PURPOSE -
Prepare a recommendation and budget for the development of a Strategic Plan for the Board to consider that incorporates existing projects and plans but also examines other opportunities and determines additional projects and plans that would be beneficial to Valley District and cost effective to its ratepayers. This committee will seek input from other water agencies in California that have done this type of analysis.

Chairperson: President Longville
Committee Member: Director Bulot

CALL TO ORDER

1. INTRODUCTIONS

2. PUBLIC COMMENT - Any person may address the Board on matters within its jurisdiction.

3. SUMMARY OF PREVIOUS MEETING
   3.1. March 8, 2018, Meeting (Page 3)
       Meeting Summary Strat Plan 030818

4. DISCUSSION ITEMS
   4.1. Presentation of the Results from the RAND Demand Analysis (Page 5)
       Staff Memo Study to Estimate Demand
       RAND Proposal to Estimate Demand

5. ADJOURNMENT
PLEASE NOTE:
Materials related to an item on this Agenda submitted to the Board after distribution of the agenda packet are available for public inspection in the District’s office located at 380 E. Vanderbilt Way, San Bernardino, during normal business hours. Also, such documents are available on the District’s website at www.sbvmwd.com subject to staff’s ability to post the documents before the meeting. The District recognizes its obligation to provide equal access to those individuals with disabilities. Please contact Lillian Hernandez at (909) 387-9214 two working days prior to the meeting with any special requests for reasonable accommodation.
The Strategic Analysis/Plan Committee held a Workshop on February 8, 2018. Director Longville chaired the meeting and Directors Bulot, Copelan, Hayes and Navarro participated in the meeting. Doug Headrick, Cindy Saks and Bob Tincher, from staff, were also in attendance. The following agenda items were discussed:

A. **Summary of February 8, 2018 Meeting.** There were no changes to the meeting summary

B. **Consider Developing a Local Resources Investment Program.** Staff is recommending that the Board consider developing a Local Resources Investment Program that would offer a financial incentive to any agency in the Valley District service area that constructs a project which provides a new source of supplemental water to the Valley District service area such as recycled water and stormwater capture. This investment in our local resources would result in increased water supply reliability which is one of the goals of the *Upper Santa Ana River Integrated Regional Water Management Plan*. This item was discussed at the February 8, 2018 Strategic Analysis & Plan Committee Workshop. The Committee asked that Metropolitan Water District of Southern California (Metropolitan) be invited to make a presentation on any lessons learned when they were developing their Local Resources Program. Metropolitan was present at this workshop and explained that the way they calculate their incentive would not work for Valley District since Valley District’s rate is much lower due to receiving property tax revenue. Some of the lessons Metropolitan shared included ensuring that
supplemental water projects perform before they receive payment and also taking into consideration the amount of staff time that it takes to administer the program. Staff was directed to develop the LRIP and return to the Committee for feedback.

C. **Update on Proposed Coordinated Operating Agreement with Metropolitan Water District of Southern California.** Staff has been working with Metropolitan staff on the terms for a new Coordinated Operating Agreement (COA) to replace the previous version that expired in 2016. This proposed COA is in compliance with Valley District Ordinance 79 which describes the procedures to be followed in the declaration and sale of surplus water. At the workshop, staff reviewed the draft term sheet with the Committee. The Committee asked that Ordinance 79 be referenced in the COA. Staff was directed to work with Metropolitan to finalize the COA and return to the Committee for review.

D. **Consider Mutual Aid Agreement with Metropolitan Water District of Southern California.** Valley District is currently working on the relocation of a portion of the Foothill Pipeline around the proposed footprint of the San Manuel Casino which has been discussed at prior Board of Directors Workshops. Staff has identified a way to utilize the Metropolitan Inland Feeder Pipeline to bypass this pipeline relocation, during construction. This would enable Valley District to continue to make water deliveries to its customers while the pipeline relocation is being constructed. Metropolitan is supportive of this coordinated use of its facilities and developed draft terms for a Mutual Aid Agreement that would be used for this, and any other, coordinated uses of our collective water delivery facilities. Long-term mutual aid would be covered in the proposed COA, discussed earlier in this meeting. Staff was directed to work with Metropolitan to finalize the mutual aid agreement.

