Japan International Cooperation Agency (JICA)

Haiphong People's Committee
Socialist Republic of Vietnam

The Study
on
Sanitation Improvement Plan for Haiphong City
in
The Socialist Republic of Vietnam

FINAL REPORT

DATA BOOK

July 2001

Nippon Koei Co., Ltd.

EX Corporation

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LIST OF REPORTS

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Volume 1	Sanitation Master Plan
Volume 2	Feasibility Studies for the Priority Projects

SUPPORTING REPORT

DATA BOOK

EXCHANGE RATE FOR COST ESTIMATION

Estimate of Base Cost : As of June 2000 Price Level

Currency Exchange Rate : USD1.0 = VND14,072

THE STUDY ON SANITATION IMPROVEMENT PLAN FOR HAIPHONG CITY

IN THE SOCIALIST REPUBLIC OF VIETNAM

FINAL REPORT

DATA BOOK

Table of Contents

Survey Data

Abbreviations

Government of Vietnam/Public Institutions

DI	:	Department of Industry
DARD	:	Department of Agriculture and Rural Development
DOC	:	Department of Construction
DOF	:	Department of Finance
DOH	:	Department of Health
DOSTE	:	Department of Science, Technology and Environment
EMD	:	Environmental Management Division
GOV	:	Government of Vietnam
HP	:	Haiphong
HPPC	:	Haiphong People's Committee
MOC	:	Ministry of Construction
MOF	:	Ministry of Finance
MOI	:	Ministry of Industry
MOSTE	:	Ministry of Science, Technology and Environment
MPI	:	Ministry of Planning and Investment
NEA	:	National Environmental Agency
NIED	:	National Institute for Educational Development
NIURP	:	National Institute for Urban and Rural Planning
PMU	:	Project Management Unit
SADCO	:	Sewerage And Drainage Company
SC	:	Steering Committee
SCPE	:	Scientific Center for Population and Environment
TEDI	:	Transportation Engineering Design Institute
TUPWS	:	Transport and Urban Public Works Service
URENCO	:	Urban Environment Company
VIWASE	:	Vietnam Institute for Water and Sanitation Engineering
WSCO	:	Water Supply Company

International / Foreign Organizations

ADB	:	Asian Development Bank
AIT	:	Asian Institute of Technology
ASEAN	:	Association of Southeast Asian Nations
AusAID	:	Australian Agency for International Development
CIDA	:	Canadian International Development Agency
DIDC	:	Department for International Development Cooperation of the Ministry for Foreign Affairs of Finland
EU	:	European Union
FINNIDA	:	Finnish International Development Agency
IBRD (WB)	:	International Bank for Reconstruction and Development (World Bank)

IFC	:	International Finance Agency
JBIC	:	Japan Bank for International Cooperation
JICA	:	Japan International Cooperation Agency
NGO	:	Non-Government Organization
OECD	:	Organization for Economic Cooperation and Development
SIDA	:	Swedish International Development Agency
UNDP	:	United Nations Development Program
UNICEF	:	United Nations Children's Fund
UNIDO	:	United Nations Industrial Development Organization
WB	:	World Bank
WHO	:	World Health Organization

Peculiar Abbreviations for this Study

City MP	:	Haiphong City Master Plan
DVEZ	:	Dinh Vu Economic zone
NDA	:	New Development Area
NUA	:	New Urban Area
OCC	:	Old City Center
SA	:	Study Area
SMP	:	Sanitation Master Plan
The Study	:	The Study on Sanitation Improvement Plan for Haiphong City
The JICA Study Team	:	The JICA Team for the Study on Sanitation Improvement Plan for Haiphong City

Others

ADWF	:	Average Dry Weather Flow
AIDS	:	Acquired Immuno- Deficiency Syndrome
AJ	:	Aerated Jokaso
AL	:	Aerated Lagoon
AnA	:	Anaerobic Aerobic Process
ARI	:	Average Recurrence Interval
AS	:	Activated Sludge
ASP	:	Activated Sludge Process
BOD	:	Biochemical Oxygen Demand
BOT	:	Built, Operate, Transfer
C	:	Carbon
CAS	:	Conventional Activated Sludge
CCTV	:	Closed Circuit Television
CECS	:	Center for Environmental Chemistry Studies
CEST	:	Center for Environmental Science and Technology
CH_4	:	Methane
Cl	:	Chlorine
CNMS	:	Customer Network Management System

CO_2	:	Carbon dioxide
COD	:	Chemical Oxygen Demand
CPP	:	Contact Purification Process
CRES	:	Center for Regional and Environmental Studies
CSO	:	Combined Sewer Overflow
CW	:	Constructed Wetlands
DID	:	Densely Inhabited District
DO	:	Dissolved Oxygen
EAR	:	Environmental Awareness-Raising
EARET	:	Environmental Awareness-Raising, Education and Training
EE	:	Environmental Education
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Master Plan
ES	:	Executive Seminars
F/S	:	Feasibility Study
FC	:	Fecal Coliform
GDP	:	Gross Domestic Product
GRP	:	Gross Regional Product
H	:	Hydrogen
HCMC	:	Ho Chi Minh City
HDPE	:	High Density Poly-Ethylene
HIV	:	Human Immunodeficiency Virus
HPWSSP	:	Haiphong Water Supply & Sanitation Program
IDF	:	Intensity-Duration-Frequency
IEE	:	Initial Environmental Examinations
IUPM	:	Industrial and Urban Pollution Management
LEP	:	Law on Environmental Protection
LM	:	Laboratory and Monitoring
M/P	:	Master Plan
MEIP	:	Metropolitan Environmental Improvement Program
MT	:	Membrane Technology
MWSP	:	Modified Waste Stabilization Pond
N	:	Nitrogen
NE	:	North East
NH_4	:	Ammonium
NRW	:	Non-Revenue Water
O	:	Oxygen
O&M	:	Operation & Maintenance
OD	:	Oxidation Ditch
ODA	:	Official Development Assistance
P	:	Phosphorous
PDWF	:	Peak Dry Weather Flow
PP	:	Poly Propylene

PS	:	Pumping Station
PVC	:	Poly Vinyl Chloride
RBC	:	Rotating Biological Contactor
SEDS	:	National Socio-Economic Development Strategy
SOE	:	State Owned Enterprises
SOP	:	Standard Operation Procedure
SP	:	Stabilization Pond
SPP		Sewerage Priority Project
SS	:	Suspended Solids
STW	:	Sewage Treatment Works
SW	:	South West
SWM	:	Solid Waste Management
SWS	:	Solid Waste Services
SWTC	:	Solid Waste Treatment Complex
TC	:	Total Coliform
TCVN	:	Vietnam Standard
TEQ	:	Toxic Equivalents
TMS	:	Time and Motion Survey
T-N	:	Total Nitrogen
T-P	:	Total Phosphorous
TSP	:	Total Suspended Particulate
TWAP	:	Treated water from Aeration Pond
TWPP	:	Treated water from Precipitation Pond
UASB	:	Up-flow Anaerobic Sludge Bed (Reactor)
UFW	:	Unaccounted For Water
VAT	:	Vietnam-Australia Training Project
VCEP	:	Vietnam Canada Environment Project
VIP	:	Ventilated Improved Pit (Latrine)
WSP	:	Waste Stabilization Pond
WTP	:	Water Treatment Plant
WWTP	:	Waste Water Treatment Plant
1A	:	Vietnam Three Cities Sanitation Program: Haiphong Component (Water Supply Phase 1)
2A	:	Vietnam Three Cities Sanitation Program: Haiphong Component (Water Supply Phase 2)
1B	:	Vietnam Three Cities Sanitation Program: Haiphong Component (Drainage & Sewerage)

Units of Measurement

T/Y	:	tonnes per year
°C	:	degrees Celsius
g/d	:	grams per day
Gm	:	Gram
ha	:	Hectare
kg	:	kilo gram
km	:	kilo meter
km^2	:	Square kilo meter
lpcd	:	liter per capita per day
m	:	Meter
m^2	:	square meter
m^3	:	cubic meter
m^3/d	:	cubic meter per day
mg/l	:	milligram per liter
Nm^3	:	Normal cubic meter
pg	:	Picogram
t/m^3	:	tonnes per cubic meter
US$	:	United States Dollar
VND	:	Vietnamese Dong
wt%	:	weight percent

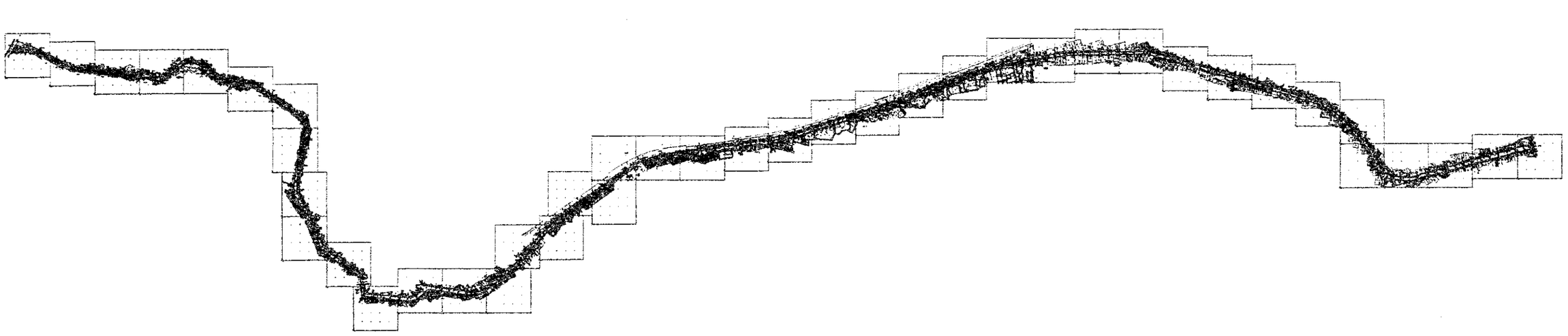
A: Drainage Topographic Survey

GENERAL LAYOUT OF AN KIM HAI CHANNEL
MẶT BẰNG TOÀN THỂ KÊNH AN KIM HẢI

NORTH

GHI CHÚ - LEGEND :

MC - 01	VỊ TRÍ MẶT CẮT.	CROSS-SECTION.
180	CAO ĐỘ BÙN	SLUDGE LEVEL.
140	CAO ĐỘ ĐÁY	BOTTOM LEVEL.
G	NHÀ GẠCH	MASONRY HOUSE.
L	NHÀ LÁ	TEMPORARY HOUSE.
T	NHÀ TẠM	



HCDC
CÔNG TY TƯ VẤN - THIẾT KẾ
CÔNG TRÌNH XÂY DỰNG HẢI PHÒNG
HAIPHONG CONSTRUCTION DESIGN AND CONSULTANT COMPANY

JAPAN INTERNATIONAL COOPERATION AGENCY
CƠ QUAN HỢP TÁC QUỐC TẾ NHẬT BẢN
JICA STUDY TEAM
NHÓM NGHIÊN CỨU JICA

THE STUDY ON SANITATION IMPROVEMENT PLAN FOR HAIPHONG CITY
NGHIÊN CỨU QUY HOẠCH CẢI THIỆN ĐIỀU KIỆN VỆ SINH TP HẢI PHÒNG

DRAINAGE TOPOGRAPHIC SURVEY
KHẢO SÁT ĐỊA HÌNH TUYẾN THOÁT NƯỚC MƯA

PLAN DRAWING OF PART NO1
MẶT BẰNG MẢNH SỐ 1

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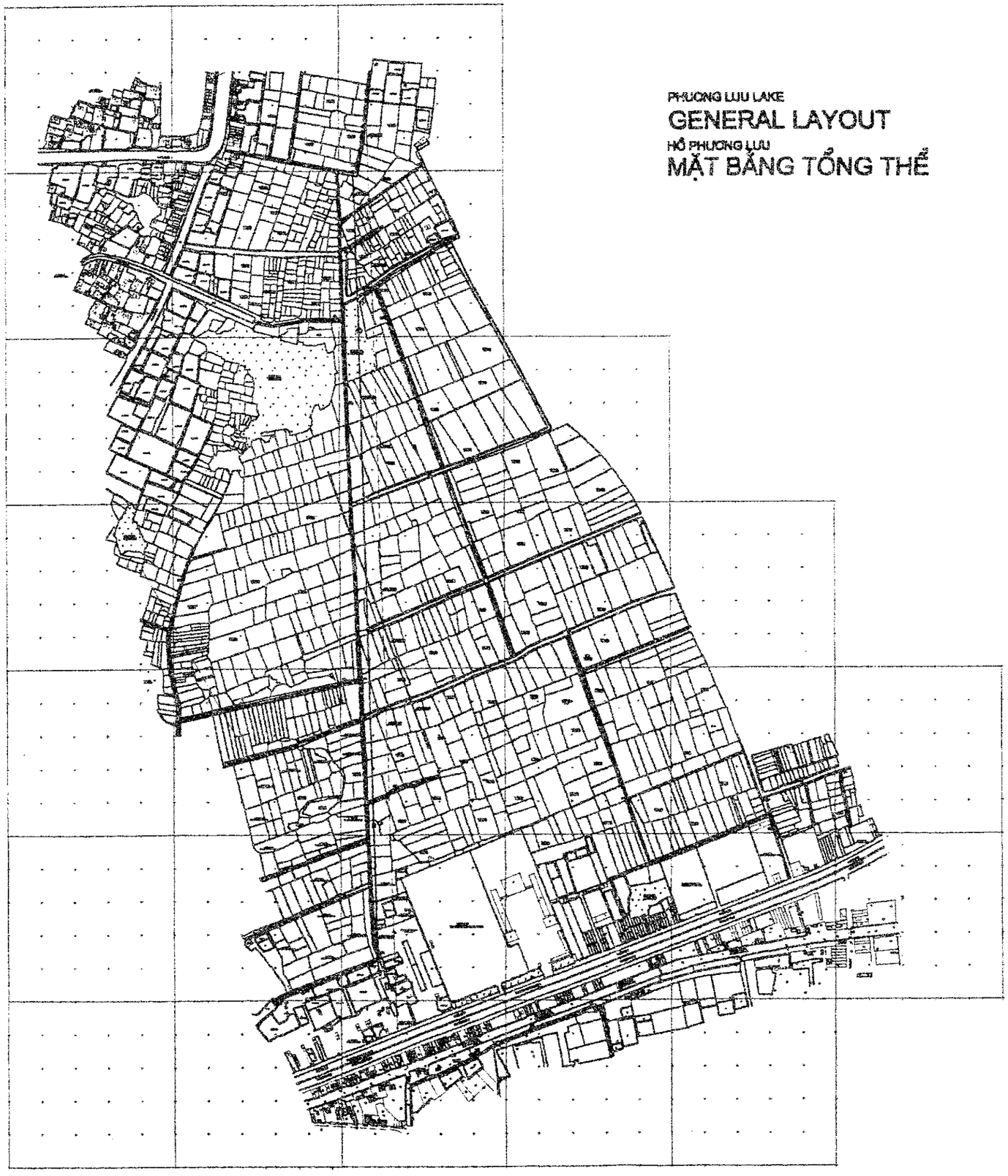
NGÀY DATE	DECEMBER 2000
BẢN VẼ DRAWING NO	AK-00



PHUONG LUU LAKE
GENERAL LAYOUT
HỒ PHƯƠNG LƯU
MẶT BẰNG TỔNG THỂ

NORTH

GHI CHÚ - LEGEND :

TOẠ ĐỘ NHÀ NƯỚC
STATE COORDINATES
CAO ĐỘ HẢI PHÒNG
HAIPHONG CITY LEVEL

G	NHÀ GẠCH	MASONRY HOUSE.
L	NHÀ LÁ	TEMPORARY HOUSE.
T	NHÀ TẠM	

HCDC
CÔNG TY TƯ VẤN - THIẾT KẾ
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DRAINAGE TOPOGRAPHIC SURVEY
KHẢO SÁT ĐỊA HÌNH TUYẾN THOÁT NƯỚC MƯA

