



**Water Supplies Department
The Government of the Hong Kong Special Administrative Region**

Agreement No. CE 50/2011 (WS)

Examination and Report on the Safety of Reservoirs

Eighth Formal Independent Inspection and Advisory Services –

Investigation

DRAFT BRIEF (13 January 2012)

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1. Introduction

This Brief is to be read in conjunction with the Memorandum of Agreement, the General Conditions of Employment of Engineering and Associated Consultants for an Investigation Assignment (1997 Edition), hereafter referred to as the General Conditions of Employment, the Special Conditions of Employment, the Schedule of Fees and any other detailed instructions issued by the Director's Representative.

2. Description of the Project

2.1 Under the United Kingdom Reservoirs Act 1975, raised reservoirs having a storage capacity exceeding 25,000 cubic metres are required to be inspected from time to time by an independent 'qualified engineer' who should produce inspection reports with recommendations on the measures or any remedial works to be carried out in respect of the safety of the reservoirs. The Water Supplies Department (WSD) has adopted this aspect of the United Kingdom Reservoirs Act as a requirement for the proper maintenance of the impounding reservoirs and service reservoirs, and has been employing consultancy services for inspection of impounding reservoirs and service reservoirs and advice on reservoir safety issues. So far, WSD has conducted seven rounds of inspection of impounding reservoirs and large service reservoirs with capacity exceeding 25,000 cubic metres, hereinafter called 'large service reservoirs'. The immediate past agreement for independent inspection and safety advice on impounding reservoirs and large service reservoirs is Agreement No. CE 26/2006(WS) "Examination and Report on the Safety of Reservoirs - Seventh Formal Independent Inspection and Advisory Services".

2.2 Because of the extremely high population density and the hilly terrain of Hong Kong, some service reservoirs are constructed on hillsides close to densely populated areas. They may pose a significant risk to the safety of

the public and water leakage from the service reservoirs, if any, may in the long term affect the stability of the slopes and/or earth retaining structures in the vicinity of the service reservoirs. To address these problems, quantitative landslip risk assessment (QRA) has been carried out for the slopes and/or earth retaining structures in the vicinity of the service reservoirs. In this Assignment, consultancy services will be employed for carrying out the safety inspection of impounding reservoirs and large service reservoirs, and QRA for the large service reservoirs.

3. Objectives of the Assignment

The objectives of the Assignment are as follows:

- (a) To assess the conditions of seventeen (17) impounding reservoirs and twenty-nine (29) large service reservoirs listed in Appendix I as may be specified in instructions in writing issued by the Director's representative from time to time, and to make recommendations on how to enhance the safety of such reservoirs;
- (b) To assess the landslip risk of the slopes and earth retaining structures that may be affected by water leakage from the large service reservoirs listed in Appendix I as may be specified in instructions in writing issued by the Director's Representative from time to time, and to rank the risk level of such service reservoirs; and
- (c) To provide advisory services on any matters related to the safety of any service reservoirs, impounding reservoirs, slopes and earth retaining structures as may be specified in instructions in writing issued by the Director's Representative from time to time and provide training to WSD's staff.

4. Description of the Assignment

- 4.1 The Assignment comprises all necessary data collection, reviews, studies, assessments, investigations, consultation, site inspections, field works and provision of advisory services and recommendations, etc. as set out in Clause 6 of this Brief to achieve the objectives in Clause 3 above. The Assignment shall cover, but not be limited to, the following major tasks:

- (a) To carry out reservoir inspections by the Advisor as defined in Clause 6(A) of the Special Conditions of Employment for such of the reservoirs listed in Appendix I as may be specified in instructions in writing issued by the Director's Representative from time to time, subject to any deletion or addition in accordance with Clause 4.4 below;
 - (b) To carry out QRAs by a Registered Professional Engineer (Geotechnical) in Hong Kong and the Advisor for the slopes and earth retaining structures that may be affected by water leakage from such of the service reservoirs listed in Appendix I as may be specified in instructions in writing issued by the Director's Representative from time to time; and
 - (c) To provide advisory services on any matters related to the safety of any service reservoirs, impounding reservoirs, slopes and earth retaining structures as may be specified in instructions in writing issued by the Director's Representative from time to time and provide training to WSD's staff.
- 4.2 The QRA required in this Assignment is only applicable to the large service reservoirs. QRA for impounding reservoirs is excluded from this Assignment. The investigation for the Assignment includes reviews of the past investigations and studies, history of past failures, field reconnaissance, geotechnical data collection, reservoir and leakage data collection, aerial photographic interpretation and field survey, and the carrying out of physical inspection of the internal and external condition of the reservoir, adjacent slopes and earth retaining structures but excludes cutting, drilling and breaking concrete, field and laboratory testing for obtaining concrete and geotechnical parameters, geophysical survey and other ground investigations requiring mobilisation of boring equipment and ground excavation unless with prior instruction from the Director's Representative in writing.
- 4.3 The Consultants shall not carry out any inspection, QRA or advisory service without receiving prior instructions in writing from the Director's Representative.
- 4.4 There is no guarantee that the Consultants will be instructed to inspect all the reservoirs listed in Appendix I. The Director's Representative reserves the right to delete any reservoirs listed in Appendix I, for which

inspections have not been carried out, to delete any QRAs included in this Assignment or to delete any advisory services. The Director's Representative also reserves the right to add any reservoirs to Appendix I, to add any QRAs or to add any advisory services. The Director's Representative will notify the Consultants of the deletion or addition in writing.

- 4.5 The inspection periods for the reservoirs shown in Appendix I are tentative only and are subject to change. The Director's Representative will notify the Consultants of the exact inspection periods in writing. The Advisor, if from overseas, is expected to stay in Hong Kong for not more than eight weeks for each inspection period shown in Appendix I.
- 4.6 The Consultants shall provide training courses to WSD's professional and technical staff to enable them to acquire the knowledge and experience in impounding reservoir and service reservoir inspections.

