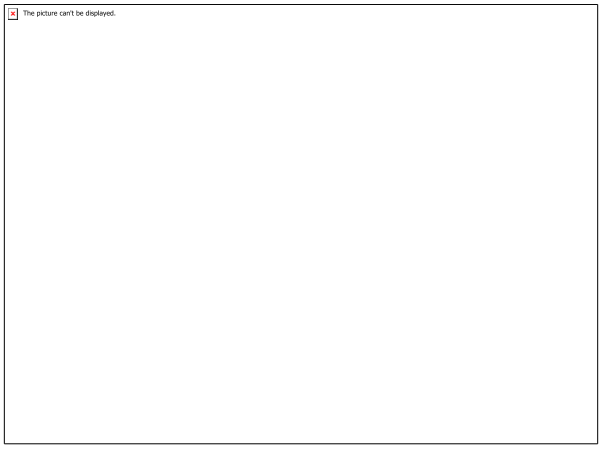
Habitats and flora communities in the plan area

The plan area is a high value area, including the shore sand area and the coastal ridge. In most of the area there is a natural habitat of semi-stabilized and stabilized sand in which no disturbance occurs. Along the roads and in places where damage has been introduced, or the sand coverage disturbed, invasive species can be seen, controlled by Sydney golden wattle. Despite the high sensitivity of the survey area, on the local scale some noticeable disturbed areas are seen, with low sensitivity, in specific cases. No red or rare species were observed in the survey area. The following is a description of the various unit characteristics (Figure B – 1.9):

Coastal ridge (MC 1)

A loam soil ridge whose height may reach up to 10 meters from the coastal area. The ridge is located in its northern section in the area of the Tel Gador nature reserve. In its southern side, close to Michmoret, there is a disturbance resulting from entrance of vehicles. The ridge's growth is relatively sparse in its southern sections, and increases towards the north. In the upper sections of the ridge and the ridge’s plateau the dominant species is chrysopsis. Other species include hottentot fig marigold, sea fennel, hispid viper's bugloss, silvery birds' foot trefoil, and procumbent centaury thist. In the sand strip at the bottom of the ridge are: three corner jack, sea rocket, sea cudweed, and prickly drop seed grass. On the eastern section on the plateau of the ridge there is sandy coverage and development of typical sandy vegetation side by side with grassy species, common species: white broom - shaggy sparrow wort, hispid viper's bugloss, leafless ephedra, Palestine clover, bicolored clover, boxthorn, love-in-a-mist, procumbent centaury thist, one-sided bindweed, and swamp hare's tail.

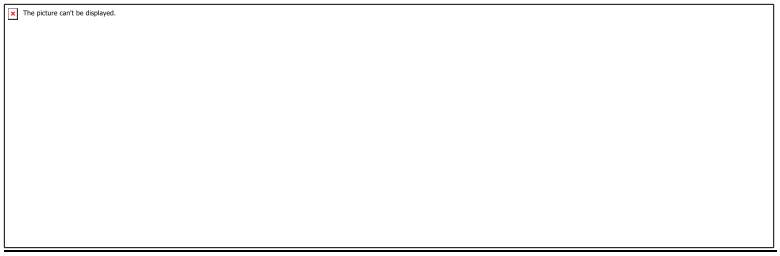
Figure 1B – 1.9.4.1.2: Plateau of the coastal ridge



Semi-stabilized sands (HD 4)

Located at the northern part of the survey area. These were probably created as a result of vehicles trampling the natural vegetation. As a result, a pattern of plant islands in the area of exposed sands was created. These islands are controlled by white broom, white wormwood and leafless ephedra.

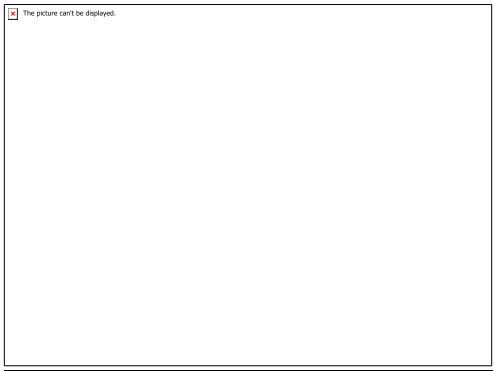
Figure 2B – 1.9.4.1.2: Area of semi-stabilized sands



Stabilized sands (MC 3)

This habitat is common in most of the survey area. The dominant plant community in undisturbed areas is sand wormwood - white broom. In disturbed areas it is possible to see establishment of Sydney golden wattle, which creates tight and tangled thicket concentrations mostly by the road side. Other species are one-sided bindweed, chrysopsis, hispid viper's bugloss, leafless ephedra, boxthorn and swamp hare's tail.

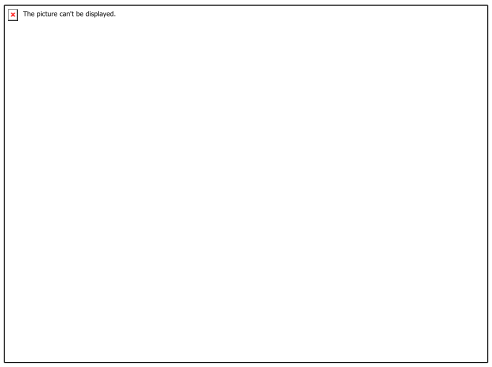
Figure 3B – 1.9.4.1.2: Stabilized sands



Built areas

A disturbed area with exposure of the top soil can be found at the south – western part of the surveyed area. Some ruderal flora is developing there, controlled by the invasive species, chrysopsis.

Figure 4B – 1.9.4.1.2: Built disturbed area on the south side



Red and rare plant types

In the survey area no red and rare plant types were found or documented.

C. Fauna

Observations and activity sites – the survey area constitutes a part of the activity area and habitat of greater Egyptian gerbil, as well as footprints of red fox, and house mouse, and in the stabilized sands Tristram's jird. Among reptiles there is known activity of Schreiber's fringe fingered lizard, and wedge snouted skink. In addition, the coastal area constitutes a potential breeding site for loggerhead sea turtles. Among birds, the area constitutes a breeding site for ground fowl such as the

Eurasian stone curlew and rock partridge, and various types of thicket birds such as warblers. In the coastal ridge a number of dug borrows were found, used for nesting of European bee eater.

The following is a list of animal species either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002).

Table C - 1.9.4.1.2: Animal species in the area of Michmoret alternative

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Eurasian stone curlew	NT	Herpestes	LC
Rock partridge	LC	Wildcat	VU
Spurwinged lapwing	LC	Greater Egyptian gerbil	VU
Hooded crow	LC	Red fox	LC
Black kite		House mouse	LC
European bee-eater	VU	Tristram's jird	LC
Reptiles			
Stellagama	LC	Green sea turtle	CR
Short-fingered gecko	LC	Schreiber's fringe fingered lizard	CR
Loggerhead sea turtle	CR	Palestine Viper	LC
		Wedge snouted skink	NT

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.1.1, as follows:

Table D - 1.9.4.1.2: Declared archaeological antiquities sites located at the coastal entry array in Nahal Hadera

System component	Site name	Number	Location and minimal distance from the plan borders
Coastal entry array	Michmoret, underwater site	4417 / 0	Coastal entry array area
	Mevo'ot Yam	1190 / 0	Coastal entry array area

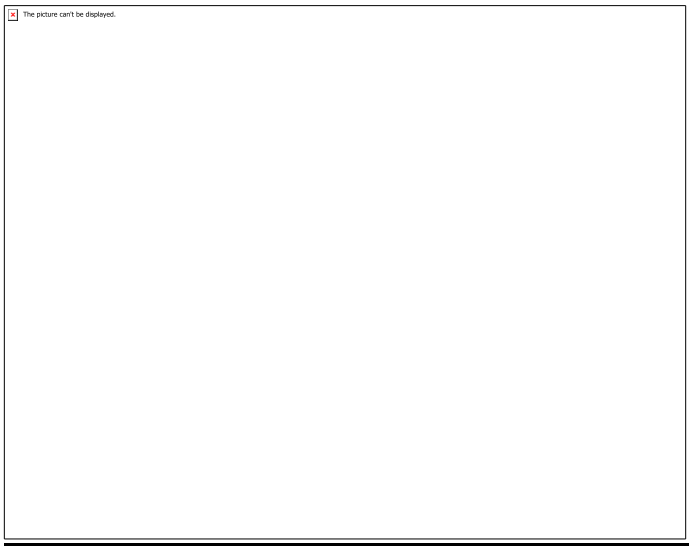
The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.1.3 Nahal Alexander

General

Ecological value of the plan area – The survey area for the onshore receiving station is located at the open areas between Michmoret and Mevo'ot Yam and Nahal Alexander. This area is characterized by a combination of sandy habitats including a number of formations – semi-stabilized sands, exposed sands, stabilized sands and moist habitats created due to the presence of high levels of groundwater and top soil digs. In the scope of the northern Sharon area survey[89] most of the sandy areas were evaluated as very high value, excluding spots of built areas and disturbed areas which were evaluated as low value (Figure 1.9.4.1.3).

Figure 1.9.4.1.3: Nahal Alexander alternative based on land values (Source: Hof HaCarmel survey, Open Landscape Institute)



A. Landscape units

Ecological corridors and discontinuation of habitats

The onshore receiving station is located inside the national ecological corridor (Figure A – 1.9.1):

1. The coastal corridor – passes along the coastal areas and kurkar ridges.

2. The Nahal Alexander corridor – passes between the river source to the west and to the east

The coastal corridor in the plan area is blocked on the north by Michmoret, therefore the plan location does not create discontinuation of the continuum. The Nahal Alexander estuary passes in the open areas between Mevo'ot Yam and Beit Yanai. The open area strip width is approximately 3 km. The survey area slightly reduces the open area, but the actual area of the onshore station is significantly smaller than the survey area, and most of it is buried underground. Therefore, it is not expected to create a disturbance on the ground.

B. Flora

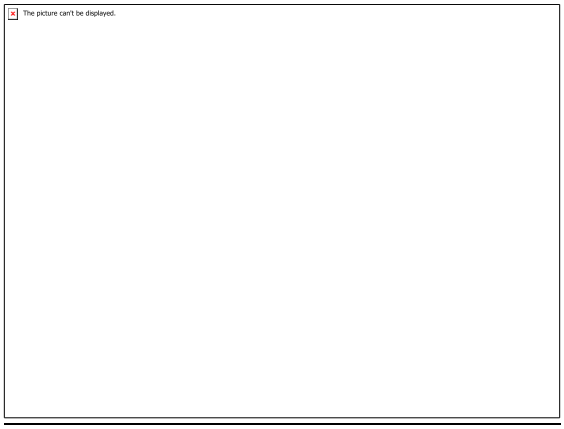
Habitats and flora communities in the plan area

The survey area is an area with high ecological value, including the coastal sands area and some moist habitats at the back of the shoreline. The moist habitats allow for the development of a unique ecological system where a wide variety of unique flora can be found. Among the unique species one can find in these habitats elephant grass (typha elephantina), which is a very rare species; this is its only habitat in Israel[90], and the species wide leaf bulrush (typha latifolia), also considered very rare. The areas on the Nahal Alexander banks are partially protected areas for the public benefit. Alongside these there is a grassy steppe developing on the stabilized sands. In this area there are some structures used by the Sea Turtles Center. In the northern part of the area there are a number of stabilized sands where a variety of flora can be found, including sand species, and invasive species. The value of this area is relatively low. The following is a description of the various unit characteristics (Figure B – 1.9):

Exposed sands (Al 1)

The beach sands, an undisturbed unit where the species marram grass, and evening primrose are common, other species: three corner jack, horrid asparagus, one-sided bindweed, chrysopsis, sand wormwood, and prickly glasswort.

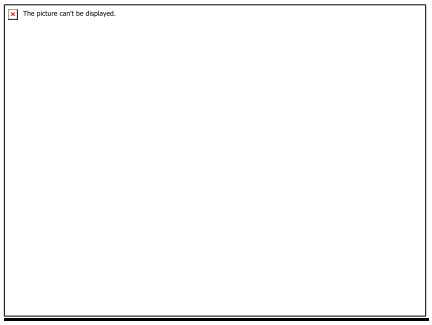
Figure 1B – 1.9.4.1.3: Beach sands



Moist hollows (AL 2)

Hollows of high underground water table and inactive oxygenation pools. Some of the pools have large concentrations of elephant grass and wide leaf bulrush. Other species include: Dutch rush, bulrush, common reed, marsh fleabane, holy bramble, stranglevine, pinkweed, and papyrus sedges. At the edges of the hollows neglected areas flora: thin safflower, chrysopsis, charlock, mallow malva alongside with local species: tamarisk, pistacia lentiscus and boxthorn.

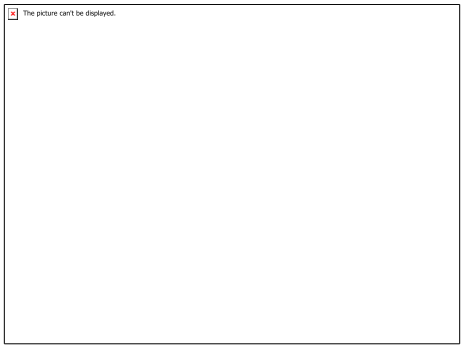
Figure 2B – 1.9.4.1.3: Moist habitats with concentrations of Bulrush grass



Grassy steppe (AL 3)

Grassy areas where a coverage of grasses develops over the sands with a look of a grassy meadow. A combination of sand species and uncultivated lands species are common: chrysopsis, horsetail knotweed, salt reed grass, silvery birds' foot trefoil and evening primrose.

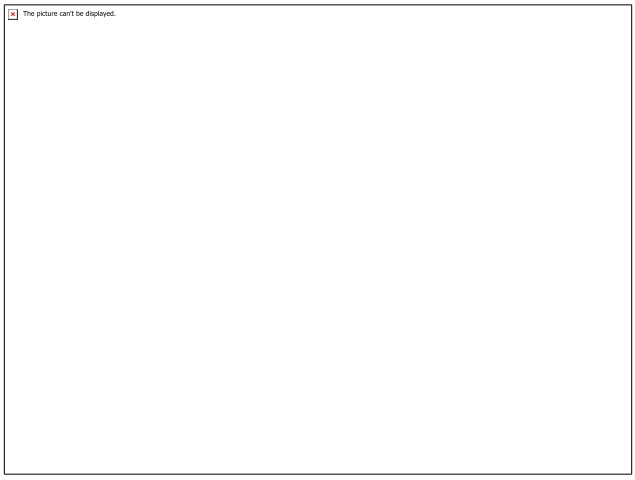
Figure 3B – 1.9.4.1.3: Deserted structure in the beach grassy steppe area



Stabilized sands (AL 4)

Areas at the eastern side of the survey area, across from the access road leading to the stream estuary. In this section the sands are disturbed and controlled by various trees and invasive flora such as river red gum, and Sydney golden wattle, (there is an ongoing operation in this area of eliminating invasive flora). The common sand plants are white broom and sand wormwood, and the common neglected areas flora are: holy thistle, chrysopsis, common reed, leafless ephedra, foxtail grass and charlock.