PHUONG LUU LAKE
GENERAL LAYOUT
HỒ PHƯƠNG LƯU
MẶT BẰNG TỔNG THỂ

TỶ LỆ SCALE: N.T.S
NGÀY DATE: DECEMBER 2000
TÊN BẢN VẼ DRAWING NO. PL-00

B: Sewerage Topographic Survey

SEWERAGE TOPOGRAPHIC SURVEY
PLANNED WWT PLANT AT VINH NIEM

GENERAL LAYOUT OF
VINH NIEM AREA

KHẢO SÁT ĐỊA HÌNH H.T THOÁT NƯỚC THẢI
NHÀ MÁY XL NƯỚC THẢI TẠI VĨNH NIỆM

TỔNG MẶT BẰNG
KHU VĨNH NIỆM

HCDC
CÔNG TY TƯ VẤN - THIẾT KẾ
CÔNG TRÌNH XÂY DỰNG HẢI PHÒNG
HAIPHONG CONSTRUCTION DESIGN
AND CONSULTANT COMPANY

JAPAN INTERNATIONAL COOPERATION AGENCY
CƠ QUAN HỢP TÁC QUỐC TẾ NHẬT BẢN
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NHÓM NGHIÊN CỨU JICA

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NGHIÊN CỨU QUY HOẠCH CẢI THIỆN ĐIỀU KIỆN VỆ SINH TP HẢI PHÒNG

SEWERAGE TOPOGRAPHIC SURVEY
PLANNED WWT PLANT AT VINH NIEM
GENERAL LAYOUT OF
VINH NIEM AREA

KHẢO SÁT ĐỊA HÌNH H.T THOÁT NƯỚC THẢI
NHÀ MÁY XL NƯỚC THẢI TẠI VĨNH NIỆM
TỔNG MẶT BẰNG
KHU VĨNH NIỆM

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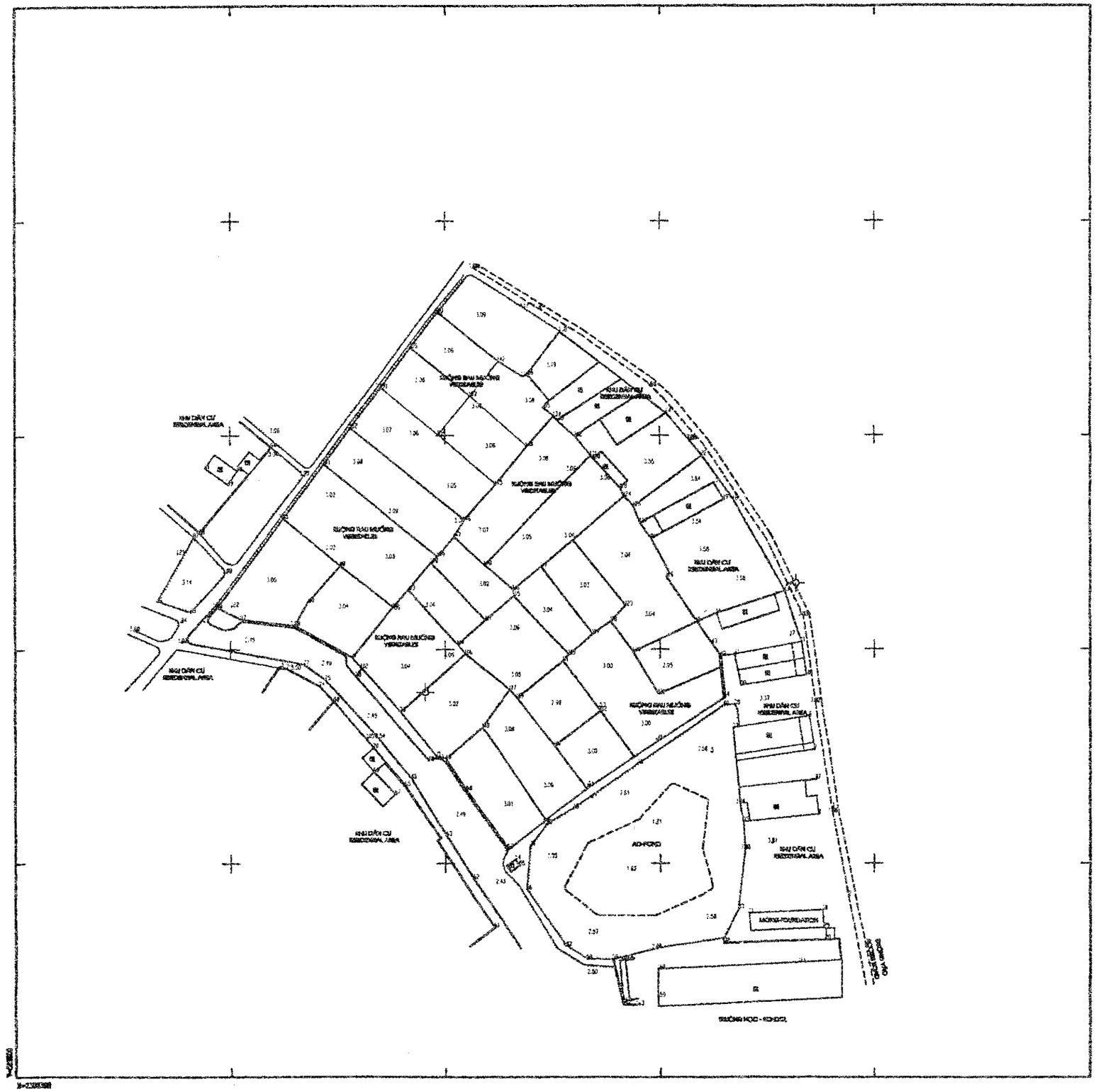
DRAWING NO.	VN-00



GHI CHÚ - LEGEND :

TỌA ĐỘ NHÀ NƯỚC
STATE COORDINATES
CAO ĐỘ HẢI PHÒNG
HAIPHONG CITY LEVEL

G	NHÀ GẠCH	MASONRY HOUSE.
L	NHÀ LÁ	TEMPORARY HOUSE.
T	NHÀ TẠM	

HCDC
CÔNG TY TƯ VẤN - THIẾT KẾ
CÔNG TRÌNH XÂY DỰNG HẢI PHÒNG
HAIPHONG CONSTRUCTION DESIGN
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SEWERAGE TOPOGRAPHIC SURVEY
KHẢO SÁT ĐỊA HÌNH TUYẾN THOÁT NƯỚC THẢI

PUMPING STATION AN DA
PLAN DRAWING
TRẠM BƠM AN ĐÀ
MẶT BẰNG

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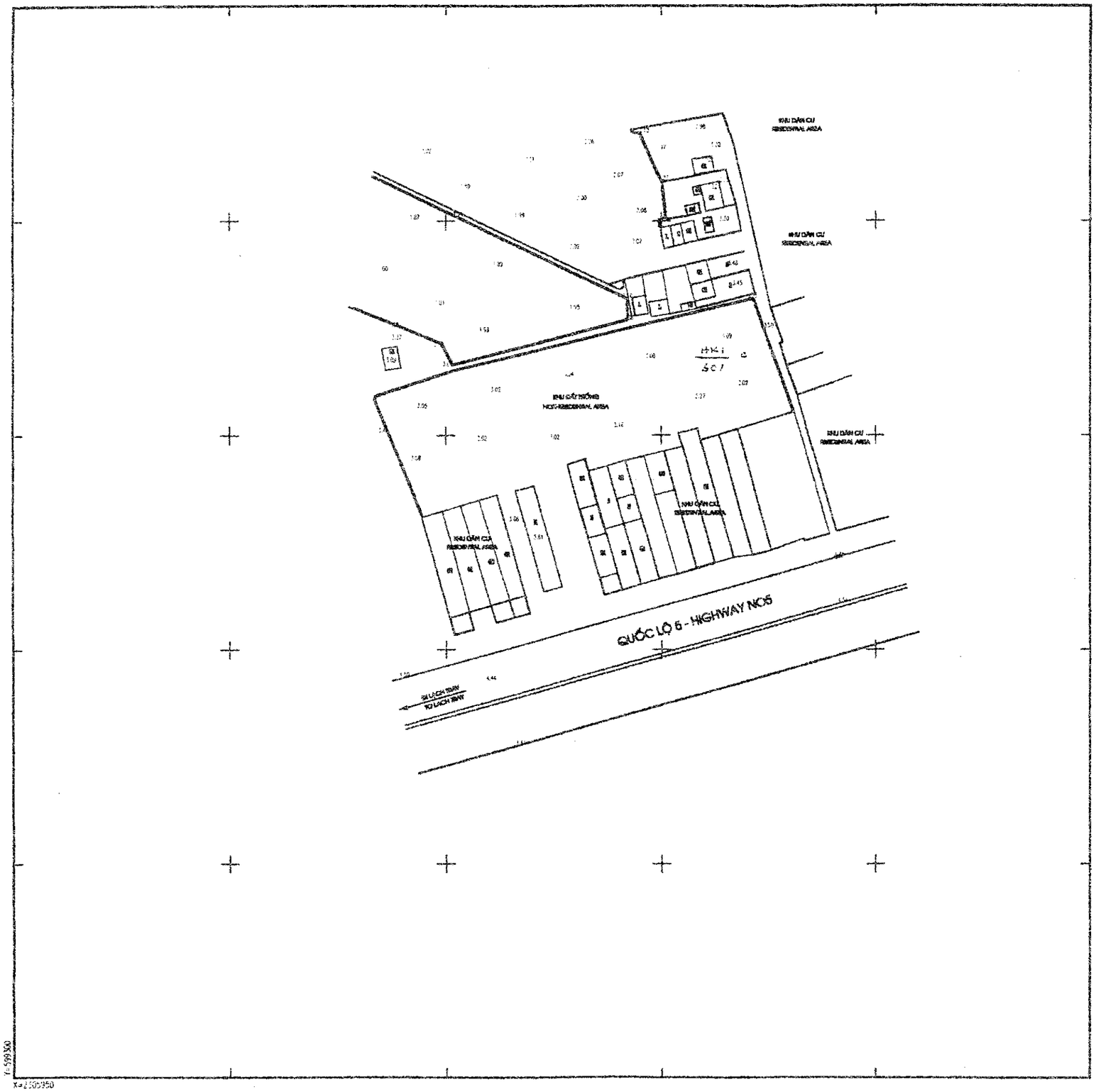
DATE	DECEMBER 2000
DRAWING No.	PP-01



NORTH

GHI CHÚ - LEGEND :

TỌA ĐỘ NHÀ NƯỚC
STATE COORDINATES
CAO ĐỘ HẢI PHÒNG
HAIPHONG CITY LEVEL

G	NHÀ GẠCH	MASONRY HOUSE.
L	NHÀ LÁ	TEMPORARY HOUSE.
T	NHÀ TẠM	

HCDC
CÔNG TY TƯ VẤN - THIẾT KẾ
CÔNG TRÌNH XÂY DỰNG HẢI PHÒNG
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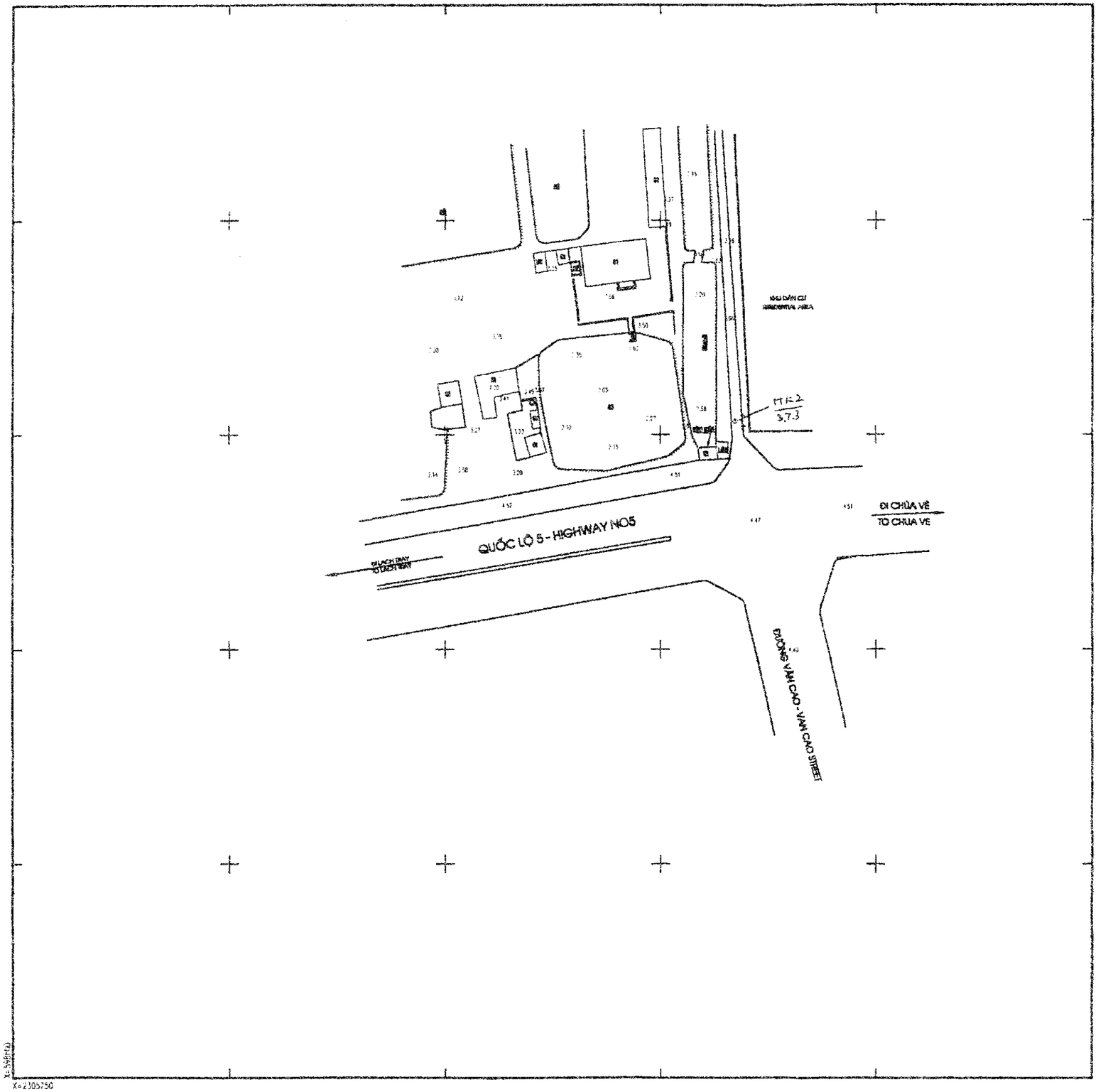
SEWERAGE TOPOGRAPHIC SURVEY
KHẢO SÁT ĐỊA HÌNH TUYẾN THOÁT NƯỚC THẢI

PUMPING STATION KIEU SON
PLAN DRAWING
TRẠM BƠM KIỀU SƠN
MẶT BẰNG

SCALE	1/500
DATE	DECEMBER 2000
DRAWING NO.	PP-02



NORTH

GHI CHÚ - LEGEND :

