GROUNDWATER WORK GROUP MEETING

(SUBGROUP OF THE OWENS LAKE MASTER PROJECT ADVISORY COMMITTEE)

Summary of Core Discussions | October 24, 2019

Prepared by the CSUS Consensus and Collaboration Program

Table of Contents

INTRODUCTION

On Thursday, October 24, 2019, the Groundwater Work Group—subgroup of the Advisory Committee related to the proposed Owens Lake Master Project—met in Keeler, CA, for four hours to undertake the following objectives:

1. Hear about results from Los Angeles Department of Water and Power (LADWP) pumping tests and discuss potential criteria for proposed future well tests;
2. Orient to the updated Owens Lake Groundwater Model and provide feedback on modeling scenarios;
3. Hear updates on progress of Resource Protection Protocol (RPP) development for vegetated dune areas; and
4. Hear updates on related work and identify key topics for further discussion.

Agenda items covered included:

- Opening remarks;
- A refresher on the context for the meeting;
- An update on 24-hour pumping tests of testing wells TW-East and TW-West;
- An orientation to the Owens Lake Groundwater Model Update and potential scenarios for model simulations;
- A presentation on RPP for Vegetated Dune Areas (VDAs);
- Updates on related work, such as refinement of Owens Lake water budget and the water banking concept; and
- A wrap-up noting action items and next steps.

The structure of this summary corresponds to those seven items. A list of meeting participants can be found as Attachment 1 to this document. The presentation slides shared at this meeting can be found as Attachment 2. The meeting was co-facilitated by Meagan Wylie and Alex Cole-Weiss (CSUS Consensus and Collaboration Program).

OPENING REMARKS

Alex Cole-Weiss, facilitator from California State University, Sacramento, welcomed participants to the meeting. Ms. Cole-Weiss noted that the facilitator who previously worked with the Groundwater Work Group (GWG) had retired since the GWG last met, in May 2018. Ms. Cole-Weiss introduced the new facilitation team, including Meagan Wylie, who co-facilitated the meeting.

Ms. Wylie reviewed the purpose of the meeting; see meeting objectives above. Participants attending in person or on the phone introduced themselves; see Appendix for the participant list.

REFRESHER ON CONTEXT FOR THE MEETING

Work Group co-chairs Dr. Saeed Jorat, LADWP, and Aaron Steinwand, Inyo County Water Department, reviewed the context of the meeting. Mr. Jorat noted that Bob Harrington, the former Inyo County co-chair of the GWG, had retired and his position was now filled by Mr. Steinwand.

The GWG had not met in nearly one and a half years. The presentations on pumping tests, the groundwater model update, and resource protection protocol for vegetated dune areas would be in-depth, with opportunity for discussion and consideration of related next steps. Time for brief updates on work conducted or planned since the last GWG meeting would be provided during the afternoon.

Nelson Mejia, LADWP, reviewed the broader context of the GWG's work. The Owens Lake Master Plan effort recognized that there are many stakeholders and interests that LADWP needs to consider in its dust mitigation efforts at the lake. The GWG is one group that was convened based upon this recognition. Mr. Mejia said that LADWP is committed to improve its communication to stakeholders about the information it has on things like groundwater at Owens Lake. LADWP is working to determine the feasibility of using groundwater for dust mitigation purposes, while also working to address stakeholders' concerns about the potential of using groundwater in this way.

UPDATE ON 24-HOUR PUMPING TESTS OF TESTING WELLS TW-EAST AND TW-WEST

PRESENTATION

Victor Harris and Eric Vogler, consultants from Stantec, presented the results from 24-hour pumping tests at testing wells TW-East and TW-West. The pumping tests were done to calculate aquifer parameters, specifically evaluating the extent to which geological faults act as barriers to the movement of water in the aquifer. The information gathered through these and other pumping tests will be used to improve the groundwater model.

For these tests, the wells were pumped at specified rates and intervals over 24 hours, and observation wells were used to measure the effect of the pumping over time and space. The tests included observation wells on either side of fault lines to determine the effect of the faults on drawdown.

TW-East is located in the northern part of the lake where there are relatively deep pumping wells, as well as a number of monitoring wells. The TW-East pump test included step tests, in which the rate of pumping was increased in 1.5-hour intervals. The observation wells showed little change, especially west of the test well, thereby producing inconclusive test results.

The test on TW-West utilized as a flowing well, equivalent to a higher rate of pumping. The deep observation wells showed some response to the test, but the other observation wells showed very little response. TW-East had less than one foot of response to the pumping at TW-West.

The results of the two tests showed that hydraulic conductivity is lower at TW-East, which also had a faster recovery from the drawdown. Due to the lack of response in observation wells, the test results cannot be used to improve the groundwater model and calculate aquifer parameters.

The presenters gave their recommendations for follow-up to the 24-hour pumping tests:

- Conduct a longer-term test at TW-East so that responses at other wells can be evaluated. If the testing well is pumped at a higher rate over a longer period of time, responses at both deep and shallow wells are expected.
- Use the current iteration of the groundwater model to simulate a 6-month pumping test, with multiple scenarios simulated.

