

Technical Memorandum No. 2



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Regional District of Okanagan-Similkameen

Osoyoos Irrigation District Water Supply Improvements Options Review Study

Evaluation and Comparison of System Options

August 2008



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Table of Contents

SECTION	PAGE NO.
Table of Contents	i
1 Objective	1
2 Evaluation Criteria	1
2.1 Cost and Cost Risks	1
2.2 Source Capacity and Water Quality	2
2.3 Treated Water Quality	2
2.4 Operation and Security	3
2.5 Environmental/Urban Impact	3
3 Importance of Evaluation Criteria	3
4 Assessment	5
4.1 Capital Costs	5
4.2 Life Cycle Cost per Lot	5
4.3 Government Funding Dependency	5
4.4 Constructability	5
4.5 Potential Regulatory Implementation Risks	5
4.6 Direct Ability to Control Future Costs	5
4.7 WTP and Pump Station Site Availability	6
4.8 Available Source Capacity	6
4.9 Raw Water Quality	6
4.10 Source Resilience to Water Quality Deterioration	6
4.11 Treatment Conformance with IHA Requirements	6
4.12 Risk of Human Consumption of Non-Potable Water	6
4.13 Flexibility for Phasing Filtration	7
4.14 Operational Robustness	7
4.15 Operational Flexibility	7
4.16 Security	7
4.17 Construction - Environmental Impacts	7
4.18 Operation – Environmental Impacts	7
5 Conclusions	8

Enclosure 2A – Qualitative Assessment of Options

TECHNICAL MEMORANDUM NO. 2

Osoyoos Irrigation District Water Supply Improvements Options Review Study Evaluation and Comparison of System Options

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1 Objective

The objective of this Technical Memorandum is to evaluate and compare shortlist supply and treatment options from Technical Memorandum No. 1 leading to a recommended option.

2 Evaluation Criteria

The following is a summary of criteria used for evaluating the various options:

2.1 Cost and Cost Risks

- **Capital Cost:** The options were ranked based on their total capital costs. The capital costs will impact the RDOS' ability to finance the proposed capital works and is therefore considered separate of life-cycle costs.
- **Life-Cycle Costs:** The options were ranked in terms of their total life-cycle costs per lot. Life-Cycle costs have been estimated on the basis of financing based on a 20 year amortization at 5% interest rate plus the operation and maintenance costs projected for the 20 year period 2007 to 2026. Options with lower life-cycle costs are ranked higher than those with higher life-cycle costs. Future operation and maintenance costs were inflated at 2.0% per annum.
- **Government Funding Dependency:** Options were ranked on terms of their dependence on outside government funding. Options that require significant government funding were ranked lower due to the probability that the RDOS would be unsuccessful in obtaining the funding.
- **Constructability:** Options were ranked in terms of their potential for constructability problems and cost overruns. Options with site constraints or potentially difficult geotechnical conditions were ranked lowest.
- **Potential Political Implementation Risks:** Options were ranked in terms of their dependence on cooperation of beneficiaries. Options that were considered to be at risk due to political cooperation issues were ranked the lowest.

- **Direct Ability to Control Future Costs:** Options were ranked based on their vulnerability to or lack of control of future costs. Options that involved significant costs beyond the direct control of the RDOS were ranked lowest.
- **Water Treatment Plant Site and Pump Station Site Availability:** The options were ranked based on their vulnerability to problems in acquiring land for facilities. Options where the availability of lands at the proposed plant site is unknown were therefore ranked lower than those not requiring land acquisition.

2.2 Source Capacity and Water Quality

- **Available Source Capacity to Meet Projected Demands:** The options were ranked in terms of the supply source ability to meet the projected demands. Those sources considered to have more spare or excess capacity were ranked higher than those with limited capacity.
- **Raw Water Quality:** The options were ranked in terms of the general source water quality relative to parameters of importance to public health. Included in this ranking was consideration of the variability of water quality including frequency and amplitude of spikes of parameters such as turbidity and colour.
- **Source Resilience to Water Quality Deterioration:** Each option was ranked in terms of resilience to future water quality deterioration. Sources having minimal existing and future potential development within their watersheds were ranked higher than those with significant existing or potential future development.

