For discussion on
17 September 2013

The Legislative Council
Panel on Environmental Affairs

Incident of Leachate from North East New Territories Landfill

Purpose

This paper briefs Members on the incident of leachate leakage from the North East New Territories (NENT) Landfill and the associated measures taken.

The Incident

2. The three strategic landfills in Hong Kong, including the NENT Landfill, are operated under a design-build-and-operate (DBO) contract managed by the Environmental Infrastructure Division of the Environmental Protection Department (EPD). More details on the DBO contract and its management are provided in **Annex A1**. All three landfills have purposely designed and built comprehensive systems to manage the wastewater[Note 1] and leachate[Note 2] produced to ensure that the impact to the environment is properly managed. Details of the different systems to manage leachate, surface water and groundwater at the NENT Landfill are provided in **Annex A2**. A typical section layout of a landfill is given in **Annex B1**.

Note 1 Wastewater includes sewage, wash water from site activities including vehicle washing facilities.

Note 2 Leachate is the liquid that has percolated through solid waste. It is generated by the moisture content in the waste, decomposition of waste, and rainwater infiltration into the waste mass. The leachate management system comprises leachate collection network, pump sumps, storage lagoons, rising mains and treatment plants for handling and treating leachate.

3. On 27 July 2013, leakage of leachate from a recently commissioned temporary leachate storage lagoon at the NENT Landfill was detected. Leachate leaking from the toe of the temporary lagoon was observed. The landfill contractor was informed immediately to take action to rectify the leaking problem. The contractor took immediate measures to contain the leachate within the landfill boundary but due to the heavy rainstorm, some leaked leachate mixed with a large amount of rainwater entered the surface water system serving the landfill and discharged into the nearby Kong Yiu Channel (the Channel). A map showing the location of the NENT Landfill, the Channel and its vicinities is in **Annex C**.

4. Operation of the NENT Landfill is subject to environmental legislation. The contractor has been licensed by the Environmental Compliance Division of EPD and the conditions include controls imposed under the Water Pollution Control Ordinance (WPCO). The Division was notified of the incident on 28 July 2013 and the staff of the Division went to the site in the late afternoon on the same day. During inspection, leakage of leachate from a temporary storage lagoon was observed. Some leaked leachate mixed with rainwater entered the surface water system serving the landfill and discharged into the Channel. The contractor was carrying out remedial measures. EPD advised the contractor that the situation should be rectified as soon as possible. Legal sample of wastewater discharged from the NENT Landfill was collected on 29 July from the storm drain at the boundary of the NENT Landfill. Analysis result was received from the Government Laboratory on 20 August. The pollutant levels in the sample collected on 29 July, though higher than normal unpolluted water, were within the legal standards.

5. Staff of the Environmental Compliance Division had been monitoring the situation and collected further legal samples on wastewater discharged from the landfill. Analysis results of the legal sample collected on 7 August 2013 was received from the Government Laboratory on 23 August 2013, which showed that the pollutant levels in the sample exceeded the legal standards. On the basis of the analysis results, EPD is considering taking legal actions under the WPCO with the contractor. Further analysis results received showed that samples collected on 23 and 30 August and 2 September also exceeded the legal standards.

6. The repairing work was completed and the damaged lagoon resumed its service on 31 August 2013. EPD continues to keep the operation of the landfill under close supervision. The Environmental Compliance Division may collect further legal samples in case any abnormal situation is observed.

Environmental Impacts of the Incident

7. The section of the Channel receiving the leachate is not a natural stream. It is a man-made, concrete lined channel, draining into the Shenzhen River. No village houses extract water from the river for potable use. There are a few small farms located along the watercourse. The landfill has been providing fresh water to one of the farmers even before the incident at times when the channel is dry. Following the incident on 27 July, the landfill contractor has also liaised with another farmer to provide him with fresh water when required. There is no known record of plant/animal species of significant ecological value along the Channel. Since the leachate leaked into a concrete channel without overland flow, significant ecological impact is thus unlikely. During EPD's field inspections, no noticeable ecological impact was observed. Nonetheless, water tanks have been provided to the farmers.

8. EPD has been conducting water quality monitoring at the junction of the Channel and Shenzhen River as well as the downstream stretch of Shenzhen River and Deep Bay. The monitoring results indicate that the leachate overflowed from NENT Landfill did not cause adverse impact to the water quality of Shenzhen River and Deep Bay.

9. Although no noticeable ecological impact had been observed, the laboratory analysis result received on 23 August showed that the levels of pollutant in the sample collected on 7 August had exceeded the legal standards. In the light of the potential offence, in parallel we issued a press release and conducted a press briefing on 28 August 2013 to keep the public informed of the incident, findings of the environmental monitoring and the remedial actions. EPD will continue to monitor the environmental water quality and the Agriculture, Fisheries and Conservation Department would follow up to offer advice to the nearby farms where necessary.

Mitigation Measures Taken

10. Once the leak was detected, the contractor took the following immediate measures to rectify the problem:

(a) provision of temporary soil bunds for interception and containment of leaked leachate;

(b) recirculation of the leachate back into the waste mass within the landfill;

(c) pumping the leachate stored at the damaged lagoon to other temporary leachate storage lagoons as far as possible;

(d) carrying out the emergency repairing works at the damaged lagoon which was completed and resumed its service on 31 August 2013;

(e) deploying road tankers to transport pretreated leachate[Note 3] direct to the Shek Wu Hui Sewage Treatment Works; and

(f) close inspection and checking of all the lagoons in the landfill and associated facilities to ensure their efficient and safe operation.

11. Moreover, the Drainage Services Department took emergency measures to stretch its sewerage network on a temporary basis to receive more pretreated leachate from NENT Landfill so as to reduce the risk of overflowing of untreated leachate off-site.

12. In parallel, EPD has asked contractors of the West New Territories (WENT) Landfill and the South East New Territories (SENT) Landfill to check the conditions of the leachate lagoons in their sites given the heavy rainfall during the period. The lagoons have all been found to be in normal operation.

Note 3 Leachate generated by the NENT Landfill is treated by an on-site treatment works to a standard suitable for discharging to public sewers for final treatment at the Shek Wu Hui Sewage Treatment Works.

Follow Up Actions and Progress

13. The DBO contracts of the three strategic landfills are performance based contracts which specify the necessary performance and environmental requirements for the contractors to comply with. The environmental performance requirements include wastewater discharge standards, air emission standards, noise emission standards, as well as operational aspects including waste examination, waste disposal performance standards, flow control of waste vehicles.