5. Deliverables

- 5.1 The non-technical Deliverables to be produced by the Consultants in this Assignment and submitted to the Director's Representative are as follows:
- (a) Programme in accordance with Clause 8.3 of this Brief.
 - (b) Progress Reports in accordance with Clause 9 of this Brief within the first seven working days of each month.
 - (c) Financial Reports in accordance with Clause 10 of this Brief within the first seven working days of each month.
 - (d) Records of meetings and correspondence with others and responses to comments.
 - (e) Insurance Policy in accordance with Clause 19 of this Brief prior to the commencement of the Agreement.
- 5.2 The technical Deliverables to be produced by the Consultants for the reservoir inspections, QRAs and advisory services under the Assignment and submitted to the Director's Representative are as follows:

- (a) Preliminary Reservoir Inspection Report (5 copies) in accordance with Clause 6.4(h) of this Brief for each reservoir required to be inspected as specified in instruction in writing issued by the Director's Representative within two weeks after completion of the inspection of the reservoir concerned. The Preliminary Reservoir Inspection Reports shall be signed by the Advisor.
- (b) Draft Reservoir Inspection Report (2 copies) in accordance with Clause 6.4(i) of this Brief for each reservoir required to be inspected as specified in instruction in writing issued by the Director's Representative within two months after completion of the inspection of the reservoir concerned. The reports shall be accompanied by all such plans, data and other documents as may be necessary or required by the Director's Representative. Upon receipt of the comments of the Director's Representative, the Consultants shall take into consideration of the comments, make revisions and submit 2 copies each of the revised report and the responses to comments received for each reservoir within one month. Upon agreement by the Director's Representative, the Consultants shall submit 5 copies of the agreed Reservoir Inspection Report for each reservoir within one month. All agreed Reservoir Inspection Reports shall be signed by the Advisor.
- (c) Draft QRA Reports (3 copies) in accordance with Clause 6.5(c) of this Brief for each service reservoir required to be inspected as specified in instruction in writing issued by the Director's Representative within two months after completion of the inspection of the service reservoir concerned. The reports shall be accompanied by all such plans, data and other documents as may be necessary or required by the Director's Representative. Upon receipt of the comments of the Director's Representative, the Consultants shall take into consideration of the comments, make revisions and submit 3 copies each of the revised report and the responses to comments received for each service reservoir within one month. Upon agreement by the Director's Representative, the Consultants shall submit 6 copies of the agreed QRA Report for each service reservoir within one month.
- (d) Draft Advisory Services Task Reports (2 copies) in accordance with Clause 6.6 of this Brief for each task of advisory service instructed by the Director's Representative within the time limit to

be agreed with the Director's Representative. The reports shall be accompanied by all such plans, data and other documents as may be necessary or required by the Director's Representative. Upon receipt of the comments of the Director's Representative, the Consultants shall take into consideration of the comments, make revisions and submit 2 copies each of the revised report and the responses to comments received for each task within one month. Upon agreement by the Director's Representative, the Consultants shall submit 5 copies of the agreed Advisory Services Task Report for each task within one month.

- (e) Draft Final Report (5 copies) in accordance with Clause 6.7 of this Brief within four months after completion of the inspection of all reservoirs required to be inspected in accordance with the instruction in writing issued by the Director's Representative. The report shall be accompanied by all such plans, data and other documents as may be necessary or required by the Director's Representative. Upon receipt of the comments of the Director's Representative, the Consultants shall take into consideration of the comments, make revisions and submit 5 copies each of the revised report and the responses to comments received within one month. Upon agreement by the Director's Representative, the Consultants shall submit 8 copies of the agreed Final Report within one month. The Final Report shall be signed by the Advisor.

5.3 The Consultants shall submit the soft copies in duplicate on compact discs (CDs) approved by the Director's Representative of the endorsed, approved or final versions of the documents, reports, programmes, drawings, records, etc. of the following, submitted in any Deliverables listed in, but not be limited to, Clauses 5.1 and 5.2 of this Brief. The CDs shall be clearly labeled on the surface the contents of files stored therein.

- (a) All drawings (using AUTOCAD or other compatible softwares approved by the Director's Representative) produced in this Assignment.
- (b) All photographs (in JPEG or other compatible format approved by the Director's Representative) taken in this Assignment.

- (c) All reports and documents (using Microsoft Office or other compatible softwares approved by the Director's Representative) produced in this Assignment.
 - (d) The programmes (using Suretrak or other compatible softwares approved by the Director's Representative) produced in this Assignment.
- 5.4 The Consultants shall provide any other reports, papers, submissions, programmes, estimates, calculations, certificates, plans, drawings and any other documents in connection with the Assignment and as required by the Director's Representative.
- 5.5 The Consultants shall keep one set of all correspondence in relation to the Assignment. At the request of the Director's Representative, the Consultants shall submit to the Director's Representative a copy of the correspondence which should be properly filed, classified and indexed to enable easy reference, search and retrieval of information.
- 5.6 The Consultants shall draw the Employer's attention to any Deliverables that are under licences and any pre-existing copyrights or patents on any Deliverables and any other restrictions whatsoever affecting the Employer's use of the same and, if required by the Director's Representative, to establish the existence of any licences, copyrights, patents or restrictions.

6. Services to be provided by the Consultants

- 6.1 Further to Clause 1 of the General Conditions of Employment, in general terms, the services to be rendered by the Consultants comprise all necessary reviews, studies, investigations, consultation, site inspections, surveys, liaison and co-ordination, preliminary design works, field works and provision of advice to achieve the objectives in Clause 3 of this Brief.
- 6.2 The duties of the Consultants shall be as defined in the General Conditions of Employment and the Special Conditions of Employment and as amplified, extended and set out in this Brief.
- 6.3 In performing the Agreement, the Consultants shall provide the following general services:

- (a) Advise the Director's Representative in writing of any immediate remedial works or improvement works that need to be implemented to rectify any defects or to alleviate the hazard of any high risk features identified in relation to the safety of the inspected reservoirs or the associated slopes or earth retaining structures in the vicinity.
- (b) Comply with all reasonable instructions from the Director's Representative and with all relevant Government Circulars, Departmental Instructions and Technical Memoranda that are relevant to the carrying out of the Assignment and as directed by the Director's Representative.
- (c) Prepare and submit a programme covering the work of the Assignment and such revised programmes as may be necessary in accordance with Clause 8.3 of this Brief.
- (d) Prepare and submit progress reports and financial reports in accordance with Clauses 9 and 10 of this Brief.
- (e) Attend progress meetings and other ad-hoc meetings as required by the Director's Representative.
- (f) Draw the attention of the Director's Representative in writing immediately upon identification of any potential slippage in the progress of the Assignment or any potential significant cost deviation, and propose necessary mitigation measures to restore progress and to control the expenditure.
- (g) Provide any information and services related to the Assignment as may from time to time be required by the Director's Representative.
- (h) Carry out all necessary reviews, studies and make such investigations, inquiries and surveys as are necessary for satisfactory completion of the Assignment and collect all necessary information available from WSD, Geotechnical Engineering Office (GEO) and other government departments.

