IRP Member Agency Technical Workgroup

Draft Results
August 3, 2015

IRP Member Agency Workgroup Process

- April 2015
  - IRP/RUWMP Kick-off 4/8
  - Water Use Efficiency Meeting 4/16
  - Uncertainty 4/22
- May 2015
  - Imported Supplies 5/18
  - Water Use Efficiency Meeting 5/20
  - Groundwater (1 of 2) 5/27
- June
  - Groundwater (2 of 2) 6/11
  - Water Use Efficiency Meeting 6/18
  - Local Resources (1 of 2) 6/24

IRP Member Agency Workgroup Process

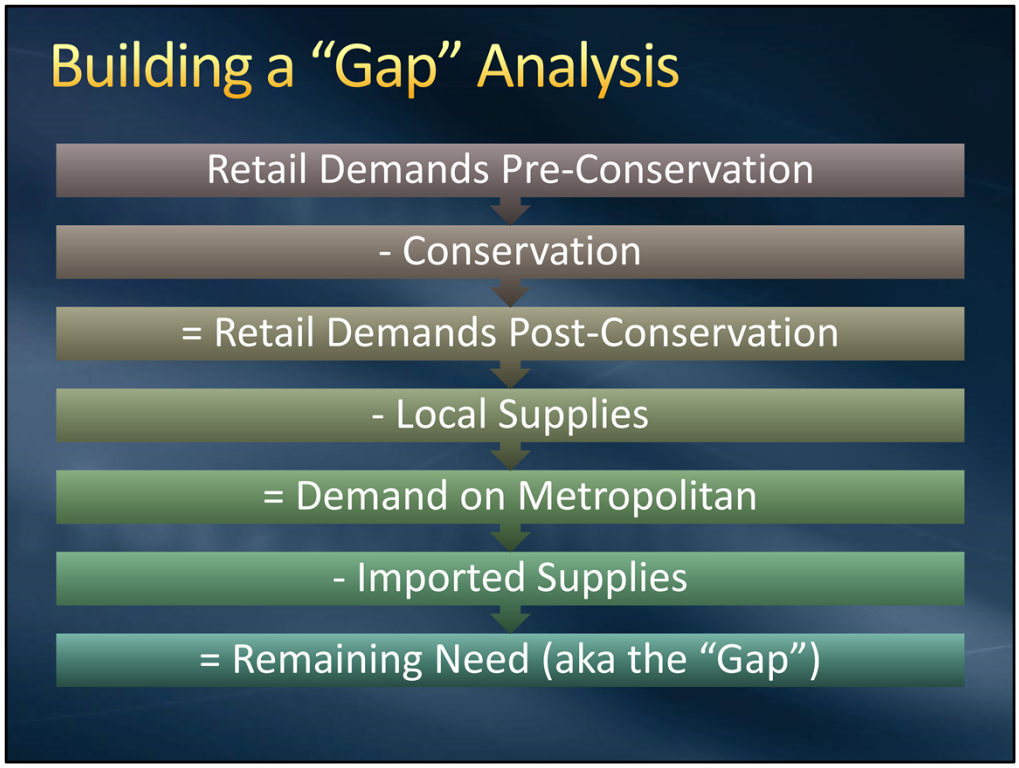
- July 2015
  - Local Resources (2 of 2) 7/8
  - Water Use Efficiency Meeting 7/16
  - Retail Demands and Conservation 7/22
- August 2015
  - Draft Results 8/3

Presentation Overview

- Meeting objectives
- Draft forecasts & existing conditions “gap” analysis
- Draft existing conditions water balance analysis
- Draft IRP Issue Paper Addendum
- Next steps


Draft IRP Forecasts
& "Gap" Analysis

Building a "Gap" Analysis



Retail Demands

Total Retail Demands

Key Assumptions

- Updated demographic forecasts
  - SCAG RTP 12
  - SANDAG Series 13
- Retail M&I Demand
  - New econometric model
- Agency provided demand forecasts
  - Agricultural
  - Seawater Barrier
  - Replenishment

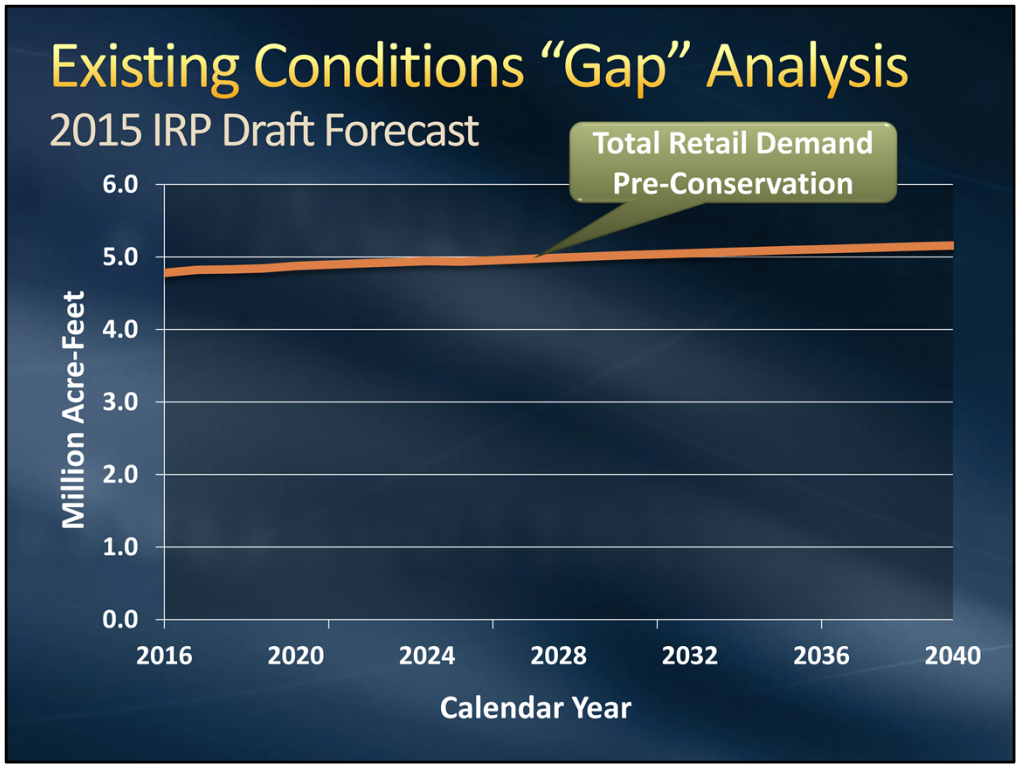
Total Retail Demand Pre-Conservation

Historical and Projected

Total Retail Demand Pre-Conservation (Million Acre-Feet)				
2020	2025	2030	2035	2040
4.88	4.94	5.02	5.09	5.16

Existing Conditions "Gap" Analysis

2015 IRP Draft Forecast



Conservation Savings

Conservation Savings

Key Assumptions

- Active and Code Based Conservation
  - Calculated in Conservation Savings Model
  - Forecast of active spending through FY 2015/16
- Price Effect Conservation
  - Embedded in econometric retail demand model
- System Loss Conservation
  - Savings from avoided system losses
  - Agency UWMP reported percent system loss

Conservation Savings*

Projected on 1990 Base Year

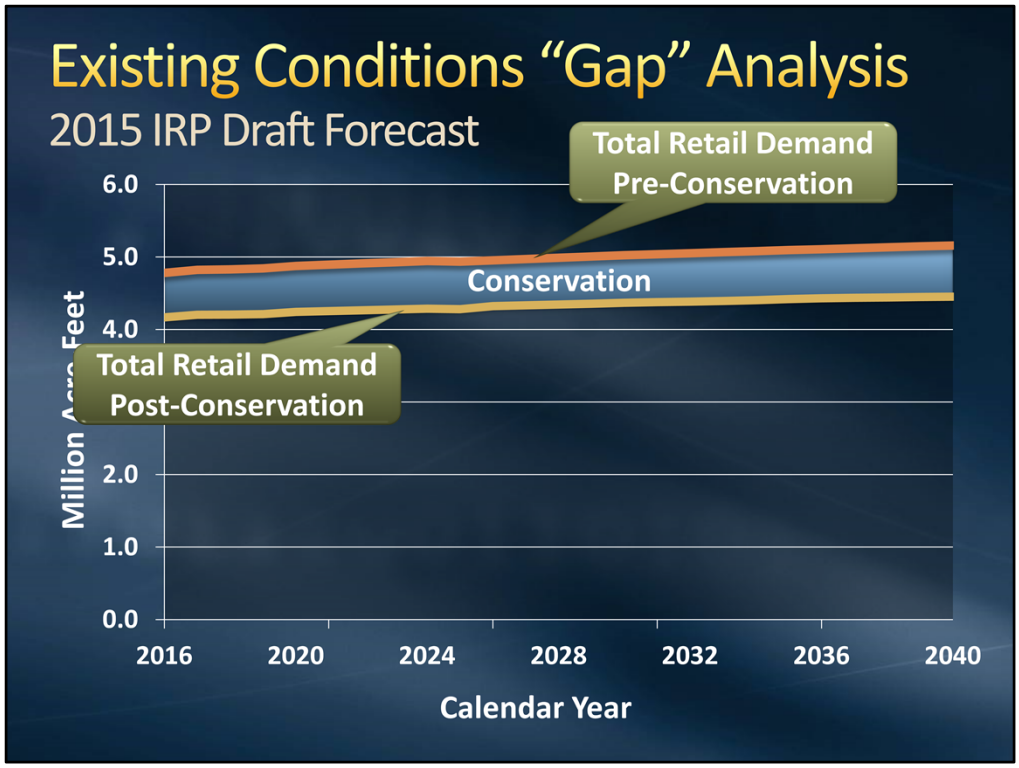
Conservation Savings* (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
551	658	655	675	705

*Does not include conservation from Price Effect

Retail Demands Post-Conservation

Historical and Projected

Total Retail Demand Post- Conservation (Million Acre-Feet)				
2020	2025	2030	2035	2040
4.24	4.28	4.37	4.42	4.45


Existing Conditions "Gap" Analysis
2015 IRP Draft Forecast
Total Retail Demand
Pre-Conservation
Conservation
Total Retail Demand
Post-Conservation
Million Acre-Feet
6.0
5.0
4.0
2.0
1.0
0.0
2016
2020
2024
2028
2032
2036
2040
Calendar Year

Local Supplies

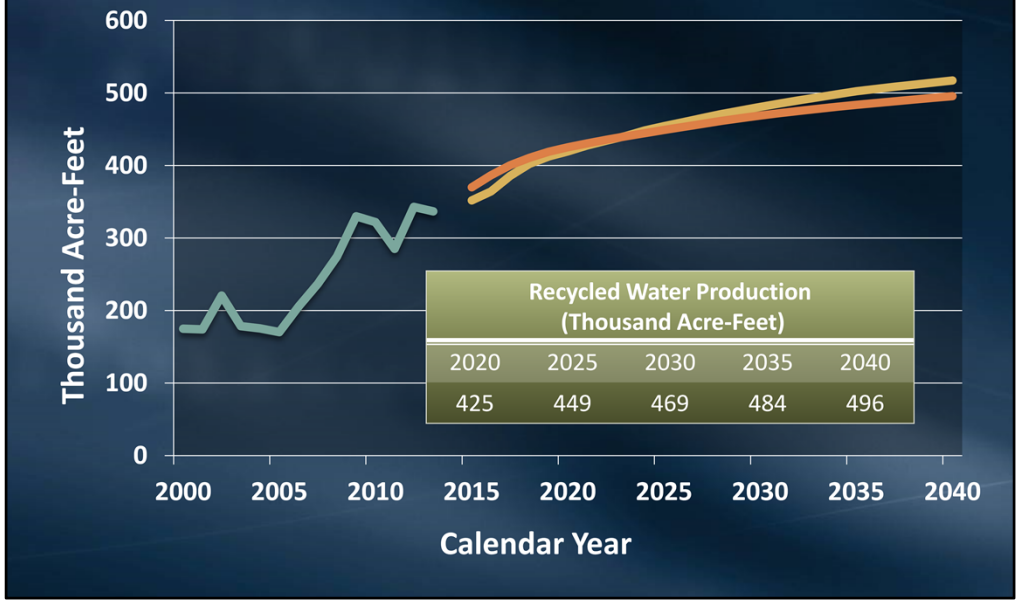
Recycled Water

Key Assumptions

- Existing projects based on observed annual growth rate
- Under construction projects based on regression modeling
  - Varies by project size
  - Indirect Potable Reuse forecasted separately
- Future projects are not included in forecast

Recycled Water Production

Historical and Projected



Recycled Water Production (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
425	449	469	484	496

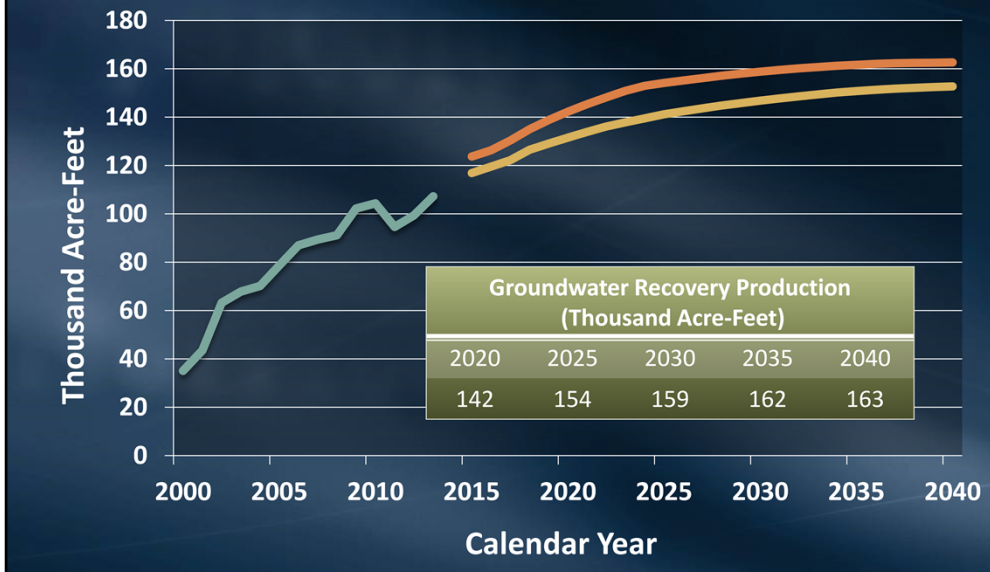
Groundwater Recovery

Key Assumptions

- Existing projects based on observed annual growth rate
- Under construction projects based on regression modeling
- Future projects are not included in forecast

Groundwater Recovery Production

Historical and Projected



Groundwater Recovery Production (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
142	154	159	162	163

Seawater Desalination

Key Assumptions

- No existing projects
- Under construction projects include Carlsbad facility
  - Dry year = 100%
  - Normal year = 93%
  - Wet year = 86%
- Future projects are not included in forecast

Seawater Desalination Production

Historical and Projected

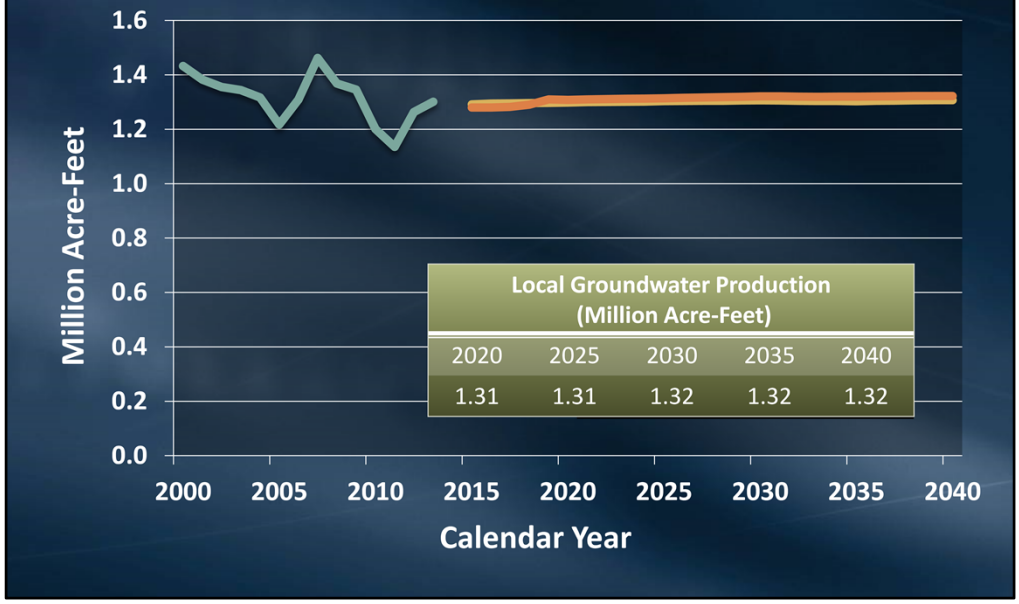
Local Groundwater

Key Assumptions

- Member Agency input
- Orange County Basin assumed 70% BPP for 2015-18 and 75% BPP thereafter
- Adjudicated basins based on 2009-13 averages
- Sustainable production
- Basin operating safe yield
- Supported by storm, recycled, and imported water