14. The NENT Landfill contractor is the Far East Landfill Technologies Ltd. The Environmental Infrastructure Division of EPD has requested the contractor to provide an incident report which will cover the causes of the incident, measures taken on site during the incident period as well as interim and longer term measures to improve the management of leachate on site and prevent the reoccurrence of similar incidents. We will study the report and determine the appropriate actions under the provisions of the contract in consultation with the Department of Justice where necessary and appropriate.

15. From the law enforcement angle, landfills are subject to control of applicable environmental legislation as well as the relevant licences and permits enforced by the Environmental Compliance Division of EPD. For the NENT Landfill, the contractor holds an Effluent Discharge Licence under the WPCO and Construction Noise Permit under the Noise Control Ordinance. As some samples of wastewater discharge collected exceeded the legal standard, the Environmental Compliance Division is conducting follow up work to collect further evidence and statements from the contractor. Advice from the Director of Public Prosecution will also be sought. In accordance with the law, a decision on prosecution will be made within 6 months from the date of suspected offence.

Related Background Information

The Sewerage Network Serving the Area

16. The pretreated leachate from the NENT Landfill is pumped through a sewerage network to the Shek Wu Hui Sewage Treatment Works. The sewerage network also serves the dual purpose of pumping domestic sewage from villages in the Ta Kwu Ling/Ping Che area to the Shek Wu Hui Sewage Treatment Works for treatment. A schematic drawing showing the sewerage network in the area is in **Annex D**.

17. The sewerage network has a total carrying capacity of 3,800m^3/day. The pipeline can handle up to about 1,300m^3/day of pretreated leachate from the NENT Landfill. Due to the anticipated population increase in the area, a review of the sewerage network was initiated in 2009 and completed in 2012. Improvement works to the sewerage network is being planned to increase its total carrying capacity to around 10,000 m^3/day. The capacity will be sufficient for serving the projected population increase as well as the planned extension of the landfill.

18. The improvement works will be carried out in two stages. The initial stage comprises upgrading of a section of pipeline that serves the NENT Landfill and the diversion of some of the domestic sewage flow to another sewerage network with a view to increasing the quantity of pretreated leachate that can be accepted by the sewerage network. We aim to complete these works within three years. The latter stage comprises the upgrading of the remaining sewers and pumping stations to receive the ultimate projected flow from the catchment. Due to the complexity of the works and need to coordinate with other public works in the area such as the Lin Ma Hang Road widening project, we aim to complete these works within six years. A schematic drawing showing the proposed improvement/upgrading works in the area is in **Annex E**.

Other Complaints on Wastewater Discharge from Landfills

19. Since 2008, there have been a total of 22 complaints received against wastewater discharge from landfills in Hong Kong. Of them 7 were about the SENT Landfill, 12 were about the WENT Landfill and 3 were about the NENT Landfill. Investigations carried out by the Environmental Compliance Division of the EPD found that 3 complaint cases concerning the WENT Landfill involved discharge of muddy rainwater after heavy rainstorms. There was also one case where prosecution was initiated against the contractor as a result of EPD's routine site inspections, although subsequently the prosecution did not proceed because the additional evidences proved that the wasterwater did not contain any leachate. The discharge was surface runoff caused by the extremely heavy rainstorm associated with a typhoon before the inspection. For the rest, no evidence could be found that there was wastewater discharged from landfills.

20. In June 2013 there was a complaint that the Ping Yuen River was polluted by wastewater discharged from the NENT Landfill. EPD conducted an investigation and carried out a joint site visit on 28 June 2013 together with Hon Fernando Cheung and Hon Frederick Fung. There was no sign of wastewater generated from the NENT Landfill. Given the topography and the water catchments in the area, it would not be possible for any wastewater discharged from the NENT Landfill into Ping Yuen River. The location of Ping Yuen River relative to the NENT Landfill can be found in **Annex C**.

Environment Bureau
Environmental Protection Department
September 2013

Annex A1

The Design-Build-and-Operate Contract

1. To achieve cohesion between the responsibilities of design, construction, operation and maintenance of the landfills, the Environmental Protection Department (EPD) has adopted a form of contract aimed at achieving unity of responsibility, namely the Design-Build-and-Operate (DBO) contract, for the development of the three strategic landfills and other waste disposal facilities in Hong Kong.

2. The DBO contract period covers the whole operational life of the landfill up to its closure together with an aftercare period of 30 years for maintenance of the closed landfill.

3. Under the DBO approach, the Landfill Contractor is allowed the flexibility to choose and adopt appropriate design and construction to meet the operational and environmental performance stipulated in the Contract. This contractual approach could therefore enable the Contractor, under the close supervision and monitoring of EPD and the Independent Consultants (IC), to use modern waste management technologies to minimize environmental impacts and enhance its operation.

4. The Environmental Infrastructure Division of EPD administers the DBO Landfill Contract, manages the Landfill Contractor, conducts regular and routine operational and environmental monitoring and auditing works to ensure the efficient, cost-effective, safe and environmentally satisfactory operation of the landfill to meet the contractual requirements.

5. At the NENT Landfill, the Environmental Infrastructure Division of EPD has a group of 10 site staff, led by a professional officer stationed on site. The essential duties of the EPD site staff are to carry out various kinds of daily inspection and monitoring of contactor’s performance to ensure that they are in compliance with the operational and environmental requirements, such as monitoring of treated leachate, surface water and groundwater, measurement of air (including odour,

dust, volatile organic compounds, etc.) and noise emissions, monitoring of ecological survey, waste examination and vehicle management, data compilation of waste disposed of (including payment verification), monitoring of site works progress and timely submission of documents, monitoring of safety and occupation health practices, etc.

6. During the full duration of the Contract period, the IC with the appropriate professional, engineering and environmental expertise was appointed as an independent third party to be responsible for providing advice, examining the performance and certifying the design and construction (including permanent and temporary works under the Contract) undertaken by the Contractor. It also covers the vetting of environmental monitoring performance and safety matters from the construction and operation stages up to the end of the aftercare period. An IC agreement was signed amongst EPD, the Landfill Contractor and the IC upon the commencement of the Landfill Contract.

7. In addition to management of contractors under the contracts, landfill operation is also controlled by the relevant environmental legislation, e.g. the Water Pollution Control Ordinance. The Environmental Compliance Division of the EPD enforces the laws and pledges to inspect each landfill not less than 4 times a year.

Annex A2

Management Systems of Wastewater, Surface Water and Groundwater at the North East New Territories Landfill

Containment Design

1. The North East New Territories (NENT) Landfill is designed as a secure containment system, which primarily consists of multi-layer impermeable composite liners at the formation level to contain landfill gas and leachate generated, so that waste is deposited and treated under an engineering controlled environment. Such containment system will avoid the adverse environmental impact to its surrounding areas, in particular the risk of causing contamination of underground water. A typical section layout is given in **Annex B1**.