The consultants recommend carrying out the model simulation first, and determining the rate and timing of the longer-term pumping test based upon the results in the simulation. They proposed conducting the longer-term pumping test from August 2020 through January 2021 at a pumping rate between 1,000 and 1,200 gallons per minute. A longer-term test should show response in observations at wells across the two faults, improving understanding of aquifer characteristics.

The consultants recommend employing the RPPs that the GWG has previously developed while the longer-term pumping test is carried out. This will allow the effectiveness of those RPPs to be evaluated as well. The consultants also recommend measuring the potential effect of pumping on groundwater levels under the vegetative dune areas (VDAs).

A report detailing the results of the 24-hour pumping test and recommended next steps will be released as part of the comprehensive Pumping Report in December 2019.

DISCUSSION

Questions and responses are summarized below:

How deep are the testing wells?
TW-East is 1,500 feet deep and TW-West is 900 feet deep.

Does the proposed longer-term pumping test use the same two wells?
The proposed test would only use only TW-East in order to take a conservative approach to pumping while gathering the necessary information.

What will be done with the water that is pumped?
It will be added to the local dust mitigation pond adjacent the testing well.

At what depths was the yield from the pumping focused during the 24-hour tests?
The testing wells have screens that range in depth from 600 to 1,500 feet. 95% of the production during the 24-hour tests came from the middle zone, with very little coming from the very deep screens.

Will the testing wells be used to monitor and fill data gaps during the longer-term test? Will additional monitoring points be added during the longer-term test?
There are many observations wells already in use for monitoring during the test, including shallow (30 feet deep), moderately deep (around 100 feet; these go through a large unsaturated zone before reaching a saturated zone), and deep (greater than 100 feet) monitoring wells. These wells together provide adequate coverage to monitor changes during the test.

Are there observation wells located within the fault zones or are they squarely on either side of the fault?
The wells were located on either side of the main network of fault splays. MW-4 was drilled across the Owens Valley fault to provide data about the effect of that fault.

Was water quality analysis conducted on the water pumped during the 24-hour test? Will water quality be analyzed during the longer-term test?
Some water quality analysis was conducted during the 24-hour test. A presentation detailing the results will be given at a later date.

Will a longer-term test like the one proposed for TW-East also be conducted at TW-West at some point?

Whether or not a longer-term test will be conducted at TW-West as well depends upon the findings from the TW-East test, but it is likely that it will eventually be done. It is possible that the TW-East testing would provide enough information to understand the hydraulic characteristics of the Owens River and the Owens Valley, in which case additional pumping tests at TW-West would not be necessary.

If a longer-term test is done at TW-West, would that happen in 2023 or after?

Moving forward with the longer-term tests depends upon the permit from the State Lands Commission, therefore 2023 or 2024 is likely within the timeframe in which this could be done.

Will testing be conducted in any areas outside the northern section of the lake, where both TW-East and TW-West are located?

LADWP is likely to only pump in the northern area of the lake, because the south and southwest areas have thicker clay layers and do not yield water. Dynamics like land subsidence will continue to be monitored, with extensometers concentrated in the northern section.

Issues identified for further consideration or action included:

1. Santec to improve the map to clarify the locations of observation wells on either side of the fault zones.
2. The Groundwater Development page on LADWP's website will be updated with agendas, presentations and meeting summaries from GWG and Habitat Work Group meetings. The presentations and summary document will also be distributed via email.

OWENS LAKE GROUNDWATER MODEL UPDATE AND POTENTIAL SCENARIOS: ORIENTATION AND FEEDBACK

Mr. Vogler, Stantec, reviewed revisions and updates to the groundwater model. With new data, the model domain was expanded, its grid was refined through quadtree refinement, and its simulations were also refined.

To expand the model domain, additional monitoring locations and additional flow were incorporated. TW-East, TW-West, and all RPP monitoring wells were incorporated, as well as new wells for calibration. The original grid of the model was 500 feet by 500 feet. Using quadtree refinement, the grid around monitoring and pumping wells was refined to 125 feet by 125 feet. Simulations were refined by extending the simulated time period, reducing the length of the stress period from six months to two months, and redistributing evapotranspiration based on a study from the U.S. Geological Survey (USGS). To reduce instability in the shallow areas of RPP locations around the model's periphery, MODFLOW code used in 2012 was converted to the USGS module.

Calibration of the model update was carried out with shorter, two-month stress periods beginning December 2016. The calibration compares simulated values with observed wells. The updated model showed improved results and was fairly consistent across stress periods.

Comparisons between calibration statistics for the original 2012 model and the updated 2019 model showed improvements in mean error, absolute mean error, and root mean squared error. Stantec will release a report about the model update, including further detail about calibration results. Continued improvement is expected as the model is further updated with additional data.

Hydrographs comparing observation and model simulations showed that the model results were often very close to observed values and in most cases followed the wells' trends over time. There was some variation in the results between shallow and deeper wells. Simulations for shallow wells performed somewhat better than the deeper wells, but the deeper well simulations did respond dynamically.

The consultants presented recommendations for further work to improve the model. Longer-term pumping tests are needed to improve calibration as well as improve the description of fault effects and better estimate aquifer characteristics such as hydraulic conductivity. Stantec plans to conduct modeling simulations to predict the effects of pumping at TW-East at 800, 1200 and 1600 gallons per minute over six months. The simulation will be carried out for two cases – high fault conductance and low fault conductance. The results of the simulation will be compared with observed data from the long-term pumping test to understand fault effects. GWG participants were encouraged to provide input about simulations that would be useful to their work.

DISCUSSION

Questions and responses are summarized below:

Is climate information being added to the model, for example simulating drought and high water years?

The model's ten-year simulation takes into account the most recent drought, before 2017. The model could be extended by extending the hydrograph with more extreme swings. Inputting more extreme swings could only be done as a forward-looking simulation, since there is not observed past data on such a scenario.

Where is TW-East located?

It is located near well T36-2 in the northern side of the lake. It is between the Owens Valley and Owens River faults, nearer to the Owens River fault zone.

How does the model account for faults – as single fault lines or zones with different conductance?

Currently the faults are modeled as single lines, with a thickness dictated by cell width. Using MODFLOW, faults are represented as a line, but this could be updated to define them as zones. More observed data is needed to gain certainty about fault effects and be able to better model them.

Where are the Keeler Community Service wells located and how deep are they?

They are located far east of the fault and are deep wells.

Have studies been done as to how old the water from the 1,500-foot TW-East well is?

Isotope sampling was conducted on the water from TW-East. The water that comes from the springs is young water, as evidenced by the tritium in the water, and comes down from between

the faults. The deeper water is old and is essentially stagnant. Further information about the analysis of the water will be posted on LADWP's website once the update of the website is completed.

How does the timing of future model updates, for example based upon information from the possible 6-month pumping test, fit in with the timeline for the master Environmental Impact Report (EIR)?

Information on the timing of the EIR will be provided later in the meeting.

Are the model updates focused on refining potential pumping scenarios?

Yes, during the development of the first version of the model, the primary interest was in flow in the western springs, which served as a bellwether. Now we want to gain information about non-LADWP wells, monitoring under seeps, and monitoring alluvial fans. The criteria for monitoring have also changed: the new model will focus on the criteria developed by the GWG, such as the RPPs. Where pumping happens will be determined by where was is located and where water is needed, but will also be informed by what is learned through monitoring and models.

Feedback regarding future simulations:

- The model should be used only for short-term simulations until information about the impacts of longer-term pumping is gathered from the proposed six-month pumping test. Simulations of things like the effects of climate change should be done only after that additional data is incorporated.
    - Some longer-term pumping tests were done in 2012 during development of the original model. Although there were fewer observation wells at the time, the model already contains some important data about longer-term pumping.

Issues identified for further consideration or action included:

- Ensure that the model correctly represents the locations of wells vis-à-vis the fault lines/zones.
- Mr. Vogler to share further detail about the hydrographs with Scott Warner, Great Basin Unified Air Pollution Control District (GBUAPCD), including maps.
- Further detail about the model update, as well as information about the water age analysis, will be posted on LADWP's website. The report on the model update is expected to be complete by the end of November 2019 and the pump test report by the end of December 2019.

RESOURCE PROTECTION PROTOCOL FOR VEGETATED DUNE AREAS

PRESENTATION ON GREAT BASIN REPORT AND LADWP COMMENTS

Mr. Jorat provided background related to the development of RPPs for vegetated dune areas. A groundwater development program was considered as part of the Owens Lake Master Project, and RPPs were developed to for the following groundwater dependent resources: subsidence,

non-LADWP wells, and springs and associated alkali meadow. The original RPPs focused on the area on the lakebed.

In early 2018, GBUAPCD raised concerns about the stability of salt crust areas and vegetated dune systems located above the area on the lakebed. GBUAPCD submitted a letter and report detailing their concerns to LADWP in September 2019. They provided information about 15 dune areas around the lake and suggested that the nature and function of the vegetation on the dunes should be assessed and a RPP should be developed for the dunes and to ensure that the groundwater level under the dunes is not lowered. Mr. Jorat noted that all RPPs will be incorporated into the Hydrologic Monitoring, Management, and Mitigation Plan (HMMMP), a plan for all monitoring required to inform operation and management of groundwater development. The updated groundwater model, and the new information that informed the updated model, may address some of the concerns raised by GBUAPCD.

Jeff Nordin, LADWP, reviewed the concerns expressed by GBUAPCD in its letter to LADWP. These include:

- Insufficiency of the current RPPs
    - Vegetation decline from groundwater pumping may destabilize the dunes and result in new dust sources
    - Current RPP is insufficient to protect against dune vegetation decline
    - RPP needs to include both vegetation and hydrologic monitoring resource protection
    - Lower groundwater levels potentially reducing salt crust thickness on the playa
- Potential impacts on vegetated dune systems
    - Increased dust emissions from reduced cover and vigor
    - Decoupling of groundwater from the root zone
- 2012 hydrologic model needs refinement
    - Be more comprehensive
    - Include both alkali meadow and vegetated dune systems
    - Accurately assess potential impacts from pumping on the near-surface groundwater system
- RPP components should include
    - A meaningful and representative baseline of groundwater and precipitation
    - Long-term baseline for vegetative cover and vigor
    - VDA specific conceptual models to understand and comprehensively protect air quality
        - Understand site-specific driving factors (including groundwater) influencing long-term cover

Mr. Nordin reviewed LADWP's activities to-date beginning to address GBUAPCD's concerns and their planned further discussions to address the concerns.

PRESENTATION ON VDA CHARACTERISTICS AND APPROACH TO RANGE OF HISTORIC VARIABILITY

Brian Schmid and Jim Richards, Formation Environmental, gave a presentation on the characteristics of the vegetated dune areas and their approach to the range of historic variability

on the VDAs. They presented an overview of the VDA resource, conceptual model development, initial field study findings, pilot study results, and plans for developing and scaling the work to inform VDA RPP.

Vegetation is the link between the VDAs and air quality in the area. Changes in depth to groundwater that make plants unable to reach water lead to decline in vegetative cover and increase in sand flux.

Conceptual Model

There are a wide variety of studies about the physiological limitations for plant establishment and persistence around Owens Lake. The conceptual model looks at long-term variability in vegetation on the VDAs and the drivers of this variability. A comprehensive list of factors affecting vegetation in VDAs was included in the conceptual model, including:

- Species characteristics (e.g. root depths)
- Successional change
- Precipitation
- Run-on flood flows
- Groundwater
- Soil layering (coarse – fine); Perched groundwater
- Erosion (soil volume and nutrient loss)
- Abrasion of shoots and roots
- Deposition (soil and litter)
- Disturbance (roads, grazing, etc.)

Some of the most important factors include root depth, successional change following changes to groundwater, and access to water affected by soil layering. Erosion of soil volume leads to both lower capacity for water storage as well as nutrient loss leading to lessened vigor of the plants.

Initial Field Study Findings

An initial field study was carried out in late 2018 to define resource boundaries, species, and communities in the VDAs, record factors affecting vegetation, and collect ground-truth data for historical analysis of vegetation carried out with aerial imagery.

Mr. Richards reviewed the study methodology. For each VDA, two transects were walked (with the exception of one of the 15 VDAs for which only a single transect was walked). Plant species, erosion, deposition, flooding, surface characteristics, watershed, and landform were observed along each transect. Current location of dunes is linked to the lake's prior high stands, especially the historic shoreline at 3600 feet.

Mr. Richards reviewed how the data from each transect was compiled to show observations across the transect, including key species in the dunes, elevation, surface characteristics, and relative biomass. The densest area of *Sarcobatus Vermiculatus* (SAVE; also known as black greasewood) is at and above the 800-year shoreline at 3619 feet elevation. There are some SAVE dunes at lower elevations, but these are dominated by smaller plants, and those at upper elevations were more dominated by *Atriplex parryi* (ATPA; also known as Parry's saltbrush).

Key conclusions from the initial field study were presented:

- SAVE, ATPA, and Suaeda nigra (SUNI; also known as bush seepweed) were the three most important shrub species in the dune areas, as expected.
- The processes leading to maintenance of the largest dunes are likely affected by groundwater access, as well as the accumulation of sediments and deposits along the 800-year shoreline. Flood flows may also intermittently recharge the water in those areas.
    - Most VDAs have the densest, largest SAVE dunes located at and above 3619 feet elevation (the 800-year old shoreline).
    - A few VDAs (01, 03, and 07) have the densest, largest SAVE dunes at 3606-3619 feet elevation (the 360-year old shoreline).
    - One VDA (06) has the densest, largest SAVE dunes at 3600 and 3606-3612 feet elevation.
    - One VDA (14) has its largest dunes at 3579 feet elevation.
- If SAVE were reliant on groundwater it would be expected that they would be found at lower elevations. However, the maximum elevations of large SAVE dunes (other than in VDA 14) are located at 3618-3648 feet elevation. The most common elevation values are 3628-3632 feet.
    - The largest SAVE plants are located at the upper end of the elevation distribution.
    - SAVE dunes at lower elevations are decadent, except when associated with seeps.
- VDA boundaries have been defined. The next step is to develop site-specific patterns of vegetation to see how the driving factors in the conceptual model might relate.
- Overland flood flows, and accumulation of fine sediments, is important in many VDAs.
- Better understanding is needed of recharge above impeding shoreline berms and soil layering.
- Decadent dunes are found at lower elevations, closer to groundwater, while vigorous dunes are found at higher elevations farther from groundwater.

Questions and Answers Regarding the Field Study

Were the locations of earthquake faults considered a factor influencing dune distribution, for example because of their influence on water retention?