- (i) Carry out investigations which shall include reviews of the past investigations and studies, field reconnaissance, geotechnical data collection, reservoir and water leakage data collection, aerial photographic interpretation and field surveys as well as physical inspections of the internal and external conditions of the service reservoirs, slopes and earth retaining structures in the vicinity. The investigations shall exclude cutting, drilling and breaking of concrete, field and laboratory testing for obtaining concrete and geotechnical parameters, geophysical surveys and other ground investigations requiring mobilisation of boring equipment and ground excavation unless with the prior instruction from the Director's Representative in writing.
- (j) Draw the attention of the Director's Representative in writing to the extent of further ground investigations, surveys and studies required to implement the recommended proposals in relation to safety of reservoirs, slopes and earth retaining structures.
- (k) Prepare action plans for emergency works, design with necessary and sufficient details, plans, drawing, profiles, sections, specifications, programme of works and cost estimates required to implement the recommended proposals in relation to safety of reservoirs, slopes and earth retaining structures as and when instructed by the Director's Representative.
- (l) Draw the attention of the Director's Representative the need to consider any legal implications and consequences arising out of or in relation to the Assignment.
- (m) Agree the presentation and format of all items of Deliverables in accordance with Clause 5 of this Brief with the Director's Representative prior to preparing the Deliverables.
- (n) Prepare and submit the Deliverables in accordance with the timing, quantities and requirements in Clause 5 of this Brief.
- (o) Take cognizance of all relevant procedures, manuals, circulars, handbooks, standards, guidelines and documents in use by the Employer, including, but not limited to, the following, in the provision of the Services:

	<u>Title</u>	<u>Issuing Authority</u>
(i)	Civil Engineering Design Manuals	Water Supplies Department
(ii)	Project Administration Manual for Engineering Works	Water Supplies Department
(iii)	Project Administration Handbook for Civil Engineering Works	Civil Engineering and Development Department
(iv)	General Specification for Civil Engineering Works 2006 Edition or any subsequent corrigenda, revisions and editions	The Government of the Hong Kong Special Administrative Region
(v)	Standard Drawings for Civil Engineering Works	Water Supplies Department
(vi)	Mechanical and Electrical Standard Specifications	Water Supplies Department
(vii)	Manual of Mainlaying Practice - 1997 Edition or any subsequent corrigenda, revisions and editions	Water Supplies Department
(viii)	Standard Methods of Measurement for Civil Engineering Works – 1992 Edition or any subsequent corrigenda, revisions and editions	Civil Engineering and Development Department
(ix)	Geotechnical Manual for Slopes (1984, 2 nd Edition, Reprinted in 2011)	Geotechnical Engineering Office
(x)	Geoguide 5 – Guide to Slope Maintenance (2003, 3 rd Edition)	Geotechnical Engineering Office
(xi)	The New Priority Ranking System for Man-made Slopes and Retaining Walls	Geotechnical Engineering Office
(xii)	Extended Natural Terrain Landslide Inventory	Geotechnical Engineering Office
(xiii)	Historical Landslide Catchment Inventory	Geotechnical Engineering Office
(xiv)	Geoguide 2- Guide to Site Investigation	Geotechnical Engineering Office
(xv)	GEO Report No. 56 –	Geotechnical Engineering Office

- Application of Prescriptive Measures to Slopes and Retaining Walls (1999, 2nd Edition)
- (xvi) Code of Practice on Inspection and Maintenance of Water Carrying Services Affecting Slopes (1996 Edition) Water Supplies Department
- (xvii) Handbook on Selection, Appointment and Administration of Engineering and Associated Consultants Revision No.10 (October 2010) Engineering and Associated Consultants Selection Board
- (xviii) EACSB Circulars Engineering and Associated Consultants Selection Board
- (xix) Public Works Department, Lands and Works Branch, Works Branch/Works Bureau, Environment, Transport and Works Bureau and Development Bureau Technical Circulars Development Bureau
- (xx) Departmental Instructions Water Supplies Department
- (xxi) Technical Circulars Civil Engineering and Development Department
- (xxii) Technical Circulars Drainage Services Department
- (xxiii) Technical Circulars Highways Department
- (xxiv) Professional Persons Planning Department
- Environmental Consultative Committee (ProPECC) Practice Notes
- (xxv) Stormwater Drainage Manual Drainage Services Department
- (xxvi) General Specifications for Electrical Installation in Government Buildings of the Hong Kong Special Administrative Region (2007 Edition) Architectural Services Department
- (xxvii) Code of Practice for the Electricity (Wiring) Regulations (2009 Edition) Electrical & Mechanical Services Department
- (xxviii) Information for Reservoir Panel Engineers, Reservoirs Act 1975 The Institution of Civil Engineers

(xxix) Regulations for Electrical Installations 17th Edition including amendments The Institution of Electrical Engineers

(p) Consult, liaise and coordinate with authorities/government departments including but not limited to those listed below, and public utility companies, that have an interest in or an effect on or which are affected by the Assignment or having rights or powers in connection with the Assignment in accordance with the requirement of Clause 19 of the General Conditions of Employment.

- (i) Agriculture and Fisheries and Conservation Department;
- (ii) Architectural Services Department;
- (iii) Buildings Department;
- (iv) Civil Engineering and Development Department including Geotechnical Engineering Office;
- (v) Development Bureau;
- (vi) District Councils of Home Affairs Department;
- (vii) District Lands Offices of Lands Department;
- (viii) District Offices of Home Affairs Department;
- (ix) District Survey Offices of Lands Department;
- (x) Drainage Services Department;
- (xi) Environmental Bureau;
- (xii) Environmental Protection Department;
- (xiii) Fire Services Department;
- (xiv) Food and Environmental Hygiene Department;
- (xv) Food and Health Bureau;
- (xvi) Government Laboratory;
- (xvii) Government Logistics Department;
- (xviii) Government Properties Agency;
- (xix) Highways Department;
- (xx) Home Affairs Bureau;
- (xxi) Hong Kong Police Force;
- (xxii) Hong Kong Observatory;
- (xxiii) Housing Department ;
- (xxiv) Lands Department;
- (xxv) Leisure and Cultural Services Department;
- (xxvi) Planning Department;
- (xxvii) Transport and Housing Bureau;
- (xxviii) Transport Department ;

(xxix) Water Supplies Department ;

- (q) Consult, liaise and coordinate with consultants and contractors that have an interest in or an effect on or who are affected by the Assignment.
- (r) Identify, communicate, liaise and correspond directly with the bodies, departments, organisations and persons from whom useful information could be obtained in connection with and for the implementation of the Assignment further to Clause 19 of the General Conditions of Employment and Sub-clauses (p) and (q) of this Clause. The Consultants shall provide a copy of such correspondence, records of telephone discussion, minutes of meeting to the Director's Representative for his record and information.
- (s) Comply with the requirements of all relevant ordinances, regulations, standards and guidelines, including, but not limited to, the following in the provision of the Services:
 - (i) Air Pollution Control Ordinance
 - (ii) Animals and Plants (Protection of Endangered Species) Ordinance
 - (iii) Antiquities and Monuments Ordinance
 - (iv) Buildings Ordinance
 - (v) Copyright Ordinance
 - (vi) Country Parks Ordinance
 - (vii) Dangerous Goods Ordinance
 - (viii) Electricity Ordinance
 - (ix) Environmental Impact Assessment Ordinance
 - (x) Factories and Industrial Undertakings Ordinance
 - (xi) Gas Safety Ordinance
 - (xii) Lands (Resumption) Ordinance
 - (xiii) Lands (Miscellaneous Provisions) Ordinance
 - (xiv) Noise Control Ordinance
 - (xv) Occupational Safety and Health Ordinance
 - (xvi) Road (Works, Use and Compensation) Ordinance
 - (xvii) Road Traffic Ordinance
 - (xviii) Town Planning Ordinance
 - (xix) Waste Disposal Ordinance

- (xx) Waterworks Ordinance
 - (xxi) Water Pollution Control Ordinance
 - (xxii) Any other Ordinance having a bearing on the works of the Assignment.
- (t) Take cognizance of, but not be limited to, the following projects during the course of the Assignment:
- (i) Systematic Identification and Maintenance Responsibility of Slopes in the Territories (SIMAR) by Lands Department.
 - (ii) Examination and Report on the Safety of Reservoirs - Seventh Formal Independent Inspection and Advisory Services by Water Supplies Department.
 - (iii) Seventh Safety Review of Small Service Reservoirs by Water Supplies Department.
 - (iv) Inspection of Buried Watermains Affecting Slopes by Water Supplies Department.
 - (v) Landslip Prevention and Mitigation Programme by Geotechnical Engineering Office.
 - (vi) Replacement and Rehabilitation of Water Mains by Water Supplies Department.
 - (vii) Engineer Inspections and Upgrading Works for WSD Slopes, 2006-2007 Programme - Design and Construction.
 - (viii) Improvement to Hong Kong Central Mid Level and High Level Areas Water Supply - Remaining Works - Design and Construction.
 - (ix) Salt Water Supply System for Pok Fu Lam Area - Design and Construction.
 - (x) Laying of Western Cross Harbour Main and Associated Land Mains from West Kowloon to Sai Ying Pun - Design and Construction.

- (xi) Expansion of Tai Po Water Treatment Works and Ancillary Raw Water and Fresh Water Transfer Facilities - Design and Construction.
- (xii) Alternative Raw Water Supply to Yau Kom Tau Water Treatment Works from Au Tau Raw Water Pumping Station - Investigation, Design and Construction.
- (xiii) Integration of Ma On Shan and Pak Kong Fresh Water Supply Systems - Investigation, Design and Construction.
- (xiv) Improvement of Shing Mun, Beacon Hill, Golden Hill and Tai Lam Chung (Sections L, M, N & O) Catchwater Systems - Investigation, Design and Construction.
- (xv) Improvement Works to Water Supply Facilities of New Territories West Region and Hong Kong & Islands Region of Water Supplies Department - Design and Construction.
- (xvi) Improvement Works to Water Supply Facilities of New Territories East Region and Kowloon Region of Water Supplies Department - Design and Construction.
- (xvii) Engineer Inspections, Preventive Maintenance Works and Upgrading Works for WSD Slopes 2009 - 2010 Programme - Design and Construction.
- (xviii) Water Supply to Housing Development at Anderson Road - Design and Construction.
- (xix) Implementation of Pressure Management and District Metering for the Fresh Water Distribution Systems of the Western, Central, Eastern, Sai Wan, Kowloon West and Tsuen Wan East Major Supply Zones - Design and Construction.
- (xx) Improvement of fresh water supply to Cheung Chau - Design and Construction.

6.4 The Consultants shall provide the following services for the inspection of the impounding reservoirs and the large service reservoirs and report the findings (reference made in this Clause for QRA is only applicable to the large service reservoirs):

- (a) Arrange and carry out reservoirs inspections in sufficient detail by the Advisor in a similar manner as that required in the United Kingdom Reservoirs Act 1975 and advise on the observations and findings in the Preliminary Reservoir Inspection Reports in accordance with Clause 5 of this Brief.
- (b) Review past investigations and studies, and carry out physical inspections and examination of the internal and external conditions of the reservoirs and the associated slopes and earth retaining structures in the vicinity. The external inspections shall cover all other super-structures, sub-structures, manholes and chambers, compartments, installations for the delivery of water to and from the reservoirs, adjacent ground surfaces, natural and man-made slopes and earth retaining structures in the vicinity of the reservoirs. The Consultants shall also obtain and examine data on water flows and levels where appropriate.
- (c) Advise on matters related to the safety of reservoirs, including safety assessment on the structures and components of the reservoirs, all associated pipework fittings and fixtures, surface and sub-soil drainage systems and the adjacent slopes and earth retaining structures which may be affected by leakage from the reservoirs and/or have effects on the safety of the reservoirs. The Consultants shall collect data and assimilate information for the water leakage investigation of the reservoirs.
- (d) Investigate and assess the conditions of the existing provisions and evaluate the reliability of the water leakage prevention, detection and collection systems of the reservoirs. The evaluation of the reliability of the water leakage prevention, detection and collection systems shall include the various causes of breakdown of such systems and the extent of water leakage penetrating into the surrounding ground from each cause so as to assess the effect of reservoir water leakage on the stability of the slopes and the earth retaining structures in the vicinity of the reservoirs. The Consultants shall also provide recommendations on the remedial

works and improvement works needed to mitigate the identified water leakage.

- (e) Advise on the effects of water leakage from the inspected service reservoirs and the combined effects of water leakage from other adjacent or nearby service reservoirs on the stability of the inspected service reservoirs and the associated slopes and earth retaining structures in the vicinity.
- (f) Identify, evaluate and recommend the short term and long term mitigation measures, remedial works and improvement works required to enhance the safety of the reservoirs.
- (g) Advise details of any necessary investigations, such as the number, location and types of samples, the method of taking and testing the samples, the interpretation of the test results, etc. required for implementing the recommendations of this Assignment.
- (h) The Preliminary Reservoir Inspection Reports shall report the observations and findings of the inspected reservoirs and the associated slopes and earth retaining structures, the preliminary recommendations on the safety of the inspected reservoirs and the associated slopes and earth retaining structures, and the remedial works and improvement works immediately required.
- (i) The Consultants shall include the following information in the Reservoir Inspection Report for each reservoir required to be inspected as specified in instruction in writing issued by the Director's Representative (reference made in this Sub-clause for QRA is only applicable to large service reservoirs):

(i) General Information

Provide information, such as the name and address of the Advisor preparing the reports, the panel to which the Advisor is appointed and the date of expiry of the Advisor's appointment, the name and location of the reservoirs, the name and address of the owner, the name and address of the Consultants, a summary of the dates of inspections, the extent and nature of the inspections, the areas covered by the inspections, the reasons for the inspections and the

information and particulars made available for the inspections.

(ii) General Description of the Reservoir

Provide a description of the external and internal arrangement of the reservoir and the associated water supplies network to and from the reservoir.

