

# SOME NUTS AND SOME BOLTS OF DEVELOPING NEW DRINKING WATER SOURCES FROM SURFACE AND GROUND WATER

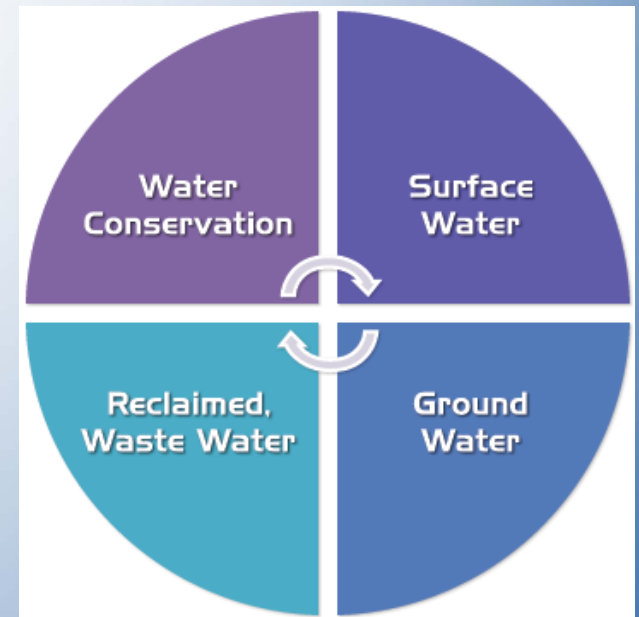
PNWS-AWWA 2014

PRE-CONFERENCE SEMINAR

MAY 7<sup>TH</sup>

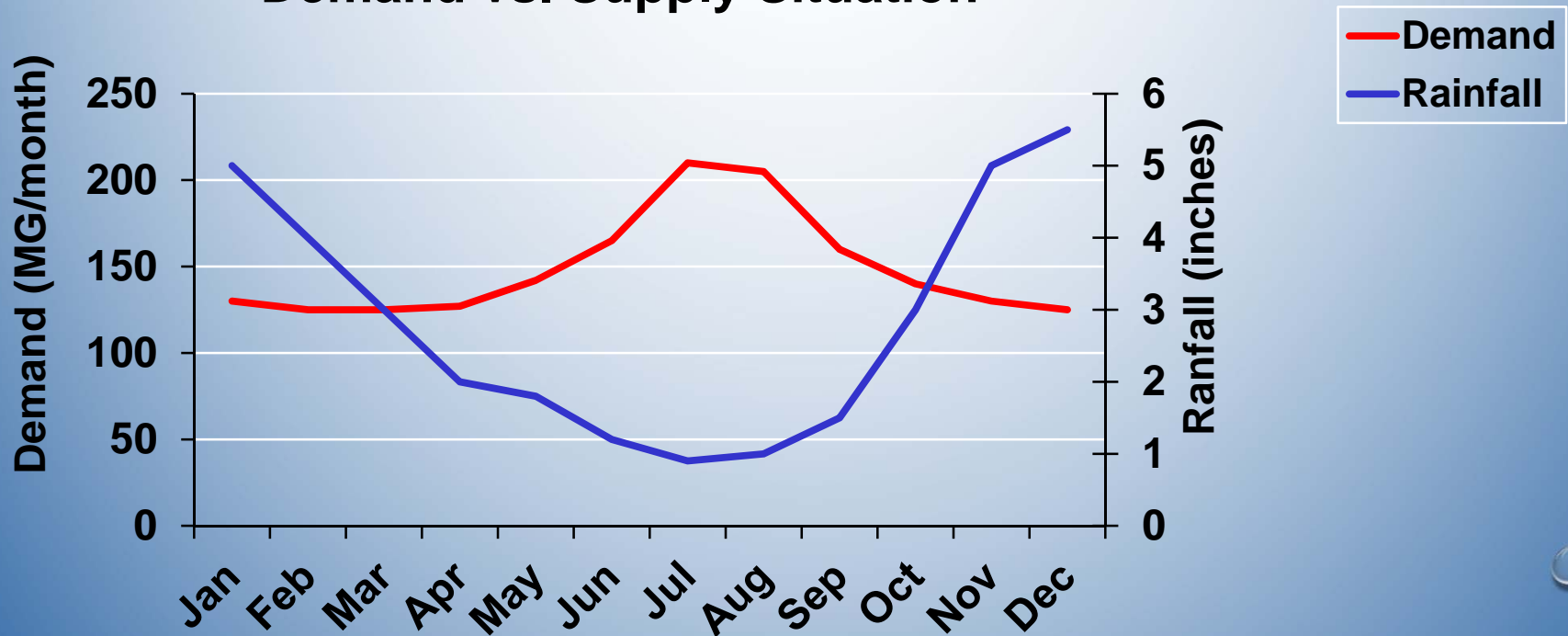
# OVERVIEW OF PRESENTATION

- EVALUATING WATER NEEDS
- DEFINING POTENTIAL WATER SOURCES
  - SURFACE WATER
  - GROUNDWATER
  - CONJUNCTIVE USE MANAGEMENT
- EVALUATING WATER AVAILABILITY
- DEVELOPING ALTERNATIVES
- EVALUATING ECONOMICS AND CIP NEEDS