TỌA ĐỘ NHÀ NƯỚC
STATE COORDINATES
CAO ĐỘ HẢI PHÒNG
HAIPHONG CITY LEVEL

G	NHÀ GẠCH	MASONRY HOUSE.
L	NHÀ LÁ	TEMPORARY HOUSE.
T	NHÀ TẠM	

HCDC
CÔNG TY TƯ VẤN - THIẾT KẾ
CÔNG TRÌNH XÂY DỰNG HẢI PHÒNG
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THE STUDY ON SANITATION IMPROVEMENT PLAN FOR HAIPHONG CITY
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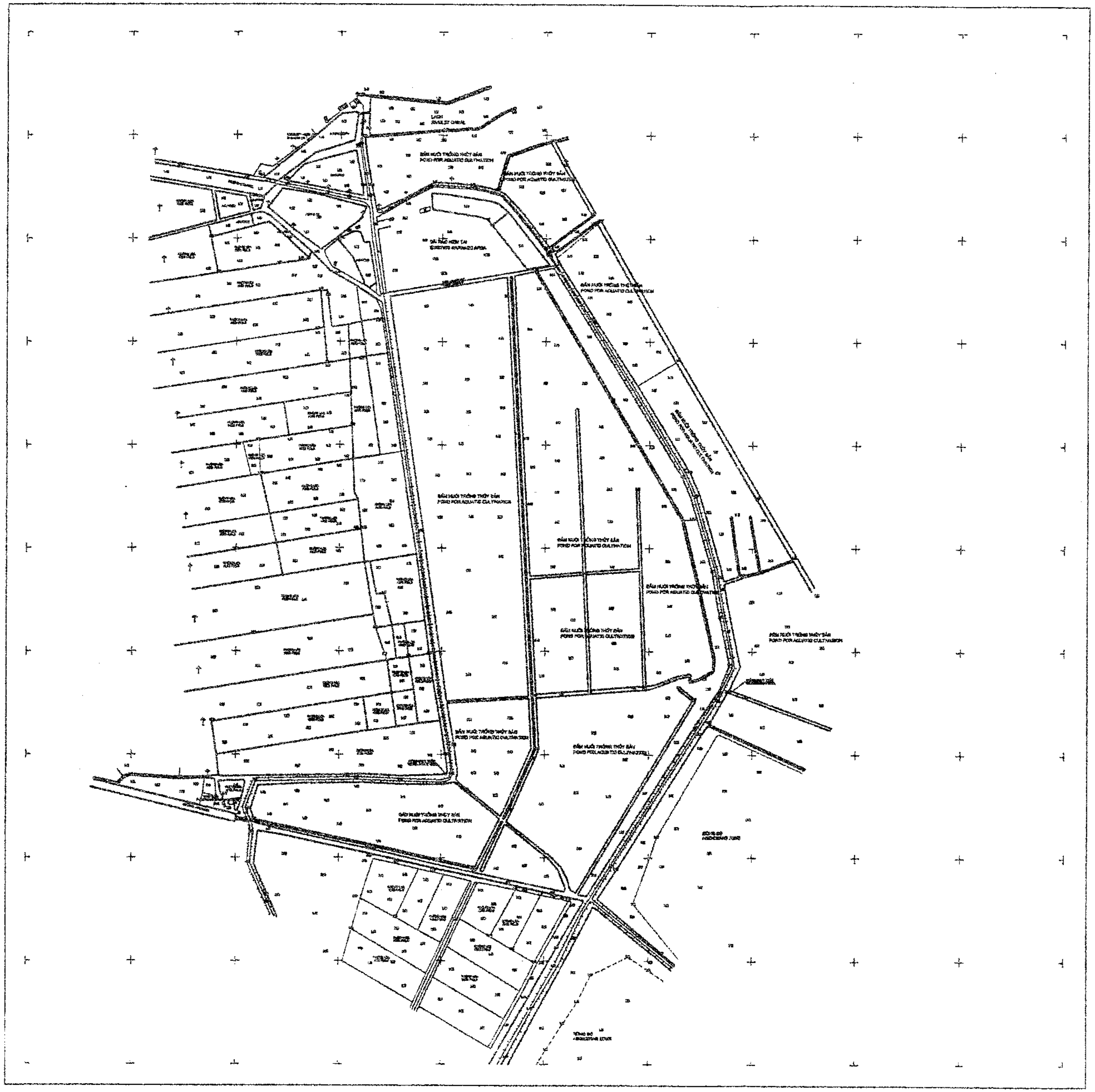
SEWERAGE TOPOGRAPHIC SURVEY
KHẢO SÁT ĐỊA HÌNH TUYẾN THOÁT NƯỚC THẢI

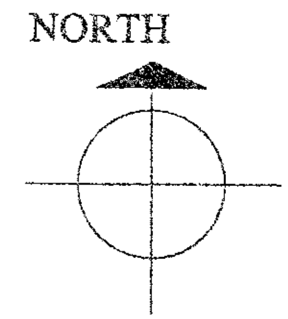
PUMPING STATION VAN CAO
PLAN DRAWING

TRẠM BƠM VĂN CAO
MẶT BẰNG

SCALE	1/500
DATE	DECEMBER 2009
DRAWING NO	PP-03

C: Topographic Survey for Trang Cat Landfill





GHI CHÚ :

- HỆ TỌA ĐỘ NHÀ NƯỚC.
- CAO ĐỘ HẢI PHÒNG.

LEGEND :

- STATE COORDINATES.
- HAI PHONG LEVEL.

GENERAL LAYOUT OF TRANG CAT LANDFILL

TỔNG MẶT BẰNG KHU TRÀNG CÁT

HCDC CÔNG TY TƯ VẤN - THIẾT KẾ CÔNG TRÌNH XÂY DỰNG HẢI PHÒNG HAIPHONG CONSTRUCTION DESIGN AND CONSULTANT COMPANY	JAPAN INTERNATIONAL COOPERATION AGENCY CƠ QUAN HỢP TÁC QUỐC TẾ NHẬT BẢN JICA STUDY TEAM NHÓM NGHIÊN CỨU JICA
PROJECT NAME - TÊN DỰ ÁN THE STUDY ON SANITATION IMPROVEMENT PLAN FOR HAIPHONG CITY NGHIÊN CỨU QUY HOẠCH CẢI THIỆN ĐIỀU KIỆN VỆ SINH TP HẢI PHÒNG	
CONTENT OF DRAWING TRANG CAT LANDFILL TOPOGRAPHIC SURVEY GENERAL LAYOUT OF TRANG CAT LANDFILL	NỘI DUNG BẢN VẼ KHẢO SÁT ĐỊA HÌNH BÃI SAN LẤP TRÀNG CÁT TỔNG MẶT BẰNG KHU TRÀNG CÁT
TỶ LỆ / SCALE	N.T.S
NGÀY / DATE	DECEMBER 2000
TÊN BẢN VẼ / DRAWING NO	TR-00

D: Geological Survey for Sewerage Project

LEVELS OF BORE HOLE

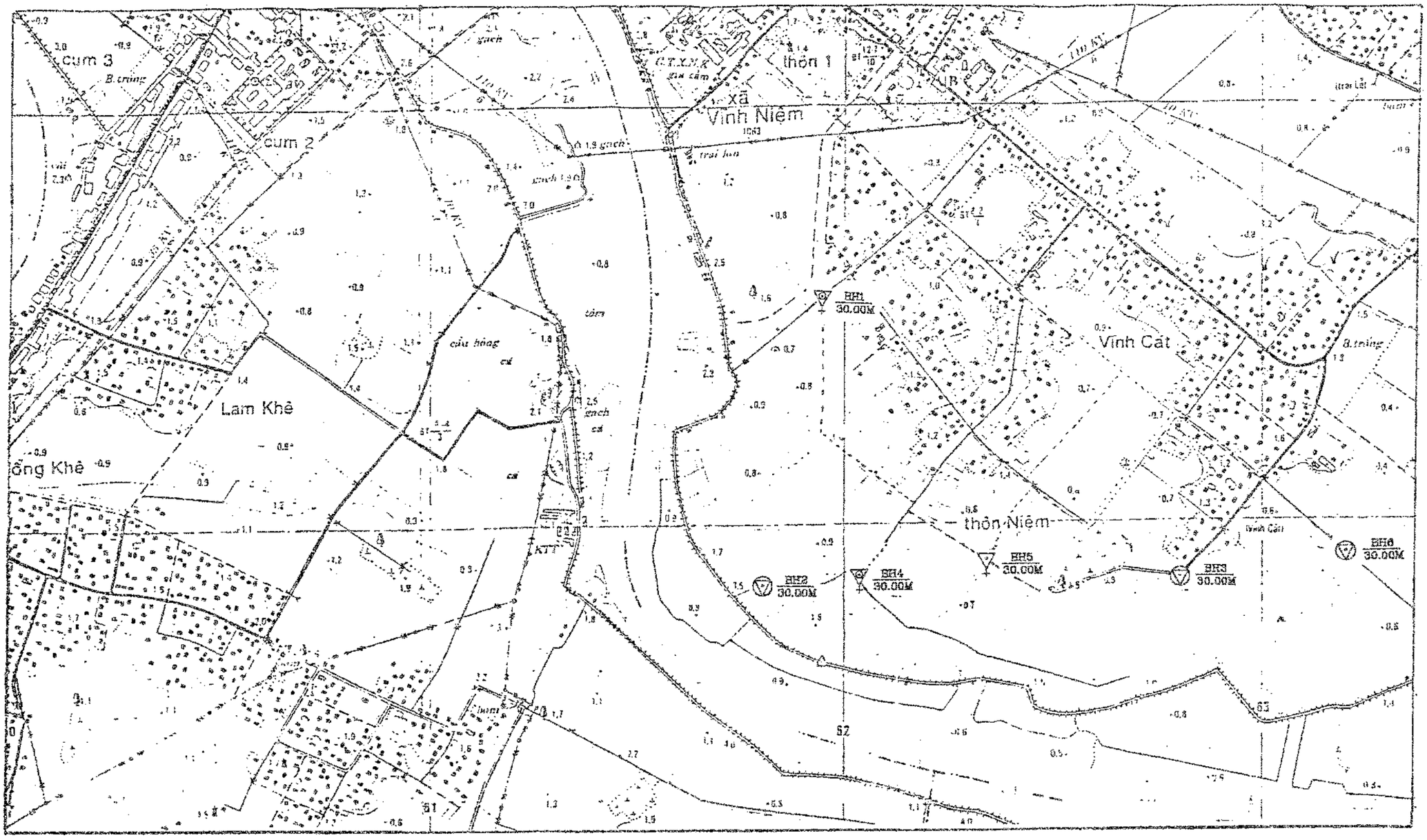
No	BORE HOLE	LEVEL (M)	LOCATION
1	BH1	+ 3.60	Vinh Niem
2	BH2	+ 3.39	-
3	BH3	+ 3.14	-
4	BH4	+ 3.12	-
5	BH5	+ 3.18	-
6	BH6	+ 3.60	-
7	BH7	+ 3.97	Van cao
8	BH8	+ 3.07	Kieu son

Note:

- Positions of Boreholes are followed Mr. Nurul ISLAM - Pilot Project Planer and Mr. Ken Kociba - Drainage Engineer instruction directly at Site.

- Levels of bore hole are supplied by HCDC.

PLAN OF BORE HOLE LOCATION



LEGEND

POSITIONS OF BOREHOLES ARE FOLLOWED Mr KHURL ISLAM-PILOT PROJECT PLANER AND Mr. KEN KOCHA-DRAINAGE ENGINEER INSTEUCTION DIRECTLY AT SITE.

BH3 / 30.00M — SYMBOL OF BOREHOLE / DEPTH OF BOREHOLE

BOREHOLE WITH SPT

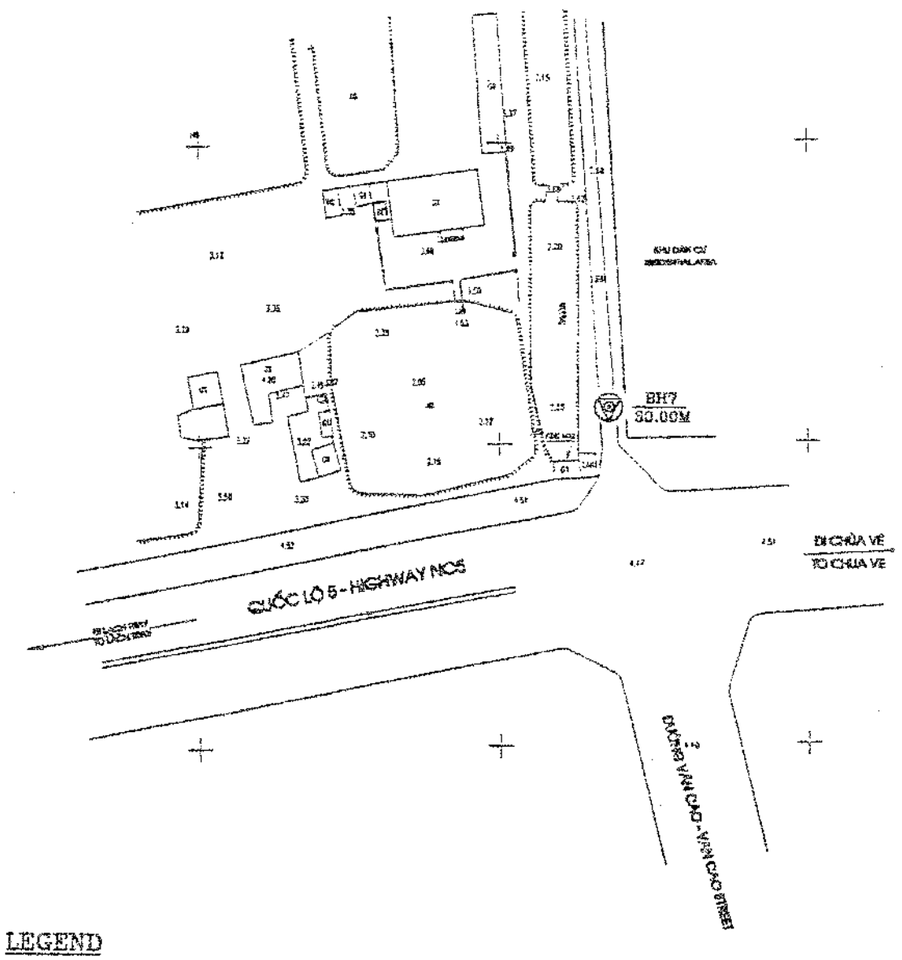
DISTUTBED SOIL SAMPLE

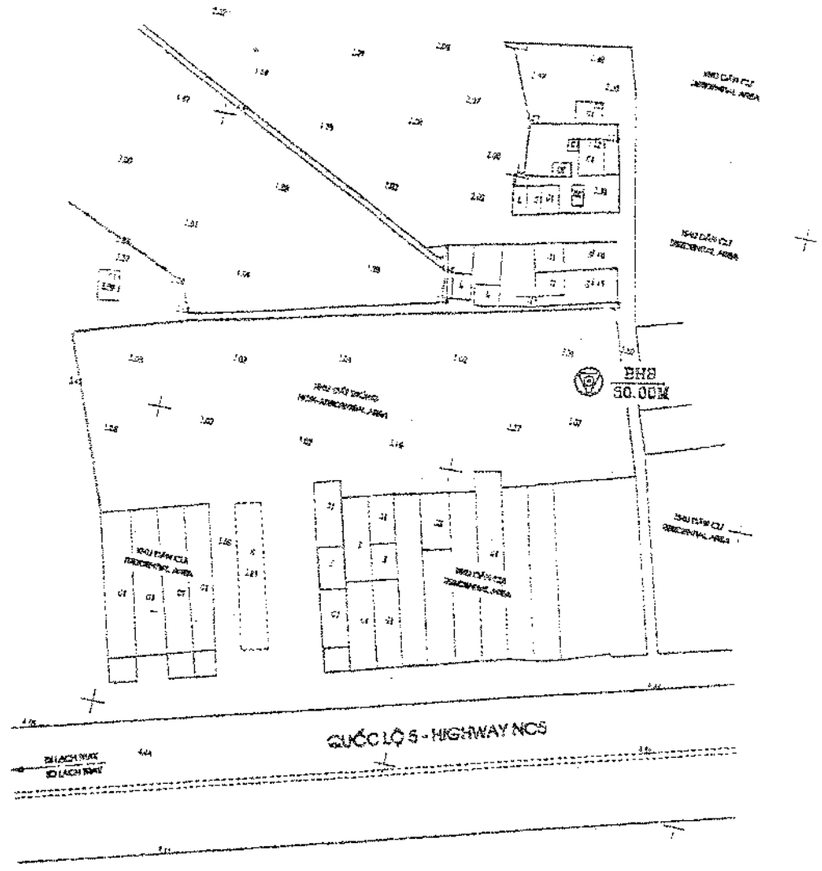
UNDISTUTBED SOIL SAMPLE

IN-SITU PETIMEABILITY TEST

SEWERAGE TREATMENT PLANT	DRAWN BY	CHECKED BY	
PLAN OF BORE HOLE LOCATION	VU VAN LOI	NGUYEN HUU TRI	DC-01 12/2000

PLAN OF BORE HOLE LOCATION





LEGEND

POSITIONS OF BOREHOLES ARE FOLLOWED Mr KNURL ISLAM-PILOT PROJECT PLANER AND Mr. KEN KOCHA-DRAINAGE ENGINEER INSTRUCTION DIRECTLY AT SITE.

BH7 / 30.00M — SYMBOL OF BOREHOLE / DEPTH OF BOREHOLE

PUMPING STATIONS	DRAWN BY	CHECKED BY	
PLAN OF BORE HOLE LOCATION	VU VAN LOI	NGUYEN HUU THI	DC-02 12/2000

BORE HOLE LOG

BORING No: BH1 (30.00M)

Project: Sewerage Treatment Plant
Sta. Day: 26 Nov-2000
Com. Day 27 Nov-2000

Location: Vinh niem-Hai phong
Bor. hole level: ?
Static water level: 1.70m

Depth (m)	Thick. (m)	Log	Depth of Sample (m)	SPT Test Blow/ 30cm	Description	CL.Bc ASTM
0.0m	0.90	0.90			Backfill: Grey, greyish brown clay; Loosing condition. Consists of organic decomposition.	
2.0	4.10	5.00		1/45	High Plastic Clay: Grey, greyish brown; Liquid condition. Consists of organic decomposition	CH
4.0						
6.0	4.70	9.70	5.00-5.50	2	Low Plastic Clay: Grey, greyish black; Liquid condition, including some shells and organic decomposition.	CL
8.0				3		
10.0	4.30	14.00	10.00-10.50	1/45	High Plastic Clay: Greyish brown; Liquid plastic condition. Consists of organic decomposition.	CH
12.0						
14.0	2.00	16.00		9	Low Plastic Clay: Yellow, greyish white to multicolour; Plastic condition, including brown iron oxide deposit.	CL
16.0	14.00					
18.0				5		
20.0			20.00-20.50	5		
22.0					Low Plastic Clay: Greyish green, greyish white, greyish light; Plastic-liquid to plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
24.0				6		
26.0				8		
28.0						
30.0		30.00		9		
		Bott. of Bore Hole 30.00m				

Symbol: Undisturbed soil sample Permeability Test
SPT Test

BORE HOLE LOG

BORING No: BH2 (30.00M)

Project: Sewerage Treatment Plant
Sta. Day: 28 Nov-2000
Com. Day 29 Nov-2000

Location: Vinh niem-Hai phong
Bor. hole level: ?
Static water level: 0.55m

Depth (m)	Thick (m)	Log	Depth of Sample (m)	SPT Test Blow/ 30cm	Description	CL.Ba ASTM
0.0m	0.70	0.70			Backfill: Grey, greyish brown clay; Loosing condition. Consists of organic decomposition.	
2.0	6.30	7.00	5.00-5.50	1/45	High Plastic Clay: Grey, greyish brown; Liquid condition with thin fine sand interlayer at some places and organic decomposition.	CH
4.0						
6.0				1/45		
8.0	5.00	12.00	10.00-10.50	3	Low Plastic Clay: Grey, greyish black; Liquid condition, including some shells and organic decomposition.	CL
10.0						
12.0	1.30	13.30		1	High Plastic Clay: Greyish brown; Liquid plastic condition.	CH
14.0	3.30	16.60		9	Low Plastic Clay: Yellow, greyish white to multicolour; Plastic condition, including brown iron oxide deposit.	CL
16.0						
18.0	13.40	30.00	20.00-20.50	5	Low Plastic Clay: Greyish green, greyish white; Plastic-liquid to plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
20.0				6		
22.0						
24.0				5		
26.0				7		
28.0						
30.0				6		

Symbol: Undisturbed soil sample
SPT Test

BORE HOLE LOG

BORING No: BH3 (30.00M)

Project: Sewerage Treatment Plant
Sta. Day: 27 Nov–2000
Com. Day 29 Nov–2000

Location: Vinh niem–Hai phong
Bor. hole level: ?
Static water level: 0.60m

Depth (m)	Thick (m)	Log	Depth of Sample (m)	SPT Test Blow/30cm	Description	CL.Sg ASTM
0.0m	0.60	0.60				
2.0	3.40	4.00		1/45	High Plastic Clay: Grey, greyish brown; Liquid plastic condition. Consists of organic decomposition.	CH
4.0						
6.0	5.50		5.00–5.50	2	Low Plastic Clay: Grey, greyish black; Liquid condition. Including some shells and many organic decomposition.	CL
8.0		9.50		3		
10.0	4.50		10.00–10.50		High Plastic Clay: Greyish brown; Liquid plastic condition. Consists of organic decomposition.	CH
12.0				1		
14.0		14.00				
16.0	7.60			11	Low Plastic Clay: Yellow, red–brown to multicolour; Plastic condition to hard–plastic. Including brown iron oxide deposit.	CL
18.0				12		
20.0			20.00–20.50			
		21.60		10		
22.0	8.40			6	Low Plastic Clay: Greyish green, greyish white; Plastic–liquid to plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
24.0						
26.0				6		
28.0						
30.0		30.00		6		

Symbol: Undisturbed soil sample
SPT Test

BORE HOLE LOG

BORING No: BH4 (30.00M)

Project: Sewerage Treatment Plant
Sta. Day: 24 Nov-2000
Com. Day 25 Nov-2000

Location: Vinh niem-Hai phong
Bor. hole level:
Static water level: 0.60m

Depth (m)	Thick (m)	Log	Depth of Sample (m)	SPT Test Blow/ 30cm	Description	CL.Ba ASTM
0.0m		0.50 / 0.50			Backfill: Grey, greyish brown clay; Loosing condition. Consists of organic decompasition.	
2.0	5.00			1/45	High Plastic Clay: Grey, greyish brown; Liquid condition. Consists of many organic decomposition.	CH
4.0		6.50	5.00-5.50			
6.0				2		
8.0	6.00			3	Low Plastic Clay: Grey, greyish black; Liquid condition with thin fine sand interlayer at some places (8.00-9.50m) and some shells.	CL
10.0		11.50	10.00-10.50			
12.0	2.00	13.50		2	High Plastic Clay: Greyish brown; Liquid plastic condition.	CH
14.0	2.00	15.50		10	Low Plastic Clay: Yellow, greyish white to multicolour; Plastic condition, including brown iron oxide deposit.	CL
16.0						
18.0				6		
20.0			20.00-20.50			
22.0	14.50			5	Low Plastic Clay: Greyish green, greyish white; Plastic-liquid to plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
24.0				5		
26.0				6		
28.0						
30.0		30.00		7		

Symbol: ▮ Undisturbed soil sample ▲ Permeability Test
▯ SPT Test

BORE HOLE LOG

BORING No: BH5 (30.00M)

Project: Sewerage Treatment Plant
Sta. Day: 24 Nov-2000
Com. Day 25 Nov-2000

Location: Vinh niem-Hai phong
Bor. hole level: ?
Static water level: 0.37m

Depth (m)	Thick (m)	Log	Depth of Sample (m)	SPT Test Blow/30cm	Description	CL.Bc ASTM
0.0m	0.70	0.70			Backfill: Grey, greyish brown clay; Loosing condition. Consists of organic decomposition.	
2.0	4.00			1/45	High Plastic Clay: Grey, greyish brown; Liquid plastic condition. Consists of many organic decomposition.	CH
4.0		4.70				
6.0	5.30		5.00-5.50	2	Low Plastic Clay: Grey, greyish black; Liquid condition with thin fine sand interlayer at some places (8.20-10.00m) and some shells.	CL
8.0						
10.0		10.00	10.00-10.50	3		
12.0	2.30			1	High Plastic Clay: Greyish brown; Liquid plastic condition. Consists of organic decomposition.	CH
14.0		14.30				
16.0	2.70			11	Low Plastic Clay: Yellow, greyish white to multicolour; Plastic condition, including brown iron oxide deposit.	CL
18.0		17.00		6		
20.0	14.50		20.00-20.50	4	Low Plastic Clay: Greyish green, greyish white; Plastic-liquid to plastic condition. From 27.00-30.00m: With thin fine sand interlayer at some places.	CL
22.0						
24.0				5		
26.0				6		
28.0						
30.0		30.00		7		

Symbol: Undisturbed soil sample * Permeability Test
SPT Test

BORE HOLE LOG

BORING No: BH6 (30.00M)

Project: Sewerage Treatment Plant
Sta. Day: 29 Nov-2000
Com. Day 30 Nov-2000

Location: Vinh niem-Hai phong
Bor. hole level: ?
Static water level: 0.26m

Depth (m)	Thick (m)	Log	Depth of Sample (m)	SPT Test Blow/30cm	Description	CL.Ba ASTM
0.0m	0.70	0.70			Backfill: Grey, greyish brown clay; Loosing condition. Consists of organic decomposition.	
2.0	2.30	3.00		1	High Plastic Clay: Grey, greyish brown; Liquid condition. Consists of many organic decomposition.	CH
4.0	5.00	8.00	5.00-5.50	2	Low Plastic Clay: Grey, greyish black; Liquid condition. Including some shells and organic decomposition.	CL
8.0	8.50	16.50	10.00-10.50	1 1/45 3	High Plastic Clay: Greyish brown; Liquid condition From 8.00-10.00m: Including some shells and many organic decomposition.	CH
16.0	2.70					
18.0	6.50	23.00		5 6	Low Plastic Clay: Greyish green, greyish light, greyish white; Plastic-liquid to plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
22.0						
24.0		30.00		8 10	Low Plastic Clay: Yellow, greyish white ; Plastic to hard-plastic condition, including brown iron oxide deposit.	CL
28.0						
30.0				10		

Symbol: Undisturbed soil sample
SPT Test

BORE HOLE LOG

BORING No: BH7 (30.00M)

Project: Pumping Station.
Sta. Day: 30 Nov-2000
Com. Day 01 Dec-2000

Location: Van cao-Hai phong
Bor. hole level: ?
Static water level: 1.15m

Depth (m)	Thick. (m)	Log	Depth of Sample (m)	SPT Test Blow/ 30cm	Description	CL.Ba ASTM
0.0m	1.10	1.10			Backfill: Grey clay. Consists of organic decomposition and gravel.	
2.0	4.00	1.50			High Plastic Clay: Grey, greyish black; Liquid condition. Consists of organic decomposition.	CH
4.0		5.50	5.00-5.50	1	Low Plastic Clay: Grey, greyish black; Liquid condition. Including some shells and organic decomposition.	CL
6.0	11.10			1	High Plastic Clay: Greyish brown; Liquid plastic condition. Consists of organic decomposition. From: 16.00-18.50m: With thin fine sand interlayer at some places and clay deposit.	CH
8.0				1		
10.0			10.00-10.50	1		
12.0				1		
14.0				2		
16.0	3.10					
18.0		18.50		2		
20.0	11.50		20.00-20.50	6	Low Plastic Clay: Greyish green, greyish yellow, greyish light; Plastic to hard-plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
22.0						
24.0				9		
26.0						
28.0				10		
30.0		30.00		9		

Symbol: Undisturbed soil sample
SPT Test

BORE HOLE LOG

BORING No: BH8 (30.00M)

Project: Pumping Station.
Sta. Day: 01 Dec-2000
Com. Day 02 Dec-2000

Location: Kieu son-Hoi phong
Bor. hole level: ?
Static water level: 1.00m

Depth (m)	Thick (m)	Log	Depth of Sample (m)	SPT Test Blow/30cm	Description	CL.Bc ASTM
0.0m	0.70	0.70			Backfill: Grey, greyish brown sand. Consists of organic decomposition.	
2.0	1.70	2.40			High Plastic Clay: Grey, greyish black; Liquid condition. Consists of organic decomposition.	CH
4.0	2.10	4.50		2	Low Plastic Clay: Grey, greyish black; Liquid condition. Including some shells and organic decomposition.	CL
6.0	15.30	19.80	5.00-5.50	1/45	High Plastic Clay: Greyish brown; Liquid plastic condition. Consists of organic decomposition. From: 14.50-19.80m: With thin fine sand interlayer at some places and clay deposit.	CH
8.0				1		
10.0			10.00-10.50			
12.0				2		
14.0						
16.0				2		
18.0				3		
20.0	10.40	27.80	20.00-20.50	6	Low Plastic Clay: Greyish green, greyish yellow, greyish light; Plastic to hard-plastic condition with thin fine sand interlayer at some places and clay deposit.	CL
22.0						
24.0				8		
26.0						
28.0	0.50	28.30		9	Sand: Grey, greyish light. Including fine sand.	
30.0	1.70	30.00		10	Low Plastic Clay: Greyish green, greyish yellow, greyish light; Plastic to hard-plastic condition.	CL

Symbol: Undisturbed soil sample
SPT Test

RESULTS OF PHYSICAL AND MECHANICAL PROPERTIES OF SAMPLE

PROJECT: SEWERAGE TREATMENT PLANT

LOCATION: VINH NIEM - HAI PHONG.

Calculated: Vu Van Loi
Checked by: Nguyen Huu Tri

No	Test number	Boring number	Depth of sample	GRAIN SIZE DISTRIBUTION - SIEVE OPENING (MM)					Wet density	Dry density	Moisture content	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Specific gravity	Voi ratio	Void	Saturation	CON. TEST		TRI. COM. TEST		UN. COM. TEST			DIRECT SHEAR TEST		Legend
				2.000	0.425	0.074	0.005	0.002												Precons press	Index Compression	Angle of internal friction	Cohesion	Un. Com. Strength	Cohesion	Compressibility	Angle of internal friction	Cohesion	
									γw	γc	Wo	LL	PL	PI	LI	σ	ωo	n	S	Pc	Cc	φ'	C	qu	Cu	E	φ'	C	
			m	%	%	%	%	%	g/cm^3	g/cm^3	%	%	%	%				%	%	kg/cm^2		Deg.	kg/cm^2			kg/cm^2	Deg.	kg/cm^2	
1- Backfill - Layer No 1																												
2- High Plastic Clay (CH) - Layer No 2																												
1	340	BH1	3.0 - 3.45		100.00	95.00	32.00	25.00			56.90	53.63	29.45	24.18	1.14	2.70													SPT Test
2	341	BH2	3.2 - 3.65		100.00	94.00	33.00	24.00			54.65	52.23	28.66	23.57	1.10	2.70													SPT Test
3	17	-	5.0 - 5.50		100.00	96.00	34.00	26.30	1.64	0.955	61.20	56.44	31.52	24.92	1.19	2.70	1.8272	64.63	90.43								0°37'	0.017	
4	337	-	6.0 - 6.45		100.00	95.00	32.00	23.00			56.40	53.70	30.20	23.50	1.11	2.70													SPT Test
5	323	BH3	3.0 - 3.45		100.00	95.00	32.00	24.00			54.55	52.00	28.74	23.26	1.11	2.70													SPT Test
6	2	BH4	3.2 - 3.65		100.00	94.00	32.00	23.00			56.96	54.87	30.42	24.45	1.09	2.70													SPT Test
7	307	-	5.0 - 5.50		100.00	97.00	33.00	23.00	1.62	1.056	53.35	51.87	27.64	24.33	1.06	2.70	1.5568	60.89	92.53	0.57	0.4	1°44'	0.049	0.20	0.10	4.80	2°04'	0.023	Con. + Tri. Com. + Un. Com. Test
8	316	BH5	3.0 - 3.45		100.00	95.00	32.00	26.00			55.50	52.46	28.75	23.71	1.13	2.70													SPT Test
9	41	BH6	3.0 - 3.45		100.00	95.00	32.00	24.00			54.15	52.04	27.46	24.58	1.08	2.70													SPT Test
Minimum					100.00	94.00	32.00	23.00	1.64	0.955	53.35	51.87	27.46	23.26	1.06	2.70	1.5568	60.89	90.43								0°37'	0.017	
Maximum					100.00	97.00	34.00	26.30	1.62	1.056	61.20	56.44	31.52	24.92	1.19	2.70	1.8272	64.63	92.53								2°04'	0.023	
Average					100.00	95.11	32.44	24.26	1.58	1.013	55.96	53.25	29.19	24.06	1.11	2.70	1.6654	62.48	90.72	0.57	0.4	1°44'	0.049	0.20	0.10	4.80	1°21'	0.020	
3- Low Plastic Clay (CL) - Layer No 3																												
10	11	BH1	5.0 - 5.50		100.00	79.50	19.70	12.00	1.78	1.317	35.20	33.09	21.35	11.74	1.18	2.69	1.0425	51.04	90.83	0.56	0.19	4°21'	0.058	0.26	0.13	5.83	6°06'	0.022	Con. + Tri. Com. + Un. Com. Test
11	366	-	6.2 - 6.65		100.00	75.00	18.60	14.00			40.00	38.45	23.44	15.01	1.16	2.69													SPT Test
12	332	-	9.0 - 9.45		100.00	73.00	18.00	13.00			39.40	37.32	22.75	14.57	1.14	2.69													SPT Test
13	344	BH2	9.3 - 9.75		100.00	74.00	19.00	14.00			34.75	32.00	20.20	11.80	1.23	2.69													SPT Test
14	331	-	10.0 - 10.5		100.00	77.00	18.50	10.00	1.84	1.401	31.30	29.04	19.75	9.29	1.24	2.69	0.9201	47.92	91.51										
15	16	BH3	5.0 - 5.50		100.00	75.00	17.50	10.80	1.83	1.376	32.95	30.65	21.23	9.42	1.24	2.69	0.9549	48.85	92.82	0.62	0.13						7°41'	0.020	
16	328	-	6.0 - 6.45		100.00	73.00	15.00	11.00			35.15	32.21	20.45	11.76	1.25	2.69													SPT Test
17	422	-	9.0 - 9.45		100.00	74.00	16.50	11.20			34.23	31.62	19.75	11.87	1.22	2.69													SPT Test
18	8	BH4	6.0 - 6.45		100.00	75.00	15.80	10.00			33.85	32.75	20.32	12.43	1.09	2.69													SPT Test
19	4	-	9.0 - 9.45		100.00	73.00	14.00	9.00			31.15	29.86	20.45	9.41	1.14	2.69													SPT Test
20	310	-	10.0 - 10.50		100.00	77.00	17.00	10.00	1.85	1.404	31.75	29.72	20.21	9.51	1.21	2.69	0.9160	47.81	93.24	0.72	0.10	5°31'	0.062	0.29	0.15	7.30	7°42'	0.022	Con. + Tri. Com. + Un. Com. Test
21	330	BH5	6.0 - 5.50		100.00	76.00	18.00	12.50	1.76	1.278	37.70	34.67	21.42	13.25	1.23	2.69	1.1049	52.49	91.78					0.20	0.10	6.40	5°27'	0.022	
22	314	-	6.2 - 6.65		100.00	70.00	13.00	8.00			29.25	28.77	19.20	9.57	1.05	2.69													SPT Test
23	311	-	9.3 - 9.75		100.00	72.00	16.40	13.50			41.00	38.55	23.44	15.11	1.16	2.69													SPT Test
24	359	BH6	5.0 - 5.50		100.00	76.00	18.00	12.00	1.78	1.276	39.45	35.02	20.43	14.59	1.30	2.69	1.1082	52.57	95.76								5°01'	0.023	
25	358	-	6.3 - 6.75		100.00	75.00	16.00	13.00			41.35	37.95	21.61	16.34	1.21	2.69													SPT Test
Minimum					100.00	70.00	13.00	8.00	1.76	1.276	29.25	28.77	19.20	9.29	1.05	2.69	0.9160	47.81	90.83	0.56	0.10	4°21'	0.058	0.20	0.10	5.83	5°27'	0.022	
Maximum					100.00	79.50	19.70	14.00	1.85	1.404	41.35	38.55	23.44	16.34	1.30	2.69	1.1082	52.57	95.76	0.72	0.19	5°31'	0.062	0.29	0.15	7.30	7°42'	0.023	
Average					100.00	74.66	17.19	11.50	1.81	1.335	35.59	33.23	21.00	12.23	1.19	2.69	1.0150	50.37	94.32	0.63	0.14	4°56'	0.062	0.25	0.13	6.51	6°23'	0.022	

RESULTS OF PHYSICAL AND MECHANICAL PROPERTIES OF SAMPLE

PROJECT: SEWERAGE TREATMENT PLANT

LOCATION: VINH NIEM - HAI PHONG.

Calculated: Vu Van Loi
Checked by: Nguyen Huu Trl

No	Test number	Boring number	Depth of sample	GRAIN SIZE DISTRIBUTION - SICVE OPENING (MM)					Wet density	Dry density	Moisture content	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Specific gravity	Voi ratio	Void	Saturation	CON. TEST		TRI. COM. TEST		UN. COM. TEST			DIRECT SHEAR TEST		Legend
				2.000	0.425	0.074	0.005	0.002												Precons press	Index Compression	Angle of internal friction	Cohesion	Un. Com. Strength	Cohesion	Compressibility	Angle of internal friction	Cohesion	
									γw	γc	Wo	LL	PL	PI	LI	σ	eo	n	S	Pc	Cc	$\varphi°$	C	qu	Cu	E	$\varphi°$	C	
			m	%	%	%	%	%	g/cm^3	g/cm^3	%	%	%	%				%	%	kg/cm^2		Deg.	kg/cm^2			kg/cm^2	Deg	kg/cm^2	
4- High Plastic Clay (CH) - Layer No 4																												
26	13	BH1	10.0 - 10.5		100.00	95.00	33.00	24.00	1.63	1.079	51.05	50.02	26.35	23.67	1.04	2.70	1.5023	60.04	91.75	0.51	0.37	1°52'	0.073	0.20	0.10	5.20	2°42'	0.023	Con. + Tri. Com. + Un. Com. Test
27	342	-	12.0 - 12.45		100.00	96.00	35.00	26.00			55.56	53.75	29.86	23.89	1.08	2.70													SPT Test
28	24	BH2	12.0 - 12.45		100.00	96.00	33.00	22.00			52.46	50.45	27.66	22.79	1.09	2.70													SPT Test
29	329	BH3	10.0 - 10.5		100.00	96.00	33.00	23.00	1.65	1.081	51.55	49.46	26.36	23.10	1.09	2.70	1.4793	59.67	94.09							2°13'	0.023	
30	324	-	12.2 - 12.65		100.00	95.00	32.00	23.00			54.20	52.00	27.84	24.16	1.09	2.70													SPT Test
31	9	BH4	12.0 - 12.45		100.00	96.50	34.00	25.00			56.30	54.30	31.96	22.34	1.09	2.70													SPT Test
32	328	BH5	10.0 - 10.5		100.00	97.00	34.00	26.00	1.54	0.933	65.00	55.03	29.45	25.58	1.39	2.70	1.8939	65.44	92.67							0°44'	0.019	
33	320	-	12.2 - 12.65		100.00	95.00	36.00	26.00			55.46	53.19	29.34	23.85	1.10	2.70													SPT Test
34	500	BH6	9.0 - 9.45		100.00	93.00	33.00	26.00			56.44	54.82	30.21	24.61	1.07	2.70													SPT Test
35	27	-	10.0 - 10.5		100.00	93.00	32.00	27.00	1.62	1.049	54.50	52.30	28.45	23.85	1.09	2.70	1.5739	61.15	93.49	0.45	0.36						1°36'	0.022	
36	39	-	12.2 - 12.65		100.00	94.00	32.00	23.00			51.10	49.96	26.85	23.11	1.05	2.70													SPT Test
37	42	-	15.0 - 15.45		100.00	96.00	31.00	23.00			54.65	53.52	29.78	23.74	1.05	2.70													SPT Test
Minimum					100.00	93.00	31.00	22.00	1.54	0.933	51.05	49.46	26.35	22.34	1.04	2.70	1.4793	59.67	91.75	0.45	0.36						0°44'	0.019	
Maximum					100.00	97.00	36.00	27.00	1.65	1.089	65.00	55.03	31.96	25.58	1.39	2.70	1.8939	65.44	94.09	0.51	0.37						2°42'	0.023	
Average					100.00	95.21	33.17	24.50	1.61	1.040	54.86	52.40	28.68	23.72	1.10	2.70	1.5962	61.48	92.80	0.48	0.37	1°52'	0.073	0.20	0.10	3.80	1°49'	0.022	
5- Low Plastic Clay (CL) - Layer No 5																												
38	339	BH1	15.0 - 15.45		100.00	92.20	31.00	23.00			35.05	41.25	22.85	18.40	0.66	2.72													SPT Test
39	335	BH2	15.0 - 15.45		100.00	94.30	31.00	23.50			35.35	41.46	21.96	19.50	0.69	2.72													SPT Test
40	322	BH3	15.0 - 15.45		100.00	93.60	32.00	22.80			33.50	42.33	23.33	19.00	0.54	2.72													SPT Test
41	321	-	18.2 - 18.65		100.00	94.00	32.00	23.40			34.00	39.78	21.44	18.34	0.68	2.72													SPT Test
42	347	-	20.0 - 20.5		100.00	95.00	31.00	22.00	1.83	1.385	32.15	37.73	20.15	17.58	0.88	2.72	0.9639	49.08	90.72							8°03'	0.073	
43	20	-	21.0 - 21.45		100.00	92.00	31.00	22.30			31.45	38.68	20.93	17.75	0.59	2.72													SPT Test
44	5	BH4	15.0 - 15.45		100.00	93.50	32.00	23.00			35.70	42.05	22.15	19.90	0.68	2.72													SPT Test
45	317	BH5	15.0 - 15.45		100.00	94.50	32.00	23.70			44.15	48.72	26.61	22.11	0.79	2.72													SPT Test
Minimum					100.00	92.00	31.00	22.00	1.83	1.385	31.45	37.73	20.15	17.58	0.54	2.72	0.9639	49.08	90.72									
Maximum					100.00	95.00	32.00	23.70	1.83	1.385	44.15	48.72	26.61	22.11	0.79	2.72	0.9639	49.08	90.72									
Average					100.00	93.64	31.50	22.98	1.83	1.354	35.17	41.50	22.43	19.07	0.67	2.72	1.0089	50.22	94.82							8°03'	0.073	

RESULTS OF PHYSICAL AND MECHANICAL PROPERTIES OF SAMPLE

PROJECT: SEWERAGE TREATMENT PLANT

LOCATION: VINH NIEM - HAI PHONG.

Calculated: Vu Van Loi

Checked by: Nguyen Huu Tri

No	Test number	Boring number	Depth of sample	GRAIN SIZE DISTRIBUTION - SICVE OPENING (MM)					Wet density	Dry density	Moisture content	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Specific gravity	Voi ratio	Void	Saturation	CON. TEST		TRI. COM. TEST		UN. COM. TEST			DIRECT SHEAR TEST		Legend
				2.000	0.425	0.074	0.005	0.002												Precons press	Index Compression	Angle of internal friction	Cohesion	Un. Com. Strength	Cohesion	Compressibility	Angle of internal friction	Cohesion	
									γw	γc	Wo	LL	PL	PI	LI	σ	εo	n	S									
			m	%	%	%	%	%	g/cm^3	g/cm^3	%	%	%	%				%	%	kg/cm^2		Deg.	kg/cm^2			kg/cm^2	Deg.	kg/cm^2	
6- Low Plastic Clay (CL) - Layer No 6																												
46	333	BH1	18.2 - 18.65		100.00	94.30	32.00	21.00			47.90	49.77	26.88	23.91	0.92	2.70													SPT Test
47	12	-	20.0 - 20.5		100.00	93.00	31.00	22.00	1.74	1.238	40.60	46.57	24.32	22.25	0.73	2.71	1.1890	54.32	92.54	0.77	0.25	4°19'	0.094	0.46	0.23	7.50	6°44'	0.062	Con. + Tri. Com. + Un. Com. Test
48	334	-	21.0 - 21.45		100.00	92.00	30.70	20.00			45.05	48.22	25.04	23.18	0.86	2.71													SPT Test
49	345	-	24.3 - 24.75		100.00	91.70	31.00	21.20			40.75	46.24	24.16	22.08	0.75	2.71													SPT Test
50	343	-	27.0 - 27.45		100.00	88.00	30.40	20.60			27.75	35.86	18.36	17.50	0.54	2.72													SPT Test
51	338	-	30.0 - 30.45		100.00	80.00	20.00	14.00			30.90	36.44	19.20	17.24	0.68	2.69													SPT Test
52	430	BH2	18.2 - 18.65		100.00	91.00	31.00	23.00			42.75	46.82	24.73	22.09	0.82	2.71													SPT Test
53	480	-	20.0 - 20.5		100.00	95.20	31.00	23.00	1.78	1.275	39.63	47.97	25.63	22.34	0.63	2.72	1.1333	53.12	95.11								7°14'	0.073	SPT Test
54	436	-	21.0 - 21.45		100.00	94.60	31.00	22.50			45.66	48.85	26.44	22.51	0.85	2.71													SPT Test
55	431	-	24.3 - 24.75		100.00	88.50	30.70	21.90			39.85	46.22	24.76	21.46	0.70	2.72													SPT Test
56	432	-	27.0 - 27.45		100.00	92.40	31.00	22.30			41.33	47.05	25.30	21.75	0.74	2.71													SPT Test
57	437	-	30.0 - 30.45		100.00	88.90	30.80	22.00			33.54	42.15	23.80	18.35	0.53	2.72													SPT Test
58	327	BH3	24.2 - 24.65		100.00	91.50	32.00	23.00			42.65	47.65	25.10	22.55	0.78	2.71													SPT Test
59	326	-	27.0 - 27.45		100.00	93.60	32.00	22.40			44.75	48.09	25.50	22.59	0.85	2.71													SPT Test
60	22	-	30.0 - 30.45		100.00	94.00	32.00	23.00			46.30	49.45	25.77	23.68	0.87	2.70													SPT Test
61	3	BH4	18.0 - 18.45		100.00	96.00	32.00	23.00			43.65	46.87	24.97	21.90	0.85	2.71													SPT Test
62	308	-	20.0 - 20.5		100.00	94.00	31.00	22.00	1.75	1.246	40.45	46.42	25.09	21.33	0.72	2.71	1.1750	54.02	93.29	0.77	0.27	4°22'	0.080	0.50	0.25	9.50	6°01'	0.058	Con. + Tri. Com. + Un. Com. Test
63	1	-	21.3 - 21.75		100.00	92.50	32.00	22.70			42.60	44.86	24.35	20.31	0.90	2.71													SPT Test
64	313	-	24.0 - 24.45		100.00	94.20	32.00	23.00			39.75	46.60	25.60	21.00	0.67	2.71													SPT Test
65	6	-	27.2 - 27.65		100.00	92.00	31.60	21.00			40.80	46.80	25.50	21.30	0.72	2.72													SPT Test
66	7	-	30.0 - 30.45		100.00	78.00	18.80	14.00			35.80	39.64	24.50	15.34	0.74	2.69													SPT Test
67	10	BH5	18.2 - 18.65		100.00	95.00	31.00	24.00			45.80	48.00	25.20	22.80	0.90	2.71													SPT Test
68	470	-	20.0 - 20.5		100.00	94.60	32.00	22.00	1.73	1.178	46.85	48.96	25.85	23.11	0.91	2.71	1.3005	56.53	97.63								5°42'	0.050	
69	315	-	21.0 - 21.45		100.00	93.00	32.00	20.50			42.05	47.20	25.91	21.29	0.76	2.71													SPT Test
70	312	-	24.3 - 24.75		100.00	94.70	32.00	23.50			47.05	48.80	25.60	23.20	0.92	2.70													SPT Test
71	319	-	27.0 - 27.45		100.00	92.60	31.40	21.80			33.15	40.40	21.80	18.60	0.61	2.70													SPT Test
72	318	-	30.0 - 30.45		100.00	79.00	18.70	13.00			33.95	38.62	22.91	15.71	0.70	2.69													SPT Test
73	318	BH6	18.3 - 18.75		100.00	93.00	31.00	21.00			46.75	49.85	26.66	23.19	0.87	2.71													SPT Test
74	318	-	21.2 - 21.65		100.00	92.00	31.00	22.00			41.85	48.65	25.78	22.87	0.70	2.72													SPT Test
Minimum					100.00	78.00	18.70	13.00	1.73	1.178	27.75	35.86	18.36	15.34	0.53	2.69	1.1333	53.12	92.54	0.77	0.25	4°19'	0.080	0.460	0.23	7.50	5°42'	0.050	
Maximum					100.00	95.20	32.00	24.00	1.78	1.275	47.90	49.85	26.66	23.91	0.92	2.72	1.3005	56.53	97.63	0.77	0.27	4°22'	0.094	0.500	0.25	9.50	7°14'	0.073	
Average					100.00	91.32	30.11	21.22	1.75	1.241	41.03	45.83	24.61	21.22	0.77	2.71	1.1837	54.21	93.94	0.77	0.26	4°21'	0.087	0.480	0.24	8.50	6°25'	0.061	
7- Low Plastic Clay (CL) - Layer No 7																												
75	45	BH6	24.3 - 24.75		100.00	85.40	31.40	21.80			29.15	38.10	19.20	18.90	0.53	2.72													SPT Test
76	35	-	27.0 - 27.45		100.00	84.00	30.00	20.00			28.80	37.86	20.40	17.46	0.48	2.72													SPT Test
77	33	-	30.0 - 30.45		100.00	87.00	31.30	21.40			30.40	38.00	20.40	17.60	0.57	2.72													SPT Test
Minimum					100.00	84.00	30.00	20.00			28.80	37.86	19.20	17.46	0.48	2.72													
Maximum					100.00	87.00	31.40	21.80			30.40	38.10	20.40	18.90	0.57	2.72													
Average					100.00	85.47	30.90	21.07			29.45	37.99	20.00	17.99	0.53	2.72													

RESULTS OF PHYSICAL AND MECHANICAL PROPERTIES OF SAMPLE

PROJECT: PUMPING STATIONS

LOCATION: VAN CAO, KIEU SON - HAI PHONG.

Calculated: Vu Van Loi
Checked by: Nguyen Huu Tri

No	Test number	Boring number	Depth of sample	GRAIN SIZE DISTRIBUTION - SICVE OPENING (MM)					Wet density	Dry density	Moisture content	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Specific gravity	Voi ratio	Void	Saturation	CON. TEST		TRI. COM. TEST		UN. COM. TEST			DIRECT SHEAR TEST		Legend
				2.000	0.425	0.074	0.005	0.002												Precons press	Index Compression	Angle of internal friction	Cohesion	Un. Com. Strength	Cohesion	Compressibility	Angle of internal friction	Cohesion	
									γw	γc	Wo	LL	PL	PI	LI	σ	eo	n	S	Pc	Cc	$\varphi°$	C	qu	Cu	E	$\varphi°$	C	
			m	%	%	%	%	%	g/cm^3	g/cm^3	%	%	%	%				%	%	kg/cm^2		Deg.	kg/cm^2			kg/cm^2	Deg.	kg/cm^2	
1- Backfill - Layer No 1																												
2- High Plastic Clay (CH) - Layer No 2																												
3- Low Plastic Clay (CL) - Layer No 3																												
1	32	BH7	3.0 - 3.45		100.00	72.00	17.00	12.00			37.30	35.40	22.42	12.98	1.15	2.69													SPT Test
2	349	-	5.0 - 5.5		100.00	77.00	18.00	12.40	1.76	1.271	38.45	34.52	21.27	13.25	1.30	2.69	1.1164	52.75	92.65	0.59	0.22	3°40'	0.054	0.19	0.09	6.10	5°51'	0.020	Con. + Tri. Com. + Un. Com. Test
3	48	BH8	3.0 - 3.45		100.00	73.00	16.80	11.50			38.35	36.24	23.20	13.04	1.16	2.69													SPT Test
Minimum					100.00	72.00	16.80	11.50	1.76	1.271	37.30	34.52	21.27	12.98	1.15	2.69	1.1164	52.75	92.65										
Maximum					100.00	77.00	18.00	12.40	1.76	1.271	38.45	36.24	23.20	13.25	1.30	2.69	1.1164	52.75	92.65										
Average					100.00	74.00	17.27	11.97	1.76	1.271	38.03	35.39	22.30	13.09	1.20	2.69	1.1098	52.60	92.18	0.59	0.22	3°40'	0.054	0.19	0.09	6.10	5°51'	0.020	
4- High Plastic Clay (CH) - Layer No 4																												
4	36	BH7	6.2 - 6.65		100.00	93.50	33.00	23.50			52.45	50.87	27.33	23.54	1.07	2.70													SPT Test
5	44	-	9.0 - 9.45		100.00	94.00	32.00	23.00			53.45	51.64	28.12	23.52	1.06	2.70													SPT Test
6	350	-	10.0 - 10.5		100.00	92.00	36.00	23.00	1.61	1.036	55.35	53.11	28.44	24.67	1.09	2.70	1.6062	61.63	93.04	0.50	0.35	0°54'	0.026	0.20	0.10	6.00	0°53'	0.020	Con. + Tri. Com. + Un. Com. Test
7	38	-	12.2 - 12.65		100.00	93.80	32.60	24.40			52.80	50.36	26.62	23.74	1.10	2.70													SPT Test
8	30	-	15.2 - 15.65		100.00	94.00	32.00	22.00			51.10	50.00	26.55	23.45	1.05	2.70													SPT Test
9	66	BH8	5.0 - 5.5		100.00	94.00	33.40	24.00	1.61	1.053	52.90	50.09	27.65	22.44	1.13	2.70	1.5641	61.00	91.32	0.45	0.40	1°16'	0.052	0.22	0.11	7.50	2°42'	0.022	Tri. Com. + Un. Com. Test
10	50	-	6.0 - 6.45		100.00	95.00	32.00	23.00			55.10	53.48	28.94	24.54	1.07	2.70													SPT Test
11	53	-	9.3 - 9.75		100.00	95.00	33.00	23.80			51.20	50.00	26.96	23.04	1.05	2.70													SPT Test
12	61	-	10.0 - 10.5		100.00	96.00	35.00	26.00	1.58	0.965	63.70	55.16	29.85	25.31	1.34	2.70	1.7979	64.26	95.66	0.45	0.41	0°48'	0.022	0.13	0.07	4.70	0°46'	0.017	Con. + Tri. Com. + Un. Com. Test
13	49	-	12.0 - 12.45		100.00	94.50	32.00	22.00			52.60	50.28	27.65	22.61	1.11	2.70													SPT Test
14	64	-	15.0 - 15.45		100.00	93.00	32.80	24.00			53.00	51.36	27.65	23.71	1.07	2.70													SPT Test
15	51	-	18.2 - 18.65		100.00	94.30	32.00	23.00			53.30	52.50	28.30	24.20	1.03	2.70													SPT Test
Minimum					100.00	92.00	32.00	22.00	1.58	0.965	51.10	50.00	26.55	22.44	1.03	2.70	1.5641	61.00	91.32	0.45	0.35	0°48'	0.022	0.13	0.07	4.70	0°46'	0.017	
Maximum					100.00	96.00	36.00	26.00	1.61	1.053	63.70	55.16	29.85	25.31	1.34	2.70	1.7979	64.26	95.66	0.50	0.41	1°16'	0.052	0.22	0.11	7.50	2°42'	0.022	
Average					100.00	94.09	32.98	23.48	1.60	1.039	53.93	51.57	27.84	23.73	1.10	2.70	1.5987	61.62	91.08	0.47	0.39	0°59'	0.033	0.18	0.09	6.07	1°27'	0.020	
5- Low Plastic Clay (CL) - Layer No 5																												
16	40	BH7	18.0 - 18.45		100.00	85.00	31.00	20.00			39.35	44.55	24.36	20.19	0.74	2.72													
17	362	-	20.0 - 20.5		100.00	95.00	33.00	23.00	1.83	1.387	31.90	40.25	22.13	18.12	0.54	2.72	0.9611	49.01	90.28			5°18'	0.108	0.78	0.39	18.50	8°01'	0.080	Tri. Com. + Un. Com. Test
18	37	-	21.0 - 21.45		100.00	90.00	31.00	21.00			34.40	41.70	23.44	18.26	0.60	2.72													SPT Test
19	31	-	24.2 - 24.65		100.00	89.40	30.80	22.50			30.05	38.62	20.75	17.87	0.52	2.72													SPT Test
20	47	-	27.0 - 27.45		100.00	87.70	31.50	21.60			31.80	40.30	22.65	17.65	0.52	2.72													SPT Test
21	352	-	30.0 - 30.45		100.00	87.00	31.00	20.50			36.40	44.25	23.75	20.50	0.62	2.72													SPT Test
22	360	BH8	20.0 - 20.5		100.00	93.00	31.00	23.00	1.77	1.239	42.60	48.41	26.00	22.41	0.75	2.71	1.1872	54.28	97.70	0.73	0.24	4°14'	0.084	0.47	0.24	13.50	6°43'	0.082	Con. + Tri. Com. + Un. Com. Test
23	58	-	21.2 - 21.65		100.00	88.00	32.00	20.00			39.20	45.40	24.10	21.30	0.71	2.72													SPT Test
24	56	-	24.0 - 24.45		100.00	89.00	32.00	21.00			35.95	43.80	23.10	20.70	0.62	2.72													SPT Test
25	54	-	27.0 - 27.45		100.00	92.00	31.50	21.50			34.85	41.90	23.60	18.30	0.61	2.72													SPT Test
26	57	-	30.0 - 30.45		100.00	90.00	31.00	22.00			32.25	37.50	22.20	15.30	0.66	2.69													SPT Test
Minimum					100.00	87.00	30.80	20.00	1.77	1.239	30.05	37.50	20.75	15.30	0.52	2.69	0.9611	49.01	90.28	0.73	0.24	4°14'	0.08	0.47	0.24	13.50	6°43'	0.062	
Maximum					100.00	95.00	33.00	23.00	1.83	1.387	42.60	48.41	26.00	22.41	0.75	2.72	1.1872	54.28	97.70	0.73	0.24	5°18'	0.11	0.78	0.39	18.50	8°01'	0.080	
Average					100.00	90.11	31.48	21.61	1.80	1.334	34.96	42.21	23.17	19.04	0.62	2.72	1.0390	50.06	91.52	0.73	0.24	4°46'	0.10	0.63	0.32	16.00	7°22'	0.071	

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Test No: 01
Location: Vinh niem - Hai phong
Depth: 2.0m
Boring No: BH1 (30.00m)
Date of Testing: 26 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-5} cm/sec)
1	13.5	1800	60	5.2	4.4
2	14.0	1800	60	5.2	4.5
3	14.4	1800	60	5.2	4.7
4					
5					
6					
AVERAGE - K_{av} (10^{-5} cm/sec):			K_{av} = 4.5 x 10^{-5} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)

Q- Constant rate of supply of water to the borehole (cm^3)

r- Inside radius of the casing (cm)

H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Location: Vinh niem - Hai phong
Boring No: BH1 (30.00m)
Test No: 02
Depth: 5.0m
Date of Testing: 26 Nov-2000

No	Q (cm^3)	t (Sec)	H (cm)	r (cm)	K (10^{-5} cm/sec)
1	45.0	1800	60	5.2	1.5
2	43.5	1800	60	5.2	1.4
3	40.6	1800	60	5.2	1.3
4					
5					
6					
AVERAGE - K_{av} (10^{-5} cm/sec):			K_{av} = 1.4 x 10^{-5} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- Inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

THHT-BH1

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Location: Vinh niem - Hai phong
Boring No: BH1 (30.00m)
Test No: 03
Depth: 15.0m
Date of Testing: 26 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-6} cm/sec)
1	12.2	1800	60	5.2	4.0
2	13.4	1800	60	5.2	4.3
3	11.8	1800	60	5.2	3.8
4					
5					
6					
AVERAGE - K_{av} (10^{-6}cm/sec):			K_{av} = 4.0 x 10^{-6} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- Inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Test No: 01
Location: Vinh niem - Hai phong
Depth: 2.0m
Boring No: BH4 (30.00m)
Date of Testing: 25 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-4} cm/sec)
1	10.0	1800	60	5.2	3.2
2	10.8	1800	60	5.2	3.5
3	10.4	1800	60	5.2	3.4
4					
5					
6					
AVERAGE - K_{av} (10^{-4} cm/sec):			K_{av} = 3.4 x 10^{-4} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)

Q- Constant rate of supply of water to the borehole (cm^3)

r- Inside radius of the casing (cm)

H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Test No: 02
Location: Vinh niem - Hai phong
Depth: 5.0m
Boring No: BH4 (30.00m)
Date of Testing: 25 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-6} cm/sec)
1	14.5	1800	60	5.2	4.7
2	15.5	1800	60	5.2	5.0
3	15.2	1800	60	5.2	4.9
4					
5					
6					
AVERAGE - K_{av} (10^{-6} cm/sec):			K_{av} = 4.9 x 10^{-6} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- Inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by:
Vu Van Loi

Checked by:
Nguyen Huu Tri

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Test No: 03
Location: Vinh niem - Hai phong
Depth: 15.0m
Boring No: BH4 (30.00m)
Date of Testing: 25 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-6} cm/sec)
1	9.2	1800	60	5.2	3.0
2	8.8	1800	60	5.2	2.9
3	8.7	1800	60	5.2	2.8
4					
5					
6					
AVERAGE - K_{av} (10^{-6} cm/sec):			K_{av} = 2.9 x 10^{-6} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- Inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

THHT-BH4

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Location: Vinh niem - Hai phong
Boring No: BH5 (30.00m)
Test No: 01
Depth: 2.0m
Date of Testing: 24 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-6} cm/sec)
1	16.4	1800	60	5.2	5.3
2	17.2	1800	60	5.2	5.6
3	16.8	1800	60	5.2	5.4
4					
5					
6					
AVERAGE - K_{av} (10^{-6} cm/sec):			K_{av} = 5.4 x 10^{-6} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

PERMEABILITY IN THE FIELD TEST

Project: Sewerage Treatment Plant
Test No: 02
Location: Vinh niem - Hai phong
Depth: 5.0m
Boring No: BH5 (30.00m)
Date of Testing: 24 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-6} cm/sec)
1	60.5	1800	60	5.2	2.0
2	58.7	1800	60	5.2	1.9
3	63.5	1800	60	5.2	2.1
4					
5					
6					
AVERAGE - K_{av} (10^{-6} cm/sec):			K_{av} = 2.0 x 10^{-6} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- Inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by: Vu Van Loi

Checked by: Nguyen Huu Tri

PERMEABILITY IN THE FIELD TEST

Project:	Sewerage Treatment Plant	Test No:	03
Location:	Vinh niem - Hai phong	Depth:	15.0m
Boring No:	BH5 (30.00m)	Date of Testing:	24 Nov-2000

No	Q	t	H	r	K
	(cm^3)	(Sec)	(cm)	(cm)	(10^{-5} cm/sec)
1	15.2	1800	60	5.2	4.9
2	15.5	1800	60	5.2	5.0
3	16.0	1800	60	5.2	5.2
4					
5					
6					
AVERAGE - K_{av} (10^{-5} cm/sec):			K_{av} = 5.0 x 10^{-5} cm/sec		

REMARK:

$$K = \frac{Q}{5.5 \times r \times H \times t} \quad \text{(cm/sec)}$$

K- Coefficient of Permeability (cm/sec)
Q- Constant rate of supply of water to the borehole (cm^3)
r- Inside radius of the casing (cm)
H- Differential head of water (cm)

Tested by:

Vu Van Loi

Checked by:

Nguyen Huu Tri

MC.-USCo.
Hai phong Construction Survey & Lab. Center

REPORT ON TESTING RESULT OF THE SOIL

Project : Vinh niem - Hai Phong

Sample sender by : Hai phong Construction design & Consultant Co.

Standard application : ASTM D2974, BS 1377-1990.

No.	Name of the sample	Depth (m)	Igniting (%)	Organic content (%)	Cation exchange (mEq/100 g soil)
1	BH1- 1	5.0-5.5	5.87	5.40	35
2	BH1-1*	6.0	5.49	5.20	26
3	BH1-2	10.0-10.5	7.83	6.90	48
4	BH1-3	20.0-20.5	5.91	2.10	18
5	BH3-5	9.0-9.45	2.52	1.90	12
6	BH3-SPT	21.0-21.45	6.32	1.20	20

Hai Phong Dec. 8th 2000

Tested by

Kiều Cao Môn
Lê Đình Hùng

Checked by

Nguyễn Thị Phượng

Appro. by

GIÁM ĐỐC
Nguyễn Quốc Oai

E: Geological Survey for Trang Cat Landfill

ELEVATION SHEET
OF GROUND WATER LEVEL
OF BOREHOLES AT THE TRANG CAT LANDFILL

Borehole N°	Elevation of Borehole (m)	Ground water level (m)
BH1	4.20	3.55
BH2	4.40	3.23
BH3	3.70	3.15
BH4	4.20	3.30
BH5	3.90	3.05
BH6	4.10	2.70
BH7	3.20	2.90
BH8	3.70	3.65
BH9	3.40	2.10
BH10	3.90	2.30
OW1	4.20	2.90
OW2	3.70	- 1.10

INSTRUCTION

FILLING SOIL

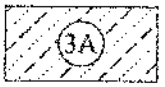
MUD CLAY, GREY WITH ORGANIC

CLAY, GREY, SOFT TO MEDIUM

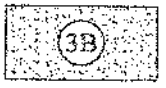
SANDY LEAN CLAY, GREY VERY SOFT

PLASTIC SILT, GREY, SOFT TO VERY SOFT

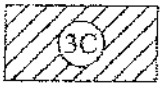
PLASTIC SILT, YELLOWISH GREY, SOFT TO VERY SOFT



YELLOWISH GREY, SANDY LEAN CLAY, SOFT



FINE SAND, WITH YELLOW CLAY, SAND WITH SILT MEDIUM DENSE



CLAY, WHITE - GREY, SOFT TO VERY SOFT

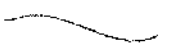
LEAN CLAY, RED - BROWN, YELLOW, STIFF

CLAY, GREY, MEDIUM

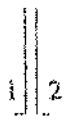
CLAY, GREY, SOFT

SANDY CLAY, GREY, STIFF TO MEDIUM

FINE SAND, GREY, SATURATED MEDIUM DENSE



THEORETICAL BORDER



1. ELEVATION OF THE BOTTOM OF LAYER

2. DEPTH OF THE BITTOM OF LAYER

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH1

Elevations of borehole :4.20m

Process :

Start Date 30-11-2000

Completion Date : 05-12-2000

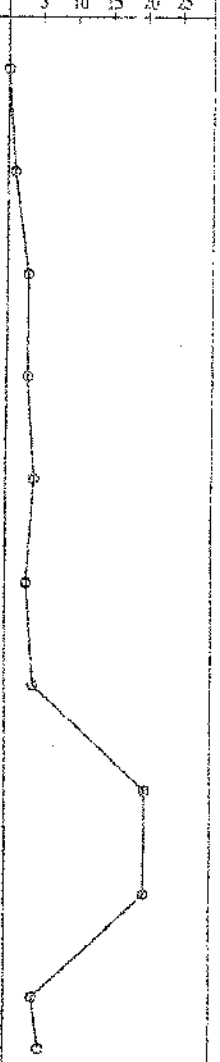
Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)
	3.50	0.70	0.70		Filling Soil	
1			8.30		Sandy lean clay very soft with organic matter	U1 5.00-5.50
	-4.80	9.00				
2			4.50		Plastic silt, grey, soft to very soft	U2 10.00-10.50
	-9.30	13.50				
3			4.60		Plastic silt, yellowish, soft to very soft	
	-13.90	18.10				
3A			2.40		Sandy lean clay, yellowish grey, soft	U3 20.00-20.50
	-16.30	20.50				
3B			5.50		Fine sand, with yellow silty clay, medium dense	
	-21.80	26.00				
5			4.00		Lean clay, grey soft	
	-25.80	30.00				

Note: Elevation of Ground water leve in BH1 is: 3.55m

STANDARD PENETRATION TEST

Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3
1	1.50	0	0	0	0
2	4.50	0	0	1	1
3	7.50	1	1	2	3
4	10.50	1	1	2	3
5	13.50	1	2	2	4
6	16.50	0	1	2	3
7	19.50	1	2	2	4
8	22.50	6	8	12	20
9	25.50	6	9	11	20
10	28.50	2	2	2	4
11	30.00	2	2	3	5

CHART



WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH2

Elevations of borehole :4.40m — Start Date 06-12-2000

Process : — Completion Date : 07-12-2000

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						CHART
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3	5 10 15 20 25
KQ	3.10	1.30	1.30		Filling Soil		1	1.50	0	1	1	2	
1			8.00		Sandy lean clay, grey, very soft, with organic matter		2	4.50	0	1	1	2	
							3	7.50	0	1	1	2	
2	-4.90	9.30	7.30		Plastic silt grey, soft to very soft		4	10.50	0	0	1	1	
							5	13.50	0	0	1	1	
	-12.20	16.60					6	16.50	0	0	1	1	
3			5.80		Plastic clay, yellowish grey soft to very soft		7	19.50	0	0	1	1	
	-18.00	22.40					8	22.50	0	0	1	1	
3C			7.10		Clay, white - grey, soft to very soft		9	25.50	0	0	1	1	
							10	28.50	0	0	1	1	
	-25.10	29.50											
4			2.50		Lean clay , brown, stiff		11	31.50	4	4	6	10	
	-27.60	32.00											

Note: Elevation of Ground water leve in BH2 is: 3.23m

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH3

Elevations of borehole :3.70m — Start Date

Process : — Completion Date :

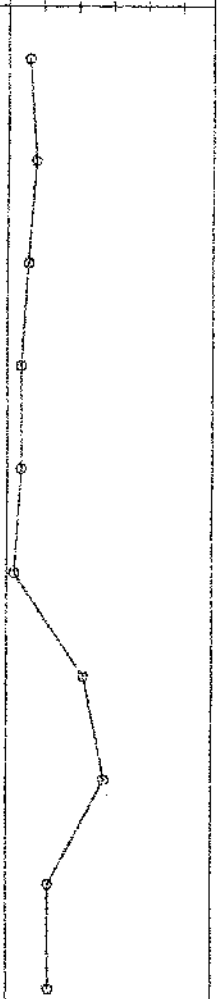
Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)
KQ	2.50	1.20	1.20		Filling Soil	
R	1.75	1.95	0.75		Grey clay medium to soft	
1	-5.90	9.60	7.65		Sandy lean clay, brownish grey, very soft	U1 5.00-5.60
2	-9.30	13.00	3.40		Plastic silt, grey, soft to very soft	U2 10.00-10.60
3	-15.60	19.30	6.30		Plastic silt, yellowish grey, soft to very soft	
4	-21.40	25.10	5.80		Lean clay, red - brown, yellow, stiff	U3 20.00-20.80
5	-26.30	30.00	4.90		Lean clay, grey, soft	

Note: Elevation of ground water leve in BH3 is: 3.15m

STANDARD PENETRATION TEST

Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3
1	1.50	1	1	2	3
2	4.50	1	2	2	4
3	7.50	1	1	2	3
4	10.50	0	1	1	2
5	13.50	1	1	1	2
6	16.50	0	0	1	1
7	19.50	3	4	7	11
8	22.50	4	5	9	14
9	25.50	3	3	3	6
10	28.50	3	3	3	6

CHART



WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH4

Elevations of borehole :4.20m — Start Date 01-12-200

Process : — Completion Date : 02-12-200

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3	CHART 5 10 15 20 25
KQ	3.00	1.20	1.20		Filling Soil								
TK	2.30	1.90	0.70		Clay, mud, grey		1	1.50	0	0	0	0	
1			6.00		Sandy lean clay, grey, with organic very soft	U1 5.00-5.50	2	4.50	0	0	0	0	
	-3.70	7.90					3	7.50	0	0	1	1	
2			5.90		Plastic silt, grey, soft to very soft	U2 10.00-10.50	4	10.50	0	1	1	2	
	-9.60	13.80					5	13.50	0	1	1	2	
3			10.50		Plastic silt, yellowish grey, very soft	U3 20.00-20.50	6	16.50	0	1	1	2	
							7	19.50	1	1	2	3	
	-20.10	24.30					8	22.50	1	1	2	3	
5			5.70		Lean Clay, grey, soft		9	25.50	1	2	2	4	
							10	28.50	1	1	2	3	
	-25.80	30.00					11	30.00	1	2	2	4	

Note: Elevation of ground water leve in BH4 is: 3.30m

WORKS: THE TRANG CAT LANDFILL GBOLOGICIAL SURVEY

BOREHOLE : BH5

Elevations of borehole :3.90m

Process :

Start Date 08-12-2000

Completion Date : 09-12-2000

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3	CHART 5 10 15 20 25
KQ	2.70	1.20	1.20		Filling Soil								
1			8.80		Sandy lean clay, grey, very soft		1	1.50	0	0	1	1	
							2	4.50	0	0	0	0	
							3	7.50	0	0	1	1	
	-6.10	10.00					4	10.50	0	0	1	1	
2			3.40		Plastic silt, grey, soft to very soft								
	-9.50	13.40					5	13.50	0	1	1	2	
3			3.40		Plastic silt, yellowish grey, very soft								
	-12.90	16.80					6	16.50	1	1	2	3	
4			5.50		Lean Clay, brown, yellowish brown, stiff		7	19.50	4	5	8	13	
	-18.40	22.30					8	22.50	2	3	5	8	
5			7.70		Lean Clay, white - grey, soft		9	25.50	3	3	4	7	
							11	28.50	3	3	4	7	
	-26.10	30.00											

Note: Elevation of Ground water leve in BH5 is: 3.05m

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH6

Elevations of borehole :4.10m — Start Date

Process : — Completion Date :

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3	CHART
KQ	2.90	1.20	1.20		Filling Soil								
R	0.60	3.50	2.30		Clay, grey, soft		1	1.50	2	2	2	4	
1	-5.50	9.60	6.10		Sandy lean, clay, greyish brown, very soft	U1 5.00-5.50	2	4.50	1	1	1	2	
							3	7.50	1	1	1	2	
2	-11.60	15.70	6.10		Grey plastic silt, soft to very soft	U2 10.00-10.50	4	10.50	1	1	1	2	
							5	13.50	1	1	1	2	
4	-18.90	23.00	7.30		Lean Clay, brownish yellow, stiff	U3 20.00-20.50	6	16.50	3	5	7	12	
							7	19.50	6	7	9	16	
							8	22.50	4	5	6	11	
5	-24.40	28.50	5.50		Lean Clay, grey, soft to medium		9	25.50	3	4	4	8	
6	-25.90	30.00	1.50		Fine sand, grey, saturated, dense		10	28.50	7	17	19	36	

Note: Elevation of Ground water leve in BH6 is : 2.70m

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH7

Elevations of borehole :3.20m — Start Date

Process : — Completion Date :

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3	CHART 5 10 15 20 25
TK	1.20	2.00	2.00		Clay, mud, greyish - brown		1	1.50	0	0	0	0	
1	-3.60	6.80	4.80		Sandy lean clay, grey, very soft		2	4.50	0	0	1	1	
							3	7.50	0	0	1	1	
2	-9.80	13.00	6.20		Plastic silt, grey, very soft		4	10.50	0	0	1	1	
							5	13.50	2	3	3	6	
4	-17.10	20.30	7.30		Lean Clay, red - brownish, stiff		6	16.50	4	7	8	15	
							7	19.50	3	4	5	9	
5	-23.50	26.70	6.40		Lean clay, grey, soft to medium		8	22.50	3	3	3	6	
							9	25.50	2	2	3	5	
5A	-28.80	32.00	5.30		Sandy clay, grey, stiff to medium		10	28.50	4	5	5	10	
							11	31.50	4	4	4	8	

Note: Elevation of Ground Water leve in BH7 is : 2.90m

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH8

Elevations of borehole :3.70m — Start Date

Process : — Completion Date :

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						CHART
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3	5 10 15 20 25
KQ	2.90	0.80	0.80		Filling Soil								
1			7.10		Sandy lean clay, grey, very soft	U1 3.00-5.50	1	1.50	0	0	0	0	
							2	4.50	0	0	1	1	
	-4.20	7.90					3	7.50	0	0	1	1	
2			5.70		Plastic silt, grey, soft to very soft	U2 10.00-10.50	4	10.50	0	0	1	1	
	-9.90	13.60					5	13.50	0	1	1	2	
3			10.50		Plastic silt, yellowish grey, soft	U3 20.00-20.50	6	16.50	0	1	1	2	
							7	19.50	0	1	2	3	
							8	22.50	1	1	2	3	
	-20.40	24.10					9	25.50	6	7	8	15	
4			5.70		Lean Clay, red - bown, stiff		10	28.50	4	4	5	9	
	-26.10	29.80											
6			1.70		Fine sand, grey, saturated, medium dense		11	31.50	8	13	14	27	
	-27.80	31.50											

Note: Elevation of Ground water leve in BH8 is : 3.65m

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH9

Elevations of borehole :3.40m — Start Date

Process : — Completion Date :

Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)	STANDARD PENETRATION TEST						CHART
							Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N2	5 10 15 20 25
KQ	2.90	0.50	0.50		Filling Soil								
1			9.00		Sandy lean clay, grey, soft		10	1.50	0	0	0	0	
							2	4.50	0	0	1	1	
							3	7.50	1	1	1	2	
	-6.10	9.50											
2			4.10		Plastic silt, grey, soft, soft to very soft		4	10.50	1	1	1	2	
	-10.20	13.60					5	13.50	1	1	1	2	
3			10.30		Plastic silt, yellowish - grey, soft to very soft		6	16.50	1	1	1	2	
							7	19.50	1	2	2	4	
	-20.50	23.90					8	22.50	2	2	2	4	
5B			5.10		Clay, grey, soft to medium		9	25.50	4	4	5	9	
	-25.60	29.00					10	28.50	2	2	3	5	
5	-26.60	30.00	1.00		Lean Clay, grey, soft								

Note: Elevation of Ground water leve in BH9 is : 2.10m

WORKS: THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY

BOREHOLE : BH10

Elevations of borehole :3.90m — Start Date

Process : — Completion Date :

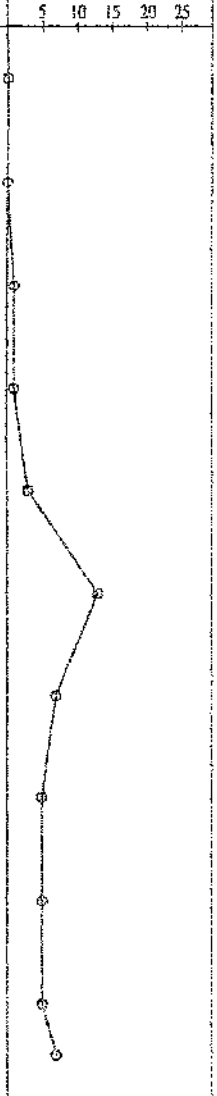
Sign of layer - name	Elevation of bottom layer (m)	Depth of bottom layer (m)	Thickness of layer (m)	Borehole Log Scale : 1 : 200	STRATA DESCRIPTION	Sample depth (m)
KQ	2.40	1.50	1.50		Pilling Soil	
1	-4.30	8.20	6.70		Sandy lean clay, grey, organic, very soft	U1 5.00-5.50
2	-9.40	13.30	5.10		Plastic silt, grey, very soft	U2 10.00-10.50
4	-13.80	17.70	4.40		Lean Clay, red - brown, stiff	
5	-26.10	30.00	12.30		Plastic silt, grey, soft	U3 20.00-20.50