Local Groundwater Production

Historical and Projected



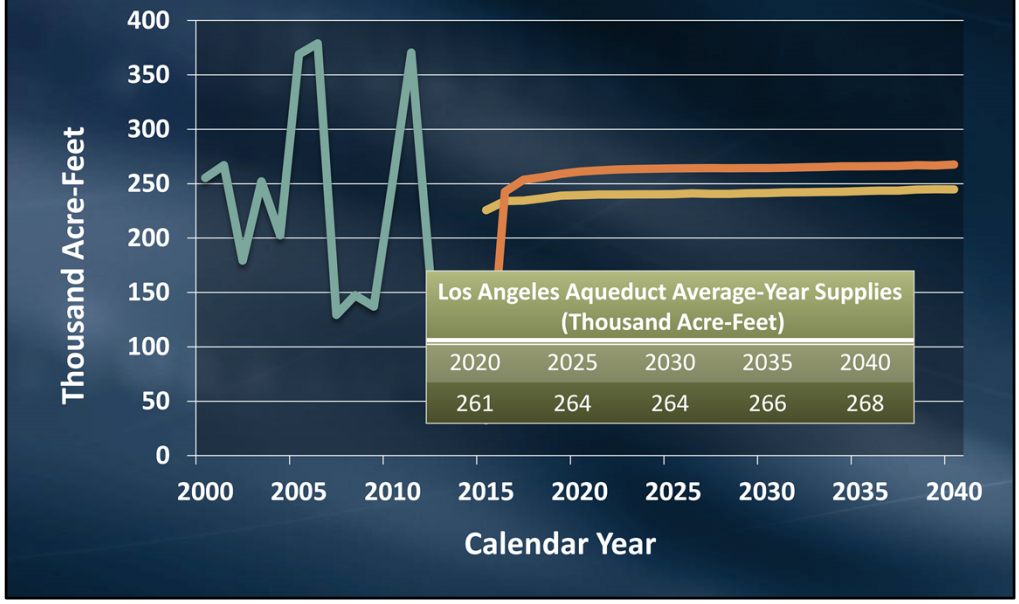
Local Groundwater Production (Million Acre-Feet)				
2020	2025	2030	2035	2040
1.31	1.31	1.32	1.32	1.32

Los Angeles Aqueduct
Key Assumptions

- Los Angeles Aqueduct Simulation Model
  - LADWP provided forecast
- 1922-2012 hydrology

LAA Average-Year Supplies

Historical and Projected



Los Angeles Aqueduct Average-Year Supplies (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
261	264	264	266	268

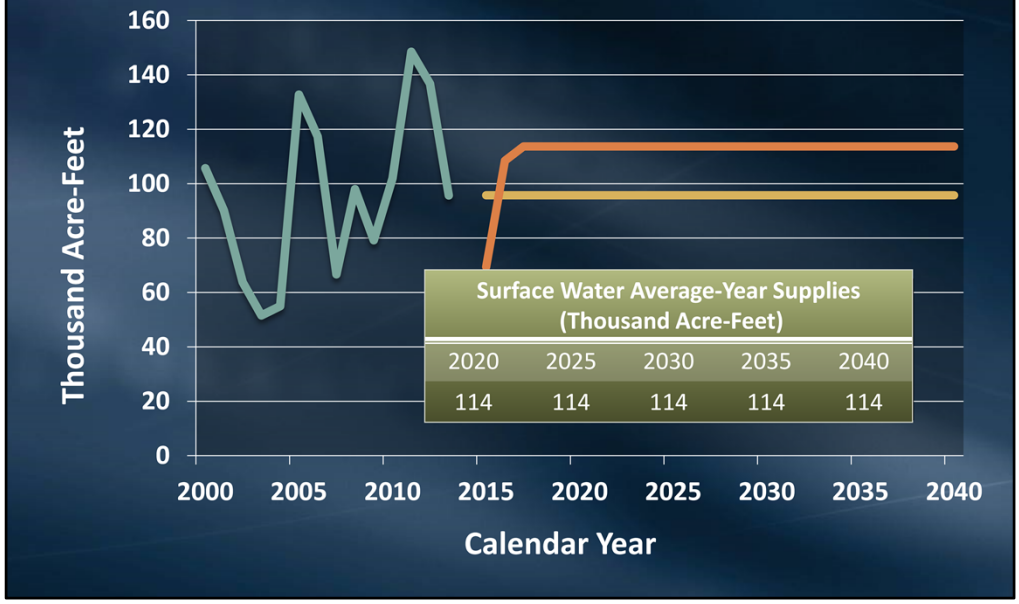
Surface Water

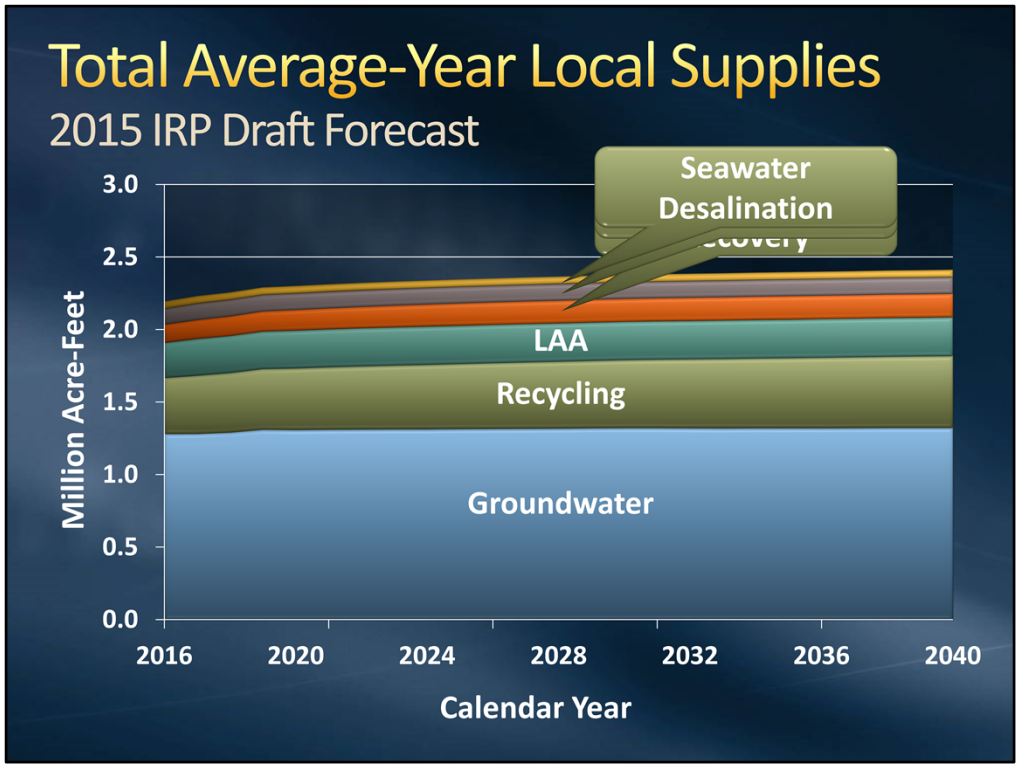
Key Assumptions

- Member Agency input
- SDCWA reservoir production based on regression model using 91 observed hydrologies
- Other reservoirs based on 2009-2013 average

Surface Water Average-Year Supplies

Historical and Projected

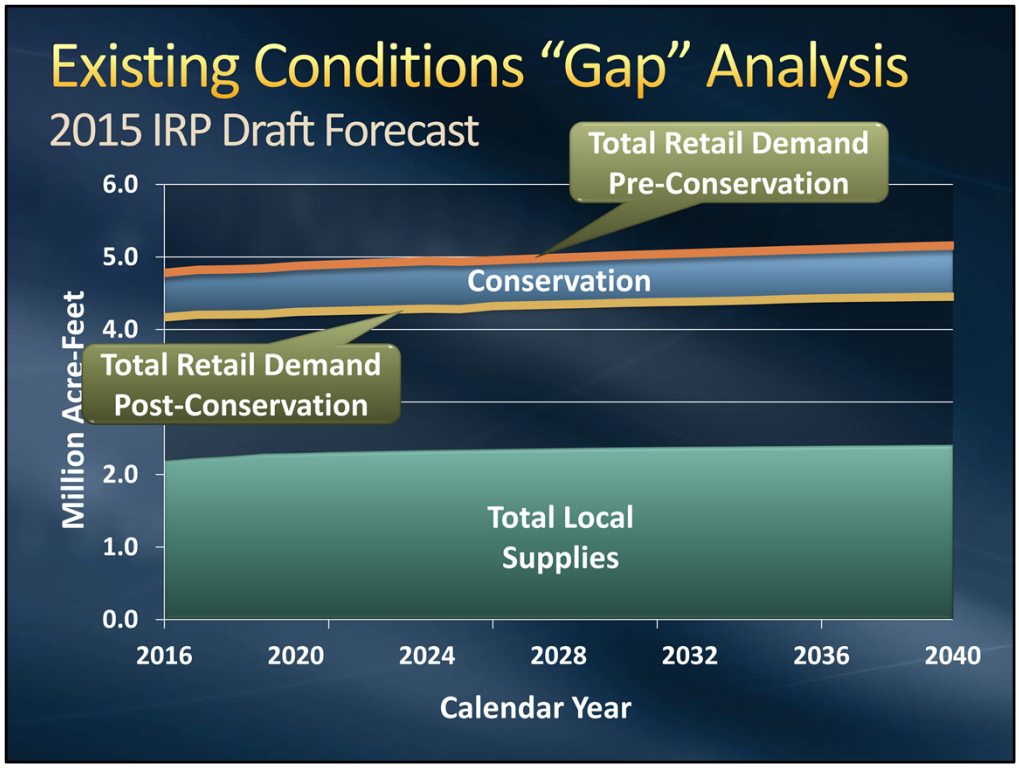



Total Average-Year Local Supplies
2015 IRP Draft Forecast
Seawater Desalination
LAA
Recycling
Groundwater
Million Acre-Feet
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2016
2020
2024
2028
2032
2036
2040
Calendar Year

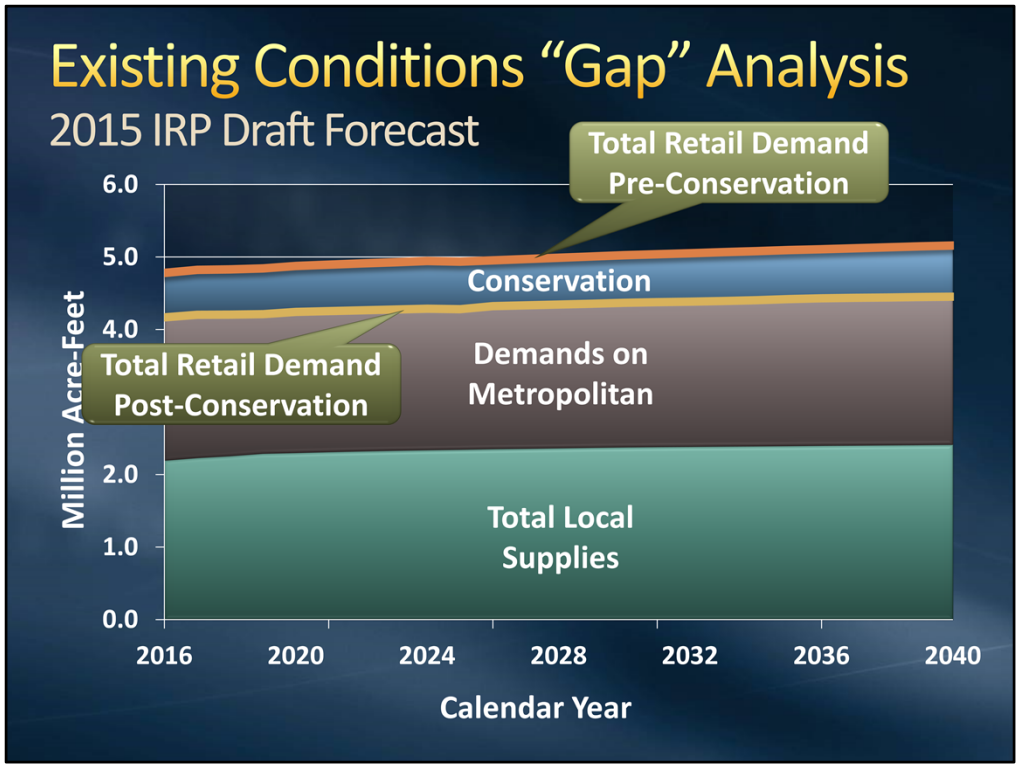
Total Average-Year Local Supplies

2015 IRP Draft Forecast

Total Local Supplies (Million Acre-Feet)				
2020	2025	2030	2035	2040
2.30	2.35	2.38	2.40	2.41

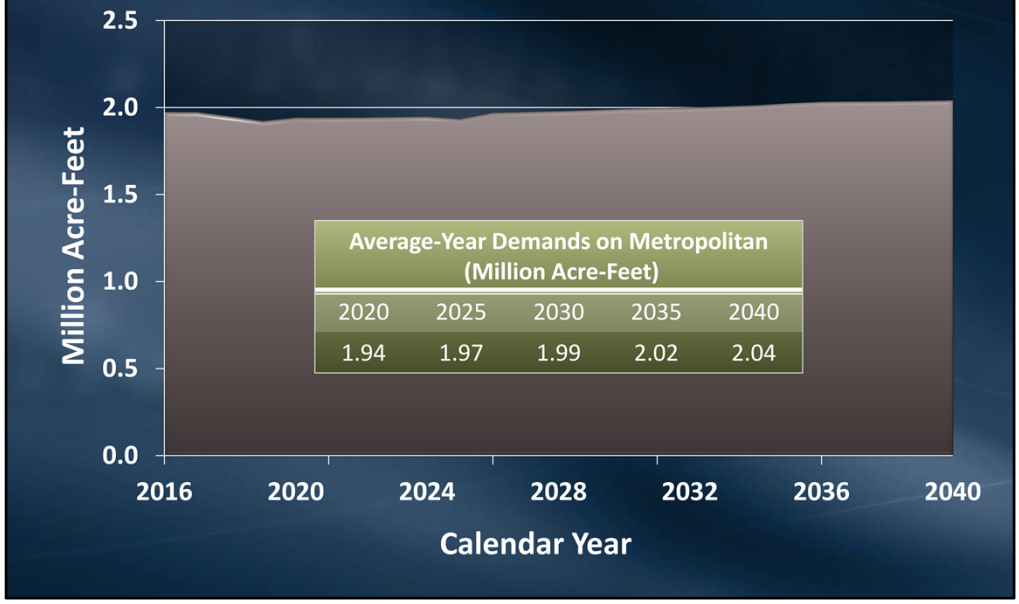

Existing Conditions "Gap" Analysis
2015 IRP Draft Forecast
Total Retail Demand Pre-Conservation
Conservation
Total Retail Demand Post-Conservation
Total Local Supplies
Million Acre-Feet
6.0
5.0
4.0
2.0
1.0
0.0
2016
2020
2024
2028
2032
2036
2040
Calendar Year

Demands on Metropolitan


Existing Conditions "Gap" Analysis
2015 IRP Draft Forecast
Total Retail Demand Pre-Conservation
Conservation
Demands on Metropolitan
Total Retail Demand Post-Conservation
Total Local Supplies
Million Acre-Feet
6.0
5.0
4.0
2.0
1.0
0.0
2016
2020
2024
2028
2032
2036
2040
Calendar Year

Existing Conditions Demand on MWD

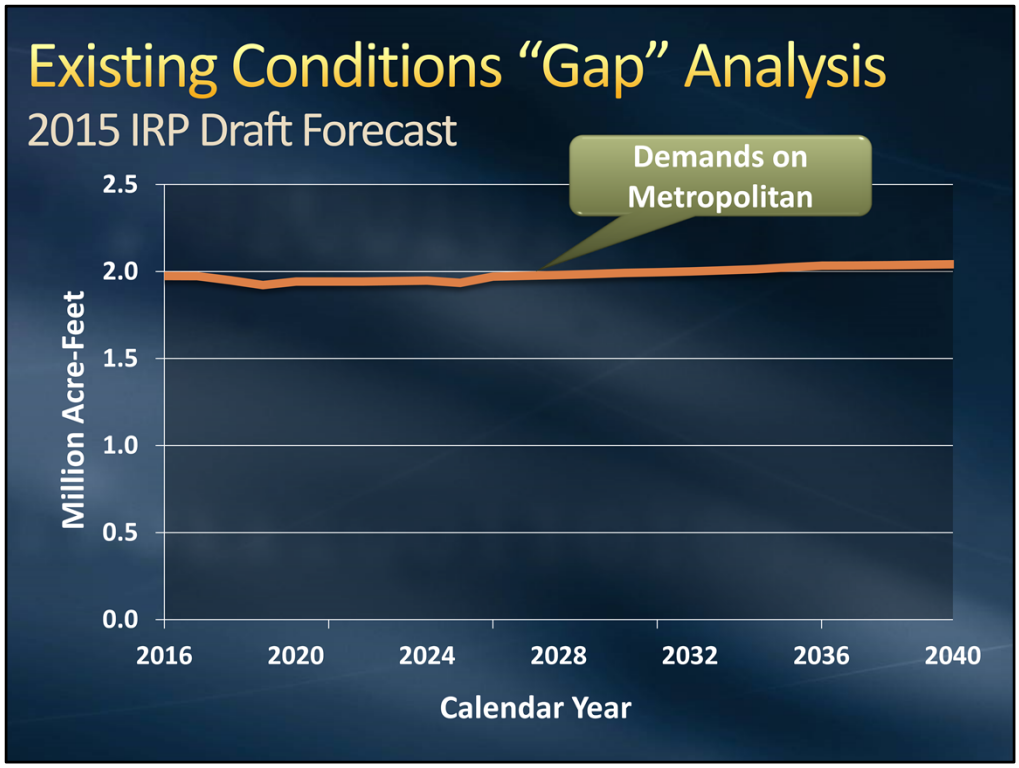
2015 IRP Draft Forecast



Average-Year Demands on Metropolitan (Million Acre-Feet)				
2020	2025	2030	2035	2040
1.94	1.97	1.99	2.02	2.04

