

Deanship of Graduate Studies

Al-Quds University



The Environmental Impact Assessment of the Bethlehem
Multidisciplinary Industrial Park

By

Sylvia Judeh Salim Shahwan

M.Sc. Thesis

Jerusalem-Palestine

1431/2010

Environmental Impact Assessment of the Bethlehem
Multidisciplinary Industrial Park

Prepared By:

Sylvia Judeh Salim Shahwan

B.Sc. Biology and Education, Jordan University, Amman,
Jordan

Supervisor: Dr. Mutaz Qutob

A thesis submitted in partial fulfillment of requirements for the
degree of Master of Science in

Environmental Studies

Department of Earth and Environmental Sciences

Faculty of Science and Technology /Al-Quds University

1431/2010

Al-Quds University
Deanship of Graduate Studies
Environmental Studies
Department of Earth and Environmental Sciences



Thesis Approval

The Environmental Impact Assessment of the Bethlehem Multidisciplinary Industrial Park

Prepared By: Sylvia Judeh Salim Shahwan

Registration No: 20724014

Supervisor: Dr. Mutaz Qutob

Master Thesis submitted and accepted:

The names and signatures of Examining Committee members are as follows:

1. Head of Committee: Dr. Mutaz Qutob Signature.....
2. Internal Examiner: Dr. Jawad Hassan Signature.....
3. External Examiner: Dr. Simon Al-Araj Signature.....

Jerusalem- Palestine

1431/2010

Dedication

To my beloved family; husband Salameh and children Suleiman, Ruslan, Firas and Sabrina who supported me all through my study years.

I will not forget my parents, father Judeh who taught me patience, perseverance and perfection and mother Su'ad who with her love helped me all the way. To my brothers Walid and Zuheir and my sister Maysoon.

A special dedication to the angel who brought new sunshine to our family, my beloved granddaughter Yeleina.

Declaration

I will certify that this thesis is submitted for the Masters degree as a result of my own research except where otherwise acknowledged. This thesis has not been submitted for a higher degree to any other university or institution.

Signature

Sylvia Judeh Salim Shahwan

Date

Acknowledgements

I would like to express my deep thanks to my teacher and supervisor Dr. Mu'taz Qutob for his continuous encouragement, academic and financial support he offered me throughout my study years and my thesis. My appreciation to all the staff in the Environmental Studies Department at Al-Quds University for their dedication and sincerity in their work. I would mention especially Dr. 'Amer Mir'i, Dr. Quassim 'Abdul Jaber and Dr. 'Adnan Lahham.

My deep gratitude to Dr. Jihad 'Abadi and the staff in the Center of Analyses Laboratory, especially to Mr. Sameh Nseibeh for their help in the water and soil analyses and to Mr. Muhammad Hdedoon in the Water and Sewerage Authority.

I would not forget the big help I had from the Bethlehem Chamber of Commerce, especially from Dr. Samir Hazboon, Mr. Nabil Bandak and Mr. Eli Shehadeh, from ARIJ, from the Ministry of Environmental Affairs and the village council of Jinnata and Hindazeh for providing me with the data and documents needed for my study.

Special appreciation to Monsieur Philippe Lecrinier, former representative of AFD (French Agency of Development) who supported me and offered me all the information I asked for concerning the project.

Last but not least, I would like to thank the administration of the Latin Patriarchate School in Beit-Jala, represented by Mr. 'Issa Abou Ghannam, the headmaster of the school for facilitating my studies by organizing my schedule and encouraging me.

Abstract

A Bethlehem Multidisciplinary Industrial Park (BMIP) came as a result of an agreement between the Palestinian Authority and the Republic of France to establish an industrial park covering an area of 530 dunums in the South Eastern part of Bethlehem near the village of Hindazeh, where small and moderate sized industrial enterprises will be moved. The aim of this industrial park is to attract investors, both local and international ones, to participate in developing the economy of the area and its surroundings. The project comprises storm water drainage, water, energy and telecommunication network and supply, roads, wastewater collection and treatment, solid waste collection system and disposal.

Environmental impact assessment (EIA) aimed to identify and predict the impact of the project on the bio-geophysical environment and on human health and well-being, to analyze the site and to process alternatives and provide solutions to mitigate the negative consequences in the future. Potential disturbances may be more costly to correct after their occurrence than before.

