APPENDIX D

TOPOGRAPHIC SURVEY

METHODOLOGY

KINGSTON SEWERAGE DEVELOPMENT PROJECT

LAND SURVEYING SERVICES FOR TOPOGRAPHIC, AND SPOT ELEVATIONS SURVEYS

The Survey will be executed in three stages as set out below.

Stage 1 SURVEY DEPARTMENT OFFICE SEARCH

A detailed search of the subject area will be carried out and a compilation of the relevant grid coordinates (Control) had prior to and during the field surveys.

Stage 2 RECONNAISSANCE AND CONTROL

One day will be spent on reconnoitering the area. Three areas of least vulnerability to disturbance during infrastructure construction will be identified for control monuments. These monuments will be established in pairs and GPS observations made to determine their N, E, & H coordinates relative to the National Grid System: (JAD 2001) for horizontal and Mean Sea Level (MSL) for vertical.
Control Traverses will be run along route. These traverses will be used to locate the existing road network, JPS power lines, drains, rivers and gullies, distinct geological and manmade features, large trees in open areas and other permanent structures within the project area. From these observations, computations will be done.

Stage 3 TOPOGRAPHICAL SURVEY

The survey will be done using ground survey methods. The horizontal and vertical controls will be extended throughout the project area. Observations will be made in such quantity and configuration to allow for the generation of contours at 1 metre vertical intervals throughout the project area. The XYZ coordinates of the observed points will be fixed using appropriate ground survey technique and instrumentation (combination of GPS, Total Stations and Automatic Levels).

The raw Survey Data will be downloaded from the instruments to the computer on a daily basis. The Data will be processed using GeoSite Professional (Version 4.1) to generate contours at 1 metre vertical interval. The data will then be converted to AutoCAD 2009 for plotting and presentation of the Topographic Plan which will be used as the basis for the preparation of the Route Layout.

SPOT ELEVATION SURVEY

Spot elevation survey will be carried out by traversing the route as indicated by indicators on location maps (Appendix 2 -5) and using GPS, observations made to determine their N, E, & H coordinates relative to the National Grid System.

SUBMISSION OF STATUS REPORTS

Reports and submissions required under this Contract together with the survey data and reports outlining the accuracies obtained and obstacles encountered during the surveys will be presented in both hard copy and electronically on CD in ASCII, Words, Excel, PDF, and AutoCAD 2009 formats accordingly.

PERSONNEL

Richard A. Stewart & Associates will provide and have overall responsibility for:
Surveyors, chainmen and other technical and supervisory survey personnel.

EQUIPMENT TO BE USED

G.P.S. surveying equipment, Total Stations, Automatic Levels, and ancillary equipment required for the execution of the project will be provided as necessary.

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS
LOT 568 WHITE WATER BOULEVARD, WHITE WATER MEADOWS, ST. CATHERINE. JAMAICA W.I. – TEL. (876) 997–2877.

CONTROL STATION DESCRIPTION

RE: TOPOGRAPHICAL ROUTE SURVEY SOAPBERRY – CAYMANAS TREATMENT PLANTS

Station No: 1001 Designation: SOAPBERRY WEST A

Northing : 649981.008m

Easting : 763747.748m

Elevation : 6.692m

Date : November 2009

Detailed Description :Iron Peg in earth, on southern edge of access road

NOTE : Northings, Eastings and Elevations are related to Jamaica National Grid & Datum

SKETCH PLAN

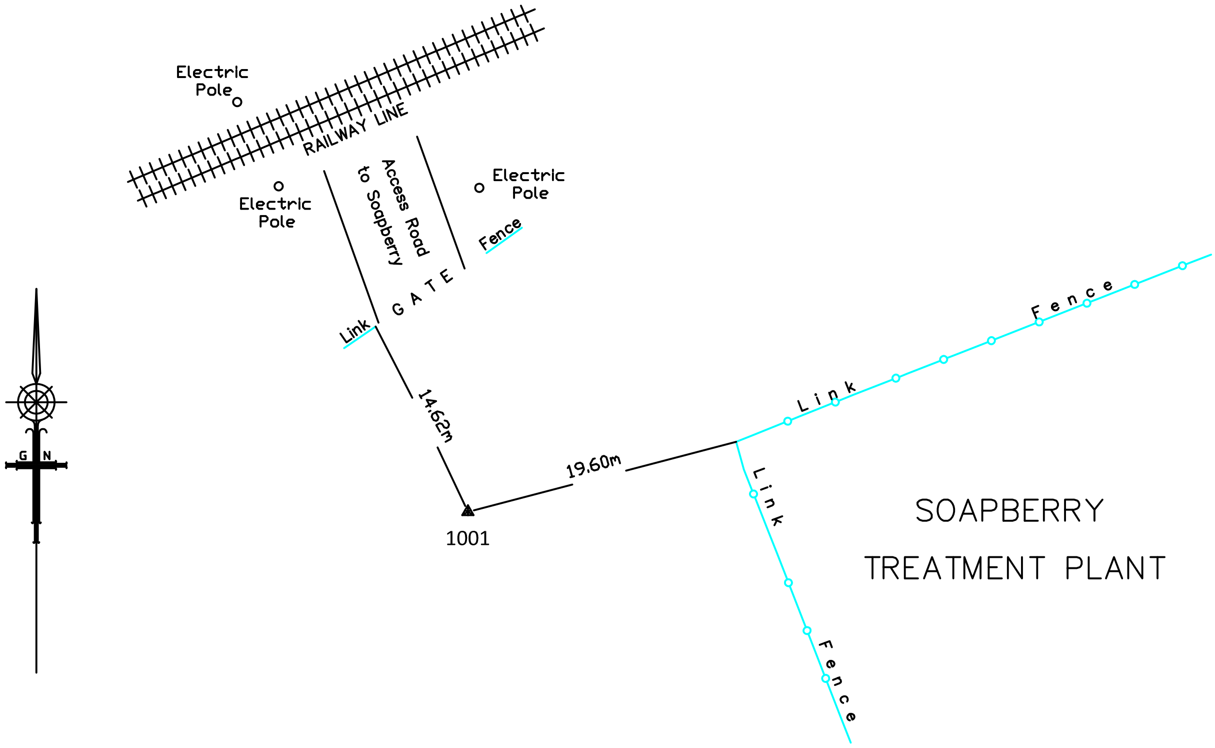


Photo 1 Distant View of BM No. 1001

Photo 2 Close View of BM No. 1001

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS
LOT 568 WHITE WATER BOULEVARD, WHITE WATER MEADOWS, ST. CATHERINE. JAMAICA W.I. – TEL. (876) 997–2877.

CONTROL STATION DESCRIPTION

RE: TOPOGRAPHICAL ROUTE SURVEY SOAPBERRY – CAYMANAS TREATMENT PLANTS

Station No: 1002 Designation: MANHOLE NORTH

Northing : 650365.8675m

Easting : 764838.7598m

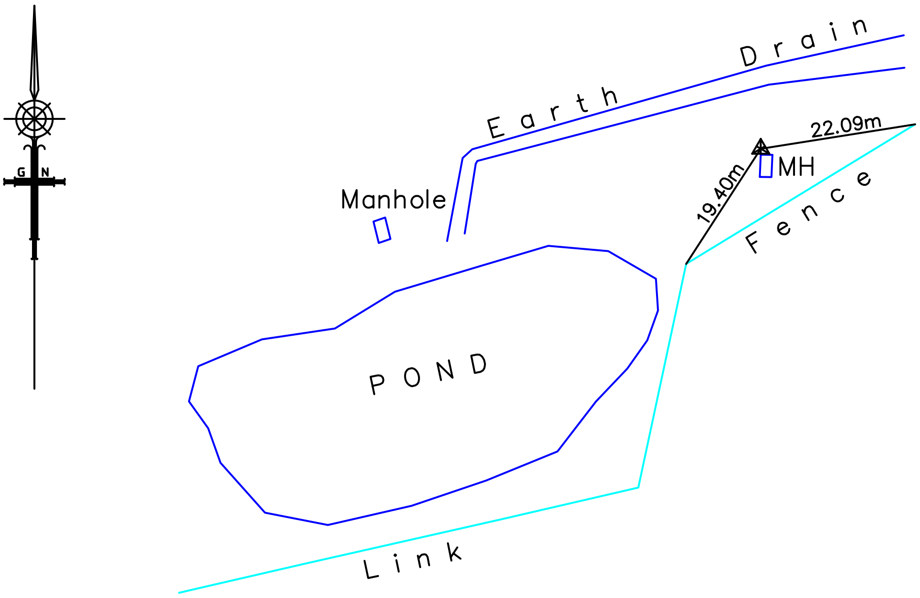
Elevation : 1.460m

Date : November 2009

Detailed Description :Iron Peg in earth, 0.8m north of north western corner of manhole

NOTE : Northings, Eastings and Elevations are related to Jamaica National Grid & Datum

SKETCH PLAN



SOAPBERRY SEWERAGE TREATMENT PLANT

Photo 3 Distant View of BM No. 1002

Photo 4 Close View of BM No. 1002

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LOT 568 WHITE WATER BOULEVARD, WHITE WATER MEADOWS, ST. CATHERINE. JAMAICA W.I. – TEL. (876) 997–2877.

CONTROL STATION DESCRIPTION

RE: TOPOGRAPHICAL ROUTE SURVEY SOAPBERRY - CAYMANAS TREATMENT PLANTS

Station No: 1004 Designation: RAILWAY SOUTH

Northing : 649779.184m

Easting : 763490.011m

Elevation : 6.721m

Date : November 2009

Detailed Description :Iron Peg in earth, 1.1m from western edge of Dyke road

NOTE : Northings, Eastings and Elevations are related to Jamaica National Grid & Datum

SKETCH PLAN

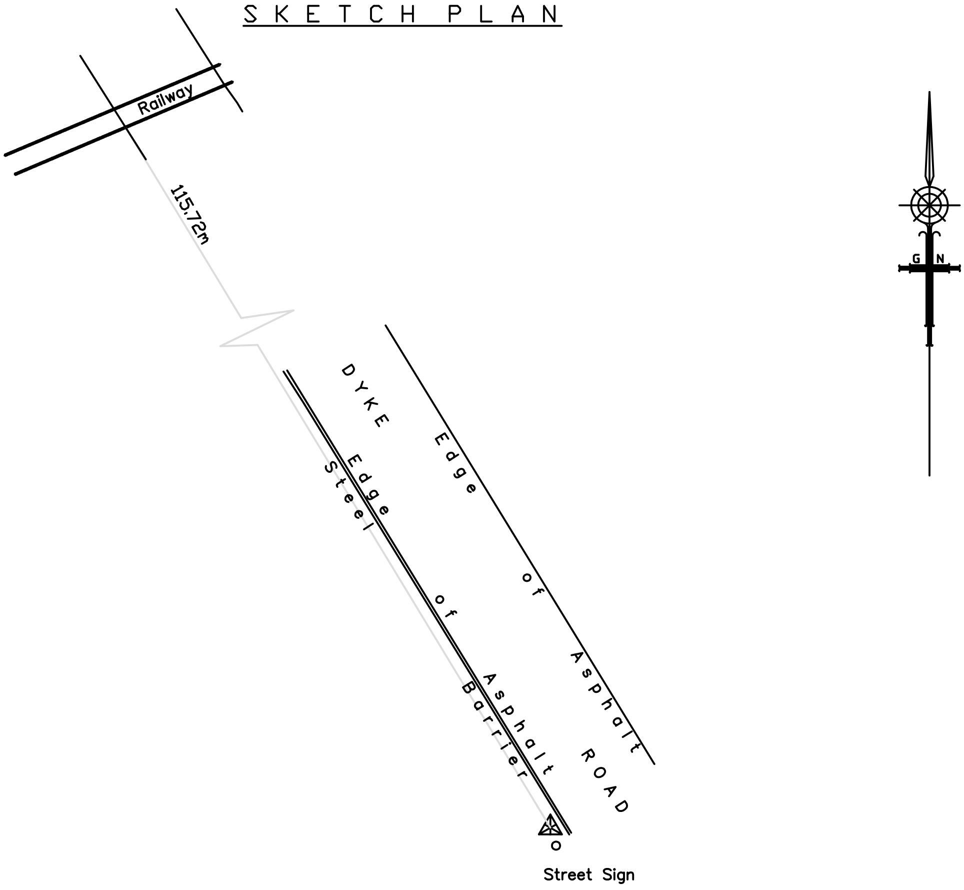

Photo 5 Distant View of BM No. 1004

Photo 6 Close View of BM No. 1004

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COMMISSIONED LAND SURVEYORS
LOT 568 WHITE WATER BOULEVARD, WHITE WATER MEADOWS, ST. CATHERINE. JAMAICA W.I. – TEL. (876) 997–2877.

CONTROL STATION DESCRIPTION

RE: TOPOGRAPHICAL ROUTE SURVEY SOAPBERRY - CAYMANAS TREATMENT PLANTS

Station No: 1006 Designation: RAILWAY NORTH

Northing : 649920.752m

Easting : 763414.044m

Elevation : 6.903m

Date : November 2009

Detailed Description :Iron Peg in earth, 1.2m from eastern edge of Dyke road

NOTE : Northings, Eastings and Elevations are related to Jamaica National Grid & Datum

SKETCH PLAN

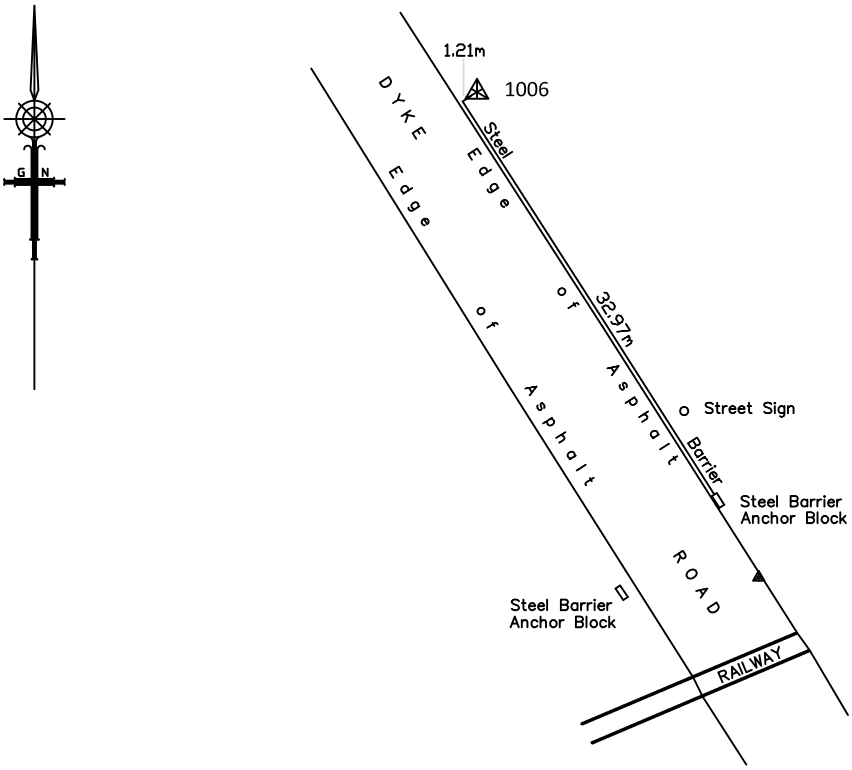

Photo 7 Distant View of BM No. 1006

Photo 8 Close View of BM No. 1006

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COMMISSIONED LAND SURVEYORS
LOT 568 WHITE WATER BOULEVARD, WHITE WATER MEADOWS, ST. CATHERINE. JAMAICA W.I. – TEL. (876) 997–2877.

CONTROL STATION DESCRIPTION

RE: TOPOGRAPHICAL ROUTE SURVEY SOAPBERRY – CAYMANAS TREATMENT PLANTS

Station No: 1009 Designation: SOAPBERRY WEST B

Northing : 650017.097m

Easting : 763742.376m

Elevation : 7.036m

Date : November 2009

Detailed Description :Iron Peg in earth, on northern edge of access road 2.79m west of transmission pole.

NOTE : Northings, Eastings and Elevations are related to Jamaica National Grid & Datum

SKETCH PLAN

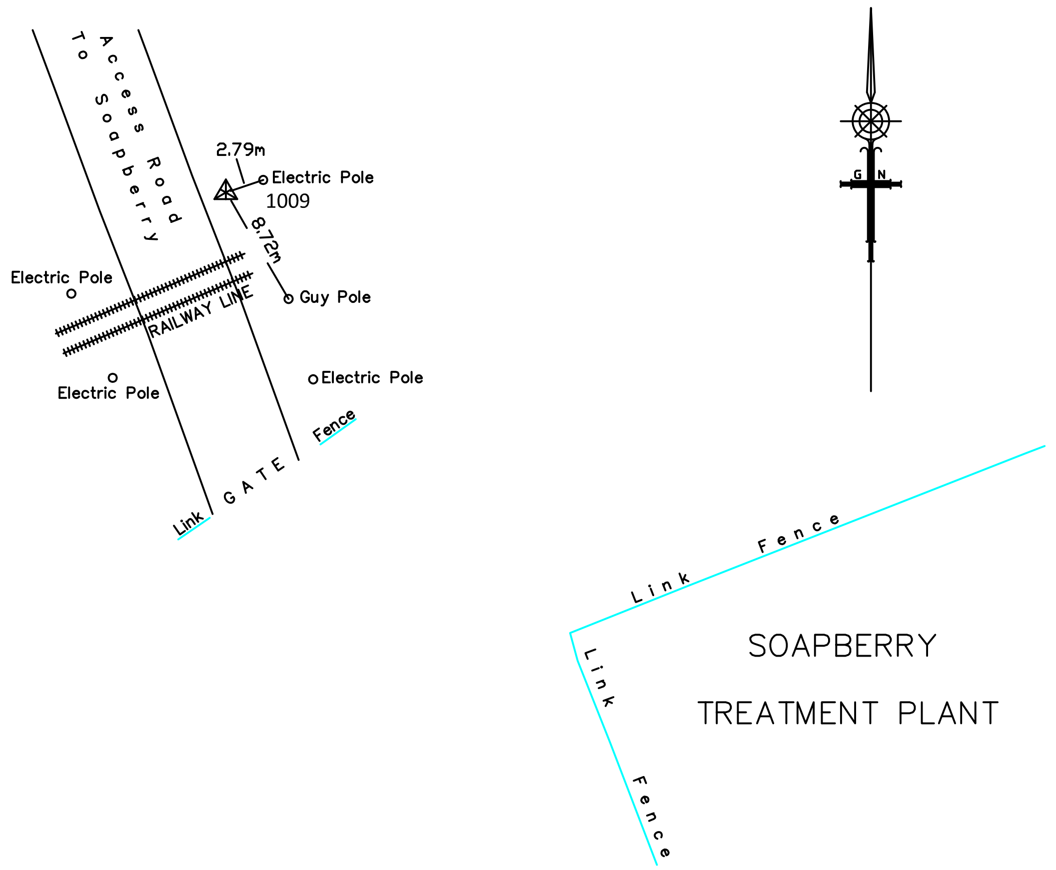
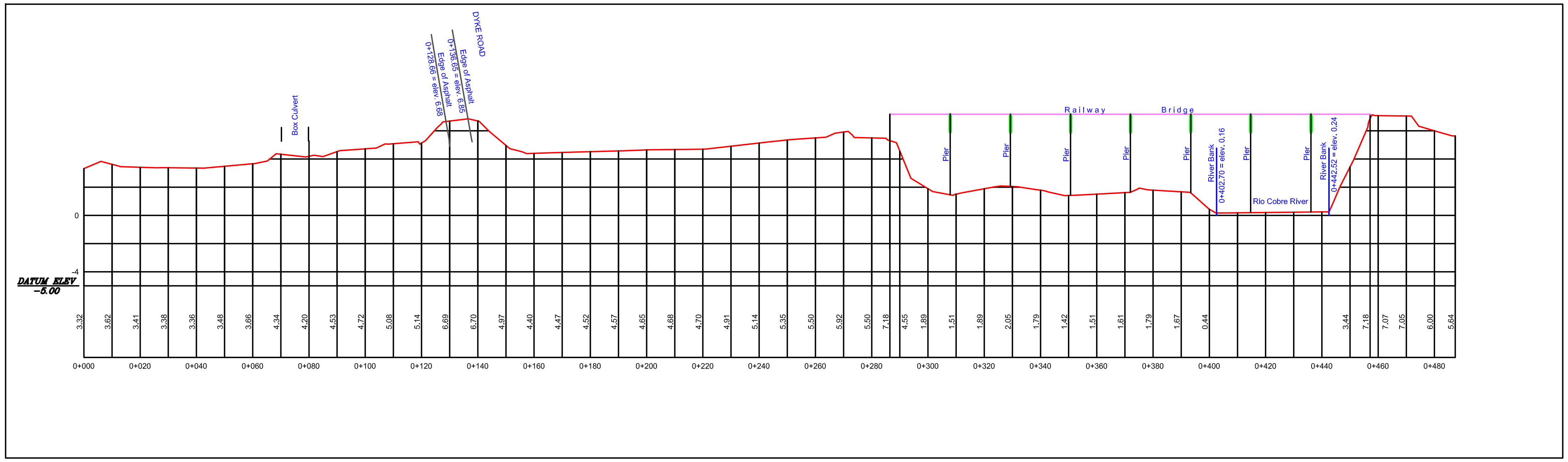
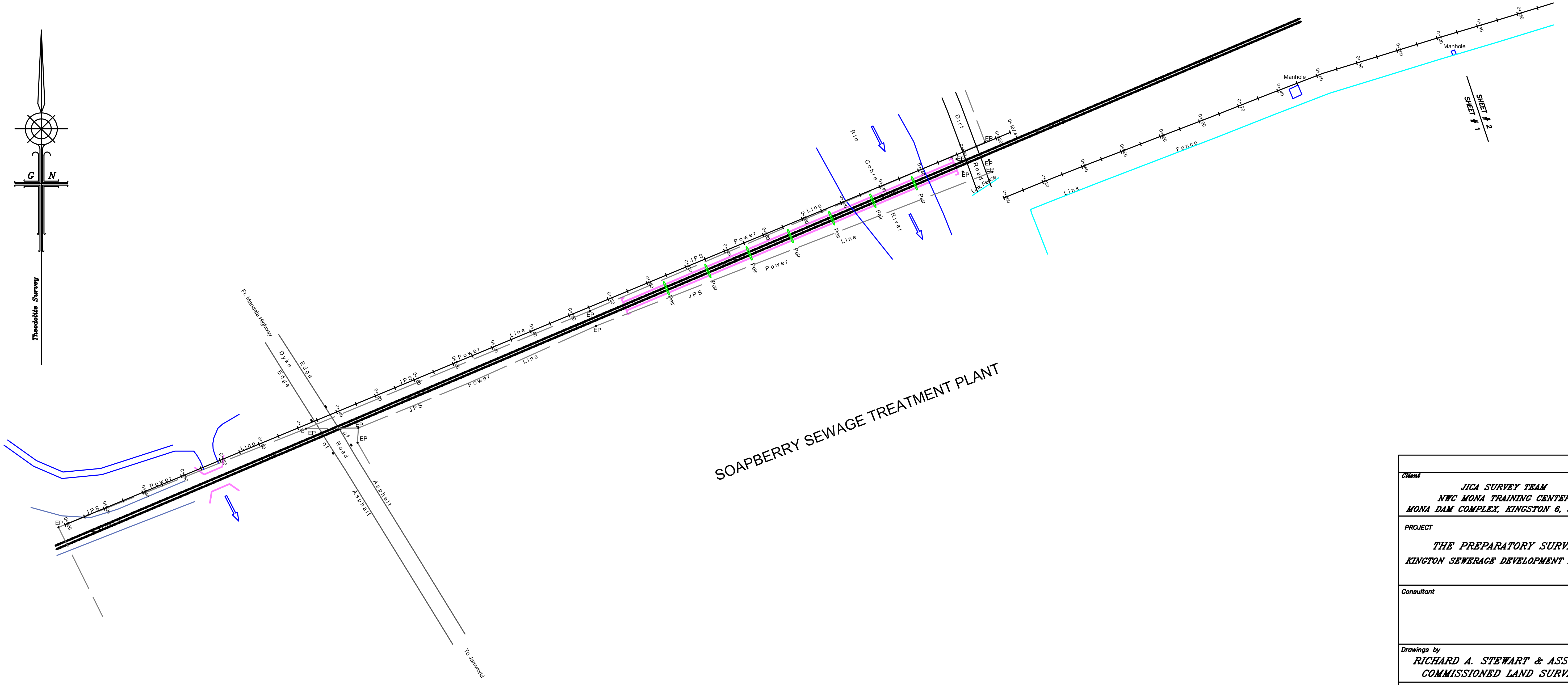


Photo 9 Distant View of BM No. 1009

Photo 10 Close View of BM No. 1009





Client

JICA SURVEY TEAM
NWC MONA TRAINING CENTER
MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

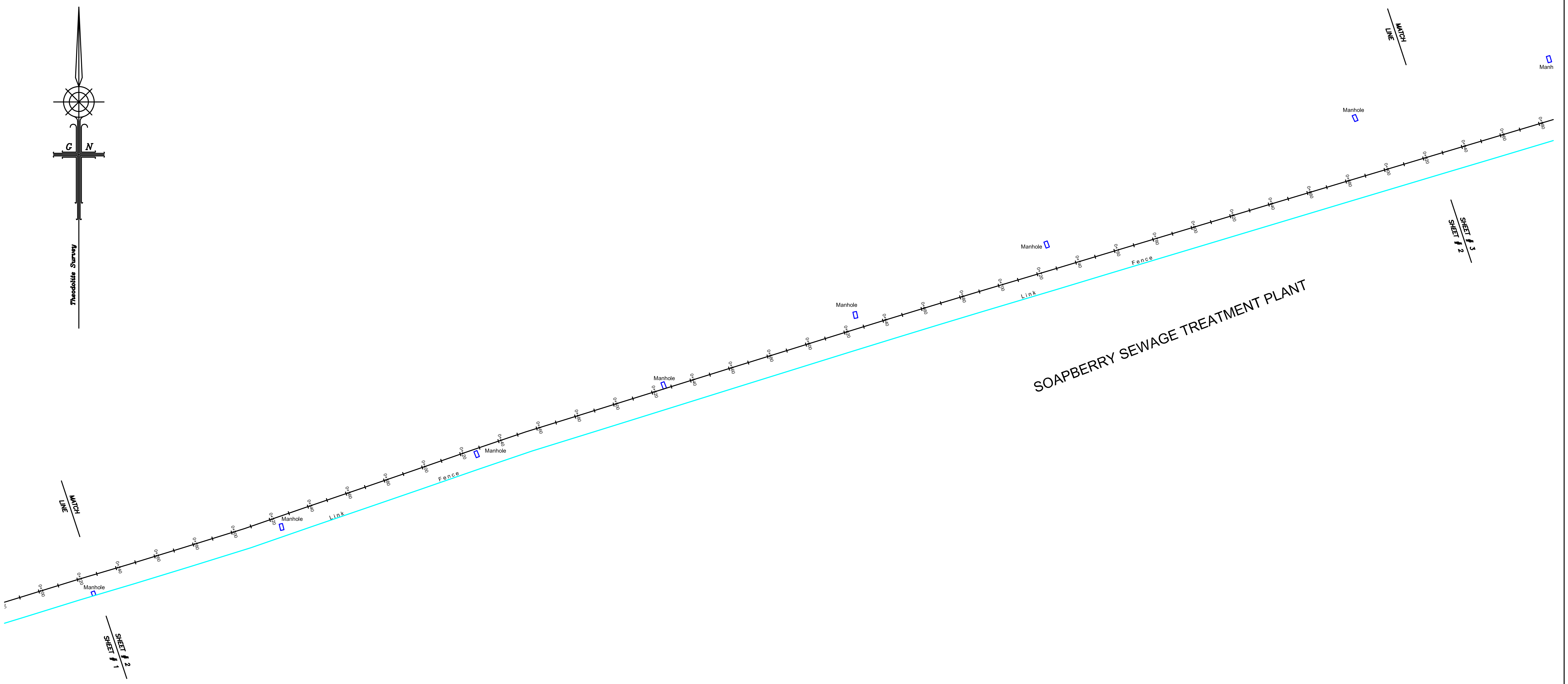
DRAWING TITLE

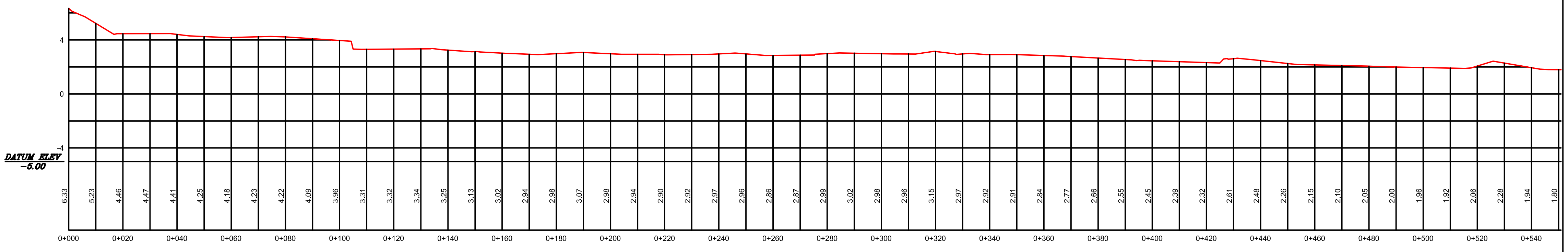
TOPOGRAPHICAL/ROUTE SURVEY
SOAPBERRY – CAYMANAS
SEWERAGE TREATMENT PLANTS

DRAWING No.
TOPOGRAPHICAL SURVEY
& PROFILE

SCALE Hor. 1000
Vert. 200

No.	DATE	CHECKED	APPROVED
DRAWING 1			
REVISED 1			
REVISED 2			
DRAWN BY :			





Client

JICA SURVEY TEAM
NWC MONA TRAINING CENTER
MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

DRAWING TITLE

TOPOGRAPHICAL/ROUTE SURVEY
SOAPBERRY – CAYMANAS
SEWERAGE TREATMENT PLANTS

DRAWING No.

TOPOGRAPHICAL SURVEY
& PROFILE

SCALE Hor. 1000
Vert. 200

No.	DATE	CHECKED	APPROVED
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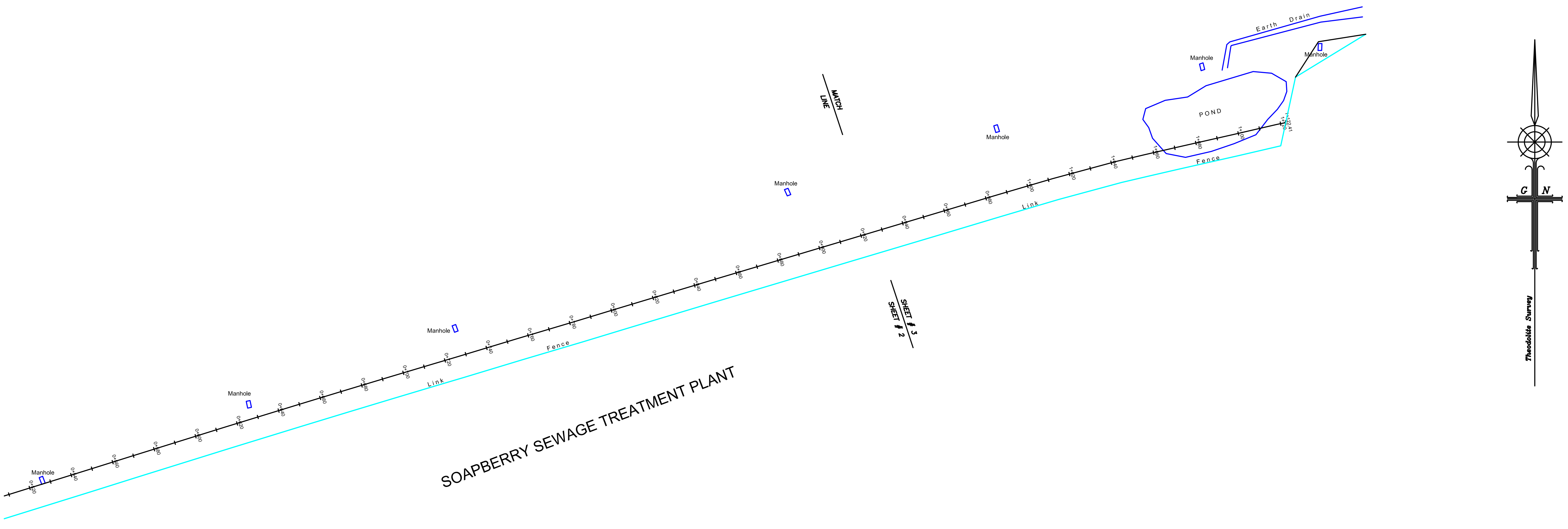
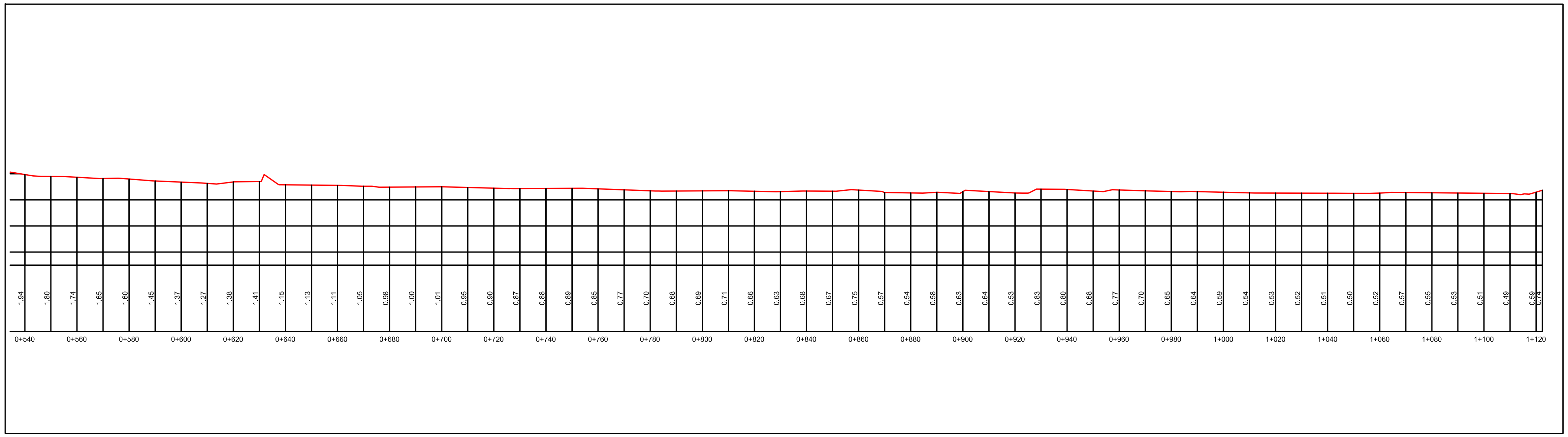
REVISED 1			
REVISED 2			
DRAWN BY :			





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KINGTON SEWERAGE DEVELOPMENT PROJECT

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DRAWING TITLE

TOPOGRAPHICAL/ROUTE SURVEY
SOAPBERRY – CAYMANAS
SEWERAGE TREATMENT PLANTS

DRAWING No.
TOPOGRAPHICAL SURVEY
& PROFILE

SCALE Hor. 1000
Vert. 200

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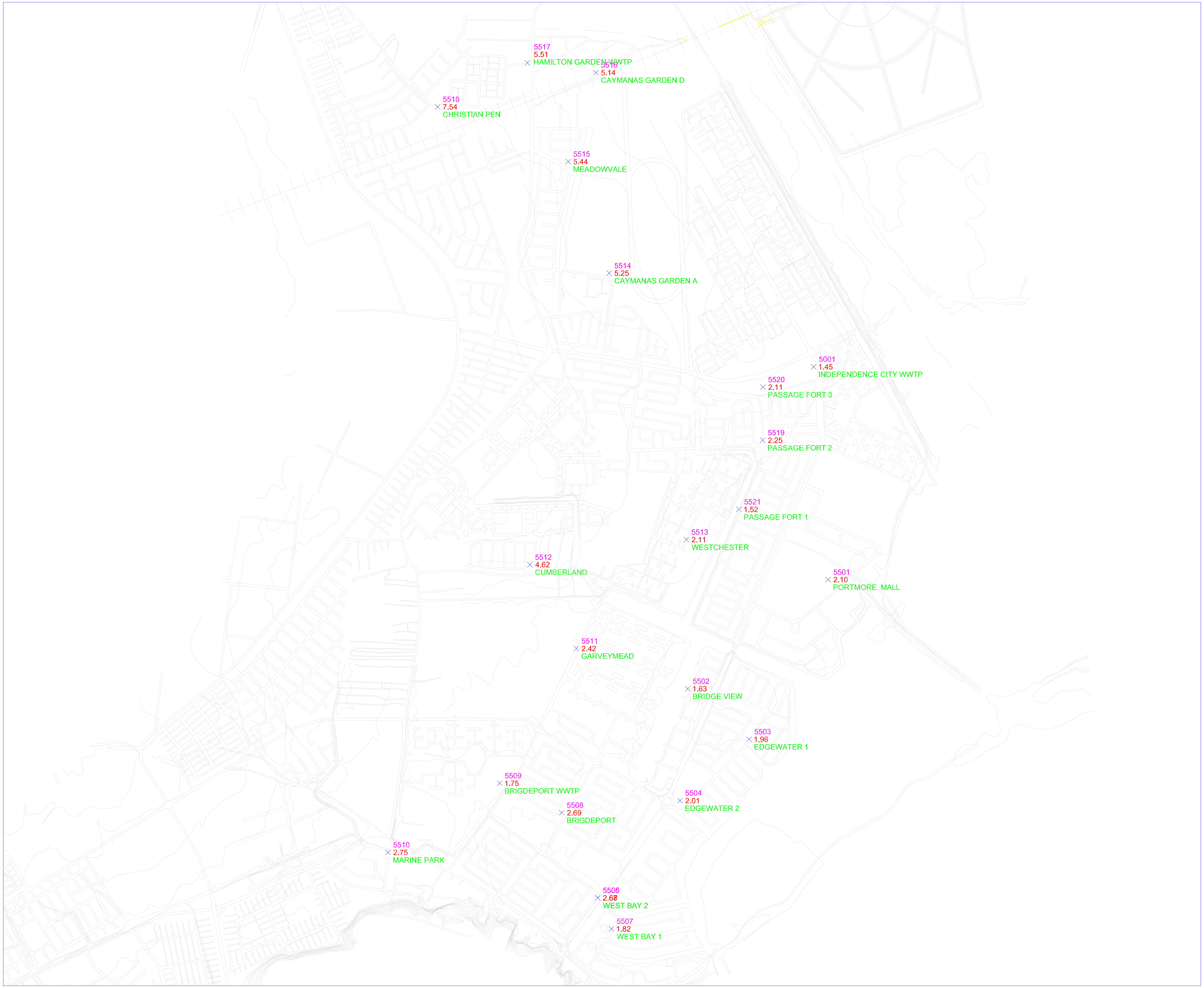
REVISED 1			
REVISED 2			

DRAWN BY :



Client

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MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

DRAWING TITLE

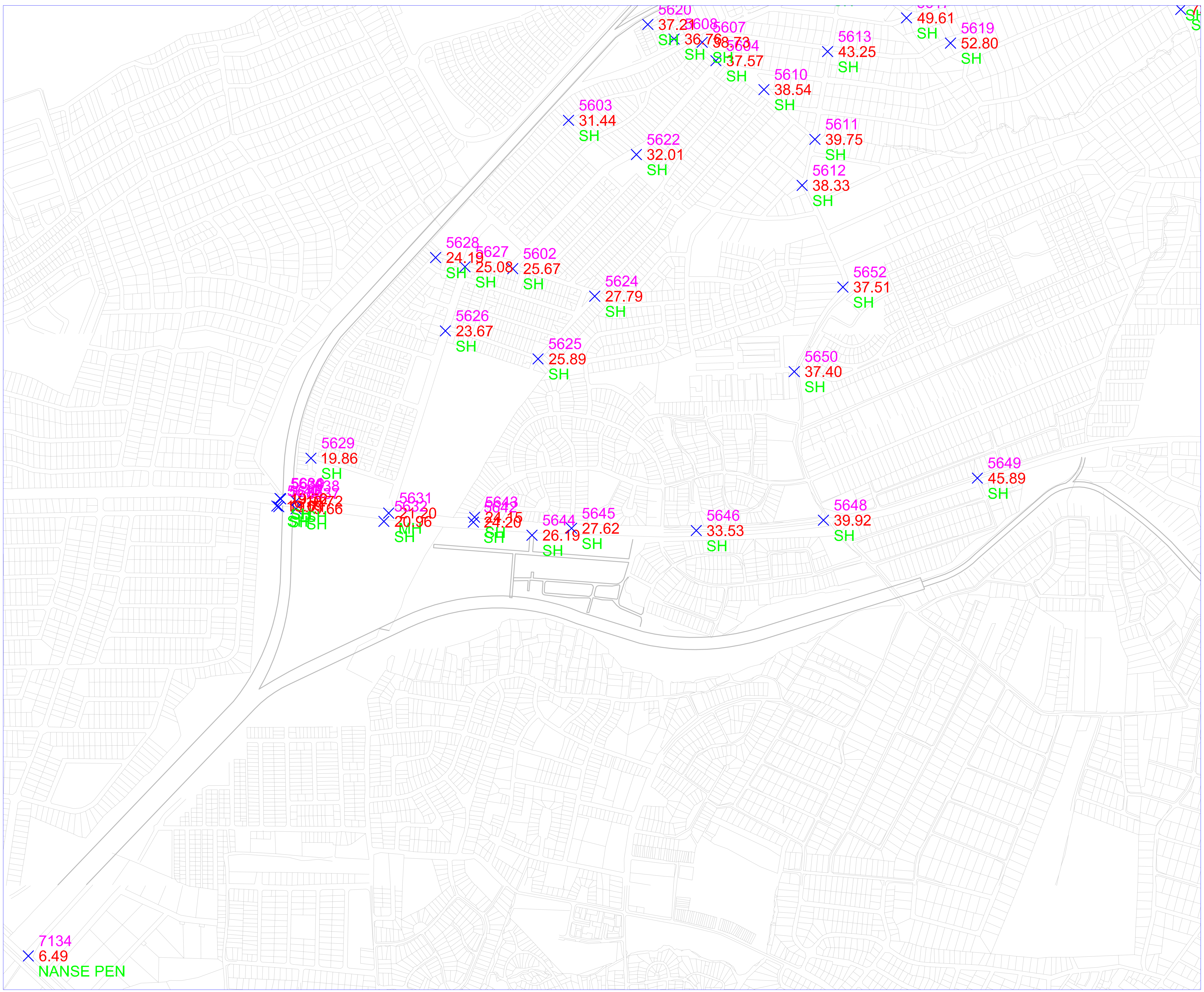
SPPOT ELEVATION SURVEY
PORTMORE AREA

DRAWING No.
SPOT ELEVATION

SCALE Hor.
Vert.

No.	DATE	CHECKED	APPROVED
DRAWING 1			
REVISED 1			
REVISED 2			

DRAWN BY :



Client

JICA SURVEY TEAM
NWC MONA TRAINING CENTER
MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

DRAWING TITLE

SPPOT ELEVATION SURVEY
KSA AREA
LOT–A PEMBROKE HALL

DRAWING No.
SPOT ELEVATION

SCALE Hor.
Vert.

No.	DATE	CHECKED	APPROVED
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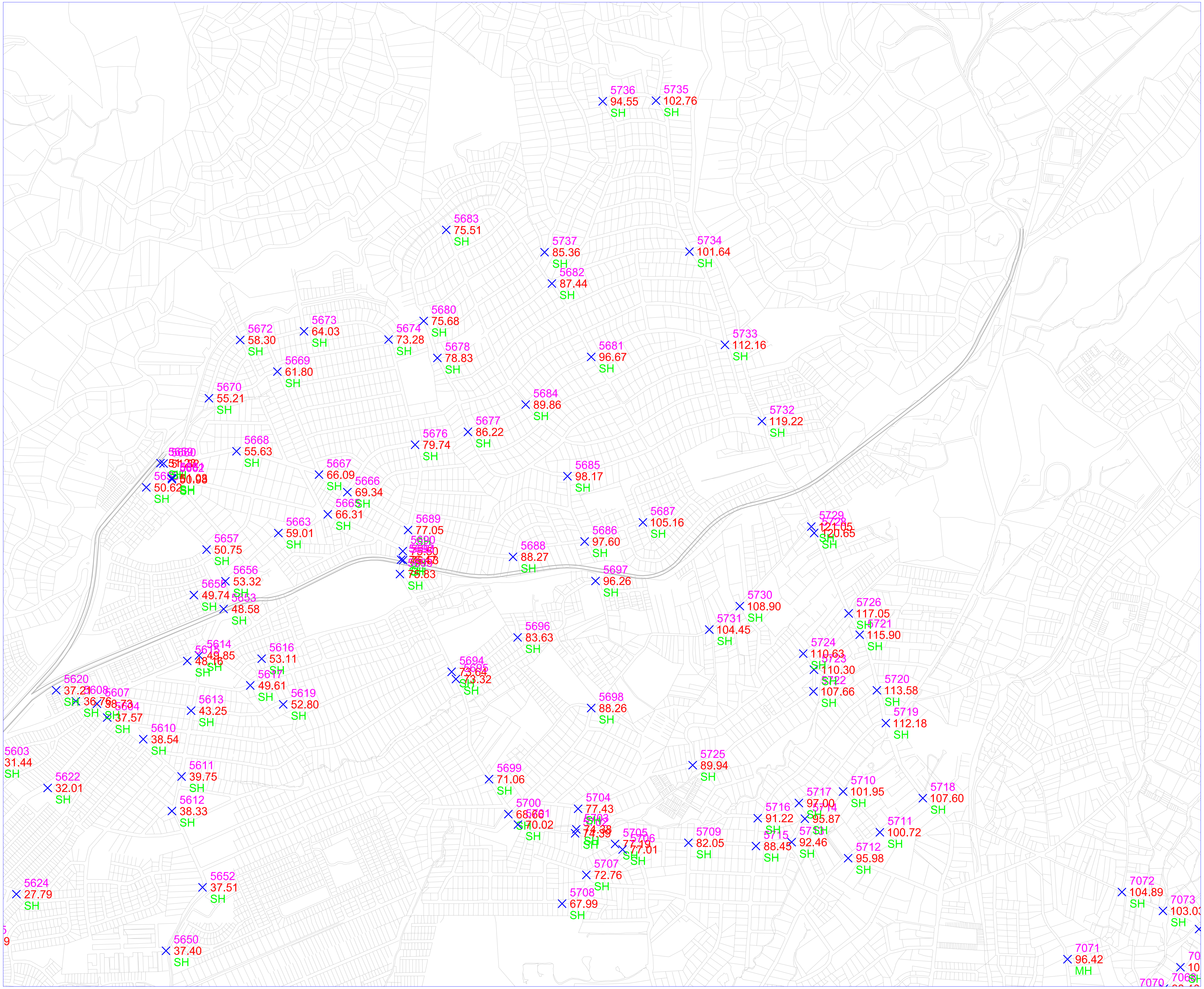
REVISED 1			
REVISED 2			

DRAWN BY :



Client

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NWC MONA TRAINING CENTER
MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

DRAWING TITLE

SPPOT ELEVATION SURVEY
KSA AREA
LOT-B HAVENDALE

DRAWING No.
SPOT ELEVATION

No.	DATE	CHECKED	APPROVED
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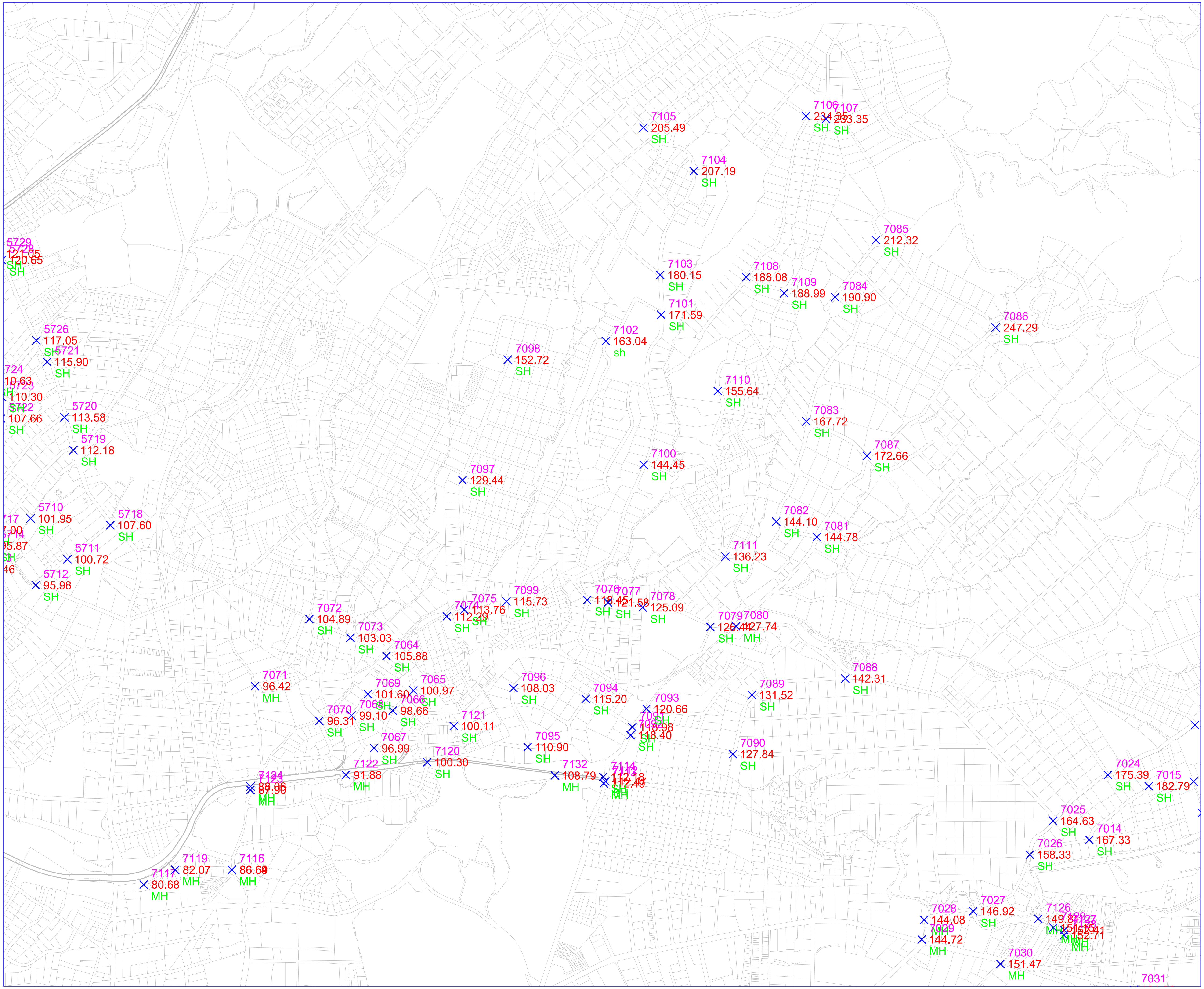
REVISED 1			
REVISED 2			

SCALE Hor.
Vert.

DRAWN BY :



Client

JICA SURVEY TEAM
NWC MONA TRAINING CENTER
MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by

RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

DRAWING TITLE

SPPOT ELEVATION SURVEY
KSA AREA
LOT-C BIRDSUCKER

DRAWING No.
SPOT ELEVATION

No.	DATE	CHECKED	APPROVED
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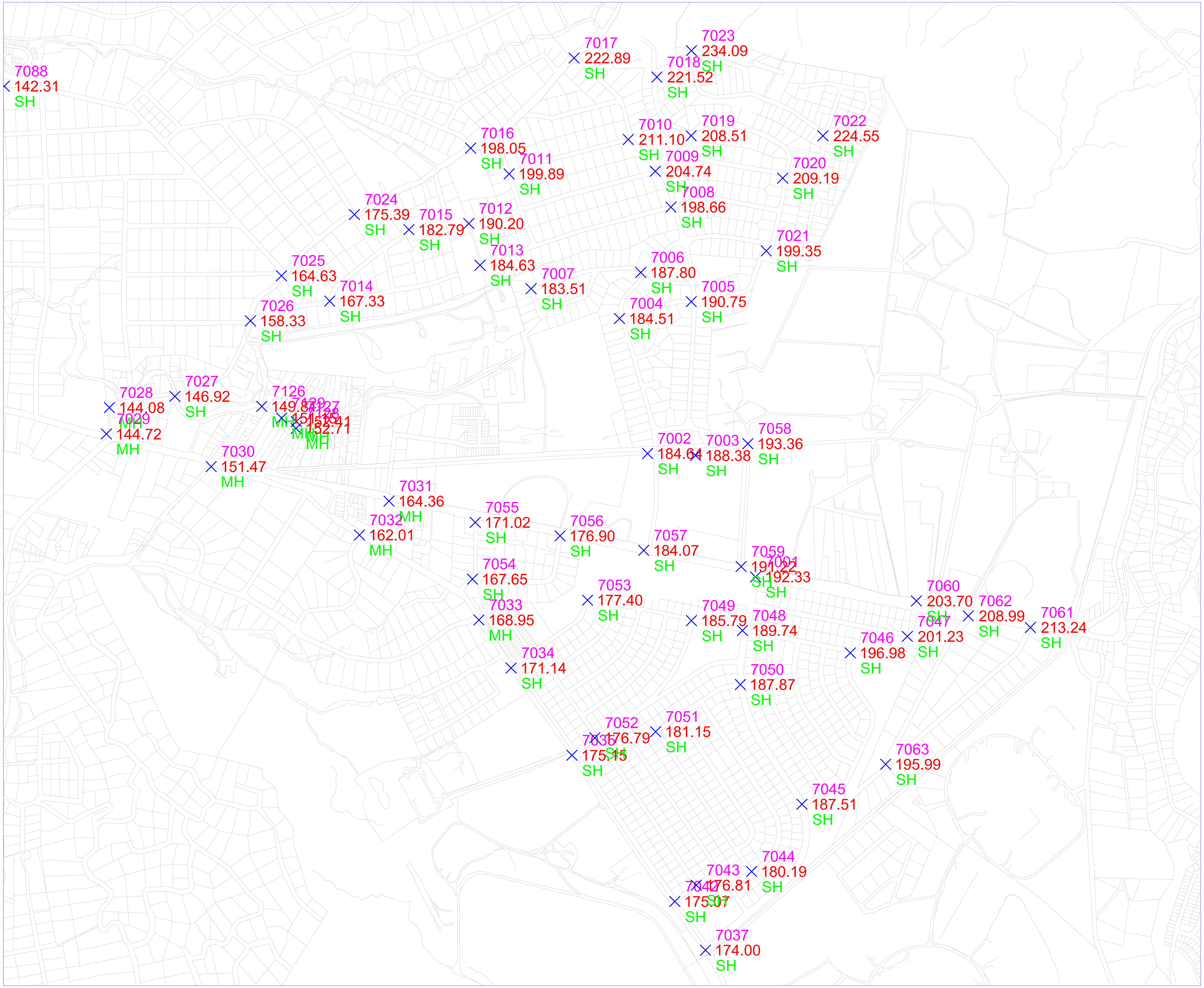
REVISED 1			
REVISED 2			

SCALE Hor. Vert.

DRAWN BY :



Client

JICA SURVEY TEAM
NWC MONA TRAINING CENTER
MONA DAM COMPLEX, KINGSTON 6, JAMAICA

PROJECT

THE PREPARATORY SURVEY
KINGTON SEWERAGE DEVELOPMENT PROJECT

Consultant

Drawings by
RICHARD A. STEWART & ASSOCIATES
COMMISSIONED LAND SURVEYORS

DRAWING TITLE

SPPOT ELEVATION SURVEY
KSA AREA
LOT-D HOPE PASTURE

DRAWING No.	No.	DATE	CHECKED	APPROVED
SPOT ELEVATION	DRAWING 1			
	REVISED 1			
	REVISED 2			
SCALE Hor. Vert.	DRAWN BY :			

APPENDIX E

GEOTECHNICAL SURVEY

SOIL INVESTIGATION REPORT

THE PROPOSED PORTMORE SEWERAGE DEVELOPMENT PROJECT
Portmore, St. Catherine, Jamaica.

Prepared for:	**Prepared by:**
JICA Survey Team **NWC Training Centre** **Mona Dam Complex, Kgn. 6**	**NHL Engineering Limited** **29 Munroe, Kingston 6,** **Jamaica**

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Authority

NHL Engineering Ltd. was requested to submit a proposal for a geotechnical survey to be carried out on a number of locations in the Portmore area to facilitate preliminary design works for their proposed Kingston Sewerage Development Project. The project is a Preparatory Survey to be completed by January 2010.

The contract was awarded to us and authorization to proceed with the field investigation was issued along with the mobilization advance.

This report contains the results of the work done; the conclusions drawn; and the recommendations made regarding the main areas of engineering concerns as defined by the scope of this investigation.

1.2 Scope of Work

The areas under investigation include; Independence City, Bridgeport, Hamilton Gardens, Portmore Dyke Road and Soapberry. NHL Engineering, was to arrange:

i) The field exploration based on the stipulated test location points, and
ii) The stipulated laboratory testing programme, which would be necessary to provide a satisfactory basis for evaluating the site for the design of the structure foundations and other infrastructural elements on site.

On completion, a report presenting the results obtained, together with our recommendations should be submitted to the Client.

1.3 Project Description

1.3.1 Site location:

The site is located in the Portmore Commercial Town Centre. The area is flat and openly accessible with low trees and shrubs. An apparent water logged/swampy area is in relatively close proximity to the site.

The site forms part of an alluvium. The insitu subsoil materials were therefore likely to be a mixed proportion of Clays, Silts, Sands and Gravels and possibly Peat.

1.3.2 Superstructure:

A detailed information of the super structure and or substructures proposed for the locations are unavailable at this time. It is however likely that pumping stations including underground tanks are constructed. The pumping stations are expected to include a single storey reinforced concrete building. Other key elements include drains and roads.

Plate 1 Picture showing general site conditions (Independence City)

Plate 2 Picture showing existing site conditions (Bridgeport)

Plate 3 Picture showing drilling crew at work (Hamilton Gardens)

Plate 4 Picture showing existing site conditions. (Dyke Road)

Plate 5 Picture showing drilling crew at work (Soapberry)

2. DATA BASE

2.1 Proposed Programme

The investigation will seek to establish the followings;

i) The insitu density of the soils on site
ii) Soil stratification and distribution across the site including depth to bedrock (if necessary), and
iii) The design parameters relevant to the design of the anticipated structural and infrastructural elements required on site

The field investigation entailed the drilling and sampling of one borehole at each location as shown in the test location plan. The borings were generally to be taken to a depth of 15.24m (50') with the exception of the Dyke Road and Soapberry location where they were taken to a depth of 30m (100'). The results are shown schematically at each location as a presumptive profile in Figures 4.1 to 4.5 below.

The methods of drilling and sampling were in accordance with the Standard Penetration Testing specifications, using the Split Spoon Sampling technique. The boreholes were to be used to recover representative samples of the soil for examination by the Soils Engineer and for the carrying out of the laboratory testing programme. These results were to be used along with site deductions during the sampling exercise and intuitive knowledge of the deposition history of the area, to arrive at a reasonable presumptive profile and subsequently a design profile across the site.

The proposed laboratory testing programme includes the conventional Classification and Index Tests along with some specific gravity tests.

2.2. Anticipated Design Approach

Given the nature of the super and sub structures to be constructed on each site and their accompanying dead, live and dynamic loadings, the foreseeable problems are as follows:

i) Undesirable total and differential deformation problems between the spans due to the possible presence of pockets of very loose/soft sands/peaty soil materials
ii) Possible Liquefaction of loose sands during extreme seismic activities

The likely modes of failure for shallow foundation placed on this site are therefore load induced shear failure and or failure related to vertical or lateral deformation. It therefore appears that a foundation type that reduces or mitigate the effects of these possibilities will be suitable for this site.

2.3 Soil Boring & Sampling

2.3.1 Methodology:

The borings were made by NHL Drillers using a truck Mounted CME Drill Rig, with a 160 mm hollow stem auger string. Sampling was done with a Split Spoon in accordance with Standard Penetration Test specifications, using a Cathead Hammer (N55 values). In general, S.S samples were taken at 0.76m intervals of depth to the first 3.81m and thereafter at 1.5 metre intervals to the maximum depth. The office logs are shown in Figs. 5.3 to 5.7 of the appendix.

2.3.2 Discussion of results:

The results of the field and laboratory tests are shown in the appendix. The soils encountered were generally a mixture of soft/loose Clays/Silts and loose to compact Silty Sands in alternating layers typical of an alluvium.

Ground water was encountered (with respect to existing ground level) in all boreholes between the 1.8m and the 3.5m depth, depending on the location.

3. LABORATORY TEST RESULTS

The soils encountered were a mixture of the plastic and the granular fraction. Twenty (23) grainsize distribution tests and twenty three (23) Liquid and Plastic Limit tests were performed. Moisture content tests were done on all the plastic samples. See also specific gravity results for selected samples in the appendix.

3.1 Classification & Index Testing:

3.1.1 Grain Size Distribution:

Figures 3.1 shows the grainsize distribution envelopes of the samples tested. The figure indicates that the samples have gradation that falls essentially into two significant groups. The following is the group descriptions:

i) Group A – the Medium to Fine Sands with Some Clays/Silts and Little Gravels (19 Samples)
ii) Group B – the Clayey/Silty Coarse to Fine Sands + Some Gravels (4 Samples)

3.1.2 Soil Plasticity:

The samples tested had significant coarse grained content. The samples generally classified as inorganic clays/Silts of Medium plasticity - four exceptions (High plastic). Their liquid limits ranged from 34.58% to 63.60% (average 46.8); their Plastic Limits ranged from 14.3% to 29.8% and their Moisture Contents ranged from 12.4% to 36.3%.

Based on these results, it is expected that these soils will exhibit moderate to high compressibility and therefore will bear significantly on the choice and design of the foundations where they are the predominant fraction.

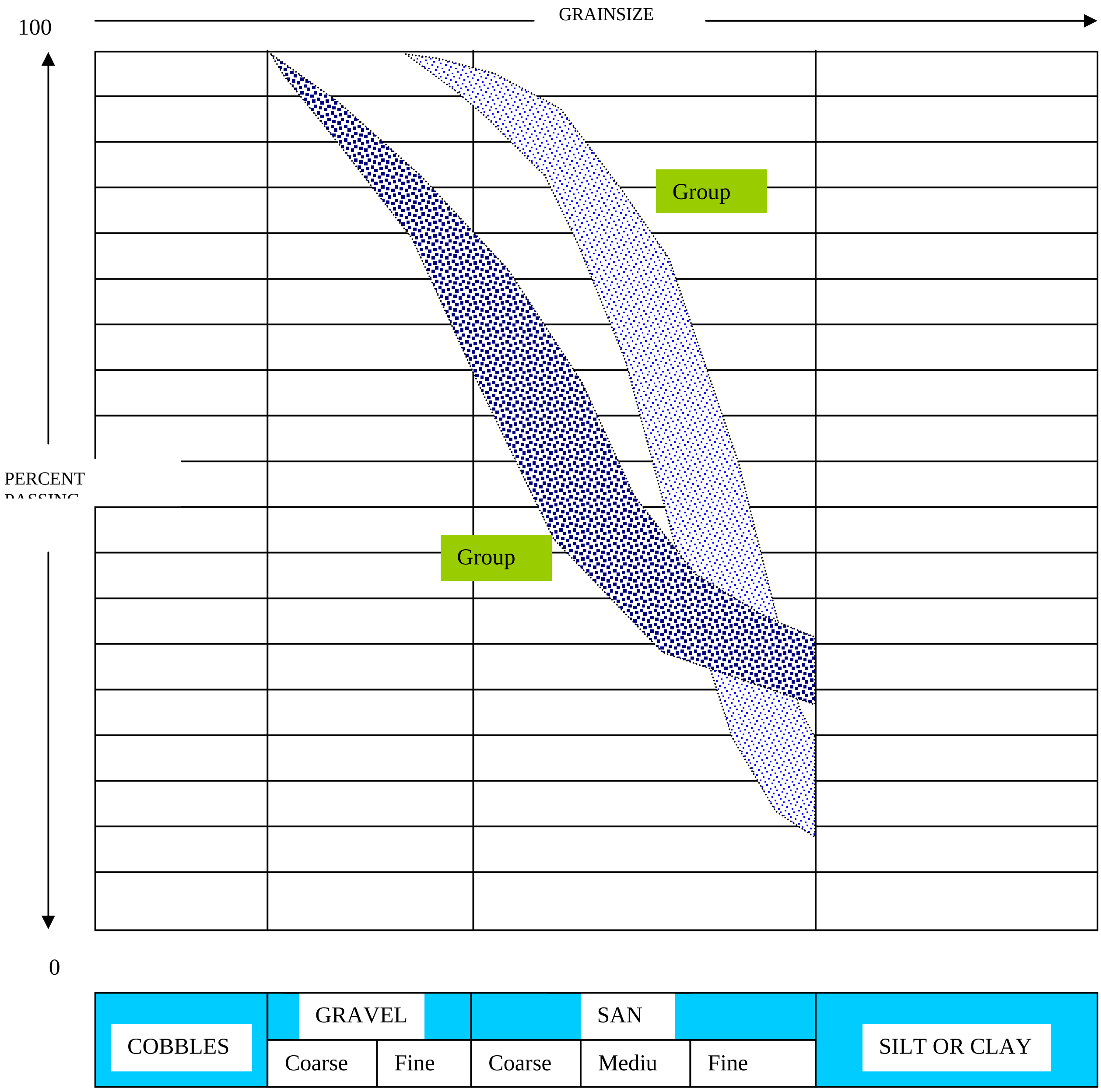


Fig. 3.1 Gradation Envelope – NWC Sewerage Expansion Survey

4. GEOTECHNICAL DISCUSSION

4.1. Presumptive Soil Profile

The subsoil layers applicable for evaluating engineering behavior and construction concerns can be characterized as two (2) distinct types, with an additional type only encountered at Borehole Location 1 (see typical site profiles below). The types are as follows:-

A) TYPE 1
The Compact Sands + Some Silts/Clays
Depth Range; Variable
Average N_{55} = 15
Borehole #s, All

B) TYPE 2
The Very Loose Coarse to Fine Sands + Some Silts/Clays
Depth Range 2 – 4.5 metres
Average N_{55} = 2
Borehole #s, 1l.

C) TYPE 3
The Firm to Stiff Clays/Silts + Some Sands
Depth Range; Variable
Average N_{55} = 12
Borehole #s, All

4.2 Depth and Type of Foundations

The soils encountered were fairly variable in distribution vertically and horizontally across the sites as shown in Figures 4.1 to 4.5 below. The Type 2 soils are very loose silty Sands and will undergo significant settlement under the proposed structure loads. These soils are also likely to liquefy under designed seismic conditions. The Type 3 soils are plastic and moderately compressible and will show some deformation under the proposed vertical loads from isolated footings. Consequently, the use of conventional shallow foundation within the insitu soils is recommended with some restriction.

Details of the proposed structure type and loading appear unavailable at this time. The following however is our general and economical foundation recommendation for each location given the information available;

4.2.1 Independence City

Use driven or cast inplace pile foundation to a depth sufficient to safely carry the anticipated loads under static and dynamic or
Lower footings to a minimum depth of 5m or

Use vibro-displacement stone columns to densify upper 6m of granular soil

4.2.2 Bridge Port

Excavate and deepen pad or mat footing to a minimum depth of 2.5m and use a compact granular pad below.

4.2.3 Hamilton Gardens

Use mechanical compaction effort after scarification to densify structure location and use pad strip or mat foundation.

4.2.4 Portmore Dyke Road

Use mechanical compaction effort after scarification to densify structure location and use pad strip or mat foundation.

4.2.5 Soapbery

a) Use mechanical compaction effort after scarification to densify structure location and use pad strip or mat foundation.

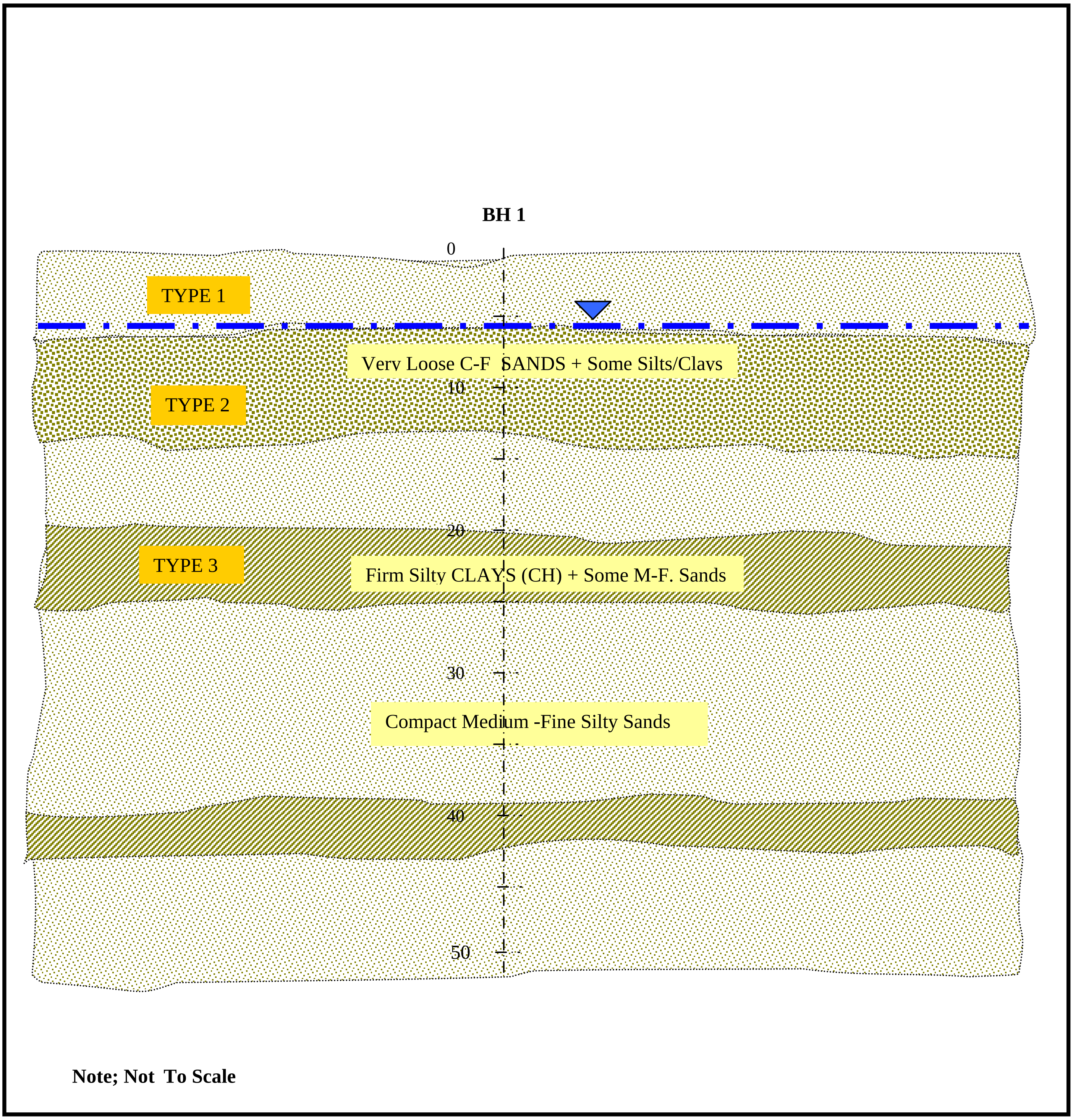


Fig. 4.1 Independence City, Presumptive Profile, Borehole #1

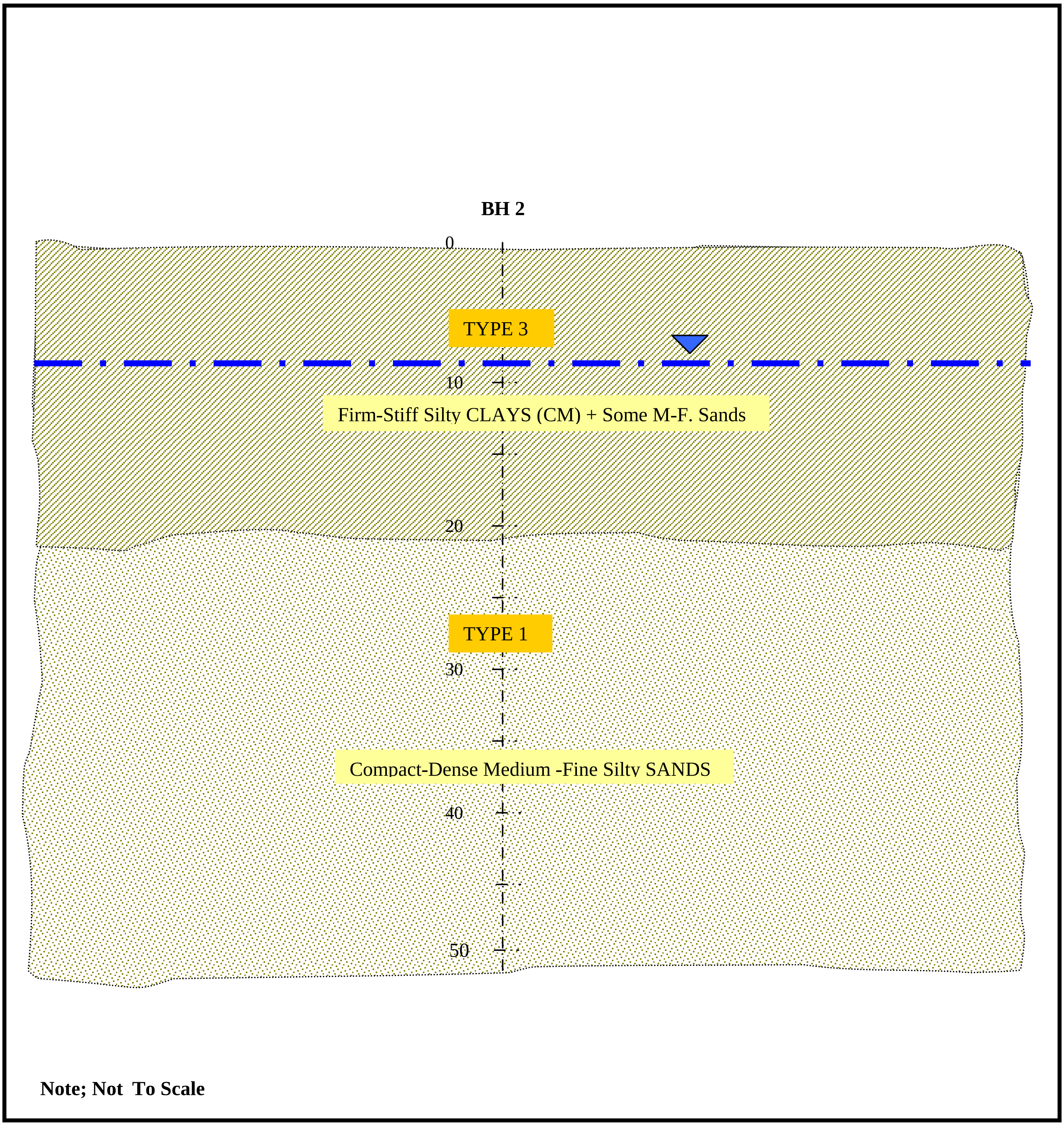


Fig. 4.2 Bridgeport, Presumptive Profile, Borehole #2

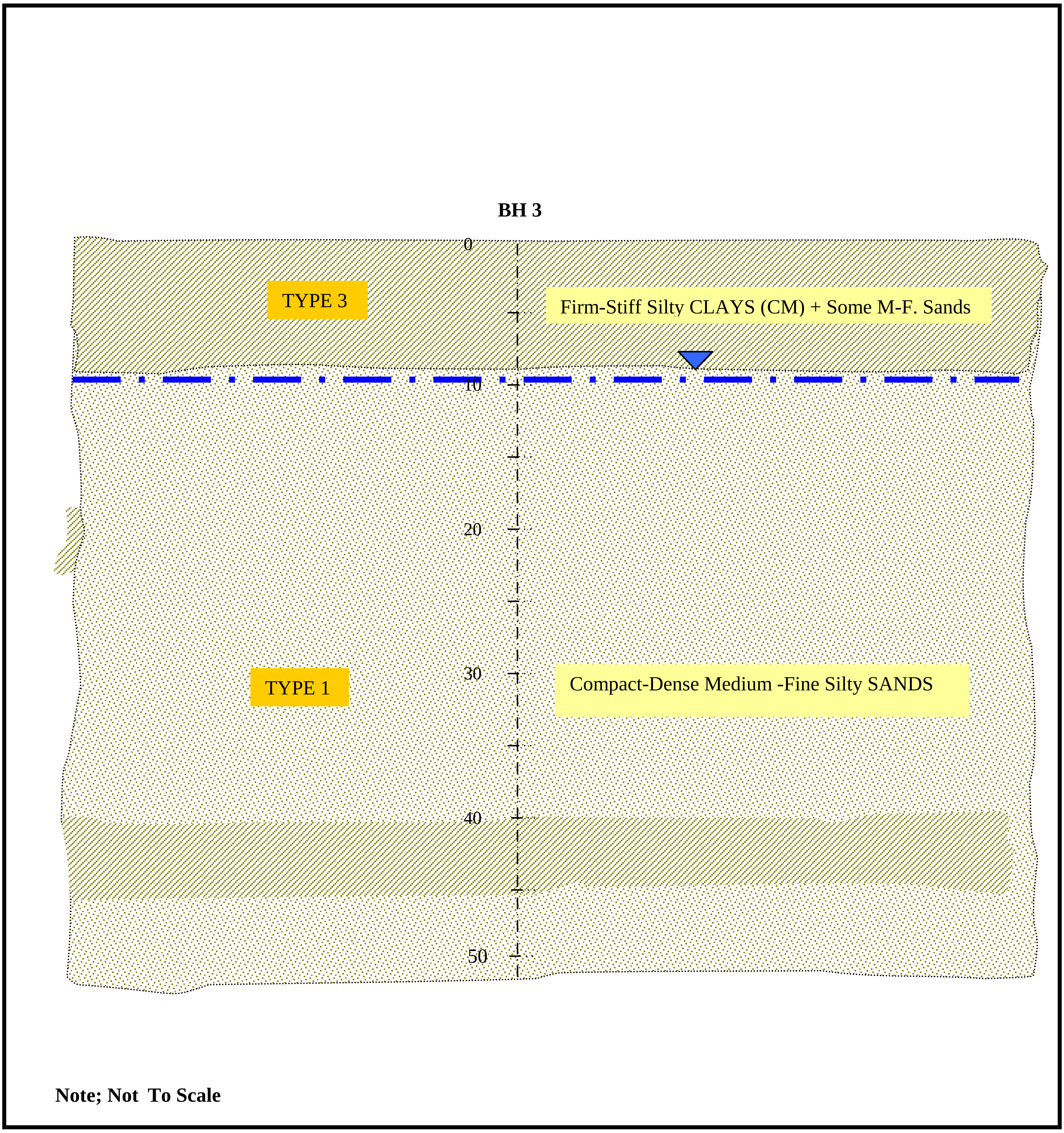


Fig. 4.3 Hamilton Garden, Presumptive Profile, Borehole #3

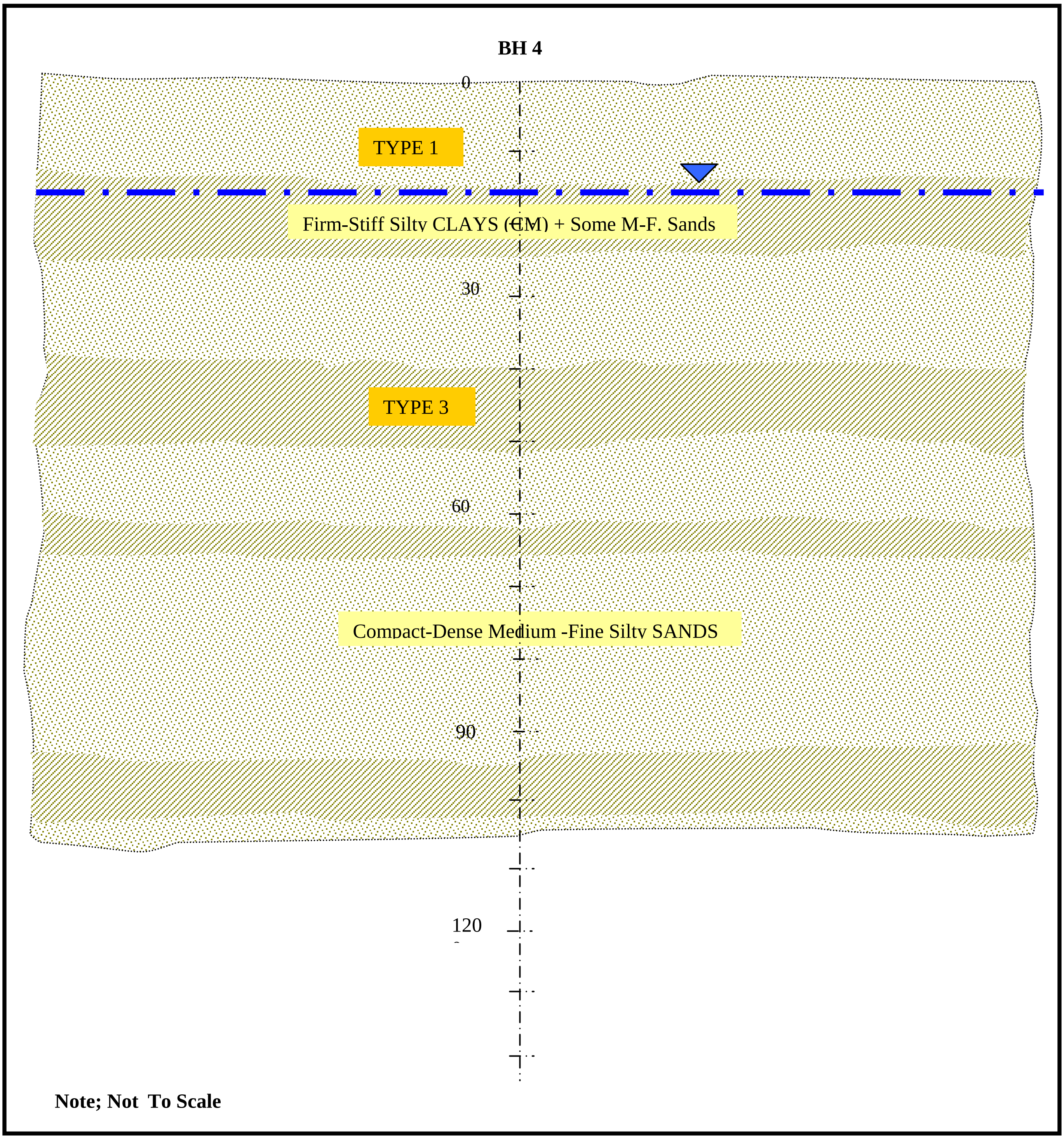


Fig. 4.4 Portmore Dyke Road, Presumptive Profile, Borehole #4

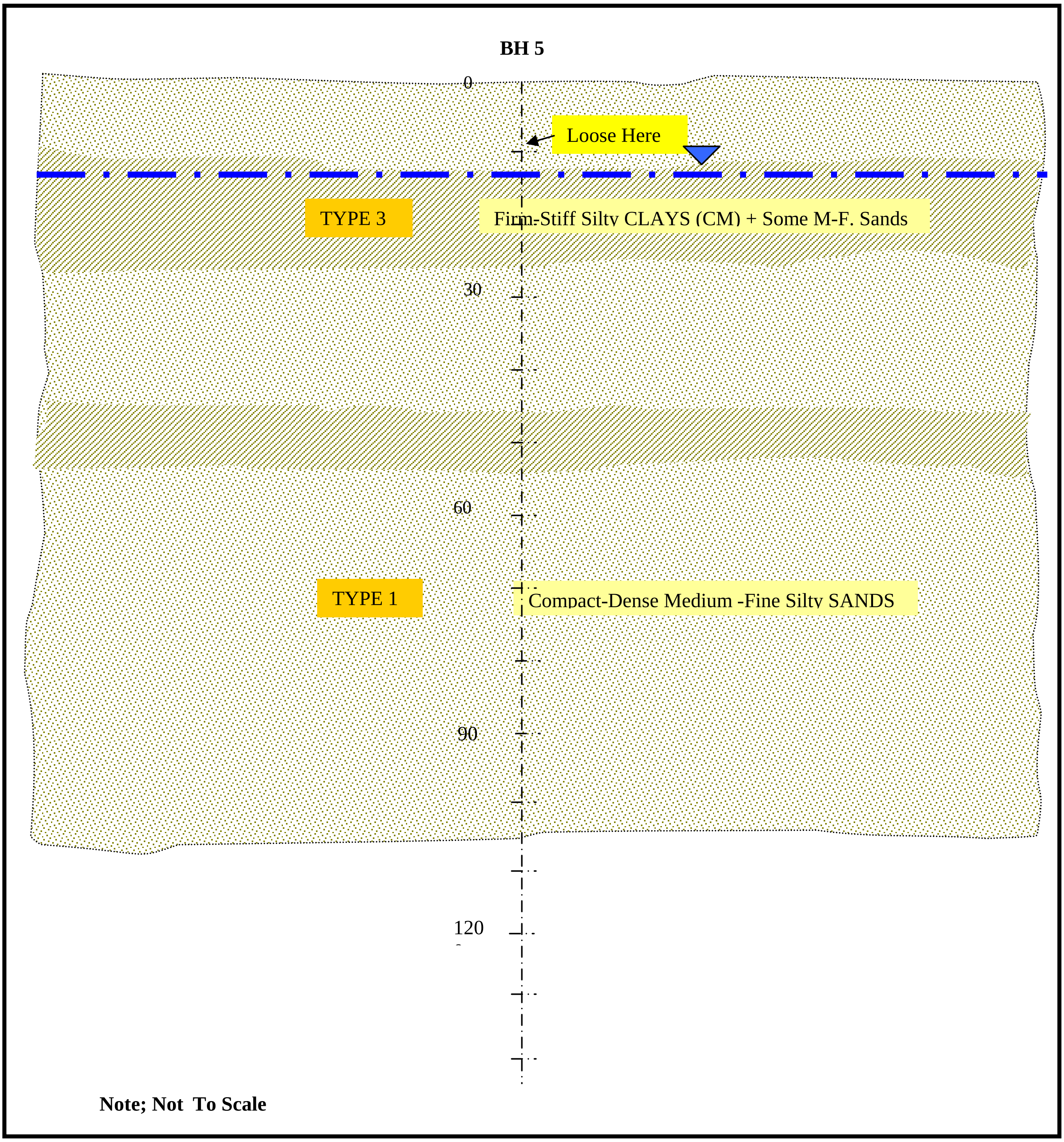


Fig. 4.5 Soapberry, Presumptive Profile, Borehole #5

4.3 Allowable Bearing Capacity

4.3.1 Shear Considerations:

Note that Ultimate values are given for the insitu soils. A Factor Of Safety of 2.5 for maximum safe load capacity is recommended based on the high variability and compressibility of the soils on site.

1) TYPE 1 SOILS – Compact to Dense M-F SANDS + Some Silts/Clays

Raft/Beam/Pad Foundation

For this alternative, the Modulus of Subgrade Reaction (Ks) is the parameter of relevance for design. The recommended value for this parameter is :-

i) Ks = 11690*(1-0.4*B/L)*B KN/m^3

Raft/Beam/Pad Foundation

For shallow spread/strip footings, the maximum Ultimate Bearing Capacity (please apply FOS) and other relevant parameters recommended for this soil type:-

i) Q_{ult}. = 516.76*D*(1+0.37*B/L)*(1+0.19*D/B) KPa

2) TYPE 2 SOILS – Very Loose C-F SANDS + Some Gravels & Silts/Clays

Raft/Beam/Pad Foundation

For this alternative, the Modulus of Subgrade Reaction (Ks) is the parameter of relevance for design. The recommended value for this parameter is :-

i) Ks = 3418*(1-0.4*B/L)*B KN/m^3

Raft/Beam/Pad Foundation

For shallow spread/strip footings, the maximum Ultimate Bearing Capacity (please apply FOS) and other relevant parameters recommended for this soil type:-

i) Q_{ult}. = 216.85*D*(1+0.28*B/L)*(1+0.17*D/B) KPa

3) TYPE 3 SOILS – Firm to Stiff Silty CLAYS + Some Sands

Raft/Beam/Pad Foundation

The Modulus of Subgrade Reaction (Ks) is a parameter of relevance for design. Using the Design Profile shown in Figure 4.1, the recommended value for this parameter is :-

i) Ks = 10268*(1+0.2*B/L) KN/m3

Raft/Beam/Pad Foundation

The Ultimate bearing capacity and other relevant parameters recommended on this site are :-

i) Q_{ult}. = 256.69*(1+0.20*B/L)*(1+0.2*D/B) + 15.45 KPa

Where,

$Q_{ult:}$ the Ultimate Bearing Capacity
Ks: the Vertical Modulus
D: the Depth of footing,
B: the Width of footing,
L: the Length of footing

For Lateral Resistance the relevant Parameter is the soil's Horizontal Modulus of Subgrade Reaction (Ks);

Type 1 Soils: Ks = 20670*(1+0.37*B/L)*$\tan^{-1}$(z/Zmax) KN/m^3

Type 2 Soils: Ks = 8674**(1+0.28*B/L)*$\tan^{-1}$(z/Zmax) KN/m^3

Type 3 Soils: Ks = 618*$\tan^{-1}$(z/Zmax) KN/m^3

Where,

B: the Width of the Footing
Z: the depth of concern
Zmax: the Depth to the Bottom of the Pile

Table 4.1 Summary of Soil Parameters

LAYER IDENTIFICATION	**TYPE 1 SOILS**	**TYPE 2 SOILS**	**TYPE 3 SOILS**
Bulk Unit Weight	16.8 KN/m3	15.2 KN/m3	19.3 KN/m3
Submerged Unit Weight	9.3 KN/m3	8.5KN/m3	9.5 KN/m3
Compression Index			0.324
Void Ratio			0.650
Undrained Cohes.(KPa)			49.9
Drained Cohes. (KPa)			3 KPa
Effective PHI/PHI	35.3 deg.	28.6 deg.	
Relative Density (%)	56.1	15.4	
Ka	0.268	0.352	
Kp	3.731	2.840	
Permeability Coef. (k)	$1x10^{-3}$	1 to $8x10^{-2}$ cm/s	$1x10^{-8}$ cm/s

4.4 Static Pile Capacities:

4.4.1 Pile Consideration:

The use of cast-in-place or driven piles is considered the feasible foundation alternative. Piles will minimize/offset the problem of deformation and the possible effects of liquefaction. The worst case borehole has been analyzed for its static capacity for a concrete pile 254.0mm in width and a maximum length of 11.3m. The results are shown below;

STATIC PILE CAPACITY 254 mm Pile (10”)
Concrete Piles

PILE CAPACITY VS PENETRATION

Test Pile Length (m)	Ult. Side Friction (KN)	Mobilized End Bearing (KN)	Est. Davisson Capacity (KN)	Allow. Pile Capacity (KN)	Ult. Pile Capacity (KN)
6.4	93.74	26.33	120.07	60.03	172.72
7.0	118.25	30.60	148.84	74.42	210.04
7.6	142.86	37.24	180.10	90.05	254.58
8.2	171.00	44.96	215.97	107.98	305.89
8.8	208.10	51.03	259.13	129.57	361.19
9.5	252.66	53.17	305.82	152.91	412.16
10.1	295.10	54.14	349.24	174.62	457.51
10.7	333.82	54.79	388.61	194.30	498.18
11.3	371.48	54.95	426.07	213.03	535.24

Notes:

1 Davisson pile capacity is the sum of the ultimate side friction and the mobilized end bearing
2 Allowable pile capacity is 1/2 the davisson capacity
3 Ultimate pile capacity is ultimate side friction plus 3xthe mobilized end bearing

4.5 Vertical Deformation Considerations:

4.5.1 Independence City:

Total settlement prediction under the anticipated single storey structure load was estimated to be approximately 114.3 mm (4.5”) for isolated footings. Differential settlements are estimated to be about 71.12mm (2.8”).