Leachate Management System

2. Leachate is generated by the moisture content in the waste, decomposition of waste, and rainwater infiltration into the waste mass. The leachate management system at the NENT Landfill essentially comprises a leachate collection network, pump sumps, storage lagoons, rising mains and treatment plants to:

    (a) control the direction and rate of flow of any leachate generated within the waste;

    (b) minimize the generation of landfill leachate by separation of clean surface water from the landfill leachate; and

    (c) enable the efficient collection and treatment of leachate to the required standards for discharge into the public sewerage and sewage treatment system (i.e. the Shek Wu Hui Sewage Treatment Works in this case) before final disposal.

3. The contractor is required to design and construct all components of the leachate management system, which are capable of coping with the volume of leachate generated during all stages of landfill development, operation, restoration and aftercare. The contractor is also responsible for projecting leachate generation rates at all stages with due account to the high rainfall rates which can occur in Hong Kong. To meet these requirements and if necessary during the wet seasons, the leachate gravitated into the leachate collection network is transferred to the temporary storage lagoons before treatment by the leachate treatment plant. A schematic layout showing the operation of the leachate management system and the role of the temporary storage lagoons is shown in **Annex B2**.

Surface Water Management System

4. Under the Contract, the contractor is required to provide a surface water management system as well as an operation plan to handle the rainstorm throughout the operation and aftercare period. An important aspect of the surface water management system is the segregation of clean surface water runoff during rainfall from contaminated fluids such as leachate. Impermeable liner is used to cover most of the non-active areas in the landfill to reduce surface infiltration. Toe and edge bunds with impermeable liners are also constructed at each active area of the landfill so as to stop the ingress of surface water to the waste mass and hence minimize the leachate generation. Any surface water discharge from the site shall meet the standards specified in the Contract with reference drawn from the "Technical Memorandum: Standards for effluents discharged into drainage and sewerage systems, inland and coastal waters".

Groundwater Management System

5. Besides surface water management, the contractor is required to design and provide a groundwater management system that includes the drains below the impermeable liner system of the landfill cells, so that groundwater below the landfill cells will not be contaminated and can be effectively collected and removed. Groundwater monitoring facilities comprising the peripheral drill holes are provided for measurement of

groundwater levels and for the collection of representative groundwater samples. The contractor is therefore able to closely monitor and manage the system in order to detect any unacceptable changes to the groundwater regime around the landfill site during landfilling operations and aftercare period. Through close monitoring of groundwater along the landfill boundary, the integrity of the impermeable liner at the base of the landfill is ensured.

Environmental and Pollution Control Requirements

6. The Contract requires the contractor, under the supervision of Independent Consultants and monitoring by the Environmental Protection Department, to undertake the necessary environmental monitoring measures as well as corrective actions for any non-compliance throughout the construction, operation and aftercare period so as to meet the contractual and statutory responsibility for protecting the surrounding environment. The scope of environmental monitoring covers a wide range of environmental parameters, including leachate, landfill gas, groundwater, surface water, noise, dust, organic emissions and odour, examination of waste, etc. A summary of groundwater quality monitoring results and surface water quality monitoring results at Ping Yuen River and Kong Yiu Channel in the past 5 years is given below. The results showed compliance with the standards required.

Table 1 – Groundwater & Surface Water Quality Monitoring at NENT Landfill (2008-2012)

(a) Groundwater Quality Monitoring

Date	Number of Samples Taken[1]	5-day Biochemical Oxygen Demand (mg/L)[2]	Chemical Oxygen Demand (mg/L)[2]	Ammonia – Nitrogen (mg/L)[2]
8-Jan-08	10	2 (<2 - 2)	3 (<2 - 6)	0.19 (<0.01 – 0.74)
13-Feb-08	7	2 (<2 - 2)	3 (<2 - 5)	0.02 (<0.01 – 0.04)
5-Mar-08	12	2 (<2 - 3)	3 (<2 - 9)	0.08 (0.02 – 0.28)
9-Apr-08	10	2 (<2 - 2)	4 (<2 - 14)	0.06 (0.02 – 0.20)
5-May-08	7	2 (<2 - 2)	6 (3 - 10)	0.07 (0.04 – 0.11)
18&19-Jun-08	12	2 (<2 - 2)	5 (<2 – 13)	0.07 (0.02 – 0.16)
8&9-Jul-08	10	2 (<2 - 2)	5 (<2 - 17)	0.07 (<0.01 – 0.24)
15-Aug-08	7	2 (<2 - 2)	3 (<2 - 4)	0.06 (0.02 – 0.12)
10-Sep-08	12	2 (<2 - 2)	4 (<2 - 8)	0.06 (0.01 – 0.14)
9-Oct-08	10	2 (<2 - 2)	2 (<2 - 2)	0.10 (0.02 – 0.54)
13-Nov-08	7	2 (<2 - 2)	2 (<2 - 4)	0.04 (<0.01 – 0.09)
3&4-Dec-08	12	2 (<2 - 2)	10 (3 - 25)	0.12 (0.03 – 0.68)
6-Jan-09	10	2 (<2 - 2)	2 (<2 - 2)	0.10 (0.02 – 0.43)
4-Feb-09	7	2 (<2 - 2)	3 (<2 - 8)	0.05 (0.02 – 0.13)
11-Mar-09	12	2 (<2 - 2)	3 (<2 - 10)	0.04 (0.01 – 0.10)
8&9-Apr-09	10	2 (<2 - 2)	3 (<2 - 5)	0.05 (0.02 – 0.14)
6-May-09	7	2 (<2 - 2)	3 (<2 - 6)	0.12 (0.02 – 0.40)
9&10-Jun-09	12	2 (<2 - 2)	3 (<2 - 9)	0.04 (<0.01 – 0.08)