Figure 4B – 1.9.4.1.3: Disturbed area with invasive flora



Red and rare flora species

In the plan area 7 unique species were identified. On the border of the sandy shoreline are sea plantain and Sharon nut grass. In the moist habitats inside the survey area subulate rush, elephant grass and wide leaf bulrush were found (in large concentrations). On the banks of Nahal Alexander the following species were

documented: urochloa mutica, saltmarsh morning glory and downy bird's foot trefoil.

Table B – 1.9.4.1.3: Red and rare plant species in the area of Nahal Alexander

Species name	Status	Habitat
Sea plantain	Rare	Saltmarsh
Subulate rush	Rare	Moist
Wide leaf bulrush	Rare	Moist
Urochloa mutica	Red	Moist
Downy bird's foot trefoil	Red	Moist
Saltmarsh morning glory	Red	Moist
Sharon nut grass	Red	Sandy
Elephant grass	Very rare	Moist

C. Fauna

Observations and activity sites – the sandy coastal area is known to be a breeding site for loggerhead sea turtle and possible activity site of the sand loving rodent Greater Egyptian gerbil. In the thicket around the moist habitats there is activity of various mammals such as jungle cat, herpestes and red fox, and in the pools and hollows areas a variety of amphibians can be found, including the Middle East tree frog and green toad. Among the birds various plovers have been seen in the past, some of which are endangered such as the Kentish plover. In the Nahal Alexander area there is a population of softshell turtles, some of which may go to the sea in the estuary area. In the river banks some nests may be found in relatively exposed areas. The following is a list of animal species specifying either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002)

Table C – 1.9.4.1.3 Animals observed in plan area (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)

Name of species	Status	Name of species	Status
Birds		**Mammals**	
Eurasian stone curlew	NT	Herpestes	LC
Rock partridge	LC	Wildcat	VU
Spur winged lapwing	LC	Jungle cat	
Hooded crow	LC	Red fox	LC
Black kite		House mouse	LC
Coot	NT	Golden jackal	
Black winged stilt	VU	Caracal	
Gray heron	CR	**Reptiles**	
Common buzzard	NT	Caspian turtle	
Common sandpiper		Green sea turtle	CR
Wood sandpiper		Schreiber's fringe-fingered lizard	CR
Eurasian golden plover		Palestine viper	LC
Kentish plover	CR	Loggerhead sea turtle	CR
Common moorhen	LC	Stellagama	LC
Little ringed plover	CR	Softshell turtle	CR
Common ringed plover		**Amphibians**	
White throated kingfisher		Middle East tree frog	VU
Ruff		Green toad	
Black tern			

D. **Heritage sites and historical sites**

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.1.3, as follows:

Table D - 1.9.4.1.3: Declared archaeological antiquities sites located at the coastal entry array in Nahal Hadera

System component	Site name	Number	Location and minimal distance from the plan borders
Coastal entry array	Michmoret, underwater site	4417 / 0	Inside coastal entry array
	Michmoret, underwater site (south)	26773 / 0	Inside coastal entry array

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.2 Pipeline route to the treatment facility

General

The source of the material presented in this chapter is in a field survey performed in July 2012. This season does not allow for optimal impression of the variety of flora in the various habitats, and particularly in reference to therophytes. In addition to the field survey, some data from the literature is presented. Literature sources are specified in the list of references.

This section presents the supply pipeline route alternative (to the treatment facility) defined by the onshore receiving station location – Hadera, Michmoret and Alexander. The Alexander and Michmoret alternatives are overlapping over large sections of the route. In addition, the connecting point to the Hadera route is located in proximity to the onshore receiving station. Therefore, the description in the main Nahal Hadera route refers to all of the alternatives. Later on we will provide an individual description of the habitats in the southern alternatives which were not surveyed in the main alternative. The transmission route exiting the treatment site and continuing east towards the national system is identical for all alternatives. There are two alternatives in existence for this route – southern and northern. In this section some of the ecological data for Sections A (landscape units) and C (fauna) are presented as one unit without separation into alternatives. In Chapter B an analysis and evaluation of each alternative will be performed.

1.9.4.2.1 Route from Nahal Hadera

A. Landscape units

Ecological corridors and discontinuation of habitats

The pipeline route passes through a national ecological corridor (Figure A – 1.9):

1. Coastal corridor – passes along the shoreline and kurkar ridge areas
2. East Emek Hefer corridor – passes through agricultural plots to the foot of Shomron mountains.
3. Nahal Hadera corridor – a transverse corridor along the river that connects between the two longitudinal corridors

The pipeline route is a buried line, therefore discontinuation of habitats and ecological corridors is unexpected. Some disruption is expected to the fauna's free movement in the work sections in the course of construction..

B. Flora

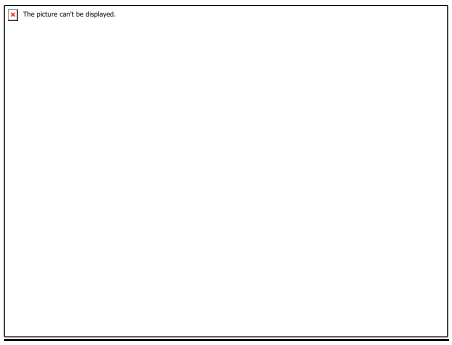
Habitats along the transmission route

At the Hadera site some alternatives exist for both the supply line from the shore and the transmission route east of the national system. The supply route is derived from the receiving station close to the Hadera – Michmoret, Alexander beach. For the east bound alternative two alternatives exist: one is south of Road 65 and the second is partially north of it. The following is a description of the characteristics of the main habitats (Figure B – 1.9).

Sands

The main sands areas spread along the beach and all the way to Road 4. In the sands areas a number of habitats exist side by side, according to the level of the surface stability. In the semi-stabilized sands are controlled by the white broom - sand wormwood community. In some of the areas, such as the Emek Hefer industrial zone, some spots can be found where other species in high concentrations have joined, such as sun rose and chrysopsis (invader). At the Michmoret area shaggy sparrow wort appears in the loam soils in proximity to the shore. The sands also constitute a unique habitat for many animal species such as the greater Egyptian gerbil, Tristram's jird, nidua fringe fingered lizard and such invertebrates as the cigaritis cilissa butterfly, which can be found in the Hephzibah sands near Hadera.

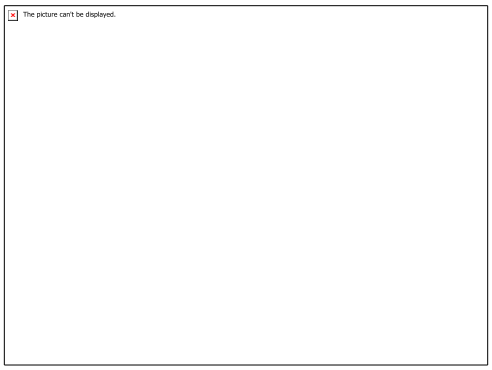
Figure 1B – 1.9.4.4: Hephzibah sands



Grassy steppe

A high quality steppe area can be found in the area of the Sharon park between spots in the carob trees forest park. These spots are rich with various types of grains and annual plants such as ovate goat grass, Sharon goat grass (endemic), purple false brome, wild oat, and Palestine clover (endemic). In the light soils area some steppe areas exist between cultivated plots, and mostly the common community is salt reed grass – procumbent centaury thist. Some rare and endemic species can be found in this habitat; its occurrence in the survey area is relatively low. In the steppes areas west of Road 2 some wide spaces can be found covered by the invasive species chrysopsis.

Figure 2B – 1.9.4.2.1: Grassy steppe at the Sharon park with invasion of chrysopsis

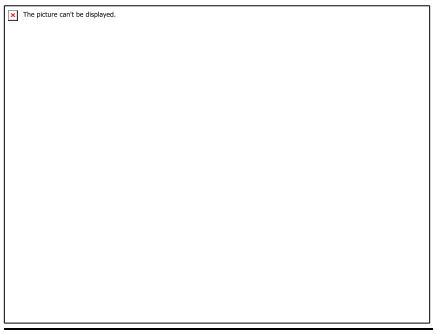


Park forest

Two appearances of coastal park forest can be found in the survey area. The most common community is Carob tree - pistacia lentiscus. This community is common in

the areas between Michmoret and Nahal Hadera, whereas in the more southern areas the format is more open and grassy plants can be found between the trees. In the flowering season impressive wildflower patches can be seen. In the northern area, near Nahal Hadera, the forest park units become crowded and closed due to high coverage by pistacia lentiscus, creating thickets between trees. Other species are leafless ephedra, European wolfberry, horrid asparagus, and common madder. The second community is the Mount Tabor oak - salt reed grass. This community can be located near the southeast border of Hadera forest, where in the northernmost areas some Palestine oak can also be found. The coastal park forest is a unique and sensitive habitat, in which preservation is considered very important, and the forest located within the route area is the highest quality of this flora formation in Israel.

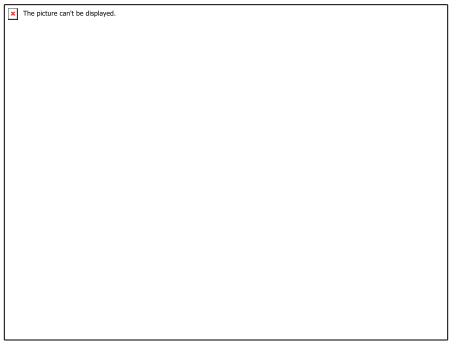
Figure 3B – 1.9.4.2.1: Coastal park forest in the western side of the carob tree park



Agricultural and uncultivated lands

Agricultural activity is taking place in most of the areas east of Road 4. Agricultural plots include seasonal crops, orchards and orange groves. At the edges of the farmed fields some scrub growth can be found, such as dwarf mesquite, spotted golden thistle, holy thistle, charlock, English beet, dyer's croton, horsetail knotweed, and rye grass. In the uncultivated areas where agriculture has stopped some pioneer plants can be seen, such as: hairy bread grass, procumbent centaury thist, and hispid viper's bugloss. In all these areas is a relatively high presence of invasive species with the common structures of Sydney golden wattle, castor oil plant, wild-sage, golden crown beard, chrysopsis, and common bead tree. The northern alternative passes through the loam soils of Pardes Hanna area, in uncultivated areas and in agricultural areas some single trees of Mount Tabor oak can be found. In addition, some typical flora can be found in recovering areas.

Figure 4B – 1.9.4.2.1: Agricultural areas to the east of the route



Kurkar ridges

The proposed route crosses the second kurkar ridge in a number of points. In the northern section the route passes in the area of the Hephzibah neighborhood. The kurkar ridge in this area is tightly covered with pistacia lentiscus bushes, and between them some low rise carob trees and leafless ephedra bushes. The alternatives coming out of the Michmoret station and Nahal Alexander pass along the route between the coastal road and the railway tracks. These areas include a variety of high quality habitats and constitute a part of the Sharon park. In the Nahal Hadera area a number of quarries exist in the kurkar ridge where moist habitats develop, and include a high number of invasive species.

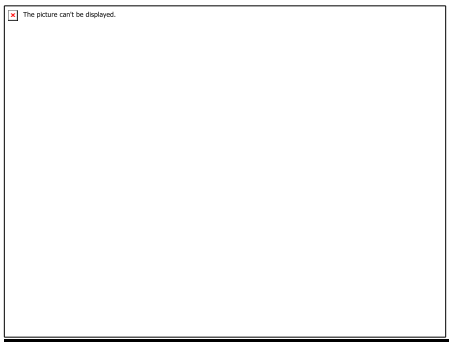
Figure 5B – 1.9.4.2.1: Kurkar ridge in the Hephzibah neighborhood area

Eucalyptus forest

Eucalyptus forests are planted forests in older areas such as the Hadera Forest. In the sandy areas adjacent to Nahal Hadera and Hephzibah eucalyptus has spread into the sandy areas and changed the habitats. The number of species in eucalyptus forests is relatively low, and can be found mainly in bald spots and in places where there is a large distance between trees. In forests where soil drainage exists some

winter pools are created (Samar Pool, Yaar Pool, and Dameira Pool), and a unique and rich moist ecology develops.

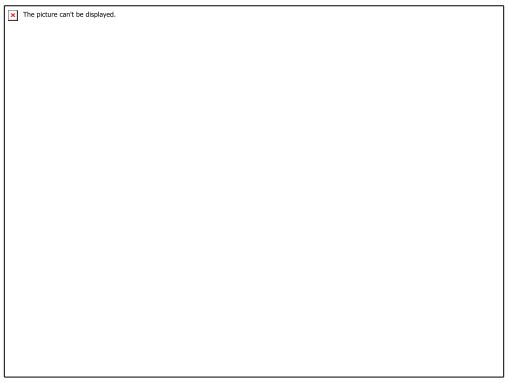
Figure 6B – 1.9.4.2.1: Eucalyptus forest in the sands south of Nahal Hadera



Moist habitats

These include winter pools, rivers and drainage canals. The Samar Pool is located within the borders of Hadera Forest, west of the railway tracks. West of the tracks there is another pool (the railway storeroom house pool). At Gan Shmuel, at the point where Road 65 crosses, the remains of Dameira Pool can be found. These pools are among the most important pools in the coastal plain and constitute a central activity site for amphibians such as the Syrian spadefoot (a species at risk of extinction) and unique crabs. Unique flora also develop in these pools, including some rare species such as Dutch rush, common spike rush, strawberry clover, common water crowfoot, jointleaf rush, tree germander, branched bur reed and flowering rush. The main streams are Nahal Alexander and Nahal Hadera, which are crossed by the route and have water flow year round, and secondary rivers where water flow is seasonal. The natural flora in these area has been damaged over the years. Most of the flora appears in the river banks and includes a composition of wet banks species and uncultivated land growth. Common species are: holy bramble, common reed, stranglevine, willow of the brook, charlock, and pinkweed. At Nahal Hadera there are observations of saltmarsh morning glory (red species). Drainage canals pass at the rims of cultivated plots and fish ponds, and these are treated in a variable manner which precludes growth of rich vegetation. The rivers constitute an activity site for water fowl and thicket birds, and at Nahal Alexander the largest population of all coastal rivers of soft shell turtles thrives.

