Clackamas County Service District #1 Wastewater Plan Discovery Survey Final Report

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CC Service District #1 Wastewater Discovery Survey Background

Since February 2006, the Citizen Advisory Council [1](CAC) has been developing a decision framework to aid them in making a recommendation on a strategic wastewater plan that they feel best suites the treatment needs of Clackamas County Service District #1. In August 2006, the Water Environmental Services[2] (WES) division of Clackamas County contracted InfoHarvest to communicate the decision framework being developed by the Citizen's Advisory Council to the general public and gather the public's feedback on the decision framework. The online Discovery Survey that InfoHarvest designed in conjunction with the Citizens Advisory Council and WES staff went live to the public on August 31st, 2006 and closed on September 10th, 2006. Paper submissions were also accepted. Given the urgency of the CAC's schedule, InfoHarvest presented a preliminary report to the CAC's Communications sub-committee on September 12th, 2006. This document provides a fuller account of what was learnt from this public outreach.

The Discovery Survey

CAC's Strategic Wastewater Plan Decision Framework

When InfoHarvest was engaged, the CAC and WES had narrowed the number of strategic wastewater plans down to the following five (5)[3].

- **A1 Maintain Kellogg, Send Excess flow to Tri-City**
- **A2 Maintain Kellogg, Send Excess flow to New Plant**
- **B1 Expand Kellogg, Send Excess flow to Tri-City**
- **D1 Send All Flows to Tri-City, Close Kellogg**
- **D2 Build New Plant, Close Kellogg**

The CAC had identified a number of principles and associated criteria[4] they intended to use to help discriminate between these five alternatives. For each principle they identified a number of criteria that would help estimate how well each alternative wastewater plan met those principles.

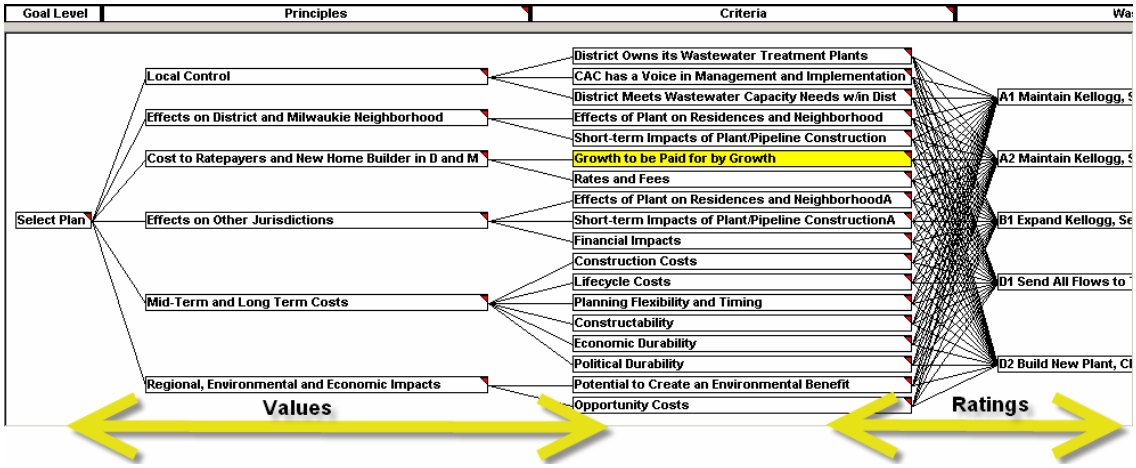


Figure 1: Decision Framework of Principles, Criteria and Alternative Wastewater Plans

The combination of principles, associated criteria, scales for measuring how well alternatives do with respect to those criteria, scales for measuring the importance of principles and criteria, and the text that describes all the above together comprise the CAC's Decision Framework.

[1] http://www.co.clackamas.or.us/wes/contact/citizenmin.htm
[2] http://www.co.clackamas.or.us/wes/
[3] http://www.co.clackamas.or.us/wes/meetings/A4FStudy_3.pdf
[4] http://www.co.clackamas.or.us/wes/meetings/FinalTechMemo22.pdf

The CAC rated each alternative wastewater plan against each criterion. While initially these ratings were estimated qualitatively, an engineering firm was contracted by WES to develop quantitative estimates for criteria such as Construction and Lifecycle costs. The concept was then to treat either all criteria or all principles as equal, and use the ratings as a guide to determine which plan to recommend.

Online Discovery Survey Concept

Obtaining the public's feedback on complex community decisions involving a choice between defined alternatives poses two major problems. The first is that such decisions are by their nature complex, and citizens lead busy lives, with many competing demands on their time. The second is that while most citizens have strongly held general values when it comes to decisions affecting their community, they will often modify those values when faced with actual, predefined alternatives. This happens because values that appear clear in the abstract often end up being traded off in real world solutions. Since the CAC was looking for feedback that might help them decide on which of the five strategic plans to recommend, these modified values might provide more insight to the CAC when making that recommendation.

Accordingly InfoHarvest formalized the decision framework described above as a classical multi-criteria decision analysis model. To obtain a measure of the public's values when looking at the wastewater challenges facing the service district, InfoHarvest proposed an online discovery survey. This survey would provide a description of the decision framework and ask the public to directly weigh the relative importance of the principles and criteria based on their own values. At all stages open comment fields would give survey takers the opportunity to share additional thoughts, such as principles and criteria that seemed missing from the decision structure. Once the survey takers had provided their initial values, they would then be shown a table indicating how well each alternative would meet their values,. Additionally, they would be invited to investigate why they received the results they did, and potentially modify their values in the face of the actual alternative plans available.

> In that sense, this discovery survey is *not* a traditional opinion survey, nor a voting tool. Survey takers are encouraged to go back and modify their values as they consider the tradeoffs inherent in the predefined alternatives.

Discovery Survey Description

The discovery survey that InfoHarvest developed in conjunction with the CAC and WES comprised of the following components (see Appendix C below for screenshots of the online survey):

- Welcome – a page with background information about the wastewater planning challenge on hand, the CAC and how to use the survey itself
- Your Neighborhood – a page asking the survey taker where they reside and work
- Your Values – a page that asks the survey taker to indicate the relative importance, to them selves, of Principles and associated Criteria. The five point qualitative scale used to capture importance was [Most Important, Very Important, Important, Less Important, Not Important].
- Your Results – a page that shows how well each of the alternatives fit their values?
- (Optional) See Why – a page that shows a breakdown of the best fit results in terms of individual principles
- Finish/Comments – a page thanking the survey taker, providing them with a user ID to return to the survey, and another opportunity to share overall thoughts before leaving the survey

In addition, two other windows were also included for optional viewing.

- CAC Preliminary Ratings screen - shows the CAC's ratings of alternatives at the time of the survey
- The Document Map screen – an overview of the decision framework with hyperlinks to source documents

The contents of these last two windows is described in the following two sections.

CAC Preliminary Ratings

At the time the survey was launched, the CAC had identified eighteen (18) criteria with respect to which they would measure each of the alternatives.

How were the Ratings Measured?

As a preliminary ratings exercise, the CAC evaluated all five alternatives against the eighteen criteria using a qualitative five point ordered scale [--,-,0,+,++] where ++ indicates that an alternative would have the highest possible rating for a given criterion, while -- means that the alternative had the lowest possible rating for a given criterion. The sense of the scale was always such that a ++ or + score against a criterion meant that, on that criterion, the alternative would be a positive choice for the District. For example on Construction Costs, the more expensive Alternatives would be given – or - - ratings, while the less expensive ones would be given + or ++ ratings.

Wastewater Plans	A1 Maintain Kellogg, Send Excess flow to Tri-City	A2 Maintain Kellogg, Send Excess flow to New Plant	B1 Expand Kellogg, Send Excess flow to Tri-City	D1 Send All Flows to Tri-City, Close Kellogg	D2 Build New Plant, Close Kellogg
District Owns its Wastewater Treatment Plants	-	++	+	--	++
CAC has a Voice in Management and Implementation	-	++	+	--	++
District Meets Wastewater Capacity Needs w/in Dist	-	+	0	--	++
Effects of Plant on Residences and Neighborhood (District & Milwaukie)	0	0	-	++	+
Short-term Impacts of Plant/Pipeline Construction (District & Milwaukie)	0	-	-	++	-
Growth to be Paid for by Growth	0	0	0	0	-
Rates and Fees	+	-	+	-	--
Effects of Plant on Residences and Neighborhood (A=Other Jurisdictions)	-	++	-	--	0
Short-term Impacts of Plant/Pipeline Construction (A=Other Jurisdictions)	-	++	-	--	++
Financial Impacts	+	-	+	++	-
Construction Costs	+	+	--	++	0
Lifecycle Costs	+	-	0	+	-
Planning Flexibility and Timing	+	++	++	-	-
Constructability	++	+	+	--	-
Economic Durability	+	+	+	-	+
Political Durability	--	-	--	-	+
Potential to Create an Environmental Benefit	-	-	-	0	++
Opportunity Costs	0	-	0	+	0

Table 1: CAC Preliminary Ratings for the Five Alternative Wastewater Strategic Plans

These are the ratings shown on the CAC Preliminary Ratings screen reachable from the Results and See Why windows of the online discovery survey and used in the calculation of best fit results (see next section).

Note: For the first twenty eight hours the survey was online (Thursday August 31 2006 Noon – Friday September 1st 2006 4PM) four of the criteria had different ratings.

Wastewater Plans	*A1 Maintain Kellogg, Send Excess flow to Tri-City*	*A2 Maintain Kellogg, Send Excess flow to New Plant*	*B1 Expand Kellogg, Send Excess flow to Tri-City*	*D1 Send All Flows to Tri-City, Close Kellogg*	*D2 Build New Plant, Close Kellogg*
District Owns its Wastewater Treatment Plants	-	+	-	--	++
CAC has a Voice in Management and Implementation	-	+	0	--	++
Growth to be Paid for by Growth	-	+	-	++	++
Construction Costs	++	0	-	++	--

Table 2: Original Values of Ratings for 4 Criteria that were Updated

The peer reviewed construction data had just arrived from HDR, and they clearly invalidated the initial estimates for Construction Costs in the 4th row above. Ratings for the other three criteria had also come under review, and the CAC updated them to reflect their understanding of how they should be measured. The updated values for the four criteria were communicated to InfoHarvest and updated online. (See the section, general Approach to Updating Ratings, below.)

For the record, all of the 17 people resident in Milwaukie who took the survey in that first 28 hour period, saw, based on the original ratings, either D1 or D2 as the best fit to their values. With the updated ratings that were uploaded and used for the remaining nine days of the survey, 16 of the 17 would still have seen D1 or D2 as providing the best fit. For the one person that would have been shown A2 as the best fit, D2 would have been very close as the next best fit.

How are Ratings used to calculate Best Fit Results?

Combining a survey taker's values with a set of ratings for the alternatives, the discovery survey calculates a single number for each alternative that tells how well that alternative fits the individual's values, This number is called the best fit, and takes numeric values between 0 and 1, where 1 would be a perfect match, and 0 no match at all. In this section we provide an overview of how that calculation works.