Date	Number of Samples Taken[1]	5-day Biochemical Oxygen Demand (mg/L)[2]	Chemical Oxygen Demand (mg/L)[2]	Ammonia – Nitrogen (mg/L)[2]
8-Jul-09	10	2 (<2 - 2)	4 (<2 - 14)	0.13 (0.01 – 0.45)
12-Aug-09	7	2 (<2 - 2)	3 (<2 - 6)	0.07 (0.03 – 0.20)
9-Sep-09	12	2 (<2 - 2)	3 (<2 - 5)	0.04 (0.01 – 0.30)
8-Oct-09	10	2 (<2 - 2)	2 (<2 - 4)	0.08 (<0.01 – 0.34)
10-Nov-09	7	2 (<2 - 2)	3 (<2 - 6)	0.04 (<0.01 – 0.17)
7&9-Dec-09	12	2 (<2 - 5)	4 (<2 - 17)	0.05 (<0.01 – 0.27)
13-Jan-10	10	2 (<2 - 2)	2 (<2 - 3)	0.06 (<0.01 – 0.50)
10-Feb-10	7	2 (<2 - 2)	7 (<2 - 12)	0.05 (0.01 – 0.18)
10&11-Mar-10	12	2 (<2 - 2)	4 (<2 - 20)	0.04 (<0.01 – 0.10)
14-Apr-10	10	2 (<2 - 2)	2 (<2 - 3)	0.08 (<0.01 – 0.51)
12-May-10	7	2 (<2 - 2)	4 (<2 - 11)	0.04 (<0.01 – 0.13)
8&14-Jun-10	12	2 (<2 - 3)	5 (2 - 9)	0.03 (<0.01 – 0.10)
6-Jul-10	10	2 (<2 - 2)	3 (<2 - 6)	0.10 (0.01 – 0.62)
10-Aug-10	7	2 (<2 - 2)	5 (<2 - 10)	0.09 (0.02 – 0.27)
7-Sep-10	12	3 (<2 - 4)	4 (<2 - 12)	0.02 (<0.01 – 0.04)
7-Oct-10	10	2 (<2 - 2)	2 (<2 - 2)	0.14 (0.02 – 0.77)
4-Nov-10	7	2 (<2 - 2)	5 (<2 - 11)	0.06 (0.02 – 0.12)
8-Dec-10	12	2 (<2 - 2)	3 (<2 - 6)	0.01 (0.01 – 0.01)
13-Jan-11	10	2 (<2 - 2)	4 (<2 - 9)	0.04 (<0.01 – 0.14)
14-Feb-11	7	2 (<2 - 2)	2 (<2 - 3)	0.03 (<0.01 – 0.14)
8-Mar-11	12	2 (<2 - 2)	4 (<2 - 8)	0.05 (<0.01 – 0.15)

Date	Number of Samples Taken[1]	5-day Biochemical Oxygen Demand (mg/L)[2]	Chemical Oxygen Demand (mg/L)[2]	Ammonia – Nitrogen (mg/L)[2]
13-Apr-11	10	2 (<2 - 2)	2 (<2 - 2)	0.19 (<0.01 – 1.50)
11-May-11	7	2 (<2 - 2)	4 (<2 - 8)	0.07 (0.02 – 0.17)
8-Jun-11	12	2 (<2 - 2)	5 (<2 - 16)	0.05 (0.01 – 0.12)
6-Jul-11	10	2 (<2 - 2)	5 (<2 - 14)	0.13 (0.01 – 0.80)
11-Aug-11	7	2 (<2 - 2)	4 (<2 - 7)	0.02 (<0.01 – 0.03)
6-Sep-11	12	2 (<2 - 2)	4 (<2 - 10)	0.01 (<0.01 – 0.03)
19-Oct-11	10	2 (<2 - 2)	2 (<2 - 4)	0.10 (<0.01 – 0.70)
7-Nov-11	7	2 (<2 - 2)	3 (<2 - 6)	0.03 (0.01 – 0.08)
5-Dec-11	12	2 (<2 - 2)	3 (<2 - 6)	0.02 (0.01 – 0.08)
11-Jan-12	10	2 (<2 - 2)	2 (<2 - 2)	0.18 (0.02 – 1.46)
7-Feb-12	7	2 (<2 - 5)	4 (<2 - 7)	0.05 (0.01 – 0.15)
14-Mar-12	12	2 (<2 - 2)	3 (<2 - 6)	0.03 (<0.01 – 0.07)
12-Apr-12	10	2 (<2 - 2)	2 (<2 - 2)	0.13 (<0.01 – 0.77)
9-May-12	7	2 (<2 - 2)	4 (<2 - 7)	0.02 (<0.01 – 0.06)
7-Jun-12	12	2 (<2 - 2)	2 (<2 - 5)	0.05 (<0.01 – 0.12)
10-Jul-12	10	2 (<2 - 2)	2 (<2 - 2)	0.23 (<0.01 – 1.80)
7-Aug-12	7	2 (<2 - 2)	2 (<2 - 2)	0.04 (0.01 – 0.07)
11-Sep-12	12	2 (<2 - 2)	3 (<2 - 5)	0.06 (0.01 – 0.14)
10-Oct-12	10	2 (<2 - 2)	2 (<2 - 2)	0.09 (<0.01 – 0.38)
8-Nov-12	7	2 (<2 - 2)	2 (<2 - 2)	0.05 (<0.01 – 0.13)
12-Dec-12	12	2 (<2 - 2)	4 (<2 - 18)	0.04 (0.01 – 0.08)

Date	Number of Samples Taken[1]	5-day Biochemical Oxygen Demand (mg/L)[2]	Chemical Oxygen Demand (mg/L)[2]	Ammonia – Nitrogen (mg/L)[2]
Average Value		2	3	0.07
Maximum Value		5	25	1.8
Minimum Value		<2	<2	<0.01
Contractual Requirement Level		Not Applicable	30	5
Compliance Percentage		Not Applicable	100%	100%

Notes:-

1. *A total of 29 monitoring points are located along the perimeter of the NENT Landfill.*
2. *Figures on the top are the average values and figures in brackets are the minimum and maximum values.*

(b) Surface Water Quality Monitoring at Ping Yuen River

Date	Number of Samples Taken[1][2]	5-day Biochemical Oxygen Demand (mg/L)	Chemical Oxygen Demand (mg/L)	Suspended Solids (mg/L)	Ammonia – Nitrogen (mg/L)
3-Mar-08	1	<2	5	10	0.21
12-Jun-08	1	<2	<2	3	0.12
1-Sep-08	1	<2	<2	3	0.10
2-Dec-08	1	<2	2	6	0.11
2-Mar-09	1	<2	<2	12	0.11
1-Jun-09	1	10	27	6	0.22
1-Sep-09	1	<2	2	<3	0.05
1-Dec-09	1	<2	12	8	0.10
1-Mar-10	1	5	16	9	0.23
4-Jun-10	1	<2	2	10	0.10
1-Sep-10	1	<2	<2	4	0.13
1-Dec-10	1	<2	<2	6	0.15
1-Mar-11	1	<2	4	14	0.26
3-Jun-11	1	<2	4	9	0.18
1-Sep-11	1	<2	4	12	0.05
1-Dec-11	1	<2	3	6	0.11
2-Mar-12	1	<2	5	10	0.22
4-Jun-12	1	<2	<2	<3	0.16
3-Sep-12	1	<2	3	7	0.07
10-Dec-12	1	<2	4	18	0.16
Average Value		3	5	8	0.14
Maximum Value		10	27	18	0.26
Minimum Value		<2	<2	<3	<0.01
Contractual Requirement Level		Not Applicable	30	20	0.5
Compliance Percentage		Not Applicable	100%	100%	100%

Notes:-

1. *One water quality monitoring point is located at Ping Yuen River.*
2. *Only those monitoring with successful collection of surface water samples are counted.*

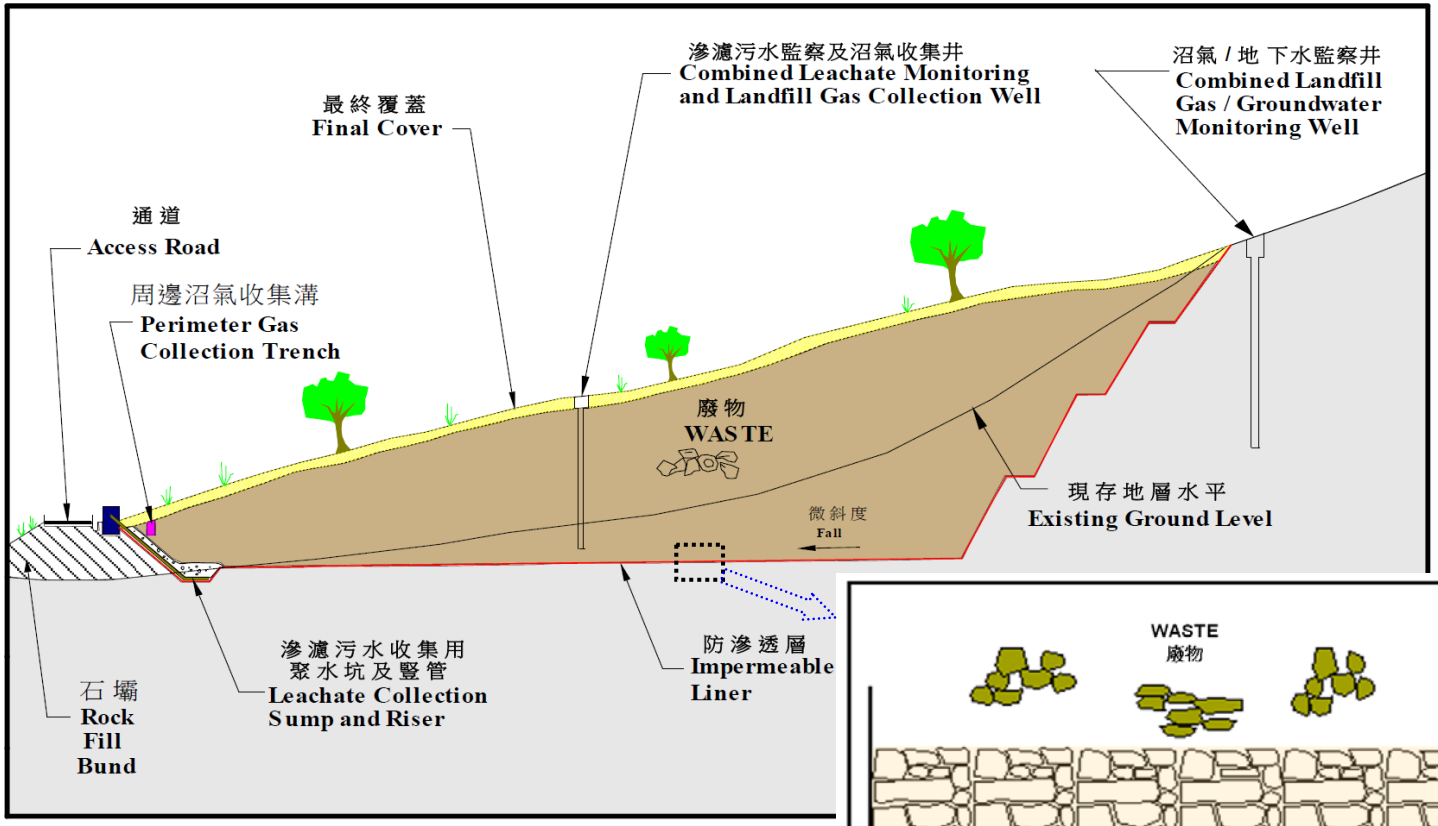
(c) Surface Water Quality Monitoring at Kong Yiu Channel

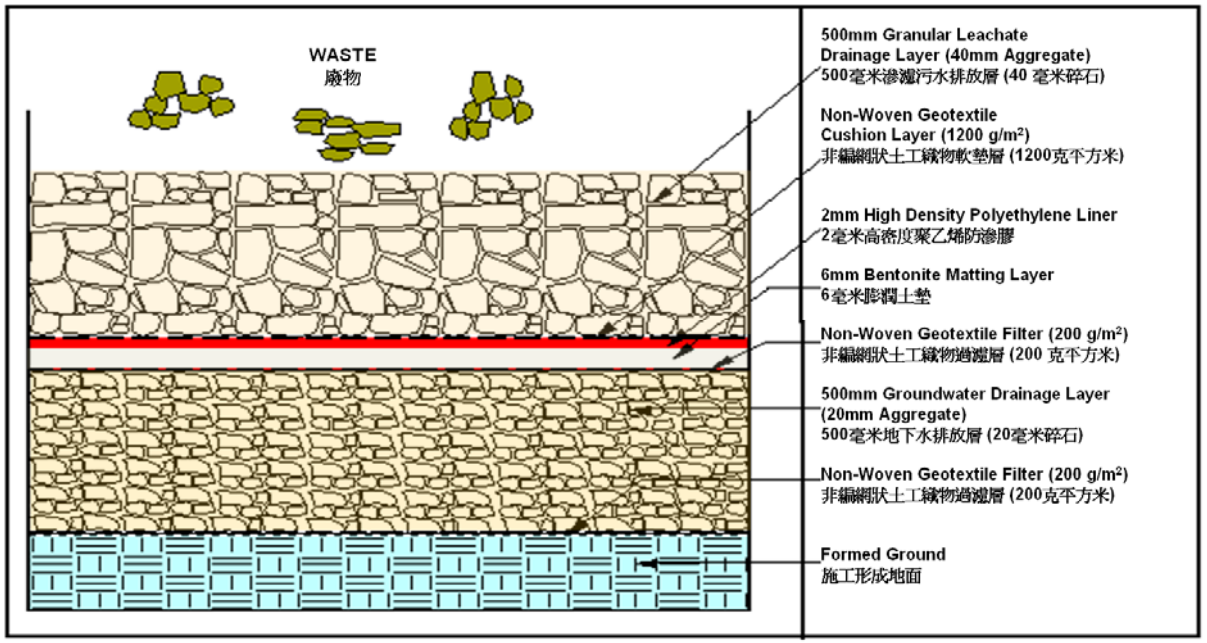
Date	Number of Samples Taken[1][2]	5-day Biochemical Oxygen Demand (mg/L)	Chemical Oxygen Demand (mg/L)	Suspended Solids (mg/L)	Ammonia – Nitrogen (mg/L)
3-Mar-08	1	<2	5	<3	0.20
12-Jun-08[3]	2	<2	<2	<3	0.24 (0.16 - 0.31)
1-Sep-08	1	<2	<2	<3	0.22
2-Dec-08	1	2	<2	<3	0.08
2-Mar-09	1	<2	<2	<3	0.07
1-Jun-09	1	<2	<2	<3	0.14
1-Sep-09	1	<2	<2	6	0.14
1-Dec-09	1	<2	4	<3	0.08
1-Mar-10	1	4	<2	4	<0.01
4-Jun-10	1	<2	<2	5	0.20
1-Sep-10	1	<2	<2	<3	0.42
1-Dec-10	1	<2	<2	<3	0.11
1-Mar-11	1	<2	<2	15	0.09
3-Jun-11	1	<2	3	<3	0.18
1-Sep-11[3]	2	<2	4 (<2 – 6)	<3	0.06 (<0.01 - 0.10)
1-Dec-11	1	<2	<2	5	0.16
2-Mar-12	1	<2	4	4	0.04
4-Jun-12	1	<2	3	5	0.35
3-Sep-12	1	<2	<2	9	0.31
10-Dec-12	1	<2	2	6	0.12
Average Value		2	3	4	0.16
Maximum Value		4	6	15	0.42
Minimum Value		<2	<2	<3	<0.01
Contractual Requirement Level		Not Applicable	30	20	0.5
Compliance Percentage		Not [illegible]	100%	100%	100%

