Integrated Resources Planning Committee

Item #4a

Subject: Uncertainty Planning in the IRP

Purpose: The purpose of this oral report is to provide the IRP Committee with an overview of uncertainty planning in the IRP. This overview provides context for the guest speaker presentations on Uncertainty Planning and Climate Change that will follow.

IRP Committee/July 28, 2015

Integrated Resources Planning Committee

Item #4a

Summary

The report provides the IRP Committee with an overview of uncertainty planning in the IRP.

Uncertainty Planning in the IRP

Integrated Resources Planning Committee
Item 4a
July 28, 2015

Overview

- General review of uncertainty
- Metropolitan's Robust Decision Making Framework

Review of Uncertainty

Types of Uncertainty

There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know.

- Donald Rumsfeld

Known Knowns

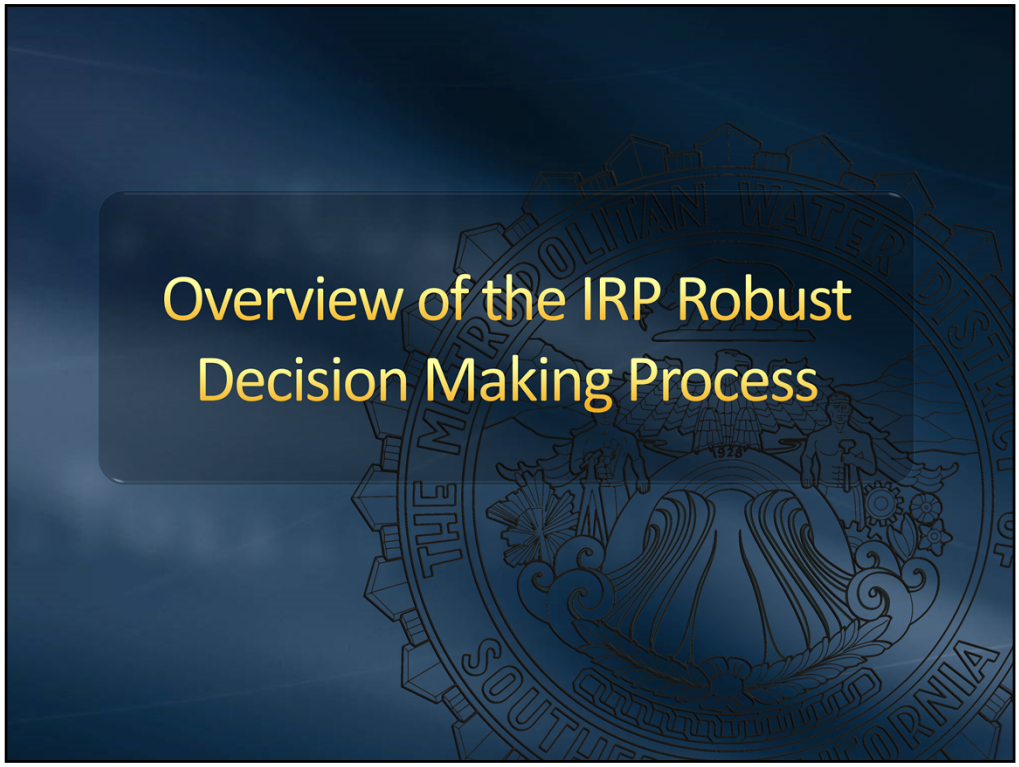
- Official Demographic projections
- Project parameters
- Project yields
- Historical weather patterns
- Other?