Note: Elevation of Ground water leve in BH10 is : 2.30m

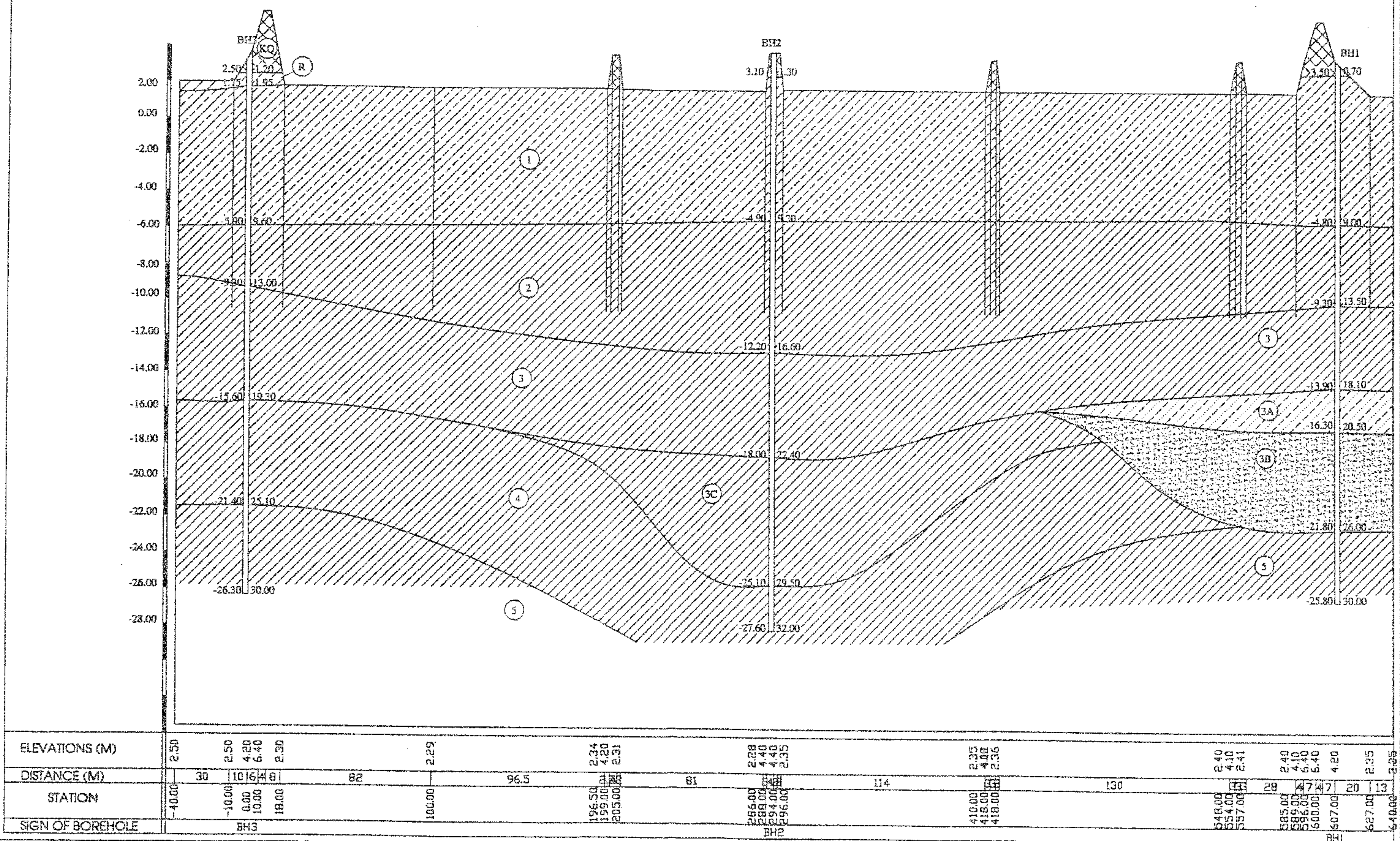
STANDARD PENETRATION TEST

Number of penetration points	Testing depth (m)	N1	N2	N3	N = N2 + N3
1	1.50	0	0	0	0
2	4.50	0	0	0	0
3	7.50	0	0	1	1
4	10.50	0	0	1	1
5	13.50	1	1	2	3
6	16.50	4	6	7	13
7	19.50	2	3	4	7
8	22.50	1	2	3	5
9	25.50	1	2	3	5
10	28.50	1	2	3	5
11	30.00	2	3	4	7

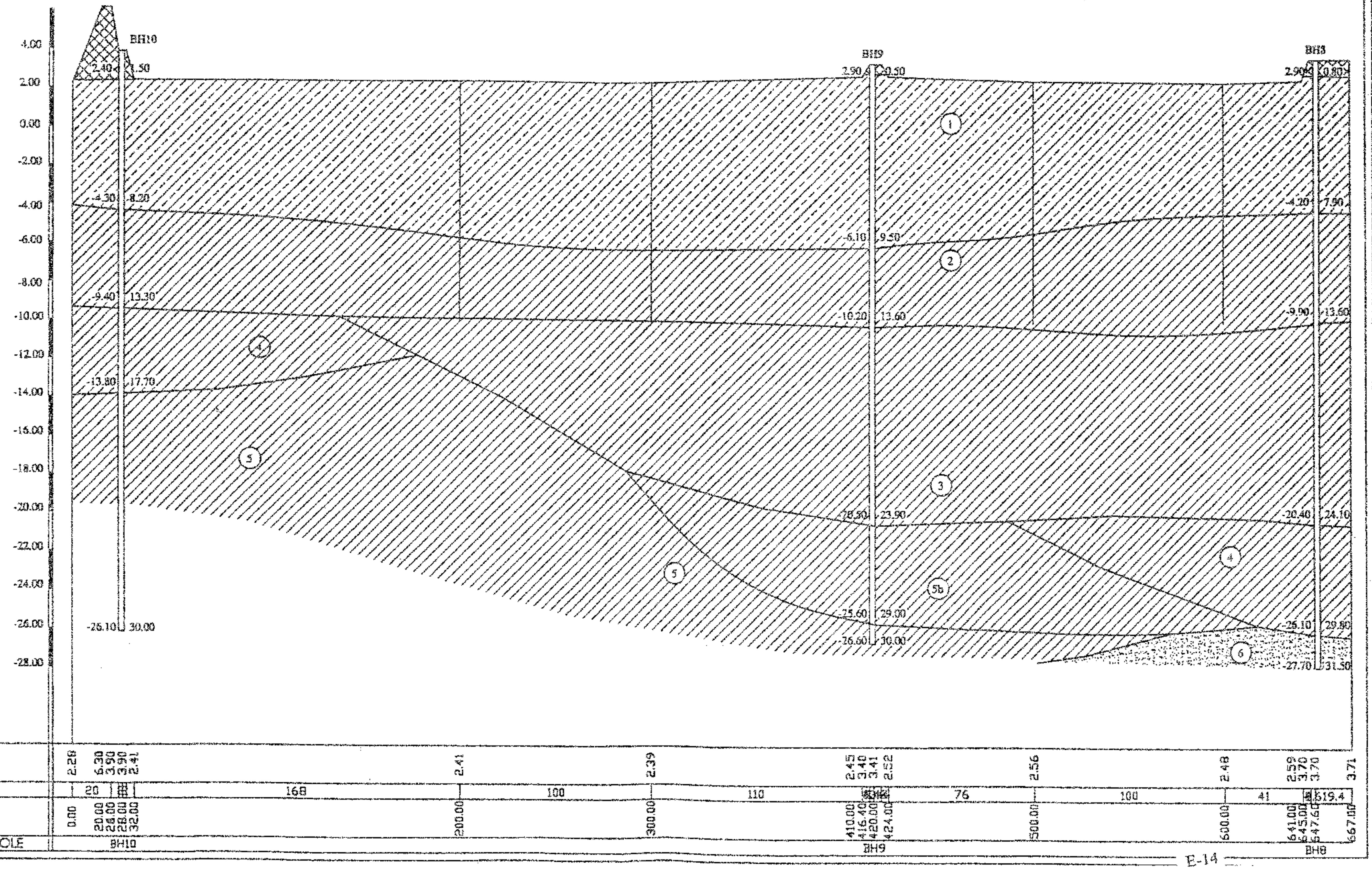
CHART



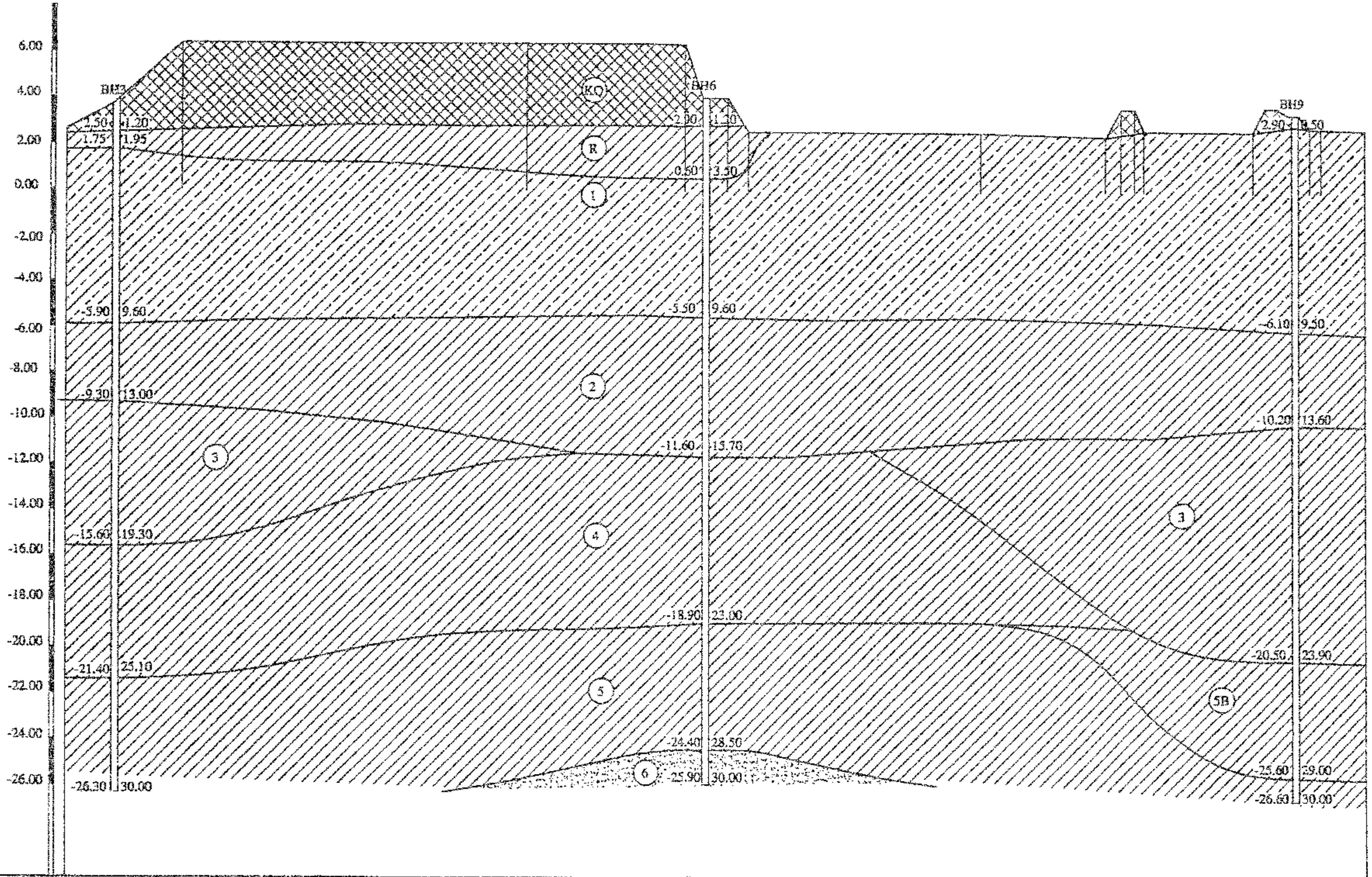
PROJECT : THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY	GEOLOGICIAL CROSS SECTION I - I	DRAWING : .... SCALE : 1/200 : 1/2000



PROJECT : THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY	GEOLOGICIAL CROSS SECTION III- III	DRAWING : ... SCALE : 1/200 : 1/2000



PROJECT : THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY	GEOLOGICIAL CROSS SECTION IV- IV	DRAWING : .... SCALE : 1/200 : 1/2000



ELEVATION (M)	3.700, 6.400, 6.400, 6.420, 4.100, 4.100, 2.610, 2.610, 2.420, 3.680, 2.710, 2.650, 3.710, 3.710, 3.400, 3.400, 2.800, 2.750
DISTANCE (M)	20, 30, 150, 70, 8, 10.9, 9.1, 102, 55, 17, 6, 4, 58, 5, 5, 20
STATION	20.00, 50.00, 200.00, 270.00, 278.00, 288.90, 298.00, 400.00, 455.00, 468.00, 472.00, 525.00, 530.00, 535.00, 539.90, 545.00, 550.00, 570.00
SIGN OF BOREHOLE	BH3, BH6, BH9

ENGINEERING PROPERTIES OF SOIL SAMPLES

PROJECT : TRANG CAT LANDFILL

Boring number	Sample number	Sample depth (m)	Percent finer					Moisture content W (%)	Wet density γ_w (g/cm^3)	Dry density γc (g/cm^3)	Specific gravity G (g/cm^3)	Void ratio e	Prosity n (%)	Degree of saturation S (%)	Liquid limit LL (%)	Plastis limit PL (%)	Plasticity index PI (%)	Liquidity index LI (%)	Sheaer test		Consolidation test				Swell Index Cs	Compression ratio a_{1-2} (cm2/Kg)	Triaxial Test		Permeability K x 10^{-7} cm/sec	Resilient Modulus E (kG/cm^2)	Chemical test result		
			4.760mm	2.0mm	0,475mm	0,0075mm	0,002mm												Angle of internal friction φ (degree)	Cohesion C (Kg/cm^2)	Preconsolidation pressure P_c (Kg/cm^2)	Coefficient of consolidation Cv (x 10^{-1}cm^2/s)	Coefficient of permeability K (x 10^{-7}cm/s)	Compression Index Cc			Angle of internal friction φ (degree)	Cohesion C (Kg/cm2)				Cation exchange (meq/100g soil)	Inition loss (%)	Organic content (%)
BH1	M1	5.0-5.5		100.00	99.50	61.50	3.40	29.60			2.61				30.60	20.10	10.50	0.90									3o19'	0.08	1.860		5.25		
BH1	M2	10.0-10.5		100.00	99.30	96.80	10.70	61.70	1.66	1.03	2.64	1.572	60.98	103.62	57.70	34.80	22.90	1.17	1°54'	0.09	0.51	0.84	0.496	0.447	0.047	0.129	7°45'	0.123	1.180	43.50			
BH1	M3	20.0-20.5		100.00	99.10	51.90	7.20	19.30	2.06	1.73	2.62	0.517	33.97	97.81	21.30	13.90	7.40	0.73	37°42'	0.16	0.92	0.832	0.077	0.045	0.008		12°06'	0.084	1.160	44.90			
BH3	M4	5.0-5.5		100.00	99.20	57.40	2.10	30.30	1.75	1.34	2.62	0.951	48.85	83.48	32.10	23.00	9.10	0.80	24°28'	0.16	0.82	0.742	0.128	0.104	0.019		13°01'	0.075	0.250		5.25	7.6	5.35
BH3	M5	10.0-10.5		100.00	99.30	97.70	9.50	61.20			2.65				57.70	34.80	22.90	1.15													27.50	14.29	10.67
BH3	M6	20.0-20.5			100.00	98.50	10.00	37.20	1.84	1.54	2.66	0.983	49.62	100.66	46.80	26.20	20.60	0.53	7°19'	0.42						0.041			0.094	72.00	15.75	11.59	8.42
BH4	M7	5.0-5.5	100.00	99.80	97.90	67.60	3.40	27.00			2.62				28.90	19.70	9.20	0.79									3°47'	0.072	7.400			6.38	5.22
BH4	M8	10.0-10.5	100.00	99.80	99.20	94.60	12.40	50.60	1.71	1.14	2.63	1.316	56.65	101.12					7°02'	0.08						0.062			0.370	20.30	13.50	11.33	8.23
BH4	M9	20.0-20.5		100.00	99.50	97.10	14.60	57.50			2.66																		0.078		23.20	12.76	9.5
BH6	M10	28.5-28.95		100.00	99.50	18.10		20.90			2.63																						
BH8	M11	5.0-5.5		100.00	99.20	60.20	3.30	29.40			2.63																				6.75	4.78
BH8	M12	10.0-10.5		100.00	99.70	98.20	12.50	63.80			2.63				65.00	34.30	30.70	0.96													14.25	10.45
BH8	M13	20.0-20.5						49.70	1.74	1.16	2.65	1.280	56.23	102.89	51.10	31.50	19.60	0.93	2°59'	0.12	0.88	0.537	0.240	0.307	0.030		5°16'	0.090	0.039		21.20	11.18	7.87
BH10	M14	5.0-5.5		100.00	97.30	61.30	4.50	26.50			2.61																				7.19	5.72
BH10	M15	10.0-10.5						67.00	1.60	0.96	2.62	1.735	63.36	101.18	59.50	37.80	21.70	1.35	3°14'	0.11						0.153			0.470				
BH10	M16	20.0-20.5		100.00	99.50	95.70	13.60	46.20	1.80	1.23	2.64	1.144	53.41	106.62	51.30	32.00	19.30	0.74	5°09'	0.30	0.67	1.068	0.232	0.159	0.039	0.057	13°40'	0.290	0.069	56.30	12.31	11.86	8.81
BH10	M17	28.5-28.95	100.00	99.70	99.00	97.20	10.80	46.50			2.69				48.70	27.60	21.10	0.90															

PROJECT : THE TRANG CAT LANDFILL GEOLOGICIAL SURVEY	GEOLOGICIAL CROSS SECTION II - II	DRAWING : .... SCALE : 1/200 : 1/2000