SOUTH EAST KELOWNA IRRIGATION DISTRICT

CAPITAL WORKS PROGRAM 2006-2016

1. INTRODUCTION

This report is an updated, ten-year Capital Works Plan for supplying water to new residential and agricultural users within the South East Kelowna Irrigation District (SEKID). The plan was last revised in 2004, and covered the period of 2004-2014. Capital Works Plans are normally updated every two to three years in order to reflect the actual growth that has occurred, adjust growth projections, ensure the conceptual plan meets these new projections, and update the cost estimates for proposed works. This also provides the District a review of Capital Expenditure Charge (CEC) rates. The capital expenditure and cash flow projection tables in this report have been updated to reflect the current situation.

As the Gallagher's Canyon development nears completion, SEKID's next priority is to increase their water source capacity with the construction of Turtle Lake Reservoir. This new source is projected to meet the District's water supply needs for at least the next ten years.

This plan also identifies the high costs of accessing the remaining water supply in SEKID's watershed. By 2016, the District will be using most of the available runoff from the watershed. Accessing new water sources will require expensive capital works projects. The rises in CEC charges presented in this report begin to represent some of these constraints.

The 2002 Capital Works Plan identified the need for a water treatment study. A pilot project was completed in 2004 along with a report, which recommended the Gallagher's Canyon and McCullough Corridor be a specified service area for future water treatment. The report outlined the options of placing a treatment facility on the intakes of either Hydraulic Creek or Field Road Reservoir. It was concluded that no action was required as part of Capital Works Plan, and that any future water treatment costs should be covered by users in the District.

The Plan should be reviewed every two years to accommodate the ever changing plans and growth of the City of Kelowna. The District must also look beyond the ten year plan to search for new sources of water; which may include new storage, wells or Mission Creek. In addition, the District will need to be prepared to meet the water treatment requirements in the newer developments .

2. WATERSHED HYDROLOGY AND STORAGE

Calculations of available annual runoff and yield from the Hydraulic/KLO Creek Watersheds are based on a report prepared by the Ministry of Environment in 1979, and revised in 1984. The gross average annual runoff within SEKID's watershed source is just over 21,100 Mega Litres (ML or Million Litres) per year.

SEKID has implemented a streamflow monitoring program, providing data for a more in-depth review of the hydrology of the watersheds. About five years of data is needed to make a reliable evaluation, and until that work is completed, the estimates for reliable, long-term yield will continue to be based on the Ministry of Environment calculations. It is here where future water supply changes, such as climate change, will impact the system.

The District will, on average, have 17,010 ML of water available for use each year once the Turtle Lake Reservoir is constructed, as shown in Table 1. Turtle Lake, an offstream reservoir, will only be filled by diversions off Hydraulic Creek during high flow periods and spring freshets.

SEKID's infrastructure is designed to provide each user enough water to fill their needs for 29 out of 30 years. It is now likely that any future water supply requirements for SEKID will require the construction of wells, diversions off Mission Creek, or interbasin transfer from the West Kettle watershed, to the existing storage system.

Table 1. Storage in the Hydraulic and KLO Creek Watersheds

Source	Annual Volume	
	(ML)	(ac-ft)
Reservoirs:		
McCulloch Reservoir System	16,615	13,475
Fish, Browne, Long Meadow	930	755
Dead Storage and other Losses	(2,415)	(1,960)
Turtle Lake (Safe Yield)*	620	500
Water available annually from storage	15,750	12,770
Groundwater:		
O'Reilly Well 170 Domestic Connections @ 0.6 ML/year	100	80
East Kelowna #1, 120 days @ 4.93 ML/day	580	470
East Kelowna #2, 120 days @ 4.93 ML/day	580	470
Water available from District Wells	1260	1020
Total Water Available to SEKID System*	**17,010**	**13,790**

- Safe Annual Useable yield: Watershed will sustain diversion through two 1 in 10 year droughts in succession. This has is an occurrence with about 50% probability of happening once in 30 years.

3. GROWTH AND WATER DEMAND PROJECTIONS

Growth

Predicting growth rates in a rural area like SEKID is difficult, since growth is highly dependent on economic conditions and land use policies. In the Kelowna region, growth rates have recently been, and are currently still high, with little indication of slowing down. Reviewing historic growth patterns is a useful guide to make future predictions. The area of irrigated land and the number of serviced lots since 1974 are tabulated below (see Table 2). To assist in determining the average annual increase in irrigated land, we have also examined rates that exclude Gallagher's Canyon Golf Course, which is considered a one-time increase.

Table 2. Historic Growth Patterns in SEKID

Year	Grade 'A' Serviced Land		Number of Domestic Services	Time Period Years	Average Increase in Grade 'A' Land		Average increase in Serviced Lots
	(ha)	(ac)		(yr)	(ha/yr)	(ac/yr)	Lots/yr
1974	1,755	4,337	657				
1995	2,156	5,327	1,340	21	19.1	47.2	33
1997	2,155	5,325	1,447	2	0.0	0.0	53
1999	2,238	5,530	1,575	2	41.5	102.5	64
2002	2,275	5,622	1,763	3	12.3	30.4	63
2003	2,278	5,629	1,911	1	3.0	7.4	148
2004	2,293	5,665	1,936	1	15.0	37.1	25
2005	2,349	5,803	1,973	1	56.0	138.4	37
Avg. annual growth since 1974					19.1	47.3	42
Without Gallagher's 2005					17.6		
Avg. annual growth since 1995					19.3	47.6	63
Without Gallagher's 2005					14.5		
Avg. annual growth since 2002					24.4	60.3	70
Without Gallagher's 2005					8.7		

Interesting trends in this table include:

- Average annual growth in irrigated land over the last 31 years in SEKID is 19.1 ha/year. Over the last three years, this average has increased to 24.4 ha/year.
- If Gallagher's Canyon development is not included, growth over 31 years is 17.6 ha/yr, but decreases substantially to 8.7 ha/year in the last 3 years.
- New domestic services average 60 per year over the 31 years of record.

Is there enough water to support new irrigated land and residential connections in the near future?

- Since the City of Kelowna 2004 Official Community Plan (OCP) does not indicate any additional large developments or golf courses in the area, we expect the growth in irrigated area to only increase by 10 ha/year. There is enough water supply from SEKID to support long term a growth rate of 10 ha/yr.
- Development beyond 10 ha/yr, however, does put SEKID at risk of water deficits beyond this ten year plan.
- A sanitary sewer collection system is currently planned for the Hall Road area. This sewer service will permit subdivision of large lots into smaller ones. The 2004 City of Kelowna OCP Servicing Plan lists the Hall Road area as Priority 4, which will extend the time of construction to around 2008. Since the Hall Road area is supplied by an independent water system, expansion in this area will not be included in any calculations until the provisions of sewers is more definite. A separate study for water supply should be initiated when timing of the sewer collection system is established.

Water Demand Projections

The projected demand in 2016 is calculated as follows:

Table 3. Predicted Demand by Year 2016

Demand	Volume	
	ML	Ac-ft
New Grade "A" 10 ha x 10 years x 6.86 da m^3/ha	686	556
Year 2006 Grade 'A' Demand 2,349 ha @ 6.86 ML/ha	16,114	13,069
Residential on Grade "A" Land 40 units x 10 years x 0	0	0
Residential on Grade "G" Land 10 units x 10 years x 0.8 ML/ha	80	65
Estimated Demand in Year 2016	16,880	13,690
Water Availability – from Table 1	17,010	13,790
SURPLUS	**130**	**100**

4. DISTRIBUTION SYSTEM

4.1. SYSTEM ANALYSIS

The distribution system has been modeled using the 'Waterworks" computer program. This model has proven very dependable and accurate over the years. The design criteria used in the analysis of the distribution system include both standard design values and values obtained from experience with other Improvement Districts. These criteria are shown in the table below.

Table 4. Design Criteria

	Metric	**English**
1. Peak Hour Demand		
a. Irrigation	From 0.78 to 1.01 lps/ha	5.0 to 6.5 USgpm/acre
b. Single-Family Domestic:		
Fee Simple Lots	0.12 lps/conn	2.0 USgpm/conn
Bare land Strata	0.06 lps/conn	1.0 USgpm/conn
c. Multi-Family Domestic	0.06 lps/unit	1.0 USgpm/unit
2. Maximum Velocities		
a. Mainlines	2.44 m/s	8.0 ft/s
b. Distribution System	2.0 m/s	6.5 ft/s
c. Pressure Reducing Valves	7.0 m/s	23.0 ft/s
3. Pipeline Friction Factors		
a. Asbestos-Cement, Concrete Pipe	C = 130	C = 130
b. PVC or Steel-Epoxy Lined	C = 140	C = 140
c. Steel – Unlined	C = 110	C = 110
4. Minimum Pressure		
a. Irrigation @ Highest elevation on lot	310 kPa	45 psi
b. Residential Main Floor Level	275 kPa	40 psi
c. Fire Flows @ Hydrant	140 kPa	20 psi
5. Maximum Pressures	830 kPa	120 psi
6. Fire Flows		
a. Rural Residential	30 lps	475 USgpm
b. Urban Residential	60 lps	950 USgpm

The model was updated with all works constructed up to December 2005, including new developments in Balldock, Gallagher's Canyon and Luxmoore Road. The most significant new demand on the system in the last two years was 900 USgpm for the Gallagher's Canyon Golf Course, whose delivery is directly off the mainline at PRV 4M. The total demand, using the above parameters, is 36,650 USgpm; 97% of which is supplied through the Hydraulic Creek mainline. Flow records from 2003, the hottest year on record, indicate a maximum day demand of 26,150 USgpm, which is only 75% of the theoretical peak.

The pipeline distribution system is designed and modeled using 85% of the peak demand. This assumption is based on the following:

> The use of the irrigation application rates recommended by the Ministry of Agriculture for each particular soil type creates an unrealistically high demand in the model. The application rates were based on irrigation technology used in the 1960's. More modern irrigation equipment and agricultural metering has improved irrigation efficiency and lowered peak demand values. New values should be applied to each lot and soil type at some time; however, in the interim, the theoretical peak demands will be multiplied by 85% for this analysis. This will create a model that is still slightly conservative, yet more meaningful and useful than using theoretical values. A copy of the existing system analysis is included in Annex 2.

4.2. MODELING SUMMARY

The analysis revealed no major system deficiencies under the current peak demand conditions. The addition of the golf course demand has had a negligible effect on pressures in the distribution system. There is no need for additional pipeline upgrades at this time to increase pressures in the system. A new pipeline loop at Saucier Road, however, will help reduce pipe velocities in that area. Any adjustments to pressure zones can be made at the pressure reducing valves, and at this point, no PRV adjustments are necessary.

There is still need for system improvements to address localized service problems in certain developments. These improvements are described in Section 5.

5. SYSTEM IMPROVEMENTS

5.1. WATER SUPPLY FACILITIES

Cost estimates for new development projects have also been updated to account for the increased construction costs within the Okanagan. Mould Engineering has reviewed these figures, and revised past cost estimates to more realistic costs for 2006 Construction.

5.1.1. Turtle Lake Reservoir

Current growth projections have confirmed the need for additional storage within the ten-year framework of this Plan. The most economical new water source is Turtle Lake Reservoir (Elevation 1,290 metres [4,232 ft]) near the Stirling Creek diversion into Hydraulic Creek, as shown on the plan on the opposite page. The new reservoir has a live storage capacity of 2,100 ML (1,700 ac-ft). The reservoir will not replenish completely in a typical year, and will only be able to supply, on average, 620 ML (500 ac-ft) annually of additional water to the SEKID system. The District has existing water licenses authorizing the reservoir construction.

Estimated Cost $1,800,000

5.2. DISTRIBUTION SYSTEM

5.2.1. Saucier Road Pipeline

Completion of the 200 mm pipeline on Saucier Road to interconnect with existing pipelines as shown on Figure 2, opposite page 12, will reduce pipeline velocities in the 500 mm and 450 mm mains, and provide an important loop for re-directing flows to facilitate maintenance and operational procedures.

Estimated Cost $100,000

5.2.2. Balldock/Luxmoore Road Pipeline

A 200 mm pipeline to interconnect the main on Luxmoore Road to a new pipeline in a subdivision being proposed on Balldock Road will improve

flows and interconnect two high-level pressure zones. This pipeline will also reduce flows in the main between PR 2S and 8S (See Figure 2).

Estimated Cost $90,000

5.2.3. Gallagher's Fairway S/Mahonia Drive Pipeline

A 300 mm pipeline, from the end of a proposed subdivision in Gallagher's' Canyon Development to Mahonia Drive, will improve fire flows in the general area. A larger area will then be supplied with treated water by the Field Road Reservoir.

Estimated Cost $145,000

5.2.4. Miscellaneous Undefined Pipelines

This contingency fund allows the upgrade of pipelines or pressure regulating stations to meet the water demands of new development.

Estimated Cost $300,000

5.2.5. Pressure Reducing Station No. 32M Upgrading

In order to connect the residential areas along McCulloch Road to the Field Road Reservoir system, a Pressure Reducing Station is needed on Carter Road to regulate water pressure to services west of Carter Road. The Field Road source will be the main supply to the residential area with PR 10K serving as a backup for fire flows or emergencies.

Estimated Cost $100,000

5.2.6. Land Acquisition for new Pumpstation

Land or right-of-way is required for a new pump station or diversion off Mission Creek. This is likely the next water source for the District in the next twenty years. Further costs can be determined at a later stage.

Estimated Cost $100,000

6. COST SUMMARY AND PROGRAM SCHEDULE

The estimated costs of the works needed to supply the anticipated growth within the South East Kelowna service area over the next ten years are summarized below:

1. Water Supply Works	
.1 Turtle Lake Reservoir	$1,800,000
2. Distribution System	
.1 Pipelines	
.1 Saucier Road	100,000
.2 Luxmoore Road/Balldock Road	90,000
.3 Gallagher's Fairway/Mahonia Drive	145,000
.4 Miscellaneous Pipelines	300,000
.2 Pressure Reducing Station No. 32M	100,000
3. Land Acquisition	100,000
4. Planning & Engineering	195,000
TOTAL	**$2,830,000**

A summary of the estimated costs and expected phasing of construction of the projects is presented in Table 5, opposite. A detailed breakdown of the cost estimates is contained in Annex 1 (Turtle Lake costs include $35,000 for engineering completed to date).

It should be noted that several of the pipeline projects are dependent on residential subdivisions proceeding. The timing of construction is therefore very speculative.

7. CAPITAL EXPENDITURE CHARGES

Development Charges (CEC's) are levied on applicants for new service. Different types of development place different demands on the water system, and estimates were made to separate the costs attributable to each class. Commercial developments, for instance, are usually low water users, but require system capacity for high fire flows. Fire flows have a major impact on pipeline and reservoir sizes, and consequently costs. Residential users have fairly high water requirements with high peak demands, while irrigation demands are relatively constant in summer, with no requirement for fire flows or winter supply. CEC's have been re-calculated and are shown in Tables 6 and 7.

8. FINANCIAL IMPLICATIONS

The cash flow implications of the ten-year plan are summarized in Table 8, opposite. In order for revenues to balance anticipated costs over the next ten years, it will be necessary to increase CEC rates. The reason for this increase is the significant rise in construction costs in the Okanagan since 2003. Although not significantly affecting the cost for construction of the Turtle Lake Reservoir, the cost of pipeline installation is expected to increase substantially. Unit costs for urban pipeline installation have also increased due primarily to a shortage of contractors in the region, as well as increased fuel and labour market shortages increasing salaries. The estimated cost of constructing Turtle Lake reservoir is currently estimated to be $1.8 million.

A deficit occurs in the bank balance for a few years of the planning period, so borrowing is required to complete construction on the time line. The Turtle Lake Reservoir project design is complete, and construction is expected to begin in summer of 2006 and be fully operational by 2008. The District will attempt to maintain a similar financial reserve at the end of the planning period, while having water available for future growth.

Also note that this Capital Works Plan does not account for escalation of costs as required by Development Cost Charge standard practices. A review of this document is recommended every two or three years to monitor growth rates and construction costs, and ensure that revenues and expenditures are being maintained. It is likely that periodic increases in the CEC rates will be required.

9. FUTURE WATER SUPPLY OPTIONS

Beyond the ten-year time frame of this Capital Works Plan, additional water sources will be required to meet future growth. We have identified some options below. To date, the most viable water source seems to be from Mission Creek.

9.1. MISSION CREEK

Mission Creek is a possible future water source for the District, provided that upland storage is developed, increasing diversions while maintaining minimum creek flows. There are some undeveloped, but expensive, potential reservoir sites in the Mission Creek watershed.

An interesting alternative may be a joint works development of the Gopher Flats site with Black Mountain Irrigation District (BMID). This project was investigated in some detail in the '80s, but was never constructed for economic reasons. The BMID continues to keep the project on the books.

Other possible projects include:

9.2. RAISING MCCULLOCH RESERVOIR

McCulloch Reservoir could be raised to increase storage capacity. There are some significant problems to overcome, however, to implement the project. There is little extra water to capture from this watershed. This project should only be implemented if another source is available; for example through inter-basin transfer from the West Kettle River Watershed.

- The reservoir will not fill every year, so storage has to be carried through a series of low runoff years. The amount of storage needed will be about four times the annual usable volume, resulting in considerable storage costs to service more land. The cost includes:
    - Six dams to rebuild,
    - A new outlet structure at the North Dam,
    - A new spillway,
    - Extensive reservoir clearing.
- A number of recreational leases, a commercial lease, and the KVR railway R/W will be impacted, and expensive to relocate.

9.3. EAST KELOWNA WELL NO. 3

Another high-capacity well could be drilled on the East Kelowna Bench. A detailed hydrogeological study is needed to verify concerns of whether the aquifer can support another well.

9.4. WILKINSON CREEK DIVERSION

A portion of Wilkinson Creek could be diverted into the Stirling Creek Watershed to augment runoff to McCulloch Reservoir. A previous attempt by the District to obtain a water license authorizing the diversion was abandoned following objections from water licensees and environmental interests on Kettle River. Obtaining a water license may be possible provided that the diversion only occurs during spring freshet.

10. RECOMMENDATIONS AND CONCLUSIONS

In order to meet the water supply requirements of existing users and also supply the growth projected for the next ten years, it is recommended that the Trustees:

1. Adopt a new Capital Charge Bylaw in 2006 authorizing the collection of charges on new developments as outlined in this report.

2. Proceed with the construction of Turtle Lake Reservoir.

3. Initiate a study to determine the next water source. Currently, the most viable option seems to be from Mission Creek, via a new pump station facility. A budget for land acquisition ($100,000) has been included in this Plan.

4. Contact the City of Kelowna to determine whether the transfer of lands in the area of Dehart/Swamp Roads is still in the City's plans, and if so, determine the time frame for implementation.

5. Continue the stream flow monitoring program and update the watershed data. Runoff conditions may have changed since the 1984 Ministry of Environment calculations, and the amount of reliable long-term yield from the watershed may be reduced, a critical factor for long-term planning, if correct.

Table 5
Program Schedule & Cost Estimates
Year 2006 - 2016

	2005*	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	TOTAL
1. WATER SUPPLY PROJECTS:													
1.1 Turtle Lake Reservoir													
.1 Design Drawings & Approvals	35,000	15,000											**$ 50,000**
.2 Reservoir Clearing & Access Roads	54,571	245,429											**$ 300,000**
.3 Borrow Pit & Site Clearing		50,000											**$ 50,000**
.4 Dam Construction			1,000,000	200,000									**$ 1,200,000**
.5 Stirling Creek Diversion, Monitoring, & Misc.				200,000									**$ 200,000**
2. DISTRIBUTION SYSTEM IMPROVEMENTS													
2.1 Pipelines													
.1 Saucier Road		100,000											**$ 100,000**
.2 Luxmoore / Baldock Road									90,000				**$ 90,000**
.3 Gallaghers / Mahonia					145,000								**$ 145,000**
.4 Miscellaneous Pipelines		25,000	25,000	25,000	25,000	25,000	25,000	30,000	30,000	30,000	30,000	30,000	**$ 300,000**
2.2 PR Station No 32M				100,000									**$ 100,000**
3. LAND ACQUISITION												100,000	**$ 100,000**
4. PLANNING AND ENGINEERING		15,000	25,000	15,000	20,000	15,000	20,000	15,000	20,000	15,000	20,000	15,000	**$ 195,000**
TOTAL ESTIMATED CONSTRUCTION COSTS		$ 450,429	$ 1,050,000	$ 540,000	$ 190,000	$ 40,000	$ 45,000	$ 45,000	$ 140,000	$ 45,000	$ 50,000	$ 145,000	**$ 2,830,000**
REVENUE		$ 220,000	$ 220,000	$ 220,000	$ 220,000	$220,000	$ 220,000	$220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	**$ 2,420,000**
Balance	$803,454	$572,571	($257,000)	($592,000)	($598,000)	($454,000)	($306,000)	($149,000)	($78,000)	$92,000	$262,000	$337,000	
Bank Interest (6%)	$0	$0	($15,000)	($36,000)	($36,000)	($27,000)	($18,000)	($9,000)	($5,000)	$0	$0	$0	
Balance after Interest	$803,000	$573,000	($272,000)	($628,000)	($634,000)	($481,000)	($324,000)	($158,000)	($83,000)	$92,000	$262,000	$337,000	$337,000

* Costs and Balance on November 30, 2005

Table 6
Capital Expenditure Charge Rates

1. Residential	
Residential on Grade 'A' Land	
Single Family	$3,100 per unit
Bare land Strata & Mobile Home Park	$3,100 per unit
Residential on Grade 'G' Land	
Single Family Detached	$4,100 per unit
Bare land Strata & Mobile Home Park	$4,100 per unit
2. Irrigation	$8,200 per ha
3. Commercial and Industrial	
Building with no sprinkler system	
First 250 m^2 (minimum charge)	$3,100
Over 250 m^2	$13/$m^2$
Building with approved sprinkler system	
First 250 m^2 (minimum charge)	$2,800
Over 250 m^2	$10/$m^2$

The amount of revenue that would be generated by the projected development is summarized in Table 6 below.

Table 7
Potential CEC Revenues over 10 Year Plan

Category			
	Number of Units	**CEC Rate**	**Amount**
1. Residential Irrigated to Residential Single Family (units)	500	$3,100	$1,550,000
2. Irrigation (ha)	100	$8,200	$820,000
3. Commercial & Industrial			$50,000
4. Total			**$2,420,000**

Table 8
Cash Flow Projections
Year 2006 - 2016

Year End	Revenues	Const. Costs	Interest	Balance
2006	220,000	450,429	-	573,000
2007	220,000	1,050,000	15,000	(272,000)
2008	220,000	540,000	36,000	(628,000)
2009	220,000	190,000	36,000	(634,000)
2010	220,000	40,000	27,000	(481,000)
2011	220,000	45,000	18,000	(324,000)
2012	220,000	45,000	9,000	(158,000)
2013	220,000	180,000	7,000	(125,000)
2014	220,000	45,000	-	50,000
2015	220,000	50,000	-	220,000
2016	220,000	145,000	-	295,000
TOTAL	**$2,420,000**	**$2,780,429**	**$148,000**	**$295,000**

CAPITAL WORKS PROGRAM
DISTRIBUTION SYSTEM

Cost Estimates

January 2006

1. Saucier Road Pipeline				
.1	200 mm PVC Pipe, 360 m @ $180	$ 65,000		
.2	Valves & Fittings	4,000		
.3	Pavement, 100 m^2 @ $20	4,000		
.4	Engineering & Contingencies @ 25%	18,000		
.5	District Administration @ 10%	9,000		
	Sub Total		***$***	***100,000***
2. Luxmoore/Balldock Road Pipeline				
.1	200 mm PVC Pipe, 200 m @ $180/m	$ 36,000		
.2	Pipeline Upsizing, 150 to 200 mm 800 m @ $20	$ 16,000		
.3	Valves & Fittings	14,000		
.4	Engineering & Contingencies @ 25%	16,000		
.5	District Administration @ 10%	8,000		
	Sub Total		***$***	***90,000***
3. Gallagher's Fairway S/Mahonia Drive				
.1	Pipeline Upsizing, 150 to 200 mm 400 m @ $20	$ 8,000		
.2	Pipeline Upsizing, 200 to 300 mm 330 m @ $40	$ 13,000		
.3	200 mm PVC Pipe, 385 m @ $180	69,000		
.4	Valves and Fittings	15,000		
.5	Engineering & Contingencies @ 25%	26,000		
.6	District Administration @ 10%	14,000		
	Sub Total		***$***	***145,000***
4. Miscellaneous Undefined Pipelines			***$***	***300,000***
5. PR Station No. 32 M				
.1	Excavation and Backfill	$ 5,000		
.2	Vault	20,000		
.3	Mechanical	30,000		
.4	Electrical	13,000		
.5	Power Supply	5,000		
.6	Engineering & Contingencies @ 25%	18,000		
.7	District Administration @ 10%	9,000		
	Sub Total		***$***	***100,000***
6. TOTAL			***$***	***735,000***

CAPITAL WORKS PROGRAM
TURTLE LAKE RESERVOIR
COST ESTIMATE

January 2006

		Quantity	$ Per Unit		
1.	***Cut-off Dam***				
	1.1 Access Road			$ 30,000	
	1.2 Stripping Dam Site, Borrow Pits, & Cutoff Trench			20,000	
	1.3 Outlet Gate, Sluice & Energy Dissipator			117,000	
	1.4 Gravel Fill, m^3	19,000	$9	171,000	
	1.5 Impervious Fill, m^3	14,000	$15	210,000	
	1.6 Rock Riprap, m^3	800	$50	40,000	
	1.7 Piezometers & Surface Reference Points			6,000	
	1.8 Toe Drain, m^3	200	$30	6,000	
	Sub Total				***$ 600,000***
2.	***Outlet Dam***				
	2.1 Stripping Dam & Cut-off Trench Excavation			$ 20,000	
	2.2 Outlet Gate, Sluice & Energy Dissipator			100,000	
	2.3 Impervious Fill, m^3	3,300	$15	50,000	
	2.4 Semi Pervious Fill, m^3	8,000	$9	72,000	
	2.5 Pervious Fill, m^3	150	$10	1,500	
	2.6 Rock Rip Rap, m^3	400	$50	20,000	
	2.7 Outlet Channel Excavation			10,000	
	2.8 Toe Drain	150	$30	4,500	
	2.9 Spillway			50,000	
	2.10 Piezometers & Surface Reference Points			12,000	
	Sub Total				***$ 340,000***
3.	***Saddle Dam***				
	3.1 Access Road			$ 5,000	
	3.2 Stripping Dam Site			1,000	
	3.3 Pervious Fill, m^3	200	$15	3,000	
	3.4 Surface Reference Points			1,000	
	Sub Total				***$ 10,000***
4.	***Stirling Creek Diversion***				
	3.1 Diversion Structure			$ 40,000	
	3.2 Clearing R/W			10,000	
	3.3 Pipeline - 18 inch diameter, ft	600	$80	50,000	
					$ 100,000
5.	***Reservoir Clearing***				
	4.1 Clearing, Burning, ac	100	$2,500		***$ 250,000***
6.	***Contingencies (10%)***				***$ 150,000***
7.	***Engineering (15%)***				***$ 200,000***
8.	***District Administration***				***$ 150,000***
	PROJECT TOTAL				***$ 1,800,000***