Existing Conditions "Gap" Analysis

2015 IRP Draft Forecast

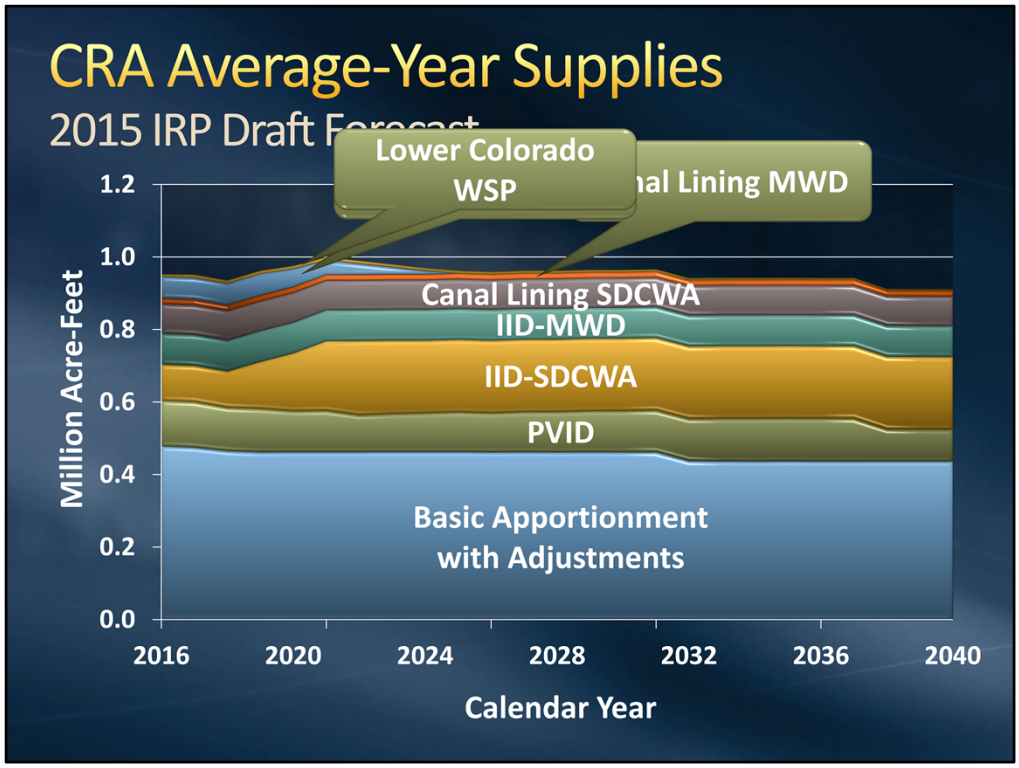


Imported Supplies

Colorado River Aqueduct Supplies

Key Assumptions

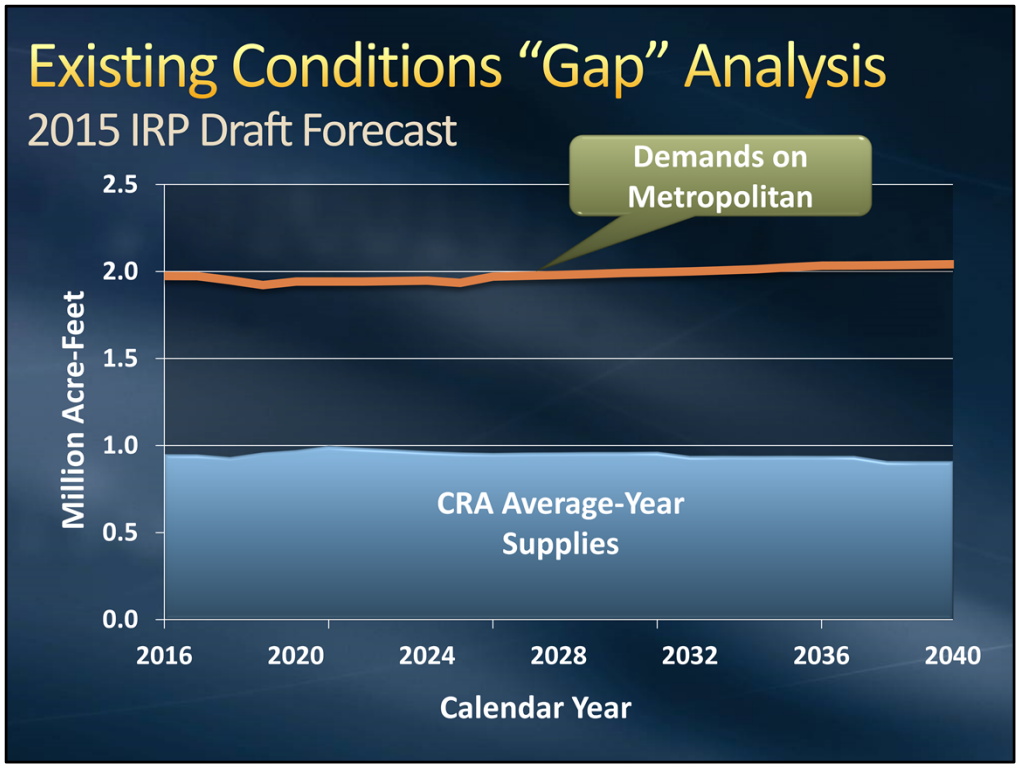
- Includes Basic Apportionment, current programs, and adjustments
  - Programs and adjustments build according to QSA schedule
  - Current USBR study with 1922-2012 hydrology
- CRA supplies that vary by hydrology are model results
  - PVID, CVWD 35TAF Transfer, Etc.


CRA Average-Year Supplies
2015 IRP Draft Forecast
Lower Colorado WSP
Canal Lining MWD
Canal Lining SDCWA
IID-MWD
IID-SDCWA
PVID
Basic Apportionment with Adjustments
Million Acre-Feet
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2016
2020
2024
2028
2032
2036
2040
Calendar Year

CRA Average-Year Supplies

2015 IRP Draft Forecast

CRA Average-Year Supplies (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
976	962	965	943	912

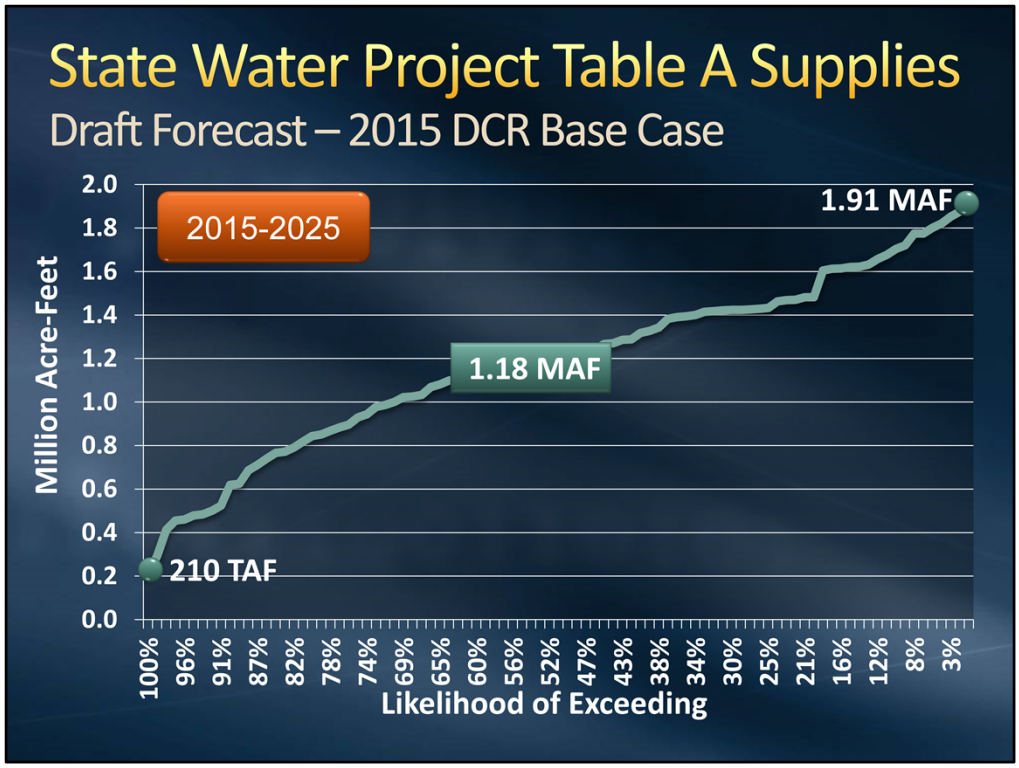

Existing Conditions "Gap" Analysis
2015 IRP Draft Forecast
Demands on Metropolitan
CRA Average-Year Supplies
Million Acre-Feet
2.5
2.0
1.5
1.0
0.5
0.0
2016
2020
2024
2028
2032
2036
2040
Calendar Year

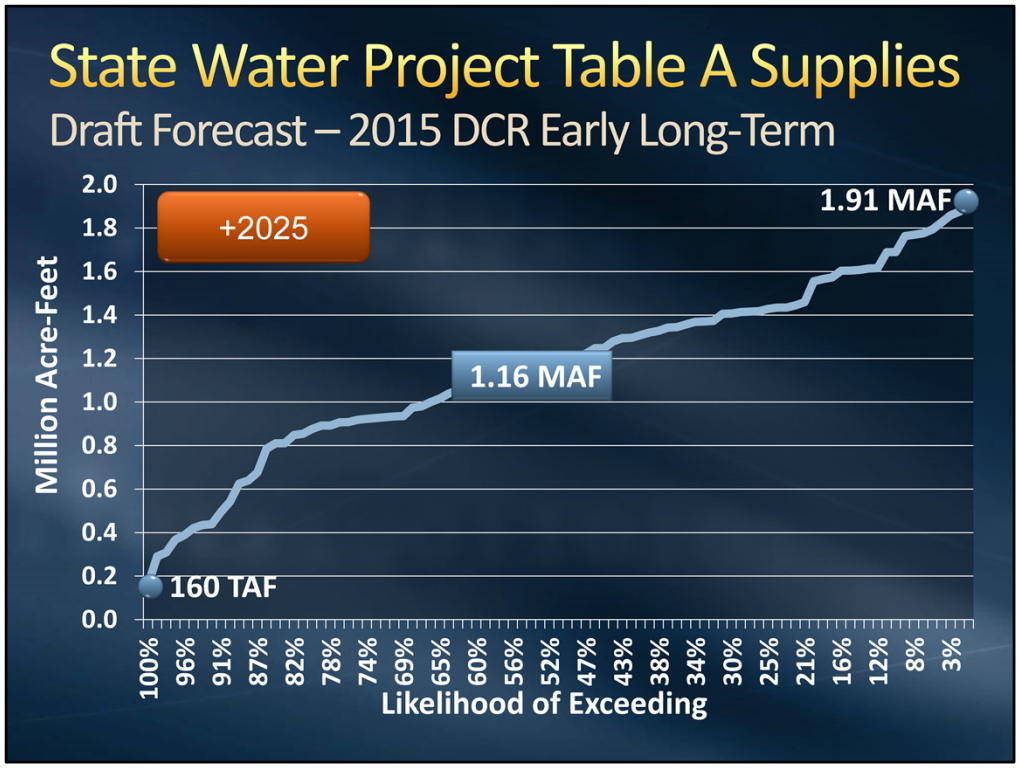
State Water Project Supplies
Key Assumptions

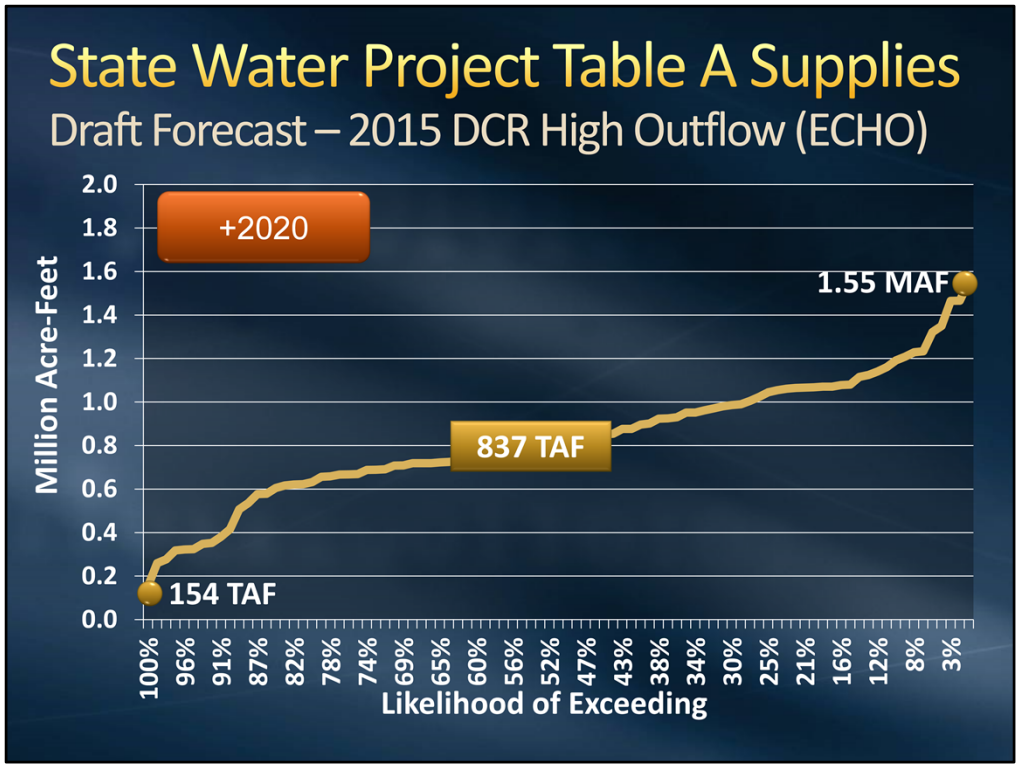
- 2015 DWR Draft Delivery Capability Report
  - Base Case
  - Early Long-Term (ELT)
  - Existing Conveyance High Outflow (ECHO)
- California Water Fix
  - Alternative 4a
- Extended modeled hydrology to 1922-2012
  - Regression Analysis

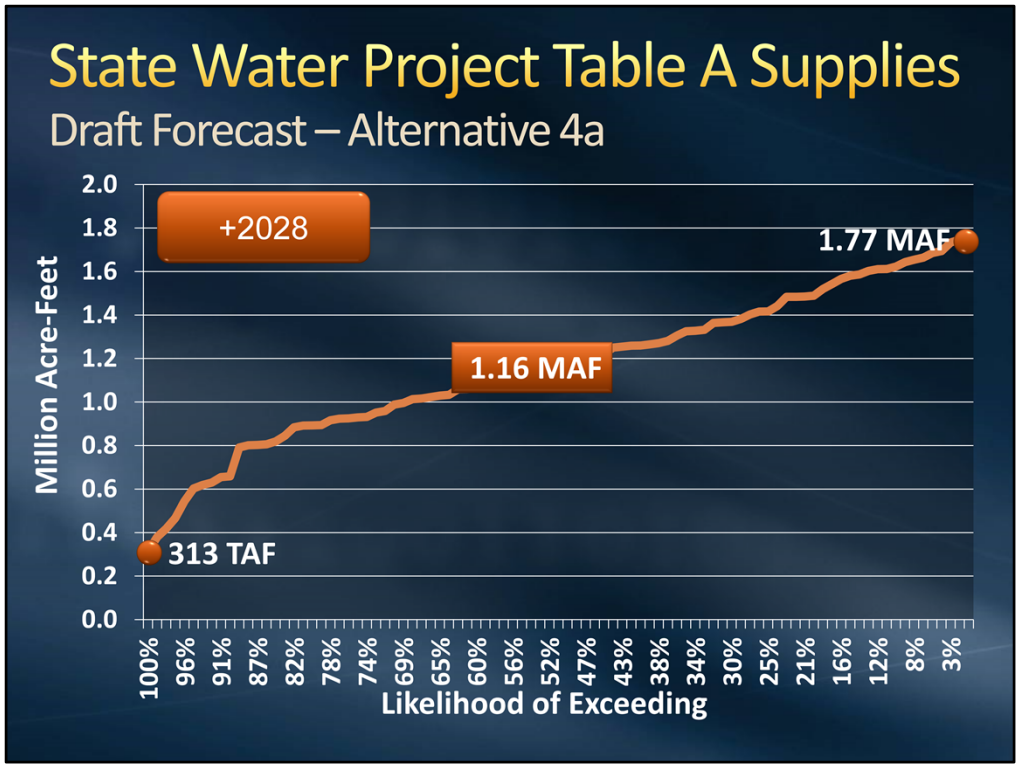
State Water Project Supplies
Key Assumptions

- Existing Conveyance
  - 2016-2019 Base Case declines to ELT
  - 2020-2040 ECHO
- California Water Fix
  - 2016-2027 Base Case declines to ELT
  - 2028-2040 Alternative 4a


State Water Project Table A Supplies
Draft Forecast – 2015 DCR Base Case
2015-2025
1.91 MAF
1.18 MAF
210 TAF
Million Acre-Feet
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
100%
96%
91%
87%
82%
78%
74%
69%
65%
60%
56%
52%
47%
43%
38%
34%
30%
25%
21%
16%
12%
8%
3%
Likelihood of Exceeding

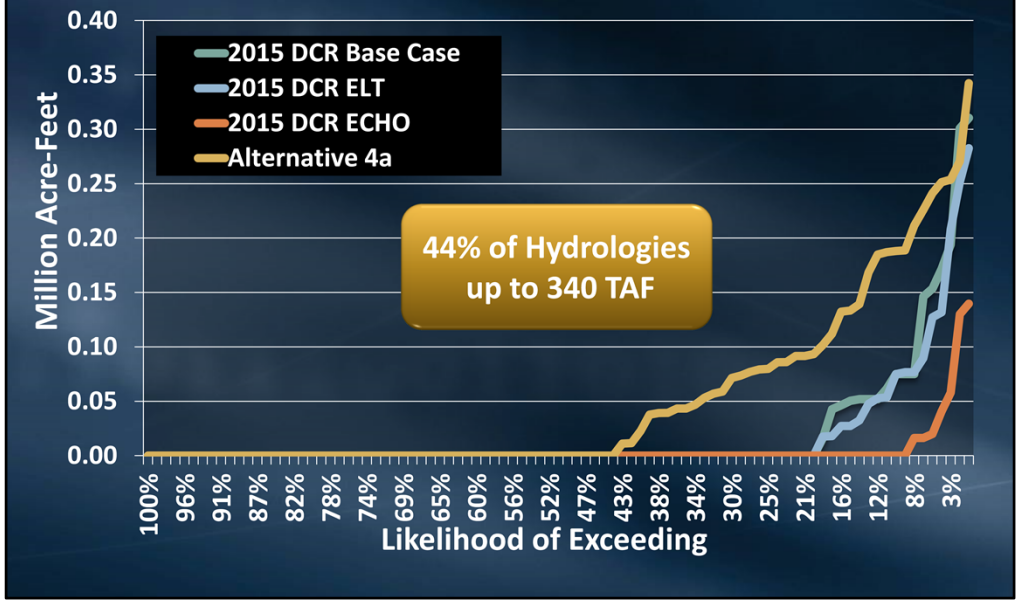

State Water Project Table A Supplies
Draft Forecast – 2015 DCR Early Long-Term
+2025
1.91 MAF
1.16 MAF
160 TAF
Million Acre-Feet
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
100%
96%
91%
87%
82%
78%
74%
69%
65%
60%
56%
52%
47%
43%
38%
34%
30%
25%
21%
16%
12%
8%
3%
Likelihood of Exceeding

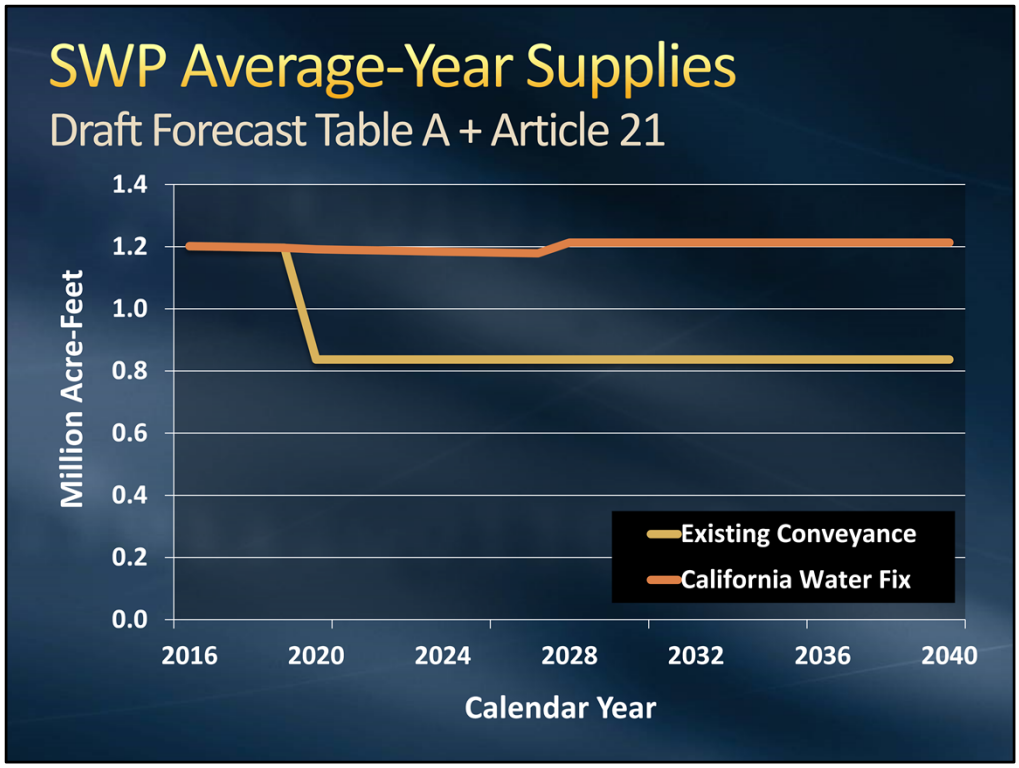

State Water Project Table A Supplies
Draft Forecast – 2015 DCR High Outflow (ECHO)
+2020
1.55 MAF
837 TAF
154 TAF
Million Acre-Feet
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
100%
96%
91%
87%
82%
78%
74%
69%
65%
60%
56%
52%
47%
43%
38%
34%
30%
25%
21%
16%
12%
8%
3%
Likelihood of Exceeding


State Water Project Table A Supplies
Draft Forecast – Alternative 4a
+2028
1.77 MAF
1.16 MAF
313 TAF
Million Acre-Feet
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
100%
96%
91%
87%
82%
78%
74%
69%
65%
60%
56%
52%
47%
43%
38%
34%
30%
25%
21%
16%
12%
8%
3%
Likelihood of Exceeding

State Water Project Article 21 Supplies

Draft Forecast

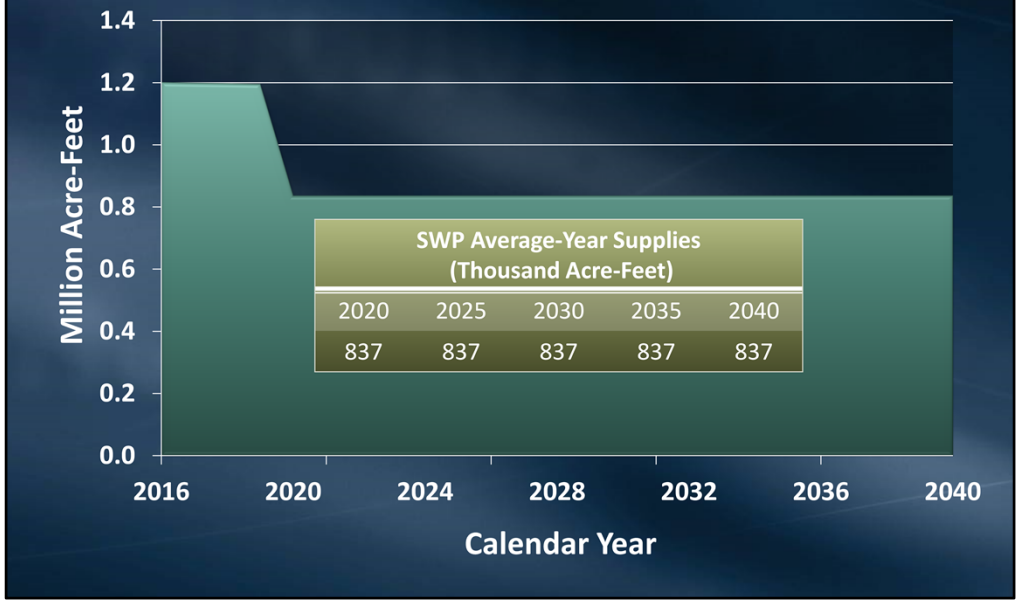




Use the 580 and the new 230 and show the growth in actual for rec and conservation

SWP Average-Year Supplies

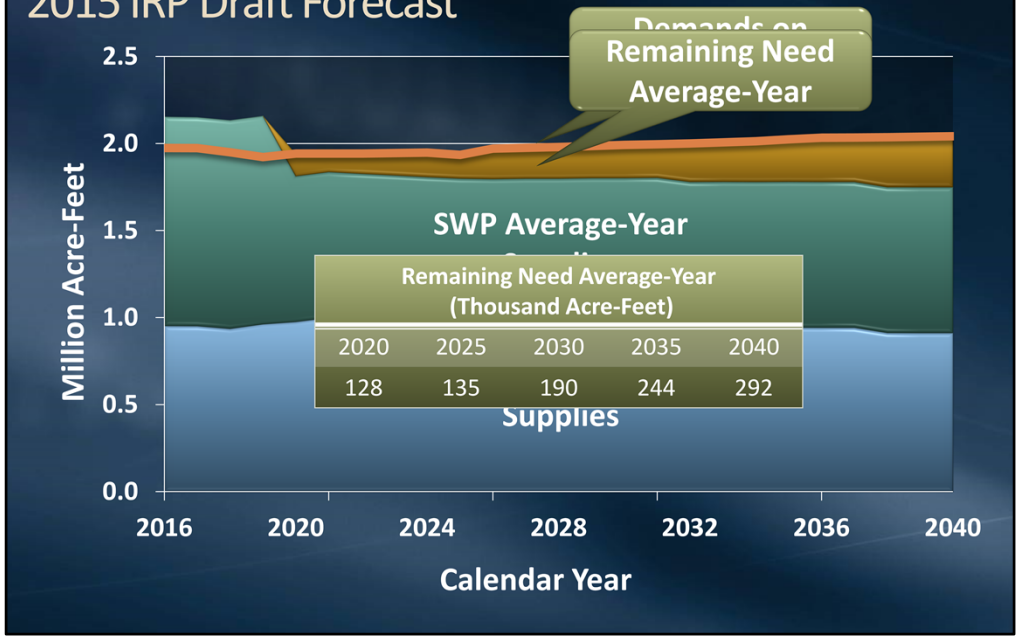
2015 IRP Draft Forecast



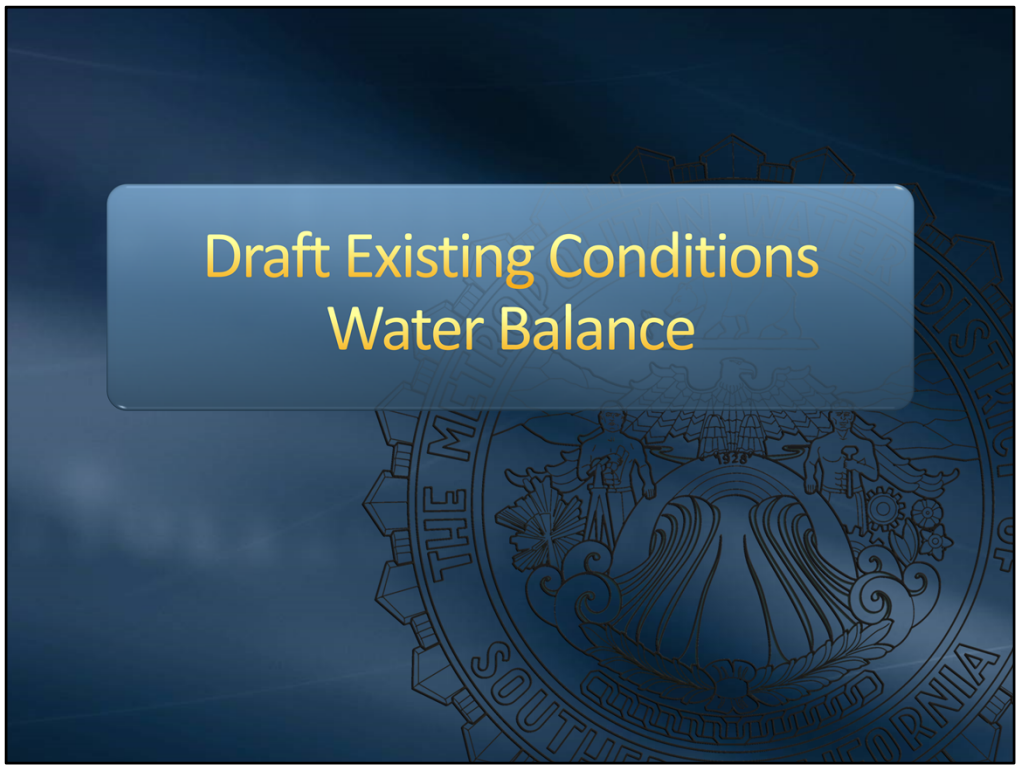
SWP Average-Year Supplies (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
837	837	837	837	837

Existing Conditions "Gap" Analysis

2015 IRP Draft Forecast



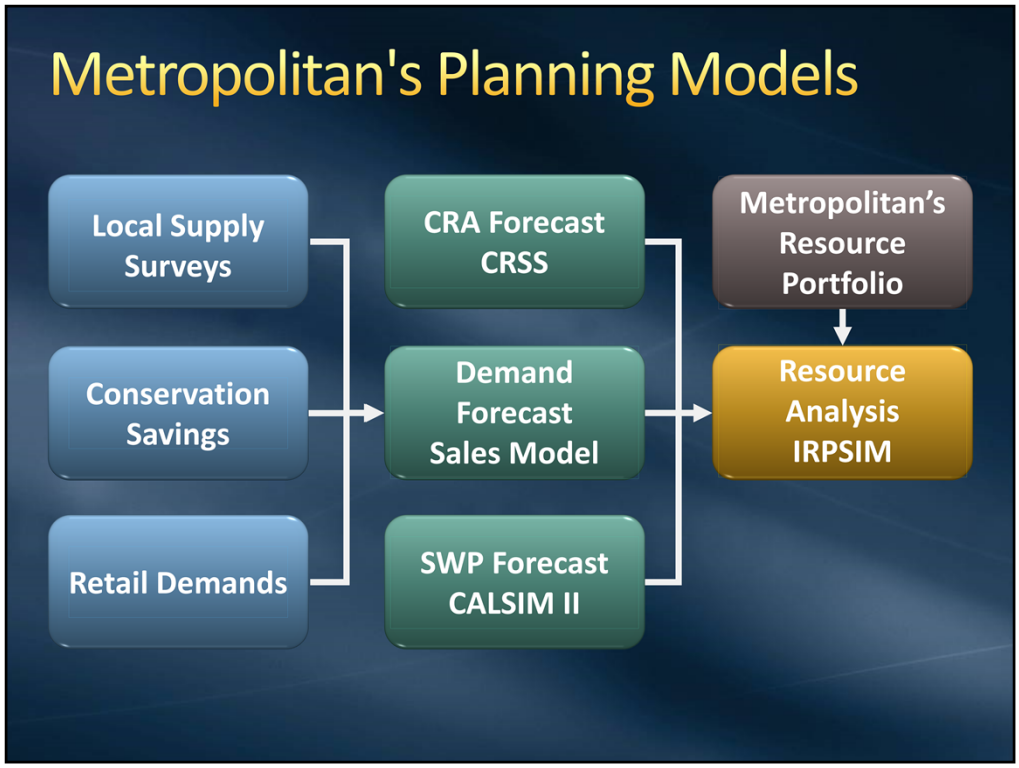
Remaining Need Average-Year (Thousand Acre-Feet)				
2020	2025	2030	2035	2040
128	135	190	244	292


Draft Existing Conditions
Water Balance

Building a Water Balance Analysis

Additional Needs for Building a Water Balance Analysis

- Forecasts of supplies and demands by hydrology
- A modeling tool that can:
  - Integrate hydrology based forecasts
  - Operate a storage and transfer portfolio
  - Maintain a sequential time series
- Defined reliability measures

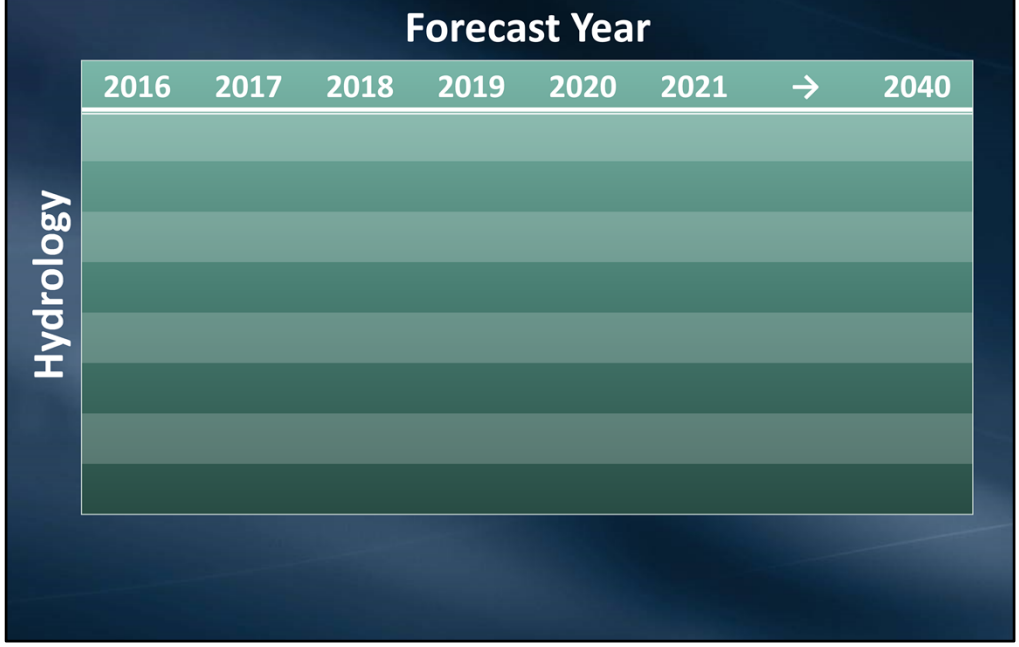

Metropolitan's Planning Models
Local Supply Surveys
Conservation Savings
Retail Demands
CRA Forecast CRSS
Demand Forecast Sales Model
SWP Forecast CALSIM II
Metropolitan's Resource Portfolio
Resource Analysis IRPSIM

Hydrologic Impacts

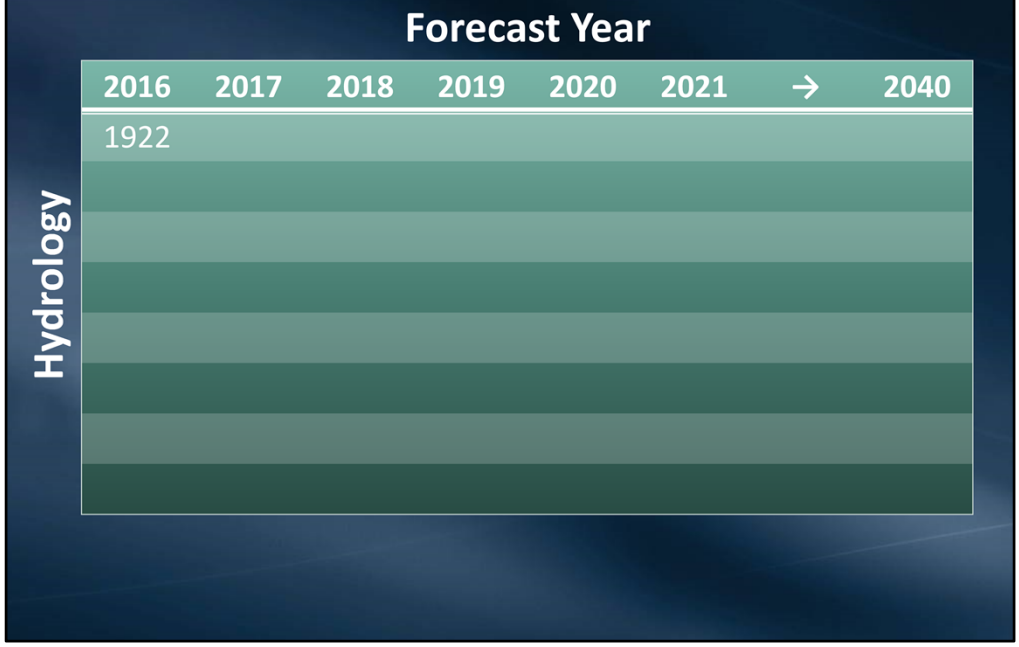
Generalized Hydrology Impacts

	Wet	Dry
Retail Demand	↓	↑
Conservation	↔	↔
Recycling	↔	↔
Groundwater Recovery	↔	↔
Seawater Desalination	↓	↑
Groundwater	↑	↓
Surface Water	↑	↓
Los Angeles Aqueduct	↑	↓
State Water Project	↑	↓
Colorado River Aqueduct	↔	↔

How IRPSIM Uses Hydrology



How IRPSIM Uses Hydrology



How IRPSIM Uses Hydrology

Forecast Year

2016	2017	2018	2019	2020	2021	→	2040
1922	1923	1924	1925	1926	1927	→	1947

Hydrology

How IRPSIM Uses Hydrology

Forecast Year

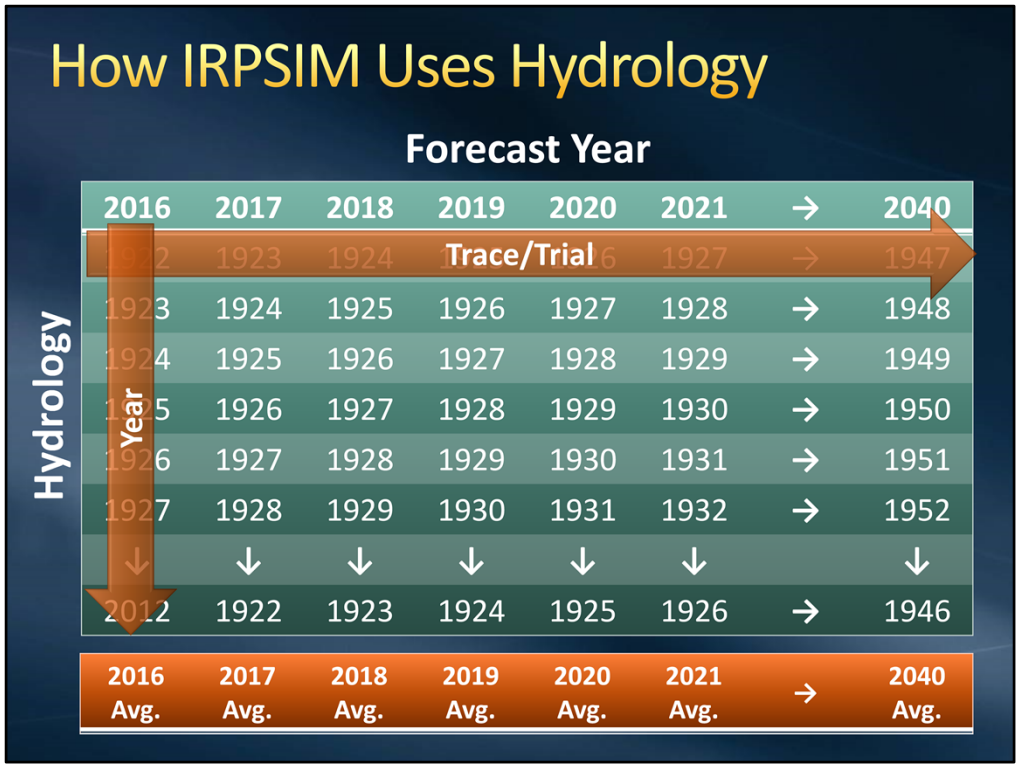
Hydrology	2016	2017	2018	2019	2020	2021	→	2040
	1922	1923	1924	1925	1926	1927	→	1947
	1923	1924	1925	1926	1927	1928	→	1948

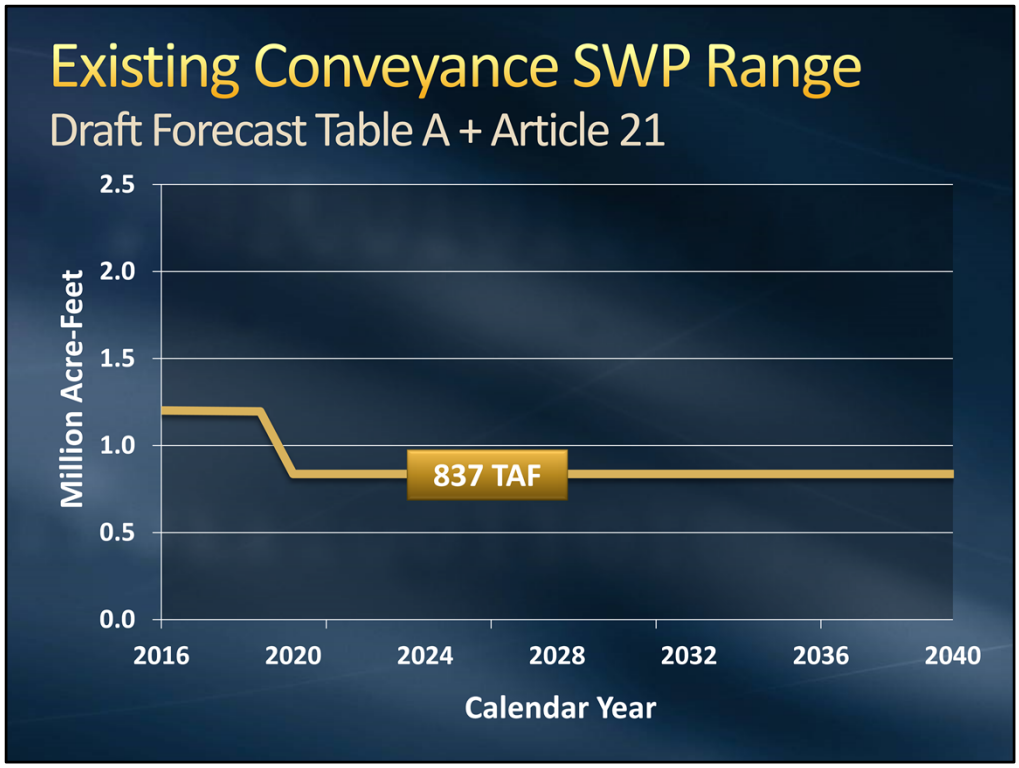
How IRPSIM Uses Hydrology

Forecast Year

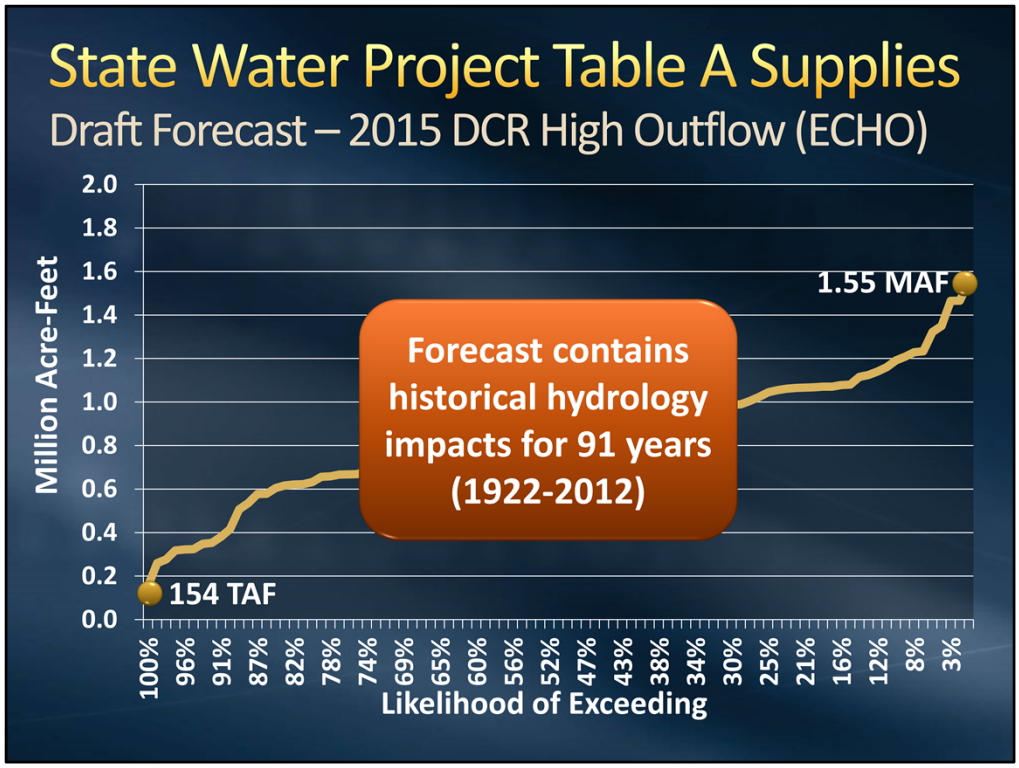
Hydrology	2016	2017	2018	2019	2020	2021	→	2040
	1922	1923	1924	1925	1926	1927	→	1947
	1923	1924	1925	1926	1927	1928	→	1948
	1924	1925	1926	1927	1928	1929	→	1949
	1925	1926	1927	1928	1929	1930	→	1950
	1926	1927	1928	1929	1930	1931	→	1951
	1927	1928	1929	1930	1931	1932	→	1952
	↓	↓	↓	↓	↓	↓		↓
	2012	1922	1923	1924	1925	1926	→	1946

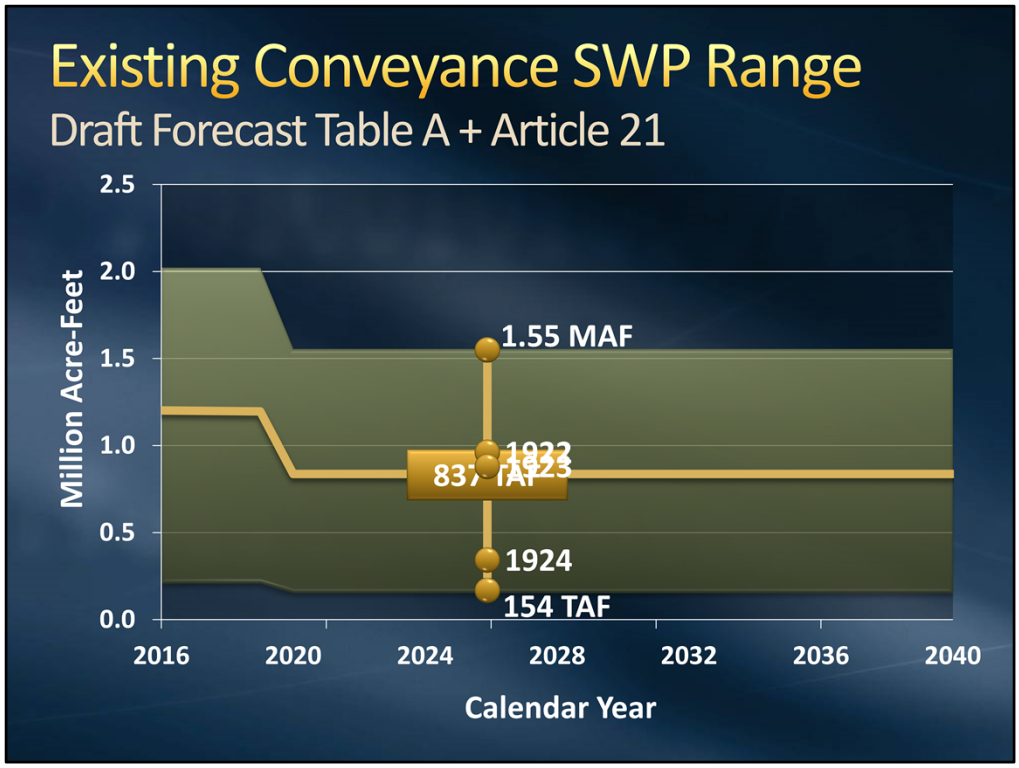
How IRPSIM Uses Hydrology





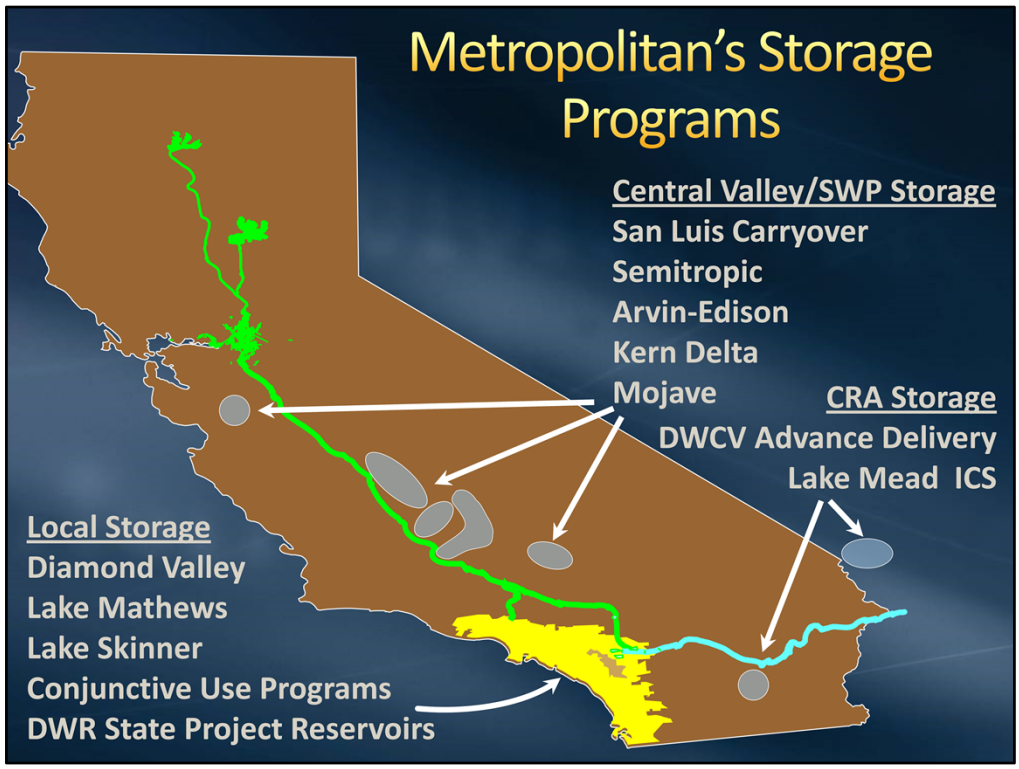
Use the 580 and the new 230 and show the growth in actual for rec and conservation


State Water Project Table A Supplies
Draft Forecast – 2015 DCR High Outflow (ECHO)
Million Acre-Feet
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1.55 MAF
154 TAF
Forecast contains historical hydrology impacts for 91 years (1922-2012)
100%
96%
91%
87%
82%
78%
74%
69%
65%
60%
56%
52%
47%
43%
38%
34%
30%
25%
21%
16%
12%
8%
3%
Likelihood of Exceeding



Use the 580 and the new 230 and show the growth in actual for rec and conservation

Storage and Transfers



Metropolitan has a number of storage programs inside & outside of the region. Partnerships have been developed with Central Valley agencies to store water. Several have been developed in recent years, and we have added additional programs this past year.

Storage and Transfers

Key Assumptions

- Each storage program is modeled in IRPSIM
  - Storage capacity
  - Put capacity
  - Take capacity
  - Program or evaporative losses
- 2016 estimated starting storage balances
- Emergency storage of ~630 TAF is held aside
- Assumes no market-type transfers

MWD Storage Programs Summary

Million Acre-Feet

	Storage Capacity	Put Capacity*	Take Capacity*	2016 Est. Starting
Central Valley & SWP	1.63	0.54	0.56	0.42
Colorado River	2.39	0.65	0.60	0.22
In-Region	1.30	0.90	0.94	0.14
Total Dry-Year	***5.32***	***2.09***	***2.10***	***0.77***
Emergency	0.63	0.63	0	0.63
Total	***5.95***	***2.72***	***2.10***	***1.40***

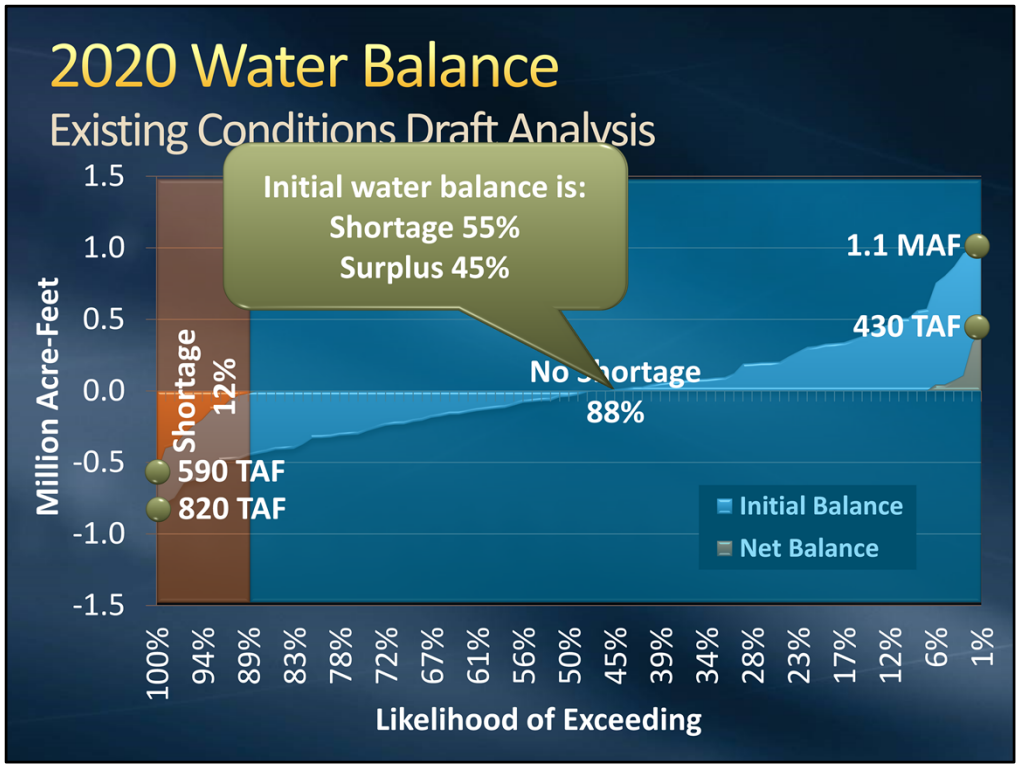
*Shows maximum capacities, actual capacity varies based on contract terms

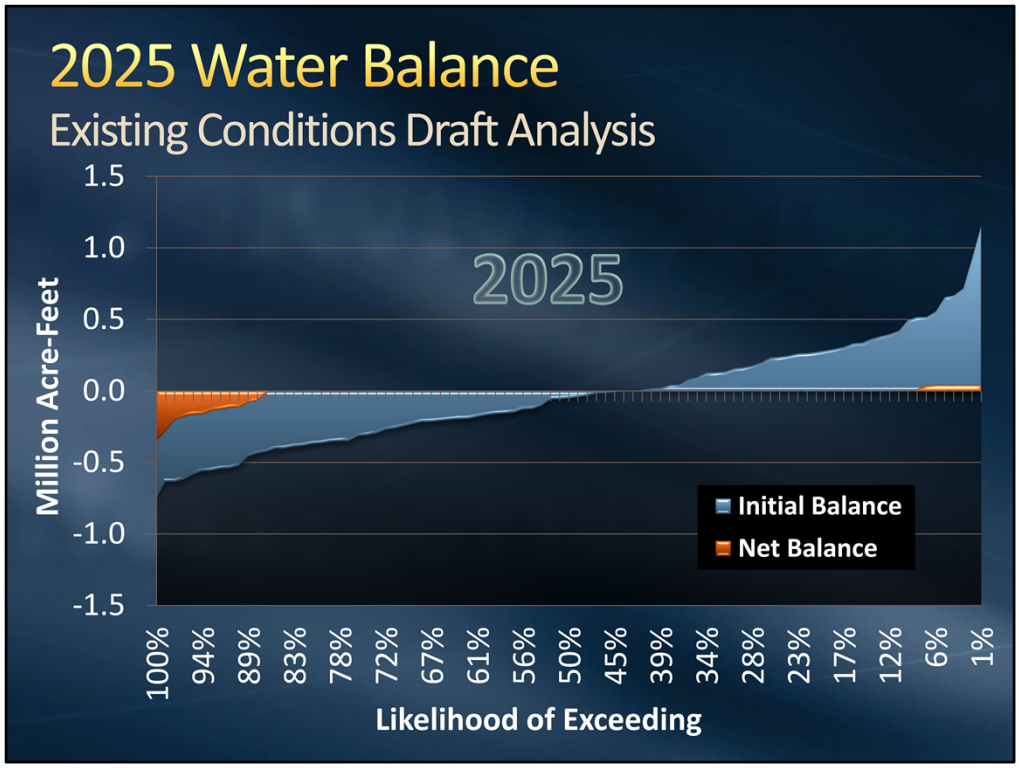
Reliability Measures

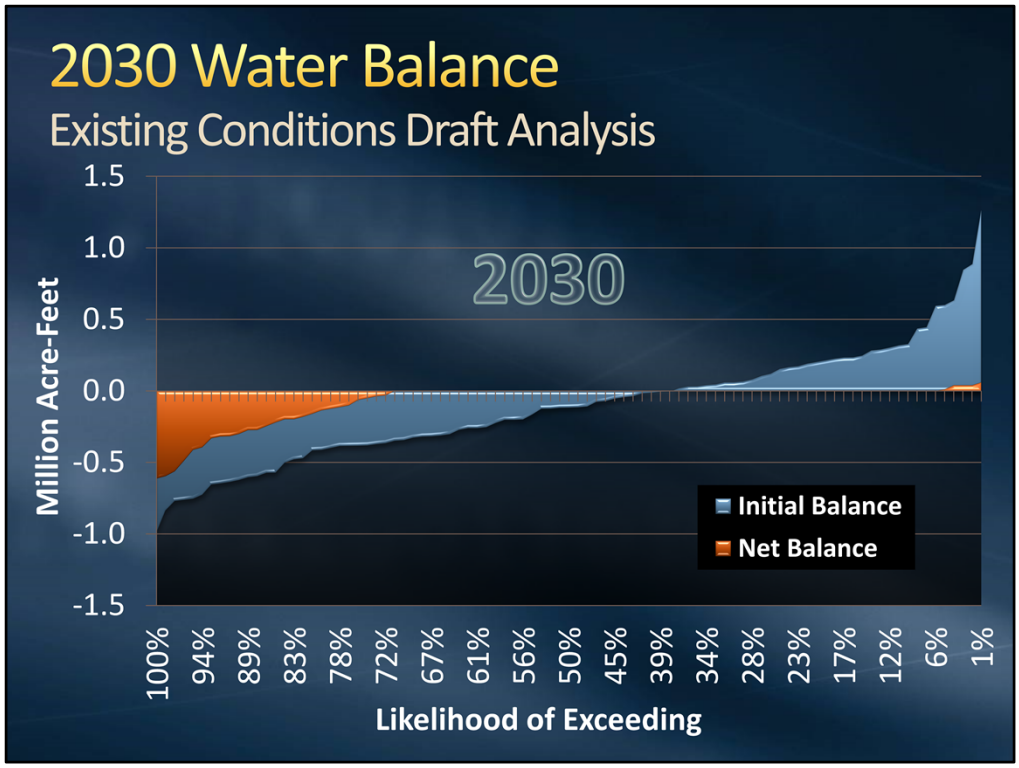
Potential Measures of Reliability

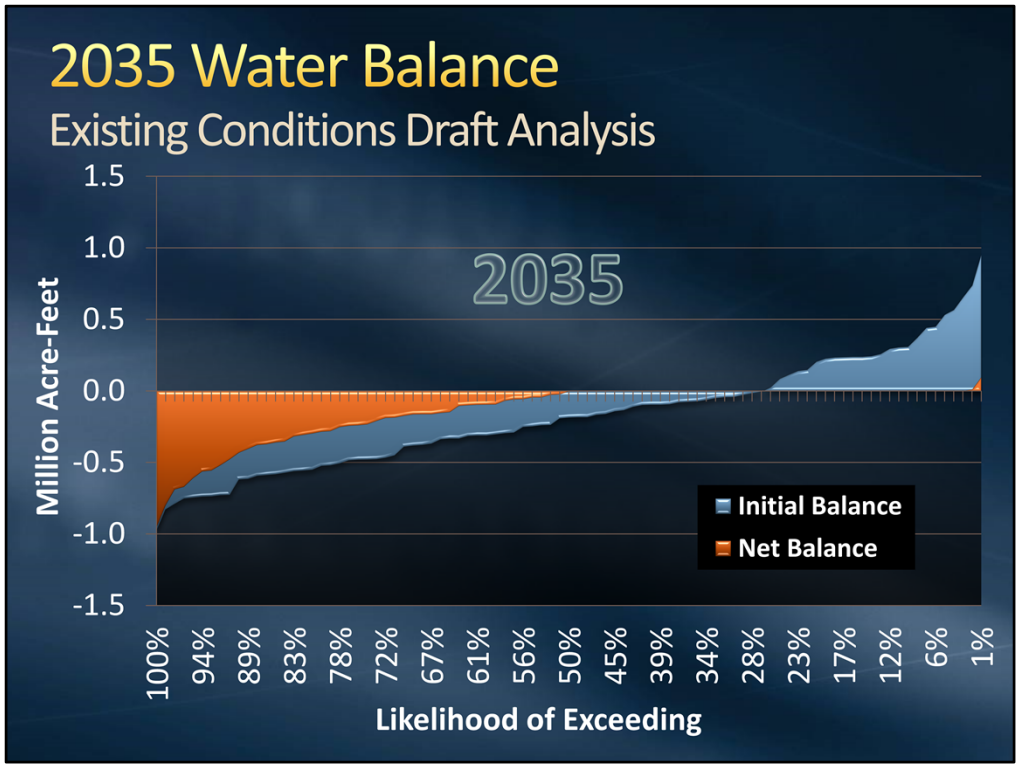
- Supply shortages
  - Frequency of occurrence
  - Maximum quantity
- Storage thresholds
  - Minimum level
  - Average targeted level

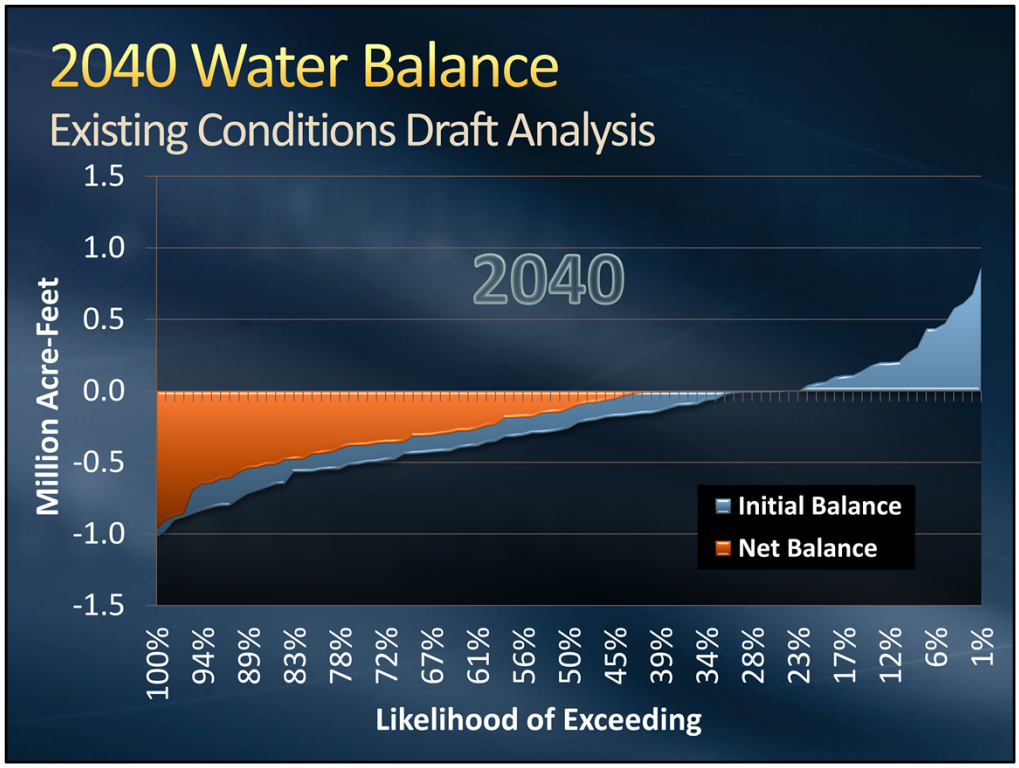
Draft Existing Conditions Water Balance


2020 Water Balance
Existing Conditions Draft Analysis
Initial water balance is:
Shortage 55%
Surplus 45%
1.1 MAF
430 TAF
Shortage
12%
No Shortage
88%
590 TAF
820 TAF
Initial Balance
Net Balance
Million Acre-Feet
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
100%
94%
89%
83%
78%
72%
67%
61%
56%
50%
45%
39%
34%
28%
23%
17%
12%
6%
1%
Likelihood of Exceeding


2025 Water Balance
Existing Conditions Draft Analysis
2025
Million Acre-Feet
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
100%
94%
89%
83%
78%
72%
67%
61%
56%
50%
45%
39%
34%
28%
23%
17%
12%
6%
1%
Likelihood of Exceeding
Initial Balance
Net Balance

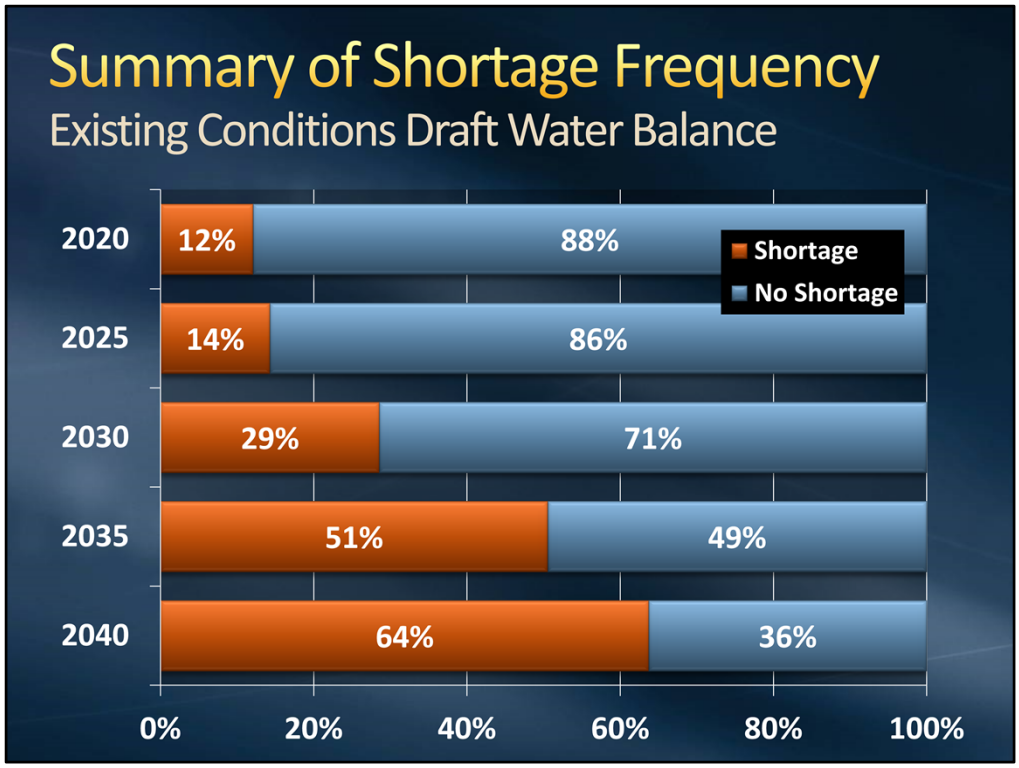

2030 Water Balance
Existing Conditions Draft Analysis
2030
Million Acre-Feet
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
100%
94%
89%
83%
78%
72%
67%
61%
56%
50%
45%
39%
34%
28%
23%
17%
12%
6%
1%
Likelihood of Exceeding
Initial Balance
Net Balance

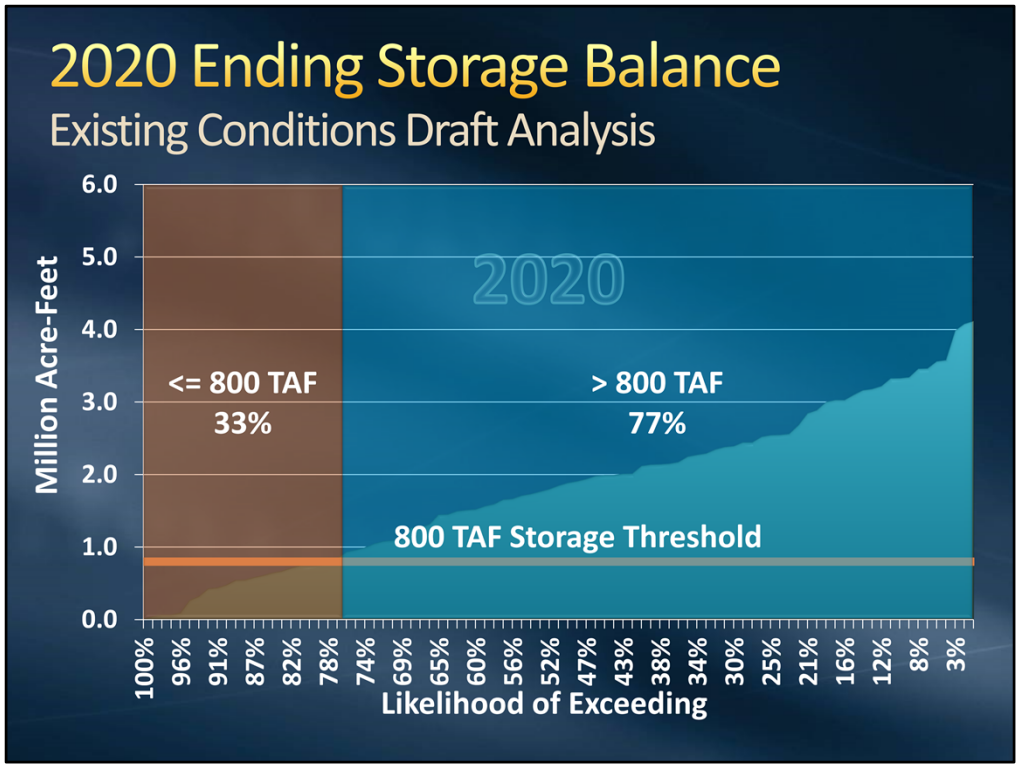

2035 Water Balance
Existing Conditions Draft Analysis
2035
Million Acre-Feet
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
100%
94%
89%
83%
78%
72%
67%
61%
56%
50%
45%
39%
34%
28%
23%
17%
12%
6%
1%
Likelihood of Exceeding
Initial Balance
Net Balance


2040 Water Balance
Existing Conditions Draft Analysis
2040
Million Acre-Feet
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
Initial Balance
Net Balance
100%
94%
89%
83%
78%
72%
67%
61%
56%
50%
45%
39%
34%
28%
23%
17%
12%
6%
1%
Likelihood of Exceeding

Summary of Shortage Frequency

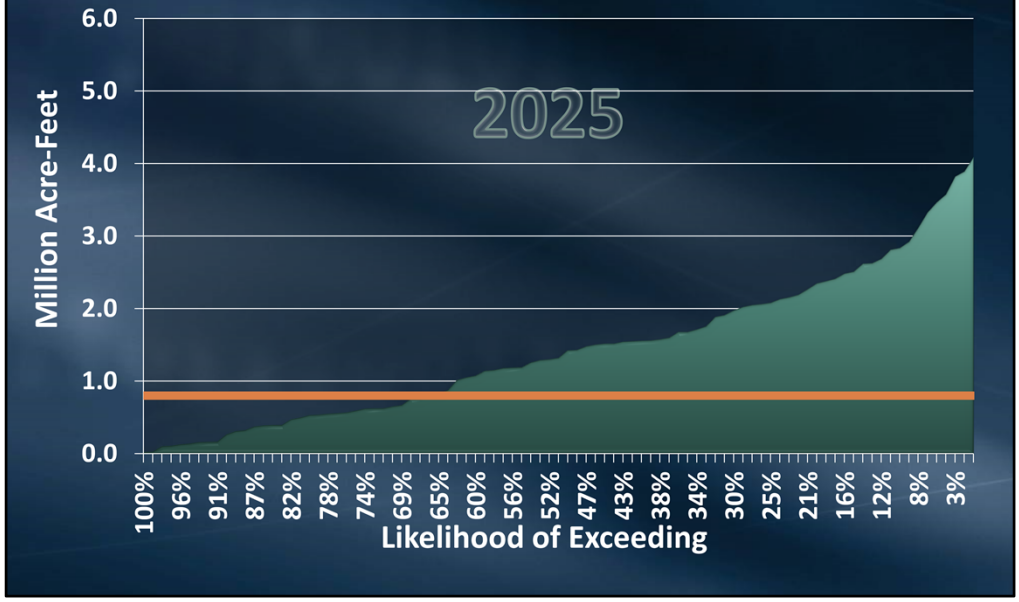
Existing Conditions Draft Water Balance




2020 Ending Storage Balance
Existing Conditions Draft Analysis
Million Acre-Feet
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2020
<= 800 TAF
33%
> 800 TAF
77%
800 TAF Storage Threshold
100%
96%
91%
87%
82%
78%
74%
69%
65%
60%
56%
52%
47%
43%
38%
34%
30%
25%
21%
16%
12%
8%
3%
Likelihood of Exceeding

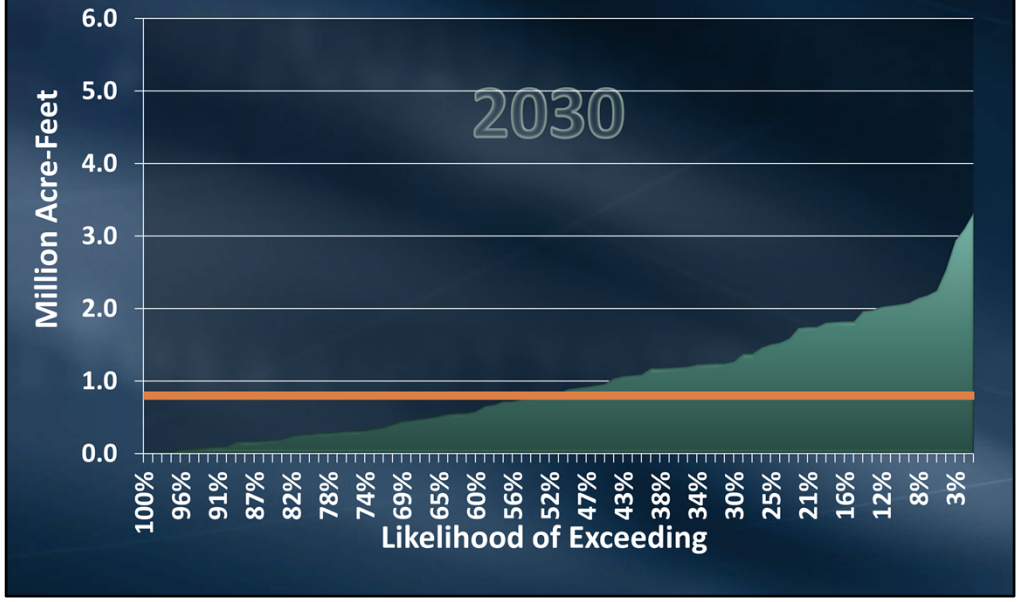
2025 Ending Storage Balance

Existing Conditions Draft Analysis



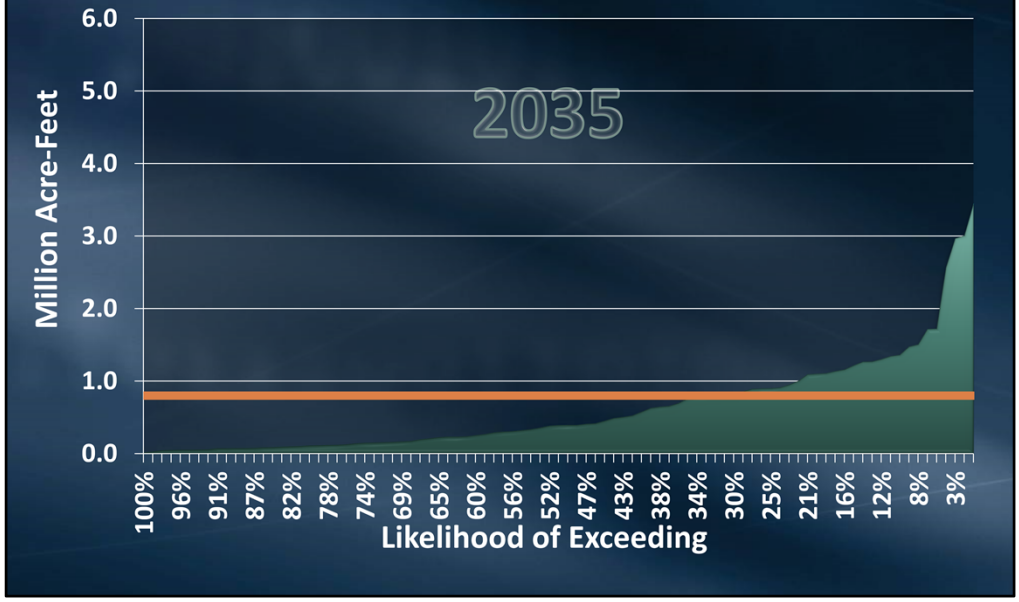
2030 Ending Storage Balance

Existing Conditions Draft Analysis



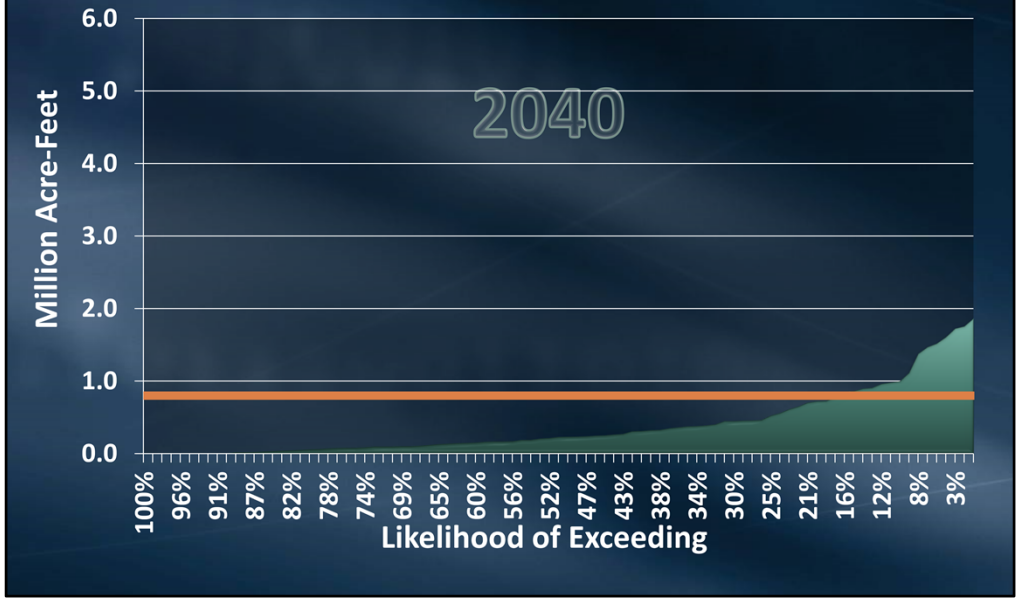
2035 Ending Storage Balance

Existing Conditions Draft Analysis



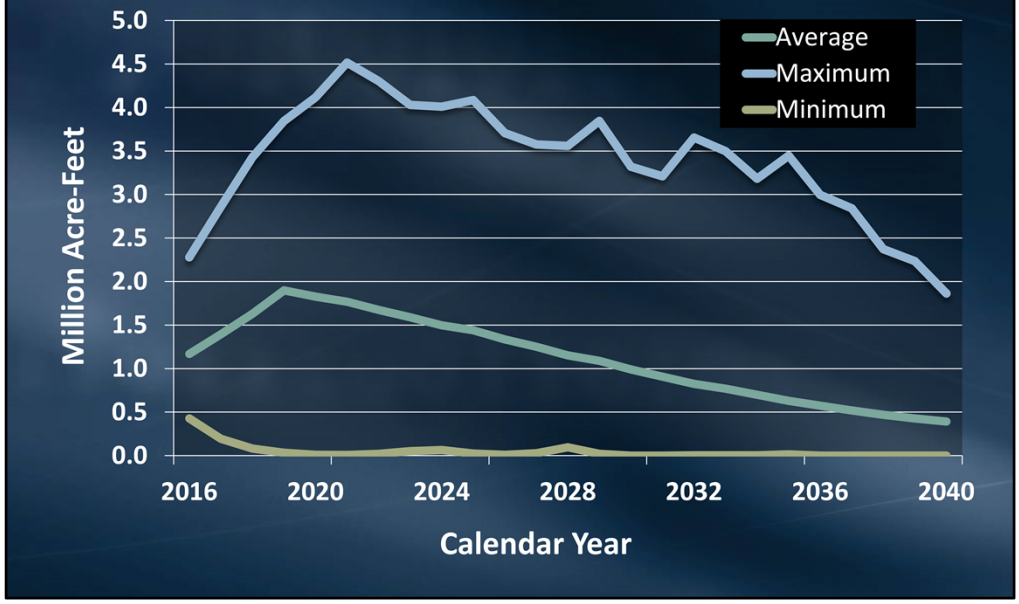
2040 Ending Storage Balance

Existing Conditions Draft Analysis



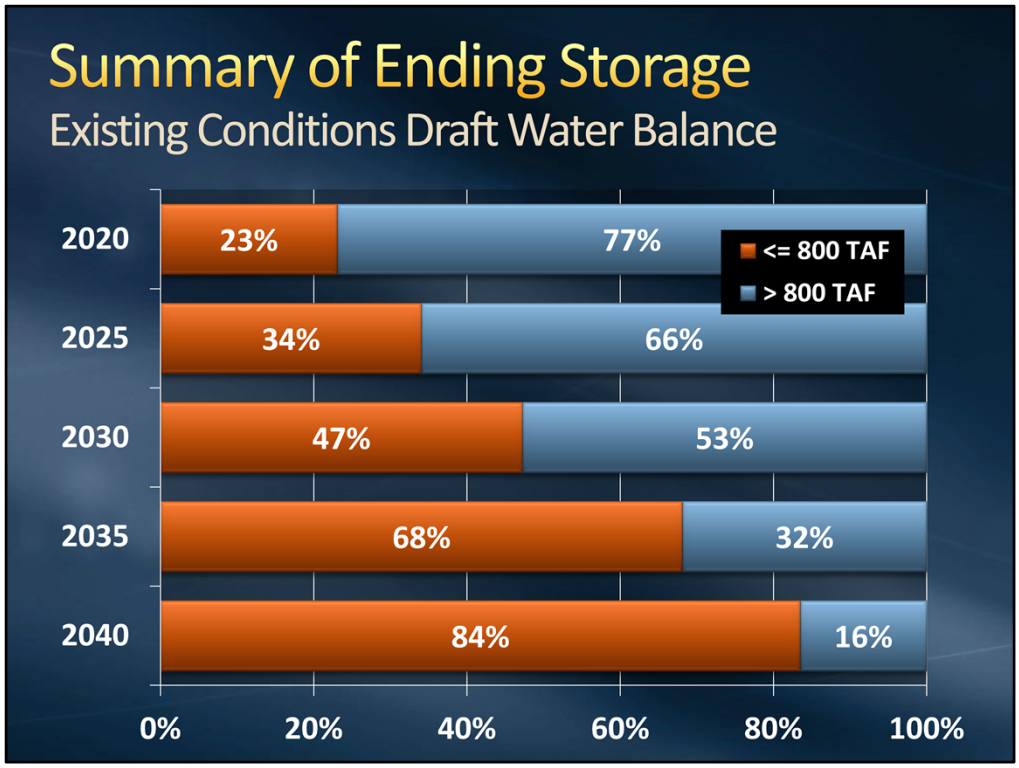
Existing Conditions Storage Levels

2015 IRP Draft Forecast



Summary of Ending Storage

Existing Conditions Draft Water Balance



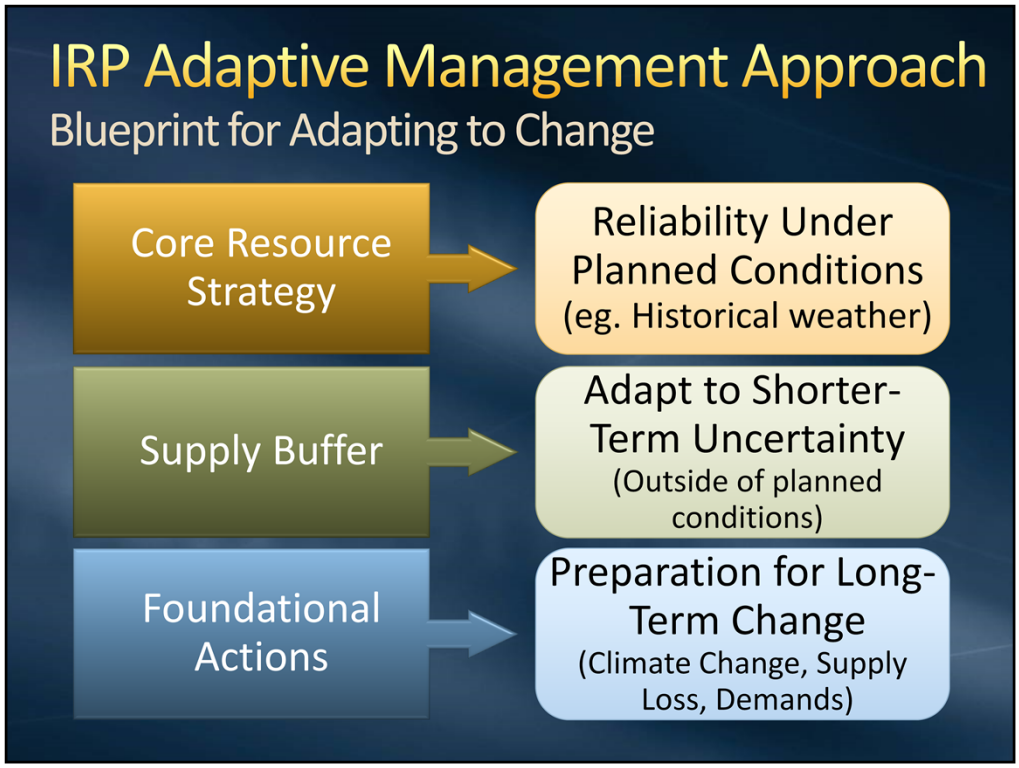
Observations

Existing Conditions Water Balance

- "Do Nothing" is not sustainable
- Shortage frequency and quantity increase over time
  - Increased Retail Demand
  - Constant or decreasing local and imported supplies
- Storage quantity decrease over time
  - Less water to store
  - Higher need for storage for balancing supplies and demands

What are the Next Steps?

- Review 2010 IRP approach
- Evaluate effect of 2010 IRP approach on reliability measures
- Refine IRP targets


IRP Adaptive Management Approach
Blueprint for Adapting to Change
Core Resource Strategy
Supply Buffer
Foundational Actions
Reliability Under Planned Conditions (eg. Historical weather)
Adapt to Shorter-Term Uncertainty (Outside of planned conditions)
Preparation for Long-Term Change (Climate Change, Supply Loss, Demands)

Water Use Efficiency
Conservation and recycling to achieve a 20% reduction at the regional level
Commitment is above and beyond 20x2020 legislation

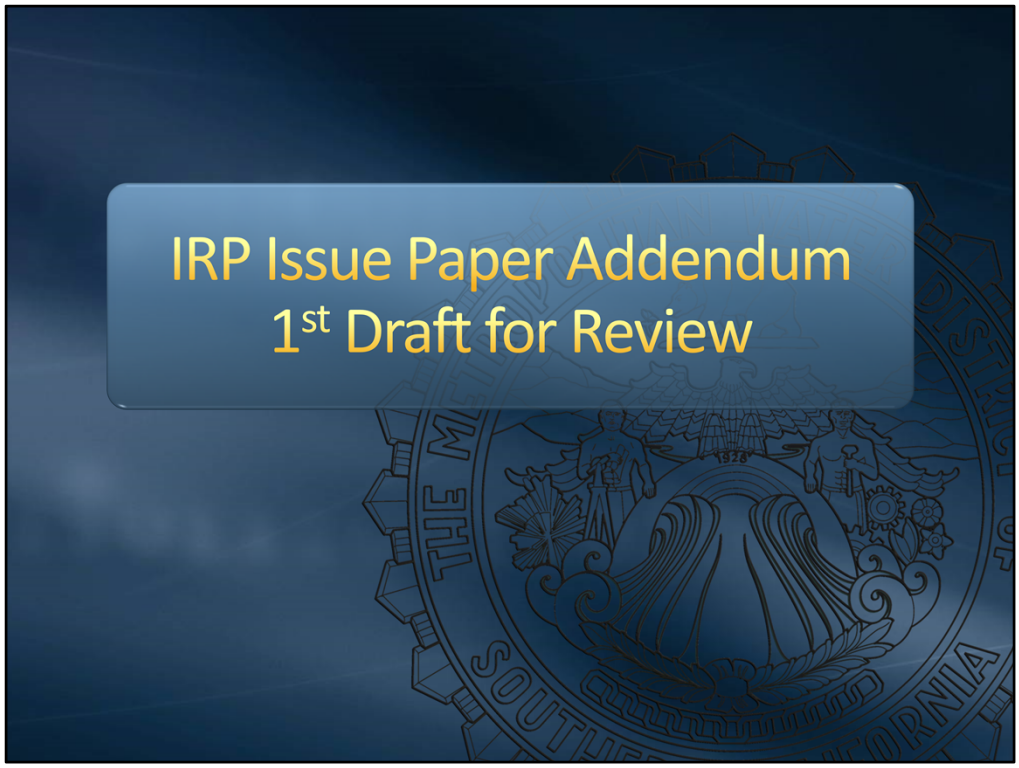
Local Resources
Sought to develop just over 100 TAF of additional local supplies through groundwater recovery, seawater desalination, and recycling

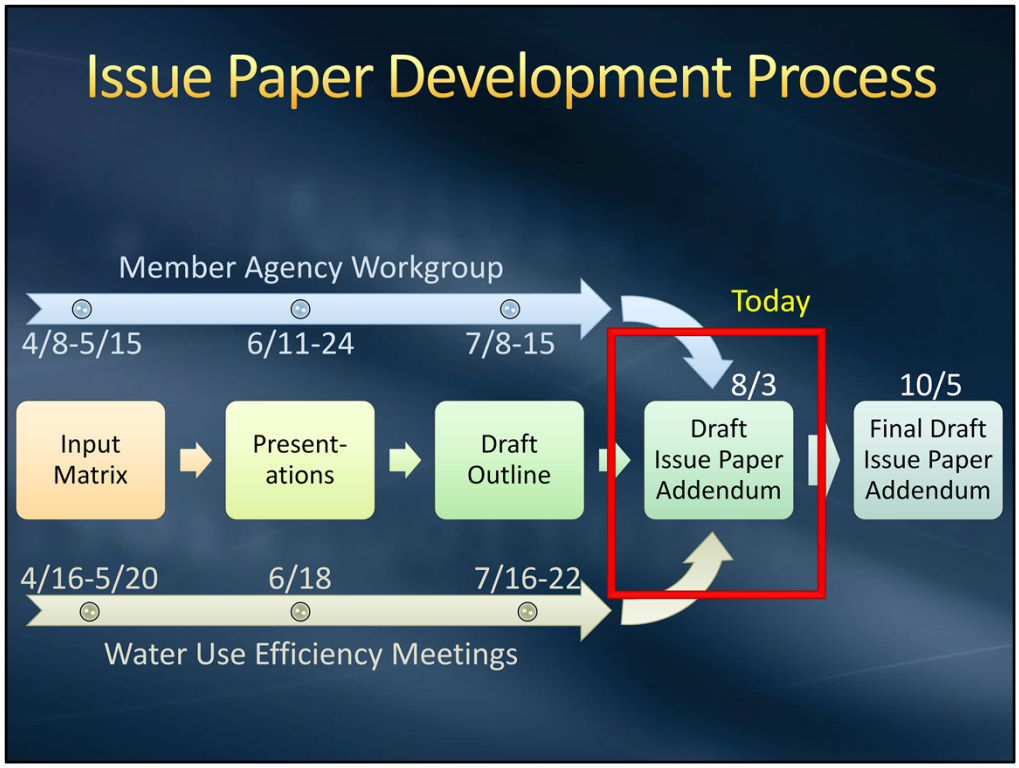
State Water Project
Pursue short, mid, and long-term improvements to help stabilize delta supplies
Short-term examples: emergency preparedness actions, Complete BDCDP
Mid-term examples: Implement BDCP, implement flood control protection
Long-term examples: Water supply conveyance, ecosystem restoration

Colorado River
Continue to develop dry-year supply programs on the Colorado River System
Provide flexibility in conjunction with Lake Mead ICS to provide a full CRA as needed

Additional Technical Issues
To Be Addressed

- Impacts of current drought actions
  - What is the lasting effect of behavioral changes and restricted water uses over time?
  - Permanent savings from SWRCB actions
  - Model landscape ordinance
- Additional input on draft forecasts
  - Final local resources Existing and Under Construction inventory
  - Agency-funded conservation programs
  - Sustainable groundwater production


IRP Issue Paper Addendum
1st Draft for Review



Thank you for all your participation and input to this point. We accomplished quite a bit, with the finish line in the horizon. Hopefully we captured your input and represented the key points in this paper.

Input matrix: introduced at the kickoff meeting, comments due 5/15
Presentations on the compiled input and issue paper content from 6/11 (groundwater part 2 workshop) to 6/24 meeting on local resources (all other resources)
Draft outline: presented and sent out for review on 7/8 (comments due 7/15)

Parallel process

Utilizing an already established venue: monthly WUE meetings, comprised of member agency and Metropolitan conservation staff (generally on the 3rd Thursday of every month)

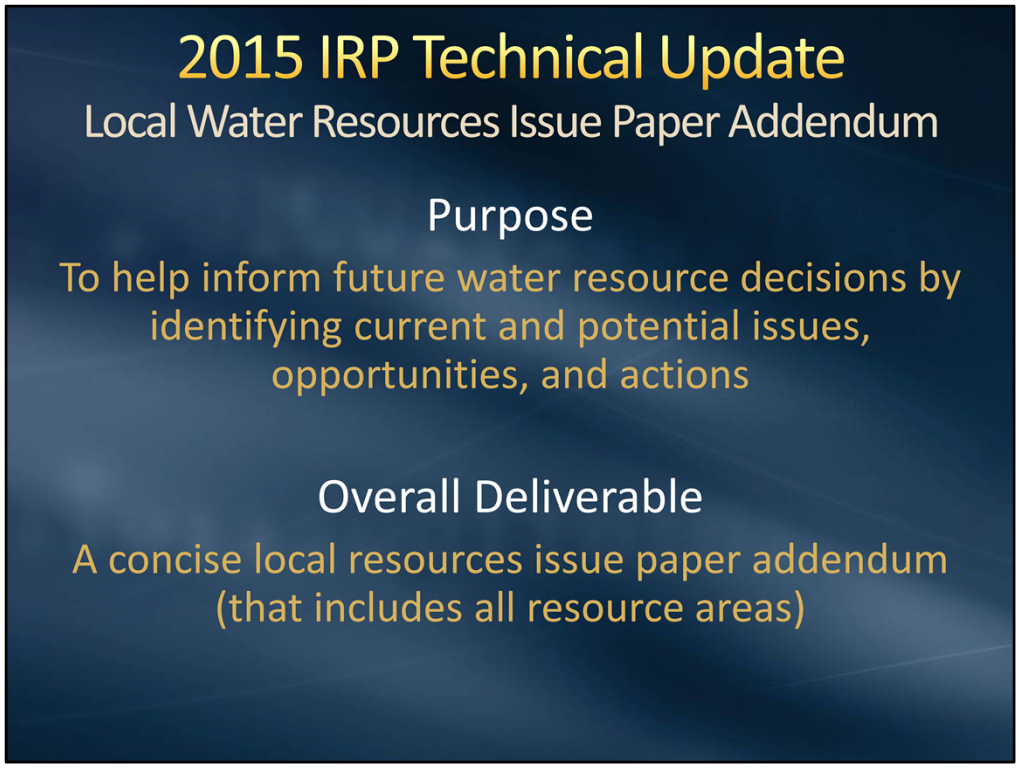
The processes (and resource topics) come together for the draft addendum to be presented on August 3rd at the MA Workgroup meeting.

A reminder about what info is included in this issue paper

Information for the IRP can be placed into three categories (information that…):

1) Informs the forecast
2) Feeds the issue paper (discuss conservation issues)
3) Will be flagged to add to a subsequent Board discussion on policies and implementation

All three feed the policy implementation discussion



It's good to remind ourselves of the **goals** of this issue paper addendum.
Not dictating policy, rather providing information to **help** with the policy development

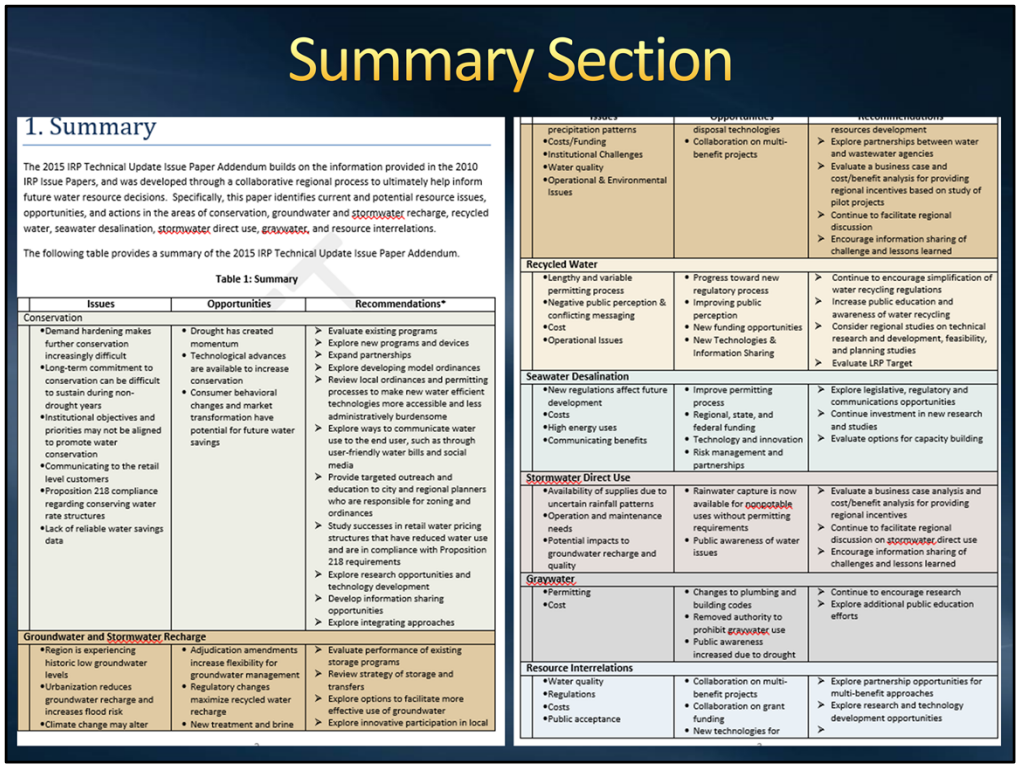
The team stayed true to this purpose and put tremendous effort to try and keep this paper focused on just the essentials for maximum effectiveness. We were brutal with each other's work…chopping away with a meat cleaver when needed. The info that we chopped were all good info, but we didn't want the reader to have to sift through info to get the main points. We are aiming for an effective (meaning concise and readable) comprehensive document.

So we are aiming for these things, but please keep in mind that this is a **1st draft** that we developed within a very challenging timeframe and it is by no means perfect…yet. That's where this review period comes in handy. And when reviewing, we ask you to also remember to stay true to the purpose of this paper: any essential pieces missing? Are things screaming at you the wrong way.

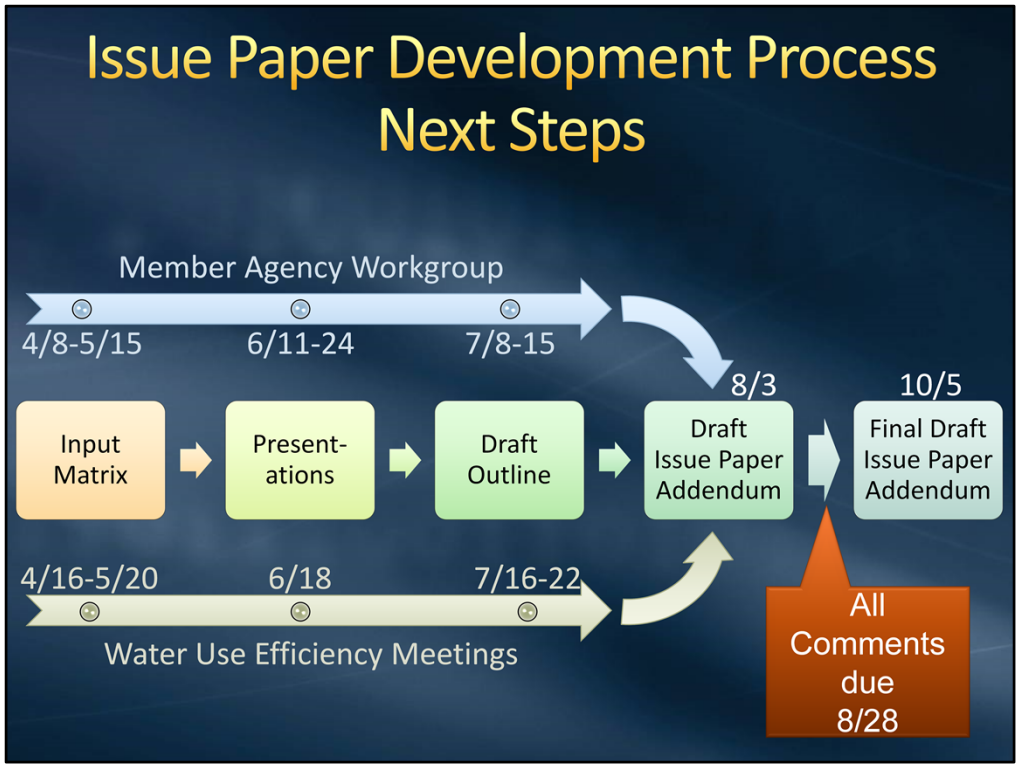
Draft Paper: Sections

- Opening Material (TOC, Summary, Intro)
- Conservation
- Groundwater and Stormwater Recharge
- Recycled Water
- Seawater Desalination
- Stormwater Direct Use
- Graywater
- Resource Interrelations
- Conclusions

Resource Subsections



Here's a preview of the summary section. If you just want to read one thing, read this section. It provides the main points of the paper…in fact, taken straight out of the headers. We designed this paper so the headers tell the story so that the key points are evident and you don't necessarily have to read through paragraphs of text to figure out what it's about.



The draft issue paper addendum will be sent out today. Please return comments to me by 8/28. We will send it in a Word file…please use the track changes feature. Again, we want to stay true to the purpose of this paper and are looking for just the essential information as concisely as possible.

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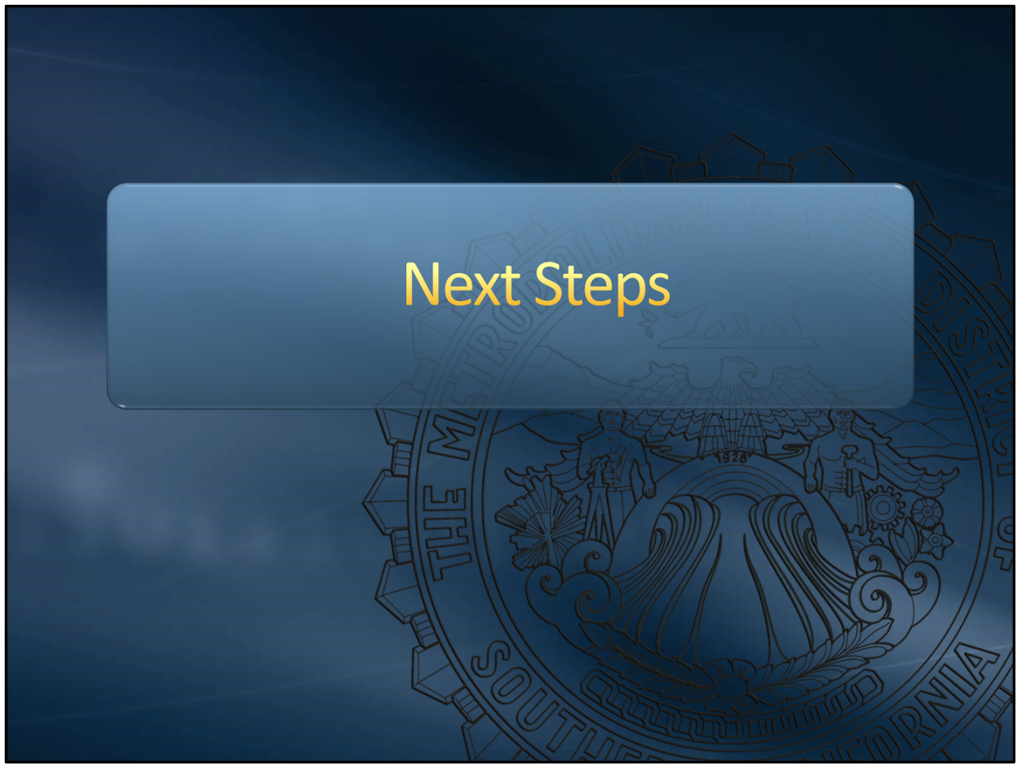
Next Steps

Upcoming Technical Process Activities
August 2015

- SCWC Water Use Efficiency Workshop August 12th
- IRP Committee Meeting August 18th
  - California Water Fix and the IRP
  - Technical process draft results
    - Retail demand and conservation forecasts
    - Local supply forecasts by type
    - Imported supply forecasts
    - Supply/demand/storage balances
  - Update on IRP outreach

Upcoming Technical Process Activities
September 2015

- Member Agency Workgroup September 9th
- IRP Committee Meeting September 22nd
  - Technical process draft results
    - Supply/demand/storage scenarios
    - Potential resource development targets
  - Update on IRP outreach

Upcoming Technical Process Activities
October 2015

- Member Agency Workgroup October 5th
- IRP Public Outreach Workshop October 20th
- IRP Committee Meeting October 27th
  - Update on IRP outreach
  - IRP Issue Paper Addendum
  - Inventory of policy issues
  - Approach for “IRP Phase 2” Board process


THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA