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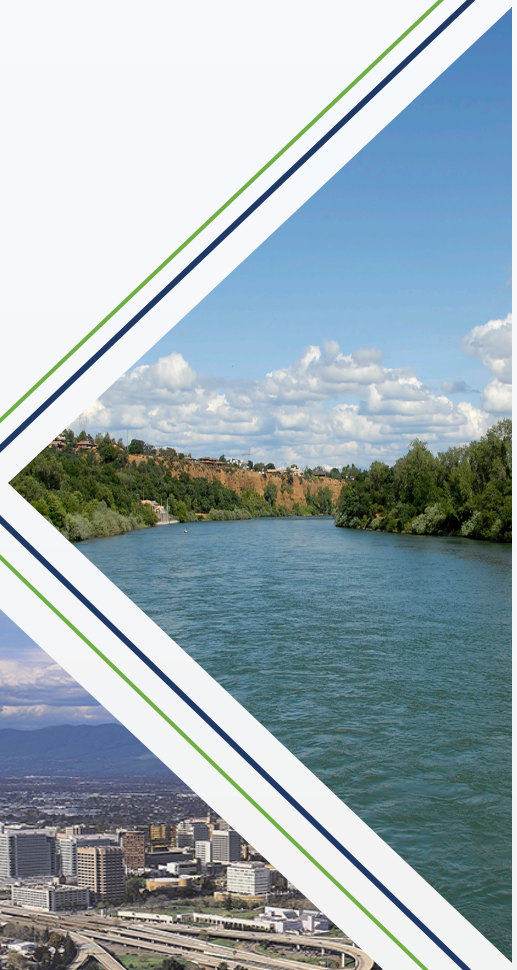
National Experience. Local Focus.

Progressive Development of Decision Support Tools and Groundwater Models for GSPs

May 3, 2017

Enrique Lopezcalva (Presenter)
Leslie Dumas



SGMA Timeline is Prescriptive

GSP deadlines:

January 31, 2020 for medium and high priority basins in critical overdraft

January 31, 2022 for other medium and high priority basins

Basins must achieve groundwater sustainability within 20 years of GSP implementation

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There's Time to Develop and Improve Our Planning and Implementation Tools

3 years for planning

Multiple steps to GSP development and implementation

- Data collection and analysis
- Water budget
- Alternatives development for programs and management actions
- Decision-making: What's the plan?
- Implementation
- Monitoring

Plan Updates Possible and Expected

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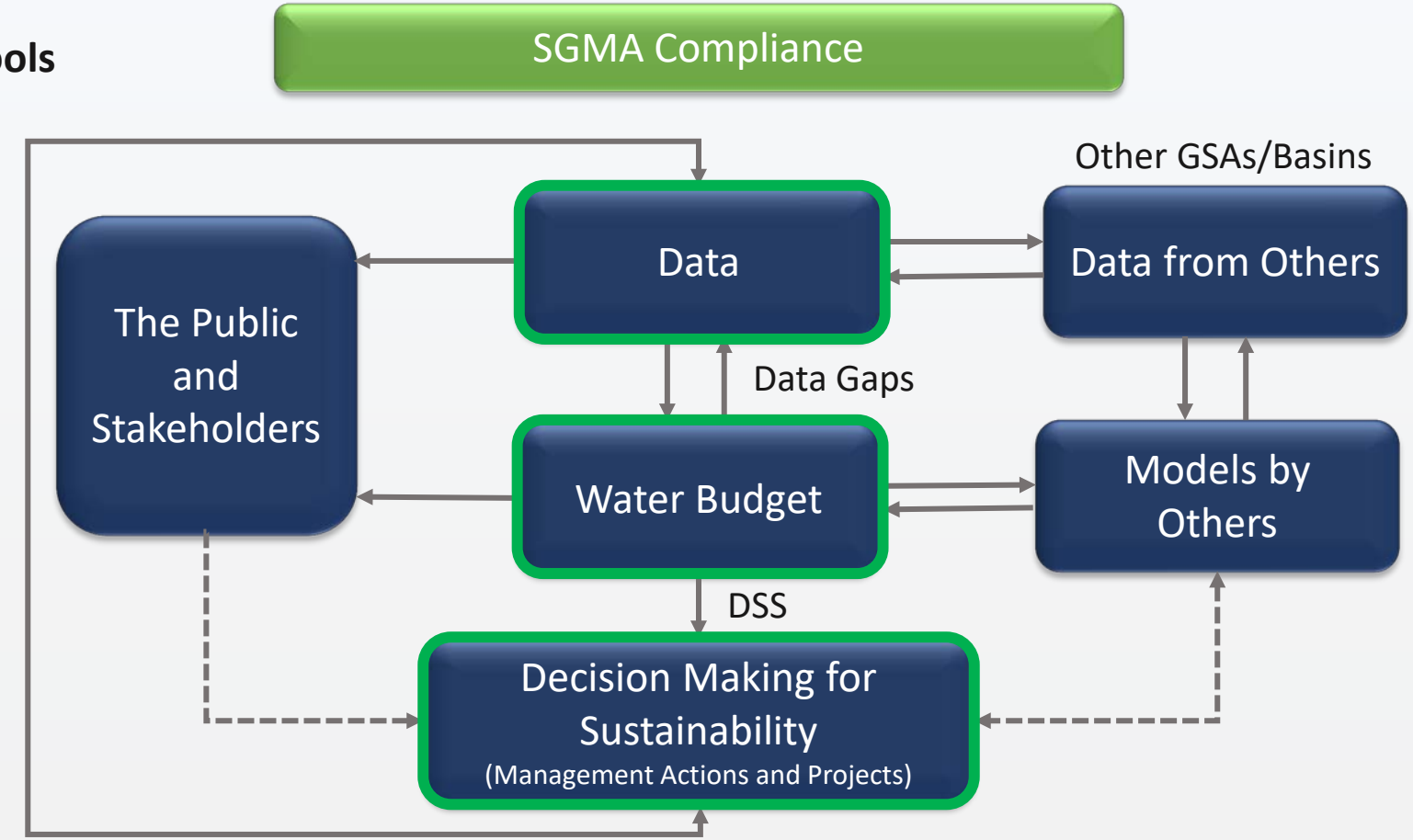
SGMA Compliance Framework

Supported by Tools



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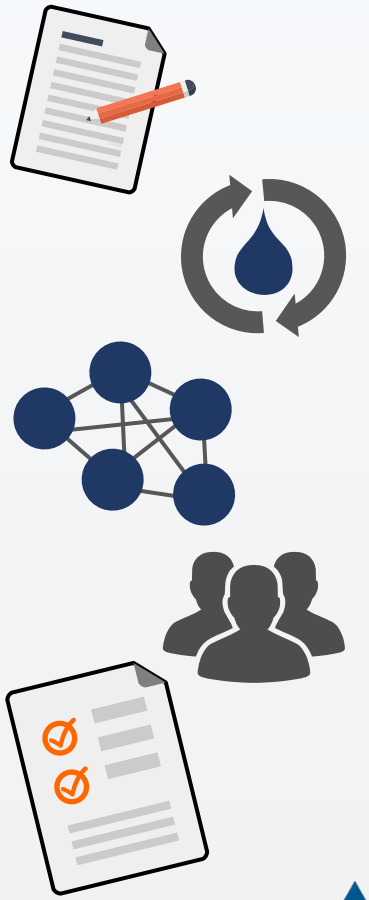
A Diverse Toolbox Will Be Required



- Data Collection and Management
- Data Analysis
- Water Budget Analysis
- Evaluating Alternatives Actions Before Implementation (Forecasting Performance)
- Decision-Making
- Communication with Stakeholders
- Administration
- Measuring and Tracking Objectives (Measuring Effectiveness of Actions)

Activities & Functions = Different Tools

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A Knowledge Management Hierarchy

