APPENDIX A

FORCE MAIN CONDITION ASSESSMENT

I. AFFECTED FORCE MAINS (AFMs)

The following force mains shall be included in the condition assessment:

Force Main	Predominant Material(s)	Year Installed	Diameter, inches	Length, feet
Ala Moana No. 2[1,2,3]	RCP/Steel	1979	78/66	8,993
Kaneohe/Kailua[4]	CCP	1976	42	15,878
Kahala	DIP/CCP	1987	24	6,247
Old Beachwalk	RCP	1964	42	6,611
Old Hart Street[5]	RCP/CIP	1948	48/42	5,236
Waimalu	CIP	1964	30	2,756

Notes:

1. Ala Moana No. 2 and Old Hart Street force mains cross under Honolulu Harbor.
2. The interior of the Ala Moana No. 2 force main was partially inspected by a diver in 2004.
3. The Ala Moana No. 2 has a reinforced concrete jacket on the exterior of the steel pipe.
4. Approximately 2,300 linear feet at the end of the Kaneohe/Kailua force main (from the H-3 interchange to the Kailua Regional Wastewater Treatment Plant) was slip-lined with 30-inch HDPE in 1989.
5. Approximately 45 linear feet near the Hart Street Wastewater Pump Station is 42-inch CIP.

II. OBJECTIVES

A. Conduct assessments of AFM pipes for the purpose of locating conditions that may cause pipe leakage, failure or interruption of service. In determining the appropriate assessment methods, cost alone is not a basis for rejecting or selecting an assessment method, but is a factor to be considered in selecting from among appropriate assessment methods.

B. Conduct inspections of all accessible valves, fittings, and appurtenances associated with each AFM for the purpose of locating conditions that may cause pipe leakage, failure or interruption of service.

C. For each inspection, document the findings of each condition discovered.

D. Assess the risk of pipe failure associated with each condition discovered.

E. Gather sufficient information on each AFM to determine the appropriate course of action so that each AFM can continue to function (either as a primary or back-up force main) without a material risk of failure.

F. Provide a plan with schedules for addressing each condition that poses a material risk of pipe failure or service interruption. Follow-up actions may include monitoring the situation, preventive maintenance, repair, rehabilitation or replacement.

III. SCREENING/PRELIMINARY RISK ASSESSMENT

A. Evaluate Previous Failures – Evaluate past force main failures, determine the likelihood of repeat failures, and identify portions of the AFM at risk for a repeat failure.

B. Prior Condition Assessments – Evaluate past condition assessments and identify portions of the AFMs at risk of failure or in need of further assessment.

C. High Risk Pipe Configuration – Review force main plans to identify piping configurations at increased risk of failure including connections, joints and bends for each AFM.

D. Identify Corrosion Risks – Identify locations along each pipeline that are at risk for corrosion of the internal or external pipe walls. CCH shall employ the best available screening methods suitable for each AFM including, but not limited to, the following:

1. Identification of pipeline high points.

2. Identification of locations with failed cathodic protection, if installed.

3. Measurements of pipe-to-soil electrical potential.

4. Soil resistivity testing.

5. Examination of force main discharge manholes for signs of corrosion indicating corrosive wastewater.

E. Right-Of-Way Inspection – Inspect pipeline right-of-ways to look for signs of pipe damage or physical changes that may affect the condition of each AFM. Right-of-way inspections shall include, but not be limited to, the following:

1. Examination of soils adjacent to pipelines to look for wet spots, unusual vegetation growth or other indications of leakage.

2. Observations of recent construction or road repairs that may have affected the structural integrity of the AFM pipe.

3. Observations of land movements (slides, rock falls, sink holes, settling) that may have affected the structural integrity of the AFM pipe.

4. Observations of other conditions, such as unusual surface loads, that may have affected the structural integrity of the AFM pipe.

F. Meet and Confer – Following completion of the Screening/Preliminary Assessment Phase of the Force Main Condition Assessment Process, CCH shall meet with EPA and DOH to discuss the results of CCH's work to date and CCH's plans for the completion of the Force Main Condition Assessment.

IV. ASSESSMENTS

A. Valves, Fittings and Appurtenances – Inspect and conduct functional analyses of, to the extent practicable, all valves, air-relief valves, drains, connections, fittings and appurtenances associated with each AFM. Identify each valve, fitting or appurtenance that is not fully functional or functioning as intended. Identify conditions that present a material risk of pipe failure or interruption of service for each AFM.

B. Cathodic Protection – Evaluate the integrity and adequacy of all installed cathodic protection systems. Identify each location where the protection has failed or where protection is inadequate. If cathodic protection is not installed on an AFM pipe, evaluate whether conditions warrant the installation of cathodic protection.