# EVALUATING WATER NEEDS

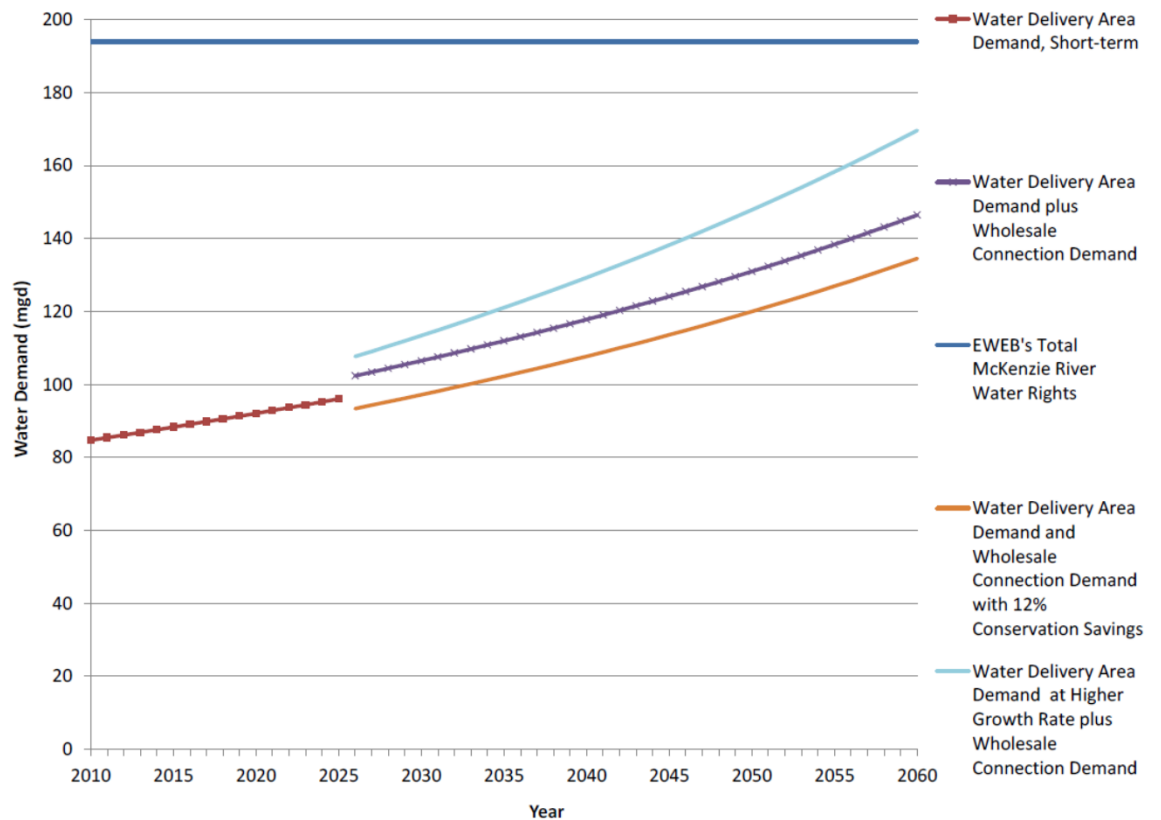
## Western States Demand vs. Supply Situation



# EVALUATING WATER SUPPLY NEEDS

- ASSESSING KEY TRENDS IN WATER SYSTEM OR REGION
  - PER CAPITA CONSUMPTION TRENDS – PEAKING FACTORS
  - POPULATION TREND
  - LAND USE TRENDS AND CHANGES
  - CLIMATE CHANGE INFLUENCES ON WATER DEMAND (AND SUPPLY)
  - INDUSTRIAL WATER USER BASE (GROWTH FACTORS)

EWEB Water Delivery Area Projected Water MDD plus Wholesale Connection Demand including 12 Percent Conservation Savings and a High Growth Rate



# EVALUATING WATER SOURCES AVAILABLE VS. SUPPLY NEEDS

- INTEGRATED WATER MANAGEMENT PLANNING – VARIETY OF NAMES
  - URBAN WATER MASTER PLANS
    - SURFACE WATER
    - GROUNDWATER
    - WATER CONSERVATION
    - INDIRECT POTABLE REUSE
    - RECYCLED/RECLAIMED WATER
  - LEAK-LOSS PREVENTION PLANNING AND ASSESSMENT
  - URBAN AND WATERSHED STORMWATER MANAGEMENT PLANS
    - AVAILABILITY OF FLOWS FOR GROUNDWATER STORAGE – VARIES BY LOCATION/JURISDICTION
    - FLOOD FLOWS ALLOCATED?

