Pre-Design Report
Domestic Groundwater Supply System
South East Kelowna
Irrigation District

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1.0 INTRODUCTION

In September 2010, the South East Kelowna Irrigation District (SEKID) issued a Request for Proposals to consultants for completion of a pre-design engineering study focused on the development of a domestic groundwater supply system. The District wishes to pursue a domestic groundwater supply system in order to improve the quality of water delivered to its customers and to ensure Interior Health Authority (IHA) compliance. The current Hydraulic Creek water source for SEKID has experienced water quality issues related to turbidity, colour, and requires protection from Giardia and Cryptosporidium, and disinfection by-products caused by the use of chlorine. Our report presents an in-depth review of the technical aspects and cost implications involved in the design and construction of a groundwater source and distribution system for delivering domestic water to SEKID customers that will be separate from water utilized for irrigation.

A report completed by Associated Engineering dated November 2007 developed and reviewed options to improve the supply of treated water to all domestic urban and rural residential connection within the South East Kelowna Irrigation District. The Associated report and subsequent Technical Memos presented a total of eight options. The preferred option, as recommended in the report and determined by SEKID, is for groundwater domestic supply. The preferred option can be summarized as an expansion of the Rutland Aquifer well field in order to supply the entire SEKID service area domestic demands utilizing groundwater. The existing Hydraulic Creek intake would be converted to supply the agricultural irrigation demands.

The Associated Report and other documents utilized as background information within our report are listed below.

Water Supply and Treatment Cost/Benefit Review
Associated Engineering; November 2007
Technical Memorandum No. 1; Source Review and Water Treatability
Technical Memorandum No. 2; System Options Development
Technical Memorandum No. 3; Evaluation and Comparison of System Options

1. Hydro Geological Evaluation Well Field Capacity, Southeast Kelowna Irrigation District
   Golder Associates; November 2007

2. Capital Works Program 2010 – 2019
   Mould Engineering

2.0 EXISTING WATER SYSTEM

The current SEKID distribution system consists of approximately 2000 domestic connections, 420 agricultural connections and 25 commercial and institutional connections. The majority of the land area within the District is supplied with surface water collected through the McCulloch Reservoir/Hydraulic Creek intake system. We understand that the water is drawn through a mechanical screening system at an elevation of 655 metres. A chlorination system at the intake consists of a gas system chlorinator.

The Hydraulic Creek supply line is a 1050mm diameter pipeline that delivers water by gravity from the intake site to the SEKID distribution system. The water distribution system consists of a complex pipe network that includes multiple pressure zones.

A portion of the water from the Hydraulic Creek intake flows by gravity to

the Field Road Reservoir. The Field Road reservoir stores water that is utilized to supply homes within the Gallagher's Canyon/McCulloch Road distribution network encompassing approximately 1200 connections.

The Hall Road area is separate from the main supply area and is supplied by the O'Reilly Road Well with backup for fire protection and emergencies provided from the main water system through two pressure sensing valves.

As previously indicated, the Hall Road area is serviced from the O'Reilly Road ground water well and provides domestic and irrigation water to customers that is separate from the water within the main service area. In the event that fire flows are required within the Hall Road area, a pressure sensing valve would allow water from the Hyraulic Creek supply to enter the Hall Road area. This would see water from the main supply area mix with the water supplied by the O'Reilly Road well.

In addition, two existing wells located on East Kelowna Road, have been utilized in drought years to supplement the Hydraulic Creek supply. The wells can supplement water within a pressure zone that includes approximately 110 connections.

Another smaller reservoir, the Hayes Road Reservoir, has a volume of 364 cu.m. and a high water level of 672m. Water is fed to this reservoir from a booster pump (elevation 590.4m) on Hayes Road. The reservoir provides domestic and fire protection to approximately 27 larger residential properties within Hayes Road Subdivision.

3.0 WATER MODEL DEVELOPMENT

CTQ utilized the WaterGems (Autocad 2012 based version) water distribution modeling software to construct a computer model of the new ground source separated domestic water system. The piping framework of the proposed system was initially constructed by duplicating the existing distribution network from a previous computer model and associated AutoCAD drawing assembled by MOULD Engineering.

The location of existing residences was plotted from a City of Kelowna aerial photo file and then reviewed to verify routing of proposed mains in order to service all domestic locations efficiently. Areas where the existing pipes were to be converted to the domestic-only system were identified and the data for the existing pipes was input into the new model. Theoretical Average Day Demands were assigned to individual junctions in the model based on the use and number of existing lots or units to be serviced. Two different demand patterns representing homes with and without an irrigation component were input for each junction. Pipe sizing was determined at 07:00 hours when Average Day Demands were multiplied by 2.6 to equate to theoretical Max Day demands.

Fireflow demands were analyzed only for the higher density residential areas, since rural areas will still have fireflow provided in the existing distribution piping when the dual pipe system is in place.

Existing pump curves were input for the two domestic supply wells and one of these curves was used as a proposed pump curve for each of the two proposed wells at East Kelowna Road. Theoretical pump curves were input for proposed booster pumps at McCulloch Road and Spaarpak Road. The WaterGems software enabled the generation of graphs showing Composite Pump Curves versus System Curves for choosing actual pump operating configurations.

The features of the software allowed many different reporting and thematic mapping options to represent the proposed system. Distribution zones were selected within the software to enable calculation of demands and unit counts per facility (e.g. booster pump stations, reservoirs). Statistics

for the separate Cost Estimate Zones, including service counts and pipe lengths, were determined through the WaterGems software.

The computer modeling assists in proposing a water system that provides optimal and cost effective water delivery to the District's customers.

4.0 GROUNDWATER SYSTEM SEPARATION CONCEPTS

The subject pre-design study has focused on providing analysis and details associated with the premise that the South East Kelowna Irrigation District would in the future provide water from two distinct sources.

1. Water from an expanded well field would be utilized for domestic supply to all customers within the SEKID service boundary.
2. Water from the existing McCulloch Lake/Hydraulic Creek Intake would be utilized for the agricultural irrigation demands.

It will be vitally important that these two systems remain completely separate and that the potential for cross contamination of the new groundwater domestic supply be eliminated.

The intent of the water system separation is to supply the higher quality well water for domestic usage. Ultimately, all lots within the SEKID boundary are to be supplied with a metered domestic water connection. The larger agricultural properties will have two water connections; an irrigation service and a domestic water connection. Water supplied for irrigation will continue to be supplied by the Hydraulic Creek Intake supply. Water for the domestic usage will be supplied from an expanded well field that is proposed to include the two existing wells on East Kelowna Road and two additional wells further to the north.

Two areas within the District, the Gallagher's Canyon/McCulloch Road corridor, and the Hall Road area consist of higher density residential lots. These areas will have their combined needs for irrigation, and for domestic demand supplied from a single well source connection. Other small rural residential areas (Hayes Road Subdivision) within the SEKID distribution system will be similarly served as the cost or other servicing factors make this a logical servicing option.

5.0 WATER SYSTEM DEMAND CRITERIA

A per lot usage was estimated for three types of properties that will have water connections supplied from the expanded well field.

1. Single Family connections categorized as standard single family residential connections that will have both a domestic and irrigation component. These lots may generally be somewhat larger than a typical City of Kelowna single family property and may in some cases have a relatively larger irrigation demand. The demands are calculated on the basis of having three persons per residence.

2. Bare Land Strata connections, such as within the Gallagher's Canyon Golf Development, will have both a domestic and irrigation component. These lots will be generally smaller in size and have a lesser irrigation demand than a typical single family lot. The demands are calculated on the basis of having three persons per residence.

3. Agricultural connections are assumed to have one hundred percent of their irrigation demands met by their existing connections from the Hydraulic Creek water supply. New domestic connections will supply in home domestic water usage as well as the exterior hose bibs that will supply limited irrigation usage.

SEKID's current design criteria are stated as follows.

Fee Simple Lots	0.12	L/s
Bare Land Strata	0.06	L/s
Multi-Family Units	0.06	L/s

In our opinion, the SEKID design criteria for single family usage is likely too high. As a reference, the City of Kelowna Bylaw maximum day design usage for a single family connection is 0.083 L/s/day (2400l/cap/day). For the purposes of our water model, for single family water usage we have used the City of Kelowna standard of 7200 L/conn/day which is equivalent to 0.083 L/s.

The Provincial guideline document, Design Guidelines for Rural Residential Water Systems, recommends that 1100 L/conn/day be allowed for strictly domestic uses. Within our model we have utilized 0.012 L/s with is equivalent to 1000 L/conn/day.

To summarize, the maximum daily water demands utilized within our analysis and water model are as follows.

Single Family	**0.083 L/s**	(7200 L/conn/day)
Bare Land Strata	**0.06 L/s**	(5000 L/conn/day)
Agricultural Lots	**0.012 L/s**	(1000 L/conn/day)

School Water Usage

From the Ministry of Environment sewage regulation, a daily sewage flow of 68 l/day/student is estimated. The South East Kelowna School has a current population of 330 students. We have used a student population of 500 for our demand calculation.

500 students x 68 L/day/student = 34,000 L/day
Round usage up to **40,000 L/day** for the max day usage (domestic usage only)

6.0 ESTIMATED FUTURE DEMAND

Demand for the ultimate domestic system demands were calculated from the existing lots within the District boundary, as well as the potential for development or subdivision of additional lots.

In 2005 there were 1973 domestic connections within the SEKID boundary comprised as follows.

- 1200 connections Gallagher's Canyon/McCulloch Road
- 173 connections Hall Road area
- Most of the remaining connections (approx. 600) are made up of agricultural properties, and rural country residential properties.
- Additionally there are a small number of institutional (school) and commercial properties.

We utilized the City of Kelowna Zoning and OCP mapping to determine the potential for subdivision and development and had estimated the number of lots based upon the full build out of the properties. Areas for potential subdivision or SEKID area expansion are summarized as follows.

6.1 Hall Road

The Hall Road area has the largest potential for expansion and an associated increase to the water demand. The City of Kelowna and/or development pressures within the area may see the area provided with sanitary sewer which would likely encourage subdivision and additional development. Future development would likely occur as additional single family lots as well as multi-family development.

We understand that an additional 60 lots off Hall Road and Wildwood Road, currently not serviced by SEKID, may also be added to the District.

6.2 Main Service Area

The Capital Works Program 2010 – 2019 document, dated August 2010, had reviewed the potential for expansion and development within the main service area. The Gallagher's Canyon Golf development lands are essentially complete.

An additional 108 Lots has been proposed as the Canyon Creek development to be located west on McCulloch Road. Domestic water for the development is proposed to be supplied from the SEKID Field Road reservoir (ultimately the well supply water). Irrigation water for 91 of the total 108 lots will be supplied by the Mission Creek trunk main (Hydraulic Creek Source), with the remaining 19 supplied from the SEKID Field Road reservoir.

Other increases to the domestic water demand within the main service area are expected to be comprised of secondary suites and recreation vehicle (RV) parks on ALR land.

6.3 Connection Summary

The following provides a summary of the number and types of connections that we had determined, as well as the ultimate maximum day demand values.

Hall Road Area & East Kelowna Bench

Single Family	307
Agricultural	246
Fixed (non residential)	6 (3.2 L/s)
MDD	= 28 L/s

Booster 565 Zone Area

Single Family	262 units
Agricultural	338 units
Bare Land Strata	96 units
Fixed (non-residential)	5 (9.9 L/s)
MDD	= 32 L/s

Field Road Reservoir Service Area

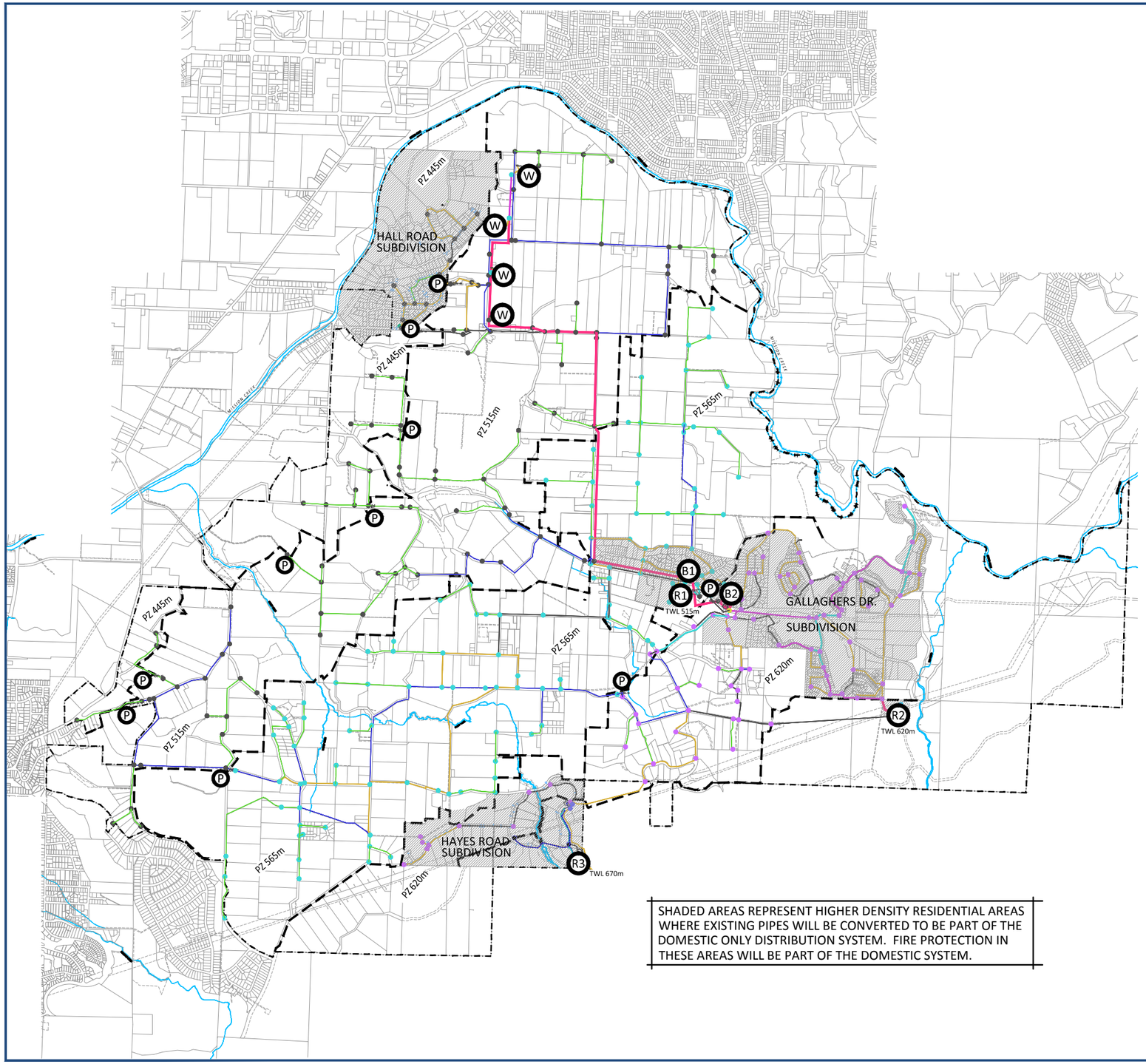
Single Family	272
Strata	652
Agricultural	124
Fixed	1 (40,000 L/day)
Commercial	2 (0.9L/day)
MDD	= 63 L/s

Total Connections	**2,311 connections**
Total Maximum Day Demand	**= 123 L/s (10.6 ML/day)**

7.0 DOMESTIC SUPPLY – SERVICING CONCEPTS

The concepts for the new domestic water system can be viewed within Figure #1 Domestic Groundwater Supply Schematic, and Figure #2, Domestic Groundwater Supply Process Flow Diagram.

As shown, the well field will be made up of the two existing wells and two new proposed wells. The East Kelowna Road wells are capable of pumping to a hydraulic grade line of 515 metres. The two new wells will be similarly sized to pump to the same elevation. The water from the well field will be pumped directly into the Hall Road area to provide domestic, irrigation, and fire protection water. The wells will need to be provided with backup power. The wells will also pump directly into within and below 515m Pressure Zone area.



SHADED AREAS REPRESENT HIGHER DENSITY RESIDENTIAL AREAS WHERE EXISTING PIPES WILL BE CONVERTED TO BE PART OF THE DOMESTIC ONLY DISTRIBUTION SYSTEM. FIRE PROTECTION IN THESE AREAS WILL BE PART OF THE DOMESTIC SYSTEM.

N

0 200 400 800 1600 2400
Meters

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- W — Well Location
- P — Proposed Pressure Reducing Valve
- R1 — Proposed Spaarpak Road Reservoir
- R2 — Existing Field Road Reservoir
- R3 — Existing Hayes Road Reservoir
- B1 — Proposed 565 Zone Booster Station
- B2 — Proposed Field Booster Station
- Proposed 50mm Pipe
- Proposed/Existing 100mm Pipe
- Proposed/Existing 150mm Pipe
- Proposed/Existing 200mm Pipe
- Proposed/Existing 250mm Pipe
- Proposed/Existing 300mm Pipe
- Proposed > 350mm Pipe
- Pressure Zone Boundary

SouthEast Kelowna Irrigation District

Figure #1
Proposed Domestic Groundwater Supply System

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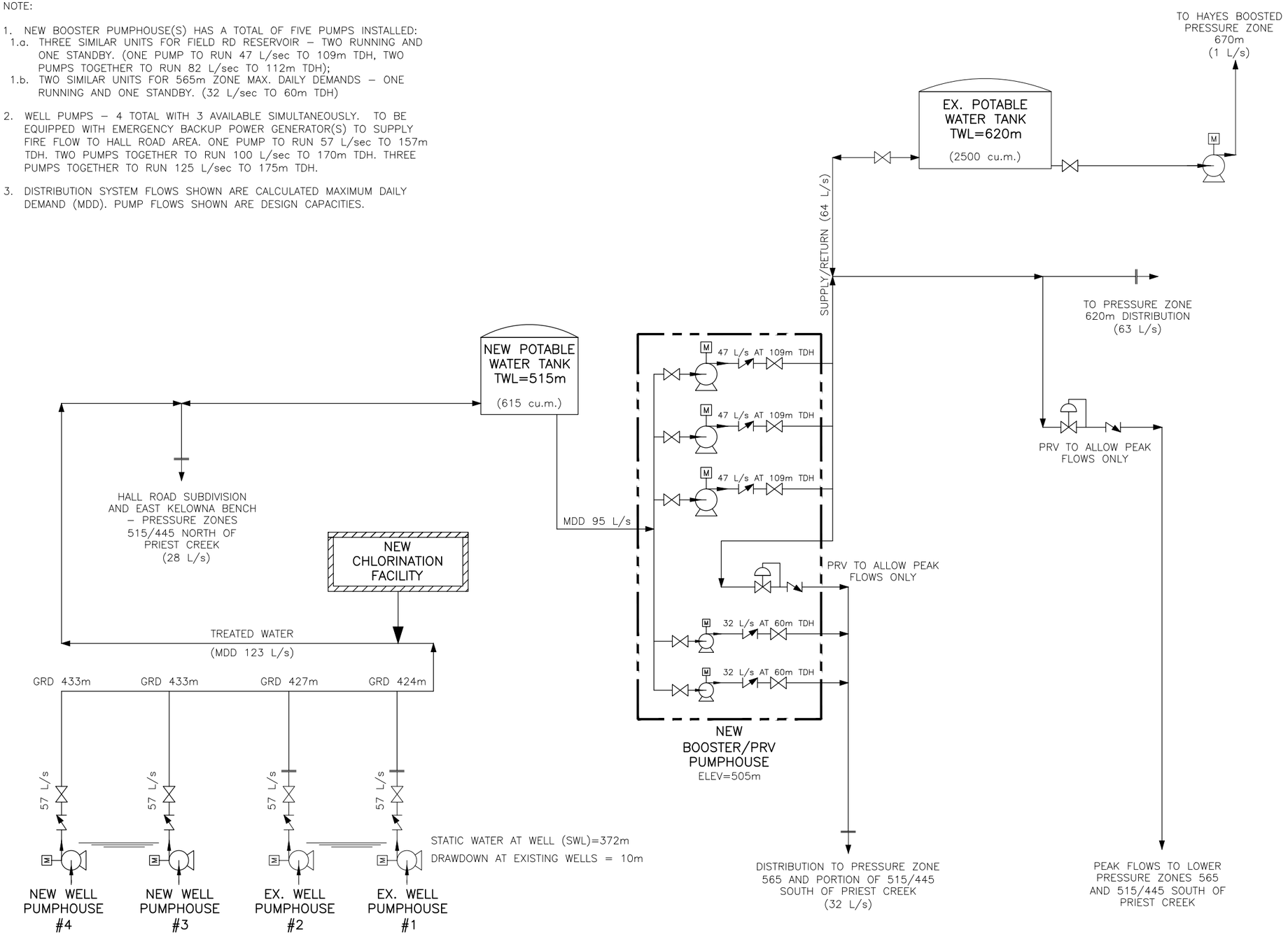
NOTE:

1. NEW BOOSTER PUMPHOUSE(S) HAS A TOTAL OF FIVE PUMPS INSTALLED:
   1.a. THREE SIMILAR UNITS FOR FIELD RD RESERVOIR – TWO RUNNING AND ONE STANDBY. (ONE PUMP TO RUN 47 L/sec TO 109m TDH, TWO PUMPS TOGETHER TO RUN 82 L/sec TO 112m TDH);
   1.b. TWO SIMILAR UNITS FOR 565m ZONE MAX. DAILY DEMANDS – ONE RUNNING AND ONE STANDBY. (32 L/sec TO 60m TDH)
2. WELL PUMPS – 4 TOTAL WITH 3 AVAILABLE SIMULTANEOUSLY. TO BE EQUIPPED WITH EMERGENCY BACKUP POWER GENERATOR(S) TO SUPPLY FIRE FLOW TO HALL ROAD AREA. ONE PUMP TO RUN 57 L/sec TO 157m TDH. TWO PUMPS TOGETHER TO RUN 100 L/sec TO 170m TDH. THREE PUMPS TOGETHER TO RUN 125 L/sec TO 175m TDH.
3. DISTRIBUTION SYSTEM FLOWS SHOWN ARE CALCULATED MAXIMUM DAILY DEMAND (MDD). PUMP FLOWS SHOWN ARE DESIGN CAPACITIES.



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Not to Scale

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Figure #2
Proposed Domestic Groundwater Supply System Process Flow Diagram

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The well pumps will feed into a proposed balancing reservoir and booster pumping system at a 515m elevation. The balancing reservoir is required to allow time for pump start-up and shut-down, balancing of demands, and to stop surges in the distribution system.

At the booster station, a duplex pump system with VFD motor drives will be set up to pump directly to the 565m pressure zone and portions of the 515m and 435m pressure zones that are located south of Priest Creek. The storage within the balancing reservoir is equivalent to 25% of the maximum day demand for the above noted areas.

A booster pump system (two duty pumps and one standby) will be required at the new balancing reservoir location to lift water from 515m elevation to the Field Road Reservoir at 620m.

The Field Road reservoir will provide the domestic and fire protection supply as required for the Gallagher's Canyon/McCulloch Road corridor as well as the domestic flows for the remainder of the 620m pressure zone. In addition, the Field Road reservoir will be available to supplement water down within the 565m Pressure Zone through pressure reducing valves.

The Field Road reservoir also provides water to the existing booster pump on Hayes Road and ultimately the existing Hayes Road reservoir. It is intended that the Hayes Road booster pump and reservoir continue to provide all of the water service requirements of the Balldock Road Subdivision.

8.0 DOMESTIC SUPPLY - SYSTEM COMPONENTS

8.1 Existing Wells

General information regarding the existing wells is provided within the Hydro Geological Evaluation Well Field Capacity report prepared by Golder Associates; November 2007. The existing wells are described as follows.

- O'Reilly Well: is located on O'Reilly Road within the Hall Road Subdivision Area. This 300mm diameter well was drilled in 1981 to 59.5m depth and is completed with a 7.3m long screen assembly. The static water level in the well is generally within 16m of the ground surface and the sustainable yield for the well is in the order of 60 L/s. The well is currently pumped at approximately 38 L/s.

  The O'Reilly Road well has been deemed to be subject to declining efficiency due to well interference and its relatively lower available drawdown. It has therefore been proposed to remove this well from active service

- SEKID Well No. 1: is located approximately 450m east of the O'Reilly Well on East Kelowna Road. This 300mm well was drilled 1986 to 97.5m depth and is completed with a 12.3m long screen assembly. The static water level in the well is generally within 52m of ground surface and the well is reportedly capable of delivering 125 l/s. The well is currently pumped at 60 L/s.

- SEKID Well No. 2: is also located on East Kelowna Road, approximately 450m north of Well #1 and 500m northeast of the O'Reilly Well. This 300mm diameter well was drilled 1990 to 125m depth and is completed with a 12.3m long screen assembly. The static water level in the well is generally within 58m of ground surface and the well is reportedly capable of delivering 125 L/s. This well is currently pumped at 60 l/s.

8.2 New Wells

Western Water Associates Ltd. have completed a review and basic hydrogeological calculations for the water balance and expected mutual well interference for the major water wells in Southeast Kelowna. These include the three existing SEKID wells, the recently completed Harvest Well, the DeMontreuil Utility well and the two future wells proposed by SEKID.

A full detailing of the information and analysis completed by Western Water Associates is included within the Appendix. In summary, the following table provides a comparison of the yield values provided in the 2007 Golder report and the current recommendations. The recommended yield rates are limited by the available drawdown in each well and the available drawdown that is lost due to a combination of mutual well interference created by other pumping wells and drawdown due to the actual pumping inside each well.

Well Name	Golder 2007 Rate (L/s)	WWAL 2011 Rate (L/s)
O'Reilly (exist.)	45	35
Well #1 (exist.)	65	60
Well #2 (exist.)	75	75
Well #3 (prop.)	65	65
Well #4 (prop.)	65	65

It is important to note that the rate for yield from the two proposed wells is subject to some uncertainty since the wells have yet to be constructed. Ultimately, the available yield will be a function of the grain size characteristics and the thickness of the aquifer encountered.

As the additional proposed draw from the aquifer will increase by an amount of over 35%, we understand that an environmental assessment and approval process will be required as per the BC Environmental Assessment Act (BCEAA) – Reviewable Projects Regulation (BC Regs.

370/2002). Additional information with respect to this assessment is available within the Golder Associates hydrogeological evaluation dated November 26, 2007.

8.3 Raw Water Supply

The two new wells and two existing wells will be tied together by a 300mm PVC main (Well #4 to Well #3), 400mm PVC main (Well #3 to Well #4), and 450mm main (Well #2 to Well #1). Chlorine injection is proposed within a structure to be located at the northeast corner of the McCulloch Road and East Kelowna Road intersection.

8.4 Water Treatment

Source waters for water utilities are assessed and approved by the Interior Health Authority on the basis of sufficient quality and quantity availability. Interior Health's 4-3-2-1-0 drinking water objective provides a performance target for water suppliers to ensure the provision of microbiological safe drinking water. The basic requirements under these guidelines are summarized as follows.

- 4 log virus removal
- 3 log Giardia and Cryptosporidium inactivation and / or removal
- 2 stages of treatment
- 1NTU turbidity maximum
- 0 coliforms

The wells are, at this time not considered Groundwater Under the Direct Influence of Surface Water. However disinfection is recommended for the primary purpose of virus control (smallest microbiological contaminant). Chlorination could be implemented in one of two ways.

- Chlorine injection prior to the first water service (without chlorine contact time). This would provide a consistent chlorine residual

throughout the water system, thereby reducing the potential for bacterial regrowth within the distribution system.

- Chlorine injection with construction of infrastructure to provide contact time. Interior Health may require the capability to inactivate any viruses or bacteria entering the water system through the well source prior to the first water service.

Discussions with the Interior Health Authority were inconclusive as to whether additional watermain would need to be installed in order to provide suitable chlorine contact time. At this time our drawings and cost estimate reflect the inclusion of infrastructure to provide the chlorine contact time. For well water, disinfection contact time for 4 log inactivation of viruses using chlorination is 6 min-mg/L. With an assumed dose of 1.2 mg/l, the chlorine contact time will be 5 minutes.

Two chlorine options are considered viable for the District's disinfection requirements.

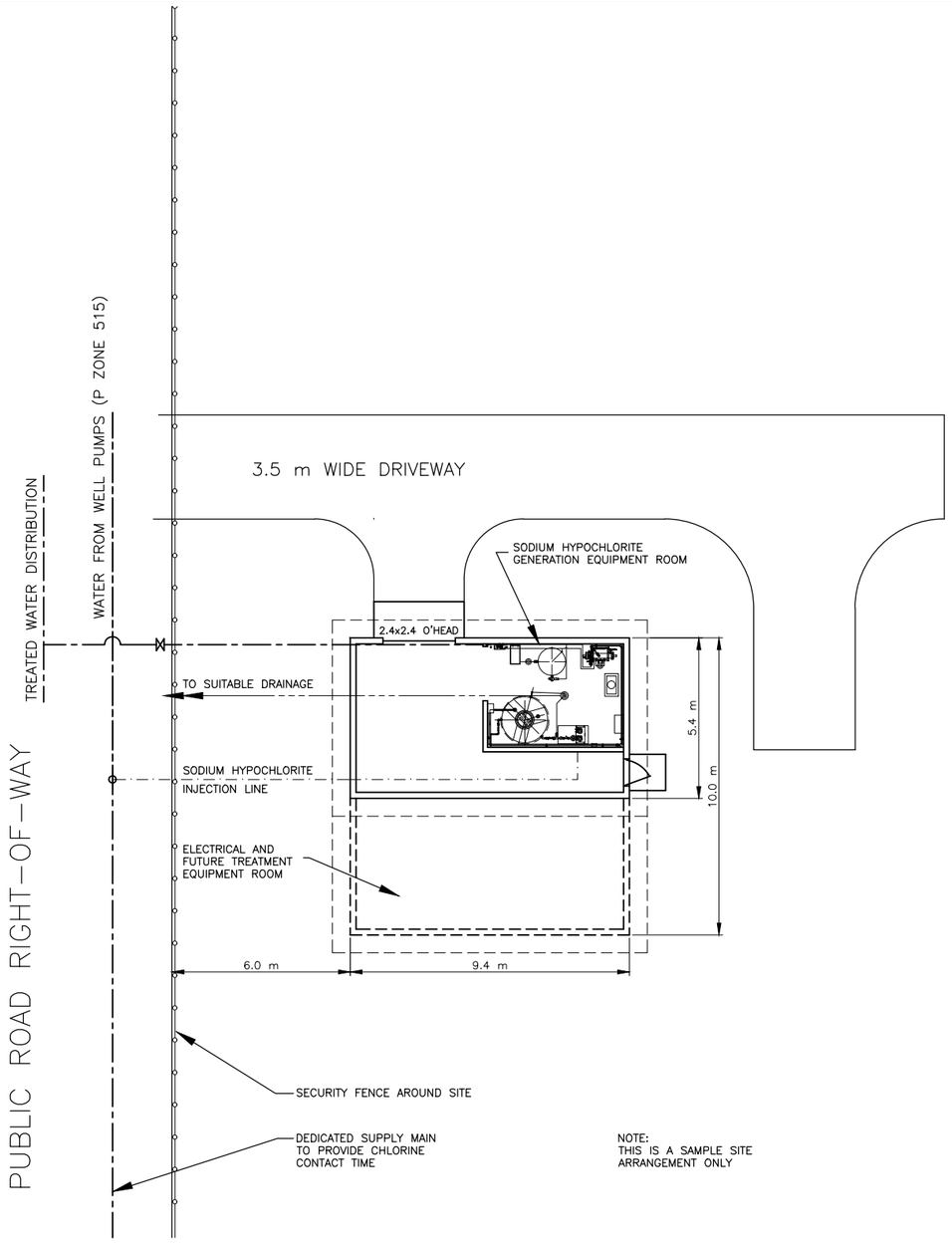
Option 1: Liquid Sodium Hypochlorite

Liquid sodium hypochlorite (NaOCl) can be purchased in various sizes of containers from a number of suppliers and comes in several concentrations. The most common solution strength is 12%.

With a 12% sodium hptochlorite system, containers of chlorine solution would be injected into a waterline using a metering pump. A flowmeter is also required to automatically adjust the chlorine injection rate to match various well flow rates.

Option 2: Onsite Hypochlorite Generation

Onsite hypochlorite generation involves the production of chlorine using salt, electricity, and water. The generation process is mechanized, with monitoring and control components. The raw materials are generally



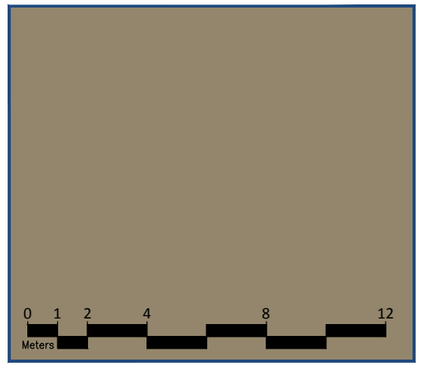


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Figure #3
Proposed Domestic Groundwater Supply System
Treatment
Preliminary Facility Layout

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significantly cheaper than purchasing a chlorine product, however the generation equipment is initially more expensive to purchase.

The water treatment system proposed for the water system separation project is an on-site sodium hypochlorite generation system and chemical metering pumps. A typical layout for the facility is illustrated by Figure 3. While a relatively new technology, it offers a robust, cost-effective, reliable, and safe method of water disinfection. Specifically, we have reviewed and priced a Corix Control Solutions ChlorTec system. The ClorTec model required for the amount of water usage proposed is 50 pounds per day (PPD) system. The system would include the following components and features.

- The system would be modified from the skid mount package, to a rack mount modular system. This enables separate component layout of the system to provide a more efficient use of space. Approximately 3.6 feet by 4.6 feet will be required.

- Safety: the Clor-Tech on-site generator produces 0.8% sodium hypochlorite which is approximately 1/15 the concentration of typical bulk hypochlorite used for disinfection of municipal water systems. This is very safe and does not require any special training for hazardous gasses. By producing this strength of concentration you also do not have the issues of "off-gassing" or degradation of strength that are typical issues of 12% hypochlrorite.

- Operating Cost: The typical raw material requirements to make the equivalent of 1 pound of chlorine gas are 2KWhr of power, 3 lbs of salt and 15 gallons of water. Typical costs are salt @ $0.12 / lb and power @ 0.07 / KWhr. Thus, the cost to make the equivalent of 1 pound of chlorine (or 1 gallon of 12% sodium hypochlorite) is $0.50.

Within the water treatment room, additional space could be left and provisions made for application of future water treatment.

8.5 Balancing Reservoir

We have proposed that a balancing reservoir be constructed at an elevation of 510m with a TWL of 515m, along with the booster pumps installation at an elevation of 505m. The well pumps will be designed in order to pump to the reservoir at the higher elevation. As previously stated, a balancing reservoir is required to allow time for pump start-up and shut-down, balancing of demands, and to stop surges in the distribution system.

The balancing reservoir has been sized to provide 25% of the maximum day demand within the 565m pressure zone or approximately 640 cu.m. of storage.

8.6 Booster Station

The booster station will be located adjacent to the proposed balancing reservoir. The booster station will consist of two sets of pumps. The first set to boost water to the Field Road Reservoir (Spaarpak Road Booster) and the second set to supply domestic pressure to the homes within the 565m Pressure Zone and the portions of the 515m and 435m Pressure zones located south of Priest Creek.

The capabilities of the two booster pump sets are as follows:

Spaarpak Road Booster

- Three 100 hp Units (two operating and one standby) each at 745 USGPM at 365’ TDH (47 L/s at 111m TDH)

565m Zone Booster

- Two 40 hp (one operating and one standby) each at 510 USGPM at 110' TDH (32 L/s at 60m TDH)

Potential pump selections were made for the two booster pump sets and the selections are included within Appendix A.

8.7 Field Road Reservoir/Water Pumping Station

The existing Field Road reservoir has a current storage volume of 2500 cu.m. The reservoir will store domestic and fire storage water for homes within Pressure Zone 620 and the irrigation water to the Gallaghers Canyon homes and the McCulloch Road corridor.

9.0 DISTRIBUTION SYSTEM

The A1 size, 1:2500 scale drawings illustrate the proposed distribution system for the domestic water supply and existing system piping. What follows is a brief description of how different areas within the South East Kelowna Irrigation District are provided with well water as their domestic supply source.

9.1 Well Source and Pumps

The distribution system piping within the Hall Road area is to remain unchanged from the current distribution piping. No new water main will be constructed within the Hall Road area. Water to the Hall Road area will be fed directly from the existing and new well source and controlled by variable frequency drive motors. Water enters into the Hall Road area via new mains on Bewlay Road and within the existing easement connecting to Hall Road just south of Fairhall Road. The Hall Road distribution piping will provide domestic and irrigation supply as well as fire

protection to the properties. Fire protection water will also be supplied to the Hall Road area from the new and existing well sources.

The Pressure Zone 515 and remainder of the Pressure Zone 435, excluding the area south of Priest Creek will also be provided domestic water from the well pumps. The new distribution system piping, dedicated to supplying potable water, will be constructed in these areas.

9.2 Field Road Reservoir

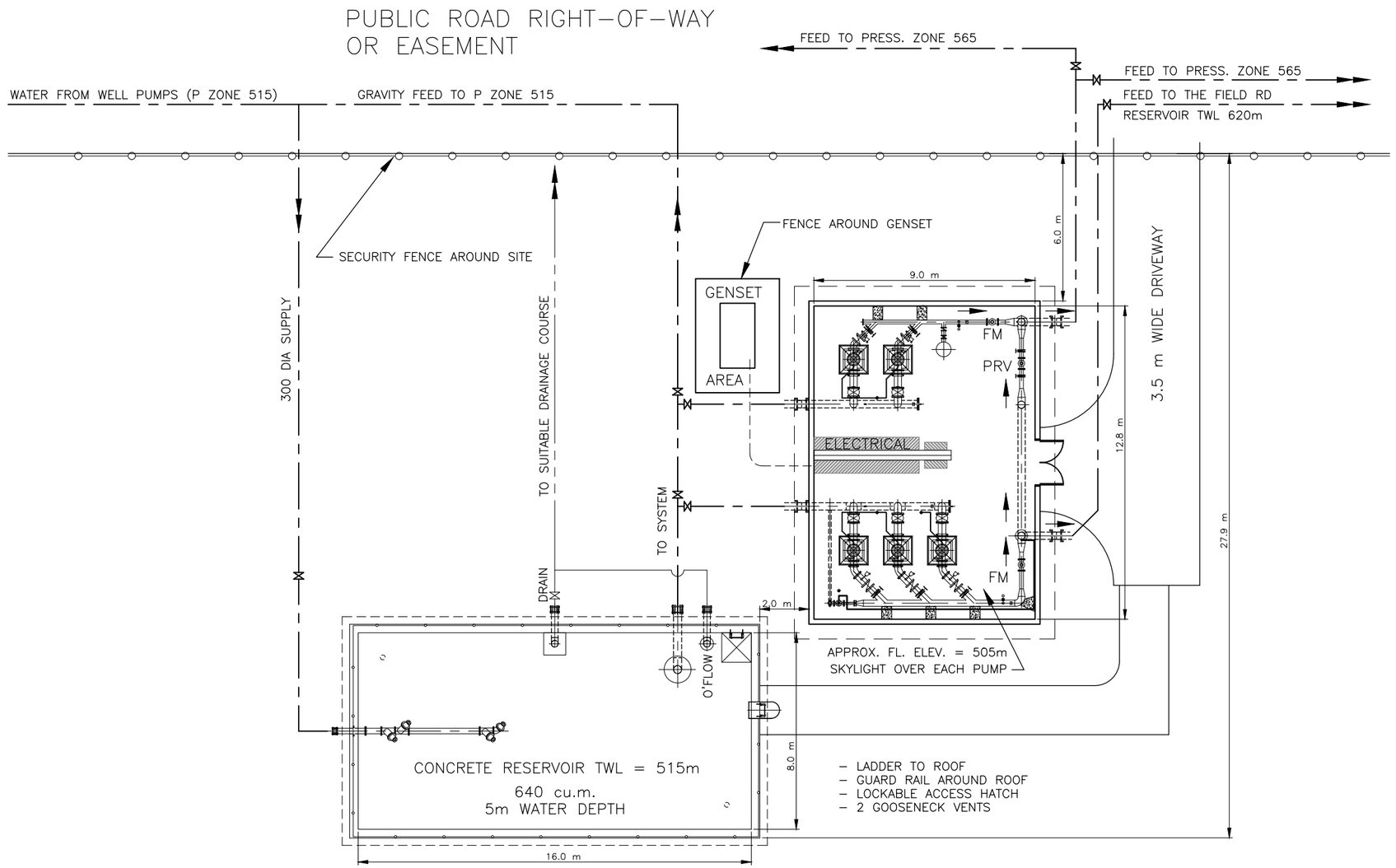
Water from the Field Road Reservoir supplies water to the Gallagher's Canyon/McCulloch Road Corridor homes. As with the Hall Road area, the distribution piping for these areas will remain unchanged and supply domestic, irrigation, and fire protection service.

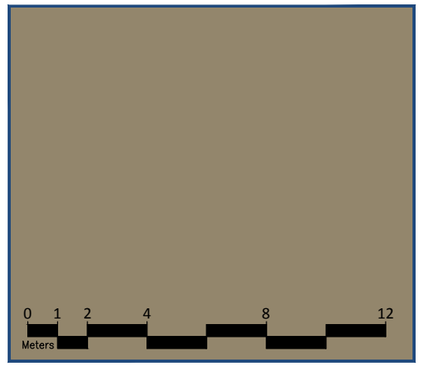
The remainder of Pressure Zone 620 will be fed by gravity from the Field Road reservoir. The exception to this will be the Hayes Road subdivision area. Water will be fed from the Field Road Reservoir to the existing Hayes Road booster pump. The existing piping and small reservoir within the Hayes Road subdivision will be retained and continue to provide domestic, irrigation, and fire supply to this area.

The homes above the Pressure Zone 620 boundary, at the southerly end of June Springs and Luxmore Road will require individual booster pumps to increase the in home pressure for the domestic supply to an acceptable level.

9.3 Duplex Booster Pumps/Balancing Reservoir

Water distribution to Pressure Zone 565 and the portion of Pressure Zones 515/435 south of Priest Creek is supplied water from the duplex booster pumps located within the new booster pump house. Water pressure to the lower zones will be controlled by pressure reducing valves at the zone





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Irrigation District

Figure #4
Proposed Domestic
Groundwater Supply System
Booster Pumps
Preliminary Facility Layout

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boundaries. The balancing reservoir, storing 25% of the maximum day demand for these areas, will be used as required to allow time for pump start-up and shut-down, balancing of demands, and to stop surges in the distribution system.

10.0 Water Meter Installation

The introduction of water meters can be an effective method to reduce domestic water consumption. However, the introduction of water meters without a relation to the pricing structure for individual rate payers may be ineffective.

In SEKID's own experience with metering irrigation usage for agricultural properties, only a minor reduction in water use was obtained with metering and education alone. A larger effect in the reduction of water usage had occurred when the rates were directly linked to the actual volume of water used. The same can be predicted with water usage. However, the introduction of meters throughout the District will have a total cost of approximately $750,000.

11.0 SCADA/ELECTRICALS AND CONTROLS

11.1 General

The electrical, instrumentation, lighting and HVAC design goal is to accomplish energy efficient smooth transfer of water from groundwater wells to the new treatment plant, new Booster #1 pumps, and new Booster #2 pumps. "Energy Star", "Power Smart", and Part 10 ASHRE guidelines will be followed where applicable.

Principal components of the design include:

- Upgrade of existing Well 1 & 2 pump houses electrical systems.

- Motor Control Centers (MCC's), HVAC, lighting and building security, instrumentation, and PLC control for new Chlorination Facility.
- Motor Control Centers (MCC's), HVAC, lighting and building security, instrumentation, and PLC control for new wells 3 & 4.
- Motor Control Centers (MCC's), HVAC, lighting and building security, instrumentation, and PLC control for the new Booster Pump Station and Reservoir.
- Backup power systems for the existing and new Well Pump Stations, new Chlorination Facility and new Booster Pump Station.
- Radio Telemetry and SCADA System for the existing and new Well Pump Stations, the new Booster Pump Station(s) and Reservoirs.

11.2 Motor Control Centre (MCC)

The two new well pump stations and the new booster pump station will require Motor Control Centers (MCC). The MCC should be equipped with surge protection on the incoming power and the distribution panel boards. It also should be equipped with a power quality monitor to display voltage, current, kW, kVAR, and harmonic distortion. This monitor would be connected to the SCADA Ready PLC Panels and provide power quality data for monitoring & controlling of the station's equipment. The MCC should be a self-contained unit that would house all the motor starter equipment, the distribution breakers, 600-120/240V transformer and low voltage load center.

The motor starters for equipment larger than 15 horsepower (Hp) should be a solid state starters with PF correction and bypass contactors. These starters are keypad programmable to provide "True-Torque" acceleration and deceleration ramps to mitigate hydraulic water hammer.

Some of the pumps in the Booster Pump Station will be designed to operate on Variable Frequency Drives (VFD). The VFD system would be designed with line and load filters for harmonic mitigation and RFI & EMI filters for protection against radio signal interference.

11.3 Backup Power Systems.

Backup Power Systems will be required at the 4 Well Pump Stations, the new Chlorination Facility, the new Booster Pump Station and Reservoir. It is recommended to use diesel power generators with Automatic Transfer Switches (ATS) as backup power for all the sites. The generators would be mounted in a "Crystal Quiet" sound deadening enclosure with a critical grade exhaust silencer. The double wall fuel tank is monitored for leakage. The generators and ATS would be connected to and monitored by the station's new PLC panel. Uninterruptable Power Supplies (UPS) should be used as a secondary backup power for the SCADA Ready PLC Panels at each of the stations.

11.4 Lighting

Interior lighting is fluorescent, 32 watt, with energy saving electronic ballasts. Exterior lighting is photocell controlled HPS, full cutoff fixture to mitigate ambient light pollution. Battery powered emergency lighting is included for safety.

11.5 HVAC

Cooling is by outside air with a PLC controlled variable speed energy efficient fan. Trim electric heat will be installed to hold space 5^{o}C above freezing.

Automatic dampers are thermally insulated with double blade seals to reduce heat transfer and air exchange when closed. Dampers are sized to reduce pressure loss.

11.6 Station Security

PLC's receive signals from the security system for keypad entry door monitoring and smoke alarm with SCADA monitoring. Optional motion sensing can be provided.

11.7 Instrumentation & Controls

Instrumentation in the stations would monitor discharge flow, pressure, water quality and ambient temperature. Each site would be equipment with a Programmable Logic Controller (PLC) Panel which would monitor and control the station's operations. The panels would be design for future connection to the District's Supervisory Control and Data Acquisition (SCADA) system. The panels would also be equipped with a local Human Machine Interface (HMI) to allow the system operator to make local control and alarming function changes at the station and a UPS for backup power purposes.

11.8 SCADA System and Radio Telemetry

There will be a requirement for some control information to be transferred between the Well Pump Stations & the new Potable Water Reservoir and between the new Booster Pump Station & the existing Potable Water Reservoir. 24/7 monitoring will also be required for some of the system's operations data and it should be transmitted back to a central location for data storage & alarming purposes.

A radio telemetry system would be designed to transmit the data & alarms between the pump stations and reservoirs. A master telemetry PLC panel would be installed at the District's office to coordinate radio

communication between all sites and it would house the new callout alarm system.

A computer running the SCADA software would be connected to the master telemetry PLC and it would be the window into the complete water system. The computer would collect the water system data and be used for reporting and displaying of this data. The computer would also log any alarms that had occurred and would be the engineering station for configuration of the PLC and Radio Telemetry systems.

11.9 Existing Well #1 and #2

Well 1 pumphouse has a 600V 600A three phase hydro service. The 150HP submersible pump motor starter is a two speed across the line starter. There is no SCADA at the site.

Recommendations include changing the starter to a solid state starter with PF correction and bypass contactor. These starters are keypad programmable to provide "True-Torque" acceleration and deceleration ramps to mitigate hydraulic water hammer. A new SCADA ready PLC panel and evaluation of existing instrumentation, HVAC, and building security are to be included in the design.

Well 2 pumphouse has a 600V 200A three phase hydro service. The 150HP submersible pump has a VFD motor controller. It was reported the radio interferes with the VFD.

The 200A service is marginal for the 150HP motor. Since the system has been operating for some time we suggest the 200A service be retained.

Recommendations include changing the starter to a solid state starter with PF correction and bypass contactor. These starters are keypad

programmable to provide "True-Torque" acceleration and deceleration ramps to mitigate hydraulic water hammer.

A new SCADA ready PLC panel, evaluation of existing instrumentation, HVAC, and building security are to be included in the design.

Diesel generators would be sized to operate each well pump station in the event of utility power failure. Automatic Transfer Switches (ATS) would either be retrofitted into or mounted adjacent to each of the existing MCCs.

11.10 New Wells #3 and #4

Wells 3 and 4 pump stations are to have 600V 400A three phase hydro services. Each station's MCC would have a 400A ATS for connection to a diesel generator and have surge protection on the incoming power.

The motor starters will be solid state starters with PF correction and bypass contactors. These starters are keypad programmable to provide "True-Torque" acceleration and deceleration ramps to mitigate hydraulic water hammer.

A new SCADA ready PLC panel, instrumentation, HVAC, and building security are to be included in the design.

Diesel generators are to be sized to operate each well pump station in the event of utility power failure.

11.11 New Chlorination Facility

The new Chlorination Facility will be located close to the existing Well #1 pump station. 600V power could be fed from Well #1 to power this new facility, if Well #1 MCC has enough space to house the feeder breaker and

new generator's ATS. If there is not enough space, a new 600V service would be installed in the new Chlorination Facility and power fed back to Well #1's MCC.

The sodium hypochlorite generator would be powered by a 600V feed from the MCC and the generator's Programmable Logic Controller (PLC) would be connected to the facility's control network.

A new SCADA ready PLC panel, instrumentation, HVAC, and building security are to be included in the design.

11.12 New Booster Pump Station and 515M Reservoir

Booster Pump Station and Reservoir are to have a 600V 600A service. The new MCC would have a 600A ATS for connection to station's backup power system. The 620M Reservoir Pumps would be operated by solid state starters with PF Correction and Bypass Contactors. The 565M Zone Booster Pumps would be operated by VFDs with line and load filter systems.

The station's backup power system would be sized to operate the 565M Zone Booster Pumps and the station's house loads. The 620M Reservoir Pumps are not required to operate during a power outage.

A new SCADA ready PLC panel, instrumentation, HVAC, and building security are to be included in the design.

11.13 Existing 620M Reservoir

The new 620M Reservoir Booster Pumps will be controlled by the level in the existing reservoir. A new SCADA ready PLC panel, instrumentation, backup power and site security are to be included in the design.

12.0 COST ESTIMATE

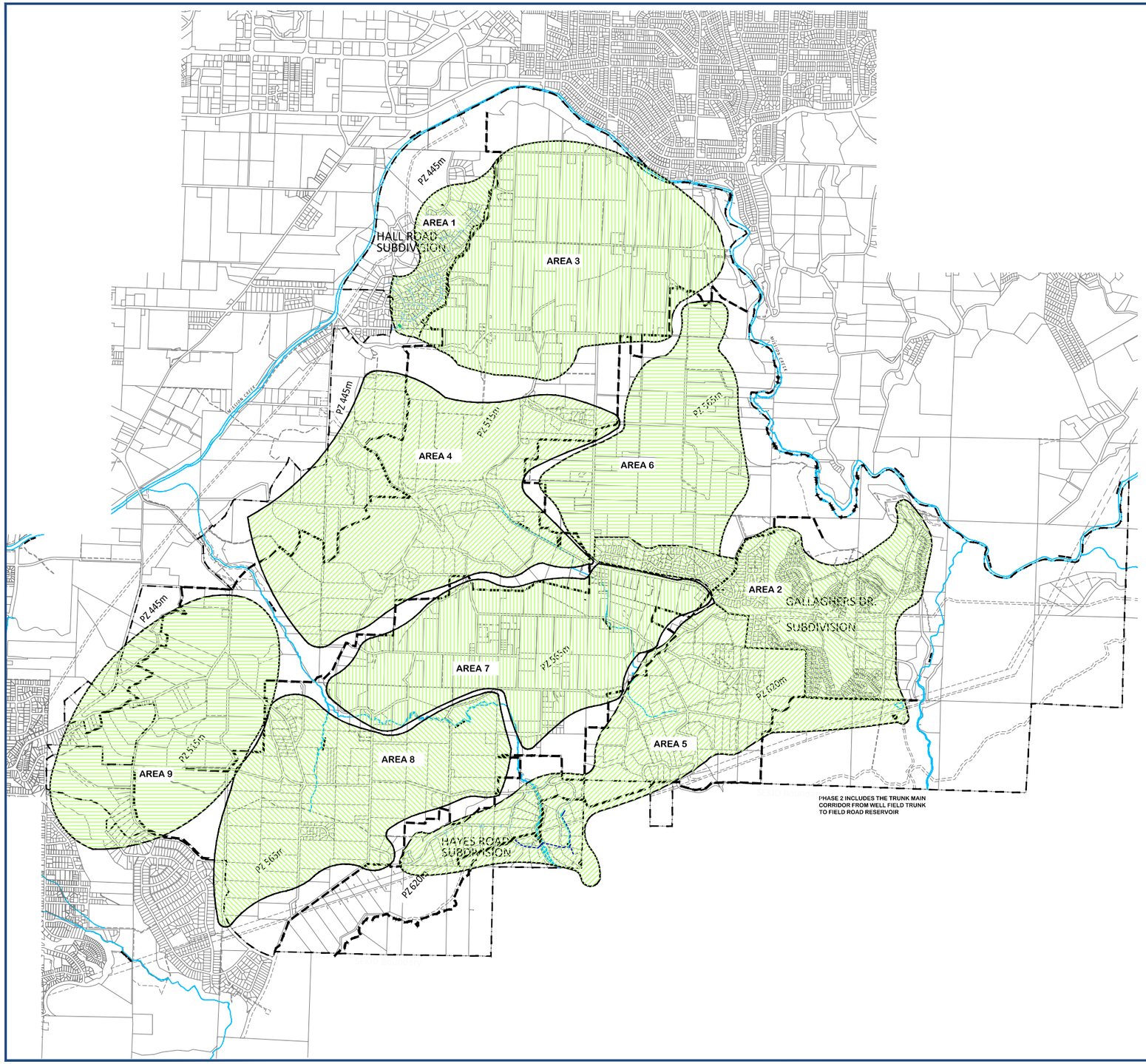
Details of the project cost estimate are included within Appendix A. A summary of the project costs are shown in the table below. The costs are broken into nine separate areas that could be done independently or grouped within larger projects. An illustration of the area breakdown is provided by Figure 5.

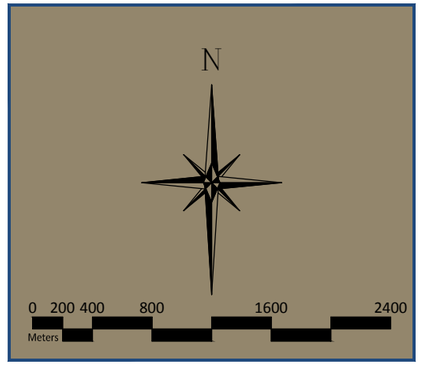
Design Sheet and Pressure Zone	Construction	Eng. Allowance	Base Capital	Contingency	Subtotal
Hall Road Area	$ 3,069,840	$ 306,984	$ 3,376,824	$ 506,524	$ 3,883,348
Gallaghers / McCulloch Corridor	$ 3,500,800	$ 350,080	$ 3,850,880	$ 577,632	$ 4,428,512
Area 3	$ 1,626,015	$ 162,602	$ 1,788,617	$ 268,292	$ 2,056,909
Area 4	$ 2,152,310	$ 215,231	$ 2,367,541	$ 355,131	$ 2,722,672
Area 5	$ 977,895	$ 97,790	$ 1,075,685	$ 161,353	$ 1,237,037
Area 6	$ 891,955	$ 89,196	$ 981,151	$ 147,173	$ 1,128,323
Area 7	$ 2,150,980	$ 215,098	$ 2,366,078	$ 354,912	$ 2,720,990
Area 8	$ 1,941,475	$ 194,148	$ 2,135,623	$ 320,343	$ 2,455,966
Area 9	$ 1,321,015	$ 132,102	$ 1,453,117	$ 217,967	$ 1,671,084
TOTAL	$ 17,632,285	$ 1,763,229	$ 19,395,514	$ 2,909,327	$ 22,304,841

The following provides a general outline of the construction anticipated within each of the nine areas identified above.

Hall Road Servicing Construction

- Existing well pump upgrading (existing Well #1 and #2);
- Well #3 and Well #4 development and installation;
- Chlorination facility installation;
- Installation of mains from well pumps to connection point at Rose Road
- Installation of mains from Rose Road back to Hall Road area;
- Installation of mains for Belway Road connection.





Legend

Pressure Zone Boundary

SouthEast Kelowna Irrigation District

Figure #5
Proposed Domestic Groundwater Supply System Cost Estimate Area Plan

CTQ
ENGINEERING PLANNING URBANDESIGN

VERSION DATE MAY 8, 2012

Gallagher's Canyon/McCulloch Road Corridor

- 505m elevation booster pump station;
- Balancing reservoir installation;
- Extension of 400m spine main from Rose Road to booster station;
- Installation of mains from Booster Station to Gallagher's Canyon Blvd.;
- Installation of mains from Booster Station to Lupin Crescent.

Areas 3 to 9

- Domestic main installation;
- Services installation (new and reconnections);
- Install 565m Pressure zone booster pumps (Area 6 servicing);
- Pressure reducing valves as identified.

13.0 FINANCIALS

13.1 User Rates to Fund System Construction

The total project cost has been estimated at approximately $22,300,000.

We have presented a scenario whereby the installation of the required infrastructure for the water system separation occurs over an eight year period. The cost for each year's proposed construction is itemized within the Cost Estimate Table (above) and the District would borrow that amount yearly to fund the construction. The project's capital cost and borrowing cost (at a 5% interest rate), spread out over a period of 25 years, would be equivalent to approximately $36,660,000. The monthly amount charged to ratepayers is dependent on the amount of the yearly construction, interest rate charged, and the duration of the loan. A spreadsheet detailing the rate and loan payment are provided in Appendix A.

We have assumed that every water user will contribute to the project costs starting at year one of the project, whether they have received a new connection during that year or within any of the eight construction years.

The per unit cost per connection will be $10,326.48 as the principal cost, and $16,971.67 as the total (principal plus interest) cost over the 25 year period. Based on the above, the monthly charge to water customers will be $56.57 per month. The yearly income, based upon 2160 existing connection, from water uses is therefore $1,466,352.39.

The total loan amount is increased in each year of the eight year construction program. The principal and interest paid on the loan rises accordingly for first eight years and then begins to decrease thereafter, while the total cash inflow from ratepayer tolls remains fixed. At year eight, the combined principal and interest payments due on the loan exceeds the revenue generated by the ratepayers. For that reason, during the first eight years a portion of the rate payer toll must be retained as "Cash Ending" in order to fund the loan beyond year eight.

Should a capital injection, either SEKID reserves, government funding, or other funding source be received, it can be applied to decrease the loan in any of the construction years, and the monthly rate for every user can be adjusted accordingly.

13.1 Operational Costs

The new domestic water supply system will have a cost to operate and maintain. This amount is additional to the amount that SEKID already pays to operate the dual domestic and irrigation supply system in current operation. For the domestic supply system operation costs, we have included only what are perceived to be new costs directly attributable to the domestic supply operation and maintenance. Stated another way, no administration costs, insurance, payroll, or other existing SEKID costs have been reallocated to the domestic system.

Operation cost include power to run the new well and booster pumps, rehabilitation of the wells (once every 5 years), and allowances for

pressure reducing valve maintenance and parts, telemetry / control maintenance, and labour.
Electrical power, related to pumping costs varies depending on the amount of water pumped and will increase as the domestic system expands, new pumps are added, and as system demand increases. Electrical rates are assumed to be $0.09 per kw hr.

Well rehabilitation is recommended at five year intervals and will cost approximately $40,000 per well. Therefore, over a 10 year period, each well will be rehabilitated once for a total cost of $160,000 or at an average yearly cost of $16,000 per year.

Additional allowance has been included for labour, PRV maintenance, and for telemetry / control equipment maintenance.

At year eight, when all of the works have been installed and are operating, the total amount required for operation and maintenance of the domestic system will be approximately $194,268 annually or a monthly charge per user of $7.50. This is in addition to the existing rates and fees that are currently charged by SEKID for the provision of water to its customers.

APPENDIX A

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Hall Road Area

Scope of Work

Existing well pump upgrading (exisitng well #1 and #2)
Well #3 and Well #4 development and installation
Chlorination facility installation
Installation of mains from well pumps to connection point at Rose Road
Installation of mains from Dal Road back to Hall Road area
Installation of mains for Belway Road connection

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	450mm from Well #2 to Rose Road	1547	m	$ 470	$ 727,090
	400mm connection to new well #3	645	m	$ 400	$ 258,000
	200mm main Rose Road to Hall Road Area	480	m	$ 120	$ 57,600
	150mm main East Kelowna Road to Delway	695	m	$ 90	$ 62,550
	200mm Pressure reducing valve station	1	ea	$ 125,000	$ 125,000
	150mm Pressure reducing valve station	1	ea	$ 100,000	$ 100,000
2.0	**Restoration**				
	Road Restoration	7410	sq.m.	$ 60	$ 444,600
3.0	**Water Treatment**				
	Sodium Hypochlorite (Chlorine) Generation System	1	each	$ 80,000	$ 80,000
	Building				$ 25,000
4.0	**Well Pump Upgrades**				
	Solid state starter with PF correction and bypass contactor	2	each	$ 15,000	$ 30,000
	PLC panel (SCADA ready)	2	each	$ 15,000	$ 30,000
	Instrumentation, HVAC, Building Security	2	each	$ 20,000	$ 40,000
	Backup Power Generator and Automatic Trasfer Switch	2	each	$ 75,000	$ 150,000
5.0	**Well Construction (Well #3 & #4)**				
	Well construction, testing and reporting				$ 180,000
	Supply and installation of new well pumps				$ 180,000
	Land Costs	1	each	$ 50,000	$ 180,000
	Building and site works				$ 40,000
	Building Electrical & Motor Control Centre	2	each	$ 75,000	$ 150,000
	PLC panel (SCADA ready)	2	each	$ 15,000	$ 30,000
	Instrumentation, HVAC, Builidng Security	2	each	$ 25,000	$ 50,000
	Backup Power Generator and Automatic Transfer Switch	2	each	$ 65,000	$ 130,000
	Subtotal , Construction Cost Estimate				$ 3,069,840
	Engineering Allowance	10%			$ 306,984
	Base Capital Cost				$ 3,376,824
	Contingency Allowance	15%			$ 506,524
	Water meters (all connections)	195	ea	$ 350	$ 68,250
	TOTAL CAPITAL COST ESTIMATE				$ 3,883,403

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Gallaghers Canyon / McCulloch Road Corridor

Scope of Work

505m elevation booster pump station;
Balancing reservoir Installation;
Extension of 400m spine main from Rose Road to booster station;
Installation of mains from Booster Station to Gallaghers Canyon Blvd
Installation of mains from Booster Station to Lupin Crescent.

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	400mm from Rose Road connection to booster station	2880	m	$ 400	$ 1,152,000
	300mm from booster station to Gallaghers Canyon Blvd.	1430	m	$ 180	$ 257,400
	250mm from booster station to Lupin Cres.	600	m	$ 150	$ 90,000
	Pressure Reducing Station	1	ls	$ 150,000	$ 150,000
2.0	**Restoration**				
	Road Restoration	10802	sq.m.	$ 60	$ 648,120
4.0	**Booster Station**				
	Booster Pumps (3)	3	ea	$ 40,000	$ 120,000
	PLC, Instrumentation and Controls	1	LS	$ 110,000	$ 110,000
	Piping and Mechanical	1	LS	$ 60,000	$ 60,000
	Building	52	sq.m.	$ 640	$ 33,280
	Land Costs	1	ea	$ 100,000	$ 100,000
	Builidng Elecrical & Motor Control Centre	1	ea	$ 90,000	$ 90,000
	PLC Panel (SCADA ready)	1	ea	$ 15,000	$ 15,000
	Instrumentation, HVAC, Builidng Security	1	ea	$ 25,000	$ 25,000
	Backup Power Generator and Automatic Transfer Switch	1	ea	$ 85,000	$ 85,000
4.0	**Concrete Reservoir (615 cu.m.)**				
	Concrete reservoir and piping	1	LS	$ 440,000	$ 440,000
6.0	**Rado Telemetry and SCADA System**				
	Radio Telemetry Modem System	7	ea	$ 5,000	$ 35,000
	Upper Reservoir PLC panel (SCADA ready)	1	ea	$ 15,000	$ 15,000
	SCADA Master PLC and Alarm Panel	1	ea	$ 20,000	$ 20,000
	SCADA Computer and Software	1	ea	$ 25,000	$ 25,000
	SCADA System Configuration and Programming	1	ea	$ 30,000	$ 30,000
	Subtotal , Construction Cost Estimate				$ 3,500,800
	Engineering Allowance	10%			$ 350,080
	Base Capital Cost				$ 3,850,880
	Contingency Allowance	15%			$ 577,632
	Water meters (approx. half of connections)	400	ea	$ 350	$ 140,000
	TOTAL CAPITAL COST ESTIMATE				$ 4,428,567

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 3

Scope of Work

Domestic main installation
Services Installation

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	150mm watermain	495	m	$ 100	$ 49,500
	100mm watermain	3920	m	$ 90	$ 352,800
	50mm watermain	3695	m	$ 70	$ 258,650
2.0	**Restoration**				
	Restoration (full asphalt)	6248	sq.m.	55	$ 343,640
	Resoration (half asphalt)	2770	sq.m.	40	$ 110,800
	Restoration (off the road)	8825	sq.m.	25	$ 220,625
3.0	**Lot Services**				
	Service connections	145	each	$ 2,000	$ 290,000
	Subtotal , Construction Cost Estimate				$ 1,626,015
	Engineering Allowance	10%			$ 162,602
	Base Capital Cost				$ 1,788,617
	Contingency Allowance	15%			$ 268,292
	Water meters	145	each	$ 350	$ 50,750
	TOTAL CAPITAL COST ESTIMATE				$ 2,056,942

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 4

Scope of Work

Domestic main installation
Services Installation

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	100mm watermain	2594	m	$ 90	$ 233,460
	50mm watermain	9326	m	$ 70	$ 652,820
	50mm Pressure reducing vavle	3	ea	$ 30,000	$ 90,000
2.0	**Restoration**				
	Restoration (full asphalt)	1905	sq.m.	55	$ 104,775
	Resoration (half asphalt)	11552	sq.m.	40	$ 462,080
	Restoration (off the road)	12767	sq.m.	25	$ 319,175
3.0	**Lot Services**				
	Service connections	116	each	$ 2,000	$ 232,000
	Water meters	116	each	$ 500	$ 58,000
	Subtotal , Construction Cost Estimate				$ 2,152,310
	Engineering Allowance	10%			$ 215,231
	Base Capital Cost				$ 2,367,541
	Contingency Allowance	15%			$ 355,131
	Water meters	116	each	$ 350	$ 40,600
	TOTAL CAPITAL COST ESTIMATE				$ 2,722,707

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 5

Scope of Work

Domestic main installation
Services Installation

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	250mm watermain	802	m	$ 150	$ 120,300
	200mm watermain	3167	m	$ 120	$ 380,040
	150mm watermain	2560	m	$ 100	$ 256,000
	100mm watermain	1462	m	$ 90	$ 131,580
	50mm watermain	1425	m	$ 70	$ 99,750
2.0	**Restoration**				
	Restoration (full asphalt)	5485	sq.m.	55	$ 301,675
	Resoration (half asphalt)	363	sq.m.	40	$ 14,520
	Restoration (off the road)	14868	sq.m.	25	$ 371,700
3.0	**Lot Services**				
	Service connections	116	each	$ 2,000	$ 232,000
	Water meters	116	each	$ 500	$ 58,000
	Subtotal , Construction Cost Estimate				$ 977,895
	Engineering Allowance	10%			$ 97,790
	Base Capital Cost				$ 1,075,685
	Contingency Allowance	15%			$ 161,353
	Water meters	116	each	$ 350	$ 40,600
	TOTAL CAPITAL COST ESTIMATE				$ 1,237,072

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 6

Scope of Work

Domestic main installation
Services Installation
565m Pressure zone booster pumps

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	150mm watermain	169	m	$ 100	$ 16,900
	100mm watermain	1426	m	$ 90	$ 128,340
	50mm watermain	5899	m	$ 70	$ 412,930
	200mm Pressure reducing station	1	ea	$ 125,000	$ 125,000
2.0	**Restoration**				
	Restoration (full asphalt)	2266	sq.m.	55	$ 124,630
	Resoration (half asphalt)	1775	sq.m.	40	$ 71,000
	Restoration (off the road)	12445	sq.m.	25	$ 311,125
3.0	**565m PZ Booster Pumps**				
	Booster pumps (2)	2	ea	$ 30,000	$ 60,000
	PLC, Instrumentation and Controls	1	LS	$ 60,000	$ 60,000
	Piping and Mechanical	1	LS	$ 20,000	$ 20,000
	Building	30	sq.m.	$ 640	$ 19,200
5.0	**Lot Services**				
	Service connections	113	each	$ 2,000	$ 226,000
	Subtotal , Construction Cost Estimate				$ 891,955
	Engineering Allowance	10%			$ 89,196
	Base Capital Cost				$ 981,151
	Contingency Allowance	15%			$ 147,173
	Water meters	113	each	$ 350	$ 39,550
	TOTAL CAPITAL COST ESTIMATE				$ 1,128,364

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 7

Scope of Work

Domestic main installation
Services Installation

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	250mm watermain	175	m	$ 150	$ 26,250
	200mm watermain	2627	m	$ 120	$ 315,240
	150mm watermain	1812	m	$ 100	$ 181,200
	100mm watermain	2671	m	$ 90	$ 240,390
	50mm watermain	2548	m	$ 70	$ 178,360
	150mm Pressure reducing station	1	ea	$ 100,000	$ 100,000
2.0	**Restoration**				
	Restoration (full asphalt)	4684	sq.m.	55	$ 257,620
	Resoration (half asphalt)	2948	sq.m.	40	$ 117,920
	Restoration (off the road)	14000	sq.m.	25	$ 350,000
3.0	**Lot Services**				
	Service connections	192	each	$ 2,000	$ 384,000
	Subtotal , Construction Cost Estimate				$ 2,150,980
	Engineering Allowance	10%			$ 215,098
	Base Capital Cost				$ 2,366,078
	Contingency Allowance	15%			$ 354,912
	Water meters	192	each	$ 350	$ 67,200
	TOTAL CAPITAL COST ESTIMATE				$ 2,721,026

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 8

Scope of Work

Domestic main installation
Services Installation

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	150mm watermain	3420	m	$ 100	$ 342,000
	100mm watermain	2506	m	$ 90	$ 225,540
	50mm watermain	5556	m	$ 70	$ 388,920
2.0	**Restoration**				
	Restoration (full asphalt)	1067	sq.m.	55	$ 58,685
	Resoration (half asphalt)	2367	sq.m.	40	$ 94,680
	Restoration (off the road)	21826	sq.m.	25	$ 545,650
3.0	**Lot Services**				
	Service connections	143	each	$ 2,000	$ 286,000
	Subtotal , Construction Cost Estimate				$ 1,941,475
	Engineering Allowance	10%			$ 194,148
	Base Capital Cost				$ 2,135,623
	Contingency Allowance	15%			$ 320,343
	Water meters	143	each	$ 350	$ 50,050
	TOTAL CAPITAL COST ESTIMATE				$ 2,455,998

PROJECT NO. 09178
SEKID - WATER SYSTEM SEPARATION
Area 9

Scope of Work

Domestic main installation
Services Installation

	Capital Cost Estimate	Quantity	Unit	Unit Price	Extension
1.0	**Pipe Installation**				
	100mm watermain	3401	m	$ 90	$ 306,090
	50mm watermain	3723	m	$ 70	$ 260,610
	100mm Pressure reducing valve	1	ea	$ 80,000	$ 80,000
	50mm Pressure reducing valve	1	ea	$ 30,000	$ 30,000
2.0	**Restoration**				
	Restoration (full asphalt)	2794	sq.m.	55	$ 153,670
	Resoration (half asphalt)	1778	sq.m.	40	$ 71,120
	Restoration (off the road)	11101	sq.m.	25	$ 277,525
3.0	**Lot Services**				
	Service connections	71	each	$ 2,000	$ 142,000
	Subtotal , Construction Cost Estimate				$ 1,321,015
	Engineering Allowance	10%			$ 132,102
	Base Capital Cost				$ 1,453,117
	Contingency Allowance	15%			$ 217,967
	Water meters	71	each	$ 350	$ 24,850
	TOTAL CAPITAL COST ESTIMATE				$ 1,671,118

APPENDIX B

South-East Kelowna Irrigation District - Constuction Loan and Customer Rate Calculation

Total Exsitng Connections	**2160**
Total Capital Outlay (Construction Costs)	$22,305,197.00
Total Number of Connections	2,160
Total Capital Outlay per Connection	10,326.48

Yearly Construction Costs	$3,883,403.00	$4,428,567.00	$2,056,942.00	$2,722,707.00	$1,237,072.00	$1,128,364.00	$2,721,026.00	$4,127,116.00				
Cash Flow	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Cash - Beginning	**-**	**1,193,928.55**	**2,070,649.02**	**2,796,701.13**	**3,318,458.48**	**3,744,953.58**	**4,082,088.24**	**4,197,096.48**	**3,963,924.45**	**3,730,752.43**	**3,497,580.40**	**3,264,408.37**
Cash In - Operating Rate Per month												
Customers												
Year 1 - Start $ 56.57	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39
Total Cash In flow	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39
Cash Out - Operating												
Connection Costs	(3,883,403.00)	(4,428,567.00)	(2,056,942.00)	(2,722,707.00)	(1,237,072.00)	(1,128,364.00)	(2,721,026.00)	(4,127,116.00)				
Net Cash - Operating	(2,417,050.61)	(2,962,214.61)	(590,589.61)	(1,256,354.61)	229,280.39	337,988.39	(1,254,673.61)	(2,660,763.61)	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39
Capital Items												
Loan - Cash Inflow	3,883,403.00	4,428,567.00	2,056,942.00	2,722,707.00	1,237,072.00	1,128,364.00	2,721,026.00	4,127,116.00				
Capital Infow	3,883,403.00	4,428,567.00	2,056,942.00	2,722,707.00	1,237,072.00	1,128,364.00	2,721,026.00	4,127,116.00	-	-	-	-
Loan Payments - Principal	(80,072.15)	(182,174.25)	(240,427.16)	(322,471.16)	(373,154.40)	(425,953.44)	(535,821.35)	(708,355.16)	(744,595.96)	(782,690.90)	(822,734.85)	(864,827.53)
Loan Payments - Interest	(192,351.69)	(407,457.68)	(499,873.13)	(622,123.88)	(666,702.90)	(703,264.30)	(815,522.80)	(991,169.25)	(954,928.46)	(916,833.52)	(876,789.57)	(834,696.89)
Capital - Outflow	(272,423.85)	(589,631.92)	(740,300.28)	(944,595.04)	(1,039,857.30)	(1,129,217.73)	(1,351,344.15)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)
Capital - Net	3,610,979.15	3,838,935.08	1,316,641.72	1,778,111.96	197,214.70	(853.73)	1,369,681.85	2,427,591.58	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)
Cash Ending	**1,193,928.55**	**2,070,649.02**	**2,796,701.13**	**3,318,458.48**	**3,744,953.58**	**4,082,088.24**	**4,197,096.48**	**3,963,924.45**	**3,730,752.43**	**3,497,580.40**	**3,264,408.37**	**3,031,236.35**
Loan Balance Beginning	**-**	**3,803,330.85**	**8,049,723.60**	**9,866,238.45**	**12,266,474.29**	**13,130,391.89**	**13,832,802.45**	**16,018,007.11**	**19,436,767.94**	**18,692,171.98**	**17,909,481.08**	**17,086,746.23**
Additional Loan	**$3,883,403.00**	**$4,428,567.00**	**$2,056,942.00**	**$2,722,707.00**	**$1,237,072.00**	**$1,128,364.00**	**$2,721,026.00**	**$4,127,116.00**				
Total Loan	**3,883,403.00**	**8,231,897.85**	**10,106,665.60**	**12,588,945.45**	**13,503,546.29**	**14,258,755.89**	**16,553,828.45**	**20,145,123.11**	**19,436,767.94**	**18,692,171.98**	**17,909,481.08**	**17,086,746.23**
Principal Payments	**(80,072.15)**	**(182,174.25)**	**(240,427.16)**	**(322,471.16)**	**(373,154.40)**	**(425,953.44)**	**(535,821.35)**	**(708,355.16)**	**(744,595.96)**	**(782,690.90)**	**(822,734.85)**	**(864,827.53)**
Lum Sum Payments												
Loan Ending Balance	**3,803,330.85**	**8,049,723.60**	**9,866,238.45**	**12,266,474.29**	**13,130,391.89**	**13,832,802.45**	**16,018,007.11**	**19,436,767.94**	**18,692,171.98**	**17,909,481.08**	**17,086,746.23**	**16,221,918.70**

Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	
3,031,236.35	**2,798,064.32**	**2,564,892.29**	**2,331,720.27**	**2,098,548.24**	**1,865,376.21**	**1,632,204.19**	**1,399,032.16**	**1,165,860.13**	**932,688.11**	**699,516.08**	**466,344.05**	**233,172.03**	
1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	36,658,809.82
1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	36,658,809.82
													(22,305,197.00)
1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	1,466,352.39	14,353,612.82
													22,305,197.00
-	-	-	-	-	-	-	-	-	-	-	-	-	22,305,197.00
(909,073.75)	(955,583.69)	(1,004,473.16)	(1,055,863.91)	(1,109,883.92)	(1,166,667.68)	(1,226,356.62)	(1,289,099.35)	(1,355,052.12)	(1,424,379.16)	(1,497,253.10)	(1,573,855.41)	(1,654,376.84)	(22,305,197.00)
(790,450.67)	(743,940.73)	(695,051.26)	(643,660.50)	(589,640.50)	(532,856.74)	(473,167.80)	(410,425.07)	(344,472.30)	(275,145.26)	(202,271.32)	(125,669.01)	(45,147.58)	(14,353,612.82)
(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(36,658,809.82)
(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(1,699,524.42)	(14,353,612.82)
2,798,064.32	**2,564,892.29**	**2,331,720.27**	**2,098,548.24**	**1,865,376.21**	**1,632,204.19**	**1,399,032.16**	**1,165,860.13**	**932,688.11**	**699,516.08**	**466,344.05**	**233,172.03**	**0.00**	**0.00**
16,221,918.70	**15,312,844.95**	**14,357,261.26**	**13,352,788.10**	**12,296,924.19**	**11,187,040.27**	**10,020,372.58**	**8,794,015.97**	**7,504,916.62**	**6,149,864.50**	**4,725,485.34**	**3,228,232.24**	**1,654,376.84**	
16,221,918.70	**15,312,844.95**	**14,357,261.26**	**13,352,788.10**	**12,296,924.19**	**11,187,040.27**	**10,020,372.58**	**8,794,015.97**	**7,504,916.62**	**6,149,864.50**	**4,725,485.34**	**3,228,232.24**	**1,654,376.84**	
(909,073.75)	**(955,583.69)**	**(1,004,473.16)**	**(1,055,863.91)**	**(1,109,883.92)**	**(1,166,667.68)**	**(1,226,356.62)**	**(1,289,099.35)**	**(1,355,052.12)**	**(1,424,379.16)**	**(1,497,253.10)**	**(1,573,855.41)**	**(1,654,376.84)**	
15,312,844.95	**14,357,261.26**	**13,352,788.10**	**12,296,924.19**	**11,187,040.27**	**10,020,372.58**	**8,794,015.97**	**7,504,916.62**	**6,149,864.50**	**4,725,485.34**	**3,228,232.24**	**1,654,376.84**	**(0.00)**	

South-East Kelowna Irrigation District - Operational Costs

Connection and Demand Summary

	Year 1	2	3	4	5	6	7	8
Cumulative Connections	195	921	1066	1182	1571	1684	1946	2160
Cumulative Average Day Demand (L/s)	13.1	45.1	46.8	48.1	52.5	54.3	57.5	60.0
Cumulative ADD Volume: (cu.m./day)	1,135.30	3,896.64	4,041.79	4,157.57	4,539.46	4,687.20	4,968.86	5,182.27

Operations Costs

Power								
Well Pumps (cost per year)	$21,299.29	$73,104.86	$75,828.06	$78,000.13	$85,164.73	$87,936.56	$93,220.86	$97,224.60
Booster Pump		$29,934.35	$29,934.25	$29,934.25	$29,934.25	$29,934.25	$29,934.25	$29,934.25
Zone Pump						$2,038.00	$5,500.00	$9,360.00
Maintenance								
Labour	$5,000.00	$15,000.00	$15,000.00	$20,000.00	$20,000.00	$28,750.00	$28,750.00	$28,750.00
Well Rehabilitation ($40,000 per well; once every five years)	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00
Pressure Recucing Valves and Maintenance			$3,000.00	$3,000.00	$3,000.00	$3,000.00	$3,000.00	$3,000.00
Telemetry / Control Equipment Maintenance	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00
Operations Costs (domestic system only)	$52,299.29	$144,039.21	$149,762.31	$156,934.38	$164,098.98	$177,658.81	$186,405.11	$194,268.85
Cost Per Connection	$22.35	$13.03	$11.71	$11.06	$8.70	$8.79	$7.98	$7.49

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