The study was based on thorough investigation of the site and its baseline conditions. Ground water of the main well fed by the watershed of the project site was analyzed for anions, cations, pH, electrical conductivity (EC), and total dissolved solids (TDS). Soil of the project site was analyzed for cations, moisture, pH, EC, TDS, organic matter and composition. Flora and fauna were studied in addition to the study of topography, geology, hydrogeology, water resources, climate, air quality, noise, public uses, socio-economic environment, agriculture, historical and sacred places, water supply, wastewater and solid wastes. Interviews

and meetings were held for the public consultation. Palestinian and international laws and regulations concerning pollution control were also revised and evaluated.

The potential environmental impact of industrial activities was found to be significant on air, water and ground quality. It was found also that the project site lies in an inhabited rural area, very sensitive to pollution. Analyses showed that the site is free of any pollution in soil and water, in addition to the presence of threatened fauna and flora. Hence, strict measurements have to be taken in monitoring the project during the construction and the operation phases to protect the environment, health and welfare of residents and workers in the BMIP.

ملخص البحث

تحقق إنشاء المنطقة الصناعية متعددة الأغراض في منطقة بيت لحم نتيجة لتفاهم مشترك بين الحكومة الفرنسية و السلطة الفلسطينية ، حيث اتفق على تسخير ما مساحته 530 دونما في المنطقة الواقعة جنوب شرقي مدينة بيت لحم و بالتحديد بالقرب من قرية هندازة حيث ستقام أو تنتقل بعض الصناعات الخفيفة و المتوسطة. إن الهدف من إنشاء المنطقة الصناعية هو جذب المستثمرين المحليين و الأجانب للمساهمة في تطوير المنطقة و ما حولها. يحتوي المشروع المقترح على وسائل للتخلص من مياه الأمطار و الصرف الصحي و النفايات الصلبة و معالجة المياه العادمة، بالإضافة إلى شبكات المواصلات و المياه و الاتصالات و الطاقة.

يهدف تقييم الأثر البيئي لتحديد و التنبؤ بأثر المشروع على البيئة البيولوجية الفيزيائية و الجيولوجية و على صحة و رفاهية الإنسان. يعنى التقييم بتحليل الموقع و دراسة البدائل و الحلول للتخفيف من الآثار السلبية في المستقبل، حيث أن إصلاح الضرر بعد حدوثه يكون مكلفا.

استند البحث إلى دراسة معمقة للموقع و الوضع الحالي . تم تحليل المياه الجوفية للنبئر الرئيسي التي تتم تغذيته من منطقة المشروع، حيث درست الأيونات الموجبة و السالبة و درجة الحموضة و الإيصالية الكهربائية و المواد الصلبة الذائبة. حلت التربة لدراسة الأيونات الموجبة و الرطوبة و درجة الحموضة و الإيصالية الكهربائية و المواد الصلبة الذائبة و المواد العضوية . درست الثروة النباتية و الحيوانية بالإضافة لدراسة طبوغرافية و جيولوجية الموقع و مصادر المياه و التربة و المناخ و جودة الهواء و الضجيج و الاستخدامات العامة للأراضي و البيئة الاقتصادية و الاجتماعية و الزراعة و المواقع التاريخية و الدينية و شبكة المياه و المجاري و النفايات الصلبة. أجريت لقاءات و اجتماعات تحت عنوان استشارة الجمهور كما و تمت مراجعة و تقييم القوانين و التشريعات الفلسطينية و الدولية المتعلقة بالتلوث البيئي.

وجد أن الأثر البيئي للنشاطات الصناعية قد يكون وخيماً على جودة الهواء و المياه و الأرض و أن المشروع يقع في منطقة سكنية ريفية حساسة جداً للتلوث البيئي. أثبتت التحاليل خلو الموقع من تلوث المياه و التربة بالإضافة إلى وجود نباتات و حيوانات مهددة بالانقراض. لذلك يجب اتخاذ الإجراءات المشددة لمراقبة و ضبط المشروع خلال مرحلتي الإنشاء و التنفيذ لحماية البيئة و صحة السكان و العاملين و رفايتهم.