(iii) Conditions of the Reservoir found during the Inspection

Provide information of the following with appropriate figures, sketches, drawings, plans and photographic records (in colour) of the reservoir indicating the salient points covered by the inspections:

- (1) Conditions of the structural elements.
- (2) Conditions of the inlet, outlet, washout/scour and overflow/spillway systems, including the associated valves, pipeworks and controlling devices.
- (3) Conditions of the surface and sub-soil drainage systems.
- (4) Conditions of the water leakage prevention, detection and collection systems.
- (5) Conditions of the slopes and earth retaining structures in the vicinity of the reservoir.
- (6) Conditions of other super-structures, sub-structures, fittings and fixtures associated with the reservoir.
- (7) Monitoring and instrumentation.
- (8) Water leakage from the reservoir.
- (9) Settlement and movement of the reservoir structures.
- (10) Movement of surrounding lands, slopes and earth retaining structures which may affect the stability of the reservoir.
- (11) Seismic risk.

- (12) Adequacy and efficiency of the overflow/spillway systems.
- (13) Safety margin between the service reservoir roof level and overflow level or between the top of the reservoir dam and overflow level.
- (14) Any alteration to the overflow sill.
- (15) Any alteration in level to which water may be stored.
- (16) Adequacy and efficiency of the water inflow and outflow systems and the means of controlling and lowering the water level.
- (17) Effects of water leakage on the slopes and earth retaining structures in the vicinity of the reservoir.
- (18) Stability of the reservoir structures and the slopes and earth retaining structures in the vicinity.
- (19) Correctness of the records kept for the reservoir and recommendation on any corrections or improvement of the records.
- (20) Any other matters in relation to the safety of the reservoir observed.

(iv) Findings and Recommendations on Improvement and Remedial Works Required

- (1) Summarise the main findings and results of the inspections for the reservoir.
- (2) Recommend remedial works and improvement works that are necessary in the interests of safety of the reservoir and the slopes and earth retaining structures in the vicinity that may be affected by water leakage from the reservoir and/or have effects on the safety of the reservoir. The Consultants shall take cognizance of the findings of the QRAs and provide details for implementing the recommendations, which shall include the materials and the method statement for the works, programme of the works and cost estimates as appropriate.
- (3) Recommend the priorities in carrying out the remedial

works and improvement works.

(v) Monitoring and Supervision

- (1) Recommend the requirements to monitor the performance of the reservoir and the water leakage prevention, detection and collection systems of the reservoir.
- (2) Recommend the requirements to monitor the slopes and earth retaining structures in the vicinity that may be affected by water leakage from the reservoir and/or have effects on the safety of the reservoir.
- (3) Recommend any additional monitoring equipment required.
- (4) Take cognizance of the findings of the inspections and the QRAs in all the recommendations.

(vi) Recommendations on the Frequency of Inspection

- (1) Recommend the frequency of inspection for the reservoir, the slopes and the earth retaining structures in the vicinity, taking cognizance of the findings of the inspections and the QRAs in the recommendations.
- (2) Recommend the time of the next independent inspection.

6.5 The Consultants shall provide the following services for the QRAs and report the findings:

- (a) Determine, propose and obtain agreement from GEO on the exact extent of slopes and earth retaining structures in the vicinity of the service reservoirs to be included in the QRAs. The slopes and earth retaining structures located within a distance of 300 m from the corresponding service reservoir shall be considered.
- (b) Carry out the QRAs for the service reservoirs under inspection. The QRAs should focus on the reliability of the water leakage prevention, detection and collection systems, the various causes of breakdown of such systems resulting in water leakage penetrating

into the surrounding ground and the effect of such water leakage on the stability of the slopes and the earth retaining structures in the vicinity of the service reservoirs. The QRAs shall include, but not be limited to, the following key tasks:

- (i) Review all relevant past geotechnical investigations and studies, including the design and construction details of the service reservoirs and their associated drainage systems, slopes and earth retaining structures.
- (ii) Take cognizance and make use of the results of the service reservoir inspections, the QRAs and the QRA methodology developed in Agreement No. CE 26/2006(W.S) or other QRA methodology as directed by the Director's Representative, and all other relevant existing information in undertaking the Assignment.
- (iii) Organise, coordinate and manage all interrelated inspections, investigations, surveys and any other activities for the completion of the Assignment, and avoid duplication of the works in particular for those works which can disrupt the operation of the water supply system.
- (iv) Carry out visual inspections of the slopes and earth retaining structures by a Registered Professional Engineer (Geotechnical), advise the Director's Representative on the necessity of any field works, such as chunam stripping to facilitate the inspections, and supervise/conduct the necessary field works as and when instructed by the Director's Representative.
- (v) Assess the existing conditions of the slopes and earth retaining structures in the vicinity of the service reservoirs.
- (vi) Consider the effect of different degree of water leakage on the stability of the slopes and earth retaining structures in the vicinity of the service reservoirs.
- (vii) Collect data and assimilate information for geotechnical studies of the affected slopes and earth retaining structures, and assess the consequence and risk-to-life due to water leakage induced landslip for the QRAs.
- (viii) Advise slope safety issues and monitoring requirements.
- (ix) Using the QRA methodology developed in Agreement No.

CE 26/2006(W.S) or other QRA methodology as directed by the Director's Representative, evaluate and compare the risk level of the service reservoirs, rank the risk level of the service reservoirs, prioritise the remedial works and improvement works required to mitigate the identified risks on the service reservoirs.

- (x) Prepare the QRA Reports.
- (c) Include the following information in the QRA Report for a service reservoir:

- (i) General Information

Provide information such as the name and location of the service reservoir, the name and address of the owner, the name and address of the Consultants preparing the report, the name and address of the Advisor, the panel to which the Advisor is appointed and the date of expiry of the Advisor's appointment, the name and address of the Registered Professional Engineer (Geotechnical) in Hong Kong carrying out the slope inspections, a summary of the dates of inspections, the extent and nature of the inspections, the area covered by the inspections, the reasons for the inspections and the information and particulars made available for the inspections.

- (ii) General Description of Inspections and QRA

- (1) Provide a description of the slopes and earth retaining structures affected by water seepage from the service reservoir. The description of the slopes and earth retaining structures shall include the area affected by water seepage from the service reservoir, all relevant past investigation, studies, historical performance and previous works of the affected slopes and earth retaining structures.
- (2) Include the dates and time of the inspections, the extent and nature of the inspections and the areas covered by the inspections.
- (3) Provide appropriate figures, sketches, drawings, plans and photographic records (in colour copy) indicating the salient points covered by the inspections.

- (iii) Conditions Found

- (1) Provide information on the conditions found on service reservoir water leakage and the associated drainage systems, the reliability and the various causes of breakdown of the water leakage prevention, detection and collection systems.
- (2) Provide information on the conditions found on the slopes and earth retaining structures and the effect of actual and potential water leakage from the service reservoir on them.

(iv) Risk Assessments

- (1) Provide information on the structures and number of lives at risk considered in the risk assessments. The information shall include the location of the structures relative to the service reservoir, the nature of the structures and the risk on the structures.
- (2) Evaluate the risk level of the service reservoir by the QRA methodology developed in Agreement No. CE 26/2006(W.S) or other QRA methodology as directed by the Director's Representative. State any assumptions made to the input data and make an assessment of the order of accuracy of the risk assessment for the service reservoir taking into account all uncertainties involved in the risk assessment. The assessed order of accuracy shall be factored into the ranking of the service reservoirs for priority action in the Final Report.

