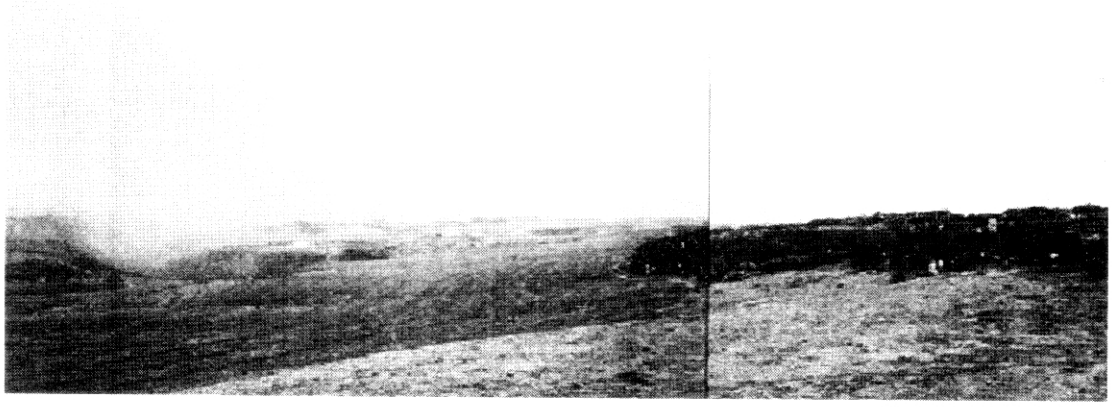
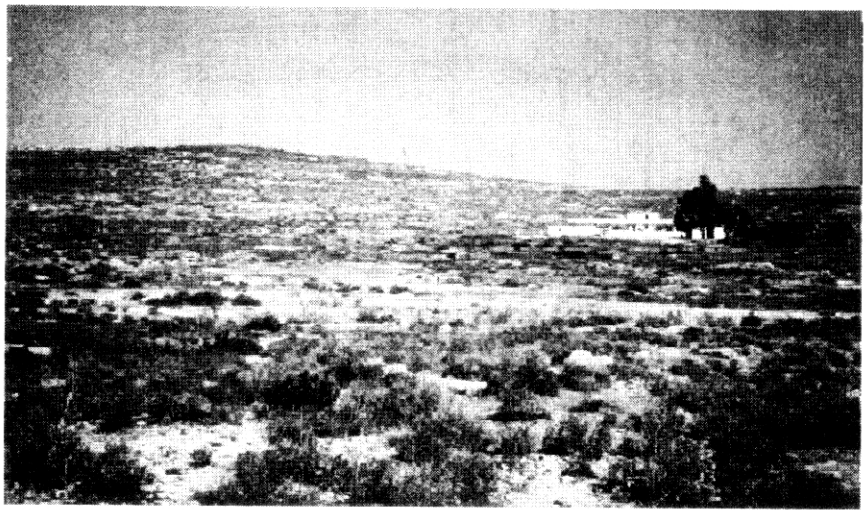


Present Landfill Site in Sofulu (Foreground is the site for extension)

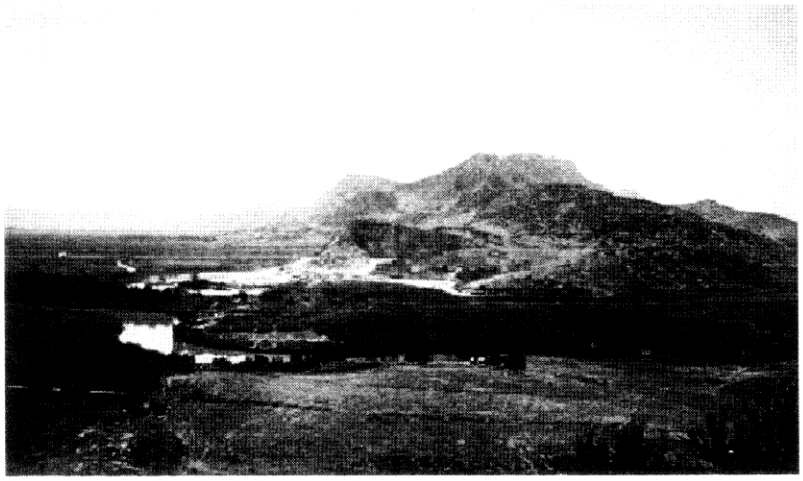
Adana Cimento Quarry



Adjacent Area of Adana Cimento

Figure 13-58: Photographs of Candidate Disposal Sites(1)

Quarries and Valleys at Karahan



Quarries at Seyhan

Site at Buruk

Figure 13-59: Photographs of Candidate Disposal Sites (2)

a. Present Landfill Site in Sofulu

The situation is described in detail in this EIA report.

b. Adana Cimento Quarry and Adjacent Area

b.1 Location and Condition of Proposed Landfill Sites

Adana Cimento is situated approximately 15km east of the City Centre of Adana. Three sites were presented near the factories of Adana Cimento.

b.1.1 Site South of Adana Cimento

The site includes or is neighbouring an area with archaeological remains. Further, a village with mayor chicken farming is neighbour to the site. The site comprise a flat area that has a ground full of boulder rocks embed in clay. Earthworks would be expensive and soil for daily soil coverage would not be easily available, unless an agreement with Adana Cimento could be obtained regarding free delivery of soil that cannot be used in the production of cement. The site was recommended by a geologist due to the prevalence of clay, not considering other requirements to a landfill site.

b.1.2 Site Southeast of Adana Cimento

The proposed site is located immediately south-east of the premises of Adana Cimento. The site comprises a flat area full of boulder rocks. Earthworks would be expensive and soil for daily soil coverage would not be easily available, unless an agreement with Adana Cimento could be obtained regarding free delivery of soil that cannot be used in the production of cement. The site is neighbouring huge fields mainly cultivated with peanuts and cotton.

b.1.3 Site Located in the Excavation Area at Adana Cimento

The excavation area is huge and holds capacity for many years disposal from Adana. Soil for daily coverage of waste is easily available, and access to the bottom of the quarry is easily available. However, most of the excavation area is still operated by Adana Cimento.

The operation of a landfill in the excavation is considered very difficult, also because many blastings are carried out. The geological and hydrogeological conditions of the site have not yet been investigated.

b.2 Summary

Three sites were presented and evaluated. Two sites were evaluated to be **infeasible** for the construction of the future landfill of the Greater Municipality of Adana.

The site located in the quarry of Adana Cimento is considered to be **feasible for further investigations at a later stage** when a suitable part of the quarry is no longer operated by Adana Cimento.

c. Quarries and Valleys at Karahan

c.1 Location of the Proposed Landfill Site

The proposed site is located 4km west of Karahan at the main road Adana/Karaisali. The site is located approximately 23km west of the City Centre of Adana, 10km west

of the present City border. The site is located approximately 2km south of the western corner of Seyhan Baraj Golu Lake.

c.2 Conditions of the Proposed Landfill Site

Two (2) villages are located to the west and south-west at a distance of 2 - 3km. The geological and hydrogeological conditions of the site have not yet been investigated. The proposed site comprises:

- **A quarry that is still operated**

  In the quarry a clay material is excavated by the Highway Department or Rural Affairs Department. The excavated material is mixed with gravel and used for road construction. The area of the quarry is roughly estimated at 50ha. The main road, Adana/Karaisali, passes right through the quarry and traffic on this road is quite heavy. Access to the quarry is easily available.

- **Three small valleys adjoining the quarry**

  The area of the valleys is roughly estimated at 50ha. The valleys are scarcely covered with bushes and few small trees. Thus, the Ministry of Forest may not easily approve the construction of a landfill in the valleys. At the end of the valleys, at a distance of approximately 300m, run-off water from the valleys is discharged into a stream. Access to the valleys can be obtained by constructing an approximately 1km access road.

  The capacity of the proposed site is considered to be enough for many years. However, the quarry is still in operation, and it considered extremely difficult to operate a landfill in the quarry unless the main road, Adana/Karaisali, is relayed. Soil for daily soil coverage is easily available.

c.3 Advantages and Disadvantages

Advantages and disadvantages for the proposed landfill site are summarised as follows.

c.3.1 Advantages

- Access to the site is easily available. However the site is located at a distance of approximately 23km from Adana City Centre.
- Soil for daily coverage of waste is easily available.

c.3.2 Disadvantages regarding the Quarry

- It will be very difficult to operate a landfill in the quarry since the quarry is still in operation and the present main road, Adana/Karaisali, passes right through the quarry

c.3.3 Disadvantages regarding the Valleys

- The Ministry of Forest may perhaps disapprove the construction of a landfill in the valleys.

c.4 Summary

The proposed landfill site that is located west of Karahan in some small valleys adjoining a clay quarry is considered **feasible for further investigation**.