Table of Contents

	Page
Dedication	
Declaration	i
Acknowledgements	ii
English Abstract	iii
Arabic abstract	v
Table of Contents	vii
List of Tables	xi
List of Figures	xiii
List of Appendices	xiv
Abbreviations	xvi
Chapter One	1
1.1 Introduction	1
1.2 Problem Statement	4
1.3 Hypothesis	5
1.4 Objectives	6
Chapter Two: Regulations and Laws Governing EIA and Environmental Pollution Control	7
2.1 Palestinian Regulations	7
2.1.1 The Palestinian Environmental Assessment Policy	7
2.1.2 Law No. 7 for the Year 1999, by Environment Quality Authority	8
2.1.3 Palestinian Environmental National Strategy	9
2.1.4 Regulations Governing Industrial Sewage Disposal in	9

	Bethlehem Municipality.	
2.2	International Regulations	10
2.3	The Rio Conference and Agenda 21 Concerning Solid Waste and Wastewater	12
2.4	National Interim Primary Drinking Water Regulations.	12
2.5	Protection of the Environment Operations Act, 1997	13
2.6	Guidelines for Drinking Water Quality.	14
Chapter Three: Literature Review		15
3.1	Status of Air Pollution in Palestine.	15
3.2	Biodiversity Status in Palestine and Bethlehem Governorate.	15
3.3	Special Problems Associated With Pesticide Manufacturing and Use	16
3.4	Industrial Wastes	17
3.4.1	Wastewaters	18
3.4.2	Solid Wastes and Sludges	19
3.5	Eco-Industrial Parks	19
3.6	EIA of Industrial Zones in Palestine	21
Chapter Four: Project Phasing and Types of Industries Expected to Move to the BMIP		24
4.1	Project Phasing	24
4.2	Industries Expected to Move to the BMIP	24
4.3	Allocation of Industry Types and Layout Scenarios	27
4.3.1	Planning Scenario 1: Ring Road Planning Scenario	27
4.3.2	Planning Scenario 2: Loop Roads Planning Scenario	27
4.3.3	Planning Scenario 3: Combined Scenario	27

4.3.4	Planning Scenario 4: Including Stone-Cutting Industry	28
-------	---	----

Chapter Five: Baseline Data of the Study Area	29
--	-----------

5.1	Location	29
5.2	Topography	30
5.3	Geology, Hydrogeology and Water Resources	31
5.3.1	Geology and Hydrogeology	31
5.3.2	Water Resources in the Project Site	33
5.4	Soil	36
5.5	Climate (Temperature, Precipitation and Relative Humidity)	36
5.6	Wind Direction	38
5.7	Flora and Fauna	39
5.8	Ambient Air Quality	45
5.9	Noise Pollution	46
5.10	Public Uses and Green Areas	47
5.11	Socio-Economic Environment	48
5.12	Agriculture	49
5.13	Historical, Sacred and Archeological sites	51
5.14	Water Supply and Wastewater	51
5.15	Solid Waste Disposal	54

Chapter Six: Possible Impacts of the BMIP on the Environment	56
---	-----------

6.1	Environmental Impacts During the Construction Phase	56
6.2	Environmental Impacts During the Operation Phase	56
6.2.1	Impacts on Water Resources	58

6.2.2	Impacts on Soil	61
6.2.3	Impacts on Air Quality	63
6.2.4	Impacts on Public and Occupational Health	64
6.2.5	Noise and Vibration	66
6.2.6	Impacts on Flora and Fauna	67
6.2.7	Aesthetic Disturbance	69
6.2.8	Impacts on Agriculture	70
6.2.9	Impacts on Land Use	71
6.2.10	Wastewater and Sewage Treatment	72
6.2.11	Impacts from Solid Waste	75
6.2.12	Impacts of Stone Cutting Industry in the BMIP	76
6.2.13	Public Consultation and Acceptability	77
Chapter Seven: Methodology		78
Chapter Eight: Results and Discussion		80
Chapter Nine: Recommendations		87
References		90
Appendices		93

List of Tables

	Page
Table 2.1 The most prominent international regulations concerning EIA, environmental protection and pollution control.	11
Table 2.2 Maximum contaminant levels for inorganic chemicals in drinking water.	13
Table 2.3 Some international and Palestinian guidelines for drinking water standards.	14
Table 3.1 Industrial zones in the West Bank and Gaza	21
Table 3.2 Industrial zones in colonies in the West Bank	22
Table 3.3 Israeli industries in the West Bank	22
Table 4.1 Percentages of Types “A” and “B” industries and weighed average areas.	26
Table 4.2 Layout scenarios for land use areas	28
Table 5.1 Hydrostratigraphic column beneath Bethlehem District	32
Table 5.2 Characteristics of Bethlehem Governorate wells around the project site	35
Table 5.3 Chemical characteristics of Bethlehem Governorate wells around the project site	35
Table 5.4 Climatic parameters in Bethlehem area	38
Table 5.5 Average rainfall in Bethlehem area	38
Table 5.6 Flora documented in the project site	40
Table 5.7 Flora supposed to be found in the project site	42
Table 5.8 Estimated water need for the project activities	52
Table 5.9 Standard of effluent parameters appropriate for irrigation	54