C. External Pipe Inspections

1. Locations – The exterior of each AFM shall be inspected at:

a) Each location where the pipe is exposed; and

b) Each location determined to present a material risk of failure or interruption of service based on the screening analyses pursuant to section III (excavation may be necessary to reach these locations).

2. Inspection Methods

a) At each location identified pursuant to section IV.C.1 above, the pipe exterior shall be visually inspected for structural damage and the integrity of protective coatings.

b) Additional inspections shall be conducted as needed to locate and assess pipe conditions that present a material risk of pipe failure or interruption of service. Special attention shall be focused on locations determined, pursuant to section III.D above, to present a material risk of pipe corrosion.

c) The exterior of each force main shall be inspected using visual inspection and/or the best proven technology that is suitable to the particular pipe to identify conditions such as cracks, corrosion, erosion, or coating damage/delamination that pose a material risk of pipe failure or interruption of service. Best proven technology may include ultrasonic examination of pipe walls or pipe wall samples, or other methods for determining the extent of pipe corrosion.

D. Internal Pipe Inspections – Internal pipe inspections shall utilize the best proven inspection technology that is suitable to the particular pipe to identify conditions, such as cracks, corrosion, erosion, coating delamination, joint deflections, pipe deformation and debris accumulation, that pose a material risk of pipe failure or interruption of service. Internal force main inspections shall be conducted on the length of pipe that is practically accessible with the selected inspection method. At a minimum, CCH shall inspect the portions of pipe necessary to identify or characterize conditions that pose a material risk of pipe failure or interruption of service, including, but not limited to, all high points in the pipes, to the extent practicable. Where practicable, CCH shall conduct evaluations in the vicinity of all access points (air relief valves, discharge manholes and other valves and fittings that provide access). If any portion of an AFM is not subjected to complete internal inspection, CCH shall provide an explanation in the final assessment report. With regard to the Old Beachwalk Force Main, CCH shall conduct some form of internal inspection to the extent practicable. This shall consist of manned entry if practicable. If not, CCTV or some other form of remote sensing shall be attempted to the extent practicable.

E. Operating Pressure Evaluations – The City shall evaluate the operating and transient pressure for each AFM. The purpose of the evaluation is to determine if the design, construction, and materials are sufficient to withstand the maximum predicted transient pressures that may be expected to occur under normal, peak flow and emergency (shut-down and start-up) conditions. This evaluation shall include, but not necessarily be limited to, a review of available pressure sensor data (SCADA and strip chart) to evaluate normal operating pressures, and an evaluation, using transient pressure models or actual pressure measurements, of the transient pressures that occur during the range of anticipated operating conditions. Any actual pressure measurements shall be limited to the range of operating conditions that is both prudent and practicable.

F. Leak Detection - The City shall follow up on observed conditions that are likely to be the source of leakage. The methodologies employed will be appropriate to the type of condition and location of the suspected leakage.

V. CONDITION ASSESSMENT REPORTS AND ACTION PLANS

A. Assessment Methods – Describe the method and extent of each assessment conducted under section IV, including valve, fitting and appurtenance inspections; cathodic protection evaluations; external and internal pipe inspections; operating pressure evaluations and leak detection tests. Describe each external and internal pipe inspection method utilized and the locations, including the length of pipe, where each method was employed. Provide justifications for the selection of inspection methods and locations. In an appendix to the report, provide copies of the original field data.

B. Assessment Results and Findings

1. Assessment Results

a) Describe the results of the screening/preliminary risk assessments conducted pursuant to section III, including a listing of the pipe segments identified as having a material risk of pipe failure or interruption of service based on corrosion potential or other factors.

b) Describe the results of each assessment conducted under section IV, including valve, fitting and appurtenance inspections; cathodic protection evaluations; external and

internal pipe inspections; operating pressure evaluations and/or leak detection tests.

2. Findings of Conditions - Identify and quantify (where practicable) observed or measured conditions that constitute a material risk of pipe failure or service interruption. In describing such conditions, characterize the nature of the risk of failure associated with the condition, the likelihood and imminence (to the extent practicable) of the failure risk and the consequences should such a failure occur. The conditions to be addressed in this report may include:

a) Pipe conditions: cracks, holes, corrosion, erosion, coating de-lamination, joint deflections, pipe deformation and debris accumulation;

b) Valve, fitting and appurtenance conditions;

c) Cathodic protection system conditions; and

d) Leaks.

C. Follow-up Action Plan – For each AFM, provide a proposed action plan to address conditions that constitute a material risk of pipe failure or service interruption as a primary or back-up force main. The action plan shall include, but not be limited to: 1) maintenance plan, 2) schedule for future assessments, and 3) schedule for design and construction of repairs, rehabilitation, improvements or replacement as applicable. In developing the action plan, CCH shall consider the actions necessary to achieve the objectives set forth above in Section II.