The 3 small valleys are proposed utilised for the first phases of the landfill. The quarry may be used at a later stage when it is no longer operated and the main road, Adana/Karaisali, has been relayed. It should be investigated if the Ministry of Forest may not resist that the valleys are used for the construction of a landfill.

d. Quarries at Seyhan

d.1 Location of the Proposed Landfill Site

The proposed site is located 6km west of Seyhan, approximately 42km east of the City Centre of Adana. The site is located approximately 500m from the Seyhan Nerie River. An ancient castle is located on the opposite side of the river bank.

d.2 Conditions of the Proposed Landfill Site

The capacity of the proposed site is considered to be enough for many years. However, the quarry is still in operation, and it will be extremely difficult to operate a landfill in the quarry. Two (2) abandoned quarries were also presented; but their capacity was too small. In the quarry, stones are excavated and crushed into gravel. The availability of soil for daily coverage is considered inadequate since the ground mostly consists of rocks.

Two (2) villages are located at a distance of less than 2km as well as an ancient castle. The landfill is visible to visitors to this recreational tourist centre. Access to the quarry is easily available.

d.3 Advantages and Disadvantages

Advantages and disadvantages for the proposed landfill site are summarised as follows.

d.3.1 Advantages

- Access to the site is easily available. However the site is located at a distance of approximately 42km from the Adana City Centre.

d.3.2 Disadvantages

- It will be very difficult to operate a landfill in the stone quarry since the quarry is still in operation.
- The requirements for soil for daily coverage of waste will not be fulfilled unless some of the required soil is imported from outside of the landfill site.
- The site is located near 2 villages and less than 2km from an ancient castle.

d.4 Summary

The proposed landfill site which is located in a quarry west of Seyhan is evaluated to be **infeasible** for the construction of the future landfill for the Greater Municipality of Adana. The main reasons are:

- The site is located at a distance of more than 40km from the City Centre of Adana.
- The quarry is located less than 2km from 2 villages and an ancient castle.
- The quarry is still in operation.
- Soil for daily coverage will not be easily available.

e. Site at Buruk

e.1 Location of Proposed Landfill Site

The proposed site is located north of Buruk, approximately 20km north of the city centre of Adana. The site is located on top of hill between two valleys. A power transmission line is situated next to the proposed landfill site.

e.2 Conditions of the Proposed Landfill Site

The proposed site is located in a rural area with fields of mainly cotton. Most of the area is owned by privates and used for agricultural purposes. The site is located far from residential areas. An approximately 5km long new access road has to be constructed to gain access to the site from the main road, Adana-Kozan. The terrain is rather hilly causing large earthworks to be involved in the construction of the access road. The area is approximately 25ha and is located on a hilltop. The geological and hydrogeological conditions of the site have not yet been investigated.

e.3 Advantages and Disadvantages

Advantages and disadvantages for the proposed landfill site are summarised as follows.

e.3.1 Advantages

- The site is located far from residential areas. However, it is located at a distance of approximately 20km from Adana City Centre.

e.3.2 Disadvantages

- As the landfill is located on top of a hill the filling height will be relative small compared to a landfill located in an excavation or in a valley. The capacity of a landfill in the proposed location is too small to fulfil the Municipality's requirement for disposal of waste for more than 8-10 years.
- The construction of a landfill in the proposed location will require construction of protecting soil embankments. As the landfill has to be expanded in the height, also the soil embankments will have to be extended in the height. The requirements for soil for the construction of protecting soil embankments and for daily soil coverage of waste will not be fulfilled unless some of the required soil is imported from outside of the landfill site.
- The construction of a landfill on top of a hill is technically infeasible. Problems with paper blown by wind will be huge.
- The initial construction works for the landfill will include huge earthworks for the construction of protecting soil embankments. A landfill located in an

excavation or in a valley would require considerably less earthwork in the construction phase.