Figure 7B – 1.9.4.2.1: Drainage canal in the area of Dameira swamp with thick coverage of branched bur reed (red species)



Rare and red species

The large variety of habitats along the suggested route allows for proliferation of a number of unique plant species concentrated mostly in moist habitats and light weight soils in the area of Sharon park and the kurkar ridge. In the Sharon park and its vicinity, 120 red and rare species have been documented over the years (the Sand Park Survey). Most of these species have disappeared over time, probably due to the damage incurred to their habitats. The following is a partial list of species in the route area:

Table 1B – 1.9.4.2.1: Species of flora in the route area from the Hadera onshore receiving station

Name of species	Status	Habitat
Chrysanthemum	Red	Sands
Philistine horehound	Rare	Sands
Aleppo crocus	Rare	Kurkar
Saltmarsh morning glory	Red	Moist
Erodium subintegrifolium	Red	Kurkar, rocky ledges
Late flowering narcissus	Red	Kurkar
Tree germander	Red	Moist

Name of species	Status	Habitat
Damson starfruit	Rare	Moist
Water plantain	Rare	Moist
Great fen sedge	Red	Moist
Paper reed	Red	Moist
Sea knotgrass	Rare	Moist
Phoenician rose	Rare	Mediterranean forest
French lavender	Red	Kurkar, loam
Urochloa mutica	Red	Moist
Yellow lupine	Red	Sands
Hirsute lupine	Rare	Steppe
Madder	Red	Moist
Eig's sage	Red	Steppe
Pink knotweed	Red	Moist
Little Neptune grass	Rare	Moist, sands

Characteristics of areas along the route

The following of a description of habitats and land cells from the section to Hadera south

Table 2B – 1.9.4.2.1: Characteristics of habitats in the route from the coastal entry array at Hadera

	Coverage	Description	Sensitivity
B1	Bush scrub mixed	Stabilized sands with a combination of local species and various invasive species. Common: white broom, sand wormwood, salt cedar, Sydney golden wattle, bead tree, common reed, leafless ephedra and chrysopsis	Medium
B2	Bush scrub sandy	Semi-stabilized sands controlled by white broom - sand wormwood. Accompanying species: callous leaved gromwell, creeping thorn rose, marram grass, chrysopsis (invasive	High

	Coverage	Description	Sensitivity
		species), common reed, leafless ephedra, Jaffa groundsel, and Sydney golden wattle (invasive species)	
B3	Park forest	At the northern section of the Sharon park in the Hadera area, a coastal forest of carob tree - pistacia lentiscus. A thick coverage of pistacia bushes and between these grassy flora such as Tournefort's mustard, ovate goat grass, Goat grass, massed alkanet, and creeping thorn rose	High
B4	Eucalyptus forest	The establishment of eucalyptus in the sandy areas leads to stabilization of the soil and the entry of uncultivated land flora. Common species: leafless ephedra, piptatherum, white broom, sand wormwood, chrysopsis, Sydney golden wattle, and salt cedar	Medium
B5	Eucalyptus forest	The establishment of eucalyptus in the sandy areas leads to stabilization of the soil and the entry of uncultivated land flora. Common species: leafless ephedra, piptatherum, white broom, sand wormwood, chrysopsis, Sydney golden wattle, and salt cedar	Medium
B6	Grassy steppe	The Sharon park areas are characterized by an open coastal forest of carob tree - pistacia lentiscus. Between the trees are grassy steppes and sandy spots. The flora is a variety of light soils flora mixed with uncultivated land and sandy flora. Common species: white broom, hispid viper's bugloss, procumbent centaury thist, sand wormwood. Among the grassy plants area various grains - Goat grass are common and various faboideae such as vetchling, medicago and trefoil. Rare plants: Chrysanthemum, erodium subintegrifolium, Philistine horehound. In some areas agriculture can be found. Along the edges of the cultivated lands is Sydney golden wattle (invasive species)	High
B7	Park forest	Areas between Hephzibah neighborhood and Road 2. High coverage of pistacia lentiscus accompanied by carob trees. Additional species: cloven petalled campion, love-in-a-mist, white	High

	Coverage	Description	Sensitivity
		broom, hispid viper's bugloss. Rare species: great fen sedge	
B8	Eucalyptus forest	The establishment of eucalyptus in the sandy areas leads to stabilization of the soil and the entry of uncultivated land flora. Common species: leafless ephedra, piptatherum, white broom, sand wormwood, chrysopsis, Sydney golden wattle, and salt cedar	Medium
B9	Built area	Hephzibah neighborhood of Hadera	Low
B10	Sandy bush scrub and agriculture	An olive grove is planted in the sandy areas. The dominant species: white broom, pistacia lentiscus. Common: hispid viper's bugloss, sand wormwood, goat grass, sun rose and one sided bindweed	
B11	Built area	Hephzibah neighborhood park and the Electric Corporation	Low
B12	Eucalyptus forest	The establishment of eucalyptus in the sandy areas leads to stabilization of the soil and the entry of uncultivated land flora. Common species: leafless ephedra, piptatherum, white broom, sand wormwood, chrysopsis, Sydney golden wattle, and salt cedar	Medium
B13	Agriculture and foresting	Cultivated areas of Hephzibah site	Low
B14	Eucalyptus forest	A row eucalyptus trees along Hephzibah site. Uncultivated land flora develops under the trees	Medium
B15	Sandy bush	Stabilized and semi-stabilized sands. Dominant species: white broom, sun rose, chrysopsis. Common species: sand wormwood, pistacia lentiscus, sorrel dock, leafless ephedra and hispid viper's bugloss	High
B16	Uncultivated	Sandy and uncultivated lands flora. Common species: common reed, carob tree, chrysopsis (invasive species), swamp hare's tail, knapweed, pistacia lentiscus, holy bramble, and Sydney golden wattle (invasive species)	Low - medium
B17	Built area	Industrial zone	Low

	Coverage	Description	Sensitivity
B18	River	The Nahal Hadera channel. River bank growth, uncultivated land flora mixed with invasive species controlled by common reed - holy bramble. Additional species: willow of the brook, lilac chaste tree, and stranglevine. Rare species: saltmarsh morning glory, and Nile bean. Invasive species: Sydney golden wattle, Castor oil plant, and chrysopsis	Medium - high
B19	Agriculture	Field crops. At the edges of the plots wasteland growth: Jaffa scabious, charlock, dwarf mesquite, dyer's croton	Low
B20	Agriculture	Field crops. At the edges of the plots wasteland growth: Jaffa scabious, charlock, dwarf mesquite, dyer's croton	Low
B21	Fish ponds	Fish ponds and field crops. Uncultivated and wasteland growth . common species: common reed, dwarf mesquite, common cocklebur, holy bramble, and common caper	Low

C. Fauna

In this section the data is presented as one unit without separation into the various alternatives of the pipeline route. Chapter B presents an analysis and evaluation of each alternative, as stated at the beginning of this section.

Observations and activity sites (Figure B – 1.9) – the route alternatives pass through a number of habitats with importance to animals:

Sands

In this habitat there are a number of rodents and reptiles that include sand-loving species such as: greater Egyptian gerbil and nidua fringe-fingered lizard. High quality sand areas can be found south of Nahal Hadera between the shoreline and Road 4 and in the Park Hasharon area north of the Emek Hefer industrial zone. The sandy area of Hephzibah park and its surroundings constitutes a unique habitat of the rare cigaritis cilissa butterfly. Another sandy spot is located at Michmoret between the shoreline and the Sharon park.

Moist habitats (Samar Pool, Dameira Pool)

This habitat has a large variety of amphibians, some of which are at risk of extinction – such as Syrian spadefoot and a large variety of invertebrates such as

crabs and snails. This habitat is rare in the area and its ecological importance is great.

Rivers

Nahal Hadera and Nahal Alexander constitute an activity site for various animal species. Potential habitats to be used by animal species are the growth thickets at the edges of fish ponds and water canals constituting an activity site for thicket birds, water fowl, and mammals such as herpestes, wildcat and red fox. As mentioned above, Nahal Alexander is constitutes the primary habitat for soft shell turtles, a species under risk of extinction.

The following is a list of animal species indicating either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002)

Table C – 1.9.4.2.1 Animals observed in plan area (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)

Name of species	Status	Name of species	Status
Reptiles			
Large whip snake	LC	Spur-thighed tortoise	VU
Mediterranean house gecko	LC	Short-fingered gecko	LC
Stellagama	LC	Schreiber's fringe-fingered lizard	VU
Palestine Viper	LC	Mediterranean chameleon	LC
Soft shells turtle	VU	Schokari sand racer	LC
Wedge-snouted skink	NT	Ocellated skink	LC
European legless lizard	NT	Montpellier snake	LC
Mammals			
Southern white-breasted hedgehog	LC	Herpestes	LC
House mouse	LC	Black rat	LC
Wildcat	LC	Common Jird	LC
Günther's vole	VU	Tristram's jird	VU

Name of species	Status	Name of species	Status
Indian crested porcupine	LC	Greater white toothed shrew	
Red fox	LC	Greater Egyptian gerbil	VU
Golden Jackal	LC	Nutria	
European badger	LC		
Amphibians			
Common toad	VU	Syrian spadefoot	CR
Middle East tree frog	VU	Marsh frog	LC
Birds			
Rose-ringed parakeet	Invader	Green sandpiper	
Laughing dove	LC	Eurasian widgeon	
Common myna	Invader	Gadwall	
Hooded crow	EN	European stonechat	
Eurasian collared dove	LC	Hoopoe	NT
Eurasian bittern		Graceful prinia	LC
Spur-winged lapwing	LC	Western marsh harrier	RE
Great spotted cuckoo	LC	Little grebe	NT
House sparrow	LC	Black-tailed godwit	
Black-winged stilt	VU	Lesser spotted eagle	NT
Common sandpiper		Greater spotted eagle	RE
Wood sandpiper		Palestine sunbird	LC
Marsh sandpiper		Water rail	LC
Sooty-headed bulbul	LC	White-throated kingfisher	LC
Grey heron	RE (as a breeder)	Osprey	
Black-crowned night heron	LC	Little egret	LC
Spotted redshank	-	Ruff	-
Mallard	NT	White-winged tern	-

Name of species	Status	Name of species	Status
Common redshank	-	Garganey	LC
Black kite	RE (as a breeder)	European herring gull	-

D. <u>Heritage sites and historical sites</u>

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.1.3, as follows:

<u>Table D - 1.9.4.2: Declared archaeological antiquities sites located at the coastal entry array in Nahal Hadera</u>

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Caesarea sands (south) (south – west)	26145 / 0	Inside the pipeline route and survey area
	Hephzibah	1332 / 0	Inside the pipeline route and survey area
	Caesarea sands (south)	1282 / 0	Inside the survey area
	Hephzibah	9503 / 0	Inside the pipeline route and survey area
	Hephzibah	27030 / 0	Inside the survey area

In addition, the heritage site Hephzibah Farm - an agricultural farm from the beginning of renewed Jewish settlement in the land of Israel is partially located in the survey area.

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.2.2 <u>Michmoret route</u>

A. <u>Landscape units</u>

Ecological corridors and discontinuation of habitats

See Section 1.9.4.2.1 above

B. <u>Flora</u>

Habitats and plant communities, red and rare plant species

The characteristics of habitat, and red and rare plant species along the route are presented in Section 1.9.4.2.1 above.

Characteristics of areas along the route

The following is a description of habitats and land cells in the section south of Hadera:

Table 1.9.4.3: Description of habitats along the route from the Michmoret onshore receiving station to the connection to Hadera route

	Coverage	Description	Sensitivity
C26	Sandy bush scrub	Southern section of the Sharon park. Sandy habitat controlled by white broom - sand wormwood. Common species: chrysopsis, hispid viper's bugloss, sixalix arenaria, and sun rose. Rare species: erodium subintegrifolium, chrysanthemum, sand campion	High
C29	Park forest	The Sharon park areas are characterized by an open coastal forest of carob tree - pistacia lentiscus. Between the trees are grassy steppes and sandy spots. The flora is a variety of light soils flora mixed with uncultivated land and sandy flora. Common species: white broom, hispid viper's bugloss, procumbent centaury thist, sand wormwood. Rare plants: chrysanthemum, erodium subintegrifolium, Philistine horehound	High
C30	Sandy bush scrub	Sandy flora with common species of white broom - sand wormwood. Other common species: sun rose, pistacia lentiscus, shaggy sparrow wort, one-sided bindweed and Sydney golden wattle (invasive species). Rare species: chrysanthemum	High
C31	Park forest	The Sharon park areas are characterized by an open coastal forest of carob tree - pistacia lentiscus. Between the trees are grassy steppes and sandy spots. The flora is a variety of light soils flora mixed with uncultivated land and sandy flora. Common species: white broom, hispid viper's bugloss, procumbent centaury	High

	Coverage	Description	Sensitivity
		thist, sand wormwood. Rare plants: chrysanthemum, erodium subintegrifolium, Philistine horehound	
C32	Park forest and grassy steppe	The Sharon park areas are characterized by an open coastal forest of carob tree - pistacia lentiscus. Between the trees are grassy steppes and sandy spots. The flora is a variety of light soils flora mixed with uncultivated land and sandy flora. Common species: white broom, hispid viper's bugloss, procumbent centaury thist, sand wormwood. Among the grassy plants are various grains - Goat grass is common and various faboideae such as vetchling, medicago and trefoil. Rare plants: chrysanthemum, erodium subintegrifolium, Philistine horehound. In some areas agriculture can be found. Along the edges of the cultivated lands are Sydney golden wattle (invasive species)	High
C33	Sandy bush scrub	Sandy area at the edges of the built area north of Michmoret. Combination of uncultivated land and stabilized sands flora with sandy species. Common species: Tournefort's mustard, Cyperus capitatus, one-sided bindweed, Madrid compact brome, Bird's-foot trefoil, and Cluster flowered rest harrow. Along the roads there are disturbed areas controlled by Sydney golden wattle with bold presence of leafless ephedra	Medium – high
C34	Park forest	The Sharon park areas are characterized by an open coastal forest of carob tree - pistacia lentiscus. Between the trees are grassy steppes and sandy spots. The flora is a variety of light soils flora mixed with uncultivated land and sandy flora. Common species: white broom, hispid viper's bugloss, procumbent centaury thist, sand wormwood. Rare plants: chrysanthemum, erodium subintegrifolium, Philistine horehound	High
C35	Grassy steppe	The Sharon park areas. Grassy growth controlled by various grains and lows shrubs such as hispid viper's bugloss, procumbent	High