Acquisition

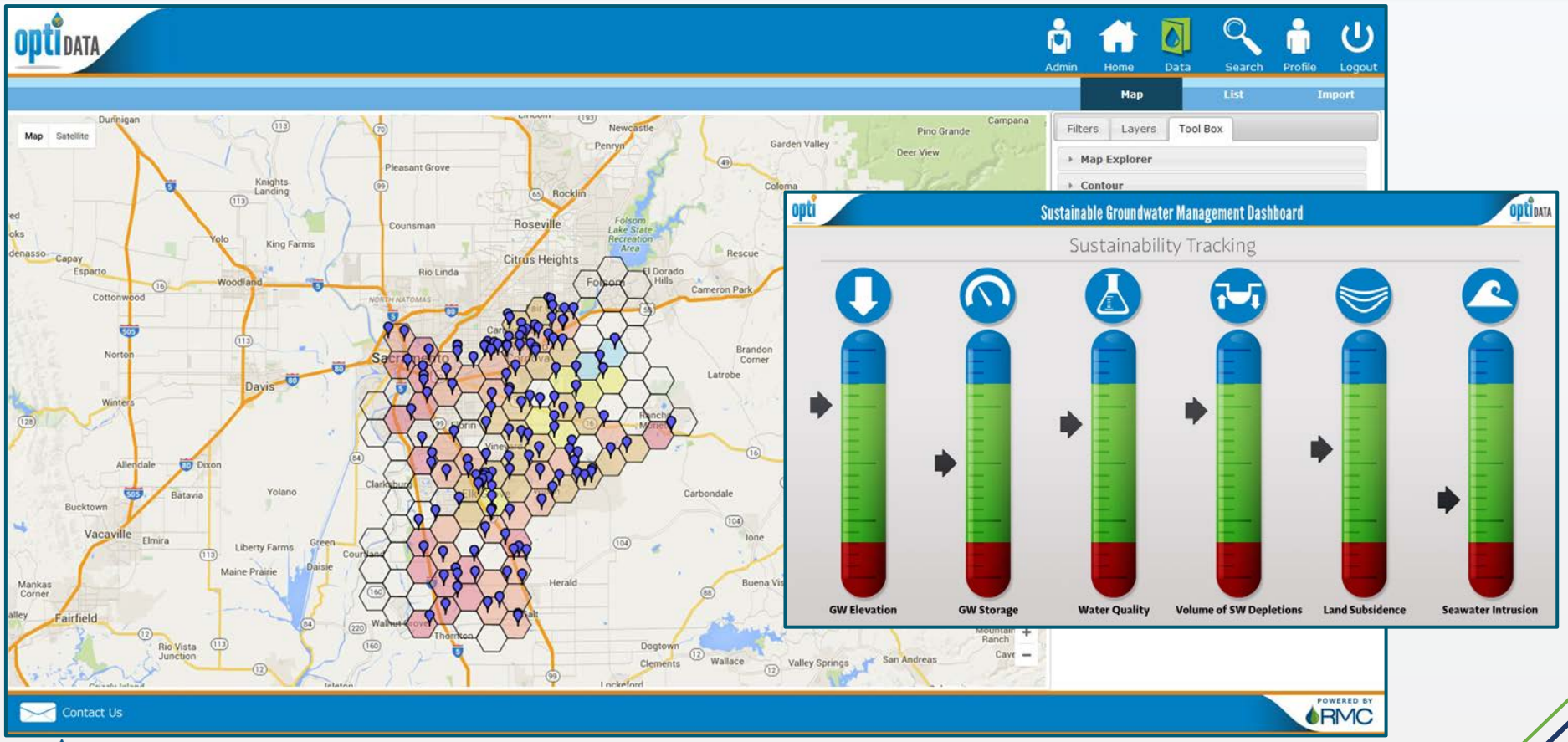
Analytics & Visualization

Decision-Making

KEY

Data is Fundamental for SGMA

Data Management and Visualization Tools will be Critical



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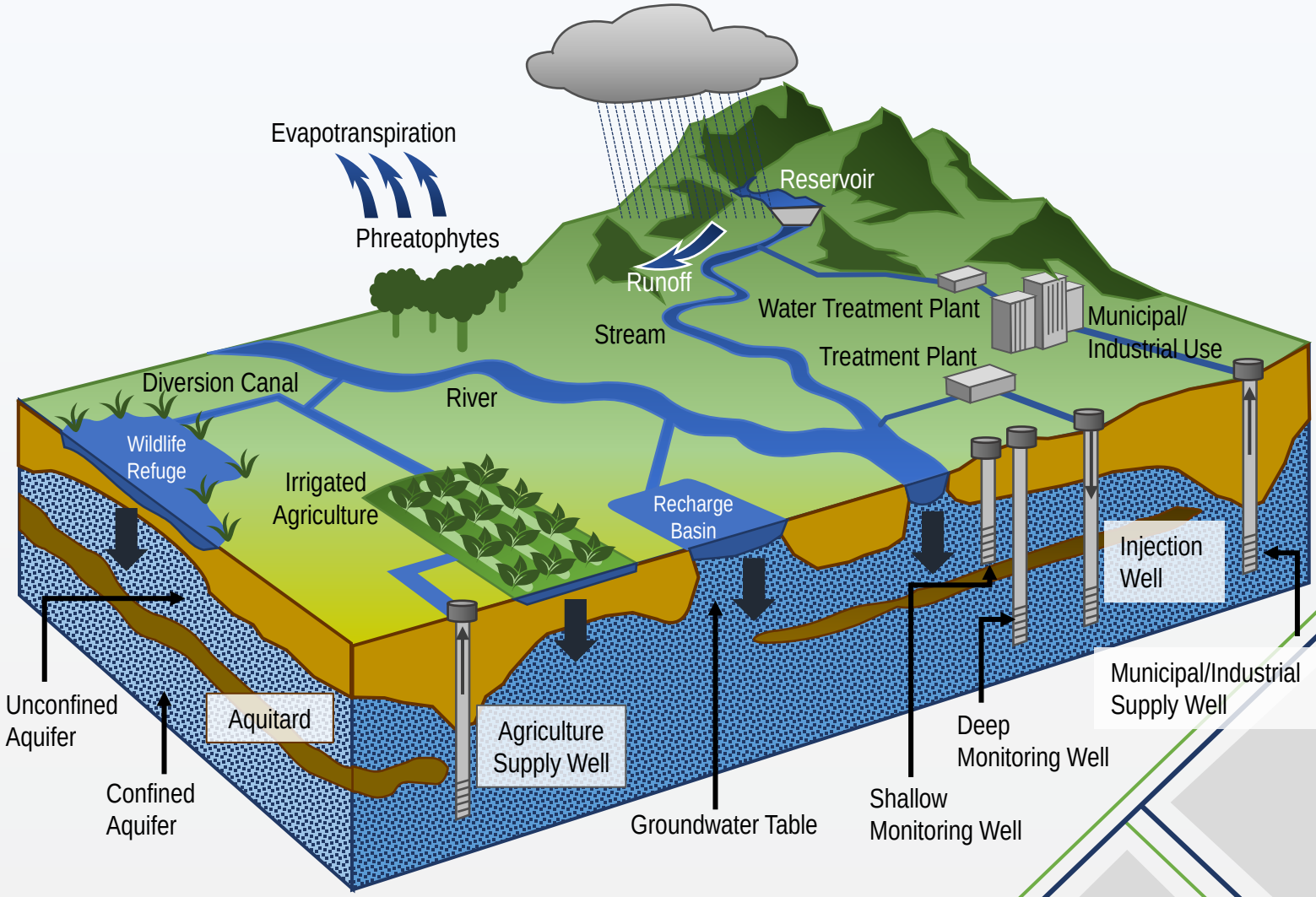
Water Budget is Fundamental

" ***Water budget*** means an accounting of the total groundwater **and surface water** entering and leaving a basin including the changes in the amount of water stored."

Water Resources System



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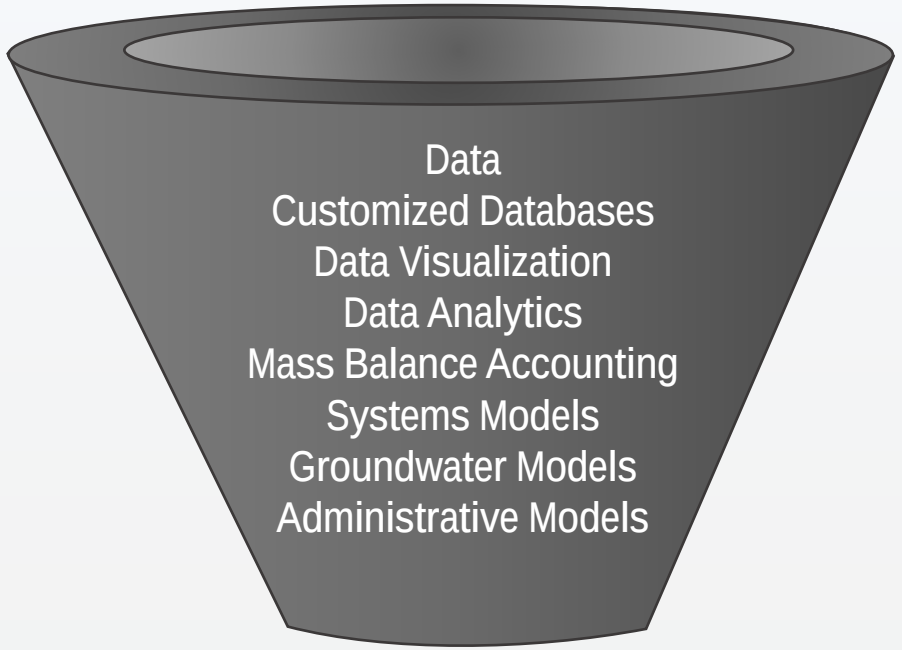
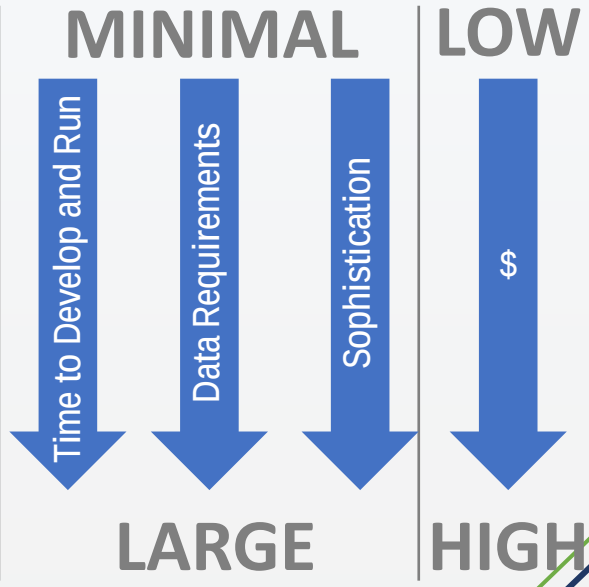
Water Budget Development and Analysis–
Groundwater Models are Not the Only Tool