2.3 Treated Water Quality

- **Treatment Conformance with IHA Requirements:** Each option was ranked in terms of its ability to meet IHA's water quality requirements, thereby addressing public health protection. Options having higher quality source water and/or multi-barrier treatment were ranked the highest.
- **Risk of Human Consumption of Lower Quality Water from System:** The options were ranked in terms of the potential risk of human consumption of lower quality water from the RDOS system. Options having components carrying lower quality water such as separated systems were ranked lower than systems containing only potable water conforming to IHA's water quality requirements.
- **Flexibility for Phasing Filtration:** The options were ranked in terms of their feasibility for phasing filtration. For example, options that include multiple unit treatment processes, thereby allowing the potential for phased treatment implementation and thus reduced initial capital cost, were ranked higher than options involving fewer process steps.

2.4 Operation and Security

- **Operational Robustness:** The options were ranked in terms of their operational complexity and robustness. Supply options having reduced mechanical and electrical components were ranked higher than those having high complexity. Treatment options having proven robust treatment components and more robust treatment processes were ranked higher than those with more complex or finicky treatment components.
- **Operations and Maintenance Accessibility:** The options were ranked in terms of their operations and maintenance accessibility. Those that have mechanical/electrical components at multiple locations or at long distance from the base of operations were ranked low.
- **Operational Flexibility:** Options were ranked in terms of their flexibility relative to potential failure of individual components. Options having more than one source of supply therefore were ranked higher than those with single sources and single pipelines.
- **Security:** Options were ranked in terms of their exposure to potential vandalism or security breaches. Options having treatment plants at remote locations away from the view of general public were ranked low. Options having treatment plants in developed areas with high public visibility were ranked highest.

2.5 Environmental/Urban Impact

- **Construction - Environmental Impacts:** Options were ranked in terms of the impact of their construction on the natural environment.
- **Operation – Environmental Impacts:** Options were ranked in terms of the impact of their operation on the natural and urban environment. For instance, options involving significant water treatment residuals management requirements, high noise generation, etc., were ranked the lowest.

3 Importance of Evaluation Criteria

In order to assist in the evaluation process, a numerical weighting was identified for each of the evaluation criteria. Numerical scoring of options is a highly subjective exercise and therefore was not used in evaluating options. It should not be used as the sole basis for selecting one option over the others. However, it was felt that understanding the importance of each criteria was important in the evaluation process.

The Criteria Importance was established in consultation with RDOS staff relative to each of the evaluation criteria. Criteria which were considered to have higher importance to the RDOS were therefore given higher weighting applied for each of the criteria:

Criteria	Importance
Cost and Cost Risks	
Capital Cost	High
Life-Cycle Cost per Lot	Highest
Government Funding Dependency	High
Constructability	Medium
Potential Political Implementation Risk	Medium
Direct Ability to Control Future Costs	Medium
Water Treatment Plant Site Availability	Medium
Source Capacity/Quality	
Available Source Capacity	Medium
Raw Water Quality	Medium
Source Resilience to Water Quality Deterioration	Medium
Treated Water Quality	
Treatment Conformance with IHA Requirements	High
Risk of Human Consumption of Lower Quality Water	Medium
Flexibility for Phasing Filtration	Low
Operation and Security	
Operational Robustness	Medium
Operational Flexibility	Medium
Security	Low
Environmental/Urban Impacts	
Construction - Environmental Impacts	Medium
Operation – Environmental Impacts	Medium

4 Assessment

The following summarizes our findings relative to the qualitative assessment of each option under each of the major assessment criteria.

4.1 Capital Costs

The option having the lowest net capital cost was Option 3a (Groundwater Domestic Supply with POE to Rural). This option's cost could potentially increase depending on the location of the wells, and the amount of additional pipeline required to connect to the urban distribution system. The lowest rating was for Option 1 due to the large size of a new water treatment plant.

4.2 Life Cycle Cost per Lot

The option having the lowest Life Cycle Cost per Lot was again Option 3a. The cost of separating the systems (Option 2) was the next lowest value.