	Coverage	Description	Sensitivity
		centaury thist, Goat grass various faboideae such as vetchling, medicago and trefoil. Rare plants: chrysanthemum, erodium subintegrifolium, Philistine horehound. In some areas agriculture can be found. Along the edges of the cultivated lands are Sydney golden wattle (invasive species). In the area some trees lines can be found of salt cedar and a few carob trees	
C36	Sandy bush scrub	Semi-stabilized sands controlled by white broom - sand wormwood. High quality presentation of sand hillocks and fields. Rare species: Philistine horehound.	High
C37	Sandy bush scrub	Areas west of the Emek Hefer industrial zone, and in proximity to the railway tracks. A combination of sandy bush scrub, controlled by white broom - sand wormwood. Common species: hispid viper's bugloss, and chrysopsis. Close to the tracks is a forest of Sydney golden wattle also creating concentrations in the sandy areas	Medium (high at specific points)
C38	Agriculture	Sandy soils agriculture, types of neglect scrub such as: common purslane, nettle leaved goosefoot, rye grass, and meadow grass	Low
C40	Moist	Old quarries in the kurkar ridge area which drain water and constitute a moist habitat, although the level of disturbance is high	High
C41	Grassy steppe	A grazing meadow formation including a variety of grassy flora. high level of disturbance due to the proximity to the urban space. Rare species observed in the past: late flowering narcissus, and goat's face grass	
C42	Uncultivated	The Hadera interchange area where scrub flora and uncultivated flora is common: chrysopsis, yellow fleabane and white broom.	Low
C43	Park forest	The Sharon park areas are characterized by an open coastal forest of carob tree - pistacia lentiscus. Between the trees are well-developed grassy steppes. The flora is a variety of grassy steppe. Common species: Tournefort's mustard, ovate goat grass, goat	High

	Coverage	Description	Sensitivity
		grass, massed alkanet, dyer's bugloss, and sun rose	
C44	Sandy bush scrub	Sandy flora where the common species are white broom - sand wormwood. Other common species: sun rose, pistacia lentiscus, shaggy sparrow wort, one-sided bindweed and Sydney golden wattle (invasive species). Due to the proximity to Road 2 a relatively high level of disturbance	Low - medium
C45	Sandy bush scrub	Sandy flora where the common species are white broom - sand wormwood. Other common species: sun rose, pistacia lentiscus, shaggy sparrow wort, one-sided bindweed and Sydney golden wattle (invasive species). Rare species: chrysanthemum	High
C46	Park forest	Areas between Hephzibah neighborhood and Road 2. High coverage of pistacia lentiscus and carob trees. Additional species: cloven petalled campion, love-in-a-mist, white broom, hispid viper's bugloss. Rare species: great fen sedge	High

C. Fauna

See Section 1.9.4.2.1 above.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.2.2, as follows:

Table D-1.9.4.2.2: Declared archaeological antiquities sites along the pipeline route to the Hadera treatment facility from Michmoret

System component	Site name	Number	Location and minimal distance from the plan borders
	Hephzibah	1332 / 0	Inside the pipeline route and survey area

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Caesarea sands (south)	1282 / 0	Inside the survey area
	Hephzibah	9503 / 0	Inside the pipeline route and survey area
	Hephzibah	27030 / 0	Inside the survey area
	Hephzibah	1334 / 0	Inside the survey area
	The Hagana cave	9504 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1280 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (east)	25695 / 0	Inside the survey area
	Hirbet Abrichatas (east)	25697 / 0	Inside the survey area
	Hirbet Abrichatas	1281 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (west)	25696 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1279 / 0	Inside the pipeline route and survey area

In addition, the heritage site Hephzibah Farm – an agricultural farm from the beginning of renewed Jewish settlement in the land of Israel is partially located in the survey area.

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.2.3 Route from Nahal Alexander

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.4.2.1 above

B. Flora

Habitats and plant communities, red and rare plant species

The description of habitat, and red and rare plant species along the route area are presented in Section 1.9.4.2.1. above.

Characteristics of areas along the route

Characteristics of areas along the route are presented in the section on the Hadera route. The following is a description of the habitats and land cells in the additional section:

Table B-1.9.4.4: Description of habitats from the Nahal Alexander onshore receiving station to the connection with Michmoret alternative

No.	Coverage	Description	Sensitivity
C1	Moist	Combination of sandy soil flora, scrub flora and various types of moist habitats: tamarisk, white broom, chrysopsis, mallow malva, papyrus sedges, and sea club rush. Rare: wide leaf bulrush	High
C2	Built	Various scrub flora at the edges of the built area	Low
C3	Uncultivated	Areas along the stream including areas of planted eucalyptus and agriculture, various scrub flora and various sand flora: leafless ephedra, boxthorn, white broom, sand wormwood, and thin safflower	Medium
C4	Park forest	Forest controlled by carob tree - pistacia lentiscus. Between the trees are bushes and grassy steppes. Common species: Bulbous barley, white broom, dwarf mesquite, Wild carrot, Christ's thorn jujube, dyer's croton, leafless ephedra, common fennel and small flowered pancratium	High
C5	Eucalyptus forest	A planted eucalyptus area used as a recreational park, some grassy plants in the sub-forest layer	Medium
C7	Stream	Nahal Alexander area, scrub thicket including: holy bramble, common reed, giant reed, stranglevine, and chrysopsis. Rare species: saltmarsh morning glory	High
C6	Agriculture	Seasonal agriculture areas. In the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, and Jaffa scabious	Low

No.	Coverage	Description	Sensitivity
C8	Disturbed Sandy bush scrub	A combination of low bushes controlled by white broom - sand wormwood and species of stabilized sands. The area includes a eucalyptus planted area	Medium
C9	Stream	Nahal Alexander area, scrub thicket including: holy bramble, common reed, giant reed, stranglevine, and chrysopsis. Rare species: saltmarsh morning glory.	High
C10	Agriculture	Seasonal agriculture areas. In the plots edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, and Jaffa scabious. Between the plots there are drainage canals where uncultivated flora of moist areas can be found: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low

C. Fauna

See Section 1.9.4.2.1 above.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.2.2, as follows:

Table D-1.9.4.2.3: Declared archaeological antiquities sites along the pipeline route to the Hadera treatment facility from Nahal Alexander

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Hephzibah	1332 / 0	Inside the pipeline route and survey area
	Caesarea sands (south)	1282 / 0	Inside the survey area
	Hephzibah	9503 / 0	Inside the pipeline route and survey area

System component	Site name	Number	Location and minimal distance from the plan borders
	Hephzibah	27030 / 0	Inside the survey area
	Hephzibah	1334 / 0	Inside the survey area
	The Hagana cave	9504 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1280 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (east)	25695 / 0	Inside the survey area
	Hirbet Abrichatas (east)	25697 / 0	Inside the survey area
	Hirbet Abrichatas	1281 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (west)	25696 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1279 / 0	Inside the pipeline route and survey area
	Hofit (north)	8720 / 0	Inside the survey area

In addition, the heritage site Hephzibah Farm – an agricultural farm from the beginning of renewed Jewish settlement in the land of Israel is partially located in the survey area.

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.3 Treatment facility

General

Ecological values of the plan area – the survey area is located at the Nahal Hadera areas, adjacent to the existing treatment facility. This area is characterized by a range of agricultural activity – field crops, citrus orchards, fish ponds, side by side with archaeological sites. Natural habitats include: kurkar hillside, rivers (Hadera, Roshrashi), winter pools, drainage canals and some loam soil spots. A large variety of plants species were documented in previous surveys at the kurkar hills in the area, among these some rare and red species (dark purple Iris). In addition, the fish ponds constitute an activity site for a variety of birds. Nahal Hadera constitutes an important regional ecological corridor connecting between a number of landscape units and a large variety of habitats such as: semi-stabilized sands, stabilized sands,

park forests, eucalyptus forests, marshland, winter pools and kurkar ridges. In the plan area there are a number of unique sites including the sands areas at Hephzibah, which constitute a habitat for the rare butterfly cigaritis cilissa; the park itself constitutes a night sleeping site for great cormorant. Eucalyptus trees along the stream provide a parking site for herons. Nahal Roshrashi, which drains the historical Dameira marsh, and whatever remained from Batich Pool passes east of the survey site, and provides a unique moist habitat and support various rare plants (such as branched bur reed, and papyrus sedge), as well as animals, and therefore, constitutes high value in the area. Caesarea sands located north of the plan areas also support a rich and unique ecological system of sand loving flora and fauna. According to the Northern Sharon Region survey[91] the survey area by itself is mostly agricultural land with a low value with respect to the variety of flora (Figure 1.9.4.3).

Figure 1.9.4.3: Value with regard to the flora variety (source: Open Landscape Institute)

A. Landscape units

Ecological corridors and discontinuation of habitats

The survey area is located in the perimeter of the national corridor passing along Nahal Hadera (Figure A – 1.9). Important axes in the corridor perimeter are the Nahal Hadera channel and adjacent areas, as well as the areas on the eastern side of the corridor which are connected to the Caesarea sands, kurkar and loam soils, and seasonal water pools in the Gan Shmuel area. Even though the contamination levels in the river are quite high, the river still constitutes an important corridor and main passage route for a variety of species in the developing urban area. The plan area is located in the area where a relative narrowing in the corridor occurs, due to the passage between Road 65 and the city of Hadera. As mentioned above, this area also constitutes an interface point and passageway between a number of ecologically important habitats. Nahal Roshrashi passing to the east of the survey area

constitutes a local ecological axis, allowing for activity of various mammals and birds in the thicket and a variety of amphibians in the river itself.

B. Flora

Habitats and plant communities in the plan area

Most areas in the survey zone are cultivated agricultural plots where no natural habitats occur. The following is a description of the various area unit characteristics (Figure B – 1.9):

Agriculture – citrus orchards

Citrus orchards spread over most of the eastern area of the survey perimeter. Local flora includes various sagittal species of citrus orchards and watered agricultural plots.

Plant community: Sagittal

Common species: nettle leaved goosefoot, common purslane, and millet grass.

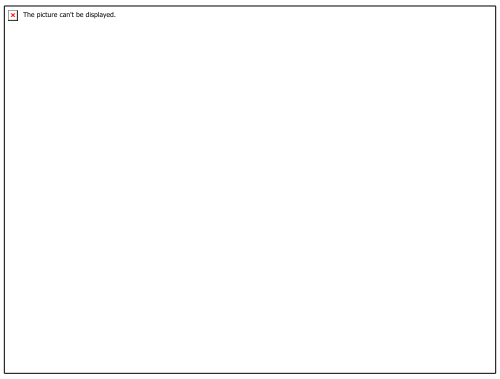
Agriculture – field crops

In the western section of the survey area there is seasonal agriculture of field crops such as grains and cucurbits. At the edges of the area are some sagittal flora (Figure 1B – 1.9.4.3).

Plant community: Sagittal

Common species: common camelthorn, dwarf mesquite and dyer's croton

Figure 1B – 1.9.4.3: Agricultural area



Kurkar hills

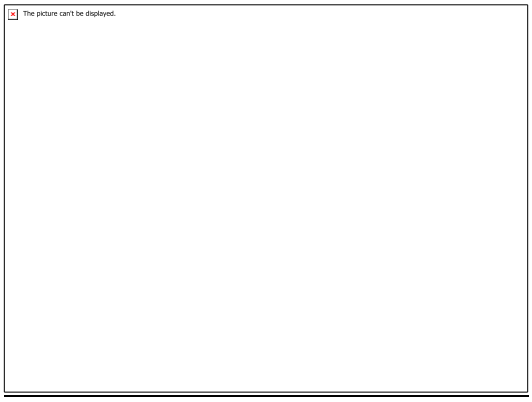
Low rise hills in the southern section of the alternative area which partially constitute archaeological digging site (Tel Zamarin). Much grazing is taking place on

the hills and most of the perennial vegetation is concentrated on the edges, over the slopes (see Figure 2B – 1.9.4.3).

Plant community: Mediterranean stinkbush – carob tree

Common species: hispid viper's bugloss, salt reed grass, thin safflower, tumble thistle and bulbous barley.

Figure 2B – 1.9.4.3: Tel Zamarin



Fish ponds

Two ponds along Nahal Hadera and a drainage canal connecting to the river channel. Most of the vegetation is concentrated at the edges of the ponds and along the drainage canal. In the south side, close to the water treatment facility are multiple invasive species (Figure 3B – 1.9.4.3).

Plant community: Common reed – holy bramble, common reed - dwarf mesquite

Common species: yellow fleabane, stranglevine, Nile bean (rare), compass plant and common caper.

Figure 3B – 1.9.4.3: Drainage canal in the fish pond area

The picture can't be displayed.

Uncultivated land

Areas in the vicinity of the river bank where a variety of sagittal and ruderal vegetation type can be found, side by side with local species and invasive species. In the river channel itself, some plants for the rare species saltmarsh morning glory can be found.

Plant communities: dwarf mesquite - millet grass

Common species: common camelthorn, yellow fleabane, Sydney golden wattle (invasive species), white mustard, stranglevine, common reed.

Red and rare species

Name of species	Status	Habitat
Nile bean	Rare	Moist
Saltmarsh morning glory	Red	Moist

C. Fauna

Observations and activity sites – most of the observed activity was of birds and water fowl. The area of Nahal Hadera constitutes an activity site for various animals. The potential habitats for the use of animals are the thickets growing at the edges of the fish ponds and the water canal which are activity sites for bush and thicket birds, water fowl and mammals such as herpestes, wildcat and red fox. Tree lines between the orange groves and agricultural plots are also established activity sites for various birds. At the edges of the survey area a great spotted cuckoo which is quite rare in the area was observed. The following is a list of animal species specifying either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002).

Table C – 1.9.4.3 Animals observed in plan area (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)

Name of species	Status	Name of species	Status
Birds		**Reptiles**	
Rose-ringed parakeet	Invader	Large whip snake	LC
Laughing dove	LC	Mediterranean house gecko	LC
Common myna	Invader	Stellagama	LC
Hooded crow	EN	Palestine viper	LC
Spurwinged lapwing	LC	Spurthighed tortoise	VU
Eurasian collared dove	LC	Amphibians	
Great spotted cuckoo	LC	Common toad	VU
House sparrow	LC	Middle East tree frog	VU
Sootyheaded bulbul	LC	Marsh frog	LC
Grey heron	RE (as a breeder)	Mammals	
Black-crowned night heron	LC	Southern white-breasted hedgehog	LC
Spotted redshank	-	House mouse	LC
Mallard	NT	Wildcat	
Common redshank	-	Günther's vole	
Black kite	RE (as a breeder)	Indian crested porcupine	LC
Little egret	LC	Red fox	LC
Ruff	-	Golden jackal	LC
White-winged tern	-	European badger	LC
Garganey	LC	Herpestes	LC
European herring gull	-		
Black-winged stilt	VU		

D. Heritage sites and historical sites

The declared archaeological antiquities sites as follows:

Table D - 1.9.4.3: Declared archaeological antiquities sites at the Hadera treatment facility alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Treatment facility	F – 20 triangulation point	9506 / 0	Overlapping to the survey area
	Tel - Zamora	1514 / 0	Overlapping to the survey area
	F – 20 triangulation point	9507 / 0	Overlapping to the survey area
	C – 492 triangulation point D	9514 / 0	Interfacing the survey area on the north
	Sheikh Hilu	6092 / 0	Approx. 400 meters from the south
	Al Dumeri	9513 / 0	Approx. 450 meters from the east
	Nachaliel	1513 / 0	Approx. 700 meters from the south
	BILU hill	6093 / 0	Approx. 700 meters from the south
	Caesarea sands (south)	1282 / 0	Approx. 1 km from the north – west

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.4 Pipeline route from the treatment facility

1.9.4.4.1 The northern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.4.2.1 above

B. Flora

Habitats and flora communities inside the survey area and species of red and rare plans

See Section 1.9.4.2.1 above.

