

# Climate Impacts, Risks, and Vulnerabilities

*Implications for an uncertain climate future for  
SNWA/LVVWD*

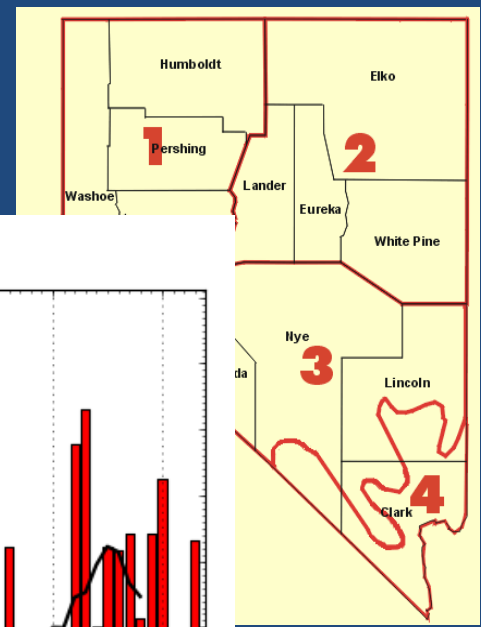
**NWRA Annual  
Conference**

**February 5, 2014  
Keely Brooks**

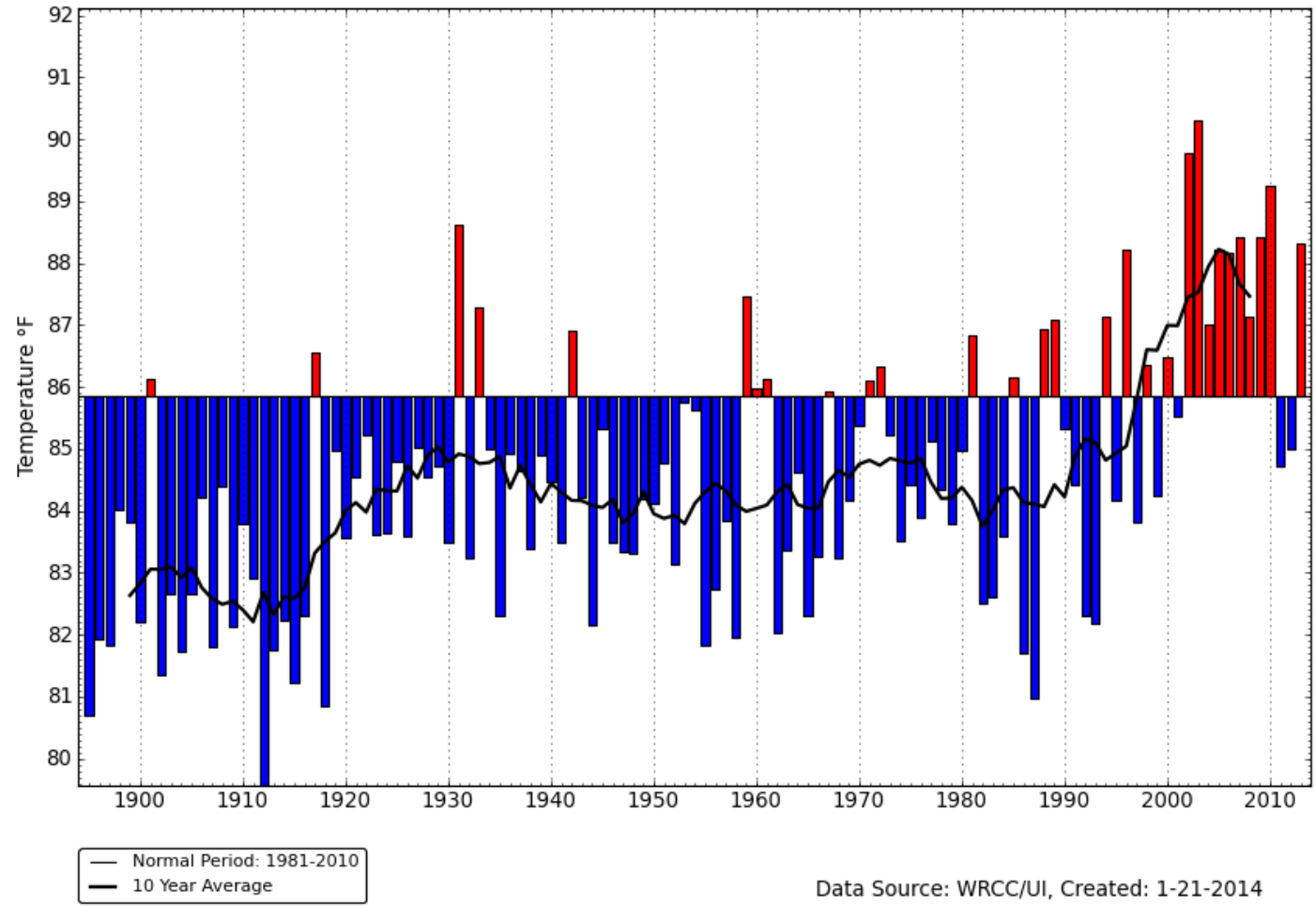


Lake Mead, NV