Notes:-

1. *Two water quality monitoring points are located at Kong Yiu Channel.*
2. *Only those monitoring with successful collection of surface water samples are counted.*
3. *Figures on the top are the average values and figures in brackets are the minimum and maximum values.*

Annex B1
附件二 之一

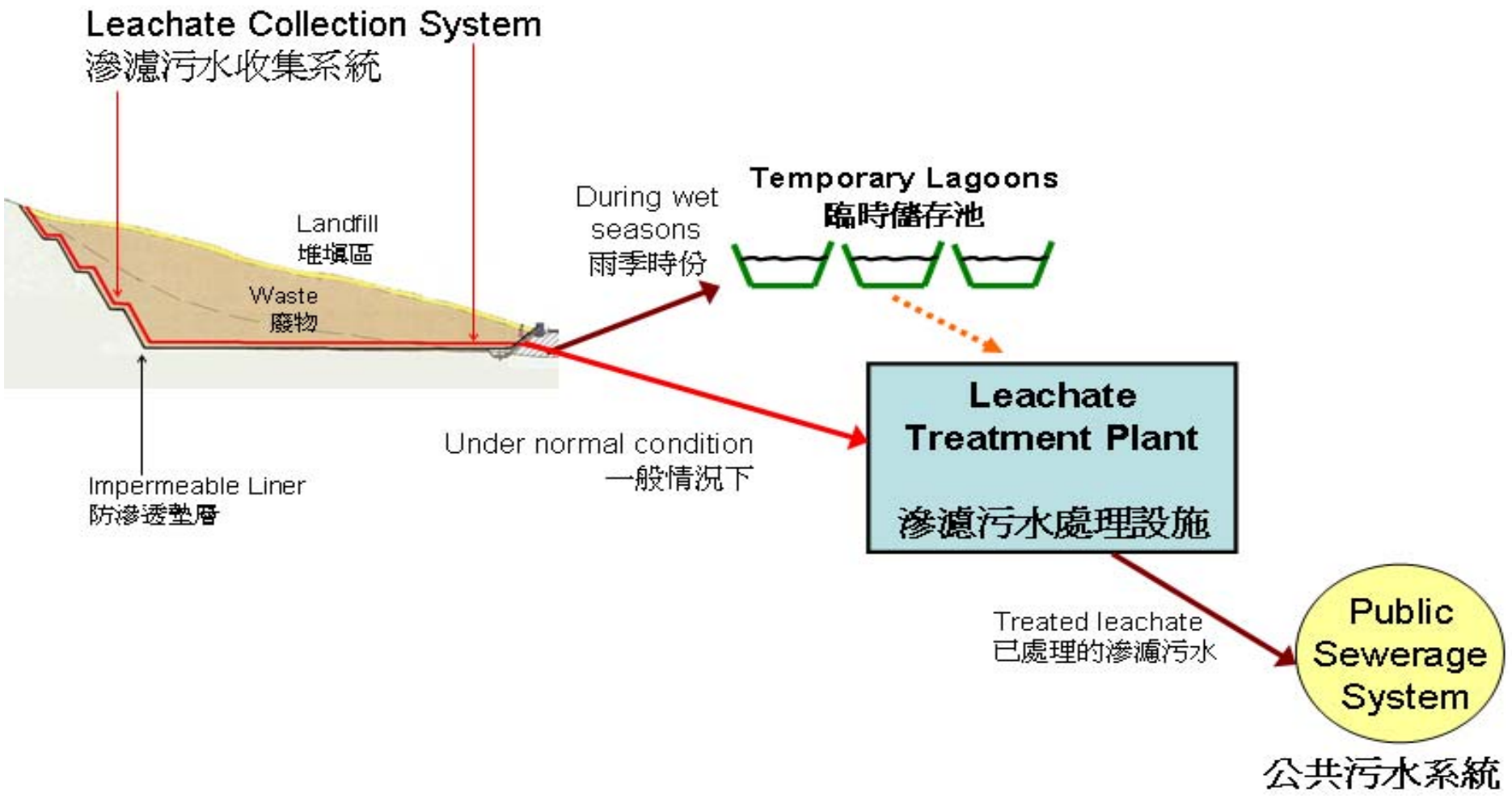


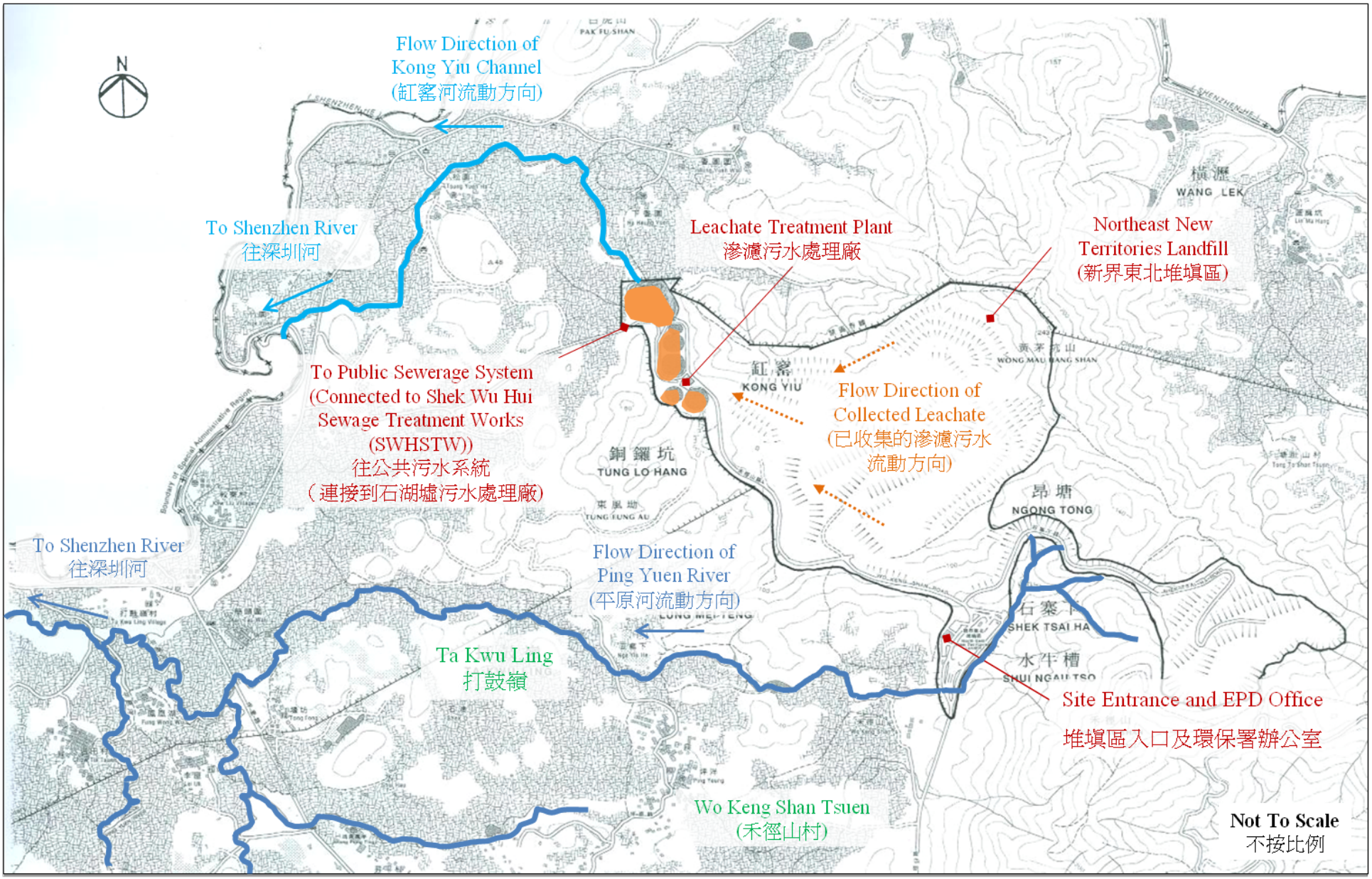


Typical Section Layout of a Landfill
堆填區典型切面圖

Not to Scale
不按比例

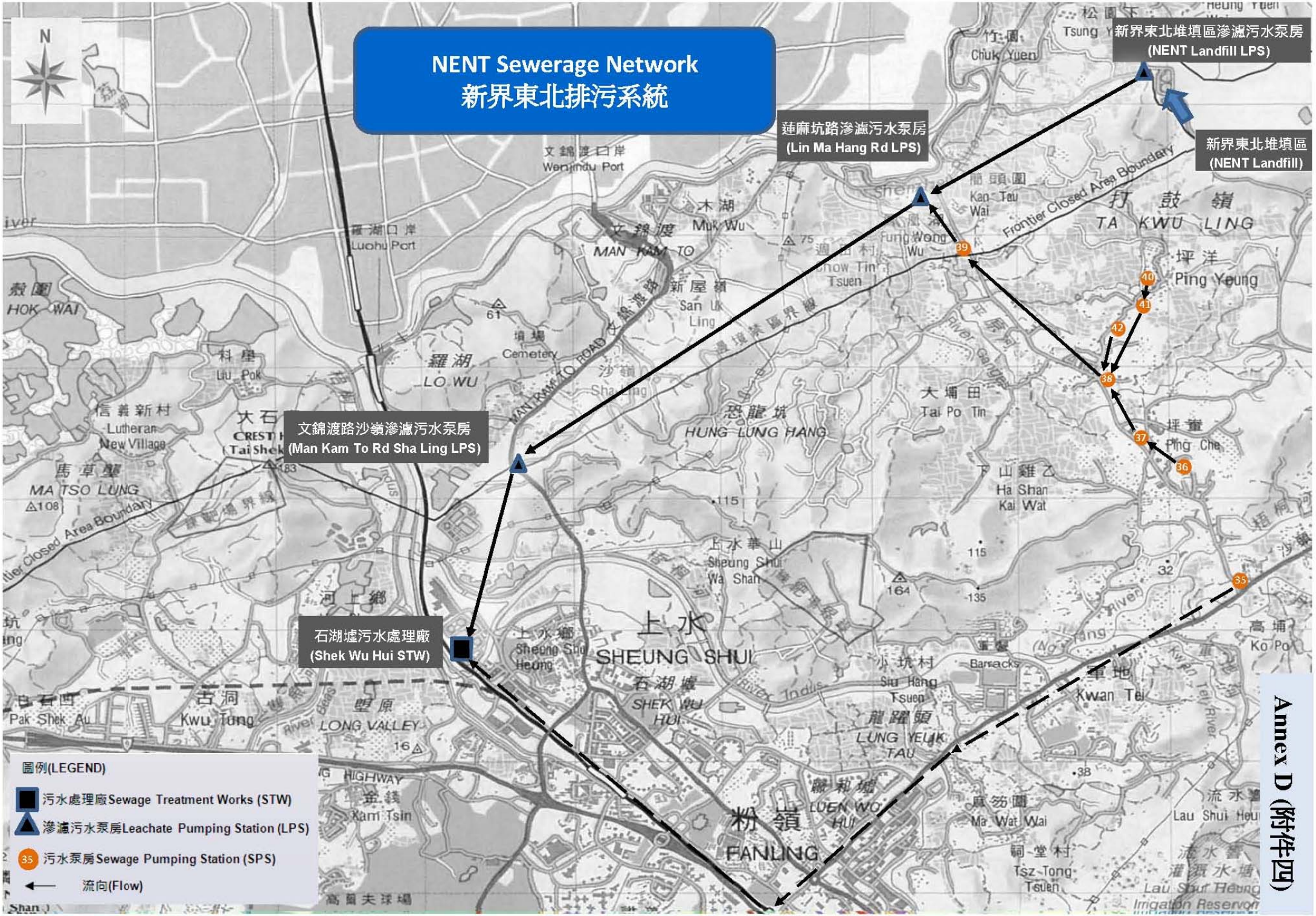
Leachate Management for NENT Landfill
新界東北堆填區 – 滲濾污水處理