4.3 Government Funding Dependency

The higher the initial capital cost, the more reliant the project is on government funding. Options 2a, 3, and 4 were less reliant on government funding and were therefore ranked the highest. In order for Option 1 to be viable, significant government funding will be required.

4.4 Constructability

The constructability of any option is highly impacted by geotechnical conditions, site constraints and any other factor which may impact the ability to construct the required facilities. There were no site constraints identified with any of the options, and they were therefore graded "average". Option 4, which required the least additional construction activities, received the best rating.

4.5 Potential Regulatory Implementation Risks

Regulatory risks to a project may include local, provincial and federal governments which may impose strict guidelines or limitations before construction can proceed. Option 4 was also rated poor due to Interior Health's reluctance to allow large scale Point of Entry systems to be implemented. This is due to concerns about the difficulty of District's ability to access and maintain the POE devices thereby increasing potential liability.

4.6 Direct Ability to Control Future Costs

All options were graded "good" in this category.

4.7 WTP and Pump Station Site Availability

Site availability is difficult to assess at this stage. Any new water treatment facility would require additional land due to the lack of space at the current pump station site. Option 2 would require a new pump house and treatment facility on a new parcel of land.

4.8 Available Source Capacity

The highest capacity water source is Osoyoos Lake. The OID has enough water license from the lake to meet its demands. Groundwater sources for the OID could potentially meet domestic demands subject to further investigation, but could limit any expansion in the future. Options 1, 2 and 4 were rated higher than Option 3.

4.9 Raw Water Quality

All options utilizing groundwater supply were graded higher than those from the Lake. The groundwater options will require disinfection and may require some additional treatment to eliminate contaminants, but likely not the full filtration options from the Osoyoos Lake options.

4.10 Source Resilience to Water Quality Deterioration

The residence time of water in Osoyoos Lake is relatively short due to significant inflows and outflows from the lake. Water quality in the Osoyoos Lake is expected to remain relatively consistent. Shallow groundwater sources may be more prone to water quality deterioration, particularly from chemicals, fertilizers and waste products. Deeper sources would typically be expected to be more resilient. Options utilizing groundwater supplies have therefore been ranked lower under this category.

4.11 Treatment Conformance with IHA Requirements

All filtered options covered under this technical memorandum were developed on the basis of treatment conformance with IHA's requirements therefore, they have been considered to be equal under these criteria. Options utilizing groundwater have been ranked the same as the surface water options subject to the findings of further water quality testing. Option 4, which utilizes POE's, has been ranked lower.

4.12 Risk of Human Consumption of Non-Potable Water

Options involving separation of the domestic and irrigation systems will involve the potential risk of ingestion of non-potable water. Options using POE's all use chlorinated raw water from Osoyoos Lake, and run the risk of contamination should the POE's fail to operate. Option 2 has a minor risk of cross-contamination at the filtration plant, and therefore requires backflow prevention. Option 3 using groundwater only for consumption was the highest rated option.

4.13 Flexibility for Phasing Filtration

It is likely that all options using raw water from Osoyoos Lake will require filtration, in addition to any other treatment required. These options were all ranked equally under these criteria. Groundwater options were rated higher.

4.14 Operational Robustness

Operational robustness is an important factor in any future OID system. Any future system which allows the District to maintain full control of its operations, particularly water treatment, will be rated higher than those without. Filtration plants require higher levels of certification than traditional chlorinated systems, and require regular maintenance.

Options 1 and 2 are based on conventional filtration treatment technology. These two options have the flexibility of treating the water using either direct filtration technology or conventional filtration (clarification and filtration) technology. Having a clarifier in the treatment process adds robustness to the process. POE options were rated lower than the other options.

4.15 Operational Flexibility

There is little operational flexibility in any of the options. If the pumpstation at Osoyoos Lake breaks down, all supply off that system is halted. Groundwater supplies will likely require two or more wells, offering some redundancy in the system. The Option 3 and 3a were given higher ratings than the other options.

4.16 Security

All options would include plants located in visible urban environments. No single option was perceived to have increased security in comparison to the other options. They were therefore considered to be equal under these criteria.