# RISING TEMPERATURES



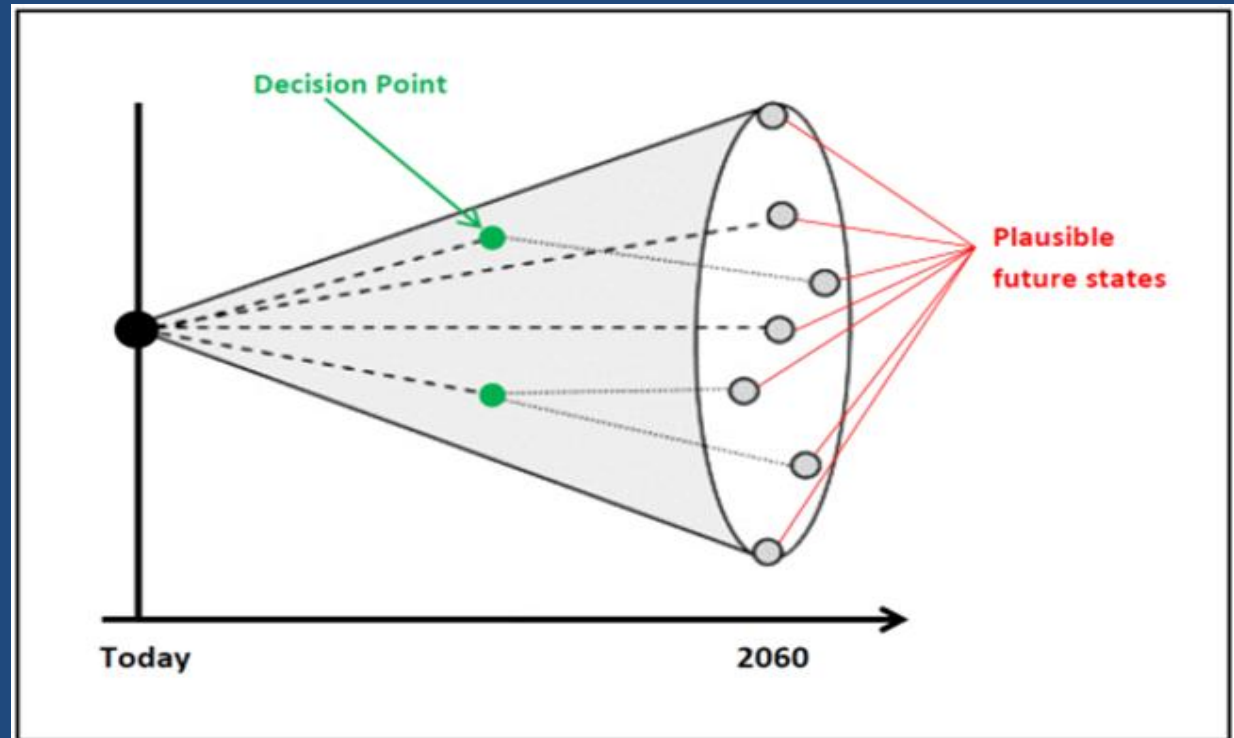
Mean Temperature, July  
NV - EXTREME SOUTHERN Climate Division



Data Source: WRCC/UI, Created: 1-21-2014

# ASSESSMENT OBJECTIVES

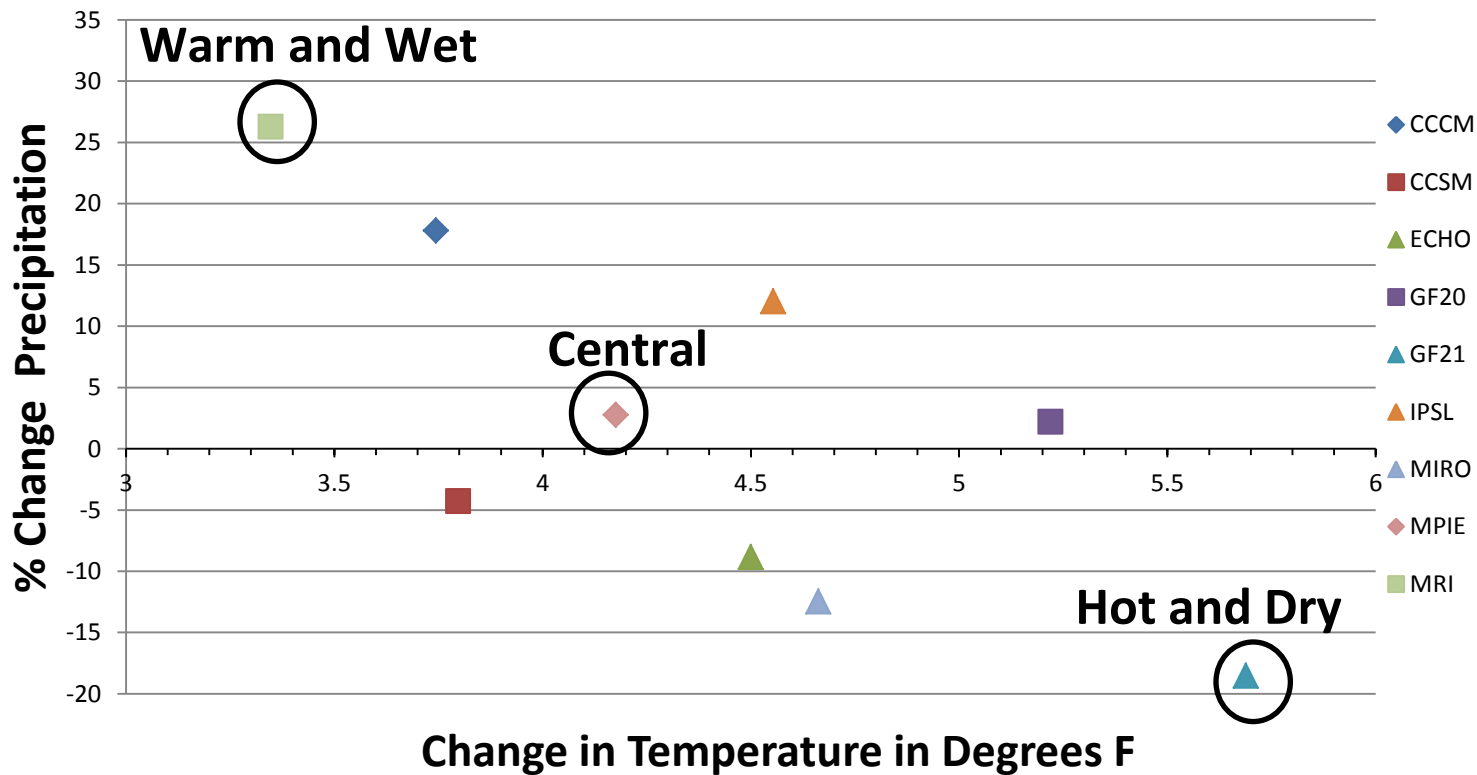
- ❑ Understand climate science
- ❑ Identify assets at risk
- ❑ Prioritize



# METHOD

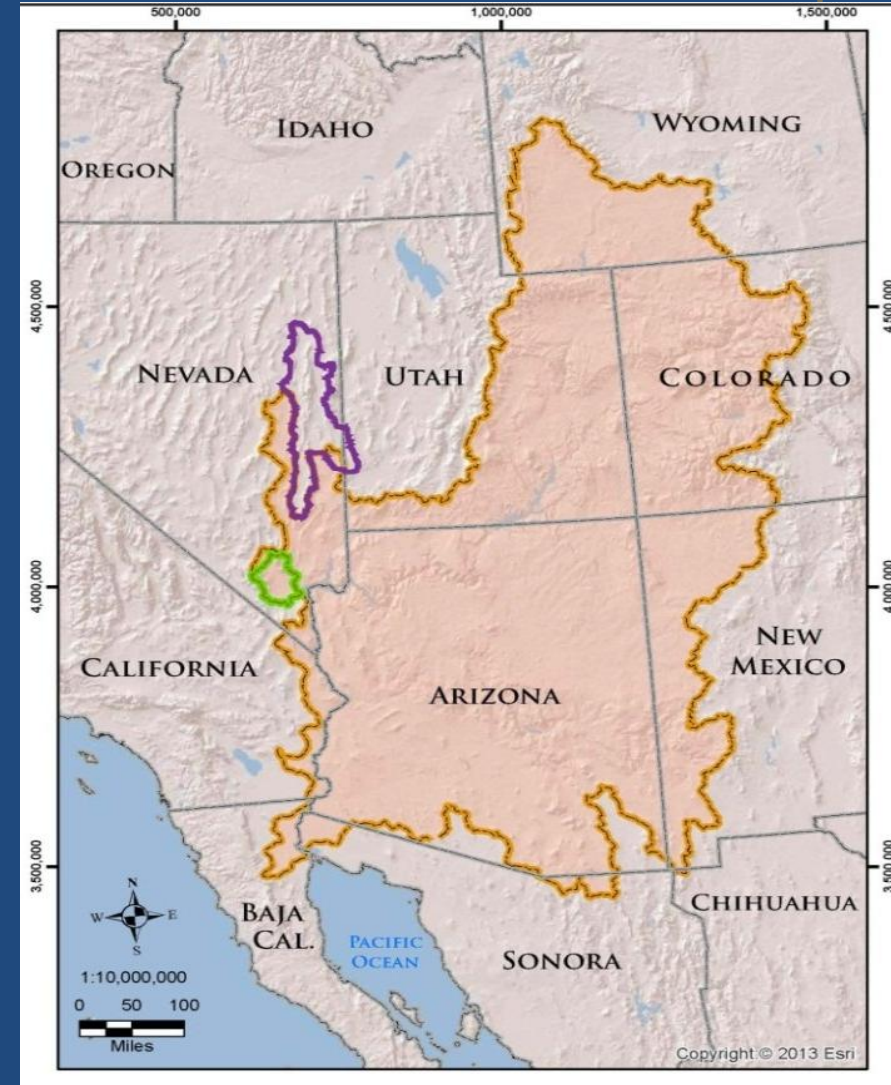
- ❑ Define Future Climate Scenarios & Time periods
- ❑ Identify Assets & Threats
- ❑ Evaluate Consequences
- ❑ Rank Likelihood
- ❑ Compare Scenario Risks

# MODEL PROJECTIONS FOR LAS VEGAS A1B Emission Scenario, 2060



# ASSESS ASSETS

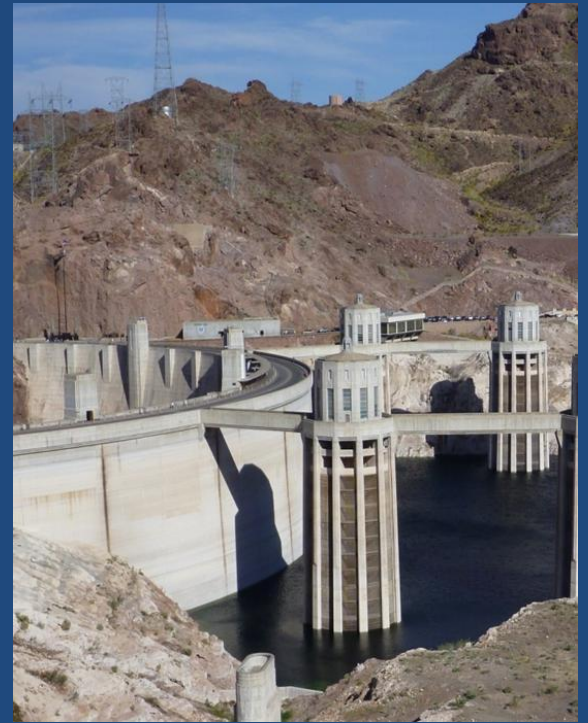
- Colorado River Supply
- Las Vegas Valley Groundwater Supply
- CLWP Groundwater Supply
- Northern Resources
- SNWA Water Intake
- SNWA Water Treatment Systems
- LVVWD Distribution System





# ASSESS THREATS

- **Lake Mead**
  - **Low Lake Levels**
  - **Extreme Low Lake Levels**
  - **Lower Raw Water Quality**
- **Warmer Water Temperature**
- **Altered Runoff Timing**
- **Reduced Groundwater Recharge**
- **Reduced Snowpack**



- **Power Grid Performance**
- **Changes in Consumptive Water Use**
- **Flooding**
- **Increase in Invasive Species**
- **Wildfire**

# ASSESSMENTS OF IMPACTS, RISKS AND VULNERABILITIES

## For Each Asset/Threat Pair:

- **Consequences (Low to Very High)**
  - Financial/Business Impacts
  - Equipment/Facility Impacts
  - Finished Water Quality and Quantity Impacts
  - Environmental Impacts
  - Public Health/Work Force Impacts
- **Likelihood of Occurrence (Low to Very High)**

**Risk Matrix = Consequences x Likelihood of Occurrence**



# RISK MATRIX CATEGORIES

## Risk Categories

	Very High	High	Very High	Very High	Maximum
Likelihood of Occurrence	High	Medium	Medium	High	Very High
	Medium	Low	Medium	Medium	Very High
	Low	Low	Low	Medium	High
	Low	Medium	High	Very High	
	Consequences				

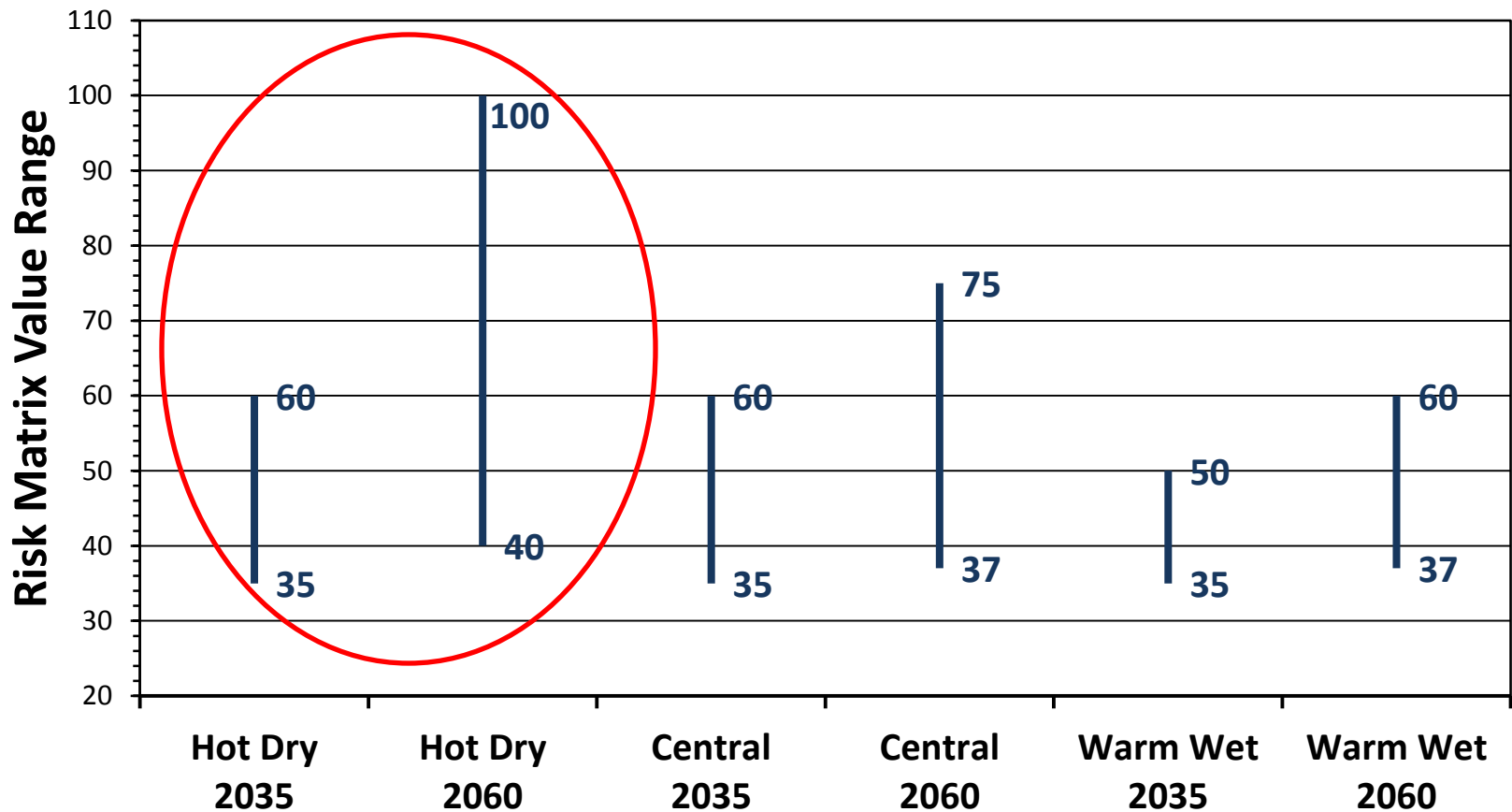


## Risk Matrix Numeric Values

	Very High	50	60	75	100
Likelihood of Occurrence	High	40	45	55	75
	Medium	37	40	45	60
	Low	35	37	40	50
	Low	Medium	High	Very High	
	Consequences				

Risk Matrix Categories translated into Numeric Values

# RESULTS: RANGE IN RISK MATRIX VALUES



Risk Matrix Values range from a minimum value = 35 to a maximum value = 100

# CLIMATE CHANGE RISKS

## 2035 HOT AND DRY

Category	Risk Matrix Values
Maximum Risk	100
Very High	60, 75
High	50, 55
Medium	40, 45
Low	35, 37

Very High		
Asset	Threat	Risk Matrix Value
Colorado River Supply	Extreme low lake (<1000')	60
SNWA Intake System	Extreme low lake (<1000')	60

High		
Asset	Threat	Risk Matrix Value
Colorado River Supply	Low lake levels (1075-1000')	55
LVVWD Distribution System	Warmer Water Temperatures	55
SNWA Intake System	Poor Power Grid Performance	55
SNWA Treatment System	Poor Power Grid Performance	55
SNWA Treatment System	Reduced water quality	55
SNWA Treatment System	Warmer Water Temperatures	55
Northern Resources	Poor Power Grid Performance	55

Medium		
Asset	Threat	Risk Matrix Value
SNWA Intake System	Invasive Species	45
SNWA Intake System	Low lake levels (1075-1000')	45
SNWA Treatment System	High flow events	45
SNWA Treatment System	Invasive Species	45
Northern Resources	Invasive Species	45
Northern Resources	Wildfire	45
LVVWD Distribution System	High flow events	40
LVVWD Distribution System	Poor Power Grid Performance	40

Low		
Asset	Threat	Risk Matrix Value
LVVWD Distribution System	Changes in residential use	35
SNWA Treatment System	Changes in residential use	35

# CLIMATE CHANGE RISKS

## 2060 HOT AND DRY

### Maximum

Asset	Threat	Risk Matrix Value
SNWA Intake System	Poor Power Grid Performance	100
SNWA Treatment System	Poor Power Grid Performance	100
SNWA Treatment System	Reduced water quality	100
SNWA Treatment System	Warmer Water Temperatures	100

Category	Risk Matrix Values
Maximum Risk	100
Very High	60, 75
High	50, 55
Medium	40, 45
Low	35, 37

### Very High

Asset	Threat	Risk Matrix Value
Colorado River Supply	Extreme low lake (<1000')	75
Colorado River Supply	Low lake levels (1075-1000')	75
LVVWD Distribution System	Warmer Water Temperatures	75
Northern Resources	Poor Power Grid Performance	75
SNWA Intake System	Extreme low lake (<1000')	75
SNWA Intake System	Low lake levels (1075-1000')	75
Clark LWP GW	Altered Runoff Timing	60
Clark LWP GW	Reduced snowpack	60
Northern Resources	Invasive Species	60
Northern Resources	Wildfire	60
SNWA Intake System	Invasive Species	60
SNWA Treatment System	Invasive Species	60

### High

Asset	Threat	Risk Matrix Value
Las Vegas Valley GW Supply	Reduced groundwater recharge	55
LVVWD Distribution System	Poor Power Grid Performance	50

### Medium

Asset	Threat	Risk Matrix Value
Las Vegas Valley GW Supply	Changes in residential use	45
SNWA Treatment System	High flow events	45
Clark LWP GW	Reduced groundwater recharge	45
LVVWD Distribution System	Changes in residential use	40
LVVWD Distribution System	High flow events	40
SNWA Treatment System	Changes in residential use	40

## SUMMARY

- **If climate warms according to the Hot and Dry scenario, SNWA/LVVWD will have significant risk from climate impacts.**
- **Risk increases from 2035 to 2060 in all scenarios if no adaptation measures are put in place.**
- **To be risk averse, adaptation planning should continue assuming the more pessimistic Hot and Dry climate scenario.**

# SUMMARY

**Adaptation Planning should focus on reducing the risks from**

- **Extreme Low Lake Levels, leading to impacts on:**
  - Colorado River Supply,
  - SNWA Water Intake System, and
- **Reduced Water Quality, from a rise in nutrients in:**
  - SNWA Water Treatment System
- **Warmer Water Temperatures, leading to the formation of THMs in:**
  - LVVWD Distribution System
  - SNWA Water Treatment System
- **Poor Power Grid Reliability, affecting:**
  - SNWA Water Intake System
  - SNWA Water Treatment System
  - Northern Resources





## NEXT STEPS

- **Adaptation Planning Process**
- **Target *Next* Water Resource Plan Review/Update Process to Incorporate Climate Change**

QUESTIONS?





# Climate Resilience Evaluation and Awareness Tool



File View Administration Resources Process Steps Help

Home
 Tools
 Climate
 Setup
 Threats
 Assets
 Baseline Analysis
 Resilience Analysis
 Adaptation Planning
 Results & Reports

Asset Tree

All Assets

Assets > Scenarios > Threats

WWTP Reservoir Location

CREAT Categories

- Natural Resource
- Surface Water

Adaptation Planning Summary Adaptive Measures Adaptation on Packages Review Packages

### Adaptation Planning Summary

This summary screen shows an overview of the material covered in the Adaptation Planning tab, and will be populated as you work through the steps in this tab. Lists and details of packages are provided with summary statistics related to risk reduction and costs of implementation. The graph to the right provides a visual comparison of package costs and benefits. A summary of adaptive measures defined by category is also shown below.

#### Adaptation Packages

Package Name	Package ID	Description				
<b>Modernization Plan</b>	<b>Moder</b>					
Adaptive Measure	Cap. Costs	Op. Costs	2015	2035	Total RRUs	
Combined sewer overflow strategies	\$25,000	\$100,000	3.5	10.9	30.8	
Energy efficiency improvements	\$200,000	\$10,000	1.5	4.2	11.2	
Green infrastructure in community	\$25,000	\$25,000	0.0	0.0	12.8	
Increased capacity – wastewater / storm water	\$2,500,000	\$150,000	0.0	0.9	7.2	
<b>Storm Protection</b>	<b>Storm</b>					
Adaptive Measure	Cap. Costs	Op. Costs	2015	2035	Total RRUs	
Green infrastructure at facility	\$250,000	\$10,000	0.0	0.0	11.3	
Sea-level rise and storm surge models	\$50,000	\$2,500	0.0	5.0	12.5	
Silt removal	\$10,000	\$25,000	0.0	3.0	6.8	
Sump pumps (WWTP)	\$15,000	\$1,000	0.0	5.0	22.5	
<b>WWTP Focus</b>	<b>WWTP</b>					
Adaptive Measure	Cap. Costs	Op. Costs	2015	2035	Total RRUs	

#### Selected Package

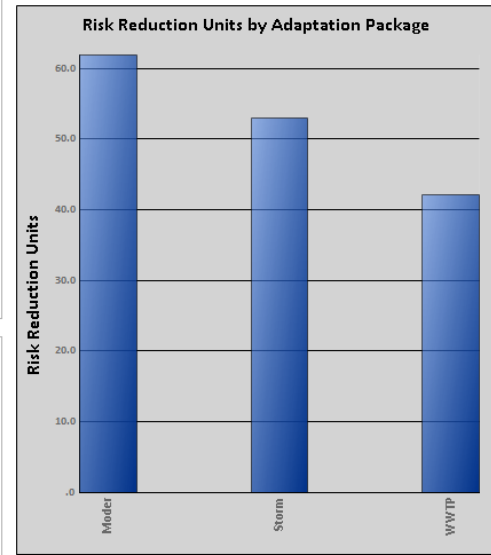
# of Assigned Measures: 4

Annualized Costs: \$560,000

Capital Costs: \$2,750,000

Risk Reduction Units: 62.0

RRUs displayed are the total for all locations, scenarios, and time periods



#### Adaptive Measure Summary

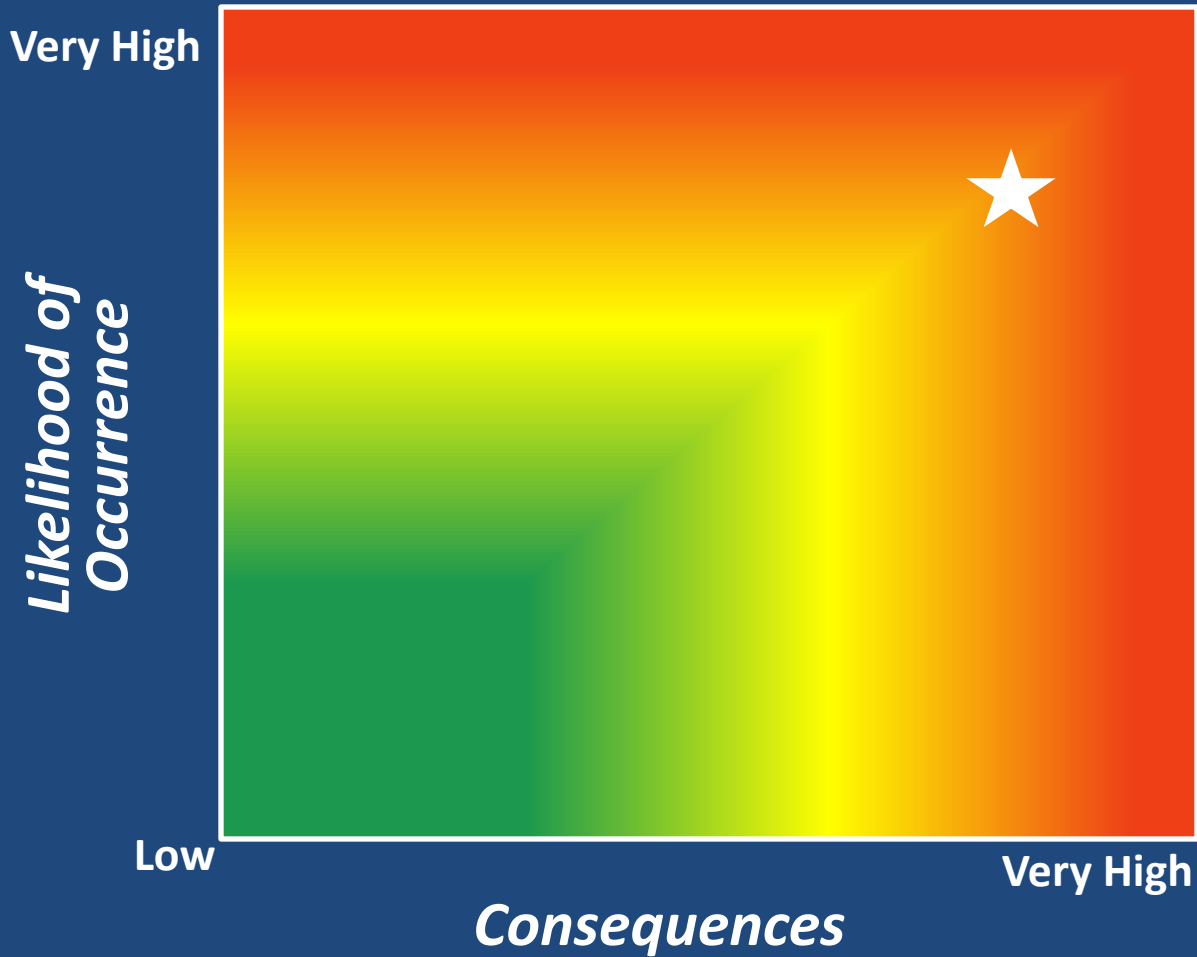
		Existing	Potential
Expanded Operating Flexibility	Options to expand operational flexibility to meet the changed operating parameters driven by the climate threat.	3	2
Expanded Capacity	Some systems can operate beyond design or current capacity without making large changes to the system.	2	4
Alternative Strategies	After the existing system reaches the limit of its capacity to absorb climate impacts, it becomes necessary to expand the system	2	3

Previous

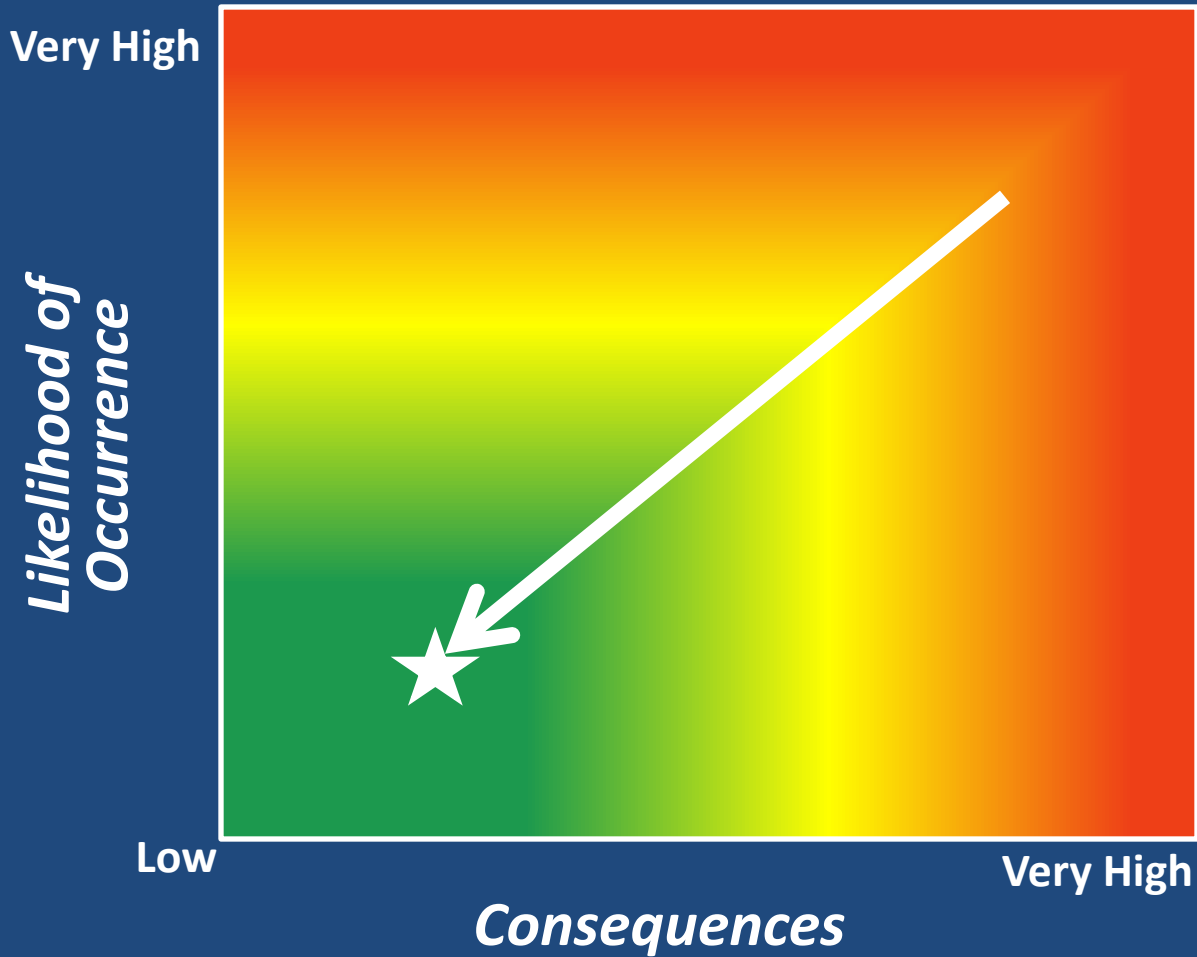
Next

# RISK

## CONSEQUENCES X LIKELIHOOD OF OCCURRENCE



# RISK REDUCTION – ADAPTION PLANNING



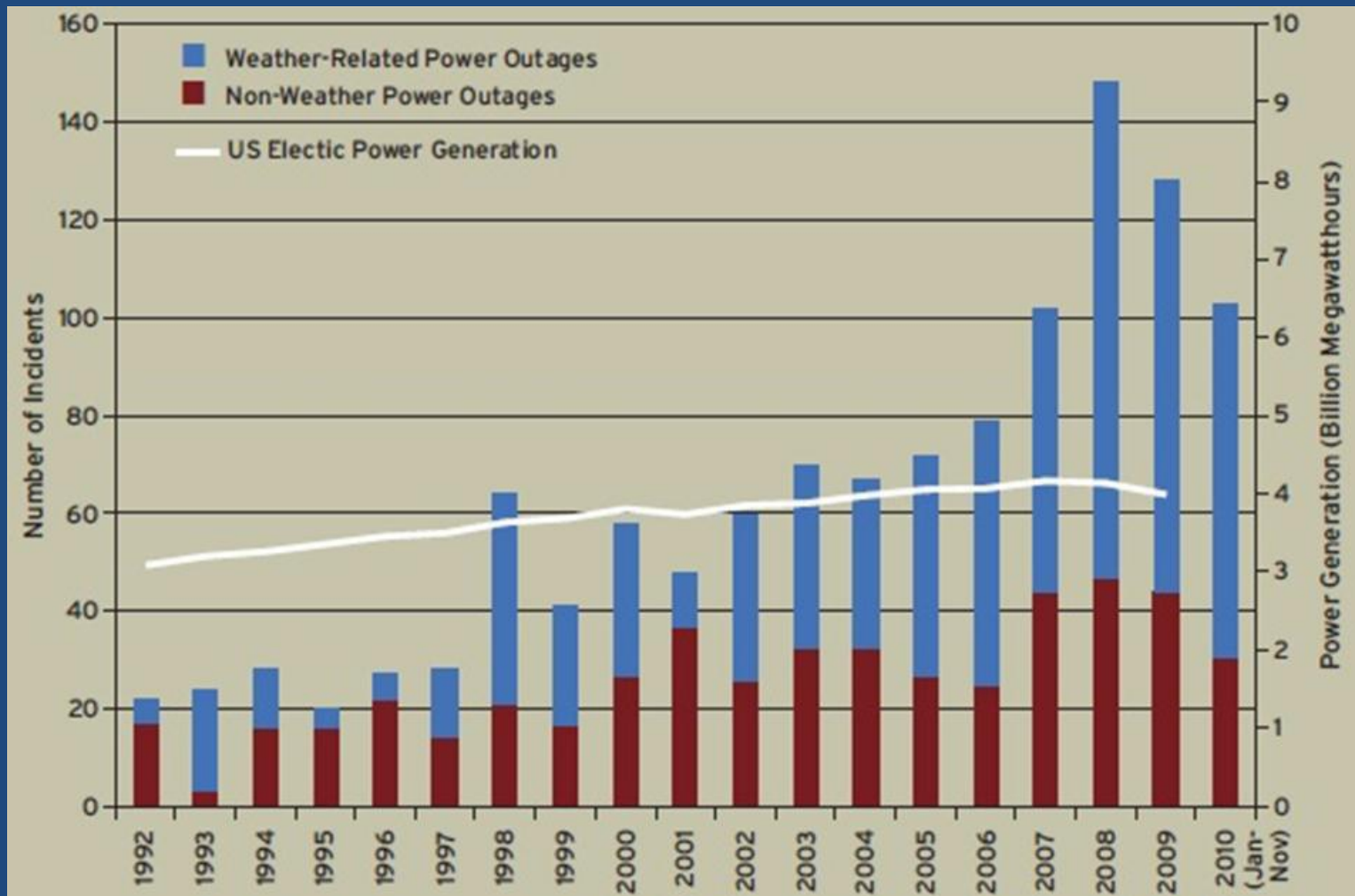


# ADAPTATION PLANNING . . . .

Asset/Threat Pair Addressed	Name	Description
Water Supply/Low Lake	Additional Demand Management Locally	Demand management to achieve beyond existing SNWA conservation goals to counteract the effects of climate change and maintain our GPCD goal (currently at 199).
Water Supply/Low Lake	Additional Water Resource Acquisition, beyond CLWP GWP	To include permitting additional groundwater applications, purchase of existing water rights, etc. (Lake lowers to 1,050 feet)
Water Supply/Low Lake	CRBS options for CR System Benefit	Work towards utilizing collaborative arrangement for development of viable options through the CRBS process to resolve Colorado River imbalances.
Water Supply/Low Lake	Interim Colorado River Resources	Continue to bank Intentionally Created Surplus (ICS) on the River; continue to pursue banking NV's unused apportionment on the River; conjunctive management of resources.
Water Supply/Low Lake	CRBS options for NV Benefit	Pursue the permanent Colorado River Augmentation options for Nevada.
Water Supply/Low Lake	Mobile barge to draw water	Potential short term option only / only if pumping solution via through intake #3 is not possible.
Water Supply/Low Lake	Replacement of IPS#1 to maintain desired pumping capacity.	Excavation and installation of pumping units [at Intake site] to provide pumping capacity between lake elevation 900 and 1000 ft
Water Supply/Low Lake	Optimize Well Use and Other Sources of Supply (MX5) and Northern Resource System	Use alternate water sources, already developed, to increase resiliency of water supply to shortages in Colorado River Supply. Managing levels of withdrawal/use and blending to preserve water quality.
Water Supply/Low Lake	Continue Leakage Reduction Program	Advance the leak detection efforts using Asset Management protocol
Water Supply/Low Lake	Colorado River System model improvement	Support continued development of Colorado River System models to further enhance understanding of climate change impacts on Colorado River water supply and Lake Mead elevations.



# WEATHER RELATED POWER OUTAGES



Source: National Wildlife Federation, 2011, based on data from North American Electric Reliability Corporation and the U.S. Energy Information Administration.

# RISK MATRIX NUMERIC ASSIGNMENTS

Likelihood of Occurrence	Very High	50	60	75	100
	High	40	45	55	75
	Medium	37	40	45	60
	Low	35	37	40	50
		Low	Medium	High	Very High
		Consequences			

**Risk Matrix = Consequences x Likelihood of Occurrence**

# CRITERIA TO ASSESS CONSEQUENCES

Category	Business Impacts	Operational/ Equipment Damage	Finished Water Impacts	Environmental Impacts	Public Health/Work Force Impact
<b>Description</b>	Revenue or operating income loss	Cost of replacing service or equipment	Quantity and Quality	Resource loss and compliance with environmental regulations	Duration and spatial extent of impacts
<b>Very High</b>	> \$5M	> \$5M	>> 20 KAF loss for >3+ years	Long term regulatory non-compliance	Long term and widespread
<b>High</b>	\$5M-1M	\$5M-1M	20 KAF loss for <3 years	Persistent environmental damage - may incur regulatory action	Short term and localized
<b>Medium</b>	\$100k-\$1M	\$100k-\$1M	< 20 KAF	Short-term -compliance can be quickly restored	Minor public health impacts
<b>Low</b>	< \$100k	< \$100k	Minor, short term	No and low impact	No and low impact

# LIKELIHOOD OF THREATS

	Hot & Dry		Central		Warm & Wet	
	Threat Likelihood		Threat Likelihood		Threat Likelihood	
Threats	2035	2060	2035	2060	2035	2060
Lower lake levels (1000'-1075')	High	Very High	Medium	High	Low	Medium
Extreme low lake level (below 1000')	Medium	High	Low	Medium	Low	Low
Poor power grid performance	High	Very High	Medium	High	Medium	High
Warmer water temperatures	High	Very High	Medium	High	Medium	High
Reduced water quality	High	Very High	Medium	High	Medium	High
Changes in consumptive use	NA	High	NA	Medium	NA	High
High flow events	High	High	High	High	High	High
Invasive species	High	Very High	Medium	High	Low	Medium
Reduced groundwater recharge (both CLWP and Las Vegas Valley)	NA	High	NA	High	NA	Medium
Runoff timing	High	Very High	Medium	High	Low	Medium
Reduced snowpack	High	Very High	Medium	High	Low	Medium
Wildfire	High	Very High	Medium	High	Low	Medium

# DESCRIPTION OF LEVEL OF LIKELIHOOD

Likelihood of Occurrence Levels	Description <sup>1</sup>
<b>Very High</b>	Occurrence within the time frame is expected
<b>High</b>	Occurrence within the time frame is likely
<b>Medium</b>	Occurrence within the time frame is less likely
<b>Low</b>	Possible, but unlikely to occur within the time frame.


<sup>1</sup>Ranking levels are subjective determinations and are not explicitly based on percent likelihood.

# CLIMATE CHANGE PROGRAM – NATIONAL ACTIVITIES

- EPA
- AMWA
- AWWA
- WRF
- WUCA

## Water Utility Climate Alliance

43 million drinking water customers



Seattle Public Utilities

Portland Water Bureau

San Francisco Public Utilities Commission

Metropolitan Water District of So. California

San Diego County Water Authority

Southern Nevada Water Authority

Denver Water

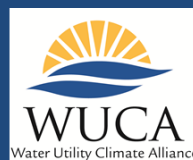
Central Arizona Project

New York City Department of Environmental Protection

Tampa Bay Water

[Mission Statement](#)

The Water Utility Climate Alliance provides leadership in assessing and adapting to the potential effects of climate change through collaborative action. We seek to enhance the usefulness of climate science for the adaptation community and improve water management decision-making in the face of climate uncertainty.





# CLIMATE CHANGE PROGRAM – REGIONAL AND LOCAL ACTIVITIES

- Colorado River Supply and Demand Study
- Las Vegas Valley
  - UNLV/DRI
  - Southern Nevada Regional Planning Coalition
- SNWA
  - Vulnerability Assessment
  - Adaptation Planning
  - Water Resource Plan Update