Characteristics of areas along the route

Characteristics of areas along the route are presented in Section 1.9.4.2.1 above. The following is a description of the habitats and land cells in the additional section:

Table1.9.4.5: Description of the habitat along the pipeline route from Hadera treatment facility, northern alternative

No.	Coverage	Description	Sensitivity
B42	Agriculture	Orchards, field crops and farm houses. Sagittal flora. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, and Jaffa scabious	Low
B43	Built	Institution area	Low
B44	Agriculture	Orchards, field crops and farm houses. Sagittal flora. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, and Jaffa scabious	Low
B45	Agriculture	Orchards, field crops and farm houses. Sagittal flora. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, and Jaffa scabious	Low
B46	Stream	Tributary coming out of Gan Shomron, dominant species including: holy bramble, common reed, accompanying species: lesser bulrush, pinkweed, yellow fleabane, charlock, and along the tributary eucalyptus	Medium
B47	Agriculture and uncultivated	Agricultural areas of light soils. Some of the plots are uncultivated and scrub species can be found. Common species: chrysopsis, millet grass, and holy bramble	Low
B48	Uncultivated	Deserted citrus orchards area, dugout and uncultivated plots where uncultivated flora has started. Common species: millet grass, chrysopsis, tolpis virgate, yellow fleabane, dog's tooth, also spread in the area a number of Mount Tabor oak trees	
B49	Agriculture	Agricultural areas of light soils. Some of the plots are uncultivated and scrub species can be	Low - medium

No.	Coverage	Description	Sensitivity
		found. Between the plots a number of Mount Tabor oak trees	
B50	Agriculture	Mature and young citrus orchards	Low

C. <u>Fauna</u>

See Section 1.9.4.2.1 above.

D. <u>Heritage sites and historical sites</u>

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.4.4.1, as follows:

<u>Table D - 1.9.4.3: Declared archaeological antiquities sites along the pipeline route from Hadera treatment facility, northern alternative</u>

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route from the treatment facility	Gan Shmuel	8720 / 0	Inside the pipeline route and survey area
	Hafailr al - Mardafa	9498 / 0	Inside the pipeline route and survey area
	Hirbet Bazea (north)	27996 / 0	Inside the pipeline route and survey area
	Hirbet Bazea (east)	25264 / 0	Inside the pipeline route and survey area
	Hirbet Bazea (south)	27997 / 0	Inside the survey area
	Missar	13051 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.4.4.2 <u>Southern alternative</u>

A. <u>Landscape units</u>

Ecological corridors and discontinuation of habitats

See Sections 1.9.4.2.1 above

B. Flora

Habitats and flora communities inside the survey area and species of red and rare plans

See Section 1.9.4.2.1 above

Characteristics of areas along the route

Characteristics of areas along the route are presented in Section 1.9.4.2.1. above. The following is a description of the habitats and land cells in the additional section:

Table B-1.9.4.6 Description of the habitat along the pipeline route from Hadera treatment facility, southern alternative

No.	Coverage	Description	Sensitivity
B22	Stream	Tributary of Nahal Roshrashi. Moist habitat growth: common reed, common cocklebur, common loosestrife, horsetail knotweed, spotted golden thistle, dwarf mesquite, Bristly ox-tongue, stranglevine, and roughfruit amaranth	Medium
B23	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, and dyer's croton	Low
B24	Stream	Tributary of Nahal Hadera. River bank flora controlled by common reed – holy bramble. Additional species: willow of the brook, lilac chaste tree, stranglevine. Rare species: saltmarsh morning glory, and Nile bean	Medium
B25	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, and dyer's croton	Low
B26	Eucalyptus forest + moist habitat	A plot of eucalyptus trees forest on both sides of a road, cut by a drainage canal leading to Nahal Roshrashi. Part of the historical Dameira marshes, where in the winter some of the forest land is flooded. Scrubs flora side by side with moist habitat species. Common: dwarf mesquite,	High

No.	Coverage	Description	Sensitivity
		scallop leaved mullein, knapweed, and common reed. In the drainage canal there is the largest concentration in Israel of the plant branched bur reed, which is considered an endangered species (red)	
B27	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, and dyer's croton	Low
B28	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, and dyer's croton	Low
B29	Built	East Hadera railway station buildings. Between the buildings eucalyptus trees	Low
B30	Agriculture	Fish ponds and field crops. Uncultivated and scrub flora. Common species: common reed, dwarf mesquite, common cocklebur, holy bramble, and common caper	Low
B31	Agriculture	Fish ponds and field crops. Uncultivated and scrub flora. Common species: common reed, dwarf mesquite, common cocklebur, holy bramble, and common caper	Low
B32	Stream	Tributaries of Nahal Hadera and Nahal Iron. River bank flora controlled by common reed – holy bramble. Additional species: willow of the brook, lilac chaste tree, stranglevine. Rare species: saltmarsh morning glory, and Nile bean	Medium - high
B33	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, dyer's croton, and spotted golden thistle	Low
B34	Agriculture	Seasonal agriculture plots. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora:	Low
B35	Agriculture		Low

No.	Coverage	Description	Sensitivity
		horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	
B36	Stream	Drainage canal of agricultural areas: common reed, common cocklebur, horsetail knotweed and dwarf mesquite	Medium
B37	Agriculture	Seasonal agriculture plots. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low
B38	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, and dyer's croton	Low
B39	Built	Agricultural structures	Low
B40	Agriculture	Field crops. At the plots edges scrub flora and local species. Jaffa scabious, charlock, dwarf mesquite, and dyer's croton	Low
B41	Agriculture	An orchard in the area of Bakaa interchange.	Low

C. Fauna

See Section 1.9.4.2.1 above.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.4.4.2, as follows:

Table D - 1.9.4.4.2: Declared archaeological antiquities sites along the pipeline route from Hadera treatment facility, southern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route from the treatment facility	Bakaa Al Garbia (north)	32260 / 0	Inside the pipeline route and survey area
	Missar	13051 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5 Meretz Wastewater Treatment Facility

1.9.5.1 Coastal entry array

For entrance arrays from Nahal Hadera, Michmoret and Nahal Alexander see Section 1.9.4.1 above.

1.9.5.1.1 Neurim

General

Ecological value of the plan area – The survey area for the onshore receiving station is located in a built area that spreads along the beach cliff in the areas of Beit Yanai and Havatzelet Hasharon. In the scope of the Northern Sharon survey most of the sands areas were evaluated at a very high value level, except in spots of built areas and disturbed areas. The kurkar ridge at Beit Yanai is built and developed and therefore, its ecological value is low (Figure 1.9.5.1.1).

Figure 1.9.5.1.1: Alternative based on land values (Source: Hof HaCarmel survey, Open Landscape Institute)

The picture can't be displayed.

A. Landscape units

Ecological corridors and discontinuation of habitats

The onshore receiving station is located at the perimeter of the national ecological corridor (Figure A – 1.9)

1. Coastal corridor – Passes along the shoreline areas and the kurkar ridge.

The corridor in the plan area is blocked all along the coastal cliff. Therefore, the plan location does not create discontinuation of the continuum. In addition, the final facility location is much smaller than the area examined, and most of it is buried underground, so that it is not expected to create a disturbance on the ground.

B. Flora

Habitats and flora communities in the plan area

The survey area is a low ecological value area including disturbed and built areas on the top of the cliff. In the survey are no red or rare species were documented or observed. The following is a description of the characteristics of the various area units (Figure 1.9.2):

Coastal cliff (NE 1)

Kurkar and loam cliff where various processes of destruction and collapse are taking place. On the vertical slope of the cliff there is sparse vegetation coverage. The top of the cliff is relatively narrow with typical plant variety, such as evening primrose and sea daffodil.

Figure 1 – 1.9.5.1.1: The coastal cliff

The picture can't be displayed.

Built areas (NE 2)

Most of the alternative area is a disturbed area used as a training facility for the Home Front Command. At the edges of the area there is some sand and scrub flora: white broom, sand wormwood, chrysopsis, and leafless ephedra.

Red and rare plant species

No red or rare plant species were documented or observed in the survey area.

C. Fauna

Observations and activity sites – the survey area is disturbed where activity is taking place frequently. The space is built intensively and does not facilitate the existence of the natural population existing in the region. It is likely that the animal species at the survey area include generalist and human-associated species such as: house mouse, black rat, stellagama, hooded crow, house cat, etc. Along the beach strip there has been observation of green sea turtles from 1989. Generally speaking, it is possible that females will come to lay their eggs in this area too. However, this area a bathing beach and supports various beach services which, in turn, create a significant disturbance.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.5.1.1, as follows:

Table D - 1.9.5.1.1: Declared archaeological antiquities sites along the pipeline route from Hadera treatment facility, southern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Coastal entry array	Beit Yanai, underwater site	4418 / 0	Inside the coastal entry array
	Beit Yanai, underwater site, (east)	26146 / 0	Inside the coastal entry array

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2 Pipeline route to the treatment facility

General

The source of the material presented in this chapter is in a field survey performed in July 2012. This season does not allow for optimal impression of the variety of flora in the various habitats, particularly with respect to therophytes. In addition to the field survey, some data from the literature is presented. Literature sources are specified in the list of references.

This section presents the alternative supply route defined by the onshore receiving station location – Hadera, Michmoret and Alexander. In the description of the route alternative to the Hadera site, a description is given of the ecological characteristics for the three receiving stations up to the railway tracks and northward along Road 2. This route is identical for the Meretz treatment facility alternatives. Therefore, in this section, only data related to areas not specified earlier in the scope of the Hadera route are presented. The detailed description in Section 1.9.5.2.1 below, as noted, is the same for all pipeline alternatives from the coastal entry arrays. A comparison between the various alternatives is performed in Chapter 2.

1.9.5.2.1 The route from Hadera

1.9.5.2.1.1 Northern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

The pipeline route passes in the perimeter of the national ecological corridor (Figure 1.9.3 – 1)

1. Coastal corridor – passes along the shoreline areas and kurkar ridges

2. East Emek Hefer corridor – passes along agricultural areas, at the foot of Shomron mountains.
3. Nahal Alexander corridor – a transverse corridor passes along the stream and connects between the two longitudinal corridors.

The pipeline route is a buried line, therefore discontinuation of habitats and ecological corridors is unexpected. Some disruption is expected to the fauna's free movement in the work sections in the course of construction.

B. Flora

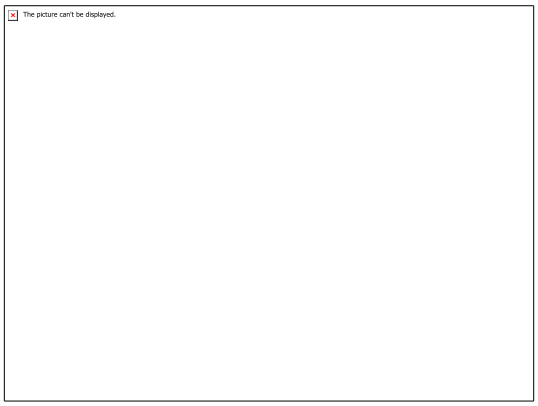
Habitats and flora communities

The following is a description of the characteristics of the main habitats (Figure B – 1.9).

Sands

The route of the northern alternative is located at the edge of the Sharon Park sands area. This is a strip of sands north of the Emek Hefer industrial zone, and south of Yaar Pool. These semi-stabilized sands are controlled by the white broom - sand wormwood company. Other spots may be found in some of the areas where other species are joining in high frequency, such as sun rose and chrysopsis (an invasive species). The sands also constitute a unique habitat for various species of fauna such as the greater Egyptian gerbil, Tristram's jird and Nidua fringe-fingered lizard.

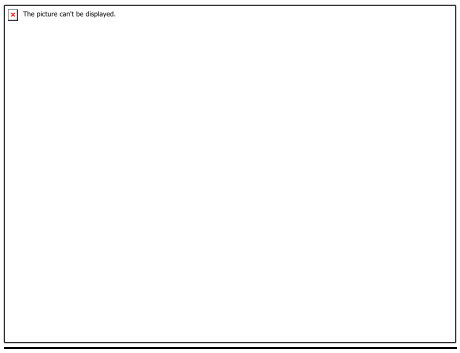
Figure 1B – 1.9.5.2.1.1: Sands north of Emek Hefer industrial zone



Grassy steppe

High quality grassy steppe areas can be found particularly in the Sharon park perimeter, between spots of carob tree park forest. Various types of grains and therophytes are common in these spots, such as: ovate goat grass, Sharon goat grass (endemic), purple false brome, wild oat, and Palestine clover (endemic). In the light soils areas some steppe areas exist between the agricultural plots. The prevalent community is mostly salt reed grass – procumbent centaury thist. In this habitat various rare and endemic species can be found; its prevalence in the zone is relatively low and is common mostly in the areas east of Givat Haim Ichud. In the steppe areas west of Road 2 large spots are covered with the invasive species chrysopsis.

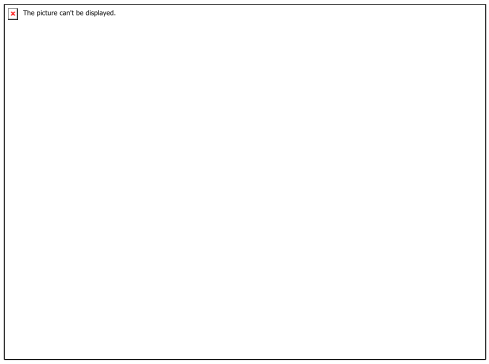
Figure 2B – 1.9.5.2.1.1: Grassy steppe at the Sharon park with invasive chrysopsis



Park forest

Two types of park forests presentations can be found in the survey area within the Sharon park perimeter. The common community is the carob tree - pistacia lentiscus community. This community can be found in the areas between Michmoret and Nahal Hadera, where in the southern areas the formation is more open and large areas of grasses can be found between the trees, and in the spring large flowering concentrations can be seen. In its northern parts, around Nahal Hadera the formation becomes much closer and tight as the high coverage of pistacia lentiscus created meadows between the trees. Common species accompanying this community are: leafless ephedra, European wolfberry, horrid asparagus, and common madder. The second community is the Mount Tabor oak - salt reed grass. This community can be found in the vicinity of the southeastern edge of the Hadera Forest; in its northern areas also Palestine oak can be found. The coastal park forests are a unique and sensitive habitat in which preservation is very important; the forest located inside the survey perimeter is the best quality in Israel of this vegetation formation.

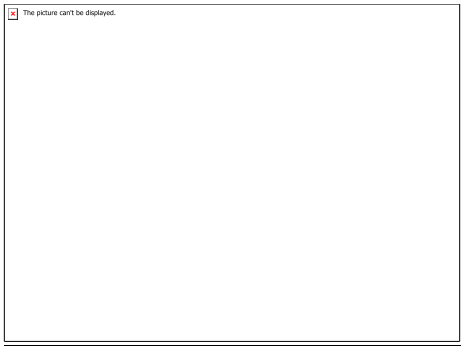
Figure 3B – 1.9.5.2.1.1: Park forest at the western part of the carob park



Agriculture and uncultivated land

Agricultural activity is performed in most of the areas east of Road 4. These areas include seasonal crops, orchards and orange groves. At the edges of the agricultural plots scrub flora can be found, such as: dwarf mesquite, spotted golden thistle, holy thistle, charlock, English beet, dyer's croton, horsetail knotweed and rye grass. In the uncultivated plots, where agriculture ceased, a variety of pioneer plants can be found such as: hairy bread grass, procumbent centaury thist, and hispid viper's bugloss. In the entire areas there is a high presence of invasive species, including: Sydney golden wattle, castor oil plant, wild sage, golden crown beard, chrysopsis and bead tree.

Figure 4B – 1.9.5.2.1.1: Agricultural areas to the east of the route



Eucalyptus forest

The eucalyptus forests are planted forests from the beginning of settlement in Israel, some of which are among the oldest in the country, such as Hadera Forest. The number of species in the eucalyptus forests is relatively low, mainly found in clearings and large gaps between trees. In the forests where upper soil drainage exists some winter / seasonal pools are formed (Yaar Pool), and a unique and rich moist habitat flora develops.

Moist habitats

These include winter pools, rivers and drainage canals. The route passes in the area of Yaar Pool, which is one of the most important pools in the coastal basin, and constitutes an activity area for amphibians such as the eastern spadefoot (an endangered species) and unique crabs. The pool has unique flora developing, including also rare species: Dutch rush, common spike rush, strawberry clover, common water crowfoot, jointleaf rush, tree germander, branched bur reed and flowering rush. At Nahal Alexander which is traversed by the route, and in secondary rivers and tributaries where seasonal water flow exists, the natural flora have been damaged over the years. Most of the flora that is found at the river banks are a combination of various moist banks species and uncultivated flora. Common

species: holy bramble, common reed, stranglevine, willow of the brook, charlock, dwarf mesquite, purple loosestrife and pinkweed. The drainage canals passing at the edges of the agricultural fields and fish ponds mostly sustain treatments at various levels, not allowing for normal rich flora growth. The rivers constitute an activity site for water fowl and thicket birds, and the largest population in Israel of the soft shell tortoise is in Nahal Alexander.

Red and rare species

The large variety of habitats along the proposed route allows for the proliferation of a large number of unique plant species concentrated mostly in moist habitats and light weight soils in the area of Sharon Park and the kurkar ridge. At Sharon Park and its vicinity 120 red and rare species have been documented over the years (Sand Park Survey). Most of these species have disappeared over time, probably due to the damage incurred to their habitats. The following is a partial list of species in the route area:

Table 1B – 1.9.5.2.1.1: Species of red and rare flora in the route area from the Hadera coastal entry array

Name of species	Status	Habitat
Chrysanthemum	Red	Sands
Philistine horehound	Rare	Sands
Aleppo crocus	Rare	Kurkar
flowering rush	Red	Moist
Saltmarsh morning glory	Red	Moist
Erodium subintegrifolium	Red	Kurkar, rocky ledges
Late flowering narcissus	Red	Kurkar
Tree germander	Red	Moist
branched bur reed	Red	Moist
Damson starfruit	Rare	Moist
Water plantain	Rare	Moist
Great fen sedge	Red	Moist
Paper reed	Red	Moist
Sea knotgrass	Rare	Moist

Name of species	Status	Habitat
Phoenician rose	Rare	Mediterranean forest
French lavender	Red	Kurkar, loam
Urochloa mutica	Red	Moist
wide leaf bulrush	Red	Moist
Yellow lupine	Red	Sands
Hirsute lupine	Rare	Steppe
Madder	Red	Moist
Eig's sage	Red	Steppe
Pink knotweed	Red	Moist
Little Neptune grass	Rare	Moist, sands

Characteristics of areas along the route

Characteristics of areas along the pipeline route are detailed in the following table, see Figure B – 1.9.

Table 2B – 1.9.5.2.1.1: Characteristics of habitats along the route from the Hadera coastal entry array to the Meretz Wastewater Treatment Facility, northern alternative

No.	Coverage	Description	Sensitivity
C17	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low
C18	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common	Low

No.	Coverage	Description	Sensitivity
		cocklebur, common loosestrife, spotted golden thistle, and sorrel	
C19	Grassy steppe	Grassy steppe of light soils around agricultural chicken coops, procumbent centaury thist - salt reed grass community. Common species: hispid viper's bugloss, Tournefort's mustard, snake tongue orchid, Palestine lupine, and chrysopsis. Potential for high variety of flowers	High
C20	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low
C21	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low
C22	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low
C23	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with	Low

No.	Coverage	Description	Sensitivity
		uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	
C27	Park forest	Hasharon forest, in this part the common species are Carob tree - Mount Tabor oak (single trees and last ones in the region); between the trees rich grassy steppes develop. Rare species: Erodium subintegrifolium, Philistine horehound, and chrysanthemum	High
C28	Eucalyptus forest	Part of Hadera Forest where the oldest eucalyptus trees in Israel grow. In the sub-forest a low variety of grassy growth. In the northern parts some presentations of moist habits may occur	High

C. Fauna

Observations and activity sites (Figure B – 1.9) – the route alternatives pass through a number of habitats with high importance for various animals.

1. Sands – this habitat includes a variety of rodents and reptiles, among them sand-loving species such as: greater Egyptian gerbil and Nidua fringe fingered lizard.
2. Winter pool – at Yaar Pool there is a large variety of amphibians, some of which are endangered species such as Syrian spadefoot and a large variety of crabs and snails (Table 2C - 1.9.5.1.1). Over the years, 35 taxa of invertebrates were identified at Yaar Pool.
3. Rivers – the area of Nahal Hadera and Nahal Alexander constitute activity sites for a variety of animals. Habitats with potential for use by animal species include the flora thicket at the edges of the fish ponds and water canals, constituting an activity site for thicket birds, water fowl and mammals such as herpestes, wildcat, and red fox. The largest population in Israel of the soft shell tortoise, which is an endangered species, is in Nahal Alexander.
4. Fish ponds and water holes – these are mostly important for migrating birds which make use of them in the course of their migration.

The following is a list of animal species either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002).

Table 1.9.5.2.1.1-1C – Animal species observed in the plan area (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)

Name of species	Status	Name of species	Status
Reptiles			
Large whip snake	LC	Spurthighed tortoise	VU
Mediterranean house gecko	LC	Short-fingered Gecko	LC
Stellagama	LC	Schreiber's fringe-fingered lizard	VU
Vipera palaestinae	LC	Common (northern) chameleon	LC
Soft shell tortoise	VU	Schokari Sand Racer	LC
Wedge-snouted skink	VU	Ocellated skink	LC
Caspian turtle	LC	European legless lizard	NT
Mammals			
Southern white-breasted hedgehog	LC	Herpestes	LC
House mouse	LC	Black rat	LC
Wildcat	VU	Tristram's jird	LC
Günther's vole	LC	Common jird	VU
Indian crested porcupine	LC	Greater white toothed shrew	
Red fox	LC	Greater Egyptian gerbil	VU
Golden jackal	LC	Nutria	
European badger	LC	Hare	LC
Wild boar	LC	Weasel	VU
Amphibians			

Name of species	Status	Name of species	Status
European green toad	VU	Syrian spadefoot	CR
Middle East tree frog	VU	Marsh frog	LC
Birds			
Rose-ringed parakeet	Invader	Common crane	
Laughing dove	LC	Great white pelican	
Common myna	Invader	Greater spotted eagle	RE
Hooded crow	EN	Western Orphean warbler	
Spur-winged lapwing	LC	European stonechat	
Eurasian collared dove	LC	Black kite	
Palid Harrier	NT	Great grey shrike	LC
House sparrow	LC	Long eared owl	LC
Sootyheaded bulbul	LC	Syrian woodpecker	LC
Eurasian eagle owl	NT	Western jackdaw	LC
Eurasian coot	LC	European nightjar	DD
Gray heron	RE (as a breeder)	Ruff	-
Black-crowned night heron	LC	Glossy ibis	LC
Common sandpiper	-	Mallard	LC
Marsh sandpiper	-	Tufted duck	-
Green sandpiper	-	Black-winged stilt	VU
Cattle egret		Common snipe	-
Black kite	RE (as a breeder)	Eurasian stone curlew	LC
Spurwinged lapwing	LC	Crested lark	LC
Whitethroated kingfisher	LC	Eurasian teal	LC
Barn swallow	LC	Kentish plover	CR
Northern shoveler	LC	Common moorhen	LC
Spotted redshank		Common shelduck	
Common kingfisher	LC	Black-faced spoonbill	

Name of species	Status	Name of species	Status
Lesser spotted eagle		Black-headed gull	
European herring gull		Garganey	LC

Table 2C – 1.9.5.2: Animal species in the Yaar Pool (Gafni Elron 2010[92])

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D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.5.2.1.1, as follows:

Table D - 1.9.5.3: Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Nahal Hadera, northern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Hephzibah	1332 / 0	Inside the pipeline route and survey area
	Caesarea sands (south)	1282 / 0	Inside the survey area
	Hephzibah	9503 / 0	Inside the pipeline route and survey area
	Hephzibah	1334 / 0	Inside the survey area
	The Hagana cave	9504 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1280 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (east)	25695 / 0	Inside the survey area
	Hirbet Abrichatas (east)	25697 / 0	Inside the survey area
	Hirbet Abrichatas	1281 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (west)	25696 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1279 / 0	Inside the pipeline route and survey area
	Triangulation point R – 590 (south) (west)	25019 / 0	Inside the pipeline route and survey area
	Triangulation point R – 590 (south)	1729 / 0	Inside the pipeline route and survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2.1.2 Southern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1.1 above.

B. Flora

Habitats and flora communities and red and rare species

See Section 1.9.5.2.1.1 above.

Characteristics of areas along the route

Characteristics of the habitats along the route are presented in Section 1.9.5.2.1.1 above. The following is a description of the habitats and land cells in the additional section.

Table B –1.9.5.2.1.2: Characteristics of habitats along the route from the Hadera coastal entry array to the Meretz Wastewater Treatment Facility, southern alternative

No.	Coverage	Description	Sensitivity
C11 C12	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low
C13	Stream	Nahal Alexander area, scrub thicket including: holy bramble, common reed, giant reed, stranglevine, and chrysopsis. Rare species: saltmarsh morning glory	High
C14	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel	Low

C. Fauna

See Section 1.9.5.2.1.1 above

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.5.2.1.2, as follows:

Table D - 1.9.5.2.1.2 : Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Nahal Hadera, southern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Hephzibah	1332 / 0	Inside the pipeline route and survey area
	Caesarea sands (south)	1282 / 0	Inside the survey area
	Hephzibah	9503 / 0	Inside the pipeline route and survey area
	Hephzibah	1334 / 0	Inside the survey area
	The Hagana cave	9504 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas	1280 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (east)	25695 / 0	Inside the survey area
	Hirbet Abrichatas (east)	25697 / 0	Inside the survey area
	Hirbet Abrichatas	1281 / 0	Inside the pipeline route and survey area
	Hirbet Abrichatas (west)	25696 / 0	Inside the pipeline route and survey area

System component	Site name	Number	Location and minimal distance from the plan borders
	Hirbet Abrichatas	1279 / 0	Inside the pipeline route and survey area
	Tel Hefer (east)	37049 / 0	Inside the survey area
	Tel Hefer (north)	37048 / 0	Inside the survey area
	Tel Hefer	1388 / 0	Inside the survey area
	Tel Hefer (west)	37047 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2.2 Route from Michmoret

Northern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1.1 above.

B. Flora

See section 1.9.5.2.1.1 above.

C. Fauna

See section 1.9.5.2.1.1 above

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.5.2.2.1, as follows:

Table D - 1.9.5.2.2.1 : Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Michmoret, northern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the treatment facility	Hirbet Abrichatas (west)	25696 / 0	Inside the pipeline route and survey area
	Triangulation point R – 590 (south) (west)	25019 / 0	Inside the pipeline route and survey area
	Triangulation point R – 590 (south)	1729 / 0	Inside the pipeline route and survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2.2.1 Southern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1.2 above.

B. Flora

See Section 1.9.5.2.1.2 above.

C. Fauna

See Section 1.9.5.2.1.2 above

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.5.2.2.2, as follows:

Table D - 1.9.5.2.2.2 : Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Nahal Hadera, southern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the wastewater treatment facility	Tel Hefer (east)	37049 / 0	Inside the survey area
	Tel Hefer (north)	37048 / 0	Inside the survey area
	Tel Hefer	1388 / 0	Inside the survey area

System component	Site name	Number	Location and minimal distance from the plan borders
	Tel Hefer (west)	37047 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2.3 Route from Nahal Alexander

1.9.5.2.3.1 Northern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1.1 above.

B. Flora

See Section 1.9.5.2.1.1 above.

C. Fauna

See Section 1.9.5.2.1.1 above.

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.5.2.1.2, as follows:

Table D - 1.9.5.1 : Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Nahal Alexander, northern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
	Hofit (north)	8720 / 0	
Pipeline route to the treatment facility	Hirbet Abrichatas (west)	25696 / 0	Inside the pipeline route and survey area
	Triangulation point R – 590 (south) (west)	25019 / 0	Inside the pipeline route and survey area
	Triangulation point R – 590 (south)	1729 / 0	Inside the pipeline route and survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2.3.2 Southern alternative

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1.2 above.

B. Flora

See Section 1.9.5.2.1.2 above.

C. Fauna

See Section 1.9.5.2.1.2 above

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.5.2.3.2, as follows:

Table D - 1.9.5.2.: Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Nahal Alexander, southern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
	Hofit (north)	8720 / 0	Inside the survey area
The pipeline route to the treatment facility	Tel Hefer (east)	37049 / 0	Inside the survey area
	Tel Hefer (north)	37048 / 0	Inside the survey area
	Tel Hefer	1388 / 0	Inside the survey area
	Tel Hefer (west)	37047 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.2.4 Route from Neurim

General

The source of the material presented in this chapter is in a field survey performed in July 2012. This season does not allow for optimal impression of the variety of flora in the various habitats, and particularly in reference to therophytes. In addition to

the field survey, some data from the literature is presented. Literature sources are specified in the list of references.

This section presents the supply route alternatives defined by the location of the Neurim onshore receiving station. The description refers to habitats and areas from the exit of Neurim station and to the connection with the Meretz alternative at the Hefer junction area.

A. Landscape units

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1.1 above.

B. Flora

Habitats and flora communities along the transmission route

The plan area is an intensive agricultural area including cultivated areas, orchards, green houses, chicken coops, cow sheds, roads, engineering facilities and infrastructures. The kurkar ridge at the Bitan Aaron area constitutes an unusual section; it is an area where an ecological kurkar habitat exists and enables large biological diversity. The reserve spreads only on part of the ridge, adjacent to farm buildings and activity sites. The following is a description of the characteristics of the area along the route (Figure B – 1.9):

Uncultivated and agricultural areas

Most of the alternative route is used for agriculture including field crops, orchards (avocado, olives) and orange groves. In a number of plots no cultivation is taking place and uncultivated flora develops with a high occurrence of ruderal species, sagittal species and common invasive species. Common: Sydney golden wattle, castor oil plant, wild sage, golden crown beard, horsetail knotweed, hairy bread grass, yellow fleabane, and horrid asparagus. Between the agricultural plots there are trees lines which at times even create small clusters. Common trees: river red gum and Mediterranean cypress.

Figure 1B – 1.9.5.2.4: Agricultural areas

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The kurkar ridge

The route crosses the kurkar ridge at the area of Bitan Aaron nature reserve. The size of the reserve is approximately 46 dunams, and it includes thick kurkar vegetation. Common species: pistacia lentiscus, spiny broom, wild pink, thin safflower, tumble St. John's wort, splendid bindweed, bilacunaria boissieri, and leafless ephedra. Some geophytes exist in the reserve which create layers of flowers: crown anemone, Persian cyclamen, common narcissus, holy orchid, sea squill, branched asphodel, and trees: Christ's thorn jujube, Mount Tabor oak, and common fig.

Figure 2B – 1.9.5.2.4: Bitan Aaron nature reserve

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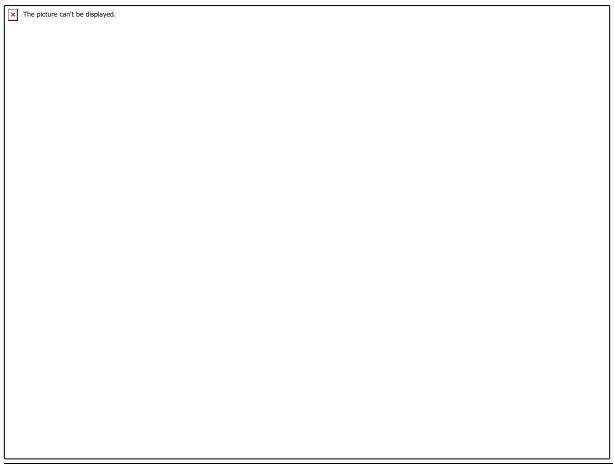
Moist habitats

In the route area are a number of agricultural drainage canals characterized by a variety of invasive plant species, such as: common cocklebur, castor oil plant and Sydney golden wattle. The route crosses the Nahal Alexander channel south of Kibbutz Maabarot. The stream carries flora characterized by moist habitat flora, including: willow of the brook, stranglevine, holy bramble, and lilac chaste tree, side

by side with uncultivated soils and scrub. On the river banks are nests of the soft shell tortoises active in the river.

Figure 3B – 1.9.5.2.4 : Channel next to Maabarot's water treatment facility



Red and rare species

Erodium subintegrifolium (red species) was documented at the Bitan Aaron nature reserve. Other red species were observed in the past - hirsute lupine and xeranthemum cylindraceum. Due to intensive agricultural activity in this route, the probability of their occurrence is very low.

Table 1B – 1.1.9.5.2.4: Characteristics of habitats along the Neurim – Hefer Junction route

No.	Coverage	Description	Sensitivity
D1	Disturbed	The area of Neurim institute is used as a training facility for the Home Front Command. Between the facility and the coastal road there is a narrow vegetation strip where white broom, sand wormwood and chrysopsis are common.	Low

No.	Coverage	Description	Sensitivity
D2	Agriculture	Seasonal agriculture plots. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots are drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel. Between the plot tree lines: Mediterranean cypress, river red gum, Sydney golden wattle and castor oil plant.	Low
D3	Uncultivated	Uncultivated plots where types of scrub flora are common, such as: yellow fleabane, horsetail knotweed, pinkweed, wild carrot, hairy bread grass, common oat, and salt reed grass.	Low
D4	Built	Areas of Moshav Bitan Aaron.	Low
D5	Uncultivated	Sagittal species coverage controlled by holy thistle. A concentration of invasive species including: Sydney golden wattle, castor oil plant and wild sage.	Low
D6	Kurkar flora	The Bitan Aaron nature reserve. Kurkar flora controlled by leafless ephedra, bilacunaria boissieri, thin safflower, tumble St. John's wort, Christ's thorn jujube trees and common fig. flowering geophytes such as common narcissus, crown anemone, Persian cyclamen, hyacinth squill, and holy orchid.	High
D7	Agricultural structures	Green houses and chicken coops	Low
D8	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel.	Low

No.	Coverage	Description	Sensitivity
		Between the plots trees lines: Mediterranean cypress, river red gum, Sydney golden wattle and castor oil plant.	
D9	Eucalyptus cluster	Cluster of eucalyptus trees creating a small forest. In the undergrowth some ruderal and sagittal growth: common reed, holy thistle, dwarf mesquite, and common oats.	Low
D10	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel. Between the plots trees lines: Mediterranean cypress, river red gum, Sydney golden wattle and castor oil plant.	Low
D11	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel. Between the plot tree lines: Mediterranean cypress, river red gum, Sydney golden wattle and castor oil plant.	Low
D12	Moist	A river bed adjacent to Netanya water treatment facility. The river bed is partially covered with concrete and well organized. A concentration of invasive species: common reed, castor oil plant, dwarf mesquite, common cocklebur and Sydney golden wattle.	Low
D13	Built	Netanya treatment facility	Low
D14	Agricultural structures	Chicken coops	Low

No.	Coverage	Description	Sensitivity
D15	Agricultural structures	Greenhouses and chicken coops	Low
D16	Stream	Nahal Alexander. area, river bank flora including willow of the brook, holy bramble, stranglevine and common reed.	High
D17	Agriculture	Seasonal agriculture plots. At the plot edges are scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel. Between the plot tree lines: Mediterranean cypress, river red gum, Sydney golden wattle and castor oil plant.	Low

C. Fauna

Observations and locations of activity – No other areas with particular importance to local fauna exist in this area other than the Bitan Aaron nature reserve and Nahal Alexander. It is likely that in the entirety of agricultural areas there is activity and passage ways for human-associated species.

The following is a list of animal species specifying either observed or likely to be present in the plan area, according to the risk level key (The Red Book of Vertebrates in Israel. Dolev, Perevolotsky 2002).

Table C – 1.9.5.2.4 Animals observed in the plan area (source: field survey, Nature and Parks Authority, Biogis, Ministry of Environmental Protection (MoEP))

Name of species	Status	Name of species	Status
Reptiles			
Large whip snake	LC	Spur-thighed tortoise	VU
Mediterranean house gecko	LC	Trionychia	VU
Stellagama	LC	Schreiber's fringe fingered lizard	VU

Name of species	Status	Name of species	Status
Vipera palaestinae	LC	Common (northern) chameleon	LC
Mammals			
Southern white-breasted hedgehog	LC	Herpestes	LC
House mouse	LC	Black rat	
Indian crested porcupine	LC	European badger	LC
Red fox	LC		
Golden jackal	LC		
Birds			
European stonechat		Common kestrel	
Laughing dove	LC	Eurasian collared dove	LC
Common myna	Invader	Pallid harrier	NT
Hooded crow	EN	House sparrow	LC
Spur-winged lapwing	LC	Sooty-headed bulbul	LC

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, archaeological antiquities sites located within this survey perimeter are presented in Table 1.9.5.2.4, as follows:

Table D-1.9.5.2.4: Declared archaeological antiquities sites along the pipeline route to the Meretz Wastewater Treatment Facility from Neurim

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route to the wastewater treatment facility	Hirbet el Sharaf	1228 / 0	Inside the pipeline route and survey area
	Tel Hefer (east)	37049 / 0	Inside the survey area
	Tel Hefer (north)	37048 / 0	Inside the survey area

System component	Site name	Number	Location and minimal distance from the plan borders
	Tel Hefer (east)	1388 / 0	Inside the survey area
	Tel Hefer (west)	37047 / 0	Inside the survey area

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.3 Treatment facility

General

The plan is located within an agricultural rural area adjacent to agricultural facilities (wastewater treatment facility and reservoir). The typical habitats, including mostly rivers and heavy soils, hardly exist in their natural state.

Most of the area is utilized for seasonal agriculture and livestock facilities. Between the plots there are regulated river beds and irrigation channels where high moisture habitats occupy spaces and allow for development of a variety of moisture loving plants. Nahal Alexander passes south of the existing wastewater treatment facility, constituting an ecological corridor and high sensitivity area. Other sites with ecological importance in the area are fish ponds and water reservoirs along the creek allowing for high moisture habitats and the development of a rich ecological system within the boundaries of the valley. Among these sites there is high importance to the areas of Einot Hogla and the old fish ponds of Kibbutz Ein Hahoresh, which are no longer in use (Koller 2010) (Figure 1.9.5.3).

Figure 1.9.5.3: General view of the survey area

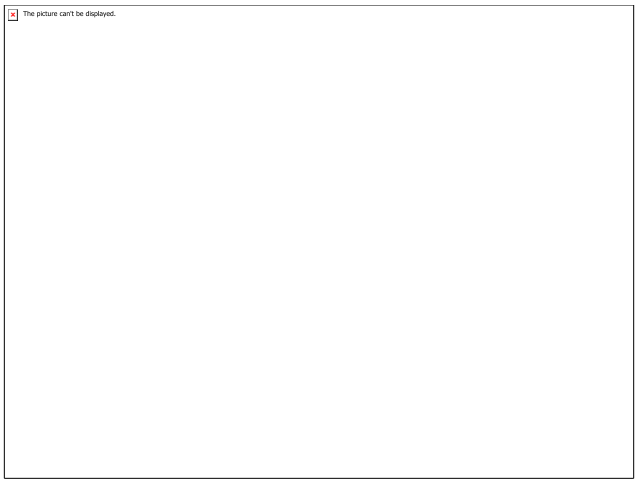
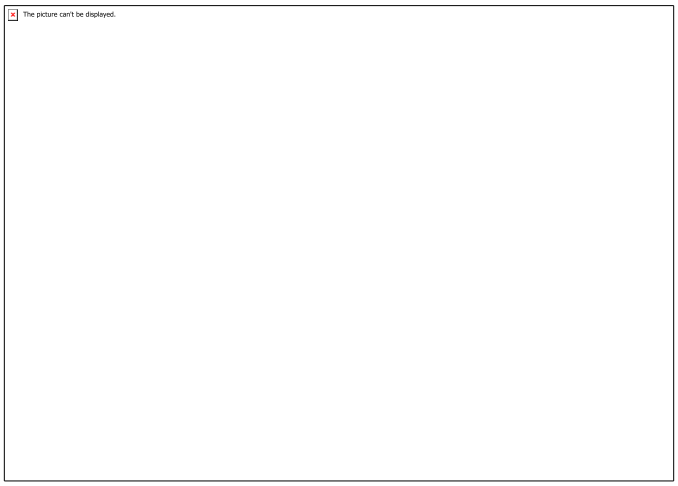


Figure 1.9.5.3 : Natural areas in the plan space (source: Natural areas survey of Emek Hefer Municipality)[93]



A. Landscape units

Ecological corridors and discontinuation of habitats

The survey area is located at the perimeter of the national corridor passing through the Emek Hefer area and connecting between the coastal region and the mountain region. The alternative is located at the corridor margins, approximately 9 km wide. The Nahal Alexander channel passes at a distance of 500 meters to the south, which constitutes an important axis in both the local and national corridors array (Figure A – 1.9).

The alternative is located adjacent to an existing engineering facility campus, therefore it is not expected to create a new discontinuation in the area and its disturbance is expected to be similar to the current disturbance.

B. Flora

Habitats and flora communities in the plan area

The survey area spreads over approximately 1200 dunams west of existing engineering infrastructures. The plan area is mostly cultivated. At the north western margins is a fenced-in area used probably as a storage area for sludge from the treatment facility. The constructed river bed of Nahal Ometz crosses on the south, and a constructed drainage canal crosses on the north. No natural habitats exist in the plan area. The following is a description of the characteristics of the area along the route (Figure B – 1.9):

Agricultural areas

The land is intensively cultivated. At the plot edges there are drainage canals with sagittal and ruderal flora.

Flora: dwarf chicory - dwarf mesquite

Common species: holy thistle, horsetail knotweed, and sorrel.

Nahal Ometz river bed

A constructed river bed of Nahal Ometz passes between the agricultural fields. In various spots there is water accumulation, allowing for appearance of various moist habitat flora.

Flora: holy bramble – common reed

Common species: dwarf mesquite, common loosestrife, winged vetchling, pinkweed, white nettle leaved goosefoot, and spotted golden thistle.

Northern drainage canal

Flora: dwarf mesquite - horsetail knotweed

Common species: yellow fleabane, sorrel, compass plant, common cocklebur, and dwarf chicory.

Invasive species: burr ragweed.

Infrastructure facilities

Flora: dwarf mesquite - horsetail knotweed

Common species: sagittal and ruderal species

Invasive species: burr ragweed and Sydney golden wattle.

Red and rare species

In the survey area no red and rare plant types were found or documented.

C. Fauna

Observations and activity sites

In the perimeter of the agricultural area and especially in its margins, most of the observed activity was of various common fowl species: hooded crow, Eurasian collared dove, sparrow, and Sooty headed bulbul. At the Nahal Ometz river bed there is amphibian activity, likely due to the presence of standing water pools in some river bed areas. According to existing knowledge the plan area constitutes an activity space for various animal species in Emek Hefer. Common observed mammals are: hare, wild boar, jungle cat, red fox and Indian crested porcupine.

