# Chapter 12

*Alternative Study*

# 12 Alternative Study

## 12.1 Sofulu Disposal Site

### 12.1.1 Overall Alternative Plan

During the meeting on the Draft Final Report (DF/R), the Turkish counterpart requested the examination of an alternative plan to reduce the project costs of the priority projects. Although the laws concerning disposal sites do not acknowledge the contents of the alternative plan, the following alternative plans will reduce project costs; from a view of environmental protection the problems will be negligible, and therefore the team recommends them.

**Municipal Solid Waste Disposal Site:**

Sofulu disposal site has operated for 10 years without an impermeable bottom structure. On the bottom surface of the disposal area, there is an impermeable stratum 2 to 6m from the top soil. Therefore, instead of constructing an impermeable bottom structure, sheet piles shall be inserted into the bottom of the valley up to the natural, impermeable strata so that they act as a leachate preventing structure to obstruct the flow of leachate downstream.

The adoption of this measure would reduce the construction costs of the municipal waste landfill site by 42.6%.

**Medical Waste Disposal Site:**

There is over 3m of impermeable strata that lies 2 to 3 m from the surface of the disposal area's top soil. The base of the disposal area shall be furnished with an impermeable structure without an HDPE liner. If the impermeable structure of the slope is constructed according to the law, i.e., "clay layer＋HDPE", the slope's gradient would have to be reduced, thus increasing the area of the impermeable structure. The impermeable layer of the slope shall be change from the legally stipulated "clay layer＋HDPE" to "mortar＋HDPE".

The adoption of this measure would reduce the construction costs of the medical waste landfill site by 49.4%.

The overall alternative plan is shown in the following figure.

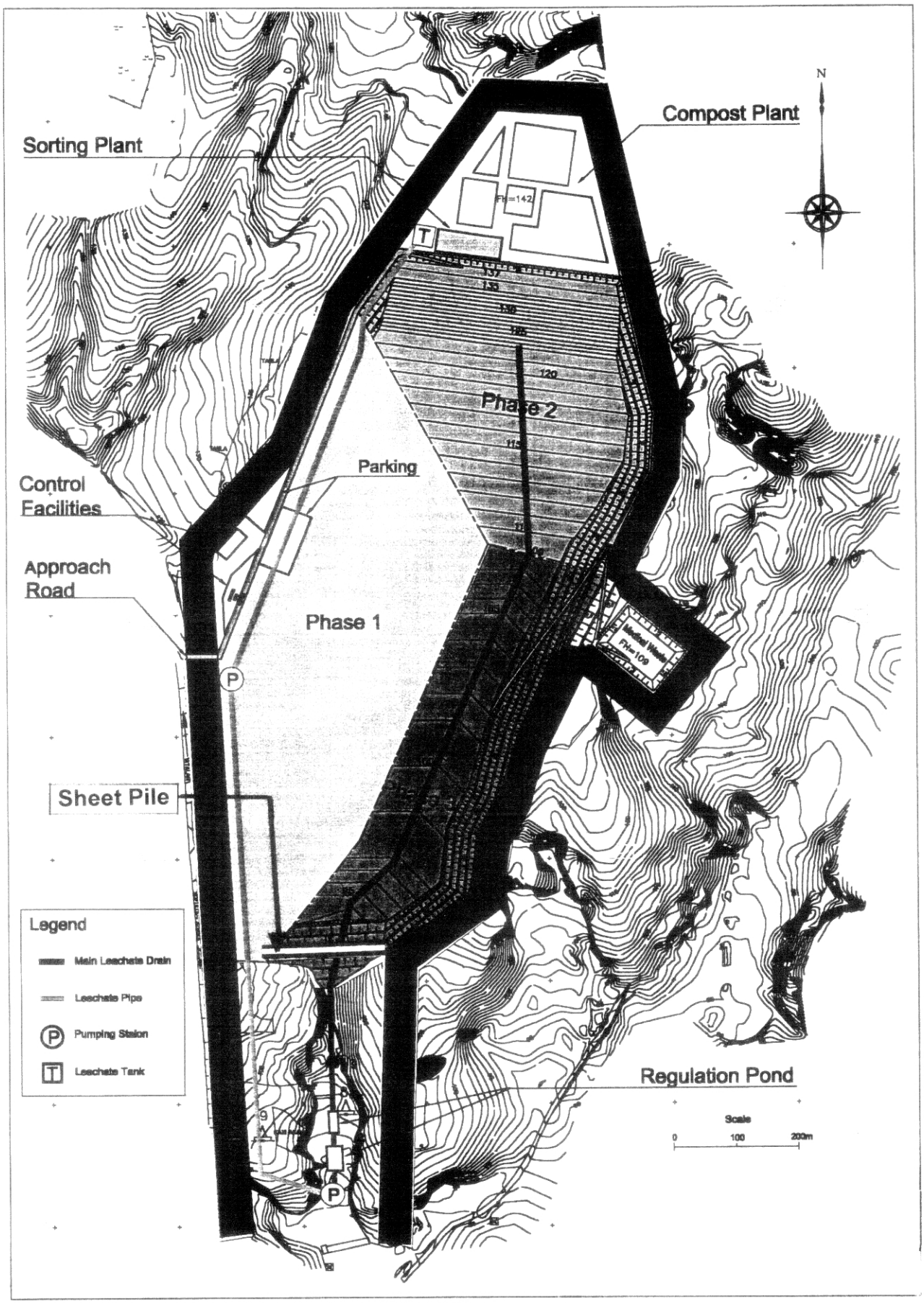



Figure 12-1: Overall Alternative Plan

## 12.1.2 Design of a Final Disposal Site

### a. Preliminary design

### a.1 Outline of the Sofulu Disposal Site

The outline of the Sofulu disposal site is shown in the table below.

Table 12-1: Outline of the Sofulu Disposal Site

| Items | Description |
|---|---|
| Land Area and Proposed Land Use | Total Area :95ha<br>Phase1:Landfill Area :25ha<br>Phase2:Landfill Area :13ha<br>Phase3:Landfill Area :17ha<br>Plant :Area :6ha<br>Medical waste landfill area :3ha<br>Buffer zone :Area :25ha<br>Others(include regulation pond)Use :6ha |
| Landfill Volume | Phase / Capacity / Disposal Period<br>Phase2 / 2,351,000m$^3$ / 2002-2006<br>Phase3 / 2,325,000m$^3$ / 2007-2009 |
| Road | Approach road (Asphalt paved) : width: 8.0m,length: 780m<br>Access road (Asphalt paved) : width4.0m,length: 1,885m<br>Operation road Temporary |
| Control facilities and approach road | Entrance area (Asphalt paved) :9,000m$^2$<br>Site office :300m$^2$<br>Weighbridge : 2sets<br>Tire washing pit : 1set<br>Gate : 1set<br>Power supply :1set<br>Water supply :1set<br>Weighbridge and washing area (conc. paved) :2,000m$^2$<br>Parking for heavy vehicle (gravel) :5,000m$^2$ |
| Leachate control facility | Leachate collection pipe $\phi$100mm: 2,485m<br>Main leachate drain $\phi$200mm: 990m<br>Pumping station: 2 sets<br>Pump:<br>4sets<br>Regulation pond: 1set<br>Leachate pipe $\phi$200mm: 1,680m<br>Leachate Tank: 1set<br>Impermeable<br>Structure : Bottom Impermeable clay layer<br>:Slope None<br>LPS : Sheet pile 200m |
| Drain for runoff water | Open concrete drain :2,665m<br>Pipe drain for rain fall :990m |
| Environmental protection facilities | Fence :4,570m<br>Buffer zone :4,570m<br>Gas removal facility (Vertical) :900m<br>Gas removal facility (Horizon) :2,485m<br>Monitoring borehole :3sets |

## a.2 Final Disposal Site

### a.2.1 Capacity of Final Disposal Site and Disposal Period

The capacity and the economic life of the alternative plan's final disposal site is the same as the master plan. The volume of municipal solid waste from Adana Greater Municipality is shown in the table below.

Table 12-2: Final Disposal Amount in Sofulu

| Item | unit | formula | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Final Waste Disposal Amount | ton/day | a | 786 | 842 | 900 | 966 | 1,042 | 1,130 | 1,234 | 1,334 |
| | ton/year | b=ax365 | 286,984 | 307,593 | 328,717 | 352,693 | 380,042 | 412,903 | 449,925 | 486,945 |
| Waste +Cover soil | $m^3$/year | c=bx1.2/0.8 | 430,476 | 461,390 | 493,076 | 529,040 | 570,063 | 619,355 | 674,888 | 730,418 |
| Total | $m^3$/year | $\Sigma$ c | 430,476 | 891,866 | 1,384,942 | 1,913,982 | 2,484,045 | 3,103,400 | 3,778,288 | 4,508,706 |

### a.2.2 The Impermeable Strata of the Final Disposal Site

According to the SWM regulation, a liner must be laid at the bottom and at the slope of the final disposal site to prevent leachate from seeping into the ground. In the alternative plan, because the bottom of the site has an impermeable clay layer, an artificial, impermeable structure for the bottom and the slope will not be constructed. Because the site slope will not have an artificial impermeable structure, leachate will flow downstream. In order to prevent the leachate from passing through the impermeable strata and leaving the disposal site, sheet piles will be inserted at the bottom of the valley. The leachate will be diverted from the sheet piles via leachate drains and treated by circulation methods.

The bottom structure and the leachate prevention structure (LPS) are as follows;

- Bottom: impermeable clay layer (K = $10^{-8}$ to $10^{-9}$ m/sec) should act as a liner.
- LPS: insert the sheet pile up to the impermeable marl layer (K = $10^{-8}$ to $10^{-9}$ m/sec), and divert the leachate that flows downstream from the impermeable layer via the leachate drain.

The bottom structure and the LPS of the final disposal site are shown in the following figure.

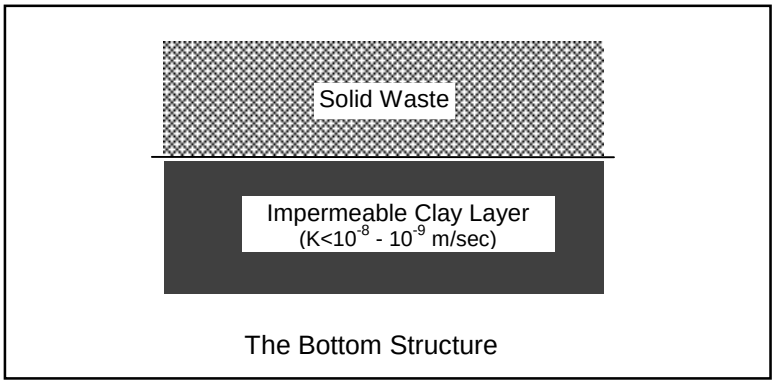
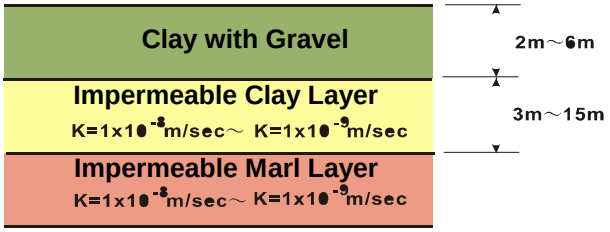



Figure 12-2: Diagrams of the Landfill's Impermeable Strata



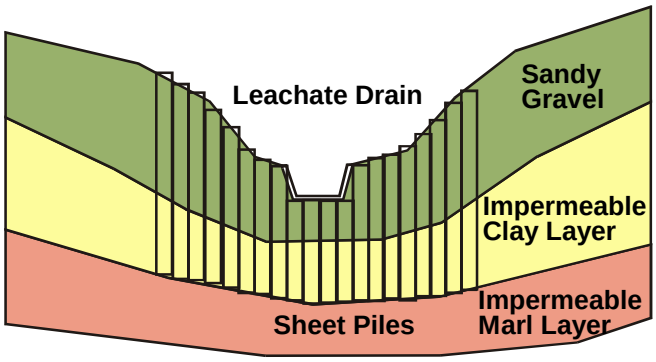




Figure 12-3: Cross Section of the LPS

The slope shall have no artificial, impermeable lining, and the gradients at this point are: cutting slope 1:1; and filling slope 1:3. A typical cross section of the slope is shown below.

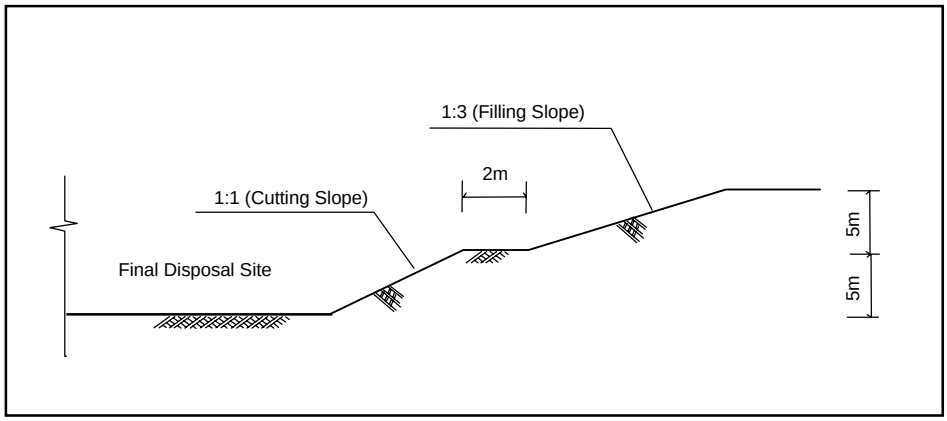



Figure 12-4: Typical Cross Section of Slope Without a Liner

### b. Control Facilities and Approach Road

The control facilities and the approach road shall be the same as the priority projects of the master plan.

### c. Leachate Control Facility

The leachate control facility shall be the same as the priority projects of the master plan.