- Groundwater models are powerful tools
- Assessment of available resources and data is critical
- Do not have to start with a model





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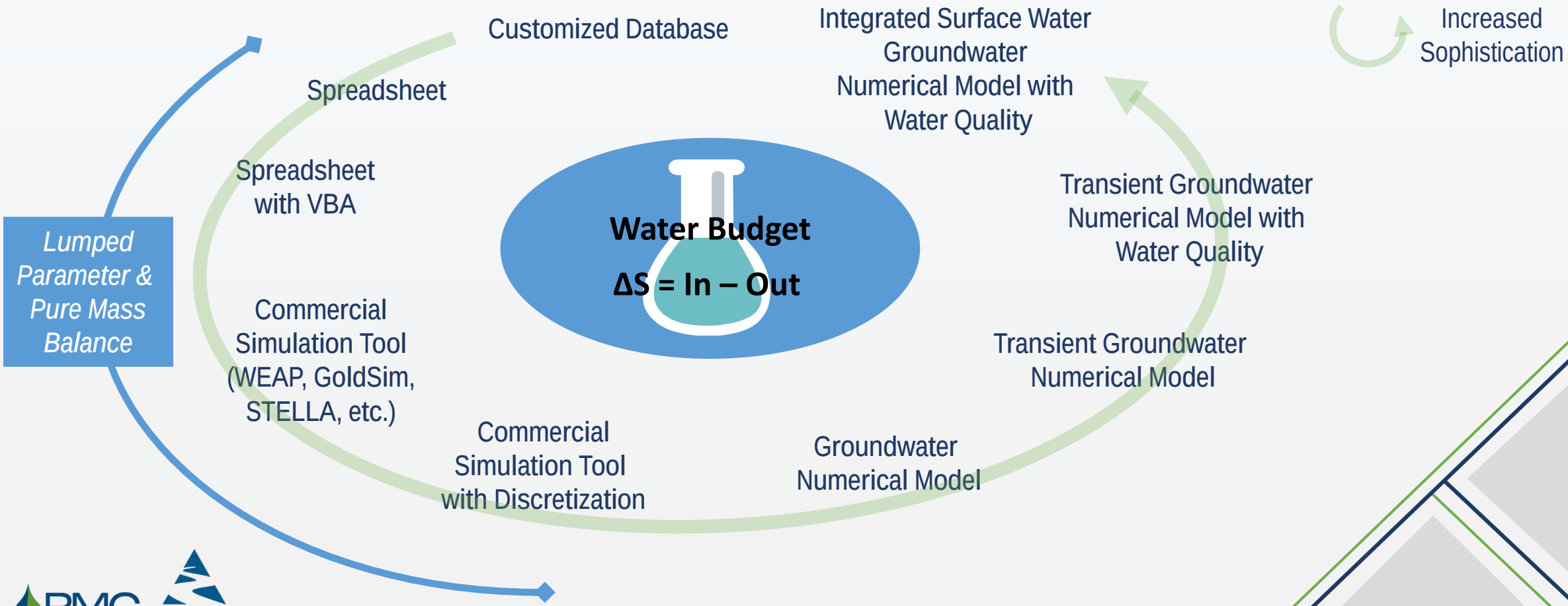
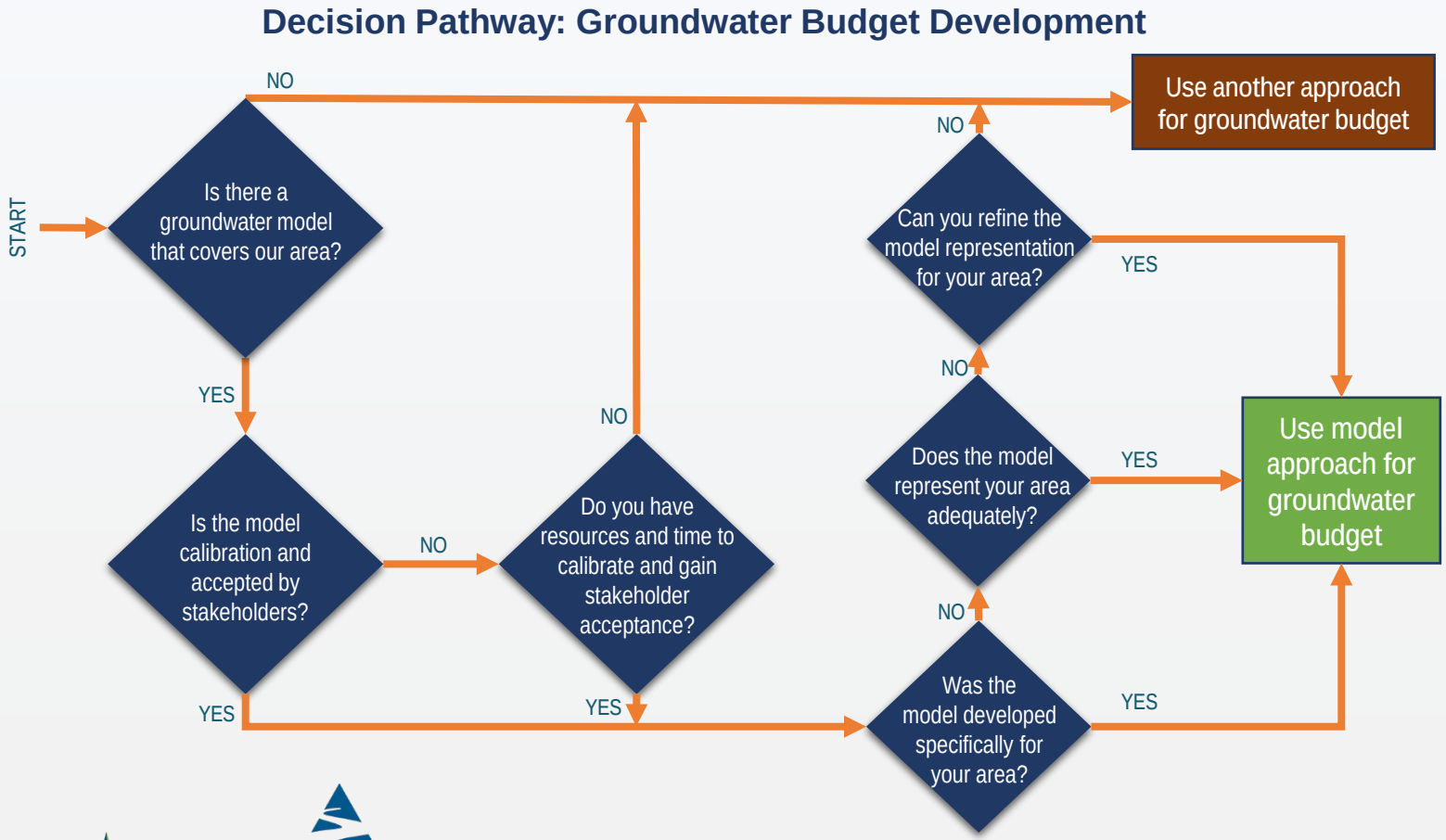
Water Budget Analysis



Water Budget Development – Should I Use a Groundwater Model



KEY

Develop an accepted water budget

On Decisions about Tools: Consider that GSPs Will Ultimately Have Components of Integrated Planning

	"Traditional" Groundwater Planning	Integrated Resource Planning
Domain	Groundwater	Water resources system
Objectives	Single objective	Multiple objectives
Alternatives	Least cost usually preferred	Multiple benefits preferred
Stakeholder Involvement	Ad hoc or no clear mechanism to accommodate stakeholders	Establishes a process for early and continued stakeholder involvement
Uncertainty	Not formally evaluated or added as sensitivity	Direct evaluation in the analysis

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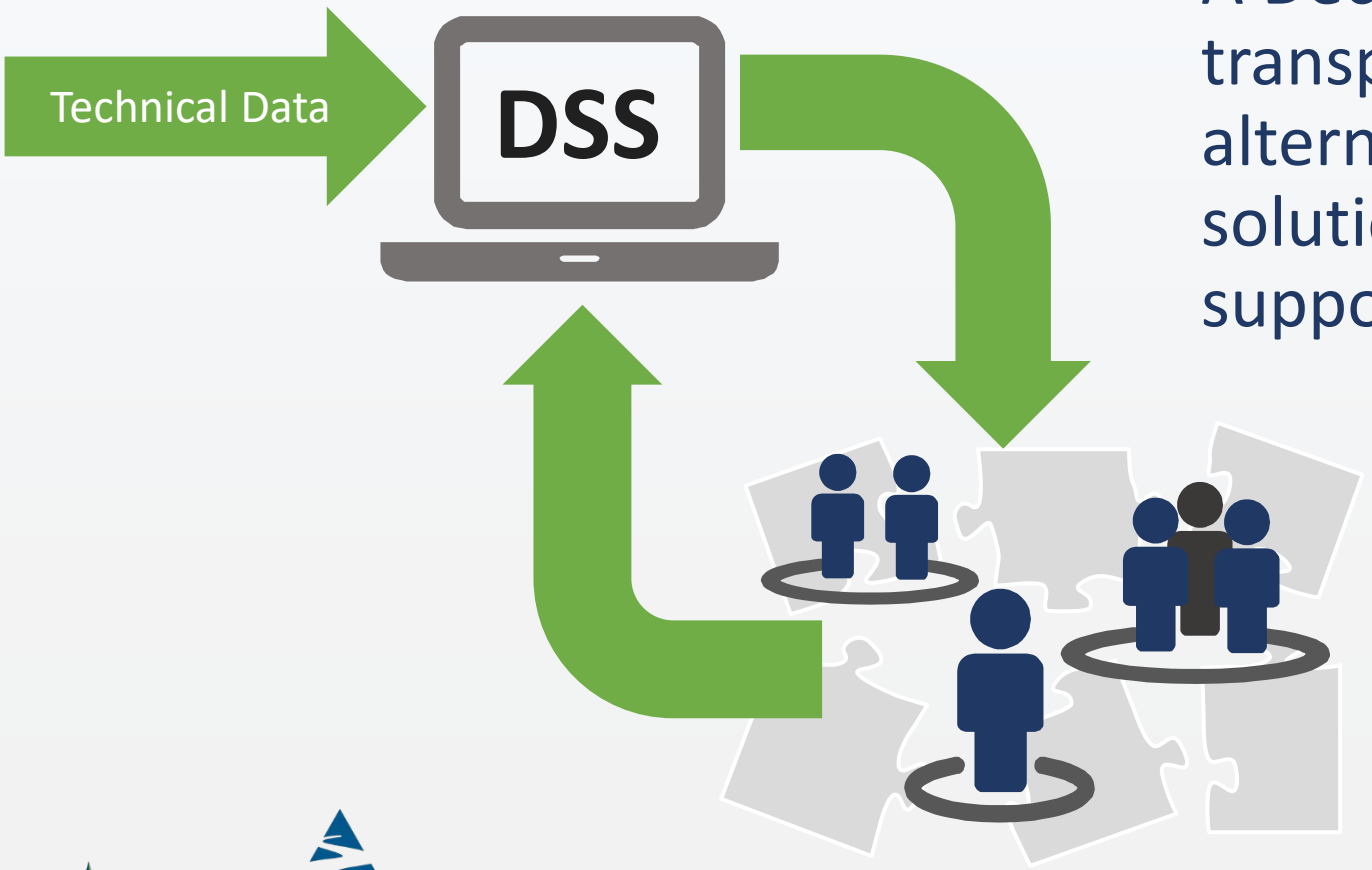
Integrated Planning is More Complex than Traditional Planning – Use Tools & Processes for Decision-Making



A Decision Support Process allows for transparent investigation of alternatives and identification of solutions – Groundwater models can support DSS

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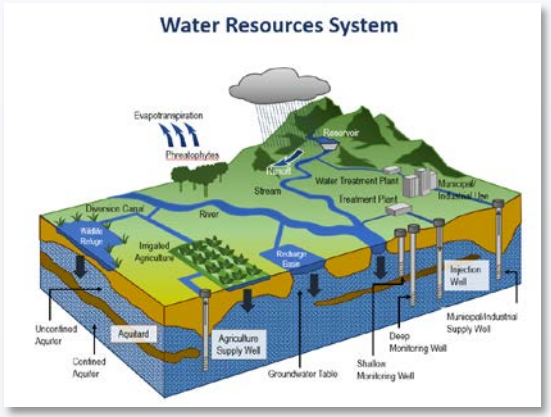
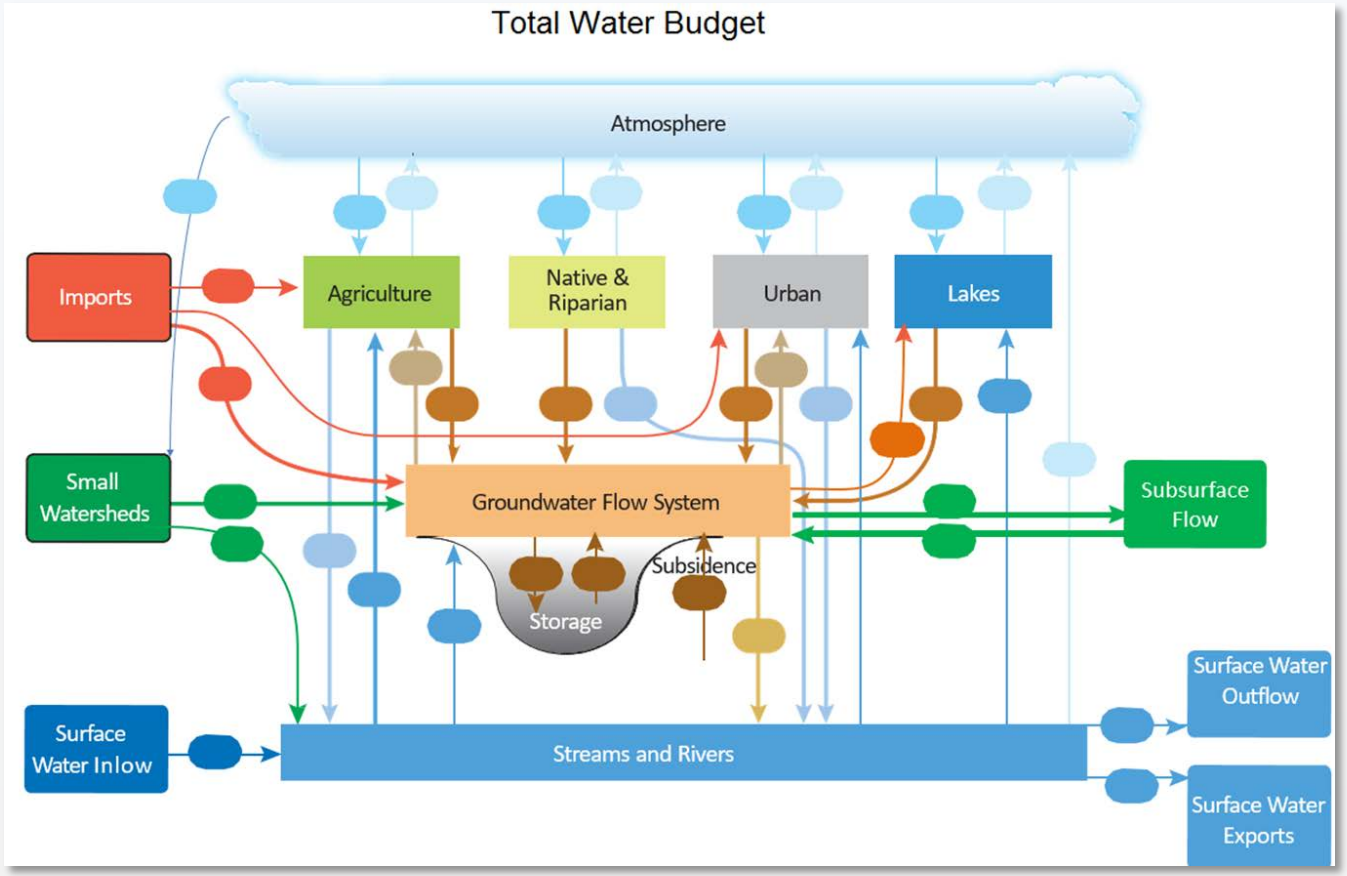
DSS – Systems Models Can Prove Very Valuable





We may be modeling the entire system!

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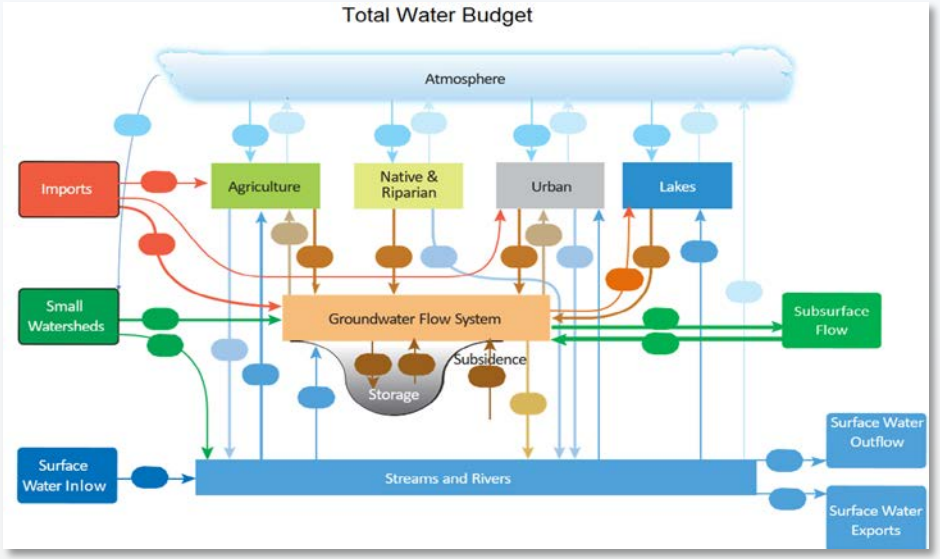
DSS – Systems Models Can Prove Very Valuable – Reduced Simulation Time & Non-Hydrogeologic Variables

Management Actions



System Simulation

System Performance

Compare Performance to Objectives

Reduced Run Times
10x – 100x

80% Information
in
20% Effort

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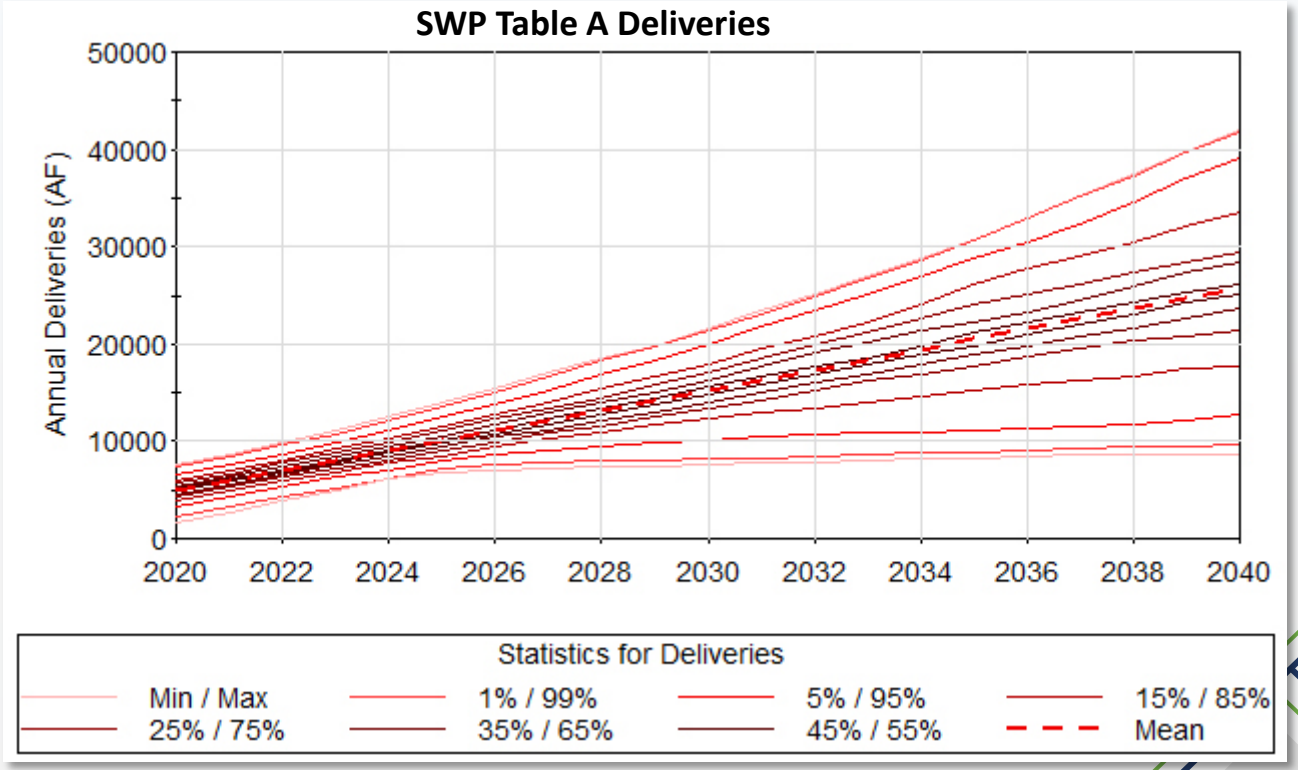
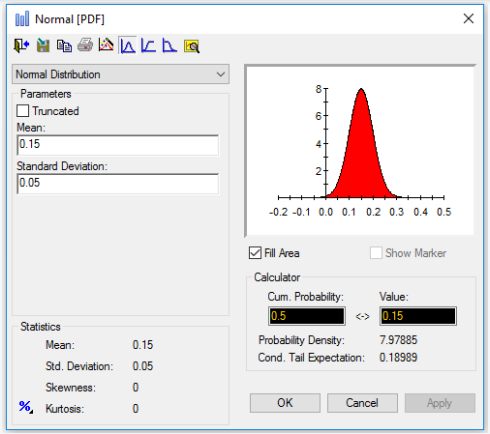
Systems Models Can Better Deal with Uncertainty

- Climate change
- Legislative
- Regulatory
- Other basins' actions
- California Water Fix
- Water markets
- Costs of water

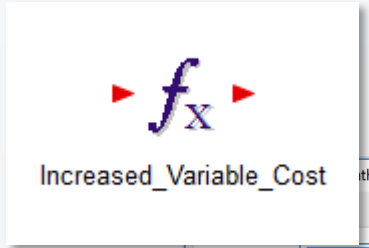


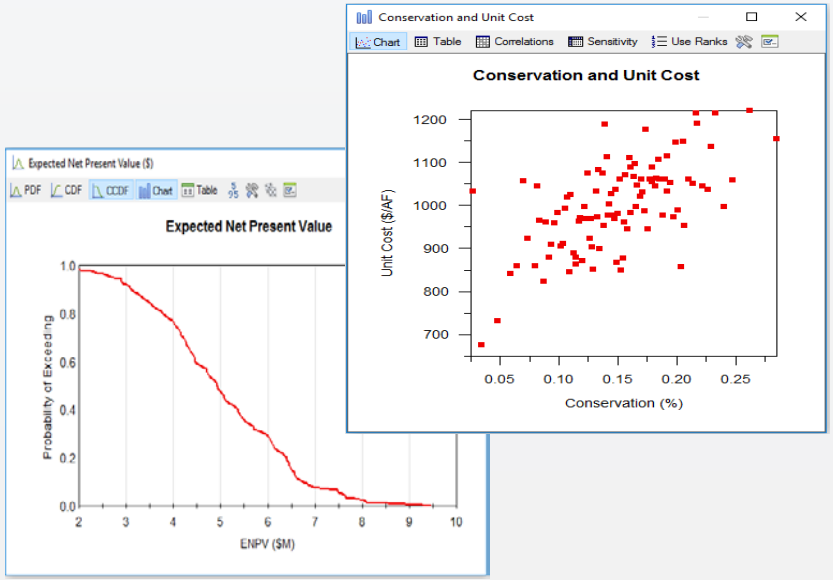
Some Simulation Tools Allow for Probabilistic Analysis

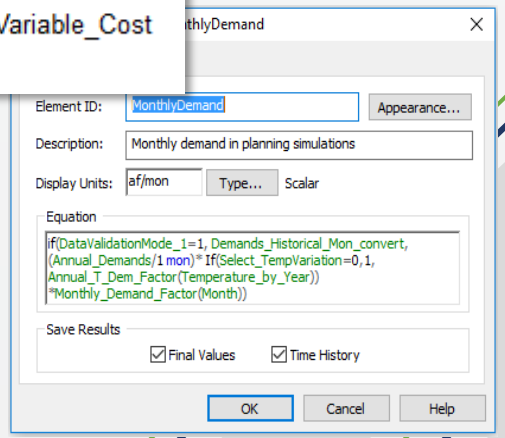


1 Define Distributions for Uncertainty Drivers

2 Use Cost Functions to Translate Uncertainty into Monetary Risk







3 Obtain Probability of Desired Financial Outcomes

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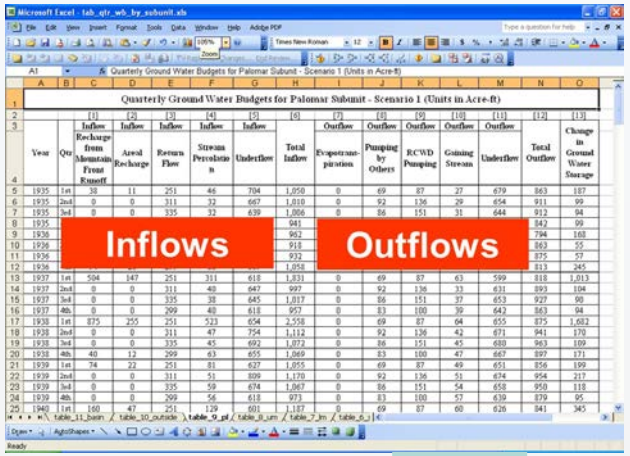
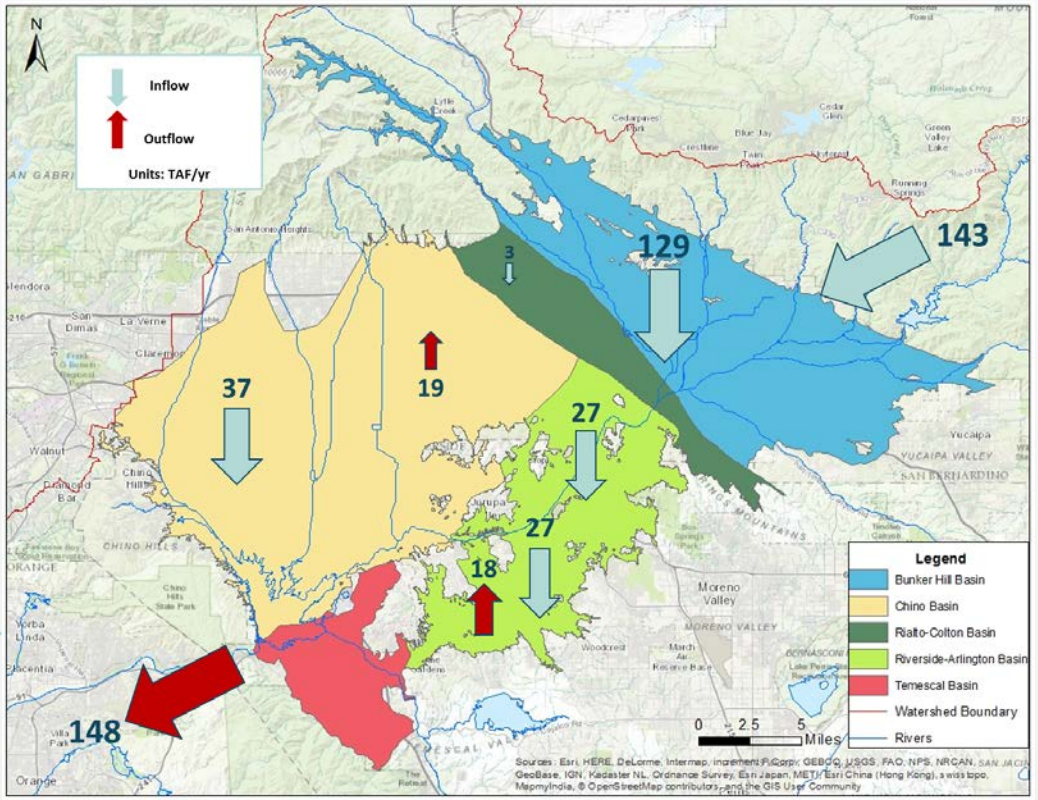
Progressive Development Example – Data to Water Budget

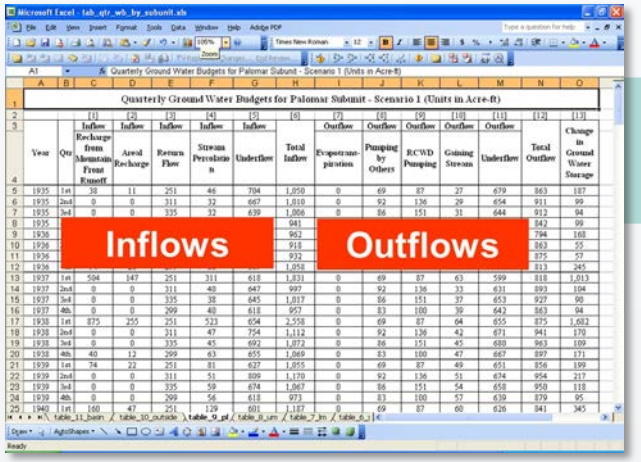


Simple Database

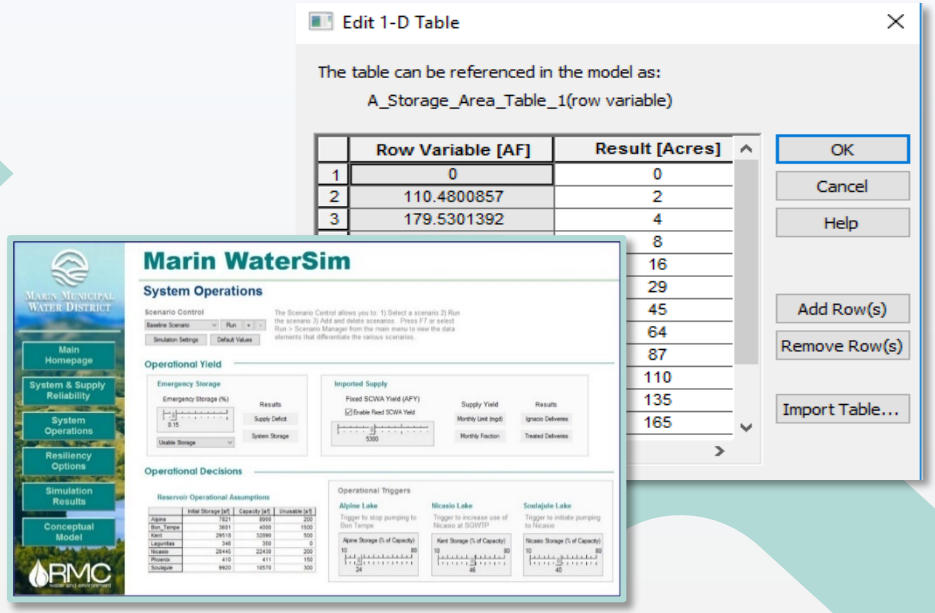


Scenarios of Static Water Budget

Progressive Development Example – Data to Conceptual Systems Model for GSP Actions Analysis

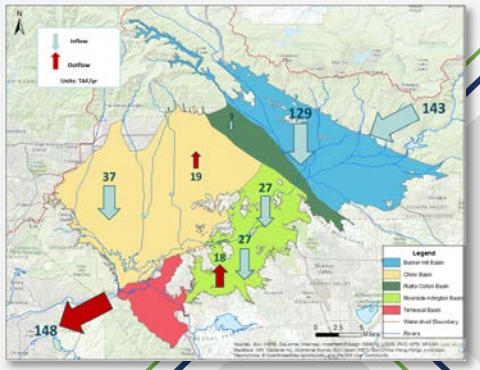


Simple Database



Evaluation of GSP Actions

Systems Model (Lumped Parameter)