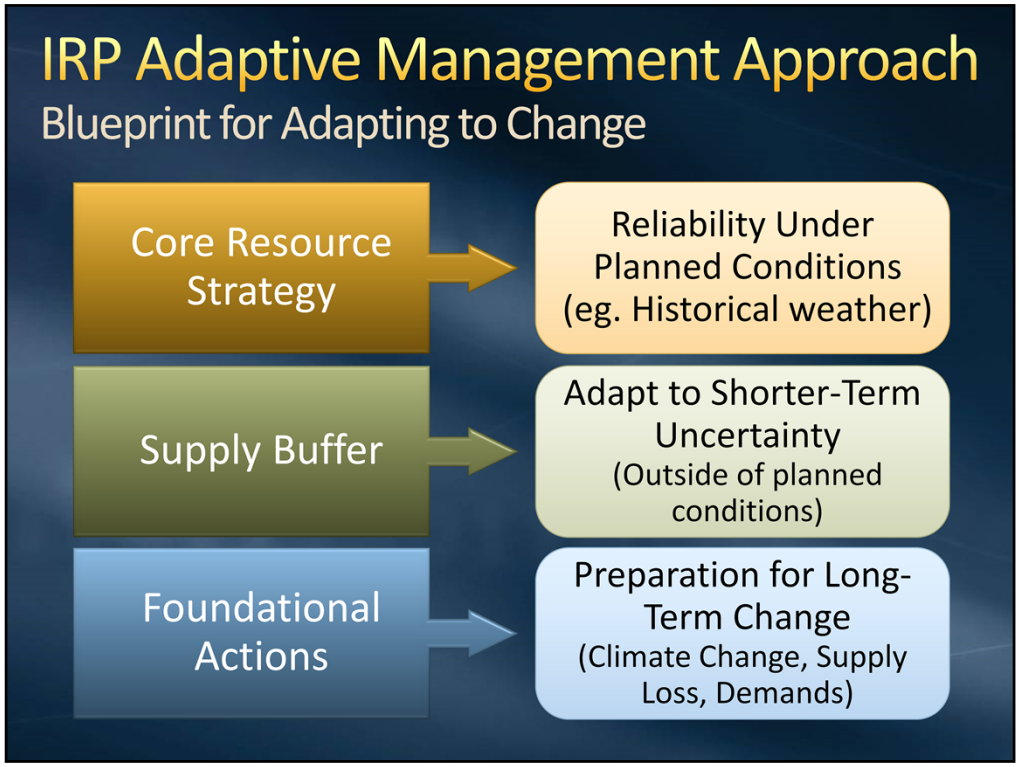
Known Unknowns

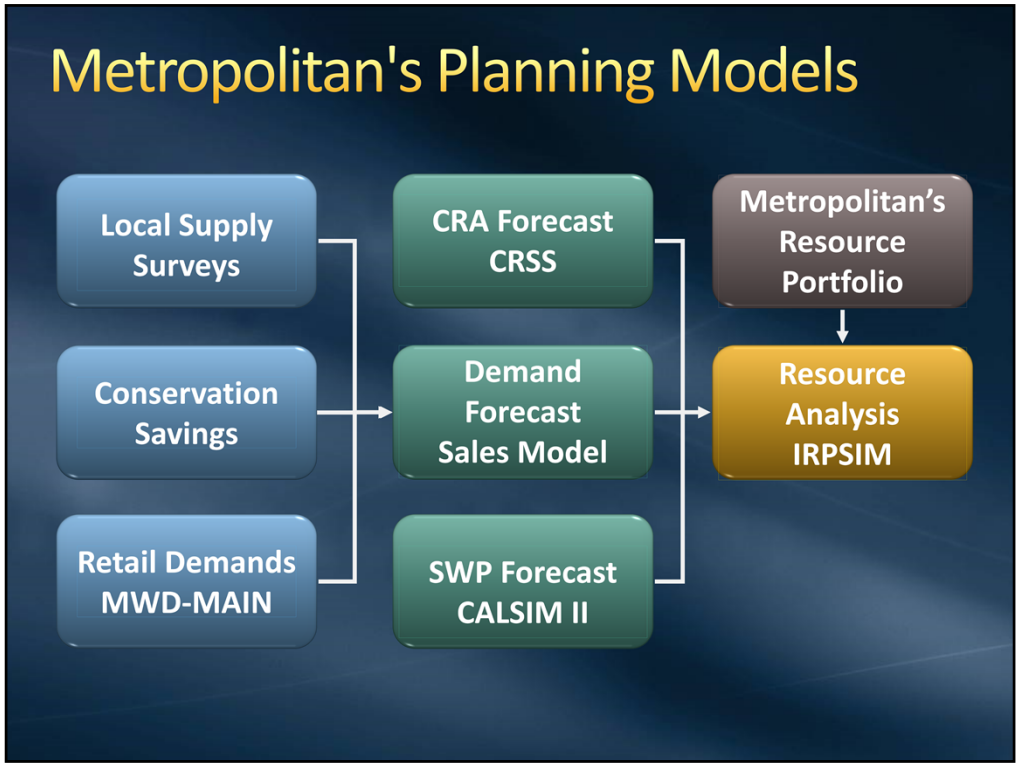
- Project losses
- Changes in project parameters
- Regulatory Changes
- Shifts in demographics
- Economic boom and bust
- Climate Change

Unknown Unknowns

- No one knows, because that's the basic idea of unknown unknowns


Overview of the IRP Robust Decision Making Process


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)


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

Summary of RDM for Metropolitan

- Developed by RAND Corporation
- Supports decision-making under deeply uncertain conditions
- Process involves data, modeling, and analytics
- Evaluates planning scenarios against a wide range of future conditions
- Identifies when and why scenarios to fail to meet planning goals
- Helps develop signposts and monitoring criteria for adaptive management

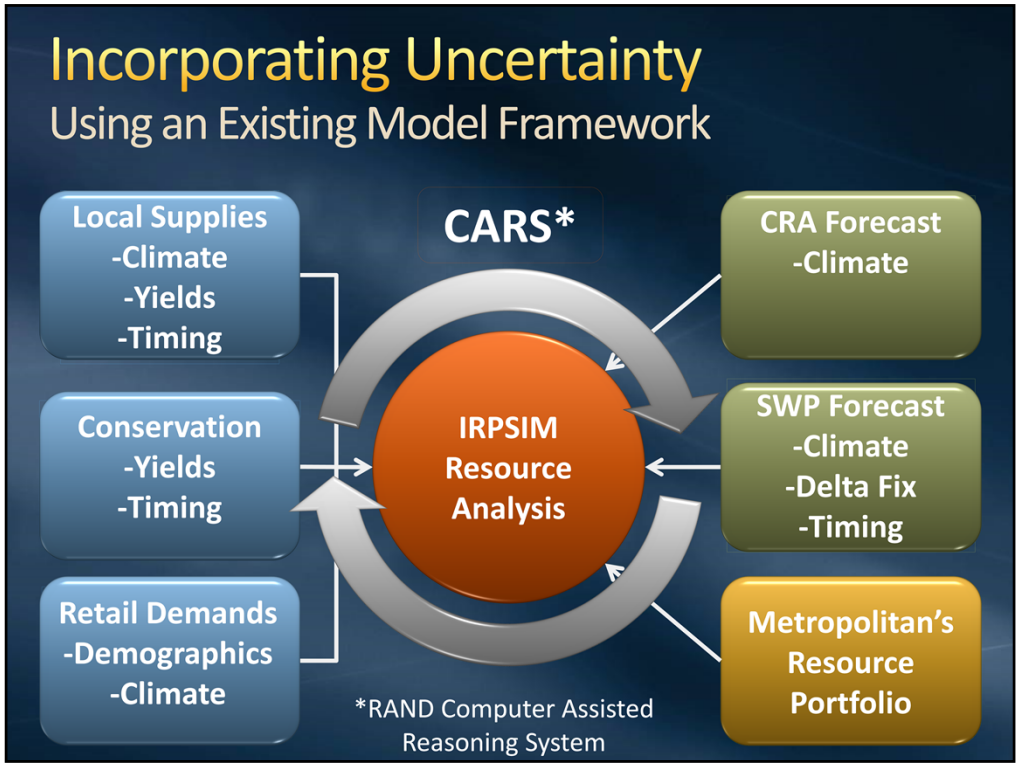


Diagram shows standard planning model framework
Uncertainty is introduced by replacing standard forecasts

Local Supplies – Climate sensitive local supply forecasts are impacted (i.e. LAA, surface production)

±20% variation in yield of forecasted development
Timing of forecasted development delayed up to 10 years

Conservation – Demographics influence quantity/density/rate of replacement of devices???

