Draft Memorandum

To: Water Supply Advisory Committee Members

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Date: 9/19/2014

Subject: Scenarios: Developing Questions of Critical Concern, Related Criteria, Scales and Rankings

During the last several Water Supply Advisory Committee (Committee) meetings a visioning process was used to brainstorm *Scenarios* that represent what the future may turn out to look like. This was done to ensure that regardless of how the future turns out, the *Alternatives* selected by the Committee can meet the community's water supply needs. As part of the brainstorming process the Committee identified visions of the future and began to identify *Questions of Critical Concern* about each future. The Questions of Critical Concern are useful in identifying both the criteria needed to evaluate how well the Alternatives perform in each Scenario, as well as the set of research tasks needed to develop answers for the questions (i.e., develop objective scales and ratings).

As part of the last meeting in August 2014, the Committee and a working group refined the list of *Criteria* and developed definitions. Stratus Consulting provided the Committee, as a separate memorandum included in this packet, with definitions of the Criteria with comments from Rosemary and Dana as well as a next iteration (September Iteration) and an Excel file that lists this set of criteria (with small suggested changes) with examples of rating scales (scales) for each criterion, as well as examples of how the scales can be used to develop *Ratings*.

In this memorandum we make suggestions for ways to further refine the Scenarios, Questions of Critical Concern, and Criteria. The objective of this next iteration is twofold: first, to have the Committee focus on the *Problem Statements*. A Problem Statement is used in the Multi-criteria Decision Support (MCDS) process as the objective to solve for. The Committee, therefore, needs to clearly define the Problem Statements for each Scenario. For example, as part of developing the scenarios and statements, the Committee needs to address the following question: *Do we have a complete non-duplicative set of Problem Statements that represent all the future uncertainties we want to examine?* Secondly, the Committee needs to review the current set of criteria, as developed to date, with an eye on identifying the additions and modifications needed to ensure that the criteria provide the Committee with the information they need to support good decision-making.

We look forward to the Committee's feedback, both prior to the September 24, 2014 Committee meeting, in writing as well as in person during the September meeting.

Using an "If-Then" Lens

Although visioning is a great way to begin thinking about the future, a useful technique for refining the Scenarios further is to switch the lens away from visioning to an *if-then* statement. An if-then statement can also be used to establish the Problem Statements for MCDS. For example, *if* the future has changes in the hydrological cycle that affect both supply and demand, *then* we need these sets of Alternatives to meet water supply requirements (note that *sets of Alternatives* are used here to reflect the fact that the Committee is likely to compare sets of Alternatives rather than one Alternative to another Alternative; for example, each set might include additional Conservation Actions, Changes in Current Supply Management, and New Supplies).

Pull-out box: Scenario descriptions using the *if-then* statement

Traditional Scenario*: If* the future looks exactly like the past except for changes in population, *then* the anticipated level of water demand is X and we need Alternative set A to meet the city's water supply needs.

Enhanced Traditional (best case) Scenario – *If* the future looks exactly like the past except for changes in population and in-stream flow requirements for fish and the climate changes moderately (best case climate scenario), *then* the anticipated level of water demand is X and we need Alternative set B to meet the city's water supply needs.

Climate Change Scenario: *If* the future looks exactly like the past except for changes in the hydrological cycle affect water supply extraction availability and demands*, then* we need Alternative set C to meet the city's water supply needs.

Economic Change Scenario: *If* the future looks exactly like the past except for changes in the economic structure of Santa Cruz, and this changes water demand, *then* we need Alternative set C to meet the city's water supply needs.

Fish and Regulatory Scenario: *If* the future looks exactly like the past except in-stream flow requirements for fish are increased and there are other new regulatory requirements that affect supply or demand, *then* we need Alternative set D to meet the city's water supply needs.

Sustainable Santa Cruz Scenario: *If* the future looks exactly like the past except the residents of Santa Cruz have made it a primary driver to ensure that all the resources used in the city – including water - are sustainable over time, *then* we need Alternative set E to meet the city's water supply needs.

Worst Case Scenario: *If* all the above scenarios combine to make a future that looks exactly like the past except:

- Population growth changes demand, AND
- Climate change alters the hydrology and demand, AND,
- Economic changes occur that create changes in demand, AND
- Fish and other regulatory requirements occur, AND
- Sustainability is a driving force.

Then we need Alternative set E to meet the city's water supply needs.

Each Scenario provides the Committee with the opportunity to pose a unique *if-then* question – where the *if* represents a specific future and the *then* represents the set of Alternatives that provide the water supply requirements needed to meet that future. As you have heard many times, Scenario planning allows you to plan for more than one future.

Potential Scenario Problem Statements

The pull-out box below provides an outline of potential Problem Statements, using the *if-then* lens. During the September meeting we will discuss these statements with the objective of further refining the Problem Statements and ensuring we have Problem Statements (i.e., scenarios) identified for every future the Committee wants to consider, without duplication.

In the remainder of this memorandum we provide a first cut at identifying, by Scenario, the Criteria and Questions of Critical Concern that *drive* each Scenario (*light up* in Carie's speech). These represent a subset of the criteria previously developed and presented in the Excel spreadsheet – Criteria: September meeting. This criteria-sorting exercise is designed to support the Committee by identifying the specific research needs and criteria necessary and sufficient to understand and represent each plausible future.

During the September meeting, we will use the framework below as a kick-off to further refine the development of the Scenarios, Criteria, and Questions of Critical Concern. We will focus the discussion on ensuring that the information developed, and represented in each Criterion, is adequate but not redundant, and that the set of criteria supplies the Committee with the information they need to make good decisions.

Traditional Scenario

- What is the demand for this Scenario that needs to be aligned with supply?
    - Criterion: Traditional supply-demand alignment criterion (note that this criterion is unique to this Scenario – this criterion can also be considered the Problem Statement that MCDS is solving)
    - Scale example: Millions of gallons per year
    - Sub-criteria:
        - Curtailment frequency and severity
            a. Scale example: Curtailments no more than once every 10 years at Tier 2, and once in 15 years at Tier 3
        - Supply and demand by seasonality.
- What is the demand projection?
    - Information needed to develop the supply-demand alignment criterion.

- What are the changes in population, development patterns, and other assumptions used to develop demand projections?
  - Information needed to develop uncertainty scales.
- Does the most recent version of the Urban Water Management Plan(UWMP) represent what the Committee wants to consider as the Traditional Scenario?
  - Should we use this document to drive the Traditional Scenario? This would make it simple in that all assumptions are laid out and transparent.
- If so, what else is included in the most recent version of the UWMP that we need to understand to run this Scenario?
  - Information needed to build confidence in use of this source.

Climate Change Scenario

- What is the demand estimate for this Scenario that needs to be aligned with supply?
  - Criterion: Climate change supply-demand alignment criteria (the Problem Statement – unique to this Scenario)
  - Scale example: Millions of gallons per year – sub-criteria include seasonality of supply and curtailment frequency and severity.
- What is the range of plausible changes in precipitation and temperature we want to examine?
  - Information needed to identify changes in supply.
- What are the changes in the local hydrology due to projected changes?
  - Information needed to identify changes in supply.
- What are the changes in extraction (i.e., supply) availability?
  - Information needed to identify changes in supply.
- What are the changes in extreme events due to climate change we want to examine?
  - Information needed to identify changes in supply.

- What are the implications of the change in extreme events on water quantity and quality?
  - Information needed to identify changes in supply.
- Will additional treatment regimens be required?
  - Water treatment cost criteria
  - Scale example: Cost/gallon.
- How will projected changes in temperature and precipitation affect demand (include seasonality and curtailment information)
  - Information needed to develop demand estimates.

Economic Change Scenario

- What is the demand estimate for this Scenario that needs to be aligned with supply?
  - Criterion: Economic supply-demand alignment criteria (the Problem Statement – unique to this Scenario)
  - Scale example: millions of gallons per year – sub-criteria should include seasonality of supply and curtailment frequency and severity.
- What is the degree to which the availability of water supports or constrains the creation and sustainability of the local economy.
  - Criterion: Supports local economy
  - Scale example: Economy obtains needed supply with no more than 1 curtailment above 15% every 10 years.
- Availability of water supports or constraints the university's ability to create and sustain a level of positive activity that contributes to and is supportive of the desired characteristics of the larger community in Santa Cruz.
  - Criterion: UCSC
  - Scale example: we can do this in two ways – (1) qualitatively, or (2) develop real numbers of what they need.
- Availability of water supports or constrains the community's ability to grow in ways that are established by, for example, the city's General Plan,
  - Criterion: Impact of water on long-term growth
  - Scale example: The general plan calls for Z growth and needs X amount of water. A 3 meets or exceeds the target.

- Characteristic of a supply project that relates to how well the approach can be modified over time to respond to changing conditions.
    - Criterion: Adaptability
    - Sub criteria: Resilience – ability to effectively operate under a range of foreseeable and unforeseeable conditions
    - Scale example: Extremely resilient to changes
    - Sub-criteria: Scalability – flexibility to add capacity increments over time (scalability) or treat water from a variety of sources with different levels of quality would be examples of adaptability
    - Scale example: Highly scalable
    - Sub-criteria: Preserves future choices – saves options that may be needed if the future looks different that the one projected
    - Scale example: Does not create an irreversible situation, and can be implemented in the future as part of an adaptive management approach.

Fish and Regulatory Scenario

- What is the demand estimate for this Scenario that needs to be aligned with supply?
    - Criterion: Fish and regulatory supply-demand alignment criteria (the Problem Statement – unique to this Scenario)
    - Scale example: millions of gallons per year – sub-criteria include seasonality of supply and curtailment frequency and severity.
- Minimizes impacts on fishery resources and aquatic ecosystems.
    - Criterion: Fishery values
    - Scale example: Provides in-stream flows at current regulatory requirements.
- What are the changes in in-stream flow requirements for fish?
    - Information needed to identify changes in supply availability.
- What other regulatory requirements need to be considered?
    - Information needed to identify changes in supply.
- What are the changes in supply, demand, and treatment due to additional regulatory requirements (these will be split up)?

Sustainable Santa Cruz Scenario

- What is the demand estimate for this Scenario that needs to be aligned with supply?
  - Criterion: Sustainable Santa Cruz supply-demand alignment criteria (the Problem Statement – unique to this Scenario)
  - Scale example: millions of gallons per year – sub-criteria include seasonality of supply and curtailment frequency and severity.
- What are the energy consumption and carbon footprint costs?
  - Criterion: Carbon costs
  - Scale example: Carbon footprint is less than X metric tons of CO_2e per AF of water produced.
- Enhance the community's ability and capacity to plan and operate in a manner that is sustainable and protects the natural environment.
  - Criterion: Eco-system values
  - Scale example: + + + (i.e., qualitative scale – a "3" being "high."
- Designed to minimize or appropriately mitigate the impacts of water supply projects and operations on terrestrial resources and ecosystems.
  - Criterion: water resources – groundwater and surface water – values
  - Scale example: + + +.
- The degree to which water cost increases make water less available to those with lower incomes or require a disproportionate amount of a household's income to pay for water service.
  - Criterion: Affordability of water rates
  - Scale example: Household water bills will stay below 1% of median household income (note that the above is based on a U.S. Environmental Protection Agency guideline, but alternative metrics can be applied, such as households in the lowest quintile of the income distribution have water bills less than 5% of household income).

- Protection of public health – includes air quality impacts due to increases in energy air pollution.
  - Criterion: Public health – air
  - Scale example: For air quality – low additional energy contribution to public health risk issues from air quality – create ranges (i.e., based on range of estimated emissions of key air pollutants, as typically linked to levels of energy use and energy sources).
- Align with the community's desire to be a leader and to look at issues and adopt solutions in a sustainable manner
  - Criterion: Pride in the community's water strategy.
- Manages and protects natural and water resources so that they are sustainable at the current level over time
  - Criterion: Sustainability.
- Recognizes and values the contributions that biodiversity and environmental resilience play in supporting human activity and the importance of taking steps to protect and enhance the environment's ability to produce and deliver these benefits.
  - Criterion: Promote biodiversity and environmental resilience

Worst Case Scenario

- What is the demand estimate for this Scenario that needs to be aligned with supply?
  - Criterion: Worst case Santa Cruz supply-demand alignment criteria (the Problem Statement – unique to this Scenario).

    Takes the most limiting demand projections – including limits on seasonality of supply and curtailments – from each individual Scenario in order to examine if the future brings all of these things to pass.
  - Scale: Millions of gallons per year – sub-criteria include seasonality of supply and curtailment frequency and severity.

Common across All Scenarios

Except for the supply-demand alignment criterion, which establishes the Problem Statement for each Scenario, all the criteria will also be included in all the MCDS Scenario evaluation runs.

These are merely illustrated by Scenario to illustrate how some criteria drive a Scenario and to show how they relate to Questions of Critical Concern for the individual Scenarios. The objective of this sorting is to support the Committee's development of a set of criteria and research tasks. We look forward to a rich discussion and further refinements.