Groundwater Storage Assessments for the Yakima Basin

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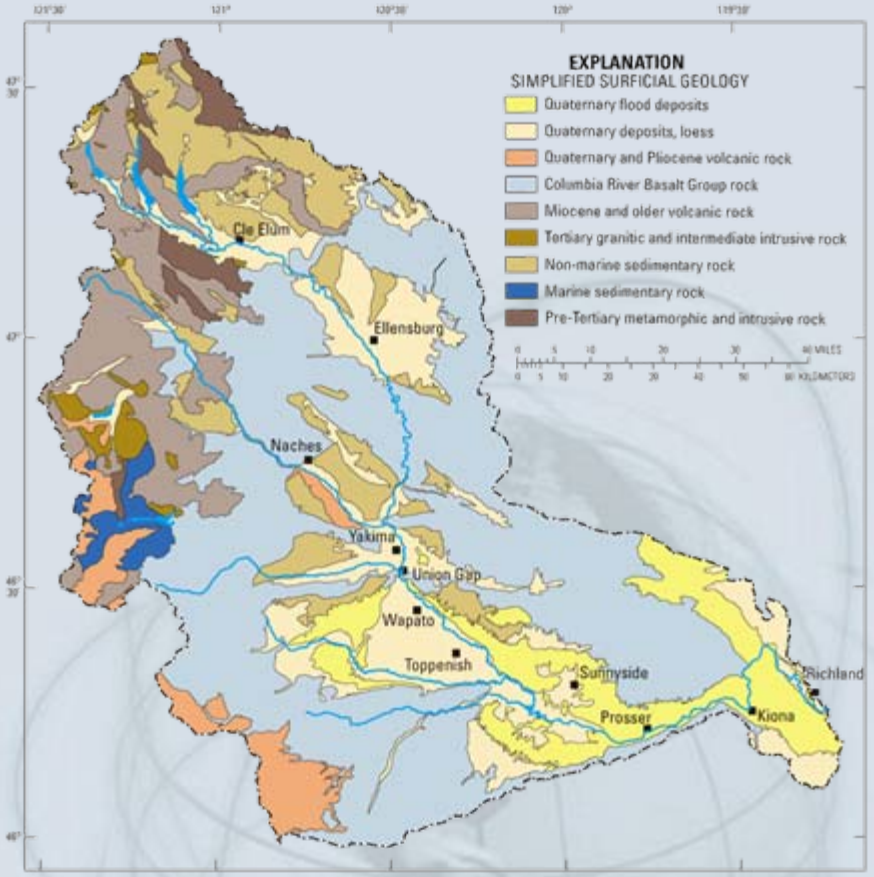
Overview

- Draft EIS:
  - Surface recharge in alluvium
  - Municipal ASR in clastic formations
- Final EIS
  - Surface recharge in alluvium
  - Municipal ASR in clastic formations
  - Large scale ASR in Basalts



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Aquifer Systems and Recharge Options