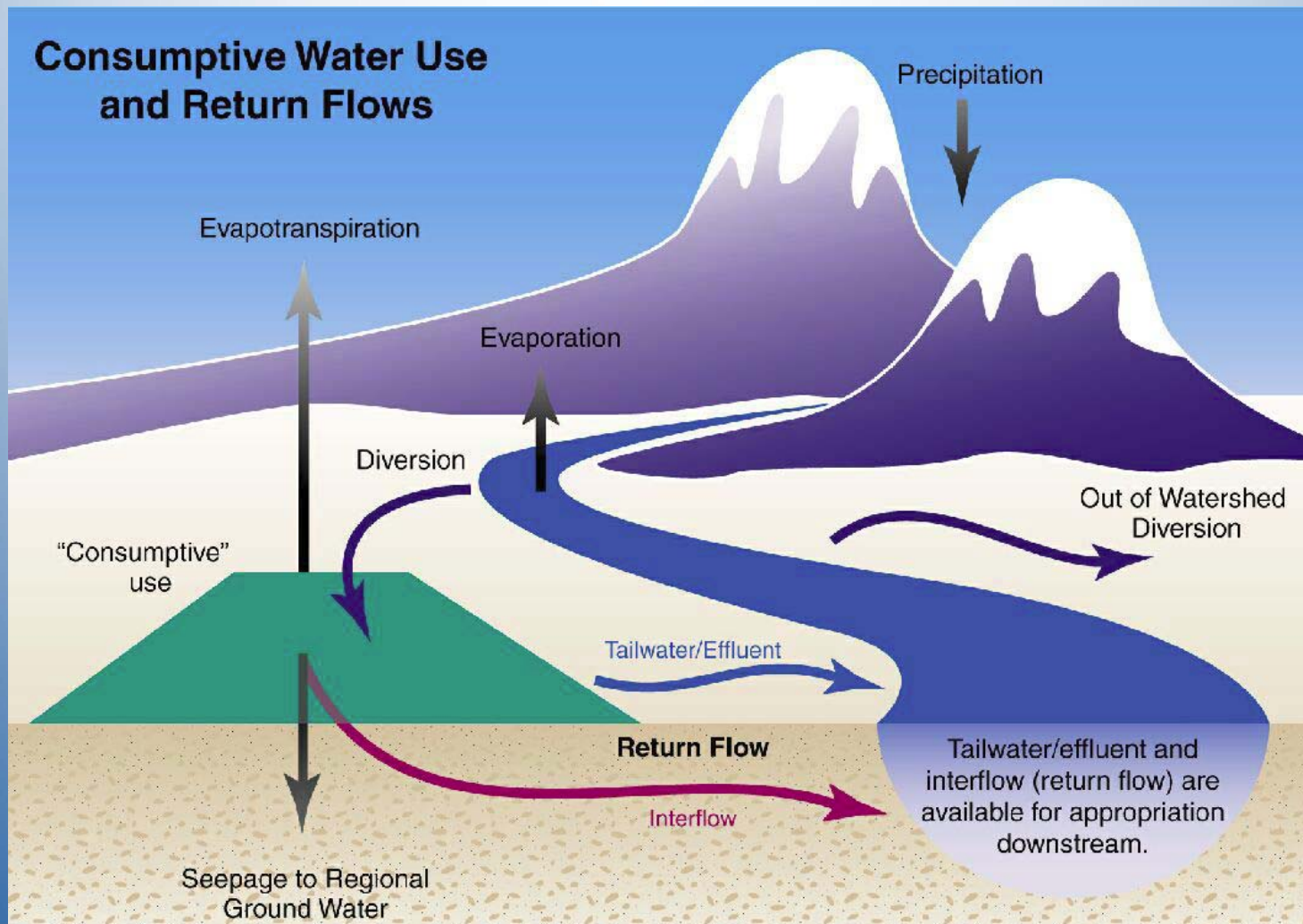
# LET'S SAY YOU NEED A NEW SOURCE IN THE WATER-SUPPLY PORTFOLIO

- WHAT'S THE TIME-HORIZON FOR WATER SUPPLY PLAN?
  - 5-YEAR
  - 20-YEAR
  - 40-YEAR
  
- THE TIME-HORIZON AFFECTS ALL ASPECTS OF PROJECT DEVELOPMENT
  - LEGAL
  - TECHNICAL
  - FINANCIAL

Scenario Key Indicators	Units	2025 Scenarios		
		Base Case	Slow Growth	Fast Growth
Instream Flow Restored	acre-feet	196,171	196,171	200,657
Municipal Demand Met	%	100%	100%	100%
Groundwater Demand Met	%	100%	99%	100%
Irrigated Land Change	%	-4%	-2%	-9%
District Revenues	\$million	10	6	16
Landowner Revenue	\$million	22	16	35
Saved Transmission Loss	%	31%	41%	21%
Total Expenditure	\$million	135	172	115

# ASSESSMENT OF WATER AVAILABILITY

## CONSUMPTIVE USE



# ASSESSMENT OF WATER AVAILABILITY CONSUMPTIVE USE

- OREGON DEFINITION
  - A CONSUMPTIVE USE CAUSES A NET REDUCTION OF INSTREAM FLOW AND IS USUALLY ASSOCIATED WITH AN EVAPORATIVE OR TRANSPIRATIVE LOSS
- WASHINGTON DEFINITION
  - "WATER USED CONSUMPTIVELY DIMINISHES THE SOURCE AND IS NOT AVAILABLE FOR OTHER USES"
- IDAHO DEFINITION
  - NOT REALLY FOUND – DOMESTIC CONSUMPTIVE USE = INDOOR + OUTDOOR IRRIGATION
- WATER CONSUMPTIVE USE
  - HISTORIC ESTIMATES FOR **MUNICIPAL/DOMESTIC = 15%** (AGRICULTURE IS 90%, USGS FACT SHEET 2008-3032)
  - PROJECTED DOMESTIC CU – NOT ANTICIPATED TO INCREASE PER REGULATOR



# DEFINING POTENTIAL NEW SOURCES AVAILABLE

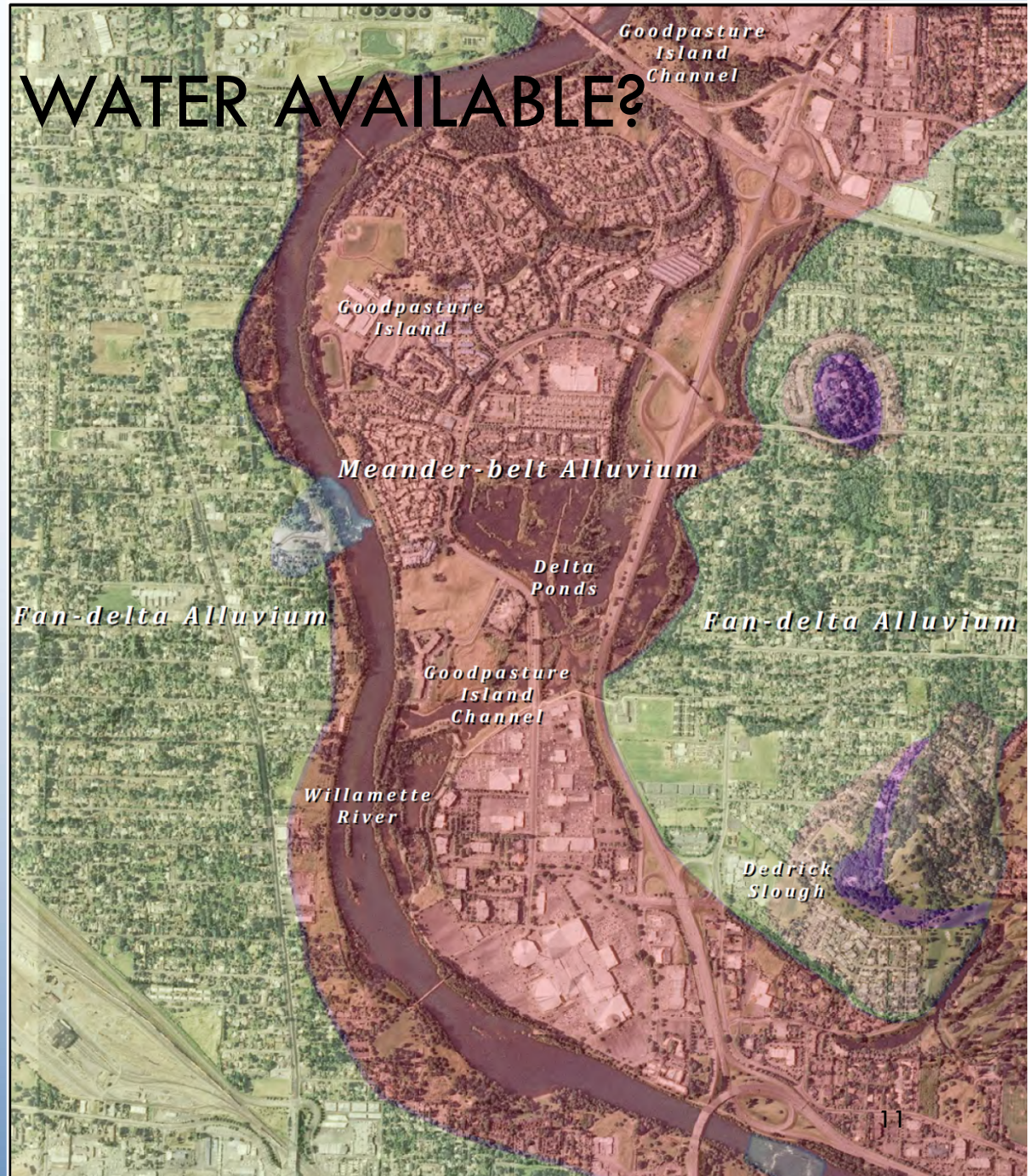
- WATER AVAILABILITY
  - THE STATES DO THIS ANALYSIS! – BUT INPUT CAN BE PROVIDED
  - SURFACE WATER FLOW REQUIREMENT
    - WHAT IS TOO MUCH
    - WHAT IS TOO LITTLE
    - TIMING IS NOT QUITE EVERYTHING!
  - GROUNDWATER BASINS
    - CONNECTION TO SURFACE WATER BODY(IES)
    - ALLOWABLE DROUGHT PERIOD DECLINES
    - DEFINITION OF MINING GROUNDWATER
- WASHINGTON SOURCE
  - [HTTP://WWW.ECY.WA.GOV/PROGRAMS/WR/RULES/IMAGES/PDF/POL\\_2010.PDF](http://www.ecy.wa.gov/programs/wr/rules/images/pdf/pol_2010.pdf)
- OREGON DEFINITION
  - WATER AVAILABILITY (**WA**) IS OBTAINED FROM NATURAL STREAM FLOW ( $Q_{NSF}$ ) BY SUBTRACTING EXISTING STORAGE (**ST**), OUT-OF-STREAM CONSUMPTIVE USES (**CU**) AND IN-STREAM DEMANDS (**IS**).
  - **WA =  $Q_{NSF} - ST - CU - IS$**
  - [HTTP://APPS.WRD.STATE.OR.US/APPS/WARS/WARS\\_DISPLAY\\_WA\\_TABLES/SEARCH\\_FOR\\_WAB.ASPX](http://apps.wrd.state.or.us/apps/wars/wars_display_wa_tables/search_for_wab.aspx)