(v) Findings and Recommendations on Remedial Works Required

- (1) Summarise the main findings and results of the QRAs for the service reservoir.
- (2) Recommend the remedial works and improvement works necessary for enhancing the safety of the slopes and earth retaining structures in the vicinity of the service reservoir and set the priorities for these works. Provide sufficient details for implementing the recommendations, which shall include the materials, method statement, programme and cost estimates for the works as appropriate.
- (3) Recommend options of practical risk mitigation

measures to the identified risks.

(vi) Monitoring and Supervision

- (1) Recommend the requirements to monitor the nearby slopes and earth retaining structures that may be affected by water leakage from the service reservoir.
- (2) Recommend any additional monitoring equipment required.

6.6 The Consultants shall provide the following advisory services:

- (a) Advise the Director's Representative on any matters in relation to the safety of any impounding reservoirs and service reservoirs (which may be reservoirs listed in Appendix I or reservoirs not listed in Appendix I), and the associated adjacent slopes and earth retaining structures as may be specified in instructions in writing issued by the Director's Representative from time to time. The advisory services shall include:
 - (i) review and comment on the reservoir safety inspections and/or the QRA reports produced by other consultants;
 - (ii) supervise or conduct the necessary field works, studies, investigations and design of the remedial works or improvement works in the interests of safety of the impounding reservoirs or service reservoirs or slopes or earth retaining structures as and when required by the Director's Representative.

The tasks for the Advisory Services will be formally issued in writing to the Consultants by the Director's Representative at such times the Director's Representative considers appropriate.

- (b) In case of emergency or as the situation warrants, the Advisor shall be available in Hong Kong within 30 hours upon receipt of written instruction issued by the Director's Representative on the provision of emergency services on matters related to the safety of impounding reservoirs or service reservoirs.

- (c) The Consultants shall provide training courses to WSD's professional and technical staff to enable them to acquire the knowledge and experience in impounding reservoir and service reservoir inspections. Each training course shall be conducted to a maximum number of 40 WSD's staff. Techniques and procedures in reservoir inspection, particularly for service reservoirs, as those recommended in international standards and/or practices will be the core subject of the training. Topics on design, construction, maintenance and repair of reservoirs should also be included in the training. Separate or combined classes will be required for staff of different grades of professional and technical staff. On site demonstrations of reservoir inspections for training purposes will be required. The Consultants shall provide and agree with WSD on the details of training and course programme.

6.7 The Consultants shall submit a Final Report concluding the Assignment, prepare and summarise the assessments and observations. The Final Report should cover:

- (a) the summary of the main findings and recommendations of the reservoir inspections and QRAs;
- (b) the risk level of the service reservoirs and a risk based ranking of the service reservoirs and the priority of implementation of any risk mitigation measures recommended, taking into account any constraint in the water supply systems, such as operational requirements, seasonal demand of water supplies, temporary diversion of water supply networks, etc.; and
- (c) review the risk level and ranking of the service reservoirs in item (b) above with the consideration of completion of the remedial works recommended by the Advisor.

6.8 Instruction to undertake any of the works stipulated in Clause 4 of this Brief shall be issued by the Director's Representative before the expiration of the Agreement Period. Notwithstanding the requirements of Clause 8.5 of this Brief, the Consultants shall execute all such tasks even if the completion date for any task agreed in accordance with Clause 8 of this Brief is beyond the expiry of the Agreement Period, provided that the task for which the agreed completion date does not extend 6 months beyond the expiry of the Agreement Period. The

Director, however, reserves the right to assign any of the uncompleted tasks to another party after the expiration of the Agreement Period.

- 6.9 Before carrying out the QRAs for the service reservoirs, the Consultants shall carry out all the necessary reviews of the QRA methodology as described in Clause 6.5 of the Brief and check with GEO to ensure that the QRA methodology to be adopted is suitable for use in this Agreement. The Consultants shall advise the Director's Representative of any necessary amendments and adjustments required in adopting the QRA methodology as described in Clause 6.5 of the Brief for ensuring successful completion of the Assignment. If the adoption of the QRA methodology would incur additional time, staff inputs and expenses not within reasonable contemplation, the Consultants shall submit recommendations on appropriate alternatives to the Director's Representative for agreement.

7. Response to Queries

The Consultants shall respond to queries under Clause 20 of the General Conditions of Employment raised on a date within 3 months after the final submission of the Deliverables required under the Agreement. Such date shall be confirmed in writing to the Consultants by the Director's Representative.

8. Programme of Implementation

- 8.1 The Agreement Period for this Assignment is 60 months from the date for commencement of the Agreement, which is set to be the date of signing the Memorandum of Agreement to be confirmed in due course. The Agreement Period may be extended subject to the agreement between the Consultants and the Director's Representative.
- 8.2 The inspections of the seventeen (17) impounding reservoirs and the twenty-nine (29) large service reservoirs are tentatively scheduled to be carried out as indicated in Appendix I. The inspection periods shown in Appendix I are subject to change. The Consultants shall not commence any inspection without prior written instruction from the Director's Representative. For each reservoir required to be inspected as specified in instructions in writing issued by the Director's Representative, the Director's Representative will notify the Consultants the exact period of the inspection in writing. The Consultants, upon receipt of the written

notice, shall carry out the inspection at such time as instructed by the Director's Representative.

- 8.3 Pursuant to Clause 26(B) of the General Conditions of Employment, the Consultants shall submit the draft programme and revised draft programmes, and the Director's Representative shall agree, or instruct, within the following periods:

Submission of the draft programme : Within 4 weeks of the due date for commencement of the Agreement.

Agreement of the draft programme : Within 4 weeks from receipt of the draft programme or instruction for submission of the revised draft programme.

Submission of revised draft programme : Within 2 weeks from the instruction of the Director's Representative.

The draft programme and revised draft programme shall be in the form of a bar chart showing the activities for each individual reservoir inspection, QRA and advisory service to be carried out, target dates for particular tasks, any decision dates that may be required for the uninterrupted progress of the Assignment and the critical path. The Consultants shall discuss with the Director's Representative during the above periods to agree the timing of submission of reports, other documents and plans for each of the main elements of the Assignment, for inclusion in the draft programme and revised draft programme. The key dates for the submission of reports shall be in accordance with Clause 5 of this Brief.

- 8.4 In case an agreement cannot be arrived at between the Director's Representative and the Consultants regarding the completion date for any task, such completion date shall be reasonably fixed by the Director.
- 8.5 All works shall be completed within the Agreement Period unless otherwise agreed by the Director's Representative. The Consultants shall endeavour to ensure that the Assignment is carried out in accordance with the programme and shall submit regular reviews as part of the progress reports referred to in Clause 9 of this Brief.

9. Progress Reports

The Consultants shall submit to the Director's Representative progress reports at monthly intervals or at such other intervals as the Director's Representative requires on all aspects of the Services relating progress to the programme referred to in Clause 8 of this Brief. The format of the report is to be agreed with the Director's Representative. The reports shall include a list of those parts of the Services of which the execution is behind the programme together with proposals to expedite progress, so as to complete the work by the due dates.

10. Financial Management

10.1 At monthly intervals or at such other intervals as the Director's Representative may require, the Consultants shall submit a report on the current and forecast expenditure on the Assignment and the fees due to the Consultants, in a form to be agreed by the Director's Representative.

10.2 Before the commencement of any reservoir inspections, QRAs or advisory services task, the Consultants shall submit to the Director's Representative a preliminary cost estimate of each task in a format to be agreed with the Director's Representative. The Consultants, within one month after inspection of the reservoir, shall submit a cost estimate of each task for the reservoir inspections, QRAs or advisory services task in terms of staff costs and out-of-pocket expenses to the Director's Representative for agreement. In the event of failure to reach an agreement, the Director's Representative shall determine the cost estimate for the task. The Employer shall not be liable for paying the Consultants for any staff input and expenses incurred in excess of the cost estimate for the task unless such staff input and expenses are authorised in writing by the Director's Representative prior to such staff input or expenses being incurred. The Consultants shall complete the task within the agreed cost estimate or the cost estimate determined by the Director's Representative, as the case may be.

11. Standards and Specifications

The Consultants shall adopt such technical and design standards and specifications as are in current use by WSD or, if non-existent, British Standard Codes of Practice and Specifications. Should instances arise for which suitable standards or specifications do not exist or for which the current standards or specifications appear to require modification or if by the adoption of the current standards or specifications the

Consultants would incur additional expenses not within reasonable contemplation, the Consultants shall submit recommendations on appropriate alternatives to the Director's Representative for agreement.

12. Variations and Other Commitments

Not used.

13. Director's Representative

The Director's Representative as defined in the General Conditions of Employment shall be the Assistant Director/Development of WSD or such other person as may be authorised by the Director of Water Supplies in writing and notified to the Consultants. The Director's Representative may delegate any of the powers and functions vested in him to other WSD officers. If the Consultants are dissatisfied with a decision or instruction of any such officer, the matter shall be referred to the Director's Representative for a ruling. During the course of the Assignment, the Consultants shall report direct to the Director's Representative.

14. Control of the Project and Assignment

The Director's Representative or such other officers of WSD as may be authorised by the Director's Representative will provide guidance to the Consultants to monitor the progress of the Assignment. Meetings will be held at such time to be determined by the Director's Representative and shall be attended by the Consultant's Project Manager and, when appropriate, other representatives of the Consultants. The Consultants shall be required to attend meetings with the concerned committees, conferences, boards, groups and make reports to the Director's Representative. The Consultants shall also be required to produce the documents for serving or reporting to these bodies.

15. Information and Facilities Provided by the Employer

15.1 Relevant documents including reports, drawings and other background materials are listed in Clause 15.2 of this Brief. The Consultants can inspect all available documents relevant to the Assignment at the regional offices or at the Reservoir Safety

Section of WSD by prior arrangement with the Director's Representative. A copy of each of the documents indicated as needed will be supplied free of charge by the Director's Representative on request from the Consultants, except those currently available from the Sales Section of the Information Services Department or the Map Publication Centres of the Lands Department.

15.2 The following information, where available, will be provided for reference of the Consultants:

- (a) Record drawings of the reservoirs and the associated structures.
- (b) Records of any alteration and/or addition to the reservoirs.
- (c) Engineers' and Inspectors' inspection reports.
- (d) Relevant information such as reservoir storage capacity, inflow/outflow records, drop test results, operation data, etc.

16. Consultants' Office and Staffing

16.1 The Consultants shall maintain for the duration of this Agreement an office in Hong Kong under the control of the Project Manager of the Consultants who shall be responsible for the Assignment. He shall have adequate authority and sufficient professional, technical and administrative support staff in all relevant disciplines to ensure progress to the satisfaction of the Director's Representative.

16.2 The Consultants shall provide the staff and manpower input in accordance with the Technical Proposal which was submitted with the Consultants' tender for this Assignment. The Director's Representative shall have the right to check the time-log record of the Consultants' staff deployed for the Assignment.

16.3 If the Director's Representative considers that the performance of the Consultants is not satisfactory due to inadequate staffing and manpower input allocated to this Assignment, the Consultants

shall, upon request of the Director's Representative, forthwith submit to the Director's Representative the time-log record of the staff deployed for the Assignment for the Director's Representative to check against the Technical Proposal.

- 16.4 The Consultants' failure to adhere to their staffing proposal, in particular the employment of core personnel of the Consultants and their sub-consultants, thus causing an adverse impact on the performance of the Services, shall be duly reflected in the Employer's performance report on the Consultants.
- 16.5 If the Consultants are unable to maintain any of the core personnel specified in the Technical Proposal, the Consultants shall as soon as possible report this to the Director's Representative and propose, for the Director's Representative's approval, a revised personnel arrangement which is equivalent to or better than the existing personnel arrangement, in terms of qualifications, experience and competence.

17. Specialist and Sub-consultant Services

The Consultants shall provide all specialist and sub-consultant services required for the satisfactory completion of the Assignment. No additional fees or expenses for the provision of such services rendered locally or overseas shall be payable by the Employer except as otherwise provided for in the Schedule of Fees.

18. Surveys

- 18.1 One velograph and two prints of topographical mapping at 1:20,000; 1:5,000 and 1:1,000 scales prepared by the Survey and Mapping Office of the Lands Department, where available for the area covered by this Assignment, can be obtained free of charge on application to the Director's Representative.
- 18.2 All field survey works required for the proper execution of the Assignment shall be the duty of the Consultants unless otherwise provided for in the Agreement. A copy of field notes, field data and resultant plans arising from these surveys shall be handed over to the Director's Representative upon completion of the Assignment. The accuracy as well as presentation of these

surveys should be of a standard agreed by the Director's Representative.

18.3 Appendix II specifies the division of responsibility for other survey work among the Consultants, the Lands Administration Office and Survey and Mapping Office as well as the relevant sub-offices at district level of the Lands Department.

19. Insurance

The amount of insurance cover to be maintained in accordance with sub-clause (A) of Clause 47 of the General Conditions of Employment shall be twice the estimated overall expenditure for the Agreement, subject to a maximum of HK\$ 150 million and a minimum of HK\$ 10 million.

Agreement No. CE 50/2011 (WS)
Examination and Report on the Safety of Reservoirs
Eighth Formal Independent Inspection and Advisory Services – Investigation
List of Impounding Reservoirs and Large Service Reservoirs

Item	Reservoir	Reservoir type (capacity)	Region	Tentative inspection period
1	Lam Tin L/L FW S/R	S/R(36,750 m ³)	K	November– December 2012
2	Sha Tin South FW S/R	S/R(31,288 m ³)	NTE	
3	North Point West FW S/R	S/R(30,926 m ³)	HK&I	
4	Tai Tam Tuk Reservoir	IP(6.047 Mm ³)	HK&I	
5	Kau Wa Keng No.2 FW S/R	S/R(35,046 m ³)	NTW	
6	Lower Shing Mun Reservoir	IP(4.299 Mm ³)	NTE	
7	Ngau Tau Kok FW S/R	S/R(26,871 m ³)	K	March – April 2013
8	Ma On Shan FW Primary S/R	S/R(39,000 m ³)	NTE	
9	Pun Chun Yuen FW S/R	S/R(68,000 m ³)	NTE	
10	Yau Kom Tau No.2 FW Primary S/R	S/R(54,681 m ³)	NTW	
11	Tai Lam Chung Reservoir	IP(20.490 Mm ³)	NTW	
12	High Island Reservoir	IP(281.124 Mm ³)	NTE	
13	Aberdeen Lower Reservoir	IP(0.486 Mm ³)	HK&I	October – November 2013
14	Aberdeen Upper Reservoir	IP(0.773 Mm ³)	HK&I	
15	Lai Chi Kok FW S/R	S/R(93,702 m ³)	NTW	
16	Tseung Kwan O East L/L FW S/R	S/R(35,600 m ³)	NTE	
17	Shek Lei Pui Reservoir	IP(0.374 Mm ³)	NTE	
18	Plover Cove Reservoir	IP(229.729 Mm ³)	NTE	
19	Ho Man Tin West FW S/R	S/R(67,434 m ³)	K	
20	Tuen Mun FW Primary S/R	S/R(26,722 m ³)	NTW	March – April 2014
21	Tai Tam Byewash Reservoir	IP(0.080 Mm ³)	HK&I	
22	Kennedy Town FW S/R	S/R(29,085 m ³)	HK&I	
23	Ma On Shan FW S/R	S/R(44,320 m ³)	NTE	
24	Tsing Yi East FW S/R	S/R(27,581 m ³)	NTW	
25	Shek Pik Reservoir	IP(24.461 Mm ³)	HK&I	October – November 2014
26	Sham Tseng West FW S/R	S/R(29,222 m ³)	NTW	
27	To Shek FW S/R	S/R(36,828 m ³)	NTE	
28	Eastern No.2 FW S/R	S/R(45,179 m ³)	HK&I	
29	Shek Kip Mei FW S/R	S/R(132,137 m ³)	K	
30	Ho Pui Irrigation Reservoir	IP(0.505 Mm ³)	NTW	March – April 2015
31	Lion Rock H/L No.2 FW Primary S/R	S/R(95,490 m ³)	K	
32	Tan Kwai Tsuen South FW S/R	S/R(77,742 m ³)	NTW	
33	Kwu Tung FW S/R	S/R(30,853 m ³)	NTE	

34	Ngau Tam Mei FW Primary S/R	S/R(40,750 m ³)	NTW	October – November 2015
35	Tsing Tam Lower Irrigation Reservoir	IP(0.060 Mm ³)	NTW	
36	Tsing Tam Upper Irrigation Reservoir	IP(0.100 Mm ³)	NTW	
37	Lok Fu FW S/R	S/R(28,872 m ³)	K	
38	Table Hill FW S/R	S/R(27,450 m ³)	NTE	
39	Mount Davis FW Primary S/R	S/R(142,843 m ³)	HK&I	March – April 2016
40	King's Park FW S/R	S/R(27,508 m ³)	K	
41	Sha Tin North FW S/R	S/R(29,252 m ³)	NTE	
42	Wong Nai Chung Reservoir	IP(0.109 Mm ³)	HK&I	
43	Wong Nai Tun Irrigation Reservoir	IP(0.160 Mm ³)	NTW	October – November 2016
44	Tai Tam Intermediate Reservoir	IP(0.686 Mm ³)	HK&I	
45	Kowloon Byewash Reservoir	IP(0.800 Mm ³)	NTE	
46	Lion Rock H/L FW Primary S/R	S/R(102,587 m ³)	K	

Note:

1. FW = Fresh Water; H/L = High Level; L/L = Low Level; IP = Impounding Reservoir; S/R = Service Reservoir
2. The Advisor, if from overseas, is expected to stay in Hong Kong for not more than eight weeks for each inspection period.
3. The Consultants should read Clauses 4 and 6 of this Brief for the details of the Services to be provided in this Agreement.

AGREEMENT NO. CE 50/2011 (WS)
Examination and Report on the Safety of Reservoirs
Eighth Formal Independent Inspection and Advisory Services –
Investigation

Responsibility for Survey Work

The Consultants shall be responsible for all engineering surveys required in connection with this Assignment. The division of responsibility among the Consultants, the Lands Administration Office, and Survey and Mapping Office of the Lands Department for other survey work required in connection with the Assignment shall be as follows:-

Description	Responsibility of
(1) (a) Provision of basic horizontal and vertical survey control	Survey and Mapping Office
(b) Checking of given control point values and establishment of survey control network(s) based on survey control given vide (a)	Consultants
(2) (a) Provision of basic mapping (at 1/1000 or other standard mapping relevant to the Assignment)	Survey and Mapping Office (excluding those specified as to be provided by the Consultants in the Assignment)
(b) Updating and verification of accuracy of information shown on plans supplied vide (a) as necessary in relation to the Assignment	Consultants
(c) Carrying out detailed surveys for site investigation and for preparation of design and contract documents as necessary in relation to the Assignment	Consultants
(3) Supply of existing cadastral plans and records and co-ordinate data	District Survey Office
(4) Computation of detailed dimensional layouts of roads, drainage and WSD reserves, platforms, etc.	Consultants (Checked and accepted by District Survey Office)

Description	Responsibility of
(5) Determination of site/lot boundaries, calculation of areas, etc. in connection with the agreed dimensioned layouts	District Survey Office (in liaison with District Lands Office)
(6) (a) Processing of resumption and surrender for privately owned land in Development Area	District Lands Office (in liaison with District Survey Office and Consultants)
(b) Resumption and surrender plans and demarcation of lands to be resumed	District Survey Office (in liaison with District Lands Office and Consultants)
(7) (a) Setting-out of roads, drainage works formation areas, etc.	Contractors (Checked and accepted by Consultants, usually by resident site staff under their supervision)
(b) Initial site survey, and interim and final payment surveys	Consultants, usually by resident site staff under their supervision (joint survey with contractors or agreed survey with contractors)
(8) Preparation of proposal plans for Government land allocations, and grants	District Survey Office (in liaison with District Lands Office)
(9) Preparation of dimensioned plans and setting out of boundaries of sites and lots for Government land allocations and for grant to architects (Government and Housing Authority)	District Survey Office
(10) As-constructed surveys (including records of levels on all underground pipelines, etc.)	Consultants, usually by resident site staff under their supervision