±20% variation in yield of forecasted development
Timing of forecasted development delayed up to 20 years

Retail Demand – Demographic patterns impact weather normal retail demands
Forecast of "climate bumps" that impact range of retail demands

CRA Forecast – RAND CORDS modeling estimated climate impacts on CRA supplies

SWP Forecast – SEC WEAP modeling forecasted climate impacts on delta exports
WEAP modeling adjusted to estimate no, partial, and full delta fix
Timing of Delta fix delayed up to 30 years

CARs – Computer Assisted Reasoning system

Defining Future Uncertainties

Factors and Ranges

Factor	Range of Uncertainty
Demographic Changes	4 Scenarios: Balanced Growth, Baseline Growth, Periurban Growth, High Growth
Climate Conditions	12 Climate Scenarios: 6 GCMs x 2 Emissions Scenarios used by IPCC
Bay-Delta Conditions	3 Scenarios: No Delta Fix, Partial Delta Fix, Full Delta Fix
Local Resource Yields	±20% Variation in Groundwater, Recycling, Groundwater Recovery, Conservation
Project Implementation Timing	Delays: 0-10 years Desalination & Recycling, 0-20 years Conservation, 0-30 years Delta Fix

Demands
Balanced Growth: IAS, lower projected growth, economic slowdown inland, increased density
Baseline Growth: **IRP, SCAG rtp12 SanDAG ???**
Periurban Growth: IAS, Growth rates similar to Baseline but concentrated inland
High Growth: IAS, Higher growth rates than baseline in all regions

Climate
GCMs: cnrm_cm3, gfdl_cm2, micro3_2_medres, mpi_echam5, ncar_ccsm3_0, ncar_pcm1
Emissions: A2, B1
Representative sample provides a sufficiently wide range to test IRP sensitivity to climate change
Result in supplies ranging from 93.7% to 104.7% of historical

Bay-Delta
No Fix: Current conditions with climate change
Partial Fix: 10% less than Full Fix
Full Fix: Current conditions with climate change, 2022 fix in proportion to 2011 reliability report -> 2005 reliability report

Local Resource Yields
80-120% of IRP forecast, each resource varied independently

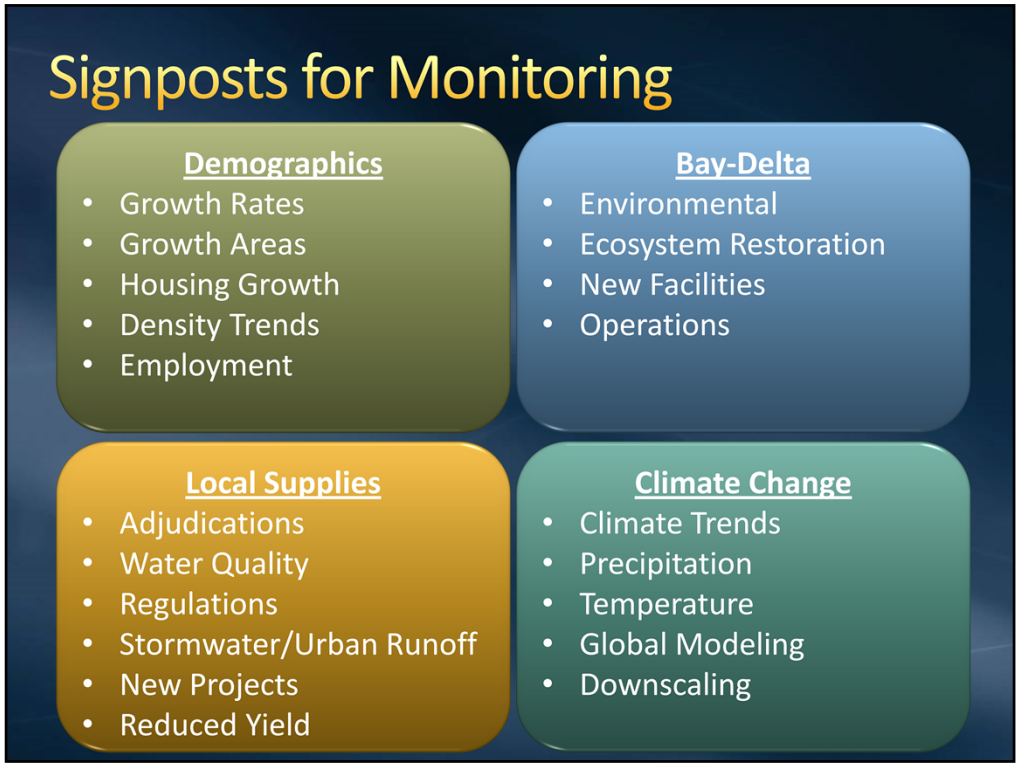
Implementation Timing
Schedule of buildup shifted into the future, each resource varied independently