4.5.2 Other Locations:

Vertical deformation is unlikely to be of major concern for a typical single storey structure at these locations if our recommendations were adopted. The effects of soil deformation under steady load conditions should be for the most part, of little structural consequence to the building. Poor detailing and bad construction practice could however result in the formation of cracks (structural and or nonstructural cracks) in the walls of the building.

4.6 Excavation Considerations:

The soils on site are generally compact and have some plastic content. Walls of open trenches will be at risk of failure during moist conditions if they were constructed near vertical. It is our recommendation that excavations be constructed with walls at a minimum slope of 1.5:2 (hor. to vert.). These excavations should not be loaded following construction with parked heavy equipment and/or overburden from the excavated soil; excavated soils should be stored a minimum of 5m from the edge of the excavation. In areas where loading of open excavation is unavoidable, or in the vicinity (within a distance of the width of the building’s footprint) of an existing building, it will be necessary to use appropriately designed lateral braces for temporary support. The design of the lateral braces should account for the active pressures of the soil and the relevant overburden

4.7 Hydrology Considerations:

The relatively low elevation of the ground level (high water table) is cause for concern during extreme weather conditions (hurricanes), and for prolonged periods of inclement weather (flooding). It would therefore be prudent to obtain hydrological data on the area for design of the floor levels.

4.8 Other Considerations:

4.8.1 Infrastructural Considerations:

The results suggest that in most areas the subgrade is mainly Sandy/Silty, as such, it could be expected that the effective C.B.R would be of the order of 15 percent. Based on the swell shrinkage properties of the Type 3 soils, stormwater drainage is very important to the long term stability of the paved areas. In the areas where they constitute the upper strata; it may be prudent to use a drainable base material (quarry crushed marl), in combination with at least 200mm of compact granular subbase course.

4.8.2 Construction Concerns:

The installation of an underground concrete tank in this high water table environment could prove very problematic in some areas. The anticipation is that some level of well pointing could be required to lower the water table during construction. Walls of excavation would be unstable in this environment without retention. Temporary works such as sheetpiles could be used to facilitate the works along with drawdown of the water table. The piles will have to be extended significantly below the base of the tank to ensure stability after excavation of the inboard soils. The excavation of the soil will lead to seepage problems that could result in ‘boiling’ of the embedded sands in the vicinity of the pile toe. This ‘boiling’ usually causes lost of shear strength of the soils in contact with the pile leading to tilting or floating (uplifting) of the structure.

4.8.3 Backfill Considerations:

The use excavated soils as backfill is location and depth dependent. Please use the schematics of the soils profiles in Figures 4.1 to 4.5 as a guide. The Type 1 soils typically are suitable for most backfill purposes having only about 15% of the plastic fraction.

NHL ENGINEERING LIMITED
per M. Carlton Hay PhD.
Registered Professional Engineer (PE)
Geotechnical Engineer

APPENDICES

Appendix I - Figures

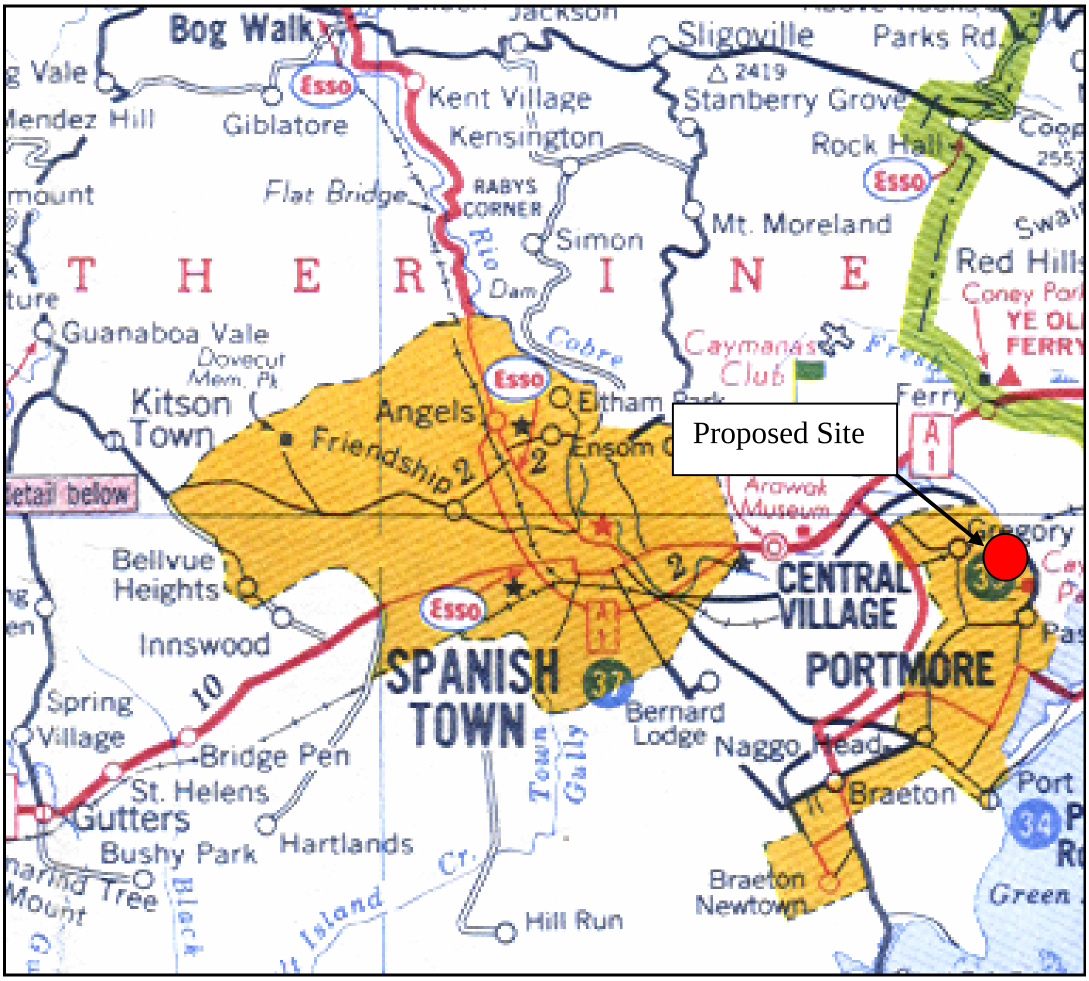


Fig. 5.1 Site Plan of NWC Development Project

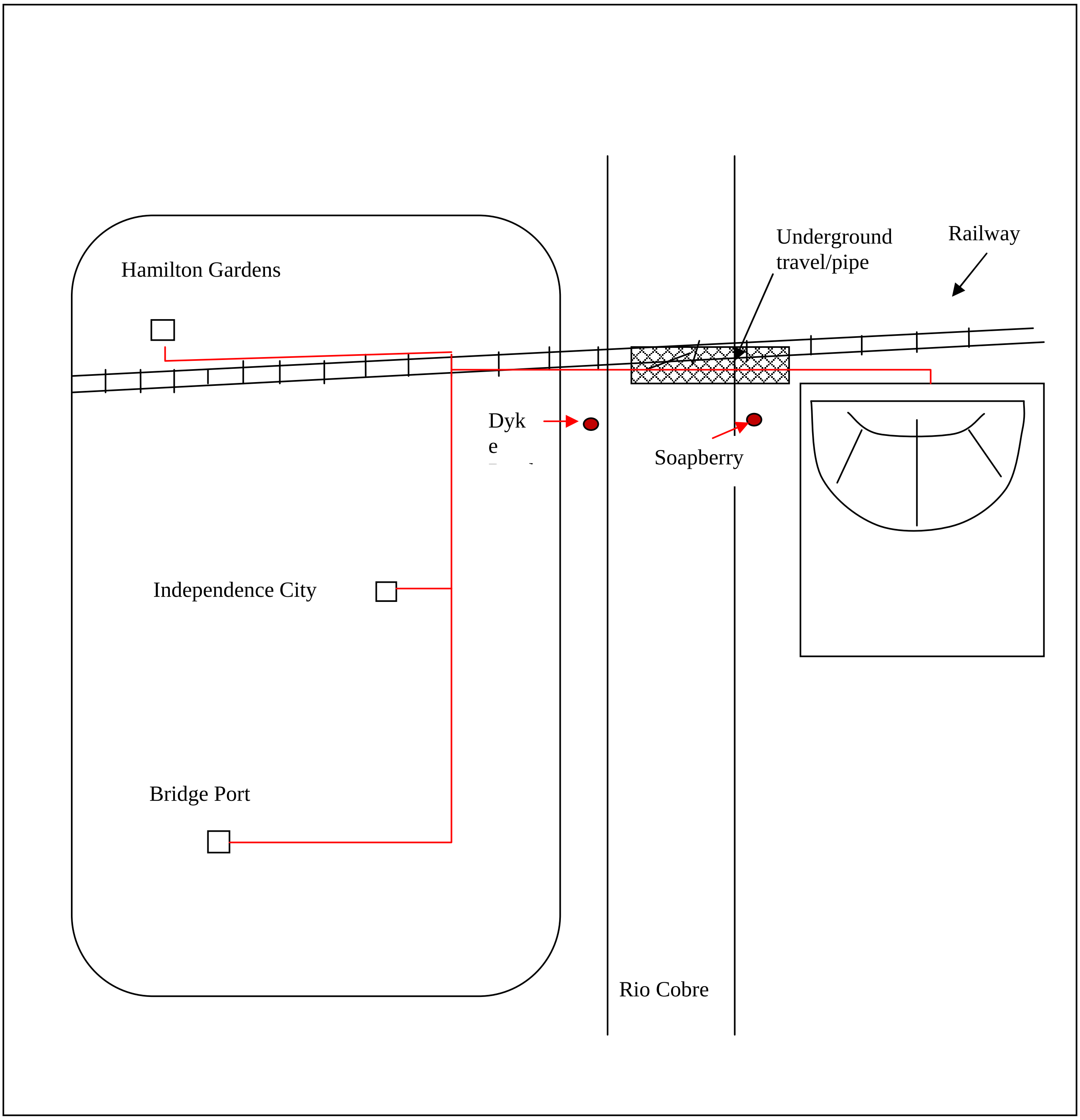


Fig. 5.2 Test Location Plan (Site Layout)

CLIENT:
PROJECT: Soil Investigation
ADDRESS:

Location Reference
NWC Water Treatment Plant (Independent City)
Datum
Elevation

Type/Size
Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types ■ Wash ▨ Grab ☒ Split Spoon ☰ T. W. Tube ◨ R. Core

Plasticity 20 80
Wet Unit Weight ☐ (kip/cu.ft) .07 .13
Standard Penetration Test (Blows/ft.) 20 100
Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 5.0

Depth (ft.)	Soil Description	Water Level	SPT Blow Count	Type	ID Mark	Recovery
0	Brown Compact M-F Silty Sand		4 4 8	☒	1	18
5		▽	4 4 7	☒	2	18
	Very loose Brown Medium to Very Fine Silty Sand + some clay		1 1 1	☒	3	18
10	Very Loose Brown Medium -Very Fine Silty Sand with Traces of Clay		1 1 1	☒	4	18
15	Compact Brown M-F Sand with Traces of Silt		2 5 7	☒	5	18
20	Compact Brown Clay + some sandy Silt		4 4 5	☒	6	18
25	Compact Brown M-F Sand + some Clayey Silt		8 9 10	☒	7	18
30	Compact Medium -Very Fine Silty Sand		6 8 12	☒	8	18
	Compact Brown M-F Sand		7 7 8	☒	9	18
35						

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29 Monroe Road
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OFFICE BOREHOLE RECORD

	Dates	Job No. …………….	
Start	19.11.09	B.H. No.	
Completion	19.11.09	BH #1	**FIG. No.**
Final W. L.	5.2 Ft		5.11

CLIENT: PROJECT:Soil Investigation	Location Reference	Type/Size
ADDRESS:	NWC Water Treatment Plant (Independent City) Datum Elevation	Hollow Stem 6.25" Diameter Auger; 3.25" I.D. Stem, 140 lbs Cathead Drop Hammer for SPT.

Sample Types ■ Wash ◿ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Depth (ft.)	Soil Description	Strata Plot	Water Level	SPT Blow Count	samples: Type	samples: ID Mark	samples: Recovery	Plasticity ⊢○⊣ 20 – 80 Wet Unit Weight ☐ (kip/cu.ft) .07 – .13	Standard Penetration Test (Blows/ft.) 20 – 100 Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 – 5.0
	Compact Brown M-F Sand								
40	Stiff Brown Silty Clay with some Fine Sand			8 7 10	☒	10	18		
45	Compact Brown - Grey Fine very Silty Sand			7 7 9	☒	11	18		
50	Compact Grey M -F Sand			10 10 12	☒	12	18		
55									
60									

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	Dates	Job No. …………….	
Start	19.11.09	B.H. No.	
Completion	19.11.09	BH#1	FIG. No.
Final W. L.	5.2 Ft.		5.11

CLIENT:
PROJECT: Soil Investigation
ADDRESS:

Location Reference
NWC Water Treatment Plant - Bridge Port
Datum
Elevation

Type/Size
Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types ■ Wash ▨ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Plasticity 20 80
Wet Unit Weight ☐ (kip/cu.ft) .07 .13
Standard Penetration Test (Blows/ft.) 20 100
Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 5.0

Depth (ft.)	Soil Description	Water Level	SPT Blow Count	Type	ID Mark	Recovery
0	Loose Brown Fine - Very Fine Silty Sand with some Clay		4 4 4	☒	1	18
5	Soft Brown Silty Clay with Traces of Fine Sand		2 2 3	☒	2	18
10	Stiff Brown Silty Clay with some Sand	∇	6 6 8	☒	3	18
	Stiff Brown Silty Clay with some Fine Sand		4 5 4	☒	4	18
15	Stiff Brown - Grey Silty Clay with some Fine Sand		5 6 6	☒	5	18
20	Stiff Brown Silty Clay with some Fine Sand		6 5 5	☒	6	18
25	Dense Brown C-F Sand with Traces of Silt		6 12 14	☒	7	18
30	Compact Brown M - F Silty Sand			☒	8	18
35			12 12 14	☒	9	8

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	Dates
Start	20.11.09
Completion	20.11.09
Final W. L.	7 Ft.

Job No. …………….

B.H. No. BH#2

FIG. No. 5.12

CLIENT:
PROJECT:Soil Investigation

ADDRESS:

Location Reference
NWC Water Treatment Plant (Bridge Port)
Datum

Elevation

Type/Size
Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types ■ Wash ◺ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Depth (ft.)	Soil Description	Strata Plot	Water Level	SPT Blow Count	samples Type	samples ID Mark	samples Recovery	Plasticity 20 – 80 Wet Unit Weight ☐ (kip/cu.ft) .07 – .13	Standard Penetration Test (Blows/ft.) 20 – 100 Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 – 5.0
	Compact Brown M - F Sand								
40	Compact Brown M - F Sand			7 8 11	☒	10	18		
	Stiff Brown M -F Sand + clayey silt								
45	Compact Brown Fine Silty Sand + traces of Clay			4 7 14	☒	11	18		
50	Compact Brown Fine - Very Fine Silty Sand with Traces of Clay			3 5 9	☒	12	18		
55									
60									

**note 51 represent refusal on spoon

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OFFICE BOREHOLE RECORD

	Dates
Start	20.11.09
Completion	20.11.09
Final W. L.	7 Ft.

Job No. …………….

B.H. No.
BH#2

FIG. No.
5.12

CLIENT: PROJECT: Soil Investigation ADDRESS:	Location Reference	Type/Size
	NWC Water Treatment Plant (Hamilton Gardens) Datum Elevation	Hollow Stem 6.25" Diameter Auger; 3.25" I.D. Stem, 140 lbs Cathead Drop Hammer for SPT.

Sample Types ■ Wash ◿ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Depth (ft.)	Soil Description	Strata Plot	Water Level	SPT Blow Count	Type	ID Mark	Recovery	Plasticity 20 — 80 Wet Unit Weight (kip/cu.ft) .07 — .13	Standard Penetration Test (Blows/ft.) 20 — 100 Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 — 5.0
0	Brown Sandy Silt with some Gravel								
	Compact Brown Fine - Very Fine Silty Sand + some Clay			8 5 8	☒	1	18		
5	Loose Brown Fine - very Fine Silty Sand with Traces of Clay			2 3 5	☒	2	14		
	Compact Brown Fine - Very Fine Silty Sand with Traces of Clay		▽	7 7 9	☒	3	18		
10	Compact Brown C-F Sand								
	Compact Brown C - F Sand			3 5 7	☒	4	18		
15	Compact Brown M-F Silty Sand with Traces of Clay			5 6 9	☒	5	18		
	Compact Brown C - F Sand								
20	Firm Brown Silty Clay with some M - F Sand			2 3 5	☒	6	8		
25	Compact Brown C-M Sand			8 7 7	☒	7	18		
				14 15 15	☒	8	12		
30	Compact Brown C-F Sand with some Silt			7 5 10	☒	9	0		
35	Compact M-F Sand with some Clayey Silt								

**note 51 represent refusal on spoon

NHL ENGINEERING LTD CONSULTING ENGINEERS 29 Monroe Road Kingston 6, Jamaica		Dates	Job No. …………….	
	Start	24.11.09	B.H. No.	
	Completion	24.11.09	BH#3	FIG. No.
OFFICE BOREHOLE RECORD	Final W. L.	9 ft.10.5"		5.13

CLIENT: PROJECT:Soil Investigation ADDRESS:	Location Reference **NWC Water Treatment Plant (Hamilton Gardens)** Datum Elevation	Type/Size Hollow Stem 6.25" Diameter Auger; 3.25" I.D. Stem, 140 lbs Cathead Drop Hammer for SPT.

Sample Types ■ Wash ◿ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Depth (ft.)	Soil Description	Strata Plot	Water Level	SPT Blow Count	samples Type	samples ID Mark	samples Recovery	Plasticity 20 – 80 Wet Unit Weight (kip/cu.ft) .07 – .13	Standard Penetration Test (Blows/ft.) 20 – 100 Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 – 5.0
	Stiff Brown Clay + some Sand & Silt								
40	Compact Brown M-F Silty Sand			11 12 14	☒	10	10		
	Very Stiff Brown - Grey Silty Clay with some Fine Sand								
45	Very Stiff Brown Silty Clay with some Fine Sand			8 10 12	☒	11	18		
50	Compact Brown Fine - Very Fine Sand + some gravel			7 11 17	☒	12	0		
55									
60									

**note 51 represent refusal on spoon

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OFFICE BOREHOLE RECORD

	Dates	Job No. …………….
Start	24.11.09	B.H. No.
Completion	24.11.09	BH#3
Final W. L.	9 FT. 10.5 "	FIG. No. 5.13

CLIENT:
PROJECT:Soil Investigation

ADDRESS:

Location Reference
NWC Portmore Dyke Road
Datum

Elevation

Type/Size
Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types ■ Wash ◿ Grab ☒ Split Spoon ☰ T. W. Tube ◨ R. Core

Plasticity 20 80
Wet Unit Weight ☐ (kip/cu.ft) .07 .13
Standard Penetration Test (Blows/ft.) 20 100
Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 5.0

Depth (ft.)	Soil Description	Water Level	SPT Blow Count	Type	ID Mark	Recovery
0						
	Compact Brown Fine Silty Sand		10 11 11	☒	1	18
5			12 12 13	☒	2	14
	Compact Brown M-F Silty Sand with some Clay		8 7 8	☒	3	18
10	Compact Brown C-F Sand					
	Compact Brown Fine - Very Fine Silty Sand		7 9 10	☒	4	18
15						
	Compact Brown Clayey Silt with some M-F Sand	▽	3 5 6	☒	5	18
20						
	Very Stiff Brown Silty Clay with some M-F Sand		5 7 9	☒	6	18
25						
	Loose Brown Clayey Silt with some M-F Sand		4 2 4	☒	7	18
	Loose Brown M-F Sand					
30			6 6 9	☒	8	18
	Compact Brown C-F Sand					
	Stiff Brown - Grey Silty Clay with some Fine Sand		9 8 7	☒	9	18
35	Stiff Grey Clay + some Sand & Silt					

**note 51 represent refusal on spoon

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OFFICE BOREHOLE RECORD

	Dates
Start	25.11.09
Completion	25.11.09
Final W. L.	17 Ft.

Job No. …………….

B.H. No. BH#4

FIG. No. 5.14

CLIENT: PROJECT:Soil Investigation ADDRESS:	Location Reference **NWC Portmore Dyke Road** Datum Elevation	Type/Size Hollow Stem 6.25" Diameter Auger; 3.25" I.D. Stem, 140 lbs Cathead Drop Hammer for SPT.

Sample Types ■ Wash ⧄ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Depth (ft.)	Soil Description	Strata Plot	Water Level	SPT Blow Count	samples Type	samples ID Mark	samples Recovery	Plasticity 20 80 Wet Unit Weight ☐ (kip/cu.ft) .07 .13	Standard Penetration Test (Blows/ft.) 20 100 Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 5.0
	Compact Brown - Grey C-F Sand								
40	Very Stiff Greyish BrownClay with some Fine Sand & Silt			10 12 14	☒	10	14		
45	Very Stiff Grey Silty Clay + some Calcareous Silty Sand			10 12 15	☒	11	15		
50	Very Stiff Brown - grey Silty Clay with some Medium - Very Fine Sand			14 11 15	☒	12	16		
	Compact Orange Brown Medium Sand								
55	Hard Orange Brown Silty Clay with some Medium - very Fine Sand			20 20 25	☒	13	18		
60	Hard Orange Brown Silty Clay with some Fine Sand			14 22 24	☒	14	14		
65									
	Dense Orange Brown Silty Sand + some clay			12 24 26	☒	15	14		
70	Very Dense Brown C-F Sand			23 34 27	☒	16	15		

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29 Monroe Road
Kingston 6, Jamaica

OFFICE BOREHOLE RECORD

	Dates	Job No. …………….	
Start	25.11.09	B.H. No.	
Completion	25.11.09	BH#4	FIG. No.
Final W. L.	17 Ft.		5.14

CLIENT:
PROJECT: Soil Investigation
ADDRESS:

Location Reference
NWC Portmore Dyke Road
Datum
Elevation

Type/Size
Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types: ■ Wash ◩ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Plasticity 20 80
Standard Penetration Test (Blows/ft.) 20 100
Wet Unit Weight (kip/cu.ft) ☐ .07 .13
Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 5.0

Depth (ft.)	Soil Description	SPT Blow Count	Type	ID Mark	Recovery
75	Very Dense Orange Brown M-F Silty Sand	12 18 35	☒	17	9
80	Very Dense Orange Brown M-F Sand	20 32 35	☒	18	16
85	Very Dense Orange Brown Silty Sand with some Fine Gravel	10 25 35	☒	19	12
	Very Dense Orange Brown C-F Sand with some fine Gravel & Traces of Silt				
90	Very Dense Orange Brown C-F Sand with some Fine Gravel & Traces of Silt	10 23 25	☒	20	14
95	Very Dense Orange Brown Fine -Very Fine Sandy Silt	11 21 23	☒	21	15
100	Dense Orange Brown Silty Clay + some sand	10 15 21	☒	22	14
105					

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29 Monroe Road
Kingston 6, Jamaica

OFFICE BOREHOLE RECORD

	Dates
Start	25.11.09
Completion	26.11.09
Final W. L.	17 Ft.

Job No. ....

B.H. No. BH# 4

FIG. No. 5.15

CLIENT:

PROJECT:Soil Investigation

ADDRESS:

Location Reference

NWC Water Treatment Plant Soapberry

Datum

Elevation

Type/Size

Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types: ■ Wash ◿ Grab ☒ Split Spoon ☰ T. W. Tube ◧ R. Core

Plasticity 20 — 80; Wet Unit Weight ☐ (kip/cu.ft) .07 — .13

Standard Penetration Test (Blows/ft.) 20 — 100; Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 — 5.0

Depth (ft.): 0, 5, 10, 15, 20, 25, 30, 35

Soil Description	Strata Plot	Water Level	SPT Blow Count	Type	ID Mark	Recovery
Dark Brown/Black Compact M-F Silty Sand			11 13 14	☒	1	15
Brown Compact M-F Silty Sand			4 6 7	☒	2	17
Brown Loose C-F Silty Sand		▽	7 9 9	☒	3	18
Brown Firm - Stiff Silty Clay			3 3 3	☒	4	12
			2 2 3	☒	5	9
			4 5 6	☒	6	8
Brown Compact - Dense M-F Sand			5 7 8	☒	7	9
			12 12 20	☒	8	10
			4 5 5	☒	9	10

**note 51 represent refusal on spoon

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29 Monroe Road
Kingston 6, Jamaica

OFFICE BOREHOLE RECORD

	Dates
Start	26.11.09
Completion	27.11.09
Final W. L.	10 Ft

Job No. …………….

B.H. No. BH#5

FIG. No. 5.15

CLIENT:
PROJECT: Soil Investigation
ADDRESS:

Location Reference
NWC Water Treatment Plant Soapberry
Datum
Elevation

Type/Size
Hollow Stem 6.25" Diameter Auger;
3.25" I.D. Stem, 140 lbs Cathead
Drop Hammer for SPT.

Sample Types ■ Wash ◿ Grab ⊠ Split Spoon ▤ T. W. Tube ◨ R. Core

Plasticity 20 80
Wet Unit Weight ☐ (kip/cu.ft) .07 .13
Standard Penetration Test (Blows/ft.) 20 100
Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 5.0

Depth (ft.)	Soil Description	SPT Blow Count	Type	ID Mark	Recovery
40	+ some Black Peaty Clay here				
		5 5 5	⊠	10	12
45		6 8 10	⊠	11	13
	Dark Brown Very Stiff Silty Clay				
		10 18 10	⊠	12	14
50					
		7 9 9	⊠	13	15
	Brown Very Stiff Silty Clay with Traces of M-F Sand				
55					
		9 14 14	⊠	14	14
60					
	Brown Compcat M-F Silty Sand				
		8 10 10	⊠	15	14
65					
		12 16 18	⊠	16	13
70		13 15 19	⊠	17	14
	Brown Compact - Dense C-F Sand with Traces of Rock Chipping				
		10 10 10	⊠	18	12
75					

**note 51 represent refusal on spoon

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29 Monroe Road
Kingston 6, Jamaica

OFFICE BOREHOLE RECORD

	Dates
Start	26.11.09
Completion	27.11.09
Final W. L.	10 Ft.

Job No. …………….

B.H. No.
BH#5

FIG. No.
5.15

CLIENT:
PROJECT:Soil Investigation
ADDRESS:

Location Reference	Type/Size
NWC Soapberry	Hollow Stem 6.25" Diameter Auger; 3.25" I.D. Stem, 140 lbs Cathead Drop Hammer for SPT.
Datum Elevation	

Sample Types ■ Wash ◪ Grab ☒ Split Spoon ☰ T. W. Tube ◨ R. Core

Depth (ft.)	Soil Description	Strata Plot	Water Level	SPT Blow Count	samples: Type	samples: ID Mark	samples: Recovery	Plasticity 20 – 80 / Wet Unit Weight (kip/cu.ft) .07 – .13	Standard Penetration Test (Blows/ft.) 20 – 100 / Undrained Unconfined Shear Strength (kip/sq.ft) Comp. Test + Vane Shear 1.0 – 5.0
80									
	Brown Compact - Dense M-F Silty Sand			11 12 12	☒	19	11		
85				12 12 20	☒	20	10		
90				12 19 25	☒	21	12		
95				13 20 26	☒	22	11		
100									
105									

**note 51 represent refusal on spoon

NHL ENGINEERING LTD
CONSULTING ENGINEERS

29 Monroe Road
Kingston 6, Jamaica

OFFICE BOREHOLE RECORD

	Dates	Job No. …………….
Start	26.11.09	B.H. No.
Completion	27.11.09	BH#5
Final W. L.	10 FT.	FIG. No. 5.15

Client: National Water Commission
Project: Independence City
Date: December, 2009

USSIEVE	BH1@5'	BH1@10'	BH1@35'	BH1@50'
20	100	100	100	100
14	100	100	100	100
9	100	99	100	100
5	95.5	95.7	99.3	99.9
2	82.7	67.9	91.6	92.2
0.8	73.5	60.2	56.2	65
0.4	52	48.8	16.4	18.1
0.08	34.7	37.5	10.6	8.6

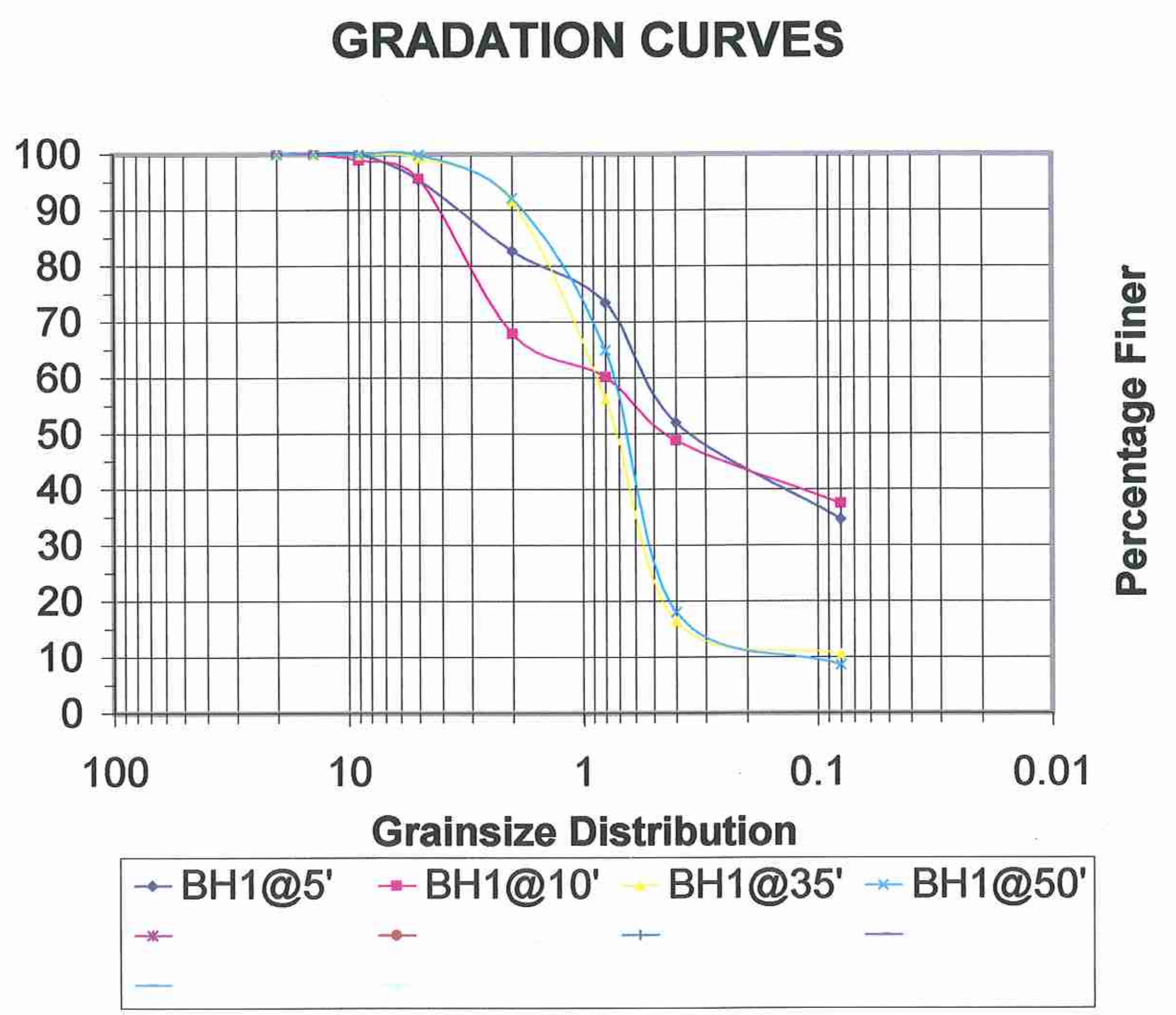


FIG. 5.8

Client: National Water Commission

Project: Bridge Port

Date: December, 2009

USSIEVE	BH2@25'	BH2@40'								
20	100	100								
14	100	100								
9	100	100								
5	93.2	99.2								
2	51.4	70								
0.8	40.9	37.8								
0.4	28.4	19.6								
0.08	21	15.9								

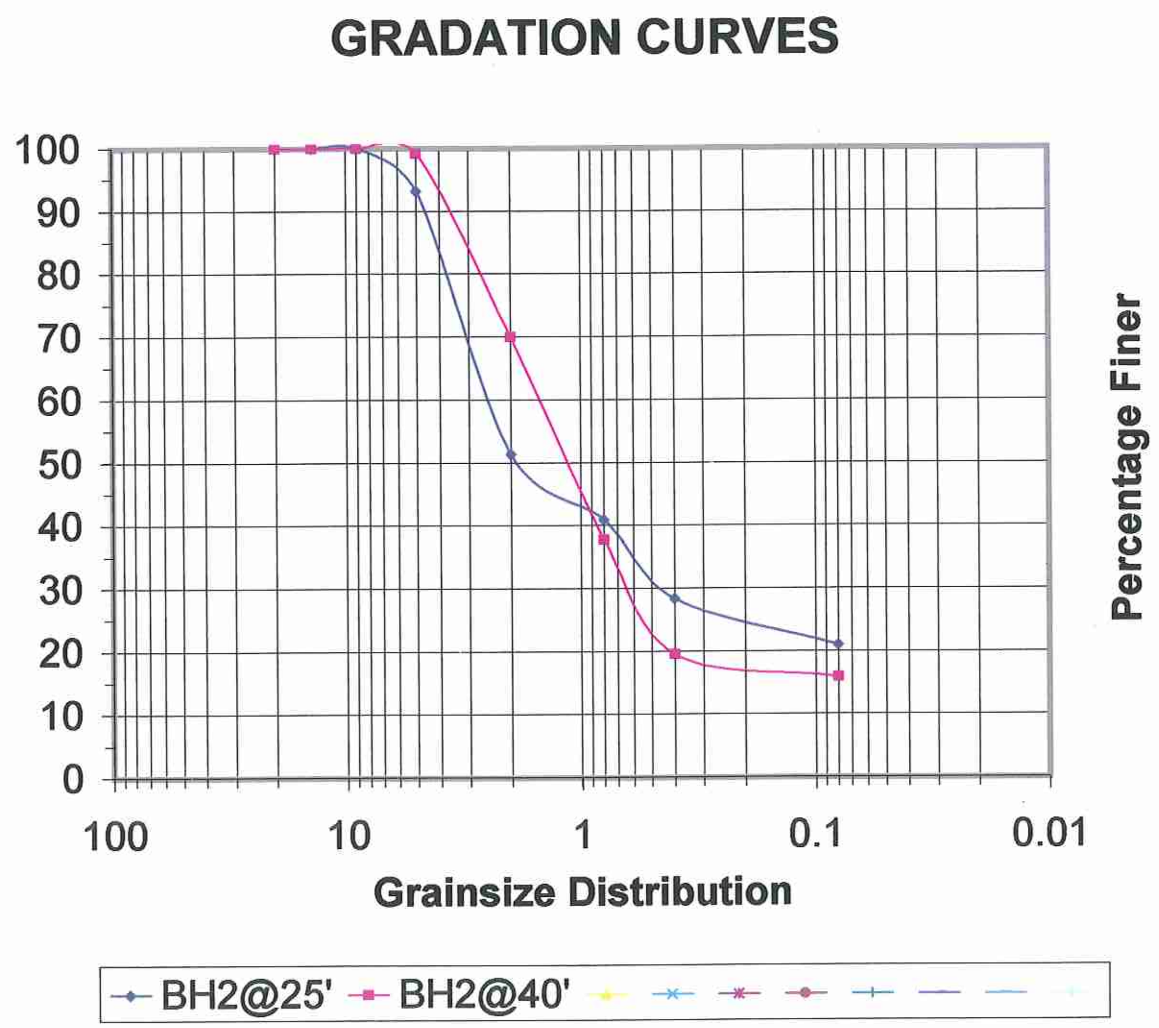


FIG. 5.9

Client: National Water Commission
Project: Hamilton
Date: December, 2009

USSIEVE	BH3@7' 6"	BH3@25'	BH3@35'							
20	100	100	100							
14	100	100	100							
9	98.3	96.6	100							
5	94	92.7	99.8							
2	54.6	54.8	67.6							
0.8	33	31.7	43.4							
0.4	15.6	14.1	24							
0.08	13	9.4	17.6							

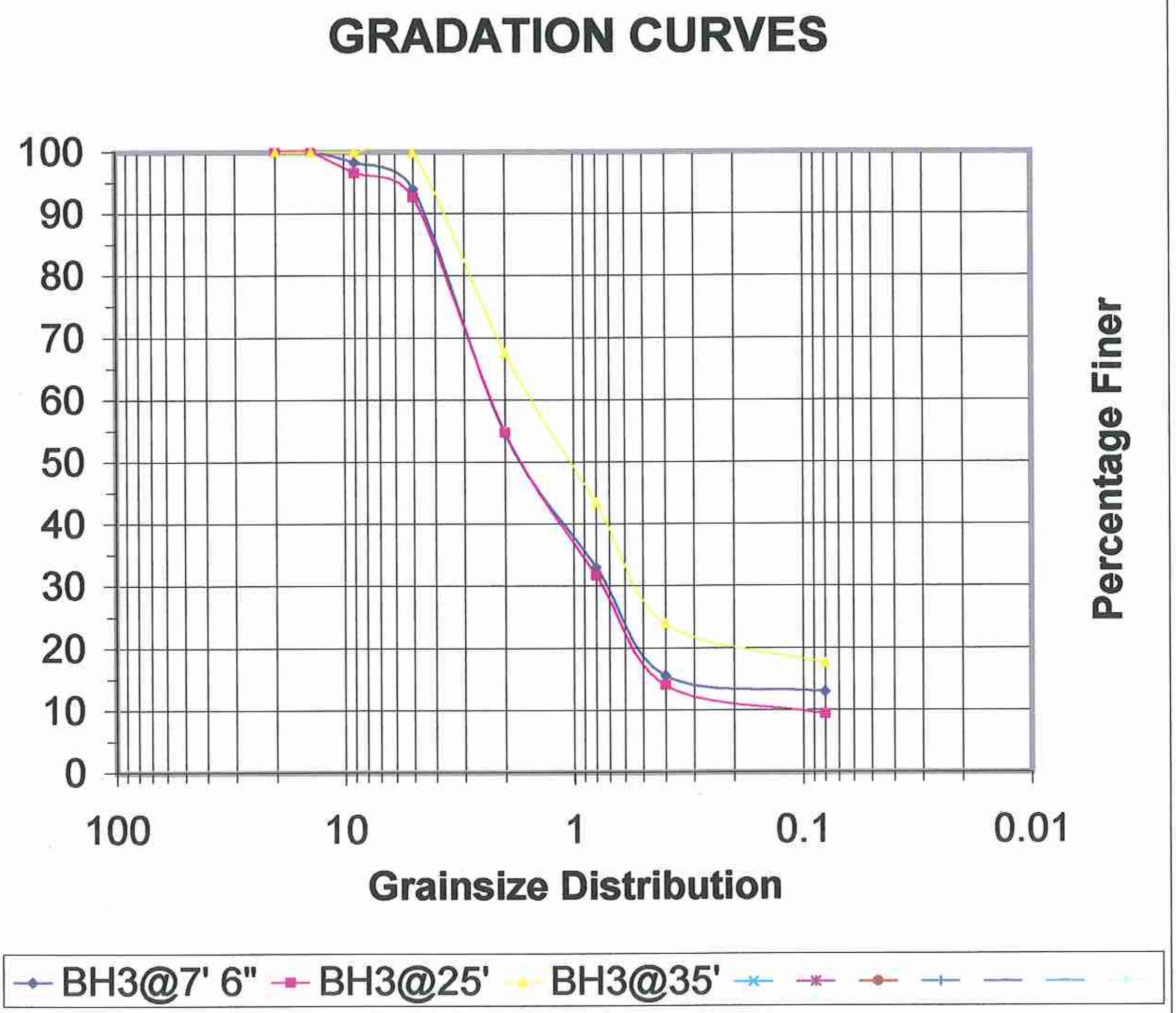


FIG. 5.10

Client: National Water Commission
Project: Portmore Dyke Road
Date: December, 2009

USSIEVE	BH4@5'	BH4@10'	BH4@25"	BH4@30'	BH4@55'	BH4@70'	BH4@90'			
20	100	100	100	100	100	100	100			
14	100	100	100	100	85.5	100	100			
9	100	100	100	100	81.9	98.5	97.6			
5	98.7	99.7	89.9	90.5	71.8	96.6	81.4			
2	87.2	78.4	63.9	63.6	52.3	61.6	44.9			
0.8	70.6	54.1	47.3	31.7	44.3	40.3	35.4			
0.4	37.2	33.9	31.7	16.3	34.1	23.5	22.9			
0.08	13.5	26.4	11.8	13.5	27.2	15.2	17.5			

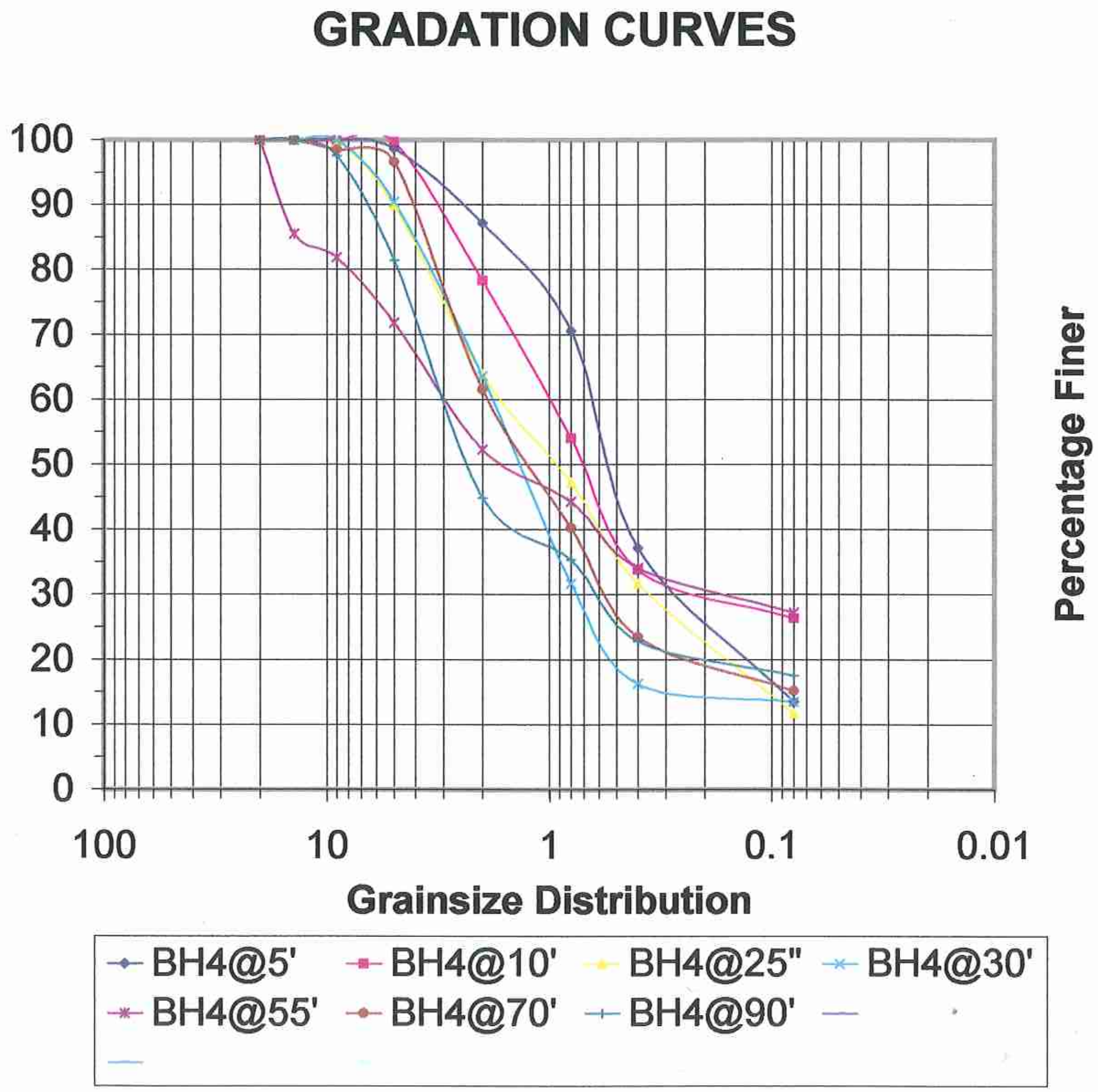


FIG. 5.11

Client: National Water Commission
Project: Soapberry Plant
Date: December, 2009

USSIEVE	BH5@2' 6"	BH5@7' 6"	BH5@40'	BH5@60'	BH5@70'	BH5@80'	BH5@95			
20	100	100	100	100	100	100	100			
14	100	100	100	100	100	100	100			
9	91.1	99.1	100	100	98.3	97.3	98.3			
5	78.5	95.7	97.3	99.1	92.1	87.8	96.2			
2	48.3	80.1	64.9	95.8	45.7	55.8	86.1			
0.8	34.1	41.8	32.4	70.3	26.6	37.8	54.9			
0.4	22.1	12	15.4	21	13.7	22.6	28.4			
0.08	15.7	6.3	11.6	12	9.5	15.7	19.1			

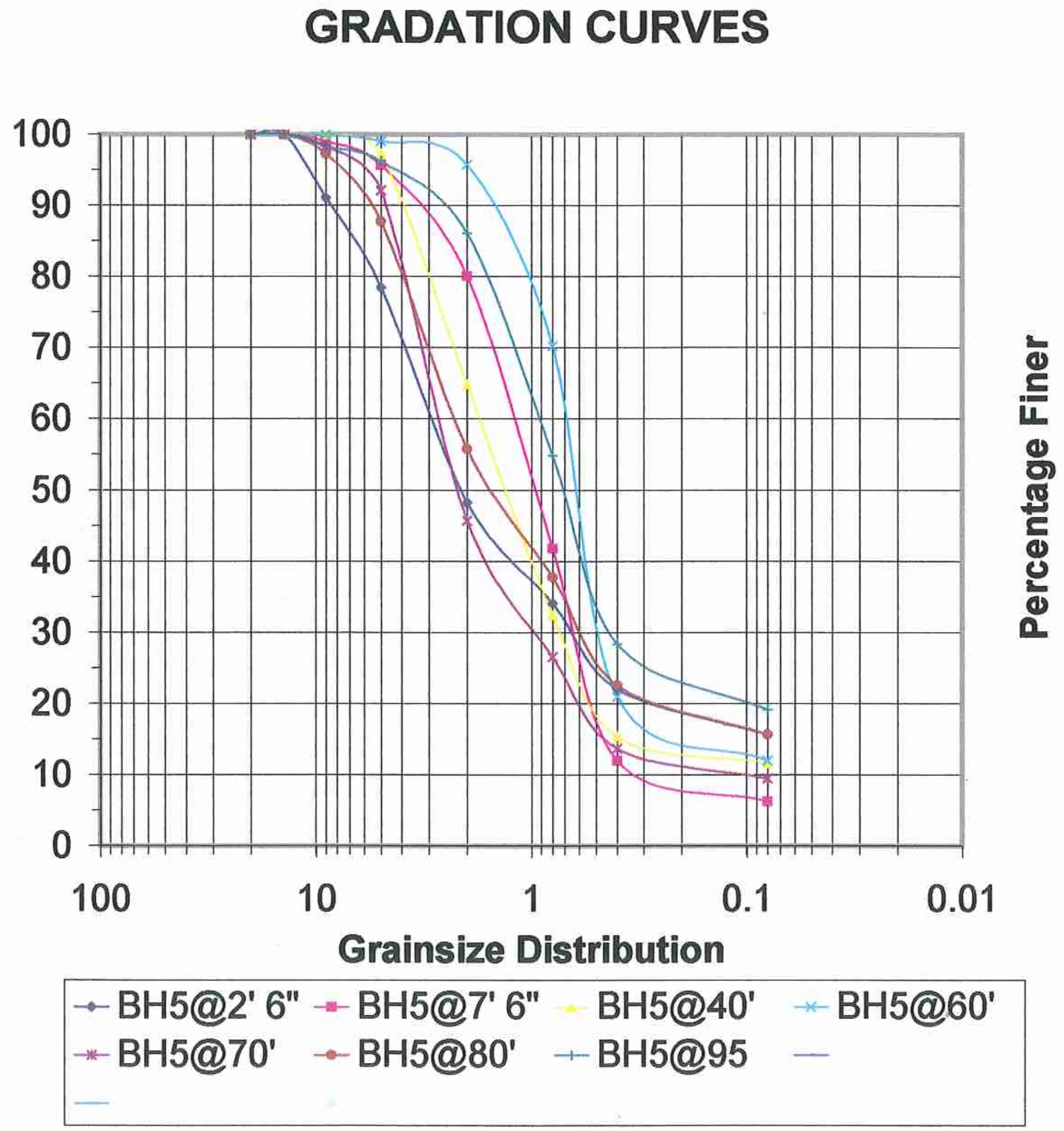


FIG. 5.12

ATTERBERG LIMIT RESULTS NWC INDEPENDENCE CITY

BH #	Sample Dept	Liquid Limit	Plastic Limit	Moisture Content	% Passing #40
BH 1	2’ 6”	34.58	21.7	17.48	69
BH 1	7’ 6”	46.2	25.2	33.87	62
BH 1	20’	55.28	19.68	29.0	74
BH 1	25’	43.9	18.1	31.5	62

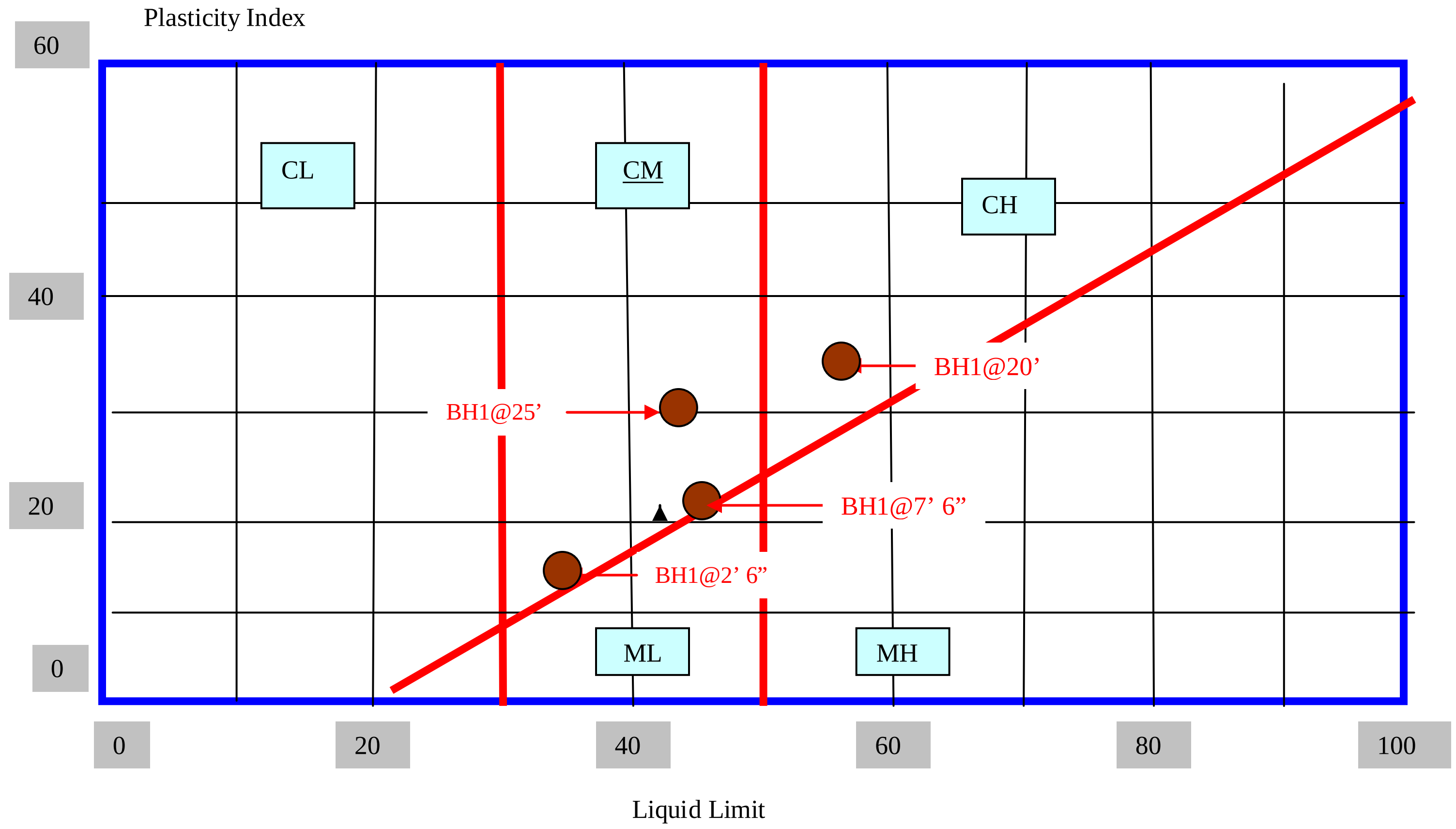


FIGURE 5.13 CASAGRANDE CHART

ATTERBERG LIMIT RESULTS NWC BRIDGEPORT

BH #	Sample Dept	Liquid Limit	Plastic Limit	Moisture Content	% Passing #40
BH 2	5’	41.1	15.9	25.7	63
BH 2	15’	35.4	17.8	25.3	67
BH 2	30’	31.05	13.8	22.4	69
BH 2	50’	35.4	16.0	24.6	81

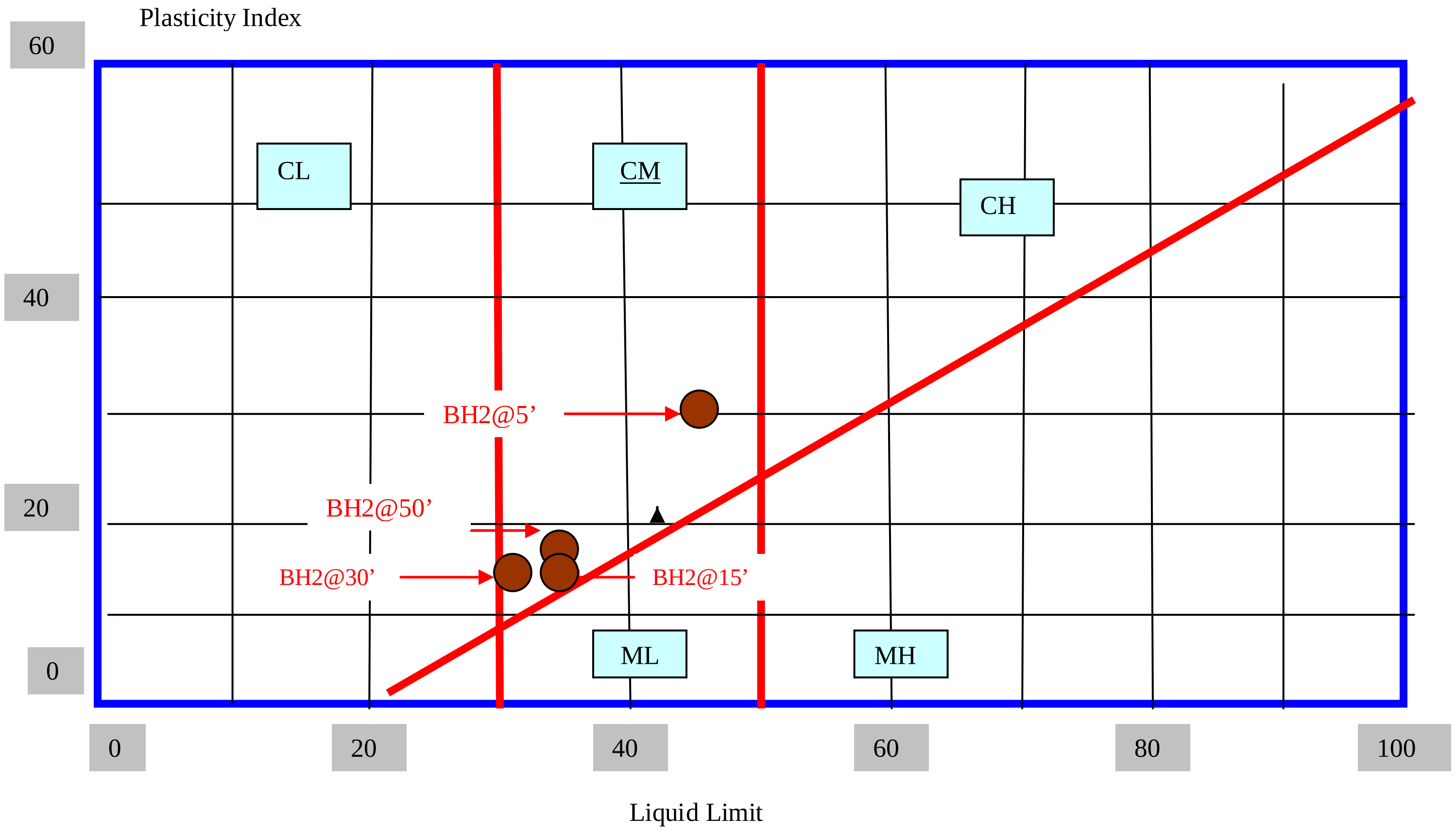


FIGURE 5.14 CASAGRANDE CHART

ATTERBERG LIMIT RESULTS NWC HAMILTON

BH #	Sample Dept	Liquid Limit	Plastic Limit	Moisture Content	% Passing #40
BH 3	2’ 6”	43.5	17.67	16.9	60
BH 3	5’	35.45	14.3	14.46	67
BH 3	20’	44.4	20.0	25.75	65
BH 3	35’	54.99	23.25	28.5	72
BH 3	45’	47.4	17.11	20.96	63

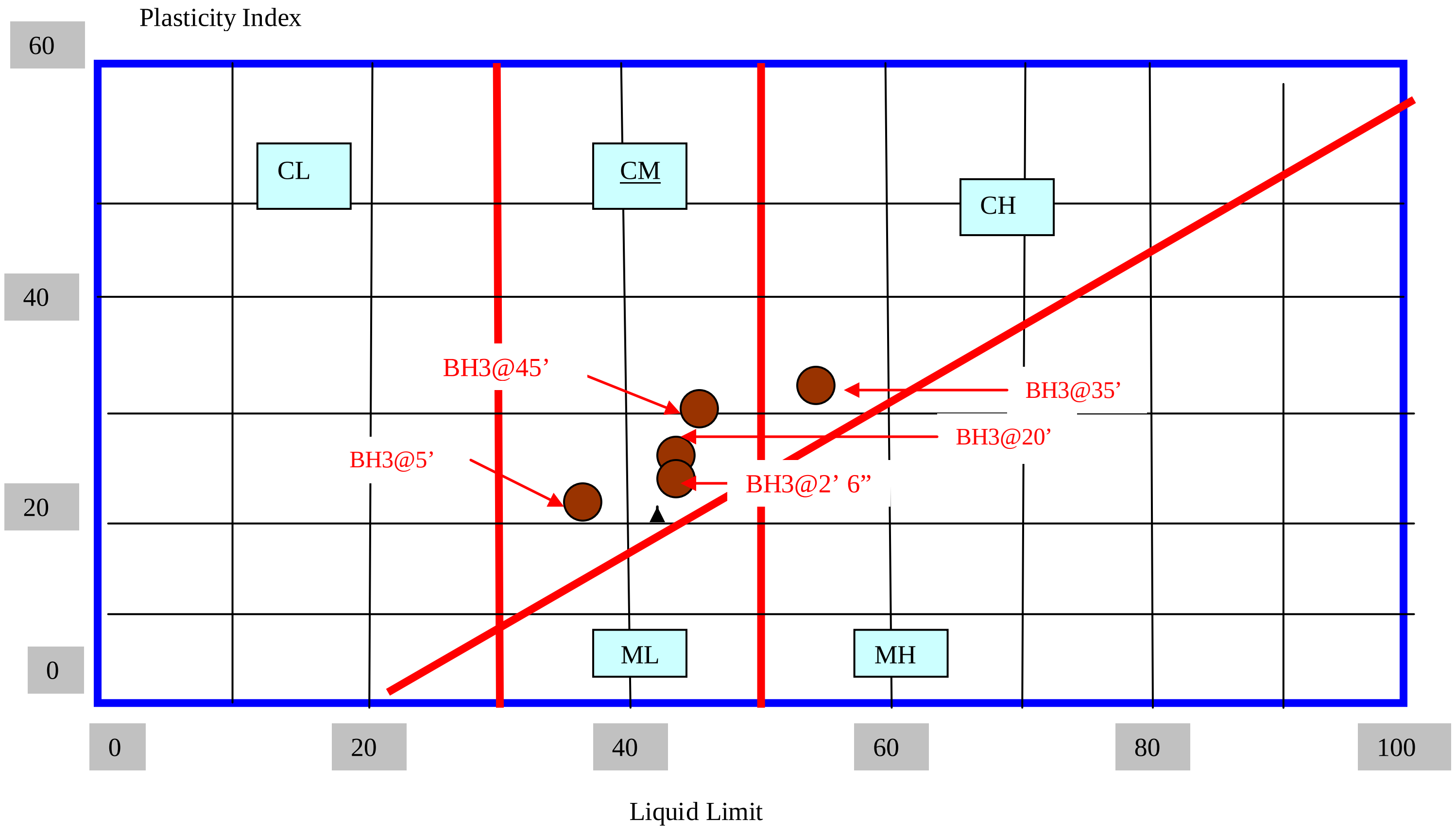


FIGURE 5.15 CASAGRANDE CHART

ATTERBERG LIMIT RESULTS PORTMORE DYKE ROAD

BH #	Sample Dept	Liquid Limit	Plastic Limit	Moisture Content	% Passing #40
BH 4	15’	37.18	18.67	19.65	73
BH 4	25’	40.66	15.9	12.4	71
BH 4	35’	49.87	19.96	25.64	60
BH 4	45’	56.4	15.3	21.3	72
BH 4	95’	42.9	23.3	19.0	65
BH 4	100’	37.7	17.5	18.5	64

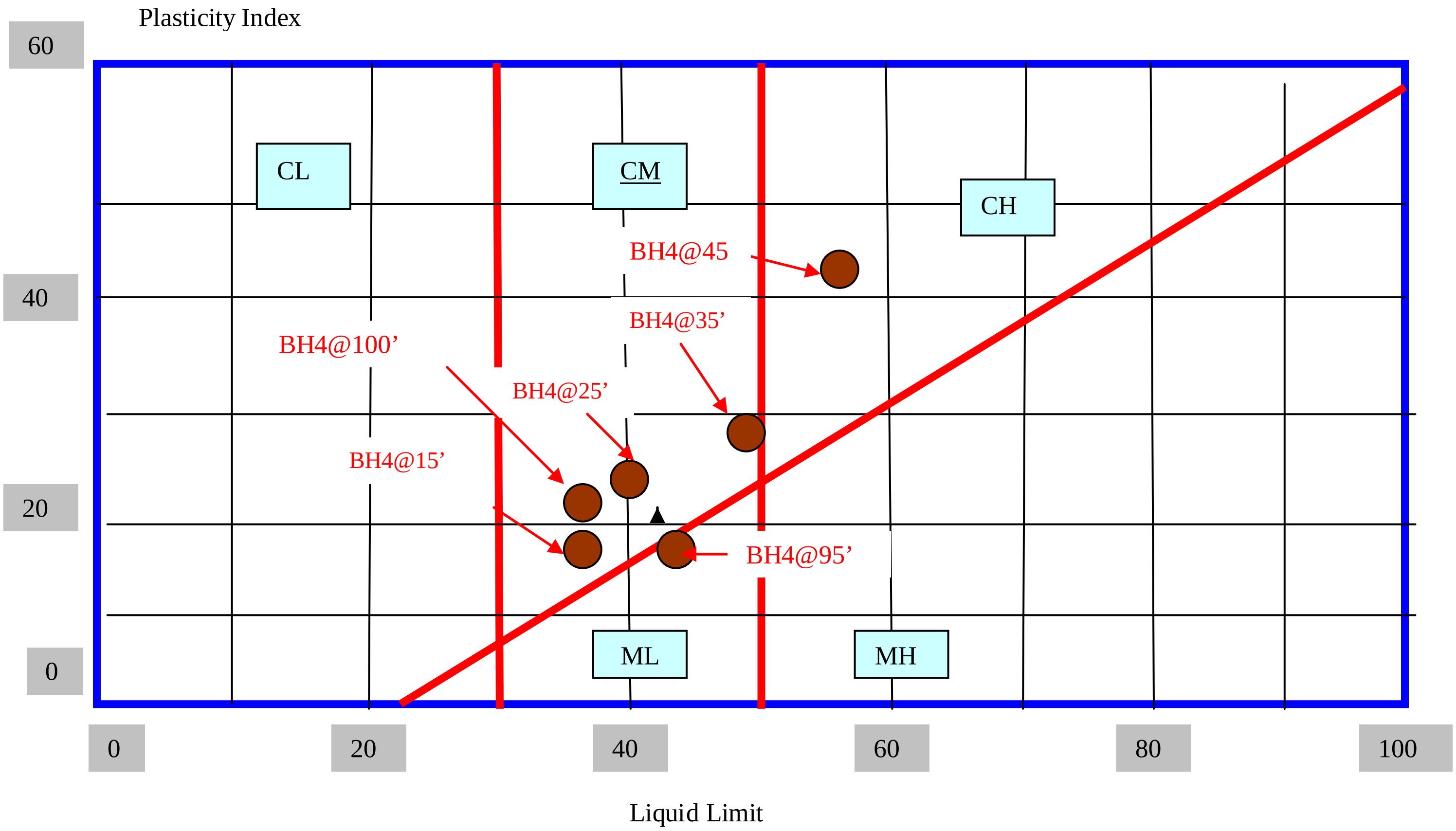


FIGURE 5.16 CASAGRANDE CHART

ATTERBERG LIMIT RESULTS NWC SOAPBERRY PLANT

BH #	Sample Dept	Liquid Limit	Plastic Limit	Moisture Content	% Passing #40
BH 5	15	50.5	19.8	21.1	63
BH 5	25’	63.6	29.78	16.67	79
BH 5	45’	45.0	21.6	23.8	80
BH 5	50’	59.33	18.42	36.3	63

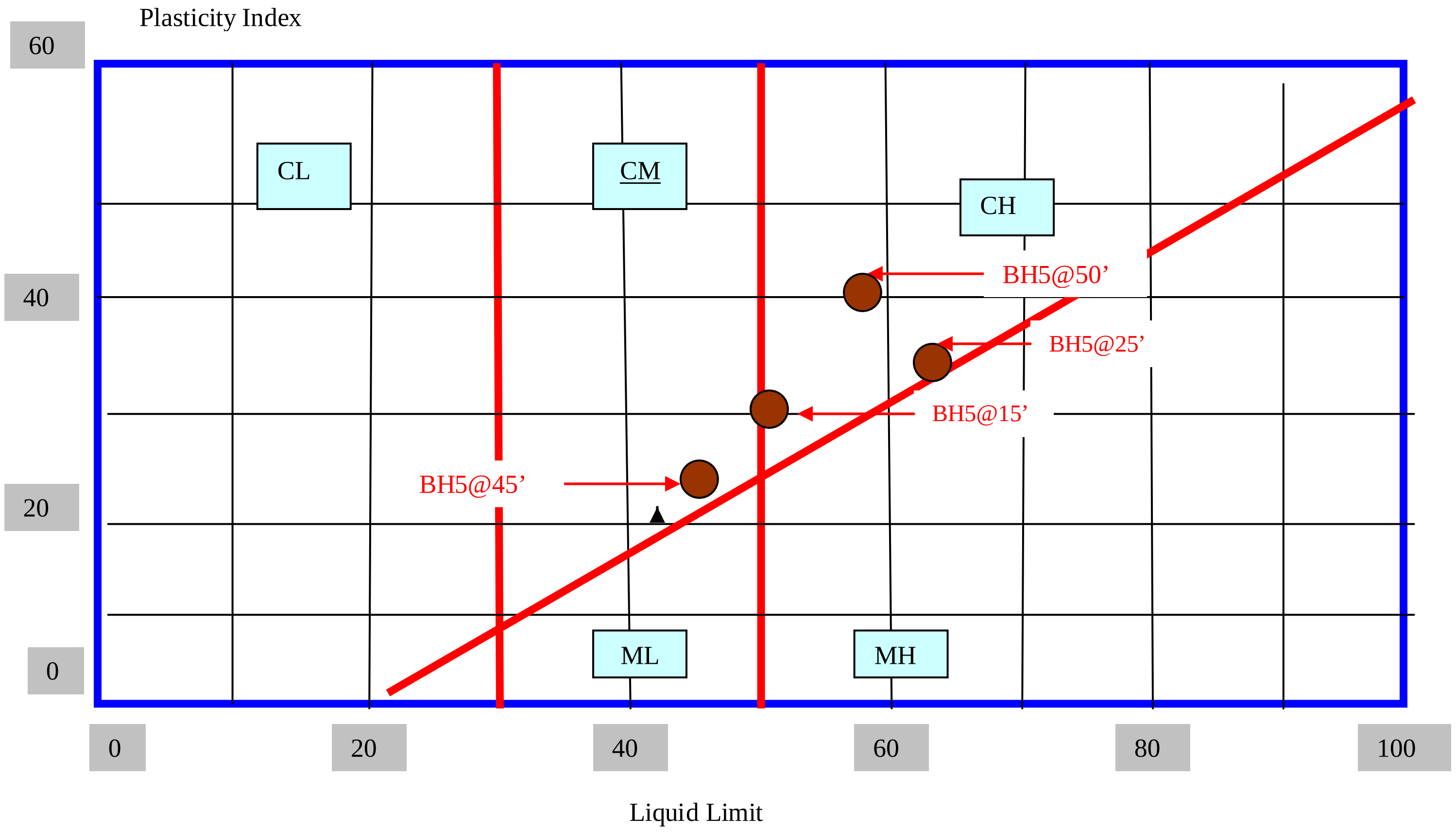


FIGURE 5.17 CASAGRANDE CHART

NHL ENGINEERING LIMITED

29 MONROE ROAD, KINGSTON 6

Laboratory Test Report

Client: JICA Survey Team (NWC Training Centre)

Client Rep: Mr. Tsuta

Project: Independence Sewerage Treatment Plant

Reported To: Client

Spec. No.	Depth	Specific Gravity Result					
BH #1	7.6'	2.653					
BH #1	30"	2.645					

Certified By: ……………………………………….

NHL ENGINEERING LIMITED

29 MONROE ROAD, KINGSTON 6

Laboratory Test Report

Client: JICA Survey Team (NWC Training Centre)

Client Rep: Mr. Tsuta

Project: Bridgeport Sewerage Treatment Plant

Reported To: Client

Spec. No.	Depth	Specific Gravity Result					
BH #2	25'	2.872					
BH #2	30'	2.798					
BH #2	35'	2.729					
BH #2	40'	2.839					

Certified By: ………………………………………

NHL ENGINEERING LIMITED

29 MONROE ROAD, KINGSTON 6

Laboratory Test Report

Client: JICA Survey Team (NWC Training Centre)

Client Rep: Mr. Tsuta

Project: Hamilton Gardens Sewerage Treatment Plant

Reported To: Client

Spec. No.	Depth	Specific Gravity Result					
BH #3	10'	2.615					
BH #3	15'	2.593					
BH #3	20'	2.587					
BH #3	25'	2.646					
BH #3	30'	2.598					

Certified By: ………………………………………

NHL ENGINEERING LIMITED

29 MONROE ROAD, KINGSTON 6

Laboratory Test Report

Client: JICA Survey Team (NWC Training Centre)

Client Rep: Mr. Tsuta

Project: Dyke Road at RailRoad Crossing - Portmore

Reported To: Client

Spec. No.	Depth	Specific Gravity Result					
BH #4	7.6"	2.76					
BH #4	35'	2.7					
BH #4	75'	2.748					
BH #4	80'	2.734					
BH #4	85'	2.738					

Certified By: ………………………………………

NHL ENGINEERING LIMITED

29 MONROE ROAD, KINGSTON 6

Laboratory Test Report

Client: JICA Survey Team (NWC Training Centre)

Client Rep: Mr. Tsuta

Project: Soapberry Plant

Reported To: Client

Spec. No.	Depth	Specific Gravity Result					
BH #5	5'	2.631					
BH #5	10	2.647					
BH #5	40'	2.603					
BH #5	60'	2.645					
BH #5	80'	2.617					
BH #5	95'	2.676					

Certified By: ………………………………………

APPENDIX F

EXAMPLE OF ASSET MANAGEMENTS

THE PREPARATORY SURVEY
FOR
KINGSTON SEWERAGE DEVELOPMENT PROJECT

FINAL REPORT
APPENDIX F
EXAMPLE OF ASSET MANAGEMENTS

TABLE OF CONTENTS

1.Sewer Management in Japan

Sewer Management in Japan –an overview

Takashi SAKAKIBARA, Head
Wastewater System Division
National Institute for Land and Infrastructure Management
Ministry of Land, Infrastructure, Transport and Tourism

1. Sewers in Japan

Japan has been working on expansion of sewer network seriously for the past century. The sewered population rate reached 72% in 2007 (slide4). This 72% includes only sewers under the sewerage law of MLIT. If sewers under other laws and onsite system are included, sanitary treatment rate was 84%. It seems that Japan has almost caught up with US in accessibility to sanitation. It was our big dream for many years.

In the same time, Japan has been investing a lot of money for the expansion of sewerage system. Especially in the 1990's, capital expenditure grew and reached almost 5 trillion yen or 50 billion dollars per year in 1998 (slide5). After the year 2000, capital expenditure started declining suddenly. This is largely because our government changed the public investment policy. Public investment has been reduced as part of restructuring program.

Japanese sewers are younger than American sewers. Intensive investment for installation started after 60' in Japan while in the US it started in the 50's (slide 6). In addition, in the US, sizable amount was installed even before the 40' while Japan did only little during the time. The GAP analysis document shows that average age of sewer network is around 40 in the US, while 16 in Japan. Thus the magnitude of aging problem might be much smaller in Japan.

2. Sewer Asset Management

Currently, different attitude for O&M of sewers are seen between big cities and small-medium municipalities. Big cities try to maintain sewers with much effort. They have relatively enough human and financial resources while facing aging problems as immediate threat. However, those with experience in O&M are retiring and new hiring is almost frozen due to downsize program of each municipality. On the other hand, small-medium municipalities do not set aside resources for O&M. They say they are still busy for expanding networks. Consequently, O&M of sewers are neglected.

MLIT has been conducting national survey on cave-ins from failed sewers since 2005 because such problem has grown serious. The increase of the cave-ins is observed (slide 9).

Our research examined furthermore where cave-ins occurred. Failed parts were categorized into four groups. They include public sewer, lateral, manhole, and cleanout (slide 11). We found that laterals were blamed most and that frequency and age of public sewers are exponentially related (slide 12).

Although aging problems are on the rise, national O&M expenditure is flat or downward in recent years (slide 13). This may cause difficulty in future generation.

What are big cities with a population of one million and over doing for asset management? We asked them 7 simple questions. We found out that they emphasize long term budget planning, database build-up, and setting target life for sewers (slide 14). However, they see the decay curve and LCC of less importance. In our view, both long term budget plan and target life are goals while the decay curve and LCC are tools for justification. They need to put more emphasis on tools as well. Otherwise, the goals cannot be justifiable to those who are mandated to reduce the budget.

3. Research Topics-Macro and Micro approaches

Our prime research goal is to give justification basis for long term sewer rehabilitation budgeting by municipalities. The other important goal is to develop prioritization method to select sewers for condition assessment and rehabilitation works. The former is macroscopic and the latter is microscopic approaches.

3.1 Average Survival Curve (ASC)

The justification for long term rehabilitation budgeting relies on average survival curve (ASC). The ASC is the integration or multiplication of survival curve using survey data (SCS) and survival curve using rehabilitation data (SCR). The SCS is common approach to draw survival curve. However, it is underestimation of failures for two reasons. One is because condition is rated at the time surveyed. Failure surely happened before the time of survey. Second is because rehabilitated sewers are excluded from the condition assessment program. In other words, still-existing old sewers are ‘stronger’. That is why they still exist. The weaker sewers, which started to be used in the same year as stronger sewers, have already got rehabilitated. The ASC needs to show how fast sewers become conditions in need of rehabilitation. Then, the SCR comes to remove the second bias. To draw the SCS, 2,700km of condition assessment data were used. To draw the SCR, all sewers ever installed in Japan were surveyed. This survey revealed how many kilometers of sewers were rehabilitated by municipality, age, and material type.

The result of SCS shows constant decrease of survival rate till around 50 years old (slide 18). After 60 years, the rates scatter. This is partly because the number of condition assessment data decreases after 60 years of age.

The result of SCR shows survival rate start decreasing at around 30 years old (slide 19). At 50 years old, around 70% of sewer survives. The SCR overestimates the failure when discussing aging of sewers because rehabilitation reasons include not only aging but also capacity augmentation and relocation accompanied by road construction works. Practically, it is impossible to separate the rehabilitation record into reasons. The ASC shows sewers start to die at the age of 13 (slide 20). The death rate or decrease of survival rate is 1.44% per year. At the age of 82, all sewers die. In other words, all sewers will become a condition necessary for rehabilitation by 82 years old.

The ASC is intended for calculating the work volume for rehabilitation. Necessary rehabilitation work arises after 13 years old. Small-medium municipalities are indifferent to aging problems even though many of their sewers are already over 13 years old. The ASC would alert them for the necessity of rehabilitation. The current ASC does not distinguish material type. This may hinder the use of ASC by municipalities because material type is considered big influence for sewer aging. PVC pipe is considered long life followed by reinforced concrete pipe and clay pipe. Our research team is now working on ASC by material type.

3.2 Prioritization of rehabilitation work

Another ongoing research is the method for prioritization of rehabilitation work and condition assessment. Why we start working on this is the simple question asked by a municipal officer. He asked, “Laterals are number one cause for sinkholes in frequency. At the same time, some big sewer mains under heavy traffic national roads are failing. No such big sewers have ever collapsed. But once it happens, enormous damage will be done to the society. Then, which rehabilitation work should we put higher priority on, laterals or trunks?”

MLIT conducts national survey on sewer cave-ins every year. Using the result of survey, risk evaluation method is being developed. Cave-in frequency formula is part of the research. Now, damage prediction model is under development.

Closing

Our institute was designed to help MLIT headquarters develop and conduct national policy. In line of the mission, our division’s mandate is to upgrade and sustain sewer service in Japan. Our research result will be of great value.

Sewer Management in Japan
-an overview

Takashi SAKAKIBARA, Yosuke MATSUMIYA,
Yasuo FUKUDA

Wastewater System Division, NILIM, MLIT

Introduction of NILIM – Wastewater System Div.

Wastewater Planning
Asset Management, Quick-construction project
Technical strategy for wastewater engineering

Sewer System Maintenance
Road cave-in problem、storage pit problem

Stormwater Control
CSO control, rainfall infiltration enhancement
Communication method in heavy rainfall

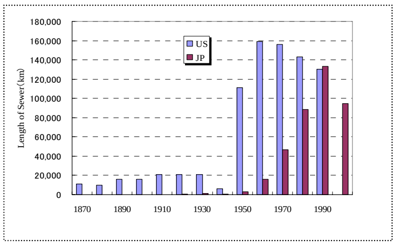
Watershed Management
Northwest Pacific Sea Marine Env. Protection

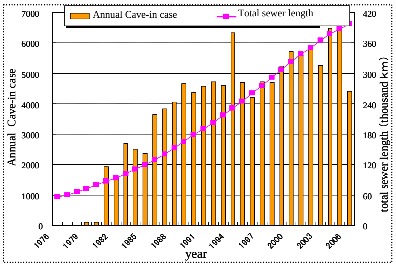
Presentation Outline

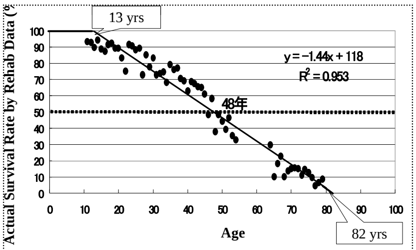
1. Sewers in Japan
   - statistical overview

2. Sewers Asset Management
   -current status in Japan

3. Research Topics
   - for better Sewer Asset Management Plan







Presentation Outline

1. Sewers in Japan
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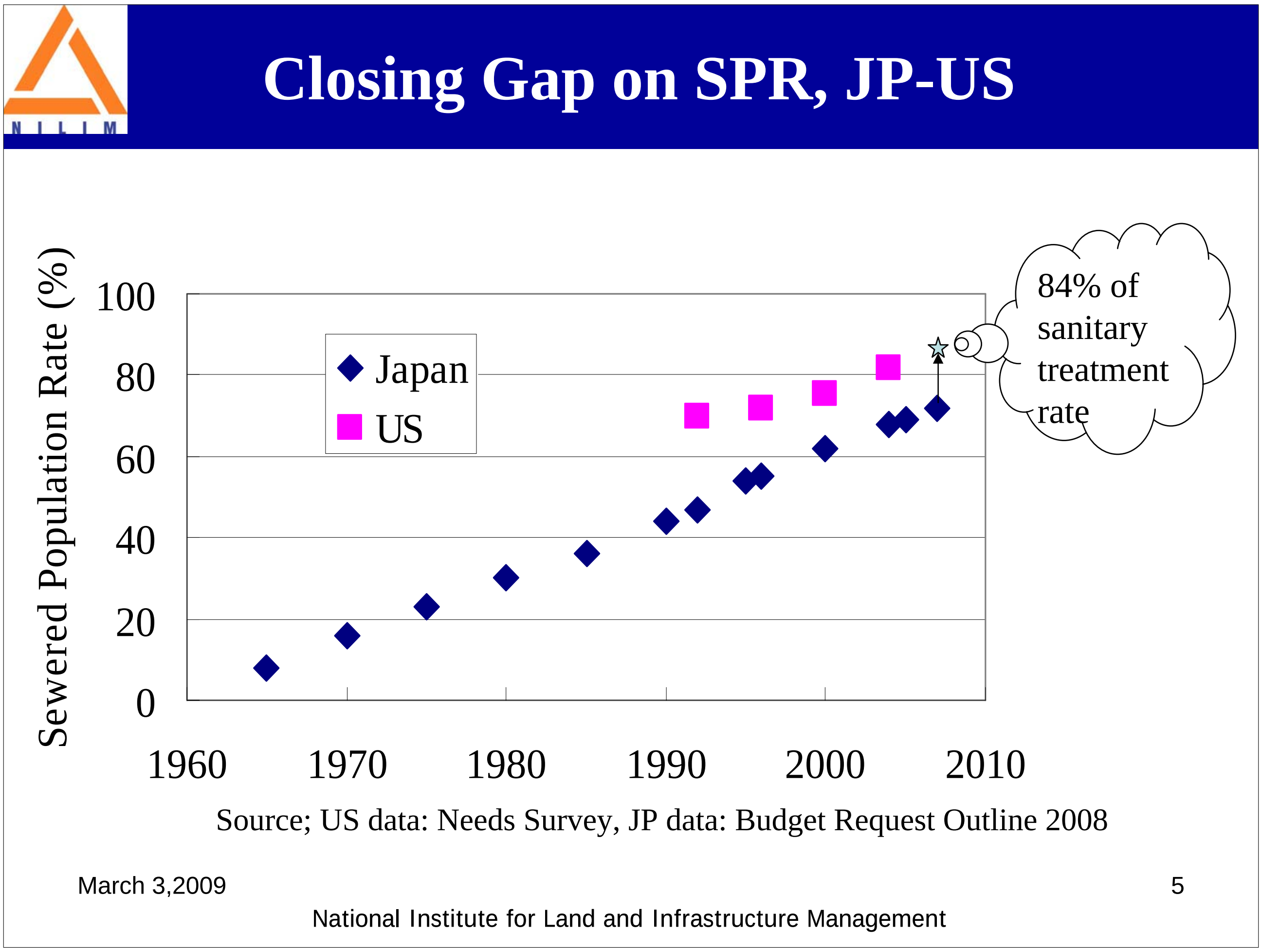
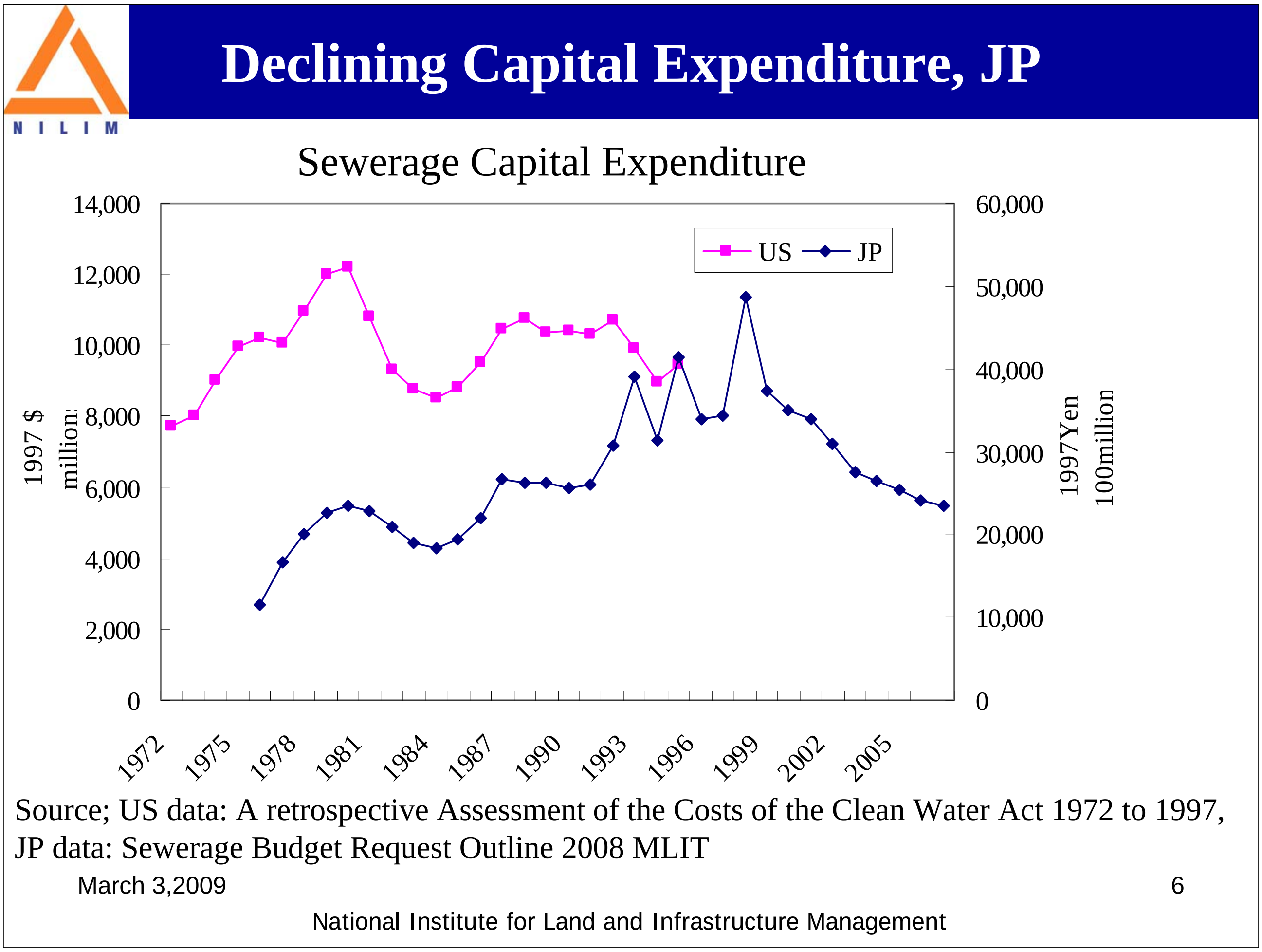


Closing Gap on SPR, JP-US

Source; US data: Needs Survey, JP data: Budget Request Outline 2008

March 3,2009

National Institute for Land and Infrastructure Management



Declining Capital Expenditure, JP

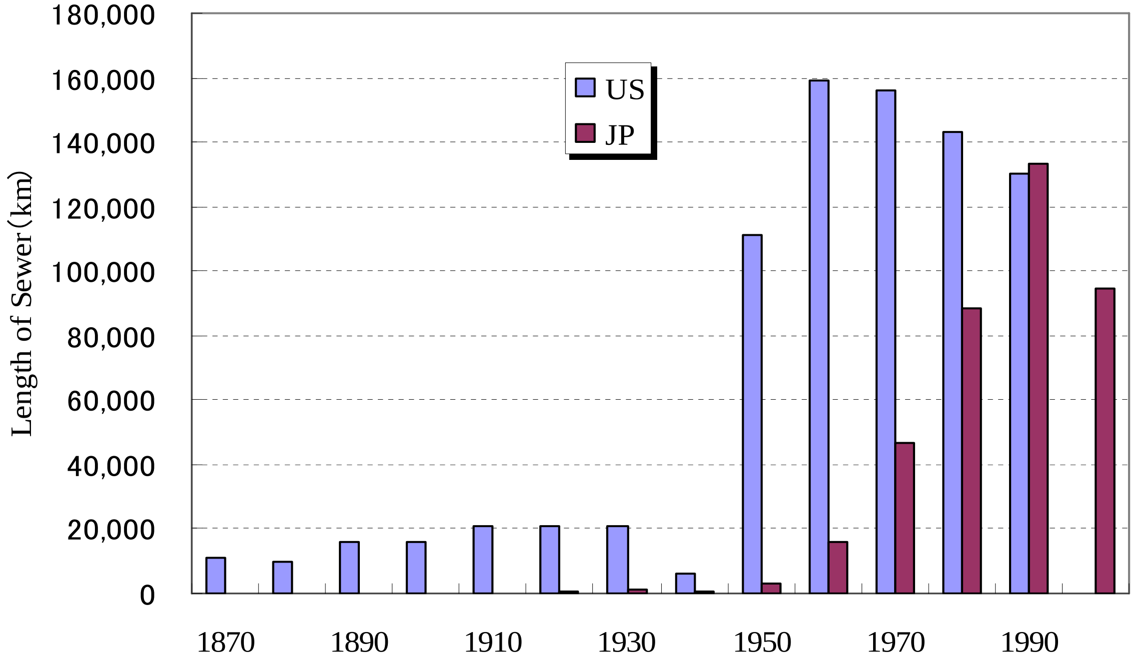
Sewerage Capital Expenditure

Source; US data: A retrospective Assessment of the Costs of the Clean Water Act 1972 to 1997,
JP data: Sewerage Budget Request Outline 2008 MLIT

March 3,2009

National Institute for Land and Infrastructure Management

Sewer of JP is younger



Histogram of Sewer Installation Length per decade

Source; US data: Gap Analysis, JP data: New Info by Our Research

Presentation Outline

1. **Sewers in Japan**
   - statistical overview

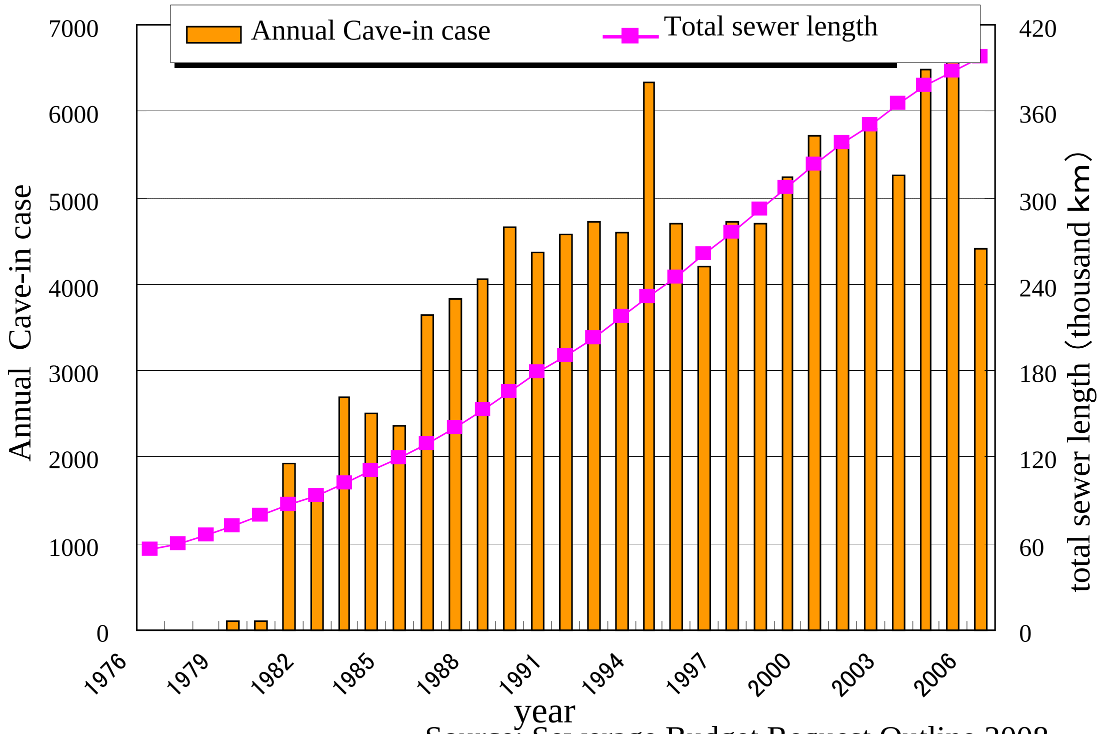
2. **Sewers Asset Management**
   -current status in Japan

3. **Research Topics**
   - for better Sewer Asset Management Plan

Current Sewer O&M

- Experience based approach by big cities
- Baby boomers retirement & downsizing
- Neglected O&M by Small/Medium Cities, due to insufficient resource; human & finance
- Need for AM approach for all cities

Increasing Road Cave-Ins, as Consequence of Failure



Source: Sewerage Budget Request Outline 2008

Source: Sewerage Budget Request Outline 2008 (left) & Tokyo Metropolitan Gov website (right)

Where do they happen?

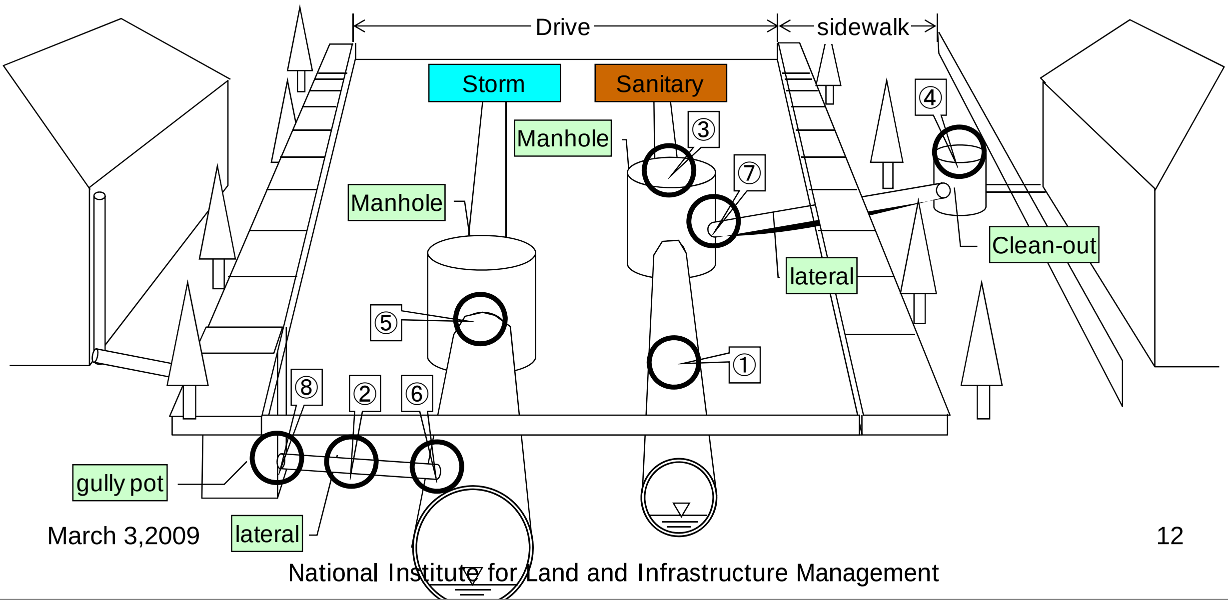
8 causal structures into 4 groups

【public sewer g.】=【①public sewer】+【⑤joint between PS. & M.】+【⑥Joint between PS. & Lat.】

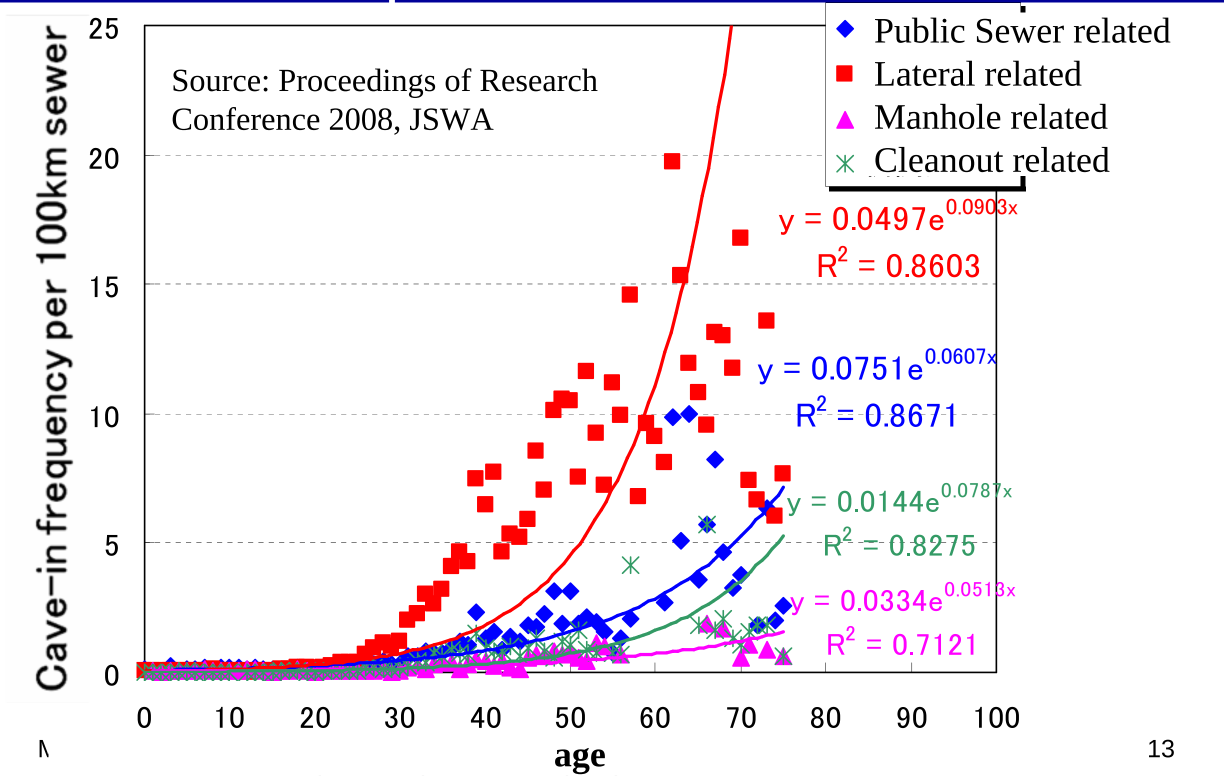
【lateral g.】 =【②lateral】+【⑥Joint between PS. & Lat.】+【⑦joint between Lat. & M.】 +【⑧joint between Lat. & CO.】

【manhole g.】 =【③manhole】+【⑤ joint between PS. & M.】+【⑦joint between Lat. & M.】

【clean out g.】 =【④clean out】+【⑧joint between Lat. & CO.】

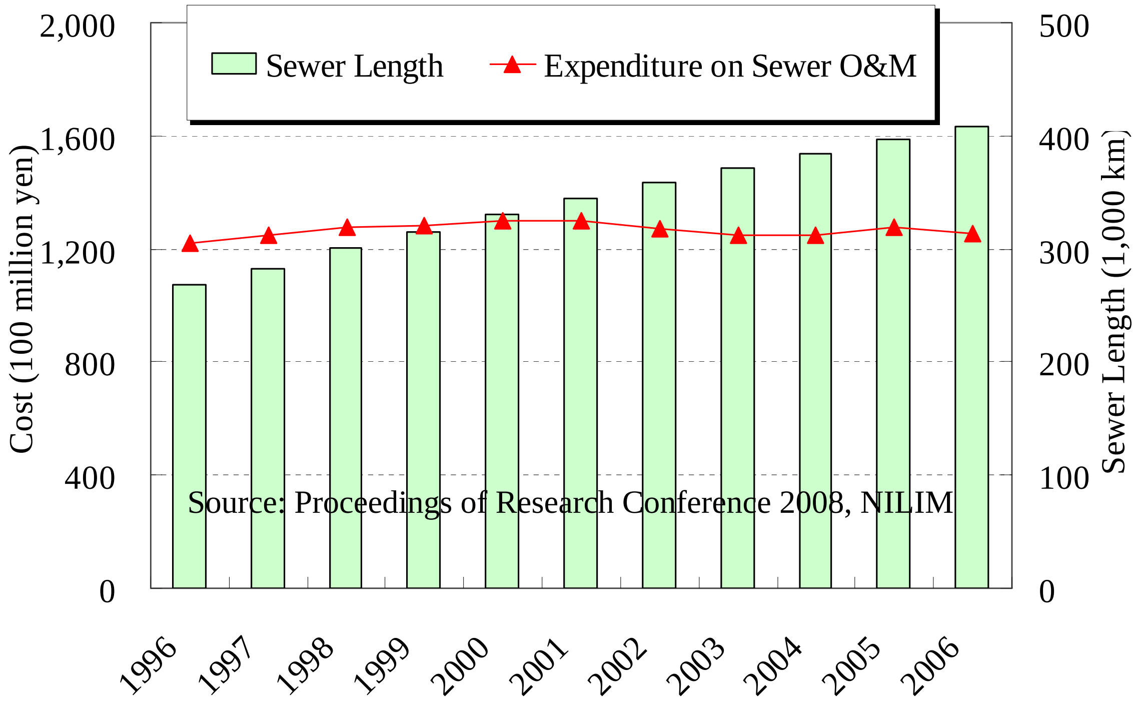


Laterals Blamed Most, Exponential Increase



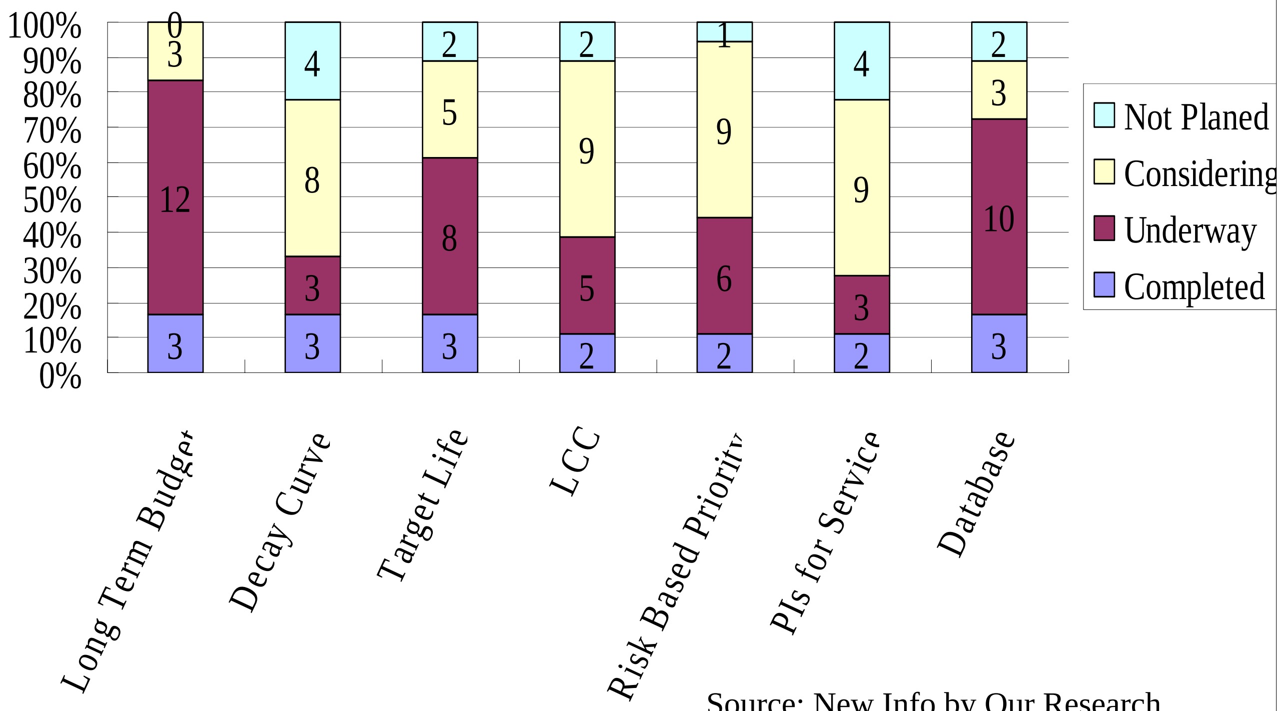
Source: Proceedings of Research Conference 2008, JSWA

Flat or Downward O&M Expenditure



Source: Proceedings of Research Conference 2008, NILIM

What are Major Cities doing for AM?



Source: New Info by Our Research

Presentation Outline

1. Sewers in Japan
- statistical overview

2. Sewers Asset Management
-current status in Japan

3. Research Topics
- for better Sewer Asset Management Plan

Our research goal for Sewer AM

◆ **Average Survival Curve (ASC)**

⇒Long term budget planning for financial sustainability

- How many kilometers of failed sewers that need rehabilitation exist now?
- How fast do those sewers increase in future?
- How many kilometers of sewers need survey every year?

◆ **Risk Evaluation Tool on Failed Sewers for Prioritization of Necessary Actions**

⇒Long term work program for sewer service sustainability

- Which sewers should be surveyed & rehabilitated first?
- Which sewers are likely to be failing？
- How big are the consequences of failed sewers? How much is a sewer collapse damage?

How to draw ASC ?

① ASC by integration of SCS&SCR
⇒Shows ASC with no rehab

② Survival Curve using Survey data (SCS)
⇒Collect CCTV & Eye Inspection data from 2,700 km Sewers. Death defined by deterioration level.

③ Survival Curve using Rehab incl. Repair & Replacement data (SCR)
⇒ Use rehab length data for 400,000km of entire nationwide sewers in 2006. Death defined by Rehab & Replacement

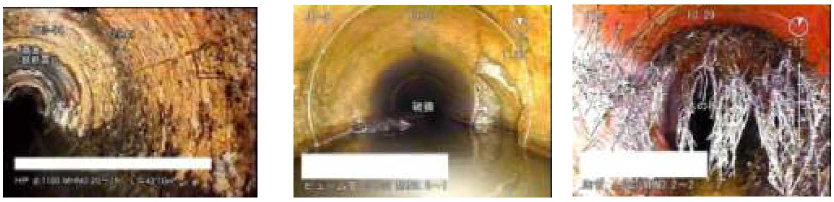
Grading Criteria for Sewer Span

Emergency	category	Criteria of Assessment	Timing of Necessary Action
Ⅰ	critical	A doimnant	immediate
Ⅱ	bad	few A & B dominant	Within 5 years after makeshift repair
Ⅲ	not well	No A, few B & C dominant	In 5 years or later after makeshift repair

◆ **Definition of 'Dead' sewers for SCS**

- Dead: Emergency 1+2, most municipalities rehabilitate EM 1+2 sewers
- Alive: Emergency 3 & No Problem
- Underestimate for physical decay

CCTV Survey of Sewer Span

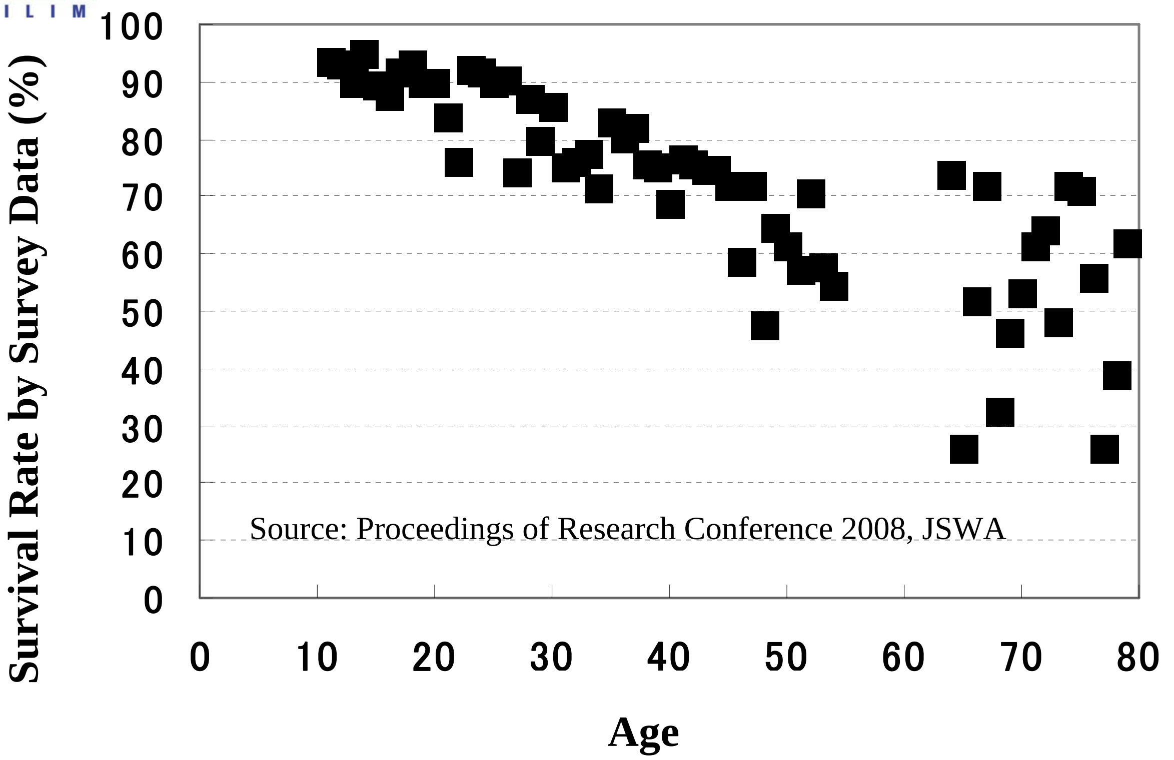


Criteria of Sewer Condition Assessment, Example

Mode by Span Basis	A	B	C
corrosion	exposed metal bar	exposed gravel	rough wall
sag	Diameter or over	Half Diameter or over	below half diameter

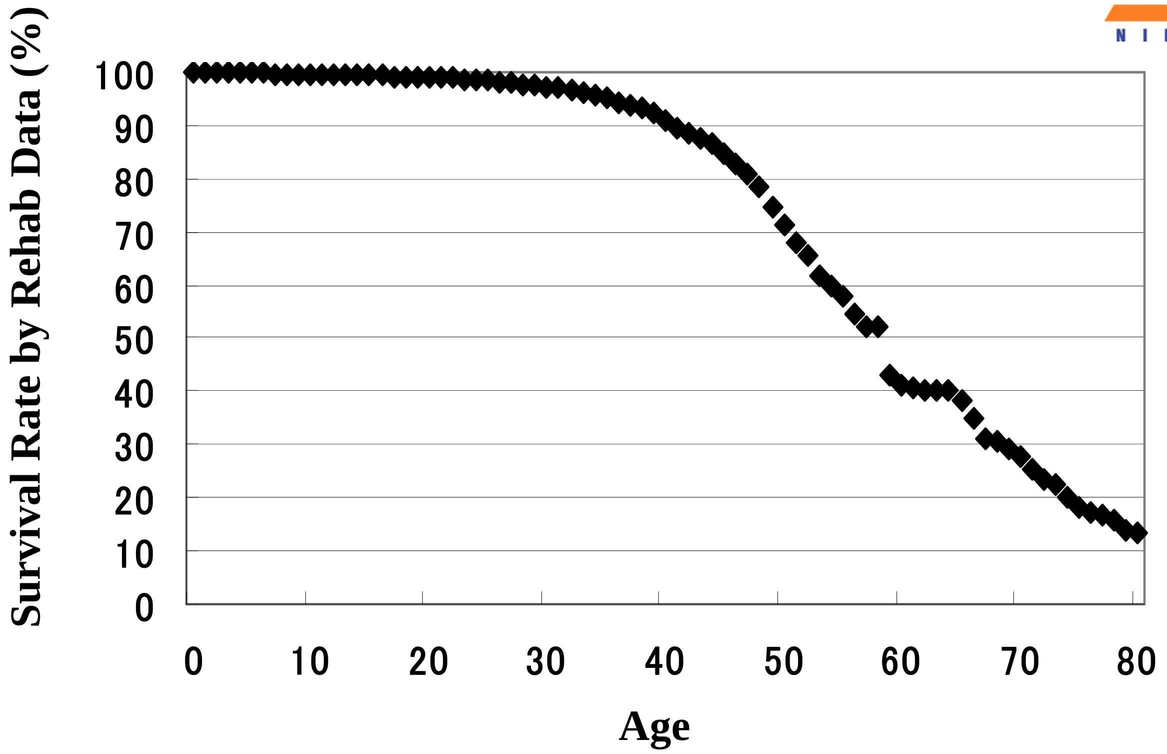
Mode by Pipe Basis	a	b	c
fracture	partially missing or longitudal crack of 5mm or	longitudal crack of 2mm or over	longitudal crack of below 2mm
crack circumferential	5mm or over	2mm or over	below 2mm
joint	displaced	70mm open or over	below 70mm open
leak	splashing	runnig	surface stain
lateral projection	Half Diameter or over	1/10 Diameter or over	below 1/10 Diameter
root intrusion grease slime	Half Diameter or over blocked	below Half Diameter blocked	na
Mortar	30% diameter or over blocked	10% diameter or over blocked	below 10% diameter blocked

Survival Curve by Survey data: SCS



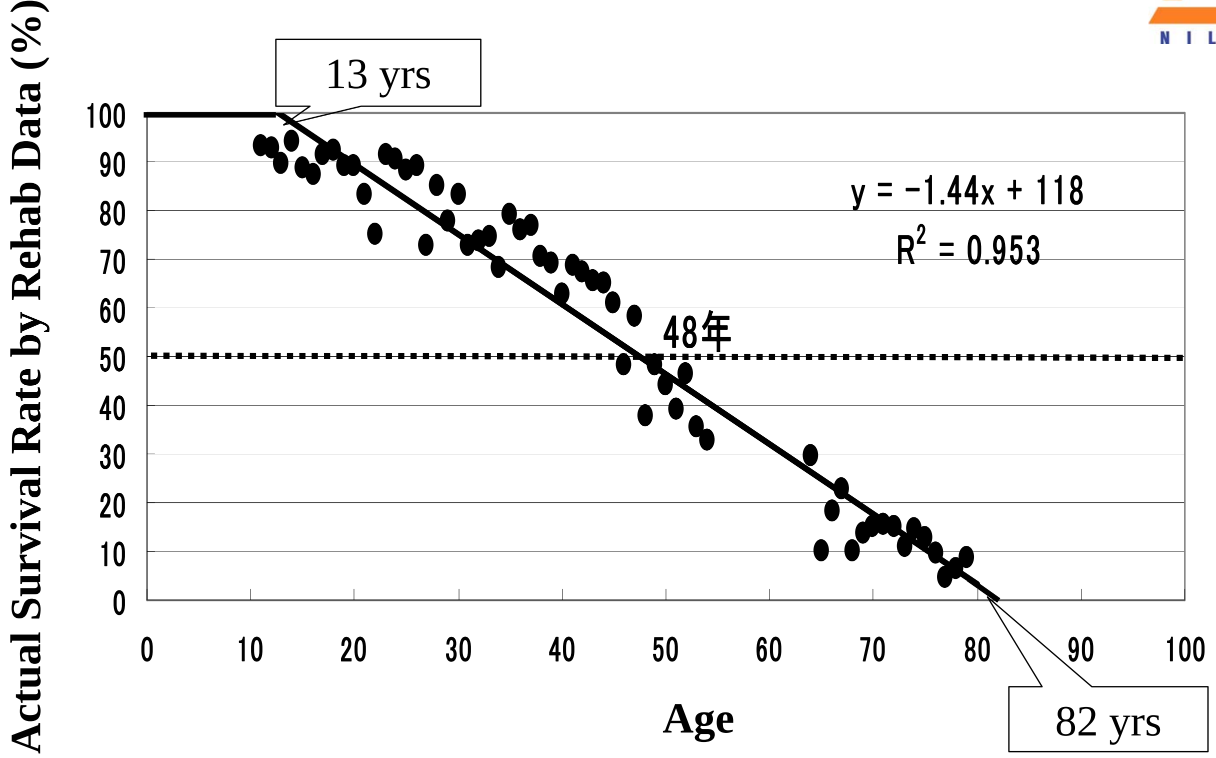
Source: Proceedings of Research Conference 2008, JSWA

Survival Curve by Rehab: SCR



Source: Proceedings of Research Conference 2008, JSWA

Actual Survival Curve



Source: Proceedings of Research Conference 2008, JSWA

Conclusion & Necessary Research

① Average Survival Curve for the estimate of work volume of Survey & Rehabilitation was gained.

② 1.44 % of sewers over age 13 added each year to the work volume.

③ Necessary to draw ASC by sewer material type as it is influential

Risk evaluation based on sewer cave-in events

① Sewer cave-ins are increasing, especially in major cities, totaling more than 4000 cases each year. Prevention of the cave-ins is requested socially.

② MLIT HQs & NILIM conduct national survey on sewer cave-ins every year.

③ Using the data, cave-in frequency prediction formula was developed as part of risk evaluation tool.

④ Currently, working on prediction model of damage magnitude by failed sewers to develop prioritization method for survey & rehabilitation

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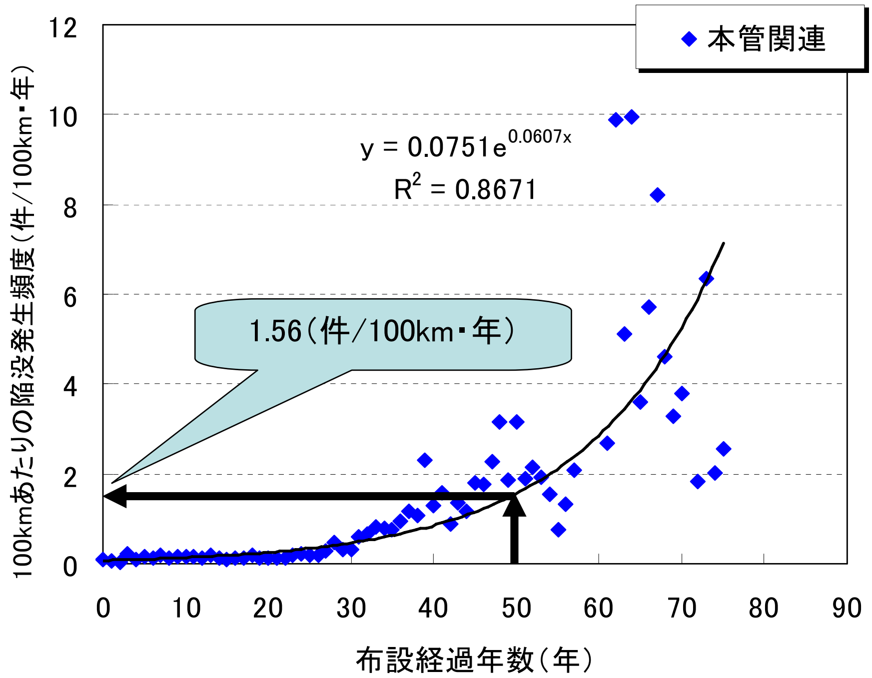
Future necessary research

【Valuated Risk 】=【Cave-in damage cost】×【frequecy】×【sewer length】

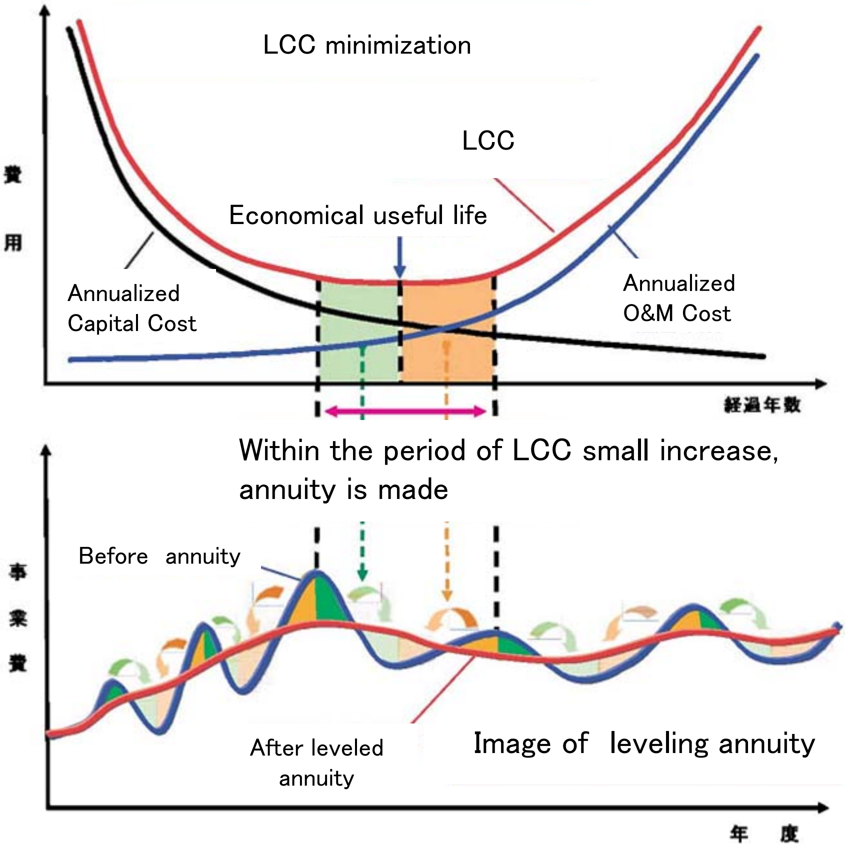


Risk Valuation
↓
By span or Area
↓
Prioritization of action; survey & rehab

Damage cost prediction
↓
Possible parameters; time & cost for repair work, traffic density, depth of sewers
↓
Under Research

Thank you for your attention

Image of Budget Annuity



LCC minimization

LCC

Economical useful life

Annualized
Capital Cost

Annualized
O&M Cost

Within the period of LCC small increase,
annuity is made

Before annuity

After leveled
annuity

Image of leveling annuity

2.Asset Management Plan in Australia

BERRIGAN SHIRE COUNCIL

SEWERAGE SYSTEM

ASSET MANAGEMENT PLAN

Version

July 2009

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ABBREVIATIONS

AAAC	Average annual asset consumption
AMP	Asset management plan
ARI	Average recurrence interval
BOD	Biochemical (biological) oxygen demand
CRC	Current replacement cost
CWMS	Community wastewater management systems
DA	Depreciable amount
DoH	Department of Health
EF	Earthworks/formation
IRMP	Infrastructure risk management plan
LCC	Life Cycle cost
LCE	Life cycle expenditure
MMS	Maintenance management system
PCI	Pavement condition index
RV	Residual value
SS	Suspended solids
vph	Vehicles per hour

GLOSSARY

Annual service cost (ASC)
An estimate of the cost that would be tendered, per annum, if tenders were called for the supply of a service to a performance specification for a fixed term. The Annual Service Cost includes operating, maintenance, depreciation, finance/ opportunity and disposal costs, less revenue.

Asset class
Grouping of assets of a similar nature and use in an entity's operations (AASB 166.37).

Asset condition assessment
The process of continuous or periodic inspection, assessment, measurement and interpretation of the resultant data to indicate the condition of a specific asset so as to determine the need for some preventative or remedial action.

Asset management
The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner.

Assets
Future economic benefits controlled by the entity as a result of past transactions or other past events (AAS27.12).

Property, plant and equipment including infrastructure and other assets (such as furniture and fittings) with benefits expected to last more than 12 month.

Average annual asset consumption (AAAC)*
The amount of a local government’s asset base consumed during a year. This may be calculated by dividing the Depreciable Amount (DA) by the Useful Life and totalled for each and every asset OR by dividing the Fair Value (Depreciated Replacement Cost) by the Remaining Life and totalled for each and every asset in an asset category or class.

Brownfield asset values**
Asset (re)valuation values based on the cost to replace the asset including demolition and restoration costs.

Capital expansion expenditure
Expenditure that extends an existing asset, at the same standard as is currently enjoyed by residents, to a new group of users. It is discretional expenditure, which increases future operating, and maintenance costs, because it increases council’s asset base, but may be associated with additional revenue from the new user group, eg. extending a drainage or road network, the provision of an oval or park in a new suburb for new residents.

Capital expenditure
Relatively large (material) expenditure, which has benefits, expected to last for more than 12 months. Capital expenditure includes renewal, expansion and upgrade. Where capital projects involve a combination of renewal, expansion and/or upgrade expenditures, the total project cost needs to be allocated accordingly.

Capital funding
Funding to pay for capital expenditure.

Capital grants
Monies received generally tied to the specific projects for which they are granted, which are often upgrade and/or expansion or new investment proposals.

Capital investment expenditure
See capital expenditure definition

Capital new expenditure
Expenditure which creates a new asset providing a new service to the community that did not exist beforehand. As it increases service potential it may impact revenue and will increase future operating and maintenance expenditure.

Capital renewal expenditure
Expenditure on an existing asset, which returns the service potential or the life of the asset up to that which it had originally. It is periodically required expenditure, relatively large (material) in value compared with the value of the components or sub-components of the asset being renewed. As it reinstates existing service potential, it has no impact on revenue, but may reduce future operating and maintenance expenditure if completed at the optimum time, eg. resurfacing or resheeting a material part of a road network, replacing a material section of a drainage network with pipes of the same capacity, resurfacing an oval. Where capital projects involve a combination of renewal, expansion and/or upgrade expenditures, the total project cost needs to be allocated accordingly.

Capital upgrade expenditure
Expenditure, which enhances an existing asset to provide a higher level of service or expenditure that will increase the life of the asset beyond that which it had originally. Upgrade expenditure is discretional and often does not result in additional revenue unless direct user charges apply. It will increase operating and maintenance expenditure in the future because of the increase in the council’s asset base, eg. widening the sealed area of an existing road, replacing drainage pipes with pipes of a greater capacity, enlarging a grandstand at a sporting facility. Where capital projects involve a combination of renewal, expansion and/or upgrade

expenditures, the total project cost needs to be allocated accordingly.

Carrying amount
The amount at which an asset is recognised after deducting any accumulated depreciation / amortisation and accumulated impairment losses thereon.

Class of assets
See asset class definition

Component
An individual part of an asset which contributes to the composition of the whole and can be separated from or attached to an asset or a system.

Cost of an asset
The amount of cash or cash equivalents paid or the fair value of the consideration given to acquire an asset at the time of its acquisition or construction, plus any costs necessary to place the asset into service. This includes one-off design and project management costs.

Current replacement cost (CRC)
The cost the entity would incur to acquire the asset on the reporting date. The cost is measured by reference to the lowest cost at which the gross future economic benefits could be obtained in the normal course of business or the minimum it would cost, to replace the existing asset with a technologically modern equivalent new asset (not a second hand one) with the same economic benefits (gross service potential) allowing for any differences in the quantity and quality of output and in operating costs.

Current replacement cost "As New" (CRC)
The current cost of replacing the original service potential of an existing asset, with a similar modern equivalent asset, i.e. the total cost of replacing an existing asset with an as NEW or similar asset expressed in current dollar values.

Cyclic Maintenance**
Replacement of higher value components/sub-components of assets that is undertaken on a regular cycle including repainting, building roof replacement, cycle, replacement of air conditioning equipment, etc. This work generally falls below the capital/ maintenance threshold and needs to be identified in a specific maintenance budget allocation.

Depreciable amount
The cost of an asset, or other amount substituted for its cost, less its residual value (AASB 116.6)

Depreciated replacement cost (DRC)
The current replacement cost (CRC) of an asset less, where applicable, accumulated depreciation calculated on the basis of such cost to reflect the already consumed or expired future economic benefits of the asset

Depreciation / amortisation
The systematic allocation of the depreciable amount (service potential) of an asset over its useful life.

Economic life
See useful life definition.

Expenditure
The spending of money on goods and services. Expenditure includes recurrent and capital.

Fair value
The amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties, in an arms length transaction.

Greenfield asset values **
Asset (re)valuation values based on the cost to initially acquire the asset.

Heritage asset
An asset with historic, artistic, scientific, technological, geographical or environmental qualities that is held and maintained principally for its contribution to knowledge and culture and this purpose is central to the objectives of the entity holding it.

Impairment Loss
The amount by which the carrying amount of an asset exceeds its recoverable amount.

Infrastructure assets
Physical assets of the entity or of another entity that contribute to meeting the public's need for access to major economic and social facilities and services, eg. roads, drainage, footpaths and cycleways. These are typically large, interconnected networks or portfolios of composite assets The components of these assets may be separately maintained, renewed or replaced individually so that the required level and standard of service from the network of assets is continuously sustained. Generally the components and hence the assets have long lives. They are fixed in place and are often have no market value.

Investment property
Property held to earn rentals or for capital appreciation or both, rather than for:
(a) use in the production or supply of goods or services or for administrative purposes; or
(b) sale in the ordinary course of business (AASB 140.5)

Level of service
The defined service quality for a particular service against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental, acceptability and cost).

Life Cycle Cost **
The life cycle cost (LCC) is average cost to provide the service over the longest asset life cycle. It comprises annual maintenance and asset consumption expense, represented by depreciation expense. The Life Cycle Cost does not indicate the funds required to provide the service in a particular year.

Life Cycle Expenditure **
The Life Cycle Expenditure (LCE) is the actual or planned annual maintenance and capital renewal expenditure incurred in providing the service in a particular year. Life Cycle Expenditure may be compared to Life Cycle Expenditure to give an initial indicator of life cycle sustainability.

Loans / borrowings
Loans result in funds being received which are then repaid over a period of time with interest (an additional cost). Their primary benefit is in 'spreading the burden' of capital expenditure over time. Although loans enable works to be completed sooner, they are only ultimately cost effective where the capital works funded (generally renewals) result in operating and maintenance cost savings, which are greater than the cost of the loan (interest and charges).

Maintenance and renewal gap
Difference between estimated budgets and projected expenditures for maintenance and renewal of assets, totalled over a defined time (eg 5, 10 and 15 years).

Maintenance and renewal sustainability index
Ratio of estimated budget to projected expenditure for maintenance and renewal of assets over a defined time (eg 5, 10 and 15 years).

Maintenance expenditure
Recurrent expenditure, which is periodically or regularly required as part of the anticipated schedule of works required to ensure that the asset achieves its useful life and provides the required level of service. It is expenditure, which was anticipated in determining the asset's useful life.

Materiality
An item is material is its omission or misstatement could influence the economic decisions of users taken on the basis of the financial report. Materiality depends on the size and nature of the omission or misstatement judged in the surrounding circumstances.

Modern equivalent asset.
A structure similar to an existing structure and having the equivalent productive capacity, which could be built using modern materials, techniques and design. Replacement cost is the basis used to estimate the cost of constructing a modern equivalent asset.

Non-revenue generating investments
Investments for the provision of goods and services to sustain or improve services to the community that are not expected to generate any savings or revenue to the Council, eg. parks and playgrounds, footpaths, roads and bridges, libraries, etc.

Operating expenditure
Recurrent expenditure, which is continuously required excluding maintenance and depreciation, eg power, fuel, staff, plant equipment, on-costs and overheads.

Pavement management system
A systematic process for measuring and predicting the condition of road pavements and wearing surfaces over time and recommending corrective actions.

Planned Maintenance**
Repair work that is identified and managed through a maintenance management system (MMS). MMS activities include inspection, assessing the condition against failure/breakdown criteria/experience, prioritising scheduling, actioning the work and reporting what was done to develop a maintenance history and improve maintenance and service delivery performance.

PMS Score
A measure of condition of a road segment determined from a Pavement Management System.

Rate of annual asset consumption*
A measure of average annual consumption of assets (AAAC) expressed as a percentage of the depreciable amount (AAAC/DA). Depreciation may be used for AAAC.

Rate of annual asset renewal*
A measure of the rate at which assets are being renewed per annum expressed as a percentage of depreciable amount (capital renewal expenditure/DA).

Rate of annual asset upgrade*
A measure of the rate at which assets are being upgraded and expanded per annum expressed as a percentage of depreciable amount (capital upgrade/expansion expenditure/DA).

Reactive maintenance
Unplanned repair work that carried out in response to service requests and management/supervisory directions.

Recoverable amount
The higher of an asset's fair value, less costs to sell and its value in use.

Recurrent expenditure
Relatively small (immaterial) expenditure or that which has benefits expected to last less than 12 months. Recurrent expenditure includes operating and maintenance expenditure.

Recurrent funding
Funding to pay for recurrent expenditure.

Rehabilitation
See capital renewal expenditure definition above.

Remaining life
The time remaining until an asset ceases to provide the required service level or economic usefulness. Age plus remaining life is economic life.

Renewal
See capital renewal expenditure definition above.

Residual value
The net amount which an entity expects to obtain for an asset at the end of its useful life after deducting the expected costs of disposal.

Revenue generating investments
Investments for the provision of goods and services to sustain or improve services to the community that are expected to generate some savings or revenue to offset operating costs, eg public halls and theatres, childcare centres, sporting and recreation facilities, tourist information centres, etc.

Risk management
The application of a formal process to the range of possible values relating to key factors associated with a risk in order to determine the resultant ranges of outcomes and their probability of occurrence.

Section or segment
A self-contained part or piece of an infrastructure asset.

Service potential
The capacity to provide goods and services in accordance with the entity's objectives, whether those objectives are the generation of net cash inflows or the provision of goods and services of a particular volume and quantity to the beneficiaries thereof.

Service potential remaining*
A measure of the remaining life of assets expressed as a percentage of economic life. It is also a measure of the percentage of the asset's potential to provide services that is still available for use in providing services (DRC/DA).

Strategic Management Plan (SA)**
Documents Council objectives for a specified period (3-5 yrs), the principle activities to achieve the objectives, the means by which that will be carried out, estimated income and expenditure, measures to assess performance and how rating policy relates to the Council's objectives and activities.

Sub-component
Smaller individual parts that make up a component part.

Useful life
Either:
(a) the period over which an asset is expected to be available for use by an entity, or
(b) the number of production or similar units expected to be obtained from the asset by the entity.
It is estimated or expected time between placing the asset into service and removing it from service, or the estimated period of time over which the future economic benefits embodied in a depreciable asset, are expected to be consumed by the council. It is the same as the economic life.

Value in Use
The present value of estimated future cash flows expected to arise from the continuing use of an asset and from its disposal at the end of its useful life. It is deemed to be depreciated replacement cost (DRC) for those assets whose future economic benefits are not primarily dependent on the asset's ability to generate new cash flows, where if deprived of the asset its future economic benefits would be replaced.

Source: DVC 2006, Glossary
Note: Items shown * modified to use DA instead of CRC
Additional glossary items shown **

1. EXECUTIVE SUMMARY

What Council Provides

Council provides a sewerage network in each of its four townships to enable the efficient collection, treatment and disposal of waste water.

This asset management plan covers the following infrastructure assets:

Sewerage infrastructure for the townships of Barooga, Berrigan, Finley and Tocumwal

Table 2.1. Assets covered by this Plan

Asset category	Dimension	Replacement Value ($M)
Gravity Mains including Manholes and Property Connections	72.5 km	$15,890,770
Rising Mains	34.7 km	$5,185,282
Pump Stations	47 No.	$10,780,000
Treatment Works	4 No.	$4,780,000
Storage Ponds	5 No.	$834,000
TOTAL		$37,470,052

What does it Cost?

There are two key indicators of cost to provide the sewerage service.

- The life cycle cost being the average cost over the life cycle of the asset, and
- The total maintenance and capital renewal expenditure required to deliver existing service levels in the next 10 years covered by Council's long term financial plan.

The life cycle cost to provide the sewerage service is estimated at $1,091,814 per annum. Council's planned life cycle expenditure for year 1 of the asset management plan is $460,172 which gives a life cycle sustainability index of 0.42.

The total maintenance and capital renewal expenditure required to provide the sewerage service the in the next 10 years is estimated at $9,094,370. This is an average of $909,437 per annum.

Council's maintenance and capital renewal expenditure for year 1 of the asset management plan of $535,390 giving a 10 year sustainability index of 0.59.

Plans for the Future

Council plans to operate and maintain the sewerage network to achieve the following strategic objectives.

1. Ensure the sewerage network is maintained at a safe and functional standard as set out in this asset management plan.
2. Ensure sufficient funds are raised through fees and charges to provide for sewer asset renewal over the life of the assets.
3. Meet or exceed community expectations in relation to sewer services.

Measuring our Performance

Quality
Sewer assets will be maintained in a reasonably usable condition. Defects found or reported that are outside our service standard will be repaired. See our maintenance response service levels for details of defect prioritisation and response time.

Function
Our intent is that an appropriate sewerage network is maintained in partnership with other levels of government and stakeholders to collect, treat and dispose of waste water from the townships of Barooga, Berrigan, Finley and Tocumwal.

Sewer asset attributes will be maintained at a safe level and associated signage and equipment be provided as needed to ensure public safety. We need to ensure key functional objectives are met:

- Waste water is efficiently and effectively collected from properties, conveyed to the sewer treatment plants, treated and re used or disposed of.
- The operation of the sewerage system does not result in an adverse impact on the environment.

The main functional consequence of ensuring the sewerage network is maintained at a safe and functional standard as set out in this asset management plan is the continued provision of sewerage services to the four townships within the Berrigan Shire at a level acceptable to the community and other stakeholders..

Safety
We inspect all sewerage infrastructure regularly and prioritise and repair defects in accordance with our inspection schedule to ensure they are safe.

The Next Steps

The actions resulting from this asset management plan are:

- Complete the Improvement Plan as set out in Table 8.2
- Make provision for the completion of the Capital Works Program attached as Appendix C
- Carry out community consultation

- ***Table 8.2 Improvement Plan***

Task No	**Task**	**Responsibility**	**Resources Required**	**Timeline**
1.	Condition Rating of assets including CCTV survey of gravity mains	EE	Staff	June 2012
2.	Review of remaining life of assets following condition ratings	EE	Staff	June 2012
3.	Componentisation of point assets such as pumping stations and treatment plants including review of unit costs	EE, TOA	Staff	March 2012
4.	Document methodology and procedures for asset useful lives, asset unit costs, condition rating and depreciation calculations	DTS, DCS	Staff	June 2010
5.	Develop chart of accounts to allow separation of operation costs and maintenance costs and to split the maintenance costs into reactive, planned and cyclic and to separate capital expenditure into renewal, new and upgrade works.	FM	Staff	June 2010
6.	Investigate options for integration of the Asset Management System with the Accounting/Financial System	FM, EXE	Staff	March 2012
7.	Carry out community consultation to allow the development of Desired Levels of Service when this plan is reviewed in 2013	DCS	Staff/External	March 2013

2. INTRODUCTION

2.1 Background

This asset management plan is to demonstrate responsive management of assets (and services provided from assets), compliance with regulatory requirements, and to communicate funding required to provide the required levels of service.

The asset management plan is to be read with the following associated planning documents:

Berrigan Shire Council Management Plan

Report on Water and Wastewater Infrastructure Maintenance Strategy, *GHD*, 1997

Sewerage Strategic Business Plan, *Fisher Stewart*,1997

OH&S Audit Report of the Water and Sewerage Schemes Facilities, *DPWS*, 1999

Finley Urban Water Plan, *DPWS*, 2000

Planning Workshop No. 2 Report, *DPWS*, 2000

Water and Sewerage Strategic Business Planning Review, *DPWS*, 2001

Water and Sewerage Strategic Business Planning Review, *BSC*, 2004

Berrigan Shire Council – State of Environment Report, 2008

Berrigan Shire Council – Local Environmental Plan, 1992

Berriquin Land and Water Management Plan, 1995

This asset management plan covers the following infrastructure assets:

Sewerage infrastructure for the townships of Barooga, Berrigan, Finley and Tocumwal

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Storage Ponds	5 No.	$834,000
TOTAL		**$37,470,052**

Key stakeholders in the preparation and implementation of this asset management plan are:

State local members	Represent community interest
Department of Water and Energy	State department responsible for management of sewerage services
Department of Commerce	Service provider for technical support
NSW EPA	Pollution prevention Protection of environmental values Legislative requirements are met
Murray Irrigation	Protection of irrigation canals and drainage channels from polluting discharges
Murray Catchment Management Authority	Coordinate management strategies within the Murray Catchment for the sustainable use of its natural resources
Department of Environment & Climate Change	Possible source of funding for recycling and energy saving projects – Protection of the natural environment and the equitable use of natural resources – Contains EPA
Department of Health	Advice on public health issues and monitoring of water quality for re-used effluent.
Berrigan Shire Council	Meet expectations of the customers with respect to levels of service Comply with EPA directive
The General Public	Improved recreational opportunities Improved visual amenity Maximise property values Reduction of flooding disruption
Tocumwal Golf Club	Utilisation of treated effluent for irrigation of greens and fairways
Finley Golf Club	Utilisation of treated effluent for irrigation of greens and fairways
Berrigan Race Club	Utilisation of treated effluent for irrigation of greens and fairways
Local businesses	Efficient disposal of waste water Improve recreational opportunities and visual amenity
Sewer Customers	Efficient disposal of waste water Improve recreational opportunities and visual amenity

2.2 Goals and Objectives of Asset Management

The Council exists to provide services to its community. Some of these services are provided by infrastructure assets. Council has acquired infrastructure assets by ‘purchase’, by contract, construction by council staff and by donation of assets constructed by developers and others to meet increased levels of service.

Council's goal in managing infrastructure assets is to meet the required level of service in the most cost effective manner for present and future consumers. The key elements of infrastructure asset management are:

- Taking a life cycle approach,
- Developing cost-effective management strategies for the long term,
- Providing a defined level of service and monitoring performance,
- Understanding and meeting the demands of growth through demand management and infrastructure investment,
- Managing risks associated with asset failures,
- Sustainable use of physical resources,
- Continuous improvement in asset management practices.[1]

This asset management plan is prepared under the direction of Council's vision, mission, goals and objectives.

Council's vision is:

> **The vision of the Berrigan Shire Council is to create a sustainable, healthy and vibrant community that takes advantage of economic opportunities, promotes innovation and diversification, realises the potential of existing businesses and welcomes compatible strategic investment into the Shire.**

In expanding the Council's vision to the 30 year planning horizon for the provision of sewerage services, the following expectations have been identified:

❐ Government policy provides regional and local leadership.

❐ Council will shape Government policy to better serve the community.

❐ A sense of belonging and pride will come from a partnership between Council and the community.

❐ Quality of life means a clean, safe environment with high social and community values

❐ Infrastructure will be properly planned and maintained.

❐ Economic development.

❐ Quality and value for money demonstrated by market testing and benchmarking.

Council's vision has implications for the provision of the sewerage services to provide excellence in service to the community to enable enhanced quality of life. This will be achieved through:

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[1] IIMM 2006 Sec 1.1.3, p 1.3

Integrity
Leadership
Selflessness
Objectivity
Accountability
Openness
Honesty
Respect
Trust and teamwork
Advocacy
Partners

2.3 Plan Framework

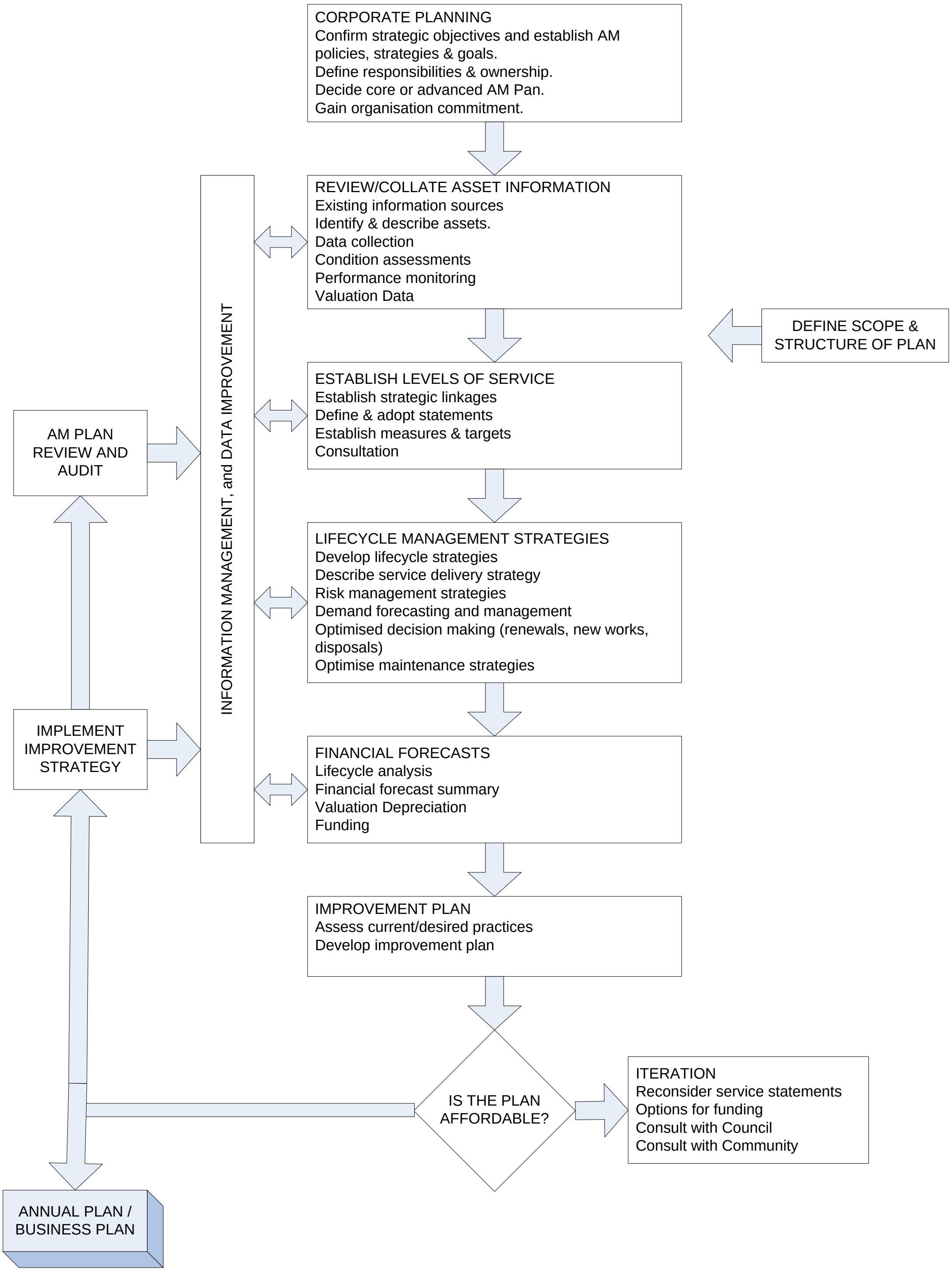
Key elements of the plan are

- Levels of service – specifies the services and levels of service to be provided by council.
- Future demand – how this will impact on future service delivery and how this is to be met.
- Life cycle management – how Council will manage its existing and future assets to provide the required services
- Financial summary – what funds are required to provide the required services.
- Asset management practices
- Monitoring – how the plan will be monitored to ensure it is meeting Council's objectives.
- Asset management improvement plan

A road map for preparing an asset management plan is shown below.

Road Map for preparing an Asset Management Plan

Source: IIMM Fig 1.5.1, p 1.11



2.4 Core and Advanced Asset Management

This asset management plan is prepared as a ‘core’ asset management plan in accordance with the International Infrastructure Management Manual. It is prepared to meet minimum legislative and organisational requirements for sustainable service delivery and long term financial planning and reporting. Core asset management is a ‘top down’ approach where analysis is applied at the ‘system’ or ‘network’ level.

Future revisions of this asset management plan will move towards ‘advanced’ asset management using a ‘bottom up’ approach for gathering asset information for individual assets to support the optimisation of activities and programs to meet agreed service levels.

3. LEVELS OF SERVICE

3.1 Customer Research and Expectations

Council has not carried out any research on customer expectations. Levels of service for previous plans have been determined from consultation with internal stakeholders ie. Council Staff. A formal system of complaints/requests is maintained with proforma sheets being distributed to all property owners with their annual rates notices. This system has not identified any obvious short falls in the current levels of service. A more formal research program to determine customer expectations will be investigated for future updates of the asset management plan.

3.2 Legislative Requirements

Council has to meet many legislative requirements including Australian and State legislation and State regulations. These include:

Table 3.2. Legislative Requirements

Legislation	**Requirement**
Local Government Act 1993	• Sets out role, purpose, responsibilities and powers of local governments including the preparation of a long term financial plan supported by asset management plans for sustainable service delivery.
Environmental Planning and Assessment Act 1979 & Environmental Planning and Assessment Amendment Act 2008	• Requirement for Local Environmental Plans and Development Control Plans. • Provides for Council control of development of towns and approval of infrastructure expansion.
Catchment Management Authorities Act 2003	• Requirement for ongoing management plan. • Promotes the coordination of activities within catchment areas. • Under the provision of this Act, Local Catchment Management Authorities oversee this process in the region.
Soil Conservation Act 1938	• Preservation of water course environment.
Public Health Act 1991	• Protection of public health from handling and treatment of waste water including effluent reuse.

Public Works Act 1912	• Provides authority for the Department of Water and Energy to construct sewerage works within the Council's area and regulates activities concerning the acquisition of land for sewerage works.
Water Act 1912 & Water Management Act 2000 & Water Management Amendment Act 2008	• Water rights, licenses, allocations and determination of developer charges.
Occupational health and Safety Act 2000	• Impacts all operations in relation to safety of workers and the public. • Council's responsibility to ensure health, safety and welfare of employees and others at places of work.
Independent Pricing and Regulatory Tribunal Act 1992	• Gives powers to the Independent Pricing and regulatory Tribunal to inquire into and regulate prices.
Protection of the Environment Operations Act 1997	• Need to control wastewater and stormwater disposal. • Control of run-off or escape of contaminants entering water courses. • Regulating pollution activities and issue of licenses as well as the monitoring of and reporting on waste output. • This act includes "Due Diligence requirements, disposal procedures for chemicals and sludge and details penalties for causing environmental impacts.

3.3 Current Levels of Service

Council has defined service levels in two terms.

Community Levels of Service relate to how the community receives the service in terms of safety, quality, quantity, reliability, responsiveness, cost/efficiency and legislative compliance.

Supporting the community service levels are operational or technical measures of performance developed to ensure that the minimum community levels of service are met. These technical measures relate to service criteria such as:

Service Criteria	**Technical measures may relate to**
Quality	Smoothness of roads
Quantity	Area of parks per resident
Availability	Distance from a dwelling to a sealed road
Safety	Number of injury accidents

Council's current service levels are detailed in Table 3.3.

Table 3.3. Current Service Levels

Key Performance Measure	Level of Service	Performance Measure Process	Performance Target	Current Performance
COMMUNITY LEVELS OF SERVICE				
Quality	No odours	Customer Complaints	0 pa	0
Quality	Provide an effective method of collection and disposal of wastewater	Customer Complaints Re-use of treated effluent	<10 pa 100% of effluent re-used	116 100% in Tocumwal, Finley and Berrigan
Function	No backup of sewage into properties	Customer Complaints	<10 pa	37
	No overflows of sewage onto public places/waterways	Incidents	0 pa	0
Safety	Low level of risk to health in the disposal & re-use of treated wastewater	Incidents of sub standard water being discharged/re-used	0 pa	0
TECHNICAL LEVELS OF SERVICE				
Function	Availability of sewerage reticulation in designated areas	% of lots serviced	100%	100%
	Provide an effective method of collection and disposal of wastewater	Failures due to rainfall and deficient capacity	0 pa	0
Condition	Provide appropriate level of operation and maintenance	Breakdowns Main blockage/collapse Age of system Maintenance to be routine	< 2 pa per town < 5 pa per town <5% assets > 95% useful life Planned/Reactive maintenance work value ratio 70%- 30%	0 116 0.25% 71%-29%
System Availability	Response time incidents	Moderate/Major Spill Minor spill/blockage	45 min 12hrs	Within 45min Within 12hrs
Cost Effectiveness	Provide service at reasonable cost	Maintenance Cost	=< previous year + cpi	
Safety	Provide sewerage service with minimal hazards and risks	Reported accidents / incidents / near misses	0 pa	0
Quality	Provide effluent at a quality that satisfies all approval conditions for re-use	Water Quality Parameters	0 incidents of failure to meet parameters	0

INSERT current service levels – See guidelines for examples of levels of service

3.4 Desired Levels of Service

At present, indications of desired levels of service are obtained from various sources including residents' feedback to Councillors and staff, service requests and correspondence. Council has yet to quantify desired levels of service. This will be done in future revisions of this asset management plan.

4. FUTURE DEMAND

4.1 Demand Forecast

Factors affecting demand include population change, changes in demographics, seasonal factors, vehicle ownership, consumer preferences and expectations, economic factors, agricultural practices, environmental awareness, etc.

Demand factor trends and impacts on service delivery are summarised in Table 4.1.

Table 4.1. Demand Factors, Projections and Impact on Services

Demand factor	Present position	Projection	Impact on services
Population	Barooga 1453 (2006)	Barooga 2668 (2028)	Treatment facilities, pump stations and trunk mains will have adequate capacity. New reticulation works will be funded by developers.
	Berrigan 929 (2006)	Berrigan 1094 (2028)	Treatment facilities, pump stations and trunk mains will have adequate capacity. New reticulation works will be funded by developers.
	Finley 2053 (2006)	Finley 2555 (2028)	Treatment facilities, pump stations and trunk mains will have adequate capacity. New reticulation works will be funded by developers.
	Tocumwal 1861 (2006)	Tocumwal 3344 (2028)	Treatment facilities, pump stations and trunk mains will have adequate capacity. New reticulation works will be funded by developers.

4.2 Changes in Technology

Technology changes are forecast to affect the delivery of services covered by this plan in the following areas.

Table 4.2. Changes in Technology and Forecast effect on Service Delivery

Technology Change	Effect on Service Delivery
Trenchless Pipeline Techniques	Should reduce the cost of pipeline maintenance and renewal Will reduce the impact of works on the community and environment.

4.3 Demand Management Plan

Demand for new services will be managed through a combination of managing existing assets, upgrading of existing assets and providing new assets to meet demand and demand management. Demand management practices include non-asset solutions, insuring against risks and managing failures.

Opportunities identified to date for demand management are shown in Table 4.3. Further opportunities will be developed in future revisions of this asset management plan.

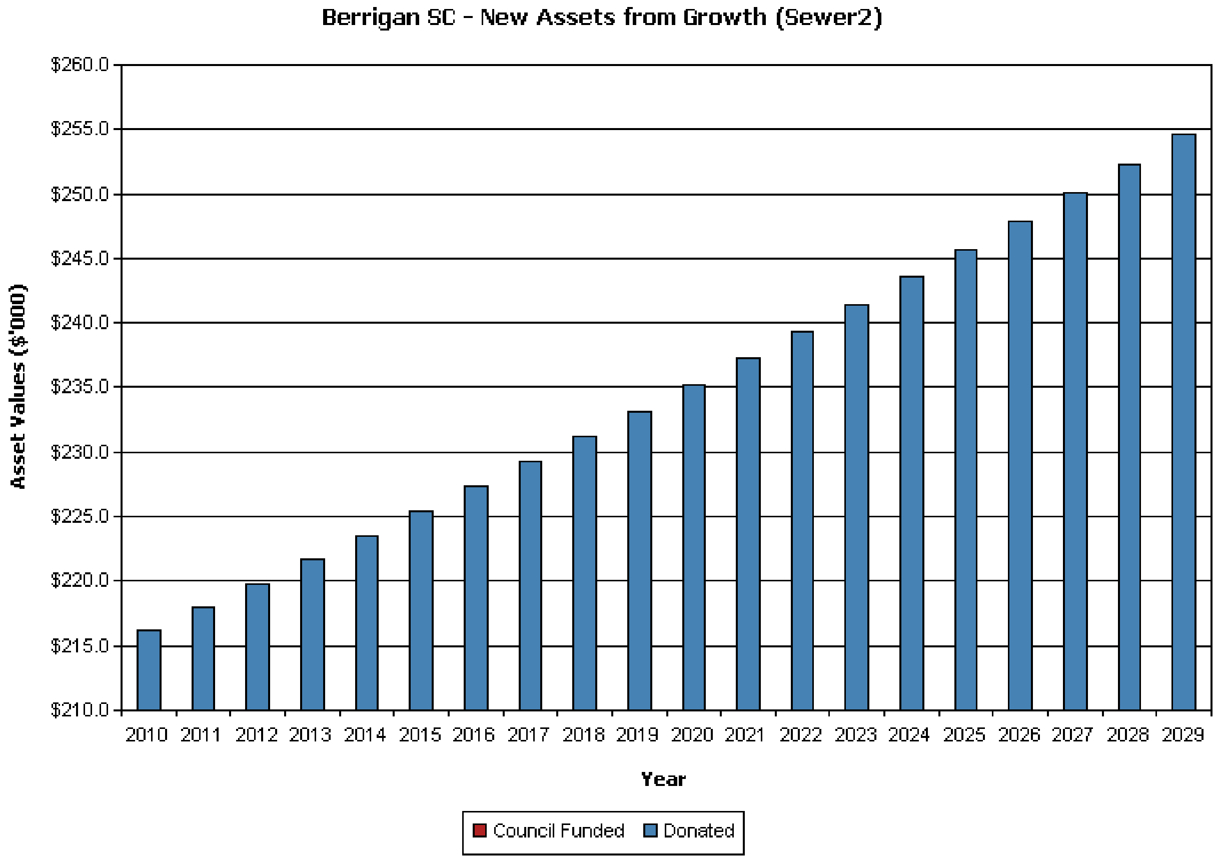
Table 4.3. Demand Management Plan Summary

Service Activity	Demand Management Plan
Expansion of reticulation network to serve new developments.	Reticulation expansion to be provided by developers of new developments.
Re-use of effluent from Barooga STP.	Develop agreement with adjoining property owner to purchase available effluent for agricultural re-use.

4.4 New Assets from Growth

The new assets required to meet growth will be acquired from land developments and constructed by Council. The new asset values are summarised in Fig 1.

Fig 1. New Assets from Growth



Acquiring these new assets will commit council to fund ongoing operations and maintenance costs for the period that the service provided from the assets is required. These future costs are identified and considered in developing forecasts of future operating and maintenance costs.

5. LIFECYCLE MANAGEMENT PLAN

The lifecycle management plan details how Council plans to manage and operate the assets at the agreed levels of service (defined in section 3) while optimising life cycle costs.

5.1 Background Data

5.1.1 Physical parameters

The assets covered by this asset management plan are shown below.

Gravity Mains including Manholes and Property Connections	72.5 km
Rising Mains	34.7 km
Pump Stations	47 No.
Treatment Works	4 No.
Storage Ponds	5 No.

These assets are distributed between four towns (Barooga, Berrigan, Finley and Tocumwal) within the Berrigan Shire. Gravity mains are constructed from a mixture of materials including Asbestos Cement, UPVC, Vitreous Clay and Reinforced Concrete. Rising mains are generally constructed from either UPVC or Asbestos Cement.

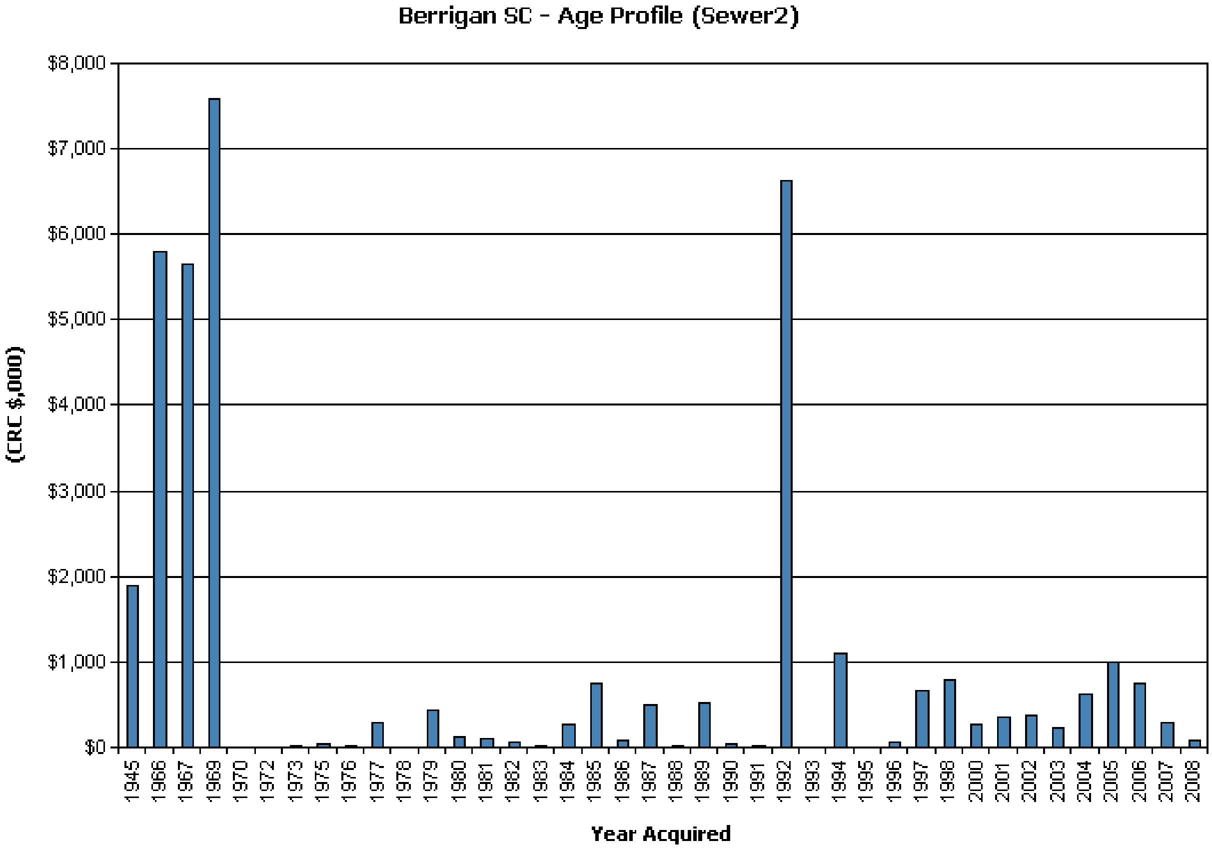
The treatment works for Berrigan, Finley and Tocumwal are conventional sedimentation trickling filter systems with maturation ponds and storage facilities while Barooga is only served by a pond treatment system.

All treatment plants are operating satisfactorily and have sufficient capacity for current loadings. The primary sedimentation tanks at Finley and Tocumwal will need to be monitored as we approach the high end of the projected loadings.

The condition of the gravity mains in Tocumwal, Berrigan and Finley is unknown and CCTV surveys are currently programmed. Barooga is a relatively new system with UPVC pipes.

The age profile of Council's assets is shown below.

Fig 2. Asset Age Profile



Plans of the sewer assets for each town are attached as Appendix A

5.1.2 Asset capacity and performance

Council’s services are generally provided to meet design standards where these are available.

Locations where deficiencies in service performance are known are detailed in Table 5.1.2.

Table 5.1.2. Known Service Performance Deficiencies

Location	Service Deficiency
Berrigan Reticulation	Excessive blockages from tree roots
Finley Reticulation	Excessive blockages from tree roots
Tocumwal Reticulation	Excessive blockages from tree roots
Barooga STP	No provision for effluent re-use.

The above service deficiencies were identified from maintenance records and officers knowledge of systems.

5.1.3 Asset condition

The condition profile of Council's assets is currently unknown and will be determined via inspections of assets to be carried out over the next two years. Reticulation will be inspected using CCTV equipment.

Council's current sewer inventory in the BizeAssets asset management system had a substantial length of asbestos cement sewers with a useful life of 45 years that were reaching this useful life over the next 3 years. Due to the fact that we have not been experiencing many failures of these pipes to this point it has been assumed that their remaining life can be increased by 10 years. This will be further substantiated and/or adjusted following the CCTV surveys of the pipes to assess condition.

Condition data will be included in future updates of this plan.

Condition will be measured using a 1 – 5 rating system.[2]

Rating	**Description of Condition**
1	Excellent condition: Only planned maintenance required.
2	Very good: Minor maintenance required plus planned maintenance.
3	Good: Significant maintenance required.
4	Average: Significant renewal/upgrade required.
5	Poor: Unserviceable.

5.1.4 Asset valuations

The value of assets as at 30th June, 2007 covered by this asset management plan is summarised below. Assets were last revalued at 30th June, 2007. Assets are valued at greenfield rates.

Current Replacement Cost	$37,470,052
Depreciable Amount	$37,470,052
Depreciated Replacement Cost	$15,121,280
Annual Depreciation Expense	$701,642

Council's sustainability reporting reports the rate of annual asset consumption and compares this to asset renewal and asset upgrade and expansion.

Asset Consumption	1.87%
Asset renewal	0.05%
Annual Upgrade/expansion	1.11%

5.2 Risk Management Plan

An assessment of risks[3] associated with service delivery from infrastructure assets has identified critical risks to Council. The risk assessment process identifies credible risks, the likliehood of the risk event occurring, the consequences should the event occur, develops a risk rating, evaluates the risk and develops a risk treatment plan for non-acceptable risks.

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[2] IIMM 2006, Appendix B, p B:1-3 ('cyclic' modified to 'planned')

[3] Berrigan Shire Council 'Core' Infrastructure Risk Management Plan - Sewer – April 2009

Critical risks, being those assessed as 'Very High' - requiring immediate corrective action and 'High' – requiring prioritised corrective action identified in the infrastructure risk management plan are summarised in Table 5.2.

Table 5.2. Critical Risks and Treatment Plans

Asset at Risk	What can Happen	Risk Rating (VH, H)	Risk Treatment Plan
Tocumwal and Finley Golf Courses and Berrigan Racetrack	Poor quality effluent delivered for re-use systems	H	Prepare and implement Operational Environment Management Plans for all sites that receive treated effluent for re-use.
Reticulation Systems	Collapse of pipes or manholes	H	Carry out CCTV inspections of all sewer reticulation and repair all structural defects.

5.3 Routine Maintenance Plan

Routine maintenance is the regular on-going work that is necessary to keep assets operating, including instances where portions of the asset fail and need immediate repair to make the asset operational again.

5.3.1 Maintenance plan

Maintenance includes reactive, planned and cyclic maintenance work activities.

Reactive maintenance is unplanned repair work carried out in response to service requests and management/supervisory directions.

Planned maintenance is repair work that is identified and managed through a maintenance management system (MMS). MMS activities include inspection, assessing the condition against failure/breakdown experience, prioritising, scheduling, actioning the work and reporting what was done to develop a maintenance history and improve maintenance and service delivery performance.

Cyclic maintenance is replacement of higher value components/sub-components of assets that is undertaken on a regular cycle including repainting, building roof replacement, etc. This work generally falls below the capital/maintenance threshold.

Maintenance expenditure trends are shown in Table 5.3.1

Table 5.3.1. Maintenance Expenditure Trends

Year	Maintenance Expenditure		
	Reactive	Planned	Cyclic
2005/06	$178,434	$216,713	$3,658
2006/07	$137,539	$242,890	$20,194
2007/08	$104,929	$260,731	$24,512

Planned maintenance work was 71% of total maintenance expenditure in 2007/08.

Maintenance expenditure levels are considered to be adequate to meet required service levels. Future revision of this asset management plan will include linking required maintenance expenditures with required service levels.

Assessment and prioritisation of reactive maintenance is undertaken by Council staff using experience and judgement.

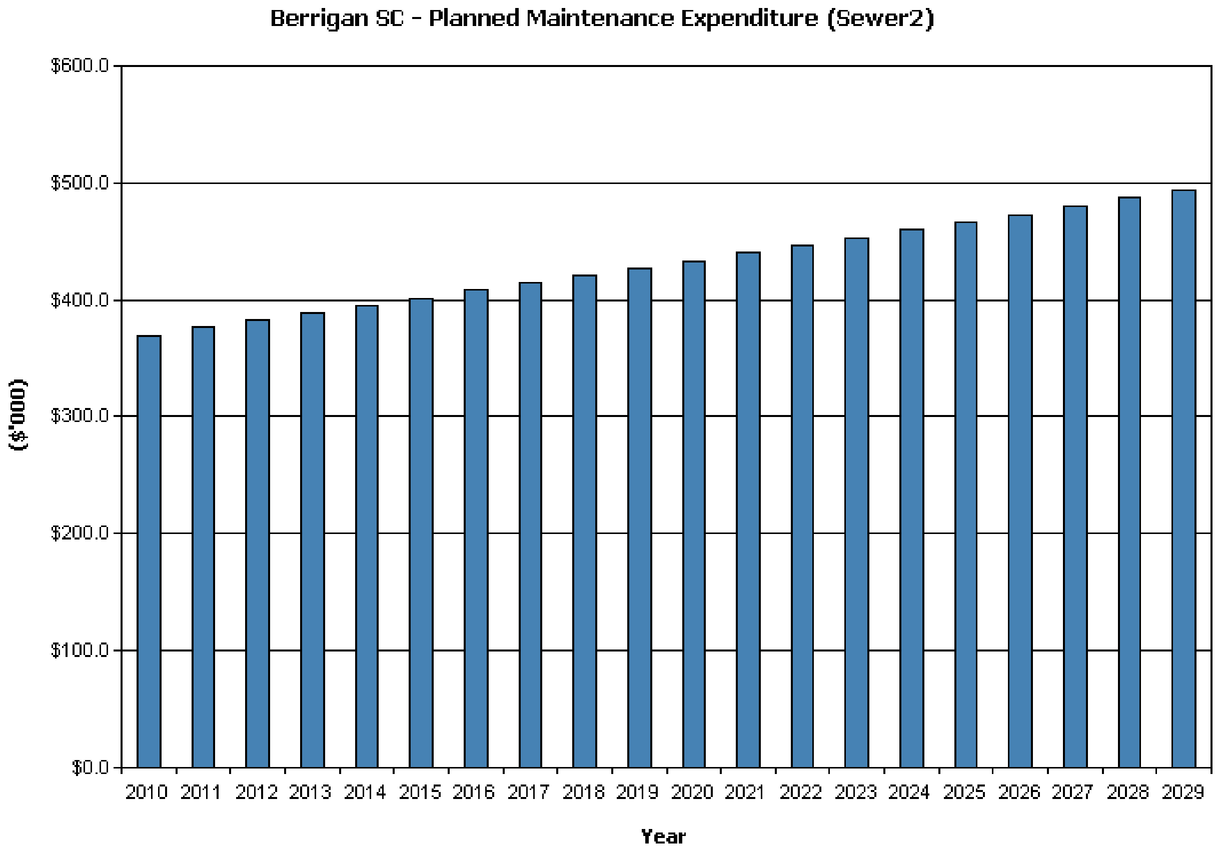
5.3.2 Standards and specifications

Maintenance work is carried out in accordance with sound industry practices, Berrigan Shire Council standard operating procedures and safe work method statements and requirements set down by manufacturers of proprietary products.

5.3.3 Summary of future maintenance expenditures

Future maintenance expenditure is forecast to trend in line with the value of the asset stock as shown in Fig 4. Note that all costs are shown in current 2008 dollar values.

Fig 4. Planned Maintenance Expenditure



Maintenance is funded from Council's operating budget and grants where available. This is further discussed in Section 6.2.

5.4 Renewal/Replacement Plan

Renewal expenditure is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original service potential. Work over and above restoring an asset to original service potential is upgrade/expansion or new works expenditure.

5.4.1 Renewal plan

Assets requiring renewal are identified from estimates of remaining life obtained from the asset register worksheets on the *'Planned Expenditure template'*. Candidate proposals are inspected to verify accuracy of remaining life estimate and to develop a preliminary renewal estimate. Verified proposals are ranked by priority and available funds and scheduled in future works programmes. The priority ranking criteria is detailed in Table 5.4.1.

Table 5.4.1 Renewal Priority Ranking Criteria

Criteria	**Weighting**
Structural Integrity	30%
Function	30%
Safety	30%
Service	10%
Total	100%

Renewal will be undertaken using 'low-cost' renewal methods where practical. The aim of 'low-cost' renewals is to restore the service potential or future economic benefits of the asset by renewing the assets at a cost less than replacement cost.

Examples of low cost renewal include trenchless technology such as relining of sewer pipes, manholes and pumpstations.

5.4.2 Renewal standards

Renewal work is carried out in accordance with the following Standards and Specifications.

Auspec

Relevant Australian Standards

Manufacturers' requirements for the installation of propriety and precast/prefabricated products.

WSAA Code for Pressure Sewerage

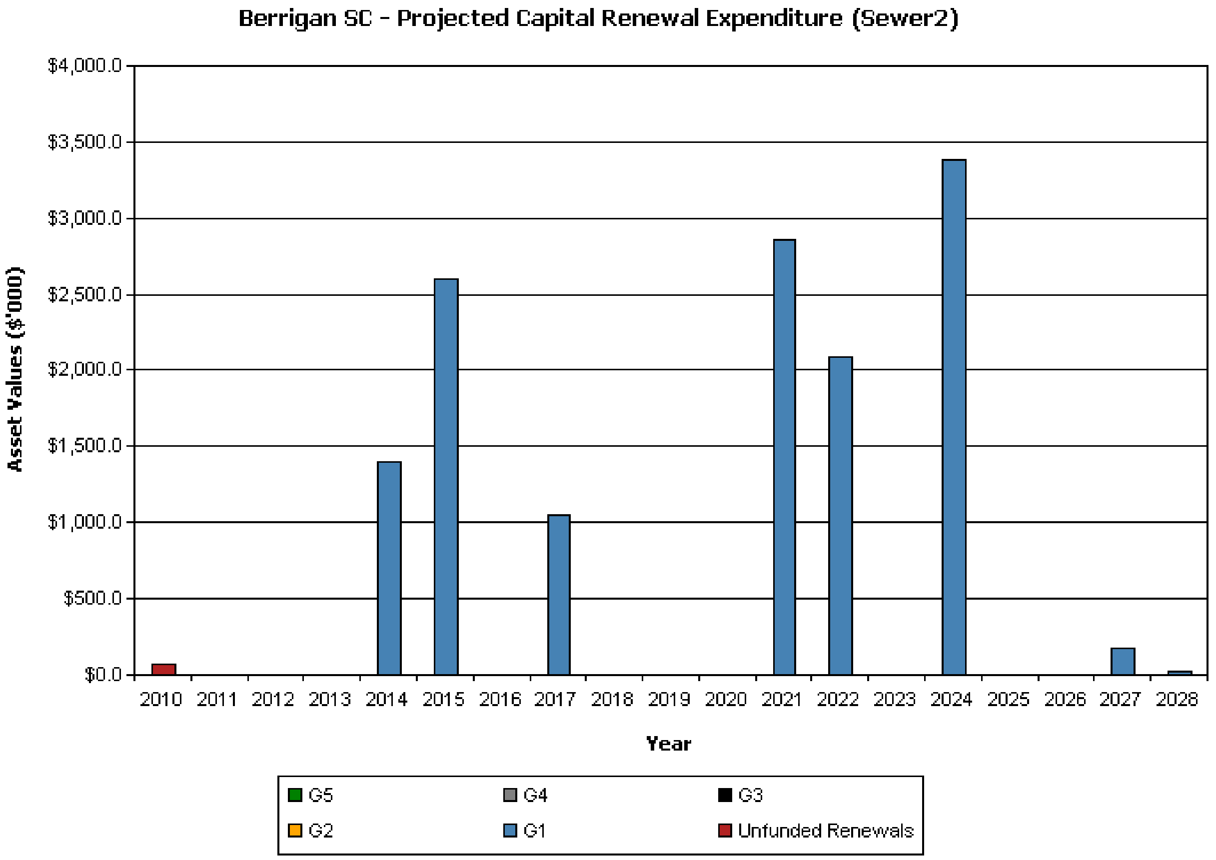
Project specific technical specifications

5.4.3 Summary of future renewal expenditure

Projected future renewal expenditures are forecast to increase over time as the asset stock ages. The costs are summarised in Fig 5. Note that all costs are shown in current 2010 dollar values.

The projected capital renewal program is shown in Appendix B.

Fig 5. Projected Capital Renewal Expenditure



Deferred renewal, ie those assets identified for renewal and not scheduled for renewal in capital works programs are to be included in the risk assessment process in the risk management plan.

Renewals are to be funded from Council's capital works program and grants where available. This is further discussed in Section 6.2.

5.5 Creation/Acquisition/Upgrade Plan

New works are those works that create a new asset that did not previously exist, or works which upgrade or improve an existing asset beyond its existing capacity. They may result from growth, social or environmental needs. Assets may also be acquired at no cost to the Council from land development. These assets from growth are considered in Section 4.4.

5.5.1 Selection criteria

New assets and upgrade/expansion of existing assets are identified from various sources such as councillor or community requests, proposals identified by strategic plans or partnerships with other organisations. Candidate proposals are inspected to verify need and to develop a preliminary renewal estimate. Verified proposals are ranked by priority and available funds and scheduled in future works programmes. The priority ranking criteria is detailed below.

Table 5.5.1 New Assets Priority Ranking Criteria

Criteria	Weighting
Inadequate capacity	50%
Increased re-use quantities	30%
Improved amenity	20%

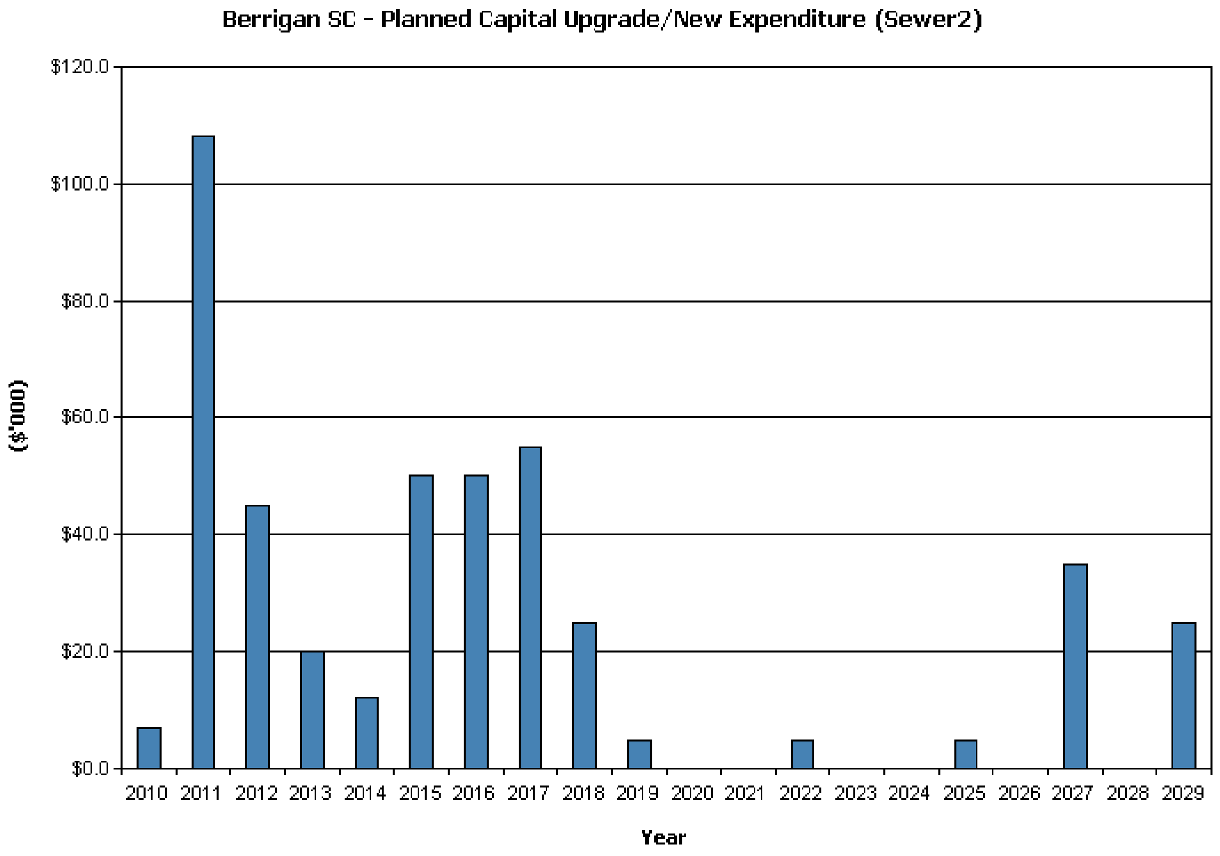
5.5.2 Standards and specifications

Standards and specifications for new assets and for upgrade/expansion of existing assets are the same as those for renewal shown in Section 5.4.2.

5.5.3 Summary of future upgrade/new assets expenditure

Planned upgrade/new asset expenditures are summarised in Fig 6. The planned upgrade/new capital works program is shown in Appendix C. All costs are shown in current 2010 dollar values.

Fig 6. Planned Capital Upgrade/New Asset Expenditure



New assets and services are to be funded from Council's capital works program and grants where available. This is further discussed in Section 6.2.

5.6 Disposal Plan

Disposal includes any activity associated with disposal of a decommissioned asset including sale, demolition or relocation. There have been no assets identified for possible decommissioning and disposal at this time.

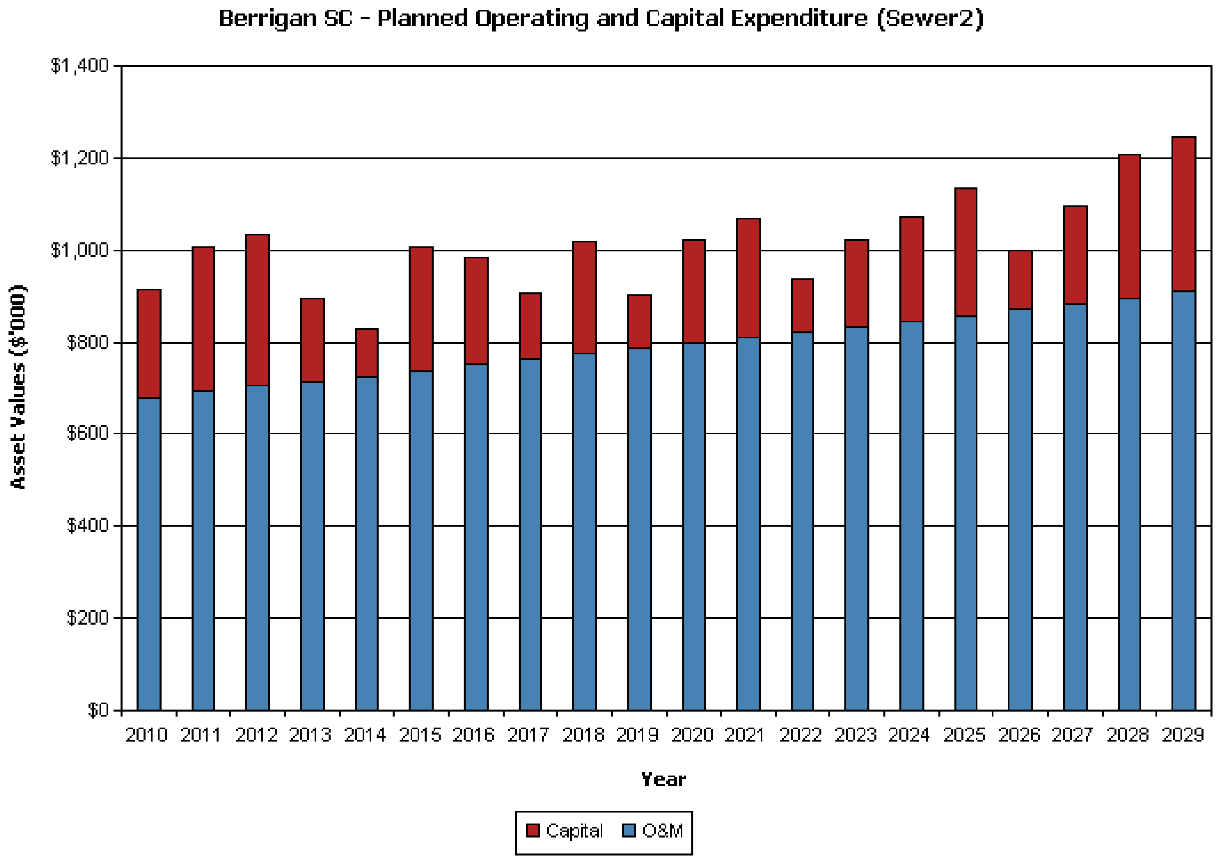
6. FINANCIAL SUMMARY

This section contains the financial requirements resulting from all the information presented in the previous sections of this asset management plan. The financial projections will be improved as further information becomes available on desired levels of service and current and projected future asset performance.

6.1 Financial Statements and Projections

The financial projections are shown in Fig 7 for planned operating (operations and maintenance) and capital expenditure (renewal and upgrade/expansion/new assets).

Fig 7. Planned Operating and Capital Expenditure



Note that all costs are shown in current 2010 dollar values.

6.1.1 Sustainability of service delivery

There are two key indicators for financial sustainability that have been considered in the analysis of the services provided by this asset category, these being long term life cycle costs and medium term costs over the 10 year financial planning period.

Long term - Life Cycle Cost

Life cycle costs (or whole of life costs) are the average costs that are required to sustain the service levels over the longest asset life. Life cycle costs include maintenance and asset consumption (depreciation expense). The annual average life cycle cost for the services covered in this asset management plan is $1,091,814.

Life cycle costs can be compared to life cycle expenditure to give an indicator of sustainability in service provision. Life cycle expenditure includes maintenance plus capital renewal expenditure. Life cycle expenditure will vary depending on the timing of asset renewals. The life cycle expenditure at the start of the plan is $460,172.

A gap between life cycle costs and life cycle expenditure gives an indication as to whether present consumers are paying their share of the assets they are consuming each year. The purpose of this Sewer asset management plan is to identify levels of service that the community needs and can afford and develop the necessary long term financial plans to provide the service in a sustainable manner.

The life cycle gap for services covered by this asset management plan is $631,642 per annum. The life cycle sustainability index is 0.42

Medium term – 10 year financial planning period

This asset management plan identifies the estimated maintenance and capital expenditures required to provide an agreed level of service to the community over a 20 year period for input into a 10 year financial plan and funding plan to provide the service in a sustainable manner.

This may be compared to existing or planned expenditures in the 20 year period to identify any gap. In a core asset management plan, a gap is generally due to increasing asset renewals.

Fig 8 shows the projected asset renewals in the 20 year planning period from the asset register. The projected asset renewals are compared to planned renewal expenditure in the capital works program and capital renewal expenditure in year 1 of the planning period as shown in Fig 8. Table 6.1.1 shows the annual and cumulative funding gap between projected and planned renewals.

Fig 8. Projected and Planned Renewals and Current Renewal Expenditure

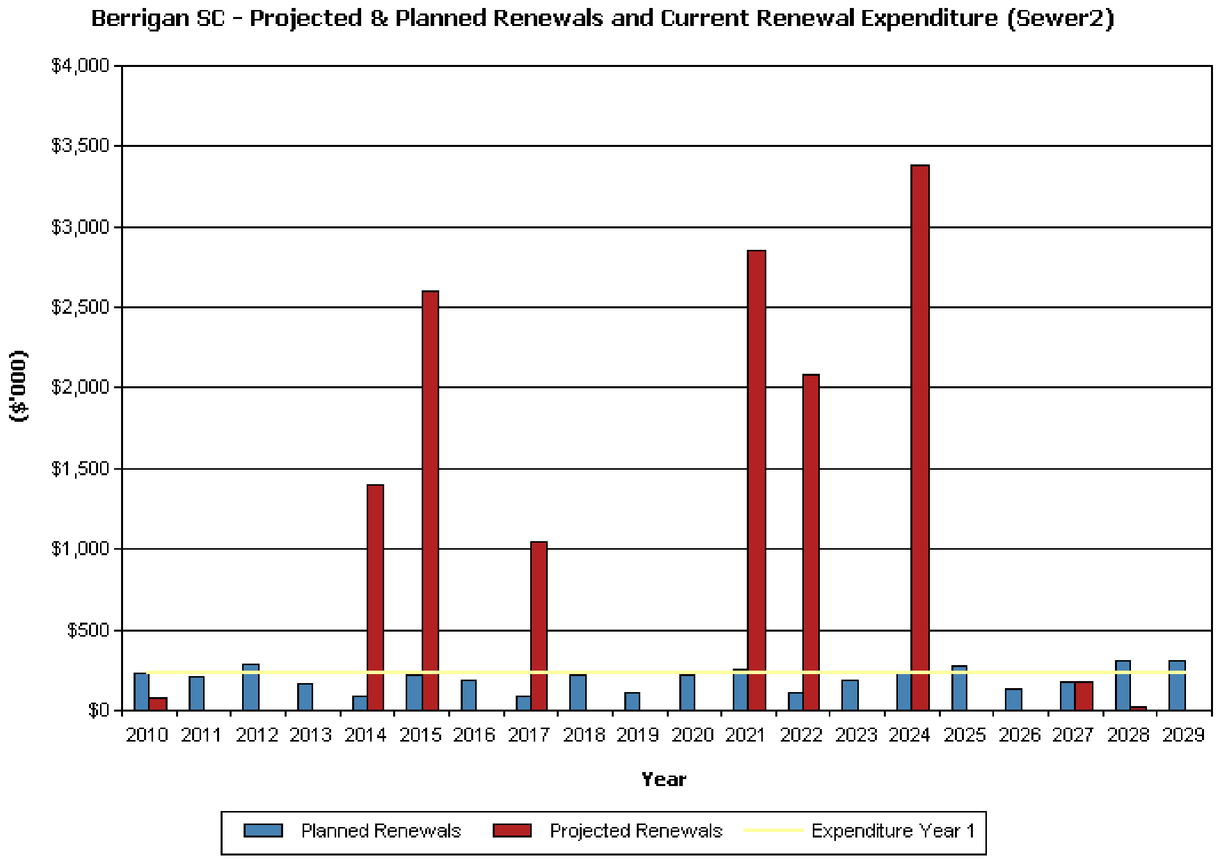


Table 6.1.1 shows the gap between projected and planned renewals.

Table 6.1.1 Projected and Planned Renewals and Expenditure Gap

Year	Projected Renewals	Planned Renewals	Renewal Funding Gap	Cumulative Gap
2010	$73.25	$229.00	-$155.75	-$155.75
2011	$0.00	$207.80	-$207.80	-$363.55
2012	$0.00	$285.00	-$285.00	-$648.55
2013	$0.00	$160.00	-$160.00	-$808.55
2014	$1,402.20	$92.50	$1,309.70	$501.15
2015	$2,599.72	$218.00	$2,381.72	$2,882.87
2016	$0.00	$183.00	-$183.00	$2,699.87
2017	$1,051.65	$90.00	$961.65	$3,661.52
2018	$0.00	$218.00	-$218.00	$3,443.52
2019	$0.00	$112.50	-$112.50	$3,331.02

2020	$0.00	$223.00	-$223.00	$3,108.02
2021	$2,856.27	$258.00	$2,598.27	$5,706.29
2022	$2,084.21	$110.00	$1,974.21	$7,680.50
2023	$0.00	$190.00	-$190.00	$7,490.50
2024	$3,385.15	$227.50	$3,157.65	$10,648.15
2025	$3.93	$270.00	-$266.07	$10,382.08
2026	$0.00	$130.00	-$130.00	$10,252.08
2027	$178.20	$178.00	$0.20	$10,252.28
2028	$18.15	$312.50	-$291.85	$9,960.43
2029	$0.00	$312.50	-$312.50	$9,647.93

Providing services in a sustainable manner will require matching of projected asset renewals to meet agreed service levels with planned capital works programs and available revenue.

A gap between projected asset renewals, planned asset renewals and funding indicates that further work is required to manage required service levels and funding to eliminate any funding gap. The quantum of the gap will be greatly impacted by any changes in the useful life of assets and in particular the sewer reticulation pipes. As many of these pipes are reaching the end of their nominal useful life it is imperative that CCTV inspections be carried out for these pipes to allow an estimation of their remaining useful life.

Council will manage the 'gap' by developing this asset management plan to provide guidance on future service levels and resources required to provide these services, and by inspecting the pipe network to estimate the remaining useful life of these assets. Once this work is complete it will be necessary to review this plan.

Council's long term financial plan covers the first 10 years of the 20 year planning period. The total maintenance and capital renewal expenditure required over the 10 years is $9,094,370.

This is an average expenditure of $909,437. Estimated maintenance and capital renewal expenditure in year 1 is $535,390 and this would give a 10 year sustainability index of 0.59.

6.2 Funding Strategy

Projected expenditure identified in Section 6.1 is to be funded from Council's operating and capital budgets. The funding strategy is detailed in the Council's 10 year long term financial plan (Attached as Appendix D)and this allows for the build up of reserve funds to balance projected renewal costs over the life of the assets.

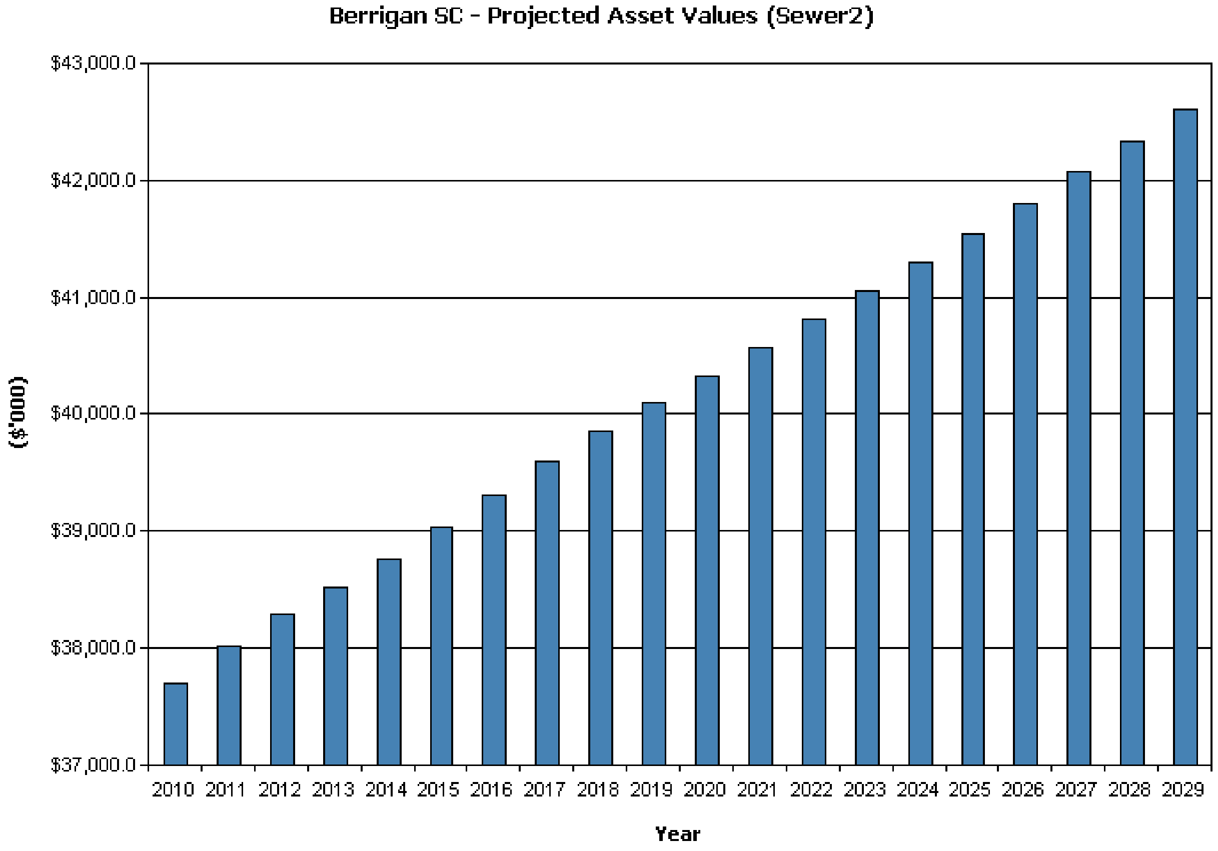
Maintaining the current level of fees and charges should see sufficient funds raised to cover the long term sustainability of all sewer assets. Within the 10 year time frame a surplus of $5.8m will be accumulated over the proposed expenditure and this compares to an $8m surplus over this period if only projected renewal works are completed.

Achieving the financial strategy will require the maintenance of current levels of fees and charges for sewerage services in real terms and the smoothing of asset renewal expenditure by prioritising renewals in line with criteria set out in Table 5.4.1.

6.3 Valuation Forecasts

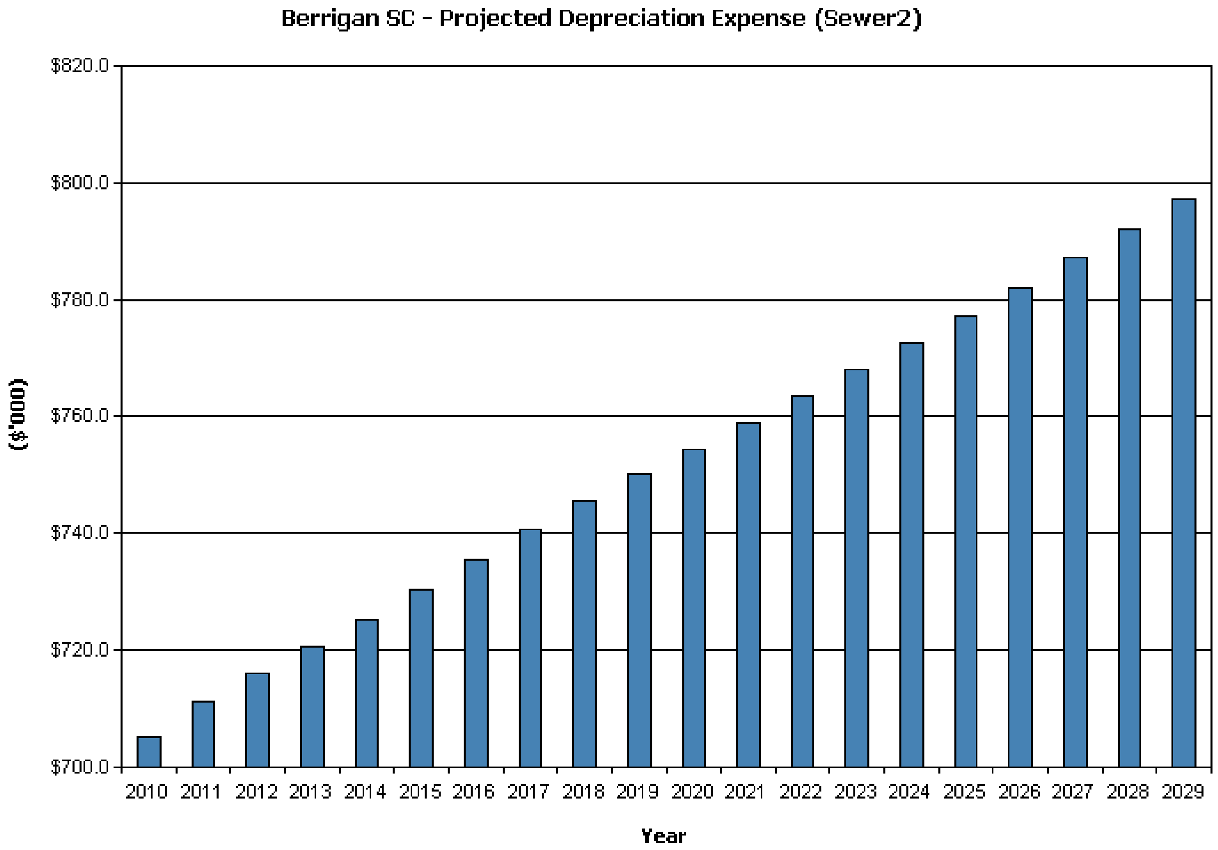
Asset values are forecast to increase as additional assets are added to the asset stock from construction and acquisition by Council and from assets constructed by land developers and others and donated to Council. Fig 9 shows the projected replacement cost asset values over the planning period in current 2010 dollar values.

Fig 9. Projected Asset Values



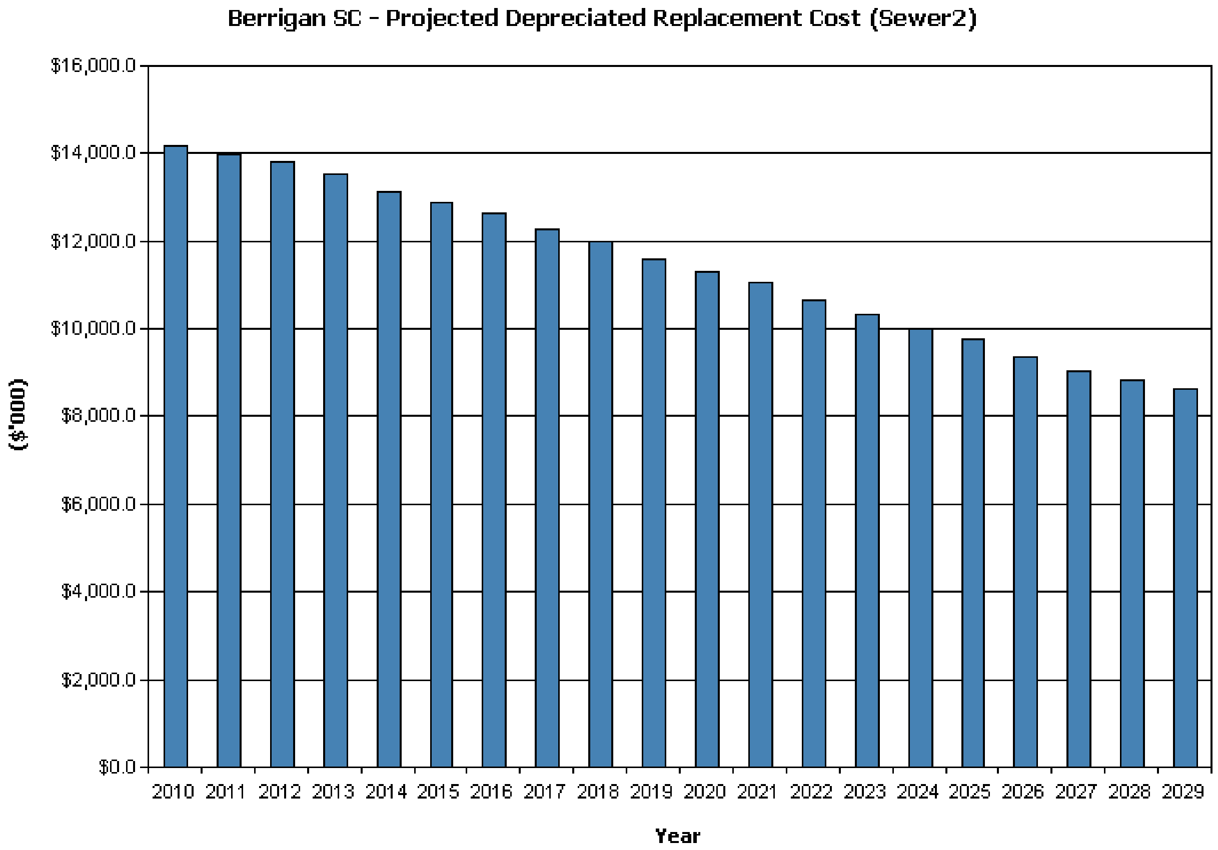
Depreciation expense values are forecast in line with asset values as shown in Fig 10.

Fig 10. Projected Depreciation Expense



The depreciated replacement cost (current replacement cost less accumulated depreciation) will vary over the forecast period depending on the rates of addition of new assets, disposal of old assets and consumption and renewal of existing assets. Forecast of the assets' depreciated replacement cost is shown in Fig 11.

Fig 11. Projected Depreciated Replacement Cost



6.4 Key Assumptions made in Financial Forecasts

This section details the key assumptions made in presenting the information contained in this asset management plan and in preparing forecasts of required operating and capital expenditure and asset values, depreciation expense and carrying amount estimates. It is presented to enable readers to gain an understanding of the levels of confidence in the data behind the financial forecasts.

Key assumptions made in this asset management plan are:

- Renewal costs for gravity mains are 80% of current replacement value as the mains would be relined rather than replaced
- Assets have been given nominal useful life values on the basis of guidelines produced by the NSW Department of Local Government.
- The useful life of all asbestos cement gravity mains have been increased from 45 years to 55 years pending CCTV survey of condition.

Accuracy of future financial forecasts may be improved in future revisions of this asset management plan by the following actions.

- Condition assessments to be carried out for all assets to estimate remaining life and subsequently reassess the useful life values.
- The expected distribution of revised useful life values will allow for a smoothing of projected renewal costs and a more accurate forecast of renewal cost projections.

- The completion of CCTV surveys of all gravity mains in Tocumwal, Finley and Berrigan is essential to provide accurate financial forecasts.

- Construction costs need to be monitored to ensure the replacement costs being used in the plan are realistic.

7. ASSET MANAGEMENT PRACTICES

7.1 Accounting/Financial Systems

The accounting/financial system used by Berrigan Shire is Civica PCS and the costing accounts for sewer are basically broken into maintenance and capital. It would be desirable for the chart of accounts to be further developed to enable the clear separation of operation costs and maintenance costs and to split the maintenance costs into reactive, planned and cyclic. It would also be desirable to clearly separate capital expenditure into renewal, new and upgrade works.

The financial system is controlled by the Finance Manager with assistance from the Finance Officer. The Finance Manager is accountable for configuration and maintenance of the system. Area managers are responsible for the timely provision of data to be input into the system and various officers subordinate to the Finance Manager are responsible for the accurate and timely input of data to the system.

The following accounting standards/regulations/guidelines shall be complied with:

Applicable Australian equivalents to International Financial Reporting Standards (AIFRSs)'

Other authoritative pronouncements for the Australian Accounting Standards Board,

Urgent Issues Group Interpretations,

The Local Government Act (1993) and Regulations and

The Local Government Code of Accounting Practice and Financial Reporting.

Where work is carried out on an asset that will increase its useful life and is greater than $5,000 in value it will be considered a capital improvement.

The chart of accounts will be further developed to enable the clear separation of operation costs and maintenance costs and to split the maintenance costs into reactive, planned and cyclic. It will also be developed to clearly separate capital expenditure into renewal, new and upgrade works.

7.2 Asset Management Systems

Sewer assets are managed using the BizeAsset system. This system is map based using MapInfo/Microsoft Access for inventory and special records. The sewer asset inventory is complete at the global level, however, it could be improved by separating assets such as pumping stations and treatment works into smaller components. The BizeAsset system also provides modelling tools for asset replacement, however, these have not been used to this point as the emphasis has been on inputting inventory data.

A maintenance management system called CWorks is also used for programming and recording maintenance activities.

Currently neither of these systems is directly linked to the Civica PCS accounting/financial system, however, such a link would be desirable to provide accuracy and consistency of information between the systems. Depreciation calculations are completed using BizeAsset and the results then transferred to Civica PCS.

The asset management system is controlled by the Director Technical Services with assistance from the Executive Engineer. Data input and validation of data is carried out by the Technical Officer – Assets with security of the system being the responsibility of the IT Officer.

It is not envisaged that the asset management system will change in the period to the next review of this plan. It would be desirable for the asset management systems to be integrated with the accounting/financial system and this is a possibility with the development of Civica products. The estimated cost of such an integration puts it out of reach within the short term.

7.3 Information Flow Requirements and Processes

The key information flows *into* this asset management plan are:

- The asset register data on size, age, value, remaining life of the network;
- The unit rates for categories of work/material;
- The adopted service levels;
- Projections of various factors affecting future demand for services;
- Correlations between maintenance and renewal, including decay models;
- Data on new assets acquired by council.

The key information flows *from* this asset management plan are:

- The assumed Works Program and trends;
- The resulting budget, valuation and depreciation projections;
- The useful life analysis.

These will impact the Long Term Financial Plan, Strategic Business Plan, annual budget and departmental business plans and budgets.

The financial reports generated by BizeAsset including valuations, depreciation calculations etc. are provided to the Finance Manager for input into Civica PCS financial system. Actual construction costs for capital works are provided by financial services staff to the Technical Officer – Assets for input into BizeAsset.

New assets constructed by Council are captured by the Technical Officer – Assets from the adopted works program with confirmation of construction from the Environmental Engineer. Actual construction costs for capital works are provided by financial services staff to the Technical Officer – Assets for input into BizeAsset.

New assets gifted to Council by developers are captured by the Technical Officer – Assets from 'As Constructed' drawings and cost estimates submitted by developers. These plans and estimates are checked and signed off by the Environmental Engineer as correct.

7.4 Standards and Guidelines

The standards and guidelines relevant to this plan are set out below:

AAS27, Financial Reporting by Local Governments, Australian Accounting Standards, June 1996.

AASB1031,Materiality, Australian Accounting Standards Board, July 2004.

AASB116, Property, Plant and Equipment, Australian Accounting Standards Board, July 2007.

2009/2010 Management Plan, Berrigan Shire Council

International Infrastructure Management Manual, Institute of Public Works Engineering Australia, 2006

Local Government Asset Accounting Manual, Department of Local Government, New South Wales, Update No. 4, 1999

8. PLAN IMPROVEMENT AND MONITORING

8.1 Performance Measures

The effectiveness of the asset management plan can be measured in the following ways:

- The degree to which the required cashflows identified in this asset management plan are incorporated into council's long term financial plan and Strategic Management Plan;
- The degree to which 1-5 year detailed works programs, budgets, business plans and organisational structures take into account the 'global' works program trends provided by the asset management plan;

8.2 Improvement Plan

The asset management improvement plan generated from this asset management plan is shown in Table 8.2.

Table 8.2 Improvement Plan

Task No	Task	Responsibility	Resources Required	Timeline
1.	Condition Rating of assets including CCTV survey of gravity mains	EE	Staff	June 2012
2.	Review of remaining life of assets following condition ratings	EE	Staff	June 2012
3.	Componentisation of point assets such as pumping stations and treatment plants including review of unit costs	EE, TOA	Staff	March 2012
4.	Document methodology and procedures for asset useful lives, asset unit costs, condition rating and depreciation calculations	DTS, DCS	Staff	June 2010
5.	Develop chart of accounts to allow separation of operation costs and maintenance costs and to split the maintenance costs into reactive, planned and cyclic and to separate capital expenditure into renewal, new and upgrade works.	FM	Staff	June 2010
6.	Investigate options for integration of the Asset Management System with the Accounting/Financial System	FM, EXE	Staff	March 2012
7.	Carry out community consultation to allow the development of Desired Levels of Service when this plan is reviewed in 2013	DCS	Staff/External	March 2013

8.3 Monitoring and Review Procedures

This asset management plan will be reviewed during annual budget preparation and amended to recognise any changes in service levels and/or resources available to provide those services as a result of the budget decision process.

The Plan has a life of 4 years and is due for revision and updating within 2 years of each Council election.

REFERENCES

DVC, 2006, 'Asset Investment Guidelines', 'Glossary', Department for Victorian Communities, Local Government Victoria, Melbourne, http://www.dvc.vic.gov.au/web20/dvclgv.nsf/allDocs/RWP1C79EC4A7225CD2FCA257170003259F6?OpenDocument

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AAS27, Financial Reporting by Local Governments, Australian Accounting Standards, June 1996.

AASB1031,Materiality, Australian Accounting Standards Board, July 2004.

AASB116, Property, Plant and Equipment, Australian Accounting Standards Board, July 2007.

2009/2010 Management Plan, Berrigan Shire Council

Local Government Asset Accounting Manual, Department of Local Government, New South Wales, Update No. 4, 1999

IPWEA NAMS.PLUS, Asset Management, A Guided Pathway to Asset Management Planning.

Report on Water and Wastewater Infrastructure Maintenance Strategy, GHD, 1997

Sewerage Strategic Business Plan, Fisher Stewart,1997

OH&S Audit Report of the Water and Sewerage Schemes Facilities, DPWS, 1999

Finley Urban Water Plan, DPWS, 2000

Planning Workshop No. 2 Report, DPWS, 2000

Water and Sewerage Strategic Business Planning Review, DPWS, 2001

Water and Sewerage Strategic Business Planning Review, BSC, 2004

Berrigan Shire Council – State of Environment Report, 2008

Berrigan Shire Council – Local Environmental Plan, 1992

Berriquin Land and Water Management Plan, 1995

APPENDICES

Appendix A Plans of Sewer Reticulation for Barooga, Berrigan, Finley and Tocumwal

G:\Asset Management Plans\Berrigan Sewer Plan

Finley Sewer Plan

Barooga Sewer Plan

Tocumwal Sewer Plan

Appendix B Projected 20 year Capital Renewal Works Program

G:\Asset Management Plans\sewer graphs\Sewer2\RenewProg_Excel

Appendix C Planned Upgrade/Exp/New 20 year Capital Works Program

G:\Asset Management Plans\CapitalWorksSewer 09 - Revised - 16.07.2009

Appendix D 10 Year Long Term Financial Plan

G:\Asset Management Plans\Sewer 10Financial Plan

3. Sewer Management for Sewer Collection Systems in USA

United States
Environmental Protection
Agency

FACT SHEET

Asset Management for Sewer Collection Systems

For wastewater management utilities, asset management can be defined as managing infrastructure capital assets to minimize the total cost of owning and operating them, while delivering the service levels customers desire. It is successfully practiced in urban centers and large regional sewer collection systems to improve operational, environmental, and financial performance. Many of these large organizations base asset management planning on sophisticated information systems and extensive personnel resources.

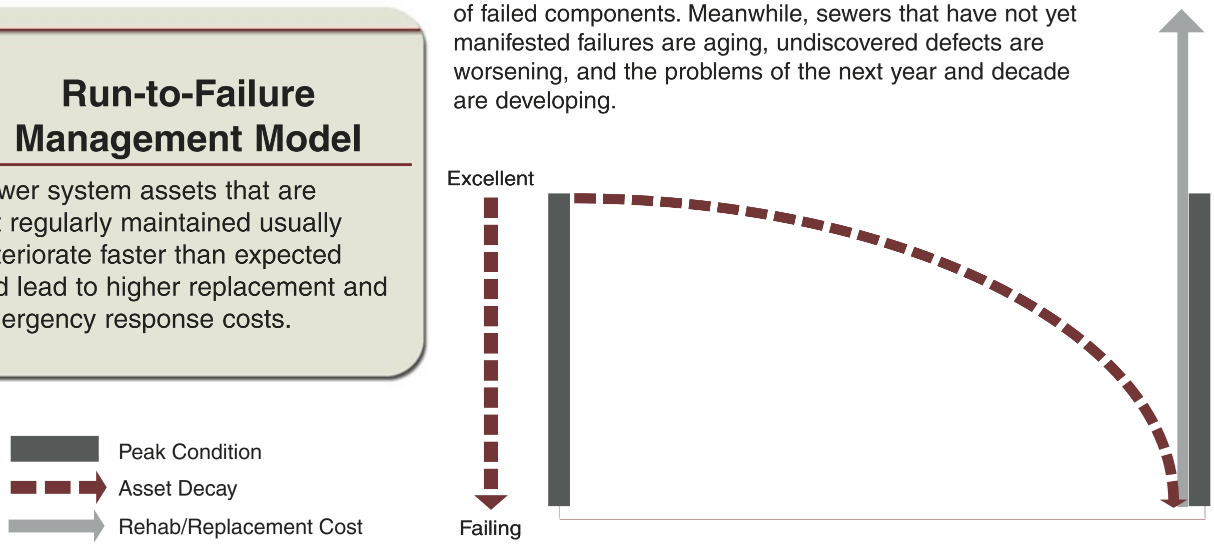
But a simpler form of asset management can be used by smaller collection system owners, starting with existing systems, staff and resources. Continuous improvement planning can then be used to provide program depth and coverage as implementation progresses. Developed to foster more efficient financial and physical resource investments and to prolong the life of infrastructure system components, asset management offers the potential to more than pay for itself over the long term. It can also serve as a logical, cost-effective framework for making organizational changes to meet new environmental regulations and financial reporting requirements.

Why Invest in Asset Management?

Many wastewater treatment utilities serving communities with individual or combined annual revenues of $100 million or less are located in areas that have grown dramatically over the past 30 years. Most have invested heavily in collection system expansions (to serve growing populations) and wastewater treatment plant upgrades (to handle the additional volumes and to meet tighter environmental requirements). Even with local rate and tax increases, a relatively small component of the wastewater utility budget goes toward improving the condition of the collection system. Lacking adequate focus on operations and maintenance, many collection system utilities have slipped into a reactive mode, with most of the operational resources allocated to emergency response and rehabilitation or replacement of failed components. Meanwhile, sewers that have not yet manifested failures are aging, undiscovered defects are worsening, and the problems of the next year and decade are developing.

Run-to-Failure Management Model

Sewer system assets that are not regularly maintained usually deteriorate faster than expected and lead to higher replacement and emergency response costs.



What is the national scope of the problem?

No one knows exactly, since there is no nationwide inventory of sewer pipe. One estimate is derived from data reported in Optimization of Collection System Maintenance Frequencies and System Performance, a 1999 study of sewer system maintenance practices prepared by the American Society of Civil Engineers (ASCE) under an EPA Cooperative Agreement (ASCE, 1999). In this study, ASCE surveyed wastewater utilities representing a good cross section of system sizes, populations served, and geographic regions. Of 42 utilities surveyed, an average of 21 feet of sewer was provided per person, which would equate to almost 1.2 million miles of sewer (owned by public and private entities) when extrapolated to the entire U.S. population served by sewers. Among these same agencies, an average of 57.5% of the system assets were reported to be between 21 and 100 years old, with 41.1% reported as between 21 and 50 years old and 16.8% greater than 51 years old. These data suggest that by 2020, up to half of the assets in these systems may be beyond the midpoint of their useful lives (which is generally assumed to be about 100 years). If these statistics hold true for the majority of utilities across the country, they represent an unprecedented need for capital replacement funding just beyond the fiscal horizon.

Each collection system utility is responsible for making sure that its system stays in good working order—regardless of the age of components or the availability of additional funds. Asset management programs with long-range planning, life-cycle costing, proactive operations and maintenance, and capital replacement plans based on cost-benefit analyses can be the most efficient method of meeting this challenge. Use of asset management will help protect sewers and extend financial resources by:

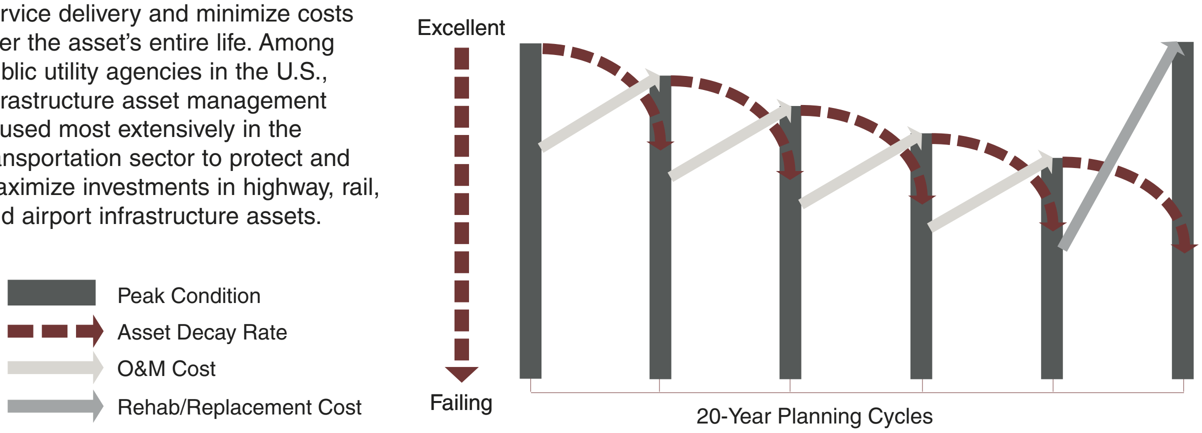
- Making sure components are protected from premature failure through proper operations and maintenance.
- Facilitating proactive capital improvement planning and implementation over longer cycles to reduce annual and overall costs.
- Reducing the need for expansions and additions through demand management (I/I reduction, flow balancing, etc.)
- Reducing the cost of new or planned investments through economic evaluation of options using life-cycle costing and value engineering.
- Focusing attention on results by clearly defining responsibility, accountability, and reporting requirements within the organization.

What is asset management?

Asset management is a continuous process that guides the acquisition, use, and disposal of infrastructure assets to optimize service delivery and minimize costs over the asset's entire life. Among public utility agencies in the U.S., infrastructure asset management is used most extensively in the transportation sector to protect and maximize investments in highway, rail, and airport infrastructure assets.

Asset Management Model

Components are regularly maintained over long planning cycles, and finally replaced when deterioration outweighs the benefit of further maintenance. Costs are well-distributed over the life of the asset.



An infrastructure asset is any long-lived capital asset that is operated as a system or network, such as a sewer collection system. The sewers, manholes, and pump stations are the primary asset components of the collection system. Buildings that are integral to the function of the network, such as pump station houses, are also considered part of the infrastructure asset.

The key elements of asset management are:

- Level of service definition
- Selection of performance goals
- Information system
- Asset identification and valuation
- Failure impact evaluation and risk management
- Condition assessment
- Rehabilitation and replacement planning
- Capacity assessment and assurance
- Maintenance analysis and planning
- Financial management
- Continuous improvement

These elements should be implemented by everyone in the organization, involving management, financial, engineering, administrative and field staff.

This sounds familiar. Isn't it the same as CMOM?

When utilities operate in a reactive mode, most of their resources go to emergency response and replacement or rehabilitation only after performance problems have surfaced. In recognition of the current and future problems associated with this approach, many people in technical leadership of the wastewater industry support the adoption of dynamic management, operation, and maintenance approaches for sanitary sewer collection systems. These dynamic approaches use information about system performance, changing conditions, and operation and maintenance practices to guide and modify responses, routine activities, procedures, and capital investments to try to prevent problems from occurring.

EPA, in conjunction with municipal and other industry representatives, has developed a framework for a dynamic management approach to collection systems called the capacity, management, operation, and maintenance (CMOM) approach. The CMOM approach is an information-based approach to setting priorities for activities and investments. CMOM embodies many asset management principles as they apply to collection systems such as defining goals, using an information-based approach to set priorities, evaluating capacity and taking steps to ensure it is adequate, developing a dynamic, strategic approach to preventive maintenance, and conducting periodic program audits to identify program deficiencies and ways to address those deficiencies.

Integrating asset management planning with a CMOM program can improve the effectiveness of the CMOM effort. An emphasis on asset management can better ensure that the key components of a strategic business plan, such as level of service definition, rate setting, budgeting, financing, and value-engineering are taken into consideration.

Sewer collection system utilities should begin implementing CMOM as soon as possible, especially if they are experiencing SSOs or contributing to peak flow violations at wastewater treatment plants. Following is a general discussion of ways to implement CMOM in an asset management framework.

What about GASB 34?

Carrot and Stick Approach to Encouraging Fiscal Responsibility

Government Accounting Standards Board Statement 34 (GASB 34) includes both requirements for reporting of public infrastructure assets in a government's financial statement and options for reporting additional information by governments that use asset management systems. The new rules are designed to establish a basic financial reporting model that will result in greater accountability by state and local governments by providing more useful information to a wider range of users than did the previous model. Communities that opt not to comply with the GASB 34 financial reporting requirements will not present financial statements in accordance with generally accepted accounting principles (GAAP).

The Stick: Full Accrual Accounting and Management Discussion and Analysis

GASB 34 requires full accrual accounting principles to be used in government-wide financial statements, reporting to readers of financial statements such as ratepayers and creditors, the historical cost of all the capital assets used in delivering services and the full cost of providing services to the public.

The modified accrual basis of accounting used by many collection systems in the past did not provide complete information about the system. This type of financial statement would show whether a given year's revenues were adequate to cover the cost of sewer system operations and debt service requirements for that same year. It would not show the capital assets used to provide service and whether the net assets of the system were increasing, decreasing, or remaining the same.

With full accrual accounting, collection system utilities must report the historical cost of the sewer system and its components. Revenues include all earnings of the system, even those that will be collected in cash in future years. Expenses of the system include annual depreciation (or preservation costs, if the modified approach is used), as well as all expenses incurred during the year, regardless of whether they were paid during the year or shortly after year end, or won't be paid until some time in the future.

Financial statements presented in the annual report must be accompanied by a management discussion and analysis (MD&A) that provides an analysis of the system's overall financial position and results of operations, to assist users in assessing whether the position has improved or deteriorated as a result of operations. The MD&A also provides information on known facts, decisions, or conditions that may have a significant effect on future financial results. It may also include information about the current condition of the system, how that condition compares with the condition level established by the government, and differences between the amount estimated to be needed to preserve and maintain the system, and the amount actually incurred.

GASB 34 offers a phased schedule for implementing the new reporting requirements. Communities with $100 million or more in annual revenues (government-wide, not just collection system revenues, for the year ending after June 15, 1999) were required to begin GASB 34 reporting in financial statements for fiscal years beginning after June 15, 2001. Communities with total annual revenue between $10 million and $100 million are required to meet the new standards in financial reporting periods beginning after June 15, 2002.

Government Total Annual Revenues in the Fiscal Year Ended After June 15, 1999	**Date of GASB 34 Transition**[1]	**End of Grace Period for Retroactive Capitalization of Infrastructure Assets**[2]
Over $100 million	June 15, 2001	June 15, 2005
$10 million— $100 million	June 15, 2002	June 15, 2006
Less than $10 million	June 15, 2003	Not required, but recommended

[1] **GASB 34 compliant financial statements should be issued for the first fiscal year beginning after this date.**

[2] **Grace period is not available for infrastructure assets reported in enterprise fund.**

Governments with less than $10 million in annual revenue should begin in financial reporting periods beginning after June 15, 2003.

Once a community has made the transition to GASB 34 reporting, any collection system components that are acquired, rehabilitated, or significantly improved should be recorded as new assets on the financial statement for the same fiscal year. Capital reporting of existing assets is also encouraged at the date of transition, but a four-year grace period is provided. Governments with less than $10 million annual revenues are not required to capitalize assets acquired before the date of transition.

Governments with less than $10 million total annual revenues are not required to retroactively capitalize system assets acquired before the date of transition. When system assets are retroactively reported, only those components that were acquired or received major renovations, restorations, or improvements in fiscal years ending after June 30, 1980, are required to be reported. It is encouraged, but not required, to report components acquired prior to that period.

Although the new infrastructure capitalization requirements will not take effect until 2005 or 2006, implementing asset management practices now would facilitate making the necessary data available when the reporting requirements take effect.

The Carrot: Modified Approach Accounting Can be Used to Avoid Depreciation

GASB 34 offers collection system owners the option of reporting the system at full historical cost, rather than reporting depreciation, as long as certain requirements are met. These requirements include maintaining the system at or above a condition level specified by the government, and managing the system using an asset management system that meets certain requirements. Under this option, known as the “modified approach,” maintenance and preservation costs are expensed and only additions and improvements to the system are capitalized. The option is appropriate for utilities that use asset management activities to preserve the service life of the system over time. In contrast, depreciation accounting, a method of systematically writing off a portion of the historical cost over an estimated useful life, is more appropriate for assets that are used up over a finite life. To use the modified approach, the asset management system must inventory the system assets, perform condition assessments, and estimate the annual amount needed to maintain and preserve the system assets at the established condition level. The condition assessment must be performed at least every three years. As required supplementary information, the government must present a schedule of the assessed condition for the three most recent condition assessments, the estimated amounts needed to maintain and preserve the system, and the amounts actually expensed for the last five years.

Depreciation Doesn’t Measure Condition

The value of a sewer system is its ability to provide service for the longest time possible for the least cost. Modified approach accounting offers a way to document in annual financial reports that the system can continue to provide service.

It may be more difficult for governments to meet the requirements to use the modified approach than it is to apply depreciation accounting, but most of these same activities are needed to meet similar CMOM requirements. The incremental effort may be modest, and the benefits of success are substantial. Sewer collection utilities that use modified approach accounting will be demonstrating to customers, lending institutions, and regulators a commitment to maintaining the assets for which they are responsible. This commitment may symbolize a government’s dedication to delivery of excellent service, proper use of public funds, and compliance with environmental and health laws. In addition, the collection system will enjoy the benefit of asset management, including lower capital replacement costs, smoother system operations, less resistance to needed rate increases, and more advantageous commercial lending terms.

Where Do Environmental Management Systems Fit In?

Asset management and environmental management systems (EMSs) have valuable attributes and can complement each other, but they are not the same. The asset management approach helps utility owners optimize maintenance and replacement cycles to cost-effectively ensure that the sewer collection system runs smoothly and to accurately predict capital funding needs over a long planning horizon. It assumes that the utility owner has identified its environmental compliance goals and has incorporated them into the planning process. By contrast, EMSs are designed to help a facility identify and manage a full range of environmental, public health, and safety issues—both regulated and unregulated (i.e., surface water, groundwater, air quality, noise, etc.) EMSs are designed to help integrate these issues into an overall system that can help continually improve environmental performance and provide other important business benefits like reduced costs through energy and water conservation, reduced chemical usage, reduced risk of noncompliance, etc.

Like asset management, EMS was developed by the private sector to improve business planning, and it has a similar philosophy: the most cost-effective way to meet environmental goals is to specifically identify them, plan for them, and set performance benchmarks to ensure they are being met. A growing number of public sector organizations, including wastewater utilities in the United States and around the world, are adopting EMSs. Many are using independent third party certification, which involves an audit by a qualified, independent third party to ensure that the EMS conforms to the elements of ISO 14001 (or another established EMS standard), and that the organization is making progress toward meeting its own performance objectives and targets. An EMS audit does not specifically look at an organization's compliance, but does help determine if the organization has procedures in place to identify legal requirements, address noncompliance should it occur, and take steps to minimize the risk of a recurrence. Several wastewater utilities in the United States have achieved ISO 14001 certification and reported significant benefits from their efforts.

The CMOM approach can be seen as a type of EMS that focuses on sewer collection system utilities. It establishes an environmental goal (employing collection system management practices to minimize SSOs or peak flow violations at a treatment plant), provides specific operations and management guidelines to achieve the goal, and requires establishment of performance measures to make sure the goal is met. It is a logical starting point for a sewer collection system utility just embarking on comprehensive business planning. CMOM does not replace the need for true EMS planning and implementation, because it only addresses environmental concerns related to surface water quality protection.

CMOM is one of many environmental management approaches available to sewer collection system utilities, and more are being developed all the time. EPA and two industry trade groups are working on a project to examine the feasibility of creating a comprehensive structure for water and wastewater utilities that brings together the strengths of tools such as asset management, CMOM, QualServe, and performance benchmarking, to create a sustainable and effective utility-wide management system. EPA, the Association of Metropolitan Sewerage Agencies (AMSA) and the Water Environment Federation (WEF) hope to present preliminary recommendations for this comprehensive approach in summer, 2002.

Does asset management have to be complex?

An asset management program does not have to be complex to be effective. A basic program can be developed around existing systems, with new systems being added as the program progresses. For utilities with relatively small collection systems and pay-as-you-go financing, complex asset management systems may not be needed to meet organizational objectives. Other communities may benefit greatly from using the asset management approach to address serious current or impending infrastructure problems. More advanced asset management systems are justified for collection systems that have:

- High value, such that asset management decisions will have a large financial impact
- Components nearing or beyond the end of their service lives, components in poor condition, and/or a history of SSOs and peak flows that contribute to permit violations at a wastewater treatment plant
- System complexity in terms of the size, design, or location of components

Regardless of the level of sophistication of the asset management system, two primary performance goals chosen by the organization should be the fullest possible implementation of the CMOM approach and compliance with the financial statement reporting requirements of GASB 34. A third recommended goal is use of the modified approach for reporting sewer collection systems in financial statements.

Components of an Asset Management System for a Sewer Collection Network

Below is a general discussion of the components of an asset management system designed to meet the objectives of the CMOM approach, comply with GASB 34 reporting requirements, and take advantage of the modified approach option for infrastructure assets.

Level of service definition.

A basic level of service definition for most collection systems will be to deliver reliable sewer collection services at a minimum cost, consistent with applicable environmental and health regulations. Level of service criteria will be system-specific, but should address CMOM and GASB 34 requirements, particularly in areas where improvements are most needed and will yield the greatest benefits. Examples include:

- Ensuring adequate system capacity for all service areas
- Eliminating system bottlenecks due to pipe blockages
- Reducing peak flow volumes through inflow/infiltration (I/I) controls
- Providing rapid and effective emergency response service
- Minimizing cost and maximizing effectiveness of CMOM programs

Performance measurements.

Performance measurements are specific metrics designed to assess whether level of service objectives are being met. Some examples of performance measurements:

- Annual performance goals for sewer system inspection, cleaning, maintenance, rehabilitation, and capital improvement
- Correlating grease control education and enforcement measures with expected reductions in the number, distribution, and severity of grease blockages
- Establishing maximum hourly and monthly peak flow volumes
- Establishing maximum emergency response time to emergency calls, tracking customer complaints and claims for private property restoration
- Performing cost-benefit analysis of key completed activities, taking into account expected vs. actual outcome and budgeted vs. actual cost

Information system.

How much information is needed to create and implement an asset management system? There is no standard answer. Each utility must analyze its information needs, based on a variety of factors such as asset management goals, performance measures selected, regulatory requirements, and collection system size, complexity, and condition.

Snapshot in Time

Begin with an evaluation and documentation of existing information systems. For each data stream, questions to answer include:

- How much data is collected?
- How is it collected and managed?
- How frequently is the information collected?
- How thorough are the records?
- Is the data available to other information systems and/or other users?

For instance, field crews may track minor sewer repairs by recording the location of the defect, the type of repair, and the cost of labor and materials. This information could be logged into an asset management system by workers who have laptop computers in the field, or they may be handwritten on a work order that ends up in a file cabinet.

Gap Analysis

The next step is to perform a side-by-side comparison between identified information needs and existing systems to reveal gaps. A prioritized, phased plan is then developed to fill in the gaps.

Automated Information Management System

Collection system information should be managed by computer to ensure its availability for analysis and decision-making. Well-designed spreadsheet databases may be adequate for some very small or streamlined collection systems, but for most utilities, information is most efficiently managed by use of asset management software programs that help organize the data, perform many standard analyses, and facilitate planning, scheduling, and budgeting. These programs range in cost and complexity from affordable, simple applications to complex, expensive solutions. A number of commercial applications are modular, so that basic systems can be enhanced and expanded over time. It is best to start with the most basic system appropriate to the utility's information needs, and add complexity over time. This approach helps control up-front hardware and software costs and makes it easier for staff to master new systems, thereby reducing margin for error during transition.

GASB 34 and CMOM Requirements for Information Systems

GASB 34 establishes use of an asset management system as a condition of eligibility for modified approach accounting, but does not set forth detailed requirements for the information system component. The CMOM approach calls for information to be managed in a way that facilitates timely decision-making for planning, prioritization, and emergency response. It also establishes basic requirements for information system elements, including:

- Up-to-date system maps.
- Data related to capacity assessment studies, sewer inspections, and sewer modeling.
- Inventory of system assets, including age, capacity, major construction materials, historical cost, and condition.
- Information related to identified structural and nonstructural defects, including type of defect, severity, location, and date of discovery.
- Records of all SSOs, including location, date discovered, internal notification procedures, estimated volume of release, emergency response action taken, and notification of affected parties, including environmental and health agencies, water supply utilities, private property owners, and the public. If the SSO impacted a surface water or sensitive environmental resource, any required environmental monitoring results should be included.
- Records of routine preventive operation and maintenance activities, including type of activity, location, date, and labor, material, and equipment costs.
- Inventory of maintenance facilities and equipment, including replacement parts.
- Results of inspections and tests for new or rehabilitated system components, including sewers, pumps, manholes, and other appurtenances.
- Schedules and budgets for routine operations and maintenance activities and planned rehabilitation and replacement projects.

For most sewer networks, geographic information systems (GIS) offer advantages over plan drawings or CAD maps. A GIS links database information to points on the map, which are primarily defined by manhole locations and their connecting sewer segments. The GIS can then be linked to the asset management system, sewer system model applications, and even billing systems. Like the asset management system, the development of a GIS can be simplified and accomplished in phases to accommodate the utility's asset management goals and available resources.

Asset identification and capitalization.

GASB 34 requires that collection system assets be identified and that their historical cost be reported.

Asset Identification

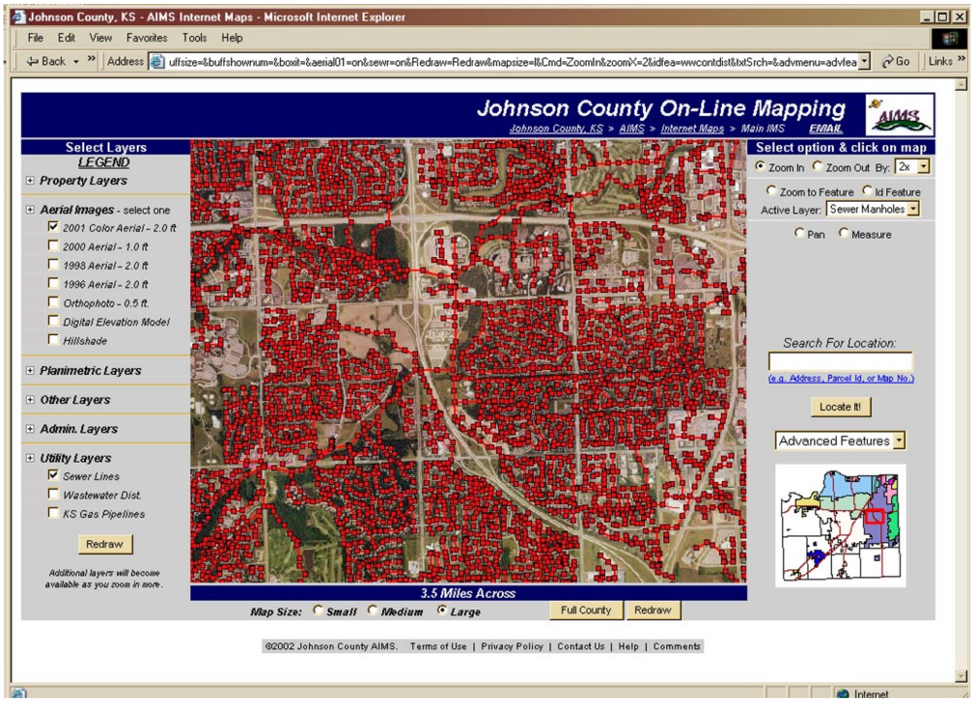
Asset identification is the process of identifying and numbering the primary components in the sewer system. Once the components are assigned unique identifiers, the utility can link information systems and aggregate data for financial, economic, technical and management use. Identification begins with architectural or engineering maps and as-built construction or repair records, which may exist in paper or electronic format. Information from these records should be transferred to a database, such as a spreadsheet, relational database, or asset management software program.

Each component record includes fields for relevant information. For instance, sewer main segments would be identified by location, length, material, size, slope, burial depth, beginning and ending manholes, and approximate or actual age. The component numbering system should be based on manholes, with the sewer segments labeled according to their relationship to the beginning and ending manholes.

Geographic Information Systems (GIS)

Johnson County, KS, uses GIS for planning, management, condition tracking, and public outreach, even providing an online mapping utility through its website.

Courtesy of Johnson County, KS



Johnson County, KS - AIMS Internet Maps - Microsoft Internet Explorer

Address: uffsize=&buffshownum=&boxit=&aerial01=on&sewr=on&Redraw=Redraw&mapsize=l&Cmd=ZoomIn&zoomX=2&idfea=wwcontdist&txtSrch=&advmenu=advfea

Johnson County On-Line Mapping

Select Layers

LEGEND

Property Layers

Aerial Images - select one

☑ 2001 Color Aerial - 2.0 ft
☐ 2000 Aerial - 1.0 ft
☐ 1998 Aerial - 2.0 ft
☐ 1996 Aerial - 2.0 ft
☐ Orthophoto - 0.5 ft.
☐ Digital Elevation Model
☐ Hillshade

Planimetric Layers

Other Layers

Admin. Layers

Utility Layers

☑ Sewer Lines
☐ Wastewater Dist.
☐ KS Gas Pipelines

Additional layers will become available as you zoom in more.

Select option & click on map

● Zoom In ○ Zoom Out By: 2x

○ Zoom to Feature ○ Id Feature

Active Layer: Sewer Manholes

○ Pan ○ Measure

Search For Location:

(e.g. Address, Parcel Id, or Map No.)

3.5 Miles Across

Map Size: ○ Small ○ Medium ● Large

©2002 Johnson County AIMS.

A utility with very little available information may limit the initial asset identification to major components, such as manholes and large-diameter gravity and force main sewers. This simple network can be expanded over time by adding smaller lines, additional manholes, pump stations, and other components.

Map data should be verified with physical system inspection methods such as closed-circuit TV (CCTV), sonar/CCTV, static camera, or person-entry. Latitude/longitude coordinates should be established or verified using global positioning surveying (GPS) techniques.

Some collection systems have never been completely inspected. Many industry experts believe that most sewer collection systems have components that are not fully identified (i.e., sewer lines that are shown on maps but have not been located in the field, or sewer lines that were added to the system, but not to the maps.) Complete sewer system inspection is an expensive and time-consuming undertaking that must be carefully planned and coordinated to support many aspects of the asset management program. Many communities will need to prioritize and plan inspection over a period of years. Highest priority for inspection should be given to sewers that have known defects, have caused or contributed to SSOs or treatment plant violations, or have the potential to impact sensitive environmental or drinking water sources.

Priorities can be further refined by performing system-wide failure impact analysis, as described below. Second-level priority should go to areas where upcoming construction projects are planned that may partially expose sewers, such as road replacement, water main construction, or other utility construction. Inspection should be coordinated so that, to the extent possible, sewer inspections are completed before the areas are disturbed. This will allow identification of sewer defects early enough to coordinate replacement or rehabilitation while the area is already being disturbed. Remaining areas of the collection system should be scheduled for inspection over a longer period of time.

Asset Capitalization

In general, the capitalized amount of an asset is defined as its acquisition cost (design, construction, land acquisition, etc.), plus capital improvements. Accumulated depreciation is also reported (except for systems accounted for using the modified approach). For collection system utilities, this capitalization amount could be established at the subsystem level—force mains, sewer mains, service laterals, manholes, catch basins, etc., or at the overall system level.

GASB 34 leaves the level of detail of asset capitalization to the discretion of the utility owner. For instance, some utilities choose to capitalize all sewer lines, manholes, and pump stations, while others capitalize only sewer mains above a certain size threshold. Either approach is considered valid.

To the extent possible, actual cost records should be used to determine the amount reported for sewer system assets. This applies unconditionally to components acquired, rehabilitated, or significantly improved after the community has made the transition to GASB 34 reporting. For these newly acquired assets, detailed acquisition records should be maintained for financial reporting purposes.

For pre-existing assets, use of actual historic cost records is encouraged, but if records are inadequate or nonexistent, GASB 34 provides several methods for estimating the historic cost. The community may decide to restrict its retroactive reporting of infrastructure to only those assets acquired, rehabilitated, and/or significantly improved after June 30, 1980. Phase 3 communities are not required to retroactively report assets, but are encouraged to do so.

Retroactive reporting of assets is not required until 2005 or 2006 for Phase 1 and 2 communities, respectively, but some communities may report those networks for which information is availabel at an earlier date. A description should be provided for those networks that are not yet reported, and whether they will be accounted for using the modified approach.

Failure impact evaluation and risk management.

The potential impacts from sewer line failures should be assessed on a system-wide basis. The goal is to identify those areas of the system that will have the most impact if a failure occurs, and focus asset management resources to minimize the risk. Failure impact severity factors to consider include location within the system, intended service function, burial depth and access barriers, proximity to public areas or environmental resources, hydrogeological features such as soil type, depth to groundwater, seismic activity, etc. Critical areas can be classified by zones, individual segments, or subnetworks within the sewer system.

As an example, a community may have established an association between a certain acidic soil type and a higher-than-average failure rate of ductile iron pipe. A high failure impact rating can then be applied to all areas where these soils occur and where ductile pipe is known to exist. Similarly, a high rating could be applied to sewer lines running under occupied structures in a commercial or residential district since any needed replacement would likely involve additional complexity, cost, and risk of private property damage.

Condition Assessment

Condition assessment is performed to identify assets that are underperforming, determine the reason for the deficiency, predict when failure is likely to occur, and determine what corrective action is needed and when.

The GASB 34 modified accounting option requires that condition assessment be based on an up-to-date inventory of assets, and that the methods used be documented in such a way that the same results could be obtained by someone else performing the same assessment. A condition level measurement scale should be used, and a minimum acceptable condition should be established and incorporated into the administrative rules governing the operation of the collection system (municipal ordinance, state or county statute, etc.)

The established condition level of the collection system is left to the discretion of the individual utility. Whatever benchmarks are chosen, they should refer primarily to the physical condition of the system and its components. For instance, an established condition level for a sewer collection system could include ensuring that no more than 10% of main sewer lines are allowed to degrade below fair condition during any 12-month period.

Condition Assessment Measurement Systems

There are many different measurement systems in use by sewer utilities. This is an example of a simple grading system found in *Managing Public Infrastructure Assets To Minimize Cost and Maximize Performance* (AMSA, 2002).

Grade	Condition	Description
0	Abandoned	No longer in service
1	Very Good	Operable and well-maintained
2	Good	Superficial wear and tear
3	Fair	Significant wear and tear; minor deficiencies
4	Poor	Major deficiencies
5	Very Poor	Obsolete, not serviceable

Condition assessment begins with the field inspector, who records defects found in sewer mains, service laterals, manholes, catch basins, and/or pump stations. These defects are characterized based on a standard notation system that is used by all field inspectors. The collection system utility establishes the appropriate level of detail. Some utilities focus on structural defects found in primary sewer lines, while others extend the inspection and rating systems to nonstructural defects and service laterals, access holes, and pump stations. The defect data gathered in the field are entered into the asset management system to allow analysis of the overall structural integrity and operating condition of each component. Some asset management software applications automatically evaluate the types and distribution of defects found in each component and assign a condition rating, while others allow the collection system manager to assign the rating manually. This analysis is then combined with the failure impact rating of the component to develop a prioritized condition rating.

Components found to be in poor condition, or with severe defects and high failure impact ratings, should be addressed as soon as possible after they are discovered. Less severe defects can be prioritized for more frequent inspection or cleaning, repair, rehabilitation, or replacement. The overall system condition is then assessed based on the aggregated condition ratings of the components to determine whether or not the system condition meets the minimum condition levels.

GASB 34 requires that the condition assessment be performed every three years:

> *Condition assessments may be performed using statistical samples that are representative of the eligible infrastructure assets being preserved. For example, one-third may be assessed each year. If a cyclical basis is used, a condition assessment is considered complete for a network or subsystem only when condition assessments have been performed for all (or statistical samples of) eligible infrastructure assets in that network or subsystem.* ***GASB 34, Paragraph 24(a), Note 19***

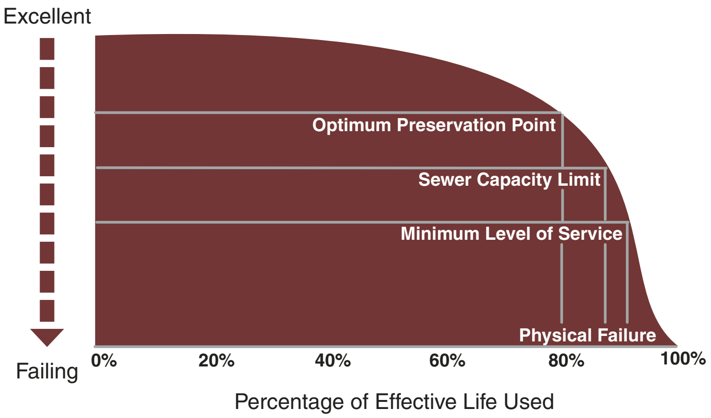
If statistical samples are employed as part of the complete condition assessment, the rationale and sampling methods must be documented. The methods must be applied consistently over time, and any changes should be documented in the MD&A.

Rehabilitation and Replacement Planning

Proactive rehabilitation and replacement planning provides the best opportunity for capital cost savings. By rehabilitating or replacing sewers and other components before they fail, the utility automatically avoids costs such as emergency contractor fees, staff overtime, unplanned repairs, and SSO cleanup costs. Additional savings can be achieved through coordination of sewer construction with other construction projects, replacing longer segments, and phasing construction over a period of years. Proactive planning also allows the utility to assess the relative economic costs and benefits of rehabilitation vs. replacement.

Replacement Planning

The goal of replacement planning is to find the point in the asset's life cycle where the cost of replacement is balanced against the accelerating cost to maintain it and declining level of service. It is much like deciding whether to repair or replace an old car.



Questions to explore for alternatives analysis include:

- When was the asset installed?
- What is the expected service life, and where is it in its life cycle?
- Can the anticipated deterioration rate and eventual failure be predicted?
- If so, what is the estimated residual life until rehabilitation or replacement is necessary?
- Could best management practices and maintenance prevent or extend the time to failure?
- Can the asset be rehabilitated? How much will rehabilitation cost?
- If so, would this extend the time to failure? By how much?
- What will be the incremental life-cycle cost of each alternative?
- Is the asset technically or commercially obsolete?

Once rehabilitation and replacement options are selected, value engineering can be performed to optimize the location, material, design, and timing of construction.

Capacity Assurance Planning

Capacity assurance planning is fundamental to the CMOM approach. EPA's draft proposed rule provides a detailed approach to sewer collection system evaluation and capacity planning (SECAP). In general, capacity planning should be based on:

- Review of operational, SSO, and peak flow data for evidence of existing capacity constraints.
- Analysis of predicted demand for sewer service, based on regional growth patterns. Where possible, sewer planning should be linked to regional land use and/or watershed management planning activities.
- Identification of current and future capacity shortfalls.
- Identification and evaluation of alternatives for correcting the deficiencies, focusing first on those that are contributing to SSOs or peak flow violations at the treatment plant.

If the utility believes that meeting the capacity demand will cause financial, operational, or physical design problems, it should explore demand management alternatives. The best way to begin is to complete a sewer system evaluation survey (SSES) to identify bottlenecks and evaluate the impact of inflow and infiltration (I/I) on system flows. If I/I is a significant component of flow, the utility should address I/I first, then evaluate capacity again. Some base flow demand management measures include flow balancing, price-based conservation incentives, and blockage elimination programs like sediment traps and grease control ordinances.

When additional capacity is required to accommodate new development, the utility can use “growth-pays-for-growth” strategies, such as requiring developers to install new service laterals as a condition of building permit issuance, requiring hook-up fees to cover costs of expanding sewer mains, additional pump stations, and treatment plant capacity. By minimizing its investment in additional capacity, the utility can focus more of its financial resources on other needed capital improvement projects.

Maintenance Analysis and Planning

An effective maintenance program keeps the sewer system running smoothly and helps prevent premature deterioration of components. Planning should be performed annually and updated throughout the year as needed to address changing conditions. Maintenance activities are either planned (i.e., inspecting all major lines in the system every 15 years, cleaning all major lines on a rotating basis every five years) or unplanned (i.e., defect repair, emergency blockage removal).

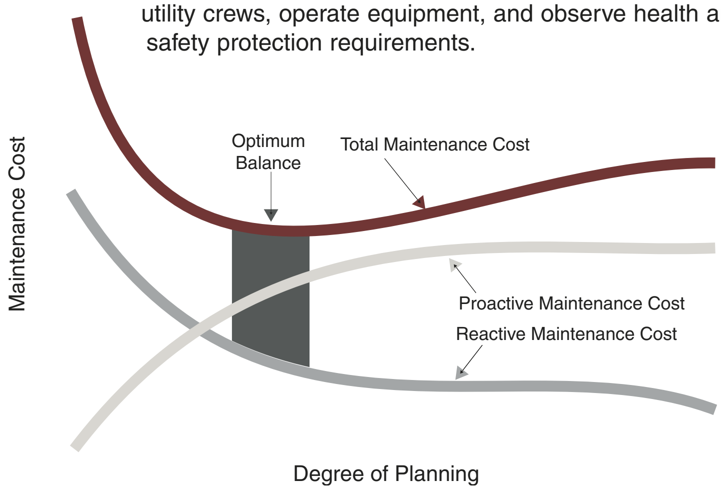
The asset management goal is to maximize planned maintenance and minimize unplanned maintenance. Planned maintenance is more cost-effective because it is performed on a non-emergency basis, is coordinated with other system operation activities, and provides more opportunity to value engineer activities during the planning process. In general, chronic unplanned maintenance conditions indicate that:

- Planned maintenance is too infrequent
- Planned maintenance is inadequate (activities are ineffective at preventing defects, or needed activities are not being performed)
- The failing component may be too deteriorated to preserve through maintenance, or it is improperly designed, and should be rehabilitated or replaced

Maintenance planning is improved by evaluating the patterns of failures leading to unplanned maintenance to see if they were related to timing (the line failed before the next cleaning was scheduled); ineffective maintenance methods (repeatedly clearing sediment blockages in a sagging line, rather than correcting the sag); or to advanced deterioration or improper design. It is important to document the assumptions, methods, and information used to support maintenance planning analysis.

Field crews should be integrally involved with maintenance planning. This gives management the benefit of field crews' on-the-ground expertise and achieves buy-in from the staff. As the maintenance program proceeds, field staff should be encouraged to provide feedback on which strategies are working and which are not, to allow mid-course corrections if necessary.

Training is also essential. Informal on-the-job training for new employees often allows improper procedures and mistaken assumptions to be passed on. This type of initiation also places too much emphasis on "what we do" and not enough on "why we do what we do," so that employees do not have enough information to respond to problems they encounter as they are performing their tasks. Maintenance activities should be documented in standard operating procedures that are reviewed for accuracy, efficiency, and effectiveness every two to three years, or as often as necessary to remain up to date. New employees should be trained on how to perform standard procedures, coordinate with other public works and private utility crews, operate equipment, and observe health and safety protection requirements.



Maintenance Planning

The goal of system maintenance is to improve system performance and preserve asset condition as long as possible. Effective planning is used to target maintenance activities to meet these goals and minimize costly emergencies.

Financial Management

The goal of sewer system financial management is to identify how much money will be needed to meet level of service goals and maintain the system at or above the identified minimum condition, forecast when the money will be needed, and use the information to set user fees, other revenues, and debt financing.

Financial forecasting should be performed over a period of five to 10 years and should be updated annually. The annual estimate of the cost to maintain the system is included in the utility's annual financial report, along with a full accounting of cash flows, debt financing, and financial reserve activity.

The better the support data, the more reliable the financial forecast. Support data include:

- Asset identification and valuation
- Condition assessment
- Performance monitoring
- Current and future capacity assessments

Where gaps in the data exist, reasonable assumptions must be used as a basis for financial forecasting.

The high up-front costs of capital acquisition often dominate the capital improvement planning process. It is important, however, to evaluate capital improvement alternatives relative to the blend of capital and lifecycle costs and the expected useful life of the asset. For instance, it may cost $1 million to construct a 36" HDPE sewer using a four-inch compacted gravel bed, and $5 million to build the same line using an eight-inch gravel bed. Over time, however, the probable higher maintenance costs and shorter useful life related to the first design would more than make up for the difference in up-front cost. Other life cycle costs that may affect the cost of ownership include the risk of harm to human health or the environment, or the risk of private or public property damage in the event of failure.

Continuous Improvement

Continuous improvement processes are based on periodic review of systems against performance measures to identify any shortfalls. Performance measures can be related to level of service goals, condition maintenance goals, or asset management system goals.

For instance, if one of the level of service goals is to shift maintenance resources from excessive emergency response to more proactive rehabilitation/replacement, then the performance measure may be a reduction in the number of sewer emergencies during the planning year, supported by corresponding increases in miles of sewer line replaced. If improvement was not achieved, the performance data would be studied to determine what barriers prevented achievement of the goal. For instance, the utility may have identified sewer lines with significant structural deterioration that required replacement, but was not able to obtain debt financing. The improvement plan would address this barrier through identification of additional sources of funding, identification of more cost-effective alternatives, or a phased replacement program to reduce the initial required investment.

Alternatively, if an operational or capital improvement program is completed and the expected performance improvement is not realized, further analysis may needed to identify the most effective next actions. Frequently, performance shortfalls occur because planning assumptions were based on incomplete information. The continuous improvement plan should include elements to improve the collection, management and use of data, including:

- More aerial coverage of asset inspection and condition assessment.
- Identification, inspection, and condition assessment of additional asset classes, such as smaller service mains and laterals.
- More sophisticated information management tools.
- Better data quality assurance.
- More data correlating types of defects and time-to-failure to improve predictive planning capability.
- More integration between operational, financial, and planning systems.
- Improved organizational efficiency through better systematization of asset management programs.

Resources

International Infrastructure Management Manual, Version 1.0. ISBN No. 0 473 06739 0 NZ National Asset Management Steering Group, Wellington, NZ, April 2000. Available for order online at www.ingenium.org.nz

Guide to Implementation of GASB Statement 34 on Basic Financial Statements–and Management's Discussion and Analysis–for State and Local Governments: Questions and Answers. Product Code GQA34. Government Accounting Standards Board, Norwalk, CT, April 2000. Available for order online at www.gasb.org

Statement No. 34 of the Governmental Accounting Standards Board: Basic Financial Statements–And Management's Discussion and Analysis–for State and Local Governments. Product Code No. GS34, June 1999. Government Accounting Standards Board, Norwalk, CT. Available for order online at www.gasb.org

Managing Public Infrastructure Assets. Association of Metropolitan Sewerage Agencies, Washington, D.C. February, 2002. Available for order online at www.amsa-cleanwater.org

For Program Information on SSO Abatement

Water Permits Division
U.S. Environmental Protection Agency
EPA East Building
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Washington, DC 20460
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Fax: (202) 564-0749
Internet: http://www.epa.gov/npdes/sso

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★ 2002 ★
THE YEAR OF
CLEAN WATER
Celebration & Recommitment

Town of Bethlehem

Department of Public Works

Asset Management

Capital Plan

Financial Analysis

Asset Management

- A comprehensive and structured approach to the long term management of assets as tools for the efficient and effective delivery of community benefits

Why Asset Management?

- Aging Infrastructure
- -Many assets reaching end of useful life
- Increased Public Awareness
- -Sewer and water line failures
- Reduced funding
- Plan for future demand

Asset Management

- Inventory all assets
- Assess Condition
- Perform Risk Assessment
- Develop Integrated Management Strategy

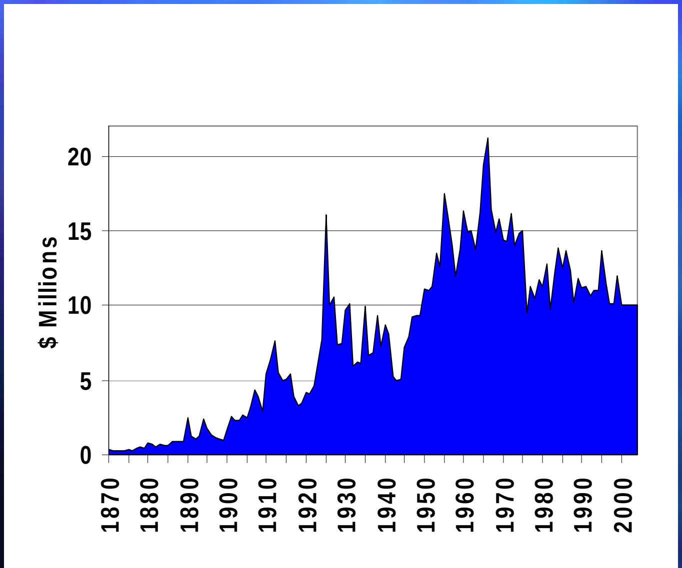
DPW Assets

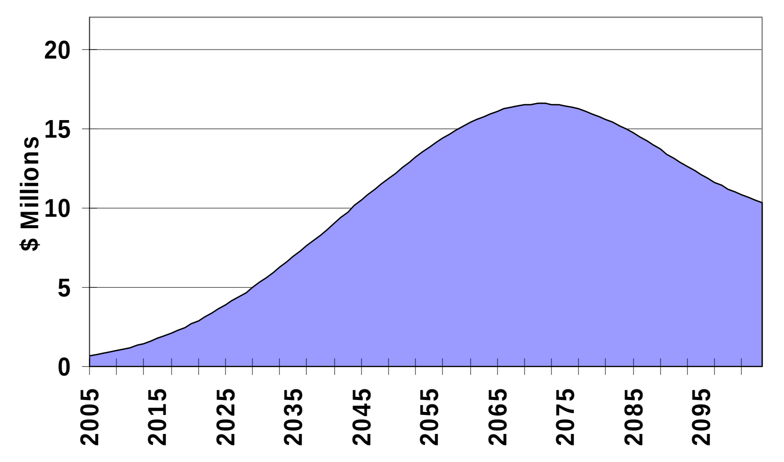
- Water mains
- Over 1,000,000 feet

Replacement needs reflect an echo of earlier demographic waves

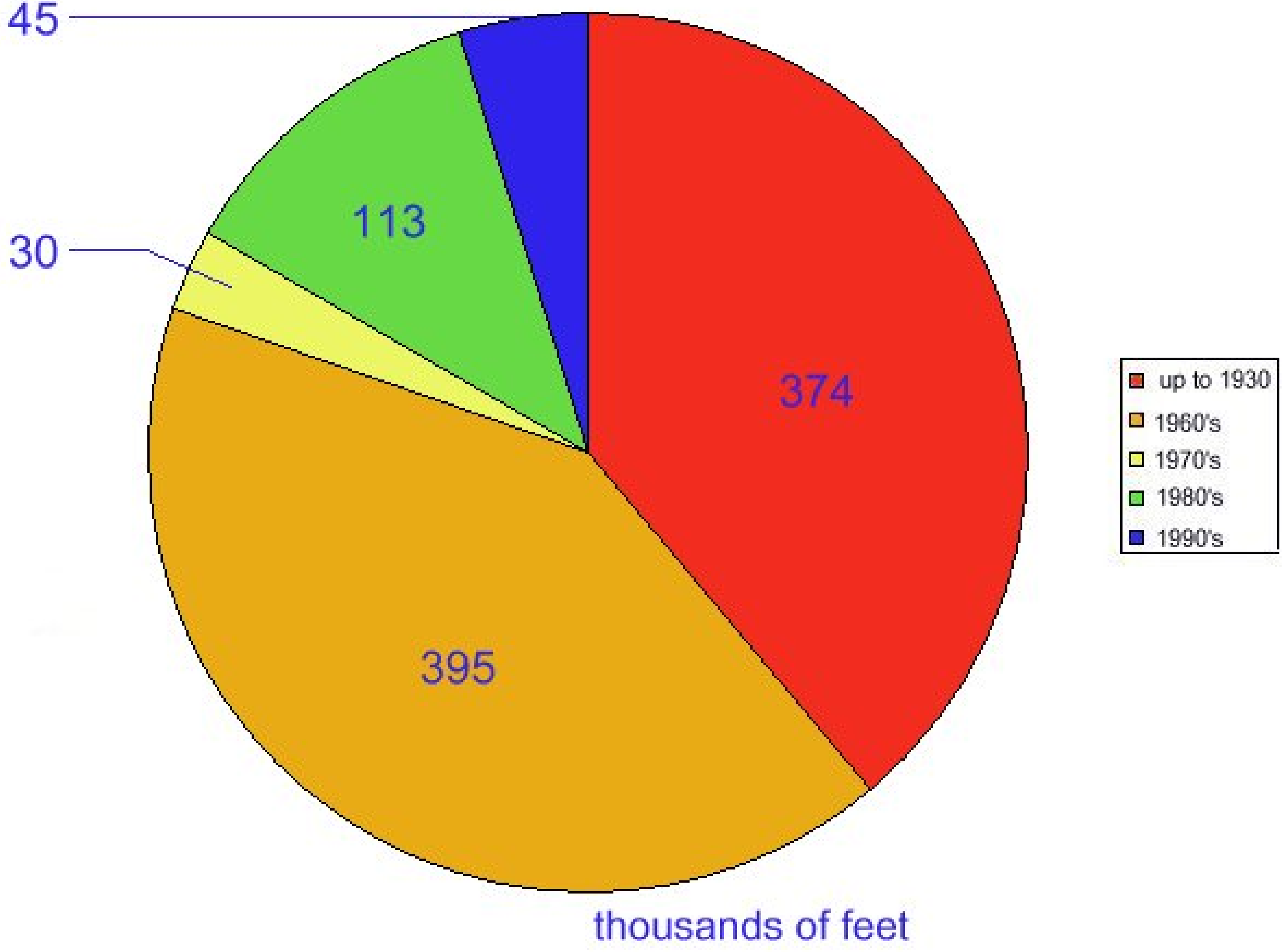
Water Main Construction

Future Pipeline Replacement Needs

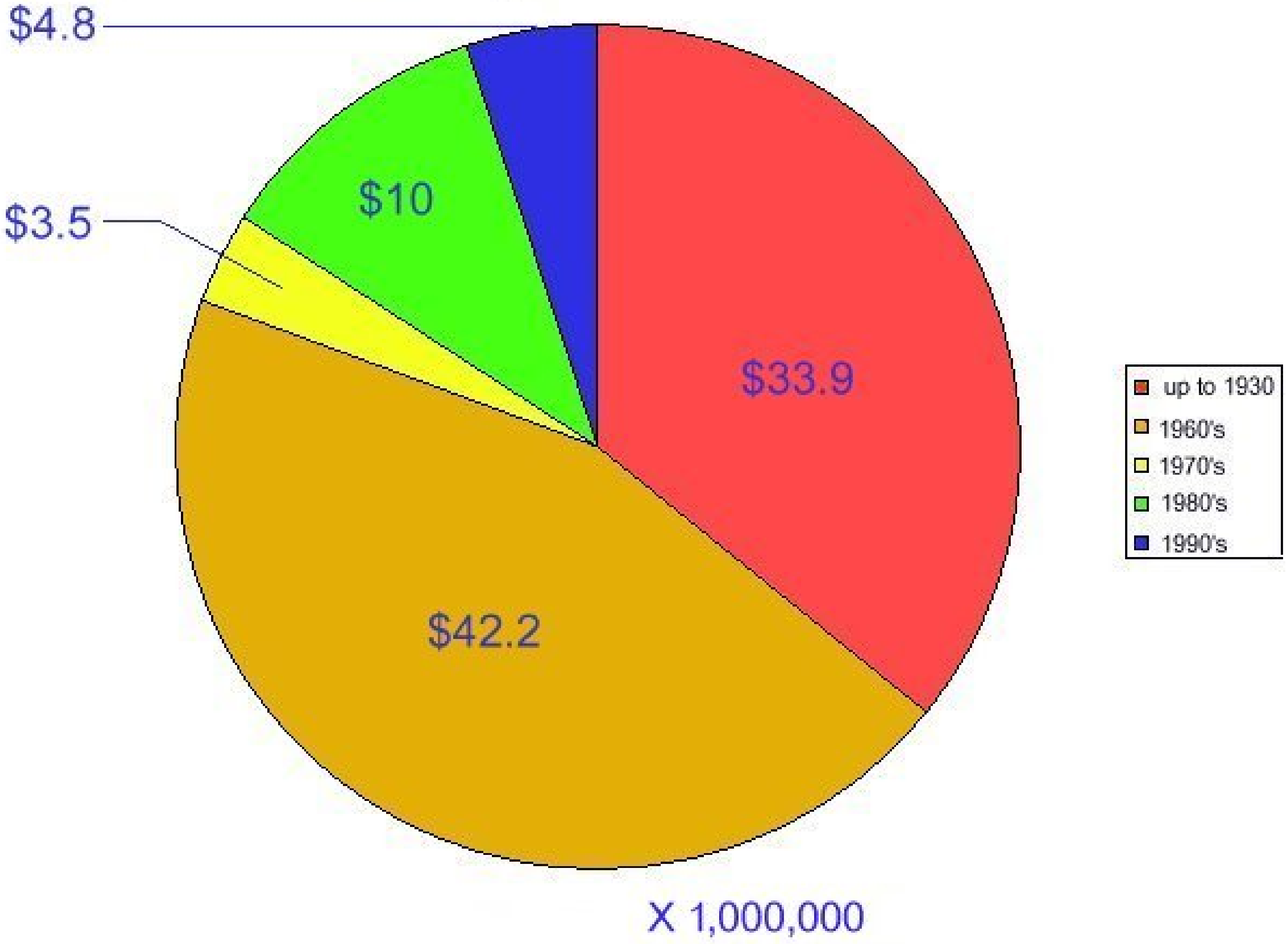




Amount of Water Pipe Installed During Various Decades



Present Replacement Value of Water Pipe Installed During Various Decades



DPW Assets

- Water Tanks
- Kenwood – 1928
- Selkirk – 1964
- Elm Ave – 1979
- Park – 1984
- New Scotland - 1984

DPW Assets

- Sewer Mains
- Over 900,000 feet

Sewer Line Infiltration

DPW Assets

- Water Filtration Plant-New Salem
- -1.1 billion gallon reservoir
- -Filtration Plant 5MGD , 50 years old and at end of useful life

DPW Assets

- Water Plant-Clapper Road
- Wells with 6 MGD capacity
- Filtration Plant with 6 MGD capacity and 12 years old

DPW Assets

- Reservoirs and Dams
    - Vly Reservoir
    - Old Reservoir adjacent to New Salem Water Tank

DPW Assets

- Sewer Plant - Dinmore Road
- 5.9 MGD permit capacity
- 33 years old

DPW Assets

- Sewer Pumping Stations
- 39 stations
- Age is from over 70 years old to two years
- 70% are over 20 years old

02.20.2007

Future Demand

- Comprehensive Plan has identified areas where we can expect additional water and sewer demand
- DPW has developed a projected water system demand and has developed a long term plan to achieve adequate supply

Capital Improvement Plan

- DPW has taken a ten year look ahead to determine the priority needs for water and sewer infrastructure
- The capital plan is reviewed annually to determine if the highest priorities are being accomplished
- A financial plan is necessary to support the capital plan

Funding

- Water and Sewer Infrastructure has historically been paid for by residential and commercial development
- Federal and State funding has contributed to construction of wastewater plants in the past
- There is very limited federal and state funding to support rebuilding infrastructure going forward

Financial Plan Analysis

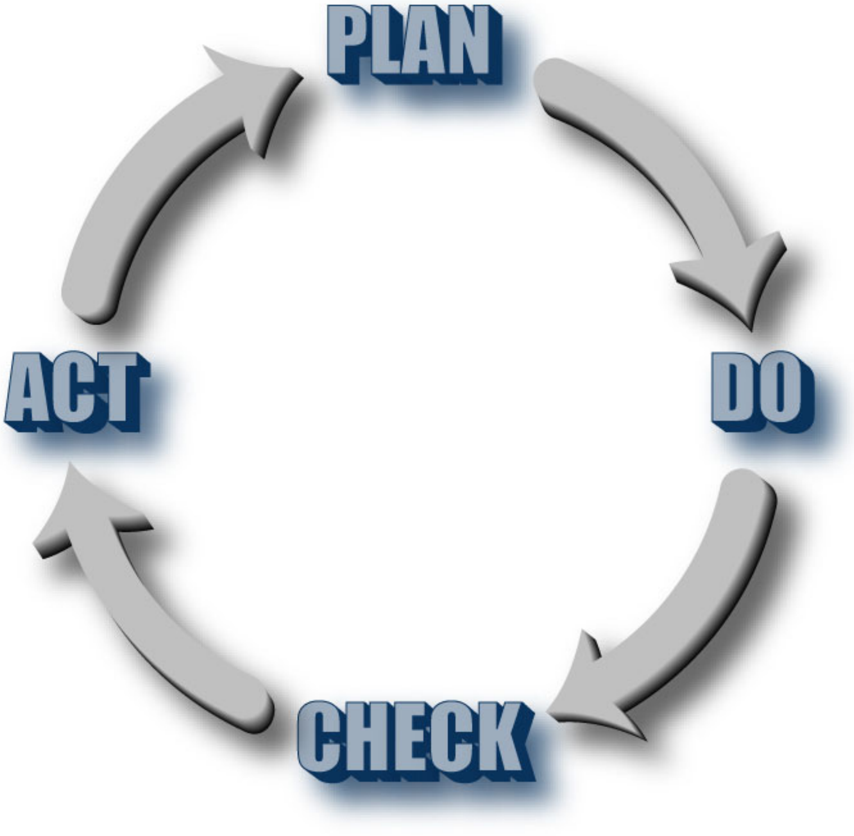
- Operating Budgets are adequate to support routine maintenance
- Water and sewer breaks will continue to erode operating budgets since they are not planned work
- A Rate Analysis has been performed to determine how best to support the long term financial requirements that support the capital investment for water and sewer services

Next Steps

- Present long range capital plan
- Provide funding strategy to support capital requirements
- Present Rate Analysis scenarios

Continual Improvement in Utility Management: A Framework for Integration

January 2004



Foreword

Dear Colleagues:

Water and wastewater utility managers today face a variety of management challenges. They must address aging infrastructure while grant monies decline and rate payer capacity is constrained, respond to new and more stringent regulatory requirements, meet increasing public expectations for service costs, environmental performance, and transparency; and plan for changing work force demographics. To respond to these challenges, utility managers have been examining and utilizing a variety of management initiatives including asset management techniques, environmental management systems, best practices assessments (such as QualServe, the APWA Management Accreditation Program, and the Partnership for Safe Water), and strategic business planning tools (such as the Balanced Scorecard). While these initiatives have proven individually very useful, there is a strong sense that, taken together, they present utility managers with a confusing array of choices and have generated a sense of "initiative overload" rather than a coherent picture of management improvement opportunities. Unfortunately, it has not been particularly clear when and how best to use the management initiatives available to us and, in particular, how these tools relate to one another.

This Guide was funded through a cooperative agreement with the U.S. Environmental Protection Agency (EPA), and sponsored by the Association of Metropolitan Sewerage Agencies (AMSA), EPA, and the Water Environment Federation (WEF). It is based on the findings and recommendations from an earlier research project (Phase I Management System Integration Project) supported by a workgroup composed of nine water and wastewater utility managers and four advisors from consulting firms. The Phase I Project examined 15 separate management initiatives - including Asset Management, ISO 14001, the National Biosolids Partnership's Environmental Management System Program, the American Public Works Association Management Accreditation Program, EPA's Environmental Management System Initiative for Local Governments, Balanced Scorecard, and QualServe - to determine the benefits of and options for integrating them under a continual improvement – "Plan, Do, Check, Act" - management system framework. The Workgroup concluded that it is feasible and desirable to integrate the management initiatives in the context of a continual improvement management system framework. The Workgroup believed that continual improvement management system frameworks provide a well established and proven management approach that provides distinct advantages over conventional utility management practices. The Workgroup further believed that there was a strong need to provide utility managers with clear direction on the interrelationship of the many management initiatives and to identify strategies for effectively integrating initiatives to meet utility objectives.

We believe this guide fills an important resource gap for utility managers. Although substantial implementation guidance exists for individual management initiatives, the available materials do not address how to effectively integrate them. The Guide responds to that need by providing a roadmap showing how the management initiatives interrelate and how a utility can best approach integrating them in the context of a continual improvement management system framework. The Guide explores what is, for our industry, relatively new territory – the use of a continual improvement management system framework to support integrated and strategically aligned utility management. Utilities throughout the United States (U.S.) and abroad have adopted individual management initiatives, but it is only very recently that utilities have begun looking to integrate initiatives in a continual improvement management system framework to drive performance improvement simultaneously in multiple areas, such as environmental, financial, quality, safety, and human resources.

We appreciate the input that we have received from the more than thirty utility managers who reviewed or contributed in other ways to the development of this guide. Their input has helped us develop a practical document that water and wastewater utility managers and staff interested in pursuing an integrated approach can use effectively, and we encourage them to do so.

The information in this guide can also be useful for utility managers in identifying opportunities for improving or strengthening an existing continual improvement management system.

The results of current integration efforts have been very encouraging with a variety of important, concrete benefits identified. The continual improvement framework has provided a proven basis for defining, achieving, communicating, and receiving recognition for high performance outcomes on an enterprise-wide basis. Utilities adopting an integrated continual improvement management framework have generated efficient and consistent productivity improvements related to service and operations across the entire scope of operations and have engendered enhanced teamwork and highly effective staff development. We hope this Guide will increase your awareness of these benefits, motivate you to embrace continual improvement management, and enable you to make efficient use of the management initiatives available to our industry.

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Key Utility Management Areas:

- Environmental performance
- Safety and health: public and occupational
- Quality: process quality, product quality, customer service quality, and service level
- Financial performance: operations and capital assets
- Human resources and skill development

Background on Utility Performance Improvement Initiatives

Utilities are using a variety of management initiatives – i.e., management systems, voluntary programs, guidance books and manuals, benchmarking programs, and best practices – to improve utility performance in management areas such as safety, quality, finances, human resources, and environment. This guide examines 15 different management initiatives available to water and wastewater utilities, each designed to help improve performance (see box at left).

Some of these initiatives specifically support performance improvement at water and/or wastewater utilities; others support all types of organizations.[1] The initiatives overlap quite substantially, covering individually or in combination the entire drinking water, wastewater treatment, and stormwater value chains.[2] The initiatives further address all key management areas to which utilities typically direct attention and resources: environmental performance; safety and health; quality; financial performance; and human resources and skill development.

Each of the initiatives support some or all of the elements of a continual improvement management system framework – the ***plan, do, check, act*** cycle - with some initiatives supporting certain elements more directly than others. The initiatives can be loosely grouped into one of three types, based on their focus:

> Best management practices;
> Strategic business planning support tools; and
> Continual improvement management system frameworks.

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[1] Appendix C provides a complete profile for each of the 15 initiatives. Appendix B provides references for further information about each initiative.

[2] The drinking water value chain includes: source/intake control; disinfection; sediment removal and filtration; corrosion control and fluoridation; and distribution systems. The wastewater treatment value chain includes: wastewater collection, stormwater, and pretreatment; wastewater treatment and solids generation; polishing and effluent discharge; solids stabilization, conditioning, and handling; and biosolids transportation and disposition.

Drivers for Management Change

Utility managers identify a number of drivers for adopting performance improvement initiatives.

- Many utilities have an aging or aged infrastructure (e.g., many facilities are nearing the end of their design life). Utility managers are facing a need for increased investment in infrastructure maintenance and replacement. On top of the increased need, there is a major decline in available grant money and other forms of financial support. This combination is forcing utility managers to think about how to do more with less, or how to better justify the need for additional funding.
- Utility managers are facing a variety of new or potential regulatory requirements (e.g., prevention of combined sewer overflows and/or sanitary sewer overflows, total maximum daily loads, Endangered Species Act, GASB-34). Utility managers perceive greater stringency and increased complexity and scope of these new/potential requirements.
- Utilities are encountering increased public expectations in the areas of service, costs, environmental performance, and transparency. Utility managers also report a greater public awareness and concern about environmental and public health impacts combined with increased expectations for public involvement and access to information.
- Public utilities in the U.S. and abroad are feeling competitiveness pressures from private entities. These pressures drive the need to improve productivity and control costs and for clearer standards and performance measures.
- Changing demographics in the work force and the impending departure of a significant portion of organizations' intellectual capital has increased the need for well-documented and reproducible work policies and procedures.

These drivers, individually or in combination, are leading utility managers to think about how to manage differently and to examine existing initiatives to support change. Despite the challenges these drivers pose, an increasing number of utilities are seeing benefits from a greater focus on utility management. This guide is intended to aid utility managers to do an even better job managing their organizations.

Challenges to Initiative Adoption

There are many examples demonstrating that the initiatives are beneficial. Benefits include: continual improvement in targeted management areas; enhanced operational consistency and reliability; improved teamwork, interdepartmental coordination, and employee awareness; and critical customer responsiveness and recognition. At the same time, utility managers express a sense of "initiative overload" and a lack of clarity about how initiatives interrelate and how they should best be used, individually or in combination, to meet utility objectives.

Participation levels indicate that even the most successful initiatives are reaching only a small portion of utilities nation-wide. Of the thousands of water and wastewater utilities nationwide, the following are approximate numbers of participants in the programs researched: 250 for Partnership for Safe Water; 53 for the NBP EMS Program; 116 for QualServe; 12 accredited for the APWA Management Accreditation, with 34 applications for accreditation; and 32 for the EPA EMS Initiative for Local Government. These numbers reinforce the belief that "initiative overload", as well as lack of clarity of how initiatives interrelate, present challenges that are inhibiting utility managers from fully utilizing the available initiatives.

It is common for management improvement initiatives to be implemented consecutively with little explanation or understanding among the staff about how the initiatives relate to one another or can leverage gains realized. This leads to a relatively high level of skepticism and a perspective that managers are pursuing a "flavor of the month" approach to improvement efforts. A consistent philosophy or system, based upon repeatable elements such as the "plan, do, check, act" cycle, can help connect initiatives and build a sustainable program. This guide provides guidance on how initiatives interrelate and identifies strategies and approaches for best using them in combination to meet utility objectives and drive consistent performance improvement.

Contents of this Guide

This guide has four primary purposes:

1. To help utility managers understand how the available management initiatives relate to each other;

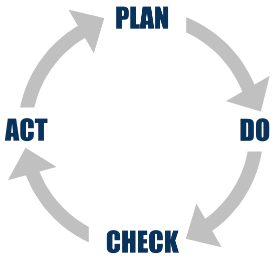
2. To help utility managers integrate various management initiatives they are now engaged in under the umbrella of a continual improvement management system framework based on the plan-do-check-act approach;
3. To help utility managers understand the basic elements of various management initiatives and their interrelationships in order to make the process of integration more efficient; and
4. To provide information on the potential benefits of integration.

The remainder of this guide includes the following.

- Chapter 1 introduces continual improvement management system frameworks and the concept of their use as a means for integrating initiatives.
- Chapter 2 describes the relationships among the performance improvement initiatives and how utility managers can use them to create a continual improvement management system framework.
- Chapter 3 provides guidance on approaches for integrating initiatives, including utility case examples.
- Chapter 4 provides a detailed description of integration opportunities with examples from four selected management initiatives.

1 Continual Improvement Management System Frameworks – An Overview

1.1 Background on Continual Improvement Management Systems



Continual Improvement Management System Framework

Continual improvement management systems are built around the total quality management framework of "plan, do, check, act". These systems provide a set of standard procedures and steps to support systemic, consistent, continual improvement of management areas. The management areas a utility must focus on and effectively balance include environmental performance, safety and health, quality, financial performance, and human resources.

In recent years, public utilities and local governments in the U.S. and abroad have begun utilizing continual improvement management systems particularly in the context of improving environmental and asset performance. Over 50 wastewater utilities are in the process of implementing an environmental management system (EMS) under the National Biosolids Partnership's program. Approximately three-dozen local government agencies are implementing environmental management systems as part of EPA's EMS Initiative for Local Government, and close to one-dozen U.S. public utilities have adopted and been certified to the ISO 14001 EMS standard. Other continual improvement management system-based initiatives receiving attention from utilities include the approach proposed by the Association of Metropolitan Sewerage Agency's (AMSA's) guidebook "Managing Public Infrastructure Assets", the ISO 9002 Quality Management System Standard, and the Occupational Safety and Health Agency (OSHA) Voluntary Protection Program.

1.1.1 Elements of a Continual Improvement Management System Framework

Management initiatives utilizing the continual improvement management system framework share a core set of elements critical to institutionalizing a culture of continual improvement and consistent performance success. Typically, they are designed to affect performance improvement in a single management area. Management areas include environmental performance; public and occupational health and safety; process, product, and service quality; operational and capital asset financial performance; and human resources and skill development. For example, the EPA EMS for Local Government Initiative is focused on environmental performance, while Asset Management is focused on capital asset performance.

Elements of a Continual Improvement Management System Framework

Plan
- Management commitment
- Policy statement
- Assessment of areas for performance improvement
- Legal and other requirements
- Objectives and targets
- Management programs for performance improvement

Do
- Structure, roles, and responsibilities
- Training, awareness, and competence
- Communications – internal and external
- Document management
- Operational controls

Check
- Measuring and monitoring
- Auditing
- Reporting
- Management review

Act
- Corrective and preventive action
- Change management

The continual improvement management system-based initiatives – such as ISO 14001, ISO 9002, OSHA Voluntary Protection Program, NBP EMS for Biosolids, EPA EMS for Local Government Initiative, and Asset Management – exhibit substantial consistency among their components and underlying logic, regardless of which management area(s) they support. Not only does each of the continual improvement management system-based initiatives have four high-level components - Plan, Do, Check, and Act - each includes a similar set of more detailed elements.

Plan

The purpose of the plan component and its elements are to: establish management commitment; prepare a written policy statement of commitment that is driven by and consistent with the organization's overall mission and/or vision; identify areas in need of performance improvement; identify legal requirements and other voluntary commitments; establish objectives and targets and related performance metrics; and develop management programs for achieving performance improvement.

The orientation of the planning elements will differ by the management area(s) supported by the continual improvement management system framework. For example, in a continual improvement management system framework focusing on environmental performance improvement, objectives and targets will be focused on the management of environmental impacts. Alternatively, for a continual improvement management system framework focusing on capital assets, the planning elements will target infrastructure performance.

In the area of planning, each of the continual improvement management system-based initiatives addresses:

- Management commitment;
- Policy statement;
- Assessing areas for performance improvement;
- Identifying legal and/or other voluntary requirements;
- Setting objectives and targets; and

- Developing plans for achieving objectives and targets, including identifying roles and responsibilities and establishing metrics for measuring progress towards goals and objectives.

Do

The purpose of the do or implementation component is to align operational and administrative practices, procedures, and processes; communications programs (internal and external); and employee training programs with the policy, objectives, and targets established during planning.

The management area(s) selected will determine the nature of the implementation component elements. For example, in a continual improvement management system framework focusing on quality, the employee training program and other implementation elements will be oriented around quality management. Alternatively, in a continual improvement management system framework focusing on safety and health, these elements will be oriented around management of occupational and public safety and health.

Each of the continual improvement management system-based initiatives supports the implementation component in a similar manner although they focus individually on different management areas. They provide the following implementation elements:

- Training, awareness, and competence;
- Internal and external communications;
- Document management; and
- Operational controls.

Check

The purpose of the check component is to align procedures and processes for the regular, ongoing monitoring of organizational performance with the policy, objectives, and targets established during planning. The check component includes elements designed to establish and align: techniques for measuring performance and progress against goals and objectives; management system audit procedures; performance reporting formats and procedures; and management review processes.

The continual improvement management system-based initiatives support the checking component by providing the elements that establish:

- Monitoring and measuring activities;
- Internal audits;
- Performance and audit result reports; and
- Management reviews.

Act

The act component establishes procedures and processes for making regular improvements to operations and the management system, based on the data and evaluations generated in the checking stage.

The continual improvement management system-based initiatives support acting by providing an approach for:

- Developing corrective and preventive actions; and
- Making adjustments to performance goals, management system elements, operations, and policies on a regular and ongoing basis.

1.2 How Continual Improvement Management System Frameworks Differ from Conventional Utility Management

There are a number of ways that continual improvement management system frameworks differ from conventional utility management approaches. Notably, continual improvement-based systems stress measurable objectives and targets, establish explicit standard operating and administrative procedures, **and require that performance be checked through on-going monitoring and measurement, periodic audits, and management review**.

Most organizations have business planning processes that cover planning and implementation (plan and do), but can fall short on monitoring progress and making management decisions based on real outcomes (check and act). This is a key advantage of the continual improvement management system framework and why utilities in the U.S., Europe, and Australia are beginning to shift from traditional business planning and management-by-objectives to this form of management.

As with planning, many of the do or implementation elements cover activities that are typically conducted as part of conventional utility management efforts. For example, all utilities have employee training programs in place. They cover on-the-job safety issues and/or include operator certification. However, incorporation into a continual improvement management system typically requires that the training program is fully integrated with other management system elements and explicitly tied to objectives and targets.

The City of Charleston Commissioners of Public Works has found that standardization of training, document control, measuring and monitoring, and reporting through EMS implementation has improved its performance under the Partnership for Safe Water.

Additionally, continual improvement management system frameworks typically drive a greater degree of process and procedural standardization and documentation than may have existed under a conventional management approach. The ability to change in response to changing circumstances is provided for in the checking and acting portions of the cycle and thus, increased standardization also supports flexibility.

A continual improvement management system framework can also produce an organizational cultural shift in that routine assessment of business practices and changes needed for improvement becomes a regular part of doing business. The continual improvement effort can also enhance inter-departmental teamwork by aligning functions across the organization in support of objectives and targets.

1.2.1 Potential Benefits of a Shift to a Continual Improvement Management System Framework

Utility managers identify a number of benefits from implementing a continual improvement management system. These benefits include the following.

> **Continual improvement in targeted management areas**: environmental performance, quality (process, product, customer service, and service level); safety and health (public and occupational); financial performance (operations and capital assets); and human resources and skill development. Sydney Water Corporation’s staff believe that an Integrated Management System has helped produce: 70% reduction in total phosphorus load discharged; 80% reduction of ammonia-nitrogen load discharged; 30% reduction in total nitrogen load discharged; and 25% reduction in operating costs.

> **Enhanced operational consistency and reliability.** The City of San Diego Metropolitan Wastewater Department’s EMS has increased institutional knowledge and memory, creating more consistency and reliability in the long-term. Managers from other utilities cite this benefit as being an important given the increased rates of staff turnover and retirements.

- **Improved teamwork, interdepartmental coordination, and employee awareness.** The Louisville and Jefferson County, KY Metropolitan Sewerage District, a utility participating in EMS for Local Government Initiative, is finding broader staff buy-in and greater staff understanding of how the environment is "everybody's job". The utility has found that more explicitly defining and documenting roles and responsibilities has increased employee understanding about roles and increased their sense of accountability. The management system has also improved internal communications.

- **Critical customer responsiveness and recognition**. The Western Carolina Regional Sewer Authority, which is integrating its NBP EMS for Biosolids with CMOM, has found that by combining efforts, its public education program better informs the public of all organizational programs and agendas. The public is well aware of new capital improvement projects and the benefits of the biosolids programs. The public education program improves agency relations with the community about all facets of the organization, including biosolids.

Integration opportunities grouped by component of the continual improvement management system framework

Plan

- Management commitment
- Vision
- Policy statements
- Assessing areas for performance improvement
- Legal and other requirements
- Objectives and targets
- Management programs for performance improvement

Do

- Training, awareness, and competence
- Communication—internal and external
- Document management
- Emergency preparedness and response
- Operational control

Check

- Measuring and monitoring
- Auditing
- Reporting
- Management review

Act

- Corrective and preventive action
- Change management

The case examples provided in Chapter 4 of this guide provide additional examples of how some utilities are responding to the drivers described above and experiencing these benefits.

1.3 Introduction to Integration Opportunities

Continual improvement management system frameworks have a set of common elements and structure, regardless of which management area(s) they support. Similarities in purpose and structure between the many management initiatives available to water and wastewater utilities create opportunities to integrate at any of the elements common to the initiatives. This guide refers to these opportunities as "integration opportunities".

The integration opportunities found under each component of the continual improvement management system framework are listed in the box at left. As could be expected, this list is very similar to the list of elements under the continual improvement management system framework (see text box on page 6). Diagram 1 (on page 13) depicts the relationships, or process flow, of the integration opportunities in a continual improvement management system framework.

Integrating management initiatives can amplify the benefits associated with a continual improvement management system framework (see Chapter 1 for a discussion of benefits) and has provided the following additional benefits.

> Integration helps utilities more effectively and strategically align improvements across a full range of management areas. It helps utilities develop a coordinated management program that provides a clear sense of priorities and interrelationships on which to base staff roles and responsibilities and resource allocation.

> Integration enables a utility to leverage the continual improvement management infrastructure (such as document control and communication procedures) established to support an individual management area. Utilities find that, once established to support a single management area (e.g., environmental performance under an EMS), the continual improvement management procedures can be easily adapted to incorporate additional management areas. More streamlined operations and decision-making, simplified employee training, consolidated and consistent communications, and substantial cost efficiencies for overall utility management result.

Two primary benefits of integration

- Integration helps a utility to more effectively and strategically align improvements across a full range of management areas.
- Integration enables a utility to leverage the continual improvement management infrastructure established to support an individual management area.

1.3.1 Key Integration Opportunities for Strategic Alignment

Although there can be gains in terms of both efficiencies and strategic alignment for each of the integration opportunities, utilities have identified certain integration opportunities as more important to strategic alignment. **The integration opportunities most critical to effective strategic alignment are:**

> Establishing policy statements;
> Assessing areas for performance improvement;
> Setting measurable objectives and targets;
> Developing management programs for performance improvement;
> Measuring and monitoring; and
> Conducting management review.

These six opportunities fall primarily under the planning and checking components of the continual improvement management system framework. Integration is important at these opportunities because:

- Planning elements, such as assessing areas for improvement and establishing objectives and targets, address what an organization wants to accomplish. These accomplishments must be consistent to avoid potentially working at cross purposes.
- The management programs for performance improvement shape the implementation elements. It is important that implementation elements such as communications, training, and operational control, provide a consistent message and direction to employees. These elements are more likely to be consistent if the policies and plans that guide them are integrated.
- Checking and acting focus on reviewing and modifying plans and the activities that flow from them. These elements must also be strategically coordinated to avoid the potential for working at cross purposes.

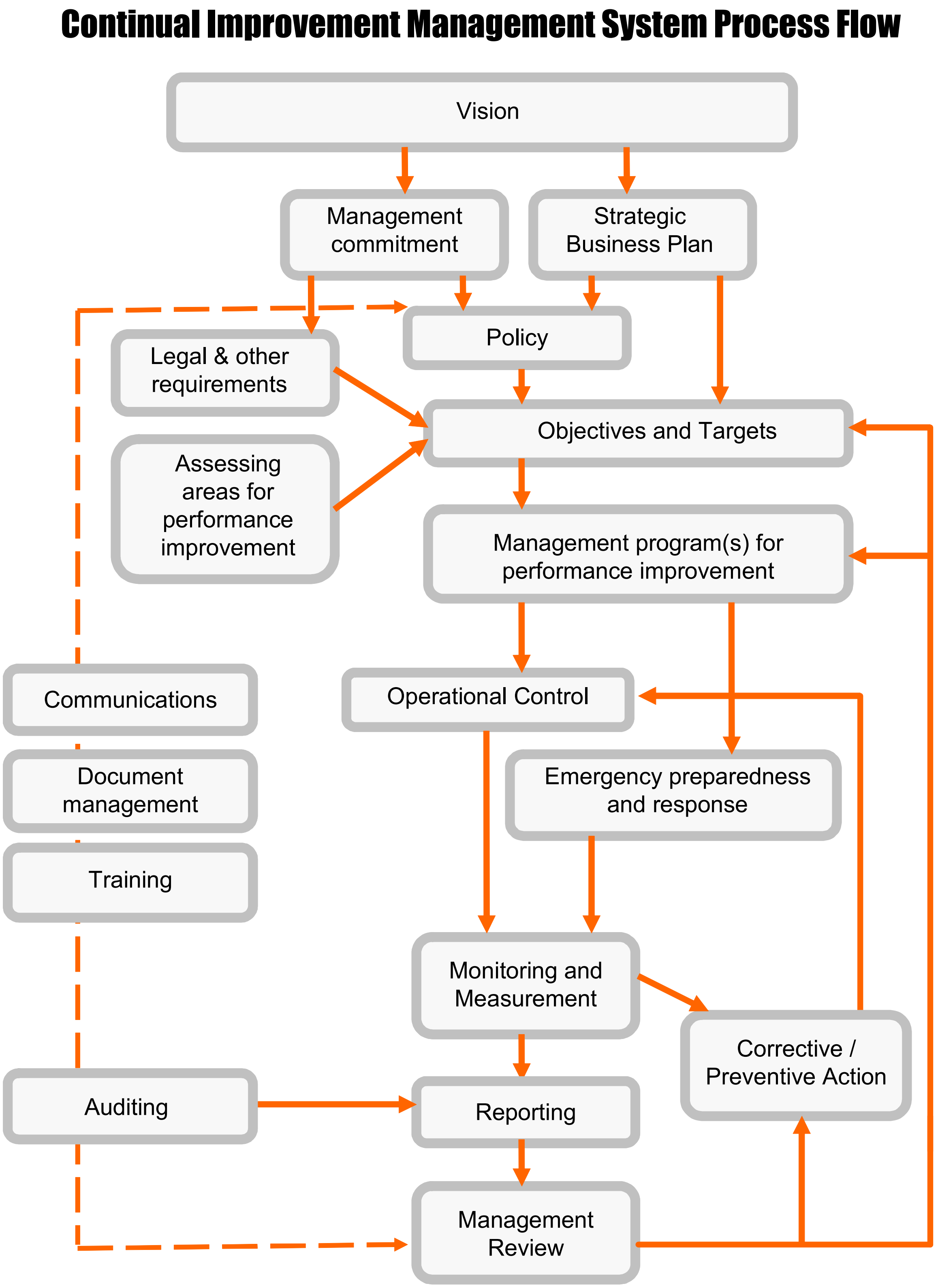
Failure to integrate at these points could result in resource allocations that are not coordinated or sufficient to meet desired management areas.

1.3.2 Integration Opportunities for Leveraging Infrastructure

Any of the integration opportunities can allow the management system infrastructure from one initiative to support another. For example, if a utility develops a document control system for its EMS, it can leverage that same document control system for materials associated with other management initiatives, such as CMOM, PSW, or AMP.

Diagram 1 depicts the relationships, or process flow, of the integration opportunities in a continual improvement management system framework.

Diagram1. Continual Improvement Management System Process Flow



2 Understanding Relationships among Utility Management Improvement Initiatives

In addition to implementing individual initiatives, utility managers are identifying opportunities to integrate them to take advantage of their overlapping purpose and/or structure and to embed them in a well-established and proven continual improvement management approach. Using any one of the continual improvement management system frameworks can provide the backbone for integrating the initiatives and provide a structure into which the desired combination of initiatives can nest.

Such an approach will support leveraging and integrating any of the variety of management initiatives to provide water and wastewater utilities with the ability to organize, direct, and adjust internal resources to achieve performance improvements and good management practices. When properly combined or integrated, the management initiatives provide a utility with a complete management package guided by a concrete business plan, supported by knowledge of best practices, and maintained through a continual improvement management framework.

A fully integrated management system framework supports performance improvement in all management areas of importance to the organization.

This complete management package, or fully integrated management system framework, supports performance improvement in all key areas. The "plan, do, check, act" framework of continual improvement management can be adapted to support the needs, priorities, and circumstances of the implementing organization.

Each of the initiatives, to a greater or lesser degree, support some or all of the elements of a continual improvement management system framework. Based on the elements they support most strongly, the initiatives can be loosely grouped into three types:

- Best management practices;
- Strategic business planning support tools; and
- Continual improvement management system frameworks.

Here are just a few examples of each type of initiative and what they can provide in the context of a continual improvement management system framework.

- Best practice initiatives such as those provided by the American Public Works Association's Management Accreditation Program help utilities improve administration, management, maintenance, and operations. Similarly, benchmarking initiatives such as QualServe and the Partnership for Safe Water help utilities understand how their operations rank in comparison to industry standards and where opportunities for improvement exist.
- Business planning support initiatives, such as the Balanced Scorecard, provide an approach to identifying measurable objectives and targets and balancing priorities and resource commitments across the full range of utility management areas.
- Continual improvement management system frameworks such as the NBP EMS Program, the EMS for Local Government Initiative, ISO 14001, and ISO 9000 provide the complete plan-do-check-act framework for building a continual improvement management system.

It is important to note that each of the management initiatives individually support improvement of utility management irrespective of a utility's interest in developing an overall, integrated management system framework.

Table 1 shows how each initiative can contribute to a continual improvement management system framework. It provides information on the key features of each initiative and which continual management system framework components and management areas they support. This table is designed to summarize the general characteristics of the initiatives and is not intended to be an authoritative reference on the initiatives.

Table 1: Characterization of Management System Initiatives

E = Environmental Performance
S = Safety and Health: Public and Occupational
Q = Quality: Process Quality, Product Quality, Customer Service Quality, and Service Level
F = Financial Performance: Operational, Assets
H = Human Resources and Skill Development

1, 2, 3 indicate relative strength, with 1 being the strongest, of each initiative in supporting the continual improvement management system framework components. This table is designed to summarize general characteristics and is not intended to be an authoritative reference on the initiatives.

Initiative	**Management Area(s) Supported**					**Key Features**	**Continual Improvement Management System Framework Components**			
	E	**S**	**Q**	**F**	**H**		**Plan**	**Do**	**Check**	**Act**
APWA Management Accreditation Program	X	X	X	X	X	Supports self and peer-based assessments of conformance with APWA recommended practices.	1	1	2	3
Asset Management	X		X	X		Provides an approach to develop an infrastructure investment strategy that supports capacity needs.	1	1	2	2
AWWA Proposed Accreditation Program[3]	X	X	X	X	X	Proposed accreditation program based on conformance with standards for water and wastewater utility operations (standards not yet developed).	1	1	3	3
Balanced Scorecard			X	X	X	Provides a high-level planning tool for balancing across management areas.	1	2	3	3
Bid-to-Goal				X		Provides an approach for evaluating operations against private sector benchmarks.	1	1	3	3
CMOM	X	X				Provides an approach for improving capacity, management, operation, and maintenance programs for sewage collection systems and wastewater treatment plants.	1	1	2	2
EPA EMS for Local Government Initiative	X					Supports establishment of a continual improvement management system, based on ISO 14001. Directed at local government operations.	1	1	1	1
GASB-34				X		Provides accounting standards for local and state governments, requiring full accrual accounting (reporting the value of infrastructure assets).	1	1	3	3

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[2] The AWWA Accreditation Program is under development and may or may not cover all management areas.

Initiative	Management Area(s) Supported					Key Features	Continual Improvement Management System Framework Components			
	E	S	Q	F	H		Plan	Do	Check	Act
ISO 14001	X					Supports establishment of a continual improvement management system focused on environmental performance. Is not specifically-tailored to water / wastewater treatment utilities.	1	1	1	1
ISO 9002			X			Supports establishment of a continual improvement management system focused on quality. Is not specifically-tailored to water / wastewater treatment utilities.	1	1	1	1
Malcolm Baldrige National Quality Program			X	X	X	Award program recognizing performance in leadership, strategic planning, customer & market focus, and information & analysis. Not tailored to utilities.	3	1	3	3
NBP EMS for Biosolids Program	X		X			Supports establishment of a continual improvement management system - industry tailored EMS loosely based on ISO 14001 standard. Focused on biosolids value chain within wastewater treatment operations. Has enhanced public participation & communications elements.	1	1	1	1
OSHA Voluntary Protection Program		X				Supports establishment of a continual improvement management system focused on occupational safety and health. Is not specifically-tailored to water / wastewater treatment utilities.	1	1	1	1
Partnership for Safe Water	X					Supports benchmarking of drinking water turbidity and provides beyond-compliance turbidity goals.	1	2	1	3
QualServe	X	X	X	X	X	Supports a high-level evaluation of all aspects of utility operations.	1	2	2	3

2.1 Drivers for Integrating Management Initiatives

Drivers for utilities to consider integrating management initiatives under the continual improvement management system framework include the following.

- Utilities are facing increasing expectations with respect to performance in a number of areas, including environment, customer service, assets, and financial performance. The continual improvement plan-do-check-act cycle is a well established and proven approach for achieving performance improvement. Utilities can integrate initiatives with a plan-do-check-act cycle to balance performance improvement in multiple areas of importance to the organization.

- Utilities are acutely aware of the need to balance decisions between multiple management areas such as environmental and financial goals. Utilities that have developed a management system with a single management area focus, such as an EMS, have found the need to supplement these with strategic business planning tools to provide a path for balancing decisions.

- Utility managers are looking to understand the connections between performance improvement initiatives. It is common for individual performance improvement initiatives to be implemented sequentially without an understanding among utility staff about how the initiatives relate or how gains realized can be leveraged. This has led to a certain degree of skepticism and a perspective that managers are pursuing a "flavor of the month" approach to improvement efforts. Incorporating initiatives into an integrated management system framework can demonstrate how individual initiatives can be an important component of the utility's overall performance.

2.2 How the Initiatives Integrate with the Continual Improvement Management System Framework

Table 1 characterizes how the 15 initiatives support the continual improvement management system framework components. The initiatives support different elements of a continual improvement management system framework. For example, strategic planning initiatives, such as the Balanced Scorecard, support planning elements such as setting objectives and targets. Best practice initiatives, like QualServe and the APWA Management Accreditation Program, can support planning elements such as assessing areas for performance improvement, and with implementing, in adopting best management practices. Management system initiatives, such as ISO 9000 and the NBP EMS for Biosolids, provide the continual improvement management system framework.

An organization can start with any of the different initiatives to build up to a continual improvement management system framework supporting all management areas of importance to the organization.

- For example, a utility could start by planning, to determine first where it wants to go, and then implement a continual improvement management system framework to support the plans.

- Or, a utility could start with a focused continual improvement management system such as the NBP EMS for Biosolids and then expand its scope to include additional operations. The NBP EMS program provides best management practices for biosolids management. After expanding the management system framework scope to include additional operations, the utility could build in best management practices for the additional operations.

- Additionally, a utility could start by adopting industry best management practices with an initiative such as the APWA Management Accreditation Program, and then tie these practices to strategic business plans. This can be done through the adoption of a continual improvement management system framework.

Any of these entry points, whether strategic business planning, best management practices, or continual improvement management system frameworks, can lead a utility to the development of an integrated management system that supports all management areas of importance to the utility.

Chapter 3 provides further description of how utilities can integrate initiatives, including some examples from utilities that have started down these paths. Chapter 4 of this guide provides more detail of how to approach integration at each of the integration opportunities, using examples from four of the 15 initiatives.

2.3 The Versatility of Integration Approaches

Utilities are taking a variety of approaches to integrating management initiatives, based on circumstances and needs. Some utilities are implementing a continual improvement management system framework in phases, starting with a particular initiative and

Because drinking water and wastewater utility operations are primarily focused on environmental and public health impacts, utility managers will find that EMS represent a natural starting point for introducing a continual improvement management system into a utility.

adding others over time. For example, some utilities begin with utility planning initiatives, such as QualServe, and then add in elements of doing, checking, and acting. This approach allows utilities to build a better understanding of where improvement may be needed and develop a case for eventually implementing a continual improvement management system framework. Other utilities are beginning with a continual improvement management system that supports a single management area – often an EMS – and then incorporating additional management areas.

Using either approach, utility managers can use the management initiatives to provide components of a continual improvement management system framework. The initiatives can be leveraged by integration to move the utility in the direction of a continual improvement management system framework that supports all management areas of importance to the utility.

Conditions such as organizational size and type may affect the approach. For example, larger utilities are likely to have more resources. However, they also tend to have more complex organizations and layers of bureaucracy, which can slow implementation. Smaller utilities may be more resource constrained, but have less bureaucracy and thus, may actually be able to enact real change more quickly and develop and integrate management initiatives, possibly even simultaneously.

Strategic business plans play an important role by helping an organization determine what are its needs and priorities for performance improvement that can be embedded in a continual improvement management system framework.

Strategic business plans play an important role by helping to identify needs and priorities for performance improvement that can be embedded in a continual improvement management system framework. Many utilities already have a strategic business plan. Some are beginning to connect the needs and priorities (high-level business goals) identified in the strategic business plan with a continual improvement management system framework.

Chapter 3 of this guide elaborates further on different implementation approaches utilities are using to integrate management initiatives. It also contains six utility case examples. The approaches and examples described in Chapter 3 demonstrate a variety of incremental or phased approaches to developing an integrated management system framework. However, it is possible that an organization might develop and implement a continual improvement management system that is integrated (i.e., addresses multiple management areas) from the start.

3 How to Integrate - Practical Considerations

3.1 Getting Started

One challenge to implementing and integrating management initiatives is determining where to start. Utilities are using a variety of approaches – each is equally valid and leads to the implementation of a continual improvement management system framework covering multiple management areas and with an enterprise-wide scope. The right place to start depends on what is already in place and what is important to an organization.

This chapter describes how utilities can approach integration of management initiatives and gives case examples describing approaches used by six different utilities.

3.1.1 Critical Success Factors

Utility managers consulted in the preparation of this guide consistently identified the following critical success factors for continual improvement management system implementation and maintenance.

- A strategic business plan with a limited number (e.g., 5-10) of measurable objectives to clearly focus organizational priorities and direction.
- Management commitment to ensure adequate resources are in place for management system planning, implementation, and maintenance.
- Connection to budget processes to ensure that organizational priorities receive necessary resources.
- Awareness of best management practices to help the utility understand where it is in relation to industry standards.
- Effective internal and external communications to ensure that employees understand the organization's vision and that interested parties understand the organization's progress towards performance improvement.
- Training programs to give employees the skills required to do their jobs and support management improvement.

- Employee “buy-in”, involvement, and feedback to promote ownership and commitment to success.
- Effective use of information (e.g., data management) to support monitoring, measuring, and reporting activities and data gathering activities required when conducting assessments for areas of performance improvement.
- Explicit checking and acting activities that effectively “close the loop” on performance levels and support the development and maintenance of a continual improvement culture.

Effectively integrating management initiatives within a continual improvement management system framework both depends on these success factors, as well as establishes an organizational environment in which the initiatives are most apt to flourish. An absence of any of these critical factors may hinder successful implementation and maintenance of the management system. For example, the management system might not be effectively implemented if there is a lack of employee understanding, or it might disintegrate from lack of commitment or resources. They key question is, how does an organization get started down this path? The answer is one step at a time, but beginning with a clear sense of the end (an enterprise-wide continual improvement management system framework) in mind.

3.1.2 Management System Scope

Two Ways of Thinking about Scope

- **Fence Line:** those operations and facilities encompassed by the management system
- **Management Areas**: environment, quality, safety, etc.

A first step in establishing a continual improvement management system framework is to define its scope. There are two ways of defining scope. This first is “fence line” – listing which operations and facilities will be covered by the management system. The other is management areas – identifying the utility performance areas the management system will address.

Several management initiatives define the fence line based on the concept of “value chain”. For example, the NBP EMS focuses on the biosolids value chain, or those operations which affect the production and management of biosolids. Not all wastewater treatment operations are covered by this Biosolids EMS, only those that relate to biosolids. Capacity, Maintenance, Operations and Management programs (CMOM) also use the value chain concept, but focus on those facilities and operations that play a role in the prevention of sanitary sewer overflows.

The 15 management initiatives do not have the same scope, though many do overlap to varying degrees in either the management areas

It is not necessary that all performance improvement initiatives have the same scope. Effective integration, however, will require that the scope of the overall continual improvement management system encompass the individual management initiatives the utility is undertaking.

they address or the utility operations / processes to which they can apply. Between some, there is no overlap. For example, Partnership for Safe Water (PSW) focuses on drinking water turbidity levels and therefore encompasses business functions that influence drinking water turbidity (e.g., sedimentation, flocculation). CMOM focuses on sanitary sewer overflows and those facilities and operations that can prevent sanitary sewer overflows. A utility implementing both PSW and CMOM will find that these initiatives have a distinctly separate scope.

Effective integration, however, will require that the scope of the overall continual improvement management system framework encompass the individual management initiatives an organization is undertaking. For example, a joint water and wastewater utility might choose to integrate both CMOM and PSW within an overall environmental management system. In this case, the EMS scope would encompass CMOM and PSW and also address other environmental aspects important to the organization.

3.1.3 Cross-Functional or Interdepartmental Team

Another early activity in implementing a continual improvement management system framework is establishing a cross-functional or interdepartmental team that includes all of the business functions included in the scope of the management system. The role of this team is to identify and assess issues, opportunities, and processes.

***The Santa Clara Valley Water District** has formed an Asset Management Team representing all divisions within the District. They believe it is likely that their EMS development would involve a cross-functional team that would include many of the same people who make up the current AMP team.*

Most of the management initiatives examined in the guide either explicitly call for or would be well supported by the establishment of a cross-functional team. A utility implementing multiple initiatives will find it likely that such teams will have highly overlapping participation, including representatives from engineering, finance, human resources, maintenance, purchasing, and operations. This overlap signals a clear opportunity for leveraging a single cross-functional team to support multiple management initiatives, or at a minimum, an opportunity to leverage standard practices for team formation and operations.

An organization that has implemented one management initiative can broaden the existing team by incorporating additional business functions and by changing the scope and responsibilities of the team. For example, a cross-functional team developed for an EMS can be utilized for an asset management program with the addition of representatives (if necessary) from capital planning and finance.

To manage workload, a cross-functional team may need to establish subgroups focused on individual management areas, such as environmental performance, or on individual initiatives. Effective integration, however, will require that the overall team is clear that its role is to support integration. This will require, in particular, that the team ensure that assessments are conducted in a coordinated if not an integrated fashion and that objectives and targets and associated management programs are strategically consistent.

EMS standards such as ISO 14001 require that organizations appoint a management representative to oversee the development and implementation of an EMS. Having a senior management representative on the cross-functional team can help address conflicts between team members who represent different business units, report to different managers, and potentially have a different sense of priorities.

3.1.4 Initial Assessment of Existing Management System Components

When developing a continual improvement management system framework, most organizations conduct an assessment of existing management system components. This is often called a "gap analysis" when done for EMS. In the context of integration, a utility should identify where management system components already exist, and where they might already support integration.

Utilities should look for opportunities to leverage management system procedures to support the management system framework. For example, if an organization has already developed a continual improvement employee training procedure, the organization should examine the procedure to determine what modifications might be necessary to support an integrated approach.

A utility could use a table such as the following (table 2) to identify existing management system components, and where they might support integration. For those components that do not support multiple management areas, it will be important to determine changes necessary to support integration. Chapter 4 of this Guide can also be helpful in supporting an assessment of existing management components.

Table 2: Assessment of Existing Management System Components

	Component Does not Exist	Component Supports Single Management Area	Component Supports Multiple Areas
PLAN			
Management commitment			
Vision			
Policy statements			
Assessing areas for performance improvement			
Legal and other requirements			
Objectives and targets			
Management programs for performance improvement			
DO			
Training, awareness, and competence			
Communication			
Document control			
Emergency preparedness and response			
Operational control			
CHECK			
Measuring and monitoring			
Reporting			
Management review			
Auditing			
ACT			
Corrective and preventive action			
Change management			

3.2 Sequencing and Phased Approaches to Integrating Management Initiatives

Phased or Incremental Development Approaches

- Starting with planning and self-assessing
- Expanding the system to cover additional operations
- Leveraging infrastructure and Increasing management areas

Most utilities phase the development and integration of management initiatives. Most are fully implementing one initiative before approaching the next and considering integration.

Examples of how various management initiatives can be integrated in sequence are discussed here. However, there are many different approaches to integration in the context of a continual improvement management system framework. The examples represent just a few options. As the later utility case examples highlight, organizations may utilize several of these approaches in the process of developing a continual improvement management system framework and integrating management initiatives.

3.2.1 Starting by Planning and Self-Assessing

One approach to integration is to start with one of the initiatives that support utility planning, and then add in elements of doing, checking, and acting. Organizations that may not yet have the management commitment, resources, or other critical success factors in place to develop and implement a continual improvement management system framework may want to start this way. In these circumstances, the approach may be to build a better understanding of where improvement may be needed and develop a case for eventually implementing a continual improvement management system framework.

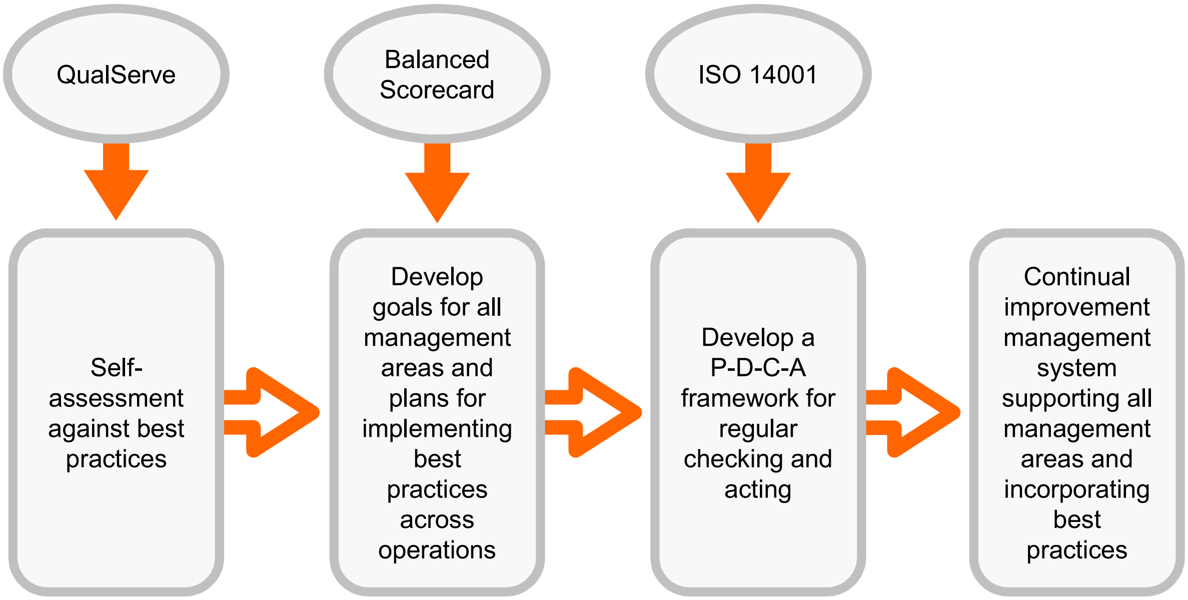
Organizations that have gone through a self-assessment and peer review process, such as those provided by QualServe, the APWA Program, or the Malcolm Baldrige Award Program, have already taken a substantial step in identifying the areas for desired improvement around which a continual improvement system could be built.

For example, an organization could start with an initiative that supports planning and self-assessing, such as QualServe or the APWA Management Accreditation Program, to identify areas for improvement. A utility could also use CMOM to conduct an evaluation of collection system and treatment capacity needs to prevent sanitary sewer / combined sewer overflows. Once an organization has identified improvement opportunities, it could use these to develop plans for implementing change and to drive a need for checking on performance goals and acting to make adjustments to meet those goals. A continual improvement management system framework, such as an EMS, can then be used to support systematic, consistent implementation.

An organization can also draw on various initiatives that support planning while it is developing an EMS (rather than as a separate step from developing an EMS). For example, a utility could incorporate the turbidity performance targets of the Partnership for Safe Water into its EMS performance objectives and targets. (See Charleston CPW case example.) A utility could utilize Asset Management to determine a financial strategy for meeting asset requirements that will support the capacity needs, goals, and targets as determined during the planning phase.

The following is a graphical depiction of one approach to starting by planning and self-assessing.

Figure 1: Starting by Planning and Self-Assessing



3.2.2 Expanding the System to Cover Additional Operations

See the case examples on the Albany, Oregon Public Works Department and Sydney Water Corporation for descriptions of how utilities are expanding systems to cover additional operations.

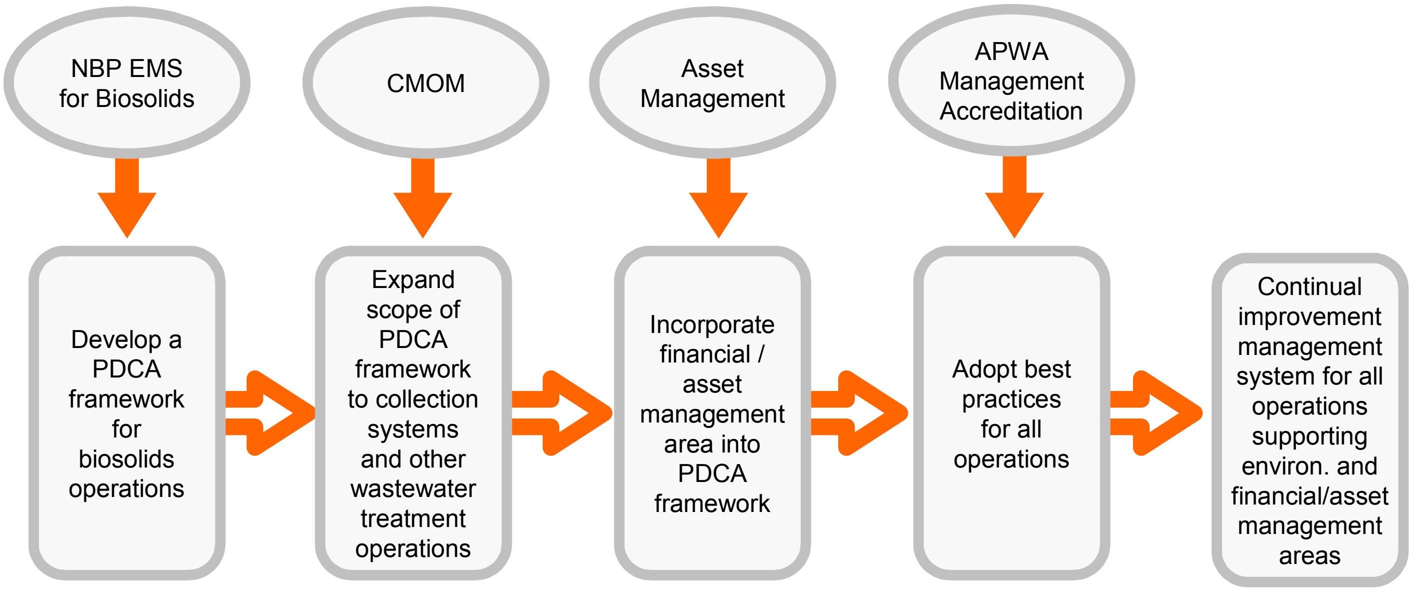
Another approach to integrating initiatives in the context of a continual improvement management system framework is to start with a single business unit or part of the value chain and expand incrementally. This approach allows for starting small, learning lessons, and building upon success. There are a number of ways an organization could expand along the value chain, limited only by the scope of the organization's operations.

One approach would be to implement the National Biosolids Partnership EMS for Biosolids, which focuses on the biosolids value chain, and then expand the elements of the EMS to other operations. This expansion in value chain moves the management area focus from biosolids to the environmental aspects of all operations.

A number of information sources on industry best practices can be used to help an organization tailor the implementation components of its EMS as it expands along the value chain. These include the NBP Program's National Manual of Good Practice, QualServe, and the APWA Management Accreditation Program.

The following is a graphical depiction of one approach to incrementally expanding the system to cover additional operations.

Figure 2: Expanding the System to Cover Additional Operations



3.2.3 Leveraging Infrastructure and Increasing Management Areas

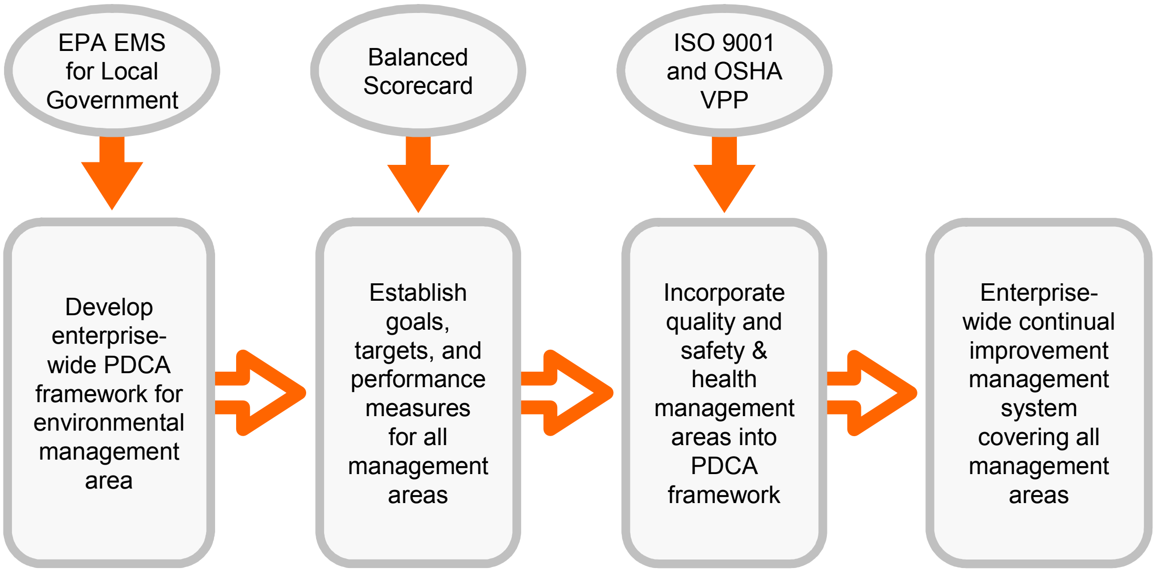
Some utilities have expanded a continual improvement management system that has a single management area focus to include other management areas. Organizations taking this approach have found that, although they experience benefits from their continual improvement management system, their system has not covered all of the important areas for which they manage. An advantage of this approach is that it allows an organization to establish some degree of comfort and experience with a continual improvement management system before incorporating other management areas.

One way to expand an established continual improvement management system would be to use Balanced Scorecard to create a broader management vision and policy. For example, The City of Eugene's Wastewater Division began by implementing ISO 14001 and is now utilizing the Balanced Scorecard to develop a vision, goals, and objectives for expanding its EMS to include other management areas. (See case example below for further description of Eugene's approach.)

A variety of management initiatives, including CMOM and Asset Management, could also be used during planning to set objectives that focus on additional management areas. For example, Sydney Water Corporation in Australia began by implementing an ISO 14001 EMS. The organization then added to their management system framework quality elements by drawing on ISO 9001 and human resources elements by drawing on an Australian occupational health and safety standard. (See case example below for further description on Sydney Water's approach.)

The following is a graphical depiction of one approach to leveraging infrastructure and increasing management areas.

Figure 3: Leveraging Infrastructure and Increasing Management Areas



3.3 Addressing Barriers to Continual Improvement Management System Adoption

Utility managers identify a number of real or perceived barriers that have the potential to impede the adoption and maintenance of a continual improvement management system framework. Utility managers also identify a variety of potential methods and/or incentives for overcoming those barriers.

Barrier

Implementing a management system framework requires substantial, upfront resources and time.

Responses

- A number of leveraging opportunities now exist. Because implementation of a management system framework is no longer "bleeding edge", utilities can draw on the work of those who have "paved the way". This has allowed for the cost and complexity of management system implementation to come down. Further, a number of handbooks, guidance documents, and presentations can help prevent utilities from having to "reinvent the wheel".
- Specific utility management initiatives can help tailor the continual improvement management system to the utility. The tools can substantially lower the burden of introducing a continual improvement management system into a utility by providing concrete planning methods and concrete guidance on best practices, procedures, and/or performance levels.
- Utilities can phase in a management system framework, starting with one plant or with one department and expanding, as they are able.

Barrier

Need to provide justification for resources, however:

- *It is difficult to quantify benefits;*
- *Benefits often are not seen until long after development and implementation costs are incurred;*
- *There are no clear requirements (e.g., adopting a management system is voluntary); and*

- *Conventional "plan and do" management is producing "satisfactory" results.*

Response

- A number of clear benefits do exist and are being articulated by the early adopters of continual improvement management systems (see benefits discussion in section 1.2.1).

Barrier

A general reluctance to change exists and implementing a management system framework requires a substantial culture shift for managers, staff, and board members.

Responses

- Promoting "best in class" status and best management practices will encourage peers who are less likely to change.
- Incorporating management system concepts into operator training courses will introduce staff to these concepts.
- Clearly presenting benefits to decision makers may also be helpful.
- Instituting ideas of continual improvement may require a long-term shift in thinking (not a "revolutionary change").

Barrier

A management system framework generates increased paperwork associated with documenting the program.

Response

- Documentation provides reproducible policies and procedures that are useful when utilities face changing workforce demographics and turnover of intellectual capital.

Barrier

A management system framework generates closer scrutiny (increased liability), creates more transparent performance goals, and results in more explicit operational evaluations.

Responses

- Increased transparency can build confidence with outside audiences.
- Increased transparency can provide an opportunity to demonstrate "a job well done".

3.4 Case Examples

3.4.1 Charleston, South Carolina Commissioners of Public Works (CPW)

Background

Charleston CPW is a municipal corporation that provides both water and wastewater treatment services to the City of Charleston, SC and portions of the greater Charleston Metropolitan Area. The wastewater utility has a 36.5 million gallon per day (mgd) (130 million liters per day [ml/d]) wastewater treatment plant with 525 miles (844 km) of wastewater infrastructure. The water utility serves a customer population of 450,000 with a 118 mgd (446 ml/d) water treatment plant and 1,400 miles (2253 km) of water distribution infrastructure.

Charleston CPW has an ISO 14001 company-wide registration for its EMS, has an approved Partnership for Safe Water (PSW) program, has completed a Balanced Scorecard system development, and is approximately 90 percent through implementing CMOM.

Integrating Management Initiatives

Charleston CPW first developed an ISO 14001 EMS for the water distribution division. This ISO 14001 EMS was expanded to cover all of the agency's divisions. Initially, separate ISO registrations were maintained for the different divisions. Eventually, however, all of the EMSs were incorporated into one ISO registered EMS. Charleston CPW followed the development approach of expanding operations, described above.

The first point of integration for Charleston CPW was identifying ***Partnership for Safe Water*** *as a voluntary requirement under their EMS Legal and Other Requirements identification.*

The first point of integration between management initiatives occurred as an EMS was developed for the water division. Charleston CPW had been a member of PSW since 1996. PSW was identified as a voluntary requirement under the EMS Legal and Other Requirements. PSW's specific targets were built into EMS objectives and targets, and PSW technical guidelines were incorporated into EMS operational controls for meeting designated drinking water targets.

Charleston CPW has experienced the following benefits from PSW and ISO 14001 EMS integration.

- Integration increased the focus on filter maintenance and improving those activities to support PSW. Charleston CPW found that existing equipment was not sufficient to detect the very low turbidity measurements (less than .1 NTU) required for PSW. As a result, CPW has upgraded some of the measuring equipment and has improved filter maintenance to exceed the 95 percent at .1 NTU requirements of PSW. Currently, CPW is achieving .1 NTU 98 percent of the time.
- CPW found that EMS implementation drove increased consistency between operators by documenting and standardizing SOPs under EMS operational control and by integrating the computerized maintenance management system (CMMS). This increased consistency and alignment of the CMMS has lead to greater consistency of performance, as is demonstrated in the 98 percent achievement of .1 NTU.
- PSW performance has also improved as a result of the standardization of other elements, such as training, document control, measuring and monitoring, and reporting, which were formalized as part of EMS implementation. CPW has used the PSW requirements for reporting and has made the measurement and reporting tools the same for both EMS and PSW.

The City of Charleston CPW has found that standardization of training, document control, measuring and monitoring, and reporting, through EMS implementation has improved its performance under the Partnership for Safe Water.

Charleston CPW has also integrated its EMS and CMOM program, which is about 90 percent complete**.** For ISO auditing and registration purposes, CPW has not yet officially integrated the CMOM program into the EMS. Rather, they are currently running in parallel, with integration occurring at strategic points.

The primary benefit of integration that Charleston CPW has experienced with CMOM and EMS is that the EMS already had put in place the majority of what was needed for implementing CMOM.

Charleston CPW has found that by having an EMS in place, the majority of what was needed for implementing CMOM was also in place. CPW had already identified SSOs as part of EMS significant environmental aspects analysis. Elements needed for CMOM that were not already addressed by the EMS included: preparing a written description of the CMOM program, incorporating some additional SOPs (e.g., for the electrical components of the pump stations), incorporating CMOM signage and posting requirements under EMS Legal and Other Requirements, pulling together schedules for maintenance and rehabilitation / repair of assets, and adding an SSO response component to the EMS Emergency Response and Preparedness Plan.

For more Information on Charleston CPW's approach to EMS and CMOM integration see "Laying the Foundation: An environmental management system is a great first step in launching a CMOM program" by Rick Bickerstaff, Adrian Williams, and John Cook, Water Environment and Technology, March 2003.

Charleston CPW has also almost completed developing a Balanced Scorecard (BSC) and has found integration opportunities between

BSC and the EMS. BSC has helped coordinate existing strategic planning processes and EMS, as it focuses on a company wide strategic direction first and then helps set measures for the strategic plan.

Balanced Scorecard helped Charleston CPW develop performance measures in areas that the EMS did not cover. BSC has helped set targets that, while not significant from an environmental perspective, are significant from the corporate management perspective.

All of the important objectives from CPW's strategic plan, including environmental objectives from the EMS and SSO objectives from the CMOM program, have been included under BSC. Use of BSC has also helped prepare measures for knowing how the utility is performing with respect to those objectives. The environmental objectives and targets, and the objectives and targets that are non-environmental, are being supported by EMS infrastructure (e.g., through standardization of SOPs, better training, etc.) but are not seen as part of the EMS for audit purposes. The EMS provides elements of implementing, checking, and acting to support all of the objectives and targets developed under BSC.

Charleston CPW has found the following benefits from integrating BSC with the EMS.

- BSC has provided connectivity that has supported effective use of frontline staff by helping them to understand the corporate objectives and how divisional objectives support these.
- BSC helped develop performance measures in areas that the EMS did not cover. BSC has helped set targets that while not significant from an environmental perspective, are significant from the corporate management perspective.
- BSC has helped prioritize between objectives and targets and this has fostered effective budget development.

Table 6 (next page) depicts the integration opportunities Charleston CPW has identified between ISO 14001, CMOM, PSW, and BSC.

For more information on Charleston CPW's management initiative implementation and integration efforts, contact John Cook, Assistant General Manager at cookjb@charlestoncpw.com

Table 6: Charleston CPW Integration Opportunities for ISO 14001, CMOM, Partnership for Safe Water, and Balanced Scorecard

ISO 14001	**CMOM**	**Partnership for Safe Water**	**Balanced Scorecard**
PLAN			
Management commitment	←		
Policy statement	←		
Assessment of areas for performance improvement	←	←	←
Legal and other requirements	←	←	
Objectives and targets	←	←	←
Management programs for performance improvement	←	←	←
DO			
Structure, roles, and responsibilities	←	←	
Training, awareness, and competence	←	←	
Communications – internal and external	←	←	
Document management	←	←	
Operational controls	←	←	
Emergency Preparedness and response	←	←	
CHECK			
Measuring and monitoring	←	←	
Auditing	←		
Reporting	←	←	
Management review	←		
ACT			
Corrective and preventive action	←		
Change management			

3.4.2 City of Eugene, Oregon Public Works Department

Background

The City of Eugene, Oregon Public Works Department includes parks/open space, transportation (airport and streets), stormwater, wastewater treatment, and natural resource stewardship. The entire Department is participating in the APWA Management Accreditation Program. The Wastewater Division of the Department has developed an ISO 14001 EMS that has been registered since September 2000 and is in the process of implementing Balanced Scorecard (BSC).

The services of the Wastewater Division include operating a 100-acre (40.5 ha) regional Water Pollution Control Facility and 49 pumping stations, treating 38 mgd (144 ml/d) of wastewater; processing 49.8 million gallons (188.5 ml) of biosolids annually at the 154-acre (62.3 ha) Biosolids Management Facility, and administering an industrial pretreatment program that monitors the wastes of 39 local industries.

Integrating Management Initiatives

The Wastewater Division began by implementing ISO 14001 and is now utilizing BSC to develop goals and objectives for expanding its EMS to other management areas. The Wastewater Division moved to BSC, in part, because managers believed that the EMS did not sufficiently address certain financial components of environmental areas. For example, the Wastewater Division found it did not have a strong basis for balancing the cost of making an operational change or new capital investment with the benefit of meeting an environmental objective.

As part of developing BSC, the Wastewater Division developed a single vision statement and made all its policies consistent with the vision. The vision statement explicitly reflects the four BSC perspectives of customer, financial, internal business processes, and learning and growth.

> *"The protection of public health and the environment shall be our highest priority and this will be evident in everything we do. We will carefully consider cost efficiency and effectiveness in all of our work. We recognize that flexibility and change are essential for improvement. Our division shall be a challenging*

> *and desirable place to work and we recognize that individual growth and development enhance our success. We will be responsive and accountable to the public we serve and will remain to be their preferred service provider."*

The Wastewater Division is in the process of developing objectives and targets to match the four quadrants of BSC (financial, customer, learning and growth, and internal business processes). Developing objectives and targets for each BSC quadrant has helped the Division identify gaps in the EMS objectives and targets. For example, BSC requires the Division to define its customers. The Division does not have direct contact with customers (local sanitary connections, as well as billing and other administrative services are not the responsibility of the Wastewater Division) and so had not identified its customer base as part of EMS planning. Under the customer perspective quadrant of BSC, the Wastewater Division is now developing objectives that are important to customers such as minimizing odors.

The Division also identified, through developing BSC objectives and targets, a gap in safety issues in the EMS. The Division is considering incorporating safety into the EMS, based on the clear connections between environment and safety. The Division is incorporating other EMS objectives into the BSC quadrant to which they most strongly relate. For example, controlling and reducing influent mercury fits in the BSC quadrant for internal business processes.

The Division cites increased transparency of the operation and capital budgeting process as one benefit of integration. Core performance measures have been identified for each program area in the Division and these measures will be fed into the annual budgeting process.

The Division has been able to leverage the existing infrastructure of the EMS to support BSC components. The development of duplicate document control systems, for example, has been avoided. To support ISO 14001 registration, the Division has developed an intranet-based documentation system, allowing all staff access to information, procedures, forms, policies, etc. The same measuring and monitoring system will be used to track progress on all objectives and targets derived from the BSC.

For more information on Eugene's management initiative implementation and integration efforts, contact Peter Ruffier, Wastewater Division Director at Peter.J.Ruffier@ci.eugene.or.us

The Wastewater Division is currently trying to integrate the best practices defined in the APWA Management Accreditation Program and are finding that this work links with EMS and BSC activities. The APWA Program helps confirm interpretations of best practices and ensures that none are overlooked.

3.4.3 City of Albany, Oregon Public Works Department

Background

The NBP EMS provided the continual improvement framework, the documentation opportunity, and the "how to" roadmap for continual improvement that staff could understand in this "fenced" area of the organization.

–Diane Dennis, City of Albany Public Works Director

The City of Albany, Oregon Public Works Department (PWD) provides drinking water, wastewater collection and treatment, transportation, and stormwater drainage services to 41,650 residents. The Albany PWD manages 4 drinking water reservoirs, an 18-mile canal (29 km), 5 pump stations, an 18 mgd (68 ml/d) water treatment plant, 220 miles (354 km) of water mains, 1 wastewater treatment plant with an average 9 mgd and maximum 20 mgd (average 34 ml/d, maximum 76 ml/d), 180 miles (289 km) of collection system pipes, and 18 pump stations.

The PWD has developed a National Biosolids Partnership (NBP) EMS that covers the wastewater treatment plant and biosolids management operations. The PWD is implementing components of CMOM for the collections system and wastewater treatment plant and components of Asset Management for the entire Department. The PWD is participating in the APWA Management Accreditation Program and adopting the APWA best management practices.

Integrating Management Initiatives

The PWD is systematically transitioning from Management-by-Objectives (MBO) to a plan-do-check-act management system approach. The PWD is incrementally expanding the EMS framework developed for NBP to include all operations. This will expand and strengthen the current MBO approach by incorporating systematic follow-up (checking and acting). The PWD is looking to incorporate other management areas, not just environment, into the management system framework.

Implementation Approach

The PWD's approach for expansion and integration will follow a step-wise, incremental path. First, all environmental aspects of wastewater treatment (beyond biosolids) will be incorporated into a continual improvement management system framework, including adding the "technical" components of CMOM and asset management. Next, drinking water operations will be incorporated, and then eventually other divisions (such as transportation) will be incorporated. The scope of the EMS will expand in terms of both fenceline and management areas.

As the EMS scope is expanded, the PWD will utilize vision and goals determined for the city (set by the City Council each January) as the basis for balancing financial and other objectives. The PWD establishes objectives and targets based on balancing customer service, environment, financial, utility business processes, and human aspects (a Balanced Scorecard-like approach). The EMS framework will provide the needed continual improvement cycle to more actively check and act on objectives and targets established under MBO. This is the primary benefit Albany PWD is seeking in making the transition from MBO to plan-do-check-act. In addition, process documentation and standardization will improve consistency and performance.

For more information on Albany PWD's management initiative implementation and integration efforts, contact Diane Dennis, Public Works Director at dtaniguchi-dennis@ci.albany.or.us

Because of third party auditing, the PWD will keep a discreet NBP EMS and use the EMS framework (plan-do-check-act) to support other divisions, as well as other management area goals and objectives. Some elements will be standardized - for example only one document control approach will serve the entire department. For other elements, different divisions may have individualized procedures, integrating only where activities cross division boundaries.

3.4.4 Sydney Water Corporation, Sydney, Australia

Background

Sydney Water Corporation has a legislative requirement and is licensed by the State Government to provide drinking water and wastewater treatment services to more than four million customers in the greater Sydney Region. The wastewater process captures, transports, and treats approximately 1,200 ml/d (320 mgd) through 22,000 km (13,670 miles) of pipes, 659 Pumping Stations, and 30 Sewage Treatment Plants. The wastewater process involves primary, secondary, and tertiary treatment plants. Approximately ninety percent of the flow is treated at the coast and discharged to the ocean, with the remainder (10 percent) treated at 17 tertiary treatment plants that discharge to the Hawkesbury Nepean River. Sydney Water Corporation (SWC) is also responsible for the beneficial use of biosolids and effluent. Over the last five years, SWC has averaged beneficial use of 99 percent of the biosolids captured with 100 percent beneficially used in 02/03 financial year. SWC also beneficially reuses approximately 35ml/day (9 mgd) of reclaimed and recycled water.

Integrating Management Initiatives

SWC's Wastewater Operations has developed a Wastewater Integrated Management System (WW-IMS) that is ISO 14001 certified and compliant with the requirements of relevant clauses of ISO 9001 and Sydney Water Corporations' Occupational Health and Safety System. The WW-IMS currently covers all 30 treatment plants and the wastewater collection network (pipes and pumping stations) and associated activities.

IMS Development Approach

SWC has implemented the WW-IMS in stages, expanding over time in terms of both the fenceline, or number of facilities covered, and the management areas addressed. The WW-IMS has been developed in the following stages.

- In 1996, an ISO 14001 EMS, with elements of quality and safety included, was developed for one sewage treatment plant. This EMS was certified to the ISO 9001 and 14001 standards. Effluent from the plant is used in homes for toilet flushing and garden watering. This activity required extra monitoring due to the increased liabilities involved and provided the driver for initial management system implementation.

- Next, two additional treatment plants developed ISO 14001certified EMS. With three separate EMS in place, SWC adopted a more uniform approach, electing to use a single management system, rather than a series of independent systems that were slightly different for each plant.

- Between 1998 and 2001, SWC's plant management team developed an ISO 14001 certified management system that covered all 30 sewage treatment plants and incorporated relevant clauses of ISO 9001and the Corporation's Occupational Health and Safety System. ISO 14001 provided the basic management system framework that was expanded to include the other areas of occupational safety and heath and quality. This phase also included building in the management of biosolids under the same management system.

> Most recently, the management system has been expanded to encompass a process-based approach, building in the wastewater collections network (thus, encompassing the entire Wastewater Operations business unit) and certain environmentally critical components of the following other wastewater business units: Planning, Maintenance, Trade Waste, and Reporting.

SWC has identified the following additional steps for future WW-IMS expansion.

> Incorporate all remaining functions of the wastewater business units (Planning, Maintenance, Trade Waste, and Reporting).

> Certify each additional business unit in the WW-IMS to the most relevant standard for that business unit. All business units will maintain an integrated approach and contain environmental, safety, and quality components. However, they will be certified to different standards. SWC has already identified which standard to apply by using a risk based approach that identified what the greatest risk was in each business unit The treatment facilities will maintain ISO 14001 certification, for example, and the maintenance division will achieve ISO 9001.

Standardized and Specialized Procedures of the WW-IMS

A team of management representatives developed the WW-IMS. The role of the team was to define which procedures should be standardized across all areas to avoid unnecessary duplication, and which procedures must be specialized for different business units. The following procedures are standardized across all business units.

> Procedures for environmental safety aspects and impacts assessments.

> Procedures for setting objectives and targets.

> Administrative procedures for training, awareness and competence; communication; document control; records management; asset commissioning; purchasing; site induction; maintenance management; and reporting.

> Cross-business workflow procedures for environmentally critical processes that have shared responsibilities across a number of business units (this is to ensure the links between each area of responsibility are effective and efficient, and there is a common understanding of the process across business units).

> Standardized operating procedures (SOPs) for key monitoring and measuring activities, such as equipment calibration.

> Procedures for conducting management review.

> Standard administrative procedures for nonconformance and corrective action.

> A common audit standard administration procedure.

The following procedures are tailored for different business units (or even different facilities within the business units) under the WW-IMS.

> Operational procedures.

> Annual aspects and impacts assessments.

> Workflow procedures for measuring and monitoring, such as daily plant readings and laboratory testing.

The policy statements; setting objectives, targets and performance measures; and management review activities have a mixed approach that include corporate-wide and individualized activities.

> The WW-IMS policy statement covers all of the requirements of ISO 14001 and ISO 9001, commitment to compliance, pollution prevention, and continual improvement, elements of safety, and strategic documents. The wastewater business units have found it helpful to have one overarching policy that incorporates all of their requirements and commitments. However, each individual plant or business unit can develop a commitment statement, based on the WW-IMS policy, to include their individual issues. The specific requirement of the policy, apart from meeting the mandatory requirements, is to make it meaningful to those using the system.

> Sydney Water Corporation has a 5-year Corporate Plan that includes objectives, targets, and performance measures for expenditure, safety, and environmental performance. The Corporate Plan is updated annually.

Objectives, targets, and performance measures in the Corporate Plan that are relevant to each division are incorporated, through an iterative process, into individual divisional plans and business unit plans. The division-level business plans contain a Balanced Scorecard of key objectives and targets covering such items as

EPA licenses and customer satisfaction (a community consulting committee provides input on customer perspectives at an enterprise-wide level). Progress on these deliverables is checked monthly via Balanced Scorecard and quarterly at specific review sessions.

Individual business unit plans also incorporate input from additional sources, other than the Corporate Plan, such as the environmental and safety aspects and impacts ranking, legal and other requirements, and asset management / improvement plans. Many of these inputs are specific to each business unit. The business unit plans are reviewed quarterly, after audits. Management review examines the results of the audits, progress on actions, objectives, and targets, appropriateness of documentation, as well as reviewing the ongoing suitability of the system.

For more information on Sydney Water Corporation's integrated management system, visit the website at www.sydneywater.com.au

IMS Benefits

Sydney Water Corporation identifies the following benefits from developing its Wastewater Integrated Management System.

- Improved cross business links.
- Improved efficiency, consistency, and reliability in meeting of objectives.
- Improved ownership and skills transfer between staff.
- Time saving and improved ability to locate current documents.
- Maintaining environmental performance improvements, including the reduction of ammonia, phosphorous, and nitrogen loading in effluent discharged.
- Reduction of operating costs and achievement of cost efficiencies.
- Quality improvements, including greater consistency in biosolids and effluent quality.
- Consistency and replicability of operating procedures through standardization and documentation.

3.4.5 Santa Clara Valley Water District, California

Background

The Santa Clara Valley Water District (District) is a special district responsible for managing Santa Clara County's drinking water resources, coordinating flood protection, and serving as steward of the county's more than 700 miles (1120 km) of streams and reservoirs. The District encompasses all of the county's 1,300 square miles (3370 km^2) and serves the area's 15 cities and 1.8 million residents. The District is a wholesale supplier of water to 13 local water retail agencies, which in turn provide drinking water to most of the county's communities. The District operates 3 water treatment plants with a total capacity of approximately 210 mgd (795 ml/d), 10 reservoirs, 3 large pump stations, and 134 miles (214 km) of large diameter pipes.

Integrating Management Initiatives

Asset Management Program

The Santa Clara Valley Water District is approximately 10 months into the development of an Asset Management Program (AMP). The District is taking an incremental development approach to their AMP by beginning with one Division, Water Utility Operations, and then later considering if and how to incorporate other parts of the District into the AMP. This approach resulted from management's belief that it could be too big of an effort to cover the entire District in its first attempt at developing an AMP.

Asset Management Program Implementation Approach in a Glance

- Incremental expansion of AMP fenceline
- Utilizing mix of consultant, cross-functional team, and stakeholder group
- Considering development of and integration with an ISO 14001 EMS

The Water Utility Operations Division is utilizing consultant help in developing the AMP. The consultant has provided some asset management tools including funding scenario and planning software applications and a condition/risk assessment database. The database communicates with the funding scenario software and a computerized maintenance management system (CMMS).

The Water Utility Operations Division has formed an AMP team representing all divisions within the District. The AMP team reports to the executive management team, which is responsible for determining certain objectives such as service and risk levels. The Water Utility Operations Division also interacts with a broad group of stakeholders, including the water retailers, for input on items such as desired service and risk levels.

The main short-term goal for the Water Utility Operations Division's AMP is to develop information systems and procedures necessary to better document and manage maintenance activities. In addition, the AMP will provide input to the Capital Program, and establish long term funding projections for equipment overhaul and replacement activities which will be incorporated into the District's overall funding plan. To achieve this end, the focus has been on developing overhaul and renewal plans, an asset inventory, more complete implementation of the CMMS, and the addition of computerized financial planning and condition assessment applications.

The Division has completed an asset inventory. In conducting the asset inventory, the Division categorized all equipment into 16 different types. For each type of equipment, a classification of attributes, such as size, power, and other attributes was developed for identifying equipment type. This “Asset Template” was created within the CMMS and is an example of the focus on improving the CMMS utilization. Asset templates are used when new “equipment records” are created in the CMMS database (which also functions as an asset registry). The templates ensure consistent data entry so queries can be made with a high confidence level that all equipment of concern is being considered.

The District believes the combination of an asset management program and an EMS will help provide a way to balance competing objectives and provide an explanation of why certain actions are important.

In addition to being assigned to a category, each piece of equipment is assigned a unique numerical identifier in the catalog. This number is used to reference the same piece of equipment in the CMMS, the condition assessment module, the funding planning software, as well as the catalog. The Water Utility Operations Division is in the process of loading the data collected during the inventory phase of the project into these systems.

ISO 14001

The CEO of the District is committed to establishing the organization as a “green agency”. As a step in that direction, the CEO has identified the adoption of ISO 14001 as a high priority initiative to be deployed District-wide. It is likely that EMS development would involve a cross-functional team including many of the members of the current AMP team.

District management finds that an EMS is becoming important with the need to adapt to changes in regulations and make policy-level decisions about environmental performance. For example, the District faces choices such as whether or not preparation of a California Environmental Quality Act (CEQA) document is necessary for taking a pipeline out of service. CEQA documentation is costly and can reasonably exceed the actual cost of the maintenance activity.

In facing decisions such as these, the District wants to be able to take a programmatic approach to making decisions and determining what level of environmental performance is desired given cost and other factors. The District believes the combination of an asset management program and an EMS will help provide a way to balance competing objectives and explain why certain actions are important.

Through AMP development, the District is identifying the relationships between activities and decisions for maintaining assets and environmental impacts. The District sees a key integration point between the AMP condition assessment and rehabilitation/renewal choices with environmental objectives. Choices made in developing the rehabilitation/renewal schedules, such as desired risk level, are reflective of established environmental (and other) performance goals.

Recognizing the connections between asset management decisions and the environment, the District will soon be launching a Programmatic Environmental Investigative Report (EIR). The EIR will examine the schedule for asset construction and rehabilitation programs and identify the associated environmental impacts. This will allow the District to plan and know when environmental impact statements will need to be prepared. The EIR will allow the District to make clear decisions about the environment from a programmatic perspective, rather than on a case-by-case basis.

For more information on Santa Clara Valley Water District's management initiative implementation and integration efforts, contact Alan Zeisbrich, Senior Project Manager at azeisbrich@valleywater.org.

3.4.6 Western Carolina Regional Sewer Authority

Background

Western Carolina Regional Sewer Authority provides wastewater treatment services to over 104,000 industrial, commercial and residential customers in Greenville County and parts of Anderson, Spartanburg, and Laurens Counties in South Carolina. Western Carolina currently operates and maintains 300 miles (480 km) of major sewer trunk lines. The agency owns and operates 12 wastewater treatment plants and three small wastewater package plants, which treat an average flow of approximately 42 mgd (160 ml/d). Wastewater is collected from 17 sewer sub-districts and municipalities that independently construct and maintain their sewer collection lines.

Integrating Management Initiatives

Western Carolina has adopted programs to increase organizational efficiency, including CMOM and the NBP EMS. CMOM, incorporated during the late 1990's, was implemented to increase the agency's ability to protect public health and water, provide customers with efficient and effective services, and maximize the effective life of infrastructure. The implementation of CMOM required the development of a variety of programs and standard operating procedures.

During the implementation of the NBP EMS, Western Carolina discovered a variety of similarities between the program requirements of the EMS and CMOM. After reviewing these thoroughly, Western Carolina concluded that with minor modifications, many elements of the CMOM program could be used to meet the requirements of the NBP EMS. Three of the major elements that Western Carolina focused on during the integration of the CMOM and the EMS were an Emergency Preparedness and Response program, a Communication and Public Outreach program, and a Documentation and Document Control program.

Emergency Preparedness and Response

CMOM development required the creation of a Contingency Planning Process to ensure a procedural response to emergencies or abnormal conditions that can negatively impact the environment. The NBP EMS requires a similar Emergency Preparedness and Response program. Although the CMOM program focuses on the wastewater and collections systems, it includes details that could easily be adapted to accommodate the requirements of the NBP EMS Emergency Preparedness and Response program. By combining efforts, each program can produce a unified, agency-wide emergency response team, with only minimal differences.

> All emergency personnel can be trained on general response at one time, rather than defining and teaching two different Emergency Response techniques. The distinct differences between the two programs are focused on during individual sessions.

> By using the same documentation practices there is an agency-wide understanding of the documentation and procedures.

> The emergency response team communications system allows for a universal understanding of procedures throughout the organization.

> By combining efforts in the training and implementation of the emergency response team and the Contingency Planning

Process, there will be an abundant number of members to respond, without overloading the program.

Communication and Public Outreach

The CMOM and the NBP EMS require a public education program. Combining public education efforts has resulted in the following benefits.

> The public education program informs the public of all organizational programs and agendas. The public is well aware of new capital improvement projects and the benefits of the biosolids program.

> The public education program improves agency relations with the community about all facets of the organization.

> The tools used to inform the public, such as annual reports, bill stuffers, press release program etc., can be used to promote general organization issues as well as the NBP EMS. This avoids the cost and time to create multiple communication avenues.

Documentation and Document Control

CMOM calls for precise documentation procedures that can be used throughout the organization. The NBP EMS also requires procedures and practices to ensure proper documentation of biosolids management activities and EMS elements. Consolidating efforts and adjusting the current documentation processes created through the CMOM program will yield the following benefits.

> Using the documentation procedures and practices in place for the CMOM program provides an umbrella framework that can be used throughout the organization, just as a manual.

> Integrating documentation processes from CMOM into the NBP EMS establishes a set of standard procedures, protocols, and formats for document creation, approval, identification, and efficiency. This standardization allows for an agency-wide understanding of the documentation process.

> Since the inception of its biosolids management program, Western Carolina has received numerous national, regional, and state awards. With the conjunction of the NBP EMS and the CMOM organizational practices, Western Carolina can continue to improve consistency and the quality of its biosolids materials.

For more information on Western Carolina Regional Sewer Authority's management initiative implementation and integration efforts, contact Ray Orvin, Executive Director at Rorvin@wcrsa.org

By instituting the integrated management system concept into the development and structuring process of the NBP EMS, Western Carolina has eliminated the duplication of program elements and, overall, improved its organizational programs. Western Carolina will continue to use this concept to further its efforts in insuring substantial management and organizational improvement.

4 Integration Opportunities – Examples with Four Initiatives

Chapters 1 and 2 of this guide provided an introduction to 15 management initiatives and explored their interrelationships in the context of a continual improvement management system framework. Chapter 3 introduced specific areas of management initiative integration, explored six key integration opportunities to drive strategic alignment, and provided case examples of how organizations are approaching, and what benefits they are seeing from, integration within a continual improvement management system framework.

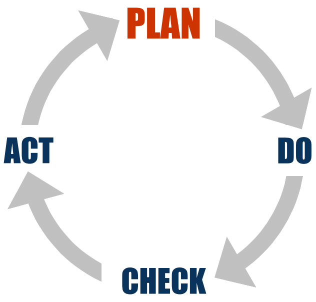
Chapter 4 provides a detailed articulation of the 18 integration opportunities in the plan-do-check-act cycle by focusing on the relations among four of the 15 management initiatives - environmental management systems (using the ISO 14001 EMS standard); asset management programs (AMP); Capacity, Management, Operations, and Maintenance Programs (CMOM); and the Partnership for Safe Water (PSW). These four initiatives were selected because together they provide an opportunity to explore the full range of integration opportunities, establish an integration approach that can be readily adapted to many other management initiatives, and address management areas of critical, current significance to both water and wastewater utilities.

This chapter, by design, covers the details of the 18 integration opportunities. It is geared to assisting management initiative implementers, such as a utility's asset management project team leader, to understand the mechanics of integration within a continual improvement management system framework. As well, this chapter can be useful in the context of a self-assessment for identifying opportunities for improvement or steps in the PDCA cycle that could be strengthened. The material has been prepared to be as specific and comprehensive as current integration experience allows. It looks to address an implementer's need to understand how to approach integration rather than just what integration is.

This text can best be approached in two steps: a quick "flip through" to gain a general understanding of the material provided and a detailed reading of the text when specifically planning and working out the details of (e.g., preparing a project workplan) how to move forward with integration.

To aid implementers' ability to hone quickly in on integration opportunities identified as critical to effective strategic alignment (in Chapter 2), the guide uses the symbol depicted below.

4.1 Plan



The planning component of the continual improvement framework relates to determining where the organization identifies areas for improvement, setting measurable goals for improvement, and making plans to achieve them.

The planning component of the continual improvement cycle provides the following integration opportunities.

> Management commitment
> Vision
> Policy statements
> Assessing areas for performance improvement
> Defining legal and other requirements
> Setting objectives and targets
> Developing management programs for performance improvement

What level of management is considered "top" for making the commitment to integration?

- Management level must be consistent with the scope of the management system.
- Management must be able to make decisions and commitments about staff and budget to ensure that adequate resources are dedicated to implement the system and enable performance improvements.

4.1.1 Management Commitment

The very first step to the development of any management initiative is explicit top management commitment to the initiative. EMS, PSW, and CMOM all require a written and signed statement of commitment.

Management commitment is also the critical first step to integrating management initiatives. Because most management initiatives are by nature focused on a specific management area (e.g., EMS focuses on environment, AMP on assets), integration will require an explicit decision and commitment by the utility to do so.

To establish and support integration, management commitment should include a clear statement from the utility's top management. This statement should articulate commitments both to pursue performance improvements in the selected management areas by implementing selected management initiatives and a clear statement to pursue integration.

A sample management commitment statement supporting integrating management initiatives in the context of a continual improvement management system framework is given below.

> "OUR COMMITMENT
> We will together develop, implement, maintain and continuously improve a Wastewater Integrated Management System (WW-IMS) complying with the requirements of ISO 14001, relevant clauses of ISO 9001 and SWC's OHS&R System."
> *Sydney Water Corporation*

Example - Identifying Top Management

The City of Eugene, Oregon's Public Works Department has implemented an EMS for its Wastewater Treatment Division. The Director of the Wastewater Treatment Division could be identified as top management as that would meet the two conditions identified above. However, since the EMS for the Wastewater Treatment Division interacts with other divisions (such as Human Resources for the training elements), it has been important that the Director of the entire Public Works Department also make a commitment to implementing and maintaining the EMS.

4.1.2 Vision

Because the core function of water and wastewater utilities is inherently environmental in nature (i.e., providing clean water), it is likely that an existing utility mission statement is consistent with the policies and commitments of an EMS.

Many utilities have a mission statement and a strategic plan that convey a vision of what the organization is, does, and wants to be. Utilities that already have a mission statement and strategic plan should revisit these to ensure they are consistent with and/or broadly encompassing of commitments made to implementing and integrating management initiatives.

Although none of the four selected management initiatives require a high-level mission statement, such a statement will be critical to establishing a clear focus for individual and integrated management efforts. The organization's vision, as reflected in the mission

- **Who is important to the organization?** Examples: satisfied customers, empowered employees
- **What is the organization's primary purpose?** Example: to provide safe drinking water
- **What is important to the organization?** Examples: stable rates, customer service
- **What does the organization want to look like in the next 3, 5, or 10 years?** Examples: best in class facility, state-of-the-art operations
- **What does the organization want to accomplish?** Examples: energy self-sufficiency.

statement, can help managers explain the reason for developing an integrated continual improvement management system framework and it can help managers choose the tools or programs that will best achieve their vision.

The mission statement can also allow managers to connect current initiatives to the vision and explain to employees, customers, elected officials, and others why the utility is launching an initiative or making an investment decision. This helps prevent the new initiative from being seen as just another "flavor-of-the-day". Instead, it can be shown to be an important component of supporting the utility's overall direction.

Although a mission statement is likely to be set by the organization's top management, it is important that input be sought from other stakeholders, such as employees, regulators, elected officials, customers, and environmental and community groups. In developing a mission statement, it can be helpful for a utility to consider a number of questions (see text box). In answering these questions, an organization can develop a mission statement that will effectively support integration.

Example Mission Statement—Charleston CPW, SC

To be a customer focused leader in the water and waste water industry, and to:

\> *provide the highest quality of service at the lowest possible cost;*
\> *provide safe and abundant drinking water;*
\> *protect the quality of the water environment;*
\> *provide superior wastewater treatment; and,*
\> *enhance the climate for long-term economic growth and community development.*

Key Integration Point for Strategic Alignment

4.1.3 Policy Statements

A policy statement lays out the utility's commitment to continual improvement in a given management area. For example, an EMS policy articulates a commitment to environmental performance. A policy statement serves as a reference point for setting specific objectives and targets for performance improvement in the relevant management area.

Environmental Policy: Eugene, OR Wastewater Division

"The Wastewater Division is committed to continual improvement of its environmental performance, and to provide sound stewardship of the environment, consistent with the Division's mission."

Selected Management Initiatives

Each of the selected management initiatives either requires or will benefit from the development of a policy statement, laying out the organization's commitments.

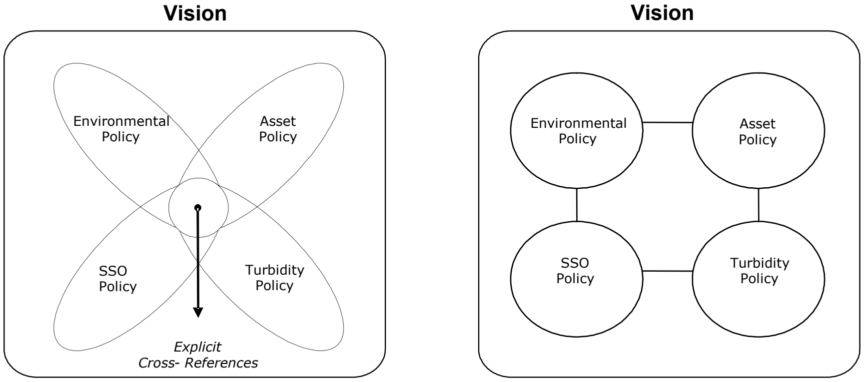
- EMS: EMS requires development of an Environmental Policy to communicate the environmental vision of the organization. The policy will typically reflect three key commitments: continual improvement; prevention of pollution; and compliance with relevant laws and regulations.
- CMOM: CMOM does not require a policy statement. However, the stated purpose of developing a CMOM is to "properly manage, operate, and maintain, at all times, all parts of the collection system that you own or over which you have operational control" and to "provide adequate capacity to convey base flows and peak flows for all parts of the collection system you own or over which you have operational control". This is the implied policy statement of an organization embarking on CMOM.
- AMP: A utility's asset management program should be driven by a set of asset management policies that reflect a commitment to continual improvement. AMP policies should include: a policy to renew and replace assets in a cost-efficient manner that maximizes opportunities to reduce costs through strategic intervention where this will reduce overall life-cycle costs compared to running assets to failure; and a policy of excellence in service to customers.
- PSW: No policy statement is mandated by PSW. However, the signed commitment required upon entry to PSW implies development of an organizational policy of commitment to improving drinking water safety and quality.

It is important to examine existing or formulate new management initiative-specific policies to address any potential inconsistencies between them. It is not necessary or, in most cases desirable, to create a single, combined policy.

Integration Opportunities

When integrating management initiatives into a continual improvement framework, a utility does not need to create, and will probably be best served by avoiding, a single, combined policy statement. That is the role of a vision or mission statement, which should be broad and encompassing of the policy statements.

Policy statements can be drafted to explicitly cross-reference one another. Or, the policy statements can sit side-by-side, without explicit reference, each remaining distinct. Although cross-referencing policy statements is one way to avoid inconsistencies and clearly establish the relationship among them, there are reasons to consider keeping them distinct. For instance, organizations that find a third party audit is important may want to keep a distinct set of policy statements – one for each management initiative. Integrating an AMP policy, for example, with an EMS policy could lead EMS auditors to examine the AMP.

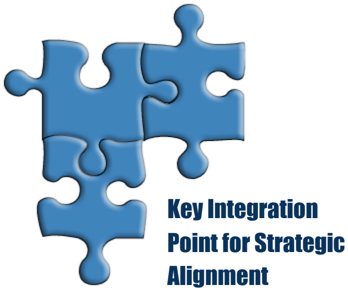


A. Policies Cross-Referenced

B. Policies Side-by-Side

How to Approach Integration

In addition to cross-checking management initiative-specific policy statements for inconsistencies, utilities will also want to examine other policies to find and resolve any inconsistencies. For example, procurement policies might require purchasing "least cost" supplies, while the environmental policy might require the purchase of supplies that are made of recycled material. These two policies will conflict if recycled material supplies are not also least cost. Reviewing all policy commitments in advance can help avoid this type problem by resolving policy conflicts in advance and determining the organization's highest priorities.



Key Integration Point for Strategic Alignment

4.1.4 Assessing Areas for Performance Improvement

Planning under a continual improvement management system framework requires that a utility assess where performance improvements are most needed. Each of the selected initiatives provides an approach to prioritizing performance improvements within their focus area.

For example, EMS planning requires that a utility conduct an environmental aspects assessment and ask "how do we impact the environment and how can we improve environmental performance?" CMOM planning requires that a utility conduct an SSO assessment and ask "how often and where are we having SSOs and what can we do to prevent them?"

Conducting assessments for performance improvement are critical for an organization to understand how it is performing (and where), and therefore, what areas need improvement. These areas identified for improvement are then "fed" into the process for setting specific objectives and targets.

Selected Management Initiatives

In their approach for assessing performance improvement, each of the four selected initiatives provides the following:

> A basis for the assessment (i.e., the entity, such as a pumping station in the collection system, for which information is gathered and organized);
> Data gathering activities (to generate the relevant "attributes" or characteristics of the selected entity) and analytical methods for conducting assessments; and
> A set of criteria for determining the significance or importance of the analytical findings.

Basis for Assessment

- **EMS** - environmental aspects, which are operational units, products, services, and activities of an organization that can interact with the environment
- **AMP** - asset management units, which are individual pieces or groups of assets having the same replacement value, condition, and capital renewal / replacement schedules; or a functional system whose components can be evaluated together as a single asset
- **PSW** - business units, equipment, and practices associated with turbidity levels
- **CMOM** - facilities and conditions that contribute to the prevention of SSOs

Each of the four management initiatives utilizes a very similar "**basis" of assessment.** The organization is divided into units of operation and/or equipment (see box left). These units form the basis, or are the entities of interest for which the assessment is conducted.

Each of the four initiatives require **data gathering activities and analytical methods** that generate specific information associated with the entities of interest (e.g., asset management units for AMP), as well as information to support an overall view of organizational performance in the area of interest.

> EMS: Organizations collect data about potential environmental impacts. These environmental impacts are associated with selected environmental aspects. Potential environmental impacts include:

- materials, energy, water, and other resources used by the organization;
- releases to the air, water, or land;
- wastes, scrap, or off-spec materials generation and disposal;
- characteristics or attributes of the products or services that could result in impact to the environment (through their intended use, end-of-life management, etc.);
- land or infrastructure interactions with the environment (e.g., building energy use); and/or
- activities that might lead to accidental releases (e.g., chemical storage).

Assessments

EMS: EMS planning requires that an organization identify and assess its environmental aspects and the potential or real environmental impacts associated with those aspects.

AMP: Under AMP, a utility must conduct an asset inventory, an asset condition assessment, and an asset risk/failure analysis. An asset management program, and the supporting analysis, is organized around (i.e., uses as its basis) asset management units (AMUs).

CMOM: With CMOM, utilities look at the SSO “value chain” or where and how facilities and conditions contribute to the prevention of SSOs. This typically translates into focusing on components of the collection system such as connections, pipes, pumping stations, etc.

PSW: For PSW, a utility examines business units, equipment, and practices associated with turbidity levels for raw water and treated drinking water.

> AMP: The data collected for each asset management unit (AMU) during the asset inventory will typically include: size/capacity; construction materials; location; installation date; original cost; replacement cost; condition assessment; performance assessment; original service life; and estimate of remaining useful life.

Data generated for each AMU to support the asset condition assessment will typically include: extent and type of current deficiencies; repairs needed; cost to complete repairs; current operating and maintenance costs; current performance and utilization; remaining useful life; and a condition rating.

> CMOM: Under CMOM the data collected and performance evaluation undertaken will typically include the following:

- determining base and peak flows;
- determining current collection and treatment systems capacity for conveying base and peak flows;
- identifying capacity deficiencies leading to SSOs;
- locating collection system areas and/or treatment facilities contributing to SSOs;
- characterizing the SSOs (e.g., frequency, location, and type);
- evaluating the lifecycle costs of collection system components and treatment facilities;
- inventorying maintenance facilities, emergency equipment, and replacement parts; and
- mapping the collections system (potentially using GIS).

> PSW: PSW requires the identification of factors limiting turbidity performance, such as operational unit processes,

maintenance processes, administrative processes, and plant design.

Each of the four initiatives has a set of given **criteria for determining the significance or importance** of what is being assessed.

- EMS: EMS planning requires identification of environmental impacts associated with environmental aspects and which aspects are “significant”. EMS guidance typically identifies the following criteria for determining significance:
  - actual or potential impacts;
  - beneficial or damaging impacts;
  - magnitude or degree of impacts;
  - frequency or likelihood of impacts;
  - duration and geographic area of impacts;
  - parts of the environment that might be affected (e.g., air, water, land, flora, fauna);
  - if the impact is regulated in some manner; and
  - interested parties’ concerns about impacts.

- AMP: AMP requires the prioritizing of assets for inclusion in the asset inventory, assigning performance standards, and setting expectations for maintenance, renewal, and replacement. These are driven by the following review criteria:
  - cost;
  - mission criticality;
  - health and safety;
  - regulatory; and
  - public relations.

  Asset management options and specific AMU performance targets are anchored by risk/failure analysis. The risk/failure analysis is largely driven by estimating the probability (frequency) and severity of risk.

- CMOM: Developing a CMOM program requires that a utility establish performance improvement priorities that translate into specific capacity investment and system maintenance activities. The criteria used to establish these priorities typically include:
  - location of the SSOs relative to sensitive receptors;
  - frequency of SSOs at different locations; and
  - severity of the SSOs in terms of extent and impacts.

> PSW: Under PSW, the primary criteria for evaluating turbidity data and performance improvements are turbidity levels. PSW requires consistently maintaining turbidity levels at or below federal drinking water treatment standards.

Integration Opportunities

There are three opportunities for integration under assessing areas for performance improvement. These are: 1) the basis for conducting the evaluations, 2) data collection, and 3) prioritization criteria. These are described further below.

Basis for Assessment

As described above, each of the four selected initiatives requires that a utility identify key business units, in terms of equipment (or assets) and business processes, that serve as the basis for conducting the performance assessment. This similarity in the basis used for assessment indicates potential for a high degree of overlap in the assessments.

In a fully integrated approach, a utility would use the same business units (i.e., equipment and processes) as the assessment basis for all of the initiatives it chooses to integrate. For example, an organization could identify “drinking water distribution” as the business process or activity and the physical “distribution system” as the associated equipment or assets.

There are several benefits to using the same basis for conducting assessments. Not only is it more efficient, but there is a potential for increased alignment in setting objectives and targets, since this requires prioritizing between potential improvements in different management areas.

However, because of the differences in focus of the four selected management initiatives, an organization may not find it practical or feasible to utilize a completely standardized basis for conducting the assessments. For example, an organization might group together as an asset management unit all collection system pipes of a similar age and function, while under CMOM an organization might prefer to group together collection system pipes by geography, based on the location of SSOs. Creative use of database architecture can potentially reconcile these different needs in a straight forward manner with attributes like function, age, and geographic location attached to collection pipe entities. This will allow sorting the database to support both the AMP and CMOM needs.

Data Collection

To conduct the assessments necessary for each of its initiatives, a utility will need to collect a variety of data about its business processes and associated equipment. In planning an EMS, the data will focus on environmental impacts. For CMOM planning, the data will focus on capacity for peak flow conveyance and contributions to SSOs. Table 3 provides examples of data that will be collected for business processes and equipment under each of the four initiatives.

Table 3: Examples of data collected for assessments.

EMS	AMP	CMOM	PSW
Environmental impacts, such as: > Materials and energy used > Emissions > Potential risk of spills or accidental releases (severity, frequency, proximity to populations)	> Capacity > Location > Condition > Replacement, repair, rehab costs > Risk failure (severity and frequency)	> Capacity for conveying base and peak flows > If contributing to SSOs > Location, frequency, and severity of SSOs > Lifecycle costs > Proximity to sensitive populations	> Filter profiles (raw, settled, and combined filter effluent) > Capacity > Frequency and severity of turbidity spikes

Table 3 indicates that there is some overlap of data collection for the four selected management initiatives. Thus, a utility would realize efficiency benefits from integrating (or at least coordinating) data collection. An integrated or coordinated approach, such as the use of a single data system, would prevent duplicative data being collected to satisfy the needs of multiple initiatives.

Prioritization Criteria

Each of the four selected management initiatives provides a set of criteria for determining significance or priorities. In some cases, these criteria overlap (e.g., importance to external stakeholders, regulatory implications, environmental and human health risks). Developing a consistent methodology for applying criteria across each of the individual assessments will ensure reasonable consistency of how the criteria influence the emergence of priorities from each of the management initiative areas. For example, if asset management analysis places a very low weight on public concerns, but EMS analysis places a very high weight on these, a discontinuity in priorities will almost certainly exist. At times, this difference in weight may make perfect sense. However, it will be necessary to explicitly articulate why this is the case if decisions about priorities are to be effectively made.

How to Approach Integration

The following describes how to approach integrating performance improvement assessments at each of the three opportunities.

Basis for Assessment

To utilize the same basis for conducting the assessments, an organization should define what are the core business units, including key business processes and equipment. An organization that has already implemented one of the four initiatives can build upon the basis used for that assessment. For example, an organization that has implemented an AMP could use the asset management units and their associated business processes as the basis to begin evaluating environmental aspects under an EMS.

Data Collection

Utilities will realize efficiency benefits from integrating (or at least coordinating) data collection. An integrated or coordinated approach, such as the use of a single data system, will help prevent duplicative data collection. An organization should determine what information will be collected for each assessment that must be conducted. This way, efforts can be consolidated and information collected one time only. For example, information collected on capacity, location, and lifecycle costs of equipment for CMOM can also be used for AMP. Similarly, data collected on water quality for PSW could be used to assess environmental impacts for an EMS.

Prioritization Criteria

The key to integrating assessment criteria is to ensure that where criteria overlap among assessments a consistent method is used for applying them. The best point at which to establish consistency will be in designing an analytical approach. It will be at this point that evaluation criteria are selected and defined and methods for applying them are established. Some criteria that are likely to overlap for multiple initiatives include: risk (severity and frequency of risk); cost effectiveness; geography or location (proximity to public or sensitive populations, proximity to receiving waters); regulations; and interested parties' concerns.

4.1.5 Legal and Other Requirements

Charleston CPW identifies ***Partnership for Safe Water*** *under its EMS legal and other requirements for "drinking water quality" at the Hanahan Water Treatment Plant.*

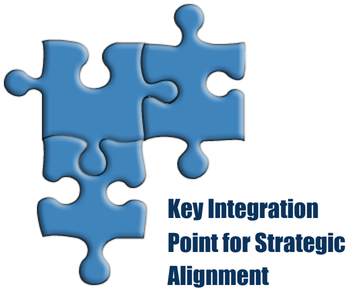
Planning for a continual improvement management system framework requires that an organization explicitly identify, track, document, and communicate applicable legal and other requirements, and ensure that these are factored into the organization's objectives and targets. Legal requirements typically include: federal, state, and local requirements; standards in locations where the organization sells products/services; and permit conditions. Other requirements might include: organization-specific codes; local ordinances; and other industry codes (such as generally applicable accounting standards) or the standards of programs to which the organization voluntarily subscribes.

Each of the selected management initiatives will require procedures for identifying and staying current with legal and other requirements and for incorporating these into objectives and targets. An integrated approach would use the same procedures for identifying, tracking, documenting, and communicating all legal and other requirements.

Utilities that have already established these procedures could readily apply them to legal and other requirements associated with other management initiatives or areas to avoid redundant activities and make the overall system much more cost effective. For example, under an EMS, an organization might establish a routine practice of reviewing the Federal Register to help identify emerging environmental regulatory requirements. When integrating asset management or CMOM into a continual improvement management system, this same review could be used for tracking emerging requirements in these areas.

Although the same procedures for identifying, tracking, documenting, and communicating legal and other requirements should be used to support multiple initiatives and management areas, it is likely that the information would be used by different departments and individuals. Although there may be some overlap, it is likely that where legal and other requirements are tracked, what the applicable legal and other requirements are, and who is responsible for utility compliance with the legal and other requirements, will be different for different initiatives and management areas. For example, requirements related to financial accounting systems that might be relevant for asset management would be communicated to and implemented by financial and accounting staff. Occupational safety and health requirements would be communicated to and implemented by human resources and/or operational staff. The key to integration is implementing consistent procedures for identifying, tracking, documenting, and communicating legal and other requirements.

4.1.6 Objectives and Targets



Objectives and targets act as the backbone of continual improvement management system frameworks and play a prominent and critical role in each of the four management initiatives. Objectives and targets are the place where an organization's assessment efforts, such as the environmental impacts assessment under an EMS, come together to establish organizational priorities. They establish the baseline against which an organization measures success and drive an organization's operational, human resource, and financial needs and priorities.

Terminology:
Goals, Objectives, Targets, and Performance Measures

The terms goals and objectives are often used interchangeably. Targets and performance measures are also used interchangeably.

Most EMS standards use and define the terms objectives, targets, and performance measures the following way:

- Objectives are overall, environmental goals that an organization sets out to achieve
- Targets are measurable and quantifiable actions required to meet objectives
- Performance measures indicate progress towards performance improvement

To be effective, an organization must define objectives and targets that are practical and quantifiable and when setting objectives and targets, will typically need to consider:

- existing high-level organizational priorities (such as those reflected in a mission or vision statement and/or resulting from strategic planning efforts);
- the products of assessments that identify areas for improvement (such as an Asset Management Conditions Assessment);
- legal requirements;
- views of interested parties (e.g., customer needs); and
- financial, technical, and human resource capacity.

Selected Management Initiatives

Each of the management initiatives addressed in this guide call for the development of explicit objectives and targets and linkage of these to financial and human resources in a management program or action plans.

- EMS: EMS objectives and targets are focused on improving environmental performance and derive primarily from the significant environmental aspects identified during the environmental aspects analysis. Objectives and targets typically will also reflect legal requirements and interested party priorities and take into consideration financial, technical, and human resource capacity.

There are no standard environmental objectives that make sense for all organizations. These objectives typically encompass the ecological and human health related impacts to air, land, and water of an organization's processes, activities, and/or products. Objectives set under an EMS are of the following types: performance based; compliance based; project based; and management activity based. Targets are measurable/quantifiable performance requirements that must be met to achieve objectives.

Table 4: Examples of EMS objectives and targets

Objectives	**Associated Targets**
Reduce enterprise energy consumption	Reduce annual electrical power consumption of pump stations by 5%
Reduce consumption of natural resources	95% of all paper goods purchased will be made from material with a minimum of 30% post-consumer recycled content
Improve quality of treated wastewater effluent	Reduce wastewater facility influent mercury loading by 10% in 5 years

> CMOM: Objectives and targets for CMOM focus on the reduction of sanitary sewer overflows. These objectives and targets must reflect a utility's analysis of SSO-related conditions, legal and other requirements, and will typically include a careful review of utility financial and technical capacity. Objectives and targets may also reflect community concerns and related input, as well as regulatory agency interests.

Under CMOM, a utility must identify and prioritize short and long term objectives, including addressing structural deficiencies and enhancing system capacity. A utility must also develop and establish performance standards (targets) to measure progress towards objectives.

Table 5: Examples of CMOM Objectives and Targets

Objectives	**Associated Targets**
Reduce overflows in city park	> Build parallel relief sewer by fall of 20XX
Reduce overflows at Main St. Pump Station	> Implement rehabilitation program by end of 20XX
Improve preparedness for power outages during ice storms	> Form an Emergency Preparedness Strategy Team in next 2 months. > Evaluate probability of natural and man-made disasters that might occur, within 4 months. > Prepare written plan to address top three risks within next 12 months.
Raise the effectiveness of maintenance resources utilized for the Collection System	> Evaluate Computerized Maintenance Management Systems, CMMS, on market and obtain best for agency in next 6 months. > Identify manholes, structures, and facilities that require excessive maintenance, or contribute to violations and prioritize their repair or replacements in 2 years.
Ensure capacity in Collection System and treatment facilities for long-term growth of the community.	> Develop a Master Facility Plan, MFP, for a 20 year planning period in 18 months. > Develop a financial plan to support the MFP within 9 months of completion.

> <u>AMP:</u> An asset management program will establish objectives and targets related to accomplishing the agency's asset management mission, ranked by priority. Overall, setting objectives will derive from establishing a target condition and associated service level for assets. These objectives will reflect the results of a detailed asset condition assessment and a review of asset failure risks. The objectives will also consider legal requirements, quality and environmental performance priorities, and financial, technical, and human resource capacity.

Areas in which specific AMP targets are typically established include: defining corrective and planned rehabilitation and renewal actions; developing asset performance standards; and determining the level of planned maintenance. These targets, which dictate the performance levels of individual assets, are based on performance criteria such as return on investment, restoration of original asset function, increase level of performance beyond original asset, and upgrade asset to meet new standards.

Example AMP objectives

Maintain assets at current condition; upgrade average asset condition; support extending service and responding to new regulatory requirements; and/or increase ability to monitor and understand asset conditions.

Example AMP targets

Addressing deficiencies that result from historical funding shortfalls within an X- year time frame; ensuring that less than 5 percent of the system is deficient with respect to operating capabilities and performance standards; recommended inspection intervals; anticipated interval for major and minor maintenance; and recommended renewal or replacement intervals.

> PSW: Objectives and targets derived from PSW focus on improving drinking water quality, with a particular focus on turbidity. Unlike the other management initiatives, PSW participation specifically commits a utility to maintaining turbidity levels at or below federal Surface Water Treatment Rule levels of .3 NTU 95 percent of the time, and sets a performance target for utilities at .1 NTU 95 percent of the time. Utilities do, however, set self-derived, specific performance goals for sedimentation basins, filters, disinfection, and other specific operations, maintenance, and design activities.

Example PSW Targets

Individual Sedimentation Basin Performance

> Settled water turbidity less than 1.0 NTU 95 percent of time when raw water turbidity is less than or equal to 10 NTU

> Settled water turbidity is less than 2.0 NTU 95 percent of time when raw water turbidity is greater than 10 NTU

Individual Filter Performance

> Filtered water turbidity less than .1 NTU 95 percent of time based on values recorded at 15 minute time intervals

> Maximum filtered water turbidity equal to or less than .3 NTU

> Maximum backwash recovery period of 15 minutes

Integration Opportunities

The four management initiatives create two important integration opportunities related to objectives and targets: harmonizing the objectives and targets; and coordinating/aligning the management system used to develop, track, report, and evolve the objectives and targets.

Harmonizing Objectives and Targets

The objectives and targets for each of the management initiatives reflect a high degree of interdependence to the extent that a failure to harmonize can represent a substantial threat to success with any one of the management initiatives. For example, a utility developing a CMOM program in response to SSO-related problems would likely also recognize SSOs as a significant environmental aspect under an EMS. It is also likely that any CMOM or EMS related performance objectives will have substantial implications for the capacity and maintenance of the utility's collection system, thus creating an important asset management priority.

In general, CMOM, EMS, and PSW objectives and targets will hold important asset management-related implications, while AMP objectives and targets can represent either a constraint on or opportunity for accomplishing CMOM, EMS, and/or PSW objectives. Because of this high degree of interdependence, setting objectives and targets for any one of these management initiatives in isolation will run the risk of establishing performance objectives that will work at cross purposes. Or, at minimum, an organization could miss the opportunity to synergistically relate objectives, targets, and associated management program efforts. Setting objectives and targets in isolation can also lead to a larger workload with sets of tasks that staff can not perform simultaneously.

Coordinating/Aligning Processes

A second integration opportunity relates to the process a utility uses to develop, communicate, and evolve objectives and targets. Each of the individual management initiatives follows very similar objectives and targets development and continual improvement paths. Objectives and targets should be reviewed and updated annually, in advance of the annual budgeting process.

Once established, the objectives and targets will be translated into a "management program" that the organization will consider for funding during the next budget cycle. For objectives that receive funding, implementation and the performance of the associated management program will need to be tracked and communicated throughout the year.

This similarity of process creates an important opportunity for an organization to develop an integrated objectives and targets development process including reviewing legal and other requirements, obtaining input from interested parties, and examining the financial, technical, and human resource capacity of the organization. Each of the management initiatives requires or would benefit from these processes, and the overlap creates the opportunity to obtain "double duty" from each. For example, if the utility establishes a community advisory panel to support setting objectives and targets for its EMS, this same panel could be used for addressing Asset Management related objectives and targets.

During management program development and budgeting, alignment of objectives and targets is critical. At both of these points, presenting a coherent strategy with clearly established links between the objectives will provide for better, more focused and more likely resource allocations.

Finally, objectives and targets will need to be tracked and communicated. This will require establishing some form of system to list, record performance against, analyze, and prepare reports related to the objectives and targets. Tracking systems of this type will typically have a fairly standard, flexible, and straightforward architecture enabling use across a broad array of objectives and targets. Using the same system for all of the objectives and targets can also allow for preparation of consolidated performance reports that clearly show the relationship among objectives and provide audiences with an integrated view of utility performance.

How to Approach Integration

As indicated earlier, the most critical aspect of integrating objectives and targets is ensuring they are developed and implemented in harmony. This will require an explicit exercise to understand the interdependence of objectives, establish priorities, and align priority objectives in advance of budget discussions.

Utilities may already have an annual objectives reconciliation process that works well and that can be applied directly to the individual objectives emerging from these management initiatives. In the absence of such a process, or if there is a sense that the existing process may be inadequate to drive a full alignment of goals, a utility can implement the steps listed below.

Step 1: Establish An Integration Team. This team should draw, at minimum, on decision makers from each of the relevant operational and functional areas of the organization critical to the success of meeting the preliminary objectives.

Step 2: Create A Consolidated List of Proposed Objectives and Targets And Decide On A Systematic Process To Evaluate Them. The consolidated list should include actual objectives and targets along with a characterization of their key drivers (e.g., do they relate to a regulatory requirement, are they tied to an agency policy, do they reflect an area of high concern from interested parties, etc.).

The organization must also utilize some form of systematic process to compare and prioritize objectives. Depending on the size and complexity of the issues, appropriate approaches could include:

- voting methods;
- a weighted matrix approach; or
- a decision science method, such as multi-attribute utility analysis.

These methods have been detailed in a variety of literature sources (e.g., the prioritization step instructions in “A Capital Planning Strategy Manual, 2001, by Beaudet et al, American Water Works Association Research Foundation and American Water Works Association).

Step 3: Conduct A Meeting of the Integration Team. Typically, this meeting will require anywhere from one to two days.

- The first third of the meeting should focus on understanding the full range of proposed objectives, discussing the interdependence among objectives, and highlighting key areas of consistency, synergy, and/or discontinuity.
- The second third of the meeting should focus on establishing priorities utilizing the previously selected systematic evaluation method(s).
- The final third of the meeting should focus on identifying the broad outline of the management program(s) needed to support the selected objectives and planning how to integrate the objectives and associated management program(s) with the annual budget process.

The management program(s) outline will be provided to the team or individual teams responsible for developing the preliminary objectives for completion of the program(s) (see integration section covering Management Program Development).

Step 4: Include Harmonized Objectives and Targets and Associated Management Program(s) In the Budget Process. To maintain alignment and the cohesiveness of the objectives and targets, it will be critical that the results of the integration meeting and ensuing work on the management program(s) be included in a cohesive fashion in the budget process. This will ensure that budget decisions consider the interdependence among objectives and that the implications of under-funding any portion of the package will be quite clear.

Organizations Have Their Own Processes for Setting Objectives and Targets: Example from Albany, Oregon

Albany has a City-wide vision and mission coupled with community goals and objectives that are set by the City Council annually (each January). The Public Works Department then integrates these City Council goals and objectives into other objectives the Department sets for itself each year. The Department program budgets are created, based on the Departmental objectives, and finalized by May for the next fiscal year.

The Public Works Department goals and objectives are translated into specific utility (Water/Wastewater/Storm Drainage/Transportation) objectives. These utility objectives are translated into specific objectives and targets for the individual programs. For example: The Water Utility is comprised of two core programs Water Distribution and Water Treatment. Shared programs for Engineering Services, Environmental Services, Financial & IT, HR, Community Services, and Utility Planning serve the entire Department. The specific objectives and targets are integrated across customer service, environmental, financial, utility business process, and human aspects, as they relate to each of the utilities, as well as the specific programs. Therefore, the individual program objectives and targets are a set integrated from the above (City Council / Department / Utility / Programs) in response to meeting the requirements of initiatives such as CMOM, the Safe Drinking Water Act Surface Water Rules, Asset Management, and APWA Best Management Practices.

4.1.8 Management Programs for Performance Improvement (Who, What, and When for Achieving Objectives and Targets)

Key Integration Point for Strategic Alignment

Management programs for performance improvement are a critical element of planning. They describe exactly how an organization will achieve the performance improvements identified in the objectives and targets. Management programs should identify specific:

- Roles and responsibilities for achieving objectives and targets;
- Activities for achieving objectives and targets; and
- Schedules for completing activities.

Selected Management Initiatives

All four of the selected management initiatives require written management programs or action plans that define roles and responsibilities, activities, and schedules for achieving objectives and targets. Several of the selected management initiatives have additional requirements related to organizational structure, roles, and responsibilities. For example, CMOM and EMS require documentation of the organizational structure. PSW, CMOM, and

EMS require that specific roles be called out (e.g., communications coordinator, management representative).

- EMS: EMS implementation requires development of an environmental program, or programs, for achieving objectives and targets. The program must identify who is responsible, what activities are necessary, and the relevant time frames for achieving objectives and targets.

  EMS implementation also requires that the definition of an organizational structure and appointment of a management representative responsible for ensuring that the EMS is established and implemented and that performance progress is reported to top management.

- CMOM: CMOM requires that a utility develop capital improvement plans that establish priorities for short and long-term rehabilitation (repair and replace) actions to address structural deficiencies and enhance system capacity. CMOM also requires that a utility identify administrative, operations, maintenance, and communications positions or persons responsible for implementing all actions in capital improvement plans, including the lines of authority using an organizational chart or similar document.

- AMP: AMP requires a utility to: translate objectives and targets into specific, quantifiable actions that can be programmed and tracked; assign specific people to manage and execute each required program activity; and establish and track the progress of each critical activity that is part of the identified strategy.

  The AMP will include both a maintenance management system (MMS) and an asset renewal and replacement strategy (RRS). The MMS will provide preventative and predictive maintenance scheduling based on historical information, manufacturer's recommendations, and/or industry standards. The RRS will focus on activities that restore or replace an existing asset toward its original size, condition, or capacity.

- PSW: PSW requires that a utility develop written action plans that address performance limiting factors. In developing the action plans, utilities are expected to: rank and prioritize performance limiting factors; identify who is responsible for each action in the plan; and establish timeframes for completing activities identified in the plans.

Two specific roles must be filled.

- Program Coordinator, responsible for ensuring that PSW commitments are completed (including overseeing data collection, self-assessment, and action plans).
- Communications Coordinator, responsible for overseeing the education of employees and customers about PSW and ensuring that the utility is recognized for its participation in and accomplishments under PSW.

Integration Opportunities

There are opportunities for integration around all pieces of the management programs: structure; roles and responsibilities; activities; and timeframes.

Structure, Roles, and Responsibilities

Integration opportunities around structure, roles, and responsibilities involve leveraging existing roles to eliminate redundancy and to address capacity issues. For structure, an organization could utilize a single chart describing the organizational structure and roles and responsibilities for all initiatives.

*At the **City of Albany, OR Public Works Dept.**, management coordinates action plans across all divisions as part of annual planning. This coordination between divisions helps avoid situations such as the transportation division laying down new pavement on major arterials and six months later the drinking water division digging up new pavement to replace water mains. Failure to coordinate improvements plans can lead to cost inefficiencies and frustrate employees and customers.*

For specific roles and responsibilities, opportunities exist to leverage existing roles or to coordinate similar roles to reduce redundancy. For example, an organization might consider appointing just one Communications Coordinator for both EMS and PSW. Or, an organization might already have a Communications Coordinator who can be assigned specific responsibilities to meet the needs of new management initiatives.

In the context of integrating roles and responsibilities, opportunities also exist to manage human resource capacity issues associated with assigning responsibilities for implementing the management programs. For example, it will be important for utility management to know if one division is responsible for implementing multiple management programs. Looking across the roles and responsibilities associated with multiple management programs can help managers identify and address the potential for overloading staff capacity.

Activities and Timeframes

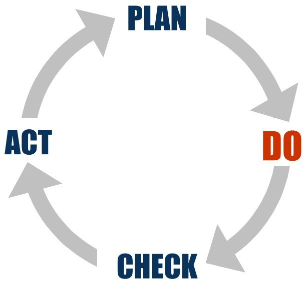
Ensuring activities and their associated timeframes across all activities in the improvement programs are coordinated and compatible can be achieved through integration. If objectives and targets have been fully harmonized, the need for management program coordination should be at a fairly detailed level (i.e., their purpose should be to support objectives and targets that are already strategically aligned.) Utility managers should consider how various management programs and activities interact. For example, would switching to vegetable based lubricants to meet EMS objectives affect the equipment maintenance schedules utilized in the CMOM or AMP? These potential conflicts need to be addressed prior to implementation so that employees have clear direction and an understanding of priorities.

How to Approach Integration

Utilizing a cross-functional integration team or management team can help ensure that management programs are harmonized. The team should look across the different management programs to find opportunities to leverage roles and responsibilities and to address potential capacity issues. The team should examine the programs for potential incompatibilities in the activities and timeframes of different programs.

For example, at the Albany PWD, management coordinates action plans across all divisions as part of annual planning. This coordination between divisions helps avoid situations such as the transportation division laying down new pavement on major arterials and six months later the drinking water division digging up the new pavement to replace water mains. Failure to coordinate management programs and their activities can lead to cost inefficiencies and frustrated employees and customers.

4.2 Do



The implementing component of the continual improvement framework addresses a series of basic management functions that ensure the organization's performance objectives are supported by knowledgeable and capable staff, clear and consistent documentation, and standard operational and administrative control requirements. The specific management system elements that provide integration opportunities under the implementing component are:

- Training, awareness, and competence;
- Communication—internal and external;
- Document management;
- Emergency preparedness and response; and
- Operational control.

4.2.1 Training, Awareness, and Competence

Continual improvement management systems place substantial emphasis on training, awareness, and competence. This emphasis derives from the recognition that, ultimately, the behaviors and decisions of individuals within the organization control the fate of both the management system and the performance it will deliver.

Training, awareness, and competence activities under continual improvement management systems such as EMS will typically have two components: content; and procedures. The content component focuses on ensuring staff are knowledgeable and aware of relevant policies, the relationship of their work activities to the relevant management area (e.g., asset conditions), key management system roles and responsibilities, procedures that apply to their work, and potential consequences of not following procedures. The procedure component establishes the training-related activities - such as keeping a training log - that ensure staff are trained in the right way at the right time. The procedure component also establishes training activity documentation (e.g., training logs) critical to supporting management system auditing.

Although staff are not all likely to receive the same training content (e.g., training on the financial aspects of asset management is likely to focus on accounting staff, while training on environmental impacts is likely to focus on operations staff), the content component of training does present opportunities for integration. For example, an operational activity such as maintenance procedures has implications for both asset management and environmental performance. Procedures for the proper handling of hazardous materials have implications for occupational safety and health, as well as environmental performance. An integrated training program would address these procedures as they relate to all management areas, and not provide separate, redundant training sessions.

The procedural component of training also holds integration opportunities. Training procedures and formats can be readily applied to the full range of training activities conducted. This will not only avoid the inefficiency of operating more than one training procedure, but also drive consistency across the organization. This will support both internal and external auditing.

4.2.2 Communications – External and Internal

The audiences for communications typically include:

- employees
- consultants / contractors
- regulators
- local residents
- customers (residential and industrial rate payers)
- community, environmental, and advocacy groups
- elected officials
- vendors and suppliers
- developers
- governing bodies and commissions
- bond rating agencies
- auditors

Effective employee and external interested party involvement is deemed critical to the development and implementation of continual improvement management systems. The cornerstone of effective involvement is communication.

Internal communication efforts and associated procedures are essential for motivating employees, gaining acceptance for objectives and targets and the overall continual improvement management approach, explaining policies, ensuring roles and responsibilities are well understood, communicating performance, and identifying continual improvement opportunities. Employees must understand what, why, and how the organization intends to accomplish performance improvements. Employees must also understand how their role and responsibilities relate to achieving performance improvements.

CMOM and EMS both require that an organization develop a complaint response and tracking system. When developing a complaint hotline for external audiences, multiple areas of concern should be considered. Setting up a separate hotline to address just one area (e.g., only for SSOs) could be potentially inefficient and confusing to external audiences.

External communications to a variety of audiences are also important. Organizations implementing a continual improvement management system will look for input from various audiences on what is important with respect to performance improvements. An organization will also want to communicate its policies, objectives, and performance achievements to external audiences and be prepared to communicate with relevant audiences about emergency situations.

Organizations implementing any one of the four selected management initiatives will need to review and refine existing communications. In this context, the communications element presents four important integration opportunities: Audience Identification and Management; Message Development and Management; Communication Methods Selection and Deployment; and Communications Procedures Development and Implementation.

Audience

Using a consistent approach to identifying audiences, maintaining relevant audience information (e.g., handling contact information consistently and in one place), and coordinating contact activity (e.g., avoiding multiple contacts to the same organization or individuals on overlapping topics) will enable an organization to maintain a cohesive and efficient communications effort.

CMOM and PSW require the development of notification procedures for SSO (CMOM) and water quality (PSW) emergencies.

Message

Message development and management present an obvious integration opportunity given the high overlap of relevant audiences and the high interdependence of the objectives and targets among the management initiatives.

Utility managers should review and identify those audiences, messages, and methods for which integration is both needed and presents the best opportunities. In most cases, internal communications processes, complaint tracking and response, and significant external communications initiatives (such as establishing/interacting with a community advisory committee, holding an annual open house, or quarterly Board meetings) will all be places where integration will be helpful if not critical.

For external communications, integrated messages, in particular, can help to highlight constraints, opportunities, and trade offs among the objectives and targets derived for each management initiative. For example, an integrated message about SSO, EMS, and AMP objectives could show SSOs as a clear environmental performance priority while AMP objectives could indicate the financial and operational commitments available for improving performance.

Communications Methods

Each of the management initiatives will require selecting and deploying communications methods. Integrating both internal and external communications methods will be both more efficient and effective.

Table 5: Communication methods

Internal Communication Methods	External Communication Methods
> Newsletters > Staff meetings > Staff trainings > Bulletin boards > Email > Staff retreats	> Public tours > Open house > Press releases > One-on-one meetings/briefings > Hotlines > Brochures, flyers, inserts > Performance reports > Websites > Advisory groups > Public meetings

For example, if the organization selects quarterly staff meetings to communicate and review EMS objectives and targets progress, the same format (and possibly the same meeting) can be used to discuss AMP, CMOM, and/or PSW objectives and targets. Similarly, an organization using a bulletin board for employee communications can use the board for conveying information about multiple initiatives.

Communications Procedures

Under a continual improvement management system, communications need to be supported by an explicit set of procedures. These procedures define the scope of communications, spell out key roles and responsibilities, and identify and establish the basic functions for key communications activities (e.g., complaint tracking and response). Integrated communications procedures will help to ensure clarity and consistency, critical attributes of any effective communication system.

4.2.3 Documentation and Document Management

Documentation and document management refer to how and what information the management system captures (documents) and how the management system provides access to the information and ensures it is up to date.

All continual improvement management systems are organized with a management system manual. This manual provides a description of how the management system elements fit together, describes the procedures that support the management system (e.g., training and communications procedures), and either covers directly or provides clear references to other important documents such as emergency response plans.

Beyond the management system manual and the procedures addressed there, individual management areas will have fairly tailored documentation needs. For example, an EMS will need documentation of the results of the environmental aspects analysis while an AMP will require documentation of the asset condition assessment.

Document management within a continual improvement management system entails the adoption of a formal document control procedure to facilitate consistent storage, retrieval, and updating. Document management procedures should assign responsibility and authority for preparing and changing documents and establish a system by which updates are consistently made and recorded.

Integration of documentation and document management holds the potential to substantially streamline the continual improvement management system. Maintaining a single, consolidated management system manual provides the centerpiece of an integration effort via a centralized location for the system description and procedures. However, if an organization's plans include using external auditors for any one management area (e.g., environmental performance) it may be necessary to maintain separate system manuals for each area (e.g., an EMS manual).

Opportunities may exist for integrating other documentation, though this will need to be approached on a case-by-case basis. Likely opportunities for integration include sampling, monitoring, and maintenance records, job descriptions, training records, and equipment calibration records. Each of these is required under EMS, CMOM, AMP, and PSW. A consistent, integrated approach to this documentation will not only be administratively efficient, but will likely substantially aid clarity of communication with responsible staff.

The document management system will represent an important and probably necessary integration opportunity. Such systems, once established for one management area, can be readily expanded to include additional documentation. The absence of a single, one time – one place document management system will undermine the basic purpose of document management – to ensure consistency, clarity, and reliability for document access and updates. Adoption of the single system will not only better preserve the system's purpose but also result in substantial organizational efficiencies.

4.2.4 Emergency Preparedness and Response

Utilities are likely to have a high degree of familiarity and experience with emergency preparedness and response. Typically, the implementation of an EMS and/or CMOM will drive updates and refinements to, rather than the entirely new creation of, an emergency preparedness and response plan.

EMS, CMOM, and PSW require the development, documentation, and implementation of an emergency preparedness and response plan. This common requirement supports integration and the likelihood that a utility would maintain more than one emergency preparedness and response plan is very low.

An EMS will typically require that the emergency preparedness and response plans address:

- potential emergency situations;
- hazardous materials used on site;
- key organizational responsibilities;
- arrangements with local emergency support providers;
- emergency response procedures, including communication procedures;
- locations and types of emergency response equipment;
- maintenance of emergency response equipment;
- training and testing of personnel;
- testing of alarm and public address systems; and
- evacuation routes, exit map, and assembly points.

CMOM requires highly similar coverage but brings a more SSO-specific focus to each of the plan areas. CMOM can thus be viewed as requiring a situation-specific portion of an overall EMS emergency response plan. Addressing drinking water safety incidents under PSW can be viewed similarly.

AMP and PSW require, during the planning stage, that an organization conduct risk analysis that are likely relevant to the development of or updates to emergency preparedness and response plans. Asset failure analysis or turbidity-related failure scenarios will likely have produced data relevant to assessing the potential for and consequences of accidents or emergencies. These data can be used to develop a more effective plan and ultimately reduce recovery time and costs related to such incidents.

4.2.5 Operational Control

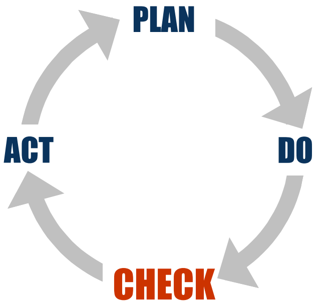
Operational Control is the deepest level within the organization that the continual improvement management system reaches. It is at this level that performance improvement plans and programs are translated into specific operational activities and operational control procedures. These activities and procedures – carried out consistently – ensure that equipment and processes operate in conformance with management system expectations and performance objectives and targets. Coordination between employee training programs and operational control is important to ensure that activities and procedures are carried out consistently.

Operational control will present some degree of opportunity for integration. In particular, whenever the achievement of objectives and targets from different management areas involve the same equipment or processes, integration opportunities arise. For example, all four of the management initiatives involve developing specifications for when and how equipment will receive maintenance. In this context, the desirability of integration is obvious – a failure to integrate will result in more than one, potentially inconsistent, set of maintenance requirements for the same equipment.

> In effect, integration at the operational control level "closes-the-loop" with the integration undertaken at the objectives and targets level. The integration ensures that the harmonized objectives and targets are supported, where overlap occurs, by harmonized operational controls. In addition to equipment maintenance, other areas of likely overlap among two or more of the initiatives include:

  - requirements and standards for the installation of new equipment;
  - requirements and standards for rehabilitation and repair;
  - procedures and standards for inspecting and testing equipment;
  - safety procedures; and
  - requirements and standards for operating equipment.

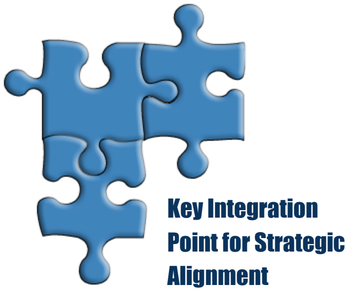
4.3 Check



The checking component of the continual improvement framework focuses on knowing how the management system is performing. This section covers each of the integration points related to checking.

- Measuring and monitoring
- Reporting
- Management review
- Auditing

4.3.1 Measuring and Monitoring



Measuring and monitoring relates to routinely monitoring what an organization does day-to-day and periodically measuring progress towards objectives and targets. Without objective, quantifiable data collected through measuring and monitoring activities, an organization will have a difficult time assessing where it is with respect to objectives and targets and making change management decisions. Furthermore, in the absence of measuring and monitoring activities, an organization will have difficulty identifying areas that require corrective action and analyzing the root cause of problems.

Selected Management Initiatives

Each of the selected management initiatives requires measuring and monitoring activities to track key operations/activities and assess progress towards objectives and targets.

- EMS: EMS requires procedures to:
    - Monitor key characteristics of operations and activities that can have significant environmental impacts an/or compliance consequences;
    - Track performance;
    - Check progress on meeting objectives;
    - Calibrate and maintain monitoring equipment; and
    - Periodically evaluate compliance with applicable laws and regulations, through internal audits.

- CMOM: CMOM requires that an organization:
    - Measure water quality (routine, investigative, and after spills) through testing downstream water intakes;
    - Inspect and test new facilities and collection system components;

- Collect and track data on performance measures;
- Maintain up-to-date maps of the collections system;
- Track overflow occurrences, work orders associated with system problems, and information on noncompliance events caused by high volume flows; and
- Document operation and maintenance preventative measures.

> AMP: An AMP requires that a utility develop systems to track the performance of assets and to track and benchmark the costs of both planned and performed emergency maintenance for each asset. AMP also requires an up-to-date electronic inventory of collection/distribution system and treatment plant assets. This inventory must include acquisition and cost information, ongoing cost logs that track the maintenance and repair requirements of strategic assets, and historical data on the system's construction and rehabilitation costs.

> PSW: PSW requires an organization to measure and monitor:
> - Turbidity levels;
> - Implementation of improvement action plans; and
> - Performance improvements (progress towards objectives and targets).

Integration Opportunities

Integration opportunities exist for coordinating data that is collected through measuring and monitoring activities, including the following.

> Data collected through ongoing day-to-day monitoring activities, such as data on receiving water quality for EMS and CMOM.

> Data about equipment calibration and maintenance. EMS, AMP, and CMOM all require tracking data on equipment calibration and maintenance.

> Asset maps. CMOM and AMP require maps of collection and/or distribution system assets.

> Progress towards objectives and targets. There may be some information about progress on objectives and targets that will be applicable to more than one management initiative. For example, if an EMS has an objective about SSOs, then progress on SSO objectives could apply to both CMOM and EMS. However,

given the focus on different management areas of the initiatives, there may be limited opportunity to coordinate information on objectives and targets progress.

How to Approach Integration

Before building any new data collection systems, a utility should review what is already in place. Chances are that many utilities are already collecting a substantial portion of the data needed for existing compliance and other reporting purposes.

Utility managers should both define measuring and monitoring needs for each initiative and look across the initiatives to identify information necessary for more than one initiative. Where possible, utilities will want to utilize the same equipment and processes for collecting and tracking data. For example:

- Many utilities use computerized systems (e.g., SCADA, laboratory systems) for collecting data on day-to-day activities and operational performance. These computerized systems provide the opportunity to collect data in one place to meet the needs of multiple initiatives.
- Many utilities have a maintenance management system (potentially computerized) to provide information on equipment maintenance and calibration for EMS, AMP, and CMOM.
- Utilities can use GIS and/or other mapping systems to develop asset maps for both CMOM and AMP.
- Utilities can develop standardized, utility-wide formats for tracking and reporting progress on objectives and targets. Consistent formats will make management review easier.

4.3.2 Reporting

Each of the management initiatives requires some type of formal reporting about performance. For example, EMS requires the preparation of internal and third party (if applicable) audit reports. PSW requires annual reports on turbidity levels, as well as progress towards objectives and targets.

The management initiatives tend to require reports that use specific formats, communicate different information, and address different audiences. As a result, there may be limited opportunities for integration.

Reports to the public about progress on objectives and targets and planned improvements present a clear opportunity for integration. Materials prepared for management review, which cover progress towards objectives and targets and results of internal audits and reviews, present another opportunity for integration.

Reporting: An Example

The San Diego Metropolitan Wastewater Department (MWWD) tracks performance indicators related to departmental business goals. Information is compiled quarterly into a “MWWD Performance Indicators Report” that supports the Management Team’s decision-making efforts and helps guide input to the annual Strategic Plan update. The report includes information on performance indicators for business goals in the following areas.

Systems Operation and Maintenance
- Wastewater Treatment Plant’s Flows
- Point Loma Flow & Effluent Quality
- North City Water Reclamation Plant
- Metro Biosolids Center
- Major Pump Stations
- Energy
- Sewer Spills
- Sewer Main Cleaning
- Sewer Main Replacement
- Sewer Back-up Claims
- Notice of Violations and Fines
- Vehicle Maintenance
- Vehicle Accidents
- Industrial User Compliance Rates

Capital Asset Management
- Construction Cost Growth
- CIP Cash Flow

High Performing Work Team
- Overtime Usage & Vacancy Rates
- Sick Leave Usage
- Recordable Injuries
- Workers’ Compensation Claims
- Incidence Rate
- Performance Evaluations
- Supervisor Initiated Rewards
- Grievances

Fiscal Management
- Sewer Fund Revenues
- Current Year Monitoring
- Resources / Operations & Maintenance

Customer Service
- Information & Organizational Support

4.3.3 Auditing

Auditing, whether conducted internally or by an outside party (such as a private third party, peer, or regulator), is critical to performance assessment, reinforcement, and continual improvement. Results of audits should be linked to the corrective and preventive action processes, so that identified systems gaps or deficiencies are corrected in a timely fashion.

Two integration opportunities exist under auditing:

> Systems audit training and implementation; and
> Audit teams.

Systems Audit Training and Implementation

Conducting any internal management system audit requires that staff be trained on how to conduct systems audits. Utilities can provide integrated training in systems audit processes and techniques, regardless of the management areas of the system(s) to be audited. Audit training developed for one continual improvement management system can be readily transferred to other management initiatives. Additionally, a utility can look to develop systems audit expertise among a core group of internal auditors. These individuals will then have the audit skills needed to support systems auditing of any management area.

Audit Team

Utilities can conduct an integrated audit in the form of a single audit that covers multiple management areas and meets the requirements of multiple management initiatives. The practicality of this will depend on the breadth of operations and the number of management areas covered by the initiatives. The use of an audit team that includes trained systems auditors combined with management area experts (e.g., financial analysts for asset management or collections system operations and maintenance staff for CMOM) could provide the breadth of knowledge required to cover all of the operations and areas in an integrated management system.

Utilities can also utilize audit teams to conduct a series of audits, each focused on an individual management area. In this case, a utility would team the individuals trained in systems auditing with experts from the management area of relevance to the specific audit.

4.3.4 Management Review

Key Integration Point for Strategic Alignment

Management review is a critical component of any continual improvement management system. It is the point at which senior management is made aware of performance accomplishments and deficiencies, system strengths and weaknesses, and needed adjustments to the management system to address changing circumstances and sustain continual improvement.

Management review entails a regular cycle (e.g., quarterly) of meetings at which individuals directly involved in monitoring system performance (those with specific performance information) inform those empowered to make decisions and allocate resources. These meetings are critical to the constant cycle of review and renewal central to continual improvement.

Selected Management Initiatives

Management review is a critical explicit or implicit element of each of the selected management initiatives. The success of each depends on on-going management attentiveness. Because the initiatives address high profile and resource intensive management areas, they are likely to represent high management priorities.

- EMS: EMS explicitly requires an organization to close the continual improvement loop with a management review. The management review will typically include examining:
  - Suitability, adequacy, and effectiveness of the environmental policy and objectives;
  - Progress towards objectives and targets;
  - Nonconformances identified during audits;
  - Status of corrective and preventive action plans;
  - Results of key measuring and monitoring activities; and
  - Incidences of environmental noncompliance.

- CMOM: CMOM requires regular review and updates to the utility’s rehabilitation and capital improvement plans and procedures. These review and update efforts draw on information related to overflow occurrences, work orders associated with system problems, noncompliance events caused by high volume flows, and performance related SSO-based objectives and targets.

- AMP: AMP involves an on-going assessment of and adjustment to a utility’s predictive and preventative maintenance protocol and its rehabilitation and renewal strategy. These adjustments typically involve changes to both short and long-term capital asset plans and shifts in financial resource requirements. They are made by management based on observed rates of asset deterioration and associated costs and failure potential and future plans for expansion or changes in service that may require modifying, replacing, or eliminating an asset.

- PSW: PSW does not contain an explicit management review element. The program, however, does include on-going review, presumably by senior utility management, of turbidity-related performance, performance related to goals for sedimentation basins, filters, disinfection, and other selected operational areas, and progress on implementation of improvement action plans.

PSW also requires the preparation and submission of an annual report reflecting this information.

Integration Opportunities

Management review creates both the opportunity and the need for integration. Needs and opportunities emerge in three areas: senior management participation; coordination of revisions to objectives/targets and associated management programs; and procedures for management review.

Senior Management Participation

Sydney Water Corporation has developed a single management system procedure for management review. This procedure is used by all business units. However, the content of the management review varies for each business unit as each has different environmental objectives and targets, safety issues, assets to manage, etc.

Review by senior members of the management team is either required or expected for each of the management initiatives. In medium to large utilities, this will include a limited number of individuals such as department/division heads and the utility deputy and executive directors. In small utilities, management review may involve only one or two individuals whose responsibilities cover a broad array of functions including executive director, operations head, and chief financial officer.

The overlap in senior management participation to support management review for each of the initiatives establishes an obvious need to efficiently utilize management's time. Integration of the management review element can address this by establishing a single management review team with responsibilities across initiatives.

Coordination of Revisions to Objectives/Targets and Associated Management Programs

Integration of objectives and targets and the associated management programs during the planning phase of the continual improvement management system has been previously identified as key to effective strategic alignment. Management review is the point in the continual improvement process that the need and direction for revisions to both of these elements takes place. As such, an integrated management review process is not only desirable but necessary to effectively maintain the previously established alignment.

Procedures for Management Review

A procedure for management review will typically involve identifying the management review cycle (e.g., quarterly), the agenda items to cover at each management review meeting, and how decisions and actions will be communicated and incorporated as changes to the management system. An integrated management review approach will require an integrated management review procedure. This procedure will ensure that the meeting agenda encompasses the full range of management areas included in the system and that decisions are delivered and actions items undertaken in a coordinated fashion.

How to Approach Integration

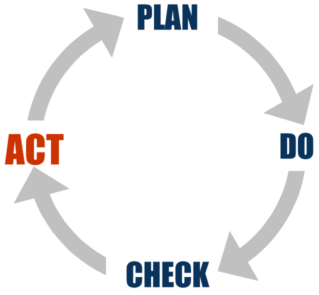
Effectively integrating the management review approach should be relatively straightforward. The key is to ensure the management review includes the right people discussing the right things – basic effective meeting management. To establish the management review team, a utility will need to review the scope of the continual improvement management system and be attentive to any particular areas of emphasis that result from the incorporation of individual management initiatives. Management system scope will inform the key departments and other organizational areas that must participate in the review.

Over time, to the extent the scope of the management system expands, an organization will need to periodically review and likely enlarge management review participation. For example, expanding the management system scope from just a focus on environmental performance to include asset management would drive the need to include a representative from financial planning.

At a certain point, expansion of the management system to multiple management areas may create the need to establish subgroups within the management review team, particularly in larger organizations. This would address a situation where the management review agenda becomes too complex or too long for clear or efficient oversight by the full group. It will be important, however, to ensure that subgroup review, including decisions and action items, remain coordinated by the full management review team.

Enabling the integrated management review will require the development of an integrated management review procedure. As discussed above, this procedure will need to establish the integrated nature of the management review by laying out agenda items fully reflective of the management system scope, identifying review participation consistent with scope, and establishing communication and other review follow-up actions compatible with the needs of the integrated system.

4.4 Act



Acting is the final step in the continual improvement management system process. It is the point at which system and operational performance - as documented during the checking step - are reflected in management system adjustments. These adjustments can span all aspects of the management system from policies and objectives and targets to operational controls. Two integration opportunities reside under this component of the management system:

- Corrective and preventive action; and
- Change management.

4.4.1 Corrective and Preventive Action

Continual improvement management system frameworks utilize explicit corrective action procedures to ensure system deficiencies and operational variances are identified, investigated, and corrected in a timely fashion. These procedures ensure an organization resolves the immediate problem, investigates the causes and whether these exist in other parts of the organization, and takes steps to prevent recurrences. Procedures typically involve identifying the type of documentation that will support corrective action (e.g., a corrective action notice), how the organization will track the corrective actions to completion (e.g., a notice tracking data system), who is responsible for initiating, addressing, and closing a corrective action, and verifying the effectiveness of corrective action.

On-going monitoring, routine audits, and direct operator observation are typical modes through which the need for corrective action is identified. To the extent that analysis of the problem (through root cause analysis) identifies the need for management system change, this information will typically flow into the management review process for further input, decision(s), and action.

All four of the selected management initiatives require a systemic approach for adjusting operational controls and procedures on the basis of identified operational condition and performance changes. For example, under an AMP, asset failures (including unexpected degraded performance) will drive examination of and possible adjustment to the relevant asset management unit’s predictive and preventative maintenance protocol.

The use of a standard corrective action procedure (e.g., one instituted to support EMS implementation) should support all of the corrective action needs of the organization. To ensure that the intent to integrate under this element is clear, it will be important to modify the scope of any existing corrective action procedures to include the additional management areas (e.g., the scope of a corrective procedure for EMS will be environmental problems, but will not cover, unless specifically modified, asset management unit failures that do not have environmental consequences).

4.4.2 Change Management

Continual improvement management systems require change management procedures to ensure the system remains relevant and effective as operations, processes, and equipment change and evolve. Change management procedures identify changes and then aid the existing management system to adapt to effectively cover the change. Changes that typically require a management system response include additions/deletions of equipment or processes, additions/deletions of regulatory requirements, and changes in the general operating environment of the organization (e.g., internal reorganizations, bonding capacity reductions, shifts in public acceptance, etc.).

As with corrective action, an organization can use a single set of change management procedures to support multiple performance improvement initiatives and the associated management areas. To support this integration, however, the organization will need to ensure that the scope of the change management procedures explicitly address the complete range of relevant management areas. Moreover, the organization will need to ensure that the change management procedure establishes a protocol for reviewing and responding to each change from the perspective of each management area. This will ensure that all relevant objectives and targets, management programs, and operational controls are adjusted consistent with the change (i.e., that the proposed changes is consistent with the organization’s policies and that it has been evaluated against the objectives and targets).

Appendices

Appendix A: Frequently Used Acronyms

AMP – Asset Management Program

AMSA – Association of Metropolitan Sewerage Agencies

APWA – American Public Works Association

AWWA – American Water Works Association

BSC – Balanced Scorecard

CMOM – Capacity Management, Operations, and Maintenance

EMS – Environmental Management System

EPA – Environmental Protection Agency

GASB – Governmental Accounting Standards Board

ISO – International Organization of Standardization

MBO – Management by Objectives

NBP – National Biosolids Partnership

PSW – Partnership for Safe Water

SSO – Sanitary Sewer Overflow

WEF – Water Environment Federation

Appendix B: Additional Reference Materials

Asset Management

"Management Public Infrastructure Assets to Minimize Cost and Maximize Performance", Association of Metropolitan Sewerage Agencies, 2002. (Available at www.amsa-cleanwater.org)

"The Gap in Water and Wastewater Infrastructure and the Changing Face of Utility Management", Steve Albee, US Environmental Protection Agency, 2003.

"Thinking, Getting & Staying Competitive: A Public Sector Handbook", Association of Metropolitan Sewerage Agencies and Association of Metropolitan Water Agencies, 1998, (Available at www.amsa-cleanwater.org)

CMOM

“CMOM Utility Self-Audit Review”, EPA Region 4, February 29, 2000.

“Guide for Conducting Evaluations of Municipal Wastewater Collection System Operations and Maintenance Management Programs”, EPA Region 4, October 1996.

"Laying the Foundation: An environmental management system is a great first step in launching a CMOM program" by Rick Bickerstaff, Adrian Williams, and John Cook, Water Environment and Technology, March 2003.

EMS

"An EMS Troubleshooters' Guide for Local Governments", GETF, October 2002. (Available at www.peercenter.net)

"EMS: An Implementation Guide for Small and Medium-Sized Organizations", NSF-ISR, January 2001. (Available at www.peercenter.net)

"EMS: Do They Improve Performance", University of North Carolina, January 2003. (Available at http://ndems.cas.unc.edu/)

Integrating Management Initiatives

“Moving Toward Comprehensive Utility Management Systems – Report of the Environmental Management Systems (EMS) for Public Utilities Integration Project”, 2002, available at http://www.wef.org/pdffiles/EMSfinalreport.pdf

Performance Measurement

"Developing and Implementing a Performance Measurement System: Volume I" Water Environment Research Foundation, 2000.

"Translating Strategy into Action- The Balanced Scorecard" by Kaplan and Norton, Boston, MA: Harvard University Press, 1996.

Appendix C: Characterization of Management Initiatives Researched

Asset Management (AMSA Asset Management Handbook – "Managing Public Infrastructure Assets to Minimize Cost and Maximize Performance") - http://www.amsa-cleanwater.org

Asset Management provides an approach for utilities to develop an infrastructure investment strategy that will support capacity needs. Asset Management methods can be applied to evaluate capacity needs in light of current infrastructure and support a utility's development of an infrastructure investment strategy that is fully integrated with and supportive of overall utility performance objectives. Asset Management will also make transparent the mid- and long-term financial requirements for achieving performance objectives.

In this regard, Asset Management provides a supplement to any continual improvement management system by driving a specific focus on and providing methods for evaluating needs with respect to the financial requirements of maintaining the reliability of costs and delivering the capacity needed to support utility performance objectives. Specifically, Asset Management can support planning by providing an approach for:

- Articulating a strategic foundation related to the utility's mission and goals;
- Developing, monitoring, and reviewing asset conditions, as well as performance and risk measurements and targets;
- Integrating maintenance and replacement with capital requirements for growth, service improvements, and compliance; and
- Assessing and communicating the service, financial, and risk implications of alternative asset-related decisions.

Asset Management can support the implementation component of a continual improvement management system by providing an approach to align maintenance elements with goals and objectives and linking the Asset Management program with strategy development, financial planning, business process design, and internal and external communication programs. Asset Management also provides an approach for developing a maintenance management system (maintenance policies, practices, and procedures) for meeting long-term strategies for the best mix of investments in repair, rehabilitation, and replacement to get the most useful life out of assets at lowest overall cost.

To successfully achieve the Asset Management objectives of providing high quality service at a minimum cost and risk, an Asset Management program must include substantial checking (e.g., performance measurement and evaluation) and acting (e.g., review and improvement). Linking the planning and implementing components of Asset Management with a continual improvement management system framework can provide an approach to the necessary checking and acting components. Utilities have implemented advanced Asset Management programs to support continual improvement by developing their own measurements, auditing procedures, reporting procedures, management reviews, and improvement plans.

Participants – Wastewater utilities
Sponsors – AMSA in partnership with WEF, AWWA, AMWA
Overarching Program Type – Continual improvement approach for managing infrastructure capital assets based on self-defined performance goals, asset identification and evaluation, risk management and capital planning
Drivers – (For water and wastewater utilities) Aging infrastructure of water and wastewater systems and need to plan for infrastructure maintenance and replacement
Goals and Desired Areas – Provision of desired service levels while minimizing the costs of operation (e.g., high quality customer service provision at minimum cost and risk)
Benefits – Optimized performance, reduced risk, minimized costs
Steps and Requirements

- Articulate a strategic foundation related to the utility's mission and goals
- Develop, monitor, and review asset condition, performance and risk measurements and targets
- Integrate maintenance and replacement with capital requirements for growth, service improvements, and compliance
- Assess and communicate the service, financial, and risk implications of alternative asset related decisions
- Link the asset management program with strategy development, financial planning and reporting, business process design, and internal and external communications programs

American Public Works Association (APWA) Management Accreditation Program - http://www.apwa.net/

The American Public Works Association (APWA) Management Accreditation Program is a planning tool that can be used in the context of a management system framework to provide an approach for: assessing existing policies, practices, and procedures; identifying deficiencies that need correction; establishing goals for complying with recommended practices (recommended by APWA); and developing strategic plans to meet goals and correct deficiencies. The program provides a "Works Management Practices Manual" that is used as the basis for self-assessing policies, practices, and procedures, and developing plans for improvement. Like QualServe, the APWA Program covers all utility management areas including financials, quality, impacts/risk (environment and health and safety management), and human resources.

To receive program accreditation, organizations must develop plans for how to improve policies, practices, and procedures to meet goals and implement recommended best practices. The implementation of a management system framework can be a way to systemically implement the plans for improving policies, practices, and procedures and align best practices with policies, goals, and targets.

The APWA Program can support the checking component of a management system framework by using the evaluative tools provided as one way of checking on or evaluating current practices. Furthermore, the program's three-year cycle of accreditation is built on the concept of continual improvement in that organizations are required to submit annual reports indicating changes that have been made to improve policies, practices, and procedures. As such, utility managers could link these requirements of the APWA Program with the reporting and management review elements of a continual improvement management system framework.

Participants – Public works agencies
Sponsors – American Public Works Association (APWA)
Overarching Program Type – Voluntary, peer-based certification program, practice-based, continual improvement system
Drivers – Provide a means of formally verifying and recognizing public works agencies for compliance with recommended management practices
Goals and Desired Areas – Improved public works performance and provision of services, increased professionalism, impetus for self-improvement
Benefits – APWA recognition, improved effectiveness, clarified budget needs, identification of operation and management needs, team work and staff development, interdepartmental coordination, improved communications
Steps and Requirements

- Document practices and use recommended practices manual to assess existing policies, practices, and procedures and to identify deficiencies that need correction
- Establish goals for complying with recommended practices
- Develop a strategic plan to meet those goals and correct deficiencies and present the plan at a public meeting
- Once improvements are implemented, submit documentation demonstrating agency compliance with all applicable practices to the Accreditation Council who will determine is the agency is ready for an on-site assessment
- Receive on-site assessment performed by public works practitioners
- Receive accreditation form the Accreditation Council (three year re-accreditation cycle)
- Submit annual reports to retain accreditation

American Water Works Association (AWWA) Proposed Accreditation Program - http://www.awwa.org

The AWWA Proposed Accreditation Program, as currently envisioned, would support the implementation component of a management system by providing a series of standards for water and wastewater utility operations. These standards would provide guidance on operational-level utility best practices that could be incorporated into the operational procedures, practices, and processes of a management system framework. A utility manager could adopt and implement any or all of the utility operations standards, depending on their utility's scope of operations (e.g., a wastewater treatment utility would only be interested in operational best practices that apply to wastewater treatment and not those that apply to drinking water) and management areas on which their management system is focused.

Participants – Water treatment, wastewater treatment, and combined utilities
Sponsors – AWWA

Overarching Program Type – Voluntary certification (independent third party), based on standards for water and wastewater utility operation and management (standards under development)
Drivers – Increased expectations about service from customers, stakeholder interest in proven utility efficiency and efficacy, heightened regulatory requirements, closer public scrutiny of tap water quality issues, tightening budgets and increasing pressure to reduce costs, greater concern about environmental issues among consumers
Goals and Desired Areas – Provide recognition for quality management practices
Benefits – AWWA recognition and certification, improvement of operations effectiveness and management efficiency, financial benefits as utilities become better investment risks, increased customer satisfaction
Steps and Requirements – Under development

Balanced Scorecard

The Balanced Scorecard is a high-level planning tool. Balanced Scorecard seeks to align measures with strategies in order to track progress, reinforce accountability, and prioritize improvement opportunities. Balanced Scorecard integrates four related perspectives: finance; customers; internal processes; and learning and growth.

The Balanced Scorecard can be used to support the planning component of a continual improvement management system framework by providing an approach for looking across management areas simultaneously to create a single, all-encompassing vision and strategy. Utility managers who have implemented one of the management system frameworks could utilize Balanced Scorecard in developing the vision, goals, and objectives for expansion to include other management areas. Alternatively, utility managers could utilize the Balanced Scorecard, before implementing a management system, to determine how a management system framework might best support the overall organization vision, goals, and objectives.

Although the Balanced Scorecard lacks explicit elements for checking and acting, connecting the Balanced Scorecard to a management system framework allows a utility to monitor/measure against performance targets, establish a regular review cycle for checking performance, and re-evaluate their vision, strategies, and policies.

Participants – Any organization
Sponsors – N.A.
Overarching Program Type - Voluntary, performance measurement planning tool.
Drivers – Provide a new way to measure performance (rather than external accounting data), based on a balance of perspectives.
Goals and Desired Areas - Align key performance measures with strategy at all levels of an organization, facilitate communications and understanding of business goals at strategies at all levels of an organization, and provide feedback and learning.
Benefits - Performance measures incorporated into manageable metrics, strategic planning and budgeting processes integrated, identification of best practices in an organization.
Steps and Requirements:

- Identify high-level vision and strategies for achieving the vision.
- Use 4 Balanced Scorecard perspectives (financial, customer, internal processes, and learning and innovation) to translate the vision into a clear set of objectives.
- Translate objectives into clear performance measures at the business unit level.
- Evaluate performance against the scorecard.
- Update and maintain the scorecard.

Bid-to-Goal

Bid-to-Goal is a service improvement and cost saving planning tool. Utility managers wanting to focus on the bid process and confronting privatization pressures might utilize Bid-to-Goal. Bid-to-Goal provides an approach for establishing goals that are reflective of the level of savings needed to be competitive with potential private proposals. As such, Bid-to-Goal could be used in the planning phase of developing a management system framework.

Bid-to-Goal provides an approach for developing a strategy that focuses on the hitting of a savings goal rather than using managed competition. Public employees meet that savings goal via a detailed offering, or a memorandum of understanding (MOU), much like that of the private sector service agreement. During the term of the agreement, which could run five to six years (with options to extend), performance discrepancies could trigger an automatic bidding process.

Three factors lead to the development of Bid-to-Goal.

- First, it can take time to implement the changes needed to become competitive. Bid-to-Goal has the potential to link firm performance criteria with phased progress.
- Second, many communities have launched business planning and competitiveness programs that feature open-ended processes. They are open-ended in that they provide no clear direction as to the results that are expected once the plans are submitted. The detailed self-analyses by public agencies are compiled in public documents that could seriously undermine the ability to bid successfully in managed competition. Bid-to-Goal requires detailed self-examination and the production of a business plan after the community has committed to firm requisites for acceptance.
- Third, there is growing reluctance among the major contract operations companies to participate in managed competition. They are not likely to bid if they do not believe they can provide the service for less than the municipal entity. For communities focused on the goal of achieving significant savings without impacting the quality of service, Bid-to-Goal provides an opportunity for public employees to demonstrate, over a reasonable period of time, that they can reach optimum levels. If the public employees fail to reach their goals, they can be precluded from participation, thus attracting private companies into a bidding pool.

There are specific criteria that must be developed as the basis for awarding the MOU including:

- A goal reflecting the level of savings needed to be competitive with potential private proposals (assuming that private companies charge for profit and other private sector costs);
- A scope of work describing the level of service, including safety margins desired by the community, in exchange for a service fee; and

- A firm schedule for submitting a jointly signed offering (management and labor) and for accomplishing the savings and performance promised under the MOU.

The goal must be matched to a specific scope of services with performance parameters detailed in the MOU. The goal represents the minimum savings required to comply with the process; however, incentives can be built into the service agreement to encourage additional savings to the community. Gain sharing programs can be used to provide incentives as well as to establish the basis for the accumulation of reserve funds and money that could play a similar role as a performance bond.

The time allowed for the development of a public offering is typically limited to less than one year (from the beginning of the Bid-to-Goal process) in order to provide a strong incentive for action. If the offering is not submitted within the time allotted, the community can solicit bids from the private sector.

Participants – Public agencies
Sponsors – N.A.
Overarching Program Type – Voluntary, service improvement and cost savings planning tool.
Drivers – Improve service delivery using public employee labor-management collaboration.
Goals and Desired Areas – Achieve operational savings and level of service modifications that are comparable or better to solutions offered by the private sector.
Benefits – Provides an innovative route to savings and efficiency; rewards ratepayers; retains community control of investments, encourages partnership of participants.
Steps and Requirements:

- Establish a goal reflecting the level of savings needed to be competitive with potential private proposals.
- Determine the scope of work describing the level of service including safety margins desired by the community, in exchange for a service fee.
- Provide a schedule for submitting a jointly signed offering (management and labor) and for accomplishing the savings and performance promised under the MOU.
- Execute a service agreement that is implementation driven and evaluated based on terms and conditions of a detailed service agreement.

Capacity, Management, Operation and Maintenance Programs (CMOM) – http://epa.gov

CMOM objectives are derived from a desire to improve sewer system operation and maintenance. When wastewater systems are not properly managed, operated, or maintained, the National Pollutant Discharge Elimination System (NPDES) permit limits can be exceeded at the associated treatment plants, and sanitary sewer overflows (SSOs) can occur from the collection/transmission systems. The infrastructure investments can deteriorate, with degraded water quality as a possible area. NPDES permittees are familiar with the permit regulations and requirements. In some utilities, however, the sewer system has been maintained by a department separate from the wastewater treatment authority, and that may have had limited knowledge of the permit conditions.

The CMOM program as developed by U.S. EPA's Region IV emphasizes that good operation and maintenance is a function of good management. The capacity aspect of the program stresses: proper installation of new and rehabilitated lines; inter-jurisdictional agreements for wastewater services; requirements for the implementation of an information management system; capacity assurance; development of overflow response and emergency operations plans; an assessment of the system's physical conditions; and a determination of which components need repair. CMOM also requires training, a summary of the management program, and periodic audits to determine the effectiveness of the program.

Utility managers that want to focus on the capacity of collections systems and treatment facilities could use CMOM as a blueprint. CMOM can be linked with an existing management system framework, or used to develop a basic "plan, do, check, act" framework focused on managing the capacity of collections systems and treatment facilities.

In either approach, CMOM can be used in the planning stage of a continual improvement management system to assess the capacity of collections systems and treatment facilities to treat peak flows and maintain compliance with permit requirements.

CMOM can support implementation of a continual improvement management system by providing an approach for:

- Optimizing collection systems and treatment facility operations;
- Implementing and enforcing sewer use ordinances or other legally binding documents;
- Maintaining information management systems that contain timely information for system operation and maintenance;
- Providing adequate preventative and routine maintenance, and for continual review and update of procedures;
- Ensuring all feasible steps are taken to stop and mitigate the impacts of SSOs and that an overflow response plan is prepared; and
- Providing employee training on the CMOM program.

CMOM provides an approach for checking by establishing continual review of preventative and maintenance procedures, periodic review of CMOM program procedures, and tracking of performance indicators. CMOM supports the acting component by establishing regular updates to preventative and maintenance procedures and CMOM program procedures. CMOM also supports acting through audits as part of the NPDES permit application (currently required by EPA Region 4).

<u>Participants</u> – Municipal sanitary sewer collection systems
<u>Sponsors</u> – US EPA
<u>Overarching Program Type</u> – Tool for evaluating and prioritizing efforts to identify and correct performance-limiting situations in the collections system. In EPA Region 4, CMOM has been incorporated as a regulatory requirement. These requirements have not yet been adopted by EPA overall. In Region 4, as part of the NPDES permit application, permittees must conduct an audit evaluating the CMOM and its compliance with the CMOM general standards.

Drivers – Aging infrastructure, history of inadequate investment in infrastructure maintenance and repair, risks to community of not providing an effective sanitary sewer collection system (sanitary sewer overflows or SSOs)
Goals and Desired Areas – Reduced health and environmental risks by increasing the investment in managing, operating and maintaining sanitary sewer collection systems and ensuring adequate capacity is provided (increased investment leads to lowered occurrence of sanitary sewer overflows)
Benefits – Leverage planning required by CMOM for getting budget approval for improvements•
Steps and Requirements

- Provide adequate maintenance facilities and equipment, identify critical parts needed for system operations, maintain an adequate inventory or replacement parts
- Implement and enforce sewer use ordinances or other legally binding documents
- Maintain information management systems that contain timely information for system operation and maintenance
- Provide adequate preventative and routine maintenance, and continually review and update procedures
- Ensure all feasible steps are taken to stop and mitigate the impacts of SSOs and develop an overflow response plan
- Assess current system physical condition
-
- Determine capacity of current collections system and satellite collection systems to meet base and peak flows, identify measures for providing additional capacity or reducing flows (as necessary to meet peak flows)
- Assess capacity of treatment facility to treat peak flows and maintain compliance with permit requirements, identify measures for providing additional capacity or reducing flows (as necessary to meet peak flows), optimize treatment facility operation
- Ensure proper installation of new sewers and connections and assess their capacity to meet peak flows
- Provide employee training on the CMOM program
- Develop and track performance indicators
- Review and update CMOM program procedures periodically
- Conduct an audit, appropriate to size of system and number of SSOs and submit a report of the audit as part of the NPDES permit application

EPA EMS for Local Government Initiative – http://epa.gov

The EPA EMS for Local Government Initiative is based on the ISO 14001 environmental management system standard. As such, this initiative provides an approach for all of the management system components in the same manner as ISO 14001.

Participants – Local government entities (broader than water / wastewater treatment)
Sponsors – US EPA
Overarching Program Type – Pilot project to assist local governments develop and implement an EMS, ISO certification encouraged but not required
Drivers – Strong management tool to help improve environmental performance, pollution prevention, and regulatory compliance

Goals and Desired Areas – Positive effect on environmental performance and compliance
Benefits – Improved environmental awareness, improved environmental performance (reduced impacts), improved efficiency, increased accountability within the agency
Steps and Requirements

- Receive training and technical assistance
- Develop and implement an EMS (see ISO 14001 for EMS development and implementation steps)

The Governmental Accounting Standards Board Statement #34 (GASB-34) – http://www.gasb.org

The Governmental Accounting Standards Board (GASB) adopted in June 1999 a new accounting standard that affects the way local and state governments report their finances. Statement 34 (GASB-34) mandates that governments change to a system of full accrual accounting, or accounting that focuses on the flow of economic assets and recognizes costs as committed resources, regardless of when the expenditures are made. The new standards provide significant changes in the information provided in the organization's annual financial report, including the first ever requirement to report the value of the organization's infrastructure assets. GASB-34 affects all state and local governments that issue financial reports in conformity with generally accepted accounting principles.

GASB-34 has provided an alternative to the historic cost, less depreciation reporting method for infrastructure assets, called the modified approach. Agencies that have a comprehensive asset management system that includes an inventory, condition assessment, and a predictive maintenance/ repair/ restoration/ replacement component will be allowed to forgo the required financial accounting for infrastructure assets. As such, the relationship of GASB-34 to the components of a management system may be described similarly to Asset Management.

The new requirements become effective based on the size of the reporting agency (city, county, township, not just the public works or infrastructure agency). Agencies with annual revenues exceeding $100 million will start using the new standard beginning June 15, 2001; between $10 million and $100 million, the new rules will take effect June 15, 2002; and for those under $10 million, the law will take effect in June, 2003.

Participants – Local government agencies
Sponsors – Governmental Accounting Standards Board (GASB)
Overarching Program Type – Requirement to implement asset management and report asset depreciation
Drivers – See asset management
Goals and Desired Areas – See asset management
Benefits – See asset management
Steps and Requirements – See asset management bottom up approach

International Organization of Standardization (ISO) 14001 Environmental Management System Standard - http://www.iso.org

ISO 14001 is an internationally recognized EMS standard that can be utilized by any industrial sector or type of organization. ISO 14001 is built around the plan-do-check-act cycle of continual improvement.

ISO 14001 provides an approach for the self-identification of environmental policy, impacts, performance goals, and objectives, with the expectation that the minimum performance target is beyond environmental regulatory compliance.

ISO 14001 provides the following elements for environmental performance improvement:

- Establishing an organizational environmental policy;
- Identifying environmental aspects (activities, products, or services which can interact with the environment) by characterizing waste streams (air, effluent, solid / hazardous waste) and identifying environmental requirements (regulatory and other voluntary commitments);
- Identifying environmental impacts associated with environmental aspects;
- Identifying which functional units are associated with the impacts;
- Setting environmental objectives and targets (with associated metrics) for controlling and reducing impacts;
- Identifying business units or individuals responsible for achieving objectives and targets;
- Developing action plans and time lines for achieving objectives and targets;
- Establishing operational and maintenance management controls;
- Establishing emergency procedures;
- Conducting measuring and monitoring activities;
- Taking corrective and preventive actions, and
- Conducting management review.

Organizations that implement ISO 14001 determine how to establish operational policies, practices, and procedures that align with organizational objectives and targets for environmental performance improvement. Some industry sectors have developed industry-specific best policies, practices, and procedures to complement ISO 14001 implementation.

Because drinking water and wastewater utility operations are primarily focused on environmental and public health impacts, utility managers will find that EMS represent a natural starting point for introducing a continual improvement management system into a utility.

Participants – Any private or public sector entities
Sponsors – International Standards Organization
Overarching Program Type – Voluntary, procedures based, environmental management system, third party certification optional
Drivers – Provide an international standard for environmental management
Goals and Desired Areas – Support environmental protection and prevent pollution while meeting socioeconomic needs
Benefits – Reduced environmental impacts, integration of environmental management and business functions
Steps and Requirements

- Establish environmental policy
- Identify environmental aspects (activities, products, or services which can interact with the environment)

  - Characterizing waste streams (air, effluent, solid / hazardous waste)
  - Identifying environmental requirements (regulatory and other voluntary commitments)
- Identify environmental impacts associated with those environmental aspects
- Identify which functional units are associated with those impacts
- Set environmental objectives and targets (with associated metrics) for reducing impacts (Note: specific performance objectives and targets, beyond meeting regulatory requirements, are not provided by ISO 14001, but an approach for setting them is.)
- Identify business units or individuals responsible for achieving objectives and targets
- Establish and document procedures to meet targets and objectives and manage environmental impacts
- Measure and evaluate performance against established objectives and targets
- Conduct a management review to ensure overall environmental performance and improvement
- Optional – Apply for third party verification and ISO certification of the EMS

ISO 9002 Quality Management System Standard - http://www.iso.org

ISO 9002 is an internationally recognized quality management system standard that can be utilized by any industrial sector or type of organization. ISO 9002 provides for the self-identification of Quality policy and objectives.

ISO 9002 provides an approach and methods for quality performance planning. ISO 9002 provides the following unique planning elements:
- Establishing quality policy and objectives;
- Identifying quality requirements (although not levels); and
- Defining and documenting how quality requirements should be met (e.g., establishment of quality plans).

As with ISO 14001, organizations that implement ISO 9002 determine how to establish operational policies, practices, and procedures that align with organizational objectives and targets for quality management. As well, some industry sectors have developed industry-specific best policies, practices, and procedures to complement ISO 9002 implementation.

Note: ISO 9002 is the quality management system standard for organizations that do not carry out design and development (those are covered by 9001) and is appropriate for water and wastewater utilities.

Participants – Any private or public sector entities
Sponsors – International Standards Organization
Overarching Program Type – Voluntary, procedures based, quality management system, third party certification optional
Drivers – Provide an international standard for quality management
Goals and Desired Areas – Improved product quality
Benefits – Improved product quality, integration of quality management and business functions
Steps and Requirements
- Establish quality policy and objectives

- Identify quality requirements (Note: Like ISO 14001, specific performance objectives and targets are not provided, but an approach for setting them is)
- Define and document how quality requirements should be met (e.g., establishment of quality plans)
- Set quality procedures
- Measure and evaluate performance against established objectives and targets
- Conduct a management review to ensure overall performance and improvement
- Optional – Apply for third party verification and ISO certification

Malcolm Baldrige National Quality Program - http://www.quality.nist.gov/index.html

The Malcolm Baldrige National Quality Award has been the centerpiece of the Baldrige National Quality Program since 1988. It is an award presented annually in recognition of performance excellence of US-based or headquartered companies and organizations. The focus of the Baldrige Program is an organization's overall performance management system. Award-winners have become recognized role models and have shared their strategies with other organizations.

The Baldrige criteria for performance excellence consist of financial and non-financial perspectives. The criteria form a framework, which is adaptable to any organization, for improving overall performance. The following categories make up the criteria for the Baldrige system.

- *Leadership* - How the organization is guided, how its responsibilities are addressed to the public, and how good citizenship is practiced by the senior executives.
- *Strategic Planning* - How the strategic directions of the organization are set, and how the key action plans are determined.
- *Customer and Market Focus* - How the organization's requirements and expectations of customers and markets are determined.
- *Information and Analysis* - How the management, effective use, and analysis of data and information are carried out in order to support the organization's key processes and performance management system.

The Malcolm Baldrige National Quality Program criteria can support the implementation component of a continual improvement management system by defining, at a high-level, good management practices.

Participants – Private and public for-profit businesses headquartered in the U.S. (manufacturing, service, and small businesses); and for profit and not-for-profit public, private, and government education and health care organizations.
Sponsor – National Institute of Standards and Technology (NIST)
Overarching Program Type – Voluntary, awards program based on 7 categories of criteria that define, at a high-level, good management practices.
Drivers – Establish a standard of excellence for high-quality management that would help U.S. organizations achieve world-class quality and enhance U.S. competitiveness.
Goals and Desired Areas – Continuous improvement in the delivery of products and/or services, greater customer satisfaction and response to stakeholders.
Benefits – Baldrige Award recognition, better employee relations, higher productivity, greater customer satisfaction, increased market share, and improved profitability.

Steps and Requirements

- Companies prepare and submit the eligibility certification and application to examiners who review the applications to determine, based on the 7 categories of award criteria, which applicants will receive site visits.
- Examiners conduct on-site verification and clarification of the application package, review pertinent records and data, and conduct interviews with executives and employees.
- Judges review the site visit reports and application packages and present Award recipient recommendations to the Director of NIST and the Secretary of Commerce.
- Examiners submit feedback reports to each applicant containing descriptions of strengths and opportunities for improvements in each of the 7 categories.
- Secretary of Commerce makes final award determinations.

National Biosolids Partnership (NBP) EMS for Biosolids - http://www.biosolids.org

The NBP EMS for Biosolids also includes the planning elements provided by the other management system frameworks. However, rather than focus on environmental impacts broadly, as does ISO 14001, the NBP EMS for Biosolids is specifically focused on those impacts that relate to biosolids management, and is thus designed for use by wastewater treatment utilities that create and manage biosolids. Because of its specific focus, utility managers concerned with biosolids areas may utilize the NBP EMS for Biosolids in one of two ways. Utility managers could adopt the biosolids specific elements and pull them into another management system framework, such as ISO 14001. The Metropolitan Wastewater District in San Diego has adopted this approach. Or, a manager could implement the NBP EMS for Biosolids as the basis for establishing the continual improvement management system framework within the utility. Several dozen utilities across the country participating in the NBP EMS for Biosolids Program are taking this approach.

The NBP EMS for Biosolids provides implementation component elements similar to ISO 14001. However, since the NBP EMS for Biosolids is specifically focused on biosolids management, elements related to the establishment of operational procedures are limited to the specific business units associated with biosolids management. The NBP EMS for Biosolids also has additional requirements associated with public participation and communications. One of the most significant differences of the NBP EMS for Biosolids from ISO 14001 is that the NBP Program provides a National Manual of Good Practices. In this regard, the NBP EMS for Biosolids provides specific guidance and direction on the use of operational-level good practices related to biosolids production and management. ISO 14001, on the other hand, does not provide direction on best practices, as it is not industry-specific like the NBP EMS for Biosolids (specific to wastewater treatment utilities).

A unique aspect of the NBP EMS for Biosolids is that it supports the checking component by providing elements that establish specific reporting formats and procedures associated with performance and audit reports.

Participants – Wastewater treatment organizations that are responsible for the full biosolids management value chain (e.g., from collections and pretreatment to final biosolids disposition)
Sponsors – National Biosolids Partnership (AMSA, WEF, EPA)

Overarching Program Type – Voluntary, procedure-based environmental management system that incorporates best practices and continuous improvement towards performance goals, independent certification
Drivers – Improve public perceptions of biosolids management practices, especially the land application of biosolids for agricultural purposes
Goals and Desired Areas – Increased public acceptance of environmentally sound biosolids management practices
Benefits – NBP recognition, increased public acceptance, institutional memory improved through documentation of procedures, improved operational efficiency
Steps and Requirements

- Establish a biosolids policy that commits the agency to the 10 principles in the Code of Good Practice
- Plan and implement an EMS (identify critical control points and associated environmental impacts, set goals and objectives based on legal/other requirements and public input, establish and document procedures to meet goals and objectives, measure and evaluate performance against established goals and objectives)
- Operate the EMS for 6 months and conduct a self-audit
- Apply for and receive third party verification
- Receive NBP recognition
- Annual cycle of management review, self-audit, corrective actions, reports, third party interim audits
- Re-verification (5 year cycle)

Note: Like the ISO management system standards, the NBP EMS for Biosolids does not dictate specific performance goals and targets. However, the NBP's program requires a commitment, through the "Code of Good Practice", to go beyond regulatory compliance.

Occupational Safety and Health Agency Voluntary Protection Program (OSHA VPP)-
http://www.osha.gov/oshprogs/vpp/

This is a voluntary program of the Occupational Safety and Health Administration. OSHA VPP provides an approach and methods for occupational safety and health planning. Specifically, OSHA VPP supports:

- Developing occupational safety and health policy, goals, and objectives; and
- Conducting worksite safety analysis.

With respect to the implementation component, OSHA VPP establishes safety / hazard prevention and control procedures (includes substantial employee involvement requirements). OSHA VPP supports the checking component by providing an approach to establish procedures for reporting safety concerns. As well, OSHA VPP provides an approach for self-inspection and accident investigation, which are similar to measuring/monitoring and corrective action elements of the other management system frameworks.

Participants – Any private or public sector entities that are regulated by OSHA
Sponsors – OSHA
Overarching Program Type – Voluntary, procedures based, occupational safety and health management system
Drivers – management tool to promote effective occupational safety and health programs
Goals and Desired Areas – protect workers from occupational safety and health hazards

Benefits – decreased costs in workmen's compensation and lost work time, increased production, improved employee morale, reduced employee injury rates, OSHA recognition
Steps and Requirements

- Management and labor statement of commitment
- Develop occupational safety and health policy, goals, and objectives
- Conduct worksite safety analysis
- Establish safety / hazard prevention and control procedures (includes substantial employee involvement requirements)
- Report safety concerns
- Receive OSHA verification of meeting program criteria
- Receive periodic OSHA reassessments (every three years for Star recognition)

Partnership for Safe Water - http://www.awwa.org/partnership

The Partnership for Safe Water is a voluntary performance program that incorporates benchmarking through data collection. The Partnership for Safe Water program provides specific targets for drinking water turbidity that are more stringent than federal regulations for safe drinking water.

Utility managers who want to focus on decreasing drinking water turbidity can implement the Partnership for Safe Water by: adopting turbidity performance targets; collecting turbidity data to benchmark utility performance; evaluating unit treatment processes and other factors (such as financial resource support) that may limit performance; and continuing an annual cycle of making improvements and collecting turbidity data. How a utility increases turbidity performance through adjustment of policies and practices is up to the individual utility – Partnership for Safe Water does not provide best practices in this regard. In the context of a management system framework, the targets provided by the Partnership for Safe Water can be directly incorporated into the process of setting goals and objectives.

Participants – Drinking water utilities providing treated surface water
Sponsors – AWWA, ASDWA, AMWA, NAWC, AWWARF, EPA
Overarching Program Type – Voluntary, performance based, benchmarking and self-assessment
Drivers – Prevent performance problems and increase public confidence in the safety of their drinking water
Goals and Desired Areas – Increased drinking water safety through continual improvement in water treatment plant performance. Exceeding Federal regulations for safe drinking water and providing a consistent level of performance
Benefits – Receipt of Partnership recognition, increased self-awareness about treatment capacity and performance levels, data to support capital planning
Steps and Requirements

- Declare commitment
- Collect and submit 12 months of turbidity data to provide a benchmark of utility performance
- Conduct a self-assessment
- Annual cycle of collecting and reporting data, making improvements

QualServe - http://www.awwa.org/Science/qualserve/qualserv.cfm

QualServe provides an approach for utilities to perform a high-level evaluation of all aspects of utility operations. QualServe covers all utility management areas including financials, quality, impacts/risk (environment, health and safety management), and human resources. Utility managers can implement QualServe to prepare a baseline or benchmark of where it is starting from, which can be utilized in the process of setting strategic direction and policy, as well as in setting organizational goals and objectives. In this fashion, QualServe can support the planning phase of developing a management system framework. However, while QualServe provides insights to an organization on where opportunities for improvement exist, it does not provide specific guidance or direction on how to implement those improvements. As such, a utility could take advantage of the lessons learned from QualServe by linking them with a management system framework that includes systemic implementation of improvement plans.

Although not specifically designed to support monitoring/measuring, auditing, or corrective/preventive actions, QualServe can support the checking component of a management system framework by using the evaluative tools provided by the program as one way of assessing current practices.

Participants – Water treatment, wastewater treatment, and combined utilities
Sponsors – American Water Works Association (AWWA) and WEF
Overarching Program Type – Voluntary, practice-based, qualitative assessment of procedures and practices through self-assessment and peer-based review
Drivers – Help utilities improve service across the entire scope of its operation
Goals and Desired Areas – Continual improvement of service
Benefits – QualServe recognition, increased self-awareness about practices, opportunities for improvement identified through the QualServe process can be leveraged in the capital improvement planning process
Steps and Requirements

- Participate in employee survey
- Provide organizational information for the peer review team (e.g., organizational charts, permit information, planning documents, etc.)
- Meet with peer review team to discuss strengths and opportunities
- Receive peer review report
- Conduct an “out-briefing” to staff on results of the peer review report

APPENDIX G

ENVIRONMENTAL & SOCIAL CONSIDERATIONS

JAMAICA

THE PREPARATORY SURVEY
FOR
KINGSTON SEWERAGE DEVELOPMENT PROJECT

FINAL REPORT
APPENDIX G
ENVIRONMENTAL & SOCIAL CONSIDERATIONS

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Attachment 6.1 Regulation Summary

Attachment 6.1 Regulation Summary

The Natural Resources Conservation Authority (NRCA) Act provides for the management, conservation and protection of Jamaica's physical environment through the Natural Resources Conservation Authority (NRCA). Section 9 provides for the declaration of 'Prescribed Areas' in which specified activities require a permit for which applicants may be obliged to provide an Environmental Impact Assessment if required by NEPA. The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order of 1996 declares the entire island as Prescribed and lists the categories of enterprise, construction or development that require a permit. The Act also addresses sewage and trade effluent discharges.

Although NRCA responsibilities were transferred to the National Environment and Planning Agency (NEPA) in 2001, the NRCA Act remains the primary instrument of environmental and planning legislation pending the passing of a NEPA Act at some future date.

In addition to the NRCA Act, the principal laws for controlling environmental and associated issues are the following:

- The Town and Country Planning Act is administered by NEPA and designates the Government Town Planner and the Town and Country Planning Authority as the responsible agencies for planning control within the legislation;
- The Land Development and Utilisation Act is also administered by NEPA and designates the Land Development and Utilisation Commission as the responsible agency for land development. Development Plans for designated areas are written under this Act.
- The Watershed Protection Act provides for the protection of watersheds and adjacent areas, and the preservation of promotion of water resources. It makes provision for watershed conservation through improved soil conservation practices;
- The Beach Control Act provides for the proper management of Jamaica's coastal and marine resources through the licensing of activities on the foreshore and seabed. The Act also addresses access to the shoreline and other rights associated with fishing and public recreation, and marine protected areas;
- The Endangered Species (Conservation and Regulation of Trade) Act of 2000 is concerned with the protection of specified species of fauna but recent review has identified the need for amendments to address the management and conservation of natural resources and the inclusion of flora. This Act was promulgated to document Jamaica's obligations under the Convention for the International Trade in Endangered Species (CITES) and governs international and domestic trade in endangered species in and from Jamaica;
- The Wildlife Protection Act is concerned with the protection of particular species of fauna declared under the Act. It has undergone review, particularly in the areas of increased fines and the number of animals now enjoying protected status. Further amendments are being undertaken to address a variety of other issues relating to the management and conservation of natural resources, and the inclusion of flora;

- The Fishing Industry Act is aimed at the management of the fisheries resources of Jamaica and the establishment of fish nurseries and sanctuaries. It has, however, not kept pace with the evolution of fishing and the attendant resource management issues, and a new Act which will provide an institutional framework for the management, planning, development and conservation of fisheries resources is being drafted;
- The Forest Act addresses the sustainable management of forests on lands in the possession of the Crown and vests management responsibility in the Conservator of Forests. The Act provides for the establishment of forests reserves, the establishment of protected areas, the promotion of forestry research areas, reforestation initiatives and the preparation of a Forestry Management Plan, and
- The Public Health Act is enforced by Inspectors working with the Parish Councils across the island and the Environmental Control Division of the Ministry of Health. Standards and practices to ensure public health are set, including that persons involved in construction, repair or alteration must take precautions to prevent particulate matter from becoming airborne.
- Jamaica National Heritage Trust Act established a Statutory Body, The Jamaica National Heritage Trust which has the responsibility to declare, protect, promote, conduct research and record the protected national heritage and national monuments of Jamaica.
- Land Acquisition Act allows the Government to compulsory acquire land when such acquisition is declared to be in the public interest. It sets out that the procedure for the acquisition and how fair compensation to owner of the land should be arrived at.

Attachment 6.2 Category of Section 38(1)(b)

Attachment 6.2 Category of Section 38(1)(b)

- Development projects (Subdivisions of 10 to 50 lots, Subdivisions of 51 lots or more, Housing projects of 10 to 50 projects, Hotel resort complex of 12 to 50 rooms and Hotel resort complex of 51 rooms or more)
- Citrus, coffee, cocoa, coconut, sugar cane processing factories
- Solar salt production
- Watershed development and soil conservation projects including river training such as river channel diversion works and works for the transfer of water resources between river basins, check dams, and retaining walls
- Agro processing and processing of agricultural wastes
- Office complexes of 5000 square meters or greater
- Eco-tourism and nature tourism projects
- Water treatment facilities, including water supply and desalination plants
- Fish and meat processing
- Food processing plants
- Detergent manufacturing including manufacturing of soap
- Manufacturing of containers and package materials including cans, bottles, boxes and cartons
- Distillery brewery and fermenting facilities
- Manufacturing of edible fats, oil and associated processes
- Tanners
- Boxing plants
- Manufacturing of textiles
- River basin development and improvement
- Irrigation and water management and improvement projects
- Slaughter house and abattoirs
- Theme parks
- Hospitals
- Airports and air fields, including runway expansion greater than 20% of the original length
- Sewage and industrial waste water treatment facilities
- Metal processing (Ferrous metals, Non ferrous metals, Metal Plating and Foundry operations)
- Industrial projects (Chemical plants)
- Pulp, paper and wood processing
- Petroleum production, refinery, storage, and stockpiling
- Cement and lime production

- Paint manufacture
- Manufacturing of pesticides or other hazardous or toxic substances
- Construction of new highways, construction of arterial roads, construction of new roads on slopes greater than 20 degrees, major road improvement projects including construction of a road of 4 or more lanes or realignment or widening or an existing road into four lanes where such road realignment or widening would be ten (10) kilometers or more in continuous length
- Land reclamation and drainage projects
- Modification, clearance or reclamation of wetlands
- Dredging, excavation, clearing and reclamation of riverine, swamp, beach wetlands or marsh areas
- Solid waste treatment and disposal facilities including waste disposal installation for incineration and chemical landfills or systems for the destruction reprocessing or recycling of such waste
- Cemeteries and crematoria
- Introduction of flora, fauna and genetic material
- Introduction of genetically modified organisms
- Hazardous waste storage, transportation, treatment or disposal facilities
- Clear cutting of forested areas and clearing of trees on land of 3 hectares and over on slopes greater than 25 degrees
- Golf Courses
- Transportation centres for more than 10 vehicles
- Construction or demolition of reservoirs, dams, dykes and aqueducts
- Railways, tramways, and cable car operations
- Causeway and multiple span bridges
- Shopping centres
- Aquaculture facilities and ponds and intensive fish farming
- Storage of scrap metal including derelict vehicles
- Off shore drilling for extraction of oil, natural gas or minerals
- Dry cleaning operations
- Mining, quarrying and mineral processing, bauxite, peat, sand, minerals, including aggregate, construction and industrial materials (Metallic and Non metallic)
- Ship yards
- Marinas and boat yards
- Power generation plants including hydroelectric plants and installations for the harvesting of wind power for energy production and nuclear reaction above one megawatt

- Electrical transmission lines and substations greater than 69 kv
- Pipelines and conveyors including underground cables, gas lines, and other such infrastructure with a diameter of more than 10 centimeters for the transport of gas, oil, or chemicals
- Port and harbour development

Attachment 6.3 TOR for EIA

Attachment 6.3 TOR for EIA

TERMS OF REFERENCE FOR THE CONDUCT OF AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE KINGSTON SEWERAGE DEVELOPMENT PROJECT

INTRODUCTION

The Kingston Sewerage Development Project (KSD) will expand and improve sewerage in Kingston & St. Andrew and Portmore. The communities of Barbican, Hope Pastures/Mona, MeadowBrook/Havendale and Pembroke Hall will benefit from the laying of sewers along existing roads. The sewage so collected will be transported to the Soapberry treatment plant via existing trunk mains with minor modifications.

In Portmore, the communities of Bridgeport, Independence City, Edgewater, Passage Fort, Caymanas Gardens, Marine Park, Westbay, Cumberland and Westchester already have a collection system attached to less than optimal functioning sewage treatment plants. The KSD project will upgrade the collection system and retire the existing sewage treatment transforming some of them into pumping stations. The sewage so collected would be transported to the Soapberry treatment plant via a pipe bridge across the Rio Cobre.

TERMS OF REFERENCE

The Terms of Reference for the conduct of the Environmental Impact Assessment are as follows.

1. Project Description

Prepare a detailed description of the project. This section will provide information on the proposed project. This information should include:

- Details of project components complete will topographic maps of the site and site layout/ schematic plan.
- Details on infrastructure development including design plans for sewage disposal system, drainage features , roads and utility requirements

2. Existing Environment

A natural resources survey of the proposed development site will be conducted. This information will form the basis upon which impacts of the project will be assessed. The following aspects will be described in this section:

- Physical Environment - Topography, soils, climate, drainage, geology, coastal features and hazard vulnerability including potential impacts on current and wave regimes in the area.

- Biological Environment – Description of terrestrial habitats, existing vegetation, flora and fauna surveys inclusive of a species list; Description of marine habitats and communities; Commentary on the ecological health, threats and conservation significance of terrestrial and marine habitats.

  This would include:

  - A detailed qualitative and quantitative assessment of terrestrial habitats in and around the proposed project sites and the areas of impact. This must also include flora and fauna surveys, including species lists.

  - A detailed qualitative and quantitative assessment of marine habitats and communities in and around the proposed project sites and the possible areas of impact. This must include but not be limited to seagrass, coral reefs and their associated biota.

  The field data collected will include, but not be limited to:

  - Percentage coral cover
  - Vegetation profile
  - Seagrass
  - Mangrove communities
  - Other benthic features of the proposed development areas as well as the areas of potential impact.
  - Species lists must be provided for each community,
  - A habitat map of the area
  - Information on fish must also be included.

- Social Environment — Demography, regional setting, location assessment and current and potential land–use patterns of neighbouring properties; Description of existing infrastructure such as transportation, electricity, water and telecommunications; Socio-economic survey determining public perception of the project, this should include potential impacts on social, aesthetic and other values.

3. Legislation and Regulatory Considerations

All applicable government policies, regulations and legislation will be highlighted. This will include local parish council plans and policies.

4. Analysis of Alternatives

This will include the no action alternative and project design alternatives. These will be assessed according to the physical, ecological and socio-economic parameters of the site. A rationale for the selection of any project alternative will be provided.

5. Impact Identification

A detailed analysis of the project components will be done in order to identify the potential environmental impacts, both negative and positive, of the project. Cumulative impacts will also be evaluated. The identified impacts will be profiled to assess the magnitude of the impacts. Each impact will then be ranked as major, moderate and minor and presented in a matrix for all the phases of the project (i.e. preconstruction, construction and occupation).

The impacts to be assessed will include but not be limited to the following:

- Design and engineering- siting, geotechnical investigation
- Visual/aesthetics and noise
- Construction - site clearance, earthworks, access, transportation and spoil disposal, traffic management
- Operation and maintenance - waste disposal, site drainage, sewage, and air quality
- Empirical data will be provided to show that the sewage treatment facility has the capacity to remove the nutrients to meet the National Sewage Effluent Standards.
- Ecological impacts- terrestrial and marine habitats and their effect(s) on species present with special emphasis on any rare, endangered, or endemic species found on site.
- Social impacts – changes in public access, change in beach/recreational use, public perception
- Beneficial impacts – national economy, development of local communities
- Cumulative impacts – synergies between existing or proposed and potential activities

6. Impact Mitigation

Mitigation and abatement measures will be developed for each potential negative impact identified. This will also include recommendations for the enhancement of beneficial impacts.

7. Environmental Monitoring and Management

An outline environmental monitoring and management plan will be developed which will detail the requirements for construction and operational phases of the project. This will include recommendations to ensure the implementation of mitigation measures and long term minimization of negative impacts.

8. Public Participation

A public meeting to present the findings of the EIA will be held as requested by the National Environment and Planning Agency (NEPA). The consultant will be responsible for this presentation. All EIA documents will be made available to the public as required.

Stakeholder meetings will also be held to inform the public of the proposed development and the possible impacts, and will also gauge the feeling/response of the public toward the development (public perception survey).

9. Permit Application

The development will require environmental permits and a beach control act license issued by NEPA. The consultant will facilitate the permit application process with the Client.

ACTIVITIES

In order to effectively and efficiently conduct the Environmental Impact Assessment it will be necessary to carry out various activities which include:

I. Documentation Review

All documentation pertaining to the development will need to be reviewed. These should include, but not be limited to, the project profile, site plan, drainage plan, applications made for financing or planning approval, and any technical and engineering studies that have been done.

Legislation and regulations pertaining to the project will also be reviewed. This will include the local parish council plans and policies as well as regional and international laws and Conventions where applicable.

II. Resource Inventory

An assessment of the present status of the proposed project site will be conducted. This will facilitate the identification of the possible impacts that will be generated from the development as well as aiding in the analysis of the possible alternatives to the development. This assessment will include the following:

a. Preparation of a Project Description

The consultant will undertake a survey of the project sites and relative documentation to provide a detailed description of the proposed project. This description will include:

- Details of project components complete with topographic maps of the site and site layout/schematic plan.
- Details on infrastructure development including design plans for sewage, disposal system, drainage features, road and utility requirements.

b. Physical Environment

A study will be conducted to determine the physical nature of the project site including the following:

- Topography
- Seismic features
- Soils
- Climate
- Drainage
- Geology
- Coastal features

- Hazard Vulnerability

Several databases and GIS systems should be accessed at UWI, WRA, Meteorological Office, and NEPA along with published materials and technical reports. Site visits to confirm, collect, and validate the data should be done.

c. Biological Environment

The consultant will make site visits to inventory the biological environment (marine and terrestrial). Any available existing data and reports on the site will be accessed and reviewed. This assessment will include:

- Description of terrestrial habitats, flora and fauna surveys inclusive of a species list indicating endangered and endemic species.
- Description of marine habitats and communities including water quality measurement.
- Analysis of the ecological stability indicating the nature, location and cause of any stresses to the habitats identified.
- Indication of the conservation significance of the terrestrial and marine habitats.

Line transects will be used for vegetation and marine studies. Spot counts and some line transects will be used for avifaunal studies. Databases at NEPA and the Institute of Jamaica should be accessed and the information used in conjunction with the data collected during site visits. Statements should be made as to the ecological functioning of the terrestrial and marine ecosystems found on site. Maps will be produced using satellite photographs of expected locations of benthic habitats, structures, flora/fauna. Photographic records will be made of the significant marine features and a fish and invertebrate assessment will also be done.

d. Social Environment

The consultant will investigate the current socio-economic status of the area by assessing the following:

- Demography
- Regional setting
- Location assessment
- Current and potential land-use patterns
- An assessment of public perception of the project
- Description of existing infrastructure (transportation, electricity, water and telecommunication).

Data collection will be done via interviews and field visits to relevant communities. Questionnaires may be used to collect data to cross check findings of the previous reports. This will afford the opportunity to present the project to the stakeholders.

III. Analysis of Alternatives

Alternatives to the site location, project design and operation conditions will be analyzed including the “no-action” alternative. These alternatives will be assessed based on the physical, ecological and socio-economic parameters of the site identified. The consultant will provide justification for the selection of the chosen alternative(s). The physical, biological and sociological settings will provide the framework in which to assess the different project alternatives.

IV. Impact Assessment

The consultant will carry out a detailed impact assessment of the project components (pre-construction, construction and operation stages) in order to identify the potential impacts (positive, negative and cumulative impacts) that will be associated with the project. The significance and magnitude (major, moderate and minor) of the impacts identified will also be evaluated through the use of a weighted matrix.

The impacts to be assessed will include but not limited to the following:

- Effects of project design and engineering
- Effects on visual aesthetics and landscape
- Effect of noise and vibration
- Effects of construction activities such as site clearance, earthworks, access routes, transportation networks and spoil disposal
- Effects of operation and maintenance activities such as waste disposal, traffic management, site drainage, sediment, sewage, public access and air quality.
- Effects on ecology including effect on terrestrial and marine habitats. Emphasis will be placed on any rare, endangered, and endemic species found.
- Effects on socio-economic status such as changes to public access, recreational use existing and potential agricultural activities, contribution of development to national economy and development of surrounding communities.

The physical, biological and sociological status will provide the framework in which to assess the impacts of the proposed project.

V. Identification of Mitigation Measures

Mitigation measures will be developed in order to eliminate or reduce the potential negative impacts that are identified. Recommendations will be made as to how the potential positive impacts identified can be enhanced.

VI. Report Preparation and Generation

The EIA will be written by integrating existing reports, reference to the baseline data mentioned above, field surveys, and having discussions with the client. The Consultant will have access to the site and to all materials and reports that will aid in the completion of a quality EIA.

VII. Development of an Environmental Monitoring and Management Plan

A monitoring and environmental management plan will be developed covering construction and operation activities of the project. This plan should protect the integrity of the environment and allow for future studies that will help to manage the development of the expanded sewerage network. It should also identify any anomalies that may arise after the study has been conducted. Due to the short time frame envisioned for the conduct of the EIA temporal variations may not be assessed to the fullest extent. The EMMP will address the long term assessment of these variations.

VIII. Public Participation Activities

Stakeholders surrounding the project site will be subject to a public perception survey in which the details of the project will be presented and feedback solicited.

NEPA has indicated that a Public Presentation to members of the surrounding communities be done. The consultant will present the findings of the EIA at convenient venues in the relevant communities. This will be done to inform and sensitise the public about the activities of the project and the significant steps being planned to address key environmental issues. A report on the Public Presentation will be sent in to NEPA as an addendum to the EIA.

IX. Permit Applications

The Consultant will facilitate the permit and license application process by having the relevant meetings, drafting of the permit and license application forms for signature by the client and respond to any queries or comments made by NEPA.

Attachment 6.3
(Not Full EIA)

Environmental and Social Review Summary

Jamaica Water Supply Improvement Project

This Environmental and Social Review Summary (ESRS) is prepared by MIGA staff and disclosed in advance of the MIGA Board consideration of the proposed issuance of a Contract of Guarantee. Its purpose is to enhance the transparency of MIGA's activities. This document should not be construed as presuming the outcome of the decision by the MIGA Board of Directors. Board dates are estimates only.

Any documentation which is attached to this ESRS has been prepared by the project sponsor, and authorization has been given for public release. MIGA has reviewed the attached documentation as provided by the applicant, and considers it of adequate quality to be released to the public, but does not endorse the content.

Country:	Jamaica
Sector:	Infrastructure
Project Enterprise(s):	The Bank of Nova Scotia Jamaica Limited and the National Water Commission of Jamaica; Vinci Construction Grands Projets (VCGP); BNP Paribas
Environmental Category:	B
Date ESRS Disclosed:	October 20, 2009
Status:	Due Diligence

A. Project Description

The Jamaica Water Supply Improvement Project (JWSIP) entails a US$198.5 million refurbishment and expansion program aimed at addressing the perennial water supply constraints affecting the greater Kingston Metropolitan, Ocho Rios, and broader rural parish areas of Jamaica. It is being sponsored and implemented by the National Water Commission (NWC) of Jamaica, a state owned enterprise created under the 1980 National Water Commission Act, and overseen by the Jamaica Ministry of Housing and Water. To facilitate the JWSIP financing, the NWC has segmented the works into two categories ("A" & "B"), which will be implemented concurrently, using the same Engineering Procurement and Construction (EPC) Contractor, Vinci Construction Grands Projets (VCGP) of France, but financed by separate entities. Category A program activities (US$83.5 million estimated cost) will be financed by BNP Paribas and VCGP, while Category B activities (US$115 million estimated cost) will be exclusively financed by the Bank of Nova Scotia (BNS) via a shareholder loan financing arrangement with its Jamaica based affiliate, the Bank of Nova Scotia Jamaica Limited (BNSJ).

Category A program activities include: replacement of Rio Cobre pipeline (6 km from Bog Walk to Flat Bridge), refurbishment of the Constant Spring water treatment plant, refurbishment of Seaview water treatment plant, construction of Halls Green Wells (including 2 wells, a pipeline and a new reservoir), and the purchase of some 70,000 water meters. Category B program activities include: Rio Cobre pipeline (12 Km from Content District to Ferry Booster Station), pipeline connection from Ferry to Red Hills, leak repairs and network improvement at Forest Hills/Red Hills, and construction of new water treatment plant at Content District.

B. Environmental and Social Categorization

This project for the improvement and construction of wells, pipelines, a reservoir and treatment plants is Category B under MIGA's social and environmental review procedures because the impacts are site-specific, limited in number, and mitigation measures are readily identifiable. Based on information provided by the sponsor the key environmental and social issues are: soil and water resources, air and noise emissions, waste disposal and management, occupational health and safety, worker relations, community health and safety and land acquisition An environmental and social due diligence site visit will be undertaken prior to Board presentation. The ESRS will be revised based on the mission's findings and conclusions.

C. Applicable Standards

While all Performance Standards are applicable to this investment, our current information indicates that the investment will have impacts which must be managed in a manner consistent with the following Performance Standards:

- PS1: Social and Environmental Assessment and Management System
- PS2: Labor and Working Conditions
- PS3: Pollution Prevention and Abatement
- PS4: Community Health, Safety and Security
- PS5: Land Acquisition and Involuntary Resettlement

There are no ecologically sensitive areas within close proximity of the project sites, therefore PS6 (Biodiversity Conservation and Sustainable Natural Management) does not apply. No national heritage sites or cultural buildings of any significance are to be found at or near the sites neither for the proposed works nor within the road reserves as is confirmed by the Jamaica Heritage Trust. MIGA does not expect the project to have any impact on cultural heritage, therefore PS8 (Cultural Heritage) does not apply. No Indigenous peoples will be affected by this project, therefore PS7 (Indigenous Peoples) does not apply.

In addition, the World Bank Group General Environment Health and Safety (EHS) Guidelines (for construction activities), and Guidelines for Water and Sanitation (for plant operations) apply to this project.

D. Key Documents and Scope of MIGA Review

MIGA has reviewed the following documents:

- Draft Interim Environmental Impact Assessment: Category A- Jamaican Water Supply Improvement Project: Pipeline Works (Replacement of the Rio Cobre Pipeline Section Through Gorges to Flat Bridge), National Water Commission, August 19, 2009
- Draft Interim Environmental Impact Assessment: Category A- Jamaican Water Supply Improvement Project: Halls Green Project (Wells, Reservoir, Pipelines), National Water Commission, August 19, 2009
- Draft Interim Environmental Impact Assessment: Category B- Jamaican Water Supply Improvement Project: Pipeline Works (Replacement of the Rio Cobre Pipeline, Ferry to Rockpond Tank <Upper Red Hills> Water Supply, Forest Hills/Red Hills Water Distribution Network Rehabilitation), National Water Commission, August 2009.
- Draft Interim Environmental Impact Assessment: Category B- Jamaican Water Supply Improvement Project: Construction of the New (Rio Cobre) Water Treatment Plant in Content District St. Catherine, National Water Commission, September 2, 2009
- List of Licensed Quarries – Saint Catherine Parish Council and Kingston Saint Andrew Corporation, September 30, 2009
- Summary of land acquisition – prepared by NWC sent to MIGA on October 2009.
- E-mail exchanges and conference call with prospective guarantee holders and NWC on labor issues and land acquisition.

MIGA's review of this project consisted of evaluating the environmental and social information submitted by VINCI and the National Water Commission, including NWC/VINCI's responses to inquiries posed by MIGA's social and environmental specialists. The submission of the finalized environmental impact assessments to MIGA will be required prior to the commencement of physical works.

E. Key Issues and Mitigation

Social and Environmental Assessment and Management Systems

The Engineering Procurement and Construction (EPC) Contractor, Vinci Construction of France is responsible for the physical/construction works for both Category A and B program activities. Vinci maintains an environmental management system that complies with the requirements of ISO 9001:2000 quality standard, ILO OSH:2001 safety standard and ISO 14001:2004 for environmental standards. Their system is certified each year by

AFAQ-AFNOR Certification. To reinforce Vinci's commitment to health and safety, it has been VCA (Contractors' Safety Checklist) certified since 1999.

The investment is expected to have no significant adverse social impacts. The key environmental issues are soil and water resources, air and noise emissions, waste disposal and management, occupational health and safety, and worker relations. Based on MIGA's review of the interim environmental assessments the investment is expected to comply with MIGA's social and environmental policies and standards. Where applicable, finalized environmental assessments and environmental management plans will be submitted to MIGA prior to the commencement of relevant physical works in accordance with national as well as MIGA's procedures for environmental and social sustainability and disclosure policies.

Water treatment plant operations including the operations and maintenance of the wells and reservoir will be subject to review by the Ministry of Health for water quality issues and the National Environment and Planning Agency (NEPA) for any point discharges. Environmental management plans for plant operations will be prepared to address wastewater, hazardous chemicals, air emissions and ecological impacts.

Labour and Working Conditions

Vinci (the contractor) is committed to complying with MIGA's PS2, the Jamaican Labour Law in ensuring workers' health and safety as well as in managing worker relationships. Information presented to MIGA indicates that Vinci's human resources policy and labour practices are in compliance with the Government of Jamaica's standards and requirements. The main principles include: fair and consistent treatment of all employees; operating as an equal opportunity employer and does not discriminate against nationality, race, religion, age, gender and culture; and freedom of association.

The National Labour Law covers the following areas: working conditions; working hours; salary and compensation; statutory deductions; paid national holidays; overtime compensation; insurance; vacation, sickness, bereavement, maternity etc; safety and welfare. The Ministry of Labour and Social Security has an International Labour Agency/Information Office which manages relations with ILO, the Organization of American States and the United Nations Development Programme and other international organizations concerned with labour matters. This office is also responsible for preparing periodic reports on labour matters to these organizations and addressing ILO recommendations. Most of the ILO conventions were ratified by Jamaica.

Vinci's hiring process includes transparent stages of application, interview, selection, discussion of remuneration, induction and training. In keeping with the local culture temporary site workers will be hired from the local project areas. Once the construction is completed, NWC will be responsible for the operations of this water project, including labour and working relations, in compliance with national standards and MIGA's Performance Standards.

Pollution Prevention and Abatement

The overall level of environmental risks associated with the investment program is judged to be low.

Vegetation/soil loss. The clearance and loss of areas of vegetation and faunal habitat will be minimal. An inspection of the proposed routes of the pipelines seems to indicate that very little vegetation will be destroyed or damaged along the routes and the secondary roads. The overall impact on vegetation will be minimal. In terms of soil loss, the interim EIAs seem to indicate that most soils in which or on which construction takes place, are already disturbed. The environmental impact of the construction activities is considered minimal. The required building materials potentially including stone, sand, marl, concrete blocks, steel and timber will be obtained from licensed quarries in the Kingston, St Andrew and St Catherine Parishes area.

Noise/Air emissions. During the course of the clearance and site preparation works, noise and dust will be generated due to the use of machinery and motorized equipment. The relatively short term nature and small scale nature of the works suggest that noise and dust levels will not be excessive or cause any major long term nuisances. The works will however, present a short term nuisance to the public and to owners adjacent to some of the project sites. In accordance with the proposed environmental management plans, several mitigation measures will be put in place to minimize and manage the negative impacts i.e. mufflers on exhausts, standard restrictions to hours of site works, water sprays, precautions taken for materials transportation, etc.

Waste management. Very little vegetation wastes will be generated during the clearing of works. The wastes generated by the works would largely be inorganic and not predicted to be excessive. Wastes will be disposed of at the existing licensed landfill site. To ensure that wastes are properly disposed of, the project sponsor will ensure that reputable truckers are engaged and conduct spot checks to verify that waste disposal is carried out in accordance with the requirements of NEPA and other agencies.

The operations of the water treatment plants will be subject to review by the Ministry of Health and Environment for water quality issues and NEPA for any point discharges. Environmental management plans for plant operations will be prepared and will include appropriate measures to avoid contamination of the nearby Rio Cobre from chemicals and materials associated with plant operations. Environmental management plans for plant operations will prepared to address wastewater, hazardous chemicals, air emissions and ecological impacts. The plans will also include modalities for environmental monitoring as well as measures that address occupational health and safety issues.

Community Health, Safety & Security

For all new construction, including the new water treatment plant and the Halls Green wells and reservoir, the contractor (Vinci) will install a security system around the site (fences and armed security guards) during the entire construction period. For the other construction sites taking place on land owned by NWC (including SeaView WTP and Constant Spring WTP), the contractor will use the NWC's existing security systems and armed guards, in addition to employing their own security to protect its equipment within the NWC's properties.

When works take place on open roads, equipment and vehicles will be brought together to one single protected place during the night to ensure both community and workers' safety. The investors are committed to construct and operate this project in compliance with MIGA's PS4 as well as the national laws and requirements related to community health and safety. It is expected that the project will improve community health in general by providing better and more reliable potable water supply.

Land Acquisition & Involuntary Resettlement

The NWC, as a government entity, has a mandate to negotiate property prices with affected owners. If land required by the project cannot be acquired through negotiations with project affected people, the NWC has the right to initiate compulsory land acquisition through the Land Acquisition Act of Jamaica - provided that general public will benefit from the subject matter project. The Land Acquisition Act of Jamaica requires compensation to be paid be established by independent evaluators.

The NWC reported that negotiations have been in progress for some time between them and the relevant land owners. At present time it is fully expected that the few concerned sites will be acquired through amicably settled negotiations with purchase agreements setting out the terms of payment as mutually agreed. As a last resort, if negotiations fail and the timetable for the completion of the totality of the project is likely to be seriously compromised, then the NWC would proceed in accordance with the provisions and regulations of the Land Acquisition Act.

Information presented to MIGA confirmed that acquisition of land for already identified sites do not require physical resettlement and economic displacement. Currently about 4000 m2 of privately owned land is required for the construction of Halls Green wells (two wells, a pipeline, and a new reservoir), the pipeline connection from Ferry to Red Hills, three pumping stations, and a new 15 MGD Water Treatment Plant at Content District. In total five owners will be affected and land is expected to be acquired through negotiations with all five owners. If negotiations fail, project investors committed to acquire land through fair and appropriate compensation.

Site locations for pumping stations are still under technical review and there are numerous technically acceptable alternative sites available for each of the 3 pumping stations and the final sites will be chosen to ensure that there will be no displacement of people, no disturbance of livelihood, and no commercial activity on land. However, if any of the project sites will require physical and economic displacement, the project affected people will be compensated in compliance with MIGA's PS5 requirements as well as the National Land Acquisition Act. Other project work (including pipeline works and refurbishment of facilities) will be carried out within existing public roads right-of-way and NWC properties.

Biodiversity Conservation & Sustainable Natural Resource Management

Jamaica, like most islands, is characterized by rich biodiversity. While none of the proposed sites are located in protected areas or ecologically sensitive areas, the interim EIAs indicate that ecological surveys for two of the sites will be conducted for the revision of the EIA. One would be carried out along the route for the proposed pipeline between the intake and the new treatment plant at Rio Cobre and the sites for the intake and water treatment plant prior to the commencement of construction. The other will be carried out along the route of the proposed Ferry to Rockpond works. Lists of flora and fauna will be observed, presented and potential impacts assessed. Additional surveys deemed necessary by NEPA will also be conducted prior to the start of any construction works. This information will be included in the revised EIAs to be approved by NEPA in accordance with national and MIGA's policies.

Cultural Heritage

No national heritage sites or cultural buildings of any significance are to be found at or near the sites neither for the proposed works nor within the road reserves as is confirmed by the Jamaica Heritage Trust. However, the investors commit that in case of chance finds mitigation measures are designed and implemented consistent with relevant national laws and PS8.

F. Environmental Permitting Process and Community Engagement

Through the Natural Resources Conservation (Permits and Licences) Regulations of the Natural Resources Conservation Authority (NRCA) Act 1991, the NRCA may require that some environmental impact assessments (EIA) be developed for certain components of the project before a decision to issue a Permit or License is made. When required, a final EIA report of the proposed development will be reviewed by the NRCA. Accordingly, the EIA report will be reviewed by the relevant government review agencies and interested members of the public. The report is available for public inspections at the following locations: public library closest to the project site, at the local offices of the consultant or developer, the NEPA Documentation Centre, 11 Caledonia Ave., Kingston, Jamaica. Any comments can be made within 30 days of the publication of the notice of disclosure. The project sponsor has held preliminary discussions with NEPA on the interim EIAs. When required, the relevant EIAs will be finalized before construction.

Applications have been made to the Water Resources Authority (WRA) for the abstraction of water for the Rio Cobre Water Treatment Plant. For the Halls Green Wells, the raw water analysis is in process and the WRA application will be done as soon as possible. Granting of a permit/license is subject to abstract and water use conditions for a given time period. Granting of a permit/license for new surface or ground water sources is made pending an advertisement of intention in a daily newspaper.

Based on the requirements of the EPC contracts, initial activities will concentrate on ensuring that the first critical construction permit/license for the new water treatment plant will be obtained at the end of the 5th months after the issue of the Order to Commence to the Contractor. Other required permits and licenses will be obtained prior to the start of the construction on site in accordance with the Contract program.

G. Availability of Documentation

The draft interim EIAs are available electronically as PDF attachments to this ESRS: Halls Green; Rio Cobre WTP; Pipeline Works A; and Pipeline Works B. It is also available for viewing at the following locations:

- Public library closest to the project site.
- At the local offices of the National Water Commission.
- NEPA Documentation Centre, 11 Caledonia Ave., Kingston, Jamaica.

Attachment 6.4 Checklist (Application for Environmental Permit)

Attachment 7.4.

THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT

The Natural Resources Conservation (Permits and Licences) Regulations, 1996 (amended) 2004
(Pursuant to section 9, NRCA Act 1991)

CHECKLIST

Application for Environmental Permit

☐ Completed Permit Application Form (4 copies) & Project Information Form (4 copies) **including:-**

- Tax Registration Number
- Contact information – Telephone, Cellular phone, Fax, Email
- For Companies – Company Registration Number; Names of Directors and Company Secretary

☐ Completed Licence Application Form **(if there will be a discharge of Trade or Sewage and or Poisonous or Harmful Substances into the environment).** (4 copies)

☐ Beach Licence Application Form **(Licence Under the Beach Control Authority for any modification to the Foreshore and Floor of the Sea)**

☐ Location Map **(Drawn to Scale 1:12,500)** (4 copies)

☐ Layout Plan or Site Plan of facility/development **(including dimensions)** (4 copies)

☐ Detailed Design of Project **including:-**

- **the proposed method of sewage treatment and disposal**
- **the location and setback of the sewage treatment facility on the Subdivision or Layout plan** (4 copies)

☐ Proof of Ownership

- A copy of the title or
- A probated will or,
- Lease agreement along with a copy of the title and a consent letter.

○ If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title.

○ If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.

○ ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the extent of their authority in relation the application and in whose name the permit/license should be issued. The letter must be signed by all the relevant parties who they represent.

☐ Project Brief describing the scope and extent of the project (4 copies)

☐ Drainage Plan (4 copies)

☐ Design Report- **Applicable only to Sewage and Waste Water Facilities** (4 copies)

☐ Application Fee of $2000.00

THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT

The Natural Resources Conservation (Permits and Licences) Regulations, 1996 (Amended 2004)
(Pursuant to Section 4 and 12, NRCA Act 1991)

CHECKLIST

Application for Environmental Licence to Discharge Sewage Effluent or Trade Effluent

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☐ Completed Licence Application Form (4 copies) & Project Information Form (4 copies) **including:-**

- Tax Registration Number
- Contact information – Telephone, Cellular phone, Fax, Email
- For Companies – Company Registration Number; Names of Directors and Company Secretary

☐ Completed Permit Application Form **(if the project which falls within any of the prescribed categories).** (4 copies)

☐ Beach Licence Application Form **(Licence Under the Beach Control Authority for any modification to the Foreshore and Floor of the Sea)**

☐ Location Map (**Drawn to Scale**) (4 copies)

☐ Layout Plan or Site Plan of facility/development **(including dimensions)** (4 copies)

☐ Detailed Design of Sewage/Waste Water (Trade Effluent) Facility (**including Discharge Points-Coordinates must be stated**) (4 copies)

☐ Map indicating the route of the pipeline/drainage channel from the sewage treatment plant to the point of discharge (4 copies).

☐ Proof of Ownership

- A copy of the title or
- A probated will or,
- Lease agreement along with a copy of the title and a consent letter.

○ If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title must be provided.

○ If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.

○ ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the extent of their authority in relation the application and in whose name the permit/license should be issued. The letter must be signed by all the relevant parties who they represent.

☐ Project Brief describing the scope and extent of the project (4 copies)

☐ Application Fee of $2000.00

THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT

The Natural Resources Conservation (Permits and Licences)
Regulations, 1996 (amended) 2004
(Pursuant to section 9)

CHECKLIST

Application for Environmental Permit for Petroleum Storage

☐ Completed Permit Application Form (4 copies) & Project Information Form (4 copies) **including:-**

- Tax Registration Number
- Contact information – Telephone, Cellular phone, Fax, Email
- For Companies – Company Registration Number; Names of Directors and Company Secretary

☐ Location Map (**Drawn to Scale 1:12,500**) (4 copies)

☐ Layout Plan or Site Plan of facility/development (**including dimensions**) (4 copies, one of which must be approved by the **Jamaica Fire Brigade. NB** (2 copies of the Layout Plans are to be submitted to JFB for approval prior to the submission of the permit application to NEPA)

☐ Project Brief describing the scope and extent of the project (4 copies)

- The Number Of Tanks
- Material of tanks
- Product(s) To Be Stored
- Quantity of product to be stored
- Location of Tanks (Above Or Underground)
- Leak Detection System - Detailed Information
- Layout Of The Project (Drawings) /Details of tank profile(cross) and elevations
- An indication if there will be servicing Of Vehicles - Information On Grease Traps & Oil Disposal

☐ Proof of Ownership

- A copy of the title or
- A probated will or,
- Lease agreement along with a copy of the title and a consent letter.

- ○ If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title.
- ○ If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.
- ○ ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the extent of their authority in relation the application and in whose name the permit/license should be issued. The letter must be signed by all the relevant parties who they represent.

☐ Closure Plan (4 copies)

☐ Application Fee of $2000.00

THE BEACH CONTROL ACT (THE BEACH CONTROL AUTHORITY LICENSING REGULATIONS, 1956)

(Licence Under the Beach Control Authority for any modification to the Foreshore and Floor of the Sea)

BEACH LICENCE APPLICATIONS CHECKLIST

☐ Beach Licence Application Form (**must be signed by Applicant and Justice of the Peace**) (2 copies)

☐ Completed Permit Application Form (**if the project which falls within any of the prescribed categories**). (4 copies)

☐ Completed Licence Application Form (**if there will be a discharge of Trade or Sewage and or Poisonous or Harmful Substances into the environment**). (4 copies)

☐ Completed Project Information Form (**if the project which falls within any of the prescribed categories**). (4 copies)

☐ Location Map (**Drawn to Scale 1: 12,500**) (2 copies)

☐ Layout Plan of the area to be licenced (**including dimensions**) (2 copies)

☐ Detail Design of Project (**including the proposed method of sewage treatment and disposal, if applicable**) (2 copies)

☐ Proof of Ownership

- A copy of the title or
- A probated will or,
- Lease agreement along with a copy of the title and a consent letter.

○ If the applicant is not the owner, a letter of authorization from the title holder(s), giving the applicant permission to use the land for the proposed activity, witnessed by a Justice of the Peace along with a copy of the title must be provided.

○ If the registered title is held jointly, either all parties must be reflected as applicant OR there should be letter or authorization from the other title holder (s) giving the applicant permission to use the land for the proposed activity.

○ ALL CONTRACTORS/AGENTS/CONSULTANTS who are applying for permits and licences on behalf of someone else must submit with each application a letter giving them authority to apply for the permit/licence. The letter must also state the extent of their authority in relation the application and in whose name the permit/license should be issued. The letter must be signed by all the relevant parties who they represent.

☐ Project Brief to include the no. of rooms if application is in connection with hotel/resort development (2 copies)

☐ Application Fee of $1000.00

☐ TRN

☐ Contact information – Tele phone, Cellular phone, Fax, Email

☐ For Companies – Company Registration Number; Names of Directors and Company Secretary

☐ Indication that **Form B**, NOTIFICATION REQUIREMENTS have been carried out

- Indication that signs have been posted
- Indication that neighbours have been notified by registered mail

THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT

CHECKLIST[1]

Application for the Export of Hazardous Waste

☐ Completed Application Form (Form 4) - *This Form should be completed in block letters and submitted in triplicate*

☐ A Completed Notification form (Form 2) - *This Form should be completed in block letters and submitted in triplicate*

☐ A Written Contract between the **exporter/generator** and the **disposer** specifying environmentally sound management of the waste

☐ Documents indicating that the appropriate insurance coverage, including indemnity for damage to third parties and for environmental damage or an adequate bank guarantee, trust fund, bond, line of credit, escrow account or such other form of security relating to damage to third parties and environmental damage, as the Authority considers appropriate, has been put in place

☐ An Emergency Response Plan - *This should cover the movement of the waste from the point of generation/storage to the point of exit from Jamaica*

☐ The Prescribed Application fee of J$2,500. *This fee is nonrefundable.*

☐ Specify Name and Registration No. of Company

☐ Address of Registered Office of Company

☐ Holder of an export licence from Jamaica Trade and Invest.

---

[1] Excerpted from *The Natural Resources (Hazardous Waste) (Control of Transboundary Movement)Regulations, 2002*

The Beach Control Act (The Beach Control Authority Licensing Regulations, 1956)

(Licence Under the Beach Control Authority for any modification to the Foreshore and Floor of the Sea)

BEACH LICENCE APPLICATIONS CHECKLIST
PORT AND HARBOUR DEVELOPMENT

- ☐ Beach Licence Application Form **(must be signed by Applicant and Justice of the Peace)** (2 copies)
- ☐ Completed Permit Application Form (4 copies)
- ☐ Completed Licence Application Form **(if there will be a discharge of Trade or Sewage and or Poisonous or Harmful Substances into the environment).** (4 copies)
- ☐ Completed Project Information Form (4 copies)
- ☐ Location Map **(Drawn to Scale 1: 12,500)** (2 copies)
- ☐ Layout Plan of the area to be licenced, with dimensions (2 copies)
    - ○ the length of the foreshore to be modified
    - ○ the structure(s) to be constructed on the foreshore, floor of the sea, on/in the water column and the distance of these structures from the high water mark.
- ☐ Detail Design of Project **(including the proposed method of sewage treatment and disposal, if applicable)** (2 copies)
- ☐ Proof of Ownership of Property **(Registered title or information on land ownership)** or Permission letter/lease supported by Proof of Ownership.
- ☐ Project Brief including but not limited to: (2 copies)
    - ○ A description of the project
    - ○ An outline of the method to be used for construction
    - ○ An estimated timeline for the construction phase(s)
- ☐ Application Fee of $1000.00
- ☐ TRN
- ☐ Contact information – Tele phone, Cellular phone, Fax, Email
- ☐ For Companies – Company Registration Number; Names of Directors and Company Secretary
- ☐ Indication that **Form B**, NOTIFICATION REQUIREMENTS have been carried out
    - ○ Indication that signs have been posted
    - ○ Indication that neighbours have been notified by registered mail

The Beach Control Act (The Beach Control Authority Licensing Regulations, 1956)
(Licence Under the Beach Control Authority for any modification to the Foreshore and Floor of the Sea)

BEACH LICENCE APPLICATIONS CHECKLIST
DREDGING

☐ Beach Licence Application Form (**must be signed by Applicant and Justice of the Peace**) (2 copies)

☐ Completed Permit Application Form **(if the project which falls within any of the prescribed categories).** (4 copies)

☐ Completed Licence Application Form **(if there will be a discharge of Trade or Sewage and or Poisonous or Harmful Substances into the environment).** (4 copies)

☐ Completed Project Information Form **(if the project which falls within any of the prescribed categories).** (4 copies)

☐ Location Map (**Drawn to Scale 1: 12,500**) (2 copies)

☐ Layout Plan of the area to be licenced (**including dimensions**) (2 copies)

☐ Detail Design of Project **(including the proposed method of sewage treatment and disposal, if applicable)** (2 copies)

☐ Proof of Ownership of Property (**Registered title or information on land ownership**) or Permission letter/lease supported by Proof of Ownership.

☐ Project Brief to include the no. of rooms if application is in connection with hotel/resort development (2 copies)

  ○ Quantity of material to be dredged
  ○ Type of equipment to be used
  ○ The benthos of the area to be dredged and or reclaimed
  ○ The methodology and mitigation measures that will be used to carry dredging works and reclamation
  ○ The quantity of material to be used in the reclamation
  ○ The area/location where the dredged spoil or excess will be disposed of.
  ○ Quantity of seagrass and or coral to be removed
  ○ The area/location where the seagrass and or coral will be relocated.

☐ Application Fee of $1000.00

☐ TRN

☐ Contact information – Tele phone, Cellular phone, Fax, Email

☐ For Companies – Company Registration Number; Names of Directors and Company Secretary

☐ Indication that **Form B**, NOTIFICATION REQUIREMENTS have been carried out
  - ○ Indication that signs have been posted
  - ○ Indication that neighbours have been notified by registered mail

ENVIRONMENTAL PERMIT CHECKLIST

INTRODUCTION OF FAUNA

1. Scientific name (genus and species)
2. Common name
3. Number of specimens of each species
4. Photographs of the specimen(s) of each species
5. Description of marks, tags, band, numbers or microchip (state number/s), age and sex.
6. Country of origin and country of export
7. Indicate if captive bred, reared in captivity or collected from the wild.
8. Purpose of introduction.
9. Describe the type, size and material of shipping container and arrangement for caring for the animal(s) during transport.
10. Name the Jamaican port through which the import will occur.
11. If CITES species, a copy of CITES permit or certificate from the exporting country is required.
12. Copy of the permit from the Veterinary Services Division, Ministry of Agriculture
13. Proposed date of import.
14. Describe the type, size and construction material for holding facility in Jamaica (diagram should be included).
15. State capacity to provide adequate health and nutritional care for the animals.

Date: March 3, 2004
Prepared by: Biodiversity Branch

Attachment 6.5 Project Information Form (PIF)

Attachment 6.5 Project Information Form (PIF)

THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT
THE NATURAL RESOURCES CONSERVATION AUTHORITY
(PERMITS AND LICENCES) REGULATIONS 1996

PROJECT INFORMATION FORM

Note: Please read the following before completing this form.

1. This document is designed to provide information on your project to the Natural Resources Conservation Authority in accordance with section 10 (1) (a) of the Act in order to determine if the project requires the preparation of an Environmental Impact Assessment (EIA).

2. Please attach certified copies of all statutory approvals and planning permission granted to date and copies of all applications made and not yet determined.

3. This application form must be completed in order to avoid delay in its processing. Where attached sheets and other technical documents are utilized in lieu of the space provided, indicate appropriate cross-references. Paragraphs that are not applicable to your application should be marked N/A.

4. This form is supplemental to your **permit application form** and may be subject to further verification and public review. Provide any additional information that you believe will be useful in processing your application.

5. It is expected that completion of this form will be dependent on information that is currently available to you and will not involve new studies, investigation and research. Where such studies are required in order to provide the information please indicate and specify in each instance.

A. PROJECT NAME AND OWNERSHIP

1) NAME AND ADDRESS OF APPLICANT:

______________________________ ______________________________
(SURNAME) (FIRST NAME)

____
(STREET)

____
(TOWN AND PARISH)

______________________________ ______________________________
(TELEPHONE) (FAX)

____
(E-MAIL)

2) NAME AND ADDRESS OF OWNER (if different from applicant)

(SURNAME) (FIRST NAME)

(STREET)

(TOWN AND PARISH)

3) NAME OF PROJECT

4) LOCATION OF PROJECT: (Provide map as well as address)

(STREET)

(TOWN AND PARISH)

4.1) Do you own the property on which you propose to carry to out this development project. Yes ☐ No ☐
4.2) If Yes Please attach certified copies of Proof of Ownership
4.3) If No, What is the nature of your interest in this property. Please attach supporting documents, justifying your claim

5) NAMES AND ADDRESSES OF ADJOINING PROPERTY OWNERS:

B PROJECT TYPE

Description or prescribed category of enterprise, construction or development for which approval is sought:
(Check and identify as many as are appropriate.)

1. ☐ Power generation plants
2. ☐ Electrical transmission lines and substations greater than 69 kV
3. ☐ Pipelines and conveyors, including underground cables, gas lines and other such infrastructure with diameter of 15 cm and over.

4. ☐ Port and harbour developments
5. ☐ Development projects
    - ☐ subdivisions of 10 or more lots
    - ☐ housing projects of 10 houses or more
    - ☐ hotel/resort complex of more than 12 rooms
    - ☐ airports including runway expansion greater than 20%
    - ☐ office complex greater than 5000 square metres
6. ☐ Ecotourism projects
7. ☐Water treatment facilities including water supply, desalination plants, sewage and industrial waste water
8. ☐ Mining and mineral processing
    - ☐ bauxite
    - ☐ minerals - including aggregate, construction and industrial minerals
    - ☐ peat ☐ metallic
    - ☐ sand ☐ non-metallic
9. ☐ Metal processing
    - ☐ non-ferrous metals
    - ☐ ferrous metals
    - ☐ foundry operations, metal plating
10. ☐ Industrial projects
    - ☐ chemical plants
    - ☐ pulp, paper and wood processing
    - ☐ petroleum production, refinery, storage and stockpiling
    - ☐ food processing plants
    - ☐ fish and meat processing plants
    - ☐ tanneries
    - ☐ detergents manufacturing, including manufacturing of soap
    - ☐ distillery, brewing and fermenting facilities
    - ☐ cement and lime production
    - ☐ manufacture of textiles
    - ☐ manufacturing of pesticides or other hazardous or toxic substances
    - ☐ paint manufacture
    - ☐ boxing plants
    - ☐ manufacture of containers and packaging materials including cans, bottles, boxes and cartons
    - ☐ manufacturing of edible fats, oils and associated processes
    - ☐ citrus, coffee, cocoa, coconut, sugarcane processing factories
    - ☐ solar salt production

11. ☐ Construction of new highways, arterial roads and major road improvement projects
12. ☐ River basin development projects
13. ☐ Irrigation or water management projects including improvements
14. ☐ Land reclamation and drainage projects
15. ☐ Watershed development and soil conservation projects including river training, check dams, and retaining walls
16. ☐ Modification, clearance or reclamation of wetlands
17. ☐ Solid waste treatment and disposal facilities
18. ☐ Hazardous waste storage or treatment or disposal facilities
19. ☐ Processing of agricultural waste
20. ☐ Cemeteries and crematoriums
21. ☐ Introduction of species of flora, fauna and genetic material
22. ☐ Slaughterhouse and abattoir
23. ☐ Felling of trees and clearing of land of 10 hectares or over for agricultural development
24. ☐ Clear cutting of forested areas of 3 hectares and over on slopes greater than 25 degrees
25. ☐ Other. Please specify! ____

If your project falls within the first 24 categories, then a permit under Section 9 of the NRCA Act is required.

Note: Other licences may be required if sewage or trade effluent are proposed to be discharged (Section 12). These licences are subject to an **Environmental Impact Assessment** being submitted to the Authority. Contact the NRCA for further information.

C. SITE DESCRIPTION (physical setting of overall project, both developed and undeveloped areas)

1. General character of land: generally uniform slope ____ or generally uneven and rolling or irregular ____ (check one)
2. Approximate percentage of proposed site with slopes ☐ 0-10%; ☐ 10-25%;☐ 25% or greater.
3. What is the predominant soil type (s) on the project site? ☐ upland plateaux soils; ☐ alluvial soils; ☐ highland soils
4. Are there bedrock outcroppings on project site? ☐ Yes; ☐ No
5. Are there any karst or limestone i.e. sinkhole conditions on site? ☐ Yes;☐ No
6. Is the project located in ☐ flood plain or ☐ coastal zone or ☐ water catchment area? ☐ No
   If no, specify____
   ____
7. Site is ☐ below Sea level; ☐ at Sea level; ☐ above the 10 m contour line.
8. Are there any water wells on or adjacent to the site? ☐ No; ☐ Yes; if yes please describe
   ____
   ____

____

9. Are there any rivers or streams or drainages within or adjacent to the project site?
☐ No; ☐ Yes; If yes, name the water body __________________________________

10. Are there any lakes, ponds or wetland areas within or contiguous to the project site?
☐ No; ☐ Yes; If yes, name the water body __________________________________

11. Present site land use: ☐ Urban; ☐ suburban; ☐ rural; ☐ industrial; ☐ commercial; ☐ agriculture;
☐ forest; ☐ other (please specify):____

12. Is the project site presently used by the community or neighbourhood as an open space or recreational area? ☐ No; ☐ yes; If yes, identify ____________________________________

D. BIOLOGICAL RESOURCES

FLORA

1. General plant ecosystem and dominant types

Forests
- ☐ inland
- ☐ coastal

Fields
- ☐ agricultural
- ☐ pasture
- ☐ open field

Wetlands
- ☐ mangroves
- ☐ morass and swamps
- ☐ seagrasses

Any other ecosystem types ☐ yes ☐ no, if yes please indicate. ____________________
____
____

2. Name the watershed that your project is being developed in ___________________________

3. Are there exotic species present at the site? ☐ Yes ☐ No

If yes, state the scientific and common names of these exotic species.
____
____
____

4. Do you plan to introduce exotic species? ☐ Yes ☐ No

If yes, state the scientific and common names of these exotic species and their places of origin.

____
____
____

5. Are there any endangered animal species in the area where your project is to be developed?

☐ Yes ☐ No If yes, state their scientific and common names.
____

____
____

6. Are there specimens of scientific or aesthetic interest in your project development area?

☐ Lignum Vitae
☐ Blue Mahoe
☐ Orchids
☐ Ferns
☐ Mangroves
☐ Sea grasses
☐ Royal Palms
☐ Bromeliads
☐ Feeder trees for birds
☐ Any others (i) ________________________
(ii) ________________________
(iii)________________________

7. Are there endemic species present at the site? ☐ Yes ☐ No

If yes, state their scientific and common names.

____
____
____

8. What is the degree of disturbance of the plant community?

☐ pristine
☐ semi-degraded
☐ totally degraded

FAUNA

1. General types

Vertebrates

☐ Mammals
☐ Birds
☐ Fishes
☐ Amphibians
☐ Reptiles

Invertebrates

☐ Insects
☐ Corals (coral reefs)
☐ Sponges
☐ Crustaceans
☐ Any others (i) ________________________

(ii) ________________________
(iii) ________________________

Please provide a species list for general fauna types indicated.

2. Habitat type

- ☐ Forests
  - ☐ inland
  - ☐ coastal
- ☐ Fields
  - ☐ agricultural
  - ☐ pasture
  - ☐ open field
- ☐ Wetlands
  - ☐ mangroves
  - ☐ morass and swamps
- ☐ Seagrass
- ☐ Coral reefs
- ☐ Sea (marine)
- ☐ Freshwater/brackish water
  - ☐ River/stream (any flowing body of water), state the name/names _________________
  - ☐ Pond/lakes (any standing body of water), state the name/names __________________

Any others ☐ Yes ☐ No If yes, please state (i) ____________________________
(ii) _____________________________
(iii) _____________________________

3. Are there any commercially valuable species in the area? ☐ Yes ☐ No

If yes, state scientific and common names

____
____
____

PROTECTED AREAS

1. Is your proposed project located in an existing Protected Area? ☐ Yes ☐ No

If yes, then name the Protected Area: ____

E. PROJECT DESCRIPTION

1. Provide physical dimensions and scale of the project (fill in dimensions as appropriate)
a) Total contiguous area owned by project sponsor _______ hectares
b) Project area developed: hectares initially _________; hectares ultimately ________.
c) Project area to remain undeveloped _______ hectares

2. Operational aspects of the project

a) Will there be sewage or trade effluent discharge during construction and or operation ?☐ No;☐ Yes
If yes describe the type(s), amount(s) and source(s). (If a discharge application has been prepared please attach.)

b) Is it ☐ sewage or ☐ trade effluent? (tick please)

c) Please indicate what effect if any your project will or is likely to have on the following. (tick appropriate categories)

☐ Land resources, ☐ Water resources, ☐ Air quality (including noise), ☐ Ecological resources,

☐ Visual resources, ☐ Open space and recreation, ☐ Growth and character of community, ☐ Energy,

☐ Transportation, ☐ Human health

d) Will there be air emissions (including fugitive dust) produced during construction and operation?

☐ No; ☐ Yes; If yes describe type(s) and source(s)____

____

____

e) Will there be any other poisonous, noxious or polluting matter discharged during construction and operation? ☐ No; ☐ Yes; If yes describe type(s) and source(s)__________________________________

____

____

f) Will blasting occur during construction? ☐ No; ☐ Yes

g) Will project routinely produce odours (more than one hour per day) ☐ No; ☐ Yes

h) Total water usage per day ______ litres/day; source: ☐ surface; ☐ underground; ☐ other:_________

i) If water supply is from wells indicate pumping capacity _______ litres per min.

j) Is surface or underground liquid waste involved?☐ No; ☐ Yes. If yes indicate the type of waste (sewage, trade, including leachate, etc.)____

____

k) If surface disposal, name receiving water body (fresh water, gully or marine) into which effluent will be discharged into.

____

l) Will the project use herbicides or pesticides? ☐ No; ☐ Yes. If yes, specify type(s)

____

____

m) How many hectares of vegetation (trees, shrubs, ground cover) will be removed from the site? ____ ha

n) Will the project involve the construction of access roads? ☐ No; ☐ Yes;

o) Will surface area of existing water bodies e.g. streams, rivers, bays etc be increased or decreased by the project? ☐ No; ☐ Yes; If yes, how much? ____.

Give detail_______________________________________

____

p) Will project require relocation of ☐ people; ☐ houses; or ☐ facilities? ☐ No. If yes, give details:

____

____

q) Does the project involve the disposal of solid waste? ☐ No; ☐ Yes; If yes, will existing municipal solid waste facility(s) be used? ☐ No; ☐ Specify location: ____________________________________

____

3. Where the project is a waste treatment and disposal facility please complete the following:

3.1 Nature of waste disposal facility (please tick) -

- ☐ a) Landfill;
- ☐ b) Transfer station - incorporating also,
  - ☐ (i) static compaction;
  - ☐ (ii) pulverization;
  - ☐ (iii) baling;
- ☐ c) Treatment plant involving -
  - ☐ (i) pulverization;
  - ☐ (ii) composting;
  - ☐ (iii) incineration;
  - ☐ (iv) chemical treatment;
  - ☐ (v) other treatment (please specify);____

3.2 Estimated maximum quantities of general waste of the following description delivered or to be delivered daily at the facility:

	Liquid (tonnes)	Sludge (tonnes)	Solid (tonnes)
a) domestic and commercial wastes -			
(i) untreated;	______	______	______
(ii) pulverized or compost;	______	______	______
(iii) baled;	______	______	______
(iv) incinerator residues;	______	______	______
b) medical, surgical and veterinary wastes;	______	______	______
c) hazardous wastes			
d) non-hazardous industrial wastes -			
(i) potentially combustible substances;	______	______	______
(ii) inert and non-flammable substances;	______	______	______
e) wastes from the construction industry;	______	______	______
f) old cars, vehicles and trailers;	______	______	______
g) sewage, sludge etc.;	______	______	______
h) mine and quarry waste;	______	______	______
i) farm waste.	______	______	______

3.3 Current or anticipated maximum rate of use of the facility. (Specify as tonnes per day of landfill sites and tonnes per hour for treatment plant.)

____

3.4 State capacity of treatment plant:
Current capacity ____________ million litres per day (ML/d)
Total design capacity ____________ ML/d

Proposed operational capacity ____________ ML/d

4. Project approvals:

a) Is there any other GOJ licence or approval required? ☐ No; ☐ Yes ; If yes list approvals with responsible department or body____

____

____

____

b) List any previous licences or permits granted in respect of this project:

	Date	Project Title	Reference No.
Issued:	___________	______________________________________	_____________
Denied:	___________	______________________________________	_____________
Other:	___________	______________________________________	_____________

c) Are there any town or local approvals?☐ No; ☐ Yes. If yes, list approvals and responsible agency.

____

____

____

E. OTHER INFORMATIONAL DETAILS

Attach any other additional information as may be needed to clarify your project.

PREPARER'S NAME: ____

PREPARER'S SIGNATURE ____

TITLE: ____

REPRESENTING: ____

DATE: ____

Attachment 6.6 Permit Application (PIA)

Attachment 6.6 Permit Application (PIA)

THE NATURAL RESOURCES CONSERVATION AUTHORITY ACT

The Natural Resources Conservation (Permits and Licences) Regulations, 1996

Permit Application

(pursuant to section 9)

Note: Please read the following before completing this form

1. This form should be completed in triplicate in block letters and submitted along with any specified or supplemental information to:

   The Natural Resources Conservation Authority
   10 Caledonia Avenue
   Kingston 5.

2. The completed Form shall be accompanied by -

   (a) a completed project information form supplied by the Authority;

   (b) a plan of the area in which enterprise, etc. will be undertaken showing -

      (i) the location and boundaries of the property;
      (ii) the location and layout of the proposed enterprise or construction or development; and
      (iii) any body of surface water, or any potable water supply that may be affected by any discharge;

   (c) a statement of the status of any required statutory approval and application ;
   (d) an application for a licence to discharge effluent, etc., where applicable;
   (e) the prescribed application fee of J$1,000 which is non-refundable.

3. Please attach certified copies of all statutory approvals and planning permission granted to date and copies of all applications made and not yet determined.

4. This application form must be completed in order to avoid delay in its processing . Where attached sheets and other technical documents are utilized in lieu of the space provided, indicate appropriate cross - references. Paragraphs that are not applicable to your application should be marked as N/A. The permit fee of J$ 15,000 becomes payable at the time of issue of the permit.

5. If you are in doubt about any provision of this application form please consult with an authorized officer of the Authority before completing it.

A. General

1. Name of applicant: ____

2. Address of applicant: ____

____

____

3. Telephone No.: ______________________________ Fax No.___________________________

4. Please specify name and registration No. of company If different from applicant ____
____

5. Address of registered office of company: ____
____

6. Name and address of premises where enterprise etc. for which approval is sought will be undertaken:
____
____

7. Name of Chief Executive Officer:
____

8. Name of Environmental Manager:
____

9. Description of category of enterprise, construction or development for which approval is sought (Categories should conform with the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996):

____
_
____
_
____
_

10. Name of local authority in whose area enterprise etc. will be undertaken:

____
_
____
_
____
_

11. List of attached documents comprising part of application:___________________________________

____
_
____
____

B. Statement by Applicant

I hereby certify that the information contained in this application and the attached Project Information Form is true and complete to the best of my knowledge and belief.

I understand that any misrepresentation contained in the forms shall lead to discontinuation of the processing of the application and the revocation of any permit granted and may also lead to prosecution. I further understand that the permit, if granted, may be suspended or revoked for breach of any of the terms or conditions stipulated therein.

Signature of applicant____

Name and title (please print or type)_________________________________

Dated this day of , 19 .

FOR OFFICIAL USE ONLY

Project information form completed and attached_______yes_____no

Other information attached: ____

Application Fee________________________ enclosed

Comments: ____

____

____

Assessment Officer ________________________________ ________________
Date

Attachment 6.7 Soapberry Wastewater Treatment Plant (Ashtrom Building Systems, December 2004)

ENVIRONMENTAL IMPACT ASSESSMENT

SOAPBERRY WASTEWATER TREATMENT PLANT
ST. CATHERINE
JAMAICA

Submitted to:

ASHTROM BUILDING SYSTEMS
Central Village
St. Catherine
Jamaica

Prepared by:

ENVIRONMENTAL SOLUTIONS LTD.
20 West Kings House Road
Kingston 10
Jamaica

DECEMBER 2004

TABLE OF CONTENTS

1. INTRODUCTION

1.1 THE REPORT

This document presents the findings of an Environmental Impact Assessment (EIA) of the proposed Soapberry Wastewater Treatment Plant, St. Catherine, Jamaica.

Wastewater treatment plants are included on the list of prescribed activities under the 1991 Natural Resources Conservation Authority Act (NRCA) that require an application for permission to develop. The National Environmental Planning Agency (NEPA), which administers the NRCAA, has requested that an Environmental Impact Assessment (EIA) be conducted for this project as a requirement for obtaining a permit to implement.

Environmental Solutions Limited (ESL) has been engaged by Ashtrom Building Systems, the Contractor, to prepare the EIA and to provide assistance in other related activities. The Terms of Reference for the EIA are provided at Section 1.3 below.

1.2 BACKGROUND

The National Water Commission (NWC) proposes to construct a 225,000/day wastewater treatment facility at Soapberry located north of Hunts Bay on the southeastern St. Catherine coast (Figure 1.1). The facility will consist of a re-circulated oxidation lagoon system, that is intended to replace the existing smaller treatment plants serving Kingston.

The installation of the wastewater treatment facility is a key component for the long-term expansion of the Kingston sewerage system, and existing and new sewerage lines will connect to the facility.

Discharge of poorly treated effluent to Kingston Harbour has been a major contributor to the ecological deterioration of this major environmental asset. Old dilapidated small plants have long been unable to meet treatment requirements, and the decision to construct Soapberry was made to remove the major source of pollutants to the harbour.

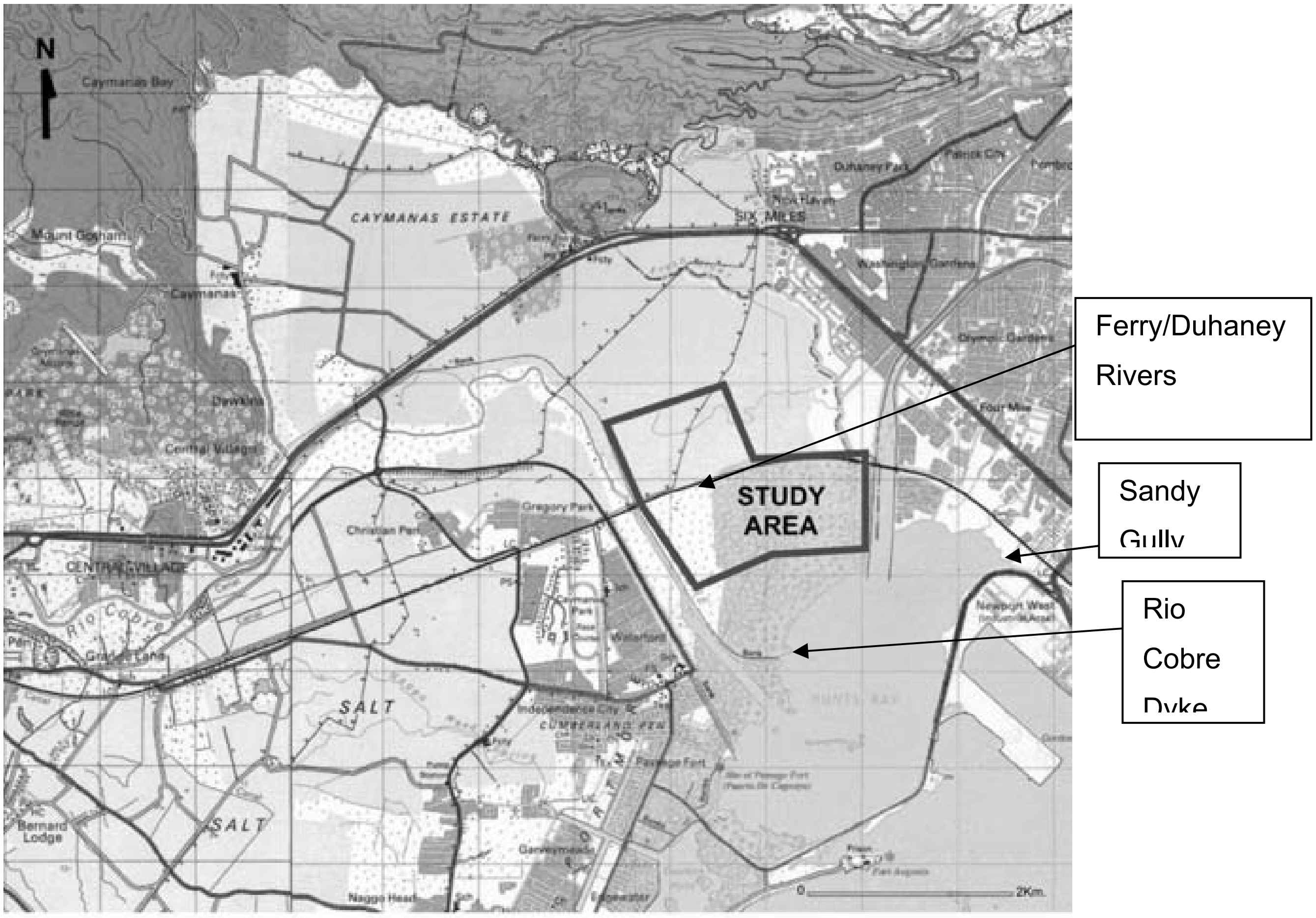


Figure 1.1: Location of project site.

1.3 TERMS OF REFERENCE

The Terms of Reference for the Environmental Impact Assessment are provided below. These have been adapted from World Bank guidelines and take account of NEPA's guidelines for EIA preparation. By letter dated November 22, 2004, NEPA commented on the TOR's, requesting that their comments be addressed in the EIA Report. These comments have been used to modify the terms of reference presented below.

1. Introduction - Identify the development project to be assessed and explain the executing arrangements for the environmental assessment.

2. Background Information - Briefly describe the major components of the proposed project, the implementing agents, and include a brief history of the project and its current status.

Study Area - Specify the boundaries of the study area for the assessment as well as any adjacent or remote areas within the area of influence of the project.

4. EIA Team – Identify the individuals responsible for collecting the data and carrying out the impact assessment and their respective skills.

5. Scope of Work - The following tasks will be undertaken:

Task 1. Description of the Proposed Project - Provide a full description of the overall project (225m^3/d) and its existing setting using plans, maps and graphic aids at appropriate scales. This is to include: location; general layout (size, capacity, etc.); areas slated for development, pre-construction and construction activities; construction methodology (earthworks, bunds, etc.), site management, operation and maintenance activities; project life span; plans for providing electricity and water; and employment. Specific attention will be given to the sewage treatment process, level of treatment and effluent disposal. In addition the management and disposal of grease and sludge will be addressed. The management of trucked septage will be addressed.

Task 2. Description of the Environment - Describe the physical, ecological, demographic, socio-cultural and institutional setting of the project. Review and present information that provides an insight into previously existing conditions of the site and the influences of past development initiatives. Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area, including the following:

a) Physical environment: coastal mainland and riverine features; topography; geology; soils; climate and meteorology; ambient noise (at site and in area of influence); hydrology; drainage and storm water runoff; and Hunts Bay water quality[1]. Any existing sources of pollution and the extent of contamination relevant to the project area will be identified. The natural hazard vulnerability of the site will also be considered, particularly with respect to potential river flooding, hurricanes and storm surge. A stand alone geotechnical report, detailed drainage maps and a hydrological analysis will be carried out.

b) Biological environment: flora and fauna of the terrestrial and wetland ecosystems on and adjacent to the project site as well as the ecology of Hunts Bay. Specify rare or endangered species, species of commercial importance, and species with potential to become vectors or nuisances.

c) Socio-cultural environment: present and projected population size, land use, community structure, issues related to squatting and relocation, current development plans, recreation and public health, public and community perceptions and attitudes on the proposed project, and any historical sites affected by the project. Identify the solid waste management facilities to be used by the project and assess public perception of the proposed development. The population of the catchment area to be served will be included.

<u>Task 3. Legislative and Regulatory Considerations</u> - Describe the pertinent environmental laws, regulations and standards governing land use control, environmental quality, health and safety, sewage effluent discharge, protection of mangroves and other sensitive areas, and protection of endangered species.

---

[1] Parameters to include: BOD, TSS, NO_3, PO_4, and faecal coliforms.

Task 4. Determination of Potential Impacts – Identify the major issues of environmental concern and indicate their relative importance to the design of the project. Distinguish long-term and short-term impacts, construction and post-construction phase impacts, positive and negative impacts, and direct and indirect impacts. Identify the significant impacts and those that are cumulative, unavoidable or irreversible.

Special attention is to be given to the following matters:

Vegetation clearance, especially wetland habitat disturbance, related to site clearance, pond construction, placement of buildings and services installation. In particular the potential impacts on crocodiles will be addressed.

Modification of existing drainage patterns and surface runoff during construction and post-construction phases.

Potable water supply, demand and resource depletion.

Solid waste management during construction and post-construction phases.

Socioeconomic conditions, effects on existing users of the coastal area, community involvement, and public perceptions of the project.

Potential impacts of the development on adjacent property owners.

Natural hazard vulnerability

Construction impacts including earth materials sourcing, transport and storage; pond construction methods; site management; noise; fugitive dust; traffic obstruction; and employment.

Reference should be made to the extent and quality of the available data and any information deficiencies and uncertainties associated with the prediction of impacts should be clearly identified.

Task 5. Mitigation and Management of Negative Impacts - Recommend feasible and cost-effective measures to prevent or to reduce the significant negative impacts to acceptable levels.

Task 6. Development of an Environmental Management and Monitoring Plan - Prepare the outline of a plan for monitoring the impacts of the project and the implementation of mitigating measures during construction. This plan is to be detailed after the permit for the project is granted and the construction plans for the project have been finalized at which time the plan is to be submitted to NEPA for approval.

Task 7. Determination of Project Alternatives – Examine alternatives to the project including the no-action option and alternatives treatment processes and site location.The examination of alternatives should appropriately defend the proposed alternative examined in the context of the EIA.

Task 8: Assist in Inter-Agency Coordination and Public/NGO Participation - Assist in co-ordinating the environmental assessment with the government agencies and in obtaining the views of local NGO's and affected groups. Manage and coordinate the public hearing on the EIA findings as required by the NEPA permit approval process.

6. Report - The environmental assessment report will be concise and limited to significant environmental issues. The main text will focus on findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The environmental assessment report will be organized according to the outline below.

Executive Summary

Policy, Legal and Administrative Framework
Description of Proposed Project
Description of the Environment
Significant Environmental Impacts and Impact Mitigation Measures
Environmental Monitoring Plan
Project Alternatives
Inter-Agency and Public/NGO Involvement
List of References

1.4 STUDY TEAM

This EIA was carried out by Environmental Solutions Ltd. The multidisciplinary team engaged to do the assessment included local expertise in environmental impact assessment, coastal ecology, environmental chemistry, and socio-economics. The team members were:

Environmental Solutions Ltd.:
Mr. Peter Reeson, M.Sc. – Team Leader and EIA Specialist
Mr. George Campbell, M.Sc. – Socio-economist
Mr. Aedan Earle, M.Phil. – Geologist
Dr. Margaret Jones Williams, Ph.D. - Ecologist
Mrs. Sharonmae Shirley, M.Phil. – Environmental Chemist

ESL associates:
Mr. Lloyd Donaldson, M.Sc. – Hydrogeologist

1.5 METHODOLOGY

1.5.1 Physical Parameters

Information was gathered on the existing physical environment, particularly as related to climate, geology, topography, soils, hydrology and drainage and natural hazard vulnerability.

1.5.1.1 Climate, Geology, Topography, and Soils

Information on the climate, geology, topography, soils, was obtained by compiling existing data from reports as well as from source agencies. Aerial photos, satellite imagery and other published maps were also examined.

Field work was carried out to augment and verify existing information relating to geology and soils and to obtain first hand knowledge of the topography.

1.5.1.2 Hydrology, Drainage and Natural Hazard Vulnerability

Surface and ground water characteristics and flows were assessed using field investigation as well as maps, aerial photographs and data from previous reports. A detailed hydrological study was carried out using existing data to assess the flood potential of the site.

Seismic exposure was determined from hazard vulnerability maps prepared for the KMA.

1.5.2 Terrestrial Ecology

In a previous study (Environmental Solutions Ltd., 1993) the flora and fauna of the project area was described and the major habitat types were identified. For the purposes of this report a field visit was conducted on October 5, 2004 to determine the extent to which the earlier assessment still prevailed. Site assessment included a wind shield survey of the project area, as well as ground truthing of the major habitats reported from 1993 (Environmental Solutions Ltd., 1993).

Field assessments were conducted in October 2004, with the following aims:

1) To determine any significant changes to the area that would have resulted in alteration of habitats;
2) To verify the presence of species previously listed from the site; and
3) To identify any species not previously reported.

1.5.3 Water Quality Survey

The primary objective of this baseline water quality assessment is to determine water quality conditions and the nature and extent of present impacts prior to the construction of the Soapberry Wastewater Treatment Plant. The extent of surface water contamination in the project area was assessed based on current data and historical information obtained from the Kingston Harbour Baseline Study [Webber et al, 2003].

Surface Water Quality Stations. Grab samples were collected at the sampling sites at a depth of between 0.5 and 1m from the surface using a "weighted bottle" sampler. All samples collected were stored in pre-cleaned 2 litre polyethylene and 250/500 ml glass bottles (transparent and opaque). Bacterial samples are collected at the water surface in sterilized 100 ml glass bottles.

Dissolved oxygen and conductivity measurements were taken *in situ* at all sampling stations. Measurements were taken at the water surface (0.1m) and just above the bottom at each site.

Laboratory Analyses were performed at the Environmental Solutions Laboratory Division using certified methodology from Standard Methods for Water and Wastewater Analyses (Eaton *et al*, 1995).

The following parameters were analysed:
pH
Conductivity/salinity
Temperature
Dissolved Oxygen
Total Suspended Solids
Nitrate
Phosphate
BOD
Total and Faecal Coliform

Conductivity/salinity, temperature, and dissolved oxygen were measured *in situ* at the sampling stations. The analytical methods used are based on established procedures in Standard Methods for Water and Wastewater Analysis.

1.5.4 Socioeconomic Survey

Rapid appraisal techniques were used in 6 locations that were proximate, to Soapberry. These were the communities of Riverton City, Riverton Meadows, Waterford, New Haven, Callaloo Mews and select enterprises on the Spanish Town Road and in Ferry. In all, 46 persons were interviewed.

2. PROJECT DESCRIPTION

The proposed Soapberry Wastewater Treatment Plant as designed by HGM Consulting Engineers & Planners (1980) Ltd. for Ashtrom Group Ltd on behalf of the Government of Jamaica, has been based on a summary of design data and hydraulic and process calculations derived from two earlier master plans, viz., ***Sentar, 1993,*** and ***KBR, 2003 .***

The ***Sentar Study*** sought to develop a best option for upgrading wastewater collection and treatment to reduce the pollution loading to Kingston Harbour. The proposal included population forecasts, expanded sewering for the Kingston Metropolitan Area (KMA), and a treatment system in the Soapberry area which coincided with earlier recommendations for a “flow west” concept.

The KBR Study utilized updated specific water consumption data generated by the National Water Commission (NWC), and revised population forecasts for the City of Kingston to produce the “Water, Drainage and Sewage Master Plan” in 2003.

Population forecasts relate to the projected connection to a sewage collection system, and not necessarily to the total population of the defined area. It is significant to note that the Soapberry Treatment system is therefore designed to handle the incremental expansion of sewage connections throughout the service area.

Based on projected flow capacities, the treatment plant will be built sequentially in three identical modules, each having a capacity of 75,000 m^3/day. The design criteria for each module are set out in Table 2.1.

Equivalent population	247,886
Average daily flow (m^3/day)	75,000
BOD loading (kg/day)	18,750
BOD concentration (mg/l)	250
Average hourly flow (m^3/hr)	3,125

Table 2.1: Design criteria for each treatment module.

The three modules will be constructed on low-lying land situated between the Duhaney River and Sandy Gully to the east, the Dyke of the Rio Cobre River flood protection system to the west, and Hunts Bay to the south. Elevation ranges from 0.3 – 1.2 metres above mean sea level (asml) throughout much of the site to 2.5 - 3.3m amsl in the northwest section. The old railway line will separate the first and third modules. The Riverton solid waste disposal site lies immediately adjacent and northeast of the STP site. (Figure 1.1).

The population already connected to the city system will be served by the first module at Stage-1 (the “Western” module), while the implementation of Stage-2 and Stage-3 will depend on the rate of connection of the neighborhoods to the sewage system on the one hand, and the progress of construction of the lagoon system, especially for Stage-2, on the other. The target-year for design is the year 2025 as specified in the “K.B.R.” report.

2.1 CONSTRUCTION OF WTP FACILITY

Each module comprises four primary lagoons in the shape of half-circle segments with radial flow and secondary lagoons encircling them, Figure 2.1. The inlet area of the primary ponds will be deeper and separated from the rest of the pond by a submerged dyke to encourage settling and fermentation. Discharge from the primary ponds will be through eight outlets along the dyke thus ensuring uniform radial flow into the secondary ponds. In this manner uniform radial flow will be achieved thereby avoiding “dead areas” in the system. The last secondary lagoon in each module will be used as a polishing pond.

It was initially planned to use constructed wetland systems to provide the final treatment of the wastewater before discharge into Kingston Harbour, at Hunts Bay. This plan has been changed and it is now proposed to treat the effluent via a sand filter.

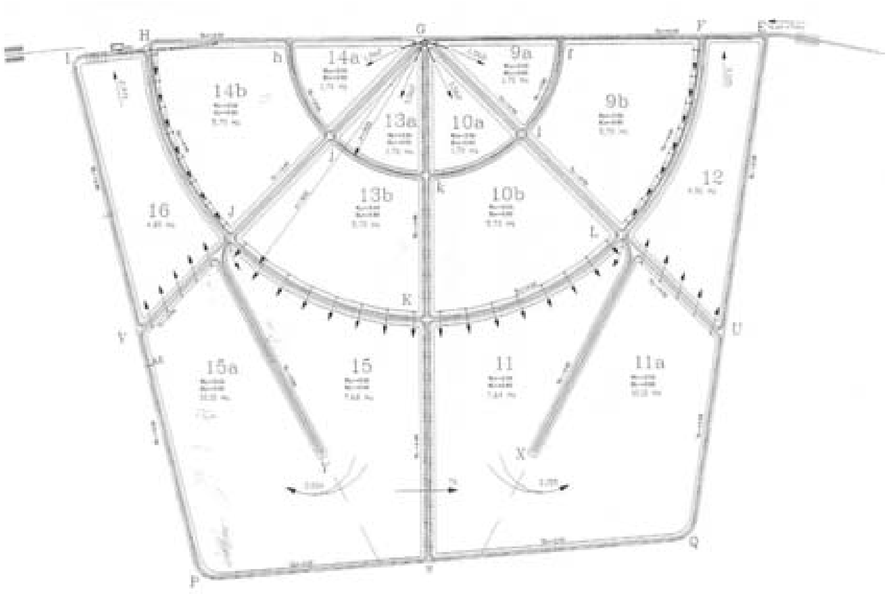


Figure 2.1: Configuration of lagoon showing flow directions

Construction of the lagoons will entail in situ excavation and use of the excavated material to build the dykes and create the lagoons. The additional amounts of earth material, required for construction of the STP are small (less than 20% of the total required fill volume) as the local excavation works will meet most of the needs. Requirements will be brought from an external source. The plan calls for completion of the three modules by 2025.

2.2 OXIDATION LAGOONS SYSTEM DESIGN PRINCIPLES

a. Clearance from the railway and the Rio-Cobre River:

Clearance from the Jamaica Railway to be 60 m from track to embankment centerline.
Clearance from the Rio Cobre Floodway dyke to be 45 m from centreline to embankment centerline.

b. All sewage flowing to Soapberry treatment plant will be pre-treated at its Station of origin:

Pumping stations will include mechanical automatic bar screens.
Greenwich Transfer Station – the Grit Removal system at the station will be rehabilitated and mechanical automatic bar screen system will be added.

c. Lagoon dike design – the following is a description of the dike design and protection and can be observed in Figure-4.

Minimum dike top width- 4.0m' finished with marl surface for protection and access.
Dike top width of 5.0m', with 4.0m' wide marl surfaces, is proposed where necessary to provide for piping or channels.
Maximum side slopes are 3:1 for pond dikes.
Top width of submerged dike at 2.0m' and top elevation of 0.5m' below pond operation level.
Lagoon lining – based on the details and characteristics of the soil described in the ***Jentech*** soil report, mainly that the soil at the western module site is clay and may serve as a sealing layer and therefore sparing the need for additional lining of the lagoons. Also, pond inner dike slopes will be lined with 1.5mm' thick HDPE sheets.

Dike wind and wave protection – the inner dikes are planned to be lined with a "Geo-web" lining as wave and wind protection. Concrete slope protection is provided on the inside slopes of all ponds from elevation- 0.75m' below high liquid levels to the dike tops. The outer dikes will be protected by Heavy "Rip-Rap" as storm protection is provided on exterior slopes adjacent to Hunt's-Bay, from top to bottom of dike slopes.

2.3 STP OPERATIONS

The proposed treatment system will be a re-circulated oxidation lagoon. The "Re-circulated Oxidation Lagoons" (ROL), concept combines the series lagoon system with recycling of treated effluent to the Primary-Lagoon for the main purpose of allowing higher organic loading on the primary lagoon without creating malodors and nuisances. Re-circulation of the effluent provides oxygen and algae rich supplement to the raw wastewater entering the system. This supplement seeds the algae in the wastewater and improves the performance of the system. Furthermore, the algae in the re-circulated stream also have the ability to absorb heavy metals. Common Re-circulation rates range from 2:1 to 1:2 based on the influent flow, the raw sewage quality and the climate conditions.

Mixed liquor, consisting of screened raw sewage and re-circulated secondary effluent, will enter through a distribution chamber at the center of the 'Half-Circle' to the primary facultative lagoons. These are relatively deep (2.4m) and this is where Suspended-Solids removal of up to 90% and BOD removal of up to 70 % take place mainly by means of sedimentation and by oxygen generated through photosynthetic activity of microscopic algae.

The next set of lagoons – secondary facultative lagoons - is shallower (~1.7m) and here oxygen is generated by the photosynthetic activity of microscopic algae. The oxygen is immediately available for bacteria in the wastewater to oxidize a major fraction of the BOD remaining.

Polishing lagoons are the final stage in the treatment process. These are shallower lagoons where further destruction of BOD and pathogenic bacteria takes place through extensive retention time and exposure to solar radiation. Some of the Secondary effluent will be pumped into the inlet channel at a re-circulation rate of 1:1 with the ability to increase the re-circulation rate, if required, to 1:1½. The rest of the secondary effluent is then passed through a sand filter bed before being discharged to the Rio Cobre.

The advantages of oxidation pond systems are:
Relatively high removal of pathogenic bacteria, viruses and protozoa due to long retention times, solar irradiation, biological competition and settling,
Simple flow scheme and simple equipment and installation (minimum piping and pumping, and reduced pretreatment facilities),
Capability to equalize peak hydraulic loads and resist shock organic loads due to large lagoon volumes, long retention times and high buffering capacity,
Low capital investment, especially with regard to construction, and
Simplicity of operation and low maintenance costs not requiring technical sophistication nor highly trained staff.

The advantages of re-circulated oxidation lagoons are:
Capacity to treat large volumes of wastewater,
Low mechanization system (except for re-circulation pumps), and
Low maintenance costs.
The expected quality of the effluent from the Soapberry waste water treatment facility is given in Table 2.2.

		Soapberry Effluent	
Parameter	NEPA Standard	Secondary	Tertiary*

Biological oxygen demand (BOD) (mg/l)	20	24	10
Total suspended solids (TSS) (mg/l)	20	Algae	10
Ammonia (mg/l)		8.5	8.5
Total nitrogen (mg/l)	10	21.5	10
pH	6 – 9	8	8
Faecal coliform	200	38	38

Table 2.2: Designed effluent specifications of proposed waste water treatment facility.

*** Sand filter**

3. ENVIRONMENTAL LEGISLATION AND REGULATORY FRAMEWORK

The environmental laws and regulations of Jamaica that are relevant to the construction and operations of a sewage treatment plant are listed and commented upon below.

3.1 LAWS

Natural Resources Conservation Authority Act (1991)

This is the main environmental legislation that relates to the proposed project. This Act establishes the Natural Resources Conservation Authority (NRCA) with primary responsibility for ensuring sustainable development through the protection and management of the country's natural resources and the control of pollution. This is partly achieved through an environmental permit and license system.

The Act gives the Authority power to:

- issue permits to the entity responsible for undertaking any enterprise, construction or development of a prescribed category in a prescribed area [Section 9]. This section, the Prescribed Area Order, designates all of Jamaica as being within the prescribed area;
- issue licenses for discharge of trade or sewage effluent or for construction or modification of any works for such discharge [Section 12 (1) (a) and (b)];
- request information or documents as the Authority thinks fit [Section 10 (1) (a)];
- request an environmental impact assessment containing such information as may be prescribed [Section 10 (1) (b)];
- request information on pollution control facilities [Section 17];
- revoke or suspend permits.

The Act also incorporates the earlier Beach Control Act, Wildlife Protection Act and Watersheds Act.

Wild Life Protection Act (1945)

Prohibits removal, sale or possession of protected animals, use of dynamite, poisons or other noxious material to kill or injure fish, prohibits discharge of trade effluent or industrial waste into harbors, lagoons, estuaries and streams. It authorizes the establishment of Game Sanctuaries and Reserves. Protected under the Wildlife Protection Act is the American Crocodile, a species that inhabits the project area.

Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order (1996)

The island of Jamaica and the Territorial Sea of Jamaica has been declared as a Prescribed Area. No person can undertake any enterprise, construction or development of a prescribed description of category except under and in accordance with a permit.

Natural Resources Conservation (Permits and Licenses) Regulations (1996)

These regulations give effect to the provisions of the Prescribed Areas Order. Sewage treatment facilities are included on the list of prescribed activities.

Natural Resources Conservation (Sewage Effluent) Regulations (Draft)

These regulations, when brought into effect, will cover the discharge of sewage effluent, the operations, monitoring and reporting mechanism for sewage treatment facilities.

Water Quality NRCA Act (1990)

The NRCA has primary responsibility for control of pollution in Jamaica’s environment, including pollution of water. National standards exist for industrial and sewage effluent discharges to rivers and streams.

Parish Council Act (1901; amended 1978) and the Local Improvements Act (1914)

The St. Catherine Parish Council is responsible for administering these laws in the parish. General approval under the Parish Council Act is needed for building permits. Section 11 of The Town and Country Planning Act also empowers the council to make decisions for the approval of development projects on its behalf.

Quarries Control Act (1983)

This Act repeals the Quarries Act of 1958 and makes provisions for quarry zones and licenses, quarry tax, enforcement and safety. The proposed project should ensure that any earth materials used for construction purposes at the construction site are obtained only from licensed quarries.

3.2 REGULATIONS

National Sewage Effluent Regulations (Draft, 2002)

These regulations are intended to cover the discharge of sewage effluent, the operations, monitoring and reporting mechanism of sewage treatment facilities. They relate to the National Sewage Effluent Standards, 1997. These standards are given in Table 3.1.

Table 3.1 Sewage effluent standards for plants built after 1997.

Parameter	Effluent Limit
Biological oxygen demand (BOD)	20 mg/l
Total suspended solids (TSS)	20 mg/l
Total nitrogen	10 mg/l
Phosphates	4 mg/l
Chemical oxygen demand (COD)	100 mg/l
pH	6 - 9
Faecal coliform	1000 MPN/100ml
Residual chlorine	1.5 mg/l

4. DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 CLIMATE

The meteorological conditions of the site, like the rest of Jamaica, is subtropical with only slight variations in temperature and rainfall throughout the year. Long term meteorological data has been collected at the Norman Manley International Airport (NMIA) which is 5 km. from the proposed site. Table 4.1 summarises the temperature, rainfall, and humidity values recorded between 1951 and 1989 and this data is indicative of the conditions that have existed at the site.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual Mean
Maximum Temp. (°C)	29.8	29.6	29.8	30.3	30.8	31.2	31.7	31.9	31.7	31.3	31.1	30.5	30.8
Minimum Temp. (°C)	22.3	22.3	22.9	22.6	24.7	25.3	25.6	25.3	25.3	24.8	24.1	23.1	24.0
Rainfall (mm)	18	16	14	27	100	83	40	81	107	167	61	31	62.1
No. of raindays	4	4	3	5	5	6	4	6	8	10	6	4	5.4
Rel. Hum.- 7am (%)	80	78	77	77	76	73	76	76	78	80	79	78	77.3
Rel. Hum.-	61	62	64	60	66	65	65	68	68	65	65	64	64.4

1pm (%)													
Sunshine (Hours)	8.3	8.6	8.5	8.7	8.2	7.7	8.2	8	7.2	7.4	7.8	7.8	8.0

Table 4.1: Monthly Mean and Annual Mean Values for Selected Meteorological Parameters: Norman Manley International Airport 1951 – 1980.

The maximum daily temperature ranges from 29.6 °C to 31.9 °C and the minimum from 22.3 °C to 25.6 °C with highest temperatures in July and August. The relatively narrow range in temperature reflects the moderating influence of the sea.

Highest monthly average rainfall occurs between May and October and the annual mean is 62.1 mm. October has the highest average monthly rainfall (167 mm) and days with rain (10).

The wind data for the period 1981 to 1990 show that the most predominant wind directions are from the east and east-south-east, (Table 4.2 and Figure 4.1.). These are the prevailing sea-breeze directions and reflect the effects of the mountains which lie along an east-west axis. The mountains deflect the dominant northeasterly trade winds and provide the easterly component to the winds.

Wind Speed	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N
Knots	020 - 030	040 - 050	060 – 070	080 – 100	110 - 120	130 - 140	150 - 160	170 - 190	200 - 210	220 - 230	240 - 250	260 - 280	290 - 300	310 - 320	330 - 340	350 010
0																
1 – 3	102	47	61	151	66	60	85	143	88	84	64	290	556	644	798	438

4 – 6	373	194	346	796	431	371	545	1035	457	297	281	697	1435	2253	3486	210
7 – 10	536	311	857	2470	1434	1027	1093	1429	578	279	216	545	866	1801	3787	302
11 - 16	169	121	868	5520	3675	1714	751	257	87	59	31	79	96	255	809	930
17 - 21	35	14	265	3734	3322	1475	327	45	10	4	2	6	8	53	108	97
22 - 27	15	0	59	2786	3254	1509	238	12	3	1	1	3	5	54	51	70
28 - 33	7	0	8	594	520	224	19	7	1	0	1	0	5	24	31	52
34 - 40	0	0	0	7	8	10	3	3	0	0	1	0	1	15	0	13
41 - 47	0	0	1	1	0	1	4	0	0	0	0	0	0	0	0	0
48 - 55	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
56 - 63	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
>63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Average Speed	18.54	19.09	18.29	14.80	13.67	14.32	17.74	19.46	19.16	18.11	18.03	16.99	16.59	17.54	18.54	18.8

Table 4.2: Wind Speed and Direction Data: Norman Manley Airport 1981 – 1990

Sea breeze influences provide a southerly component. Winds from the north-northwest and north are the other dominant direction and reflect land breeze as well as influences of cold fronts and the northeast trades.

