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February 18, 2008
File No.: 2231-27303-1.2

Deep Bay Waterworks District
RR 1, Site 150, C4
Bowser, BC V0R 1G0

Attention: Ms. Leslie Carter, Administration

Reference: Deep Bay Waterworks District –
Water System Evaluation February 15, 2008

Dear Ms. Carter:

The above-referenced study has been revised to address the District's review comments and is now issued as a Final Report. Nine (9) bound copies were sent by courier on February 18, 2008. Enclosed find one (1) un-bound copy for your records.

The final report includes the following two (2) changes in addition to some minor edits:

- Capital Works that Serve Existing Customers is expanded to include main replacement on Longview Road.
- Capital Works that Serve Future Development is expanded to include a dedicated reservoir feed line.

Recommended Capital Expenditure Cost Charge is increased to $6500 per door to reflect this additional work.

Please contact our office if you have any questions.

Yours truly,

McElhanney Consulting Services Ltd.

Russ Irish, P.Eng.
Senior Project Engineer

RRI:cms
Enclosures

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DEEP BAY WATERWORKS DISTRICT

WATER SYSTEM EVALUATION

February 15, 2008

Prepared by:

McElhanney Consulting Services Ltd.
Suite 1, 1351 Estevan Road,
Nanaimo, BC V9S 3Y3

Deep Bay Waterworks District
Water System Evaluation
February 15, 2008

Executive Summary

The Deep Bay Waterworks District was established in 1972 and serves 565 customers. The District implemented a universal metering program in 2004/2005 resulting in a marked decrease in water consumption. The District's current Capital Works Plan and Capital Expenditure Cost bylaw were established using demand projections that are now out of date. This study updates the District's Capital Works Plan and Capital Cost Expenditure Plan based on current demand and current growth projections.

Average Day demand is lowered to 850 litres per customer per day. The existing available land base offers the community a build-out potential of 1080 customers. This equates to approximately 23 years of growth at an historic rate of 3% per year.

Design criteria are proposed and the existing system is assessed to identify a list of Capital Works that are required to upgrade the system to meet current need and to accommodate projected growth. The following Funding Options are identified and discussed:

- Renewal Reserve Fund;
- Borrowing;
- Capital Expenditure Charges;
- Condition of Subdivision; and
- Latecomer Charges.

This study recommends that funding for Capital Works be split as follows:

- Capital Works that Serve Existing Customers to be funded through a Renewal Reserve Fund. Total value of these works is $1.58 million
- Capital Works that Serve Future Development to be funded through Capital Expenditure Charges levied against new customers. Total value of these works is $3.34 million.

Capital Works Projects funded through the Renewal Reserve Fund are proposed for 2008, 2012, 2015, 2017 and 2018. Capital Works Projects funded through Capital Expenditure Charges to be constructed as warranted when funds are available. Construction of CEC projects may be triggered by development.

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APPENDICES

DRAWINGS

1.0 EXISTING SYSTEM

1.1. Background

The Community of Deep Bay is located on the east coast of Vancouver Island within the Regional District of Nanaimo. The local water distribution system serves an area of approximately five square kilometers that borders the Strait of Georgia for a distance of five kilometers. The community is primarily residential with limited commercial land use.

The Deep Bay Water System serves 565 customers and is owned and managed by the Deep Bay Waterworks District. The District's toll structure is based on a metered rate and revenue is used to fund operating costs, administration, maintenance and upgrades that benefit current users.

The Water District Boundary is shown on Figure1.1

1.2. Administration

The Deep Bay Waterworks District was established by an Order in Council in 1972. The District is managed by a Board of Trustees who meet monthly to administer the Board's business. The Water District administers the Deep Bay Fire Protection District and occupies an office in the Fire Station.

The Water District is staffed by an Administrator and one Clerk. Maintenance is provided under contract.

1.3. Water Supply

Water supply for the Deep Bay Water System is provided by seven wells that are located generally north and south of the Island Highway for a distance of 700 meters either side of Gainsburg Road. Water from these wells is pumped directly into the distribution system. Wells are summarized in Table 1.1

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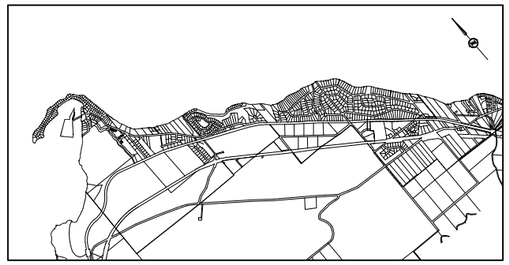


LEGEND

DEEP BAY WATER DISTRICT BOUNDARY
BOWSER WATER DISTRICT BOUNDARY

SCALE : 1:20000

0 100 200 400 600 800m

(ALL DIMENSIONS ARE IN METRES)

DEEP BAY WATERWORKS DISTRICT

WATER SYSTEM EVALUATION - JANUARY 2008

FIGURE 1.1 - WATER DISTRICT BOUNDARY

Designed: RRI	Checked: –	Date: JAN 2008	Drawing No. 27303-1-1
Drawn: JAD	Surveyed: –		Revision: A
MCSL Project No. 2231–27303–1			

Table 1.1 – Deep Bay Water District – Water Wells

	Location	Year Drilled	Capacity
Well 1	Adjacent to Fire Hall on Gainsburg Road	1973	4.8l/s (65 IGPM)
Well 2	North of Highway, 700 m west of Gainsburg Road	1973	3.0 l/s (40 IGPM)
Well 3	100 meters east of Well 1	1969	5.7 l/s (75 IGPM)
Well 4	South of Highway opposite Gainsburg Road	1977	5.3 l/s (70 IGPM)
Well 5	South of Highway, 400 meters east of Gainsburg Road	1985	10.0 l/s (130 IGPM)
Well 6	South of Highway, 200 meters east of Gainsburg Road	1990	9.0 l/s (120 IGPM)
Well 7	120 meters south of Well 6	1996	Not in Production
Well 8	South of Highway, 600 meters east of Gainsburg Road	1997	11.0 l/s (145 IGPM)
		Total Well Capacity	48.8 l/s (645 IGPM)

1.4. Water Treatment

Raw water supplied to the Deep Bay Water System is not treated. Water samples were taken and tested for chemical and bacteriological characteristics as part of the Pacific Hydrology Consultants study dated March 29, 2007. Test results were compared to maximum acceptable concentration limits as specified in Guidelines for Canadian Drinking Water Quality. PHCL found that "*The quality of groundwater at Deep Bay is excellent and there are no signs that it is changing. Normal precautions to protect a shallow unconfined aquifer should be adequate to protect water quality. The chance of an accident or other event which could endanger the quality of water from several wells is remote.*"

The District samples water from the system on a regular basis and samples are tested for Bacteriological Indicators. Samples are tested for Chemical and Physical parameters yearly. Test results have not raised concern.

1.5. Water Storage

Water storage for the Deep Bay Water Distribution System is provided by an above ground concrete reservoir located on the hillside south of the Island Highway. This structure was built in 1975 and provides 545 cubic meters (120,000 Imperial Gallons) of storage. This reservoir is divided in half by a vertical wall and both sides can operate independently.

1.6. Water Distribution System

The Deep Bay Water System has been constructed in Phases over a period of more than 4 decades. The original lines were built before the District was established in 1972. Approximately 80% of the system was constructed using Asbestos Cement (AC) pipe, and the remainder is Polyvinyl Chloride (PVC) pipe.

The majority of the lines were constructed with 150 mm (6 inch) diameter pipe. Larger pipe was used along Gainsburg Road and Thompson Clark Drive to provide a trunk main, and smaller 100 mm (4 inch) diameter pipe was used for short dead end lines and within the Longview, Seaview and Shoreline Drive subdivision. Network analysis has shown that smaller lines restrict the capacity of the system to provide Fire Flows, and in some cases lines would need to be upgraded to meet the insurance industry's recommended guidelines.

AC pipe went out of common use in the mid 1970's when PVC became available. Since that time many communities have experienced problems with deterioration and eventual failure of their AC pipe system. This problem results from a combination of the following factors:

- Failures are most prevalent in districts that use a surface water supply that tends to be slightly more acidic than ground water. This 'soft' water attacks the cement and reduces pipe strength.
- AC pipe is a brittle material that is prone to crack when subjected to uneven loads due to trench settlement, slope movement or vehicle loads.
- Insufficient bedding during installation may result in point loads against the outside of the pipe that result in high stress and pipe failure.

The eventual cost of replacing AC water mains will be a large expense and many communities in BC have adopted AC pipe replacement programs to spread this cost out over time. The warrant for immediate action is assessed on a case by case basis depending on factors that relate to a specific community. The Deep Bay Waterworks District should give consideration to this issue and adopt an

appropriate course of action. As discussed later in this report some of the smaller diameter AC mains also warrant replacement to provide increased capacity.

1.7. Previous Studies and Standards

The following reports and standards are referenced in this study;

- Completion Report, Ground Water Study at Deep Bay Waterworks District. Pacific Hydrology Consultants Ltd., March 29, 2007
- Completion Report, Installation and Testing of Well 8-97 and Re-evaluation of groundwater supply potential for Quadra Sand Aquifer at Deep Bay, Pacific Hydrology Consultants Ltd. November 25, 1997
- Implications of October 1996 Aquifer Test of Deep Bay Water Wells installed within DL 28, west of the Island Highway, to the installation of additional Production Wells, Pacific Hydrology Consultants Ltd. March 21, 1997
- Deep Bay Waterworks District, 2003 Report on Water System. John Motherwell and Associates Engineering Ltd.
- Deep Bay Waterworks District, 2004 Report on Water System. John Motherwell and Associates Engineering Ltd.
- Local Government Act
- Improvement District Manual, March 2006. BC Ministry of Community Services.
- Design Guidelines for Rural Residential Community Water Systems, 2004, Land and Water British Columbia, Inc.
- Water Supply for Public Fire Protection, 1999, Fire Underwriters Survey – A Service to Insurers and Municipalities.
- Guidelines for Canadian Drinking Water Quality.

1.8. Previous Identified Capital Projects

Studies undertaken by Motherwell in 2003 and 2004 identify the following eight Capital Projects as required to meet future demand:

- Well # 9
- Two Cells of Storage
- Pumping Main
- Western Trunk Main
- DL 28 Main
- Jamieson Road Pipeline
- Eastern Trunk Main

- Monitoring and Alarm System

The Jamieson Road Pipeline was constructed in 2006, however the other projects identified remain outstanding.

The implementation of universal water metering throughout the District in 2004 and 2005 has changed the conditions under which these projects were identified. In particular, the rate of consumption has dropped. This report will reassess those requirements with respect to present conditions and will set new priorities for Capital Works Projects.

2.0 DESIGN POPULATION

2.1 Population Served

The population served is defined as the product of the population density expressed as persons per dwelling unit (ppdu) and the number of services. Regional District of Nanaimo electoral area H includes Deep Bay, Bowser and adjacent areas to the west. The 2006 Canada Census counted a total population of 3474 persons and 1573 Private Dwellings (occupied by usual residents) in Area H. The resulting population density is 2.2 ppdu.

The Deep Bay Waterworks District currently services 565 customers within the boundaries defined for both the Water District and the Fire Protection District. Using a population density of 2.2 ppdu we estimate the current population served by the DBWD at 1243 persons.

2.2 Zoning and Land Use

Zoning and land use within the Deep Bay Waterworks District is regulated by the Regional District of Nanaimo. Current designations within the District are limited to six zones. A summary of those zones is provided in Table 2.2.

Table 2.2 – Current Zoning within the Deep Bay Water District

Zone	Land Use Restrictions
Rural 1 (RU 1)	- Permits agriculture, aquaculture, silvaculture, and residential - One dwelling allowed on parcels smaller than 2.0 hectares - Two dwellings allowed on parcels larger than 2.0

Zone	Land Use Restrictions
	hectares
Resource Management (RM1)	- Permits agriculture, aquaculture, silvaculture, forestry related activities and residential - One dwelling allowed on parcels smaller than 8.0 hectares - Two dwellings allowed on parcels larger than 8.0 hectares
Residential 2 (RS2)	- Permits residential and home-based businesses - One dwelling allowed on parcels larger than 0.2 hectares
Residential 3 (RS3)	- Permits residential, home based businesses and multiple dwelling units - One dwelling on parcels larger than 0.2 hectares
Commercial 5 (CM5)	- Permits a variety of commercial uses primarily related to tourism plus resort condominium and residential
Public Use (PU1D)	- Permits personal care, public assembly, public utility and school use - One dwelling unit per parcel

Several large parcels within the Deep Bay Waterworks District are designated as Agricultural Lands under the Agricultural Land Reserve Act (ALR). Parcels identified as ALR are typically restricted from development and must be re-classified to allow residential development.

Future development within the District is restricted, in part, by current Official Community Plan, Zoning and ALR designations. Experience has shown that changes will occur to these designations in response to development pressure. This study develops a plan for system expansion based on an assumption of continued future growth.

2.3 Growth Potential

The potential for growth of the Water District is divided into three components: Housing Construction; Property Development; and, Boundary Expansion. We comment on these three components as follows:

Housing Construction

There are currently a small number of remaining vacant lots within the Deep Bay Waterworks District. We have assumed that all of these lots have the potential to be developed with a single family house and our analysis assumes 100% build-out.

Property Development

We have identified eleven additional areas within the District Boundaries with potential for development. Development potential for each of these areas may be constrained by site conditions, zoning, ALR designation and other factors. Analysis of those factors is beyond the scope of this report and therefore general assumptions have been made to estimate the aggregate growth potential due to property development.

Areas with potential to develop are identified on Figure 2.1. Parcel size, current land use designation and potential lot yield is presented as a table on that figure. The total un-developed land area is 145 hectares and we estimate the total housing potential as 515 units representing 91% growth.

Boundary Expansion

The list of properties included in the original Letters Patent did not include a number of individual parcels that are located within the general boundaries of the District. Those properties were intentionally left out because the owners at the time did not petition for inclusion. Over the subsequent years, several of these properties have applied to join the District and the Letters Patent have been amended to include them. We understand that the remaining properties will join the District under a current petition process and we have included those properties in our analysis.

We are not aware of any other proposals to expand the boundaries of the Water Improvement District. No additional allowance is made for this type of growth.

2.4 Future Population

The number of customers served by the District has increased from 196 in 1979 to 565 in October, 2007. That increase represents a total growth of 188% in 28 years. Rapid initial growth of 15% per year was seen in the first two years followed by fairly steady growth at an average rate of 3% per year (compounded

annually). Continued growth is expected as properties are developed and homes are built.

We estimate the total growth to build-out of vacant or under-developed land within the current boundaries of the Water District is 515 units. Assuming growth at the historic average rate of 3% per year (compounded annually), this threshold will be realized in the year 2030. Thus a design population of 2376 persons with 1080 connections represents a 22-year growth projection.

Historic and projected growth within the District is illustrated on Figure 2.2.

3.0 WATER DEMAND

3.1 Water Consumption

The District's Maintenance Contractor provides a monthly report to the Board on system operation. Those reports include a record of pump operation and water consumption. As discussed, the District implemented a universal metering program in 2004 and that program has been very successful in reducing water consumption.

Water demand rates used in this report are defined as follows:

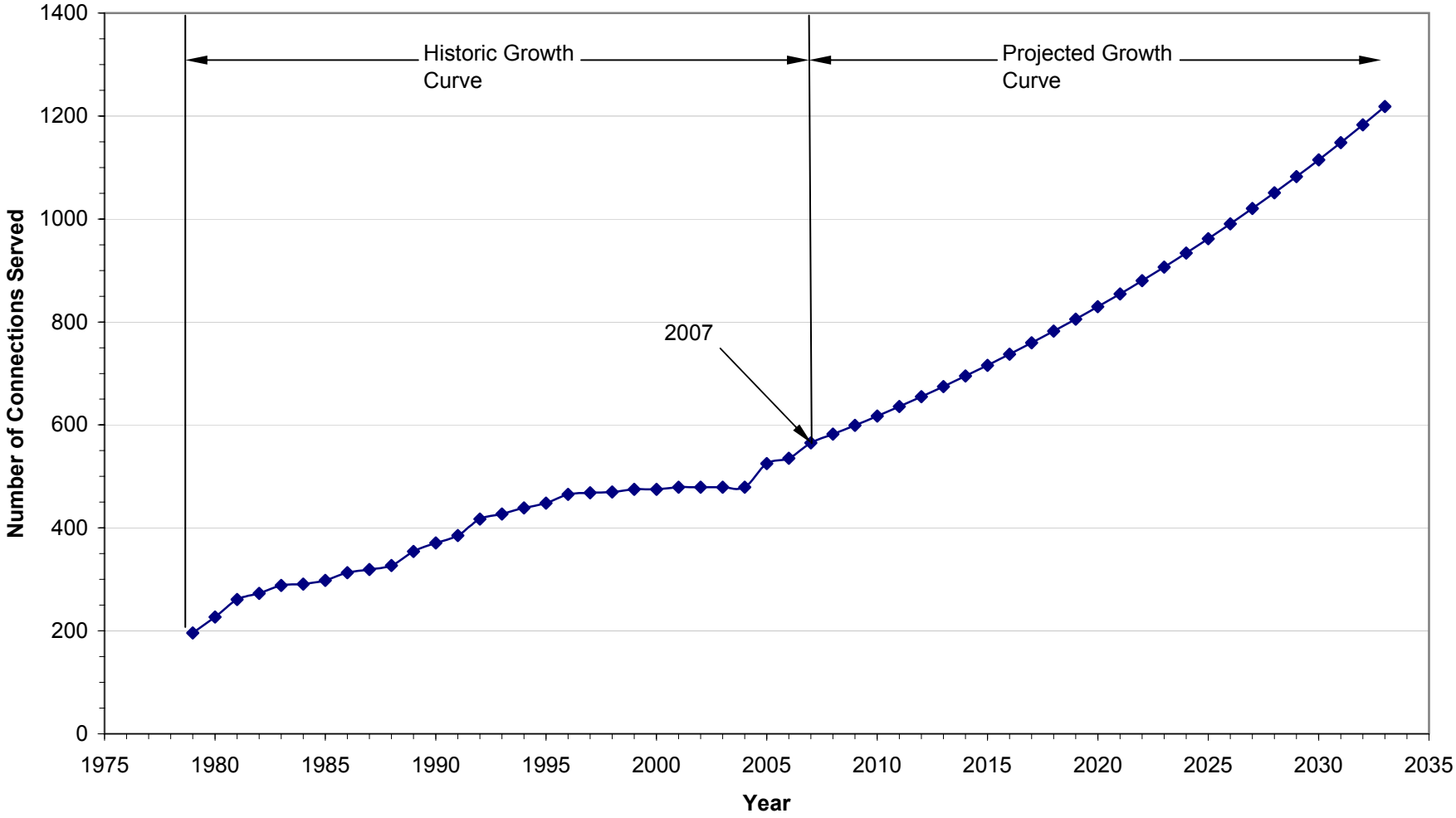
Average Day Demand (ADD) is the average daily rate of consumption in a given year. For Deep Bay Waterworks District the ADD is calculated by dividing the total consumption from 12 consecutive months of record by the number of days in that record period.

Maximum Month Demand (MMD) is the average daily rate of consumption for the single highest demand month of the year. For Deep Bay Waterworks District the MMD is calculated by dividing the total consumption for the highest demand month by the number of days in that record period.

Maximum Day Demand (MDD) is the rate of consumption during the single highest demand day of the year. The Deep Bay Waterworks District does not record daily water consumption; therefore Maximum Day Demand is calculated using Average Day Demand and a representative peaking factor.

Peak Hour Demand (PHD) is the rate of consumption during the highest demand hour of any day during the year. The Deep Bay Waterworks District

Deep Bay Waterworks District - Water System Evaluation (January 2008)
Figure 2.2 - Historic and Projected Growth Curve
Annual Growth Rate of 3.0% (Compounded)



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does not record hourly water consumption; therefore Peak Hour Demand is calculated using Average Day Demand and a representative peaking factor.

Water consumption records for the period of January 2004 to October 2007 have been compiled and are presented in Appendix 1. That data is plotted in Figure 3.1. With reference to Figure 3.1, we note the following observations:

- Summer time water consumption is many items higher than winter time consumption. This increase in consumption can be explained by lawn and garden watering, the increased use of recreational residences during the summer months, and permanent residents who may vacation for extended periods in the winter months.

- Summer peak water consumption in July 2004 was 60,000 cubic metres (13.2 million Imperial Gallons); summer peak water consumption in June 2007 after three years of metering was 25,000 cubic metres (5.5 million Imperial Gallons).

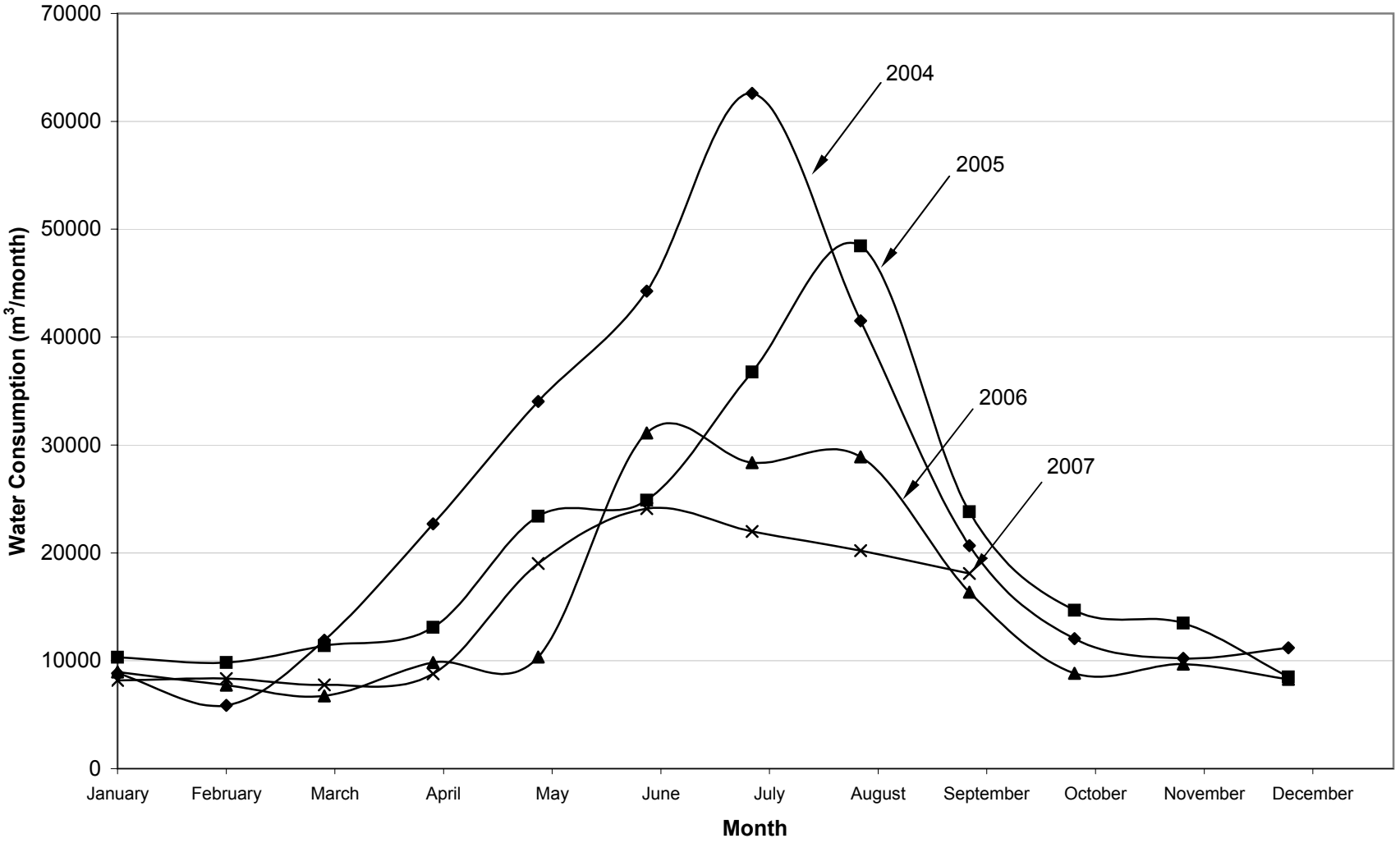
- Winter average water consumption has dropped by approximately 20%. This decrease in consumption can be explained by the repair of leaks identified through water metering.

The data in Appendix 1 has been used to calculate total annual consumption, average annual consumption per dwelling unit, and summer time peaking factor. Those results are presented in Table 3-1.

Table 3-1 – Summary of Water Consumption Data

Year	Number of Services	Total Annual Consumption m^3 (million imperial gallons)	Average Day Demand for Year (ADD) m^3/service (imperial gallons/service)	Total Highest Monthly Consumption m^3 (million imperial gallons)	Maximum Month Demand (MMD) m^3/service (imperial gallons/service)	Maximum Month Demand Peaking Factor
2004	525	286,184 (63.0)	1.49 (328)	62,602 (13.8)	4.0 (881)	2.7
2005	525	238,599 (52.6)	1.25 (275)	48,454 (10.7)	3.08 (678)	2.5
2006	538	175,216 (38.6)	0.89 (196)	31,128 (6.85)	1.92 (423)	2.2
2007	556	163,378 (36.0)	0.80 (176)	24,107 (5.31)	1.44 (317)	1.8

Deep Bay Waterworks District - Water System Evaluation (January 2008)
Figure 3.1 - Water Consumption for the Period January 2004 to October, 2007



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With reference to Table 3-1 we find the peaking factor for Maximum Month Demand has dropped from 2.7 in 2004 to an average of 2.0 in 2006 and 2007.