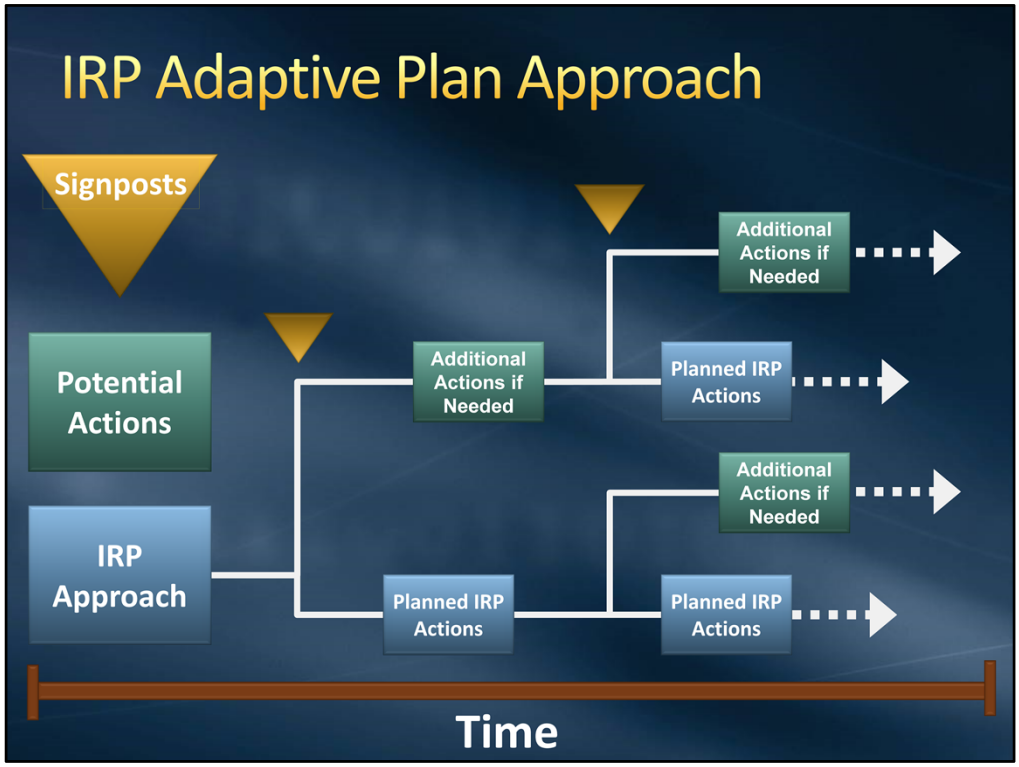
Analytical Approach

- Analyzed +6,900 combinations of uncertainty
- Used “scenario discovery” to identify where IRP goals were not met
  - Net Balance
  - Total Storage
- Used statistical methods to determined common areas of vulnerability

Summary of RDM Conclusions

- The IRP approach is vulnerable when two or more uncertainties turn out unfavorably
- Key uncertainties to monitor
  - Future Delta conditions
  - Demographic trends
  - Groundwater yields
  - Climate Conditions


Signposts for Monitoring
Demographics
Growth Rates
Growth Areas
Housing Growth
Density Trends
Employment
Bay-Delta
Environmental
Ecosystem Restoration
New Facilities
Operations
Local Supplies
Adjudications
Water Quality
Regulations
Stormwater/Urban Runoff
New Projects
Reduced Yield
Climate Change
Climate Trends
Precipitation
Temperature
Global Modeling
Downscaling


IRP Adaptive Plan Approach
Signposts
Potential Actions
IRP Approach
Additional Actions if Needed
Planned IRP Actions
Additional Actions if Needed
Planned IRP Actions
Additional Actions if Needed
Planned IRP Actions
Time


THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA