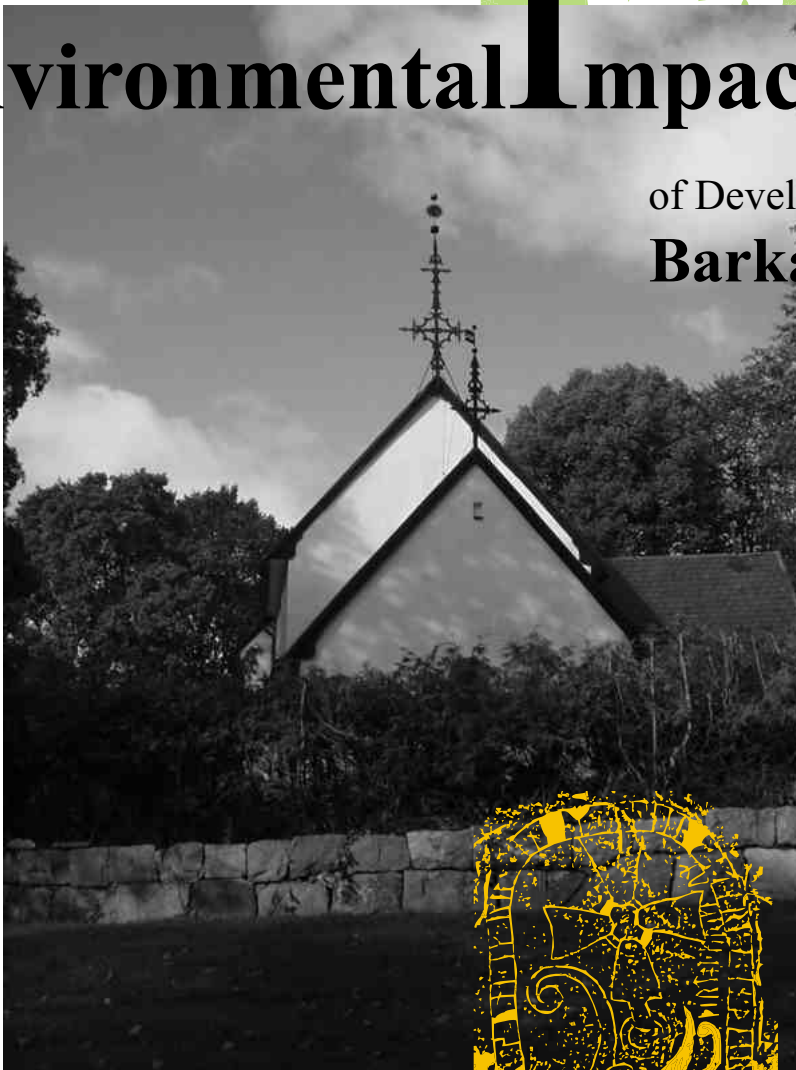


# Environmental Impact Statement

of Development Proposals for the  
**Barkarby Field**



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## NON-TECHNICAL SUMMARY

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The Environmental Impact Statement (EIS), here presented, accompanies the planning scheme concerning different proposed developments for the Barkarby field. The group L, of the EIA course, has been in charge of its preparation.

The EIS is an important instrument, which gives the guidelines to evaluate the impacts of each project considered.

The EIS examines the receiving environment, the different alternatives proposed, the most significant impacts, the measures for lessening the adverse effects on the environment and the monitoring program.

The area of the proposed development covers the Barkarby field, which is a “green area” situated in the north-western part of greater Stockholm. The different alternatives involve, in different percentages, residential and commercial land uses.

Different land uses characterised the current receiving environment. There are few settlements in the south of the area, mostly around the church of Järfälla. The commercial area is situated in the north-western part, and it's characterized by the shopping zone around IKEA store.

There are also different and important recreational areas, as golf courses and horse paddocks.

The flora and fauna of the receiving environment has, in generally, a medium value, except the “Stone Loach “. This kind of fish, living in the Igelbäcken stream, has been catalogued by the EU as endangered species. That constituted therefore a strong restriction for future developments within the area.

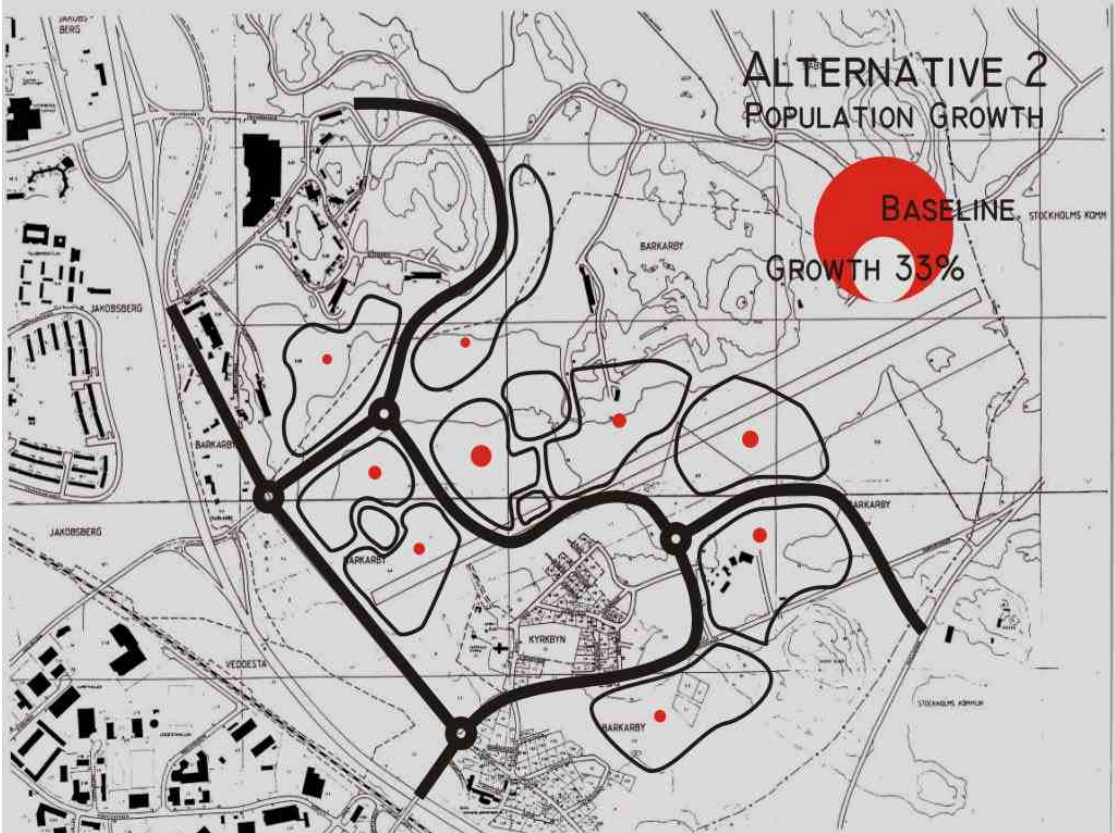
The proposed developments has different impact on the existing environment, that could be positive and negative. The main impacts involve the traffic, the noise, the air, soil and water quality, the runoff, the flora and fauna and the community (residential, commercial, working and recreational uses of the area). The latter is quite complicated since different parts have interest in the area: the municipality, the existent community and all the company of recreational aims. All these possible impacts are to be considered for each alternative and then the results should be compared and assessed in order to find the best solution for the area.

Measures for lessening the adverse effects are proposed for the main impacts for each alternative. Moreover, a monitoring programme is also discussed.

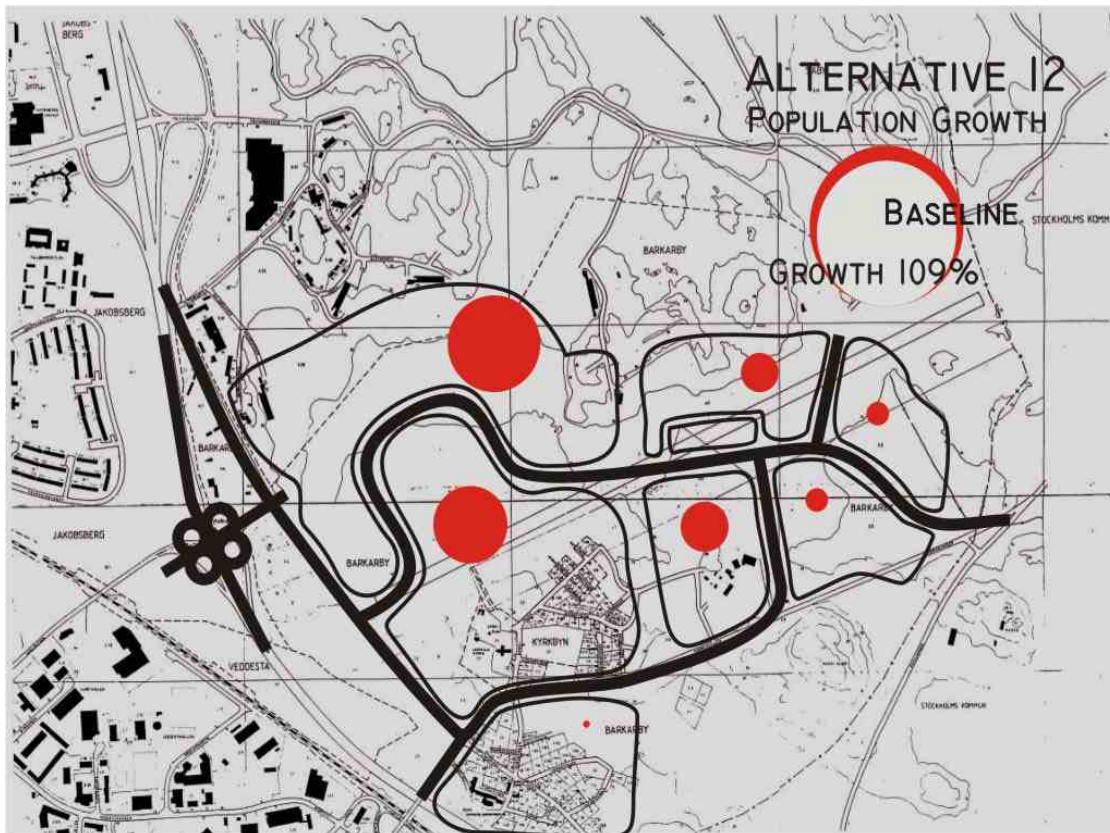
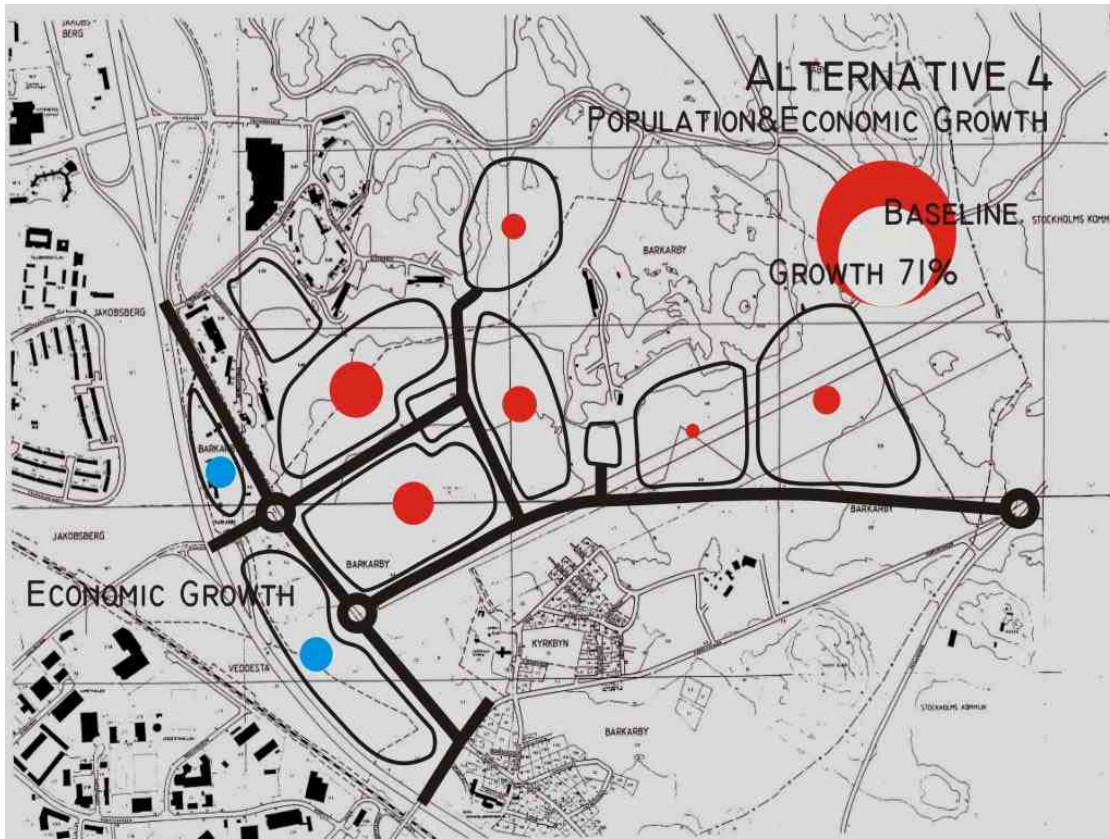
In addition, this EIS attempts to show the great concerned about taken the public into consideration during the whole process. Different ways of involving the public are thereby analysed.

The final decision by the Consultants in group L was that the alternative 4 was the most balanced one. The adverse effects on the environment were not hazardous and almost similar in all proposed alternatives. But benefits from the development of alternative 4, the extra housing and working places exceed the benefits in the other proposed alternatives.

On the maps below there is a presentation of population and economic growth for all 3 alternatives.







## **INTRODUCTION**

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Since the 1990s the northwest of Barkarby Field has fast commercial development. Few established Swedish companies, like IKEA, El-Gigante, Factory outlet, opened stores in Barkarby turning it into popular shopping place in Stockholm. A new housing-commercial project is proposed for the Barkarby Field to see the further possibilities for the development of the area.

The present document is the result of the Environmental Impact Assessment of the development proposals for the Barkarby field area. It aims at describing the environmental and socio-economical issues of the project as well as providing solutions to the expected resulting problems. This should be a support for the competent authority by providing all the relevant information they need to decide whether the project should take place or not. It should also give understandable, unbiased and complete information to any person interested in the project. This EIS intends to be as objective and transparent as possible.

An Environmental Impact Statement was carried out by the Consultants to evaluate the proposed alternatives for the development. The developer Barkarby Community has offered 3 alternatives for the future development.

## **PROJECT DESCRIPTION**

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The proposed development project intends to build a new housing complex in the Barkarby field, north and east of the old village of Barkarby, where currently stands the private Barkarby airfield. Three different alternatives are considered. An area ranging from 85 to 133 hectares is concerned, depending on the alternative. Different types of housings are proposed, from low-density villas to four-storey buildings. Recreation and commercial/business areas, new services, roads and public transport networks are included in the project. The proposal aims to provide modern high-quality housing to face the increasing demand in the Stockholm surroundings.

The screening process is intended to point out whether an EIA was needed for this project or not. According to the European Council Directive 97/11/EC, this type of project is subjected to mandatory EIA (Annex I). The size of the project, its strategic geographical situation, its demographic influence and the presence of neighboring endangered species thus justify the need of a complete environmental impact assessment.

## **ENVIRONMENTAL BASELINE**

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### **GEOGRAPHY**

The Barkarby field is situated in the Järfälla municipality within the Great Stockholm area. It is part of a big green wedge that stretches from the countryside to the centre of Stockholm. It is bordered by the E18 Motorway on the west, by Akallavägen on the southeast and a natural reserve on the north.

Its northwestern extremity contains an important commercial area that has known a significant growth since an IKEA store opened in the 1990s. A private owned airfield crosses the whole area in its centre from west to east, which is also used for car and motorbike testing. At the eastern end of the runway, there are a golf course practice and horse paddocks.

The population is concentrated in the Barkarby village, which is located south from the runway. It is crossed by Norrviksvägen stretching from the motorway to Akallavägen. Enköpingsvägen links the commercial area with the village.

The total population of the municipality of Järfälla is 61'343 people from 2003 census and also it is estimated to be 10'164 for the Barkarby community. The densely populated area is found in the Järva field, north of the Barkarby field.

### **CULTURAL BACKGROUND**

There are traces of human presence in the Barkarby field dating from 3000 years ago. All archaeological findings in the field have been documented. Two landmark buildings, the Lesse-Maja inn and the Järfälla church, give the Barkarby village its own identity. New houses have been built in the old town following the traditional architecture in order to preserve Barkarby's unique character.

One old typical farm is located 300 meters east of Barkarby village. It is the last remaining example of the agricultural society, which used to live in the area.

Nowadays, Barkarby is essentially renowned for its popular commercial centres in the IKEA area.

### **TRAFFIC, NOISE AND AIR QUALITY**

The major noise pollution in the Barkarby field emanates from vehicle traffic and air traffic from the airport. Noise from aircraft affects a large part of the town of Barkarby, especially



the last dwellings on the north side of the village. The traffic in the area is mainly concentrated on the four roads previously mentioned. This generates high noise levels along the motorway, which often exceed the recommended limits. Moreover, this traffic causes significant air pollution with nitrogen dioxide. The levels measured do not sometimes comply with the standards.

## **HYDROLOGY**

Two streams run through the field: the Bällstaån in the western border of the area and the Igelbäcken in the eastern part. The Bällstaån catchment area is mostly built-up, the natural course of the river is totally changed and has a runoff of 120 L/s. The Igelbäcken is 10km long and has a runoff of 45 L/s. Its flow is very much disrupted and does not go through its natural bed because of human activities. However, strong efforts have been put to restore it and its attractiveness for wild fauna and flora as well as Sunday-walkers has increased. The flow of the Igelbäcken is being maintained by pumping water to the river. Both rivers flow from North to South.

Hydrological assessments revealed that both streams are affected by nutrients coming from the use of fertilizers in the agriculture.

## **FLORA AND FAUNA**

The flora existing around the airfield is mainly consisted of grasslands. Three main forest areas are situated east of the IKEA area, north of the runway and between Norrviksvägen and Akallavägen. These zones have been damaged by prior military trainings and no particular valuable species are to be found. Nevertheless, special attention must be paid to their edges, where specific ecotones with a few rare species are growing.

The whole area constitutes an important ecological corridor linking the Järva field in the north and the Igelbäcken valley in the south. It is however fragmented by the presence of the airport.

The most valuable species found in the area are the Stone and Spined Loach, which live in the Igelbäcken. Those two types of fish are catalogued in the EU list "Natura 2000" as endangered species and are thereby protected by law. Ecological organizations are currently requiring the creation of a natural reserve around the Igelbäcken (ref. Appendix 15).

## **GEOLOGY**

The Barkarby field is a generally low-lying area. There are however some hills in the central part of the area, which are of special concern for the landscape because it's where forest is to be found. The area is characterised by a great number of De Geer moraines, which have left important boulders at the end of the last Ice Period.

The soil type is mainly clay with variable thickness up to 10 meters throughout the area. In addition, organic soils are found in the northern part of the field.

## **SCOPING OF IMPACTS**

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The scoping was conducted to establish the main issues to be considered in the EIS. The process got to the conclusion that the main impacts of the proposed development are:

- Road traffic increase in the area
- Ecological impact on the endangered Stone and Spined Loach
- Socio-economic impact due to demographic increase
- Visual impact on the landscape

Therefore, the EIS places particular emphasis in these areas.

There is also a plan for public participation. It is consisted of questionnaires and interviews for the residents and club members for the initial phase of the assessment that would be added in the Appendix 8. Public hearings will be arranged as well. Members of the public will be able to comment on the EIS and show his point of view about all the matters concerning the developments. The public will be informed about the day, time and place where the public hearing is to take place through a notice published in the newspapers and advertisements on the radio.

A meeting with representatives of the commercial and leisure centre and the air club is also to be arranged. The leaders of these sectors should state their opinions on the projects.

The first key issue taken in concern is traffic impact, the analysis of the proposed alternatives as the 0 alternative focuses on noise increase and air quality degradation in the proposed housing areas and the existing village. The increasing carbon monoxide (CO) and nitrogen dioxide (NO<sub>2</sub>) emissions are being quantified.

The second key issue was socio-economic impact with priority on population and economic growth in the community. The social impact in the area will essentially be of demographic

purpose since the creation of new housing areas will cause an enhancement in population. The analysis of the social impacts should involve the wider public participation possible.

The third key issue is the ecological impact, the stream and the catchments area needs to be protected during the construction phase and monitored for water quality changes since two species “The Spined Loach”, as well as the endangered “The Stone Loach” are found in Igelbäcken at the Järva field.

Regarding the visual impact, the Järfälla church as well as the old village of Barkarby has great significance and gives the unique character to the area. Therefore, the construction of high buildings in the neighborhood can perceptively damage the scenery.

## **PRESENTATION OF THE ALTERNATIVES**

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### **ZERO-ALTERNATIVE**

The zero-alternative is a scenario where none of the proposed alternatives are finally retained and the project does not take place at all. In that case, the Barkarby airfield would probably remain as it is nowadays. As the air traffic has been increasing in the last years, it would at least remain stable, if it would not increase. The noise caused by the take-offs and landings would indeed stay even to the present state.

There would probably be no -or very few- changes in the land use, as new housings close to the village would be restricted due to the proximity of the airfield. Thus, the land value would remain identical in most of the area, not bringing new incomes to the municipality.

However, considering the speed of the development of the commercial area since IKEA was implemented, it would probably continue its expansion. As the Natural Reserve border stands just north of the commercial complex, it would most likely spread out in the South and Southeast, at walking distance from the existing parking. This would generate an increase of road traffic in the area, which would affect the living inhabitants of Barkarby more and more as the commercial area gets closer to the village.

In addition, the prospected natural increase of road traffic in the region is approximately of two percents per year, which will engender a sensible increase of noise pollution.

The living ecosystems would remain similar to their current state and the efforts put in the restoration of the Igelbäcken would probably help the endangered Spined and Stone Loach populations to enlarge. The Igelbäcken and its surroundings would maybe end up being

protected as a nature reserve. The forests previously damaged by military trainings would slowly be naturally restored.

## **ALTERNATIVE 2**

The alternative 2 is based on nine housing neighbourhoods, two of them around the existing commercial zone near IKEA and seven around the Barkarby village. It extends over 865 000 m<sup>2</sup> forming rings that surround the existing zones, the residential in Barkarby village and the commercial zone near IKEA. All the new zones with the existing Barkarby village form one centralized residential zone with low density. The density is higher in the centre (The Left Kidney, The Heart and The Spleen) with apartments on 4 and 3 storeys, working and service area. The outer housing zones just follow the existing urban scheme of the Barkarby village with 2 storey high apartments and villas. The new housing development of alternative 2 can accommodate 4450 people in 2225 apartments and 150 inhabitants in 75 villas.

With regards to the implementation of new infrastructure, the proposal includes a network of gathering roads that surround the new housing neighbourhoods. Roundabouts are created in the intersection of the roads by way of facilitating the flow of circulation. Norrviksvägen will be eliminated from the road network. There are two exits: one on E18-motorway and another on Akallavägen. It is worthy to point out the absence of a public transport network within the area.

The alternative also involves the construction of two service areas that will satisfy the needs of the future population.

## **ALTERNATIVE 4**

Alternative 4 is a mixed alternative, with three zones dedicated to commercial/business use and six zones for housing. It extends over 965'500 m<sup>2</sup> of which 783'900 m<sup>2</sup> are for housing development and 182'200 m<sup>2</sup> for commercial/business purposes. The proposed development concerns the North and the West of the village of Barkarby, leaving the East and South free of new constructions.

The project intends to build a new main road on the north side of the actual village, joining the existing crossing between Norrviksvägen and Akallavägen on the East and Enköpingsvägen, 400 meters southeast of the E18-northwest motorway exit, on the north-western side of the village.

The alternative proposes six housing neighbourhoods, four of them being situated between the existing commercial IKEA area and the village of Barkarby. These zones, called Bronx, Brooklyn, Harlem and Beverly Hills, contain apartments in four storeys buildings, with high exploitation coefficients ranging from 0.35 to 0.45. They are connected to the new main road and to Enköpingsvagen by two secondary roads. They have in their centre an important service area and each of them encloses a playground and a kindergarten. Two new junior and intermediate level schools are also planned in Bronx and Brooklyn, as well as numerous parking places.

The last two housing areas, Hollywood and Bel Air, are situated north of the new main road, on the right bank of the Igelbäcken. They consist of two-storey villa type constructions with an exploitation coefficient of 0.25. Bel Air includes facilities such as a junior and intermediate school, a kindergarten, a playground, a post-office and a local shop. Between the apartments' and the villas' zones, it is planned to build a big sports ground and a senior level school. The entire housing part of alternative 4 can accommodate 7170 people in 520 villas and 1870 apartments.

The three commercial/business sub-areas, Down Town, Long Island and Queens, are located just south of the existing commercial area and on the western edge of the Barkarby field, between the E18-northwest motorway and Enköpingsvägen. They should provide a total of 3640 new work places.

Pedestrian and cycling paths are designed around all the housing areas and two new bus lines serve the six neighbourhoods.

## **ALTERNATIVE 12**

The development objectives for alternative 12 are of housing, commercial uses, leisure uses and the creation of new and improved roads, bus routes and car parking among others. New and enhanced amenities will also be provided in the area.

The project intends to build a new road, north of the existing village to join the existing roads on the west and east of the Barkarby field as well as the existing road that passes through the existing village. A number of bus routes have been provided to connect other places. In addition a number of pedestrian and cycling paths have been designed to link majority of the places.

The project proposes 7 residential areas to be constructed on a total area of 310,000m<sup>2</sup>. Four of these buildings are along the newly built road in the Northern eastern side of the existing village. These housing neighbourhoods –the Grape, Apple and Pear occupies a land area of

110'000 m<sup>2</sup> each with the exception of the Orange, which occupies an area of 140'000 m<sup>2</sup>. The respective features of these residential areas are the followings: 1375 inhabitants in 550 apartments of 2-storey building; 825 inhabitants in 330 apartments of 3 storey; 825 inhabitants in 330 apartments of 3 storey and 1750 inhabitants in 700 apartments of 4 storeys respectively.

The other two housing neighbourhoods on the other hand are situated along the newly built road in the North Western side of the existing village. The Banana and the Peach occupies a land area of 450'000 m<sup>2</sup> with 3375 inhabitants in 1350 apartments and another area of 360'000 m<sup>2</sup> containing 2700 inhabitants in 1080 apartments respectively.

Only one settlement (the Raspberry) is located in the southern part of the existing village. It covers an area of 50'000 m<sup>2</sup> with 100 apartments for 250 inhabitants.

Parking place for these areas ranges from 300 to 1220. The project has been designed in such a way that the exploitation coefficient for the various construction on these areas ranges from 0.2 to 0.5. Thus only a portion of the land area assigned for the housing project will be cleared of its vegetation and be constructed.

Junior and intermediate level schools and kindergarten are to be constructed in all the residential areas for the inhabitants of the place. Further more, two new working areas are to be constructed from the western side of the existing village extending to the IKEA in the North.

Apart from the construction of the residential and commercial areas, alternative 12 also proposes to create a recreational facility in the north by preserving the current environment. This recreational area extends from the north-western side of IKEA to the north eastern and south eastern side of the existing village.

## RESUME OF THE MAIN FIGURES

The following table resumes the main figures for the three alternatives. The detailed statistics are presented in appendix 5.

	Area (ha)	Type of development	New population	
			Inhabitants	Workers
<b>Alternative 2</b>	86,5	Housing	4600	0
<b>Alternative 4</b>	95,49	Housing + Commercial / Business	7170	3640
<b>Alternative 12</b>	133	Housing	11100	0



## **CONSTRUCTION PHASE**

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### **TIMESCALE**

The Järfälla municipality owns the Barkarby field, so it can control the timescale itself. There can be two scenarios for each of the three alternatives; one with a long and the other with short timescale, depending of the needs of the municipality for housing and commercial space. The short timescale can range from six months to one year and the long one can last for up to five years.

### **DEMOLITION OF THE BARKARBY AIRPORT**

The prerequisite for the development of all the three alternatives is the demolition of the Barkarby airport. The demolishment phase can have significant impacts on noise levels as well as soil, air and water quality.

### **CONSTRUCTION METHODS AND BUILDING MATERIALS**

Advanced building techniques like green building practise should be applied in the construction phase. Green buildings promote resources conservation, energy efficiency, water protection features and use of renewable energies. They consider environmental impacts, try to minimize waste production and reduce operation and maintenance costs.

In the same spirit, the use of green building materials is proposed, materials that are composed of renewable, rather than non-renewable resources.

## **IMPACTS IDENTIFICATION AND PREDICTION**

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### **OPERATION PHASE**

#### ***Traffic***

The proposed development is analysed within a timescale of ten years. at complete. It assumes that the regular traffic will increase of 2% each year, like in the zero-alternative.

Each alternative involves an additional increase of traffic in the area. Two different types of traffic are distinguished: the working traffic which involves the people going working into the

area and the living traffic which concerns the people who live in the area and who go working out of it.

The working traffic concerns only the alternative 4. There are 2700 new work places between Long Island and Queens (Down Town is not taken into account, its road access comes from the north) and it is assumed that the 75% of the workers go to work by private car, so Enköpingsvägen has significant peaks of traffic in the morning and the afternoon.

Each alternative has one or two transit roads. As a whole, this traffic is about 20'000 vehicles per day. This traffic generates a problem at the end of Norrviksvägen, at the end of the Barkarby area. The densest concentration is in the alternative 2, but in each alternative it is necessary to find mitigation measures to reduce the traffic at the exit of the area. Alternative 12 manages to minimize this problem, since there is a tunnel under the area. In term of noise pollution, it is a good solution because it transfers the transit traffic in the tunnel, only leaving the living traffic near the housing area. In the alternative 4, there are two transit roads, the main one being just south of the new residential areas, which will reduce the traffic through the Barkarby village on Norrviksvägen. In the alternative 2, the traffic through the village is also reduced, but in a smaller way.

The living traffic is very different for each alternative. In alternatives 4 and 12, it is reduced by supplying a bus-network and limited parking areas. In alternative 2, there is no bus network. This explains why the ratio between vehicles and inhabitants is the highest.

The Appendix 1 present the maps about the traffic.

### ***Air quality***

All the alternatives taken into account for the development of the area consider the creation of new housing area or even working areas along with new roads. A significant amount of inhabitants will come as a consequence. Therefore, an increase of the number of cars circulating in the area is expected within next years. That will enhance the air pollution in the Barkarby field due to the contribution of CO and NO<sub>2</sub> originated by the traffic.

An air pollution analysis has been carried out in each relevant road for every alternative as well as for the baseline. Two main facts should be mentioned before continuing the description of the results. On one hand, CO emissions remain under control for all the alternatives since any prediction of the CO levels exceeds the recommendations. Consequently, the CO levels do not constitute a major threat. On the other hand, the NO<sub>2</sub> prediction for the motorway shows unacceptable levels at 10 and 15 meters for the alternatives and for the baseline. An explanation of the results is now presented.

#### Baseline:

The existing levels of contamination are very low for the baseline. Apart from the motorway, only the air pollution concerning NO<sub>2</sub> at a distance of 10 meters for road 2 exceeds the limits.

#### Zero-alternative:

NO<sub>2</sub> emissions are above the required level along the motorway. This fact was expected because of the great deal of cars circulating on it. Norrviksvägen also present high values at 10 meters from the road.

#### Alternative 2:

Road 2 and 3 present values above the limits at a distance of 10 meters. Both roads concentrate a considerable number of cars as they communicate the housing areas with the main roads.

#### Alternative 4:

In this alternative, two main roads in working area (4 and 5) guide the main quantity of traffic. In these roads the values at 10 meters exceeds the recommended level.

#### Alternative 12:

NO<sub>2</sub> emissions coming from traffic circulating along road 3 are above the standards.

A special mention to the NO<sub>2</sub> emissions should be done by way of concluding this section. All alternatives present values of NO<sub>2</sub> that are above the limits for at most two roads. Nevertheless, these high levels only constitute a threat for a distance of 10 meters. The motorway represents the main source of air pollution in the area.

In the Appendix 3 there are all the maps about the air pollution.

#### *Noise*

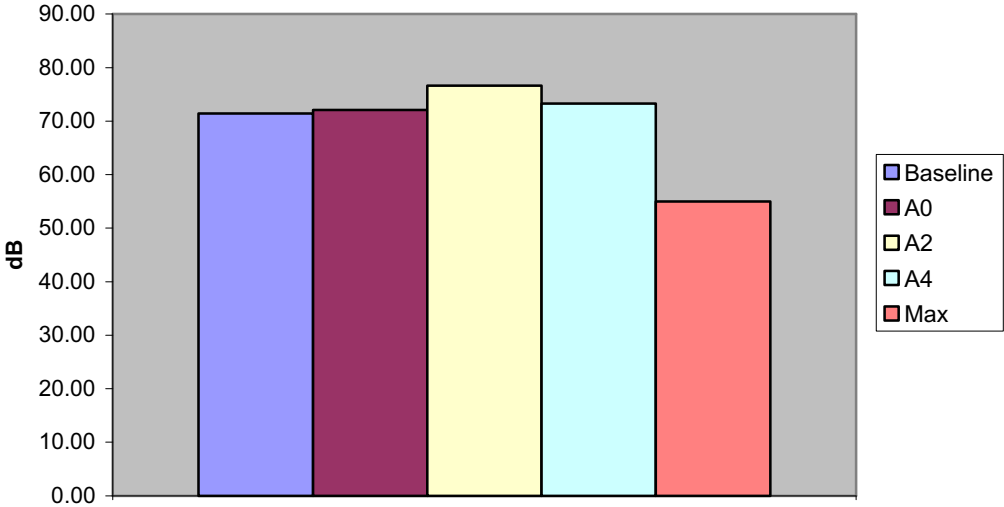
As it has been appointed in previous sections, the prediction of the noise levels in the catchment's area is of primary importance in the study of the impacts. The construction of new housing and commercial areas, coupled with the addition of new infrastructures such as roads or tunnels, will create a new distribution of the traffic. This will therefore lead to a new map of noise in the area. The aim of this section is, thus, to show these changes and compare

them to the legislation values. This will set a basis for the final assessment of the impacts. The table below summarizes the results obtained. Values in green comply with legislation whereas values in orange and red do not. All the values in red show a very high level of noise that have to be taken into consideration during the mitigation stage.

	baseline	0-alternative	alternative 2	alternative 4	alternative 12	Max
point1	71,45	72,10	76,60	73,25		55,00
point2	61,25	62,60	58,40	63,90	62,40	55,00
point3	58,40	61,60	73,40	62,05	68,45	55,00
point4	54,60	55,00	57,10	55,75	54,65	55,00
point5			68,60	68,15	67,05	55,00

**Point 1:**

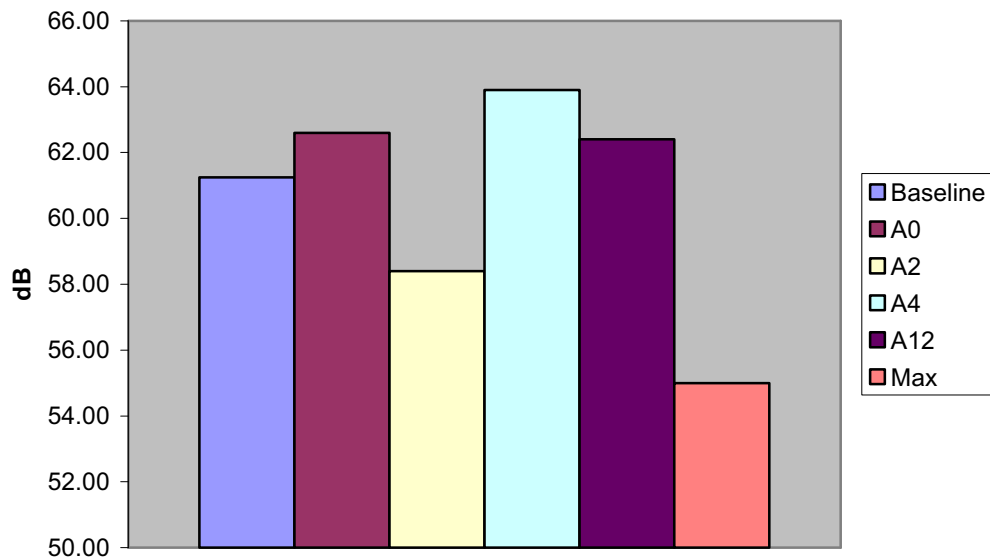
This point is of high relevance in the study of the impact due to its proximity to the motorway. As it is shown on the graph, neither the baseline nor the different alternatives comply with the legislation. Some mitigation measures will be presented in following sections.



**Point 2:**

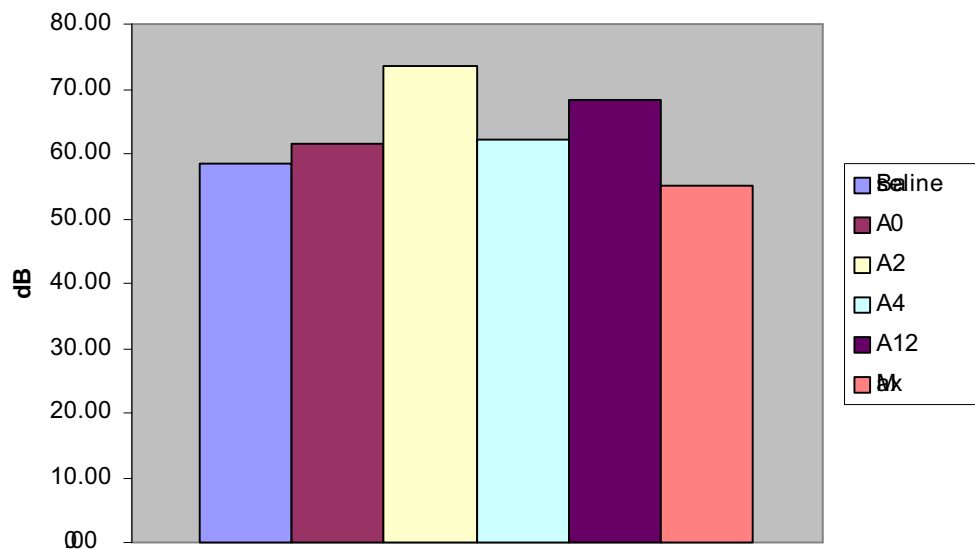
This point is located in the town of Barkarby. The surroundings of the village will undergo an important transformation according to the proposed developments. As it can be seen in the graph, all the alternatives, apart from alternative 2, increase the noise level in Barkarby.

Nevertheless, it is worthy to point out that the current noise level in the village (baseline) does not comply with the legislation.



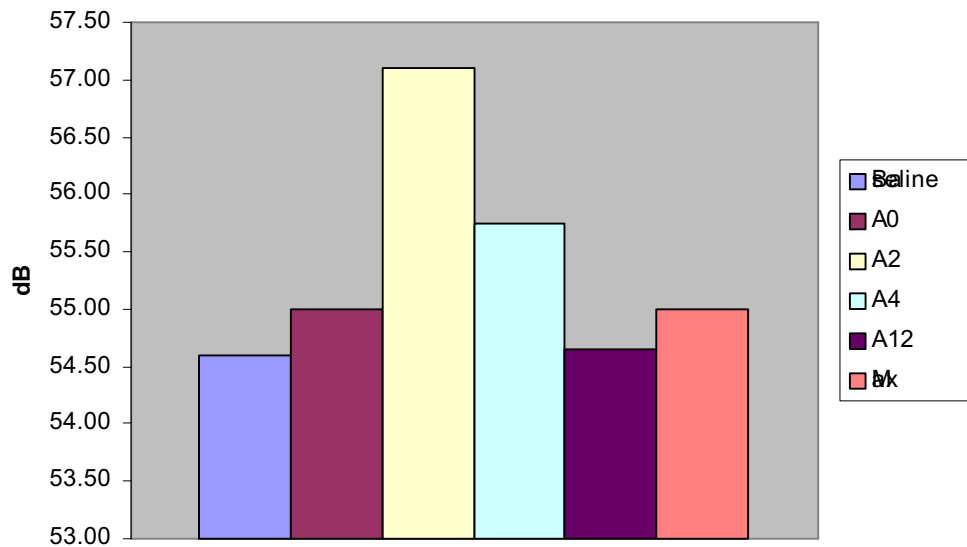
Point 3:

Point 3 shows the situation of the noise in the area flanked by the airport and Norrviksvägen. This particular area constitutes a protected site. However, alternative 2 and 12 consider new buildings in the area. The noise levels are thus in these alternatives the highest.



Point 4:

This point has been selected in order to show the current and future situation concerning the noise level in the surroundings of the commercial area where IKEA is located. The graph below shows a very slight increase with respect to the baseline conditions. The worst situation (alternative 2) implies a build-up of 2 dB above the recommended noise level, which does not constitute a very important threat.



Point 5:

Every alternative has its own intrinsic features in terms of new infrastructures in the area. That may imply the creation of new roads, tunnels and roundabouts. This will therefore create new “conflictive points” that must be under study for each alternative. Since point 5 is located in different sites depending on the alternative it is, thus, impossible to use this point to make the comparison them. This point tries to show a specific situation within each alternative.

As a way of conclusion, these results support the idea expressed before concerning the importance of taking the noise impact into account. The Barkarby field will unavoidably be affected in terms of noise pollution in all the alternatives under study. However, it is worth pointing out the high current values of the area that often do not comply with the recommended values.

**Runoff**

By increasing the built-up surface, the hydrology of the area will be sensitively perturbed. The transformation of grasslands and forests into built-up surfaces diminishes the infiltration



coefficient of rainwater into the soil. The overland flow will increase and more rainwater will end up in the Igelbäcken and Bällstaån, changing their discharge. The current runoff in the Igelbäcken is 45 l/s. It is 120 l/s in the Bällstaån. The following values have been calculated for each alternative:

<b>Igelbäcken catchment area</b>		
	New built-up surface (ha)	New runoff (L/s)
Alternative 2	5,11	45,0109
Alternative 4	7,17	45,0287
Alternative 12	12,85	45,0514

<b>Bällstaån catchment area</b>		
	New built-up surface (ha)	New runoff (L/s)
Alternative 2	15,45	120,0579
Alternative 4	38,23	120,2682
Alternative 12	31,55	120,1252

These values may seem insignificant, but it is only due to the small size of the area concerned by the project compared to the superficies of Igelbäcken's and Bällstaån's catchment areas. It is therefore important to keep in mind the impact that a similar development, on a bigger scale, can have on the runoff of a river.

### ***Water quality***

The proposed development will modify the quantities of phosphates and nitrates released in the environment. These chemicals are leached in the soils by infiltration water and they reach the rivers surrounding the area. High levels of phosphorus or nitrogen can kill aquatic flora and fauna, the endangered Stone Loach being particularly sensitive, and cause eutrophication. The nutrients released in runoff water will be, for the different alternatives:

<b>Igelbäcken catchment area</b>		
	Nitrogen depletion (kg/ha,y)	Phosphorus depletion (kg/ha,y)
Alternative 2	7,40	0,200
Alternative 4	7,27	0,200
Alternative 12	8,63	0,300

<b>Bällstaån catchment area</b>		
	Nitrogen release (kg/ha,y)	Phosphorus release (kg/ha,y)
Alternative 2	7,09	0,198 – 0.1975
Alternative 4	6,28	0,200 – 0.1903
Alternative 12	6,79	0,195 – 0.1937

According to the Swedish Environmental Protection Agency, these values are considered as high losses, typical from regularly ploughed cropland and nitrogen saturated forested areas. The modification of land use, from grasslands to built areas, will in fact reduce the amount of nitrates released. On the other hand, the few sub-areas planned on actual forests will increase the quantity of phosphates released:

<b>Igelbäcken catchment area</b>		
	Nitrogen increase (%)	Phosphorus increase (%)
Alternative 2	-7,50	0
Alternative 4	-9,06	0
Alternative 12	-13,97	0

<b>Bällstaån catchment area</b>		
	Nitrogen increase (%)	Phosphorus increase (%)
Alternative 2	-10,00	0,26
Alternative 4	-15,25	5,10
Alternative 12	-11,69	0,68

The increases of phosphorus are relative to the amount released before development, which is different for each alternative, as the land occupation is not identical in the three alternatives. For instance, alternative 4 is planned on some forested areas, where the phosphorus liberation is lower than for grasslands and built-up areas. Thus, the calculated increase of 5,10 % in the Bällstaån catchment area is comparatively high.

Concerning the Igelbäcken, the global impact will be positive as no phosphorus increase will occur and the quantity of nitrogen will decrease.

### ***Soil quality***

No heavy industries are planned in the development alternatives, the risk of soil pollution by heavy metals such as cadmium, mercury or lead is therefore very low. In addition, the low slopes encountered in the area are not particularly sensitive to erosion.

### ***Flora and fauna***

The fauna will generally be very little affected by the proposed development. The airfield fragmentises already the ecosystems and the new housings will not worsen the present situation. Dense constructions as proposed in alternative 12 will certainly have a bigger

impact on fauna then dispersed housings like in alternatives 2 and 4, leaving wider green corridors between the north and south parts of the area.

The biggest concern is the proximity of The Apple (alt 12) and Bel Air (alt 4) to the Igelbäcken. Nearness of human settlements, increase of people, children and domestic animals may compromise the survey of the Spined and the Stone Loach. It is crucial that the quality of the water is maintained and that an acceptable runoff in the stream remains. In addition, the closeness of these settlements would make it very difficult to protect the stream as a nature reserve, as demanded by the Green party in Stockholm.

Ecotones such as forest edges are kept untouched in the three alternatives, apart from The Throat (alt 2), the southern limit of The Right Lung (alt 2) and the western edge of Beverly Hills (alt 4). In these areas, the urban pressure on the surrounding environment will be important. Rare species like the Pasque-flower or the Wormwood may possibly be threatened.

### ***Cultural heritage***

The cultural heritage of the region will be preserved according to the three alternatives. As long as new housing close to the village, like the Raspberry (alt 12), the Appendix or the Gall Bladder (alt 2), remains in the same architectural style of the old town of Barkarby, its natural charm will remain. Only the old farm east of the village will be lost, in case alternatives 2 or 12 are adopted.

The De Geer moraines found throughout the area have to remain on place because of their geological and historical value. New constructions should avoid these punctual places.

### ***Visual impact***

There will be no visual impact from the development on Barkarby village for alternative 4.

In the alternative 2 there will be additional housing in the Barkarby village, but the density of the housing proposed is same as the one in the village. So there will be no negative visual impact of the development.

On the other hand, higher density housing is proposed near the Järfälla church in the alternative 12. Without the respect for the built environment, there is possibility of visual pollution. The positive visual impact of Järfälla church should not be disturbed by the proposed development.

There will be an obvious visual impact on the landscape of the Barkarby field. Nowadays, the whole area where the airfield stands is open land. The construction of 3 and 4 storeys

buildings will prominently affect the scenery from the golf course, the commercial area in the north and from the surrounding roads.

### ***Demography***

The proposed development will considerably boost the population of the Barkarby community. Depending on the alternative, the number of inhabitants in Barkarby will have an increase of 33% (alt 2), 71% (alt 4) or 109% (alt 12). This involves plenty of administrative adjustments and new services (police, fire, school, busses, sports centre...).

In addition, the Regional Development Plan for Stockholm Region has done demographic increase previsions for the Järfälla municipality. The forecasting shows the acceptable range to be considered between the base and high levels (Regional Development Plan 2001 for the Stockholm Region):

Municipality	Year 2000		Base Level year 2015		High Level year 2015	
	Inhabitants	Dwellings	Inhabitants	Dwellings	Inhabitants	Dwellings
Järfälla	60'500	26'500	64'500	32'000	70'000	34'500

By adding the proposed number of new inhabitants to the population of the Järfälla municipality for each alternative, the total population once the development is completed will be:

Alternatives	Completed development (2008)	
	Inhabitants	Dwellings
Alternative 2	65'940	29'200
Alternative 4	68'510	29'290
Alternative 12	72'440	31'340

This leads in the statement that alternative 12 will exceed the predicted population levels for the whole municipality, which is not acceptable, seeing the smallness of the Barkarby field compared to the entire municipal area.

### ***Waste production***

The production of solid and liquid waste will considerably increase. This will be proportional to the number of new inhabitants in the area. It is of particular concern to treat the wastewater before releasing it into the Igelbäcken or the Bällstaån. The lack of such a treatment cannot only cause the loss of valuable biological species, but also odours pollution. As the area is

topographically low, these odours may remain a long time before being dissolved. The Järfälla municipality will have to take care of the solid waste collect. In addition, none of the alternatives include recycling collect points, which should be available at walking distance from every building.

### ***Recreation areas***

Barkarby has a strong potential for outdoor recreation. The horse paddocks and the golf course together with the surrounding forests can cause a positive social impact in recreation for the entire municipality. This recreation area must have better connection with the new residential areas and their walking path structure, so the desirability and the number of visitors could rise.

### ***Commercial areas***

All three alternatives will have an influence on the development of the commercial area north of the Barkarby field. Alternatives 2 and 12 will reduce its expansion possibilities to the South, leaving an area of approximately five hectares between The Stomach, respectively The Banana, and the IKEA parking. A larger expansion of the commercial area would have to take place between the E18-northwest motorway and Enköpingsvägen, on the western edge of the Barkarby field. It would thus push this spreading out closer to the village of Barkarby, with additional traffic increase.

On the other hand, alternative 4 includes commercial/business development in these areas. No further expansion of the existing commercial area would then be possible anymore.

### ***Desirability***

There are currently two factors, which have a negative influence on the desirability for housing in the Barkarby field: the proximity to the Barkarby airport and the former military training grounds around. People do not appreciate living near old military installments and the noise caused by the air traffic lows down the land value around the airfield. Usually these areas have higher commercial and industrial desirability rather than residential, which explains why there has been a fast commercial development in the area in the past ten years and low population growth.

The prerequisite for boosting residential desirability is thus the demolition of the Barkarby airport and rejuvenation of the former military fields. On the other hand, the Air club has recreation value citywide, and even some historical value.

## **CONSTRUCTION PHASE**

### ***Air quality***

The air quality will be locally deteriorated with high concentrations of dust due to the frequent truck traffic on the building site. Cement dust close to the Igelbäcken can also have negative impacts on the development of the Spined and the Stone Loach.

### ***Waste production***

A large amount of construction waste will be produced with the demolition of the Barkarby airport. A new landfill area must be planed for the construction waste.

### ***Soil and water quality***

The soil will be slightly affected by the construction phase. The constant truck traffic will inevitably induce soil compaction in the dump areas. All the ordinary precautions towards the use of chemicals and hydrocarbons have to be taken.

The soil and the water may be polluted in the airport demolition phase due to important handling of waste and unexpected leaking. For this reason, the landfill should be put up as far as possible from the Igelbäcken.

### ***Noise***

The presence of workmen and their machineries will generate additional noise in the village of Barkarby, especially in the airport demolition phase and or the construction of The Peach (alt 12), The Raspberry (alt 12) and The Appendix (alt 2), which are particularly close to the village. This noise can also disturb the communication between birds, which may leave from the area during the construction phase. Truck traffic will punctually increase the noise levels as well.

On the other hand, once the airport will be removed, there won't be any noise from take-offs and landings anymore.



## MITIGATION MEASURES

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### OPERATION PHASE

#### *Traffic, noise and air pollution*

The increase in noise and air pollution is a consequence of the build-up of road traffic. The previous calculations of noise and traffic impacts show that each alternative is in need of mitigation measures.

#### Point1

As it is shown in the maps enclosed in the appendices, every alternative involves an increase of traffic close to the motorway. Consequently, the level of noise in point 1 is very high.

The alternative 2 does not include working places in this area, so the best mitigation involves a screen along a stretch of Enköpingsvägen to reduce the noise in The Kidney residential areas.

In alternative 4, it is necessary to insert a screen along the motorway and a stretch of Enköpingsvägen since there are different working places in the surroundings.

In alternative 12, this point is not relevant, because the residential area is far enough from it to be not interested of the traffic of the motorway.

#### Point2

In the Barkarby village, the traffic and, consequently, the noise increase in each alternative. In this case, it is possible to increase the public transports network and to reduce the speed limit to dampen the impact on the village.

#### Point 3

This point is situated at one end of the area, so in some alternative it is interested of a large percentage of the transit traffic.

In alternative 2, there is the highest value of noise. It is necessary to build a screen along The Right Lung residential area.

In alternative 4, the level of noise is not as high. It is enough to consider a non-building area along the transit road, which crosses the whole area. As shown on the map in appendix 6, the non-building area is wider at the end of the road, where the other street becomes very close.

In alternative 12, the traffic is concentrated in this zone, so the combined use of non-building border and a screen is suitable for reducing properly the noise.

#### Point 4

This point presents an acceptable level of noise in all the alternatives. The highest level is in alternative 2, but it could be reduced with the introduction of one or two bus lines.

The following table summarises all the mitigation measures for the analysed points:

	Alternative 2	Alternative 4	Alternative 12
<b>Point 1</b>	Screen on Enköpingsvägen (he= 3m)	Screen on Enköpingsvägen (he = 1m) Screen on motorway (he=3,8m)	
<b>Point 2</b>	Public transport Speed limit	Public transport Speed limit	Public transport Speed limit
<b>Point 3</b>	Screen (he = 1,5)	Non-building area	(Screen he=1,3) Non-building area
<b>Point 4</b>	Public transportation		
<b>Point 5</b>	Non-building area		Non-building area

In alternative 2, the introduction of a public transportation system is essential to reduce the traffic, the noise and the air pollution. The new buss network, like all mitigation measures, is shown on the map of Appendix 6.

#### ***Flora and Fauna***

Alternative 2 leaves a wide passage along the Igelbäcken, which can be used by the fauna. It would therefore be possible to make a natural reserve of this corridor. This would prevent any other construction in the area and thus restore the green wedge spreading from Järva field in the north to the Igelbäcken valley in the south, which is presently fragmented by the airfield. The fauna underpass being currently built at the crossing of Akallavägen and Norrviksvägen will complete the link. This measure would provide appropriate protection to the Stone Loach, as required by the EU Directives.

As alternatives 4 and 12 plan new housings right on the right bank of the Igelbäcken, restricted access to the river should be considered to avoid people from throwing wastes in it. Planting vegetation fences like bushes can serve such a purpose.

### ***Visual impact***

The residential areas have to remain as green as possible, in order to minimize the visual impact of the project. Trees can be planted along the new roads and between the villas. The architectural style of the new constructions should be similar to the traditional architecture of the Barkarby village. The height of the new buildings neighboring the old village should be limited to two storeys.

## **CONSTRUCTION PHASE**

### ***Air quality***

As seen before, the dust will be the main source of air pollution in the construction-demolition phase. Dust control measures should therefore be regularly done to check the levels close to the Barkarby village and the Igelbäcken.

### ***Water quality***

To minimize the impacts on water quality, any wastes found on site will be removed for disposal along with any construction debris prior to completion of the construction. Wastes generated during facility operation will be handled, stored and disposed of, in accordance to the applicable state and federal regulations.

### ***Noise***

Measures to minimize noise impacts include confining construction activities to normal working hours when possible as well as employing noise-controlled construction equipment.

## **PUBLIC PARTICIPATION**

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### **INTERESTED GROUPS**

Public participation is of high relevance to correctly fulfil the Environmental Impact Assessment of the proposed developments in the Barkarby area. The public should be aware of the importance of their participation during the main stages of the EIA process. In this line, effective measures should be taken in order to clearly communicate all information concerning the projects. Furthermore, the EIA process must facilitate and make possible this participation and feedback between public, developers and authority within the EIA framework.

Nevertheless, there is a confluence of interests in the vicinity. Several groups having their own interest are present in the area. Therefore, it is crucial to properly identify these groups:

- Commercial Area
- Village
- Farms
- Barkarby Airport
- Leisure centre
- Municipality

The commercial centre includes a large number of stores led by IKEA, which constitutes the main attraction of the area. An improvement of the infrastructure as well as the construction of housing areas with the consequent arrival of new potential customers will be welcome by this group.

The village of Barkarby dates back to the twelfth century and it is characterized by its good conservation of the old centre coupled with a well-done integration of new districts throughout centuries. The village will see the new proposed developments as a rupture of this pattern.

It is also worthy to point out the presence of farms that will vanish if any of the projects takes place. The owners of these farms may be against the developments.

The Barkarby Air club is a group that is extremely worth taking into consideration. Any of the proposed alternatives for the project plans to remove the airport from the zone. Moreover, as the Barkarby field is affected by noise pollution originated in the airport, potential conflicts between the village and the club may appear.

The leisure centre offers a wide variety of activities in the area like golf or horse riding. It is another group that may be interested in the implementation of the projects due to the arrival of new population to the zone.

The Municipality may also be attracted by the idea of new development in the area in order to get some money from the selling of lands.

There is, thus, a significant amount of groups affected by the developments. It is, therefore, important to collect their opinions about the different issues concerning the EIA process.

## **INVOLVEMENT OF THE PUBLIC**

Several initiatives will be undertaken in order to involve the different groups existing in the current Barkarby area.

The different groups can give an important knowledge of the area and should have an active role in the scoping stage, the identification and evaluation of impacts and the proposal of mitigation measures. To reach this aim, public hearings will be arranged. A lay member of the public will be able to comment on the EIS and show his point of view about all the matters concerning the developments. The public will be informed about the day, time and place where the public hearing is to take place through a notice published in the newspapers and advertisements on the radio. Since gathering a lot of people to discuss the issues related to the projects will be neither effective nor possible other possibilities will be taken into consideration. A list of all the inhabitants of Barkarby will be retrieved from the local authority. Those residents will be gathered in groups of 40 people from the same neighbourhood. The group will select one representative democratically. Different meetings will then be arranged with all the representatives giving them the basic information about the projects. Representatives will communicate the issues to the rest of the members of the group. Likewise, a meeting with representatives of the commercial and leisure centre and the air club is also to be arranged. The leaders of these sectors should state their opinions on the projects.

As a way of concluding this chapter, it is important to point out that finding an effective way to involve all the affected groups is quite a difficult task. Many problems like a lack of interest of the diverse groups may occur during the process. Nevertheless, it is very important to strive on that point; therefore any possible improvement will be taken into account.

## **MONITORING PROGRAMME**

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This section aims at providing the guidelines for the implementation of the monitoring programme within the framework of the Barkarby EIA. “Monitoring involves the measuring and recording of physical, social and economic variables associated with development (impacts” John Glasson). These variables will range from quantitative to qualitative and will be explained throughout this section. The final purpose of the monitoring is to verify that the project progresses as predicted and to identify and correct all possible unforeseen evolution of the impacts before it is too late to act.

The focus in the expensive monitoring process is put on preserving the Igelbäcken stream and the protection of the endangered species of fishes there.

Quantitative variables:

- Traffic

A comprehensive study of the traffic should be undertaken subsequently, once the development is finished. The number of cars circulating daily on each road will be counted up. More study will be carried out every year in order to determine the tendency in traffic, in other words, to quantify the evolution in the number of cars in the roads of Barkarby.

- Noise levels

Measurement instruments for the noise levels will be placed in strategic points of the Barkarby field. These instruments will give daily data of the noise situation of the whole area. By this means it will be possible to compare the prediction made with the real values obtained once project has been developed.

- Air quality

As it will be done for the noise levels, measurement instrument will be fixed in points where the concentration of pollutants is likely to be the highest. In this line, the measurements will put special attention to the motorway and its surroundings due to the great deal of NO<sub>2</sub> that will be liberated to the air.

- Water Quality

A monitoring plan is proposed for the water quality of the Igelbäcken. Samples of the water from Igelbäcken would be controlled by the Stockholm Water Institute together with the County Administration Board. The results could be used as a base for research of the efficiency or inefficiency in nature rejuvenation and protection of the green building housing proposed for the development.

- Ecology

There is also proposal for monitoring the populations of “The Stone Loach” and “The Spined Loach” in Igelbäcken. The Swedish Museum of Natural History or National Board of Fisheries would be responsible for monitoring of the fish population together with the County Administration Board.

Qualitative variables:

- Decisions and policies of the local authority and developer:

Once the project has been totally carried out, the local authority or the developer may be interested in changing some characteristics of the project like for instance a diversion in a road or the construction of new infrastructure in the area. This will likely change the magnitude and significance of the impacts and may cause new impacts too. The monitoring programme should therefore take into consideration all these possibilities.

- Opinions:

The monitoring programme should try to collect the opinion of the different social groups of Barkarby about the project. These opinions are likely to be rather subjective but it can help when it comes to evaluating effects like the visual impact.

The monitoring programme will therefore include all variables that may cause a significant effect on the environment as well as the variables that represent impacts with a considerable degree of uncertainty. Furthermore, all the data recorded during this stage should be communicated to relevant participants in the EIA process.

## **EVALUATION AND RECOMMENDATION**

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This section aims at evaluating the different alternatives proposed by taking into account the magnitude and significance of the impacts involved on each one. A final recommendation concerning what must be done in the area will be stated.

The Delphi method is applied in order to reach these goals in a way as much objective as possible. However, it is important to point out the limitations of the process. It does not exist a perfect and objective method. Therefore a certain degree of subjectivity is unavoidable.

The three alternatives and the 0 alternative have been taken into account. They differ in the number of population and in the magnitude of the impacts.

The development of the alternative 2 is not worthwhile because the opportunity of new community, residential and working occasions don't balance the loss of flora and fauna. The development proposed has a low density on a wide area. This alternative present levels of noise that are not acceptable, especially in the working areas.

The alternative 12 is the development with the highest number of inhabitants. This kind of development involves an important negative impact on the flora, the fauna and the water quality, and therefore it can become a problem for the conservation of the “Stone Loach”.

Using the Delphi method we decided that alternative 4 is the most balanced alternative, because of the positive social-economical impacts, which are better than in the other alternatives. This option causes the less environmental damage on the environment in terms of water quality. This is a very important issue in order to preserve the habitat of the “Stone Loach”. With respect to the noise pollution it is possible to assert that this alternative involves moderate levels of noise that can be mitigate with adequate screens and by keeping a secure distance.



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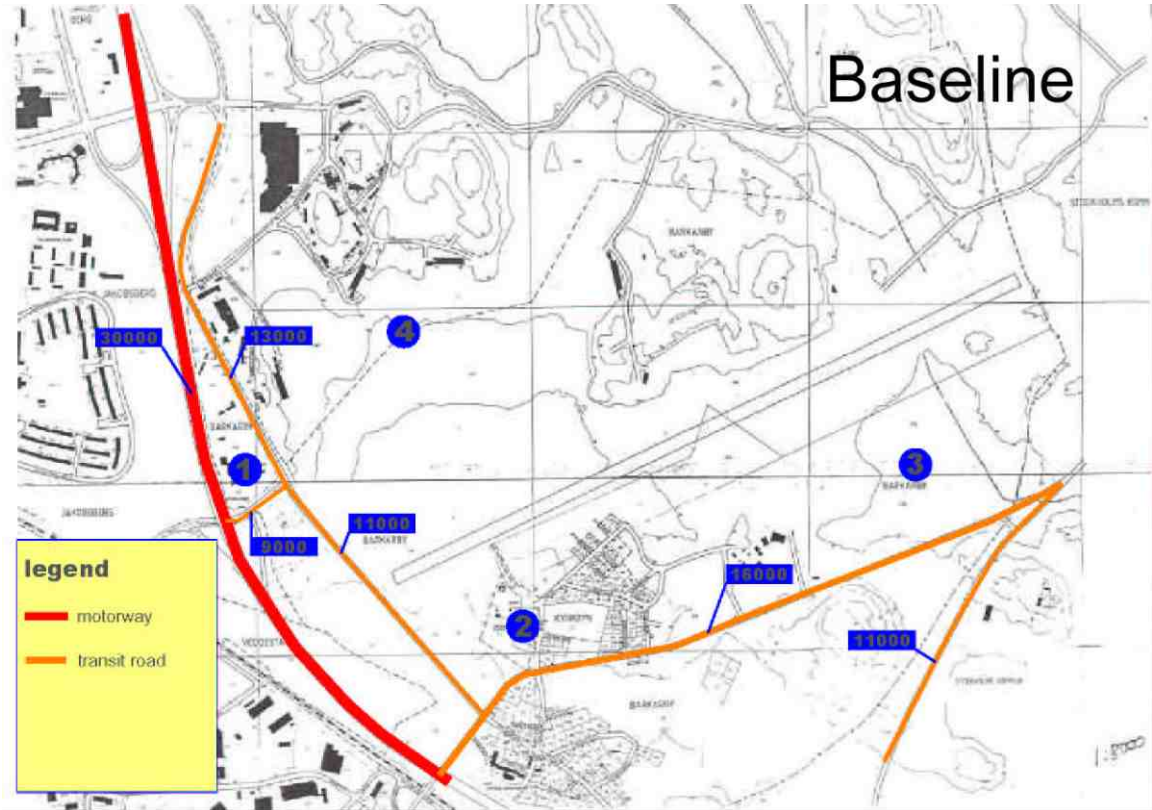
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# APPENDICES

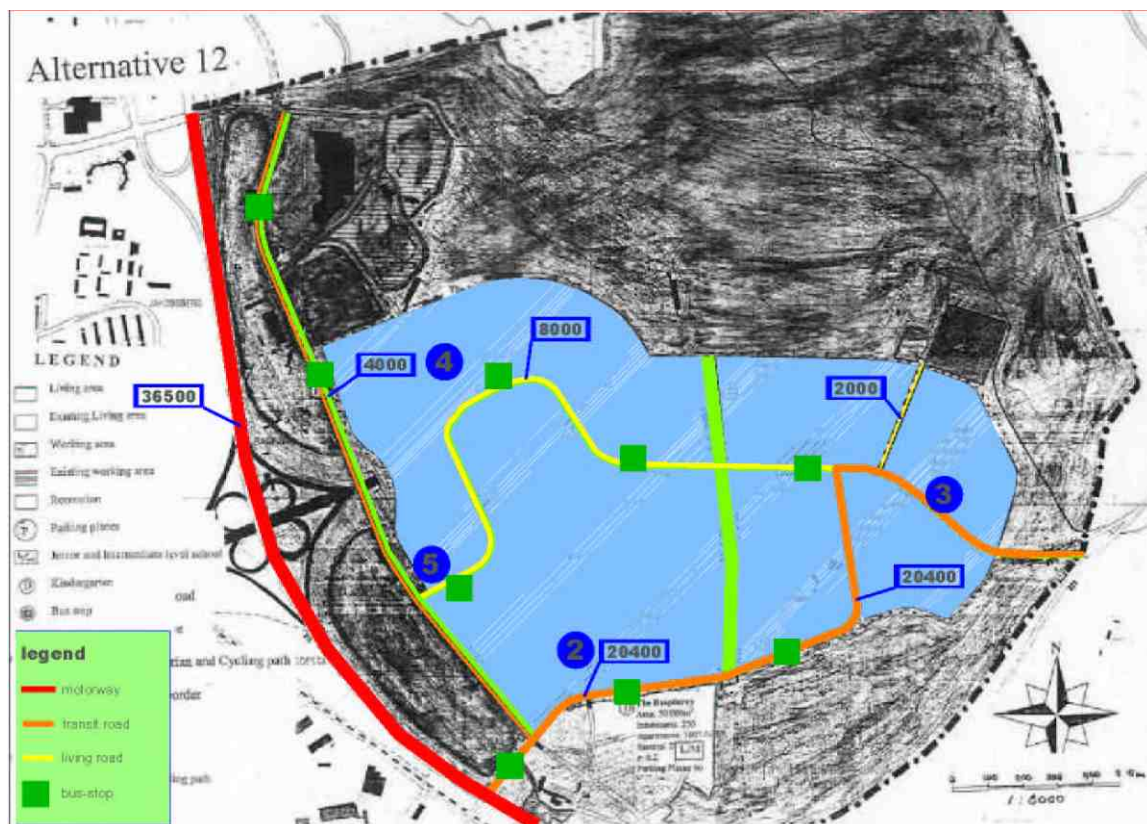
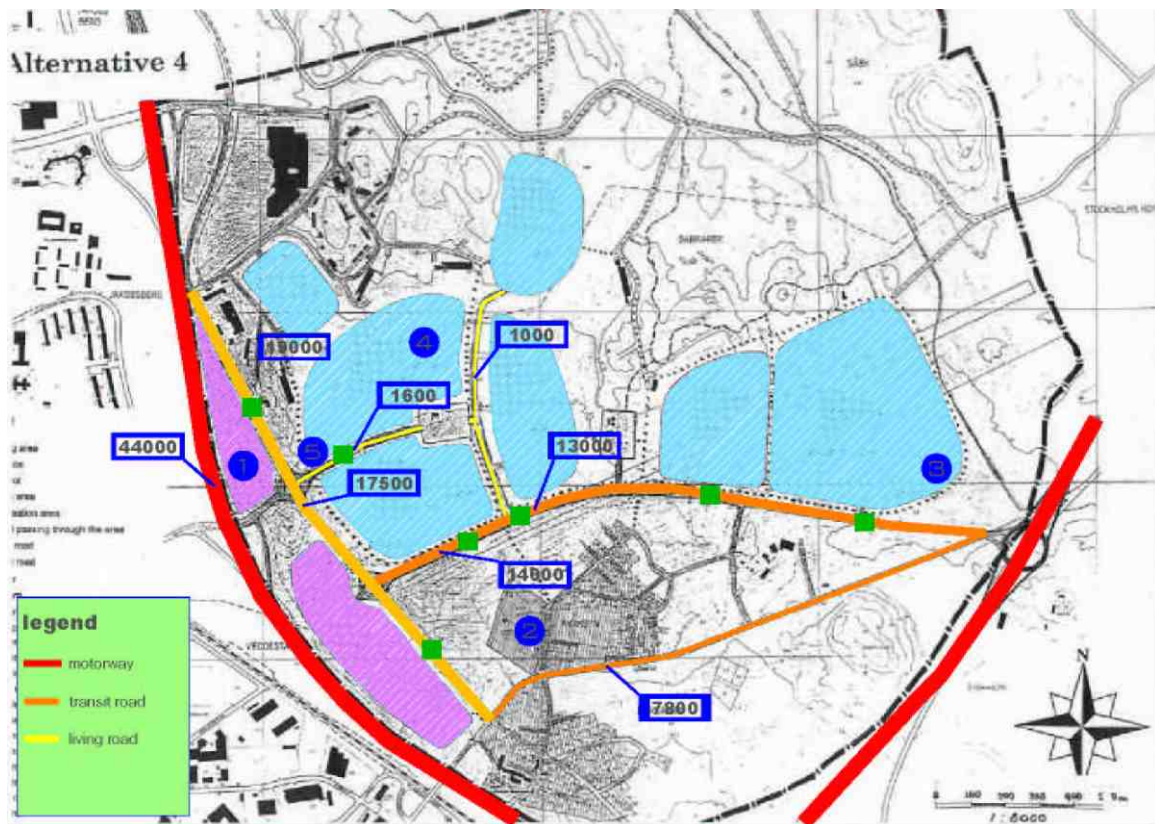
## APPENDIX 1: TRAFFIC

The following maps show the traffic situation for each alternative. The colours illustrate the different kinds of roads and the dimension of the lines is proportionate at the number of vehicles/day.









## APPENDIX 2: NOISE CALCULATIONS

All the calculations carried out by way of predicting the noise impact in the area were based on the methodology developed by the Nordic Council of Ministers. As the standards recommend, the results concerning the sound pressure level are presented in dB using the  $L_{Aeq}$  descriptor.

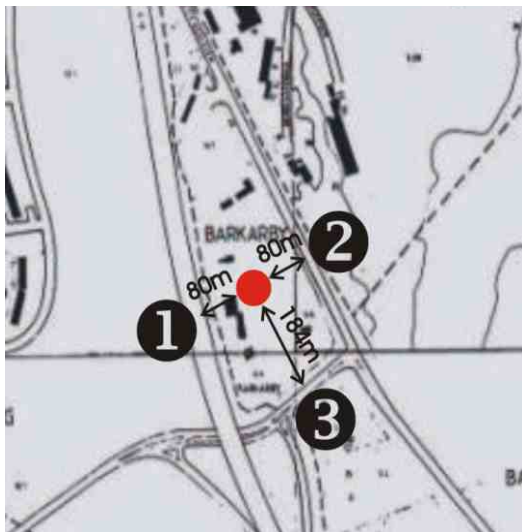
In order to fulfill the calculations, strategic points were selected for each alternative as well as for the baseline and the -alternative. This selection took into account the worst conditions that might occur in the area for each alternative. Those points are however related so as to make possible the comparison between the alternatives. The points selected are highlighted in the enclosed maps.

A Basic Noise Level was calculated each time for each point taking then into consideration a distance correction.

### Example of calculation: the 0-Alternative

The calculations were carried out from the basis of a 2% increase in a period of 10 years.

POINT 1:



Data:

	Road 1		Road 2		Road 3	
Speed limit	90 km/h		70 km/h		50 km/h	
% Heavy	20		10		10	
Distance	80 m		80 m		184	
Number of cars	36569	Light: 29255	15846	Light: 14261	10970	Light: 9873
		Heavy: 7313		Heavy: 1584		Heavy: 1097

Firstly, the Basic Noise Level originated in point 1 was calculated adding for each road the sound pressure level coming from light and heavy traffic. Then the distance correction was applied using the nomogram included in the *Nordic Prediction Methods*. In the end, a logarithmic addition of each corrected sound pressure level leads to the final result for point 1. The table below summarizes the methodology described.

Road	Laeq (dB)		First addition	Distance correction (dB)	Laeq (dB)	Final addition (dB)
	Light	Heavy				
1	75	77,5	79,4	(-9)	70,4	72,1
2	75	67	75,6	(-9)	66,6	
3	64	62	66,1	(-12)	54,1	

The remaining points were calculated using the same process. Likewise, all the calculations for the other alternatives carried out following the same pattern. The results are presented in the section concerning the noise impact.

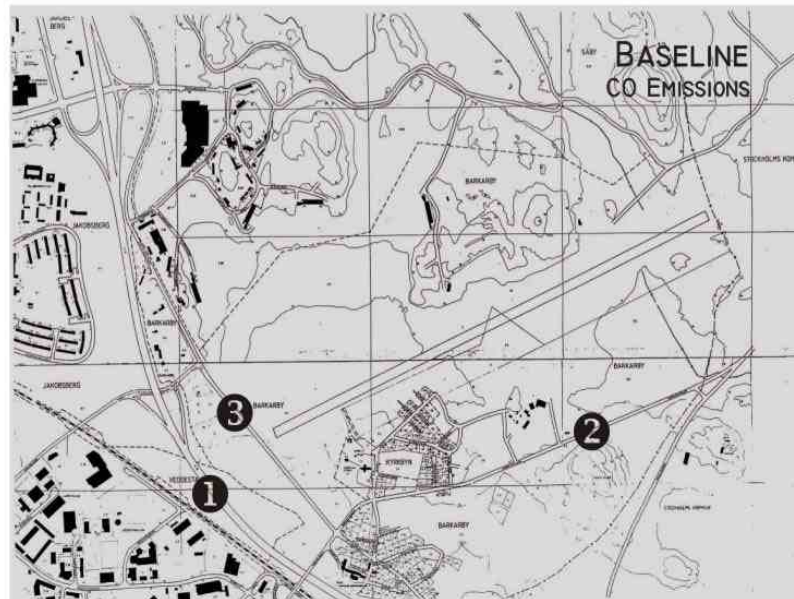
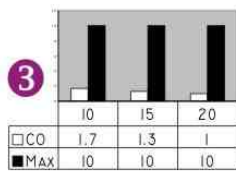
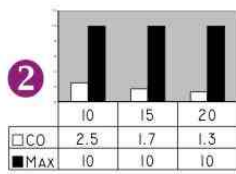
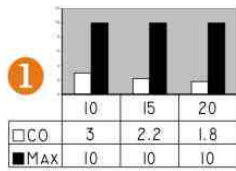
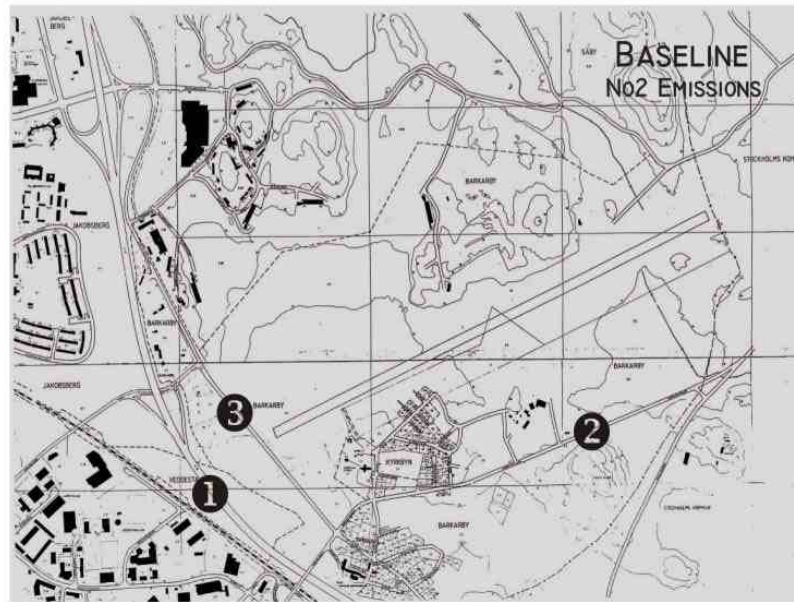
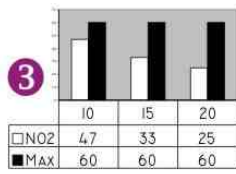
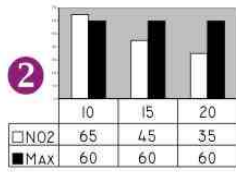
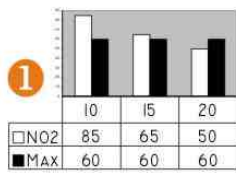
### **APPENDIX 3: AIR QUALITY**

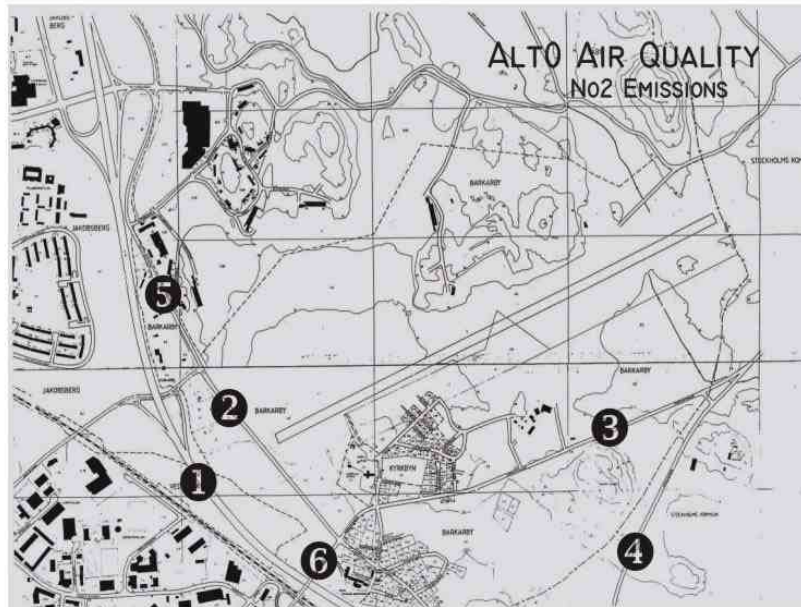
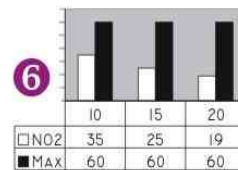
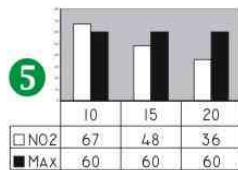
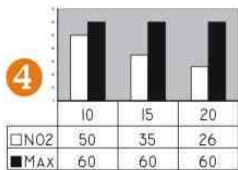
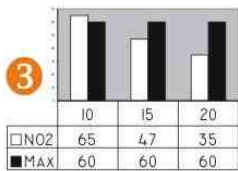
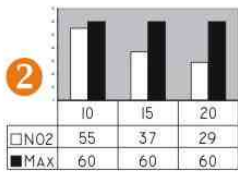
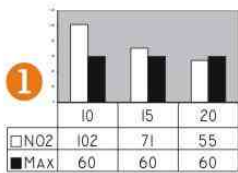
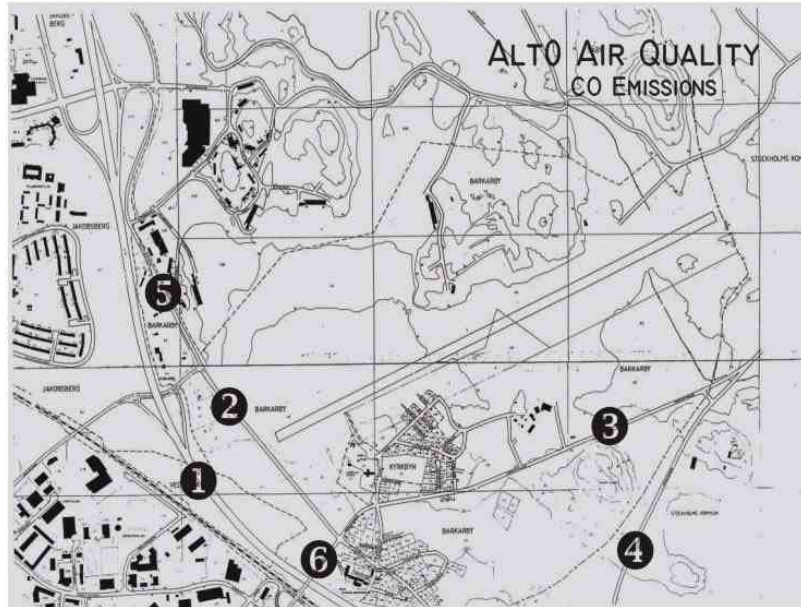
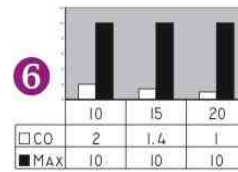
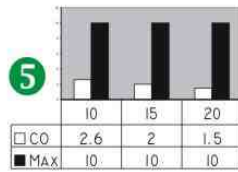
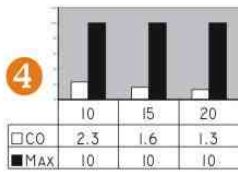
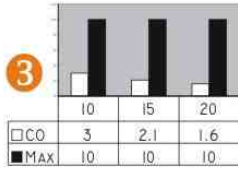
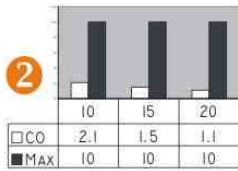
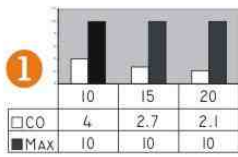
The calculation of air pollution for each alternative was undertaken using a series of nomograms, which provides for each road its contribution to Carbon monoxide and Nitrogen dioxide emissions.

In order to fulfil an accurate prediction of the impact, the whole road was taken into consideration instead of taking single points. Therefore, for each road, the calculations were made at a distance of 10, 15 and 20 meters.

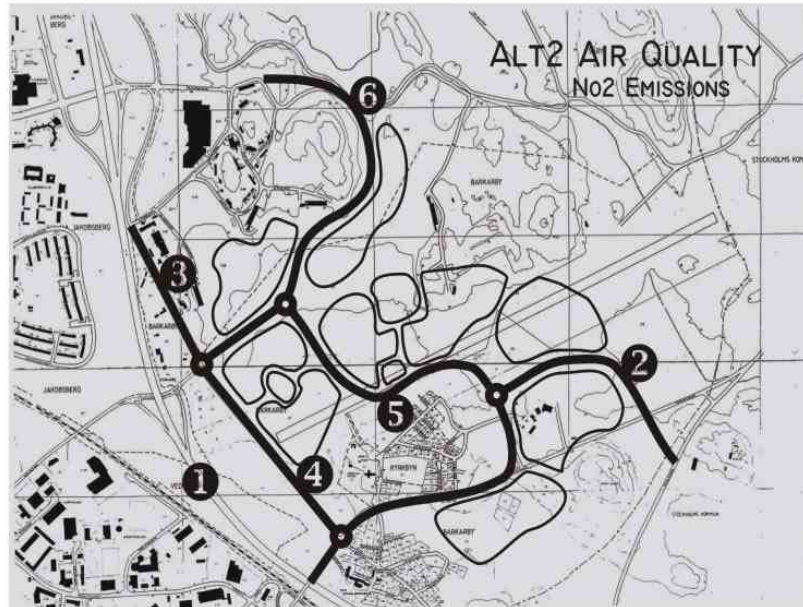
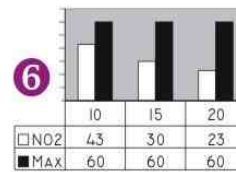
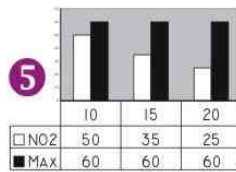
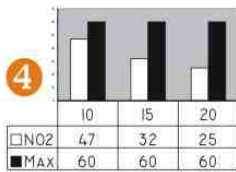
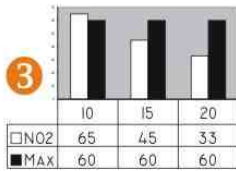
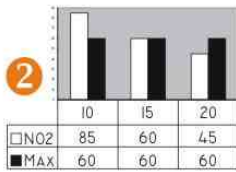
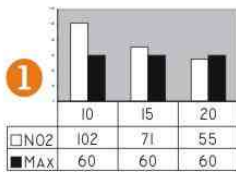
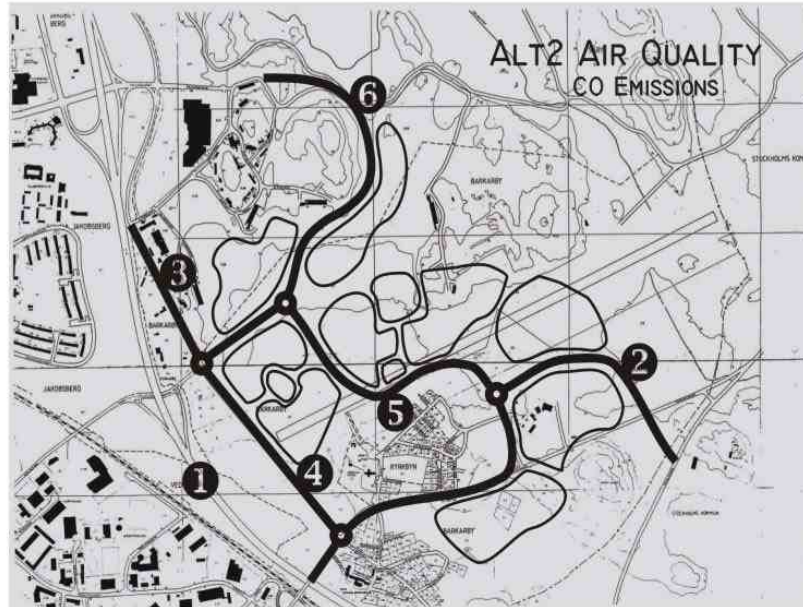
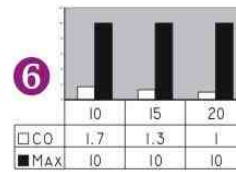
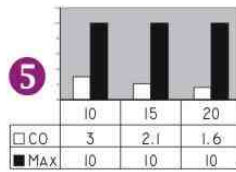
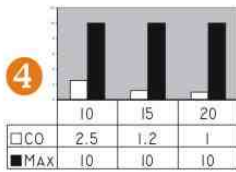
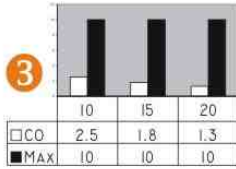
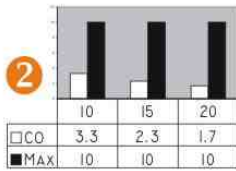
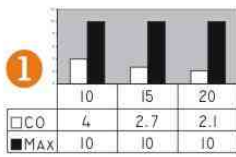
The traffic density and speed limit as well as the distance to the road were the data used in the nomograms to obtain the CO and NO<sub>2</sub> contribution. All the calculations have been carried out following the guidelines provided by the National Environment Protection Agency.

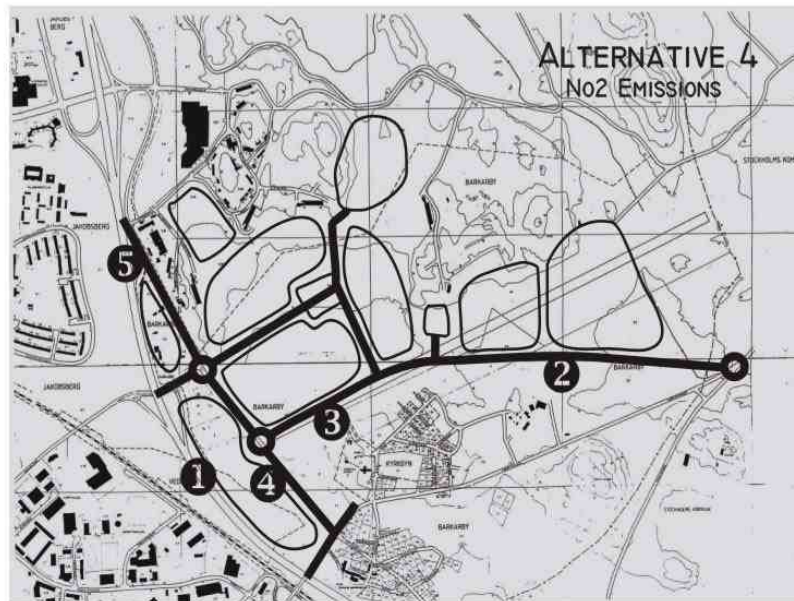
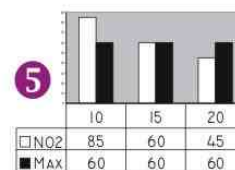
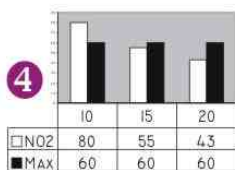
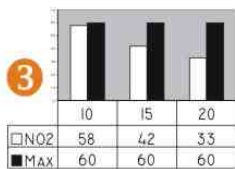
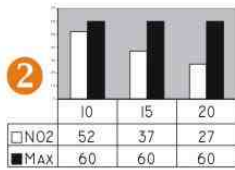
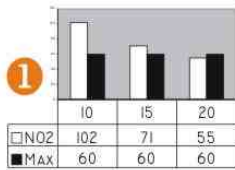
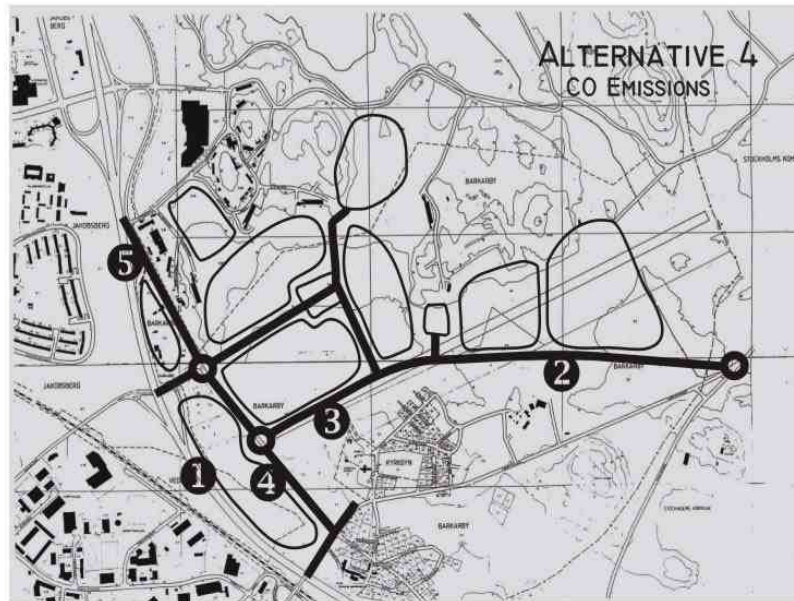
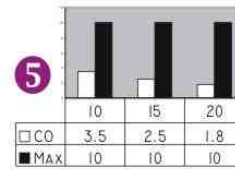
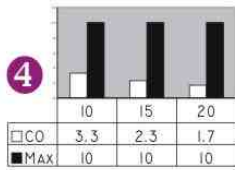
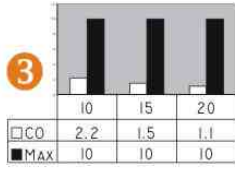
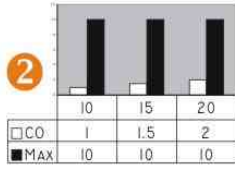
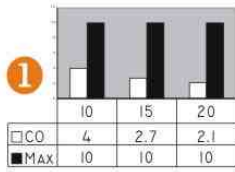




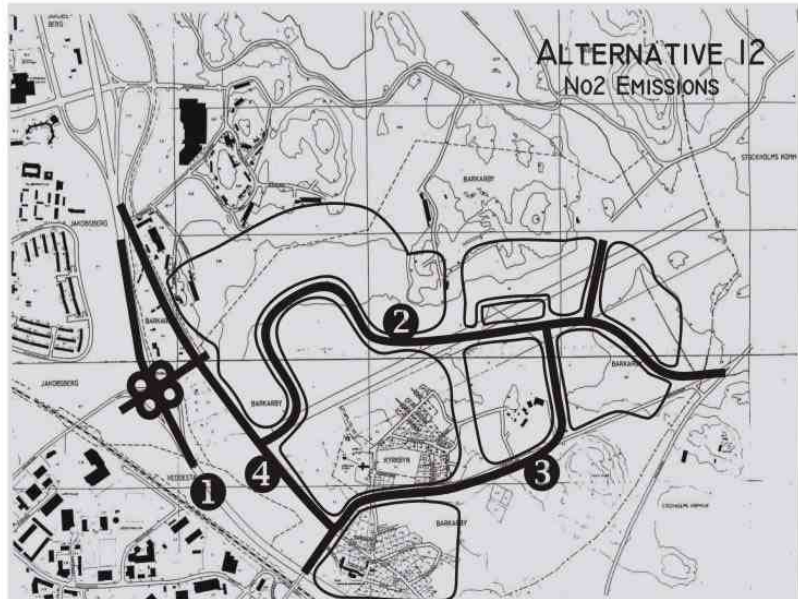
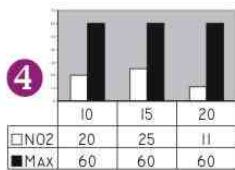
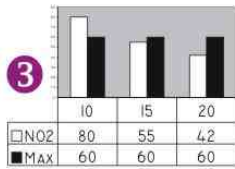
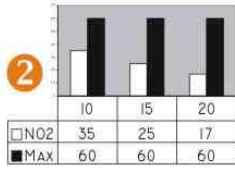
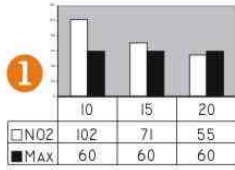
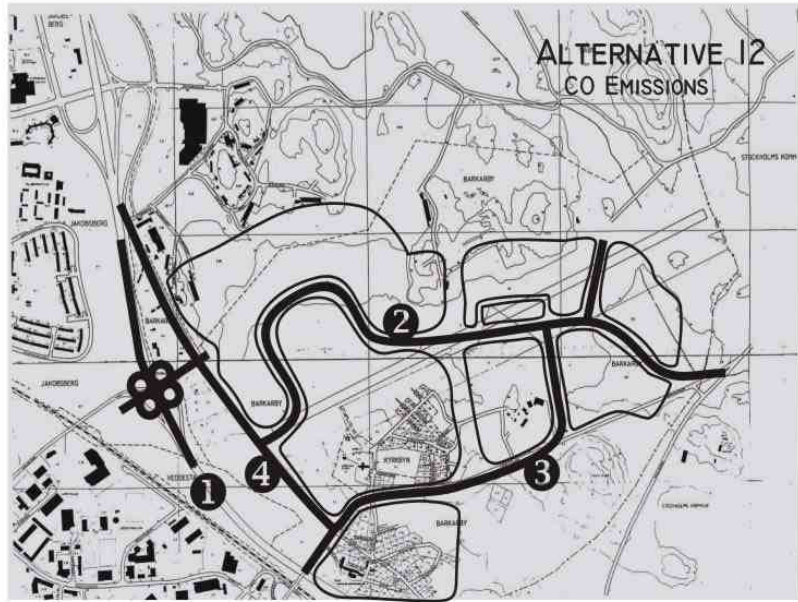
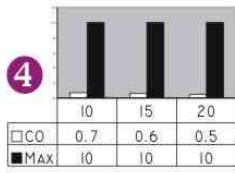
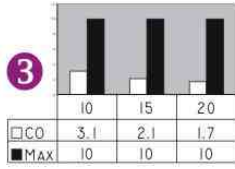
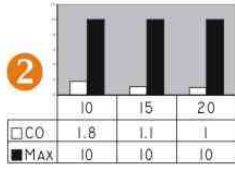
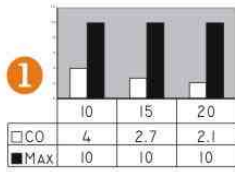












## APPENDIX 4: RUNOFF

These tables are about the calculations of runoff for each alternative.

<b>Alternative 2</b>		
<b>Ballstaån catchment area</b>	<b>New built up surface /km2</b>	<b>Runoff L/s</b>
Stomach	0.0164	0.0065
Left Kidney	0.0255	0.0102
Heart	0.036	0.0144
Spleen	0.0255	0.0102
Liver	0.0194	0.0039
Appendix (50%)	0.0025	0.001
Right Kidney	0.0162	0.0065
Throat	0.013	0.0052
<b>Total</b>	<b>0.1545</b>	<b>120.0579</b>

<b>Igelbäcken catchment area</b>	<b>New built up surface /km2</b>	<b>Runoff L/s</b>
Left lung	0.024	0.0096
Right lung	0.0246	0.0984
Appendix (50%)	0.0025	0.001
<b>Total</b>	<b>0.0511</b>	<b>45.0109</b>

<b>Alternative 4</b>		
<b>Ballstaån Catchments Area</b>	<b>New built up surface /km2</b>	<b>Runoff L/s</b>
Beverly Hills	0.0302	0.0987
Bronx	0.0649	0.0259
Brooklyn	0.04986	0.0199
Harlem	0.042345	0.0151
Hollywood (50%)	0.01275	0.0051
Long Island	0.0416	0.0624
Down Town	0.047	0.0188
Queens	0.0936	0.0223
<b>Total</b>	<b>0.382255</b>	<b>120.2682</b>

<b>Igelbäcken catchment area</b>	<b>New built up surface /km2</b>	<b>Runoff L/s</b>
Hollywood (50%)	0.01275	0.0051
Bel Air	0.058944	0.02358
<b>Total</b>	<b>0.071694</b>	<b>45.02868</b>

<b>Alternative 12</b>		
<b>Ballstaån catchment area</b>	<b>New built up surface /km2</b>	<b>Runoff L/s</b>
Banana	0.135	0.054
Peach	0.108	0.0432
Raspberry	0.01	0.003
Orange (50%)	0.035	0.014
Grape(50%)	0.0275	0.011
<b>Total</b>	<b>0.3155</b>	<b>120.1252</b>

<b>Igelbäcken catchment area</b>	<b>New built up surface /km2</b>	<b>Runoff L/s</b>
Apple	0.033	0.0132
Grape (50%)	0.0275	0.011
Pear	0.033	0.0132
Orange (50%)	0.035	0.014
<b>Total</b>	<b>0.1285</b>	<b>45.0514</b>

## APPENDIX 5: WATER QUALITY

These tables are about the calculations of water quality for each alternative.

### Igelbäcken

Alternative 2						
	Before development		Difference		After development	
Area	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Left Lung	96	2.4	-7.2	0	88.8	2.4
Right Lung	98.4	2.46	-7.38	0	91.02	2.46
Appendix (50%)	10	0.25	-0.75	0	9.25	0.25
Total [kg/year]	204.4	5.11	-15.33	0	189.07	5.11

Total developed area [ha]	25.55
Nutrients released per hectare [kg/ha,y]	7.4      0.2
Increase caused by development (%)	-7.50      0.0

Alternative 4						
	Before development		Difference		After development	
Area	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Bel Air	196.48	4.912	-17.6832	0	178.7968	4.912
Hollywood (50%)	40.8	1.02	-3.825	0	36.975	1.02
Total [kg/year]	237.28	5.932	-21.5082	0	215.7718	5.932

Total developed area [ha]	29.66
Nutrients released per hectare [kg/ha,y]	7.27      0.2
Increase caused by development (%)	-9.06      0.0

Alternative 12						
	Before development		Difference		After development	
Area	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Apple	88	2.2	-9.9	0	78.1	2.2
Pear	88	2.2	-9.9	0	78.1	2.2
Orange (50%)	56	1.4	-10.5	0	45.5	1.4
Grape (50%)	44	1.1	-8.25	0	35.75	1.1
Total [kg/year]	276	6.9	-38.55	0	237.45	6.9

Total developed area [ha]	27.5
Nutrients released per hectare [kg/ha,y]	8.63      0.3
Increase caused by development (%)	-13.97      0.0



## Bällstaån

Alternative 2						
Area	Before development		Difference		After development	
	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Liver	77.6	1.94	-5.82	0	71.78	1.94
Heart	72	1.8	-10.8	0	61.2	1.8
Spleen	68	1.7	-7.65	0	60.35	1.7
Stomach	65.6	1.64	-4.92	0	60.68	1.64
Left Kidney	68	1.7	-7.65	0	60.35	1.7
Right Kidney	64.8	1.62	-7.29	0	57.51	1.62
Throat	52	1.3	-3.9	0	48.1	1.3
Gall Bladder	2.28	0.084	0.744	0.0312	3.024	0.1152
Appendix (50%)	10	0.25	-0.75	0	9.25	0.25
<b>Total [kg/year]</b>	<b>480.28</b>	<b>12.034</b>	<b>-48.036</b>	<b>0.0312</b>	<b>432.244</b>	<b>12.0652</b>

Total developed area [ha]	60.95	
Nutrients released per hectare [kg/ha,y]	7.09	0.198
Increase caused by development (%)	-10.00	0.26

Alternative 4						
Area	Before development		Difference		After development	
	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Brooklyn	88	2.2	-14.958	0	73.042	2.2
Harlem	75.28	1.882	-12.7035	0	62.5765	1.882
Bronx	115.52	2.888	-19.494	0	96.026	2.888
Beverly Hills	69.12	1.728	-9.072	0	60.048	1.728
Hollywood (50%)	40.8	1.02	-3.825	0	36.975	1.02
Down Town	37.6	0.94	-14.1	0	23.5	0.94
Long Island	16.9312	0.66967	3.8688	0.16224	20.8	0.83191
Queens	52.0416	1.38528	-5.2416	0.48672	46.8	1.872
<b>Total [kg/year]</b>	<b>495.2928</b>	<b>12.71295</b>	<b>-75.5253</b>	<b>0.64896</b>	<b>419.7675</b>	<b>13.36191</b>

Total developed area [ha]	66.81	
Nutrients released per hectare [kg/ha,y]	6.28	0.2
Increase caused by development (%)	-15.25	5.10

<b>Alternative 12</b>						
	<b>Before development</b>		<b>Difference</b>		<b>After development</b>	
<b>Area</b>	<b>Nitrogen</b>	<b>Phosphorus</b>	<b>Nitrogen</b>	<b>Phosphorus</b>	<b>Nitrogen</b>	<b>Phosphorus</b>
Banana	360	9	-40.5	0	319.5	9
Peach	288	7.2	-32.4	0	255.6	7.2
Raspberry	9.5	0.35	3.1	0.13	12.6	0.48
Orange (50%)	56	1.4	-10.5	0	45.5	1.4
Grape (50%)	44	1.1	-8.25	0	35.75	1.1
<b>Total [kg/year]</b>	<b>757.5</b>	<b>19.05</b>	<b>-88.55</b>	<b>0.13</b>	<b>668.95</b>	<b>19.18</b>

Total developed area [ha]	98.5	
<b>Nutrients released per hectare [kg/ha,y]</b>	<b>6.79</b>	<b>0.195</b>
<b>Increase caused by development (%)</b>	<b>-11.69</b>	<b>0.68</b>

## APPENDIX 6: TRAFFIC MITIGATION

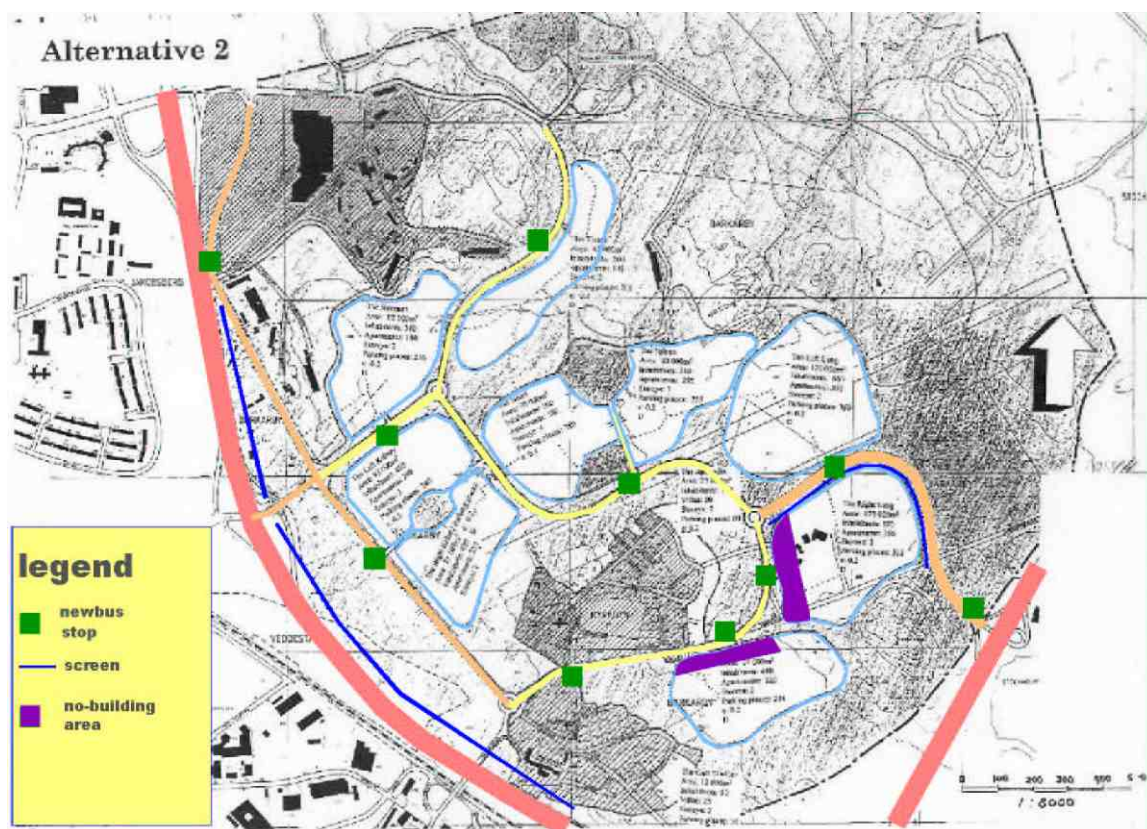
These are about two different kind of mitigation measures: no building area and the screen.

The process for calculating the depth of the non-building area is the opposite of the distance correction's one. It's necessary to choose the decibel's reduction, then the depth of the non-building area was found using the nomogram included in the *Nordic Prediction Methods*.

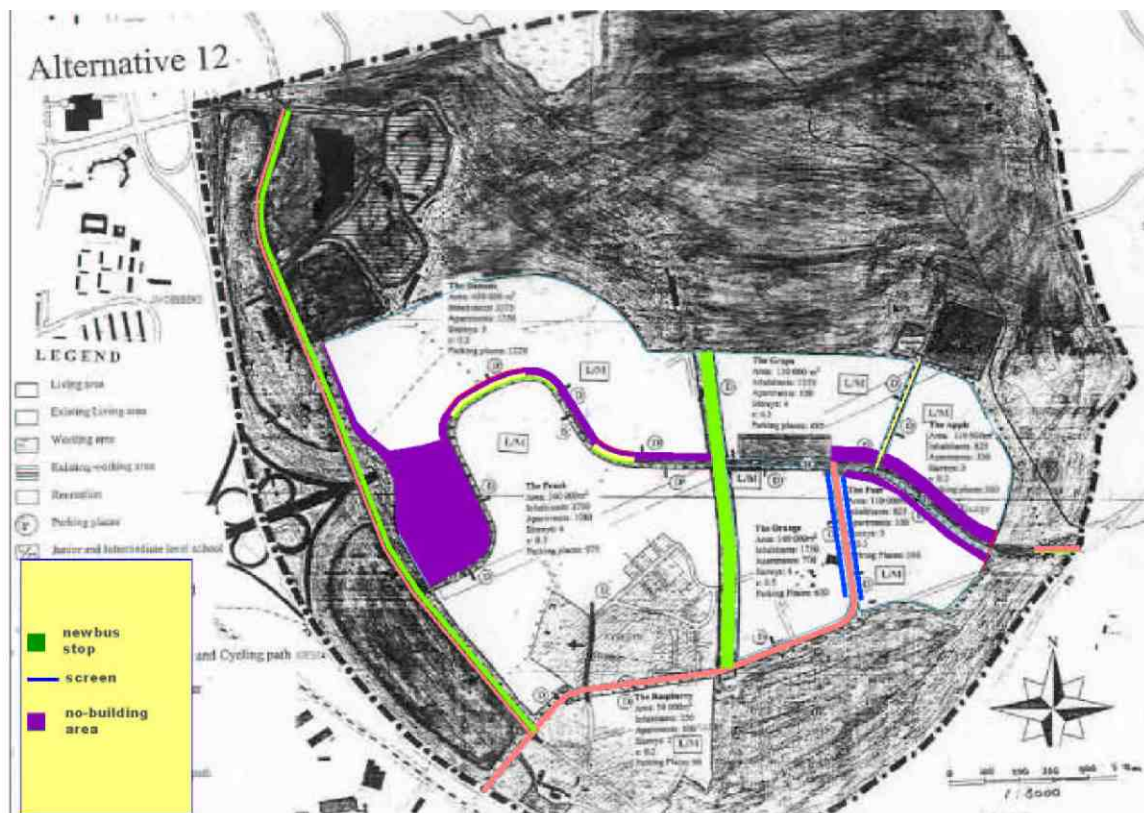
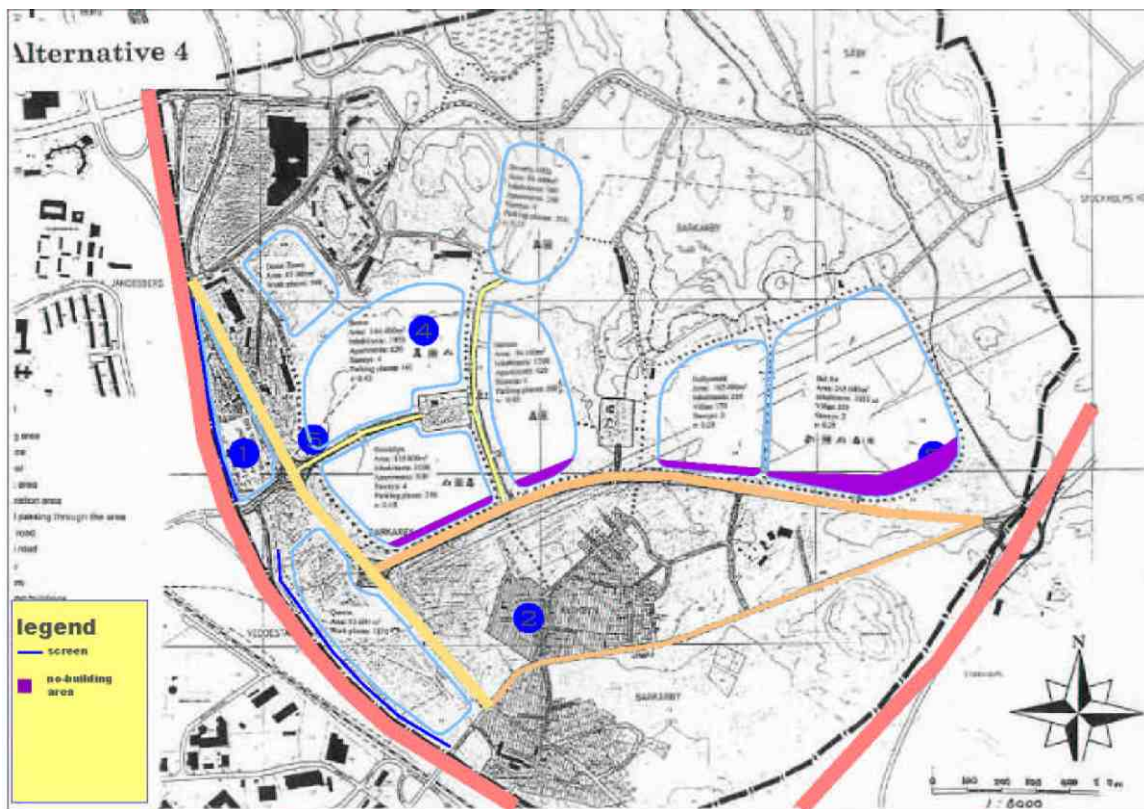
To calculate the height of the screen, it is necessary choice: the distance from the screen to the centre line of the road, the distance from the screen to the receiver and the decibel reduction.

Then, whit these data, it's possible to enter in another nomogram, ncluded in the *Nordic Prediction Methods*, and find the height of the screen.

The heights of the screen, which will be introduced in the alternative, are reported in section 4. The following maps show all mitigation measures for each alternative: screens, no-building area and, for alternative2, the new public-bus-network.







Appendix 7  
Alternatives statistics

	Area (ha)	Type of development	Type of housing	Villas / apartments	Storeys	Inhabitants / Work places	Exploitation coefficient
<b>Alternative 2</b>							
Left Lung	12	Housing	Apartment	300	2	600	0.2
Right Lung	12.3	Housing	Apartment	260	2	520	0.2
Appendix	2.5	Housing	Villa	50	2	100	0.2
Liver	9.7	Housing	Apartment	220	2	440	0.2
Heart	9	Housing	Apartment	380	4	760	0.4
Spleen	8.5	Housing	Apartment	255	3	510	0.3
Stomach	8.2	Housing	Apartment	180	2	360	0.2
Left Kidney	8.5	Housing	Apartment	240	3	480	0.3
Right Kidney	8.1	Housing	Apartment	210	2	420	0.2
Throat	6.5	Housing	Apartment	180	2	360	0.2
Gall Bladder	1.2	Housing	Villa	25	2	50	0.2
<b>Total</b>	<b>86.5</b>			<b>2300</b>		<b>4600</b>	

Appendix 7  
Alternatives statistics

	Area (ha)	Type of development	Type of housing	Villas / apartments	Storeys	Inhabitants / Work places	Exploitation coefficient
<b>Alternative 4</b>							
Bel Air	25.56	Housing	Villa	350	2	1050	0.25
Hollywood	10.2	Housing	Villa	170	2	510	0.25
Brooklyn	11.08	Housing	Apartment	500	4	1500	0.45
Harlem	9.41	Housing	Apartment	420	4	1260	0.45
Bronx	12.44	Housing	Apartment	650	4	1950	0.45
Beverly Hills	8.64	Housing	Apartment	300	4	900	0.35
Down Town	4.7	Commercial/Business				940	1
Long Island	4.1	Commercial/Business				830	1
Queens	9.36	Commercial/Business				1870	1
<b>Total</b>	<b>95.49</b>			<b>2390</b>		<b>7170 + 3640</b>	

	Area (ha)	Type of development	Type of housing	Villas / apartments	Storeys	Inhabitants / Work places	Exploitation coefficient
<b>Alternative 12</b>							
Banana	45	Housing	Apartment	1350	3	3375	0.3
Peach	36	Housing	Apartment	1080	4	2700	0.3
Raspberry	5	Housing	Apartment	100	2	250	0.2
Orange	14	Housing	Apartment	700	4	1750	0.5
Grape	11	Housing	Apartment	550	4	1375	0.5
Apple	11	Housing	Apartment	330	3	825	0.3
Pear	11	Housing	Apartment	330	3	825	0.3
<b>Total</b>	<b>133</b>			<b>4440</b>		<b>11100</b>	

## **APPENDIX 8: PUBLIC PARTICIPATION**

Questions to the residents in Barkarby village:

What do you think about the proposed alternatives for the development of the Barkarby field?

What do you think about the increase of population of Barkarby?

What do you think about the increase in traffic?

Do you think that the character of the area near the church of Jarfalla should remain the same, without visual disturbance?

Should the air traffic from Barkarby airport transfer to Arlanda or any other airport near Stockholm?

Questions to the club members of Barkarby airport

What do you think about the demolition of the Barkarby airport?

Do you see as an option the transfer of the air club to Arlanda or any other airport near Stockholm?

How costly would be the transfer to other airport for the club members? Do you think that the club members are capable of paying the costs for the transfers?

## APPENDIX 9: EVALUATION OF IMPACTS (DELPHI METHOD)

The Delphi method was used for the analysis of the impacts in the demolition and construction phases of the alternatives.

Demolition Phase						
Impact	Magnitude	Cumulative	Time	Significance	Mitigation	Magnitude after mitigation
Noise disturbance to the local residents	-6	Yes	Short	Major	Setting demolition time schedule	-5
Noise disturbance to the local birds and animals	-3	Yes	Short	Minor	Setting demolition time schedule	-2
Additional air pollution	-4	Yes	Short	Major	Dust control measures	-2
Water pollution due to unexpected leaking and handling waste	-1	No	Short	Minor	Prevention measures	0
Soil pollution with construction waste	-6	Yes	Long	Major	Waste management programme	-3
Construction Phase						
Impact	Magnitude	Cumulative	Time	Significance	Mitigation	Magnitude after mitigation
Noise disturbance to the local residents	-5	Yes	Short	Minor	Setting traffic schedule	-3
Noise disturbance to the local birds and animals	-4	Yes	Short	Minor	Setting traffic schedule	-2
Additional air pollution	-4	Yes	Short	Minor	Dust control measures	-2
Loss of grasslands and forests	-1	No	Long	Minor	Green buildings design	-1
Creation of new green buildings habitats	5	No	Long	Major		5



Operational Phase - Alternative 2						
Impact	Magnitude	Cumulative	Time	Significance	Mitigation	Magnitude after mitigation
Air pollution	-4	Yes	Long	Major	Measures on traffic	-2
Noise pollution	-5	Yes	Long	Major	Measures on traffic	-1
Runoff	-1	No	Long	Major		-1
Water pollution	-2	No	Long	Major		-1
Soil contamination	-2	No	Long	Minor	Particular precautions	-2
Loss of flora and fauna	-3	No	Short	Minor	Fauna passages	-1
Waste production	-4	No	Long	Major	Good monitoring	-2
Cultural heritage	0	No	Short	Minor		0
Visual impact	-2	No	Long	Minor	Plant trees Restriction on the height of buildings	-1
Demography	4	No	Long	Major		4
Recreation areas	2	No	Long	Minor		2
Commercial areas	0	No	Short	Minor		0
Desirability	3	No	Short	Minor		3

Operational Phase - Alternative 4						
Impact	Magnitude	Cumulative	Time	Significance	Mitigation	Magnitude after mitigation
Air pollution	-3	Yes	Long	Major	Measures on traffic	-2
Noise pollution	-4	Yes	Long	Major	Measures on traffic	-1
Runoff	-2	No	Long	Major		-1
Water pollution	-2	No	Long	Major		-1
Soil contamination	-2	No	Long	Minor	Particular precautions	-1
Loss of flora and fauna	-3	No	Short	Minor	Fauna passages	-1
Waste production	-5	No	Long	Major	Good monitoring	-2

Cultural heritage	0	No	Short	Minor		0
Visual impact	-3	No	Long	Minor	Plant trees Restriction on the height of buildings	-1
Demography	5	No	Long	Major		5
Recreation areas	2	No	Long	Minor		2
Commercial areas	5	No	Short	Minor		5
Desirability	4	No	Short	Minor		4

Operational Phase - Alternative 12						
Impact	Magnitude	Cumulative	Time	Significance	Mitigation	Magnitude after mitigation
Air pollution	-4	Yes	Long	Major	Measures on traffic	-2
Noise pollution	-3	Yes	Long	Major	Measures on traffic	-1
Runoff	-3	No	Long	Major		-3
Water pollution	-4	No	Long	Major		-2
Soil contamination	-3	No	Long	Minor	Particular precautions	-1
Loss of flora and fauna	-4	No	Short	Minor	Fauna passages	-2
Waste production	-6	No	Long	Major	Good monitoring	-3
Cultural heritage	0	No	Short	Minor		0
Visual impact	-6	No	Long	Minor	Plant trees Restriction on the height of buildings	-4
Demography	7	No	Long	Major		7
Recreation areas	3	No	Long	Minor		3
Commercial areas	1	No	Short	Minor		1
Desirability	3	No	Short	Minor		3

## APPENDIX 10: MONITORING

The plan proposed for the monitoring of the development.

Monitoring	Agency responsible for monitoring	Frequency				Agency responsible for retaining monitoring results
		Monthly	Quarterly	Annually	Upon complains or requests	
Traffic	County Administration Board			X	X	County Administration Board
Noise	County Administration Board			X	X	County Administration Board
Air quality	Swedish Meteorological and Hydrological Institute			X	X	County Administration Board
Water quality in Igelbäcken	Stockholm Water Institute		X		X	County Administration Board
Fish population in Igelbäcken	Swedish Museum of Natural History or National Board of Fisheries		X		X	County Administration Board

## **APPENDIX 11: EU DIRECTIVE ON EIA**

### **APPENDIX B**

#### **PROJECTS LISTED IN ANNEX II OF DIRECTIVE 97/11/EC**

Article 4(2) of Directive 97/11/EC requires that the following types of projects must be subject to EIA if it is determined, either by case-by-case examination or on the basis of thresholds and criteria set by the Member State, that they are likely to have significant effects on the environment.

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#### **Annex II Projects**

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##### **1. Agriculture, silviculture and aquaculture**

- (a) Projects for the restructuring of rural land holdings;
- (b) Projects for the use of uncultivated land or semi-natural areas for intensive agricultural purposes;
- (c) Water management projects for agriculture, including irrigation and land drainage projects;
- (d) Initial afforestation and deforestation for the purposes of conversion to another type of land use;
- (e) Intensive livestock installations (projects not included in Annex I);
- (f) Intensive fish farming;
- (g) Reclamation of land from the sea.

##### **2. Extractive industry**

- (a) Quarries, open-cast mining and peat extraction (projects not included in Annex I);
- (b) Underground mining;
- (c) Extraction of minerals by marine or fluvial dredging;
- (d) Deep drillings, in particular:
  - geothermal drilling,
  - drilling for the storage of nuclear waste material,
  - drilling for water supplies,with the exception of drillings for investigating the stability of the soil;
- (e) Surface industrial installations for the extraction of coal, petroleum, natural gas and ores, as well as bituminous shale.

##### **3. Energy industry**

- (a) Industrial installations for the production of electricity, steam and hot water (projects not included in Annex I);
- (b) Industrial installations for carrying gas, steam and hot water; transmission of electrical energy by overhead cables (projects not included in Annex I);
- (c) Surface storage of natural gas;
- (d) Underground storage of combustible gases;
- (e) Surface storage of fossil fuels;
- (f) Industrial briquetting of coal and lignite;
- (g) Installations for the processing and storage of radioactive waste (unless included in Annex I);
- (h) Installations for hydroelectric energy production;
- (i) Installations for the harnessing of wind power for energy production (wind farms).

#### 4. Production and processing of metals

- (a) Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting;
- (b) Installations for the processing of ferrous metals:
  - (i) hot-rolling mills;
  - (ii) smithies with hammers;
  - (iii) application of protective fused metal coats;
- (c) Ferrous metal foundries;
- (d) Installations for the smelting, including the alloyage, of non-ferrous metals, excluding precious metals, including recovered products (refining, foundry casting, etc.);
- (e) Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process;
- (f) Manufacture and assembly of motor vehicles and manufacture of motor-vehicle engines;
- (g) Shipyards;
- (h) Installations for the construction and repair of aircraft;
- (i) Manufacture of railway equipment;
- (j) Swaging by explosives;
- (k) Installations for the roasting and sintering of metallic ores.

#### 5. Mineral industry

- (a) Coke ovens (dry coal distillation);
- (b) Installations for the manufacture of cement;
- (c) Installations for the production of asbestos and the manufacture of asbestos-products (projects not included in Annex I);
- (d) Installations for the manufacture of glass including glass fibre;
- (e) Installations for smelting mineral substances including the production of mineral fibers;
- (f) Manufacture of ceramic products by burning, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain.

#### 6. Chemical industry (Projects not included in Annex I)

- (a) Treatment of intermediate products and production of chemicals;
- (b) Production of pesticides and pharmaceutical products, paint and varnishes, elastomers and peroxides;
- (c) Storage facilities for petroleum, petrochemical and chemical products.

#### 7. Food industry

- (a) Manufacture of vegetable and animal oils and fats;
- (b) Packing and canning of animal and vegetable products;
- (c) Manufacture of dairy products;
- (d) Brewing and malting;
- (e) Confectionery and syrup manufacture;
- (f) Installations for the slaughter of animals;
- (g) Industrial starch manufacturing installations;
- (h) Fish-meal and fish-oil factories;
- (i) Sugar factories.

## 8. Textile, leather, wood and paper industries

- (a) Industrial plants for the production of paper and board (projects not included in Annex I);
- (b) Plants for the pretreatment (operations such as washing, bleaching, mercerization) or dyeing of fibers or textiles;
- (c) Plants for the tanning of hides and skins;
- (d) Cellulose-processing and production installations.

## 9. Rubber industry - Manufacture and treatment of elastomer-based products.

## 10. Infrastructure projects

- (a) Industrial estate development projects;
- (b) Urban development projects, including the construction of shopping centres and car parks;
- (c) Construction of railways and intermodal transshipment facilities, and of intermodal terminals (projects not included in Annex I);
- (d) Construction of airfields (projects not included in Annex I);
- (e) Construction of roads, harbors and port installations, including fishing harbours (projects not included in Annex I);
- (f) Inland-waterway construction not included in Annex I, canalisation and flood-relief works;
- (g) Dams and other installations designed to hold water or store it on a long-term basis (projects not included in Annex I);
- (h) Tramways, elevated and underground railways, suspended lines or similar lines of a particular type, used exclusively or mainly for passenger transport;
- (i) Oil and gas pipeline installations (projects not included in Annex I);
- (j) Installations of long-distance aqueducts;
- (k) Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works;
- (l) Groundwater abstraction and artificial groundwater recharge schemes not included in Annex I;
- (m) Works for the transfer of water resources between river basins not included in Annex I.

## 11. Other projects

- (a) Permanent racing and test tracks for motorized vehicles;
- (b) Installations for the disposal of waste (projects not included in Annex I);
- (c) Waste-water treatment plants (projects not included in Annex I);
- (d) Sludge-deposition sites;
- (e) Storage of scrap iron, including scrap vehicles;
- (f) Test benches for engines, turbines or reactors;
- (g) Installations for the manufacture of artificial mineral fibres;
- (h) Installations for the recovery or destruction of explosive substances;
- (i) Knackers' yards.

12. Tourism and leisure

- (a) Ski-runs, ski-lifts and cable-cars and associated developments;
- (b) Marinas;
- (c) Holiday villages and hotel complexes outside urban areas and associated developments;
- (d) Permanent camp sites and caravan sites;
- (e) Theme parks.

13. Any change or extension of projects listed in Annex I or Annex II, already authorised, executed

or in the process of being executed, which may have significant adverse effects on the environment;

Projects in Annex I, undertaken exclusively or mainly for the development and testing of new methods or products and not used for more than two years