

# DISCUSSION PAPER

## Capital Regional District Core Area Wastewater Management Program

### Integrated Resource Management Strategy

#### Discussion Paper: A Decision-Making Framework for the Wastewater Biosolids Management Program 031-DP-1

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## 1 Objective

The objective of this discussion paper is to provide a decision-making framework that the CRD can use to arrive at a decision on the overall strategy for wastewater biosolids management and the biosolids/resource management facility(s) while holistically considering both the District's solid waste and liquid waste programs and requirements and potential opportunities for program integration. This same framework will be used elsewhere in the Program Development Phase to facilitate decision-making.

## 2 Background

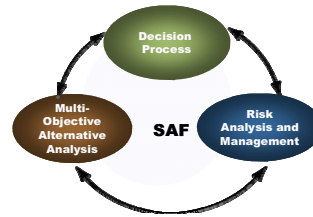
The conceptual-level planning currently underway on the CRD's Core Area Wastewater Management Strategy, which was adopted by the Board in June 2007, is working towards the refinement of the wastewater solids/biosolids management program that will be needed as the CRD implements wastewater treatment. Independent of the wastewater strategy, the CRD has actively developed its solid waste management strategy that includes a variety of initiatives intended to reduce/reuse/recycle solid waste. The CRD is also working towards resolving the remaining two solid waste "Rs", which include resource recovery and residuals management.

The CRD's historical circumstances have now provided the District an exciting opportunity to holistically develop its wastewater and solid waste programs. The products of both programs can be viewed as potential resources and, through the lens of an Integrated Resource Management Strategy and Greenhouse Gas Management Strategy, the CRD has the prospect to develop an optimum overall solution. The solution may conceivably involve some level of integration of liquid and solid waste management. Key to development of the optimum overall solution is a decision-making framework that will guide the CRD through the complexities of issues and the myriad of alternatives that will require development and analysis, ultimately culminating in the specific decisions needed to move forward.

### 3 Decision-Making Framework

#### 3.1 Overview

The proposed decision-making framework has been assigned the descriptor of the Sustainability Assessment Framework (SAF) (Figure 1). The SAF is an enhanced triple bottom line approach that considers the economic, social and environmental effects of different alternatives. It includes three distinct yet interdependent elements:



**Figure 1**  
The Sustainability Assessment Framework

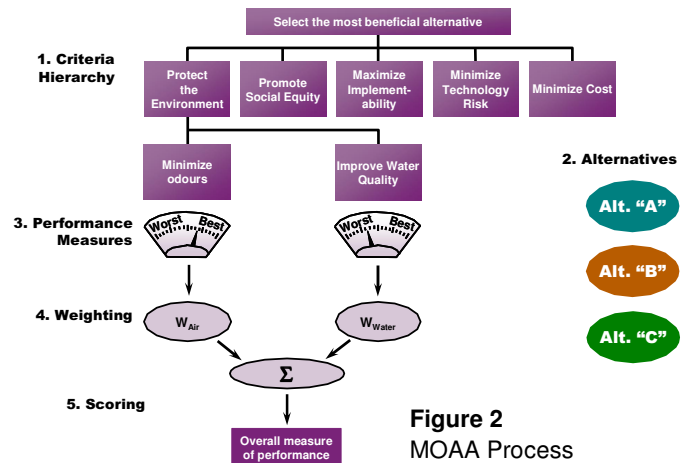
- .1 multi-criteria alternative analysis
- .2 risk identification and analysis
- .3 decision process

Through these elements the SAF provides a defensible method of developing and evaluating alternatives that addresses multiple, and potentially conflicting, objectives while identifying and mitigating key risks.

The following sub-sections provide further information on each element.

#### 3.2 Multi-Objective Alternative Analysis

The multi-objective alternative analysis (MOAA) is simply a procedure to evaluate a selection of alternatives (Figure 2). It begins with the establishment of an objectives hierarchy. This hierarchy will include a wide range of items, such as regulatory compliance, worker and community safety, flexible facility operations and others, that are important to the CRD and reflect its community values.



**Figure 2**  
MOAA Process

The next key part of the MOAA is formulating performance measures against which the alternatives are assessed for each criteria. The performance measures are based on a numeric scale, say from 1 to 5, where 1 reflects the poorest performance measure and 5 represents the best. The performance measures could be qualitative (e.g. 4 = high probability that final effluent meets all regulatory requirements at all times) versus a more quantitative context (e.g. 4 = 95% probability that final effluent meets all regulatory requirements).

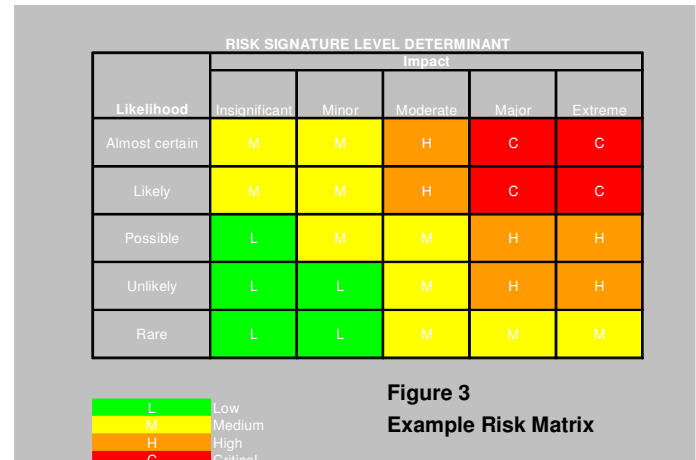
In fact, the “scalable” nature of setting the performance measures fits in well with the overall process, where the initial screening of alternatives may be qualitative in nature, followed by a more quantitative evaluation of the few remaining short-listed alternatives. In this situation different performance measures would be used for the different stages of the evaluation.

With the criteria hierarchy and performance measures in place, the next MOAA step is weighting the relative importance of each criterion. In other words, we need to assess the relative importance of different criteria i.e., are two criteria of equal importance or is one twice as important or half as important as the other. This weighting is independent of alternative. Again, the weighting should reflect the CRD priorities and community values.

Finally, the alternatives are scored using the performance measures and weightings. All measures and weights are normalized to a 0-1 scale and a weighted average of scores and weights is calculated, resulting in a score for each alternative.

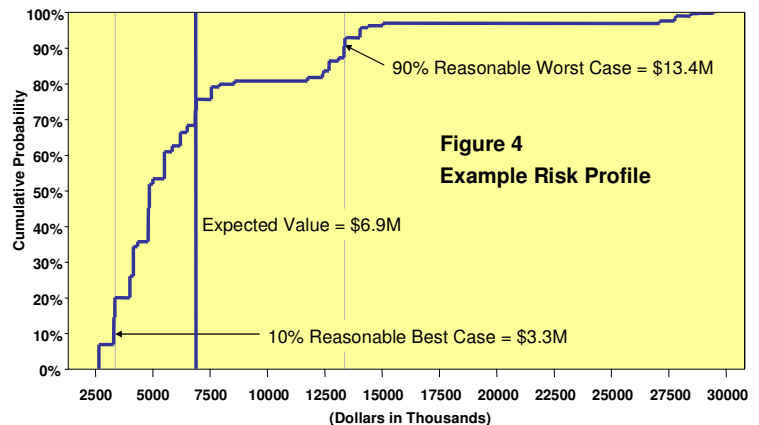
### 3.3 Risk Identification and Analysis

Although “risk” is sometimes included in the MOAA, the proposed decision-making framework explicitly deals with risk identification and analysis (RIA) as a specific, and separate, effort that feeds into the overall SAF. Individual risks are identified for each alternative in a brainstorming session using influence diagrams. A risk signature is developed for each risk by assessing the likelihood of occurrence (e.g. rare to almost certain) and the severity of their impact should they occur (e.g. insignificant to extreme).



Initially this will be done at a screening level where risk matrixes are used to develop the risk signature (Figure 3).

Should risk prove to be a particularly important factor in the evaluation of alternatives, we can quantify risk by assessing probabilities associated with likely cost outcomes and use monte



carlo simulation or decision trees to quantify the risk associated with different alternatives. The outputs of this process can result in additional insights by viewing the shape of the cost distribution (Figure 4), or by identifying which risks contribute the most to overall cost uncertainty by examining the tornado diagram (Figure 5).

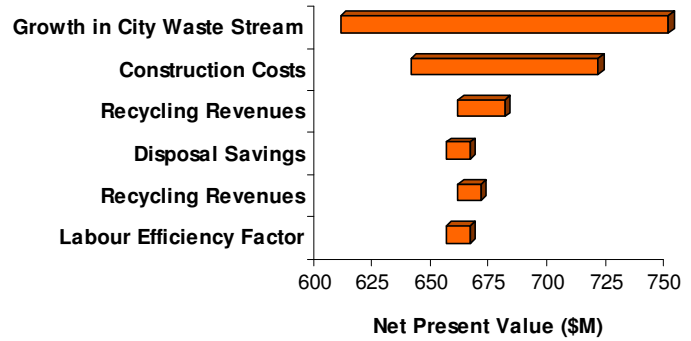


Figure 5  
Example Tornado Diagram

### 3.4 Decision Process

The decision process is the sequence of events that frames the problem and eventually leads to the decisions required to move forward and develop the implementation plan (Figure 6). This process involves development of alternatives and subjecting them to the MOAA and RIA, and identifying a communication plan to ensure that check-in points with decision makers are thought through in advance and communication with stakeholders is done at appropriate times with appropriate media.

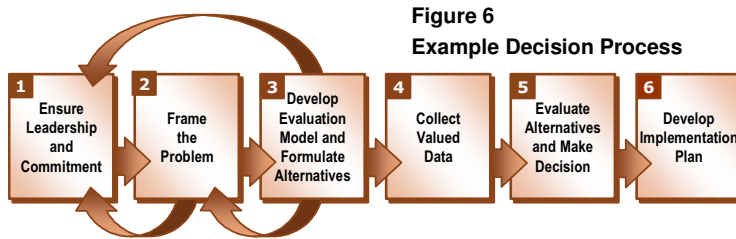


Figure 6  
Example Decision Process

The decision process is also iterative in nature, where the CRD has an active role in establishing criteria, performance measures, criteria weightings, and risk attributes.

## 4 Framework Implementation

Table 1 illustrates the proposed SAF activities, the timeline and the levels of participation of CRD wastewater and solid waste staff through the decision-making process. The target will be to determine the overall wastewater solids/biosolids management strategy, which may include some level of integration with the solid waste program, by late spring. More detailed work on the overall wastewater solids/biosolids management strategy will continue through the summer and fall.

The two key timeline dates are June 30 and December 31. The CRD will update the Minister of Environment in June, with a more definitive response on Program elements by December 31.

**Table 1**  
Sustainability Assessment Framework Activities

Sustainability Assessment Framework Activities	Timeline	AE/CH/KWL	CRD Wastewater	CRD Solid Waste
<b>Workshop 1</b> - identify key liquid waste and solid waste issues, opportunities and constraints - develop thematic approach to identify alternatives - discuss proposed evaluation/decision-making methodology	March 4/08	W	W	W
		W	W	W
		W	W	W
<b>Analysis Block 1</b> - prepare discussion paper on decision-making framework - create objective hierarchy - develop screening performance measures and scales - develop alternative long-list - prepare discussion paper on alternative long-list and decision-making elements	Available for review April 14/08	CTA	DP	DP
		CTA		
	Available for review May 8/08	CTA		
		CTA	DP	DP
<b>Workshop 2</b> - confirm objective hierarchy and establish weights - refine performance measures/scales, as required - develop short-list from the long-list of alternatives	Week of May 12/08	W	W	W
		W	W	W
		W	W	W
<b>Analysis Block 2</b> - analyze alternative short-list - develop recommended alternative/strategy - prepare discussion paper on short-list analysis and decision-making elements	Available for review June 20/08	CTA		
		CTA		
		CTA	DP	DP*
<b>Workshop 3</b> - review alternative short-list evaluation - confirm final strategy	Week of June 30/08	W	W	W*
		W	W	W*

**Legend**

CTA	consultant team activity
W	partipate by workshop
DP	review and comment on discussion paper
*	only if liquid waste/solid waste integration