

Sacramento Regional County Sanitation District

Interceptor Sequencing Study

**Technical Memorandum No. 8
Alternatives Risk Analysis**

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1.0 INTRODUCTION

A business risk is the threat that an event, action or inaction will adversely affect an organization's ability to achieve its business objectives and executes its strategies successfully. A comprehensive evaluation of alternatives needs to account for varying levels of risk that may impact the selection of a preferred alternative or range of alternatives.

The ISS has been tasked with investigating conveyance, satellite treatment, and recycled water as options for providing sewage conveyance and treatment services to future growth areas within the SRCSD service boundary. Because some potential alternatives have large variations in risk profiles, an evaluation of risk needs to be considered as part of the overall analysis. This technical memorandum makes recommendations on how to identify, quantify and evaluate risk for the project alternatives evaluation.

2.0 BACKGROUND

Previous SRCSD master plan documents (1993/94 Sacramento Sewerage Expansion Study and Master Plan 2000) did not fully utilize asset management principles to scrutinize capital investment options by subjecting a broad range of alternatives to a business case evaluation.

Risk is often difficult to incorporate into a business case evaluation due to the lack of knowledge about the risk events, the risk probabilities, and the consequences. Establishing these parameters for a broad range of master plan level alternatives is subjective and the results are qualitative in nature.

SRCSD performed a pilot study in January 2009 to evaluate risk at various levels in the SRCSD organization. The resulting report, "Business Risk Methodology Evaluation Methodology and Pilot", documents the results of the pilot study. The study describes two levels that risk analysis can be applied: corporate and projects/assets. At the corporate level, risks are focused on long term stakeholder and operational issues. At the project/asset level, risks are focused on project specific risks and consequences. The ISS alternatives analysis falls in-between the corporate level and the project/asset level.

3.0 APPROACH

An analysis of risk commonly identifies the risk of an event, analyzes the probability of failure and the consequence of failure, calculates a risk score, ranks the risk and develops risk mitigation strategies if required.

The methodology recommended for the ISS alternative analysis involves the following steps:

- Identify potential risk categories and corresponding failure events for each alternative
- Determine risk signature for each alternative
- Evaluate alternatives based on project costs and risk signatures
- Optional - Develop strategies to manage risk for preferred alternatives

3.1 Risk Categories

A failure event occurs when an asset or service is not provided as needed or expected. The failure may occur for a variety of reasons. Seven risk categories have been identified for the ISS alternatives evaluation. The recommended risk categories are shown in Table 8.1.

Table 8.1 ISS Alternative Analysis Risk Categories

Category	Description of Impacts
Asset and Service Reliability	Failure to deliver expected levels of service. Failure or unreliability is reflected in outages, response times, complaints, and increased maintenance costs.
Environment	Temporary or permanent harm to life forms and their habitat. Potential for releases of or exposures to toxic materials and disruption of the environment.
Financial	Unplanned variation in costs or revenues that aren't easily assimilated into an existing budget and therefore require a rate increase or decrease. Impacts to SRCSD bond rating as a result of poor financial performance or audit findings.
Legal	Action or inaction that causes harm to individual or property and creates civil or criminal liability. Legal risk is evidenced by claims and lawsuits brought on by private parties or criminal sanctions.
Public Health	Temporary or permanent harm to humans.
Public Trust	The failure to meet expectation regarding customer service and stewardship of public resources. System performance below expectations results in customer complaints, political response, and negative publicity.
Regulatory	Reflects SRCSD's ability to implement and comply with rules or orders established by governmental agencies. Lack of implementation or violations may result in notices or sanctions in the form of fines, mitigation, enforcement, or loss of authority.

3.2 Risk Signature Level Determinant

The risk signature of an alternative represents the level of risk that implementing that alternative has when compared to other alternatives. The risk signature is a five point scale that contains both a qualitative and a quantitative component.

Qualitative – The risk event is assigned a subjective ranking ranging from minimal to critical.

Quantitative – The risk event is assigned a probability and a consequence cost and a resulting risk cost is produced by multiplying the probability by the consequence cost. Each consecutive higher risk level represents an order of magnitude increase in the cost of the consequences.

The recommended risk probabilities and consequence values are shown in Table 8.2.

Table 8.2 ISS Risk Signature Level Determinant

Likelihood	Consequence				
	Minimal \$10,000	Minor \$100,000	Moderate \$1,000,000	Major \$10,000,000	Extreme \$100,000,000
Almost certain 1 occurrence every year - 100.0%	Medium \$10,000	Medium \$100,000	Critical \$1,000,000	Critical \$10,000,000	Critical \$100,000,000
Likely 1 occurrence every 10 year - 10.0%	Low \$1,000	Medium \$10,000	Medium \$100,000	Critical \$1,000,000	Critical \$10,000,000
Possible 1 occurrence every 20 year - 5.0%	Low \$500	Low \$5,000	Medium \$50,000	High \$500,000	Critical \$5,000,000
Unlikely 1 occurrence every 50 year - 2.0%	Low \$200	Low \$2,000	Medium \$20,000	Medium \$200,000	Critical \$2,000,000
Rare 1 occurrence every 200 year - 0.5%	Low \$50	Low \$500	Low \$5,000	Medium \$50,000	High \$500,000

3.3 Determination of Alternative Risk Signatures

Determining the risk signature of an alternative requires identifying a single risk event for each of the seven risk categories. Although multiple risk events can be identified for each category, only the highest probability or highest consequence event should be considered. After the risk event has been identified, a probability and a consequence cost are chosen from the template derived from Table 8.2. Each category will have a risk signature that corresponds to an annual risk cost. Table 8.3 contains an example of the risk assessment data filled in for Alternative 1, Conveyance Only.

Table 8.3 ISS Alternative Risk Signature Example

Alt 1: Conveyance Only - Option 1 Risk Assessment

	Description	Likelihood	Consequence	Risk Signature
Asset and Service Reliability	Large 100+MGD facility in south area has moderate potential for failure.	Unlikely 2%	Moderate \$1,000,000	Medium \$20,000
Environment	Large 100+MGD pumping station located near Consumes River would damage waterway if SSO occurred.	Unlikely 2%	Major \$10,000,000	Medium \$200,000
Financial	Alternative has 2 pump stations. Capital and M&O costs are predictable.	Rare 0.5%	Moderate \$1,000,000	Low \$5,000
Legal	System configuration has relatively low potential for legal actions.	Rare 0.5%	Moderate \$1,000,000	Low \$5,000
Public Health	100+MGD pump station could have health impacts to humans if SSO occurred.	Rare 0.5%	Major \$10,000,000	Medium \$50,000
Public Trust	Alternative has relatively low potential to impact public trust.	Rare 0.5%	Minor \$100,000	Low \$500
Regulatory	Alternative relies on single discharge permit at SRWTP that requires additional permitted capacity.	Unlikely 2%	Major \$10,000,000	Medium \$200,000

3.4 Evaluation of Alternatives

After the risk signature analysis for the alternatives has been completed, the risk signature can be summed to represent a total annual risk cost for the alternative. This risk cost can then be expressed as a lifecycle cost to help understand the total risk cost over the analysis period. When comparing the alternatives, the lifecycle risk costs should be kept separate from the capital and O&M costs to better understand the actual expected expenditures compared the potential costs of risk.

3.5 Risk Mitigation Strategies

Selection of alternatives is based on a combination of cost, risk, and other non-quantifiable factors. Alternatives with relatively higher risk profiles may be preferred for various non-

economic reasons. If the risk of a preferred alternative is considered excessive, developing mitigation strategies may be warranted. Typical mitigation strategies include: added redundancy, manage post-failure impacts, insure, influence customer expectations, etc.

4.0 CONCLUSION

Risk is an important consideration when subjecting alternatives to a rigorous lifecycle analysis. The ISS scope includes long range service options for SRCSD's expansion areas that include sewage conveyance, treatment, disposal, and providing recycled water. The alternatives have initial implementation dates that are many years away and may occur over decades. It is therefore recommended that the analysis of risk be re-evaluated periodically as regulatory, economic, and societal conditions change.