Alluvium

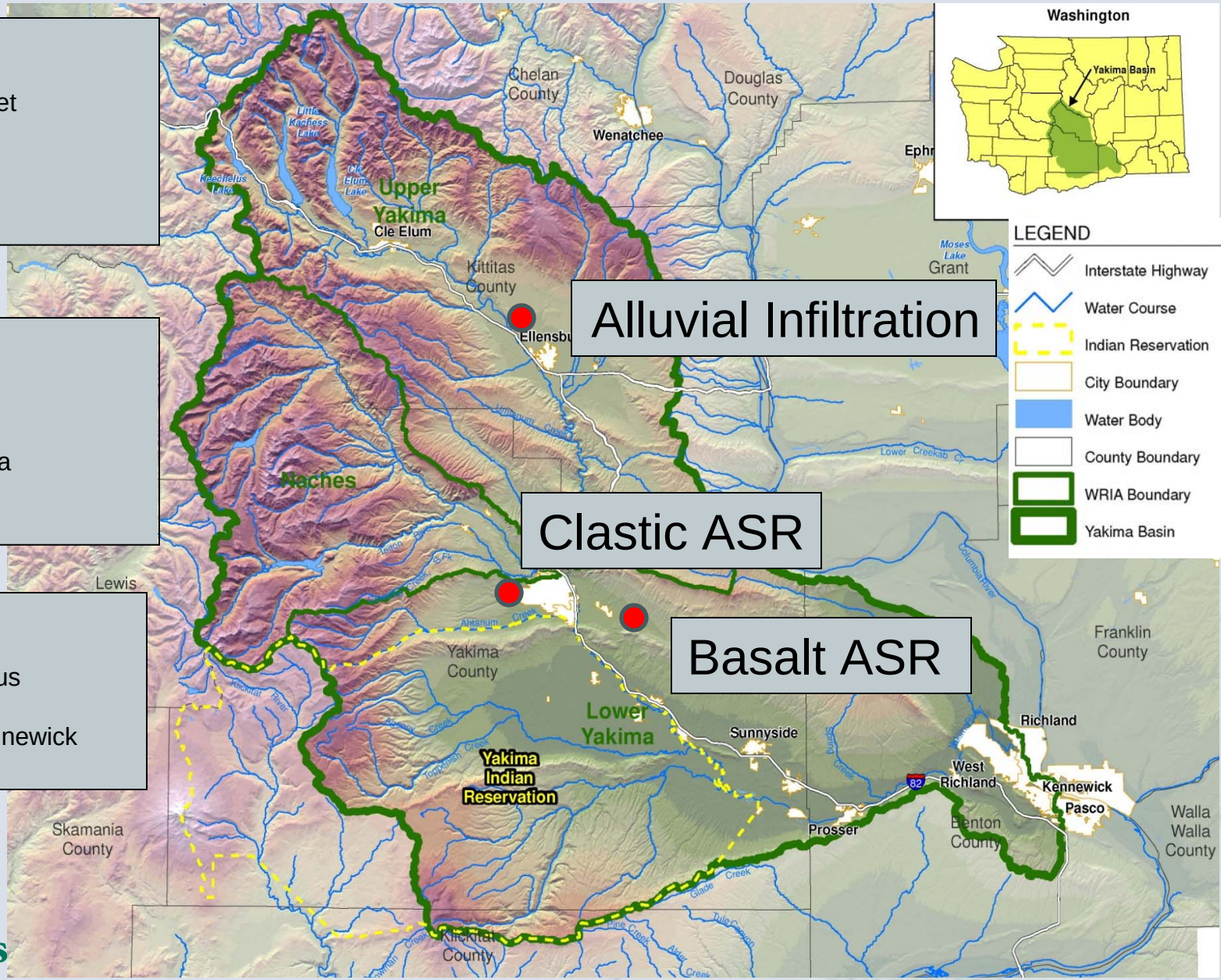
Surface infiltration Target
Upper River Focus;
- Ellensburg
- Toppenish

Clastics

Municipal ASR Target
Mid-River Focus
Ellensburg Fm. - Yakima

Basalt

Mid to Lower River Focus
Ag ASR Target - Roza
Muni ASR Target – Kennewick
Grand Ronde Basalts



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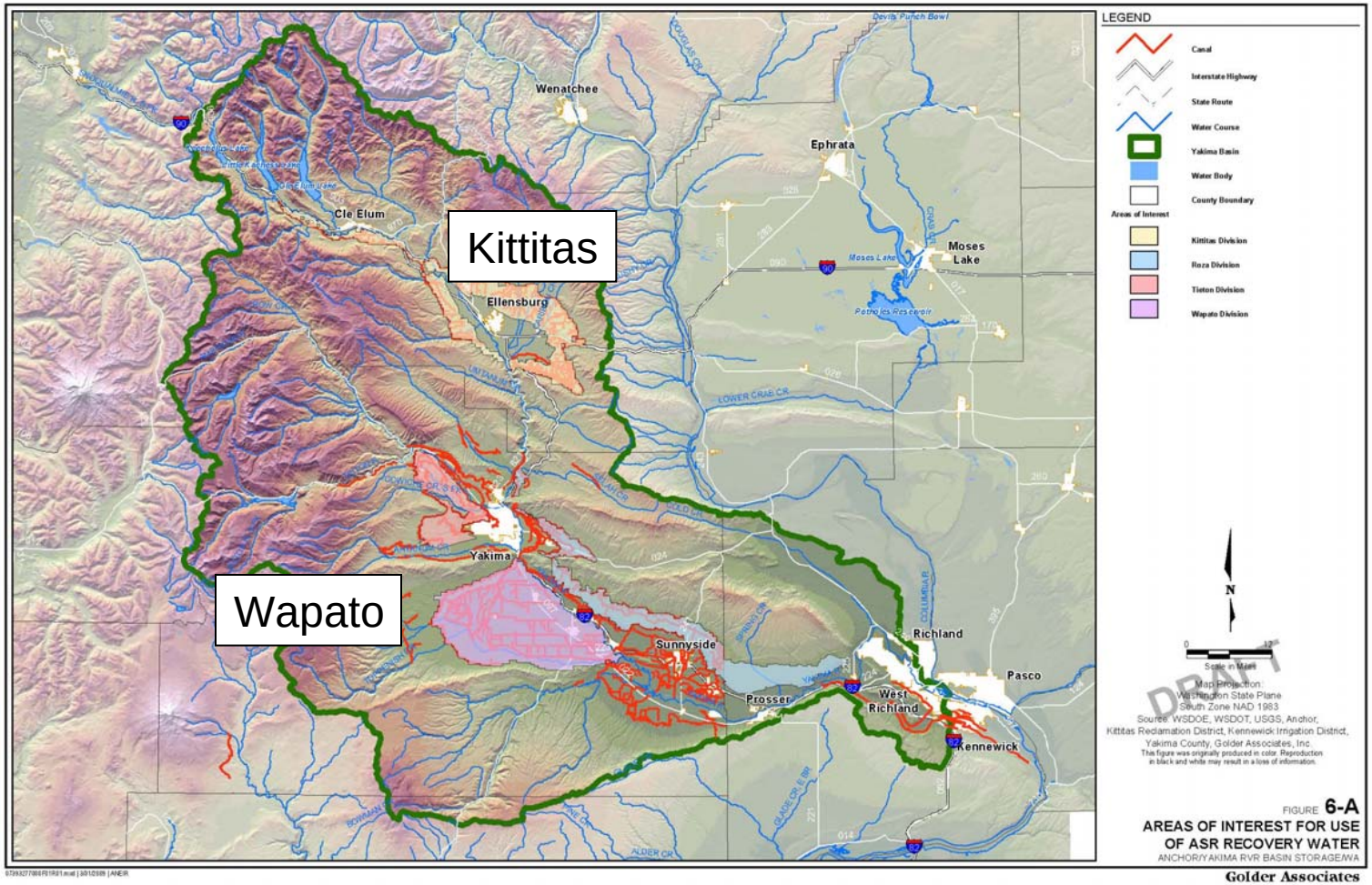
Infiltration and Return Flow Target Areas

