Annex I

Proposals for Further Tests for Land Contamination Assessment

SHA TIN SEWAGE TREATMENT WORKS STAGE III EXTENSION EIA STUDY: PROPOSAL FOR FURTHER TESTS FOR LAND CONTAMINATION ASSESSMENT

1 *INTRODUCTION*

According to the results of preliminary land contamination assessment, further investigation is recommended to confirm the total volume of contaminated soil requiring disposal, and to characterise concentrations of additional metal compounds and the leaching potential of the heavy metal contaminants in soil that is to be excavated in the previous sludge lagoon area. For that reason, it is recommended that an additional investigation be performed, with additional sample analysis for metals in the Dutch List and TCLP tests to evaluate if the contaminated materials from the project area will meet the landfill acceptance criteria. The detailed requirements of these tests are provided below.

The investigation will aim to satisfy the following requirements:

- further define the lateral and depth profile of contamination in the former sludge lagoons so that the volumes of contaminated soil requiring disposal can be accurately estimated;
- identify and analysis contaminants in the Dutch List which could be present in the disposed sludge. (EPD had indicated that previous information presented indicated that some heavy metals on the Dutch list such as arsenic, nickel and tin can be found in sludge. These metals were not previously assessed, and thus will be included in proposed laboratory testing); and
- determine the toxicity characteristic leachate procedure (TCLP) values of all concerned contaminants in the soil to be disposed of.

Upon full characterisation of the volume and quality of the contaminated wastes, an application should be submitted to the Waste Policy Group of EPD, including the sample analysis results and expected volume for disposal. This will be copied to the EPD's Facilities Management Group, who will in turn notify the SENT Landfill, judged to be the appropriate facility for accepting contaminated soil wastes.

2 *EXCAVATION AND SAMPLING PROGRAMME*

It is judged that 15 additional soil samples be collected for analysis from the area of S4, where previous analysis has indicated that heavy metals are in exceedence of the Dutch C level in the surface sample. For the locations where the lead concentrations have exceeded the Dutch B criteria, and areas where the complete Dutch List metals had not been analysed in the preliminary assessment, sampling is required at nine locations with a total of 18 additional soil samples. The soil sampling depths are based on the expected depths for foundation excavation for the Stage III Extension project. This is understood to be a maximum depth of 3m at the Stage III aeration tanks areas (S4 and S3 areas) and a maximum depth of 2m at the Stage III primary sedimentation tanks areas (S1 and S2 & S5 and S6). *Figure*

1 shows the proposed additional sampling locations.

The samples will be collected using appropriate excavation equipment with a sampling tool, and the sampling programme will be undertaken following appropriate protocols so as to minimize the potential for cross-contamination between sampling locations. Prior to commencement of intrusive activities, all excavation equipment will be checked for cleanliness. Sample tools will be cleaned with a non-phosphate soap solution and water, with a distilled water rinse. This procedure will be repeated after use at each hole to avoid potential cross contamination between holes, and during sampling to ensure that any contamination from the surface of the site does not affect deeper substrata or the ground water.

The excavation process will be performed by an appropriate excavation contractor, under the direction of a qualified geologist, who will record the lithology.

The final hole depth will be dependent upon the site conditions for sampling, at the discretion of the on-site geologist. Based on previous analysis and further information on the final proposed excavation depths provided by DSD, it is recommended that the sampling programme shown in *Table I1* be carried out. The sampling locations are shown in *Figure I1*.

Table I1 ***Sampling Programme for Further Investigation***

Sampling Location	No. of Sampling Points(s)	Sampling Depth	Parameters to be tested	TCLP Test Parameters
Area S4	5	Surface, 0.5m, 2m	12 Dutch List metals	TCLP extraction and scan for 12 Dutch List metals. For 3 of the surface samples, the following parameters will be tested following TCLP extraction: Cd, Cr, Cu, Ni, Pb, Zn, Hg, Sn, Ag, antimony, As, Be, Th, V, Se, Ba.
Area S3	1	0.5m, 2m	12 Dutch List metals	TCLP extraction and scan for 12 Dutch List metals
Area S2	4	0.5m, 1.5m	12 Dutch List metals	TCLP extraction and scan for 12 Dutch List metals
Area S1	1	0.5m, 1.5m	12 Dutch List metals	TCLP extraction and scan for 12 Dutch List metals
Area S5	1	0.5m, 1.5m	12 Dutch List metals	TCLP extraction and scan for 12 Dutch List metals
Area S6	2	0.5m, 1.5m	12 Dutch List metals	TCLP extraction and scan for 12 Dutch List metals

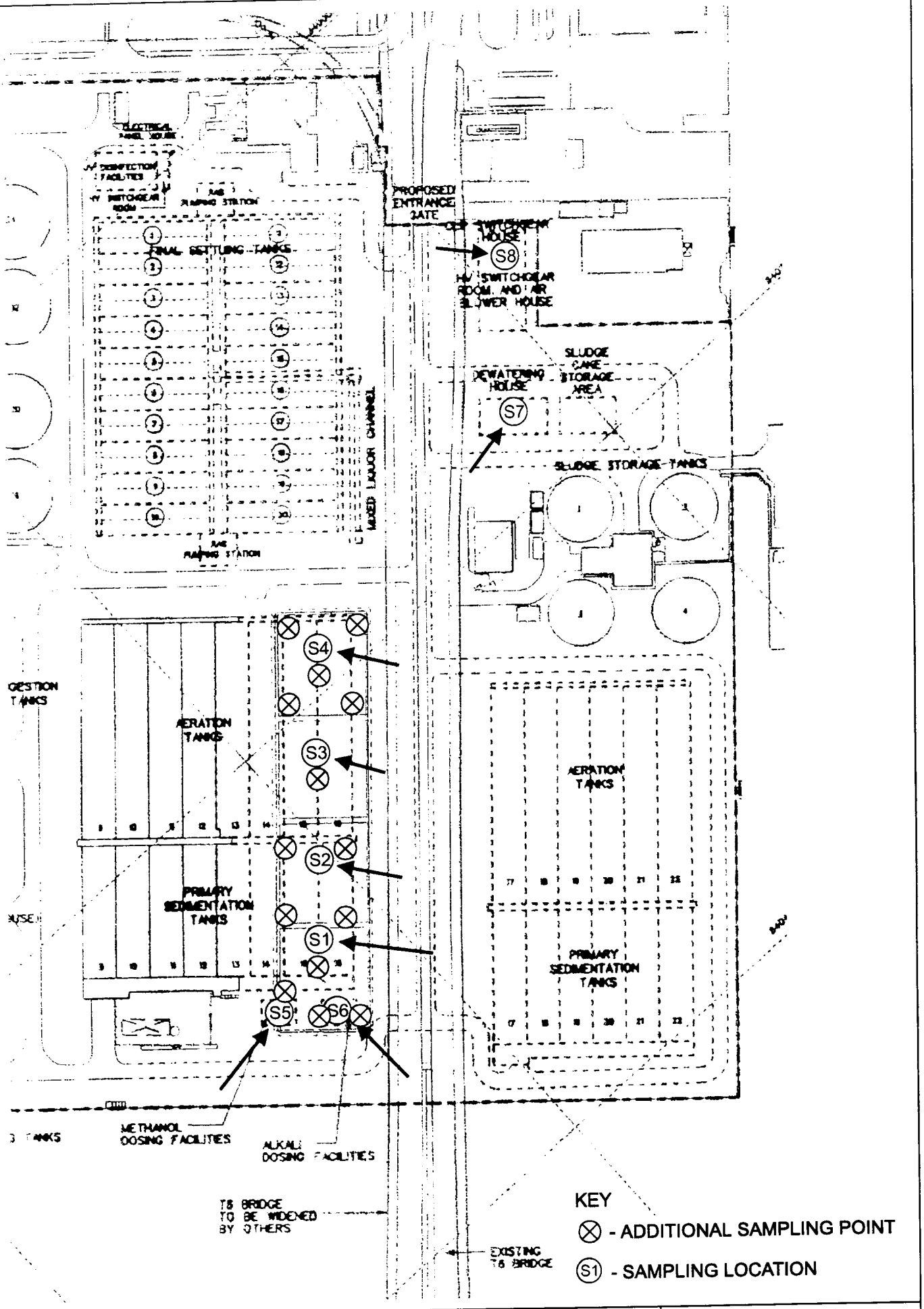

FIGURE I1

ADDITIONAL SOIL SAMPLING LOCATIONS

Environmental Resources Management

ERM

FILE: C1795/C1795K
DATE: 09/09/98

The soil sampling methodologies specified are based on methods developed by the US EPA, adapted to Asian standards of practice. These methods include decontamination procedures, sample preparation and preservation, and chain-of-custody documentation. Full details of these protocols have been provided previously, and can be provided upon request.

Analysis of samples will be carried out by an appropriately qualified and equipped laboratory in Hong Kong. The laboratory chosen is also expected to maintain high standards of analytical and technical services including internal quality control/quality assurance (QA/QC). All analysis will be conducted according to standard procedures set by the US EPA.

Each soil sample will be analysed for the following:

- TCLP by USEPA 1311 or appropriate HOKLAS method for non-volatile analytes (metals in the Dutch List);
- priority pollutant heavy metals in the Dutch List (12 metals), by appropriate method ICP-MS/AA (including chromium (Cr), cobalt(Co), nickel(Ni), copper(Cu), zinc (Zn), arsenic (As), molybdenum (Mo), cadmium (Cd), tin (Sn), barium (Ba), mercury (Hg) and lead (Pb);
- For three of the surface samples at location S4, the following parameters will be tested following TCLP extraction: Cd, Cr, Cu, Ni, Pb, Zn, Hg, Sn, silver (Ag), antimony (Sb), arsenic (As), beryllium (Be), thallium (Th), vanadium (V), selenium (Se), and barium (Ba).

3 *REPORTING AND APPLICATION FOR DISPOSAL*

Upon completion of the additional sampling, the results will be incorporated in the Final EIA Report, which includes an assessment of the analysis results and final determination of the volume of soil requiring disposal to landfill.

Formal application should then be made to the EPD and Facilities Management Group for disposal of contaminated soil to landfill prior to the construction phase of the Project. The Facilities Management Group will liaise directly with the Landfill and notify the contractor of any additional requirements and the allowable volumes of soil for disposal.

Upon receipt of formal approval and issuance of a disposal license, the work should commence following appropriate protocols according to the appropriate regulations.