Among the fowl the following species have been observed: barn owl, long-eared owl, European goldfinch, snake eagle, partridge, long-legged buzzard, Eurasian crane, pelican, mallard duck and osprey. Habitats important for animals are presented in Figure 1.9.5.3 based on natural areas with high value marking. The following is a detailed list of animal species either observed or likely to be present in the plan area:

Table B – 1.9.5.3.: Animal species observed in the plan area (source: field survey, Nature and Parks Authority, Biogis, and the Ministry of Environmental Protection (MoEP)

Name of species	Status	Name of species	Status
Birds		**Reptiles**	
Rose-ringed parakeet	Invader	Large whip snake	LC
Laughing dove	LC	Mediterranean house gecko	LC
Common myna	Invader	Stellagama	LC
Hooded crow	EN	**Mammals**	
Spur-winged lapwing	LC	Indian crested porcupine	LC
Eurasian collared dove	LC	Red fox	LC
Pallid Harrier	NT	Golden jackal	LC
House sparrow	LC	European badger	LC
Sooty-headed bulbul	LC	Herpestes	LC
Horned owl	NT	Jungle cat	
Eurasian coot	LC	Wildcat	
Grey heron	RE (as a breeder)	Wild boar	LC
Black-crowned night heron	LC	Common hare	LC
Common sandpiper	-	Günther's vole	LC
Marsh sandpiper	-		
Green sandpiper	-		
Pallid harrier	RE (as a breeder)		
Black kite	RE (as a breeder)		

Name of species	Status	Name of species	Status
Spur-winged lapwing	LC		
White-throated kingfisher	LC	**Amphibians**	
barn swallow	LC	Marsh frog	NT
Kentish plover	CR	Common toad	EN
common moorhen	LC	Middle East tree frog	VU
Ruff	-		
Glossy ibis	LC		
Mallard	LC		
Tufted duck	-		
Black-winged stilt	VU		
Common snipe	-		
Eurasian stone curlew	LC		
Crested lark	LC		
Eurasian teal	LC		

D. Heritage sites and historical sites

Declared archaeological antiquities sites are presented as follows:

Table D-1.9.5.3 : Declared archaeological antiquities sites at the Meretz Wastewater Treatment Facility alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Wastewater treatment facility	Tel Nurit	1654 / 0	Approx. 50 m west, and inside the pipeline survey area to the treatment facility (northern alternative)
	Bir al Abed (south)	25021 / 0	Approx. 450 m from the north – west
	Maabarot, fish ponds (north)	28573 / 0	Approx. 600 m from the south
	Bir al Abed (east)		Approx. 650 m from the east

System component	Site name	Number	Location and minimal distance from the plan borders
	Hama'apil		Approx. 700 m from the east, and inside the pipeline survey area to the treatment facility
	Hama'apil (north)		Approx. 700 m from the east
	Maavarot, fish ponds (east)		Approx. 800 m from the south
	Maavarot, fish ponds		Approx. 850 m from the south

The proposed plan area with regard to the declared archaeological antiquities layer is presented in Figure D – 1.9 below.

1.9.5.4 Pipeline route from the treatment facility

A. <u>Landscape units</u>

Ecological corridors and discontinuation of habitats

See Section 1.9.5.2.1 above.

B. <u>Flora</u>

Habitats and flora communities and red and rare species

See Section 1.9.5.2.1.1 above.

Characterization of the areas along the route

Characterization of habitats along the route are presented in Section 1.9.5.2.1.1 above. The following is a description of the habitats and land cells in the additional section:

<u>Table 1B – 1.9.5.4: Characteristics of habitats along the route from the Meretz Wastewater Treatment Facility</u>

No.	Habitat	Description	Sensitivity
C15	Agriculture	Seasonal agriculture plots. At the plots edges scrub flora and local species. Common species: dwarf mesquite, common fennel, Jaffa scabious. Between the plots drainage canals with uncultivated vegetation of moist habitat flora: horsetail knotweed, pinkweed, common cocklebur, common loosestrife, spotted golden thistle, and sorrel.	Low
C16			

No.	Habitat	Description	Sensitivity
		Between the plots trees lines: Mediterranean cypress, river red gum, Sydney golden wattle and Castor oil plant.	

C. Fauna

See Section 1.9.5.2.1 above

D. Heritage sites and historical sites

According to the archaeological antiquities layer submitted to the planning team as of 2011, the archaeological antiquities sites located within this survey perimeter are presented in Table D - 1.9.4.4.1, and in Figure D – 1.9 below as follows:

Table D - 1.9.4.4.1 : Declared archaeological antiquities sites along the pipeline route from the Hadera wastewater treatment facility, northern alternative

System component	Site name	Number	Location and minimal distance from the plan borders
Pipeline route from the wastewater treatment facility	Triangulation pt. P - 168	8730 / 0	Inside the pipeline route and survey area
	Triangulation pt. P – 168 (east)	25013 / 0	Inside the pipeline route and survey area
	Ometz	8732 / 0	Inside the pipeline route and survey area

Figure A – 1.9: Ecological corridors

Figure B – 1.9: Habitats and natural values

Figure D – 1.9: Declared archaeological antiquities sites

1.10 Oceanographic and Meteorological Conditions

1.10.1 Relative prevalence of compass winds from the shoreline to a bottom depth of 60 meters and wave regimen*

This section will be presented as part of the environmental impact survey for the marine environment conducted as part of the plan, and submitted as a continuation of this document.

1.10.2 Meteorological conditions which may cause sand movement and pipeline exposure

During the winter strong storms arrive to our shores, with significant wave height of up to 5 meters (Hs < 5 m) and maximal height may even reach 8 meters (Hmax ≤ 8 m). In the course of these storms the breaker area widens and may reach up to 1 km from the shoreline (depth of approximately 10 meters).

During particularly strong storms, which return between 1:20 and 1:30 years, unusually high gales may hit the shoreline, whose significant height may be over 7 meters (Hs < 7 m) and maximal wave height may even be over 13 meters (Hmax ≤ 13 m). Under these extreme conditions, the breaker area widens and may reach up to 1.5 km from the shoreline (depth of approximately 15 meters). Such unusual waves were measured in Israel during the winters of 2001 and 2011.

An analysis of wave data performed recently by Levin et al[94], based on a series of waves measured in Ashdod between 1992 – 2009, reached results similar to those obtained by Tzvieli[95]. The analysis shows that in the 17 years of wave measuring in Ashdod, 70 events were measured where the surf was high (approximately 4 storms per year), and where a significant wave, higher than 3.5 m was measured. In addition, on average, every year there was one storm of 5 meters.

Impact of placing the pipeline on sand movement

Along Israel's coastline, a gas pipeline was placed from which the coastal entry was executed using the method recommended for this plan – the HDD method.

According to information obtained from the existing offshore gas pipeline maintenance team, along all sections where HDD was used, the pipeline was not exposed, even though during the past few years there have been a number of storms with wave return of 1:20 years. Therefore, it may be determined that in the horizontal drill sections (water depth of 10 meters) no problems are expected of pipeline exposure or development of unusual morphology along the pipeline.

In places where water depth exceeds this, there are sections where the pipeline was exposed after storms. The extent of exposure depends on the burying depth. The

existing pipeline was exposed at depths of 30 meters as well. Once the pipeline is exposed there is a possibility of changes in flow that can cause morphology of cutoff on the sea bed.

1.11 Noise

1.11.1 Onshore environment

General

In order to assess the acoustic climate characterizing the plan area in general and specifically the noise level for potential main noise recipients, some noise level measurements were performed under current conditions.

Measurement of noise levels under current conditions constitutes a baseline for comparison with calculated expected noise levels under future conditions, and establishing the change in noise levels as a result of said plan. Noise sources in the current situation include all sources existing on a permanent basis in the vicinity of the noise recipients and sensitive areas, which may be impacted by the plan.

Description of alternatives and noise recipients

Noise levels under current conditions were measured for 5 alternatives, as follows:

- Dor north alternative, located at approximately 1 km from Dor and Fureidis, which are the closest noise recipients.
- Ein Ayala quarry alternative is located at approximately 1 km from Moshav Ein Ayala and the northern tip of Fureidis.
- Hagit east alternative is located approximately 1 km from Moshav Elyakim.
- Hadera treatment facility alternative is located approximately 1 km east of Hadera's eastern neighborhoods.
- Meretz Wastewater Treatment Facility alternative is located approximately 1 km from Moshav Ma'apil and approximately 1.5 km from Moshav Ein Hahoresh.

For the purpose of characterizing the noise levels for Dor north, Emek Hefer – Meretz and Hagit east, two series of noise level measurements were conducted, one during the daytime, on July 26, 2012 and the other during the night time between July 26 and July 27, 2012.

Ambient noise measurement levels were conducted at 10 minute intervals in each point. Daytime noise level measurements were conducted between 2 pm and 7:30

pm and the nighttime noise level measurements were conducted between 10 pm and 3 am.

Dor North –Measurements were performed in 4 representative location points. 2 near the plan borders and another 2 in proximity to residential houses in Dor and in Fureidis. The microphone was placed at a height of 4 meters from the ground level in all measurement points, except in Dor, where the microphone was placed at a 2 meter height from ground level, in accordance with the window levels.

Hagit east – Measurements were performed in 2 representative location points, one near the plan borders and one at Moshav Elyakim. The microphone was placed at a height of 4 meters from ground level in all measurement points.

Emek Hefer – Meretz Wastewater Treatment Facility – Measurements were performed in 2 representative location points, near the plan borders. One point at Moshav Hama'apil, and another point at Moshav Ein Hahoresh. The microphone was placed at a height of 4 meters from ground level in all measurement points.

The location of the measurement points is presented in Figures no: 1.11.1 – 1 through 1.11.1 – 3 below.

For the purpose of characterizing noise levels at Ein Ayala and the Hadera treatment facility, two series of noise level measurements were conducted, one during the daytime, on April 26, 2010 and the other during the nighttime between April 28 and April 29, 2012.

Ambient noise measurement levels were conducted at 10 minutes intervals in each point. Daytime noise level measurements were conducted between 2 pm and 9 pm and nighttime noise level measurements were conducted between 11 pm and 2:30 am.

Ein Ayala – Measurements were performed at 3 representative points, one near the plan borders, and two more near residential homes in Ein Ayala and Fureidis. The microphone was placed at a height of 4 meters from ground level in all measurement points.

Hadera treatment facility –Measurements were performed at 2 representative points, one near the plan borders and the other near Hadera's northern neighborhoods. The microphone was placed at a height of 4 meters from ground level in all measurement points.

The location of the measurement points is presented in Figures 1.11.1 – 5 and 1.11.1 – 4 below.

Figure 1.11.1 – 1: Location of noise level measurement points – Dor north

The picture can't be displayed.

Figure 1.11.1 – 2: Location of noise level measurement points – Hagit east

The picture can't be displayed.

Figure 1.11.1 – 3: Location of noise level measurement points – Meretz Wastewater Treatment Facility

The picture can't be displayed.

Figure 1.11.1 – 4: Location of noise level measurement points – Ein Ayala

The picture can't be displayed.

Figure 1.11.1 – 5: Location of noise level measurement points – Hadera treatment facility

The picture can't be displayed.

Equipment and measurement methodology

Measurements were conducted in accordance with the requirements of the Nuisances Regulations (Unreasonable Noise, 5750 – 1990). Measurements were conducted using the following equipment:

- Real time spectrum analyzer, Model 831 from Larson Davis, USA
- Pre amplifier, model PRM831 from Larson Davis, USA
- Capacitor microphone, model 377A02 from PCB, USA
- Calibrating device for noise levels, model CAL200 from Larson Davis, USA
- Wind shields and tripods.

This equipment meets the requirements of the international standard IEC 67672 for noise measurement precision devices of type 1 – Precision. A noise level analyzer was programmed to measure the noise level in a dB scale with A weighing in fast status. The device output was programmed to include during measurement equivalent noise levels, marked as LAeq (1 sec) in each 1 second interval. This measurement technique allows for full understanding of the measurement results and ability to separate between events, including disturbance in measurement from various sources in the course of the measurement. Measurement disturbances are defined as all sources of noise that are uncharacteristic to the general noise at the point of measurement, such as dogs barking attributed to the presence of the measuring personnel, or a parking car alarm, etc.

Noise measurement results

Table 1.11.1 – 1 summarizes the results of the noise measurements for each one of the alternatives and details the main sources of noise that determine the existing acoustical ambiance.

Table 1.11.1 – 1: Details of measurement points and equivalent noise levels measured in dB with A weighting

Alternative	Point of measurement marking	Location	Noise level equivalent in dB with A weighting		Main noise sources
			Day time	Night time	
Dor north	DN – 1	Western border of Dor north alternative	53.2	46.7	Vehicle traffic on Road 2, vehicles traffic on Road 7011, crickets at night
	DN – 2	Eastern border of Dor north alternative	52.8	39.9	Vehicle traffic on Road 7011, crickets at night
	DR – 3	Moshav Dor	45.9	43.0	Vehicle traffic on local road, music from a neighbor's house, train bell
	FR – 4	Fureidis	59.4	56.6	Vehicle traffic on Road 4, vehicles traffic on local road. Conversations from neighbor house
Ein Ayala	MEA - 1	Western border of Ein Ayala quarry alternative	61.7	**	Quarry plant
	EA - 2	Ein Ayala	44.2	37.7	Vehicle traffic on Road 4
	FR - 3	Fureidis	50.2	48.7	Vehicle traffic on Road 4
Hadera treatment facility	HE – 1	Southern border of	52.9	52.0	Suction systems, Vehicle traffic on Road 65

Alternative	Point of measurement marking	Location	Noise level equivalent in dB with A weighting		Main noise sources
			Day time	Night time	
		Hadera alternative			
	H – 2	Hadera	48.1*	43.5*	Hadera industrial zone, railway traffic
Hagit east	HM – 1	Northern border of Hagit east alternative	40.1	44.2	High power cables, Hagit power plant
	HM – 2	Southern border of Hagit east alternative	54.7	52.6	High power cables, Hagit power plant, Vehicle traffic on Road 70.
	EL – 3	Moshav Elyakim	49.6	54.3	Vehicle traffic on Road 70, vehicle traffic on local roads. During the night a constant unidentified noise in the Moshav
Emek Hefer Meretz Wastewater Treatment Facility	MM – 1	Western border of Emek Hefer - Meretz Wastewater Treatment Facility	43.3	**	Light plane traffic
	MM – 2		45.6	**	Light plane traffic, agricultural truck traffic, truck traffic to the treatment facility
	EH – 3		54.1	38.1	Vehicle traffic on local roads

Alternative	Point of measurement marking	Location	Noise level equivalent in dB with A weighting		Main noise sources
			Day time	Night time	
	HM – 4		42.9	**	Birds chirping, Vehicle traffic on local roads., Vehicles traffic on route 581

* This level does not include railway noise

** No access allowed to measuring personnel during nighttime

1.11.2 Offshore Environment*

This section will be presented as part of the environmental impact survey for offshore environment components, conducted as part of the plan, and submitted as a continuation of this document.

[i]

[ii] F. Pasquill, *Atmospheric Diffusion: The Dispersion of Windborne Material from Industrial and other Sources, D. Van Norstand Company, Ltd., London, 1962.*

[iii]http://www.ims.gov.il/NR/rdonlyres/903F1DC2-8E4D-4748-8E9C pdf.
ערכיטמפרטוررהרבשנתיים 20091995 לאתר /D8BCDEECAA80/0

[iv]http://www.ims.gov.il/NR/rdonlyres/903F1DC2-8E4D-4748-8E9C pdf.
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[v]http://www.ims.gov.il/NR/rdonlyres/903F1DC2-8E4D-4748-8E9C pdf.
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[vi]http://www.ims.gov.il/NR/rdonlyres/903F1DC2-8E4D-4748-8E9C pdf.
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[vii] D. Bruce Turner, Workbook Of Atmospheric Dispersion Estimates (1970).

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