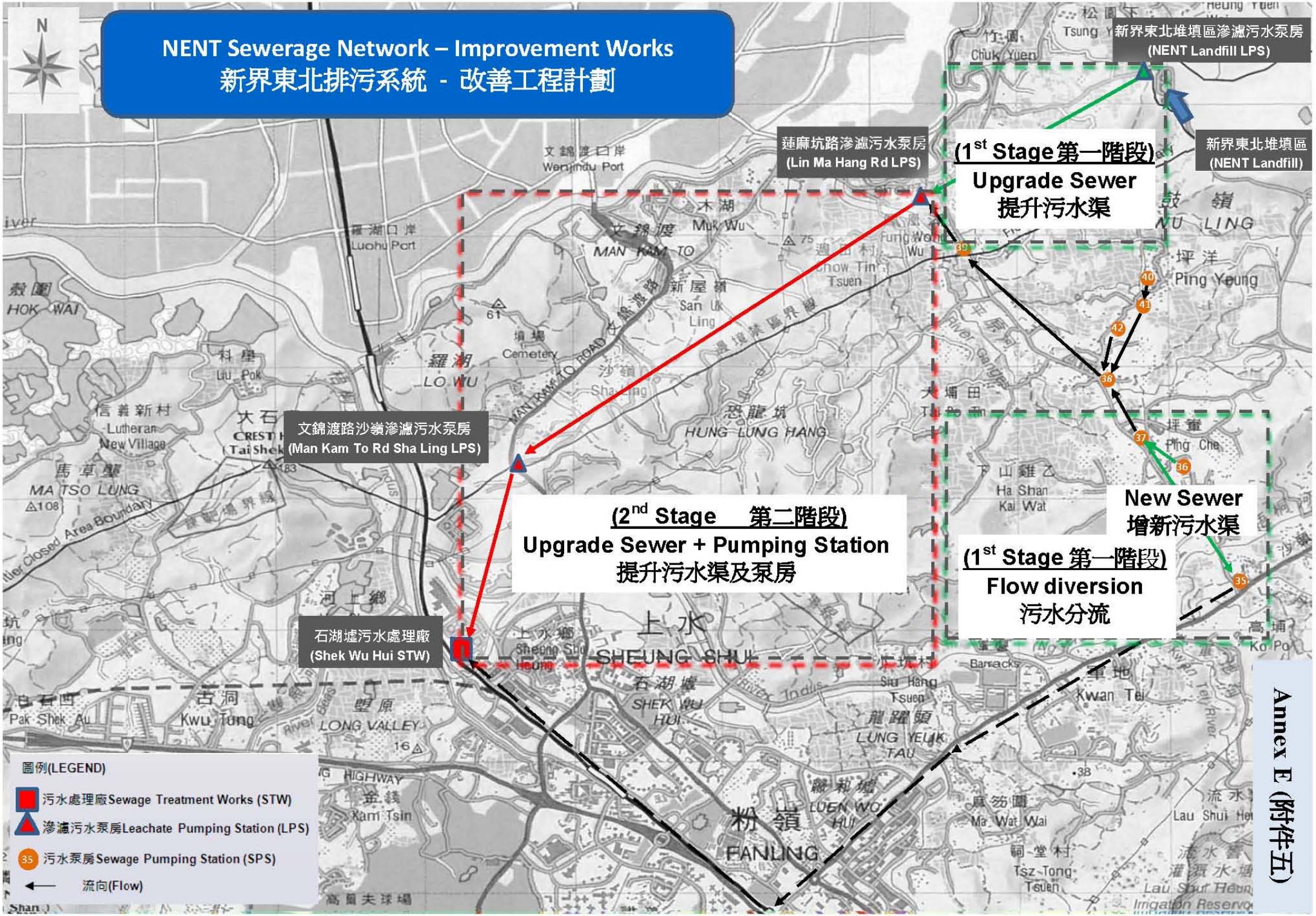


Location Map of NENT Landfill, Kong Yiu Channel and the Vicinities

新界東北堆填區、缸窰河及附近地方位置圖


NENT Sewerage Network
新界東北排污系統
新界東北堆填區滲濾污水泵房
(NENT Landfill LPS)
新界東北堆填區
(NENT Landfill)
蓮麻坑路滲濾污水泵房
(Lin Ma Hang Rd LPS)
文錦渡路沙嶺滲濾污水泵房
(Man Kam To Rd Sha Ling LPS)
石湖墟污水處理廠
(Shek Wu Hui STW)
Frontier Closed Area Boundary
MAN KAM TO
SHEUNG SHUI
FANLING
LONG VALLEY
HUNG LUNG HANG
LUNG YEUK TAU
TA KWU LING
Ping Yeung
Tai Po Tin
Ha Shan Kai Wat
Ping Che
Sheung Shui Wa Shan
Kwan Tei
Ko Po
Kwu Tung
Pak Shek Au
Lau Pok
Lutheran New Village
MA TSO LUNG
Cemetery
Barracks
圖例(LEGEND)
污水處理廠Sewage Treatment Works (STW)
滲濾污水泵房Leachate Pumping Station (LPS)
污水泵房Sewage Pumping Station (SPS)
流向(Flow)

Annex D (附件四)


NENT Sewerage Network – Improvement Works
新界東北排污系統 - 改善工程計劃
新界東北堆填區滲濾污水泵房
(NENT Landfill LPS)
新界東北堆填區
(NENT Landfill)
蓮麻坑路滲濾污水泵房
(Lin Ma Hang Rd LPS)
(1st Stage第一階段)
Upgrade Sewer
提升污水渠
文錦渡路沙嶺滲濾污水泵房
(Man Kam To Rd Sha Ling LPS)
(2nd Stage 第二階段)
Upgrade Sewer + Pumping Station
提升污水渠及泵房
New Sewer
增新污水渠
(1st Stage 第一階段)
Flow diversion
污水分流
石湖墟污水處理廠
(Shek Wu Hui STW)
圖例(LEGEND)
污水處理廠Sewage Treatment Works (STW)
滲濾污水泵房Leachate Pumping Station (LPS)
污水泵房Sewage Pumping Station (SPS)
流向(Flow)
Annex E (附件五)