E. **Update on RAND Corporation Demand Analysis.** Staff reported that this project is on schedule. RAND is currently developing a questionnaire that will be sent to the retail water agencies within the Valley District service area. The information they receive from the questionnaires will be used in their demand analysis.

**Staff Recommendation:**
Receive and file
DATE:       June 14, 2018
TO:         Strategic Analysis & Plan Committee Workshop
FROM:       Bob Tincher, Deputy General Manager - Resources
SUBJECT:    Presentation of the Results from the RAND Demand Analysis

In November 2017, the Board authorized the RAND Corporation (RAND) to estimate the future water demand in the Valley District service area (proposal attached). At this workshop, RAND will present the results from this study.

BACKGROUND
At the October 9, 2017, Committee workshop, staff recommended a study that would evaluate the amount of investment to make in various water management strategies. The original scope of work included: (1) providing an independent analysis of water demand in the Valley District service area, (2) analyzing the cost-effectiveness of the water management strategies in the Upper Santa Ana River Watershed Integrated Regional Water Management Plan (IRWMP) against new water supply scenarios and (3) helping determine the amount of investment in water management strategies, such as recycled water. The Committee asked that the scope be reduced to providing an independent analysis of water demand in the Valley District service area and asked staff to request a single proposal from RAND.

**Fiscal Impact**
The total cost of this study is $44,142.
Staff Recommendation:
Receive and file

Attachment
RAND Proposal for “Estimating Future Water Demand for San Bernardino Valley Municipal Water District”
Estimating Future Water Demand for San Bernardino Valley Municipal Water District

David Groves, David Catt, Michelle Miro, Benjamin Miller
RAND Corporation
October 31, 2017

Introduction

Water utilities develop projections of future demand to help inform their long-term investment plans. For regions experiencing rapid growth, demands are expected to rise and uncertainty about the rate of rise affects the timing of supply needs only. In less rapidly growing regions, demand may rise slowly or even decline as water use patterns change. Under these conditions, uncertainty about a utility’s long-term demand projection can introduce significant uncertainty about how best to invest in supplies and efficiency. For example, preparing for higher than realized demand could lead to unnecessary costs and stranded investments.

The San Bernardino Valley Municipal Water Valley District (District) updated its Regional Urban Water Management Plan (RUWMP) in 2016 that describes how the region could meet water demands over the coming 25 years (through 2040) (Water Systems Consulting Inc, 2016). This long-term plan is based on estimates of retail demand (including a reliability margin) over time reflecting a single set of assumptions about local population growth, conservation uptake, and weather dependent usage. The District now recognizes that these estimates could be uncertain and need an independent evaluation. Such a review would help better characterize the range of plausible demands and help ensure that Valley District’s long-term plans achieve District needs at a reasonable cost.

Proposed Project to Evaluate and Refine San Bernardino Valley WMD’s Demand Projections

RAND proposes to assist the District in evaluating and updating its long-term demand forecasts to reflect a wide range of plausible future drivers of demand, including hydrologic conditions influenced by climate and variability (including more severe and “mega droughts”) and patterns of urban development and population growth. To increase the reliability and resiliency of regional water management in the Valley District’s service area, this project will also evaluate how the range of future demands that we develop could be incorporated into existing management plans. Finally, we will identify key management implications of the future balance between a wider range of demands and existing estimates of future supply.

In Task 1, RAND researchers will provide an independent review of the District’s existing demand forecasts. Specifically, we will assess the District’s current...
projections of future demand from the RUWMP and compare them to those based on SCAG population projections and other regional land use projections from academic literature or planning agencies. Based on available data and communication with the District and regional retail agencies, we will then identify the key regional variables that drive local demand, such as the number of and types of water users, water use rates, the adoption of improved water use efficiency building standards, and future weather patterns. This second component of Task 1 will enable a more complete understanding of the sources and ranges of variables that contribute to future District-wide demand uncertainty and allow us to more adequately quantify these values. Further, this type of quantitative insight into the principal drivers of demand will provide an additional benefit of increased demand management capacity to the District.

In Task 2, we will compile and analyze data on the key drivers of demand and quantify how they contribute to demand uncertainty. We will then modify demand projections to account for these uncertainties. The output of Task 2 will be a range of future annual demand. To do this, we will collect the following types of data. It is important to note that this list is a starting point and will be updated and refined as we determine the key drivers of demand locally in the District’s service area.