Qualitative	Normalized
++	1
+	0.75
0	0.5
-	0.25
--	0

Table 3: Scales Conversion

1. Using a standard approach to multi-criteria decision analysis named Simple Multi-Attribute Rating Technique or SMART[5], the ratings are "normalized" to an internal scale that runs from [0,1], where the relationship of the CAC's qualitative ratings scale and this normalized scale is shown in Table 3.

2. The survey takers' values measured on the Importance Scale are also normalized but in a three step process. First, the qualitative scale is converted into a numeric scale from 0 to 100. This numeric scale is in turn normalized using the following simple relative normalization algorithm:

[5] http://www.infoharvest.com/ihroot/infoharv/infoharvestfaq.asp#What%20SMART

$$\text{Normalized Value} = \frac{\text{Numeric Value}}{\text{Sum (Numeric Values)}}$$

So for instance, if a survey taker assigns the following values to a set of criteria (See Table 5),Very Important, Less Important and Important, the corresponding normalized values are 0.5, 0.17 and 0.33 respectively.

Qualitative	Numeric	Normalized
Most Important	100	Algorithm
Very Important	75	Algorithm
Important	50	Algorithm
Less Important	25	Algorithm
Not Important	0	Algorithm

Table 4: Normalizing Values Importance Scale

Criteria for principle Effects on Other Jurisdictions	Value	Numeric	Algorithm	Normalized
Effects of Plant on Residences and Neighborhood	Very Important	75	=75/**150**	0.50
Short-term Impacts of Plant/Pipeline Construction	Less Important	25	=25/**150**	0.17
Financial Impacts	Important	50	=50/**150**	0.33
	Total	**150**		

Table 5: Normalization of Importance Values

3. The survey taker assigns relative importance to the principles, and then in turn to the criteria associated with each principle. Assigning great importance to a principle, and then to a criterion associated with that principle gives that criterion great weight in the outcome of the model. In fact the overall weight of a criterion, called its model weight, is calculated by multiplying its relative normalization as a criterion with respect to its principle, by the normalized weight of that principle with respect to the other principles.

4. The fit of an alternative to a survey taker's weights is then calculating by multiplying the normalized rating of the alternative with respect to a criterion by the model weight of that criterion, then summing the products for all the criteria. This is then repeated for each alternative in turn.

All 18 Criteria	*A1 Maintain Kellogg, Send Excess flow to Tri-City*	*Model Weights*	*product for each criterion*
District Owns its Wastewater Treatment Plants	0.25	0.045	0.01
CAC has a Voice in Management and Implementation	0.25	0.05	0.01
District Meets Wastewater Capacity Needs w/in Dist	0.25	0.057	0.01
Effects of Plant on Residences and Neighborhood	0.5	0.112	0.06
Short-term Impacts of Plant/Pipeline Construction	0.5	0.066	0.03
Growth to be Paid for by Growth	0.5	0.097	0.05
Rates and Fees	0.75	0.081	0.06
Effects of Plant on Residences and Neighborhood	0.25	0.046	0.01
Short-term Impacts of Plant/Pipeline Construction	0.25	0.029	0.01
Financial Impacts	0.75	0.045	0.03
Construction Costs	0.75	0.031	0.02
Lifecycle Costs	0.75	0.035	0.03
Planning Flexibility and Timing	0.75	0.029	0.02
Constructability	1	0.03	0.03
Economic Durability	0.75	0.033	0.02
Political Durability	0	0.023	0.00
Potential to Create an Environmental Benefit	0.25	0.101	0.03
Opportunity Costs	0.5	0.088	0.04
Best Fit result			**0.48**

Table 6: Best Fit Calculation for A1, Demonstrating that the Best Fit Result is the Sum of Products

Best Fit for Model where all Values are Equal – the "Default Survey"

An insight into the CAC's Preliminary Ratings used for none out of 10 days of the survey is given by considering a survey in which all the principles are considered to be of equal importance and the criteria associated with each principle are considered equally important in measuring the fit of an alternative to that principle. In the actual survey, this was the default set of values for each of the value screens, and we refer to this as the "Default Survey".

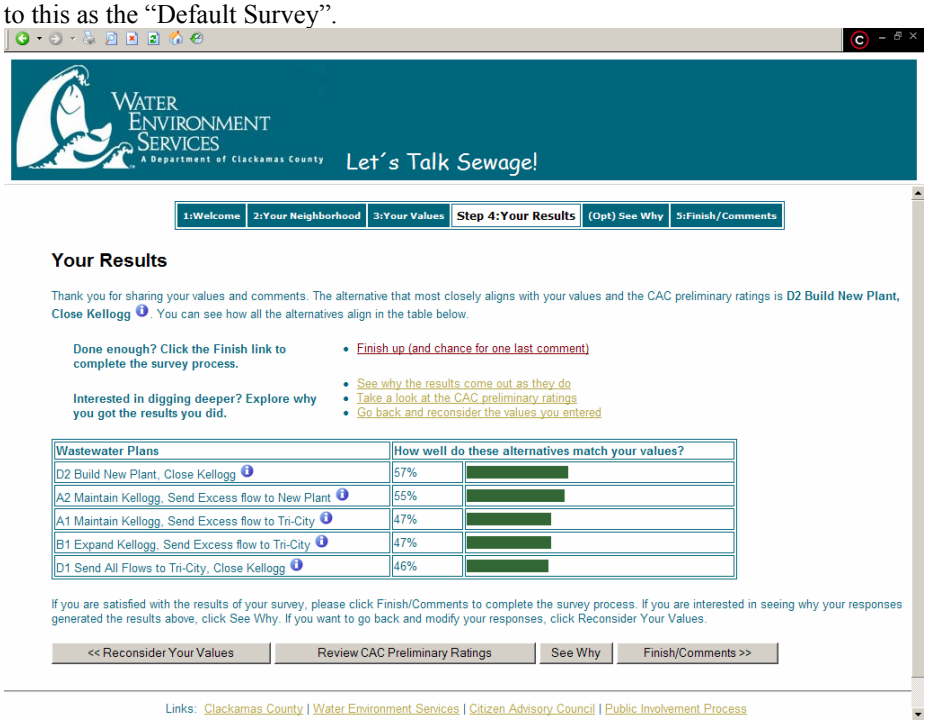


Figure 2: Best Fit for Survey where Principles and their Criterion are all <u>Important</u>

As can be seen from the Your Results screen shot, the CAC's Preliminary ratings support alternative [D2 Build New Plant, Close Kellogg] as a slightly better fit than [A2 Maintain Kellogg, Send Excess Flow to New Plant].

Though these two alternatives share the common element of building a new plant their ratings vary considerably as can be seen from this head to head comparison of the two alternatives' best fits.

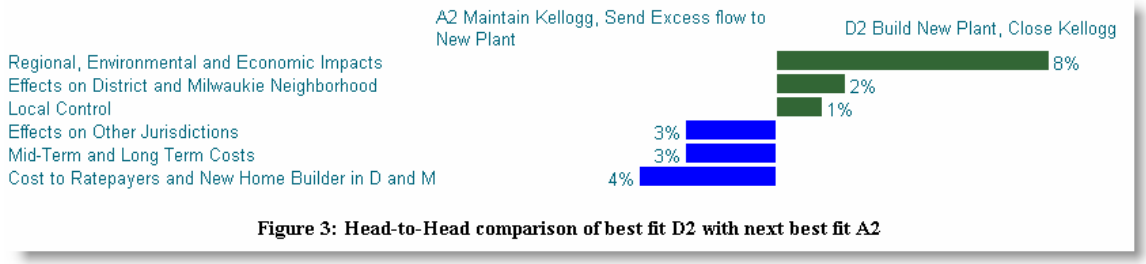


Figure 3: Head-to-Head comparison of best fit D2 with next best fit A2

Figure 3: Head-to-head Comparison of D2 and A2 at the Level of Principles

General Approach to Updating Ratings

One advantage of establishing a formal decision framework is that the validation of the decision process can begin before all expert ratings are gathered. By asking for the public's feedback in terms of both values and open-ended comments while ratings are still preliminary, the CAC can obtain early indicators as

to whether their framework is a) capable of discriminating between alternatives, b) comprehensive and c) can transmit values. As ratings that are more accurate become available, usually through the completion of expert studies, the ratings are updated to make the framework more accurate. In the best case, as more reliable estimates for ratings become available, they are immediately updated and the original survey takers invited to return and reconsider their values. Typically, as ratings become clearer, so too do the tradeoffs inherent in each alternative and the survey taker may update their values so that the tradeoffs truly reflect their values.

With the schedule under which this discovery survey was operating, there was only time to have the public provide a first appraisal of the survey. The hope was that expert estimates for life cycle costs, rates and fees and other criteria would be available before the survey was launched but this was not to be.

Document Map

The CAC and WES have posted an exhaustive set of meetings minutes, technical memos, calendars and other relevant documents on WES's Let's Talk Sewage website at (http://www.co.clackamas.or.us/wes/contact/citizenmin.htm). For members of the public who haven't attended the many public meetings and followed the CAC's process over the last eight months, the Document Map provides a quick bridge between the decision framework described and used in the discovery survey and the many related documents on the Let's Talk Sewage website.

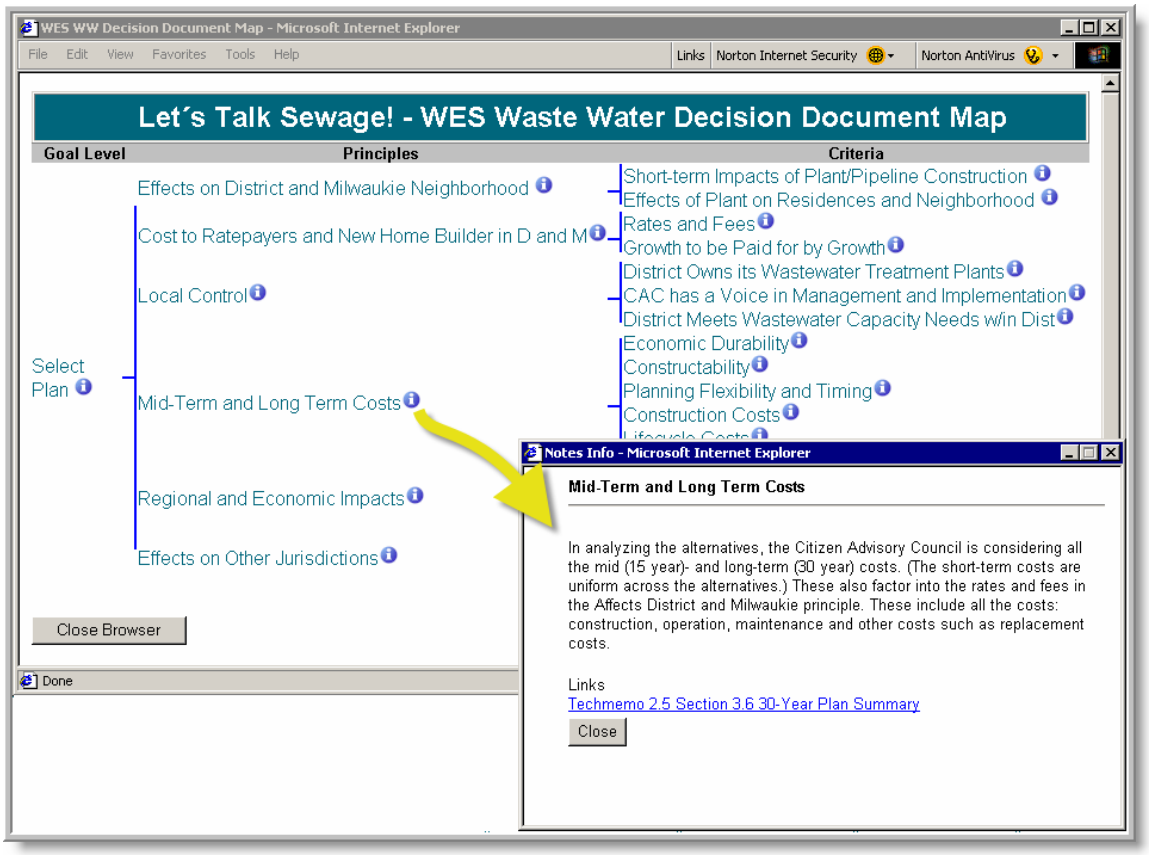


Figure 4: Document Map has I-buttons that Open Notes Info Windows

The Document Map shows the relationship between the principles and the criteria. Beside each principle and criterion this window displays an information or i-button - . Each i-button provides short notes on the principle or criterion, and in many cases links to relevant background documents. In the above screen capture of the DocumentMap, clicking the i-button for the principle [Mid term and Long term Costs] pops up the Notes Info window shown. The Notes Info window in turn contains a link to Techmemo 2.5 on

WES's Let's Talk Sewage website, and indicates that the relevant text is contained in Section 3.6 30-Year Plan Summary. Most of the linked documents are in the PDF format which can be displayed by most browsers and printed by most printers.

I-buttons Available in the Discovery Survey

I-buttons and Notes Info windows for the alternatives are accessible within the survey itself. The i-buttons for the alternatives also provide a rich set of links.

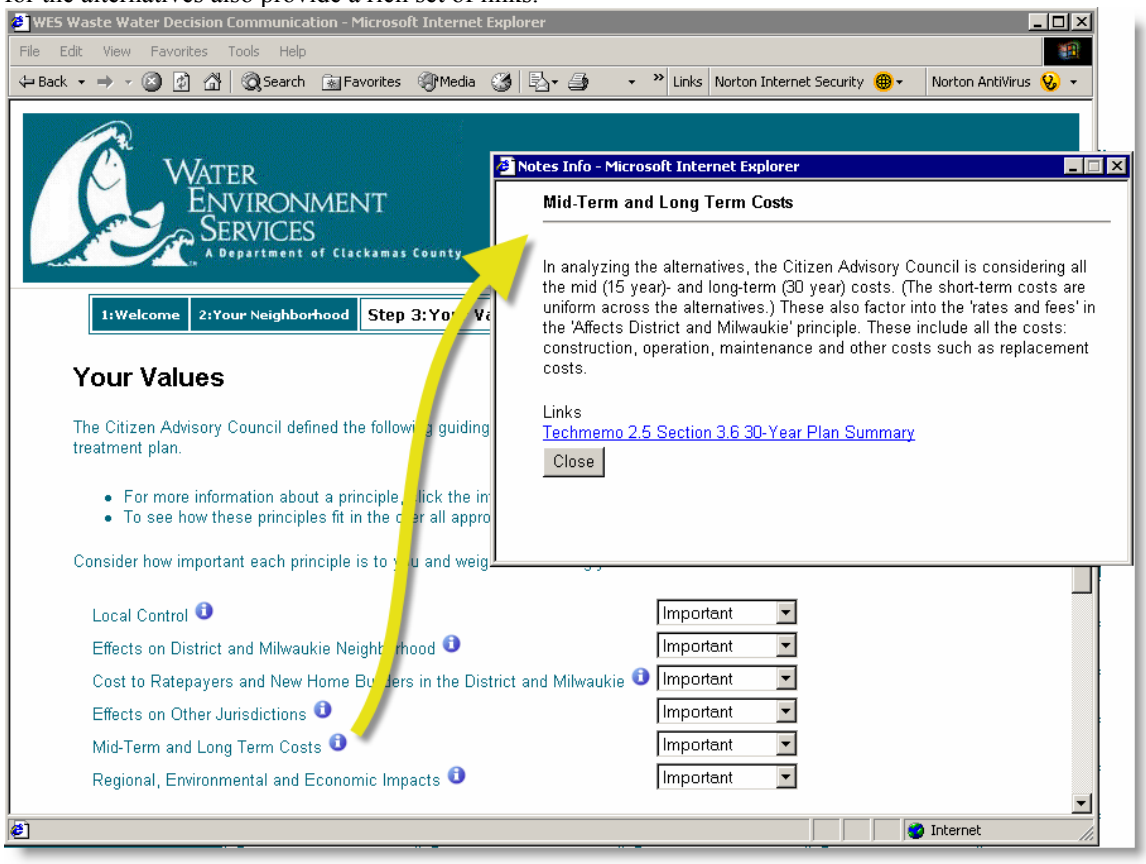


Figure 5: Access Info Notes directly from the Survey Pages by Clicking I-buttons

Survey Response

This section of the report summarizes how many people accessed the discovery survey, how much they utilized and basic statistics on who they are and what they provided for values and comments feedback.

Survey Usage

The discovery survey was open to the public from noon August 30th through midnight September 10th. Three surveys were received by regular mail and are included in all analysis, and for tabulation purposes they are treated as arriving on the last day of the survey.

Discovery Survey Scope
The discovery survey was open to all, whether or not the survey taker is a rate payer of Service District #1.

Discovery Survey Identity Management
The survey was anonymous, with a user ID being made available at the end of the survey that could be used copied and used to enter the survey again at a later time. Since the purpose of the discovery survey is to inform and get general feedback, InfoHarvest gathered no information that could identify an individual, other than encoded IP addresses associated with the machine the survey takers were using, and these are only decoded or checked upon request. No such request was received for this project.

Depth of usage	Survey takers	%
Saw Your neighborhood page	360	100%
Completed Your neighborhood page	327	91%
Edited Values	307	85%
Left any Comments	128	36%
Visited optional See Why Page	85	24%

Table 7: Survey Usage Totals

Viewed Your Neighborhood Page
Over the ten day period 360 visitors clicked from the Welcome page to the Your Neighborhood (Profile) page. Once a user clicks the Start button on the Welcome page, the Your Neighborhood page appears, and they are recorded as having seen the Your Neighborhood page.

Completed Your Neighborhood Page
The Your Neighborhood page asks the survey taker from what perspective they are taking the survey and where they are resident or own a business, and in each case to provide a zip code. Thirty three (33) people saw that page and abandoned the survey without continuing. While some may have just come to reconnoiter and may well have come back later and taken the survey, it is also likely that this page may have confused survey takers, for while map was supplied, the visual cues on the map did not directly match the answers to the questions asked.

Edited Values
Three hundred and seven (307) survey takers made a change to at least one of the default values in the survey. That leaves twenty surveys (327-307 = 20) where no change was made to any value, and only in two of these cases was any comment left. Nonetheless, it was decided in the preliminary survey report to the CAC Communications sub-committee that these 20 should be kept, as they have been happy with the default values.

Visited Optional See Why Page
The survey was designed so that those who had input their values could look at the best fit results (Your Results) move immediately to exit the survey. For those who were curious how the best fits results were

calculated, they could choose to "look under the hood" and check out the See Why page which showed how the best fit results for each alternative were broke down in terms of principles. Eighty-five (85) survey takers took this invitation.

Daily Survey Response

#	Month	Day	Saw Your Neighborhood	Completed Your Neighborhood	Edited Values	Left Any Comments	Visited See Why
1	Aug	31	19	17	15	4	7
2	Sept	1	40	39	35	20	15
3	Sept	2	35	34	33	18	9
4	Sept	3	34	27	26	11	1
5	Sept	4	41	40	37	16	7
6	Sept	5	55	49	47	11	8
7	Sept	6	47	40	36	15	15
8	Sept	7	24	22	19	7	8
9	Sept	8	25	21	21	10	6
10	Sept	9	15	15	15	8	4
11	Sept	10	25	23	23	8	5
		Tot:	360	327	307	128	85

Table 8: Daily Survey Response

On Friday Sept 1st, 2006, WES mailed out cards inviting people to take the survey to 18,000 households that were ratepayers in Service District #1. It is likely that the first few days of the survey saw members of the public familiar with the CAC process taking the survey, accounting for the initial peak on Friday, September 1st. By Tuesday September 5th, the day after Labor Day, the number of people accessing the survey started to rise again, peaking at 55, and tailing off through the next weekend.

Geographic Description of Survey Takers

I am responding to this survey primarily as:

RespondingAs - Value	Frequency
A residential rate payer of CCSD#1	259
A business rate payer of CCSD#1	13
I am not a rate payer of CCSD#1	55

Table 9: Responding to this Survey Primarily as

Given that ninety six (96) people answer the following question that they are residents of the City of Milwaukie, and as such would be wholesale customers of the Kellogg plant, it is clear this question confused many people.

My residence is located inside the city limits of the:

WhereResident - Value	Frequency
Community of Boring	7
City of Damascus	5
City of Gladstone	8
City of Happy Valley	37

City of Johnson	2
City of Milwaukie	96
City of Portland(Clackamas County)	13
City of West Linn	5
Unincorporated Area of North Clackamas County	133
Not a resident of North Clackamas County	21

Table 10: My Residence is Located Inside the City Limits of

My residential zip code is

ResidenceZip - Value	Frequency
97015	32
97027	11
97034	3
97035	1
97045	4
97068	6
97086	46
97089	5
97222	102
97236	5
97266	4
97267	77
97269	1
Other	24
Not Resident	6

Table 11: My Residential Zip Code

Note: Specific zip codes for Happy Valley (97086) and Damascus (97089) were only added at 5PM on 8/31/06. These new zips were then assigned by the DBA to any one who had selected one of those cities prior to that.

My business is located inside the city limits of the:

WhereBusiness - Value	Frequency
Community of Boring	1
City of Damascus	2
City of Happy Valley	5
City of Johnson	2
City of Milwaukie	35
City of Portland(Clackamas County)	5
City of West Linn	1
Unincorporated Area of North Clackamas County	34
Not a business owner in North Clackamas County	242

Table 12: My Business is Located Inside the City Limits of

Clearly while over eighty five (85) of the respondents are business owners, and thirty four of these have their businesses in the Unincorporated Area of North Clackamas County, only thirteen of them declared

that they were answered the survey from the perspective of a business ratepayer in Service District #1. Again, this would suggest that the perspective question, which specifies ratepayers of Service District #1, was not well designed.

My Business zip code is

BusinessZip - Value	Frequency
97015	19
97027	2
97068	2
97086	5
97089	1
97222	39
97266	1
97267	18
Other	15
No Business Zip	225

Table 13: My Business Zip Code is

From here on, this report will use the geographic breakdown provided by the residence question (Table 10 above) to provide a geographic segmentation of the data..

Values Responses

In this part of the report, only those surveys where the Your Neighborhood section was completed (327) were included.

Values: Relative Importance of Principles

Principles/Importance Scale	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Local Control	40	97	104	52	34	28.8	**327**
Effects on District and Milwaukie Neighborhood	78	85	116	34	14	27.3	**327**
Cost to Ratepayers and New Home Builder in the District and Milwaukie	69	98	113	39	8	25.7	**327**
Effects on Other Jurisdictions	3	40	158	93	33	21.3	**327**
Mid-Term and Long Term Costs	56	110	140	16	5	22.0	**327**
Regional, Environmental and Economic Impacts	93	98	98	26	12	26.8	**327**

Table 14: Frequencies of Values - Relative Importance of Principles

The table headings along the top are the value items from the Importance Scale used in the Your Values pages of the survey, ranging from Not Important to Most Important. The rows in the table correspond to the principles in the model. The cells on the tables show how many of the 327 respondents selected the particular importance scale value for each Principle. For example, forty (40) survey takers declared that the principle of [Local Control] was Most Important to them when looking at this decision. On the other hand thirty-four (34) said [Local Control] was Not Important to them. It should be noted that the numbers in Table 14 reflect only the values placed on the principles by survey takers, and are not combined with the CAC Preliminary ratings in any way.

The next to last column "SDev" gives the standard deviation for the distribution when the Importance Scale is transformed to the quantitative scale [0, 25, 50, 75, 100] – see the section above "How are ratings used to calculate best fit results?" The SDev, or standard deviation, is an indication of how widely the survey takers views differed on the importance of each principle. For instance, there was a much wider range of opinion on the importance of the principle [Local Control] than there was on the importance of the principle [Effects on Other Jurisdictions].

To calculate any meaningful statistical measures for these frequencies of values tables, one needs to take into account the fact that from a decision perspective, declaring that all principles are Important, or that all principles are Most Important is to the say the same thing – that all principles are equally important. This is taken care of by the normalization of values that was discussed in the section "How are ratings used to calculate best fit results?"

If we first normalize all the values, then take the average of the normalized values, we can calculate more meaningful averages and variances for these tables.

Normalized Average Values >>	Numeric	Verbal	SDev
Local Control	54	Important	27.9
Effects on the District and Milwaukie Neighborhoods	63.64	Very Important	26.0
Cost to Ratepayers and New Home Builder in the District and Milwaukie	63.76	Very Important	24.1
Effects on Other Jurisdictions	41.21	Important	20.7
Mid-Term and Long Term Costs	65.43	Very Important	20.7
Regional, Environmental and Economic Impacts	68.08	Very Important	26.6

Table 15: Average Normalized Values - Principles

On average, the survey takers considered all the principles to be Very Important, except for [Local Control] and [Effects on Other Jurisdictions] which values as Important only. Whereas the variance for [Local Control] is the largest, there is much more agreement on the value for the importance of the principle [Effects on Other Jurisdictions].

Values – Relative Importance of the Criteria for [Local Control]

Importance Scale >>	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
District Owns its Wastewater Treatment Plants	44	64	112	64	43	30.16	**327**
CAC has a Voice in Management and Implementation	40	77	143	33	34	27.53	**327**
District Meets Wastewater Capacity Needs w/in District	85	82	104	25	31	30.53	**327**

Table 16: Frequencies of Values – Relative Importance of the Criteria for [Local Control]

Normalized Average Values >>	Numeric	Verbal	SDev
District Owns its Wastewater Treatment Plants	**48.71**	**Important**	**22.34**
CAC has a Voice in Management and Implementation	**54.88**	**Important**	**24.48**
District Meets Wastewater Capacity Needs w/in District	**63.46**	**Very Important**	**27.03**

Table 17: Average Normalized values - [Local Control]

Values – Relative Importance of the Criteria for [Effects on District and Milwaukie Neighborhood]

Importance Scale >>	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Effects of Plant on Residences and Neighborhood	112	77	104	26	8	26.87	327
Short-term Impacts of Plant/Pipeline Construction	11	46	124	104	42	24.65	327

Table 18: Frequency of Values for [Effects on District and Milwaukie Neighborhood]

Normalized Average Values >>	Numeric	Verbal	SDev
Effects of Plant on Residences and Neighborhood	71.15	Very Important	20.19
Short-term Impacts of Plant/Pipeline Construction	39.48	Important	20.19

Table 19: Average Normalized Values - [Effects on District and Milwaukie Neighborhood]

This is a very strong statement that the public is willing to put up with short-term disruption and are more concerned about long-term impacts.

Values - Relative Importance of the Criteria for [Cost to Ratepayers and New Home Builder in District and Milwaukie]

Importance Scale >>	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Growth to be Paid for by Growth	109	104	96	14	4	23.74	327
Rates and Fees	60	74	149	37	7	24.59	327

Table 20: Frequency of Values for [Cost to Ratepayers and New Home Builder in District and Milwaukie]

Normalized Average Values >>	Numeric	Verbal	SDev
Growth to be Paid for by Growth	73.61	Very Important	15.42
Rates and Fees	60.26	Important	15.42

Table 21: Average Normalized Values for [Cost to Ratepayers and New Home Builder in District and Milwaukie]

Values – Relative Importance of Criteria of [Effects on Other Jurisdictions]

Importance Scale >>	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Effects of Plant on Residences and Neighborhood	60	102	123	29	13	25.41	327
Short-term Impacts of Plant/Pipeline Construction	6	30	143	108	40	22.16	327
Financial Impacts	52	85	147	36	7	23.86	327

Table 22: Frequency of Values for [Effects on Other Jurisdictions]

Normalized Average Values >>	Numeric	Verbal	SDev
Effects of Plant on Residences and Neighborhood	62.88	Very Important	22.21
Short-term Impacts of Plant/Pipeline Construction	37.41	Less Important	17.59
Financial Impacts	61.94	Important	22.43

Table 23: Average of Normalized Values for [Effects on Other Jurisdictions]

Once more, short-term disruptions are discounted.

Values – Relative Importance of [Mid-Term and Long-Term Costs]

Importance Scale >>	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Construction Costs	38	85	173	26	5	21.2	327
Lifecycle Costs	61	114	139	11	2	20.86	327
Planning Flexibility and Timing	18	82	183	40	4	19.31	327
Constructability	31	84	180	26	6	20.61	327
Economic Durability	53	117	133	19	5	21.99	327
Political Durability	18	38	148	79	44	25.44	327

Table 24: Frequency of Values - [Mid-Term and Long-Term Costs]

Normalized Average Values >>	Numeric	Verbal	SDev
Construction Costs	60.28	Important	19.32
Lifecycle Costs	67.33	Very Important	17.97
Planning Flexibility and Timing	55.14	Important	14.81
Constructability	58.11	Important	16.04
Economic Durability	64.53	Very Important	16.74
Political Durability	42.39	Important	23.43

Table 25: Average of Normalized Values for [Mid-Term and Long Term Costs]

Once more the public is focusing on the long-term – [Life Cycle Costs] and [Economic Durability]. The relatively high variance for [Political Durability] may indicate some confusion as to what it means and how it would be measured.

Values – Relative Importance of [Regional, Environmental and Economic Impacts]

Importance Scale >>	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Potential to Create an Environmental Benefit	88	92	121	22	4	24.3	327
Opportunity Costs	33	77	180	31	6	21.1	327

Table 26: Frequency of Values for Criteria of [Regional, Environmental and Economic Impacts]

Normalized Average Values >>	Numeric	Verbal	SDev
Potential to Create an Environmental Benefit	67.79	Very Important	15.01
Opportunity Costs	58.05	Important	15.01

Table 27: Average of Normalized Values of [Regional, Environmental and Economic Impacts]

What do these Value Frequency Tables Tell Us?

A) All the principles introduced by the CAC were, on average, considered important by the survey takers, though 10% considered [Local Control] and [Effects on other Jurisdictions] to be Not Important. This is an important affirmative result in validating the overall decision framework, which is discussed in detail later.

B) The only criteria to receive an average normalized value of less than 40% were [Short-term Impacts of Plant/Pipeline Construction], with respect to both the principles of [Effects on Other Jurisdictions] and [Effects on District and Milwaukie Neighborhood]. Throughout the survey, most survey takers felt that long-term issues outweighed immediate issues.

C) The criteria that received the widest range of values were the three under [Local Control] as well as the criterion [Political Durability]. The formers' variance is likely due to very different opinions on the criteria, the latter is, based on some of the comments, a problem of understanding what is meant by political durability.

The Aggregate Values Survey

A useful way to summarize the values of the 327 surveys is to form an Aggregate Values survey, which is the survey whose values are the average normalized values recorded in Tables 15, 17, 19, 21, 23 and 27.

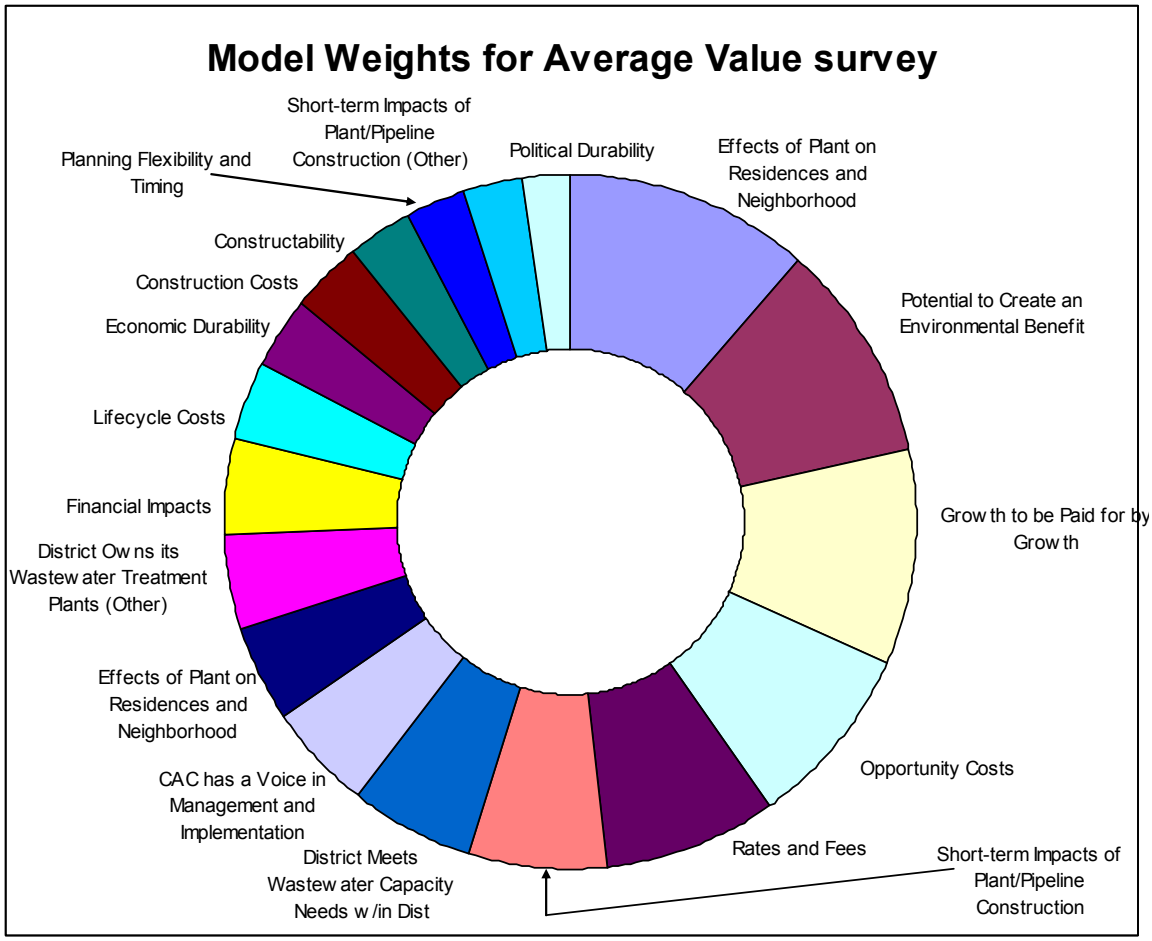


Figure 2: Model Weights for Aggregate Values Survey

These model weights are calculated directly from the public's value frequency tables, and are independent of any ratings. They can be combined with the CAC Preliminary ratings in order to obtain the best fit based on those ratings, and the results of the calculation are shown in the figure below.

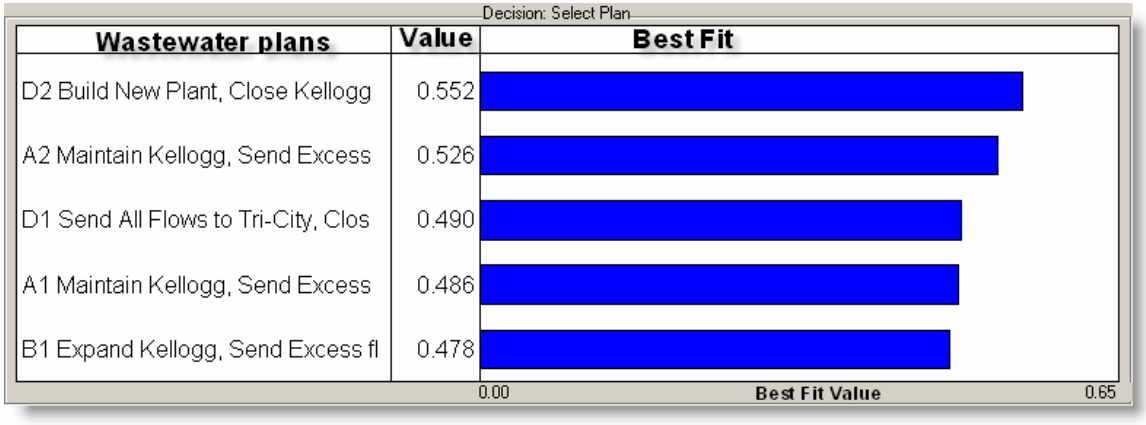


Figure 3: Best Fit for Aggregate Values Survey and CAC Preliminary Ratings

The Aggregate Values survey will be used frequently in the analysis sections to come.

Comments Statistics

Of the 327 survey takers that went beyond the Your Neighborhood page, 128 of them left on average 3.0 comments in their wake. There were open comment boxes the Principle Values page, on all six (6) Criteria Values pages, and one more opportunity on the Exit page.

Note: These numbers (387 comments from 128 survey takers) differ from those in the preliminary presentation because these final counts include three mailed-in survey responses and excluded empty responses.

Some survey takers took full advantage of all eight comment opportunities.

Number of Comments	Survey Takers
8	10
7	9
6	6
5	10
4	7
3	13
2	18
1	55
0	199

Table 28: Number of Comments per Survey

Comments Area	#Comments
Comments on Principles	78
Comments on Local Control	42
Comments on Effects on District and Milwaukie Neighborhood	46
Comments on Cost to Ratepayers and New Home Builder in District and Milwaukie	57
Comments on Effects on Other Jurisdictions	30
Comments on Mid-Term and Long Term Costs	30
Comments on Regional, Environmental and Economic Impacts	30
Comments from Exit page	74
Total Comments	**387**
Total Commenters	**128**
Total Respondents	**327**
Average for all Survey takers	**1.2**
Average per Commenter	**3.0**

The survey comments area had a limit of about two hundred words. Unfortunately, this limit was not communicated to survey takers and some comments were truncated on submittal. A full listing of all comments (with an index) can be found in Appendix A.

Comments on Discovery Survey Itself

The majority of comments contained opinions about aspects of the CCSD1 wastewater challenge, however some made reference to the survey itself. Survey-specific comments addressed the decision framework (i.e. principles and criteria) and related definitions (as spelled out in the survey's i-buttons), the process for making the public aware of the survey, as well as reaction to their best fit alternative. This section provides a complete listing of these comments. Survey takers' syntax remains as submitted.

Principles

cost to ratepayers and cost to home builders should be a separate question.

Don't lump new homebuilders and ratepayers into the same category. They're entirely different classes of folks. New homebuilders pay SDCs, keeping rates lower for existing ratepayers...so the cost impacts to these two groups (new homebuilders and existing ratepayers) vary depending on the treatment option that's selected.

Effects on District and Milwaukie Neighborhood

Don't lump "District" and "Milwaukie". Milwaukie is not within CCSD1; they've intentionally chosen the path of being a wholesale customer of the District's plant. They're two separate entities.

Mid-Term and Long Term Costs

Truthfully this line of questions delves deeper than most ratepayers can opine about such detail. Obviously all of these factors have to be weighed in devising a future approach to waste treatment and the appointed and elected decision

makers need to do this hard thinking on behalf of others..while also sharing their own opinions about these factors since they are more closely in tune with them

this part of the survey is ambiguous as mid term costs are one aspect and long term costs are mostly speculation.

These above criteria are among the most important of this survey!

These criteria are difficult to understand and to evaluate.

By "political durability" it's assumed that you mean perhaps the construction of a neighborhood after the site has been set up for a treatment plant? Or is this aimed at developers who decide they want a piece of property after the plant is built and want to have it moved for their own profits? This is unclear! If you are aiming for a shift in public perception, such as perhaps why the Kellogg site is "no longer acceptable", you might want to check with some of the folks who didn't want it sited where it is now, but were steam-rolled by the power structure of the day.

Regional, Environmental and Economic Impacts

Your "i" for Opportunity Costs uses the phrase to define itself...you never actually explain what the phrase means. I don't understand what your asking me to judge, so I'll leave it ranked at the middling, "important".

These issues should be secondary concerns, in my opinion. They should only be considered as "tiebreakers" if all else were equal.

This survey is stuck on this page and will not go further!!! [IH All this users values were recorded, so must have been a problem with Your Results page – unable to reproduce it]

opportunity costs is a bit confusing. If one is trying to site a new treatment plant I image the process in Oregon based on land use processes would take at least 8 to 10 years.

Most people do not know what "Opportunity costs" are. A better approach might have been to describe opportunities taken or missed, such as installing the pipeline at the same time the Trolley Trail is built. That's a huge opportunity benefit to the tune of several million dollars.

The information button isn't working, so I don't really know what Opportunity Costs are. Sorry.

Since it is very unclear what an "opportunity cost" really is it is very hard to have any opinion about it.

Exit Comments

Although the results of my survey did not indicate this, I would prefer to see them keep Kellogg Treatment plant open and have the overflow go to the Tri-City plant. I do not see a need to fix something that does not need fixing.

What I found interesting is that my values supported the construction of a new plant (not expanding Tri-cities)which is what I generally support. I would rather see a truly regional solution where everyone from Damascus to Tigard pays for on good large (highly techno)facility. But that means that EVERYONE between D and T must also pay (along with 50% against SDCs)to remove "old" stuff--whether it be a Lake Oswego plant or Kellogg plant and redirecting flows through new lines, including force mains. We haven't heard overtures from LO because they seem to have enough money to [Truncated on Submit]

I'm pleasantly surprised that my feelings about this issue were actually reflected in my survey results. From the questions, I had no idea how my responses would relate to the actual topic of which alternative was best. Maybe that's the sign of a well designed survey... Many of the principles/criteria baffled me as far was what you were really asking. I hope that I am a lone voice of discontent with the survey itself and that you get lots of "takers". People with loads of patience and LOTS of time on their hands, no doubt. Thanks for asking!

I do NOT agree with the final evaluation. I feel if this is the conclusion of my comments, then the evaluation is in error or my understanding of the survey is flawed. I am AGAINST closing Kellogg under any condition. The replacement consideration appears to more political than rational and economic. The question is why does Milwaukie deserve property to build a hotel or convention center at our expense?

I think the scoring method is rigged. If you read all of my previous comments, you'll see that I'm very skeptical of closing Kellogg, yet it somehow ranked at the top of my list!

I don't quite understand how my survey answers said that there are 42 and 47 % scores for closing Kellogg's plant. That question was not asked. For the record, I'm totally against closing the present plant.

It's nice that my opinion is being asked, here, but I thought we came to this decision a long time ago. I can't believe we're still discussing where to send our excrement. Send it someplace we can't see it -- like to Oregon City, if they want it! Can you IMAGINE what we could accomplish with all of the time, energy, and tax dollars being spent on your survey (& etc.), here, if we focused them on something else? Talk about waste ...

The graph is correct in that I would like to close Kellogg Creek and send the outflow to Tri-cities. I am not in favor of

This survey is slanted toward getting rid of the present plant. There is no A1 choice of keeping the present plant and under local control up dating it is need is seen.

As the norm, this survey is slanted to give results that the survey developers want, not what those taking the survey are really indicating

it is complicated survey... i dont understand those fancy terms.... it should be explained clearly and easy to read...

I assume that the postcards were sent to everyone in the district at some cost to the district. Yet when I looked for this survey, it was nearly impossible to find. I don't know if I could find it again if I had to. The cost of printing and sending these postcards for something that is apparently not important enough to be on the main web page was an absolute waste of my money, and I will keep that in mind during the next election.

As a citizen of Milwaukie, I am greatly upset about the shoddy and costly handling of the original Clearwater proposal: the underhanded scuttling of the costly project study, being left out of the CAC committee and finally, being denied even a voice in the mail in version. I have just completed this on line survey. It took me almost an hour of confusion to plow through it and I'm quite sure most citizens gave up long before the end.

I am chagrined that only CCSD1 retail customers were notified about this survey. As a resident of Milwaukie, a wholesale customer of the district, I should have as much say (since I pay my sewer bills, too) as the people who live within the district. The CAC really only serves retail ratepayers, and they are only about a third of the districts total customers. This is a sham.

The only weakness of this survey is this last page -- there should be an option to e-mail yourself the user ID. Few people are going to bother copying down such a long number! (IH: In response to this suggestion, the email option was added on September 2, 2006).

This survey process is very interesting. I would like the County to consider using it for other larger issues, so that citizens can have a more active role in decision making. The Information button isn't working at the moment, for your information. Thursday, 4:40 PM.

To me this survey looks slanted. I didn’t see all the questions that in some way concluded what you say I said. When we voted on this last year or whenever, the people voted it down. We concluded that the two treatment plants had recently been brought up to speed and that they were fine and could handle our needs now and in the future. We spent a lot of money to refurbish them and that would all go to waste. We also concluded that there was about 6 mil. in reserves and that would maintain the systems for 15 to 20 years. We voted to leave things alone. Why is it that now someone wants to bring [Truncated on Submit]

What BS is this? My opinion is just the opposite. Read previous comments, Leave Kellogg open!!!

Summary of Comments Regarding the Survey Itself

Comment Type	*Number of Comments*	*InfoHarvest Response*
Survey rigged to remove Kellogg	3	CAC preliminary ratings slightly favor D2 when all values equal – hardly a direction CAC would choose
Explanations unclear/confusing	9	This was a major problem – time constraints and CAC process precluded needed clarifications
Too complicated/ too long	2	The CAC is facing a complex decision
Restricted distribution/hard to find	2	Hard for WES to mail non-direct customers. Also the mailers were sent out before WES new actual URL.
Disagree with best fit alternative	5	The decision is to choose one of the five wastewater plans, and keeping/removing Kellogg alone is not a solution. A better description of what is meant by "Best Fit" might have been helpful here.
Technical issues	3	On some browsers, some pop-up blocking programs can stop the Notes Info screens from appearing when the i-buttons are clicked.

Table 29: Comments on Survey - Breakdown by Type

Preferred Alternatives Based on Comments

Looking through all the comments (See Appendix A), we extracted the following table that looks at all comments that indicate that the commentator has a predetermined outcome in mind.

	A2- Keep Kellogg, New Plant	*B1- Expand Kellogg, excess to Tri-City*	*D1- Close Kellogg, all flows to Tri-City*	*Decommission Kellogg*	*Keep Kellogg*
City of Boring				1	
City of Damascus					
City of Gladstone					
City of Happy Valley				1	2
City of Johnson					
City of Milwaukie			8	17	5
City of Portland (Clackamas County)				2	
City of West Linn					
Unincorporated Area of North Clackamas County **	2	2	2	3	6
Not a resident of North Clackamas County				2	

***Two residents of the Unincorporated Area of North Clackamas County suggested that some other alternative should be considered.*

Table 30: Preferred Outcome broke down by Residence

There were 25 comments from the 96 survey takers resident in Milwaukie that pointed to solutions that involved removing Kellogg, with five (5) comments arguing for Kellogg to be kept. Ten (10) of those from the Unincorporated Area of North Clackamas County wanted solutions (A2, B1) that keep Kellogg, whereas five (5) expressed their feeling that Kellogg should go.

Geographic Segmentation

This, and conversation with the CAC and WES staff, suggest that three useful geographic groups to use for further analysis are:

North Clackamas District (179 out of 327)

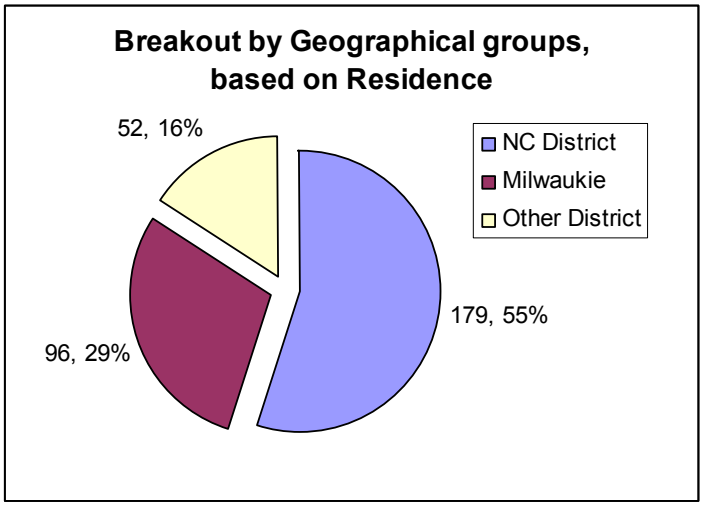
= City of Happy Valley, City of Johnson, Community of Boring, and the Unincorporated Area of North Clackamas County

City of Milwaukie (96 out of 327)

= City of Milwaukie

Other Districts (52 out of 327)

= City of Damascus, City of Gladstone, City of Portland (Clackamas County), City of West Linn and "Not a resident of North Clackamas County"



Response Analysis

In this section, we make use of the best fit calculations and the geographic breakdown from the last section to investigate the validity of the CAC decision framework.

Please note that all the data used so far (values and comments) has been that provided by the public through the discovery survey. From here on we will be combining the values data from the public with CAC's Preliminary ratings.

Validating a Decision Framework

In Multi-Criteria Decision Analysis (MCDA), there are three key properties a decision framework must have to be useful in helping in a winner-take-all decision with many stakeholders.

A) Comprehensiveness – Does the decision framework take into account all the major criteria that might help discriminate between alternatives?
B) Power of Discrimination - Can it discriminate between predefined alternatives?
C) Signal Transmission - If a sub group of survey takers can be found that have a strongly preferred outcome, and one or more alternatives is a viable alternative with the properties they want, will the decision framework recognize those alternatives as best fits?

The discovery survey and the public's responses (values and comments) allow us to investigate all three.

Comprehensiveness

The survey takers were encouraged to note anything that came to mind as they studied the list of guiding principles and their associated criteria.

In fact there was only one principle that was consistently mentioned in comments, and which we missed in the preliminary report. And that is Regionalism – giving value to solutions that work at a regional level. We missed it because we saw it as the flip side of [Local Control], but feedback from the CAC Communication meeting on Sept 12th, 2006 made us realize that there is significant interest in creating a regional solution regardless of how control is exercised. When we re-examined the comments in Appendix A, there were fifteen (15) comments that were not necessarily about disparaging the principle of [Local Control], but rather their authors wanted to see alternatives that provided for regional solutions given credit for that. This would be worth adding to the decision framework, though much thought is required to unravel the interconnections between [Local Control], [Effects on other Jurisdictions] and this new regional principle/criteria.

For a problem as complex as this wastewater challenge, to have only one principle not fully or adequately represented, is a significant accomplishment for the CAC and those working with them.

Power of Discrimination

The ability of the framework to discriminate between alternatives based on the criteria and their measures, all depends on the ratings produced. If the ratings across alternatives are so similar that all the alternatives produce similar best fits scores with similar drivers, it usually means that the criteria are so vague and the alternatives sufficiently similar that no true differences are being registered. This phenomenon is better illustrated with reference to the following figure.

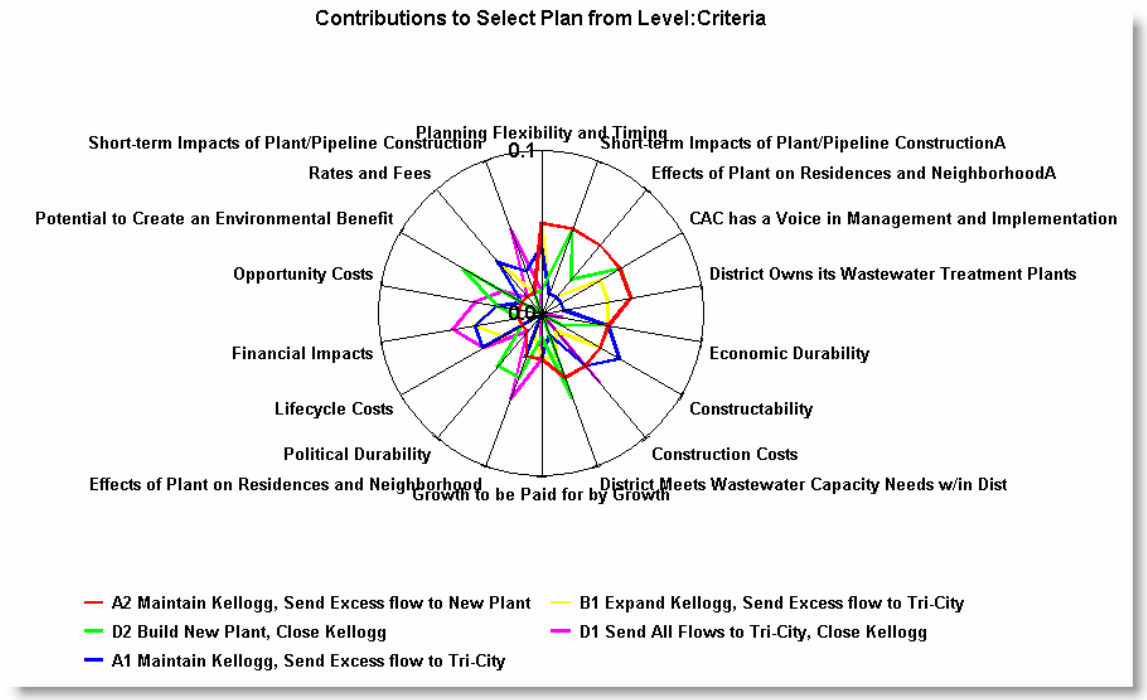


Figure 4: Radar Chart of Normalized Ratings of Criteria

The radar chart above shows the normalized ratings for all five alternatives against all criteria. The eighteen (18) criteria provide the 18 axes you see in the figure. Each alternative is a colored band, with its distance along each criteria axis indicating how well it rates against that criterion. For example, A2 (in red) has very high ratings in a host of criteria from [Planning Flexibility and Timing] clockwise around to [Construction Costs], but it rates very poorly on criteria such as [Opportunity Costs] and [Political Durability].

If the model had no power of discrimination, you would see one of two visual patterns.

a) All or some of the alternatives with a band of very similar shape around all the criteria. No matter how a stakeholder would rate the model, those alternatives with always have a similar fit to the stakeholders values.
b) That one alternative, called the dominant alternative completely encloses one or more of the others. That means that no matter how a stakeholder would value the various criteria, that dominant alternative, scoring highest on all criteria axes, would always be the best fit. If you trace any of the five bands in the figure above, you will see none dominate any of the others, let alone all of them.

In fact, as we mentioned for the Default Survey (all principles being equal, and all their associated criteria being values equally also) the best fit breakdown looks like:

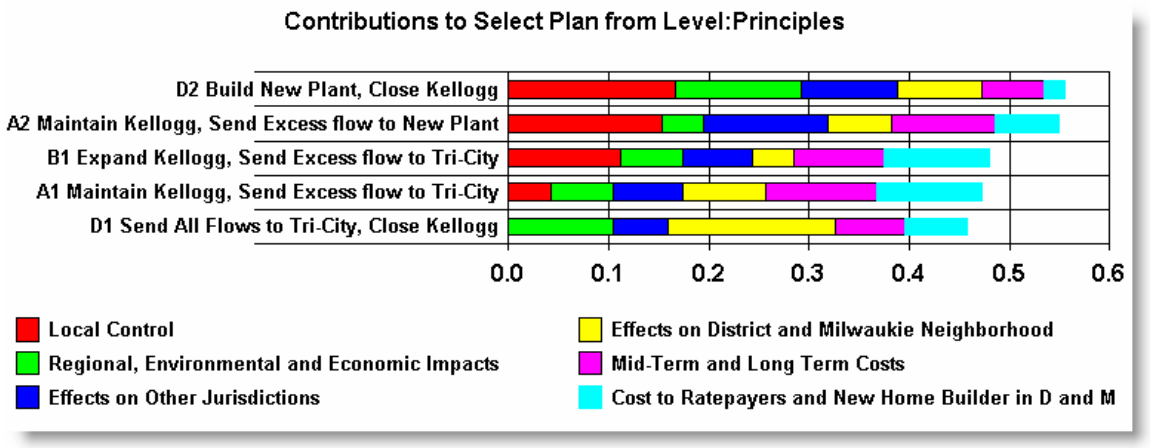


Figure 5: Breakout of Best Fit Calculation for Default Survey

As was noted in the section "How are Ratings Used to Calculate Best Fit Results" the CAC's Preliminary ratings provide D2 with a slight advantage for the Default Survey, with A2 possessing with a very similar fit score, but for very different reasons, as can be seen for the above figure.

Transmits Values

From their comments regarding preferred outcomes, and the history and location of the Kellogg plant, it is a reasonable hypothesis that many of the survey takers resident in Milwaukie would likely chose D1 or D2 as both of these plans involve the removal of the Kellogg treatment plant. Conversely, since many in the Unincorporated Area do not want to see Kellogg closed (though many from the same area do), we expect to see a weaker fit with solutions such as D1 and D2. We test this hypothesis using Best Fit matrices.

Best Fit Matrices

When a large population of stakeholders has separately input their values, one way to summarize the fit of the alternatives to each individual's values is in a Best Fit matrix. This matrix or table shows for how many survey takers each alternative was calculated to be the best fit to their values, for how many it was the 2nd best fit and so on.

Table 31 and subsequent similar tables use the A1, A2, B1, D1 and D2 designation for the alternatives.

A1 Maintain Kellogg, Send Excess flow to Tri-City
A2 Maintain Kellogg, Send Excess flow to New Plant
B1 Expand Kellogg, Send Excess flow to Tri-City
D1 Send All Flows to Tri-City, Close Kellogg
D2 Build New Plant, Close Kellogg

The Best Fit matrix for all the 327 surveys included for analysis is below.

Best Fit [327]	A1	A2	B1	D1	D2	A1 (%)	A2 (%)	B1 (%)	D1 (%)	D2 (%)
Best	19	65	6	46	191	6%	20%	2%	14%	58%
2nd Best	43	150	25	54	55	13%	46%	8%	17%	17%
3rd Best	45	61	129	58	34	14%	19%	39%	18%	10%
4th Best	184	39	48	26	30	56%	12%	15%	8%	9%
5th Best	36	12	119	143	17	11%	4%	36%	44%	5%

Table 31: Best Fit Matrix for all 327 Surveys, with %

For example, nineteen (19) survey takers would, on reaching the Your Results page, have seen that A1 was calculated to be the Best Fit to their individual values. This calculation is based on their own values that they entered in the survey, and the CAC Preliminary ratings in use.

With the CAC's Preliminary ratings and the values from the survey, all the alternatives did appear as a best fit for some one. That it was possible that each alternative might be the best fit for someone we knew from the analysis in the section "Power of Discrimination" above. What the Best Fit matrix shows is that the range of values amongst the survey takers is in fact broad so that each of these plans fits the values of at least of the survey takers.

This survey is not a voting process. The Best Fit matrix above shows how well the alternatives, using the current, preliminary ratings of the CAC, fit the values of those who took the survey.

Within that population of 327, D2 would have shown up most often as the best fit for 191 (58%) of surveys takers, A2 65 (20%), D1 46 (14%), with A1 and B1 below 10%.

With the CAC's Preliminary ratings based entirely on the qualitative scale [--, -, 0, +, ++] and with expert evaluation on a majority of the criteria unavailable at the time of the survey, these numbers can be expected to change significantly. But they are encouraging that the decision framework is sensitive to different inputs, which we will confirm in the next section.

An important datum from the Best Fit Survey is that D2 shows up as either the best or next best fit for 75% of the surveys, and A2 for 66% of the surveys. After that, D1 trails far behind with 31% of the surveys. When such an overlap of the top two best fitting alternatives occurs, it often suggests that there may be a way to generate a new alternative from the disparate pair that might fit more peoples' values than either one alone could. We'll return to this in the Ways Forward section below.

Values Broken Down by Geography

Here we use the geographic segmentation developed in the Survey Response section to show that the values of the Milwaukie group vary significantly from that of the District group, and that the decision framework does indeed transmit these difference through to the Best Fit results.

Principles/Importance Scale	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Local Control	7	20	35	22	12	27.54	**96**
Effects on District and Milwaukie Neighborhood	53	28	13	0	2	21.64	**96**
Cost to Ratepayers and New Home Builder in D and M	9	32	38	14	3	23.47	**96**
Effects on Other Jurisdictions	1	17	49	22	7	21.04	**96**
Mid-Term and Long Term Costs	12	24	53	5	2	21.22	**96**
Regional, Environmental and Economic Impacts	29	37	23	3	4	25.32	**96**

Table 32: Frequency of Values for Survey Takers Resident in Milwaukie

Principles/Importance Scale	Most Important	Very Important	Important	Less Important	Not Important	SDev	Total
Local Control	28	65	50	23	13	27.91	**179**
Effects on District and Milwaukie Neighborhood	17	44	76	31	11	25.31	**179**
Cost to Ratepayers and New Home Builder in the District and Milwaukie	57	54	44	21	3	26.68	**179**
Effects on Other Jurisdictions	2	16	83	56	22	21.49	**179**
Mid-Term and Long Term Costs	40	64	63	10	2	22.7	**179**
Regional, Environmental and Economic Impacts	49	48	54	20	8	28.24	**179**

Table 33: Frequency of Values for Survey Takers Resident in the District

Calculating the average normalized values from the above two tables, we combine them into a single table for comparison.

	Milwaukie		NC District	
Normalized Average values >>	Numeric	Verbal	Numeric	Verbal
Local Control	46.87	Important	59.52	Important
Effects on District and Milwaukie Neighborhood	84.7	Very Important	53.34	Important
Cost to Ratepayers and New Home Builder in the District and Milwaukie	57.2	Important	69.9	Very Important
Effects on Other Jurisdictions	45.98	Important	38.18	Important
Mid-Term and Long Term Costs	60.37	Important	68.62	Very Important
Regional, Environmental and Economic Impacts	71.03	Very Important	66.03	Very Important

Table 34: Average Normalized Values by Geography

Representing these graphically, it is clear to see the similarities and differences between the two groups. Both group consider the principle of to [Regional, Environmental and Economic Impacts], to be very important. Neither group emphasizes the [Effects on Other Jurisdictions].

But while those residing in Milwaukie place great importance on the [Effects on District and Milwaukie Neighborhood], those from the District emphasize the cost related principles.

While [Local Control] *is* considered somewhat more important by those in the District, the disparity here is much smaller than that for [Effects on District and Milwaukie Neighborhood].

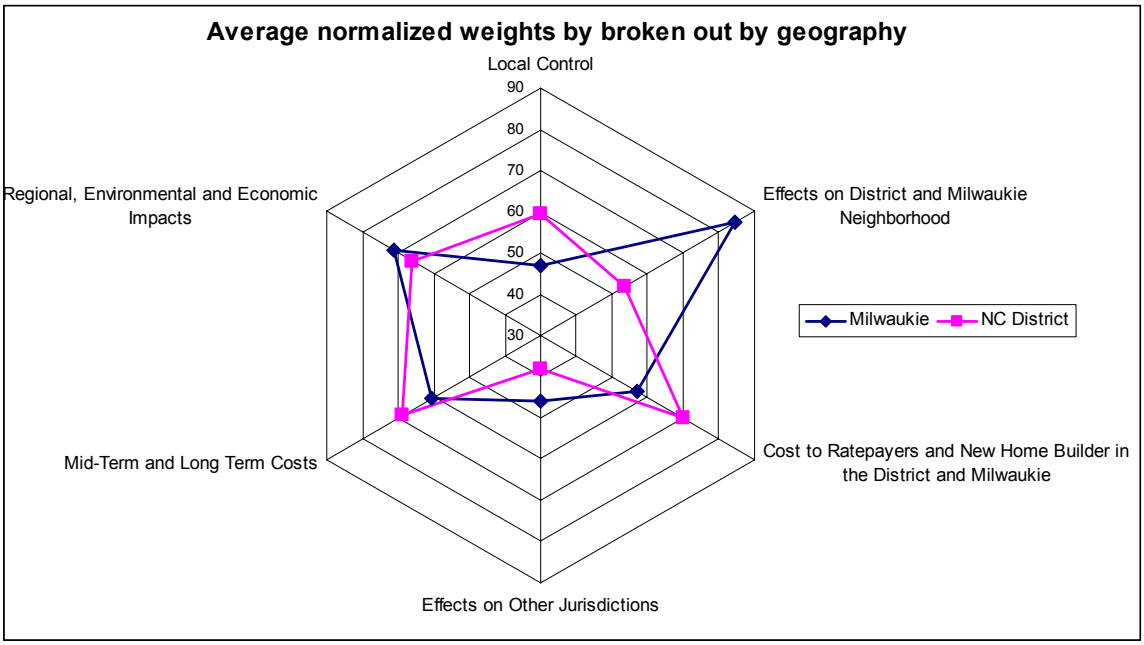


Figure 6: Average Normalized values for Milwaukie and NC District

Best Fits Broken out by Geography

Given that the values of the two groups are significantly different, does the decision framework transmit those values? Since D1 and D2 both involve removing Kellogg and freeing up Milwaukie waterfront, one would expect to see these alternatives to fit the Milwaukie's group's values more than those resident in the district.

Best Fit [96]	A1	A2	B1	D1	D2	A1 (%)	A2 (%)	B1 (%)	D1 (%)	D2 (%)
Best	1	8	0	20	67	1%	8%	0%	21%	70%
2nd Best	16	40	1	27	12	17%	42%	1%	28%	13%
3rd Best	11	34	19	25	7	11%	35%	20%	26%	7%
4th Best	57	13	12	7	7	59%	14%	13%	7%	7%
5th Best	11	1	64	17	3	11%	1%	67%	18%	3%

Table 35: Best Fit Matrix for the 96 Milwaukie Residents

Best Fit [179]	A1	A2	B1	D1	D2	A1 (%)	A2 (%)	B1 (%)	D1 (%)	D2 (%)
Best	17	50	5	14	93	9%	28%	3%	8%	52%
2nd Best	17	83	24	22	33	9%	46%	13%	12%	18%
3rd Best	28	18	88	24	21	16%	10%	49%	13%	12%
4th Best	100	19	28	13	19	56%	11%	16%	7%	11%
5th Best	17	9	34	106	13	9%	5%	19%	59%	7%

Table 36: Best Fit Matrix for the 179 NC District Residents

For easy comparison, we assemble the Best Fit results for all three geographic groups.

Geo Group	A1	A2	B1	D1	D2	A1 (%)	A2 (%)	B1 (%)	D1 (%)	D2 (%)
NC District	17	50	5	14	93	9%	28%	3%	8%	52%
Milwaukie	1	8	0	20	67	1%	8%	0%	21%	70%
Other Districts	1	7	1	12	31	2%	13%	2%	23%	60%

Table 37: Comparison of Best Fit Results for the Three Populations

Sure enough, D1 and D2 were calculated to be the best fit for 91% of the survey takers from the Milwaukie group, but they accounted for only 60% for the survey takers from the District. Conversely, while A2 was the best fit for 28% of survey takers from the District, it was calculated to be the best fit for only 8% of those from Milwaukie.

Conclusions about the Decision Framework

So while the decision framework suffers somewhat from vagueness in its wording of principles and criteria, a group with a distinct set of values that favors particular alternatives will see those values result in the outcome they would expect. While new ratings may change the outcomes significantly, and biased ratings could render the decision framework valueless, the structure of the decision framework is valid for the purpose for which it was intended.

Looking Forward

A Hybrid Alternative

As mentioned in the report, Best Fit matrices are useful in discovering different alternatives that might be a good fit to the same individual, and which alternatives if combined carefully might produce a better fit than the current alternatives.

A case in point is A2 for the 96 people who identified themselves as resident in Milwaukie. From Table 36 it appears that for half of these Milwaukie dwelling survey takers, A2 would have been the best (8) or next best (40) fit. Within the NC District group, 70% would have D2 as best or next best fit, and 74% A2. If one looks at the Contributions Analysis based on the Aggregate Values for the Milwaukie group it may be less surprising than it appears:

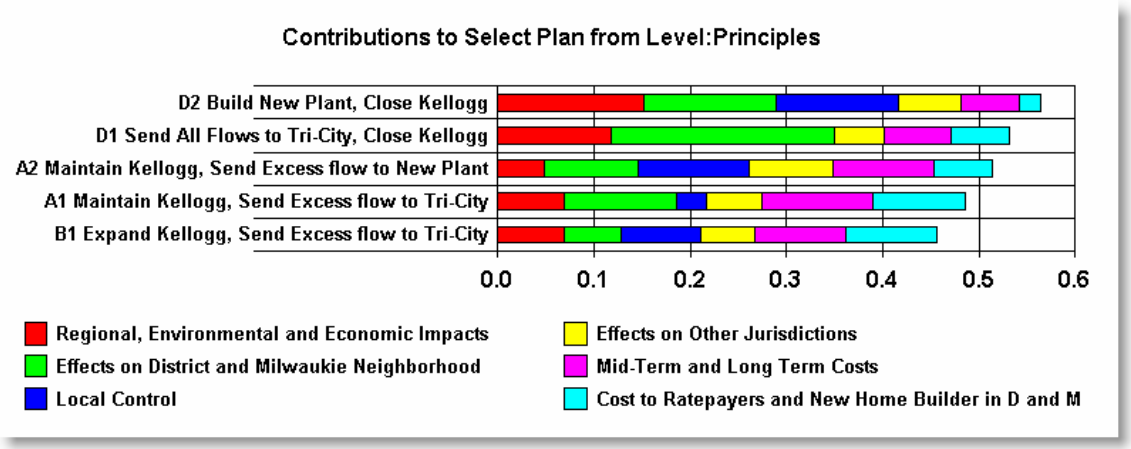


Figure 7: Contributions for Aggregate Value Survey for Milwaukie Group
Residents of Milwaukie also value [Mid-Term and Long Term Costs] and [Cost to Ratepayers and New Home Builders in the District and Milwaukie], where A2 performs better than D2.

This suggests that if a solution were developed that has the advantages of A2 combined with the advantages of D2, the resulting solution might be a better fit for the people of Milwaukie's values than either of the

current ones do. [We don't consider D1 on account of its combined best + next best % in NC District being only 20%.]

At first glance A2 and D2 may seem diametrically opposed, at least for the Milwaukie group, but time is a consideration. In neither solution does Kellogg disappear immediately, since building a brand new plant takes time. A more acceptable solution might be one in which Kellogg is kept going for some years to reduce the risk in moving all wastewater to the new plant, but once that new plant is running and tested, Kellogg would at last be phased out.

To which Values is the Best Fit Most Sensitive?

If a survey taker were to acquire more information about the wastewater planning decision, they might change some of their values. While there are 24 different values being used in the model, only a few will drive which alternative is the best fit. Knowing which values are driving a model gives insight into which of the public's values, if changed, will most likely alter the best fit. This is called Criticality.

Recall that for the Aggregate Values survey, D2 is the best fit, followed by A2. Using the average normalized weights for all 327 survey takers, we calculate a Criticality quantity for every importance value in the model.

Principle	Criticality	Current Value	Crossover Value	New Best Fit
Regional, Environmental and Economic Impacts	4%	Very Important	Important	A2
Local Control	6%	Important	Less Important	D1
Mid-Term and Long Term Costs	7%	Very Important	Most Important	A2

Table 38: Values to which Best Fit is most sensitive based on CAC Preliminary ratings and Aggregate Value survey

The smaller the size of the Criticality parameter for a criterion, the more sensitive the outcome of the model is to changes in the importance of that criterion. In the above table, a change of the current average value of the importance of the principle [Regional, Environmental and Economic Impacts] from Very Important down to Important would result in A2 becoming the best fit for *this average model*. On the other hand, a change in the average normalized importance of [Local Control] from Important to Less Important would have D1 become the best fit rather than the current best fit, D2.

To which Rating is the Best Fit Most Sensitive?

Obtaining more accurate ratings values takes time, money and expertise. When decision makers are budgeting time and resources to obtain better ratings, knowing which ratings are most likely to effect the best fit can help focus resources and people power on the most necessary research.

For a decision framework where all the criteria use the same ratings scale (--, -, 0, +, ++), the model weights (defined in the section "How are Ratings used to calculate Best Fit Results") for a survey taker directly determine the sensitivity of the best fit to the ratings. The higher the model weight of a criterion, the more sensitive the best fit will be to a change in those ratings.

Using the Aggregate Values survey once more, the average normalized model weights are give in Table 40, in decreasing size.

Criteria	Model Weights
Effects of Plant on Residences and Neighborhood	0.12
Potential to Create an Environmental Benefit	0.10
Growth to be Paid for by Growth	0.10
Opportunity Costs	0.09
Rates and Fees	0.08
Short-term Impacts of Plant/Pipeline Construction	0.06
District Meets Wastewater Capacity Needs w/in Dist	0.06
CAC has a Voice in Management and Implementation	0.05
Effects of Plant on Residences and Neighborhood	0.05
District Owns its Wastewater Treatment Plants (Other)	0.04
Financial Impacts	0.04
Lifecycle Costs	0.04
Economic Durability	0.03
Construction Costs	0.03
Constructability	0.03
Planning Flexibility and Timing	0.03
Short-term Impacts of Plant/Pipeline Construction (Other)	0.03
Political Durability	0.02
Total	**1.00**

Table 39: Model Weights of Criteria for Aggregate Values Survey

Recall that with the current CAC Preliminary ratings, the best fit for both the Default and Aggregate Value surveys is D2. The effect that unit changes of ratings for A2 for the top three criteria (from Table 40) have on the Best Fit matrices is shown in Table 41 below.

Top three Criteria with highest model weights	Model Weight	Current Rating A2	Changed Rating A2	A1	A2	B1	D1	D2
Best Fit based on Current CAC Preliminary Ratings >>>>				**19**	**65**	**6**	**46**	**191**
Effects of Plant on Residences and Neighborhood	0.12	**0**	**+**	**15**	**140**	**6**	**41**	**125**
		0	**-**	**27**	**34**	**8**	**46**	**212**
Potential to Create an Environmental Benefit	0.10	**-**	**0**	**17**	**138**	**2**	**44**	**126**
		-	**--**	**24**	**38**	**8**	**46**	**211**
Growth to be Paid for by Growth	0.10	**0**	**+**	**12**	**142**	**0**	**44**	**129**
		0	**-**	**28**	**22**	**16**	**46**	**215**

Political Durability	0.02	-	**0**	18	93	6	45	165
		-	--	21	58	7	46	195

Table 40: Effect Single Changes in Selected Ratings for A2 has on Best Fit Matrices

Numbers in red indicate a decrease compared to the best fit numbers based on the CAC Preliminary ratings (top row). Increasing the rating for A2 by one increment for any of the criteria with the three highest model weights would result in best fit matrices in which A2 would be the best fit for most surveys. In contrast, a unit change in the rating of A2 for [Political Durability] has considerably less impact on the best fit numbers. It might be best to concentrate future efforts on obtaining better ratings for those criteria with the highest model weights in the Aggregate Values survey. Note that the model weights for the Aggregate model are calculated directly from the public's values and are independent of the ratings used.

Summary

The Citizen Advisory Council has created a decision framework to help them arrive at a recommendation for one of the five wastewater treatment plans that have been developed in conjunction with the public and WES. When the decision framework was published on the web, 327 survey takers took the time to answer all the questions on values and provided many insightful comments. The values provided indicate a broad range of values amongst the public in the District, the City of Milwaukie and beyond. By providing feedback to the public in terms of which alternatives best fit their values, the discovery survey elicited strong reactions and feedback.

Based on the public's values we have analyzed the decision framework and find it to be a comprehensive, valid decision structure capable of matching any one of the alternatives to the values of the user. It was demonstrated that those survey takers resident in the District have significantly different values than those in the City of Milwaukie, and that the decision structure transmits such differences. Based on the CAC's Preliminary ratings and the public's individual values, the alternative D2 was calculated to be the best fit for most survey takers, with A2 being the next best fit. These outcomes are entirely dependent on the CAC's ratings, which at the time the survey was launched, were preliminary and based on a qualitative scale for all criteria, with expert estimates for technical criteria expected any day.

Ways Forward

If the CAC, WES or the BCC were to continue to make use of this decision framework, then the main task is to replace as many of the preliminary ratings with more accurate ratings, if and when demonstrably more accurate ratings are available. Such ratings may come from hired experts, from WES staff, or insights from the CAC members themselves. The analysis performed in this report on which ratings are most likely to effect the best fit gives some suggestion as to which criterion's ratings should be prioritized.

If the ways in which new ratings are superior to CAC's preliminary ratings is well documented, then there would be considerable value in reopening the survey and inviting those who had taken it with the preliminary ratings in place to come and review the effects of the newer ratings. Where qualitative scales are replaced by quantitative scales with recognizable units, some of the tradeoffs will become visible and may prompt some of the public to rethink their values and provide fresh feedback.

Appendices

Appendix A: Capture of Comments from the CCWES Wastewater Discovery Survey

Appendix B: Text for Principles and Criteria Used in the Discovery Survey

PRINCIPLES:

Appendix C: Screenshots of the Online Survey

These appendices are not included in this version of the report.

The appendices are available online at:

http://www.co.clackamas.or.us/wes/contact/citizenmin.htm