4.17 Construction - Environmental Impacts

The water filtration plants in this case will likely not be located near the Lake or any streams. The groundwater wells will likely be located on higher ground, and away from creek beds. Option 4 had the lowest impact construction-wise. All of the other options were graded the same.

4.18 Operation – Environmental Impacts

The most significant environmental impact created by the operation of water supply and treatment facilities involves the handling of liquid and solid residuals from the treatment process, both for the filtration plants and the POE's. The groundwater Option 3 was ranked the highest, with Option 3a ranked slightly lower.

5 Conclusions

This brief analysis was performed to assess the various risks associated with the construction of any of these options. Criteria for assessing the weighting of importance were based on discussions with RDOS Board and staff members.

As a result of this evaluation:

Option 3 – Groundwater Domestic Supply had the highest overall rating. Twinning the domestic pipeline throughout the system has a higher initial capital cost than Option 3a, however the long term operation and maintenance is significantly lower. Further groundwater testing is still required however to confirm whether is adequate capacity in the aquifers to meet the OID domestic requirements. There may be opportunities here as well to examine groundwater sources further south of the District boundary, and share those resources.

Option 2 provides the next highest rating. The guarantee of long term water supply coupled with relatively lower life cycle costs make this a possible alternative to Option 3. The OID would be required to split the system and construct a small water filtration facility.

The lowest ranked option is Option 1, where the costs to treat all water in the District is prohibitive.

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Enclosure - 2A

ENCLOSURE 2A – QUALITATIVE ASSESSMENT OF OPTIONS

**Regional District of Okanagan-Similkameen
Osoyoos Irrigation District Water Supply Improvements
Options Review Study**

**Table 2-1
System Options Qualitative Evaluation**

OPTION	NAME	TREATMENT	COST AND PROJECT RISK							SOURCE CAPACITY/QUALITY			TREATED WATER QUALITY			OPERATION & SECURITY			ENVIRONMENTAL IMPACT		OVERALL ASSESSMENT
			Net Capital Cost Based on Gov't Grant of 2/3 of Onsite Costs	Total Annual Cost per Lot	Government Funding Dependency	Constructability	Potential Regulatory Risks	Direct Ability to Control Future Costs	WTP and Pumpstation Site Availability	Available Source Capacity to Meet Projected Demands	Raw Water Quality	Source Resilience to Water Quality Deterioration	Treatment Conformance With HA Requirements	Risk of Human Consumption of Non-Potable Water From System	Flexibility For Phasing Filtration	Operational Robustness	Operational Flexibility	Security	Construction - Environmental Impact	Operation - Environmental Impact	
CRITERIA IMPORTANCE			High	Highest	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium	High	Medium	Low	Medium	Medium	Low	Medium	Medium	
1	Osoyoos Lake Treated Supply	Clarification/Filtration	\$3,617,000	\$5,176	Poor	Average	Good	Good	Poor	Good	Average	Average	Good	Good	Average	Good	Average	Average	Average	Average	Lowest
2	Osoyoos Lake Treated Domestic Supply	Clarification/Filtration	\$1,460,000	\$893	Average	Average	Good	Good	Poor	Good	Average	Average	Good	Average	Average	Good	Average	Average	Average	Average	Above average
2a	Osoyoos Lake Treated Domestic Supply (POE in Rural Residences)	Clarification/Filtration	\$1,116,000	\$895	Good	Average	Average	Good	Poor	Good	Average	Average	Good	Average	Average	Average	Average	Average	Average	Average	Average
3	Groundwater Domestic Supply	Groundwater	\$1,412,000	\$768	Average	Average	Good	Good	Average	Average	Good	Poor	Good	Good	Good	Average	Good	Average	Average	Good	Highest rating
3a	Groundwater Domestic Supply (POE in Rural Residences)	Groundwater	\$1,011,000	\$743	Good	Average	Average	Good	Average	Average	Good	Poor	Good	Average	Good	Average	Average	Average	Average	Average	Above average
4	Osoyoos Lake Supply with POE Systems	POE	\$851,000	\$1,316	Good	Good	Poor	Good	Good	Good	Average	Average	Average	Poor	Average	Poor	Average	Poor	Good	Average	Below Average