- **Climate data**: We will develop a large set of temperature and precipitation time series projections to reflect a wide-range of plausible future weather conditions and resulting water demand. These data will also take into account extreme droughts that may dramatically change both indoor and outdoor water use behaviors.

- **Urban dynamics**: We will compile data on variability and uncertainty in population growth, customer type (industrial, residential), land use changes, water efficiency measures, conservation behaviors, etc.

In Task 3, we will describe the implications of our range of projected annual demands from Task 2, the District’s existing estimates of future supply availability, and the potential for future unmet demands. This will help the District to identify key vulnerabilities in their long-term plan, that is, the key uncertain demand conditions that could lead to unacceptable outcomes. These key vulnerabilities can then be used in future work to define the system’s tipping points when supply no longer meets demand and to approach demand management in the future. The goal of Task 3 is to illustrate the principal ways in which the District could integrate the range of demand projections into their planning and management.

In Task 4, we will produce a final Project Report that describes the entire project for use by District staff and is also targeted towards the broader water management stakeholder community. The report will include a summary section designed to present the analysis in a format that is accessible to District’s board.

**Project Personnel**

This project will be co-led by Dr. David Groves and Dr. Michelle Miro, with significant participation by Dr. Benjamin Miller (Economist) and Mr. David Catt.
(Project Associate). A senior RAND researcher will provide internal RAND peer review of the project’s final report. Lastly, Brief bios of the key personnel are included at the end of this proposal.

**Level of Effort**

The following table indicates the level of effort (in days) for each task and RAND team member. The cost proposal also includes publications costs for one internally-reviewed RAND Project Report.

<table>
<thead>
<tr>
<th>Task</th>
<th>Activity Description</th>
<th>Groves</th>
<th>Miro</th>
<th>Miller</th>
<th>Catt</th>
<th>Reviewer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review existing demand forecasts</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Modify demand projections</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Discuss utility of demand projection for District</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Final Project Report</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td><strong>Project total</strong></td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Project Schedule**

The total project, except for Task 4, would take 4 months. Assuming availability of District staff, Task 1 could be completed by the second month. Tasks 2-3, would then be performed over the following two to three months. The timing of Task 4 is subject to internal RAND review, which generally takes a two to three months of review time. A review draft of the Project Report will be made available for review by District staff before it is finalized.

**Researcher Biographies**

**Dr. David Groves** is codirector of the RAND Water and Climate Resilience Center, a senior policy researcher at the RAND Corporation, and a professor at the Pardee RAND Graduate School. He is a key developer of new methods for decisionmaking under deep uncertainty, and works directly with natural resources managers worldwide to improve planning for the uncertain future. His primary practice areas include water resources management and coastal resilience planning, with an emphasis on climate adaptation and resilience. Groves has worked with major water agencies throughout the United States, including the U.S. Bureau of Reclamation, California Department of Water Resources, Metropolitan Water District of Southern California, and Denver Water, helping them to address climate variability and change in their planning. He also works internationally, most recently in China, Peru, and Mexico.

**Dr. Michelle Miro** is a hydrologist and civil engineer with expertise in water resources planning and management, groundwater and hydrologic modeling and remote sensing. She holds a PhD in Civil Engineering from UCLA where she worked with researchers at NASA’s Jet Propulsion Laboratory. Dr. Miro has carried out research projects related to quantifying sustainable yield under California’s Sustainable Groundwater Management Act, characterizing groundwater depletion...
and recovery in the San Joaquin Valley groundwater basin, optimizing conjunctive water management in Nebraska and modeling urban hydrology and stormwater in New York and Chicago.

**Dr. Benjamin Miller** joined the RAND Corporation as an Associate Economist in 2015 after completing his Ph.D. in Economics at the University of California, San Diego. One vein of Dr. Miller’s research examines interplay between weather, infrastructure, and economics. The second looks at the financial incentives created by insurance, taxation, and regulation. Examples of research currently under review include an examination of federal policies surrounding transportation and water infrastructure finance, an estimation of the causal impact of weather warning systems on fatalities and injuries from tornadoes, a forthcoming forecast of demand for satellite broadband services, and a forthcoming textbook chapter on econometric techniques for determining the value of geospatial information. Dr. Miller’s recent publications examine how changes to the National Flood Insurance Program impact housing affordability, shed light how taxpayers’ consumption decisions respond to complex tax changes in the federal tax code, and discuss the opportunities and challenges associated with the U.S.’s new regulatory budget. Prior to joining RAND, Dr. Miller worked as a Statistician supporting the U.S. Census Bureau’s Survey of Income and Program Participation.

**Mr. David Catt** is currently a doctoral fellow at the Pardee RAND Graduate School, pursuing a PhD in public policy analysis, and an assistant policy researcher with the RAND Corporation. Previously, he had two years of experience as a water resources and civil design engineer at Black & Veatch. He also has published research on federal and California water reuse policy and practices. David earned his B.S. in civil engineering from the University of Kansas.

**References**


Estimating Future Water Demand for San Bernardino Valley Municipal Water District

Michelle Miro; David Groves; Benjamin Miller; David Catt
June 14, 2018
What if we are wrong?
A History of Droughts Longer than 3 Years

San Bernardino Basin Area Three Station Precipitation Index

Average Annual Precipitation (in.)

Water Year


Cumulative Departure from Safe Yield Period Avg (in.)
WHAT IF DROUGHTS LAST LONGER?

A 200-year drought? Evidence from tree rings shows that drought was historically much more widespread in the American West than now, while the 20th century was wetter than normal. Percentage of the West affected by drought from 800 A.D. to 2000:

- Medieval megadroughts: The West experienced two abnormally dry periods lasting close to 200 years each during the Middle Ages.
- 1850: California becomes state

Source: E.R. Cook et al, Earth Science Reviews
Evaluating Uncertainty

Demand

Supplies
Western water managers work to address future challenges

- Continued growth and water needs in Valley District
- Prolonged droughts, exacerbated by rising temperature
- State water conservation and water use targets
- Land use changes and population growth
- Other institutional and legal constraints
Demand forecasts drive water supply planning

- Demand forecasts are typically based on:
  - Population growth
  - Per capita water use
  - Climate
  - Other variables

- Demand forecasts compared to supply projections ("gap analysis")

- Investments identified to fill gap at least cost and subject to other criteria
Future demand is uncertain and has implications for water management

Many sources of uncertainty about future demand:
- Growth in users
- Type of use
- Adoption of technology
- Sensitivity to droughts, policies

Projections that are too high lead to over-investments and vice versa

Source: Groves et al., 2014 Developing Key Indicators for Adaptive Water Planning
This project is evaluating demand projections and developing additional future scenarios

<table>
<thead>
<tr>
<th>Task</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Review existing demand forecasts</td>
<td>Identification of key drivers of demand</td>
</tr>
<tr>
<td>2. Develop set of demand scenarios and tool</td>
<td>Improved understanding of plausible future demand</td>
</tr>
<tr>
<td>3. Compare demand scenarios to current supply projections</td>
<td>Identify risks and opportunities to long-term Valley District management plans.</td>
</tr>
</tbody>
</table>
## Project schedule and process

<table>
<thead>
<tr>
<th>Task</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Review existing demand forecasts</td>
<td>i. Review existing forecasts, demand models and input data assumptions.</td>
</tr>
<tr>
<td></td>
<td>ii. Compare input data assumptions to values from scientific literature, other agencies.</td>
</tr>
<tr>
<td>2. Develop set of demand scenarios and tool</td>
<td>i. Literature review to compile data on and develop range of key drivers of demand (temperature, population, etc.).</td>
</tr>
<tr>
<td></td>
<td>ii. Update RUWMP model to incorporate key drivers.</td>
</tr>
<tr>
<td>3. Compare demand scenarios to current supply projections</td>
<td>i. Compare range of demand forecasts to existing District estimates of future water supply.</td>
</tr>
</tbody>
</table>

*Four check-in meetings with Valley District staff, Presentation to BTAC, Final Report (in preparation)*
Retail agencies use a modified unit water demand approach

\[
\text{Demand in 2020} = \text{Demand in 2015} \times \text{Population Growth from 2015-2020} + \text{10% Reliability Factor} + (+10\% \text{ Wet} -10\% \text{ Dry})
\]

Reliability Factor used to provide a buffer for uncertainties in supplies including any associated with climate variability.
Key assumptions include population growth, water use rates, customer types and climate

- Population growth rate estimates are accurate to 2040
- Per customer water use rates are constant (no change in technology, behavior, regulations, economics)
- The breakdown of customer types will not vary
  - No land use changes
- A 10% increase or decrease in demand captures likely changes in demand due to dry or wet periods
- Temperature and precipitation changes impact all user types equally
We modified RUWMP demand forecasts with additional factors to reflect technology, consumer behavior and temperature.

**RUWMP Approach**

\[
\text{Demand in 2020} = \text{Demand in 2015} \times \text{Population Growth from 2015-2020} + \text{10\% Reliability Factor} + \text{+10\% Wet -10\% Dry}
\]

**Updated RAND Approach**

\[
\text{Demand in 2020} = \text{Demand in 2015} \times \text{Range of Pop. Growth 2015-2020} \times \text{Range of Efficiency Factor} + \text{Range of Climate Factor}
\]

Task 2
Three additional factors are derived from local estimates, scientific studies and future temperature projections.

For a normal hydrologic year:

\[
\text{Demand in 2020} = \text{Demand in 2015} \times \text{Range of Pop. Growth from 2015-2020} \times \text{Efficiency Factor} + \text{Climate Factor}
\]

- **RUWMP**: SCAG population growth estimates
- **Range of Pop. Growth from 2015-2020**: Scientific studies on changes in per customer water demand by water use type (residential, industrial, etc)
- **Range of Climate Factor**: Studies on changes in water demand per change in temperature
- **Range of Efficiency Factor**: Downscaled estimates of future temperature
In the updated model, wet years and dry years are accounted for with a **10%** difference from normal.
We developed future scenarios to reflect plausible ranges in population, technology, consumer behavior and temperature

Scenario 1: Low population growth
Scenario 2: Higher population growth
Scenario 3: Higher population growth + lower per customer water use
Scenario 4: Higher population growth + lower per customer water use + higher temperature
Task 2

RUWMP demand estimates project 289,820 AF of demand in 2040

RUWMP Normal Year Demand Estimates

Water Demand (AF)

- Normal Year Demand
- Normal Year Demand with Reliability Factor

2020: 250,000
2025: 250,000
2030: 250,000
2035: 250,000
2040: 289,820

RUWMP 2040 Estimate
Task 2

Low plausible population growth could result in a future with a -5% difference in projected demand by 2040.
Task 2

Higher plausible population growth could result in a future with a +17% difference in projected demand by 2040.
Task 2

In futures with high population growth, technology and conservation gains result in lower projected demand.
Task 2

High population growth, lower per customer water use and higher temperatures could result in a future with +8% difference in projected demand by 2040

Scenario 4: High Population Growth + Lower Per Customer Water Use + Increased Temperature

Water Demand (AF)

2020 2025 2030 2035 2040

RUWMP 2040 Estimate
Revised demand model suggests range of future demands for the Valley District

2040 Future Demand Scenarios and RUWMP Estimates

- Scenario 1: Low Population Growth
- Scenario 2: High Population Growth
- Scenario 3: High Population Growth + Lower Per Customer Water Use
- Scenario 4: Hot, Low Efficiency, Moderate Population Growth

 RUWMP 2040 Estimate with Reliability Factor
Initial scenario analyses suggest potential updates to the reliability factor in future RUWMP releases.
We are developing more scenarios based on the full plausible range of additional demand factors

- Understand how different factors will effect future demand
- Improved understanding of plausible range of future demand

**Next step:** Compare demand scenarios to current supply projection
Project timeline and next steps

Kick-off meeting

Task 1) Review existing methodology (complete)

Task 2) Develop Revised Demand Model and Scenarios (complete)

Task 3) Finalize scenario output and compare to RUWMP Supply projections (finalizing)

Task 4) Reporting (in process)

January February March April May June July

Submit final project report

2018
Next Steps

- Valley District can integrate suggested updates to the reliability factor into future RUWMP releases

- Possible research path for Valley District:
  
  - Apply scenarios and demand analysis to full range of future supply estimates
Questions?

Thank You