II.3 XUAN DINH TRANSFER STATION

3.1 NATURAL GEOGRAPHIC CHARACTERISTICS AND ENVIRONMENTAL STATUS

3.1.1 LOCATION

The survey area is located in Xuan Dinh commune, at the coordinates 21° 03.880 North latitude and 105° 47.089 East longitude, 7.2 km NW away from the center of Hanoi.

Xuan Dinh commune is located in the North of Hanoi city, bounded in the North with Phu Thuong commune, in the South and in the East with Xuan La ward, in the West with Dong Ngac and Co Nhue communes.

The transfer station is located in the paddy field of Xuan Dinh commune, with trapezoidal shape where the height is 80 m, base of 670m, top of 625m and area of 51,800 m^2.

- In the West it is bounded with the Hanoi - Vinh Phuc railway
- In the East it is bounded with the Thang Long - Noi Bai expressway
- In the North it is bounded with the living quarter of Ha Thai railway company and Bridge Company No 12.
- In the South it's bounded with drainage canal which is the boundary between Xuan Dinh and Co Nhue commune

(see the outline and photographs)

3.1.2 TOPOGRAPHY

The project site is located in the North of Tu Liem district, suburb of Hanoi. The land surface is rather flat. The mean elevation is 6.6 - 6.8 m. This area is occupied mainly by wet paddy fields, with very little dry crop area. There are 2 small ponds with an area of about 80 - 100 m^2 each and mean depth of 0.6 - 0.8 m, ***a knoll with 2 graves on it.***

3.1.3 AIR ENVIRONMENT

The climate of the project site bears the general characteristics of Hanoi area, which is of hot and humid tropical monsoon climate (see item I.3).

Air environment: the air environment is rather clean, except for dust and waste gas caused by means of transport in the Thang Long - Noi Bai expressway. To survey the air environment in the area, the CCET collected and analyzed 4 air samples taken from the the study area with the results are shown in the following Table 3.1:

Table 3:1: *Results of air analysis in Xuandinh transfer station (taken and analyzed by the CCET on August 7 1999)*

N°	Indicator	Sample Marks				TCVN 5937 - 1995
		XĐ 01	XĐ 02	XĐ 03	XĐ 04	
1	NO_x (mg/m^3)	0.012	0.036	0.016	0.28	0.4
2	NH_3 (mg/m^3)	<0.01	0.14	0.06	0.09	-
3	CH_4 (mg/m^3)	0.45	0.3	0.29	0.35	-
4	CO (mg/m^3)	0.45	0.2	0.15	0.33	40
5	CO_2 (mg/m^3)	88	286	116	215	-
6	SO_2 (mg/m^3)	0.011	0.01	0.02	0.015	0.5
7	H_2S (mg/m^3)	<0.01	<0.01	<0.01	<0.01	0.008 *
8	Dust (mg/m^3)	0.06	0.09	0.11	0.09	0.3
9	Noise (dB)	47-50	49-54	45-50	48-50	70 **
10	RH (%)	68	65	70	68	-
11	Temperature (°C)	37	38	35	37	-
12	P (mmHg)	720	715	720	720	-
13	Wind direction	ES	ES	ES	ES	-
14	Wind velocity (m/s)	0.5-0.8	0.4-0.6	0.3-0.5	0.3-0.5	-

Sample XD 01 is taken adjacent to Thang Long-Noi Bai express way and close to Thai Ha Railway enterprise

Sample XD 02 is taken from the paddy field within the site

Sample XD03 is taken from paddy field of Co Nhue commune in the West of the transfer tation

Sample 04 is taken from paddy field in the South of the transfer station

Remarks The analysis results show that all indicators are below the standard limits The air environment in the project area is clean

3.1.4 HYDROLOGY

The study area is 1,500 m west of Nhue river.

The project site is about 2.2 km north of the Red river (see item I.4)

No main river flows across the project area. There are only two small ponds which have no influence on the hydrogeological characteristics of the area

Surface water environment in the study area:

The surface water environment in the area is quite clean. Here, there is 1 canal conducting water from the Hanoi knitting Company. The water is relatively dirty and has bad smell. For environmental survey of the site, the CCET have collected 3 surfacewater samples on August, 7 1999 (see the location of sampling points). The results of sample analysis are presented in table 3.2

Table 3.2: *Results of surface water analysis in Xuandinh transfer station*

N°	Indicator	Sample Marks			TCVN 5942 - 1995 (column B)
		XĐ 02	XĐ 03	XĐ 05	
1	COD (mg/l)	45.6	13.6	5.2	< 35
2	BOD_5 (mg/l)	26.4	5.2	1.8	< 25
3	Phenol (mg/l)	0.008	0.008	0.006	0.02
4	Cyan (mg/l)	0.006	0.005	0.002	0.05
5	As (mg/l)	0.00034	0.00185	0.0004	0.1
6	Pb (mg/l)	0.0015	0.0037	0.005	0.1
7	Cu (mg/l)	0.0063	0.0004	0.004	1
8	Zn (mg/l)	0.0031	0.0094	0.012	1
9	Cd (mg/l)	0.0009	0.0008	0.0005	0.02
10	Hg (mg/l)	0.00416	0.00088	0.0009	0.002
11	Mn (mg/l)	0.35	0.45	0.057	0.8
12	Ni (mg/l)	0.05	0.02	<0.01	1.0
13	Cr (VI) (mg/l)	0.009	0.001	0.004	0.05
14	F (mg/l)	0.48	0.25	0.38	1.5
15	Ca (mg/l)	48	22	10	-
16	Mg (mg/l)	10.8	4.8	2.4	-
17	Coliform (MPN/100ml)	32	56	25	10000
18	Sulfate (mg/l)	4.0	2.0	8.0	-
19	pH	7.5	7.0	7.2	5.5 - 9.0
20	Fe (mg/l)	1.39	1.67	0.98	-

N°	Indicator	Sample Marks			TCVN 5942 - 1995 (column B)
		XĐ 02	XĐ 03	XĐ 05	
21	NO_2 (mg/l)	0.0	0.0	1.5	0.05
22	NH^+_4 (mg/l)	11.0	0.0	0.2	1
23	NO_3 (mg/l)	0.0	1.38	8.26	15
24	Clorua (mg/l)	53.18	5.32	31.91	-

Sample XD02 is taken from drainage canal from Ha Noi knitting company

Sample Xd03 is taken from pond in the North-west of the transfer station

Sample XD04 is taken from irrigation in the South of the project area

Remarks: According to the analysis results, content of NH^+_4, Hg, BOD_5, COD exceed the permissible level for irrigation water.Therefore, the waste water of Hanoi knitting company doesn't fulfill the standard limits.

3.1.5 HYDROGEOLOGY.

The proposed Xuan Dinh transfer station is next to Co Nhue transfer station, so the hydrogeological characteristics of Xuan Dinh transfer station is similar to that of Co Nhue transfer station (see II.2, 1.5)

The results of ground water analysis are presented in the table below:

Table 3. 3: *Results of ground water analysis in Xuandinh transfer station (taken and analyzed by the CCET on August 7 1999)*

N°	Indicator	Sample Marks		TCVN 5944 - 1995
		XĐ 01	XĐ 04	
1	COD (mg/l)	4.8	5.2	-
2	BOD_5 (mg/l)	1.6	1.8	-
3	Phenol (mg/l)	0.005	0.006	0.001
4	Cyan (mg/l)	0.002	0.002	0.01
5	As (mg/l)	0.00053	0.0004	0.05
6	Pb (mg/l)	0.0069	0.005	0.05
7	Cu (mg/l)	0.0006	0.004	1.0
8	Zn (mg/l)	0.0034	0.012	5.0
9	Cd (mg/l)	0.0006	0.0005	0.01
10	Hg (mg/l)	0.00026	0.0009	0.001
11	Mn (mg/l)	0.1	0.057	0.1 - 0.5
12	Ni (mg/l)	<0.01	<0.01	-

N°	Indicator	Sample Marks		TCVN 5944 - 1995
		XĐ 01	XĐ 04	
13	Cr (VI) (mg/l)	0.003	0.002	0.05
14	F (mg/l)	0.05	0.24	1.0
15	Ca (mg/l)	2.0	32	-
16	Mg (mg/l)	3.6	3.6	-
17	Coliform (MPN/100ml)	0	0	3
18	Sulfate (mg/l)	1.0	1.0	200-400
19	pH	6.5	7.0	6.5 - 8.0
20	Fe (mg/l)	0.7	0.21	1 - 5
21	NO_2 (mg/l)	0.0	0.01	-
22	NH^+_4 (mg/l)	0.0	0.0	-
23	NO_3 (mg/l)	8.94	4.82	45
24	Clorua (mg/l)	8.86	10.64	200-600

Sample XD 01 is taken from mini drilled tubs in living quarter of Ha Thai railway enterprise

Sample XD 04 is taaken from drilled well of a household living in Co Nhue commune

Remarks: The analysis results show that indicators in shallow groundwater is below the standard limits ecxept for Phenol content which is 5-6 times higher than the permissible level

3.2 SOCIO-ECONOMIC CHARACTERISTICS

3.2.1 SOCIO- ECONOMIC CHARACTERISTICS OF XUAN DINH COMMUNE.

a. Population.

The Xuan Dinh transfer station area is located in the territory of Xuan Dinh commune, Tu Liem district, Hanoi.

Deputy Chairman: Mr. Duong Xuan Loc

Tel: 8 361095

The commune has 6 villages: Dong village, Trung village, Nhang village, Loc village, Cau Dinh village and tan Xuan village. The commune has population of 17,762 inhabitants living in 4,059 households

b. Infrastructure

The commune has 85.0853 ha of land, of which 70.1381 ha is residential land, remaining area is land of enterprises and schools. 344.5095 ha is agricultural land which includes 321 ha of paddy field and 23.5 ha of other crops.

In the commune there is 1 clinic with 12 beds, 1 primary school of 1,134 pupils, 1 basic secondary school of 1,436 pupils, 1 secondary school of 2,144 pupils.

The commune is crossed by the Hanoi - Phuc Yen railway and Thang Long - Noi Bai expressway, which is an important road from the Noi Bai airport to Hanoi. The roads in the commune are mainly asphalt and concrete roads. . 100% of population have access to electricity. Main sources of domestic water are ground water and rainwater. According to statistic, the whole commune has 3,853 drilled well, 28mdeep on average. 47.7% of population use toilet with septic tank, 49.9% use two compartments latrine and 0.6% use others.

c. Main occupation

Agriculture is the main occupation in the commune. Besides there are some other small businesses and traditional occupations such as confectionery, etc.

3.2.2 SOCIO-ECONOMIC CHARACTERISTICS OF THE TRANSFER STATION AND ITS VICINITY .

a. In the transfer station.

No household living within the transfer station. There are 4 graves, a high voltage power line and a telephone line.

b. In the vacinity (within distance of 200m from the boundary of the site).

The transfer station by the express way and surrounded maily by paddy field. In the North and NE are living quarter of Ha Thai Railway enterprise and Bridge Company No12 and residential area of Xuan Dinh commune. There are about 430 people living in 90 households. When the transfer station is built, no household is needed to be resettled.

3.2.3 RESULTS OF ENVIRONMENTAL AND SOCIAL SURVEY

During the surveys, we cooperated with communal People's committee, worked with communal leaders, statistical department and collected information on land use status around the project area, socio-economic conditions of the commune. We also interviewed 41 households in the area intended for the transfer station and the vicinity. The results of the survey and interview show that:

+ *As regards the surrounding environment :*

- Severely polluted: 9.8 %,
- Not severely polluted: 68.2 %
- Not polluted: 22 %

+ *Evaluation of the interviewees on the degree of pollution (in %):*

Degree / Aspect	Severely polluted	Not severely polluted	Not polluted
Waste	2.4%	29%	68.3 %
Water resource	4.9 %	17.1 %	78 %
Odor	7.3%	41.5%	51.2 %
Gas, dust	12.2%	36.6 %	51.2%%
Noise	17.1%	36.6 %	46.3 %
Vibration	17.1 %	31.7 %	51.2 %

+ *As regards the degree of pollution caused by the surrounding solid wastes:*

7.3.% - Polluted, 48.8 % - Not very clean, 43.9%: Clean

+ *Point of view of the population about the construction of the transfer station:*

53.7 % of them agree with the construction of the transfer station

4.9 % not agree and

41.5 % giving no idea.