# ASSESSMENT OF WATER AVAILABILITY VIA DATA

- HOW MUCH STORAGE IS AVAILABLE?
  - SURFACE RESERVOIRS
- SURFACE WATER FLOW EVALUATION
  - GAUGE PRECISION – REVISED FLOW RATING CURVES(AQUARIUS SOFTWARE)
  - FLOW ACCRETIONS/DEPLETIONS
    - VIA DIRECT DIVERSION
    - VIA GROUNDWATER
  - TMDL IMPAIRMENTS ASSESSMENT VIA DATA
- GROUNDWATER POTENTIAL
  - SUSTAINABLE YIELD ANALYSIS
  - STORAGE EFFICIENCY
  - STORAGE YIELD(S)

# SURFACE WATER AVAILABLE?

- VARIES A GREAT DEAL BY STATE AND LOCATION
- QUANTIFICATION OF FREQUENCY AND TIMING OF EXCESS FLOWS
- ENVIRONMENTAL CONSTRAINTS
- PUBLIC PERCEPTION & ACCEPTANCE MAY LIMIT YOUR OPTIONS



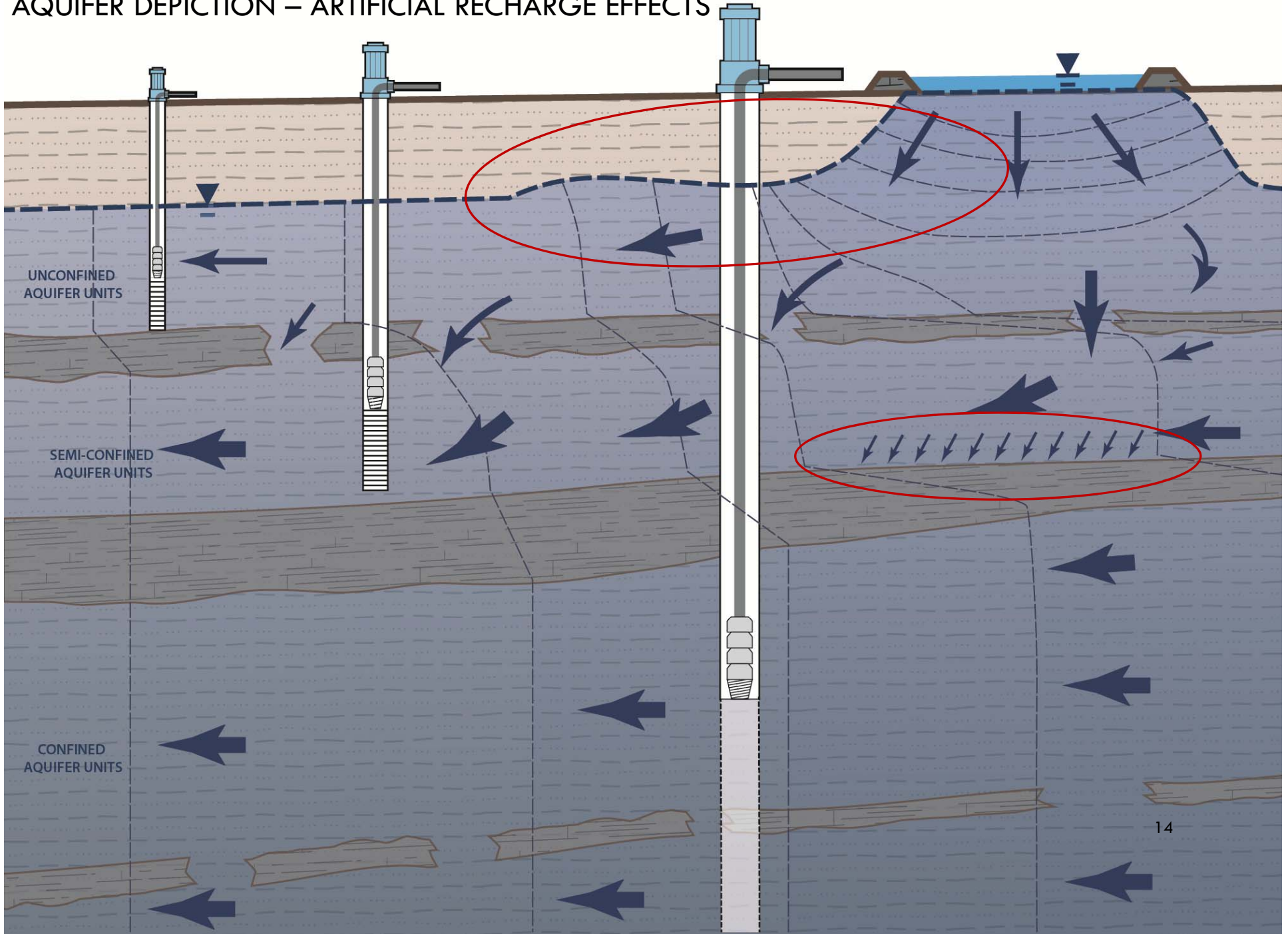
# DEFINING POTENTIAL NEW GROUNDWATER SOURCES

- GROUNDWATER STORAGE
  - IS THERE AVAILABLE SURFACE WATER
    - IS IT STRONGLY CONNECTED TO GROUNDWATER
  - CAN YOU 'BANK" SURFACE WATER OR RECLAIMED WATER?
    - FOR WHAT PURPOSES
    - AT WHAT RATE
    - AT WHAT LOSS FACTOR
    - [HTTP://UCOWR.ORG/ISSUE-144/STATUS-OF-GROUND-WATER-BANKING-IN-IDAHO](http://ucowr.org/issue-144/status-of-ground-water-banking-in-idaho)
- INDIRECT POTABLE REUSE
  - REGULATIONS ON METHOD AND MEANS OF INTRODUCING WATER
  - AQUIFER STORAGE **TREATMENT** AND RECOVERY (**ASTR**)
    - QUALITY OF WATER
    - REGULATIONS ON TIMING TO POINT OF DIVERSION (POD)