- New protecting soil embankments will be required during the operation and expansion in the height of the landfill. Also these earthworks will be huge compared to a landfill located in an excavation or in a valley.
- An approximately 5km long new access road has to be constructed to gain access to the site from the main road, Adana-Kozan.

e.4 Summary

The proposed landfill site which is located on a hill north of Buruk is evaluated to be technically and financially **infeasible** for the construction of the future landfill for The Greater Municipality of Adana. The main reasons are:

- As the landfill is located on top of a hill the filling height of waste will be relative small compared to landfills located in excavations or in valleys. Thus, the capacity of the landfill will be too small to fulfil the Municipality's requirement for disposal of waste for more than 8-10 years.
- The initial construction works for the landfill will include huge earthworks for the construction of protecting soil embankments, and new protecting soil embankments will be required during the operation and expansion in the height of the landfill. The requirements for soil for the construction of protecting soil embankments and for daily soil coverage of waste will not be fulfilled unless some of the required soil is imported from outside of the landfill site.
- A landfill located in an excavation or in a valley would require considerably less earthworks, and soil for daily coverage can more easily be obtained in such locations
- It will be very difficult to operate a landfill in the proposed location. The site is not naturally protected from wind and will face huge problems due to paper blown by wind.

f. Recommendations

The above-mentioned evaluation is summarised in the table below.

Table 13-39: Evaluation of Candidate Final Disposal Sites for Adana GM

Site Name	Current Conditions	Evaluation	Basis
1. Present landfill site in Sofulu	• 10 km from the centre of Adana • Present dump site for Adana GM and its adjacent municipalities.	Feasible for further investigations.	• The extended landfill site holds capacity for many years disposal from Adana. • Urgently required rehabilitation works can be done in a cost effective way if combined with continued operation of the landfill. • Daily covering soil is easily available.
2. Adana Cimento quarry	• 15 km from the centre of Adana • Mining area of lime stone for Adana Cimento	Feasible for further investigations at a later stage.	• When mining operation is completed and Adana Cimento agrees for the use of waste disposal, the site will become an ideal candidate site for final disposal. • Because of huge landfill capacity, availability of covering soil, favourable surrounding land use, easy operation, etc.
3. Adjacent area of Adana Cimento	• 15 km from the centre of Adana. • A flat land with a ground full of boulder rocks embed in clay.	Not feasible.	• The site includes or is neighbouring an area with archaeological remains. • A village with chicken farming is neighbour to the site. • Earthworks would be expensive and covering soil would not be easily available.
4. Quarries and valleys at Karahan	• 23 km from the centre of Adana. • An operating soil quarry and three small valleys adjoining the quarry.	Feasible for further investigations if the Ministry of Forests gives a permission of the use as a landfill.	• Far from the population. • Access to the site is easily available, but a little bit far from the city centre. • Daily covering soil is easily available.
5. Quarries at Seyhan	• 42 km from the centre of Adana. • An operating quarry and 2 abandoned quarries.	Not feasible.	• Too far from the city centre. • The site is located less than 1 km from 2 villages and an ancient castle. • A quarry is still operating. • Covering soil would not be easily available.
6. Site at Buruk	• 20 km from the centre of Adana. • Agricultural land.	Not feasible.	• Due to the location on top of a hill the filling height of waste will be relatively small. • The cost of construction/operation is extremely high due to the construction of the embankments. • The site is not naturally protected from wind and will face huge problems of blown papers and plastics due to wind.

Based on the results of the evaluation, the Study Team recommended the present landfill site in Sofulu to be operated for maybe another 10 years to serve the Greater Municipality of Adana, and to be the final disposal site for the F/S (Feasibility Study). The continued operation of Sofulu Landfill is subject to:

- Urgently required rehabilitation works of the landfill are undertaken as soon as possible. The rehabilitation works can be carried out in a cost effective way if combined with continued operation of the landfill.
- New procedures for operating the landfill are introduced.

- The construction of residential areas immediately north and west of the landfill site is postponed.

13.7 Monitoring Program

13.7.1 Landfill

The waste dumped from collection vehicles is flattened, compacted by a bulldozer and covered with soil every day at the operation stage. As inflammable gases are removed through the ventilation system, there is little opportunity of landfill fire. Furthermore, fire extinguishers, a water tank for extinguishing fire and a water spray truck should be equipped at the disposal site. The operator of bulldozer and relevant workers will be responsible for extinguishing the landfill fires. In an emergency it is possible to use the leachate in the treatment pond for extinguishing the landfill fire.

There is no need of monitoring after the termination of operation.

13.7.2 Gas Removal

Gas ventilation system has already been equipped at phase 1 site in the pilot project of JICA Study Team. At phase 2 and 3 site vertical facilities(1,981m) and horizontal facilities (3,060m) for gas removal system are installed. The gas generated at the disposal site is inflammable methane. Since the gas is dispersed in the open air through pipes, there is little possibility of explosion. The bulldozer driver or relevant workers should monitor sometimes whether the gas is flowing out or not from the ventilation system. If the gas is not sensed, the cause should be thoroughly investigated.

At the stage of aftercare it is necessary to pay attention to monitoring of gas generation until it is determined that landfill gas emission is negligible. The gas should be detected by equipment at least once a year.

13.7.3 Offensive Odour

Offensive odour is produced mainly from the decomposition of organic matter. Therefore, it is most important to cover the waste with soil and let the anaerobic decomposition promote under the soil in order to prevent the dispersion of offensive odour. As the waste is compacted at first on the site and covered with soil at the end of the day, daily soil cover must be observed necessarily without failure. The manager of the disposal site should inspect the situation of soil cover and direct the workers to cover the waste with soil completely, if not covered.

Since the compost plant is introduced in this project and compostable waste (organic waste) is transported not to the disposal site but to the compost plant separately, it is expected that most of the waste hauled to the disposal site is not organic and the productivity of offensive odour is low.

Offensive odour from compost plant may give an impact to the surrounding area. Therefore, the monitoring of odour should be conducted once a week.

13.7.4 Leachate

At the stage of operation the leachate should be inspected regularly twice a year. The items of water quality analysis should be decided according to Water Pollution Control Regulation. However, the number of the items can be decreased because the standards are prepared for discharging and the leachate is not discharged out of the site in this case. For example, BOD and COD may be enough.

The leachate may possibly infiltrate into the ground of phase 1 site because the permeable soil layer is kept under the existing waste. In order to monitor the possibility of pollution of groundwater, three monitoring wells should be prepared downstream of the site. Two wells of W2 and W3, where the water quality analysis was already carried out to know the present situation, are suitable for monitoring of groundwater pollution. The third well should be prepared in the site of Cukurova University because the site of University is located downstream of the proposed site. Inspection should be carried out once a year.

The leachate is not discharged from the medical waste disposal site and circulated in the site. Although there is no possibility of groundwater pollution by medical waste, the quality of leachate and groundwater should be monitored , preparing for the worst. The monitoring program for ten years shall be prepared according to the Regulation on Control of Medical Waste. The leachate should be inspected twice a year during operation and once a year after the termination of operation, because the medical disposal site is capped with impermeable sheet at the stage of aftercare and the productivity of leachate is reduced rapidly.

To monitor the impact on the groundwater by medical waste, the inspection of three wells described above should be substituted.

13.8 Conclusion

The existing dumping site in Sofulu has been giving many kinds of impacts on the surrounding environment, like water pollution due to the leachate, air pollution due to landfill fire and nuisance of offensive odour, etc. The implementation of this project terminates the dumping of waste and brings the positive impact on the surrounding area in Adana City because the dumping site is improved by the introduction of the system of leachate circulation, gas ventilation and sanitary landfill.

The intermediate treatment facilities like sorting plant and compost plant is to be introduced and the waste is recycled and reused effectively as resources in this project. The positive impact on the economic activities is expected. Negative impact from these plants like offensive odour, waste water and noise will be negligible because the mitigation measures are taken.

At the bottom of the disposal site the impermeable clay/ marl layer is to be kept to prevent the leachate going into the underground, and the leachate is collected in the regulation pond and circulated in the site without being discharged. Negative impact is expected to be negligible.

The outbreak of landfill fires and offensive odour can be controlled by the sanitary landfill. The waste is flattened, compacted and covered with soil every day at the disposal site. Negative impact is negligible.

The medical waste disposal site is to be constructed separately from the municipal waste disposal site. The waste is disposed of according to the sanitary landfill system stipulated in the Medical Waste Control Regulation of the MoE and leachate is circulated in the site. The daily management is strictly controlled.

The monitoring of environmental impact is to be conducted for control of water pollution and air pollution. The quality of groundwater and the quantity of gas will be monitored during operation and aftercare period.

Based on the result of careful examination on (1)the project, (2)existing situation of environment, (3)the impact on the environment by the implementation of the project, (4)measures to mitigate the impact, and (5)monitoring programs during operation and after termination of the operation, it is expected that the negative impact on the environment can be controlled to be negligible.