3.3 ACCESSIBILITY OF THE INTENDED TRANSFER STATION.

3.3.1 DISTANCE OF WASTES TRANSPORTATION

The distance and time of truck travel from URENCO office to the transfer station are 9.6 km and 20 minutes respectively.

The distance and time of truck travel from the transfer station to Nam Son landfill are 37 km and 1 h respectively.

3.3.2 TRUCK TRAFFIC FLOW ON THE ACCESS ROAD TO THE TRANSFER STATION

Access road to the transfer station is directly connected with Thang Long-Noi Bai express way. This is an important road connecting Noi Bai airport and Northern provinces with Hanoi. Therefore, during peak hours, there are 187 big trucks and 322 small trucks and beyond peak hours, there are 215 big trucks and 318 small trucks.

3.3.3 ACCESS ROAD TO THE TRANSFER STATION

The station is adjacent to Thang Long - Noi Bai expressway, therefore the access road and the exit road can connect directly with this expressway. This is the main road with high traffic. If the transfer station is constructed here, there will be an additional number of 400 waste trucks going in and out of the transfer station of which 100 trucks are of 25 tons capacity, thus increasing the traffic density in this road.This is an expressway, if the waste trucks access and go out directly from the express way, this will affect the traffic of the area, therefore a fly-over must be built over the expressway to ensure traffic safety in the area. On the other hand, construction of a fly over

is also impossible because when constructing, there must be an access road for fly over. The site is limited by the railway in the West, access road for the fly over can not be built. Consequently construction of a flyover has low feasibility (see the outline)

3.3.4 CURRENT STATUS OF THE TRANSFER STATION

The study area is occupied by paddy fields of Xuan Dinh commune, covering 51,800 m^2. The paddy here is planted in two crops per year with productivity reaching 120 kg to 150 kg/360 m^2. There are 4 graves. The site is crossed by a high voltage power line and a telephone line. Besides, there are several irrigation and drainage channel and 2 small ponds with area of 180m^2 accounting for 0.35% of the area of the transfer station. The commune has sold 20,000 m^2 of land in the area adjacent to the living quarter of Ha Thai railway enterprise to the Hanoi bus company.

In order to study the composition of soil in the project area, the CCET have collected 02 soil samples on August, 7 1999 . The results of analysis are presented in the table below:

Table 3.4: ***Results of soil analysis in Xuandinh transfer station***

N°	Indicator	Sample Marks	
		XĐ 01	XĐ 02
1	Hg (mg/kg dry soil)	$2.8x10^{-5}$	
2	As (mg/kg dry soil)	$0.65x10^{-4}$	$0,79x10^{-4}$
3	Pb (mg/kg dry soil)	0.0048	0.0024
4	Cu (mg/kg dry soil)	0.0187	0.0257
5	Fe (mg/kg dry soil)	3.85	2.75
6	Al (mg/kg dry soil)	8.5	5.8
7	CaO (mg/kg dry soil)	1.72	2.06
8	MgO (mg/kg dry soil)	1.7	1.1
9	Mn (mg/kg dry soil)	0.068	0.052
10	Clo (mg/kg dry soil)	0.0081	0.0104
11	pH	6.7	7.25

Sample XD01 is taken from paddy field within the project area
Sample XD02 is taken from residential area in Co Nhue commune

Remarks:The analysis results show that the content of iron and aluminum in soil is fairly high

3.3.5 ISSUES TO BE NOTED

- The transfer station is located between Thang Long-Noi Bai express way and Hanoi-Vinh Phuc railway. Both are main roads from Noi Bai airport to the City so it's often traveled by many foreign delegation. If the transfer station is constructed here, it will influence the esthetics of the area
- The transfer station is located in the area planned for development of the city. Moreover, it's close to the area intended for the construction of Foreign Diplomatic Compound
- The project area is 1,000m South-east of wells in Cao Dinh wellfield and has open hydrodgeological condition. If the transfer station is built here, it will have direct impacts to Cao Dinh wellfield
- The proposed transfer station is located between Thang Long-Noi Bai express way and Hanoi-Vinh Phuc railway. If 20m safety corridor of the express way and the railway is excluded.The area for the transfer station will decrease to a haft, not meeting the requirement. If the transfer station is selected, another 1,250m long area must be expanded which will encroach the nearby residential area
- The transfer station is bounded in the North with residential area, living quarter of Ha Thai railway enterprise so the construction will be opposed by residents.
- Within the transfer station, there is not any household. There are 4 gravers, 1a high voltage power line and atelephone line. In the vicinity of the site, within distance of 200m from the site boundary, there are 90 households.

3.4 COMMENTS OF THE SURVEY TEAM

- *As regards the area of the site: The area of the site is enough as required. However, if the safety corridor of the express way and the railway is ensured, it will not be wide enough*
- *As regards distance: The transfer station is located adjacent to the Thang Long - Noi Bai express way which is the road for transporting waste to the Nam Son landfill. Therefore, the distance is favorable and economically efficient*
- *Access road: The transfer station is located adjacent to Thang Long - Noi Bai expressway, therefore, the cost for road construction is not very high. However, this is an expressway, the turning of trucks when going in and out the station will affect the traffic of the area, therefore a fly-over must be built over the expressway which is very costly. On the other hand, if a flyover isn't built, waste trucks must cover an additional distance of 3km . This will increase cost for waste transportation*
- *Topography of the site: The topography of the site is flat, 0.6 - 0.8 m lower than the surface of the main road. Before the construction of the*

transfer station, the ground at the site must be raised up to 1-1.5m high by adding more earth materials.

- ***Geological setting.*** *The geological setting of the site ensure good conditions for the construction of the transfer station.*
- ***Surface water:*** *The transfer station is located beyond the flood area. and not in the influence area of any water course or body.*
- ***Groundwater.*** *The transfer station is located in the area which has the open hydrogeological condition (with hydrogeological window). Therefore, measures against pollution must be taken if the transfer station is constructed*
- ***Location:*** *the transfer station. is located in the area planned for development of the City and in the area intended for construction of diplomatic area*
- ***Distance to residential area:*** *the transfer station is 200 m North and 180 m West of population areas of Co Nhue commune. Influences on residential area can not be avoided if the transfer station is built and put into operation*
- ***Environment:*** *The environment of the area has no sign of pollution, there are no polluting factories and enterprises around the site.*
- ***Public opinion :*** *53.7% of the population in the study area support the construction of the transfer station.*
- ***Esthetics:*** *the station is between the expressway and the railway which are the main communication lines traveled by many foreign delegations. If a transfer station is constructed here, it will affect the esthetics of the area.*
- ***Site clearance:*** *the site is located mainly in the paddy field the compensation and site clearance will be easy.*
- ***Others:*** *the proposed site is 1,000 m South-west from the Cao Dinh wellfield. The hydrogeological characteristics is open and very sensitive to pollutant.*

II.4 PHU THUONG TRANSFER STATION

4.1 NATURAL GEOGRAPHIC CHARACTERISTICS AND ENVIRONMENTAL STATUS

4.1.1 LOCATION

The study area is located in the Phu Thuong ward, North of Tay Ho districts the coordinates 105° 48.49 North latitude and 21° 04.32 East longitude, It is bounded in the North with Red river.

The proposed transfer station is located on the side of Lac Long Quan road, 1,600 m North from the Red river, 50 m East from the West lake. In the West it is bounded with the graveyard of Phu Thuong ward and peach flower gardens of Nhat Tan ward, in the North with the fish ponds of Nhat Tan ward and buildings of Ho Chi Minh Mausoleum safe-guarding unit (see the outline and photographs).

4.1.2 TOPOGRAPHY

The project site is fish ponds of Phu Thuong ward, with the mean elevation of 6.2 m a.s.l., covering an area of 16,560 m^2, of which 10,080 m^2 is occupied by fish ponds and 6,440 m^2 is the peach planting land. As the mud in the ponds is collected to fertilize the peach gardens, the ponds are rather deep. In the middle of the pond, there is a patch of land running along the pond. The depth of the pond varies from 1.5m to 3m.

As the area of the site is only 16,560 m^2, not meeting the requirements, the study team of CCET surveyed an additional area of 33,500 m^2 of peach planting land of Nhat Tan ward. In the land area of Nhat Tan ward there are also 2 small fish ponds formed by digging of soil to plant peaches. The total area of the two ponds is 750m^2. the depth of the ponds is 2.3 to 2.5 m. Besides, in the area there is also 3 canals and 31 tombs.

4.1.3 AIR ENVIRONMENT

The project site is located in the Northern urban area of Hanoi, so it bears the general climatic characteristics of Hanoi area, which is of hot and humid tropical monsoon climate.

Air environment is rather clean except for dust and waste gas caused by means of transport in Lac Long Quan road and unpleasant odor due to fresh night soil used to fertilize the peach flower gardens by the local population. To survey the air environment in the area, the CCET collected and analyzed 4 air samples in the study area on August 12 1999 (see the location of sampling points) with the results shown in the table below:

Table 4.1: *Results of air analysis in Phuthuong transfer station*

N°	Indicator	Sample Marks				TCVN 5937 - 1995
		PT 01	PT02	PT03	PT04	
1	NO_x (mg/m^3)	0.016	0.028	0.048	0.037	0.4
2	NH_3 (mg/m^3)	0.36	0.48	0.22	0.38	-
3	CH_4 (mg/m^3)	0.4	0.4	0.47	0.44	-
4	CO (mg/m^3)	0.2	0.2	0.2	0.2	40
5	CO_2 (mg/m^3)	88	88	176	78	-
6	SO_2 (mg/m^3)	0.03	0.02	0.03	0.02	0.5
7	H_2S (mg/m^3)	<0.01	0.03	0.015	0.02	0.008 *
9	Noise (dB)	55-60	47-59	45-51	50-55	70 **
10	RH (%)	60	60	50	60	-
11	Temp (°C)	28	30	32	30	-
12	P (mmHg)	710	705	705	710	-
13	Wind direc	ĐN	ĐN	ĐN	ĐN	-
14	Wind Velocity (m/s)	0.3-0.6	0.2-0.4	0.5-1.0	0.4-0.6	-

* *According to Vietnamese 5938 -1995;*

** *According to Vietnamese 5949-1995*

Remarks:The analysis show that all the indicators are lower than the permissible level except H_2S content which is 1.9-3.8 times higher than the permissible level

4.1.4. HYDROLOGY.

The study area is fish ponds of Phu Thuong ward as mentioned above . Around the site along Lac Long Quan road there are also many fish ponds. These ponds were formed long ago by excavating earth for road and dike construction. Nowadays, these ponds are regularly dredged to fertilize peach flower gardens, therefore they are rather deep, 1.5 - 2.5 m. The proposed transfer station is 1600m South of Red river and 50m West of West lake . Hydrogeological regime of these water bodies has little influence on the proposed transfer station site

The water environment here is generally clean. For environmental survey of the area the CCET collected and analyzed 3 surface water samples on August 12 1999. The results of sample analysis are presented in table 4.2.

Table 4.2: Results of surface water analysis in Phuthuong transfer station

N°	Indication	Sample marks			TCVN 5942 - 1995 (Column B)
		PT01	PT02	PT03	
1	COD (mg/l)	13.6	19.2	12.0	< 35
2	BOD_5 (mg/l)	4.8	6.8	3.6	< 25
3	Phenol (mg/l)	0.003	0.003	0.002	0.02
4	Cyan (mg/l)	0.005	0.005	0.001	0.05
5	As (mg/l)	0.00095	0.00107	0.00161	0.1
6	Pb (mg/l)	0.0048	0.0067	0.0044	0.1
7	Cu (mg/l)	0.0036	<0.0001	0.0004	1
8	Zn (mg/l)	0.01	0.0279	0.0048	1
9	Cd (mg/l)	0.0005	0.0004	0.0007	0.02
10	Hg (mg/l)	0.00094	0.00048	0.00016	0.002
11	Mn (mg/l)	0.055	0.25	0.03	0.8
12	Ni (mg/l)	<0.01	0.02	0.01	1.0
13	Cr (VI) (mg/l)	0.003	0.004	0.0065	0.05
14	F^- (mg/l)	0.36	0.51	0.37	1.5
15	Ca (mg/l)	30	28	30	-
16	Mg (mg/l)	10.8	9.6	10.8	-
17	Coliform (MPN/100ml)	32	76	40	10,000
18	Sulfate (mg/l)	4.0	3.0	4.0	-
19	pH	7.0	7.0	7.2	5.5 - 9.0
20	Fe (mg/l)	0.42	6.0	2.1	-
21	NO_2 (mg/l)	0.01	0.3	0.0	0.05
22	NH^+_4 (mg/l)	0.2	0.3	0.2	1
23	NO_3^- (mg/l)	2.75	3.78	2.15	15
24	Clorua (mg/l)	24.82	14.18	19.5	-

Sample PT01 is taken from fish pond wthin the proposedtransfer station
Sample PT02 is taken from the drainage canal running across the project area
Sample PT03 is taken from the pond of Phu Thuong ward

Remarks:According to the analysis results, all indicators are below the standard limits in TCVN 5941- 1995 (column B)

4.1.5 HYDROGEOLOGY

The project area has similar hydrogeological characteristics to that of Co Nhue transfer station. According to research results of hydrogeologists, water of West lake has close hydraulic relation with water of Q_{II-III} aquifer and around West lake the aquifer Q_{III} is almost absent. Therefore surface water from the transfer station may percolates into aquifer Q_{II-III}

Results of groundwater analysis are shown in the table below:

Table 4.3: *Results of groundwater analysis in Phuthuong transfer station*

N°	Indicator	Sample Marks		TCVN 5944 - 1995
		PT04	PT05	
1	COD (mg/l)	3.2	2.4	-
2	BOD_5 (mg/l)	1.0	0	-
3	Phenol (mg/l)	0.001	0.005	0.001
4	Cyan (mg/l)	0.001	0.003	0.01
5	As (mg/l)	0.00046	0.00032	0.05
6	Pb (mg/l)	0.0134	0.0067	0.05
7	Cu (mg/l)	0.0065	0.0008	1.0
8	Zn (mg/l)	0.0024	0.0216	5.0
9	Cd (mg/l)	0.0004	0.0005	0.01
10	Hg (mg/l)	0.00014	0.0003	0.001
11	Mn (mg/l)	2.65	0.065	0.1 - 0.5
12	Ni (mg/l)	0.125	0.015	-
13	Cr (VI) (mg/l)	0.002	0.0035	0.05
14	F (mg/l)	0.25	0.28	1.0
15	Ca (mg/l)	46	38	-
16	Mg (mg/l)	48	32.4	-
17	Coliform (MPN/100ml)	0	12	3
18	Sulfate (mg/l)	0.0	6.0	200-400
19	pH	7.2	7.5	6.5 - 8.0
20	Fe (mg/l)	0.21	0.3	1 - 5

N°	Indicator	Sample Marks		TCVN 5944 - 1995
		PT04	PT05	
21	NO_2 (mg/l)	0.0	0.07	-
22	NH^+_4 (mg/l)	0.0	0.0	-
23	NO_3^- (mg/l)	3.44	3.44	45
24	Clorua (mg/l)	8.86	8.86	200-600

Sample PT04 is taken from the residential along Lac long Quan road
Sample PT05 is taken from residential group No5 of Phu Thuong ward

Remarks: The Coliform and Phenol content in sample PT05 exceed the permissible level, content of Mangan in sample PT04 is 4 times higher than the permissible level.

4.2 SOCIO-ECONOMIC CHARACTERISTICS

4.2.1 SOCIO-ECONOMIC CHARACTERISTICS OF PHU THUONG WARD.

a. Population.

The population of the ward is 10,422 inhabitants living in 2,611 households. The population growth rate is 1.36 %.

Chaiman: Nguyen Van Vach
Tel: 8.368407

b. Infrastructure

The study area is located in Phu Thuong ward, Tay Ho district, Hanoi. This ward has an area of 609.5 ha, of which residential land is 200 ha and agricultural land is 188.4 ha, consisting of 87 ha of paddy field and 101.4 ha of peach flower gardens.

In the ward there are 300 dug wells, in average 7 - 10 m deep and 1,800 drilled wells in average 20 m deep. There is a clinic and 3 schools:

01 primary school with 730 pupils

01 basic secondary school with 698 pupils

01 supplementary secondary school with 443 pupils.

The roads in the commune are mainly asphalt and concrete roads. . 100% of population have access to electricity. Main sources of domestic water are ground water and rainwater. According to statistic, the whole commune has 1,800 drilled well, 20m deep on average and 300 dug wells 7-10m deep on average. 20% of population use toilet with septic tank, 60% use two compartments latrine and 20% use others.

c. Main occupation

Agriculture is the main occupation in the commune. In addition, a portion of population are involved in flower growing and small business.

4.2.2 SOCIO-ECONOMIC CHARACTERISTICS OF THE TRANSFER STATION AND ITS VICINITY.

a. In the transfer station.

No household is found living within the site. There are 31 graves. (see detail description in the 3.4 below).

b. In the vicinity

The transfer station is surounded by peach-flower garden. In the North, there are 20 households living, in the East 50 households. In the South is garden which supply trees for President Ho Chi Minh Mousoleum.. The site is by the Lac Long Quan road so when the transfer station is constructed, no household is needed to be relocated or compensated.

4.2.3 RESULTS OF ENVIRONMENTAL AND SOCIAL SURVEY

During the surveys, we cooperated with communal People's committee, worked with communal leaders, statistical body and collected information on land use status around the project area, socio-economic conditions of the commune. We also interviewed 35 households in the area intended for the transfer station and the vicinity. The results of the survey and interview show that:

+ *As regards level of pollution in the surrounding environment :*

- Severely polluted: 5.8 %,
- Not severely polluted: 82.8 %
- Not polluted: 11.4 %

+ *Evaluation of the interviewees on the degree of pollution (in %):*

Degree Aspect	Severely polluted	Not severely polluted	Not polluted
Waste	2.9%	14.3%	82.9
Water resource	0 %	2.9 %	77.1 %
Odor	17.1 %	60%	22.9%
Gas, dust	2.9%	51.4%	45.7 %
Noise	5.7%	51.4%	42.9 %
Vibration	0 %	54.3%	45.7 %

+ *As regards the degree of pollution caused by the surrounding solid wastes:*

8.6 % - Polluted, 85.75 % - Not very clean, 5.7%: Clean

+ *Point of view of the population about the construction of the transfer station:*

37.1% of them agree with the construction of the transfer station

62.9 % not agree.

4.3 ACCESSIBILITY OF THE INTENDED TRANSFER STATION

4.3.1 DISTANCE OF WASTES TRANSPORTATION

- The distance and time of truck travel from URENCO office to the transfer station are 10.1 km and 20 minutes respectively.
- The distance and time of truck travel from the transfer station to Nam Son landfill are 42.7 km and 1.20 h respectively.

4.3.2 TRUCK TRAFFIC FLOW ON THE ACCESS ROAD TO THE TRANSFER STATION

Lac Long Quan road is 5 -6 m wide. At present, in average there are 42 vehicles/ hour travelling in this road.

During peak hours: There are 46 trucks, 4 buses and 11 cars.

Beyond peak hours: There are 40 trucks, 4 buses and 13 cars.

Here, at night the average number of container trucks carrying cargoes 40 per night.

4.3.3 ACCESS ROAD TO THE TRANSFER STATION

This transfer station is adjacent to Lac Long Quan road, therefore the access road to the station from Lac Long Quan road is very near (20-30m). Lac Long Quan road starts from Buoi slope to Red river dike. This road is asphalt road, 5-6m wide and 5.4m long. Road section from Buoi slope to the project area is 5.5m wide and 3.8m long. Along this road section, there are 648 households, 3 pagodas, 8 offices and enterprises. If the transfer station is built here, 300 vehicles will be added a day in this road which is 80 vehicles/hour. Given the current level of 59 trips/hour, the traffic flow in the road is still ensured.

Exit road of the transfer station starts from Lac Long Quan road to Red river dike and then to Thang Long-Noi Bai express way. Road section from the transfer station to the Red river dike is 1.6km long, 5-6m wide and there are 81 households spreading along this road. If the transfer station is selected, this road section will not ensure travel of 25 tons capacity waste trucks with the maximum width of 3m and length of 8m. Therefore, it must be upgraded. Road section in Red river dike is asphalt road, 3.7km long and 5-6m wide. In flood season, big capacity trucks are not allowed to travel in this road

Apart from the above-mentioned existing road, a new road can be built which connect directly with Thang Long-Noi Bai express way. This

proposed new road is 2.1km long, 8-10 wide. The cost of construction would be about 3.85 billion VND excluding the compensation for 21,000 m2 of agricultural land when the road is built.

4.3.4 CURRENT STATUS OF THE TRANSFER STATION

The study area is divided into two parts: the area covering 16,560ha, of which 10,080 m^2 are fish ponds and the remaining 6,440 m^2 are peach flower gardens belongs to Phu Thuong commune. Area belonging to Nhat Tan ward is 33,500,000m^2 and is being used for growing peach flower. Within the latter, there are two fish ponds with total acreage of 760m^2. In the transfer station, there are 03 small guard houses and 31 tombs.

Results of analysis of dissolved compositions in 02 soil samples taken in the transfer station on August, 7 1999 are shown in the table below:

Table 4.4: *Results of soil analysis in Phuthuong transfer station*

N°	Indicator	Sample Marks	
		PT01	PT02
1	Hg (mg/kg dry soil)	$0.9x10^{-5}$	$0.8x10^{-5}$
2	As (mg/kg dry soil)	$1.3x10^{-4}$	$0.9x10^{-4}$
3	Pb (mg/kg dry soil)	0.008	0.0068
4	Cu (mg/kg dry soil)	0.0175	0.012
5	Fe (mg/kg dry soil)	3.05	3.8
6	Al (mg/kg dry soil)	9.18	9.32
7	CaO (mg/kg dry soil)	0.84	0.77
8	MgO (mg/kg dry soil)	1.4	1.45
9	Mn (mg/kg dry soil)	0.02	0.028
10	Clo (mg/kg dry soil)	0.0057	0.0057
11	pH	7.0	7.4

Sample PT01 is taken from peach garden within the transfer station
Sample PT02 is taken from fish pond in the transfer station

Remarks: The results show that the content of iron and aluminum in soil is fairly high

4.3.5 ISSUES TO BE NOTED

- The transfer station is located by the access road to cemetery of Phu Thuong ward. Within the transfer station, there are 31 tombs of which 16 are brick tombs and 15 earthen tombs. If the transfer station is built here, these tombs

must be relocated

- The transfer station is located in the are inténded for development of City (Ho Tay Tourist area). The proposed site is also reserved for construction of a new commercial area and sport area. Moreover, the area along Lạc Long Quan road is the boating sport area and administrative area of Tay Ho district. Consequently, siting of the transfer station will affect the development plan around West lake and tourist environment
- The proposed site is 1,000m East from wells in Cao Dinh wellfield and on the flowing part of groundwater from the Red river to the wellfield. The hydrogeological characteristics is unfavorable for construction of the transfer station because it will directly affect the wellfield. If the transfer station is selected, absolutely sufficient measures for environmental protection are needed.
- Wthin the site, there isns't any households but there are 31 graves. Within distance of 200m from thr site boudary, there live70 households.