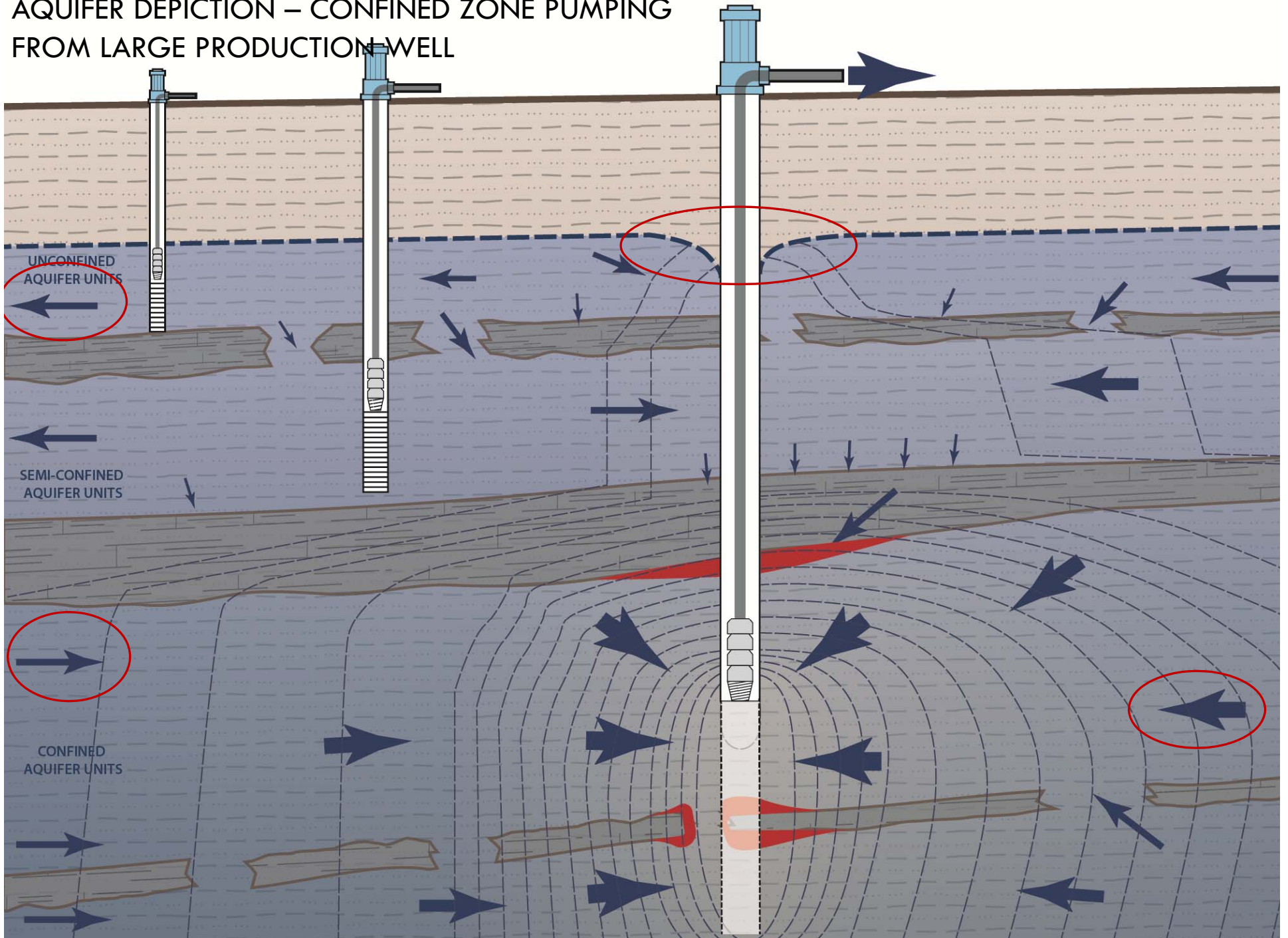
# DEFINING POTENTIAL NEW GROUNDWATER SOURCES

- GROUNDWATER NEXUS TO SURFACE WATER
  - TIMING FOR BASE FLOW SUPPORT
    - LOTS ON THIS FROM IDAHO & CALIFORNIA
    - BASED ON DISTANCE FROM SURFACE WATER AND AQUIFER DIFFUSIVITY
  - LOCATION FOR BASE FLOW SUPPORT – MOUNTAIN FRONT RECHARGE
  - THERMAL BUFFERING
- WATER CONTRACTS FROM AGRICULTURAL OR OVERLIER  
GROUNDWATER RIGHTS
  - AGAIN IDAHO HAS PERHAPS THE CLEAREST PICTURE OF RIVALRY  
BETWEEN SURFACE AND GROUNDWATER SOURCE AND TRANSFERS

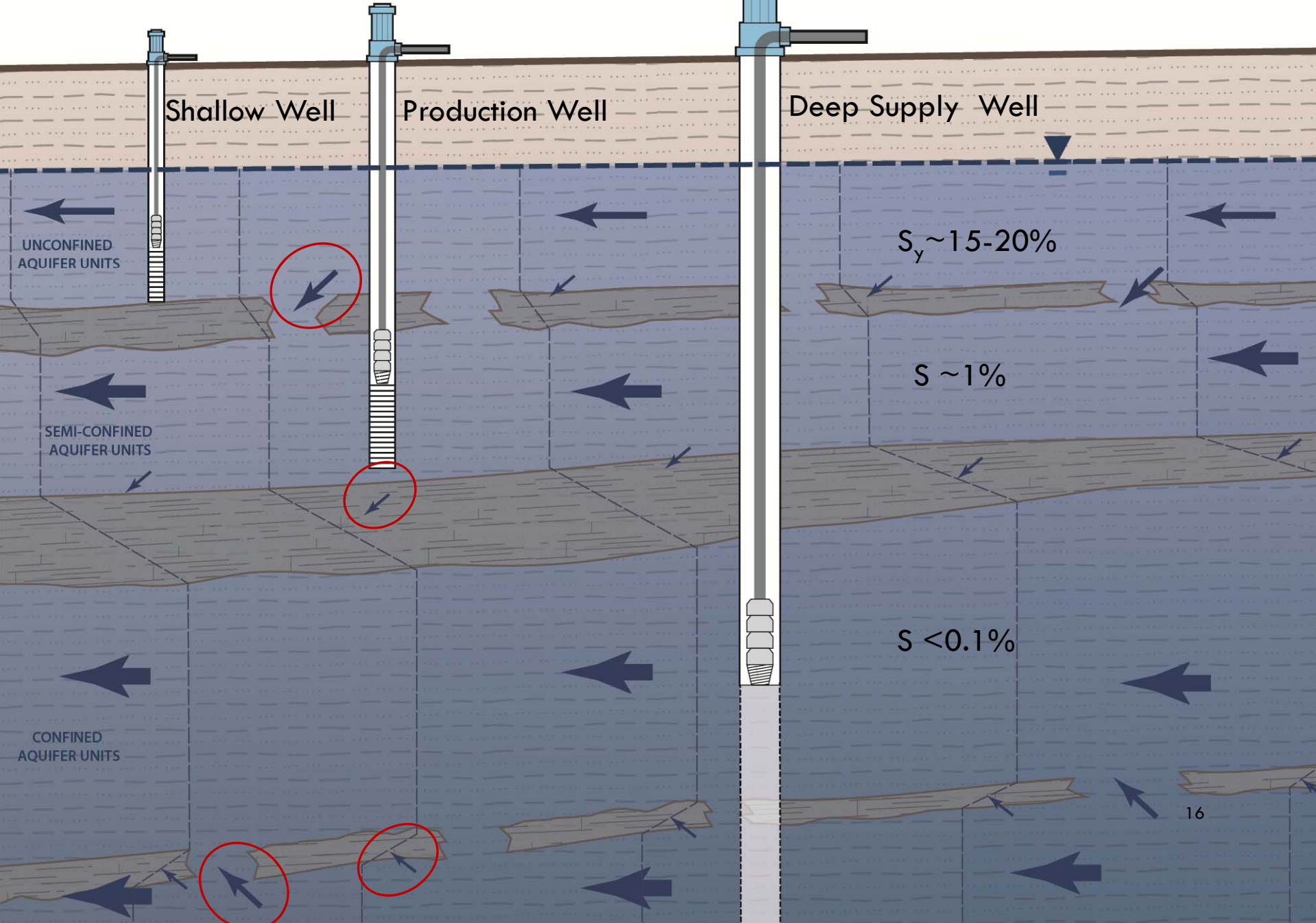
# AQUIFER DEPICTION – ARTIFICIAL RECHARGE EFFECTS



# AQUIFER DEPICTION – CONFINED ZONE PUMPING FROM LARGE PRODUCTION WELL



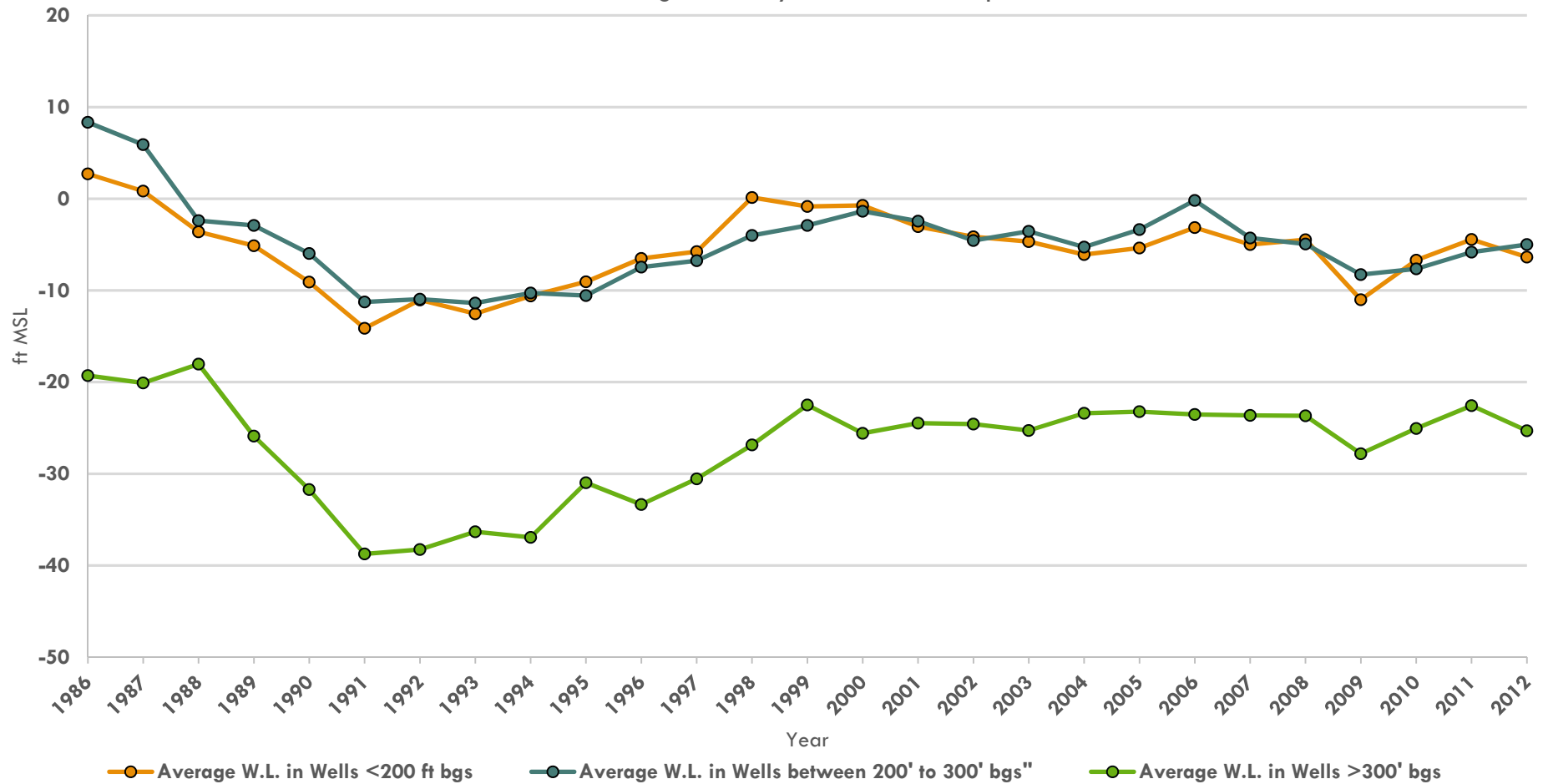
# AQUIFER DEPICTION - AMBIENT CONDITIONS



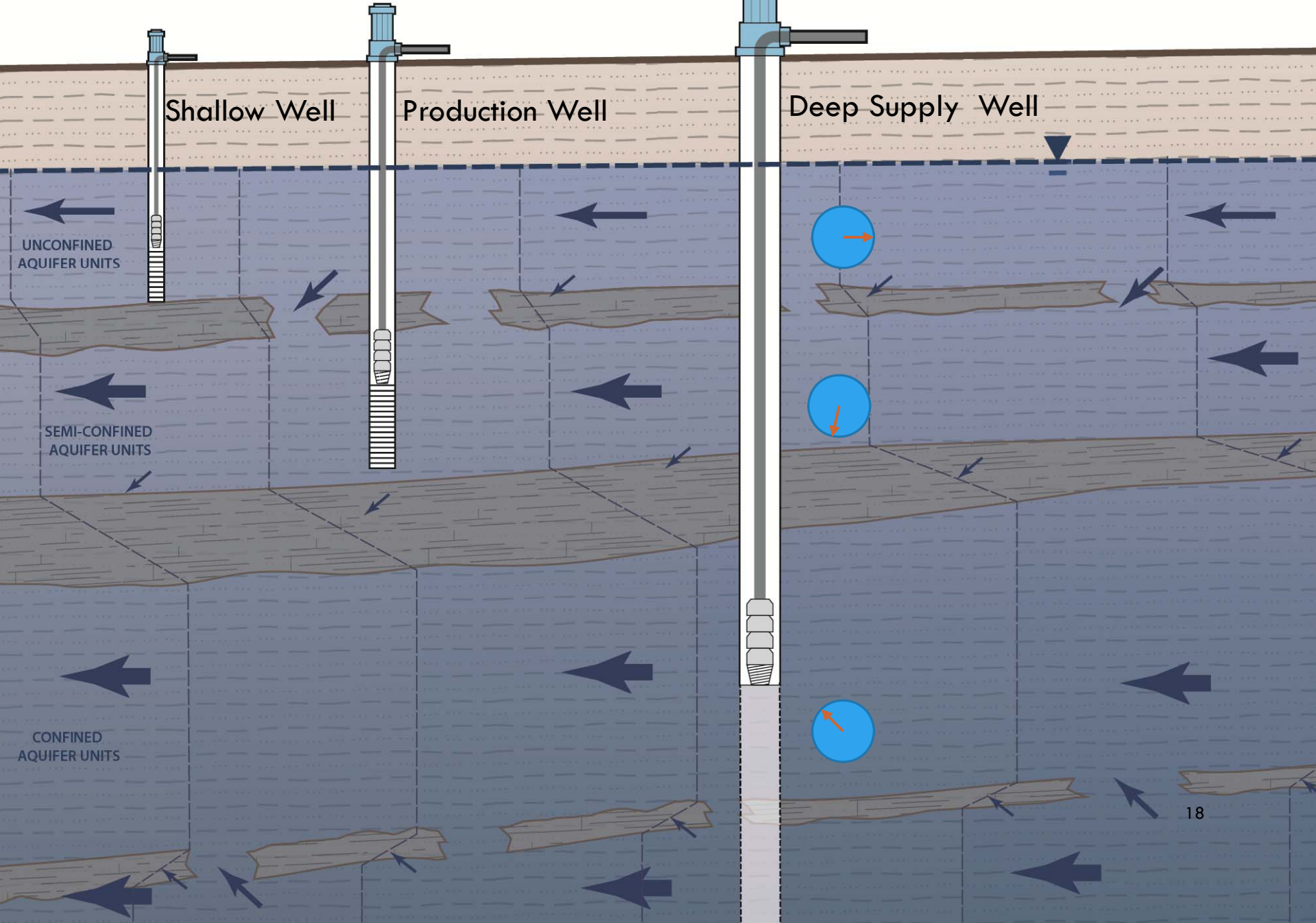


# GROUNDWATER HYDROLOGY 301

Regional Average Groundwater Elevations  
Wells Categorized by Mid-Screen Depth



# AQUIFER DEPICTION - AMBIENT CONDITIONS



# ASSESSMENT OF GROUNDWATER AVAILABILITY VIA MODELS

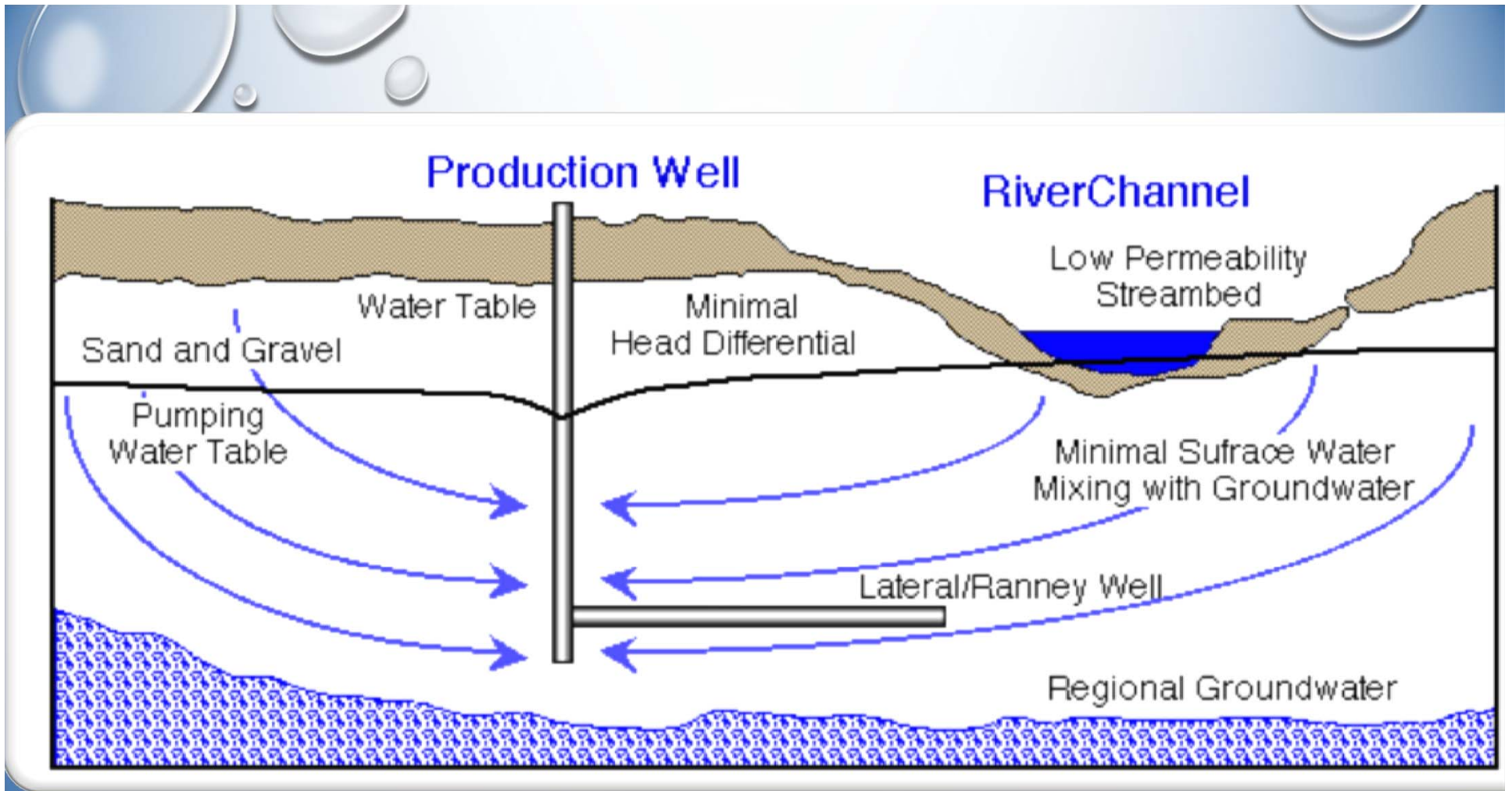
- “ESSENTIALLY, ALL MODELS ARE WRONG, BUT SOME ARE USEFUL”
  - - GEORGE BOX, STATISTICIAN (EMERITUS) UNIVERSITY OF WISCONSIN, 1979
- MODELS NOT NEARLY AS GOOD A TOOL AS REGULATORS AND OTHERS MAY THINK
- GROUNDWATER MODELS ARE BUILT FOR SPECIFIC PURPOSES
  - THEY DON'T PROVIDE A UNIVERSAL TOOL FOR ANSWERING ANY QUESTION – PARTICULARLY AS TO WELLS AND WATER RIGHTS
  - ONE MILE BY ONE MILE SECTION GRIDS CANNOT EVALUATE MORE THAN BULK MASS BALANCE -
- "THE PURPOSE OF COMPUTING IS INSIGHT, NOT NUMBERS"
  - - RICHARD HAMMING, A MATHEMATICIAN AND COMPUTER SCIENTIST, 1971

# DEVELOPING NEW SOURCE ALTERNATIVES GOVERNING CONSIDERATIONS

- HYDRAULICS
  - WATER IS HEAVY
  - PRESSURE ZONES AND ALIGNMENTS/EASEMENTS OFTEN DOMINATE
- RESILIENCE – DROUGHT AND CLIMATE CHANGE
- CAPACITY AND RELIABILITY REQUIREMENTS
- WATER TREATMENT REQUIREMENTS
  - LONG TERM 2 ENHANCED SURFACE WATER TREATMENT RULE (LT2)
  - STAGE 2 DISINFECTANTS AND DISINFECTION BYPRODUCT RULE (STAGE 2 DBP RULE)

# DEVELOPING ALTERNATIVES

- SURFACE WATER
  - INTAKE REVISIONS FOR ANOTHER WATER RIGHT
    - RELOCATION OF THE POD CAN LIBERATE WATER
    - NATURAL CONVEYANCE ALLOWANCE
  - STORED WATER
    - RE-ALLOCATION OF FLOOD WATER
    - INCREASED STORAGE CAPACITY
- GROUNDWATER
  - MANAGED AQUIFER RECHARGE
  - GROUNDWATER BANKING
  - AQUIFER STORAGE TREATMENT AND RECOVERY (ASTR)
  - DEVELOPING LOWER QUALITY SOURCES (E.G. DESALINATION)



## RIVER BANK FILTRATION

- Provides LT2 credit
- Lowers cost of treatment
- Avoids Many DBP Issues

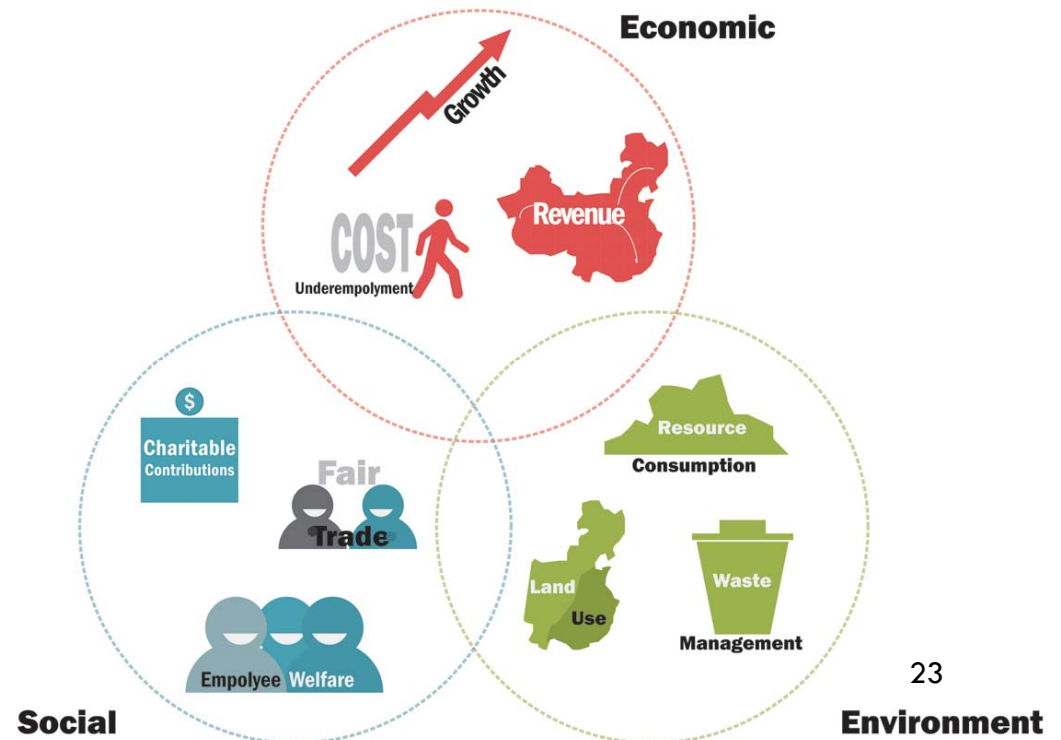
THIS CAN BE A SURFACE WATER  
RIGHT OR A GROUNDWATER RIGHT –  
IDEAL TO AVOID GWUDI

# EVALUATING ECONOMICS OF NEW SOURCES OF SUPPLY

- DEFINING THE INCREMENTAL COST OF NEW SUPPLY
  - TYPICALLY THE BEST BENCHMARK ON PURE ECONOMICS
- TRIPLE BOTTOM LINE ACCOUNTING IS A NEW METRIC

Water Availability may be a huge component of regional economic growth

Ways to think about Social Value or Costs in this analysis – Ideas?



# CAPITAL IMPROVEMENT PLAN INFORMATION NEEDS

- FEASIBILITY STUDY
  - ENGINEERING ECONOMIC COST ANALYSIS
  - SUFFICIENT LEVEL OF DESIGN TO CREDIBLY DEFINE COSTS
    - AACE GUIDELINES ON COST ESTIMATING
    - BUILT-IN FEEDBACK LOOP FURTHER YOU ARE ON A PROJECT THE CLEARER COSTS BECOME – SOMETIMES UP ENDS THE PROJECT IN LATE STAGES
- TIMING THE PROJECT FINANCE FOR THE RIGHT PLANNING HORIZON
- COST OF FINANCING AND AVAILABILITY



# QUESTIONS?

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