Dynamic Water Budget

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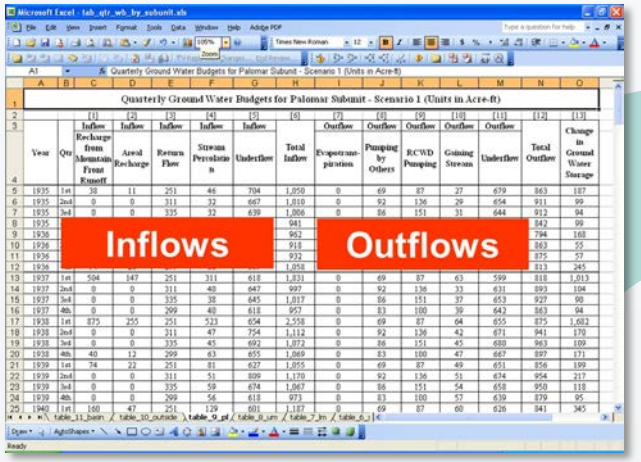
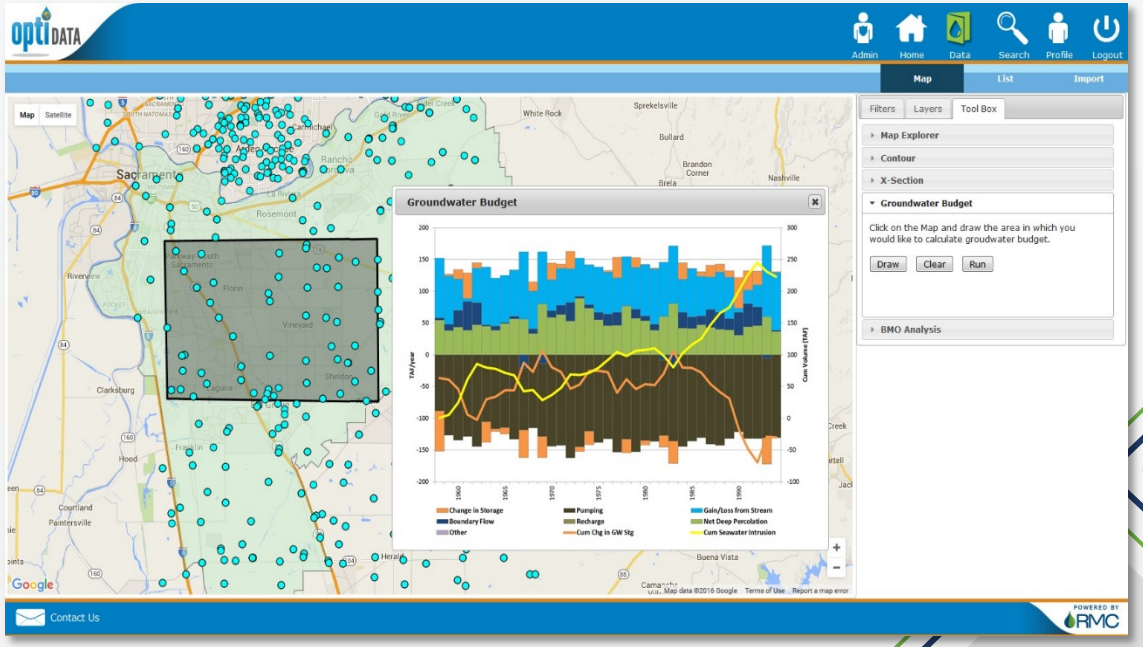
Progressive Development Example – Data to Advanced Database with Visualization and Analytics



Simple Database

Advanced Database with Visualization



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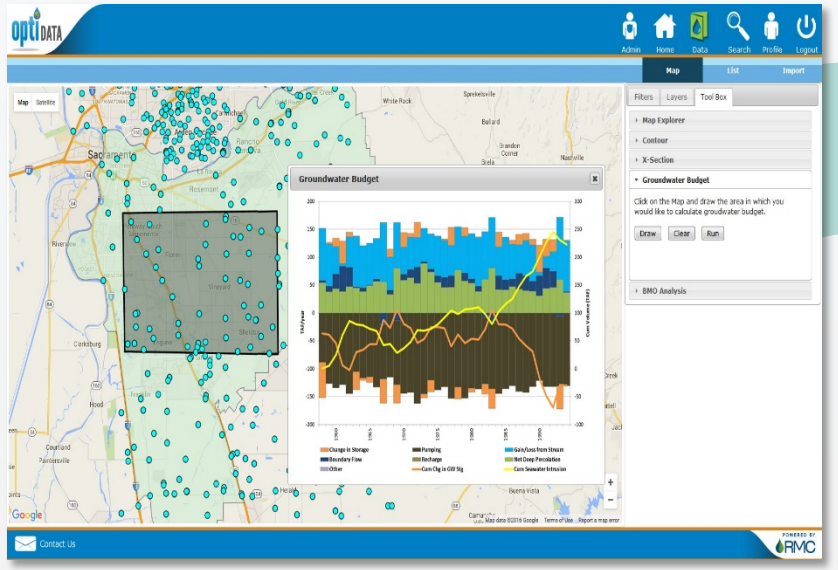
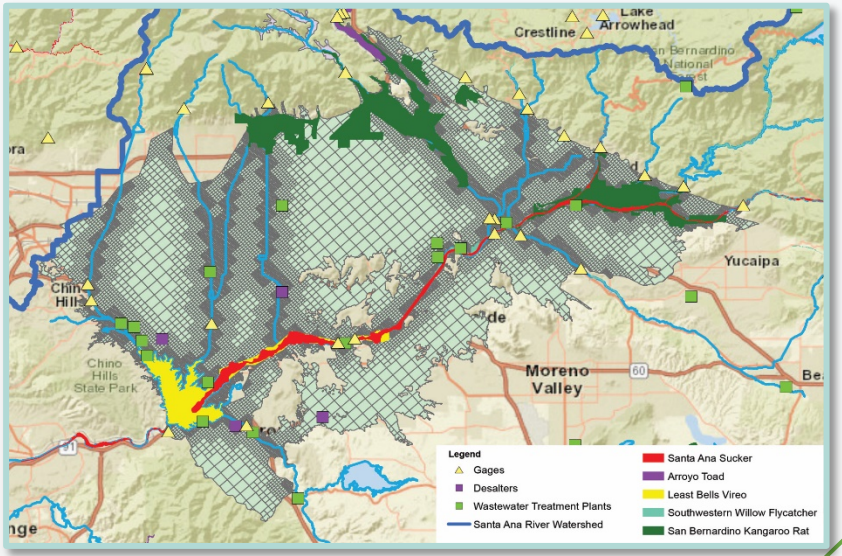
Progressive Development Example – Geodatabases to Numerical Groundwater Model

Advanced Database with Visualization





Numerical Groundwater Model

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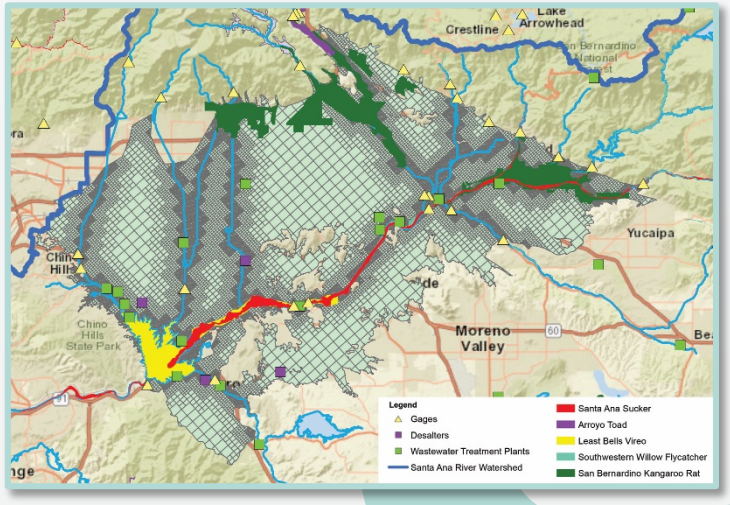
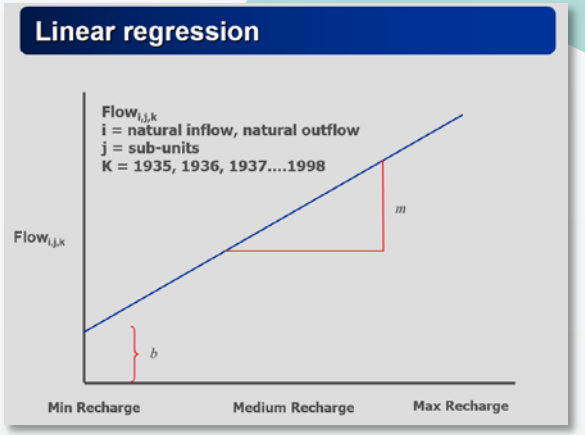
Progressive Development Example – Improve Systems Model with Groundwater Model

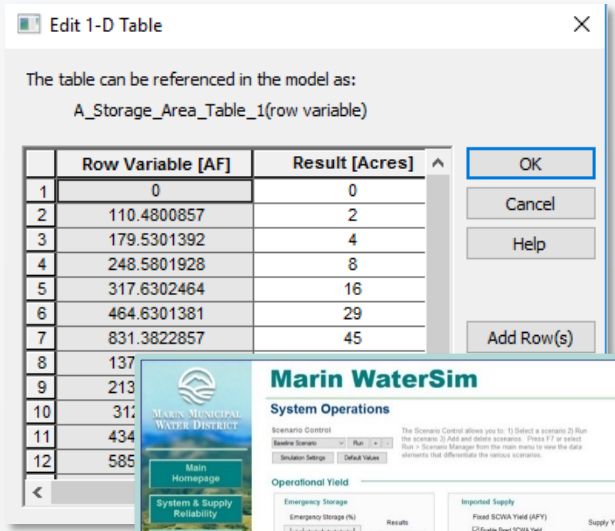
Numerical Groundwater Model





Response Functions

Refined Systems Model



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4	248.5801928	8
5	317.6302464	16
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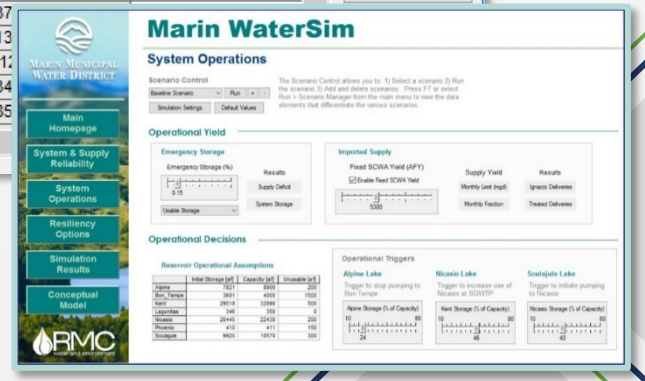
7	831.3822857	45
8	137	
9	213	
10	31	
11	434	
12	585	



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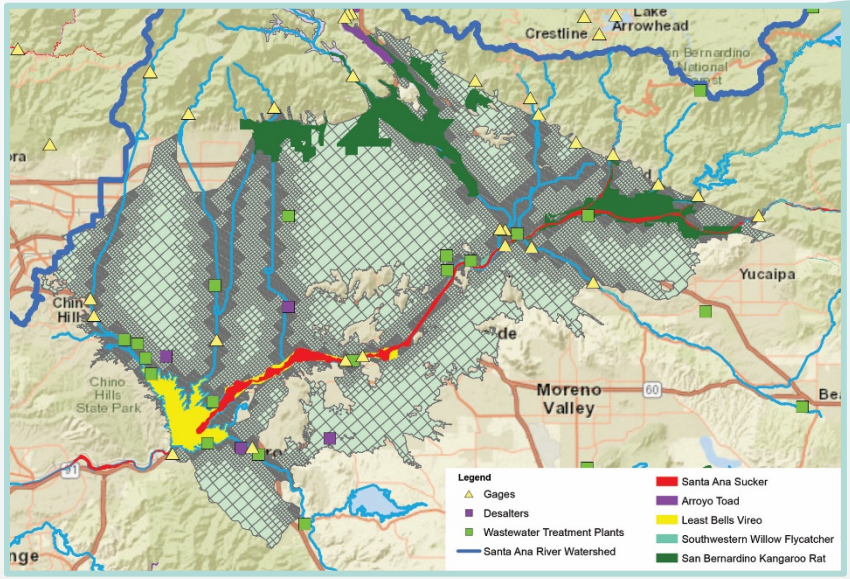
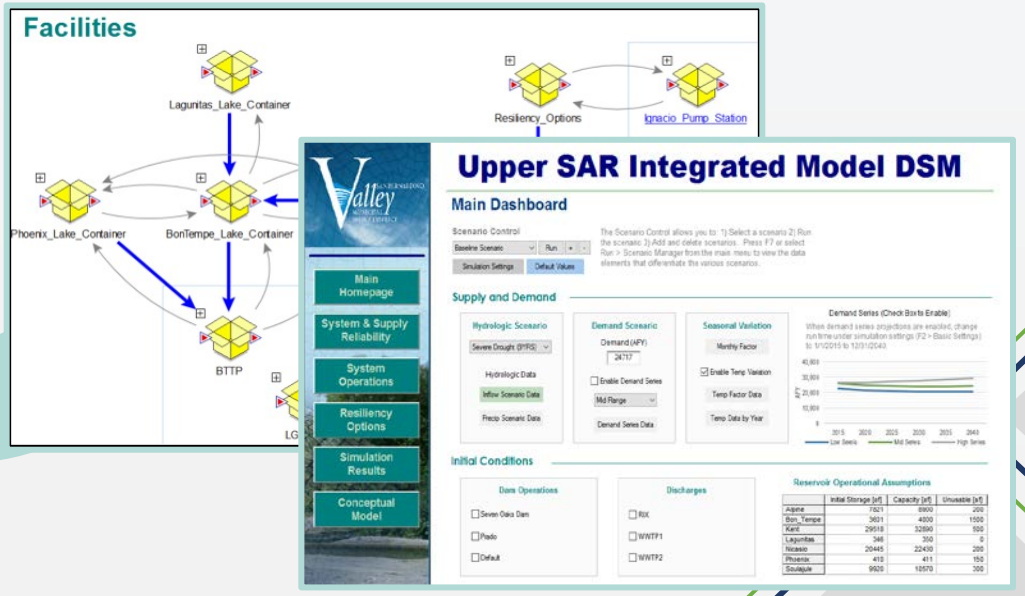
Systems Models Can Work in Tandem with Numerical Groundwater Models



- Critical areas for Groundwater Model
- Critical data gaps
- High-Value options and scenarios

- Response functions for system interrelationships
- Validation of results of high-value options and scenarios



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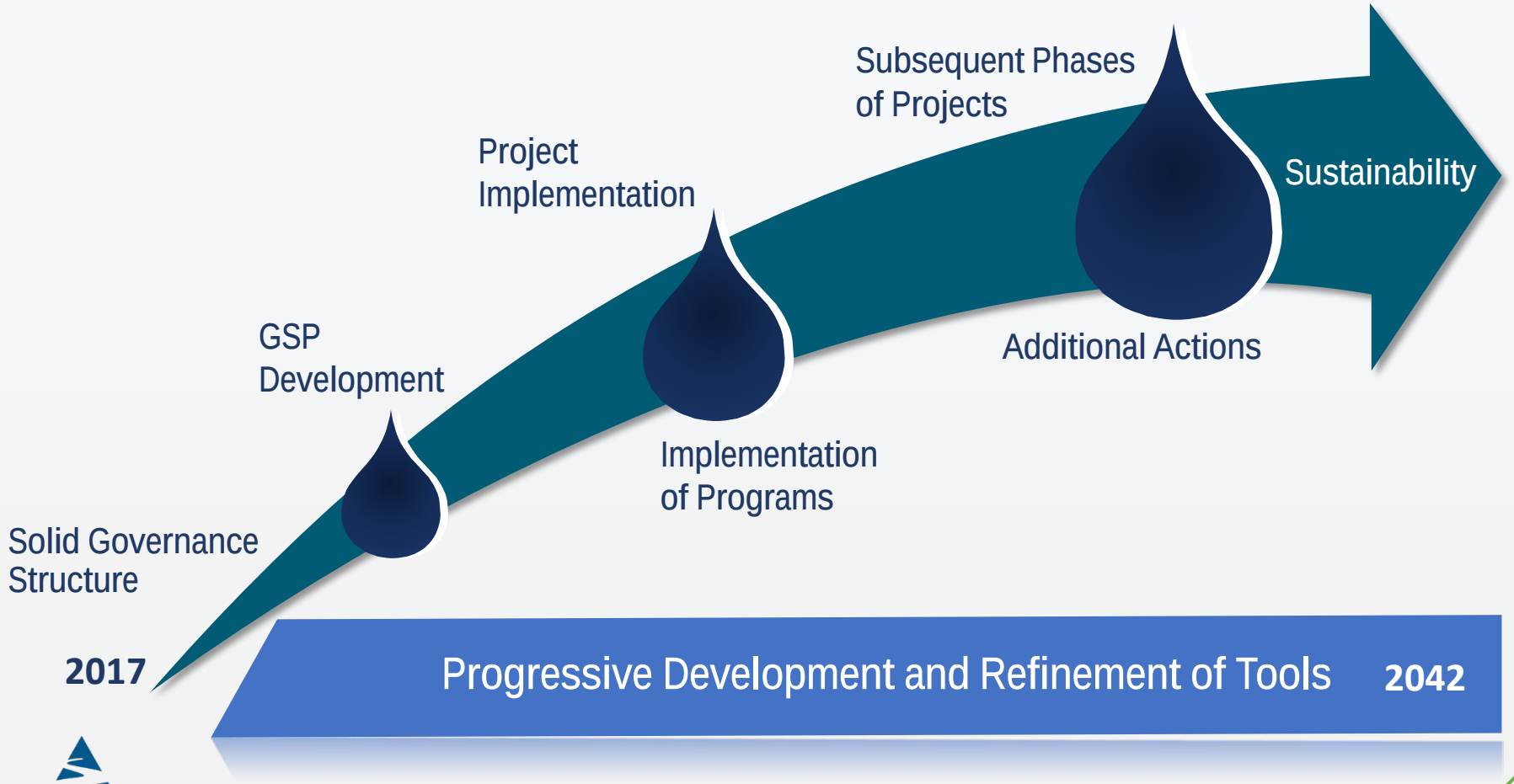
When Defining Modeling and Analysis Needs

- Consider appropriateness for desired outcomes
- Phase of the GSP
- Scalability and expandability

Three Years of Planning - 20 Years of Action



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Questions

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