4.4 COMMENTS OF THE SURVEY TEAM

- *As regards the area of the site: The area of the site is too small as compared with the requirements (16,560 m^2). If the transfer station is constructed, another area of 33,500 m^2 of peach flower gardens and fish ponds of Nhat Tan ward should be added.*
- *As regards distance: The transfer station is located adjacent to Lac Long Quan road, 10.1 km away from the center of Hanoi, and along the waste transport route to the Nam Son landfill. Therefore, the distance is favorable.*
- *Access and exit road: The transfer station is located adjacent to Lac Long Quan road, therefore the access road is very short and cost for road construction is low. However, the exit road is only 5 - 6 m wide and not sufficient for 25 - 35 tons capacity trucks to travel and by-pass. Therefore, a new 2.1 km road should be built or 7.1 km of the existing road should be upgraded. This will raise the cost for road construction.*
- ***Topography of the site:** The topography of the site is not flat. There are many fish ponds with large area. The average depth of 2 m. Before the construction of the transfer station, the ground at the site must be raised up by adding more earth material. At the site intended for construction of the transfer station, there are 31 graves, before construction these graves must be removed.*
- ***Geological setting.** The geological setting of the site ensure good conditions for the construction of the transfer station.*
- ***Surface water:** The transfer station is located beyond the flood area.*
- ***Groundwater.** the transfer station has open hydrogeological structure.*

The station is located on the flowing part of groundwater from the Red river to the Pleistocene aquifer which is the main water supply for Hanoi.

- *Location:The site is in the area intended for City development. this place is reserved for a Trade corporation to construct new commercial centers. The site is also near administrative area and boating sport area of Tay Ho district , a place vulnerable to pollution .*
- *Distance to residential area: The intended transfer station is located in 8 km West of the population area of Nhat Tan ward and in the North is adjacent to the building of Ho Chi Minh Mausoleum safe-guarding unit. This is very unfavorable in term of living environment of residents*
- *Environment: The environment of the area is currently clean, there are no polluting factories and enterprises around the site.*
- *Public opinion: Win no support from local residents and local authority (62.9% do not support).*

- *Site clearance:The site is occupied mainly by the peach flower gardens and fish ponds, the compensation will be favorable. However,, resettlement of tombs will be difficult.*
- *Others:The site is 1,000 m away from the wells in Cao Dinh wellfield, on the main path of the groundwater flowing from the Red river to the wellfield. The area has open hydrogeological structure and is very vulnerable to pollution.*

II.5 TAY MO TRANSFER STATION

5.1 NATURAL GEOGRAPHIC CHARACTERISTICS AND ENVIRONMENTAL STATUS

5.1.1 LOCATION

The Tay Mo waste transfer station is located in the territory of two communes: Juan Fungi and Taiyo Mo, at the coordinates 21° 01.060 North latitude and 105° 45.009 East longitude, at the end of the road connecting between Cau Nga shooting ground and National Road No 32 along Nhue river.

Tay Mo commune is located in the South of Tu Liem district, bounded in the North with Xuan Phuong commune, in the South with Dai Mo commune, in the East with Me Tri commune, of Tu Liem district, in the West with An Khanh commune of Hoai Duc district, Ha Tay province. In the vicinity are the Mechanical Factory No 5, Tu Liem brick enterprise, Cau Nga shooting ground, Hanoi detention camp.

The site of the transfer station is about 10 km away from the center of Hanoi, in the trapezoidal shape, covering 45,900 m^2.

- In the North it is bounded with the water morning-glory field of Tay Mo commune, 300 m from the Hanoi detention camp.
- In the East it is bounded with the Cau Dien waste processing plant, 150 from the Nhue river.
- In the South it is bounded with a canal, 1,000 m from the Lang - Hoa Lac express way.
- In the West it is bounded with the paddy field of Tay Mo commune.

5.1.2 TOPOGRAPHY

The site intended for construction of the transfer station comprises all the existing Tay Mo waste dump site covering 25,900 ha with elevation of 8 m above the paddy field and 2,000m^2 paddy field of Tay Mo commune with maximum elevation of 4.9-5.1m. Around the site is fish ponds formed by excavating earth for brick kiln

Tay Mo waste dump site is used to be pits with depth of 1.5-2m formed by excavating earth materials for brick kiln. The site was improved to become waste cells

5.1.3 AIR ENVIRONMENT

The project site is located in the western suburb of Hanoi, so it bears the general climatic characteristics of Hanoi area, which is of hot and humid tropical monsoon climate.

Air environment:

The study site is a waste dump site of Hanoi city. Here wastes are dumped open without covering according to the regulation, causing unpleasant odor, badly affecting the environment. Besides influences of the dump site, every day hundreds of waste trucks come in and go out from the site creating dust pollution (dust measured is much higher than the permissible level). Results of air survey and measurement in the transfer station (see the location of sampling points) of the CCET on July, 29 1999 are presented in the table below:

Table 5.1: *Results of air analysis in Taymo transfer station*

N°	Indicator	Sample Marks				TCVN 5937 - 1995
		TM01	TM02	TM03	TM04	
1	NO_x (mg/m^3)	0.06	0.048	0.052	0.055	0.4
2	NH_3 (mg/m^3)	0.43	0.36	0.33	0.38	-
3	CH_4 (mg/m^3)	0.45	0.65	0.5	0.55	-
4	CO (mg/m^3)	0.4	0.5	0.4	0.47	40
5	CO_2 (mg/m^3)	310	321	254	307	-
6	SO_2 (mg/m^3)	0.12	0.225	0.12	0.17	0.5
7	H_2S (mg/m^3)	0.04	0.03	0.2	0.03	0.008 *
8	Dust (mg/m^3)	0.45	0.36	0.44	0.42	0.3
9	Noise (dB)	60-65	55-58	50-55	55-58	70 **
10	RH (%)	80	80	70	80	-
11	Temperature (°C)	32	32	39	35	-
12	P (mmHg)	715	710	710	710	-
13	Wind direction	ES	ES	ES	ES	-
14	Wind velocity (m/s)	0.3-0.8	0.3-0.5	0.2-0.6	0.5-0.8	-

** Taken form TCVN 59338-1995*

Sample TM01 and TM02 is taken from Cau Dien Waste treatment plant
Sample TM03 is taken within the transfer station
Sample TM04 is taken on the access road to the site

Remarks:Dust content of all of 4 samples are 1.2-1.5 times higher than the permissible level. The content of NH_3 as compared with TCVN 5938-1995 is 1.65-2.2 times higher, content of H_2S 3.75-25 times. The content of CH_4

is quite high.

5.1.4 HYDROLOGY

The site is 150 m West of Nhue river. The Nhue river is a branch of the Red river. It originates from the Chem sluice (Lien Mac commune), flows in N-S direction through Noi, Dien, Ha Dong bridge, crossing Thanh Oai, Thong Tin, Phu Xuyen districts and then to Nam Ha province. The section of the Nhue river flowing across Hanoi is 25 km long, 45 - 56 m wide. From the ancient time the Nhue river has been receiving storm water and waste water from the South of Hanoi through Thanh Liet gate. The catchment area of the river is 107,000 ha. The designed water level for the Nhue river at Ha Dong is + 5.44m ; at Dong Quan is + 4.83m; at Phu Ly is + 4.4m. However, the flow regime is very complicated as the Nhue river serves both as a drain during flood and a supply source during the drought for area south of Ha Dong. In the South adjacent to the study site is the flood releasing canal of Hoai Duc district, Ha Tay province, which is 5 - 6 m wide, 1 m deep.

The site is now beyond the flood area.

In the study area, the leachate from the waste dump site, which is not collected, flows out the surrounding environment and Nhue river in a black color, generates unpleasant odor affecting the environment. The analysis results of sample taken in typical points (see the location of sampling point) of the CCET are presented in the table 5.2 below:

Table 5.2: *Results of surface water analysis in Taymo transfer station*

N°	Indicator	Sample Marks			TCVN 5942 - 1995 (column B)
		TM02	TM03	TM04	
1	COD (mg/l)	228	400	18.4	< 35
2	BOD_5 (mg/l)	98	281	7.4	< 25
3	Phenol (mg/l)	0.02	0.4	0.01	0.02
4	Cyan (mg/l)	0.1	0.3	0.004	0.05
5	As (mg/l)	0.00025	0.00038	0.00096	0.1
6	Pb (mg/l)	0.0068	0.018	0.0105	0.1
7	Cu (mg/l)	0.0004	0.019	0.0048	1
8	Zn (mg/l)	0.0023	0.6604	0.0294	1
9	Cd (mg/l)	0.0006	0.005	0.0006	0.02
10	Hg (mg/l)	0.0021	0.00092	0.0005	0.002
11	Mn (mg/l)	0.46	1.64	0.09	0.8
12	Ni (mg/l)	0.24	0.38	0.13	1.0

N°	Indicator	Sample Marks			TCVN 5942 - 1995 (column B)
		TM02	TM03	TM04	
13	Cr (VI) (mg/l)	0.0074	0.007	0.006	0.05
14	F (mg/l)	1.07		0.56	1.5
15	Ca (mg/l)	64	80	24	-
16	Mg (mg/l)	25.2	54	7.2	-
17	Coliform (MPN/100ml)	0	5400	40	10,000
18	Sulfate (mg/l)	6.0	8.0	4.0	-
19	pH	8.2	8.5	7.2	5.5 - 9.0
20	Fe (mg/l)	0.7	0.98	3.49	-
21	NO_2 (mg/l)	0.05	-	0.0	0.05
22	NH^+_4 (mg/l)	120	130	6	1
23	NO_3 (mg/l)	0.0	0.0	0,0	15
24	Clorua (mg/l)	241.8	446.71	17.73	-

Sample TM02 is taken from fish pond of the household living next to the transfer station
Sample Tm03 is taken from fish pond of Ha Noi detention camp
Sample TM04 is taken from Nhue river

Remarks: In general, surface water quality in the study area is not ensuring and bears the influence of the dump site. COD, BOD_5, Cyanua, Phenol, Nh^+_4 content in sample TM02 and TM03 is higher than the permissible level, content of mercury in sample TM02 is higher than the permissible level.

5.1.5 GEOLOGY AND HYDROGEOLOGY

**Geological setting*

In the study area are present the following stratigraphic units:

- *Upper Pleistocene marine sediments (Q_{III}):*

These sediments are exposed on the land surface at the elevation of over 10 m. They have typical motley red and white color in the upper part, changing to gradually to deep yellow, brown, white Grey and blue Grey in the deeper part. When dry they are in blue white color, with massive structure, uniform both in area and in depth, stiff and medium stiff. If soaked in water they become rapidly plastic. In mineral composition they are mainly composed of kaolinite. According to the petrography composition they are divided into the following layers: Silty clay is usually occurs in the lowest part on the surface of the Pleistocene alluvial- marine sediments, in some cases in the

form of interlayer between the layers of the same formation. They are in yellow, light yellow color, plastic when wetted, with a thickness of 2 - 3 m, rarely 4 - 5 m. The silty clay has a typical motley color of the formation, with low water content, over 10 m thick. The top clay layer is 5 m thick with easily recognizable yellowish blue, bluish color in the upper part and light yellow color in the lower. When dry it has grey white color.

- *Pleistocene alluvio-marine sediments (Q_{II-III}):*

These sediments occur at the depth of 35 - 40 m. The lower layer is composed of ash grey or brown grey color, with poly-mineral composition but composed mainly of quartz. The grain size increase upward, consisting of sand, poorly rounded gravel, with grain size varying widely from 1 cm to 7 cm and larger. The upper part is an organic soil layer consisting of black and black grey, thin bedded clayey sand, intercalated with 2 -5 cm sandy clay layers. The sand content increases with the depth. This layer contain well preserved plant remains, mainly grey color leaves, which become black when dry, occurring in layers parallel with the bedding of the sandy clay. The thickness of these sediments is 3 - 5 m. Hydraulically these sediments are the upper part of the confined aquifer.

* ***Hydrogeological characteristics***

To study the hydrogeological characteristics, the Hydrogeological Faculty-University of Mining and Geology investigation bored the borehole P1 at Tay Mo waste processing plant (Cau Dien) and conducted hydrogeological experiment . The results show that there exist aquifers as follow:

- *Aquiclude in upper Pleistocene sediments (Q_{III}):*

The sediments in this aquiclude have complicated composition. They are exposed on the surface and extend to the depth of 44.3 m. The depth of occurrence and lithological composition of each layers in are this layer as follows:

From 0 to 2 m: made ground, with mixed composition, containing broken brick.

From 2 to 18 m : Motley yellow brown, red brown stiff to very stiff silty clay. The thickness of this layer is 16 m. This silty clay layer is a low permeability layer or called confining layer.

From 18 to 22.2 m is a yellow brown soft mixed silty sand and silty clay layer.

In general, this layer has small permeability coefficient of 10^{-6}-10^{-7}m/s

- *Confined aquifer in Pleistocene sediments (Q_{II-III})*

This aquifer is discovered at boreholes P1 at the depth of 44.3 m to 60 m. These sediments are composed mainly of poly-mineral sand, cobbles, gravel with lithological composition of this layer as follows:

From 22.2 to 34.5 m is a intercalating sand layer with a thickness of 12.3 m. This layer is composed of light yellow medium grained sand mixed with

fine grit with size 2 - 4 mm. This is an aquifer with static water level of 10.5 m. This layer has high permeability and the groundwater here is of good quality. All UNICEF type wells tap the groundwater in this layer for domestic water supply of the people.

From 43.5 to 40 m is an ash grey medium stiff silty clay layer. This is a low permeability layer or relatively confining layer.

From 40.0 to 44.3 m, is a water bearing layer, with a thickness of 4.3 m, composed mainly of yellow medium grained sand mixed with grits 2 - 4 mm in size.

According to the result of pumping test at the borehole in Tay Mo, the discharge of this aquifer is 9.8 l/s, with average drawdown 12.5 m. The static water level is 10.76 m. The water is of bicarbonate -chloride-magnesium-sodium chemical type. The water in this aquifer is of good quality. with abundant reserve. Therefore the groundwater in the Q_{II-III} aquifer is now the main source for exploitation of the wellfields in Hanoi.

The site is 3 km away from Mai Dich well field which is downstream from it in the groundwater flow which is the source of water supply for Hanoi. Quality of ground water are shown in the table below:

Table 5.3: *Results of groundwater analysis by the CCET on July, 29 in Taymo transfer station*

N°	Indicator	Sample Marks		TCVN 5944 - 1995
		TM01	TM05	
1	COD (mg/l)	4.0	2.4	-
2	BOD_5 (mg/l)	1,2	0	-
3	Phenol (mg/l)	0.008	0.01	0.001
4	Cyan (mg/l)	0.001	0.001	0.01
5	As (mg/l)	0.00061	000077	0.05
6	Pb (mg/l)	0.0026	0..0026	0.05
7	Cu (mg/l)	0.0015	0.0024	1.0
8	Zn (mg/l)	0.0071	0.0166	5.0
9	Cd (mg/l)	0.004	0.0005	0.01
10	Hg (mg/l)	0.00017	0.00038	0.001
11	Mn (mg/l)	0.06	0.23	0.1 - 0.5
12	Ni (mg/l)	<0.01	0.15	-
13	Cr (VI) (mg/l)	0.006	0.05	0.05
14	F (mg/l)	0.047	0.5	1.0

N°	Indicator	Sample Marks		TCVN 5944 - 1995
		TM01	TM05	
15	Ca (mg/l)	26	24,0	-
16	Mg (mg/l)	36.6	21.8	-
17	Coliform (MPN/100ml)	0	0	3
18	Sulfate (mg/l)	0.5	1.0	200-400
19	pH	8.0	7.5	6.5 - 8.0
20	Fe (mg/l)	0.14	0.3	1 - 5
21	NO_2 (mg/l)	0.0	0.0	-
22	NH^+_4 (mg/l)	0.0	0.0	-
23	NO_3^- (mg/l)	1.72	2.06	45
24	Clorua (mg/l)	17.73	19.5	200-600

Sample TM01 is taken from the drilled well of household living next to the transfer station

Sample TM05 is taken from drilled well in mechanical living quarter , 200 away from the transfer station

Remarks: In general, the water quality is good except for Phenol content which 8-10 times higher than the permissible level

* *Ecological environment in the study area*

Flora: The present plant ecosystem in the study area is a cultivated ecosystem, consisting of eucalyptuses, senna, water morning-glory

The terrestrial fauna consist of wild animals which are small beast such as rat, reptilians like snakes, amphibians such as frogs insects...

Aquatic fauna mainly comprise fish, shrimps, soft-shelled turtle, clam, snail, etc. in paddy field. However these natural species are not numerous due to the pollution caused by the leachate from the waste dump site.

5.2 SOCIO-ECONOMIC CHARACTERISTICS.

5.2.1 SOCIO-ECONOMIC CHARACTERISTICS OF TAY MO COMMUNE.

a. Population

The site intended for construction of the transfer station is located in the territory of Tay Mo commune, Tu Liem district, Hanoi. Therefore the socio-economic survey was carried out mainly in Tay Mo commune.

According to the data from the People's Committee of the commune, the population of the commune is 10,548 inhabitants living in 2,300 households. The average population growth rate is 0.76 %.

Chairman: Mr. Nguyen Dinh Kien

Deputy Chairman: Mr. Bui Huu Hon

Tel: 8 390044

b. Infrastructure

The commune has 618 ha of land, of which 65.3 ha is residential land, 370 ha is agricultural land which include 338 ha of paddy field and 32 ha of dry crops and other crops. The paddy productivity reaches 4.8 tons/ha.
Public facilities and infrastructures within the Tay Mo commune comprise 7 small scale factories and enterprise, 2 schools, 1 clinic, 10 pagodas and temples, one central water supply station. The road system consists mainly of concrete and asphalt roads. 100% of population have access to electricity. Main sources of domestic water are ground water and rainwater. According to statistic, the whole commune has 300 drilled well, 30m deep on average and a water supply system. 20% of population use toilet with septic tank, 80% use two compartments latrine.

The study area is mainly in Nhue Giang village. This village has 84 households with 22 ha of farm land, of which 2 ha is occupied by fish ponds.

c. Main occupation

Agriculture is the main occupation in the commune. About 88 % of households are engaged in agriculture and the remaining 12 % live on other occupations.

5.2.2 SOCIO-ECONOMIC CHARACTERISTICS OF THE TRANSFER STATION AND ITS VICINITY.

a. In the transfer station.

Within the transfer station, there isn't any household (see detail description in the 3.4 below).

b. In the vicinity (within distance of 200m from the site boudary)

Around the transfer station, there are 35 households and Hanoi detention camp with 60 prisoners. In the East of the site are Cau Dien Waste treatment plant and Shooting ground of Hanoi detention camp.

5.2.3 RESULTS OF HOUSEHOLD SURVEY ON ENVIRONMENTAL CONDITIONS IN THE PROPOSED SITE

During the surveys, we cooperated with communal People's committee, worked with communal leaders, statistical department and collected information on land use status around the project area, socio-economic conditions of the commune. We also interviewed 30 households in the area

intended for the transfer station and the vicinity. The results of the survey and interview show that:

+ *As regards the surrounding environment :*

- Severely polluted: 80 %,
- Not severely polluted: 20 %
- Not polluted: 0 %

+ *Evaluation of the interviewees on the degree of pollution (in %):*

Degree	Severely polluted	Not severely polluted	Not polluted
Aspect			
Waste	80%	20%	0
Water resource	73.3 %	16.7 %	10 %
Odor	80 %	20 %	0
Gas, dust	70 %	20 %	10 %
Noise	50 %	16.7 %	33.3 %
Vibration	33.3 %	30 %	36.7 %

+ *As regards the degree of pollution caused by the surrounding solid wastes:*

53.3 % - Polluted, 46.7 % - Not very clean, 0%: Clean

+ *Point of view of the population about the construction of the transfer station:*

3.3% of them agree with the construction of the transfer station,
93.4 % not agree and
3.3 % giving no idea.

5.3 ACCESSIBILITY OF THE INTENDED TRANSFER STATION

5.3.1 DISTANCE OF WASTES TRANSPORTATION

The distance and time of truck travel from URENCO office to the transfer station are 11.6 km and 25 minutes respectively.

The distance and time of truck travel from the transfer station to Nam Son landfill are 47.4 km and 1.20 h respectively.

5.3.2 TRAFFIC FLOW ON THE ACCESS ROAD TO THE TRANSFER STATION

At present the access road to the transfer station is the same road for the trucks to Tay Mo waste dump site. The distance from the National Highway No 32 to the site of transfer station is 3,000m. The road is 5 - 6 m wide. According to the data up to 27 July 1999, in average in one peak hour there are 17 waste trucks and in one non peak hour thee are 30 waste trucks.

5.3.3 ACCESS ROAD TO THE TRANSFER STATION

* *Access road to the transfer station.*

At present the access road to the transfer station is the same road for the trucks to Tay Mo waste dump site. This road section is asphalt road 3,000m long and 5 - 6 m wide. When the transfer station is built the access road to the stationdoes not ensure the travel of 25 - 35 tons capacity trucks so a new access road must be built or the old road should be upgraded. Because the existing road is in bad condition, some part is cracked causing vibration and affecting residential houses along the road

- *Upgrade of the existing road*

The existing access road to the transfer station need to be expanded to 8 m wide to be sufficient for large trucks to travel. If the road is expanded to 8 m wide with free space on each side of 1.5 m wide, an area of 18,000 m^2 of land must be cleared and compensated with the current price of 1,000,000 VND/1m^2 and houses of 230 households need to be compensated

- *Construction of new road*

As the transfer station is 1,000 m away from the Lang - Hoa Lac expressway, it is possible to build a new access road to the transfer station from the Lang - Hoa Lac expressway with a cost of 183,400 VND/ m^2 and a compensation for of 10,000 m^2 of paddy field to Tay Mo commune with the current price of 32,500 VND/ m^2 of class I farmland and 19,300 VND/m^2 of class II farmland, plus the price for construction of infrastructure of Tay Mo commune as negotiated with the local authorities. Exit road will follows Lang-Hoa Lac road to Thang Long-Noi Bai express way.The distance from the transfer station to Nam Son landfill is 48.3km and population living along the road is not affected.

* *Households living along the access road to the transfer station*

Along the access road, there are 443 households, 6 State agencies, 1 military unit and 2 pagodas.

5.3.4 CURRENT STATUS OF THE TRANSFER STATION

The study area is a part of the Tay Mo waste dump site with an area of 25,900 m^2 accounting for 55,56% of the area of the transfer station and 20,000 m^2 of paddy field land of Tay Mo commune.

At the existing waste dump site, the waste layer is dumped to the elevation of about 8 to 10 m above the land surface. At present, waste is not dumped at waste cell No 1 but at waste cell No 2 B (see the drawing). The wastes are not covered with land, causing unpleasant odor.

Due to the discharge of the leachate from the waste dump site, rice in the fields of Tay Mo commune has low output. At present, every year the URENCO must compensate 195,000 VND/360 m^2 of paddy field and 0.3 kg of fish/1 m^2 of fish ponds to the population in the Tay Mo commune.

Analysis results of dissolved composition of 02 soil samples (sample TM01 is taken from garden of household living next to the transfer station, TM02 is taken form paddy field adjacent to the transfer station) are presented in the

table below:

Table 5.4: *Results of soil samples analysis in Taymo transfer station*

N°	Indicator	Sample Marks	
		ĐTM 1	ĐTM2
1	Hg (mg/kg dry soil)	1.0×10^{-5}	1.46×10^{-5}
2	As (mg/kg dry soil)	0.68×10^{-4}	0.87×10^{-4}
3	Pb (mg/kg dry soil)	0.01	0.02
4	Cu (mg/kg dry soil)	0.184	0.0123
5	Fe (mg/kg dry soil)	4.0	4.5
6	Al (mg/kg dry soil)	10.8	10.8
7	CaO (mg/kg dry soil)	0.84	0.84
8	MgO (mg/kg dry soil)	1.8	1.6
9	Mn (mg/kg dry soil)	0.074	0.056
10	Clo (mg/kg dry soil)	0.0139	0.0142
11	pH	6.7	6.6

5.3.5 ISSUES TO BE NOTES

- Due to bad influence of the existing Tay Mo waste dump site to the living environment, local people is currently blocking the road to prevent waste trucks from entering the dump site. Therefore, residents in the area will oppose to the construction of the transfer station
- The proposed transfer station is located 3km away from Mai Dich wellfield. If the transfer station is constructed here, the top clay layer must be protected. No harm to this layer is permitted
- If the transfer station is constructed, a new 1km long access road connecting the transfer station with Lang-Hoa Lac express way is proposed to be built.
- No household is found living within the transfer station. Around the site, there are 35 households and a deteention camp with 60 prisoners. In the East of the site is shooting ground of the detention camp where there are 22 graves of prisonners.

5.4 COMMENTS OF THE SURVEY TEAM

- *As regards the area of the site: The area of the site is not wide enough (4.5 ha) even when the nearby paddy field of Tay Mo communeis added*
- *As regards distance: far from waste generating places, far from the landfill, near the population area.*
- *Access road: The old 3 km long road is not satisfied. It must be*

upgraded or a new 1 km long road must be built. Once the new access road is built, waste transportation will be favorable

- *Topography of the site: The topography of the site is unfavorable for the construction of the transfer station as it is on the ground of an old waste dump site and the waste must be moved away to consolidate the foundation*
- *Geological setting. The geological setting of the site ensure good conditions for the construction of the transfer station.*
- *Ground condition: On the ground at the site there is a thick clay layer (20 m thick), ensuring good conditions for the construction of the transfer station.*
- *Surface water: The transfer station is located beyond the flood area.*
- *Groundwater. In the area of the transfer station there is no contact between the waste and the groundwater.*
- *Location: the transfer station is located in the suburb of Hanoi, not in the area planned for development of the city.*
- *Distance to residential area: the transfer station is near population, at a distance of only 100 m from a residential area of Tay Mo commune.*
- *Environment: Due to the impacts of the old waste dump site, the area is governed by unpleasant odor. Here the leachate spills out affecting the water environment, production and health of residents.*
- *Public involvement, politics: The local people and authorities do not support the construction of the transfer station.*
- *Site clearance: This is an old waste dump site of Hanoi city, the site clearance will be quick, not affecting the population. The land of the old waste dump site covering 25,900 m^2 is the land of the city, not requiring compensation. The site clearance of the 20,000 m^2 of paddy field land of Tay Mo commune is also easy.*
- *Others: the study area is 3 km from the wellfield of Mai Dich water plant that is in the downstream of the groundwater flow which serves as water supply source for Hanoi.Therefore, special attention should be paid so as not to break the clay layer which protect this aquifer.*

II.6 NOI DU TRANSFER STATION

6.1 NATURAL GEOGRAPHICAL CHARACTERISTICS AND ENVIRONMENTAL STATUS

6.1.1 LOCATION

The proposed Noi Du transfer station is located in Du Ngoai village, Mai Lam commune, Dong Anh district, within the coordinate:

20°05'20" - 20°05'31" North latitude

105°53'54" - 105°54'02" East longitude

- In the North: it's bounded with paddy field of Du Ngoai village, Mai Lam commune
- In the East: it is bounded with paddy field and Construction material export-import Company
- In the South: it is bounded with National road No3
- In the West: it is bounded with low-lying paddy field of Mai Lam commune

6.1.2 TOPOGRAPHY

The proposed Noi Du transfer station is located in a submerged low-lying area covering 5ha and divided into 03 parts:

- *Fish pond*: Close to the National Road No3, covering an area of 0.6 ha and has average depth of 1.2-1.5m
- *Spinach-growing area* : Covering an area of 2.6 ha next to the fish pond. The terrain is sloped to the South-West. This part has maximum elevation of 4.8-5.6 m
- *Rice field*: Covering an area of 1.8 ha. The terrain is sloped to the South.The maximum elevation is 5.6-5.9m

The proposed site is surrounded by low-lying area which is often submerged. This area is covered by rice in one crop and dry crop in the other. The main drainage is in North-West direction

6.1.3 AIR ENVIRONMENT

According to results of measurements at 4 different location in Noi Du transfer station on August, 5th 1999, the environment is quite clean and there is no sign of pollution. Almost all the indicator is many times below the permissible level. The analysis results is presented in table 6.1 below:

Table 6.1: *Soil analysis result at Noi Du transfer station*

No	Indicator	Sample mark				TCVN 5937 - 1995
		ND1	ND2	ND3	ND4	
1	NO_x (mg/m^3)	0.02	0.028	0.02	0.025	0.4
2	NH_3 (mg/m^3)	<0.01	0.06	0.10	0.08	-
3	CH_4 (mg/m^3)	0.30	0.30	0.30	0.30	-
4	CO (mg/m^3)	0.20	0.20	0.20	0.20	40
5	CO_2 (mg/m^3)	176	198	110	150	-
6	SO_2 (mg/m^3)	<0.01	0.01	0.02	0.02	0,5
7	H_2S (mg/m^3)	<0.01	0.01	0.01	0.01	0.008 *
8	Dust (mg/m^3)	0.10	0.12	0.11	0.13	0.3
9	Noise (dB)	45 - 51	48 - 50	50 - 55	48 - 50	70 **
10	RH (%)	75	75	72	74	-
11	Temperature (°C)	34	35	38	35	-
12	P (mmHg)	720	710	710	710	-
13	Wind direction	ĐN	ĐN	ĐN	ĐN	-
14	Wind velocity(m/s)	0.6 - 0.8	0.3 - 0.5	0.6 - 0.8	0.5 - 0.6	-

** Taken from Vietnamese Standard TCVN 5938 -1995*

*** Taken from Vietnamese Standard TCVN 5949-1995*

6.1.4 HYDROLOGY

The project area is crossed by Duong river in the South and surrounded by Ngu Huyen Khe in the West and NW (some 1.5-2m away)

According to statistics of Thuong Cat monitoring station, the maximum total water flow in Duong river is 5884m^3/s in July. The minimum is 895m^3/s in February and the mean water flow is 2197m^3/s. In addition, the proposed site is also bounded with Ngu Huyen Khe river in the East of the site.

Within the site, there is a lake covering an area of 1 ha. Water in this lake is rather muddy and contains many organic substances (see the analysis results of sample ND01). Around the site, there system of irrigation channels and some small ponds which is now being used for fish breeding. Analysis results of surface water samples are presented in the table below:

Table 6.2: *Analysis result of surface water in Noi Du transfer station*

No	indicator	Sample mark			TCVN 5942 - 1995 (column B)
		ND01	ND03	ND03	
1	COD (mg/l)	13.6	14.4	22.4	< 35
2	BOD_5 (mg/l)	5.6	6.2	8.8	< 25
3	Phenol (mg/l)	0.006	0.003	0.005	0.02
4	Cyanua (mg/l)	0.005	0.003	0.003	0.05
5	As (mg/l)	0.00138	0.00212	0.00178	0.1
6	Pb (mg/l)	0.0015	0.0027	0.0037	0.1
7	Cu (mg/l)	0.0152	0.0055	0.0004	1
8	Zn (mg/l)	0.0028	0.0144	0.0024	1
9	Cd (mg/l)	0.0009	0.001	0.0008	0.02
10	Hg (mg/l)	0.00048	0.00019	0.00082	0.002
11	Mn (mg/l)	0.18	0.05	0.11	0.8
12	Ni (mg/l)	0.003	0.012	0.025	1.0
13	Cr (VI) (mg/l)	0.003	0.0026	0.001	0.05
14	F^- (mg/l)	0.20	0.30	0.28	1.5
15	Ca (mg/l)	50.0	52.0	20.0	-
16	Mg (mg/l)	14.4	14.4	7.2	-
17	Coliform (MPN/100ml)	18	30	14	10000
18	Sulphat (mg/l)	2.0	4.0	5.0	-
19	pH	7.5	7.5	7.2	5.5 - 9.0
20	Fe (mg/l)	1.39	1.39	1.39	-
21	NO_2 (mg/l)	0.00	0.07	0.00	0.05
22	NH^+_4 (mg/l)	0.20	0.06	0.30	1
23	NO_3^- (mg/l)	3.10	2.75	1.03	15
24	Clorua (mg/l)	14.18	24.82	21.7	-

- ND 01 : Taken from fish pond at the site

- ND 02 : Taken from irrigation channel near the previous pumping station

- ND03 : Taken from drainage channel in the North of the site (Dong tao area)

Remarks: According to the analysis results, content of substances is below the standard limits . Surface water in the area is clean and there is no sign of pollution (as compared with TCVN 5942-1995 column B).

6.1.5 HYDROGEOLOGY

In the study area exist 2 aquifers and one aquiclude as follows:

1. *Holocene aquifer*: This aquifer is exposed right on the land surface. It occurs to the depth of 18 - 24 m. On top it is covered by a thin silty clay layer (cultivation layer). Lithologically this aquifer is composed of fine grained sand, sandy sand, silty clay. The water bearing capacity is moderate to low. The pH value is 7.3, the total dissolved solid (TDS) content is M = 0.39 g/l. The water level of this aquifer strongly varies in seasons, depending on the water level in the Duong river.

2. *Aquiclude in upper Pleistocene sediments*: This aquiclude occurs in the form of lenses of clay in the area. Lithologically it is composed of low permeability silty clay, sandy clay, silt. Its depth of occurrence is 22 - 26 m.

3. *Pleistocene aquifer*: This aquifer occurs all over the area, at the depth of 25 - 58 m. This is the main source of groundwater exploitation in the area. Lithologically it is composed of medium to coarse grained sand mixed with quartz gravel in the upper part and cobble, gravel mixed with some quartz sand in the lower part, with high water bearing capacity. In the study area, the clay layer separating the Holocene and the Pleistocene aquifers is in many places eroded away, forming hydraulic windows between these two aquifers. The pH value is usually 7.5, the total dissolved solid (TDS) is M = 0.29 g/l. The groundwater is of bicarbonate-chloride type.

   The water level regime of this aquifer is under the influence of the flow of the Red river and the Duong river, varying strongly in seasons.

   The result of survey at some wells in the area show that the local people exploit and use the groundwater from the depth of 30 - 35 m. In flood season the groundwater in the wells is equal to the ground surface. In the dry season it is 2.5 - 3.0 m below the surface. The groundwater has low TDS. The phenol content in the groundwater exceeds the permissible level. The iron content in the drilled wells is high (16.75 - 27.9 mg/l), therefore the water cannot be used directly. In particular, sample ND04 has Hg content exceeding the permissible level (0.013 mg/l). The result of groundwater sample analysis are presented in the following table:

Table 6. 3:*Analysis result of groundwater at Noi Du transfer station*

No	Indicator	Sample mark		TCVN 5944 - 1995
		ND04	ND05	
1	COD (mg/l)	5.6	5.6	-
2	BOD_5 (mg/l)	2.2	2.0	-

No	Indicator	Sample mark		TCVN 5944 - 1995
		ND04	ND05	
3	Phenol (mg/l)	0.005	0.006	0.001
4	Cyanua (mg/l)	0.006	0.003	0.01
5	As (mg/l)	0.00124	0.000118	0.05
6	Pb (mg/l)	0.0022	0.0027	0.05
7	Cu (mg/l)	0.0006	0.0007	1.0
8	Zn (mg/l)	0.00194	0.0056	5.0
9	Cd (mg/l)	0.0009	0.0003	0.01
10	Hg (mg/l)	0.0013	0.0002	0001
11	Mn (mg/l)	0.15	0.38	0.1 - 1.5
12	Ni (mg/l)	0.11	0.035	-
13	Cr (VI) (mg/l)	0.003	0.001	0.05
14	F (mg/l)	0.15	0.10	1.0
15	Ca (mg/l)	55.0	50.0	-
16	Mg (mg/l)	16.2	14.4	-
17	Coliform (MPN/100ml)	48	0	3
18	Sulphat (mg/l)	0.0	0.0	200-400
19	pH	7.5	7.5	6.5 - 8.0
20	Fe (mg/l)	16.75	27.92	1 - 5
21	NO_2 (mg/l)	0.0	0.0	-
22	NH^+_4 (mg/l)	4.0	2.8	-
23	NO_3 (mg/l)	0.0	0.0	45
24	Clorua (mg/l)	5.32	42.54	200-600

- *ND04: Taken from drilled well of Printing material export-import company (60m to the East of the site)*
- *ND05: Taken from drilled well of residential area in the North-West of the site.*

6.2 SOCIO - ECONOMIC CHARACTERISTICS :

6.2.1 SOCIO - ECONOMIC CHARACTERISTICS OF MAI LAM COMMUNE.

a. Population

Mai Lam commune has a population of 9963 inhabitants living in 2214 households. The annual growth rate is 1.6% and the natural area is 584.08 ha. The commune has of 7 village : Du Ngoai, Du Noi, Thai Binh, Phuc Tho,

Le Xa, Loc Ha and Mai Hien. The communal people's committee is located in Mai Hien village, tel 048 832003.

b. Infrastructure

Within the commune, there are many enterprises such as Wooden workshop for interior decoration of Kim Quy Co.ltd, Mechanical - installment company (under Hanoi construction corporation), printing material export - import company...

The commune has 01 lower - secondary school (level II) with 668 pupils, 01 primary school (level I) with 875 pupils. There isn't any hospital but a communal clinic with 08 beds.

The internal road of the commune is concrete and asphalt road. 100% of households has electricity.Main sources of domestic water are ground water and rainwater. According to statistic, 45% of the household use water taken from drilled well (with the depth of 22m on average). The rest use water from dug well and rain water tanks. 43.6% of the population in the commune use toilet with septic tank, 50% use two compartments latrine and 6.4% use others

c. Main occupation

Farming, animal husbandry and working in factories or enterprises within the commune are major occupation of local people. A small portion involve in commercial activities (mainly along National road N° 3). According to statistics, the mean income in of people in the commune is 110,000 VND/capital/month.

6.2.2 SOCIO-ECONOMIC CHARACTERISTICS OF THE TRANSFER STATION AND ITS VICINITY.

a. In the transfer station.

The transfer station is occupied by paddy field and other dry crops so theere is no population living within the site boundary. However, there are 22 graves.

b. In the vicinity

Within distance of 200m from the site boundary, there are 12 households living in Du Noi village. In the SE of the site is Export-Import printing materials enterprise and. Population here live mainly on farming and small bussinesses. If the transfer sation is selected, there is no need for land acquisition or house relocation ecxept 22 graves.

6.2.3 RESULT OF HOUSEHOLD SURVEYS ON ENVIRONMENTAL CONDITIONS

During the survey, we have cooperated with communal People's committee worked with chairman and statistical department to collect information on land use status and socioeconomic condition of the locality. We have interviewed 33 households living in Du Noi, Du Ngoai villages (most of

them live near the site and have cultivation land within the site) and those living in military living quarter (West of the site)

The results of surveys and interviews show that:

+ *As regards the surrounding environment :*
  - Severely polluted: 0 %,
  - Not severely polluted: 63.64 %
  - Not polluted: 36.36 %

+ *Evaluation of the interviewees on the degree of pollution (in %):*

Degree	Severely polluted	Not severely polluted	Not polluted
Aspect			
Waste	3.0%	60.6%	36.6%
Water resource	0.0 %	30.3 %	69.7 %
Odor	0.0%	6.1 %	93.9%
Gas, dust	0.0 %	21.1 %	78.8 %
Noise	12.1 %	30.3 %	57.6 %
Vibration	9.1 %	15.1%	75.8 %

+ *As regards the degree of pollution caused by the surrounding solid wastes: 0 %* - Polluted, 15.2 % - Not very clean, 84.8%: Clean

+ *Point of view of the population about the construction of the transfer station:*
  60.6% of them agree with the construction of the transfer station
  39.4 % not agree.

6.3 ACCESSIBILITY OF THE INTENDED TRANSFER STATION

6.3.1 DISTANCE OF WASTES TRANSPORTATION

The distance and time of truck travel from the transfer station to Nam Son landfill are 33 km and 40-45minutes respectively.

The distance and time of truck travel from URENCO office to the transfer station are 13.5 km and 30 minutes respectively.

6.3.2 TRAFFIC FLOW IN THE ACCESS ROAD

The average number of vehicles in National road No3 is 256 trips per hour of which:

Kinds of vehicles	Number of vehicles	Ratio (%)
Small struck (under 4.5 tones)	80	31.25
Big struck (over 4.5 tones)	80	31.25
Small car under 16 seats	50	19.53
Passenger car over 24 seats	110	42.97
Minitrucks	16	6.25

6.3.3 ACCESS ROAD TO THE TRANSFER STATION.

The transfer station is adjacent to National road No3, 13.5km away from City centre. National road No3 is the artery connecting Hanoi with North-Eastern provinces, so the Road has good quality

- Kind of road: Asphalt road, in good condition
  Road way: 10m wide
- Road foundation: solidly consolidated and ensuring travel of big capacity trucks

Due to the above characteristics, construction of access road to the transfer station is easy and not very costly. However, since the transfer station is located North of the City, waste transportation route must run over two bridges (Chuong Duong and Duong bridge). This will increase the traffic densityin the road and bridge,affecting the esthetics

6.3.4 CURRENT LAND USE STATUS OF THE TRANSFER STATION

The proposed transfer station cover an area of 5 ha and is divided into 3 parts: 0.6 ha fish pond (accounting for 125 of the area of te site); a spinach-planting area of 26,000 m^2 (called as Ao ca), Accounting for 52 % of the area of the transfef statuion and a rice field of 16,000m^2 (called as Bay Dot), accounting for 36%. The land use status is as follow:

- Fishpond : Covering an area of 1 ha. This pond was tendered by Mrs. Sửu from co-operative for fish breeding in 5-year duration (from April, 1999 to April,2003 with tax of 8,3 million VND/year (according to the contract signed by Mrs. Suu with the Co-operative). Up to now, this family has invested over 30 million VND to improve the pond
- Ao ca : This a low-lying area, mainly covered by spinach and dry crops (1 crop per year , Winter - spring crop) This yield can be maintained for 4 - 6 months per year
- Bay Dot area ; mainly covered by paddy field with mean productivity of 120 kg/0,036 ha/crop.
- In general, this area is low and often submerged making difficult for cultivation. Therefore, it has low productivity and often suffer from crop failure.

Analysis results of dissolved composition of soil sample is presented in table below:

Table 6.4: *Analysis result of soil sample in Noi Du transfer station*

N°	Indicator	Sample mark	
		ND1	ND2
1	Hg (mg/kg dry soil)	0.000041	0.000052
2	As (mg/kg dry soil)	0.000089	0.00089

N°	Indicator	Sample mark	
		ND1	ND2
3	Pb (mg/kg dry soil)	0.0049	0.0029
4	Cu (mg/kg dry soil)	0.0494	0.0572
5	Fe (mg/kg dry soil)	3.8	4.30
6	Al (mg/kg dry soil)	5.93	5.93
7	CaO (mg/kg dry soil)	0.91	1.40
8	MgO (mg/kg dry soil)	1.55	1.60
9	Mn (mg/kg dry soil)	0.052	0.076
10	Clo (mg/kg dry soil)	0.0078	0.0097
11	PH value	6.9	7.1

ND1: Taken from drainage channel at the site
ND2: Taken from boundary in the West of the site (near residential area).

Currently, there is no building at the site. There are 22 tombs (6 of which were solidly built) and 2 temporary houses of 6m^2 . Additionally, there is an old pumping station (which is now out of operation) and drainage system

6.3.5 ISSUES TO BE NOTED

- Within the proposed transfer station, there are 22 tombs of residents living in Du Noi and Du Ngoai village of which 6 tombs are solidly built. If the transfer station is built here, these tombs need to be removed to the planned place.
- The site is low and often submerged in rainy season, this will be costly for foundation filling.
- The transfer station is covered by paddy field and there is no household living. There are 22 graves which need to be relocated.

6.4 COMMENTS OF THE STUDY TEAM

- *Acreage: The proposed site has an area of 5 ha and can be expanded so it meets the requirement.*
- ***Distance of waste transportation:*** *The proposed transfer station is located far from waste generating area but quite near landfill (13.5km from the city center, 33.0 km from Nam Son landfill) so cost for waste transportation is not high. However, since waste trucks have to go over 2 bridges (Chuong Duong and Duong bridge). This will have certain*

impacts on the esthetics and cause traffic jam.

- ***Access road:*** *The transfer station is by the National road No3 so it's favorable for waste transportation. Road ensure travel of big capacity trucks*
- ***Topography:*** *Most of the site is occupied by paddy field, only a small area is fish pond so it's favorable for construction*
- ***Geological setting:*** *According to results of geological survey, there is no faults or slides at the proposed transfer station. The site foundation ensure good condition for construction*
- ***Surface water:*** *the proposed site is unfavorable because it is located in low-lying area with poor drainage capability and vulnerable to flood*
- ***Ground water:*** *At the proposed site, the clay layer between Pleistocene and Holocene aquifer is discontinuous. So attention should be paid when constructing the transfer station*
- ***Environment:*** *The air environment is generally clean and there is no sign of pollution*
- ***Distance to residential area:*** *The transfer station is 600m away from the residential area so it's quite favorable*
- ***Land use status:*** *No solid structure is found within the transfer station. However, there are 22 tombs which is difficult resettlement*
- ***Public opinion:*** *Results of household survey revealed that most of household having cultivation land in the transfer station support the construction (60,6%). The rest (49.4%) oppose because their house is adjacent to the proposed site or on the access road to the site.*
- ***Land compensation:*** *The proposed transfer station is in agricultural land of low quality and productivity. This land hasn't been allocated to local resident for long-term use so land acquisition is easy and cost of compensation is low.*

II.7 THE PROPOSED TAM HIEP TRANSFER STATION

7.1 NATURAL GEOGRAPHICAL CHARACTERISTICS AND ENVIRONMENTAL STATUS

7.1.1 LOCATION

The proposed Tam Hiep transfer station is located in Huynh Cung village, Tam Hiep commune, Thanh tri district, suburb of Ha Noi. The proposed site is within the coordinates:

20^0 56' 33" - 20^0 56' 40" North latitude

105^0 49' 12" - 105^0 49' 16" East longitude

The proposed site is on the ground of the closed Tam Hiep landfill

- In the North: it's bounded with the paddy field of Tam Hiep commune
- In the North-East: it's bounded with a small fish lake and a military camp. Van Dien cemetery is a bit far away.
- In the East: It's is bounded with fish lakes and fish ponds
- In the South and South-West: It's bounded with irrigation channels of Ta Thanh Oai commune
- In the West are lakes, cultivation area and deserted brick kilns. A little bit far away, there locating mud-releasing site (Attracted from the sewers of Ha Noi drainage Company)

7.1.2 TOPOGRAPHY

The elevation of the proposed site varies strongly, the lowest area being only 0.2m above the water level of the lake and the highest area 2.7m. The center and the North-West of the site is very low whereas the South-East and the South-West is very high. The differential elevation is 2.5m. Nearly all the foundation is formed by organic humus and decomposed solid waste (since it's the previous dump site of the City which has been closed on July 1883 without covered by soil). Currently, the site is covered by vegetation density such as vegetables of all kinds such as banana, mangoes, potato and other kind of weeds

The topography of the vicinity is low, the maximum elevation varies 3.1-3.9m and the site slopes gently to the South-East

7.1.3 AIR ENVIRONMENT

The results of air survey and measurement at 4 typical locations of the transfer station on August,3-4 1999 are shown in the table below:

Table 7.1: *Air analysis result at Tam Hiep transfer station*

No	Indicator	Sample mark				TCVN 5937 - 1995
		TH1	TH2	TH3	TH4	
1	NO_x (mg/m^3)	0.028	0.016	0.03	0.028	0.4
2	NH_3 (mg/m^3)	< 0.01	< 0.01	< 0.01	< 0.01	-
3	CH_4 (mg/m^3)	0.34	0.38	0.4	0.38	-
4	CO (mg/m^3)	0.25	0.22	0.26	0.25	40
5	CO_2 (mg/m^3)	220	226	225	224	-
6	SO_2 (mg/m^3)	0.02	0.025	0.022	0.025	0.5
7	H_2S (mg/m^3)	0.05	0.08	0.06	0.07	0.008 *
8	Dust (mg/m^3)	0.09	0.18	0.15	0.168	0.3
9	Noise (dB)	45 - 55	47 - 50	51 - 57	48 - 51	70 **
10	RH (%)	65	60	60	60	-
11	Temperature (°C)	38	40	39	39	-
12	P (mmHg)	715	710	715	710	-
13	Wind direction	ĐN	ĐN	ĐN	ĐN	-
14	Wind velocity (m/s)	0.3 - 0.5	0.3 - 0.5	0.2 - 0.4	0.2 - 0.4	-

** Taken from Vietnamese Standard TCVN 5938 -1995*

*** Taken from Vietnamese Standard TCVN5949-1995*

Remarks: The analysis result show that the content of substances is below the standard limits except for H_2S content which is 10 times higher than the acceptable level (TH2), Metal content is very high.

7.1.4 HYDROLOGY

* *General characteristics.*

No main river is found flowing across the site.The only To Lich river, which is the drainage river of the city flows in the North-East of the site. In addition, there are some irrigation ditches and channels of Ta Thanh Oai and Tam Hiep commune supplying water for nearby rice fields

The site is surrounded by many lakes and ponds which is used to be soil quarry of DaiLa brick-producing enterprise.Waste water and rain water flow to channels, ditches and lakes and drain to the west of the proposed site (to Vinh Ninh village, Vinh Quynh commune

** Hydrological chartateristics of the proposed transfer station*

In the South-eastern part of the site , there is a irrigation channel,128m long and 4m wide supplying water for the whole area. Currently, water in this channel is almost stagnant. Most of the surface water is covered by water morning-glory and water-ferns.

In the North-east of the site, there is a fish-breeding lake separating the military camp and the site. This lake has L-shape, covering 30m^2 with two sides of 125m and 70m. The mean depth is 1.5-2.0m. The surface water acreage of 4,900m^2 . In the East and North-east of the site, there is a large lake with one side runing along the road (at a distance of about 120m) and the opposite side along irrigation channel in the South-west. The average depth of this lake is 1.5-2.5m and the surface water area is about 3ha. Currently, these two lake are leased by the family of Mr. Chi for fish breeding. Water in the lake is quite muddy (see the analysis result of water sample mark TH02)

In the North and North-West of the site, there are 3 fish ponds of local people in Ngau village, Ta Thanh Oai commune. Water in these lakes are almost stagnant, muddy and has bad smell. The analysis result is presented in table 7.2 (Sample mark TH03)

Table 7.2: *Analysis result of surface water at Tam Hiep transfer station*

No	Indicator	Sample mark				TCVN 5942 - 1995 (column B)
		TH02	TH03	TH05	TH08	
1	COD (mg/l)	16.8	19.2	16.8	30.4	< 35
2	BOD_5 (mg/l)	6.8	8.6	7.2	13.6	< 25
3	Phenol (mg/l)	0.005	0.005	0.001	0.001	0.02
4	Cyanua (mg/l)	0.003	0.003	0.002	0.005	0.05
5	As (mg/l)	0.00173	0.00156	0.00013	0.00353	0.1
6	Pb (mg/l)	0.0068	0.0028	0.0066	0.0041	0.1
7	Cu (mg/l)	0.004	0.007	0.0002	0.001	1
8	Zn (mg/l)	0.0023	0.0004	0.0006	0.0015	1
9	Cd (mg/l)	0.0006	0.0003	0.0005	0.0005	0.02
10	Hg (mg/l)	0.0006	0.00086	0.00021	0.0015	0.002
11	Mn (mg/l)	0.055	0.055	0.09	0.11	0.8
12	Ni (mg/l)	0.01	< 0.01	< 0.01	0.05	1.0
13	Cr (VI) (mg/l)	0.0074	0.006	0.008	0.0060	0.05
14	F (mg/l)	1.92	2.50	2.05	1.5	1.5
15	Ca (mg/l)	37.0	47.0	40.0	46.0	-

No	Indicator	Sample mark				TCVN 5942 - 1995 (column B)
		TH02	TH03	TH05	TH08	
16	Mg (mg/l)	16.2	21.6	14.7	24.0	-
17	Coliform (MPN/100ml)	0	0	100	400	10,000
18	Sulphat (mg/l)	6.0	6.0	8.0	0.5	-
19	pH	8.0	8.0	8.0	7.8	5.5 - 9.0
20	Fe (mg/l)	0.84	0.56	0.7	2.1	-
21	NO_2 (mg/l)	0.0	v	0.0	0.01	0.05
22	NH^+_4 (mg/l)	0.20	0.20	0.30	1.40	1
23	NO_3^- (mg/l)	3.78	6.19	7.22	4.82	15
24	Clorua (mg/l)	31.92	49.63	35.45	44.32	-

TH05: Taken from drainage channel in the South-West .

TH08: Taken from the irrigation channel in the South West.

Remarks: The analysis results show that the content of substances is below the standard limits for surface water quality. Three-forth of the total samples of Florua indicator are 1.3 -1,7 times higher than the permissible level. NH_4 content in irrigation water for the paddy field is 1.4 times higher than the standard limits

7.1.5 GEOLOGY AND HYDROGEOLOGY

a. Geological characteristics

According to the results of geological and engineering geological investigations and the exploratory drilling carried out in the area of the intended transfer station (the old dump site), the following soil layers are met:

- From 0.0 to 4.5 m: Waste
- From 4.5 to 6.4 m: Brown, yellow brown and pink stiff plastic clay
- From 6.4 to 7.6 m: Densed clayey fine sand
- From 7.6 to 12.0 m: Black fine sand intercalated with thin layer of silty clay
- From 12.0 to 25 m: Black medium to coarse sand, with moderate permeability.

The physico-mechanical indicators of the silty clay layer at the depth from 6 to 10m are as follows:

- Natural water content : 31.7%
- Bulk density : 1.87 g/cm3

- Dry density : 1.42 g/cm3
- Specific gravity : 2.71 g/cm3
- Porosity coefficient: 0.91
- Porosity: 48%
- Degree of saturation: 94%
- Liquid limit: 46.1 %
- Plastic limit : 29.5%
- Plasticity index: 16.6%
- Consistency: 0.13
- Permeability coefficient: 1.55x10-6 cm/s

b. Hydrogeological characteristics

In the study area there the following hydrogeological units:

a. Holocene aquiclude in Upper Thai Binh sub-formation ($Q_{IV}^3 tb_2$)

This aquiclude occurs at the surface of the area, consisting of alluvial swamp sediments.

It is composed of pink, blue grey stiff plastic clay, in the lower part of brown, grey silty sand intercalated with clayey silt layer and plant remains.

The water bearing capacity of these sediments is low to very low. Permeability coefficient is K = 400 x 10-7 to 1,700 10-7cm/s. The clay layer on top has K = 10 -6 cm/s.

The total thickness of this aquiclude is 6 - 9 m.

b. Holocene aquifer (qh) in Lower Thai Binh sub-formation ($Q_{IV}^3 tb_1$)

This aquifer occurs all over the intended transfer station. It is met in all exploration boreholes in the form of sand lenses.

It is composed of medium to coarse sand mixed with some gravel, in some places intercalated with some thin silty clay layers. The water bearing capacity is moderate. The transmissibility coefficient is 20 - 50 m2/day. The specific capacity of boreholes drilled into this aquifer is commonly 0.2 - 1 l/sm.

The groundwater is mainly of bicarbonate-chloride-calcium-sodium type, with pH = 7.3, with average total dissolved solids (TDS) content is M = 0.39 mg/l.

The groundwater level of this aquifer is 1.0 - 2.1 m deep, depending on the ground elevation.

The regime of this aquifer depends on the hydro-meteorological conditions. In dry season the water level in the boreholes rises and in dry season it drops. The thickness of the aquifer varies from 7.8 to 15.3 m. The quality of groundwater samples collected from the boreholes drilled into this aquifer are shown in Table 7. 3. (Samples TH01, TH04, TH09).

c. Upper Pleistocene aquiclude in Vinh Phuc formation (Q_{III}^2vp)

These sediments occurs all over the area of Tam Hiep transfer station. They are covered by the younger sediments and are met at the depth of 25 - 28 m.

Lithologically this aquiclude is composed of non-water bearing white grey, black grey clay and sandy clay. The permeability coefficient is K = 10 -7 cm/s.

The thickness of this aquiclude is 8.5 - 11.9 m.

d. Pleistocene aquifer (qp) in Hanoi formation ($Q_{I-III}hn$)

These sediments are completely covered by younger sediments. They occur at the depth of 35-37.5 m downward.

Lithologically these sediments are composed of cobble, pebbles, gravel, sand on the upper part and cobbles and pebble weakly cemented by silty clay in the lower part.

The material has high and relatively uniform permeability. The transmissibility coefficient is about 700 - 1,000 m^2/day. The specific capacity of boreholes is great. This is the main aquifer for water supply to Hanoi city.

The groundwater is of bicarbonate-chloride-sodium-magnesium type. The total dissolved solid (TDS) content is M = 0.29 g/l, pH = 7.5.

The thickness of this aquifer is 25 - 30 m.

The water level of this aquifer varies seasonally with small amplitude, with disturbed regime.

According to the water level monitoring data, in the study area the groundwater of the Holocene aquifer flows in NE-SW direction, i.e. from the transfer station to Vinh Quynh commune, whereas the groundwater of the Pleistocene aquifer, as affected by the cone of depression of Ha Dinh wellfield, flows in SW-NE direction, contrary to that of the Holocene aquifer.

According to the pumping test result, between the Holocene and Pleistocene aquifers there is no hydraulic relationship.

Analysis result of groundwater sample are presented in the table below:

Table7.3: ***Analysis result of groundwater at Tam Hiep transfer station***

No	Indicator	Sample mark					TCVN 5944 - 1995
		TH01	TH04	TH06	TH07	TH09	
1	COD (mg/l)	11.2	29.6	16.4	11.2	8.0	-
2	BOD_5 (mg/l)	5.6	12.6	7.0	4.8	2.6	-
3	Phenol (mg/l)	0.001	0.005	0.004	0.010	0.005	0.001
4	Cyanua (mg/l)	0.005	0.006	Unident ification	0.007	0.005	0.01

No	Indicator	Sample mark					TCVN 5944 - 1995
		TH01	TH04	TH06	TH07	TH09	
5	As (mg/l)	0.00054	0.00025	0.00152	0.00011	0.0002 8	0.05
6	Pb (mg/l)	0.0066	0.0045	0.0051	0.0046	0.0021	0.05
7	Cu (mg/l)	0.0015	0.0005	0.0003	0.0008	0.0004	1.0
8	Zn (mg/l)	0.0161	0.0294	0.0028	0.030	0.0017	5.0
9	Cd (mg/l)	0.0004	0.0006	0.0003	0.0006	0.0002	0.01
10	Hg (mg/l)	0.00023	0.00031	0.00019	0.00012	0.0032	0.001
11	Mn (mg/l)	0.13	0.16	0.33	0.50	0.24	0.1 - 0.5
12	Ni (mg/l)	0.02	0.015	< 0.01	0.085	0.032	-
13	Cr (VI) (mg/l)	0.007	0.0074	0.006	0.003	0.005	0.05
14	F (mg/l)	0.17	0.43	0.58	0.56	0.02	1.0
15	Ca (mg/l)	48.0	42.0	38.0	35.0	42.5	-
16	Mg (mg/l)	22.0	19.8	23.4	20.4	11.1	-
17	Coliform (MPN/100ml)	1600	320	180	120	60	3
18	Sulphat (mg/l)	0.5	0.5	0.5	05	0.5	200-400
19	pH	8.0	8.5	8.0	8.0	8.0	6.5 - 8.0
20	Fe (mg/l)	14.66	5.86	6.2	4.19	14.66	1 - 5
21	NO_2 (mg/l)	V	0.0	0.01	0.01	V	-
22	NH^+_4 (mg/l)	20.0	14.0	7.0	7.0	20.00	-
23	NO_3 (mg/l)	0.0	27.52	0.0	0.0	0.0	45
24	Clorua (mg/l)	72.68	51.41	37.23	35.45	72.68	200-600

- *Sample TH01 : Taken at the site*
- *Sample TH04 : Taken from a drilled well, 150m to the North-East of the site.*
- *Sample TH06 : Taken from a drilled well in the military camp(Pleistocene aquifer)*
- *Sample TH07: Taken from a drilled well of Tam Hiep mechanical enterprise (Pleistocene aquifer)*
- *Sample TH09 : Taken from drilled well in Huynh Cung commune.*

Remarks:The analysis results show that Phenol content in ground water is quite high, only one sample equal to the permissible level. The rest 4 samples is 4-10 times higher than the permissible level. Other indicator such as bacteria is high (500 times higher than the permissible level (sample TH01), the lowest level is also 20 higher than the standard limits.