REGIONAL DISTRICT OF
CENTRAL OKANAGAN

Fintry Water Utility System Study Report

Prepared by

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1.0 BACKGROUND

1.1 INTRODUCTION

CTQ Consultants has prepared this report in response to a request from the Regional District of Central Okanagan (RDCO) to undertake a study of the Fintry Water Utility, of which is privately owned and operated. This study provides the required information to assess the condition of the system, determine upgrading requirements to meet the RDCO Bylaw 704 standards, prioritize improvements, prepare rough cost estimates, and address any other issues that are deemed critical to the District in their decision making. The primary objective of this assignment is to provide professional advice and recommendations regarding the potential acquisition of the water utility by the RDCO.

The RDCO would like to review the condition of the Fintry Water Utility system in order to determine whether the District should proceed with taking over management and operation of the utility in partnership with the community. Based on a favorable status of the utility and depending on capital improvement costs, RDCO may assume responsibility. The District may also apply for a grant under the Canada/BC Infrastructure Program (CBCIP) for funding of any deficiencies or upgrades required to meet current RDCO standards for domestic water systems.

During the review of the water system and the assessment study, we collected available data on the existing water infrastructure from various public and private sources. We also extracted information from the Northwest Side Water Report by Aqua Consulting, Sept 2007 to the Regional District. A site visit was conducted on February 25, 2010 to inspect the infrastructure and meet with the current owner of the utility, Mr. Peter Muhlberger. In addition to reviewing the arrangement, age and condition of the system, we also identify water consumption (both current and future demands), water quality and water storage for both domestic needs and fire fighting.

Lastly, we identify the system upgrades required for lower Fintry to meet the standards of the Regional District Subdivision and Development Servicing Bylaw 704. The estimated capital costs for these upgrades are identified and separated as recommended upgrading and longer term upgrading.

1.2 SERVICE AREA

Lower Fintry is located on the west side of Okanagan Lake, east of Westside Road N. at the junction with Fintry Delta Road, Kelowna, BC, and approx 40 km north of Highway 97 in Westbank. The original water utility including pumphouse and distribution system was designed in 1966 and built shortly thereafter.

Various drawings have been located on this utility and subdivision. These include the following drawing sets, of which are also attached under **Appendix A.**

- Fintry Utilities, dated **April to June 1966**, Drawing #57901 to 57906, includes general layout for Stage I development and detail drawings. Drawings prepared by Interior Engineering Services Ltd.
    - COMMENTS: These drawings show the original lot layout and infrastructure such as watermain sizing and type of pipe; hydrant details including valve box; service connections; and original intake, pump house and concrete reservoir. We note however that the rectangular pumphouse structure shown on the drawings clearly does not exist today (see picture below of existing round pumphouse).
- Fintry Utilities, dated **June 1967**, Drawing #75401 showing general layout for Stage II development. Drawings prepared by Interior Engineering Services Ltd.
    - COMMENTS: This drawing only shows a hand full of additional lots in the subdivision over the 1966 drawings. Also, only 2 hydrants are shown whereas there are actually 6 hydrants today.
- Fintry Utilities, dated **October 1971**, Drawing #1105-01 showing general layout of additional proposed lots in subdivision. Drawings prepared by Interior Engineering Services Ltd.
    - COMMENTS: Although a little hard to read, this drawing is considered one of the most relevant in terms of what exists today and the lot layout. We note that a number of the lots shown on this drawing have since been turned over to the adjacent park.

- Fintry South Management Ltd., dated **February 15, 1982**, Drawing #WP-01 to WP-05, includes design details for a proposed new wet well, pump house, intake and chlorination system. Drawings prepared by the UMA Group.

    - COMMENTS: Although this drawing set is interesting in terms of what was planned for upgrading the supply system, they are largely irrelevant. None of what is shown on these drawings was ever built.

The buildable lots for development are included under three Plan numbers as follows.

From the plat drawings, there are three Plan numbers.

- Plan #15329 Lots 1 – 91
- Plan #18481 Lots 1 – 15
- Plan #20614 Lots 1 – 12 plus Gate House for Park

Of the above noted lots, there are about four lots that are designated as 'beach access' or other public access. It appears that there are about 108 buildable lots with 83 lots currently developed and connected to the system. Two additional lake lots are developed but have their own private water wells and thus are not connected to the utility system. This is a seasonal community. Approximately 33 of the 83 dwellings are considered full time residents.

1.3 SYSTEM ARRANGEMENT

Review of the utility system included a review of the original subdivision drawings as noted above, water quality data obtained from Robert Birtles of Interior Health Authority (IHA), information obtained from Christoph Moch of the BC Water Stewardship Division, phone conversations with Teal's Water Services and Mt. View Electric, review of the intake piping by Aqua-Bility Projects Ltd., and the author's February 25, 2010 site visit. The water system review and subsequent recommendations are based on the information collected.

As noted earlier, the layout drawings from 1966 to 1971 are not a current representation of the local buildable lots today as many have been turned over to the Park.

INTAKE AND PUMP STATION

The high lift pumping station and wet well is located right adjacent to the boat launch as shown on the attached drawings under **Appendix A**.

The pumphouse is a wood frame structure and the wet well is of concrete construction. We understand that the roof has been re-shingled since the pumphouse had been originally constructed. In general, this pumphouse structure appears to be in good shape.

The lake intake consists of a 200mm diameter pipe that runs about 60m out into the lake. The depth of the intake, as confirmed by Aqua-Bility Projects Ltd., is 8.5m below the surface of the lake. The original 1966 drawings show it as CL2400 concrete sewer pipe. Several joints on the intake pipe show signs of leakage. The intake pipe is apparently backfilled with native gravels. Lake levels are said to fluctuate ± 0.6m or so, but the fluctuations have not been an issue with the intake elevation. A diver was hired about 15 years ago to inspect and de-silt the intake screen. The recent inspection by Aqua-Bility Projects Ltd. indicates that the intake screen has fallen off and that the screen itself does not meet current M.O.E fishery specification.

The concrete wet well casing is located inside the pumphouse and is 1200mm in diameter and approximately 4.5m in depth. According to Mr. Muhlberger, he cleans out the wet well annually although there are no maintenance records to indicate this. The wet well pumps consist of the following:

- One – 10 hp submersible pump rated for about 95 USgpm at 200ft TDH
- One – 15 hp submersible pump rated for about 105 USgpm at 200ft TDH

Both pumps are about 4 years old including the new wall-mounted starters. In addition, the old Goulds submersible pumps (1 – 10 hp and 1 – 3 hp) are in storage in the pumphouse as emergency backups. We understand that the new pumps have never cavitated indicating that the water level in the wet well over the pumps has been of sufficient level under maximum demand.

Pump Starters

Wet Well

Under heavy summer water usage, both pumps cannot run simultaneously, as they will trip the 100 Amp breaker in the pumphouse. There is also no pressure gauge on the pumps although distribution pressure is thought to be up around 90 psi typical at the lot line.

There are no additional (high lift) pumps. These wet well pumps push water directly up to the reservoir. There is a dedicated 150mm diameter ductile iron pipe that runs from the pumphouse directly up to the reservoir. Length of this dedicated line is estimated to be 125m.

POWER & CONTROL PANEL

Power supply to the Fintry pumphouse is “single phase” with a single transformer on a nearby hydro pole. The breaker box is 100 Amp/220 Volt supply. Normal pump operation is a lead/lag sequence.

The pictures above show the control panel in the pumphouse. Some of the components in the panel have recently been upgraded including dual starters and other electrical switches, wiring, etc.

CHLORINATION SYSTEM

The only treatment at the utility is disinfection using Sodium Hypochlorite, which is located inside the pumphouse. The liquid hypochlorite system uses a Hypochlorite bleach solution. The chlorination system consists of a one-year old PulsaFeeder chlorine metering pump and a new chemical holding poly tank, which discharges directly into the wet well. Residual readings are taken daily and submitted to the IHA.

TURBIDITY MONITORING

There is no online turbidimeter or chart recorder and thus no method of monitoring of turbidity levels. No turbidity readings are taken or observed with the exception of monthly grab samples of the raw water, which are also submitted to the IHA.

RESERVOIR

The water reservoir for the Fintry Water Utility is located along Fintry Delta Road about half way up the embankment between the lakeshore pumphouse and Westside Road. We understand that the reservoir was built in about 1977. The high water elevation in the reservoir is about 60m above the intake wet well pumps. The 60m head (87 psi) is higher than that shown on the 1966 drawings but, again, these old drawings may not reflect what was actually built and at what elevation.

The reservoir is a partially below-grade, single compartment, unbaffled, reinforced concrete structure (rectangular in shape) with an assumed capacity of 50 m^3 (11,000 Imp gallons). The structure has an attached utility room that houses the piping and valves and has an electrical box for a new beacon light on the outside of the structure. The beacon is a warning light that comes on when the reservoir water level drops below minimum and/or there is a power outage.

There is a dedicated 150mm ductile iron main from the pumphouse up to the reservoir.

There is a second mechanical/storage room which was built should a second reservoir tank be constructed. Pipe works would be placed inside this room, also adjacent the existing reservoir. New electrical outlets have been installed inside the mechanical room including electric heaters in both the utility and mechanical rooms.

The concrete reservoir was designed and built for future expansion. The original structure was designed such that a second reservoir cell and possibly even a third cell could be added on to the existing structure. The existing reservoir has extension walls in-place with rebar for tying into newly constructed concrete walls. (see photo to the right and the 1966 Drawing #57903 in the Appendix).

DISTRIBUTION SYSTEM

The distribution system is capable of feeding to and servicing approx 108 buildable lots. Currently, 83 lots are connected and serviced from the utility system and consists of a single pressure zone. Water mains are indicated on the original layout drawings as being 150mm diameter AC (Asbestos Cement) pipe and are buried from 1.2m to 1.5m below grade. The exception to this is on Morden Road where the mains are 100mm diameter. There is approximately 1,860 lineal meters of water main along the three roads in Fintry. Size of mains under each of the roads including approximate length of pipe (scaled from the drawing) is as follows:

- 808 meters (2,650 lineal feet) of 150mm main along Delta Road
- 686 meters (2,250 lineal feet) of 150mm main along Shorts Road
- 366 meters (1,200 lineal feet) of 100mm main along Morden Road

The pipe sizes noted above have recently been confirmed in the field. In order to meet the RDCO Bylaw specifications in terms of minimum fire flow (60 l/s) and maximum flow velocity

within the pipes (4m/s), mains that are to supply fire protection (hydrants) need to be a minimum of 150 mm (6 in.).

Residential home pressure at the house lot lines is relatively high; in the range of about 90 psi. The pressure is confirmed by the elevation of the reservoir at approximately 60m or 87 psi. This pressure range is higher than what may be considered an ideal pressure of 60 psi (400 kPa), but the District Bylaw states a maximum static pressure of 145 psi (1000 kPa) is acceptable. New building codes recommend pressure reducing valves at each house if pressure is higher than normal levels.

Hydrant locations are indicated on the 1971 drawing under **Appendix A**. These are the smaller 100mm size hydrants, common in smaller rural communities such as Fintry, whereas 150mm hydrants are more common in larger communities and towns. The hydrant spacing appears beyond the accepted standard on the three main roads in Fintry. With a fire flow of 60 l/s, the maximum hydrant spacing is 143m. The maximum spacing between hydrants in Fintry is as much as 274m.

There are a total of 6 fire hydrants located as follows:

- 2 hydrants on Delta Road, marked as #1 and #2
- 1 hydrant on Morden Road, marked as #3
- 3 hydrants on Shorts Road, marked as #4, #5 and #6

The distribution system is partially looped. It appears that the main along Shorts Road dead ends about 15 lots past the conjunction with Morden Road. It is assumed that the Delta Road mains dead end at the park gate house towards the north end.

1.4 SYSTEM OPERATION

The Fintry Water Utility system is currently owned and operated by Mr. Peter Muhlberger of Fintry, BC. Peter Muhlberger has a Small Water System Operators Certificate. On February 25, 2010, Peter was available for discussions in regard to the utility's operation, including an inspection of the system equipment and infrastructure.

A 200mm diameter intake pipe extending 60m into the lake supplies lake water to a wet well located inside the pumphouse. The depth of the intake is approximately 8.5m below the surface of the lake. The two wet well submersible pumps feed water up to the 50 m^3 (11,000 Imp gallons) reservoir at an elevation of approximately 60m above the pump elevation.

The water level within the reservoir is controlled by level switches with activate / deactivate the submersible pumps in the wet well. The two pumps can be cycled on and off but cannot run simultaneously due to an inadequate 100 Amp breaker box which trips the breaker. It may be desirable during high demand days in the summer to be able to run both pumps simultaneously. It is unknown as to how long it takes to fill the reservoir but it is suspected that the 10 or 15 hp

pump runs quite frequently during peak demand. The pump hours are recorded by hand on a calendar in the pumphouse.

Liquid sodium hypochlorite is used for disinfection within the water system. The liquid is metered via a PulsaFeeder metering pump directly into the wet well. However, the dosage rate of the metering pump could not be determined. When the pumps starts to fill the reservoir, the hypochlorite metering pump injected chlorine into the wet well at an unknown pre-set metering rate.

The North Westside Fire Rescue Department provides fire protection services to the Fintry area residents. This is a 'registered' fire department with the Province.

With no flow meter, it is not possible to determine actual water usage and more importantly actual peak demands. However, based on Mr. Muhlberger's manually calculated pump usage of 12 - 16 hours (average) per day recorded in July and August on his calendar, Maximum Day Demand (MDD) can be estimated.

There appears to be no formal operational records other than hand written notes on drawings and calendars of the pump hour usage for example. Water bacteriological testing is conducted by Interior Health Authority regarding drinking water quality. Water sampling (monthly grab samples) and daily chlorine residual monitoring is being conducted by the system operator. Only limited historical data and chlorine residual data was available from Robert Birtles of IHA.

2.0 SYSTEM REVIEW

2.1 APPLICABLE STANDARDS

For the purpose of our review, the adequacy of the Fintry water system has been evaluated using the standards and specifications contained within the Regional District of Central Okanagan Bylaw 704.

2.2 WATER SUPPLY

The Fintry water system uses water from Okanagan lake for domestic use and fire protection. There is a 200mm diameter intake from the wet well that runs into the lake about 60m and is about 8.5m deep. This has been confirmed recently by an inspection of the intake piping and screen by Aqua-Bility Projects Ltd. Robert Birtles of IHA had stated that a deeper intake (although desirable) would likely be costly due to a natural shelf on the west side of the lake that extends out a considerable distance before it drops off. Therefore, the 8.5m depth may be near the maximum achievable without a substantial capital expenditure to deepen the intake.

Rough calculations indicate that the 200mm diameter intake (assuming a roughness coefficient C = 100) should have plenty of capacity to meet MDD. However, the limiting capacity factor is really the screening on the end of the pipe. The inspection of the intake has shown that the intake screen is no longer attached to the intake and will need to be reattached or replaced.

Information on the water license for the Fintry Water Utility was provided by the Water Stewardship Division in Victoria. The water license was issued in December 1968 for 50,000 Imp gallons per day. Based on our calculations, current usage (average day demand) appears to be about 144 m^3 (31,619 Imp gal/day) based on 83 connected lots.

The submersible pumps are capable of supplying the current maximum day demand for the system. However, it may be desirable to increase to a 200 Amp service so that both submersible pumps could run simultaneously if needed during peak water demand. The dependency on an aging water system of 40 years is an issue of concern for the short and long term. Further discussion on water consumption is covered under **Section 2.3**.

2.3 WATER CONSUMPTION AND PUMP USAGE

Actual water demand cannot be determined because there is no flow meter on the pumps. However, some information was obtained from the operator on pump hours as shown below.

There is one – 10 hp submersible rated for about 95 USgpm at 200 ft TDH and one – 15 hp submersible rated for about 105 USgpm at 200 ft TDH.

Therefore, using an average pump flow rate of 100 USgpm (1 pump running) and the pump hours for 2009, we can calculate the demand as follows:

Jan 1, 2009	11510 hours
Dec 31, 2009	13820 hours
Total pumping/09	2,310 hours

At a pump rate of 100 USgpm the water usage is 13,860,000 gallons/year, or average an average of 37,973 USgal/day. This is equivalent to 144 m^3 / day (31,619 Imp gal/day).

During July & Aug 2009, pump usage varied between 12 – 16 hours average during high peak demand, which is equivalent to a MDD of 273 m3/d (72,000 USgal) – 363 m3/d (96,000 USgal). July 3, 2009 was a peak demand day in which the system operator had to enforce water restrictions. A pump runt time of 19 hours recorded, which is equivalent to 432 m3/d (114,000 USgal).

Therefore, assume MDD in the summer months is a high of 432 m3/d (114,000 USgal), and based on 83 connections to the system, the per lot usage is 5.2 m3/d/lot. The RDCO Bylaw MDD of 3000 l/cap/day and an average of 3 persons per residence, is equivalent to a per lot usage of 9.0 m3/d/lot

The actual MDD per lot calculated from pump usage is less than the RDCO Bylaw design guideline for MDD of 9.0 m3/d/lot. The water model analysis utilized the RDCO Bylaw design guideline for MDD.

It is recommended that the Fintry Water Utility, in the short term, install a flow meter and pump-hour meter to get a better handle on demands and daily pump usage. It would help build a database should the community elect to keep their current system for the short term or upgrade the existing system.

Existing reservoir capacity is assumed to be 50 m3 (11,000 Imp gallons). RDCO design guidelines suggest a minimum storage volume of 324 m3 for fire protection, plus an additional 25% of MDD and an additional 25% for emergency storage volume. This suggests a reservoir volume of 540 m3 (119,000 Igal). The expansion of the existing concrete tank structure is possible, but would not practically satisfy the minimum fire storage as required by the Regional District Bylaw 704.

2.4 COMPONENT CONDITION

A brief observation of the condition of the components of the water system suggests that the system has been maintained and is in fair to good condition, and has also been upgraded recently (new high lift submersible pumps, chlorination feeder, controls, etc). However, given the 40+ year age of the system, it is difficult to predict the amount of service life left on some of the infrastructure, especially the buried mains and even the concrete reservoir. Although the watermains, valves, hydrants and service connections have for the most part been without

major problems or repairs according to parties who have maintained them for the Water Utility, there are no guarantees as to how long before repairs become more frequent.

Approximately 3 years ago, the water mains were pressure tested to determine if any leaks existed. This work was done by Teal's Water Service of Vernon (formally Western Water). The author of this study had a telephone discussion with Dennis of Teal's Water Service on March 1, 2010. The following are highlights of this discussion.

- Teal's has been servicing the Fintry Utility for almost 10 years.
- Dennis confirmed the pressurized leak tests on the water mains were done 3 years ago.
- Other than one slightly opened valve near the end of Delta Road (of which was ultimately closed), there were no issues with the AC water main.
- The leak testing consisted of pressuring closed sections of the distribution system with between 100 – 120 psi pressure held for approx 1 hour. All tests passed.
- He also confirmed that there are curb stops with valve boxes at every lot.
- Teal's has flushed the water mains on a number of occasions and reported that Pete Muhlberger also flushes the mains himself.
- Teal's has also cleaned out the reservoir tank and confirmed its condition is good (no leaks).
- Dennis could not say much about the intake itself but did confirm that the wet well has been cleaned out.
- He verified that the 100mm fire hydrants are all in good working order.

No formal maintenance schedule exists at this time but should be developed, as the IHA normally requires this for conditions of operating permit. Also, it appears as though no maintenance journal exists to record on going repairs or upgrades. An Emergency Response Plan should be updated and submitted in accordance with the IHA requirements and regulations. This should define the telephone tree hierarchy for action in an emergency.

For the delivery of domestic demands, system appears functional with relatively recent upgrades on some components such as pumps and control panel upgrades. The pumphouse structure appears to be in relatively good shape considering its age. However, there are some major concerns with the utility. The most critical are those indicated below:

1) Reservoir storage capacity is critically inadequate. A fire storage volume (50 m3) is only a fraction of what is required under the Regional District standards.

2) The major components of the system are quite old, most of which was built between 1966 and 1971. The condition of some of the underground distribution infrastructure (AC watermain piping) appears from the recent site excavations to be in good condition but is difficult to evaluate fully without removing and testing a section of the pipe.

3) The 100 Amp service should be increased to 200 Amp so that both submersible pumps could run simultaneously if needed during high demand days. There is also no backup power such as a generator.

Other less critical, the following are other items that should be addressed either now or in the future:

1) Install a master flow meter and pump cycle meter, of which are both recommended to better understand and record the operational capability and demand on the system.

2) Install an on-line turbidimeter to build a data base on the variability of the water quality for subsequence treatment considerations in the future such as UV and/or filtration.

The electrical power and control equipment (some new), which is mounted on the wall of the Pumphouse, appear to be in good condition. The only concern might be that a break in the water piping could spray and damage the electrical equipment but screening could be provided to reduce the risk.

There are a number of both short-term and longer-term upgrades that should be considered, as identified under **Section 3.0**.

Recent upgrades and servicing/maintenance that have occurred include:

1) New submersible pumps in wet well including new wall-mounted starters

2) Upgrades to control panel

3) New Hypochlorite Pulsa-Feeder metering pump and poly chemical tank

4) Watermains were flushed by Teal's Water Service

5) Reservoir was cleaned by Teal's Water Service a few years ago

2.5 WATER QUALITY

The Design Guidelines refer to the *Guidelines for Canadian Drinking Water Quality* as the basis of determining whether the water is free of harmful chemicals, pathogens, and without objectionable colour, odour, and taste.

2.5.1 Physical and Chemical Analyses

The following information on the Fintry Water Utility was provided by Robert Birtles at IHA. Unfortunately, the data is limited at best. Copy of the data including Golder Associates sampling of the intake water directly after a plane crashed near the pumphouse in 2009 is included under **Appendix B**. The following is a summary of water quality data (or lack thereof) collected on the system from IHA including other inspection observations:

1) The last two IHA inspection reports were reviewed with some of the deficiencies corrected.

2) There is no filtration or UV currently for this utility.

3) Water intake depth noted as 8.5m is correct.

4) Emergency Response Plan should be updated.

5) There is no consistent history on lake turbidity levels for this utility. An on-line turbidimeter should be installed to develop a history of water quality, especially for when levels rise above 1 NTU.

6) A full water analysis was not available. Should UV be installed in the future, this information would be required to properly size a UV system and determine the appropriate UVT value for design. The following **Table 2** represents some typical water quality parameters that are tested under a complete water analysis. The values under the Analysis column are those typically recommended for drinking water quality.

Table 2 – Typical Water Quality Test Parameters

Parameter	Analysis
pH	6.5 – 8.5
Turbidity, NTU	0.30
Colour, TCU	≤ 15
Total Hardness, mg/l	≤ 500
Chloride, mg/l	≤ 250
Sulphate, mg/l	≤ 500
Sodium, mg/l	≤ 200
Iron, mg/l	≤ 0.30
Manganese, mg/l	≤ 0.05

NOTE: High Chloride concentrations can sometimes be an indicator of wastewater contribution to the water supply or road salt application in the vicinity. Given that all lots are on septic systems in the Fintry area, a high chloride level could be an indication of untreated or partially treated wastewater entering into the lake.

In addition, as many of the residences are seasonal there is a higher potential for standing water in the ends of the lines.

2.5.2 Bacteriological Testing

The system is tested regularly for bacteriological testing by the local Heath Authority. Test records were retrieved from IHA for 2009 and 2008. The results were all acceptable for Total Coliform and E.coli.

Minimum chlorine residuals are required by IHA within the distribution system to protect against bacteriological contamination in the pipe network. The only test data received was for 2008 of which showed a few unacceptable residuals (< 0.2 mg/l).

One concern is the proximity of existing septic fields to the lakeshore as every house in the subdivision has a septic field system. Current regulations require a minimum separation distance of any drinking water source of 100 ft from septic systems. The location of the pumphouse appears to meet this minimum separation distance.

2.5.3 Disinfection System

The current disinfection system is a liquid hypochlorite system that uses a bleach solution. The liquid tank container is metered via a PulsaFeeder metering pump. This is fairly new equipment. For the most part the system is considered adequate but a better method may need to be determined for ensuring the proper residual is maintained throughout the distribution system. Also, a second metering pump should be considered for backup.

2.5.4 Regulations and Treatment Goals

The Safe Drinking Water Act of 2003 and its Regulation (including current amendments) is bringing about significant change requiring water purveyors to supply healthier water to its customers. The continued use of sources of questionable quality is no longer acceptable to Regulatory Authorities. The Interior Health Authority (IHA) has set standards for all water purveyors to work towards. These include the 4-3-2-1-0 Guidelines as defined below:

4	4 log (99.99%) inactivation of viruses
3	3 log (99.9%) reduction or inactivation for both giardia and cryptosporidium
2	Two treatment barriers for all surface waters
1	1 NTU maximum turbidity with a target of 0.1 NTU
0	0 total and fecal coliforms and E. Coli

The Okanagan Lake water quality is of relatively high quality with moderate to low turbidity. However, additional water quality information and analysis is required to confirm this. One of the biggest health risks with surface water is the possibility of pathogens, such as

Cryptosporidium and *Giardia*, entering the water system and ultimately through the distribution system onto the consumer.

The IHA is requiring that all "surface water" sources be filtered in providing one of the barriers for pathogen removal. However, we believe a staged approach towards this longer term filtration goal would be the planning for Ultraviolet Disinfection (UV) as one of the barriers. There are small packaged UV systems that are available on the market. The existing Fintry pumphouse may have enough room to house small wall-mounted UV systems.

Chlorination is generally ineffective against *Cryptosporidium* but is still required for maintaining a disinfection residual in the distribution system and in providing for protection from viruses. The current disinfection system is a liquid hypochlorite system that uses a bleach solution. The liquid is metered via a PulsaFeeder metering pump. When the pump kicks on, based on reservoir level control, the hypochlorite metering pump also starts up and chlorine is fed directly into the wet well at a pre-set metering rate.

To inactivate viruses and bacteria, the minimum disinfection contact time measured before the first customer should be six milligrams per minute per liter (6 mg-min/L). This value is called "Chlorine Contact Time" or CT. Unfortunately, due to insufficient information on residuals and a reliable water analysis, chlorine contact time (CT) could not be accurately determined.

While currently these are only goals, all water purveyors must develop plans of how they will work towards these. This can have a significant financial impact on water systems, particularly small ones. As part of our study, we have reviewed the existing treatment system and available water quality testing to provide an overall assessment of future treatment upgrades (if necessary) and estimated costs.

2.5.5 Source to Tap Assessment Guideline

This section is included because it might warrant further study should treatment be considered utilizing the current surface water intake source, and because an assessment of the current source may be necessary should "*filtration deferral"* be pursued in favour of just UV protection.

This is for long term considerations and should not affect any of the short term recommendations discussed under **Section 3.4**.

The Source to Tap Assessment Guideline is a document under the BC Ministry of Health Services. The guideline fulfills the need for a comprehensive assessment that may be ordered by a Drinking Water Officer when significant risks are identified for a water system. This in no way suggests the Fintry water system is at risk. However, the guide is also a tool for better understanding potential risks and how to produce the best possible water quality.

The primary aim of the Source to Tap Guideline is to characterize and assess the water source components, risks for potential contamination, and recommend actions for improved drinking water protection. The first module of this guideline considers the watershed area and evaluates the integrity and location of the water intake.

It would still be our recommendation to pursue and budget for UV disinfection as a staged approach to a better water quality. Filtration may ultimately still be required in the future, unless *filtration deferral* can be justified. With *filtration deferral*, it is likely that the assessment would show the need for a deeper intake, which IHA has already alluded to this being desirable.

The Agua Consulting report to the RDCO on the Northwest Side Water Study, dated Sept 26, 2007, was also reviewed. This report suggests a deep lake intake on the north side of the Fintry delta could be obtained to a depth of 35 m (115 ft) at a distance of about 500 meters (1,640 ft) from shoreline. A cost at that time was estimated at **$175,000** to install a deep lake intake.

2.6 RESERVOIR AND FIRE PROTECTION CAPACITY

2.6.1 Reservoir Volume

The North Westside Fire Rescue unit provides fire protection services to the Fintry area residents. This is a 'registered' fire department with the Province. There are sufficient fire hydrants within the community but the reservoir storage is much too small to adequately fight fires.

The RDCO Bylaw (Fire Underwriters Survey) design guidelines requires a minimum storage volume of 324 m3 for fire protection, plus an additional 25% of MDD and an additional 25% for emergency storage volume. The minimum fire storage volume of 324 m^3 is based on a fire flow of 60 l/s for 1.5 hours.

It appears the concrete reservoir is capable of being expanded by adding at least one more tank of the same size and potentially up to two more additional tanks. Extension walls had been constructed, with rebar for tying into newly constructed concrete walls (see the 1966 Drawing #57903 in the Appendix). If this were considered, the ultimate volume, utilizing the existing tank could be as follows:

Existing tank,	50 m3 (11,000 Imp gal)
Second tank,	50 m3 (11,000 Imp gal)
Third tank,	100 m3 (22,000 Imp gal)
Total Volume increase	**200 m3 (44,000 Imp gal)**

To meet the RDCO Bylaw standards, the minimum reservoir volume for future water usage and fire storage should be 540 m3. Although the expansion of the existing reservoir is an option, storage would still be inadequate. Another drawback is the age of the structure and thus the condition. The structural integrity of the concrete structure should be verified by a structural engineer if this option is pursued. A more viable option may be the construction of a new reservoir at a cost as estimated in Section 3.2.1.

2.6.2 Fire Flow Capacity

A computer simulation of the system was prepared to estimate the fire flow capacities at the hydrants. The simulation report is attached under **Appendix B**. System Demands were input at 3000 liters per day per capita and assumed 3 people per single family lot. Hydrant flows to sustain a minimum main pipe pressure of 20 psi were generated.

A Hazen-Williams coefficient of friction C = 100 was assumed for all pipes.

Per the RDCO design guidelines, the minimum diameter of distribution mains that provide fire flows is 150 mm (6 in.). However, the water main diameter is only 100mm along Morden Road.

The model calculated available fire flows at each hydrant of:

Hyd 1 - Delta Road	34 l/sec	150mm dia main
Hyd 2 - Delta Road	47 l/sec	150mm dia main
Hyd 3 - Morden Road	41 l/sec	100mm dia main
Hyd 4 - Shorts Road	58 l/sec	150mm dia main
Hyd 5 - Shorts Road	52 l/sec	150mm dia main
Hyd 6 - Shorts Road	40 l/sec	150mm dia main

There are insufficient fire hydrants within the community to meet the hydrant spacing required. The fire flow capacity at the hydrants does not meet the 60 l/s Regional District Bylaw requirements for fire flow.

2.7 PRESSURES

The distribution system is comprised of 150mm and 100mm dia AC watermain as indicated above including a dedicated 150mm main between the pump station and reservoir. Teal's Water Utility Services pressure tested the AC water mains in about 2007 and found no line breaks. The leak testing consisted of pressuring closed sections of the distribution system with between 100 – 120 psi pressure held for approx 1 hour. All tests passed. However, the system is over 40 years old; thus, there are no guarantees about potential future repairs.

Given the assumed elevation of the reservoir (~ 60m or 87 psi) and confirmation by the residents that pressure at the lot line is also within this pressure range, then adequate pressures do not appear to be an issue with this utility. These values are within the working pressure range recommended in the Design Guidelines of 275 to 1000 kPa (40 psi to 145 psi). However, a pressure gauge should be installed in the pumphouse on the pumps to better determine *actual* pressures on the system.

We suggest that a pressure reducing station could be considered to reduce the current operating pressures. While within acceptable limits, the higher pressures may tend to increase the likelihood of leaks and other maintenance related issues within the distribution system.

2.8 CAPACITY FOR EXPANSION

The population service area appears to be limited to a build-out of 108 lots. 83 lots are currently connected to the utility system. In addition, about 33 of the 83 connected dwellings are considered seasonal residences. As a result, the MDD is seasonally based with the highest in the summer months. All of the dwellings are single-family homes.

The potential for expansion and thus increase demand on the system is considered to be only an additional 25 lots or so. It is very unlikely that other subdivisions such as Upper Fintry and the Valley of the Sun would connect to the lower Fintry system. In fact, the opposite is more likely a possibility that Fintry could someday be connected to a community system for the Valley of the Sun. It is our understanding that the RDCO is investigating the possibly of a well source located in the lower Fintry delta area that would service the Valley of the Sun, Upper Fintry and Kubas subdivisions.

Based on the review of the existing water demand and future water demand under **Section 2.3, 562.0 m3/d MDD** (based on 108 connections and the estimated pump run times) should be considered the design MDD for any system upgrades including a new reservoir. However, as previously indicated, the installation of a flow meter would be better able to confirm actual water usage.

Without storage and /or pumping upgrades (new reservoir), no real capacity exists for expansion of the Fintry Water Utility. As noted, any expansion to the water service boundary should also be evaluated with the knowledge that fire storage is inadequate.

<u>WATER LICENSE</u>

Information on the water license for the Fintry Water Utility was provided by the Water Stewardship Division in Victoria. The water license was issued in December 1968 for 50,000 Imp gallons per day. From the pump hours for 2009, the water usage was **31,619 Imp gal/day** based on 83 connected lots. This is less than the permitted water usage. At a future build-out of 108 lots, it could be estimated then that usage may climb to about 41,000 Imp gal/day average, of which is still less than the permitted 50,000 Imp gal/day.

3.0 WATER SYSTEM UPGRADE PROGRAM

3.1 NEED FOR UPGRADING

In this section, the deficiencies in the system are summarized and estimates of the likely capital improvements that should be considered are presented. An objective of the upgrading project is to improve the reliability and quality of the water supplied to customers of the Fintry Water Utility. However, a further objective is to give the residents short-term options should the Regional District (RDCO) not enter into an agreement to assume management of the system. Should an agreement be reached, it is our understanding that the Regional District would require the supply and distribution system be brought up to current standards and regulations first, whether grant monies become available or not.

3.1.1 Required Improvements

The required improvements as outlined below are no guarantee that the water system will provide reliable service for years to come. Although the water system as a whole appears to be in reasonably good condition, the system is over 40 years old. The deficiencies noted which should be corrected are based on the site visit of February 25, 2010, discussions with IHA and other relevant information that was collected:

1. Complete the maintenance repairs to the intake and wet well as identified within the Aqua-Bility Projects Ltd. investigation and letter.

2. Install a master flow meter on the system at the pumphouse;

3. Install pump-hour meters on the submersible pumps;

4. Provide a stand-by hypochlorite metering system (spare PulsaFeeder).

5. Upgrade the electrical breaker box to 200 Amp service so that both submersible pumps can run simultaneously should demand require it periodically.

6. Upgrades will be required in order to meet the IHA 4-3-2-1-0 guidelines for water treatment. In order to meet the guidelines, filtration and UV treatment would need to part of the treatment process. The UV requirements - dosage, lamp power, etc., are in part a function of the turbidity, determining the Percent UV Transmittance (UVT). Therefore, in order to gauge the requirements and effectiveness of the UV treatment, a turbidimeter for continuous on-line turbidity monitoring would be needed.

7. A back up generator should be provided to provide power to the wet well pumps.

8. In order to provide additional fire flow volumes, the 100mm piping should be replaced with at least 150mm diameter piping, and the undersized hydrants replaced with standard municipal hydrants. Additionally, a blow off should be provided at the mains terminating at dead ends.

9. Increase reservoir capacity to provide a reasonable storage volume for fire protection.

10. Residential service meters should be installed within each home. We understand the Neptune Technologies has a current contract with the RDCO and that the cost of the meters is $500.00 per house to supply and install.

11. A longer term objective would be the installation of 3-phase power to the utility. We understand this is a long term goal of the RDCO. A cost to upgrade to 3-phase (provided from BC Hydro) has been included in our capital cost estimates.

3.2 ESTIMATED UPGRADE COSTS

3.2.1 Required Improvements

The *short-term* costs for the required improvements under **Section 3.1.1** are as follows:

1. Maintenance to lake intake piping and screen replacement	$10,000
2. Install magnetic flow meter and pump hour meter	$12,500
3. Spare PulsaFeeder chlorine metering pump	$1,200
4. Turbidimeter	$5,500
5. Upgrade electrical box to 200 Amp service	$5,000
6. Screening of electrical power components	$1,000
7. Replace 100mm diameter piping, and install blow offs	$55,000
8. Replace existing / install new hydrants (8 @ $3,200)	$33,600
9. Residential Service Meters (83 @ $500)	$41,500
10. Back up Generator	$20,000
11. Install new 540 m3 reservoir	$270,000
Total Recommended Improvement Costs	**$455,300**
Potential Upgrades (*Longer Term* Costs)	
12. UV Disinfection System	$65,000
13. Filtration	$400,000
14. SCADA System	$15,000
15. Pressure Reducing Station	$30,000
16. BC Hydro Installation of 3-Phase power	$170,000
Total Long Term Upgrades	**$680,000**

Notes *:
Items 1 to 11 are considered to be required improvements for the water system and we suggest that they are necessary whether or not the RDCO agrees to assume responsibility for the water system. The required improvements are necessary in order to meet the following objectives.

- Bring the system to a level that is consistent with current municipal and Regional District Bylaw specifications and standards for provision of potable water to a community.
- Provide adequate fire protection to the community.
- Provide maintenance and monitoring capabilities for the system operation.

Items 12 and 13 are included and may be required as some point by IHA in order to meet the 4-3-2-1-0 guidelines. Filtration or the option to apply for a deferral of filtration is dependent on the turbidity characteristics of the supplied water. There is currently no longer term, reliable source monitoring data for turbidity, hence we have suggested the installation of a turbidimeter. The relative shallow depth of the intake is somewhat of a concern in regard to turbidity. Further information and discussion of the potential UV and filtration options are discussed in Section 3.2.2 below.

A SCADA system, costed as item 14, would allow for remote monitoring of the system components thereby increasing the system reliability and reducing the operating costs.

The installation of 3-phase power to the utility has been considered. The cost to upgrade to 3-phase (provided from BC Hydro) has been included in the capital cost estimate as a longer term goal. A rough ballpark estimate was provided by BC Hydro of $10,000 per pole x 17 poles (estimated). The estimate is high due to limited information on the site; ie., topographical map, drawings, tree clearing required, anchors required, etc. With more information, a more accurate determination could be made of how many and height of poles and labour to install.

3.2.2 Water Treatment Upgrading

1) **Ultraviolet Disinfection (UV)** should be considered as a staged approach for providing a safer drinking water. Although two barrier protection for surface waters is the goal (normally includes for filtration), UV could be the first step. Getting a better handle on the water quality first is paramount before a UV and potentially a filtration system can be properly designed. Recommended capital cost option as below:

a) Because there seems to be sufficient room in the pumphouse, it is our opinion that a least cost option for UV and one which is easily expandable as demand increases, would be small wall-mounted units such as offered by UV Pure or other similar packaged UV system. These UV wall units are in use in BC and have been acknowledged by IHA as reliable systems for small water utilities.

b) Because these small (30 gpm units) UV package systems can be added as demand increases, we recommend sizing the UV treatment for a current MDD demand (108 lots) of 560 m3/d. Based on pumps running up to 18 hours per day, this equates to about 100 USgpm UV system.

c) These wall UV units are 30 gpm rated. Therefore, for capital costing purposes, we have assumed 4 duty units and 1 standby unit.

Example of wall mounted UV units

2) **Filtration** is typically recommended under the IHA 4-3-2-1-0 guidelines for surface water sources. All new small water systems (with surface water sources) are expected to provide filtration and disinfection in order to meet the 4-3-2-1-0 performance objectives. The specific method of filtration (slow sand filter, pressure filtration, or other) would need to be reviewed. The type of filtration and associated costs would be largely dependent on the chemical and physical characteristics of the source water. Filtration, depending on the water characteristics and associated filtration equipment required has the potential to be costly considering the number of residences within the water system.

3.2.3 Residential User Fees

Based on information provided from Mr. Christoph Moch of the Water Stewardship Division, and Peter Muhlberger the current water tariff rates set for the Fintry Water Utility were as follows:

- Full time residential (33 lots) = $700/year
- Seasonal residential (50 lots) = $500/year

The revenue generated by the water tariff rates is equivalent to $48,100 per year. We have estimated that the annual maintenance costs for the system are $4,000 per year.

Trust Funds as of December 31, 2007 were $23,342 for RRTF (Replacement Reserve Trust Fund) and $9,760 for DCTF. This is information on record as of February 2010.

3.2.4 Value of the Existing Water System

The Regional District has requested that we estimate the value of the current water system. The water system components (piping, pumps, reservoir etc.) have a value that, given the age of the system may be difficult to evaluate.

The existing water system was constructed in 1966. Some of the water system components, such as the submersible pumps and chlorine injection system, have been installed or upgraded since the original construction of the water system. We have attached an estimate of the water system construction at current construction rates. The cost to construct the water system components, if the water system was installed at today's construction costs, is approximately $785,000 (including a 25% allowance for engineering and contingency and GST at 5%).

Utilizing the Consumer Price Index data we estimate that the water system would have been constructed in 1966 at a cost of approximately $138,000.

To assist in determining a value for the water system, we have completed a net present value analysis for the water system in which we compare the cost to complete the necessary upgrading of the system to the revenue stream that the system would generate over a 20 year time frame. For the purpose of our analysis, we assume that the Required Upgrading (as noted in Section 3.2.1) is to be constructed immediately and that the longer term upgrading (excluding the conversion to 3 – phase power) that will be required. The attached spread sheet shows the capital cost of the Required Upgrading and Potential Longer Term Upgrades at a Total Present Value of $820,923.00.

The revenue stream for the utility includes the Residential User Fees as noted in Section 3.2.3 less whatever maintenance costs are applicable for the system. We have assumed the maintenance fees for the system to be $4,000.00 per year. We have assumed that the user fees would be increased at a rate equivalent to 5% per year. The present day value of the income stream, including current assets, under a 20 year time frame is $519,139.00. The water system has a deficit value of almost $300,000.00.

Unless the water system receives capital funding in order finance the water upgrading that will be required, or the yearly user fees are increased substantially more than 5% per annum, the water system is not sustainable. The present worth of the water system components, while difficult to evaluate is certainly less than the $300,000.00 deficit of the system and therefore we suggest that the water system does not have a positive worth.

4.0 RECOMMENDATIONS AND CONCLUSIONS

The Fintry Water Utility system was built in about 1966 with additional infrastructure changes and/or improvements in 1971 and 1977. This is a 108-lot subdivision on the west side of Okanagan Lake. It is currently under the authority of Ministry of Environment (MOE) although the Regional District of Central Okanagan (RDCO) may look at taking over the management of the water utility. Currently, Mr. Peter Muhlberger owns and operates the utility. Mr. Muhlberger is also a certified small water system operator.

In general, it is our opinion that the water utility infrastructure is in relatively fair to good condition given the approx 40 year age of the utility. However, as with any aging infrastructure, there can always be unknowns.

A critical issue is the inadequate size of the existing concrete reservoir, which is not capable of providing even the minimum water storage required for fire fighting. It has been recommended to consider this a short term upgrade objective due to its importance to the community. Replacement of the 100mm piping on Morden Street and updating the hydrants is also an important component to the fire fighting capability of the water system.

Improved monitoring of chlorine residual and turbidity as well as other chemical and physical characteristics of the water will provide the operator and residents with the information needed to make water treatment decisions. Maintaining and documenting minimum chlorine residuals in the system is necessary as there appears to be no formal records as such. Also because IHA has noted on occasion that the chlorine residual was less than required in meeting the chlorine CT.

The leaks along the intake piping and intake screen replacement should also be a high priority. Other short term upgrades include improvements inside the pumphouse such as installing a flow and pump hour meters and upgrading the electric box to 200 Amp service.

Longer term capital upgrades might include UV disinfection and filtration once the raw water characteristics have been better defined. The water treatment upgrades are necessary to meet the utility's goal for conformance to the requirements of IHA and the BC Drinking Water Regulations.

Installing 3-phase power is also a RDCO long term objective. This may be necessary in the future to provide adequate electrical service to pumps and water treatment systems that have been proposed.