No specific evidence was found of fault locations influencing distribution of dunes. This will be further investigated when the research is scaled.

Were the drivers of presence and dominance of SAVE in other locations in the western part of the lake investigated?

It is clear that the initial establishment of SAVE seems to occur along shoreline berms, generally surrounding the lake as it recedes. The dunes grow as they trap material and form into a band. At Mono Lake the largest, most vigorous dunes are located at the upland edge rather than close to the lake. The establishment of SAVE occurred but many are now dying, similar to the decadent dunes at Owens Lake.

Was this research done as a single field study? Are additional field studies planned? Have past studies been reviewed to analyze seasonal variation?

This was a single study carried out in December 2018. It provides only a single snapshot in time but will be used to assess the accuracy of aerial image analysis. Such analysis will then be used to conduct historical analysis and applied in a pilot study to extend through space and time.

Pilot Study Results

Mr. Schmid presented results from a pilot study conducted to quantify the historical variability of the VDA resource and its relation to the driving factors identified in the conceptual model, and to extend that improved understanding to set triggers and thresholds for moving forward with groundwater development at Owens Lake.

The pilot study looks at vegetative cover and other factors over time at two VDAs, VDA 02 and VDA 03. The two VDAs were chosen because they are located fairly close to one another but are diverse with regard to vegetative cover and surface water inflows. Both have historical imagery, transect data, and groundwater data available.

Watershed delineation and surface water characteristics were reviewed for the two VDAs. Historical runoff was used as the basis for selecting dates from which to review high-resolution imagery of the VDAs. The dates selected encompass a range from the lower to upper ends of runoff to ensure that a range of precipitation and surface water input levels are captured in the review. The dates used span from 1944 to 2018, therefore there is significant variability in the image quality and spatial resolution of the images reviewed.

Images were georeferenced to a common base to ensure that the same 40-meter-wide area was reviewed in each image. A semi-automated analysis approach was used to delineate shrubs ("objects") in the images. Manual Quality Assurance/Quality Control and editing of the automated delineation was then conducted.

Accuracy assessment was done by comparing the image analysis with the field notes within a four square-meter area around each point on the transect. Overall, between the 31 points in VDA 02 and the 20 points in VDA 03, 93% of points were correctly classified.

Analysis was carried out to determine which parts of the transects are more or less dependent on groundwater. The landscape was stratified into zones based on past shoreline levels, shrub density and size, and species composition, particularly SAVE dominance. The five zones are:

- Zone 1: Upland: low density, small shrubs dominated by more upland species (ATPA, SUNI) (SAVE scattered and usually associated with rills)
- Zone 2: Transition: higher density, larger shrubs with more importance of SAVE
- Zone 3: SAVE Dunes: very large SAVE plants dominant but with SUNI (and a few ATPA) mixed in, especially in swales
- Zone 4: Vegetated Playa: SUNI and ATPA with scattered (decadent) dunes of SAVE
- Zone 5: DISP or salt crust only on playa

Zone 3, which is dominated by SAVE, is the key vegetative area that that is likely to be at least partially dependent on GW, as well as the transitional Zone 2.

Trends in percent cover in the five zones was reviewed over time, from 1944 through 2018. This was compared with data on precipitation and run-on flood flows. Future work will include incorporating comparisons of percent cover with data on the other drivers of cover variability to better understand how the variation in those drivers correlates with variation in vegetation.

Mr. Schmid reviewed trends in percent cover by zone. Correlations with current year precipitation, previous year precipitation, and current plus previous year precipitation were calculated. In VDA 02, R-values increased with longer-term precipitation trends, suggesting that vegetative cover over time is driven by inputs of surface soil moisture. In Zone 2 the correlation was weaker, which may be due to increased infiltration and higher flood flows that are not correlated as well with precipitation and Owens Valley flood flows. In VDA 03, the correlations were weaker and not statistically significant. This suggests that VDA 03 may be more dependent on groundwater and less dependent on surface water. Population dynamics through time, such as growth of individual shrubs and recruitment, were not yet evaluated.

Over the past five years, the Habitat Work Group (HWG) developed a seasonal leaf area index (LAI) dataset. In the high-cover area of VDA 03, percent cover can be seen through the new dataset as well as the more granular SLAI data. Other indicators can be used to augment the analysis to include things like vigor, not only cover, as was done in the Alkali Meadow.

Evapotranspiration (ET) data can also be used to improve understanding of areas where plants might be relying on groundwater. In areas where ET is higher than precipitation, groundwater is likely augmenting precipitation. A statewide dataset of actual evapotranspiration (ETa) from the Department of Water Resources (DWR) will be available for 2010 through 2018. The consultants from Formation Environmental collaborated with LADWP and Stantec to assess the ET of native riparian and desert ecosystems. ET was validated through Eddy Covariance from 2000-2003 in Inyo County. Satellite and on-the-ground ET measures were compared to ensure that there was general alignment between the two.

Data from DWR's CalETa California Irrigation Management Information System (CIMIS) is used as the backbone for the meteorological data (MET data), with site-specific estimates improved through MET stations around Owens Lake. Heat storage components for water bodies and LAI data from the alkali meadow RPP are incorporated. ETa values from satellite image analysis were shown.

Mr. Schmid explained that the field study and pilot study contribute to development of VDA RPP criteria. They inform setting of a historical baseline and conceptual site model, which will integrate with the hydrologic RPP components to develop the VDA RPP.

The next steps in the process for developing RPP for the VDAs begin with further meetings between LADWP and GBUAPCD to get further details on their concerns and input on the process being undertaken. Technical work in collaboration with GBUAPCD will continue, and then the HWG will collaborate to develop VDA RPP.

Discussion Regarding the Pilot Study

What is known about the establishment of SAVE through time?

Establishment of SAVE is neither consistent nor reliable; successful establishment happens quite infrequently. A number of studies in other desert areas such as Mono Lake suggest that it only happened twice in last 20 years, during multiple successive years of high-moisture inputs.

Does SAVE reproduce clonally?

It does sprout from roots that are exposed by erosion and can re-sprout when buried by sand. However, it is challenging to identify single genetic individuals. The detailed observations that have been done to identify individual plants at Mono Lake suggest establishment is very episodic. The establishment of SAVE seems to be more concentrated in shoreline berms around a lake as the lake level recedes. Berms are formed by accumulation of organic material, which provide nutrients and also traps seeds and precipitation. For this reason, it is unlikely to establish on a flat playa.

Is it accurate to say that it would be almost impossible to restore the SAVE plant communities if they were to die? If so, every effort should be made to ensure that nothing happens to the existing plants.

It would be very difficult. It has taken hundreds of years for the large SAVE plants to become established.

Will the cumulative effects of each factor affecting cover in VDAs be considered in development of the RPP? Consider that there are likely to be cyclical effects, such as erosion leading to decline in cover, leading to further erosion. The RPP should go beyond a simple threshold; they should ensure that the VDAs do not reach a position of such stress that recovery becomes impossible.

The conceptual model is used to understand the drivers of change. There may be VDAs that are more connected to the groundwater system, and therefore are more sensitive, whereas other areas with more soil layering and more perched conditions may use more surface water and be less sensitive to groundwater changes.

It is important to recognize that we will not have full understanding of dynamics, so caution is called for.

An early warning indicator was established for the Alkali Meadows signaling the occurrence of a change early on, triggering adaptive management. A linear approach to developing a better understanding of the dynamics in the VDAs is needed; as understanding improves to the extent possible, this will feed into the RPP.

Will the VDA RPP also be reviewed by the HWG, as was the process for development of the Alkali Meadows RPP?

Yes.

UPDATE ON RELATED WORK

Presenters gave updates on related work, completed and ongoing since the last GWG meeting.

REFINEMENT OF OWENS LAKE WATER BUDGET

Consultants from Stantec reviewed progress in refining the Owens Lake water budget. The water budget was initially developed between 2009-2012. Owens Lake is a terminal basin, meaning that the only outflow components are consumptive use and exports by Crystal Geyser. The latter makes up a quantifiable but small amount of the water consumed. Therefore, consumptive use through evapotranspiration (ET) is the key component to balance inflow with outflow. With improved technology, ET can now be measured using a model, which improves overall accuracy in space and time. Satellite-derived data can also be compared to the model to improve the resolution of the zones in the water budget and improve the model itself. Satellite data to conduct this analysis is available from the early 1980s onward.

WATER BANKING CONCEPT

Mr. Jorat presented the concept of water banking in and around Owens Lake. Water banking, or aquifer storage and recovery, is the storage of water in underground aquifers when there is excess water available and pumping it back out when it is needed. Water can be put underground either by letting it infiltrate through recharge basins, which can be done in areas where there is an unconfined aquifer, or through injection wells, which must be done in areas where there is a clay layer that prevents infiltration. The latter is often accomplished through a well that can both inject water and also pump it back out.

Water banking is being considered at Owens Lake to provide operational flexibility, to help ensure successful dust mitigation by providing an additional water source, to optimize water use, and as a way to capture runoff that might otherwise damage dust mitigation infrastructure. The possibility of water banking both on the lakebed and off are being evaluated.

4,000-8,000 acre-feet of pond water is lost to evaporation at the end of wind season each year. LADWP is evaluating the possibility of storing pond water at the end of the wind season and pumping it back into the pond early in the following season. This would provide redundancy so that LADWP would have a way to supply water for dust mitigation in emergencies, such as if the mainline is shut off.

The ponds that are typically dried at the end of the wind season are generally clustered in the southeast of the lake. Water banking in those areas would require installation of injection wells to get the water beneath the thick clay layer. Mr. Jorat noted that LADWP must get a lease from the State Lands Commission for any work done on the lakebed, including potential water banking.

Off-lakebed banking is also being evaluated to deal with high levels of runoff from the Owens Valley during wet years, which are predicted to become more extreme due to climate change. The estimated cost of protecting dust mitigation infrastructure from runoff based on the wet year 2017 was approximately $25,000,000. Additionally, LADWP would like to take advantage of wet years to store water for use during drought years. LADWP is considering four areas as potential water banking sites off the lakebed:

- Area 1: from Lubkin turnout along the mainline,
- Area 2: the western alluvial fans between the Lubkin turnout and Cottonwood Creek,

- Area 3: north of Owens Lake along Highway 136, and
- Area 4: the area between Highway 136 and pump back station along the Owens River

The land in Areas 1, 3, and 4 is owned by the City of Lone Pine, and the land in Area 2 is owned by both the City and the Bureau of Land Management (BLM). The formation along the mainline presents an opportunity to install a relatively shallow injection well. The Inyo-Los Angeles water agreement allows for water banking, so it is likely possible to work with Inyo County to develop water banking in this area.

The considerations in evaluating the possibility of water banking include:

- Hydrology
- Geology
- Engineering
- Regulatory
    - Permitting
    - Lease
- Environmental evaluation
    - California Environmental Quality Act (CEQA)
- Planning

LADWP hopes to move forward with the necessary evaluations of water banking and will determine how to proceed from there. LADWP plans to evaluate potential water banking options all along the LA aqueduct, not only at Owens Lake. The GWG will be engaged in additional conversations about the potential for water banking as the possibility is further evaluated.

Discussion:

- Concerns that should be considered in evaluating water banking include effects on:
    - Habitat, including interaction with habitat baseline values
    - Subsidence
    - Water quality, including potential salinity due to cycling of water between the aquifer and ponds
- Technical analysis should be carried out and should consider whether head pressures can be overcome.
- Evaluation of water banking should consider the four co-equal outcomes of dust control, habitat, efficient use of resources, and protection of cultural resources.
- Per the Inyo-LA water agreement, Inyo County is committed to not be “unreasonable” in considering LADWP proposals. Some vegetation protection issues might not arise if banking is done on Inyo County land, although Inyo County shares many of the concerns raised by other participants.
- A participant said that, as someone who lives in the Owens Valley, water banking in the Owens Valley is generally favorable.
- There is general scientific consensus that climate change will decrease the storage of water as snow in the Sierra Nevada mountains. It will become more important to ensure that water is being stored as efficiently as possible when it is available.

Clarifying Questions:

How much volume would LADWP want to bank?

Likely between 1-1.5 feet per acre of pond areas, or a total of 4,000-6,000 acre-feet.

Would existing wells be used for injection?

No, injection wells have a slightly different design than other pumping wells.

Might this process increase the salinity of the water in the aquifers?

The water quality tests conducted so far show that the water in the aquifer is of poorer quality compared to the water on the surface. Additionally, the same water would not continually be cycled into the aquifer and onto the surface. Rather, additional water will be added each time. Nevertheless, filtration or other measures may need to be taken.

Would water banked off the lakebed be used solely on the lake or might it also be exported?

The Inyo-Los Angeles water agreement allows export of water. Practically, it makes more sense to put banked water in the lake rather than transfer it back up to the aqueduct for export. LADWP's intention at this time is to use it on the lake, but it is possible that it may be moved elsewhere.

UPDATE ON MASTER PROJECT CEQA

CEQA for the Owens Lake Master Project is moving forward. Its schedule is dictated by the schedule of completion of the HMMMP. A draft EIR is expected to be ready for release by fall 2021. The VDAs and other RPP will flow into the HMMMP, which itself feeds into the EIR.

SGMA & OWENS LAKE GROUNDWATER DEVELOPMENT PLAN

The Sustainable Groundwater Management Act (SGMA) does not apply to adjudicated areas, such as the long-term water agreement. Whether or not SGMA applies to Owens Lake is the subject of litigation, which is on hold pending the outcome of the GWG's work on groundwater development at Owens Lake. However, State agencies are required to consider the policies of SGMA, so the lake may be indirectly subject to regulation by a Groundwater Sustainability Plan (GSP), for example through a lease agreement with the State Lands Commission in which compliance with SGMA is made a condition of the lease.

Owens Valley Groundwater Authority (OVGA) is the Groundwater Sustainability Agency (GSA) for the Owens Valley groundwater basin under SGMA. As the GSA for the basin, OVGA has certain powers and responsibilities. A central responsibility of GSAs is development of a GSP that would avoid the following undesirable results of unsustainable groundwater use:

- Lowering of Groundwater Levels
- Reduction of Groundwater Storage
- Seawater Intrusion
- Degraded Water Quality
- Land Subsidence
- Depletion of Interconnected Surface Water that has significant and unreasonable adverse impacts on the beneficial uses of surface water

There will likely be coordination between the work done under SGMA and the RPPs developed by the GWG.

GSPs may include provisions specific to certain geographical areas, called "management areas," based on hydrological conditions. For example, Owens Lake may be designated as a management area due to its distinct conditions.

The GSA Board of Directors does not include any members from the far southern area of the valley, so an advisory committee may be formed to bring in representatives from the area.

Owens Valley groundwater basin was classified by DWR as a medium priority basin, but may be re-prioritized as a low priority basin. In this case, the basin would not be required to develop and implement a sustainability plan under SGMA. However, several members of the OVGA, including Inyo County, desire to remain in the OVGA and proceed with GSP development regardless of basin status. OVGA's status as a GSA remain valid despite changes in board composition due to the reclassification. Any GSP developed by the OVGA would be enforced only within remaining members' jurisdictions. If the GSP moves forward, OVGA consultants would be asked to participate in the GWG in order to interface between GWG efforts and GSP preparation.

Questions

What does the possible re-classification as a low priority basin imply about how groundwater use has been managed in the past?

Low priority basins are unlikely to see undesirable results given their historic groundwater use.

If OVGA completes a GSP, when would it be submitted?

OVGA has received a grant to support GSP preparation. This grant would expire around May 2022, so the plan would be submitted by that time.

OUTREACH

LADWP plans to update the website for its groundwater development program. One outreach idea is to prepare an informational series in the form of PowerPoints posted to the website reviewing topics such as how LADWP will prevent subsidence at Owens Lake, resource protection protocol, non-LADWP wells, habitat, and others.

Suggestions of additional content for the website and outreach series:

- Additional topics for the outreach series:
    - The "four-legged stool" principle with co-equal priorities of dust control, habitat, efficient use of resources, and protection of cultural resources
    - Groundwater banking
    - Groundwater pumping
    - Science and development of models
    - Cultural resources

WRAP-UP: ACTION ITEMS AND NEXT STEPS

Participants made the following final comments at the conclusion of the meeting:

- The threat of groundwater being used up by all the new wells that have been installed is concerning. Wells should not be added in Mono Lake as well.
- Placing new wells causes significant destruction of cultural resources and vegetation. This is a critical consideration when deciding whether to build new wells.
    - There is a desire to be able to monitor water levels under each VDA, but such monitoring wells would be drilled with a hand auger to minimize impacts.

The primary next steps include:

- LADWP will update its website, including information about isotope testing related to the age of water in the deep aquifer, presentations and summaries from GWG meetings, reports, and outreach content.
- Santec to improve maps to clarify the locations of observation wells on either side of the fault zones. Ensure that the model correctly represents the locations of wells vis-à-vis the fault lines/zones.
- Stantec will complete the report on the groundwater model update by the end of November 2019.
- Stantec will complete the report on pumping test results by the end of December 2019.
- GWG participants to provide input about groundwater model simulations that would be useful to their work.
- Stantec will integrate suggestions from GWG members into scenario modeling.
- Mr. Vogler will share further detail about the hydrographs, including maps, with Scott Warner, GBUAPCD.
- Formation Environmental will follow up about the potential impacts of earthquakes on VDA and dune development.
- Formation Environmental will complete the report on VDA RPP.
    - The report will be reviewed by the Habitat Work Group.
- LADWP will continue to evaluate the potential for groundwater banking.

The next meeting of the GWG will take place in January or February 2020. Agenda items for that meeting include:

- Follow-up on water banking
- OVGA/SGMA update
- VDA RPP (consider holding a joint meeting with the Habitat Work Group)

APPENDIX 1: MEETING PARTICIPANTS

Participants	**Affiliation**
Aaron Steinwand	Inyo County Water Department (ICWD)
April Zrelak	Lone Pine Paiute Shoshone Reservation
Brian Schmid	Formation Environmental
Drew Simpkin	State Lands Commission
Gabe Gaspar	
Grace Holder	GBAPCD
Jennifer Mattox	State Lands Commission
John Hunter	
Keith Rainville	ICWD
Margaret Cortez	Timbisha Shoshone Tribe
Mary Roper	Owens Valley Committee
Mike Prather	Eastern Sierra Audubon
Nathan Francis	Rio Tinto Minerals - Boron Operations
Pete Pumphrey	Eastern Sierra Audubon Society
Sarah Mongano	State Lands Commission
Scott D. Warner	GBUAPCD
Sondra Grimm	GBUAPCD
Trisha Moyer	California Department of Fish & Wildlife
Staff / Consultants	Affiliation
Alex Cole-Weiss	CSUS (facilitation team)
Arash Agahi	LADWP

Chuck Holloway	LADWP
Collette Gaal	LADWP
Dustin Fischer	LADWP
Eric Volger	Stantec
Eugenia Lin	LADWP
Fabiola Moreno	LADWP
Gary Reiser	LADWP
Jaime Valenzuela	LADWP
Jane Hauptman	LADWP
Jeff Nordin	LADWP
Jim Richards	Formation Environmental
Joseph Flies-Away	LADWP
Julia Van Horn	CSUS (facilitation team)
Meagan Wylie	CSUS (facilitation team)
Nelson Mejia	LADWP
Ray Ramirez	LADWP
Saeed Jorat	LADWP
Sarah Bryson	LADWP
Victor Harris	Stantec
Observers	Affiliation
Kathy Bancroft	Lone Pine Paiute Shoshone Reservation