The mean wind speed over the period was 10.3 knots (19.1 km/h). Winds from the south had the highest wind speeds (19.5 knots (kt)) followed by the south south-west. Winds from the ESE had the lowest average wind speeds. Calm winds were reported 14.7% of the time and wind speeds of 1 to 3 kt 4.2% of the time.

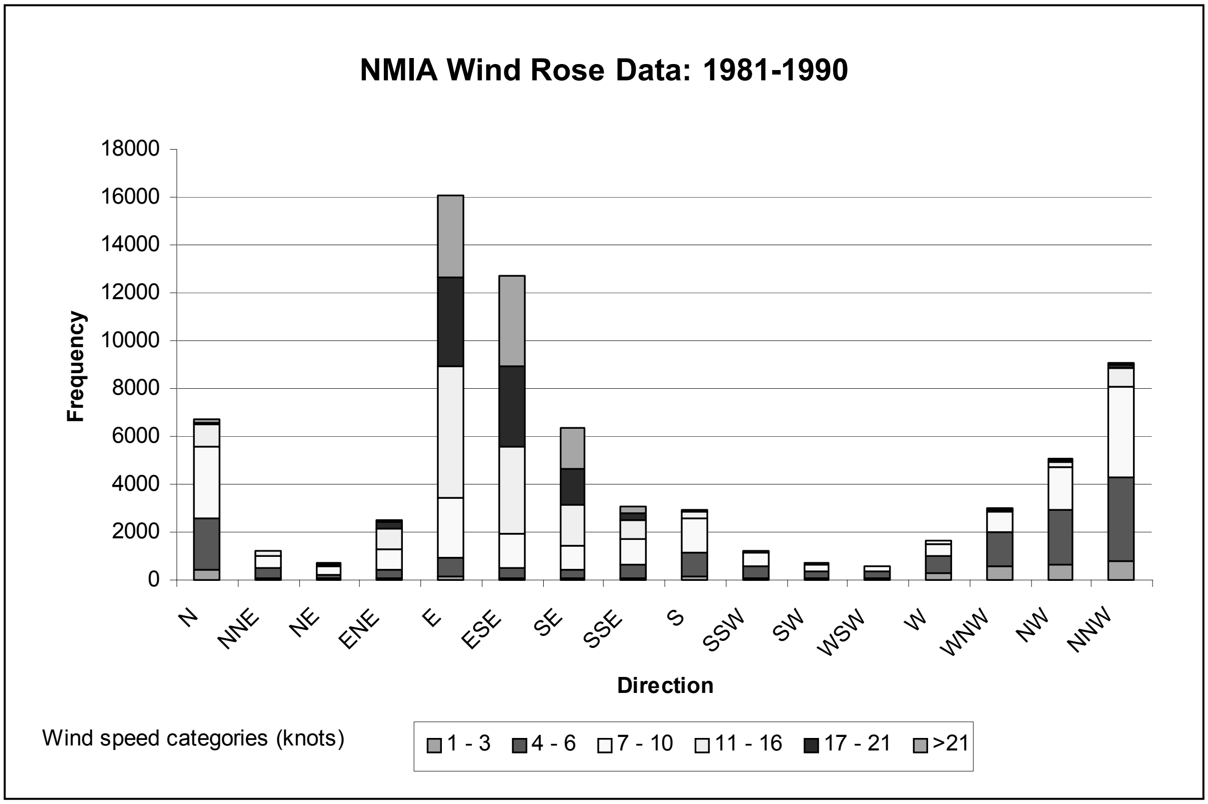


Figure 4.1 :Wind Speed and Wind Direction Frequencies: Norman Manley International Airport, 1981 - 1990

4.2 TOPOGRAPHY

The Soapberry site lies on a strip of coastal flatland at the southern end of an expansive alluvial plain that extends from the limestone foothills in the north to the coast at Hunts Bay in the south, (Figure 4.2). The site lies between the Rio Cobre in the west and the Duhaney River in the east, and is bounded on the northern, western and eastern sides by berms that are about 2.5 meters high. The area is flat with maximum elevation of 4 meters but generally the site is close to sea level with depressions up to 1 meter below sea level. The land slopes very gently towards the south.

The site can be divided into three distinct areas that correspond to the location of the three phases of the project, (Figure 4.2). The Phase 1 area is to the west of the site adjacent to the Rio Cobre. The berm on which the railway line runs forms the northern boundary while the western boundary is marked by the construction a dyke running along the bank of the Rio Cobre. This area is generally flat with the highest elevations towards the west and gently to the east and south. Elevations here are in the order of 3.5 meters.

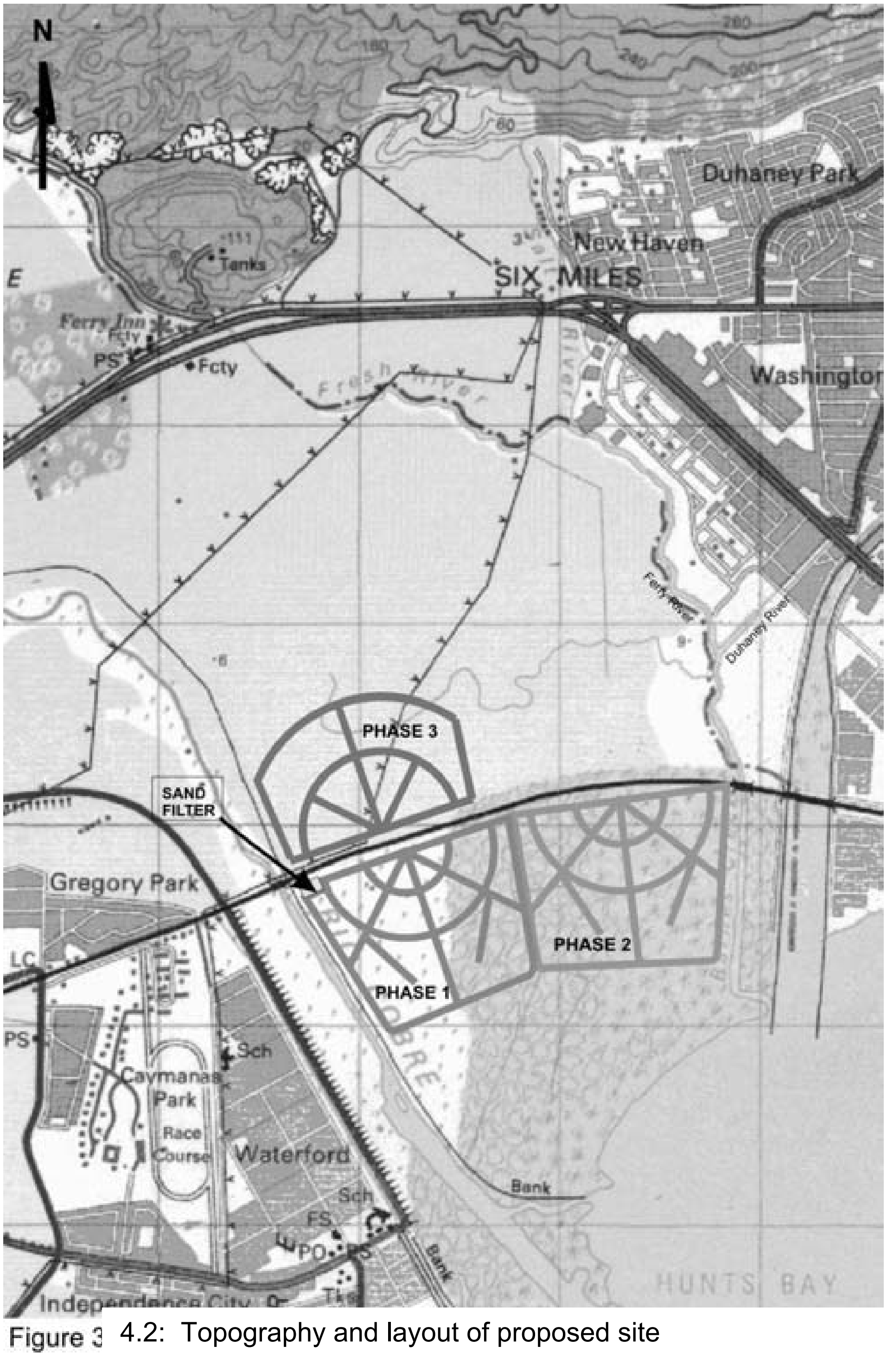


Figure 3 4.2: Topography and layout of proposed site

Phase two is located to the east and is bounded on all sides by a berm. This area has been completely filled in with dredge spoil and is entirely flat with the surface about 2 meters above sea level. The Phase 3 area is located to the north of the railway line that forms the southern boundary. The land is generally flat but has been made uneven by numerous pits dug for sand mining. A coastal marsh occupies the land between the proposed site and the Hunts Bay coastline to the south.

4.3 GEOLOGY AND SOILS

The site is underlain by a thick sequence of alluvium that is part of an extensive alluvial plain extending from Kingston in the east to southern Clarendon in the west. The alluvial plain is bounded in the north by the foothills of the central white limestone plateau. No significant geologic structures such as faults traverse the site.

Boreholes drilled on the site indicate that the soils are generally very soft clay, peaty clay or peat, (Appendix 2). The soils found on the western side of the site consist of soft to firm clays while soils on the eastern side are mainly soft clay or peat. Results of tests carried out on these soils is given in Appendix. The soils were classified as medium sand mixed with clay or silt. The soils were shown to be normally consolidated with optimum compaction water content of 27.5 percent and maximum dry density of 1425kg/m^3. The measured permeability at optimum compaction was 8.87 * 10^{-8} cm/sec.

4.4 SURFACE DRAINAGE

The surface drainage of the proposed site is determined by the regional topography and modifications that have altered the local surface flow conditions. The proposed site lies on the divide separating the Rio Cobre drainage basin and the smaller sub-basin of the Ferry-Duhaney Rivers, Figure 4.3. The Rio Cobre drains a watershed area of 580 Km2 located in north east St. Catherine.

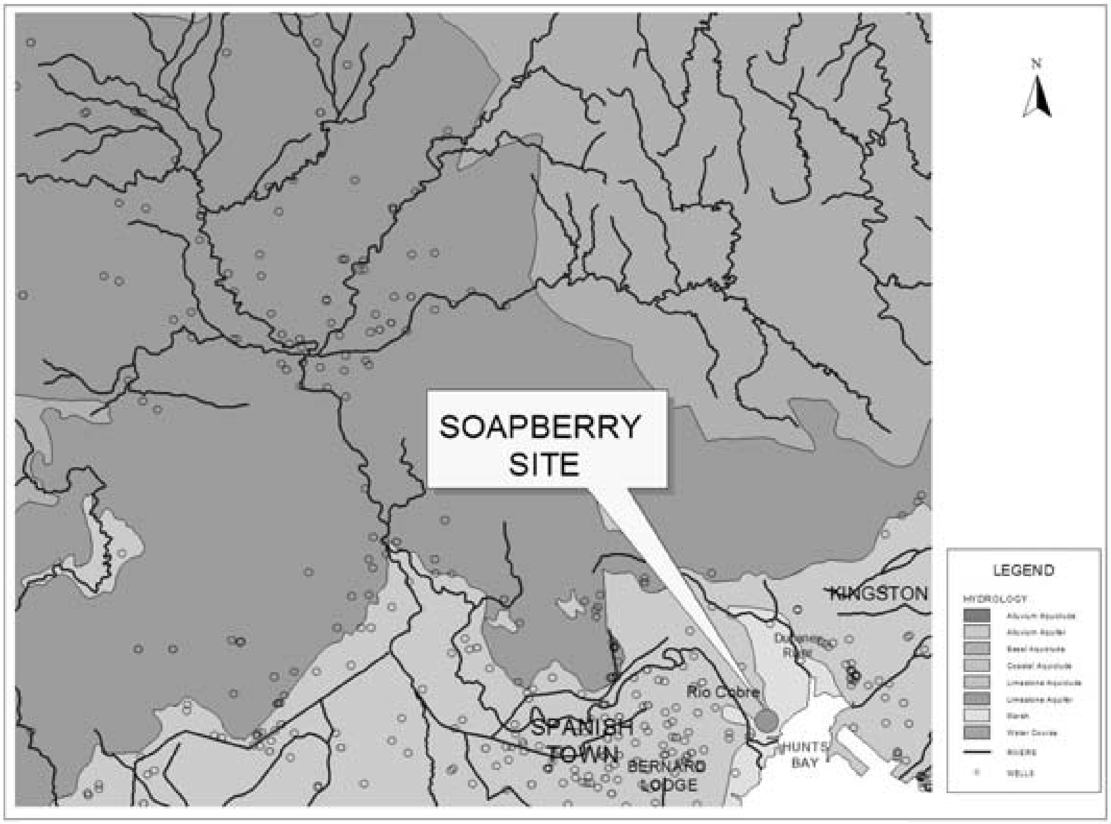


Figure 4.3: Drainage and Hydrology

The Rio Cobre flows in a southerly direction along the western boundary of the proposed site. In the vicinity of the site a 3 meter high dyke has been built on the western and eastern banks to contain flood flows within the channel. The mean discharge of the Rio Cobre is approximately 6.2 m^3 s^{-1} but during flash floods peak flow may rise to 283 m^3 s^{-1} .

The Ferry River joins with the Duhaney River close to the eastern boundary of the site and flows southerly into Hunts Bay. These streams are fed by upwelling of ground-water along the limestone-alluvial contact at the base of the foothills in the north. The estimated mean discharge of the Ferry River below the confluence with the Duhaney River is 2.8 m^3/sec.

The generally low-lying flat alluvial plain between the limestone hills to the north and the sea has no other distinct drainage features. After long duration intense rainfall, significant sheet flow occurs overland and flows slowly to the south. Significant ponding occurs over large areas. The proposed site receives this overland flow which slowly accumulates in the Rio Cobre and the Ferry and Duhaney Rivers, and dissipates into the sea as slow moving overland flow or evaporates over time from the ponded areas. A detailed drainage map of the proposed project is provided in Appendix 2.

The construction of the proposed project will modify the existing drainage conditions by forming an obstacle to the movement of overland flow. However the designed drainage system around the constructed lagoons will divert overland sheet-flow around the facility allowing it to flow southward to the sea. In addition the present low lying areas in which extensive ponding occurs will be surrounded or raised by the construction of the lagoons and therefore less ponding of this overland flow is expected.

The Rio Cobre flowing along the western boundary of the project site has the potential to generate significant discharge during peak flows. In order to prevent overbank flow from the Rio Cobre, dykes have been constructed along both the western and eastern banks of the Rio Cobre in the vicinity of the project site. The potential for flooding by the Rio Cobre is discussed further in the hazard vulnerability section below.

4.5 GROUND WATER

The silty-clay and sand sequence underlying the site represents the eastern extension of the Rio Cobre Alluvium Aquifer. The water table elevation at the site is less than 0.3 m above mean sea level and the groundwater gradient is very flat. Groundwater flow in this area, is influenced by the Ferry and Rio Cobre Rivers, the wetlands, recharge over the existing disposal site and tidal activity.

The groundwater flow direction will vary depending on the factor exerting the greatest influence at the time of groundwater level measuring. The regional groundwater flow direction is however south towards the coast at Hunts Bay. Groundwater level fluctuation in this area is typically less than 0.2m.

4.6 TERRESTRIAL ECOLOGY

4.6.1 Flora

Previous investigations (Environmental Solutions Ltd., 1993) revealed that the site has a relatively calm seacoast where the black mangrove (*Avicennia germinans*) and the white mangrove (*Laguncularia racemosa*) trees dominate. The presence of Seaside Purslane and other halophytes indicate high salt levels in the substrate.

A list of plants previously identified from the area is given in Table 4.3 and the main ecological habitats are shown in Figure 4.4. Many of the plants exhibited morphological adaptations to high light intensity and dryness. Some of these features are thorns, succulents, small leaves and hairy stems. Most of the plants present on the site are typical of coastal areas.

Family	Botanical Name	Common Name	Habit
Monocotyledones:			
Arecaceae	Cocos nucifera	Coconut	Tree
Cyperaceae	Cladium jamaicense	Saw Grass	Herb
Liliaceae	Sanseviera metallica	Mother-in-law's Tongue	Herb
Poaceae	Andropogon sp.		Herb
Poaceae	Chloris barbata		Herb
Poaceae	Gynerium sagittatum	Wild Cane	Herb
Poaceae	Panicum maximum	Guinea Grass	Herb
Poaceae	Rhynchelytrum repens		Herb
Poaceae	Sporobolus pyramidatus		Herb

Family	Botanical Name	Common Name	Habit
Dicotyledones			
Aizoaceae	Sesuvium portulacastrum	Seaside Purselane	Herb
Amaranthaceae	Alternanthera halimifolia		Herb
Apocynaceae	Urechites lutea	Nightshade	Shrubby Vine
Asteraceae	Tridax procumbens		Herb
Asteraceae	Vernonia cineria		Herb
Avicenniaceae	Avicennia germinans	Black Mangrove	Shrub/ Tree
Bignoniaceae	Tecoma stans	Yellow Elder	Shrub
Boraginaceae	Cordia alba	Duppy Cherry	Shrub/ Tree
Boraginaceae	Cordia sp.		Shrub/ Tree
Boraginaceae	Heliotropium angiospermum	Dog’s Tail	Herb
Caesalpiniaceae	Cassia alata	King-of-the-Forest	Shrub
Caesalpiniaceae	Cassia emarginata	Yellow Canlewood	Shrub/ Tree
Capparaceae	Capparis flexuosa	Bottle-cod Root	Shrub
Combretaceae	Laguncularia racemosa	White Mangrove	Shrub/ Tree
Combretaceae	Terminalia catappa	West Indian Almond	Tree
Euphorbiaceae	Euphorbia blodgetti		Herb
Euphorbiaceae	Jatropa gossypifolia		Shrub
Fabaceae	Abrus precatorius	Crab’s eye	Climber
Malavaceae	Sida aggregata		Undershrub
Malvaceae	Thespesia populnea	Seaside Mahoe	Tree
Mimosaceae	Acacia farnesiana		Tree
Mimosaceae	Leucaena leucocephala	Lead Tree	Shrub
Mimosaceae	Pithecellobium unguis- cati	Bread-and-Cheese	Tree
Portulaccaceae	Talinum triangulare		Herb
Zygophyllaceae	Tribulus cistoides	Kingston Buttercup	Herb

Table 4.3: Flora on the project site in 1993.

Figure 4.4: Ecological habitats

Three ecological habitats were distinguished in 1993 on the basis of vegetation type, prior and current land use, and physical features. These were mangrove scrub, tidal mudflats, and scrubland.

The field visit carried out in October 5, 2004 confirmed the continued presence of those zones. However, there have been modifications to the estuarine mudflats and the scrublands. Firstly, 113 hectares (280 acres) of mudflats at the north eastern area of the site have now been filled with dredge spoil from ongoing maintenance dredging at the mouths of the Rio Cobre and the Sandy Gully, (see Plates in Appendix 3). Secondly, contractors in preparation for site development have since cleared a small area of closed canopy woodland in the scrubland at the northwestern section of the site.

Ponds reported from the site in 1993, largely created by sand mining, still exist except for that in the northwestern section which has since been filled by dredge material. The present extent of the habitats described above are shown in Figure 4.4.

4.6.2 Habitats

The three main ecological zones or habitats (Figure 4.4) categorised in 1993 are still the main zones occurring in the project area. These are as follows:

- **Mangroves**

  Mangroves were identified lining the banks of the Rio Cobre (west), the Duhaney River (east), Hunts Bay (south) and the train track (north). The shoreline of the Duhaney River is less disturbed than that of the Rio Cobre having low sloping grassy banks. The banks of the Rio Cobre are very steep reaching up to 20ft. in some areas.

- **Tidal mudflats**

  A large mudflat exists in the eastern half of the property. This zone can be divided into three sections:

  a. The northern section with muddy flats, scattered mangroves, ponds, many mangrove stumps, and 280 acres of dredge spoil, (see plates in Appendix 2).
  b. Higher ground in the central region where landfill activities appeared to have been concentrated. This area has a grassy belt, scattered *Acacia* sp. (Cassia) trees, scrub and coastal herbs (*Sesuvium* sp.). There are many ridges, depressions, sand patches and mounds giving further evidence of land-fill.
  c. The southern portion of the project area is muddy with mangrove stumps. This area was reported as having the remains of several coal kilns in 1993, as coal

burning was a major activity on the site resulting in the loss of the dense coverage of mangroves that had existed prior to that time.

- **Scrubland**

The western side of the property was reported in 1993 (ESL, op. cit.) as being densely vegetated with grass, shrubs and trees. This area remains so today with large trees (15-20 ft in height). The closed canopy woodland (trees 30-40 ft in height) reported in 1993 exists no longer as these trees have been cleared from the property.

The area to the north of the railway line, slated for Phase 3 of the STP development, which was not assessed in 1993, is also covered with disturbed scrub vegetation. This area is dominated by the thorny scrub *Acacia sp*. with ruinate vegetation and mined out sand pits.

4.6.3 Fauna

- **Birds**

  The list of birds identified in 1993 is given in Table 3.4. The same species were also observed in 2004. The 1993 study was conducted toward the end of the summer and several migratory and over-wintering species were reported. On October 5, 2004, migratory species were also observed. The common winter visitor, the American Redstart (*Setophaga ruticilla*), was observed in the wooded areas and scrubland, identified for the establishment of Phase III of the project. This species was not reported in the 1993 study.

  Because of the variety and availability of habitats the birds at Soapberry show a high degree of diversity and abundance. The majority were species that utilise the shoreline, river banks, mangroves and ponds such as terns, herons, egrets, plovers and sandpipers. The other dominant species of birds were those usually reported from open areas and scrubland.

Scientific Name	Common Name	Status
Cathartes aura	Turkey Vulture	Common resident
Fregata magificens	Magnificent Frigate Bird	Common resident
Pelecanus occidentalis	Brown Pelican	Common resident
Arenaria interpres	Ruddy Turnstone	Common winter visitor
Himantopus mexicanus	Common Stilt	Common resident
Ardea herodias	Great White (Blue) Heron	Common winter visitor
Butorides virescens	Green Backed Heron/Gaulin	Common resident
Nycticorax nycticorax	Black Crowned Night Heron	Fairly common resident
Nycticorax violaceus	Yellow Crowned Night Heron	Common resident
Egretta caerulea	Little Blue Heron	Common resident
Egretta tricolor	Tricoloured Heron	Fairly common resident
Egretta thula	Snowy Egret	Common resident
Larus atricella	Laughing Gull	Common resident
Gallinula chloropus	Common Moorhen	Very common resident
Sterna antillarum.	Least Tern	Common summer resident
Calidris sp.	Sandpiper	Six species of Sandpipers occurring in Jamaica: 2 fairly common winter visitors; 1 common winter visitor; and 3 uncommon winter visitors
Charadrius sp.	Plover	Common winter visitor and fairly common winter visitor
Charadrius vodiferus	Killdeer	Common resident
Eudocimus albus	White Ibis	Uncommon resident in mangroves
Ralllus longirostris	Clapper Rail	Uncommon resident
Zenaida aurita	Zenaida Dove	Locally common resident
Columbina passerina	Ground Dove	Very common and widespread resident
Tyrannus caudifasciatus	Loggerhead Kingbird	Common and widespread
Dendroica discolor	Praire Warbler	Common winter visitor
Dendroica petechia	Yellow Warbler	Common resident
Helmitheros vermivorus	Worm Eating Warbler	Uncommon transient and winter visitor
Crotophaga ani	Smooth Billed Ani	Common resident
Saurothera vetula	Jamaican Lizard Cuckoo	Resident, less common than the Chestnut-bellied Cuckoo
Chordeiles gundlachii	Antillean Nighthawk	Common summer resident
Falco sparverius	American Kestrel	Very common resident
Loxigilla violacea	Greater Antillean Bullfinch	Common resident
Tachornis phoenicobia	Antillean Palm Swift	Very common resident
Setophaga ruticilla	American Redstart	Common winter visitor

Table 4.4 List of birds identified at Soapberry

* Identification and status based on Downer and Sutton, 1990; Bull and Farrand, Jr, 1977; Bond, 1985

- **Butterflies**

In 1993, nine species of butterflies were observed only within the scrubland and mangrove areas (Table 3.3) and none recorded from the landfill or grassy areas.

Common Name	Scientific Name	Distribution
Julia	*Dryas iulia delila*	Islandwide
Antillean Great White	*Ascia monuste eubotea*	Islandwide
Buckeye	*Precis evarete zonalis*	Islandwide
Maerula	*Anteos maerula maerula*	Islandwide
Cloudless orange	*Phoebis agarithe cubana*	Islandwide
Statira	*Aphrisa statira cubana*	Islandwide
Sulphur	*Eurema sp.*	Islandwide
Antillean malachite	*Siproeta stelens stelens*	Islandwide

Table 4.5: List of butterflies reported from the project area in 1993.
Identification and status based on Brown and Heineman (1972)

In the site assessment of 2004, several of these species were observed within the same habitat areas.

- **Mammals**

The only mammals that were recorded on the property in 1993 were dogs (as evidenced by tracks) and mongooses. No dogs or mongooses were observed in October 2004, but it is likely that these species are still present.

- **Fish**

Representative fish specimens were not collected in 1993, but reports from fishermen in the area indicated that snook, mullet, tarpon, and perch were present in the rivers.

Mangroves provide a major ecological function for Hunts Bay as they provide a source of detritus, act as shoreline protection and provide nursery habitat for fish. The ecology of Hunts Bay has been severely compromised by development in recent times.

- **Reptiles**

Reptiles observed in 1993) and noted again in 2004 included several species of lizards (Table 3.4) and the American Crocodile, C*rocodylus acutus,* which inhabits the Rio Cobre, Duhaney River, and the Hunts Bay.

Scientific Name	Status	Distribution
Anolis lineatopus	Endemic	Islandwide
Anolis grahami	Endemic*	Islandwide
Anolis valencienni	Endemic	Islandwide

Table 4.6: Reptiles recorded at Soapberry

Identification and status based on Schwartz and Henderson, 1991

* Introduced on Bermuda

- **Other invertebrates**

Many invertebrates were observed on the site in 1993 and were still present in 2004, including dragonflies, mosquitoes, lady bugs, flies, bees, wasps, termites, land crabs, fiddler crabs, and shrimp (rivers and Hunts Bay).

- **Endangered species**

The American crocodile (*Crocodylus acutus*) is indigenous to Jamaica occurring naturally in wetland areas where there is brackish water and adequate food. Populations in Jamaica are primarily found along the south coast from St. Thomas to Westmoreland,

and on the north coast in Hanover and Trelawny. The population of Jamaican crocodiles is threatened by destruction of wetlands particularly for coastal developments, aquatic pollution, hunting and wanton killing. The mangrove fringed Hunts Bay, the rivers leading into the Bay and the Kingston Harbour environs are known habitats for this species. *Crocodylus acutus* is protected by both national and international legislation. It is illegal to kill or to have in ones' possession any part of the animal. A crocodile management plan is included as Appendix 5.

4.7 HUNTS BAY ECOLOGY

Hunt's Bay has traditionally been a major source of shrimp fishery. The fisherfolk located on the Causeway, fish in Hunts Bay, as well as further out to sea. Based on data received from the Fisheries Division (Environmental Solutions Ltd, 2002). Hunts Bay has a licensed fishing beach with seventeen (17) boats in use. The Portmore Causeway fishing beach is not registered but has one hundred and three (103) boats in use. The Causeway Fishing Beach, though unlicensed, is the largest fishing beach in the Harbour rim.

The main resources for the fisherfolk on the Causeway Beach and in Hunts Bay are snapper and shrimp. Kingston Harbour and Hunts Bay have both been recognized as dying ecological systems resulting from continued pollution loading over the years, and the fisheries have been further compromised by overfishing. Anecdotal information over the years has indicated that the shrimp fishery in the Bay has steadily declined and the fisherfolk indicated that fish and shrimp have almost disappeared from the Harbour.

Webber *et al* (2003a) noted that organic pollution of Kingston Harbour has continued unabated since the initial ecological assessments conducted in the early 1970's)indicated that the area was under stress. Species of polychaetes previously described as being indicators of organic pollution in Hunt's Bay and the Inner Harbour/Upper Basin no longer occur. There has been a complete loss of benthic macrofauna in the central areas of Hunts Bay and the Upper Basin. The only animal groups found in these areas are meiofauna with a dominance of nematodes (90 - 100%) in this assemblage. The sediment macrofauna have totally disappeared from the deeper basins within the Harbour as well as in Hunts Bay.

A study by Webber, *et al* (2003) showed that there are three major types of currents in Kingston Harbour. These are density or salinity driven currents, wind driven currents and tidal currents. All sources act in concert with each current type to determine the circulation pattern in the different zones of the harbour. The outer harbour behaves as a true estuary with density currents dominating surface circulation patterns while deep currents are tidally driven. The inner harbour however, appears to be more tidally driven due to existing bathymetry, which accentuates the tidal currents.

High rainfall levels and winds influence the inner harbour surface layers with wind and density generated currents frequently opposing each other. The upper basin appears to be least active and is dominated by wind driven currents that are strong but short-lived. These currents produce gyres of circulation enhancing mixing within the upper basin but there is little net current motion between inner harbour and upper basin.

4.8 WATER QUALITY

Hunts Bay is a shallow basin of an area of 10.10 km^2 with depth ranges from 0.31 m - 4.57 m (Goodbody, 1970; Wade, 1976; Ranston, 1998 in Webber 2003). The Bay is subjected to considerable salinity fluctuations due to fresh water run off from the Rio-Cobre, Ferry and Duhaney Rivers and from the Sandy Gully (Fig. 3.5) and is now only connected to the Harbour by a 213.36 m opening since the construction of the Causeway Bridge in 1969 (Webber 2003).

Fresh water enters the harbour at Hunts Bay from two main rivers, the Rio-Cobre and the Duhaney Rivers, and by a drainage scheme, the Sandy Gully as well as via several intermittent streams (Webber, 2003). The most important source of fresh water is the Rio-Cobre, which has a mean discharge of approximately 6.2 $m^3 s^{-1}$ but during flash flood peak flow may rise to 283 $m^3 s^{-1}$ (Government of Jamaica, 1968; Wade, 1976 in Webber 2003).

The discharge rate of the Duhaney River is fairly uniform (2.83 $m^3 s^{-1}$) but is less than half that of the Rio Cobre while Sandy Gully discharge over a one-year period was approximately 61,317 million litres or 1.9 $m^3 s^{-1}$ (Government of Jamaica, 1968; Wade, 1976 cited in Webber 2003). When there is significant land runoff, water also enters the harbour along its northern shore via several gullies. The flow rate of these gullies on the north shore was 1.7 $m^3 s^{-1}$ or 54,504 million litres per year (Webber, 2003).

Webber et al (2003) clearly show that the concentration of pollutants in Hunts Bay have increased considerably over the last twenty years. Webber (2003) further show that the eutrophication of Kingston Harbour can only be reversed by control of the domestic and industrial waste presently released into it. Even with such waste being diverted, the slow flushing time of the Harbour make that a difficult task (Webber 2003). It is important therefore that adverse impact(s) on these surface water systems be minimized to prevent further degradation of the water quality.

Treatment of sewage by the proposed Soapberry WWTP will considerably improve the water quality of the Rio Cobre and Hunts Bay. The water quality in these water bodies is presently quite stressed with high bacterial, nutrient and organic loading. In the long term this should contribute to the reduction of the effects of eutrophication and a restoring of some of the ecological attributes of the Bay.

Three surface water sampling stations were investigated indicated on Figure 4.5 as stations SB1, SB2 and SB3, and described in Table 4.7. The results obtained from the analysis of these samples are presented in Table 4.8. The current and historical water quality data gives an indication of the water quality of the surface water systems under investigation.

STATION	LOCATION
SB3	Rio Cobre at its mouth
SB2	Hunts Bay – South
SB1	Duhaney River at the mouth

Table 4.7: Surface Water Quality Stations

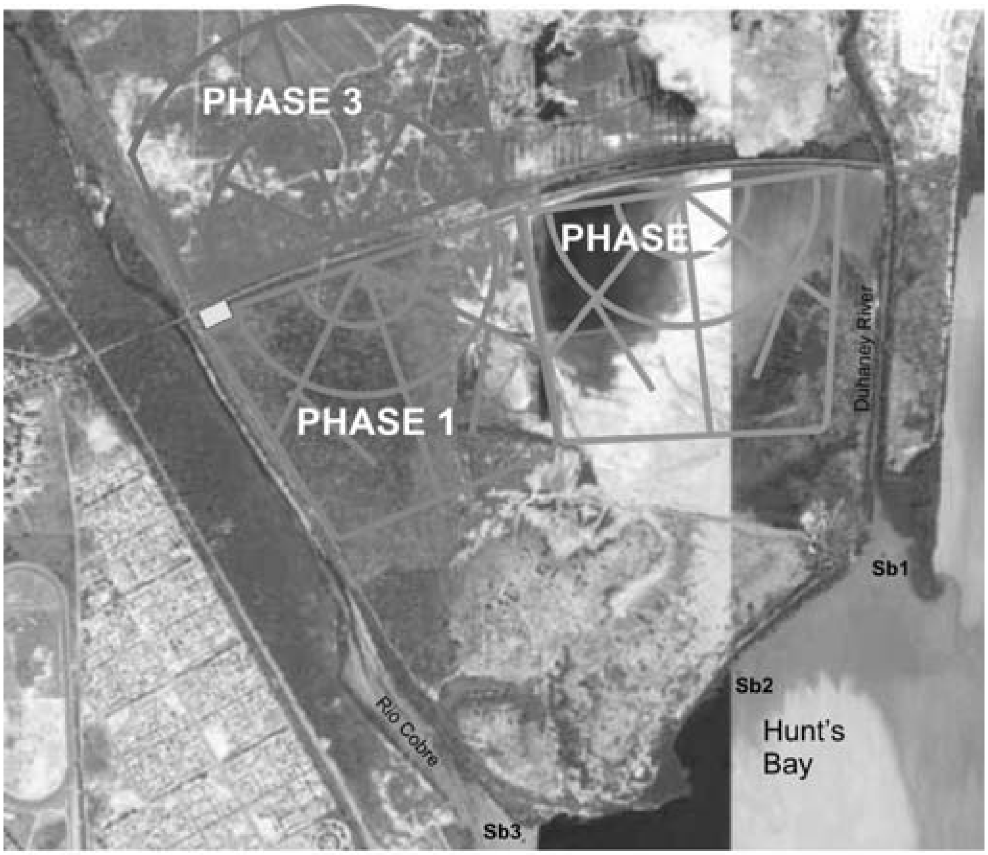


Figure 4.5: Water quality sample stations

PARAMETERS	SAMPLES			NEPA Marine Standards
	SB 1	SB 2	SB3	
pH	7.8	8.7	8.3	8.0-8.44
Salinity (ppt)	4.0	9.1	2.2	-
Dissolved Oxygen (mg/L)	2.8	7.8	5.9	4.5-6.8
BOD (mg/L)	3.0	12.0	10.0	0.57-1.16
Nitrate (mg/L)	1.2	0.1	3.8	0.001-0.081
TSS (mg/L)	5.0	16.0	31.3	-
Phosphate (mg/L)	0.2	0.2	0.3	0.001-0.055

Oil & Grease (mg/L)	2.0	0.5	0.7	-
Total Coliform (MPN/100ml)	>2400.0	93.0	>2400.0	48-256
Faecal Coliform (MPN/100ml)	1100.0	23.0	1100.0	<2-13

Table 4.8: Water Quality Data for the Soapberry EIA

Key:* : Draft NEPA Ambient Water Quality Standard for Marine Water

The data generated for the surface water systems show considerable organic contamination and high bacterial loading.

Dissolved Oxygen

Dissolved oxygen levels were good at Stations S1 and S3 ranging from 5.9 to 7.8. The dissolved oxygen levels at the mouth of the Duhaney River were however quite low.

pH

The waters at all three stations sampled were slightly alkaline.

Biochemical Oxygen Demand (BOD$_5$)

BOD for surface waters in excess of 2.0 mg/l indicates elevated organic loading, which is a cause for concern. BOD levels were elevated at all three stations ranging between 3 and 12 mg/l. High BOD levels are a direct consequence of the high concentration of oxygen demanding species in the surface waters.

Total and Faecal Coliform Bacteria

Faecal Coliform is used as indicators of the possible presence of pathogenic organisms. The generally accepted limit for faecal coliform in surface waters is 200 MPN/100 ml. A guideline of 450 MPN/100 ml is used for one off samples. This limit has been significantly exceeded at two stations, where levels were in excess of 1,100 MPN/100ml. Sewage effluent (raw and partially treated) from several sewage treatment facilities, as well as raw sewage from residences without sanitary facilities is discharged into these surface water systems. It is well known that many of these treatment plants are not operating efficiently and are discharging untreated sewage effluent into the surface water systems. These activities are the probable cause of the high faecal coliforms present in the surface water systems.

Total Suspended Solids (TSS)

Total Suspended Solids loading at the water quality stations ranged between 5 and 32 mg/l. The mouth of the Duhaney River was most impacted with considerable quantities of detritus.

Oil and Grease

The oil and grease concentration recorded at each station was below the recommended national guideline.

4.9 NATURAL HAZARD VULNERABILITY

The project site is exposed to the main natural hazards that affect Jamaica, hurricanes, earthquakes and flooding. The location, topography and geology of the proposed project site makes it susceptible to coastal and riverine flooding associated with high intensity rainfall from hurricanes and other extreme weather systems. In addition the site is susceptible to earthquake induced ground shaking located as it is in the zone of highest earthquake frequency and intensity.

4.9.1 Flood Hazard

The site is located close to the eastern bank of the lower reach of the Rio Cobre as well as the coastline in the south from which it is separated by a coastal marsh. The flatness of the land surface and low elevation of the site makes it susceptible to flooding. The potential sorces of flooding are from over bank flow from the Rio Cobre, inundation from storm surge run-up as well as from overland sheet flow.

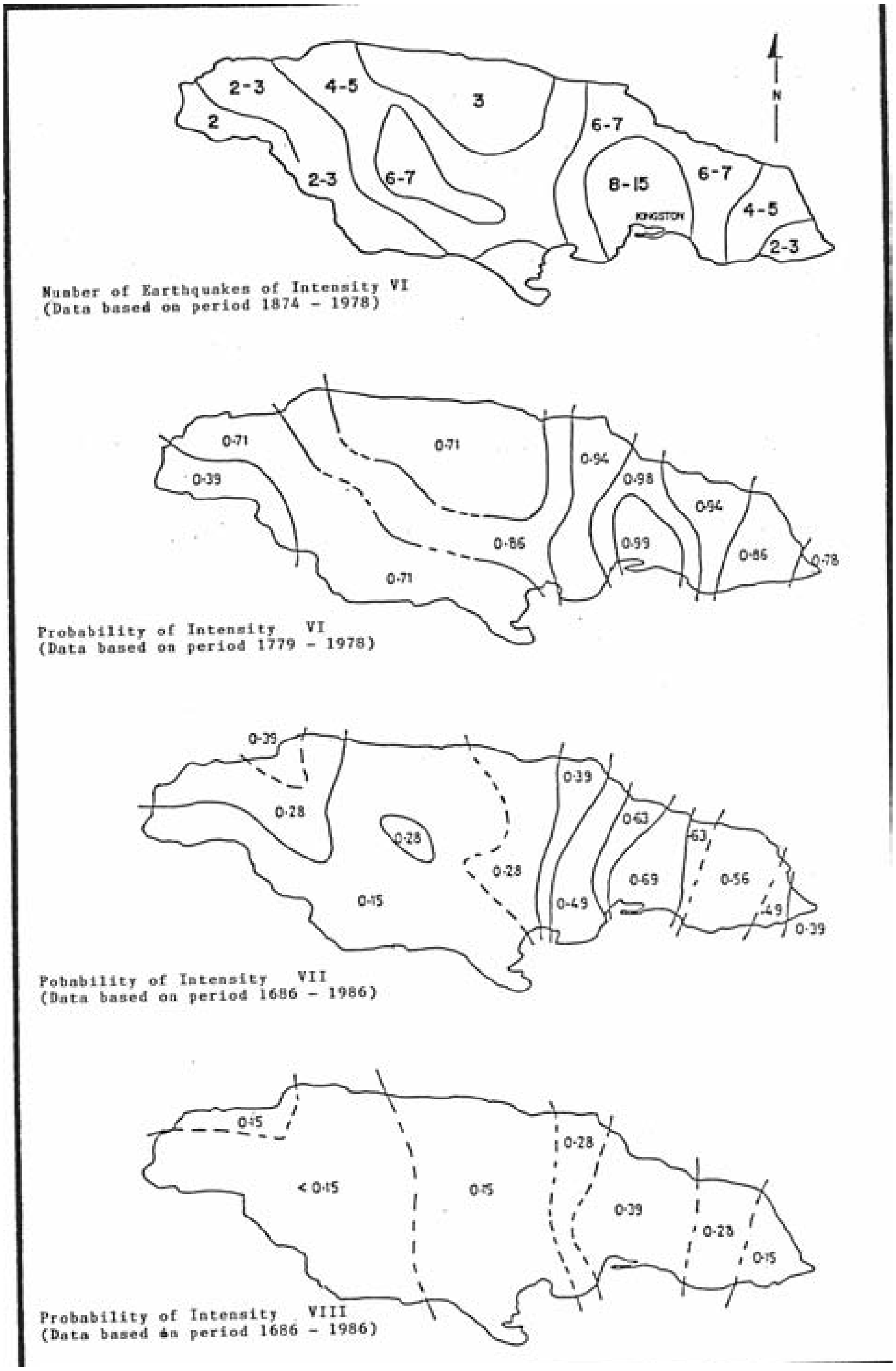
A dyke has been constructed on both banks of the Rio Cobre to contain overtopping the banks from flood flows. While 50 and 100 year peak flows have been estimated for the Rio Cobre at close to 2000 and 2500 m3/sec respectively, no significant flooding has been recorded in this area as a result of high flows in the Rio Cobre. In 2002 flood flows in the Rio Cobre resulting from intense rainfall were determined to represent 100 year discharge levels. However no overtopping of the dykes in the vicinity of the project site occurred.

The passage of Hurricane Ivan in 2004 along the southern shoreline of Jamaica generated significant storm surge that inundated susceptible parts of the south coast. However, no significant storm surge was recorded within Hunts Bay or along its northwestern coastline that is adjacent to the project site. The control of overland sheet flow by an appropriate storm water drainage system will effectively divert overland storm water flow around the facility and into Hunts Bay. This will have the effect of channelizing and controlling storm water flow and thus preventing ponding.

The presence of the dykes along the river bank separating the site from the Rio Cobre together with the height of the berms for the WTP lagoons suggests that riverine flooding will not adversely affect the structures of the WTP facility. However the low lying, flat nature of the site will require an extensive stormwater drainage system to prevent ponding. Storm surge inundation effects are also expected to be limited as these will be minimized by the expected relatively low storm surge heights and the distance of the WTP facility from the coastline.

4.9.2 Seismic Activity

Earthquake hazard zonation for Jamaica determined over the period 1692 to the present time, shows that the Kingston area is susceptible to seismic activity (Figure 4.6). Data from the Earthquake Unit at the University of the West Indies indicate that for Modified Mercalli Intensities (MMI) the Kingston area has an average exposure rate of 7 occurrences per century. MMI is the threshold for damage to ordinary but well-built structures.



Number of Earthquakes of Intensity VI
(Data based on period 1874 – 1978)

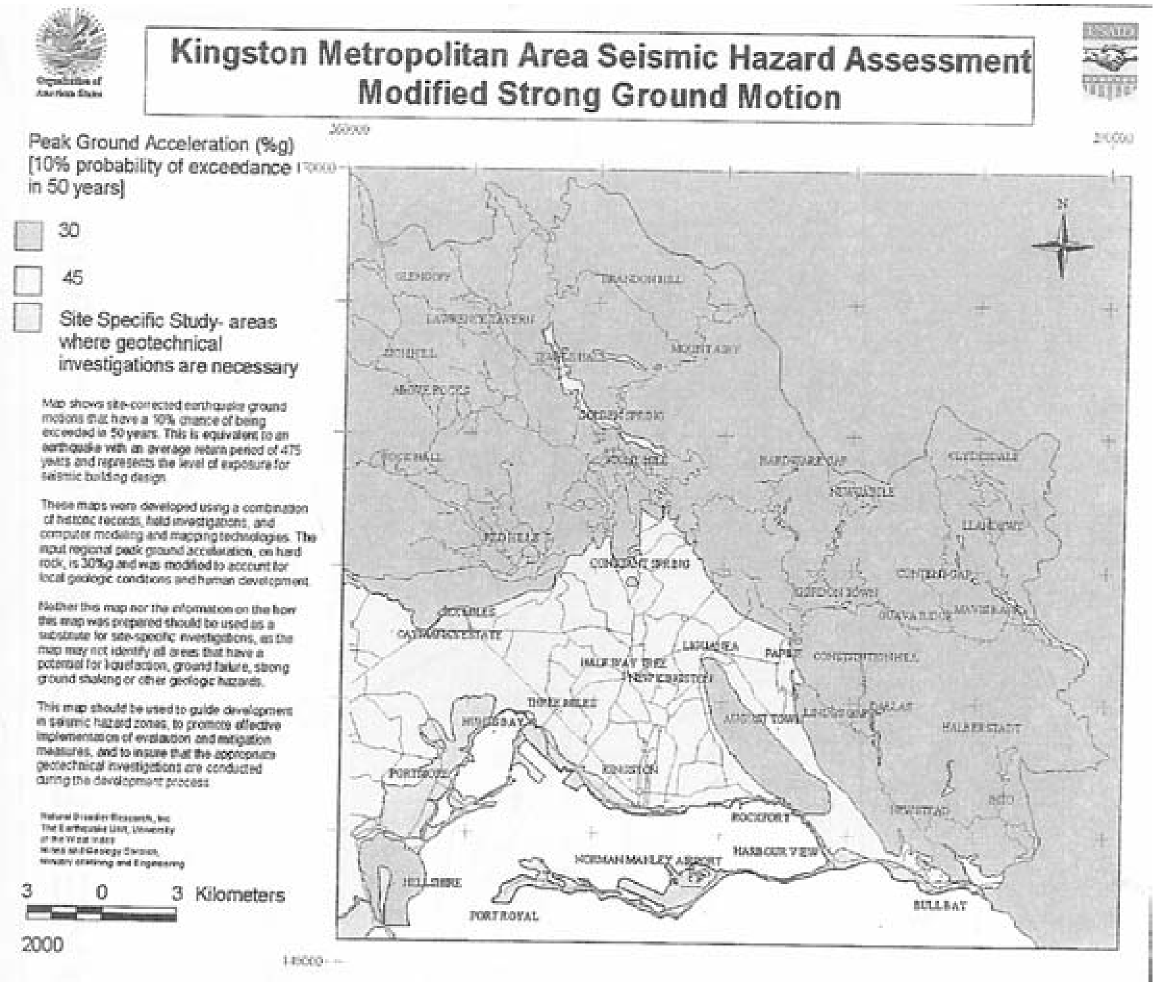
Probability of Intensity VI
(Data based on period 1779 – 1978)

Pobability of Intensity VII
(Data based on period 1686 – 1986)

Probability of Intensity VIII
(Data based on period 1686 – 1986)

Figure 4.6: Earthquake hazard Zonation of Jamaica.

Strong motion studies of earthquakes and the response of underlying materials by the CDMP 1999, produced a strong motion earthquake hazard map for Kingston Metropolitan Area. This map presented as Figure 3.7 shows the horizontal ground motion expected as a percentage of gravitational acceleration in areas of differing underlying substrate. The acceleration rates represent the site-corrected earthquake ground motion that have a 10% chance of being exceeded in 50 years. The map indicates that the proposed project site lies in an area that requires a site specific ground motions study to determine the likely behavior of the existing soils to ground motion induced by earthquakes.



Map shows site-corrected earthquake ground motions that have a 10% chance of being exceeded in 50 years. This is equivalent to an earthquake with an average return period of 475 years and represents the level of exposure for seismic building design.

These maps were developed using a combination of historic records, field investigations, and computer modeling and mapping technologies. The input regional peak ground acceleration, on hard rock, is 30%g and was modified to account for local geologic conditions and human development.

Neither this map nor the information on the how this map was prepared should be used as a substitute for site-specific investigations, as the map may not identify all areas that have a potential for liquefaction, ground failure, strong ground shaking or other geologic hazards.

This map should be used to guide development in seismic hazard zones, to promote effective implementation of evaluation and mitigation measures, and to insure that the appropriate geotechnical investigations are conducted during the development process.

Natural Disaster Research, Inc
The Earthquake Unit, University of the West Indies
Mines and Geology Division,
Ministry of Mining and Engineering

Figure 4.7: Strong motion seismic hazard for the Kingston Metropolitan Area

4.10 SOCIO-ECONOMIC ENVIRONMENT

The socio economic assessment involved conducting interviews in communities and select enterprises thought to represent or lie on the periphery of any negative human settlement impacts that might arise from the Project. The communities included Riverton City, Riverton Meadows, Waterford and New Haven.

4.10.1 The Communities

Waterford

Waterford is one of the earlier housing developments undertaken in Portmore. It lies roughly east of Caymanas Park and north of Independence City, and is bordered by the Dyke Road. As such, it is the nearest of the Portmore communities to Soapberry.

The community can be characterized as a mainly lower middle income residential community, with employment being outside of the community and in the KMA and Greater Spanish Town areas in particular. Most occupations are represented within the community. Civic pride is evident and the community is well-maintained.

Riverton City

Riverton City spreads west of the Spanish Town main road from a point a mile south east of the Six Mile intersection, to the north of the Old Passport Office. The community is a squatter community with substandard housing in all instances observed, and one which has been well documented as one of the most depressed urban communities in terms of living conditions. Fronting, or close to the main road through the community to the landfill were about 121 shanty units, although observation suggests that the total number of dwellings could be twice this number.

It is a community whose existence is integrated with the main landfill serving several Eastern parishes.

Riverton Meadows

Riverton Meadows is a part of the larger Riverton community, but lies to the south of Riverton City. It takes its name from a low income housing scheme constructed several years ago, to rescue the community from the image of squalor associated with it. It lies just east of Riverton City, but like Riverton City, its existence is highly integrated with the landfill. The housing scheme comprises 100 completed units with 20 more units remaining to be finished. However, at least a similar number of shanty dwellings also border the scheme.

New Haven

New Haven is located at Six Miles on the Mandela Highway. Geographically it lies farthest from Soapberry. It comprises a core planned residential community, increasingly encroached upon by unplanned residential development. It is mainly a lower middle class community, but likely to number most occupations within the community. Seven (7) persons were interviewed.

4.10.2 Land Use and Livelihoods

Recycling waste is a very important form of livelihood in the Riverton City and Riverton Meadows communities. This is a hustling occupation where the main incomes come from collecting and selling glass bottles, copper scraps, aluminum scraps, brass scraps and rebuilding broken items of furniture etc. A recycling enterprise, Caribbean Paper Recycling, located close to the entrance of Riverton is one focal point of this activity.

Of those engaged in sorting occupations, 70% reside within the community and 30% are visiting sorters. For all sorters, 77% do this as their sole source of income. (Hamilton, 1998). Periodically, uneasy relationships develop between public management of the dump and the community members, and this has in the past led to setting fire to the dump.

Community members complained of the lack of reliable employment and stated that most community members did not hold jobs outside of the community. From the large number of apparently idle persons observed, underemployment is likely to be high. In keeping with other communities visited, a frequent question directed at interviewers is the possibility of employment within the project being planned.

4.10.3 Public Health and Safety

New Haven is fully served by public utilities and shares a health clinic with its neighbouring Duhaney Park. Similarly its fire services and policing rely on those facilities located at Halfway Tree and Duhaney Park, respectively. There is a New Haven Citizens Association, which meets periodically.

Riverton receives its water through illegal connections to the main NWC supply serving neighbouring areas or from entities that allow their supply to be tapped. A spring is said to exist in the community, and several persons were seen carrying containers to and from its reported location. Toilets are mainly pit latrines with very few dwellings appearing to have inside flush toilets.

Several random and unmanaged dump sites were observed, especially for old car and truck bodies. Smoke and dust from the landfill is repeatedly complained about. Dust is also generated by the vehicles bringing garbage to the landfill, both from their contents and also from the unpaved roads serving the landfill site.

Riverton Meadows, being an approved development, receives its water through NWC and its electricity through metered JPS connections. Outside of the housing scheme, water supply seemed to be derived from the same type of sources as for Riverton City.

All of the scheme houses are sewered but those in the surrounding shanty community use mainly pit latrines.

Riverton Meadows is evidencing clear signs of urban deterioration. The housing scheme itself, presents the appearance of becoming overcrowded and poorly maintained. Green spaces are virtually non existent, except in the form of a poorly maintained football field. Mini dump sites are crowding the schemes borders. A church affiliated small visiting clinic exists, but seems to cater mainly to the children of the basic school which it operates.

Waterford also enjoys full access to the utilities, including a reliable supply of water from NWC. The entire scheme is sewered and garbage is routinely collected by the municipality. Although not served by its own health clinic, it has access to one in Independence City, and the nearest hospital is in Spanish Town. Similarly its fire services and policing rely on those located in nearby communities and serving the Portmore area. There is a Waterford Citizens Association that meets periodically.

4.10.4 Social and Physical Infrastructure

Several churches and basic schools exist in New Haven and Waterford. A small computer lab has been sponsored by the Roman Catholic Church, which is active in the area, and is used to teach computing skills to interested adults. There is also a secondary school in Waterford.

Drainage is a problem in the communities which are generally flood prone. Riverton City and Waterford and New Haven flood regularly due to either low-lying/flat topography and/or poorly designed and maintained drainage ways. Waterford residents complained that flooding is mainly attributable to poor drainage that pushes water from surrounding areas into Waterford.

4.10.5 Attitude to Project

Knowledge of the proposed project was minimal, but residents generally regarded the planned project with apprehension and cynicism. Their view of sewage treatment plants was invariably negative, the main concern being the persistent odour associated with them. They pointed to the ever-malfunctioning plant at Independence City, the ponds at Hillview and the relatively small plant at Portmore Villas. Members of the community were willing to accept that the technology of treatment ponds is reliable, but they had no faith in the private or public sector, whether central or local government, to operate and maintain the technology over time. Several members within groups spoken to were very vocal against the project. In addition to odour the main concerns were mosquitoes and general health.

It is evident that the community, based on its experiences, can easily be mobilized to strongly resist the project. Among those interviewed was a total consensus that the project would not benefit the community in income or employment terms, sufficiently to offset its perceived disadvantages. Community dialogue and awareness building may help to reassure residents that their concerns can be addressed, and may help avoid any public conflict over the project.

4.11 Design Flow Comparisons

Two population forecasts for Kingston and Portmore provide an indication of the number of persons who will benefit from the project when it is completed. The Sentar study (SENTAR, 1993) estimated the combined populations in 2015 to be 966,035. The K.B.R. Master Plan projects the populations in 2025 to be 966,990. Both figures include an ‘equivalency’ factor which adjusts for industrial and commercial use.

The proportion of the populations to be served can be approximated from the ratio of projected flows to the plant over the phasing of the Project. The daily flows to Soapberry in 2025 are projected at 220,213 m^3/day. The proportion of this total achieved at the end of each phase is given in Table 3.9.

	STAGE 1	STAGE 2	STAGE 3
TOTAL	56%	66%	100%

Table 4.9: Proportion of Population Served at the End of Each Phase

A comparison of design between the SENTAR study (SENTAR, 1993) and the K.B.R. study (2003) are summarized in Table 4.10 below.

	Stage 1 (start)	Stage 1 (end)	Stage 2 (end)	Stage 3 (end)
Soapberry	63,188	104,573	126,794	201,082
Portmore	8,800	19,131	19,131	19,131
Total	71,988	123,704	145,925	220,213

Table 4.10: Summary of Design Flows to Soapberry Treatment Plant [m^3/ day] [1]

5. ENVIRONMENTAL IMPACTS AND MITIGATION

5.1 Engineering Assessment

The construction of the Soapberry Sewage Treatment facility is a positive and necessary intervention. However there are both positive and negative impacts of this proposed new sewage treatment facility for Kingston and Portmore. The main issues include:

1. Level of treatment provided to sewage produced in the KMA and Portmore

At present a large volume of the sewage produced in the KMA is untreated or treated at a very basic level and well below the established NEPA effluent standards. The Sentar report (1993) and the K.B.R. report show that raw sewage, poorly treated sewage and non-point source sewage enter Kingston Harbour. The non-point source sewage comes from several lots where sewage is discharged into the ground through various types of soil absorption systems including absorption pits with direct discharge of sewage to the pits; and elsewhere, the direct discharge of sewage to the storm drain systems from communities that have developed along the banks of these storm-drains.

The Western Sewage Treatment plant, as well as Greenwich STP, receive septage removed from the absorption pits and septic tanks throughout the KMA, and some from areas far outside the KMA. With no treatment occurring at these plants this septage is effectively being discharged untreated into Kingston Harbour.

Once the lagoon system sewage plant is constructed in Soapberry, it will be able to receive and treat all the sewage described above before disposal to the harbour, with secondary treatment removing more than 90% of organic loadings and tertiary treatment bringing the BOD concentrations to around 10 mg/l.

The proposed Oxidation Lagoon System STP will be able to reduce loadings as shown in the following table:

Element	Removal Rate (%)
Biochemical Oxygen Demand (BOD)	90-97%
Chemical Oxygen Demand (COD)	90-95%
Total Nitrogen	80-90%
Total Phosphorus	55-60%
E Coliform bacteria	99.99%

2. Method of treatment employed

The large sewage treatment facilities in Jamaica that have relied on mechanical means for treatment have not over the long term been effective because of the maintenance and repair costs. These facilities have not been maintained at the standard that they should, and consequentially the effluent quality declines.

The knowledge of these facts brought both Sentar (in the 1993 report) and KBR (in the 2003 report) to the conclusion that the most suitable solution recommended for the treatment of the KMA and Portmore sewage are stabilization ponds.

In addition, the climatic conditions in Jamaica in general and in Soapberry in particular, are optimal for stabilization ponds: winds for mixing, warm weather, and sun all year round for photosynthesis and disinfection.

The application proposed for Soapberry is a natural system utilizing ponds. The operation and maintenance costs of these systems are much reduced and therefore the ability to effect better quality control is enhanced. In addition, these plants are far better suited for shock loads and for fluctuating loads.

3. Effluent quality and maintenance of effluent quality

The use of natural means to treat the sewage is strongly recommended in keeping with earlier comments. The combination of the sewage lagoons and the sand filter will provide effluent of a high quality. Through the monitoring of this development a further design strategy can be implemented in the second phase of the plant to ensure that the phosphorous level is further reduced.

As effluent quality is good it should also be considered for use as irrigation, especially if used in the normal flood method within the cane producing areas.

4. Disposal of effluent

The effluent is to be discharged into the Rio Cobre just downstream of the lower railway bridge.

5. Sludge management

Scum develops on the top of lagoons and requires management to reduce accumulation. Scum accumulation can create three main problems:

It accumulates in specific areas induced by the wind and direction of flow through the plant and eventually affects the design flow regime.

It produces odours because it accumulates and becomes anoxic.

It breeds flies because it is floating and the upper surface remains above the liquid level.

The radial design of the system will reduce the effects of accumulated scum. The shape is intended to have the ponds aligned with the wind so that the scum will not accumulate because the flow is in opposition to the wind and the accumulation areas are in the acute angular corners out of which the sewage is discharged. The sewage flow will therefore push the scum out of these areas and reduce accumulation.

Sludge accumulation in sewage ponds is minimal when properly designed. Therefore it is absolutely important that the design flow for the ponds is not exceeded, as this is a significant factor in sludge accumulation in ponds. When flows increase, or other areas are brought on to the sewage collection system, they must not be connected to the Soapberry system without the due expansion of the treatment facilities.

The STP is designed in 3 modules and each module has its maximum loading ability. When loadings increase as a result of connection of more neighborhoods or increase in septage or both, the modules will be added according to need for treatment. Also, re-circulation at the design rates will be adjusted to the incoming flows. The regulatory agencies are to monitor this, and expansion of collection must have a preceding expansion in treatment capacity.

The sedimentation zone of the primary ponds is deeper than the other ponds allowing anaerobic activity at the bottom, and also acting as storage for stabilized sludge accumulating over the years. The amounts of stabilized sludge accumulating will be negligible.

If it is found necessary, desludging could be carried out approximately every 7 years. The distribution chamber at the inlet to each module will be equipped with penstocks in order to isolate a train to empty, clean and maintain if needed.

Once the ponds are emptied, sludge at the bottom of the ponds should be allowed to drain and dry. As the dry sludge at the bottom will be stabilized, it could be gathered by mechanical means and removed to the nearby Riverton City Solid Waste Disposal site.

6. Odour

In order to avoid odour problems that may occur in these systems re-circulation of plant effluent to system inlet is added at a minimum rate of 1:1, thereby reducing the load on the plant inlet and primary pond.

Another potential source of odour is scum which has already been discussed above. If the ponds are overloaded it will result in odour problems because the treatment capacity will be exceeded.

If for process reasons or others, scum does accumulate at a particular time, scum removal systems will be in place including:
High-pressure water spray to break up the scum so that it will settle.
Boats and rakes to allow staff to break up the scum or remove it from the pond.

Finally, preliminary treatment (screening) was added at Greenwich (also existing grit channels will remain) and Nanse Pen pumping station, thereby reducing one of the sources of odours.

5.2 SITE CLEARANCE AND PREPARATION IMPACTS

5.2.1 Loss of natural habitat and biodiversity

The clearing of existing vegetation during pond construction and the development of the facility will result in the complete loss of associated ecological habitats and their fauna, within the footprint of the development. Noise, vibrations, and intrusive activities related to construction works will tend to scare away any animals remaining on the site after vegetation clearance. These are the environmental trade-offs for the anticipated improvement in the water quality and biology of Kingston Harbour. The existing salina and scrub habitats will be replaced by an artificial but productive aquatic system maintained by natural climatic factors.

Mitigation:

- *The purpose of the wastewater treatment project is to reduce the current amounts of untreated sewage that enters Kingston Harbour, thereby allowing for recovery of the inherent natural productivity of the harbour and restoration of the economic benefits to be derived from a healthy ecosystem.*
- *Clearing and construction activity should be restricted to within the footprint of the development.*
- *There should be no side-tipping of excavated material or cleared vegetation unto areas outside the footprint.*
- *The fringing mangrove on the Hunt's Bay and the Rio Cobre should not be altered during construction activities. The habitat for the endangered crocodile Crocodylus acutus is therefore not at threat of loss.*

5.2.2 Soil erosion

Vegetation clearance, road construction, excavation works, and pond construction works will expose soils in the affected project areas leaving them vulnerable to erosion by surface run-off and ultimately threatening adjacent coastal waters with high turbidity and sediment deposition, a negative consequence. Such conditions are only likely to occur during periods of intense rainfall. The flat topography of the site would tend to reduce erosive surface flows and the overall threat of turbidity should exist only for the duration of construction works before embankments and drainage works are put in place that would reduce the susceptibility to soil erosion. The Duhaney River and Hunts Bay near to the site could be affected by soil erosion and turbidity.

Mitigation:

To the greatest extent possible, phase site clearance so as to minimize the area of exposed soil at any given time.

- *Temporarily bund exposed soil and redirect flows from heavy runoff areas that threaten to erode or result in substantial surface runoff to adjacent marine waters*
- *Monitor areas of exposed soil during periods of heavy rainfall throughout the construction phase of the project so as to implement sediment dispersal measures as appropriate.*

5.2.3 Nuisance dusting

It can be anticipated that a certain amount of air borne particulate matter (dust) will be generated by earth moving activities during pond construction and during off loading of marl. This situation will be worse during the dry season and during the afternoons when the winds are most prevalent. Air borne particulates may pose a hazard to residents in the vicinity or downwind of the construction site that suffer from upper respiratory tract problems. Otherwise it may only be a nuisance. The impact of dusting is short-term, lasting for the duration of the construction activity, but it may be severe if it causes significant health problems.

Mitigation:

Access roads and exposed ground should be regularly wetted in a manner that effectively keeps down the dust.

Stockpiles of fine materials (e.g. marl) should be wetted or covered with tarp during windy conditions.

Workers on the site should be issued with dust masks during dry and windy conditions.

5.2.4 Noise

The use of heavy equipment during site clearance and road construction works will inevitably generate noise but this should not be of any consequence to adjacent communities that are located sufficiently far away as to not be affected. The remoteness of the site should help to ameliorate noises.

Mitigation:
If necessary, local residents should be given notice of intended noisy activities so as to reduce degree of annoyances.
Workers operating equipment that generates noise should be equipped with noise protection gear. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs. Workers experiencing prolonged noise levels of 70 – 80 dBA should wear earplugs.

5.3 CONSTRUCTION IMPACTS

5.3.1 Loss of land use options

The construction of a wastewater treatment plant will involve building large embankment structures on what is a green field site. This will result in a loss of the options for alternative land use and thus represents an irreversible commitment of land resources. Although the loss of optional uses for the land in the future is considered to be a negative impact, in this case the land is marginal in terms of alternative agricultural or residential use and the impact is not considered significant.

Mitigation:

N/A

5.3.2 Earth material sourcing

Earth materials needed for construction (e.g. marl, sand) are normally obtained from quarry and mining operations. Conscious or unwitting purchase of these materials from unlicensed operations indirectly supports, encourages and promotes environmental degradation at the illegal quarry sites and causes medium to long-term negative impacts at source.

Mitigation:
Earth materials must be obtained from officially licensed and approved quarries and copies of the relevant licenses made available for inspection at the site by the Contractor.

5.3.3 Materials transportation

The various materials required for pond and building construction (e.g. steel, blocks, lumber, marl, etc.) will be obtained from sources elsewhere and transported to the site. Transportation of these materials, typically in over-laden and sometimes uncovered trucks, usually results in undue road wear-and-tear. Special note is made here of the unpaved road surfaces in the Caymanas/Soapberry area.

In the case of fine earth materials, dusting and spillages occur on major roadways between source and site. Dusting degrades local air quality and material spillages worsen driving conditions and increase the risk of road accidents. These occurrences represent indirect, short-term, reversible, negative impacts on public health and safety.

Mitigation:
All fine earth materials must be enclosed during transportation to the site to prevent spillage and dusting. Trucks used for that purpose should be fitted with tailgates that

close properly and with tarpaulins to cover the materials. The cleanup of spilled earth and construction material on the main roads should be the responsibility of the Contractor and should be done in a timely manner (say within 2 hours) so as not to inconvenience or endanger other road users. These requirements should be included as clauses within the contracts made with relevant sub-contractors.

The transportation of lubricants and fuel to the construction site should only be done in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums.

As far as possible, transport of construction materials should be scheduled for off-peak traffic hours. This will reduce the risk of traffic congestion and of road accidents on the access roads to the site.

Appropriate traffic warning signs, informing road users of a construction site entrance ahead and instructing them to reduce speed, should be placed along the main road in the vicinity of the entrance to the Soapberry lands.

Flagmen should be employed to control traffic and assist construction vehicles as they attempt to enter and exit the project site.

5.3.4 Materials storage

The improper siting of stockpiles and storage of sand, gravel, cement, etc., at the construction site could lead to fine materials being washed away, during heavy rainfall events, into Hunts Bay and Kingston Harbour. This would not only represent a waste of materials but would also contribute to turbidity and sedimentation with consequent negative impacts on inshore marine water quality of the bays.

Refueling and maintenance of large vehicles and earth moving equipment will take place at the construction site and therefore fuel and lubricants will have to be stored on the site. This will create the opportunity for accidental spills of hydrocarbons and contaminants could be washed into the sea at Hunts Bay.

Mitigation:

The stockpiling of construction materials should be properly managed and controlled. Fine-grained materials (sand, marl, etc.) should be stockpiled away from surface drainage channels and features.

Low berms should be placed around the piles and/or tarpaulin used to cover open piles of stored materials to prevent them from being washed away during rainfall.

Safe storage areas should be identified and retaining structures put in place prior to the arrival and placement of material.

Hazardous chemicals (e.g. fuels) should be properly stored in appropriate containers and these should be safely locked away. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities.

5.3.5 Modification of surface drainage

Mitigation:

- *The appropriate design of storm water drainage system*

5.3.6 Construction waste disposal

Solid waste generated during site preparation and construction work would include cut vegetation and typical construction waste (e.g. wasted concrete, steel, wooden scaffolding and forms, bags, waste earth materials, etc.). This waste would negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite. Cleared vegetation burnt onsite would generate smoke, possibly impacting negatively on ambient air quality and human health. Vegetation and solid waste, if allowed to accumulate in drainage ways, could cause localised pooling and flooding. Pooling of water, in turn, would create conditions conducive to the breeding of nuisance and health-threatening pests such as mosquitoes. Poor construction waste management constitutes a short-term negative impact.

Mitigation:

A site waste management plan should be prepared by the contractor prior to commencement of construction works. This should include designation of appropriate waste storage areas, collection and removal schedule, identification of approved disposal site*, and a system for supervision and monitoring. Preparation and implementation of the plan must be made the responsibility of the building contractor with the system being monitored independently.

Vegetation and combustible waste must not be burned on the site.

Reusable inorganic waste (e.g. excavated sand) should be stockpiled away from drainage features and used for in filling where necessary.

Unusable construction waste, such as damaged pipes, formwork and other construction material, must be disposed of at an approved dumpsite.

The official dump for eastern Jamaica is at Riverton Landfill.

5.3.7 Sewage and litter management

Inadequate provision of toilets for use by workers can lead to ad hoc defecation in secluded areas on the site, thus creating unsanitary conditions and sources of fly infestation. Improper disposal of food cartons and other domestic forms of construction camp garbage could lead to littering of the site and pollution of adjacent coastal waters.

Mitigation:

Proper solid waste receptacles and storage containers should be provided, particularly for the disposal of lunch and drink boxes so as to prevent littering of the site.

Arrangements should be made for the regular collection of litter and for its disposal only at the Riverton site.

5.3.8 Replanting and landscaping

Landscaping and replanting of trees will be needed to recreate some semblance of the original appearance and condition of the site and to provide some aesthetic quality. No details of landscaping plans or planting material are available at this stage but the plant species selected for replanting will in large part determine which types of birds, butterflies, and other fauna, if any, inhabit the area surrounding the ponds after their construction. In addition to enhancing the aesthetic appeal of the project site, landscaping provides the means for partially restoring the site's natural elements and ecological habitats. It is therefore a significant mitigation activity with a positive impact.

The landscaping plan should seek to avoid the use of non-native and potentially invasive species. It should include low-maintenance local species and the types of trees and shrubs used for feeding by local bird species. The landscape design should seek to encourage bird life, especially for the endemics, and maximize shade.

Mitigation:

N/A

5.3.9 Employment/Income generation

Several categories will be required during the construction phase. This will include skilled and unskilled labourers, engineers, and a small number of other professionals. These levels of short-term employment would have a positive impact on the local economy and on regional unemployment.

Mitigation:

N/A

5.4 OPERATION IMPACTS

5.4.1 Employment/Income generation

The STP facility will provide employment for several persons. This would represent a positive long-term impact.

Mitigation:

N/A

5.4.2 Water supply

Workers at the facility will demand water for drinking, washing, and flushing toilets. This demand will be insignificant in terms of resource depletion and impact on the local water supply network.

Mitigation:

N/A

5.4.3 Facility sewage disposal

Sewage generated by workers at the STP facility will be collected and treated on site.

Mitigation:

5.4.5 Use of electricity

The Jamaica Public Service Company Ltd. (JPSCo.) will supply power for the development site from the existing mains. The incremental demand will be within the capacity of the system and this will be confirmed in writing by the utility. The expansion should therefore not cause any supply shortages to the rest of the system. However, this increased demand will commensurately increase the utility‘s use of fossil fuel to generate that electricity, and thus the project will indirectly incur negative impacts associated with greenhouse emissions.

Mitigation:

- *Mitigation measures relate to improving energy management and conservation practices.*
- *Sub-meters and real-time energy monitoring equipment, timers, photoelectric cells, thermostats, etc. should be installed in the villas.*
- *Install translucent shades and fluorescent lighting.*
- *Pipe insulation, tank lagging (not asbestos!) and heat recovery systems should be installed wherever it is practical to do so.*

5.4.6 Odour

Whereas one of the main sources causing odour is scum, overloading of the ponds will also result in odour problems because the treatment capacity will have been exceeded. Wind action on the ponds can also cause odours. Odour is best controlled by proper design and the nuisance risk is reduced by proper alignment of the ponds. The size of the ponds will result in some degree of wave action. The wind is the effective source of aeration through surface mixing, but too much wind action can disturb bottom sediments and also create an odour problem.

The odour caused by scum has already been discussed. However, the scum that is removed must be properly treated. The scum could be treated as a solid waste and could be taken to the Riverton Sanitary Landfill, after appropriate arrangements are made with the National Solid Waste management Authority (NSWMA). Alternatively, the scum should be solar dried, stabilized and then disposed of orr utilized as with the sludge.

Mitigation:
Ensure proper sizing and alignment of the lagoons
Ensure scum is appropriately disposed of or properly stabilized.
The issues of scum and overloading have been addressed above. However it is also important that the effect of wave action be carefully considered in the design. If aggressive wave a action occurs bottom sediments will be disturbed. The proposed radial configuration must be evaluated also against this possible situation. There are lessons are to be learnt from the existing pond sewage treatment plants in Greater Portmore, Negril and Montego Bay.

5.4.7 Habitat Modification

The creation of ponds and associated effluent transportation systems will constitute an enhancement of habitat for certain species including the endangered crocodile and waterfowl. The establishment of the sewage treatment facility is already within the crocodiles' habitat and enhancement of the habitat by the creation of features attractive to the animal, will encourage the animal in the area. In terms of the habitat, this will not result in any displacement of the animal through habitat modification. However, the encouragement of the animal into the operative area (ponds and waterways) of the sewage treatment facility could pose a threat to workers in the area. This is so during the construction phase while activities such as clearing and trenching are ongoing, and during the operation phase while ponds are in use.

Waterfowl, shoe birds and waders already within the habitat of the proposed development site, will be somewhat displaced as their food source will be altered. However, the creation of the ponds adjacent to the wetlands and the Hunt's Bay will mean that species should find alternative feeding grounds in close proximity.

Mitigation

A Management Plan which speaks to the possible interactions of humans and crocodiles, and ways to minimize the potential threat to human welfare, is given in Appendix 5.

5.4.8 Water Quality

Impacts on water quality are anticipated as being only positive impacts, as treated sewage effluent will significantly reduce pollutant loading to the harbour.

Mitigation:

No mitigation measures required.

5.4.9 Flood Hazard

The low lying flat nature of the site and proximity to the Rio Cobre, the coastline and the region's drainage characteristics make the site susceptible to flooding. While the effects of riverine and coastline flooding are assessed to be minimal the obstruction of overland or storm water runoff by the facility can have potential negative impacts.

Mitigation:

Design of a comprehensive storm water drainage system involving the construction of cut-off drains around the facility to intercept excessive overland flow. Adequately sized and configured conduits would control and divert excessive overland flow and discharge it into Hunts Bay.

6. CONSIDERATION OF ALTERNATIVES

The alternatives to the proposed waste water treatment plant is presented below . These include alternate treatment process options, alternate project sites and the no action alternative.

6.1 Alternative treatment options

A comparison of the features of the two main waste water treatment options available is presented below as Table 6.1.

	Oxidation Lagoon Systems	**Waste Activated Systems**
Capital investments	Low	High
Investment in equipment and spares importing costs	Low	High
Energy consumption and operation costs.	Low	High
Ability to function with little control and minimal or no use of electromechanical equipment	High	Low
Area and land requirements	High	Low
Process control	Low	High
Operation and maintenance requirements and requirements of technical sophistication and personnel training	Mediocre – With effluent re-circulation.	High
Ability of equalization of large volumes ability of peak hydraulic loads and	High – Due to large lagoon volumes, long	Low

	Oxidation Lagoon Systems	**Waste Activated Systems**
resistance to shock organic loads.	retention times and high buffer capacity.	
Effluent quality	Mediocre	High
Ability to control the process for removal of substances other than organic, such as nitrogen, phosphorus - to an exact desired concentration.	Low	High
Flow schemes, equipment and installation	Simple - Piping, pumping and reduced pretreatment facilities.	Complex
Removal of pathogenic bacteria, viruses and protozoa	Relatively high due to long detention periods, solar irradiance, especially in Jamaica.	Low
Year round climate in Jamaica	Advantage – utilization of high stable temperatures, humidity and winds for the process.	Disadvantage – accelerated deterioration of equipment, motors due to the humidity and rainfall.

Table 6.1: Comparison of the advantages of Oxidation Lagoon or systems to Waste-Activated sewage systems.

6.2 Alternative site

The Soapberry Lands is the only available site with the size, topography and proximity to Kingston, that is adequate for the installation of the lagoon sewage treatment plant system.

6.3 No action alternative

The No Action Alternative would see the continued release of untreated sewage into the Kingston Harbour system, exacerbating the deterioration of the Harbour ecosystems. The Soapberry Wastewater Treatment Plant is seen as a long awaited option for the treatment of sewage for the Kingston Metropolitan Area.

7. DEVELOPMENT OF AN ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

If a permit is granted for the proposed project, and before site preparation and construction activities begin, the project developers, should submit an Environmental Management and Monitoring Plan to NEPA, **if this is requested by the Agency**. The aim of the Environmental Management and Monitoring Plan is to ensure compliance with relevant legislation, implementation of the mitigation measures, and long-term minimization of negative environmental impacts.

The Monitoring Plan should include a Construction Plan and Schedule with a description of any proposed phasing of activities, recommended mitigation measures, and proposed methods of compliance. The Environmental Management and Monitoring Plan should also include an Inspection Protocol; planned Supervision of Site Preparation and Construction Activities, and implementation of Post Construction Monitoring.

During construction, reports should be submitted to NEPA at intervals, as and if specified by NEPA in the permit.

8. SUMMARY AND CONCLUSIONS

The proposed sewage treatment plant (STP) to be built on the Soapberry Lands in St. Catherine Jamaica is a large scale facility that will ultimately treat all the sewage from the sewered areas of the Kingston Metropolitan Area. The proposed STP will be a recirculated lagoon facility consisting of three arc shaped modules to be constructed in three stages. This system is a low maintenance biological system that will produce high quality effluent after it is filtered through a sand filter before discharge into the nearby Rio Cobre River.

The proposed Soapberry Lands site is located on the north western coastline of Hunts Bay between the Rio Cobre and the Duhaney Rivers on its western and eastern boundaries respectively. The site lies south of the railway and north of the coastal marshland. The site is the southern extension of the St. Catherine alluvial plain that extends southward into a coastal marsh. The site is highly disturbed with both the underlying soils and ecosystems being highly disturbed. Crocodiles are the only species that will require special attention in terms of their potential interaction with humans.

The site lies in the flood plain of both the Rio Cobre and Duhaney Rivers, and is located in an area susceptible to earthquakes, overland stormwater run off and storm surge effects of hurricanes. The flat terrain comprising the project site as well as the protective berm along the Banks of the Rio Cobre will prevent flooding by overbank peak flow of the Rio Cobre. Storm surge effects will be minimized by the sheltered nature of Hunts Bay and the distance of the facility from the coastline. Special attention will have to be given to the design of the facility to ensure diversion of overland flow and adequate safety factors for construction on soils susceptible to ground shaking from earthquakes.

The proposed STP will ultimately receive the sewage produced from sewered areas of Kingston and will have the highly beneficial effect of stopping the pollution of Kingston harbour with untreated sewage. The nature of the proposed system will prevent the production of odours and sludge thus making the facility of little nuisance to the surrounding communities. Effluent quality will be of a high standard and will be discharged into the Rio Cobre which then flows into Hunts Bay. The specified quality of the effluent from the facility will be of a higher quality than the water in the Rio Cobre as well as the water in Hunts Bay.

It is expected that the proposed facility as specified will provide a long term solution to the sewage disposal needs of Kingston and its environs. With proper maintenance and environmental monitoring the facility is not expected to have any adverse effects on the terrestrial or marine environments or on the surrounding communities.

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APPENDICES

APPENDIX 1: JENTECH - SOIL INVESTIGATION REPORT, 2001

(Attached as separate document)

APPENDIX 2: DETAILED DIAGRAMS OF PROPOSED DRAINAGE SYSTEM.

APPENDIX 3: ECOLOGY PLATES

Plate 1: Scrubland

Plate 2: Ponded Area

Plate 3: Existing road through the property

Plate 4: Large pond on site

Plate 5: Ruinate vegetation

Plate 6: Shrubland

Plate 7: Ruinate vegetation – grassland and shrubs

Plate 8: Old building on the property

Plate 9: Mudflats

Plate 10: Ponded area

Plate 11: Area filled in with dredge spoil

Plate 12: Dredge fill areas

Plate 13: Ponded area with vegetation stumps

APPENDIX 4: COMMENTS ON TERMS OF REFERENCE FROM NEPA

Letter from NEPA

November 22, 2004

Mr. Peter Reeson

Director, Environmental Solutions Limited
20 West Kings House Road

Kingston 10

Dear Mr. Reeson:

Re: Comments on Terms of Reference (TORs) for an Environmental Impact Assessment (EIA) for the proposed Sewage treatment Plant at Soapberry, St. Andrew

The National Environment and Planning Agency (NEPA) has reviewed the captioned TORs and the comments are attached for your attention.

Please address these comments as part of the EIA Report to be submitted to NEPA. You are reminded that at least ten (10) copies of the EIA Report will be required, along with an electronic copy to facilitate an expeditious circulation and review.

Do not hesitate to contact us for clarification on any matter.

Yours sincerely

Joseph McCarthy

for Chief Executive Officer

cc: Frances Blair - Manager, Applications Secretariat

Comments on Terms of Reference (TORs) for the Proposed Sewage Treatment Facility at Soapberry, St. Andrew

General Comments

Based on the proposed location for the site, a Geo-technical and Hydrological Study should be conducted.

A Drainage Plan should be developed for approval by the National Works Agency (NWA).

Specific Comments

Task 1 – Description of the Proposed Project

The population or catchment area to be served should be included.

Sludge, as well as oil and grease management and disposal should be addressed.

The facility should be designed to receive and treat septage. Activities surrounding the receival of septage should be covered in the study.

A Risk Assessment of the project should also be conducted.

Task 4 – Determination of Potential Impacts

Wetland habitat disturbance should also be addressed with respect to any potential for impact on crocodiles.

Task 6 – Development of a Monitoring Plan

This caption should read "Development of an Environmental Management and Monitoring Plan".

The Plan should include both Environmental Management and Monitoring.

The Environmental Management and Monitoring Plan should cover both construction and operation phases of the project.

Task 7 – Determination of Project Alternatives

An estimate of the costs associated with each alternative should also be provided.

Section 6 - Report

The significant issues reported on should be related to Tasks 1-8. Data reported should be the most current available.

"Environmental Monitoring Plan" should be revised to "Environmental Management and Monitoring Plan".

The EIA Report shall be presented to the National Environment and Planning Agency (NEPA) for review. At least ten (10) hard copies and an electronic copy of the Report shall be presented.

Applications Processing Branch (APB)

November 19, 2004

APPENDIX 5: DRAFT MANAGEMENT PLAN FOR POTENTIAL INTERACTION BETWEEN HUMANS AND CROCODILES.

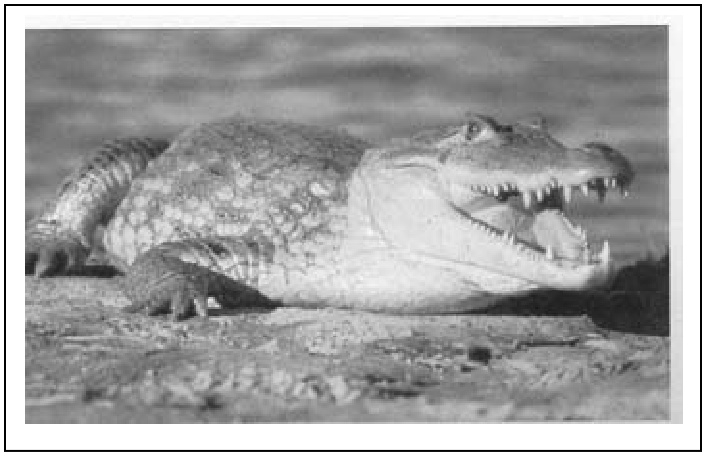

Table of Contents

1.0 Context

This document has been prepared as part of the environmental management services being offered to the Ashtrom Limited regarding the establishment of the Soapberry Wastewater Treatment Plant in St. Catherine. The location of the project area adjacent to the Rio Cobre and Duhaney Rivers and in close proximity to Hunts Bay, is within a known habitat for the endangered American Crocodile *Crocodylus acutus*. This document seeks to identify issues related to the potential interactions between humans and crocodiles, as contact is likely.

There are twenty-one species of crocodiles throughout the world occurring in wetlands, rivers and lakes in the tropics and sub-tropics. Crocodiles are the largest predators in their habitat and can pose a significant threat to humans and their livestock. Worldwide, many species are exploited for their valuable skin. The loss of any crocodilian would be a significant loss to biodiversity as well as global economic potential and ecosystem stability.

The American crocodile (*Crocodylus acutus*) is indigenous to Jamaica occurring naturally in wetland areas where there is brackish water and adequate food. Populations in Jamaica are primarily found along the south coast from St. Thomas to Westmoreland, and on the north coast in Hanover and Trelawny. The population of Jamaican crocodiles is threatened by destruction of wetlands particularly for coastal developments, aquatic pollution, hunting and wanton killing. The mangrove fringed Hunts Bay, the rivers leading into the Bay and the Kingston Harbour environs are known habitats for this species.

2.0 Relevant Legislation

Crocodylus acutus is protected by both national and international legislation. It is illegal to kill or to have in ones' possession any part of the animal. The following legal instruments apply:

2.1 The Endangered Species (Protection, Conservation and Regulation of Trade) Act (1999)

This Act deals with restriction on trade in endangered species, regulation of trade in species specified in the schedule, suspension and revocation of permits or certificates, offences and penalties, and enforcement. Many species of reptile, amphibian and birds that are endemic to Jamaica but not previously listed under national protective legislation, or under international legislation, are listed in the Appendices of this Act.

2.2 Wildlife Protection Act (1945)

The Wildlife Protection Act of 1945 prohibits removal, sale or possession of protected animals, use of dynamite, poisons or other noxious material to kill or injure fish, prohibits discharge of trade effluent or industrial waste into harbours, lagoons, estuaries and streams, and Authorizes the establishment of Game Sanctuaries and Reserves. Protected under the Wildlife Protection Act are six species of sea turtle, one land mammal, one butterfly, three reptiles and several species of birds including rare and endangered species and game birds.

2.3 Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) (1983)

Adopted in March 1983 in Cartagena, Colombia, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, also known as the Cartagena Convention, is the only legally binding environmental treaty for the Wider Caribbean. The Convention came into force in October 1996 as a legal instrument for the implementation of the Caribbean Action Plan and represents a commitment by the participating governments to protect, develop and manage their common waters individually and jointly.

Ratified by twenty countries, the Cartagena Convention is a framework agreement which sets out the political and legal foundations for actions to be developed. The operational Protocols, which direct these actions, are designed to address special issues and to initiate concrete actions. The Convention is currently supported by three Protocols. These are:

The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;

The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region (The SPAW Protocol), which was adopted in two stages, the text in January, 1990 and its Annexes in June, 1991. The Protocol entered into force in 2000;

The Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region (LBS Protocol), which was adopted in October, 1999.

2.4 Biodiversity Convention

The objectives of the Convention on Biological Diversity are "the conservation of biological diversity, sustainable use of its components and the fair equitable sharing of the benefits arising out of the utilization of genetic resources". This is the first global, comprehensive agreement which has as its focus all aspects of biological diversity: genetic resources, species and ecosystems. The Convention acknowledges that the "conservation of biological diversity is a common concern of humankind and an integral part of the development process". In order to achieve its goals, the signatories are required to:
Develop plans for protecting habitat and species.
Provide funds and technology to help developing countries provide protection.
Ensure commercial access to biological resources for development.
Share revenues fairly among source countries and developers.
Establish safe regulations and liability for risks associated with biotechnology development.

Jamaica’s Green Paper Number 3/01, entitled Towards a National Strategy and Action Plan on Biological Diversity in Jamaica, speaks to Jamaica’s continuing commitment to its obligations as a signatory to the Convention.

2.5 Convention for International Trade in Endangered Species of Flora and Fauna (CITES) (1975)

The CITES Convention aims to regulate international trade in animas and plants that are, or may be threatened, to ensure that the trade is sustainable and not threatening to the survival of the species. CITES is one of the largest and most important treaties on species conservation, and has more than 150 countries signatory to the convention. *Crocodylus acutus* is listed on Appendix I of CITES where no commercial trade is allowed.

3.0 Reasons for Potential Interactions

3.1 Project Location in Habitat

Crocodiles are known to inhabit the mangrove areas adjacent to the Rio Cobre, the Duhaney River and Hunts Bay.

3.2 Site Preparation and Construction Activities

During the site preparation and construction phases for the treatment ponds and associated transmission lines, particular works such as trenching and pipe laying will provide new niches for individuals and also opportunities for direct contact with humans. Experience with other projects that have similar activities has shown that crocodiles do take advantage of trenches and pipes laid, and water bodies created.

4.0 Plan of Action

4.1 Sensitization of Project Staff and Contractors

Sensitization Sessions should be scheduled and held with project staff that are likely to be in contact with the crocodiles, through working in their habitat. These sessions should be conducted by NEPA and assisted by other organizations that constitute the Crocodile Rescue, Research and Operations Committee, as necessary.

Topics to be covered in the Sensitization Session should include, but not necessarily be limited to, the following:

Description and Basic Biology of the Species

Preferred Habitats
Behavioral Patterns
Breeding Season
Preferred Nesting Areas
Basic Do’s and Don’ts if an interaction occurs
Emergency numbers to call

Copies of the NEPA brochure entitled *Crocodiles - The last of the dinosaurs* should be made available to the project team.

4.2 Increased Diligence During the Breeding Season

During the breeding season (March to August) there should be increased diligence and awareness of the project staff. This is because females can become more aggressive in the protection of nesting areas and their young. A Sensitization Session should be conducted at the beginning of the breeding season in March, and half-way through the breeding season in June, during each year of construction.

4.3 Solid Waste Management

All waste material should be disposed of in an appropriate manner using designated bins and/or skips and collected by a certified waste removal company. This is essential as adult crocodiles will scavenge through garbage dumped along rivers, in wetlands and along beaches, particularly if their regular food supply of birds, frogs, crabs, snakes and fish, is low. All work sites should be adequately equipped with skips which are emptied regularly by an approved contractor. Kitchens and lunch areas should be kept clean and food waste removed daily.

4.4 Reporting Procedure

If a crocodile is observed in the project area, in a trench, pipe, river or canal the project management team must be immediately informed by the site staff or contractors, and they will contact NEPA. NEPA would be responsible for the dispatch of a qualified individual to visit the site and assist in the restraint and removal of the animal, if it is posing a threat to workers, or its presence has resulted in the cessation of construction activities. Project staff or contractors should make no attempts to tie, secure or capture any crocodile.

4.5 Security

Security is an issue to be considered for the project. Security in the form of fencing may also be required to restrict access to the ponds by crocodiles, and to minimize the potential for human/crocodile interactions.

4.6 Monitoring

Monitoring should be carried out, if required by NEPA and any conditions specified in the environmental permit. Monitoring Reports should be submitted to NEPA for review and approval as required. NEPA should also routinely conduct their own site inspection and monitoring of the project works.

References

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