Peaking factors used to calculate Maximum Day Demand and Peak Hour Demand will vary from one community to the next depending on population, the customer mix (residential, commercial and industrial water users), climate, lifestyle and other factors. A review of the available literature gives a typical range for MDD peaking factor of 1.5 to 3.0. Likewise the typical range for Peak Hour Demand peaking factor is 2.5 to 7.0.

Smaller communities typically have higher peaking factors and we recommend the following peaking factors for use in this study:

Maximum Day Demand	3 times Average Day Demand
Peak Hour Demand	6 times Average Day Demand

An Average Day Demand of 0.85 m^3 / service (187 imperial gallons / service) based on 2006 and 2007 recorded consumption has been used in this study.

3.2 Design Criteria

Design criteria used for sizing the various water system components are provided in a number of the referenced standards and guideline documents. With reference to these standards and guideline documents, we recommend the following design criteria for the Deep Bay Waterworks District.

Water Supply

The total developed groundwater capacity, or dependable yield of the wells should equal or exceed the design Maximum Day Demand. The groundwater sources need to sustain this rate of flow continuously for 100 days in the summer, during which the aquifer would not be recharged by precipitation and without utilizing more than 70% of the available drawdown below the lowest seasonal static groundwater table. (Reference Design Guidelines for Rural Residential Community Water Systems.)

Water Treatment

Where there are problems with the potability of the source or aesthetic concerns, the provision of treatment may be a condition of source approval. (Reference Design Guidelines for Rural Residential Community Water Systems.)

Water Storage

Provide storage for balancing, emergency use and fire protection. Balancing storage should not be less than 25% of the Maximum Day Demand. Also emergency storage should not be less than 25% of Maximum Day Demand. (Reference Design Guidelines for Rural Residential Community Water System.)

An adequate water system can deliver fire flow plus maximum day demand for the required duration of fire flow. (Reference Water Supply for Public Fire Protection, FUS.)

Distribution System

Water distribution systems are sized to supply peak water consumption. The critical design criteria are typically based on either, Maximum Day Demand plus Fire Flow or Peak Hour Flow. MDD plus Fire Flow is found to be the more stringent requirement for smaller water systems and has been used as the design case for this study.

System Pressure

The working pressure at peak hourly flow should range between 275 kPa (40 psi) and 700 kPa (100 psi). (Reference Design Guidelines for Rural Residential Community Water Systems.)

A minimum residual water pressure of 150 kPa (20 psi) in the street main is required during fire flows. (Reference Water Supply for Public Fire Protection, FUS.)

Hydrant Spacing

Hydrant location should be convenient for fire department use. *Water Supply for Public Fire Protection*, (FUS.) recommends a hydrant spacing of not more than 180 meters in single family residential areas. *Design Guidelines for Rural Residential Community Water Systems* recommends a hydrant spacing of not more than 300 meters.

3.3 Fire Demand

Fire flow requirements are presented for a typical single family residence and the Bowser Elementary School using criteria outlined by Fire Underwriters Survey (FUS). Those fire flow calculations are included as Appendix 2.

The FUS Guidelines also offer recommendations for the duration of fire flow based on the fire flow required. Calculation results for the Deep Bay Water Works District are presented in Table 3-2. We have assumed that all wells are operating to supplement reservoir storage during fire flow conditions.

Table 3-2 – Fire Flows based on Fire Underwriters Survey Guidelines

Location	Calculated Fire Flow	Well Supply	Fire Duration	Required Fire Storage
Single family Residences	70 l/s (930 IGPM)	48.8 l/s (645 IGPM)	1.55 hours	118 m^3 (26,000 Igal)
Bowser Elementary School	53 l/s (700 IGPM)	48.8 l/s (645 IGPM)	1.3 hours	20 m^3 (4300 Igal)

3.4 Projected Water Demand

Projected water demand for build-out of the un-developed land base has been calculated based on current rates of consumption, projected growth, and peak factors. Future water demand is presented in Table 3.3.

Table 3.3 – Projected Water Demand

Year	Number of Services	Average Consumption	Average Day Demand (ADD)	Maximum Day Demand (MDD)	Peak Hour Demand (PHD)
2007	565	0.85 m^3/service/ day	480 m^3/day	1440 m^3/day	2880 m^3/day
		0.01 l/s/service	5.6 l/s	16.7 l/s	33.4 l/s
2030	1080	0.85 m^3/service/ day	918 m^3/day	2754 m^3/day	5508 m^3/day
		0.01 l/s/service	10.6 l/s	31.9 l/s	67.8 l/s

4.0 SYSTEM ANALYSIS

4.1 Water Supply and Storage

Water Supply

Projected MDD for the year 2030 is 2754 Cubic Meters per day (607,000 Imperial Gallons per day). The existing eight wells provide a combined capacity of 48.8 l/s (645 IGPM) or 4216 Cubic Meters per day (930,000 Imperial Gallons per day). Additional capacity would be available by bringing Observation Well 7 into production. Existing well capacity exceeds projected future MDD, therefore no further well development is required for the term of this study.

Water Storage

Our calculation of total water storage requirement for the year 2030 is summarized as follows:

Balancing Storage (25% of MDD)	688 m^3	(151,000 Igal)
Emergency Storage (25% of MDD)	688 m^3	(151,000 Igal)
Fire Storage (fire flow less well capacity)	118 m^3	(26,000 Igal)
Total Storage Requirement	1494 m^3	(328,000 Igal)
Current Storage	545 m^3	(120,000 Igal)
Additional Storage Requirement	949 m^3	(208,000 Igal)

4.2 Computer Model

A computer model that was previously developed for the Deep Bay Water System was used to assess the capacity of a distribution system to meet delivery requirements.

Model inputs define the physical characteristics of the system and the anticipated flows. The distribution system is modeled as a network of pipes interconnected at nodes. Pipes in the model are assigned the physical characteristics of pipes in the field (length, diameter and roughness), the nodes define the points of connection between the lines and define the points of water demand in the system (both domestic and fire flows).

Model outputs include the flow and head loss along each line and the pressure at each node. Pipes and nodes are shown on Figure 4.1. Computer model output is included as Appendix 3.

4.3 Model Scenarios

The model was used to assess a number of scenarios to confirm the system upgrades that are required to meet projected water demands. Modeled scenarios are presented in Table 4.1.

Table 4.1 – Water Model Scenarios

SCENARIO	MODELED DEMAND	OBSERVATIONS
Scenario 1.1 - Existing System, Year 2007 flows	MDD plus Fire at south end (Maple Guard Drive)	System can deliver a fire flow of 60 l/s with a residual pressure of 140 kPa (790 IGPM at 20 psi)
Scenario 1.2 - Existing System, Year 2007 flows	MDD plus Fire at school	System can deliver a fire flow of 70 l/s with a residual pressure of 150 kPa (920 IGPM at 22 psi) *note: hydrant test yields 79 l/s, residual unknown*
Scenario 1.3 - Existing System, Year 2007 flows	MDD plus fire at north end (Deep Bay Drive)	System can deliver a fire flow of 38 l/s with a residual pressure of 160 kPa (500 IGPM at 23 psi) *note: hydrant test yields 24 l/s, residual unknown*

SCENARIO	MODELED DEMAND	OBSERVATIONS
Scenario 1.4 - Existing System, Year 2007 flows	MDD plus Fire at south end of Shoreline Drive	System can deliver a fire flow of 20 l/s with a residual pressure of 280 kPa (260 IGPM at 40 psi) *note: hydrant test yields 38 l/s partway along Rd., residual unknown*
Scenario 2 – Add DL 28 Main, Year 2030 flows	MDD plus Fire at south end (Maple Guard Drive)	System can deliver a fire flow of 63 l/s with a residual pressure of 140 kPa (830 IGPM at 20 psi)
Scenario 3 – Add DL 28 Main and Morgan Loop, Year 2030 flows	MDD plus Fire at south end (Maple Guard Drive)	System can deliver a fire flow of 70 l/s with a residual pressure of 260 kPa (920 IGPM at 38 psi)
Scenario 4 – Add DL 28 Main, Morgan Loop , and Pumping Main, Year 2030 flows	MDD plus Fire at south end (Maple Guard Drive)	System can deliver a fire flow of 70 l/s with a residual pressure of 270 kPa (920 IGPM at 39 psi)
Scenario 5 – Us-size Shoreline Drive with a 150 mm main, Year 2030 flows	MDD plus Fire at south end of Shoreline Drive	System can deliver a fire flow of 65 l/s with a residual pressure of 170 kPa (860 IGPM at 25 psi)
Scenario 6 – Add main connecting Well 2 to Mountainview Road, Year 2030 flows	MDD plus fire at north end	System can deliver a fire flow of 45 l/s with a residual pressure of 170 kPa (590 IGPM at 24 psi)
Scenario 7 – Add Western Trunk Main from Reservoir to Crome Point Rd., Year 2030 flows	MDD plus fire at north end (Deep Bay Spit)	System can deliver a fire flow of 52 l/s with a residual pressure of 170 kPa (690 IGPM at 24 psi)
Scenario 8 – Add Western Trunk Main and up-size Crome Pt Rd. to 150 mm, Year 2030 flows	MDD plus fire at north end (Deep Bay Spit)	System can deliver a fire flow of 61 l/s with a residual pressure of 145 kPa (810 IGPM at 21 psi)

4.4 System Pressure and Hydrant Spacing

System Pressure

Line pressure in the Deep Bay Water System varies between 320 kPa (46 psi) at Mountainview Drive and 910 kPa (130 psi) at sea level. An on-line pressure reducing valve is used on Gainsburg Road between Hembrough Road and Burne Road to reduce static pressures along Crome Point Road, Burne Road, and Deep Bay Drive. No pressure reduction is provided on the 100 mm diameter (4 inch) main that runs along Shoreline Drive. Pressure reduction is currently provided at each residence. Installation of a PRV may prolong the life of that line.

Hydrant Spacing

The Deep Bay Water system has 53 hydrants with an average spacing of 230 meters. The range of spacing between hydrants varies from 100 meters to 350 meters and generally meets criteria established by the Province for Rural Residential Community Water Systems.

5.0 CAPITAL WORKS

The Local Government Act provides a Local Improvement District with several methods to fund a Capital Works project. In general these funding options are developed to fund two different types of projects:

- Projects required to serve existing customers; and,
- Projects required to serve future development.

These funding methods are described as follows:

5.1 Funding for Projects that Serve Existing Customers

Renewal Reserve Fund

Renewal Reserve Funds allow a Local Improvement District to put money aside to finance the cost of renewing capital infrastructure. This saving mechanism can reduce or eliminate the amount of borrowing required to construct future works. Renewal Reserve Funds can be formally established with a bylaw

passed by the Board of Trustees and registered with the Inspector of Municipalities. Funding sources typically include the following:

- Operating surpluses
- Budgeted annual contributions
- Miscellaneous revenue items
- Sale of assets

Short Term Borrowing

The Board of Trustees is authorized to pass borrowing bylaws as required to meet approved expenditures. Short term borrowing is typically used to fund unexpected costs and to provide interim financing for capital projects. Temporary borrowing bylaws are registered with the Inspector of Municipalities and are secured by the toll and taxing powers of the Improvement District.

Long Term Borrowing

The Local Government Act allows an Improvement District to borrow money by issue and sale of notes, bonds debentures and other securities. In practice this method of borrowing is arranged through the Municipal Finance Authority and is guaranteed by the Province. Long term borrowing bylaws and associated documents are prepared by the Ministry of Community Services.

5.2 Funding for Projects that Serve Future Development

Capital Expenditure Charges

The ability of a Water Improvement District to serve future development may be restricted by the system's capacity to meet that additional demand. Upgrades to the system that are required to meet this increase in demand, but are not tied to a single specific development project are typically funded through a Capital Expenditure Charge (CEC) Fund.

The Deep Bay Waterworks District has a CEC bylaw and collects CEC funds from new customers when they receive service. This funding method has been used in the past to construct capital works projects that are identified in the District's CEC bylaw. This study updates the list of projects covered by the District's CEC bylaw to reflect reduced water consumption rates, current construction costs and projected future growth. A copy of the District's current CEC bylaw is included in Appendix 4.

Subdivision Regulation Bylaw

Subdivision applications made to the Ministry of Transportation are referred to the Improvement District for review and comment. The District's position to support an application is typically based on capacity available in the existing system and the ability to service newly created lots. The cost of servicing new development is typically allocated to the applicant and not existing users.

Improvement Districts are empowered to pass bylaws that define servicing standards to be met with new construction and the Approving Officer must not approve a subdivision until services meet those standards. Servicing Standards typically apply to development as well as subdivision and are subject to the following limitations:

- Standards can only apply to works that are included in the Letters Patent (waterworks in the case of the Deep Bay Waterworks District).
- The landowner is 100% responsible for the cost of works required to meet standards that are built on his property and on highway adjacent to his property.

The Deep Bay Water District's Subdivision Bylaw is included in Appendix 4.

Latecomer Charges

In certain cases the developer is required to oversize works that are constructed on his property or within adjacent road right of way, or he may be required to construct works that extend beyond his property to serve his development. When excess or extended services also benefit adjacent properties, then the developer has a right to request that the Improvement District pass a Latecomer's Bylaw that allows him to recoup his additional costs.

5.3 Capital Works that Serve Existing Customers

The following upgrades are identified to improve the operation of the existing system. Projects are listed in order of priority. Distribution system upgrades are illustrated on Figure 5.1.

1-1 Miscellaneous Improvements to Wells and Reservoir

Well Head Access Improvements

Pipe work and valves for Wells 1, 2, 3 and 4 are contained in below-grade concrete vaults. Vault access is gained through a hatch in the roof. Headroom is adequate, however this is a confined space and precautions must be taken before entry. Worker safety and convenience could be improved by excavating adjacent to each of these vaults and installing concrete stairs and a man door.

Reservoir Access Upgrades

The existing above-ground concrete reservoir was constructed in 1975 and has a roof height of 5.5 meters. Workers use a portable ladder to gain access to the roof for regular maintenance and to inspect reservoir operation. Safety requirements have changed over time and BC's Occupational Health and Safety Regulation requires fall protection if workers are at risk of falling more than three meters. This structure does not meet current fall protection requirements and the following upgrades are identified to meet current worker safety standards:

- Access ladder with cage; and,
- A railing system around roof perimeter

Backflow Prevention for Well Head Blow-off Lines

The head works for Wells 1, 2, 3 and 4 include provision to discharge stagnant water at pump start-up. This provision consists of a blow-off line that discharges to ground. Blow–off lines are operated by a hand valve within the pump house that discharges water through a 15 meter line. Check valves are fitted at the discharge end of these lines, however hand valve operation introduces a risk that stagnant or contaminated water could backflow into the system. Back flow prevention assemblies should be installed on discharge lines to eliminate this risk.

Pump Control Electrical Improvements

Pump operation is controlled by level sensors in the reservoir with the signal carried using underground cables that run between the reservoir and each well head. Manual over ride for pump operation is available at each well head. Additional signal wires are available that could allow installation of separate manual pump controls at a central location (possibly at Well No.1).

Water Supply - Control Switch for Level Controls

Pump operation is controlled by a series of probes that hang from the reservoir ceiling, one probe per pump. The height of each probe controls the sequence of pump operation (highest probe signals first start-up). In order to change the order of pump operation District staff must access the roof of the reservoir and adjust probe lengths. Installation of an electrical switch in a lockable exterior grade box mounted on the outside of the reservoir wall will improve convenience and safety for District Staff.

Water Storage - Reservoir Supply Line Improvements

The existing reservoir is connected to the distribution system by a single line that provides both water supply and delivery. This line enters the reservoir through the floor. Reservoir turnover could be enhanced by installing an insulated supply line that discharges to the top of the reservoir with resulting water quality improvements.

1-2 Distribution System – Shoreline Main Replacement

Shoreline Drive is a long Cul-De-Sac that runs down the escarpment below Seaview Drive and extends along the beach for a total distance of 960 meters. This road provides access to 15 lots that are served by a 100 mm (4 inch) diameter dead-end water main. The section of line that runs along the waterfront operates at high pressure due to the elevation difference between the reservoir and the ocean. This line also supplies two fire hydrants, however fire flows are inadequate due to the small pipe diameter (FUS recommends that mains serving hydrants be 150 mm diameter or larger).

This line is constructed with AC pipe and has broken twice in recent years. Continued breaks may be expected. Proposed upgrades include replacement of this existing 100 mm (4 inches) diameter AC line with a 200 mm (8 inches) diameter PVC line. Static pressure in this line is 910 kPa (130 psi) which exceeds the maximum working pressure of 700 kPa (100 psi) recommended by the Design Guidelines for Rural Residential Community Water Systems. Pressure reducing valve(s) (PRV's) are required to limit the pressure in residential plumbing. Two options are available:

- Install a single large diameter PRV on the watermain above the escarpment and use standard pressure pipe material; or
- Use high pressure pipe material and install individual PRV's on each service.

On-line PRV's are costly to install and require regular inspection and maintenance. This equipment is typically installed in a below-grade chamber that requires special equipment and procedures for maintenance access. In contrast, a PRV on an individual service is typically installed within the home or in a crawl space and does not require special attention from District works personnel. We recommend that the District use high pressure pipe material and individual PRV's on each service to avoid the cost and maintenance of a below grade installation.

1-3 Distribution System – Deep Bay Drive Watermain Replacement

Deep Bay Drive is a long Cul-De-Sac that runs along the beach west of Burne Road for a distance of 1000 meters (3300 feet). This road provides access to 65 lots that are served by a 150 mm (6 inch) diameter dead-end water main. Pressure in this line is controlled by a PRV located to the east on Gainsburg Road. The Deep Bay Drive watermain supplies five fire hydrants, however fire flows are constricted by the small diameter pipe.

This line is also constructed of AC pipe, however there have been no recent reported breaks. Proposed upgrades include replacing this existing 150 mm (4 inch) diameter AC line with a 200 (8 inch) mm diameter PVC line. High pressure pipe material will allow the District to consider removing the existing PRV on Gainsburg Road in the future.

1-4 Longview Main Replacement

The watermain on Longview Drive feeds the Shoreline Drive Main from Thompson Clark Drive East. This line is 350 meters (1150 feet) long and is constructed with 100 mm (4 inch) diameter AC pipe. Proposed upgrades include replacement with a 200 mm (8 inch) diameter PVC that includes connection to existing lines on Seaview Drive and Longview Drive to the east. This work is required to improve fire flows to Shoreline Drive and the adjacent subdivision.

1-5 Distribution System – Crome Point/Burne Road Watermain Replacement

The watermains on Crome Point Road and Burne Road are 100 mm and 150 mm diameter respectively (4 inch and 6 inch). Crome Point Road will provide a tie-in point for the Western Truck Main and these lines will need to be replaced with larger lines to eliminate a future bottleneck in the distribution system. Proposed upgrades include replacing these existing 100 mm (4 inch) and 150 mm (6 inch) diameter AC lines with a 200 mm (8 inch) diameter PVC line.

5.4 Capital Works that Serve Future Development

The following upgrades are identified to provide additional capacity to serve future development. Projects are listed in order of priority however the timing of construction may vary in response to development requirements and available funding.

2-1 DL 28 Main (200 mm)

Construction of the DL 28 Main will improve supply to the south end of the system and increase system redundancy by providing a second feed line to compliment the lines on Gainsburg Road and Thompson Clark Drive West.

Construction of this line should be considered as a requirement to service development of Area 'H". As such, construction may be triggered by subdivision of DL 28 through the District's Subdivision Water Regulation Bylaw. If an application to develop those lands is received, then the District may consider the option of having the Developer construct the entire line as a CEC credit project.

2-2 Water Storage - Additional Reservoir(s)

The existing water reservoir provides 120,000 Imperial Gallons of storage (545 cubic meters). Additional storage will be required to accommodate projected growth and to provide improved fire protection. Pump control probes are currently set high to limit the amount of draw-down and to maximize the amount of water storage for fire protection. Limited draw-down results in limited turn-over of water within the reservoir itself. Reservoir expansion should include provisions to facilitate turn-over.

The existing reservoir was designed to be doubled in size with the addition of two new cells; other options for additional storage include a stand-alone concrete or steel structure(s). Storage could be phased by constructing two reservoirs instead of one. Construction of a stand alone reservoir(s) would also provide the opportunity to construct a new reservoir in another location and enhance system redundancy. Options for location, size and style of construction will need to be assessed prior to design and construction.

2-3 Western Trunk Main (250mm)

Construction of the Western Trunk Main will improve supply to the north end of the system and increase system redundancy by providing a second feed line to compliment the line on Gainsburg Road.

Construction of this line should be considered as a requirement to service development of Areas 'B' and 'C'. As such, construction may be triggered by subdivision of those lands through the District's Subdivision Water Regulation Bylaw. If an application to develop those lands is received, then the District may consider the option of having the Developer construct the entire line as a CEC credit project and establishing a Late-comer's Bylaw that allows him to recoup the additional cost of works beyond those properties.

2-4 Dedicated Reservoir Feed Line (200mm)

The existing reservoir is connected to the water distribution system through a single 300 mm (12 inch) diameter line that runs along Gainsburg Road. This line is 850 meters (2800 feet) long and serves as both the supply line to the reservoir and the discharge line into the system. Construction of a second dedicated reservoir feed line running parallel to this existing line would offer the following benefits;

- a second line would offer redundancy and provide back-up in case of failure
- a dedicated supply line will enhance turnover in the reservoir(s) thereby reducing storage time and improving water quality

2-5 Morgan Loop (150mm)

Construction of a new watermain on Henry Morgan Road will provide a connection between existing lines on Maple Guard Drive and Thompson Clark Drive East. This loop will provide system redundancy and improve fire flows to the south end of the system.

Construction of this line should be considered as a requirement to service development of Area 'K'. As such, construction may be triggered by subdivision of that land through the District's Subdivision Water Regulation Bylaw. If an application to develop those lands is received, then the District may consider the option of having the Developer construct this line as a CEC credit project.

2-6 Pumping Main (300 mm)

Construction of the Pumping Main will increase the capacity of the lines running between the main production wells and the reservoir. Coupled with construction of the DL 28 Main, this line will improve supply to the east end of the system.

6.0 CAPITAL EXPENDITURE PROGRAM

6.1 Cost Estimates

Cost estimates have been prepared for the listed Capital Works projects and are presented in Appendix 5 (Tables 6.1 and 6.2). These estimates are summarized in Tables 6.3 and 6.4:

Table 6.3 - Capital Works that Serve Existing Customers

1.1	Miscellaneous Improvements to Wells and Reservoir	$59,352
1.2	Shoreline Main Replacement (200mm)	$521,307
1.3	Deep Bay Watermain Replacement (200mm)	$549,413
1.4	Longview Main Replacement (200mm)	$210,870
1.5	CromePoint / Burne Road Watermain Replacement (200mm)	$236,434
	Total	$1,577,376

Table 6.4 – Capital Works that Serve Future Development

2.1	DL 28 Main	$259,009
2.2	Additional Reservoir(s)	$1,296,165
2.3	Dedicated Reservoir Feed Line (200 mm)	$275,080
2.4	Morgan Loop (150 mm)	$180,895
2.5	Pumping Main (300 mm)	$248,170
2.6	Western Trunk Main (250mm)	$1,080,437
	Total	$3,339,756

6.2 Proposed Capital Works Plan

The proposed Capital Works Projects have been identified to improve system operation and address identified fire flow requirements. These projects provide the basis of the proposed 10-year Capital Plan presented in Table 6.5. This plan assumes funding at a rate of $150,000 per year through a Renewal Reserve Fund to be initiated in the 2009 Budget year.

Table 6.5 – Proposed Capital Works Plan

		2008	2012	2015	2017	2018
1.1	Miscellaneous Improvements to Wells and Reservoir	$37,674				
1.2	Shoreline Main Replacement (200mm)		$521,307			
1.3	Deep Bay Watermain Replacement (200mm)			$549,413		
1.4	Longview Main Replacement (200mm)				$210,870	
1.5	CromePoint / Burne Road Watermain Replacement (200mm)					$236,434

6.3 Existing Capital Expenditure Cost Bylaw

The District's current Capital Expenditure Bylaw was passed in November 2003 and identifies charges based on location and land use. A general rate schedule is provided for the overall District and specific charges are identified for two specific areas. The rate schedule is summarized in Table 6.1 and a copy of that bylaw is included in Appendix 4.

Table 6.6 – Existing CEC Rate Schedule

LAND USE	BASIS OF ASSESSMENT	CHARGE
General Rate Schedule		
Single Family	Parcel	$3,500
Multiple occupancy	Unit	$2,550
Mobile Home Park	Space	$3,500
Trailer	Pad or Space	$1,650

LAND USE	BASIS OF ASSESSMENT	CHARGE
Bare land Strata	Dwelling	$3,500
Remaining "fill in lots"		
Single Family	Parcel	$5,100
District Lot 1 and 86		
Single Family	Parcel	$8,500
Multiple Occupancy	Unit	$6,300
Bare land Strata	Dwelling	$8,500

6.4 Proposed Capital Expenditure Cost Bylaw

The Deep Bay Waterworks District currently serves 565 customers. Analysis of the land base indicates the potential to develop an additional 515 units within the current District boundaries. The historic annual growth rate in the community is 3%. Assuming future growth at the same rate we estimate the community will gain a further 515 units by the year 2030.

This study identifies six separate capital works projects that will be required to serve future development. These projects are summarized in Table 6.7.

Table 6.7 – Proposed CEC Works

PROJECT	PRIORITY	ESTIMATED COST
DL 28 Main	Highest	$259,000
Additional Reservoir(s)		$1,296,000
Western Trunk Main		$1,080,000
Dedicated Reservoir Feed Line		$275,000
Morgan Loop		$181,000
Pumping Main	Lowest	$248,000
	Total Cost	**$3,339,000**

This list of projects is similar to the list identified in previous reports, however the following changes are noted:

- The Eastern Trunk Main is no longer required
- Additional well supply is no longer required
- Reservoir capacity has increased
- Independent Reservoir Feed Line is identified
- Jamieson Loop has been constructed

- Modifications to the pump control system are identified as Capital Works

We estimate that approximately 30% of future growth will occur east of Gainsburg Road and 70% will occur west of Gainsburg Road. The DL 28 Main and the Morgan Loop will benefit only the eastern area. The Western Trunk main will benefit only the western area. The remaining projects, Additional Reservoir(s), Dedicated Reservoir Feed Line and Pumping Main benefit both areas. The cost of identified works is nearly proportional to the distribution across the developable areas and therefore we propose that a single rate be used throughout the District. The recommended Capital Expenditure Cost Charge is $6,500 per door.

Russ Irish, P.Eng.
Senior Project Engineer

Bob Hoffstrom, P.Eng.
Review Engineer

Appendix 1

Water Consumption Records January 2004 to October, 2007

Deep Bay Waterworks District — **McElhanney Consulting Services Ltd**
Water System Evaluation — **2231-27303-01.4**
Water Consumption Records January 2004 to October 2007 — **January 2007**

Period from	to	Days	Well 1 Imp. Gal.	Well 2 Imp. Gal.	Well 3 Imp. Gal.	Well 4 Imp. Gal.	Well 5 Imp. Gal.	Well 6 Imp. Gal.	Well 8 Imp. Gal.	Total Imp. Gal.	cu. meters
YEAR 2004											
Jan 3 / 04	Feb 3 / 04	31	110	568700	497860	8580	669100	158000	45690	1948040	8844
Jan 28 / 04	Mar. 1 / 04	31	167600	58	6463	220	367300	6000	742700	1290341	5858
Mar 1 / 04	Apr. 1 / 04	30				440	465100		2158500	2624040	11913
Mar 29 / 04	Apr 29 / 04	30						2000	4703100	4705100	21361
Apr 29 / 04	May 31 / 04	30		756800		1463660		1804000	3833100	7857560	35673
May 31 / 04	Jun 30 / 04	30		155840	1440560	1681078		3285000	3189200	9751678	44273
Jun 30 / 04	Jul 30 / 04	30		1940190	1498200	1963940	2499100	1751000	4136600	13789030	62602
Jul 30 / 04	Aug 30 / 04	31		983840	311300	324500	1446700	3596000	2480300	9142640	41508
Aug 30 / 04	Sept 30 / 04	30		1092740		35860	1407500		2017600	4553700	20674
Sept 29 / 04	Oct 29 / 04	30			220	186340	1129000		1338800	2654360	12051
Oct 29 / 04	Nov 30 / 04	31			220	47520	1191300	5000	1007700	2251740	10223
Nov 30 / 04	Jan 03 / 05	34		1448480		880	353500	2000	663000	2467860	11204
YEAR 2005		368								**Annual Consumption**	**286184**
Jan 2 / 05	Jan 31 / 54	29		581800		775800		916000		2273600	10322
Feb 1 / 05	Mar. 1 / 05	29					1036600	32000	1095600	2164200	9825
Mar 1 / 05	Mar 31 / 05	30		54780			1092100	177000	1183800	2507680	11385
Apr 1 / 05	May 2 / 05	32	639100			198880	1163000		886400	2887380	13109
May 2 / 05	May 30 / 05	29			443080		2250000	5000	2453500	5151580	23388
May 30 / 05	Jun 30 / 05	32		797710			2234600		2450600	5482910	24892
Jun 30 / 05	Jul 28 / 05	30	647800		680020		2736800	1109000	2922800	8096420	36758
Jul 29 / 05	Aug 29 / 05	30		1296000		1512000	2668800	2383000	2812800	10672600	48454
Aug 29 / 05	Sept 29 / 05	31	2089300				1506600	5000	1643200	5244100	23808
Sept 29 / 05	Oct 31 / 05	32	1471800		1529660		110600	1000	121900	3234960	14687
Oct 31 / 05	Nov 30 / 05	30				2862720	49888		56200	2968808	13478
Nov 30 / 05	Dec 29 / 05	30				5000	874000	20000	971700	1870700	8493
YEAR 2006		364								**Annual Consumption**	**238599**
Dec 29 / 05	Jan 30 / 06	32		1824768			69500		77900	1972168	8954
Jan 30 / 06	Mar. 1 / 06	31					810300		892700	1703000	7732
Mar 1 / 06	Apr 1 / 06	31					775000		711700	1486700	6750
Apr 1 / 06	May 1 / 06	31					1026000		1143100	2169100	9848
May 1 / 06	May 31 / 06	31					2054000	1100	223100	2278200	10343
May 31 / 06	Jul 4 / 06	34					3185600	13200	3657500	6856300	31128
Jul 4 / 06	Aug 2 / 06	30	645400				2599700	160000	2843900	6249000	28370
Aug 2 / 06	Sept 3 / 06	32	556000				2921900	6000	2882900	6366800	28905
Sept 3 / 06	Oct 4 / 06	31					1704400		1899800	3604200	16363
Oct 4 / 06	Nov 1 / 06	28					918000	5000	1023500	1946500	8837
Nov 1 / 06	Dec 4 / 06	33					1200800	8000	927900	2136700	9701
Dec 4 / 06	Jan 3 / 07	30					797400		1027800	1825200	8286
YEAR 2007		374								**Annual Consumption**	**175216**
Jan 3 / 07	Feb 1 / 07	30					851900		952400	1804300	8192
Feb 1 / 07	Mar 5 / 07	32					687300	397100	755600	1840000	8354
Mar 5 / 07	Apr 2 / 07	28					809300		901800	1711100	7768
Apr 2 / 07	May 3 / 07	31		909480			320200		707900	1937580	8797
May 3 / 07	Jun 4 / 07	31					2161000		2029600	4190600	19025
Jun 4 / 07	Jul 3 / 07	29					2494800	5000	2810100	5309900	24107
Jul 3 / 07	Aug 4 / 07	31			112320		2244700	22500	2465900	4845420	21998
Aug 4 / 07	Sept 4 / 07	31		853380			1712000		1886600	4451980	20212
Sept 4 / 07	Oct 4 / 07	30			1268700		1282800		1435500	3987000	18101
October	from 2006	28								2006 Rate Assumed	8837
November	from 2006	33								2007 Rate Assumed	9701
December	from 2006	30								2008 Rate Assumed	8286
		364								**Annual Consumption**	**163378**

Year	Average Day for Year	Peak Month	Average Da for Peak Month	Peak Factor
2004	778	July	2087	2.68
2005	655	August	1615	2.46
2006	468	June	916	1.95
2006	449	June	831	1.85

Appendix 2

Fire Flow Calculations

McElhanney

Engineering Calculation Sheet

November 1, 2007
File: 27303-04

Deep Bay Water System Analysis - Estimated Fire Flow Requirements
Bowser Elementary School

Design assumptions: 1) Calculations prepared in accordance with the 1999 Water Supply for Public Fire Protection published by the Fire Underwriters Survey

Description		Calcs		Notes
1) Type of construction:		Concrete Block and Steel Roof		
Co-efficient (C):	C =	0.8		
Ground floor area:	Ground A =	2300	m^2	One story
Total floor area:	A =	2300	m^2	
Fire Flow ($F=220*C*A^{1/2}$):		8,441	L/min	
2) Increase or decrease for type of occupancy:	-25%	-2110	L/min	
(E + D)	E =	6330	L/min	Total Flow
3) Decrease for sprinklers:	-50%	-3165	L/min	
4) Exposure:				
North side:	0%	0	L/min	
East side:	0%	0	L/min	
South side:	0%	0	L/min	
West side:	0%	0	L/min	
Total increase for exposure:		0	L/min	
Total fire flow:		3165	L/min	
		53	L/s	
		696	Igpm	←

Sprinkler System Information

Distance from sprinkler fire connection at building to nearest available fire hydrant: _____ m

Are sprinkler Systems wet or dry? _____

Backflow Prevention: _____

Calculations by:_____

Date:_____

Professional Seal

McElhanney

Engineering Calculation Sheet

November 1, 2007
File: 27303-04

Deep Bay Water System Analysis - Estimated Fire Flow Requirements
Single Family House

Design assumptions: 1) Calculations prepared in accordance with the 1999 Water Supply for Public Fire Protection published by the Fire Underwriters Survey

Description		Calcs		Notes
1) Type of construction:		Wood Frame		
Co-efficient (C):	C =	1.5		
Ground floor area:	Ground A =	186	m^2	
Total floor area:	A =	186	m^2	
Fire Flow ($F=220*C*A^{1/2}$):		4,501	L/min	
2) Increase or decrease for type of occupancy:	-25%	-1125	L/min	
(E + D)	E =	3375	L/min	Total Flow
3) Decrease for sprinklers:	0%	0	L/min	
4) Exposure:				
North side:	15%	506	L/min	
East side:	10%	338	L/min	
South side:	0%	0	L/min	
West side:	0%	0	L/min	
Total increase for exposure:		844	L/min	
Total fire flow:		4219	L/min	
		70	L/s	
		928	Igpm	←

Sprinkler System Information

Distance from sprinkler fire connection at building to nearest available fire hydrant		m
Are sprinkler Systems wet or dry?		
Backflow Prevention:		

Calculations by:_____

Date:_____

Professional Seal

Appendix 3

Computer Model Output

Appendix 4

Deep Bay Waterworks District
Referenced Bylaws

SUBDIVISION WATER REGULATION BYLAW NO. 168

The trustees of the Deep Bay Waterworks District enact as follows:

INTERPRETATION

1. In this bylaw:

(1) "applicant" means the owner of property, or the authorized agent of the owner, who has submitted a completed application for the subdivision of land to which water may be supplied by the District.

(2) "District" means the Deep Bay Waterworks District.

(3) "Subdivision" means subdivision as defined in the *Land Title Act* or the *Strata Property Act*.

(4) "standards" means the District's water system construction and design standards as established by the District's bylaws.

(5) "District's system" means the water distribution system including all works owned and operated by the District.

(6) "trustees" means the trustees for the District.

(7) "works" means any structures, including pipes, and all attachments, fittings, and facilities for the storage, supply, conveyance, treatment and distribution of water.

OTHER ENACTMENTS

2. Nothing contained in this bylaw shall relieve any person from responsibility for seeking out and complying with other enactment's applicable to their undertaking.

GENERAL PROHIBITION

3. Land that is connected to the District's system, or is proposed for connection to the District's system, must not be subdivided contrary to this bylaw.

APPLICATION

4. (1) An owner of land who proposes to subdivide land and wishes to connect one or more parcels to be created by the subdivision to the district's system must apply to the District by delivering to the District:

(a) the form prescribed as Schedule "A" to this bylaw.

(b) the plans and other information specified in Schedule "A".

(c) a subdivision application fee of $ $200.00 per lot with a minimum of $1,000.00 per subdivision.

(2) Every application for subdivision of land that will create a parcel to be connected to the District's System must include a calculation of the peak hourly water demand and pressure requirement for the ultimate development of the parcels and sufficient information, plans and drawings for the District to determine whether the proposed works comply with this bylaw.

GENERAL PROVISION

5. (1) The trustees may refuse to approve the proposed subdivision where:

(a) the proposed subdivision does not comply with the provisions of this and other applicable bylaws of the District.

(b) one or more parcels to be created by the subdivision are to be connected to the District's System and the District has an insufficient water supply to provide such parcels with a supply of water.

(2) For the purpose of (1)(b), the demand that would be placed on the District's System as a result of the proposed subdivision will be calculated having reference to the peak hourly water demand and pressure requirement for the ultimate development of the parcels or provided under section 4(2).

(3) Despite subsection (1), an application may be approved where the owner of the land provides to the District with a reasonable proposal to increase the supply capacity of the District's System so that it is capable of providing the parcels to be created by the subdivision with a sufficient supply of water.

CONSTRUCTION OF WORKS WITHIN SUBDIVISION

6. (1) Subject to section 747.1(3) of the *Local Government Act*, an owner of land who proposes to subdivide the land must:

(a) provide, locate and construct a water distribution system within the subdivision; and land.

(b) Connect the water distribution system to the District's System in accordance with the Standards.

(2) The cost of providing, locating and constructing the water distribution system and connecting the water distribution system to the District's System must be paid completely by the owner of land providing the Works.

(3) The costs referred to in paragraph (2) include the cost of all permits, inspections, engineering costs and other costs related to the proposed subdivision.

CONSTRUCTION OF WORKS IN ADJACENT HIGHWAYS

7. In addition to the requirements of section 6, the Board of Trustees of the District may also, by resolution, require that an owner of land provide works and services in accordance with the Standards, on that portion of a highway immediately adjacent to the site being subdivided or developed up to the centre line of the highway, in accordance with section 747.1(4) of the *Local Government Act*.

CONSTRUCTION OF EXTENED SERVICES

8. Where the Board of Trustees requires that an owner of land provide excess or extended services under section 747.2 of the *Local Government Act*, the District will determine the proportion of the cost of the extended or excess service which will be borne by the applicant in accordance with the *Local Government Act* and any policy regarding latecomer charges approved by the Board of Trustees.

EXTENSION OF WORKS AND SERVICES

9. (1) All works required to be installed under section 6 must be installed along the full frontage of the land being subdivided or developed unless the lands beyond the land being subdivided or developed are incapable of further subdivision or development, as determined by the District.

(2) For the purpose of subsection (1) lands are not incapable of further subdivisions or development by reason only that an amendment to an enactment of a local government or the District would be necessary to permit further subdivision or development.

TRANSFER OF WORKS TO DISTRICT

10. (1) An owner of land who has installed works under this agreement must:

(a) transfer the works to the District and,

(b) where any part of the works transferred to the District are located on lands owned by any person other than the District or within a highway, provide a statutory right of way agreement for the works in a form acceptable to the District, naming the District as transferee with priority over any financial encumbrances registered against the title to the land.

(2) An owner who transfers works to the District must

(a) remedy all defects in the Works for one year following the date of the transfer; and

(b) deposit with the District an irrevocable standby letter of credit valid for at least one year from the date of the transfer in an amount not less than 10% of the cost of the Works as security for the performance of the owner's obligations under (a).

COPIES OF PERMITS

11. The owner required to install Works under this bylaw must provide to the District a copy of the construction permit for the Works, issued by the Ministry of Health.

CONNECTION CHARGES

12. No person may connect any parcel to the District's System without paying all applicable charges in accordance with the District's bylaws.

APPROVAL PERIOD

13. (1) Subject to changes in an enactment, which may affect a subdivision, approval of a subdivision under this bylaw will be valid for a period of six months from the date of approval by the Board of Trustees on Schedule A.

(2) An approval under this bylaw must not be interpreted as limiting the function or authority of the Approving Officer under section 87 of the *Land Title Act*.

VIOLATION

14. A person who does any act or suffers or permits any act to be done in contravention of this bylaw or who neglects to do or refrains from any act or thing, which is required to be done by this bylaw, commits an offense.

PENALTY

15. A person who commits an offense under this bylaw is liable on summary conviction to a penalty in accordance with the *Offense Act*.

SEVERABILITY

16. If any section, subsection, clause, or phrase of this bylaw is for any reason held to be invalid by the decision of any court, such section, subsection, sentence, clause or phrase may be severed from the remaining portion of this bylaw with the remaining portions of the bylaw remaining valid and of full force and effect.

INSPECTION AND RIGHT OF ACCESS

17. (1) The trustees, or an officer or employee of the District may enter at all reasonable times upon land subject to this bylaw, to ascertain whether the provisions of the bylaw are being obeyed, provided that:

(a) consent to inspect the land is obtained from the owner or occupier of the land, or;
(b) where such consent has been refused, written notice of the intent to inspect is given to the owner or occupier no less than 24 hours prior to the time of inspection.

(2) No person shall obstruct or prevent a person in paragraph (1) from carrying out any of the provisions of this bylaw.

REPEAL

18. Subdivision Water Regulation Bylaw No. _____ is repealed. (not applicable)

CITATION

19. This bylaw may be cited as the "Subdivision Water Regulation Bylaw No. 168."

INTRODUCED and given first reading by the Trustees on the 15th day of October, 2003.

RECONSIDERED and finally passed by the Trustees on the 15th day of October, 2003.

Chair of the Trustees

Secretary to the Trustees

I hereby certify that this is a true copy of Byaw No. 168
Of the Deep Bay Waterworks District, passed by the
Trustees on the 15th day of October, 2003.

A true copy of By-Law No. 168
registered in the office of the Inspector
of Municipalities this 23rd *day of*
October 2003.

Deputy Inspector of Municipalities

SCHEDULE "A"

SUBDIVISION WATER REGULATION BYLAW NO. 168

Application for Water Service to Proposed Subdivision

Property Address(es): _____

Legal Description of Property (ies): _____

Registered Owner(s): _____

Address (Correspondence/calls To be directed to: _____

Phone: _____ Fax: _____

THE FOLLOWING MUST ACCOMPANY THIS APPLICATION:

1. Copy of Indefeasible Title(s), dated within 30 days of the date of application.
2. A letter of authorization if the applicant is not the owner.
3. Plan of proposed subdivision with dimensions clearly illustrating lot layout, roads, etc. to a scale of not less than 1:2000. Four copies are required.
4. The layout sketch plan, in metric, must be prepared by a consulting engineer, planner, or land surveyor and show the following:
   - The full legal description of the parcel(s) to be subdivided;
   - The dimensions and area of all proposed lots;
   - The arrangement of parcels and streets which will be created by the subdivision, including the widths of the proposed streets and alteration of lot lines or subdivision of any existing parcels;
   - The location of all existing buildings and structures on the property;
   - existing property lines and highways to be eliminated by the proposed subdivision;
   - the location of all natural features and watercourses and setbacks required by the RDN;
   - the relationship of the development to neighbouring parcels and highways;
   - intended use of each parcel to be created by the subdivision;
   - topographic information where land affected by the application is steep, irregular, or otherwise difficult to appraise in respect of the proposed development;
   - a plan of the water system to service the subdivision designed in accordance with the District's Standards.
5. An application fee of $200.00 per lot, a minimum of $1,000.00 per subdivision.
6. Evidence of approval or authorization from other agencies involved in the subdivision process.

PLEASE NOTE THE FOLLOWING:

Personal information collected on this form is collected for the purpose of processing this application and for administration and enforcement of District bylaws related to subdivision. Personal information or business information submitted on this form is not considered to be supplied in confidence.

The District, or their duly appointed representative, are authorized to enter the property for inspection purposes.

Property owner(s) signature(s) _____
OR:
Authorized agent's signature _____

Date of application _____

Approved this ____day of _____ by the Board of Trustees.

_____
Board Chairman

Deep Bay Waterworks District
Bylaw No. 170

A bylaw to fix a charge for Capital Expenditures on parcels of land to provide for the time and manner of payment thereof

WHEREAS it is considered that due to the future and continuing development of land it will be necessary at a future date to increase source capacity, enlarge supply mains, increase storage or otherwise augment the capacity of the works of the District to ensure an adequate water supply; and

WHEREAS capital expenditure charges may be fixed for the purpose of providing funds to assist the District in paying the Capital cost of providing, altering or expanding water facilities to ensure an adequate supply; and

WHEREAS it is considered that the costs of the said increasing of source capacity, enlarging of supply mains, increasing storage or otherwise augmenting the capacity of the works of the District to ensure adequate water supply shall be borne by those persons developing land;

The Trustees of the Deep Bay Waterworks District ENACT AS FOLLOWS:

1. In this Bylaw, "parcel" means any lot, block, strata lot, or other area in which land is held or into which land is subdivided

2. In addition to other charges applicable under other bylaws of the District every person who develops land shall pay (prior to subdivision approval or servicing approval by the trustees) the applicable expenditure charge as set out in Schedule "A" attached hereto and forming part of this bylaw.

3. The capital expenditure charges established under Section 2 shall be similar for all developments that impose similar cost burdens to the District.

4. No capital development charge shall be required to be paid:
   a) If a capital expenditure charge has previously been paid with respect to the same development unless, as a result of a further development, new capital cost burdens will be imposed on the District, or
   b) Where the development does not impose new capital cost burdens to the District

5. All sums of money collected under this Bylaw shall be deposited in a special trust fund separate from all other funds of the District.
   a) The District shall use money deposited in the trust fund plus all interest on earnings thereon for the purposes for which it was deposited, namely, capital payments (including engineering and legal costs) for providing, altering, or expanding water facilities to supply, directly or indirectly, the development for which a capital expenditure charge has been imposed.
   b) Monies shall be disbursed only by a resolution of the Trustees of the District which has been given prior approval by the Inspector or Deputy Inspector of Municipalities.

6. Severability: If any section, subsection, clause, or phrase of this bylaw is for any reason held to be invalid by the decision of any court, such section, subsection, sentence, clause or phrase may be severed from the remaining portion of this bylaw with the remaining portions of the bylaw remaining valid and of full force and effect.

7. This Bylaw repeals Bylaw No. 146 in its entirety, passed by the Trustees of the Deep Bay Waterworks District on November 17, 1998~~, and is effective the 12th day of November, 2003.~~

8. This Bylaw may be cited as the "**Capital Expenditure Charge Bylaw.**"

INTRODUCED and given first reading by the Trustees on the 12th day of November, 2003.
RECONSIDERED and finally passed by the Trustees on the 12th day of November, 2003.

Chairman of the Trustees

I hereby certify under the seal of the Deep Bay Waterworks District that this is a true copy of Bylaw 170 of the Deep Bay Waterworks District, passed by the Trustees on the 12th day of November, 2003.

Officer

170
12th December 2003

SCHEDULE "A"

DEEP BAY WATERWORKS DISTRICT

Capital Expenditure Charge Bylaw No. 170

Capital Expenditure Charges (Water Supply)

Land Use	Basis of Assessment	Charge
Residential		
1) Single Family	Parcel	$3,500
2) Multiple Occupancy	Unit	$2,550
3) Mobile Home Park	Space	$3,500
4) Trailer	Pad or Space	$1,650
5) Single Family Dwelling on Bare Land Strata Development	Dwelling	$3,500

Remaining "fill in" lots applying for connection to the Districts Water System:
DL 40, Newcastle District ,Plans 15814,16121,16375, 20505 and 21776 (Buccaneer Beach)

Land Use	Basis of Assessment	Charge
Residential		
1) Single Family	Parcel	$5,100

For land situated within all that part of District Lot 1 & 86, Plan 48840, Lot A, Newcastle District, except Parts in Plan VIP 56846; and Lots B and C, Plan 38643, except that Part in Plan 52642, District Lot 86, Newcastle District; and District Lot 1 & 86 Plan VIP 70719; (Deep Bay Ventures)

Land Use	Basis of Assessment	Charge
Residential		
1) Single Family	Parcel	$8,500
2) Multiple Occupancy	Unit	$6,300
3) Single Family Dwelling on Bare Land Strata Development	Dwelling	$8,500

Chairman of the Trustees

I hereby certify under the seal of the
Deep Bay Waterworks District that
this is a true copy of Bylaw 170 of the
Deep Bay Waterworks District, passed by
the Trustees on the 12th day of November, 2003.

Officer

Appendix 5

Capital Cost Estimates

Deep Bay Waterworks District — **McElhanney Consulting Services Ltd**
Water System Evaluation — **2231-27303-01.4**
February 15, 2008

Table 6.1 - Capital Works That Serve Existing Customers

Description	Quantity	Unit	Rate	Extension	Total
1-1 Water Supply and Storage					
- Miscellaneous Improvements to Wells and Reservoir					
Man door at well heads	4	each	$ 3,000	$ 12,000	
Reservoir access Upgrades	1	each	$ 10,000	$ 10,000	
Install BFPD at wellheads	4	each	$ 800	$ 3,200	
install central over-ride	1	LS	$ 3,000	$ 3,000	
install level switch control	1	LS	$ 1,500	$ 1,500	
install exterior supply line	1	LS	$ 10,000	$ 10,000	
			Sub total	$ 39,700	
			Contingency (30%)	$ 11,910	
			Sub total	$ 51,610	
			Engineering (15%)	$ 7,742	
			Total	**$ 59,352**	**$ 59,352**
1-2 Distribution System					
- Shoreline Drive Watermain Replacement (200 mm)					
Asphalt cutting	2000	m.	$ 5	$ 10,000	
200 mm Gate Valve	3	each	$ 1,500	$ 4,500	
200 mm main	960	m.	$ 200	$ 192,000	
Crushed Gravel	480	cu.m.	$ 50	$ 24,000	
Pit Run Backfill	1800	cu.m.	$ 30	$ 54,000	
Hot Mix Asphalt	240	tonnes	$ 180	$ 43,200	
Shoulder Gravel	100	cu.m.	$ 60	$ 6,000	
Hydrants	2	each	$ 4,000	$ 8,000	
Blow off	1	each	$ 2,000	$ 2,000	
Tie to existing main	1	each	$ 5,000	$ 5,000	
			Sub total	$ 348,700	
			Contingency (30%)	$ 104,610	
			Sub total	$ 453,310	
			Engineering (15%)	$ 67,997	
			Total	**$ 521,307**	**$ 521,307**
1-3 Distribution System					
- Deep Bay Drive Watermain Replacement (200 mm)					
200 mm Gate Valve	5	each	$ 1,500	$ 7,500	
200 mm main	970	m.	$ 200	$ 194,000	
Asphalt cutting	1000	m.	$ 5	$ 5,000	
Crushed Gravel	500	cu.m.	$ 50	$ 25,000	
Pit Run Backfill	1800	cu.m.	$ 30	$ 54,000	
Hot Mix Asphalt	250	tonnes	$ 180	$ 45,000	
Shoulder Gravel	100	cu.m.	$ 60	$ 6,000	
Hydrants	4	each	$ 4,000	$ 16,000	
Tie to existing main	3	each	$ 5,000	$ 15,000	
			Sub total	$ 367,500	
			Contingency (30%)	$ 110,250	
			Sub total	$ 477,750	
			Engineering (15%)	$ 71,663	
			Total	**$ 549,413**	**$ 549,413**

Table 6.1 - Capital Works That Serve Existing Customers

Description	Quantity	Unit	Rate	Extension	Total
1-4 Distribution System					
- Longview Watermain Replacement (200 mm)					
Asphalt cutting	350	m.	$ 5	$ 1,750	
200 mm Gate Valve	3	each	$ 1,500	$ 4,500	
200 mm main	350	m.	$ 200	$ 70,000	
Crushed Gravel	180	cu.m.	$ 50	$ 9,000	
Pit Run Backfill	650	cu.m.	$ 30	$ 19,500	
Hot Mix Asphalt	90	tonnes	$ 180	$ 16,200	
Shoulder Gravel	35	cu.m.	$ 60	$ 2,100	
Hydrants	2	each	$ 4,000	$ 8,000	
Tie to existing main	2	each	$ 5,000	$ 10,000	
			Sub total	$ 141,050	
			Contingency (30%)	$ 42,315	
			Sub total	$ 183,365	
			Engineering (15%)	$ 27,505	
			Total	**$ 210,870**	**$ 210,870**
1-5 Distribution System					
- Crome Point Road/Burne Road Watermain Replacement (200 mm)					
200 mm Gate Valve	4	each	$ 1,500	$ 6,000	
200 mm main	370	m.	$ 200	$ 74,000	
Asphalt cutting	750	m.	$ 5	$ 3,750	
Crushed Gravel	200	cu.m.	$ 50	$ 10,000	
Pit Run Backfill	700	cu.m.	$ 30	$ 21,000	
Hot Mix Asphalt	100	tonnes	$ 180	$ 18,000	
Shoulder Gravel	40	cu.m.	$ 60	$ 2,400	
Hydrants	2	each	$ 4,000	$ 8,000	
Tie to existing main	3	each	$ 5,000	$ 15,000	
			Sub total	$ 158,150	
			Contingency (30%)	$ 47,445	
			Sub total	$ 205,595	
			Engineering (15%)	$ 30,839	
			Total	**$ 236,434**	**$ 236,434**
			Total Cost of Capital Works that Serve Existing Customers		**$ 1,577,375**

Estimated costs are derived from recent experience locally, but there is no warranty that actual costs will not vary. McElhanney accepts no liability for actual costs which may vary from the estimated construction costs provided herein.

Deep Bay Waterworks District — **McElhanney Consulting Services Ltd**
Water System Evaluation — **2231-27303-01.4**
February 15, 2008

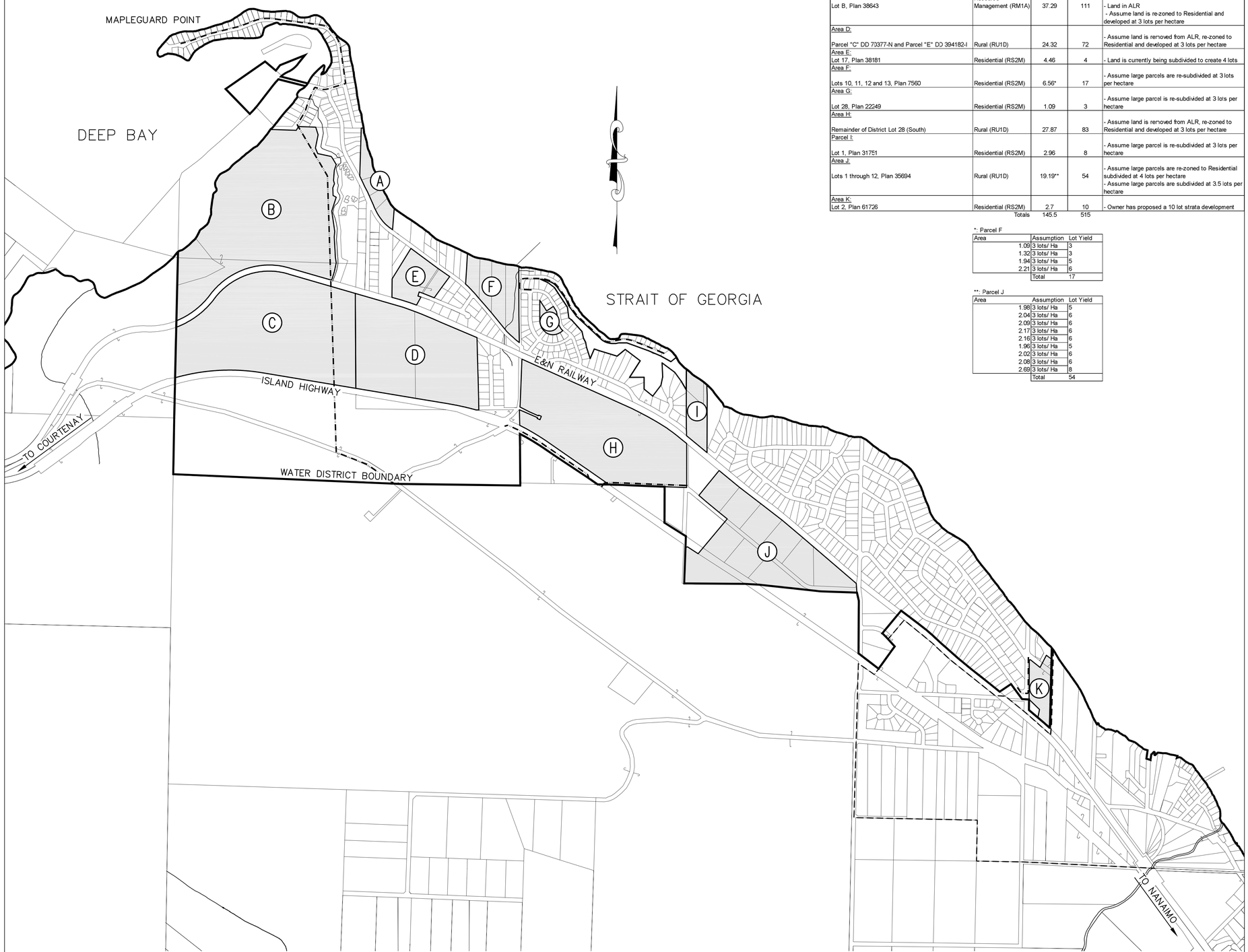
Table 6.2 - Capital Works That Serve Future Development

Description	Quantity	Unit	Rate	Extension	
2-1 Distribution System					
- DL 28 main (200mm)					
Right of Way Acquisition	0.25	ha	$ 50,000	$ 12,500	
Clear and grub	0.25	ha	$ 15,000	$ 3,750	
Highway Crossing	1	LS	$ 50,000	$ 50,000	
200 mm main	430	m.	$ 200	$ 86,000	
200 mm Gate Valve	2	each	$ 1,500	$ 3,000	
Hydrants	2	each	$ 4,000	$ 8,000	
Tie to existing main	2	ea	$ 5,000	$ 10,000	
			Sub total	$ 173,250	
			Contingency (30%)	$ 51,975	
			Sub total	$ 225,225	
			Engineering (15%)	$ 33,784	
			Total	**$ 259,009**	**$ 259,009**
2-2 Water Storage					
- Additional Reservoir(s)					
Bolted Steel Reservoir	208,000	Gallon	$ 4	$ 832,000	
Site Preparation	1	LS	$ 15,000	$ 15,000	
Pipework	1	LS	$ 20,000	$ 20,000	
			Sub total	$ 867,000	
			Contingency (30%)	$ 260,100	
			Sub total	$ 1,127,100	
			Engineering (15%)	$ 169,065	
			Total	**$ 1,296,165**	**$ 1,296,165**
2-3 Distribution System					
- Western Trunk main (250mm)					
Right of Way Acquisition	1.2	ha	$ 50,000	$ 60,000	
Clear and grub	1.2	ha	$ 15,000	$ 18,000	
Highway Crossing	1	LS	$ 50,000	$ 50,000	
Railwayway Crossing	1	LS	$ 50,000	$ 50,000	
250 mm main	1950	m.	$ 250	$ 487,500	
250 mm Gate Valve	8	each	$ 2,400	$ 19,200	
Hydrants	7	each	$ 4,000	$ 28,000	
Tie to existing main	2	ea	$ 5,000	$ 10,000	
			Sub total	$ 722,700	
			Contingency (30%)	$ 216,810	
			Sub total	$ 939,510	
			Engineering (15%)	$ 140,927	
			Total	**$ 1,080,437**	**$ 1,080,437**

Table 6.2 - Capital Works That Serve Future Development

Description	Quantity	Unit	Rate	Extension	
2-4 Distribution System					
- Independent Reservoir Feed Line (200mm)					
200 mm main	850	m.	$ 200	$ 170,000	
200 mm Gate Valve	6	each	$ 1,500	$ 9,000	
Tie to existing main	1	ea	$ 5,000	$ 5,000	
			Sub total	$ 184,000	
			Contingency (30%)	$ 55,200	
			Sub total	$ 239,200	
			Engineering (15%)	$ 35,880	
			Total	**$ 275,080**	**$ 275,080**
2-5 Distribution System					
- Morgan Loop (150mm)					
Asphalt cutting	400	m.	$ 5	$ 2,000	
Crushed Gravel	125	cu.m.	$ 50	$ 6,250	
Pit Run Backfill	1500	cu.m.	$ 30	$ 45,000	
Hot Mix Asphalt	65	tonnes	$ 180	$ 11,700	
Shoulder Gravel	25	cu.m.	$ 60	$ 1,500	
150 mm main	250	m.	$ 175	$ 43,750	
150 mm Gate Valve	2	each	$ 900	$ 1,800	
Hydrants	1	each	$ 4,000	$ 4,000	
Tie to existing main	1	ea	$ 5,000	$ 5,000	
			Sub total	$ 121,000	
			Contingency (30%)	$ 36,300	
			Sub total	$ 157,300	
			Engineering (15%)	$ 23,595	
			Total	**$ 180,895**	**$ 180,895**
2-6 Distribution System					
-Pumping main (300mm)					
300 mm Gate Valve	2	each	$ 3,200	$ 6,400	
300 mm main	480	m.	$ 310	$ 148,800	
Hydrants	2	each	$ 400	$ 800	
Tie to existing main	2	ea	$ 5,000	$ 10,000	
			Sub total	$ 166,000	
			Contingency (30%)	$ 49,800	
			Sub total	$ 215,800	
			Engineering (15%)	$ 32,370	
			Total	**$ 248,170**	**$ 248,170**
			Total Cost of Capital Works that Serve Future Development		**$ 3,339,755**
			Number of Services		**$ 515**
			Cost per Service		**$ 6,485**

Estimated costs are derived from recent experience locally, but there is no warranty that actual costs will not vary. McElhanney accepts no liability for actual costs which may vary from the estimated construction costs provided herein.



Deep Bay Water District - Potential Development Areas

Legal Description	Current Zoning	Parcel Size (hectares)	Potential Lot Yield	Comments & Assumptions
Area A: Lot 1, Plan 45313 & Lots 2, 3 and 4 Plan 7560	Commercial (CM5M)	2.92	28	- Zone allows 10 condominiums per hectare
Area B: Rem Lot A , Plan 48840	Rural (RU1D)	41.88	125	- Land removed from ALR April, 2004 - Assume land is re-zoned to Residential and developed at 3 lots per hectare
Area C: Lot B, Plan 38643	Resource Management (RM1A)	37.29	111	- Land in ALR - Assume land is re-zoned to Residential and developed at 3 lots per hectare
Area D: Parcel "C" DD 70377-N and Parcel "E" DD 394182-I	Rural (RU1D)	24.32	72	- Assume land is removed from ALR, re-zoned to Residential and developed at 3 lots per hectare
Area E: Lot 17, Plan 38181	Residential (RS2M)	4.46	4	- Land is currently being subdivided to create 4 lots
Area F: Lots 10, 11, 12 and 13, Plan 7560	Residential (RS2M)	6.56*	17	- Assume large parcels are re-subdivided at 3 lots per hectare
Area G: Lot 28, Plan 22249	Residential (RS2M)	1.09	3	- Assume large parcel is re-subdivided at 3 lots per hectare
Area H: Remainder of District Lot 28 (South)	Rural (RU1D)	27.87	83	- Assume land is removed from ALR, re-zoned to Residential and developed at 3 lots per hectare
Parcel I: Lot 1, Plan 31751	Residential (RS2M)	2.96	8	- Assume large parcel is re-subdivided at 3 lots per hectare
Area J: Lots 1 through 12, Plan 35694	Rural (RU1D)	19.19**	54	- Assume large parcels are re-zoned to Residential subdivided at 4 lots per hectare - Assume large parcels are subdivided at 3.5 lots per hectare
Area K: Lot 2, Plan 61726	Residential (RS2M)	2.7	10	- Owner has proposed a 10 lot strata development
	Totals	145.5	515	

*: Parcel F

Area	Assumption	Lot Yield
1.09	3 lots/ Ha	3
1.32	3 lots/ Ha	3
1.94	3 lots/ Ha	5
2.21	3 lots/ Ha	6
	Total	17

**: Parcel J

Area	Assumption	Lot Yield
1.98	3 lots/ Ha	5
2.04	3 lots/ Ha	6
2.09	3 lots/ Ha	6
2.17	3 lots/ Ha	6
2.16	3 lots/ Ha	6
1.96	3 lots/ Ha	5
2.02	3 lots/ Ha	6
2.08	3 lots/ Ha	6
2.69	3 lots/ Ha	8
	Total	54

McElhanney

McElhanney Consulting Services Ltd.

SUITE #1, 1351 ESTEVAN RD.
NANAIMO, BC V9S 3Y3

PH (250) 716-3336
FAX (250) 716-3339

LEGEND

- DEEP BAY WATER DISTRICT BOUNDARY
- BOWSER WATER DISTRICT BOUNDARY
- POTENTIAL DEVELOPMENT AREAS

SCALE : 1:10000

0 100 200 400 600 800 m

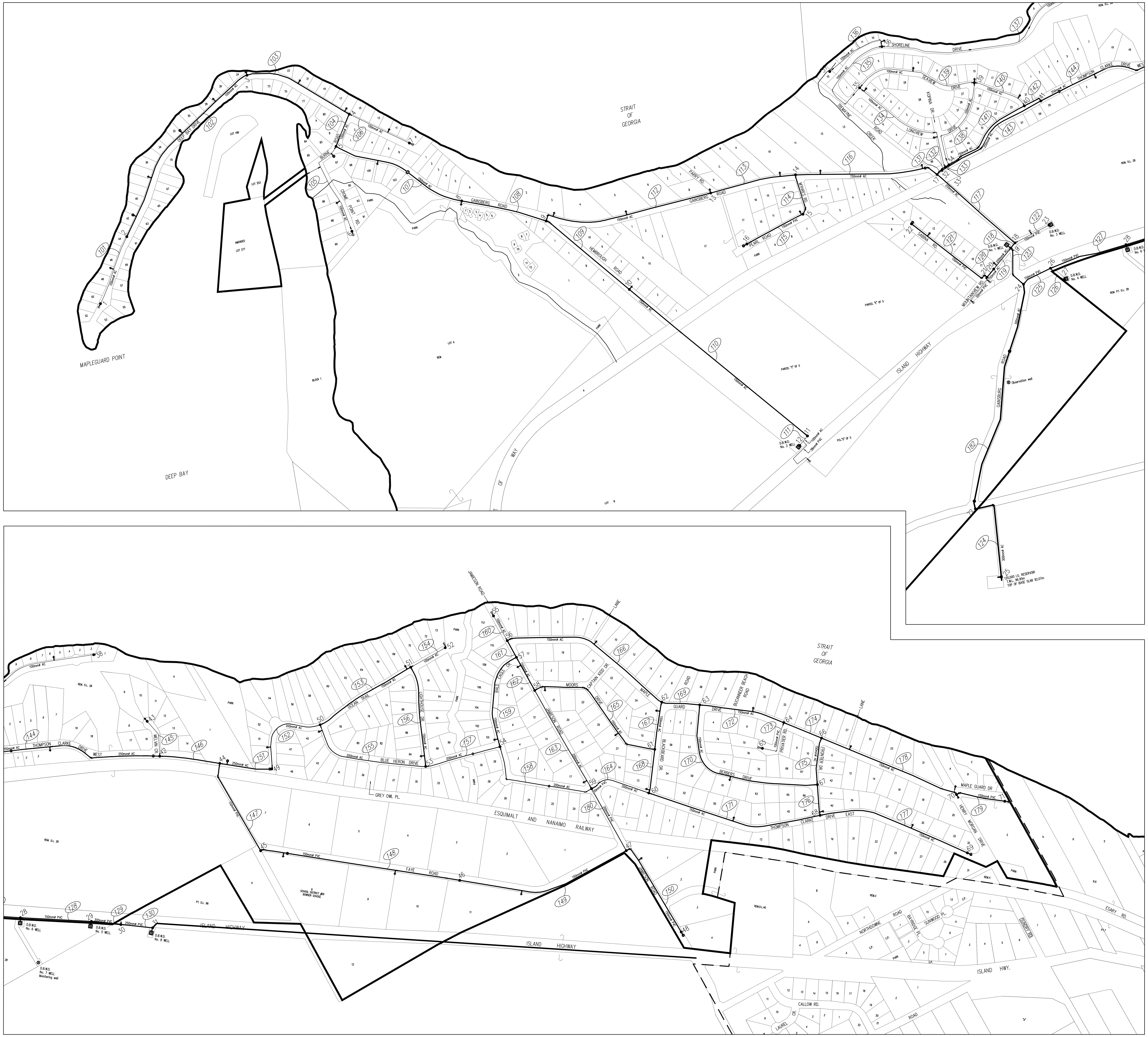
(ALL DIMENSIONS ARE IN METRES)

DEEP BAY WATERWORKS DISTRICT

WATER SYSTEM EVALUATION - JANUARY 2008

FIGURE 2.1 - POTENTIAL DEVELOPMENT AREAS

Designed: RRI	Checked: –	Date: JAN 2008	Drawing No. 27303-1-2
Drawn: JAD	Surveyed: –		Revision: A
MCSL Project No. 2231–27303–1			



McElhanney
McElhanney Consulting Services Ltd.
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REVISIONS & NOTES:

1. ALL LEGAL INFORMATION CONCERNING LOCATION OF PROPERTY LINES, ETC. YET TO BE CONFIRMED.

2. SEPT. 21 / 06 – DBWD's FIRE HYDRANT #'s AND FLUSHOUT #'s UPDATED AS PER INFORMATION RECIEVED FROM DEEP BAY WATER DISTRICT.

3. REV #1 FEB. 26 / 07 – ADDED PIPE #80 ALONG JAMIESON ROAD FROM NODE 47 TO 59.

LEGEND

DEEP BAY WATER DISTRICT BOUNDARY
BOWSER WATER DISTRICT BOUNDARY

FLUSHOUT
HYDRANT
150mmø AC
AIR RELEASE VALVE
VALVE
PRESSURE REDUCING VALVE STATION
WATERMAIN DIAMETER, AND PIPE MATERIAL

SCALE : 1:5000

0 50 100 200 300 400m

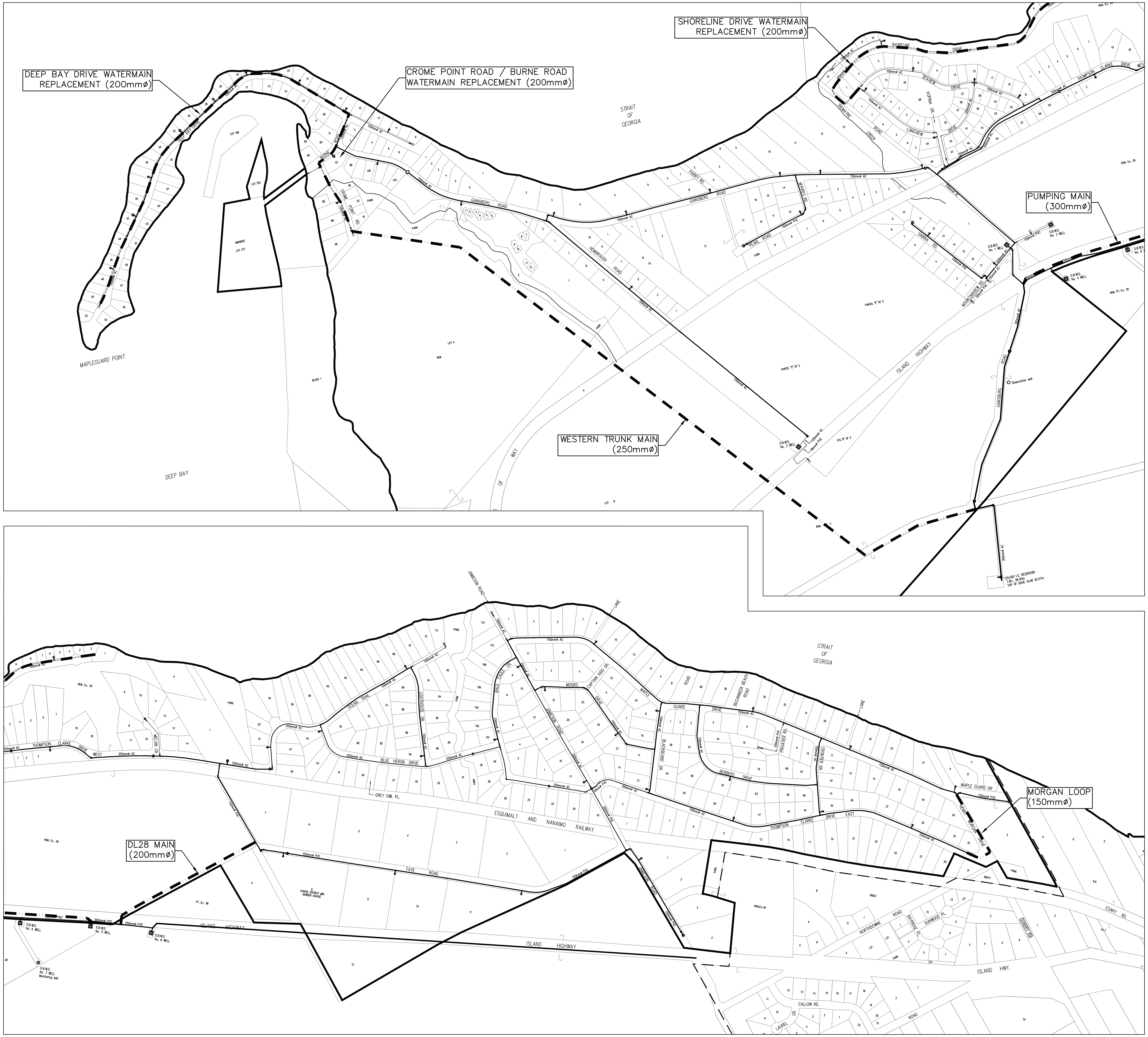
(ALL DIMENSIONS ARE IN METRES)

DEEP BAY WATERWORKS DISTRICT

WATER SYSTEM EVALUATION - JANUARY 2008

FIGURE 4.1 - PIPE AND NODE PLAN

Designed: RRI	Checked: –	Date: JAN 2008	Drawing No. 27303-1-4
Drawn: JAD	Surveyed: –		
MCSL Project No. 2231–27303–1			Revision: A



McElhanney
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LEGEND

- PROPOSED WATERMAIN
- DEEP BAY WATER DISTRICT BOUNDARY
- BOWSER WATER DISTRICT BOUNDARY

FLUSHOUT, HYDRANT, AIR RELEASE VALVE, VALVE, PRESSURE REDUCING VALVE STATION, 150mmø AC — WATERMAIN DIAMETER, AND PIPE MATERIAL

SCALE : 1:5000
0 50 100 200 300 400m
(ALL DIMENSIONS ARE IN METRES)

DEEP BAY WATERWORKS DISTRICT

WATER SYSTEM EVALUATION - JANUARY 2008

FIGURE 5.1 - PROPOSED DISTRIBUTION SYSTEM UPGRADES

Designed: RRI	Checked: –	Date: JAN 2008	Drawing No. 27303-1-5
Drawn: JAD	Surveyed: –		
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