Objective : Passive return flow to streams



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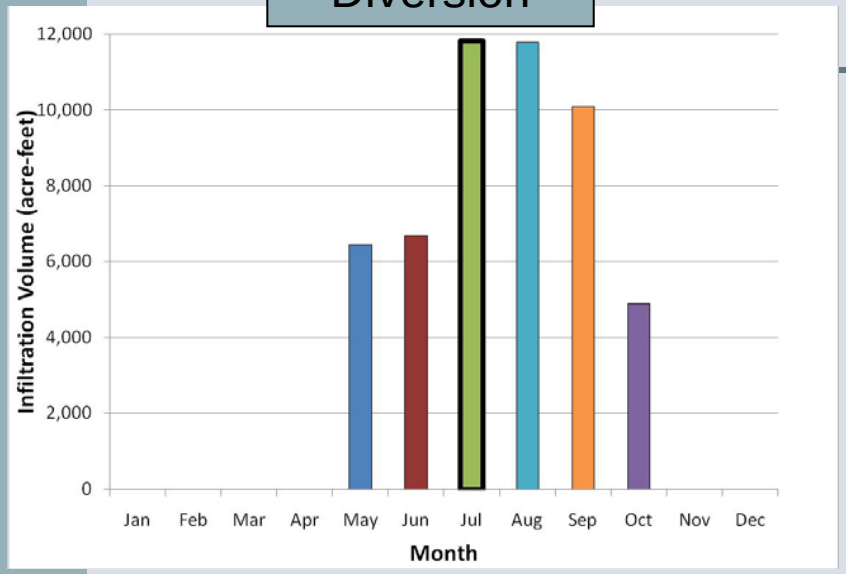
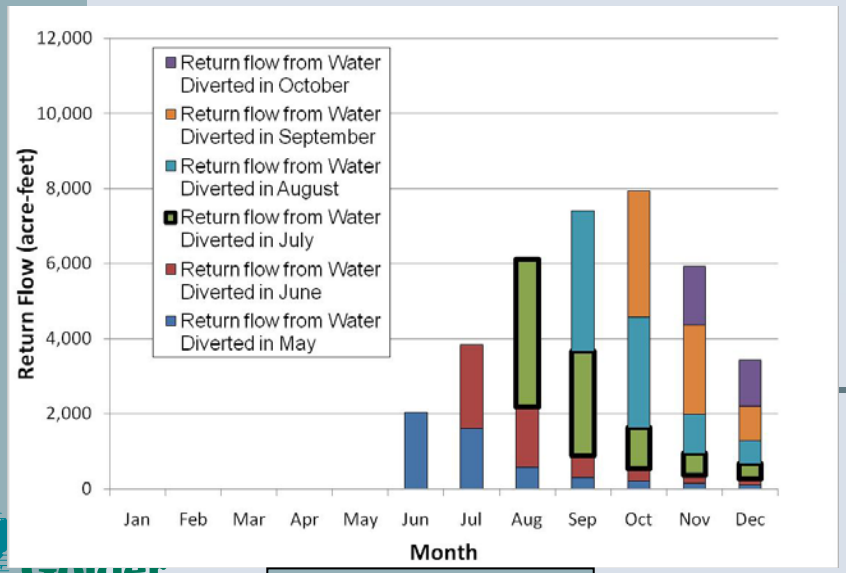
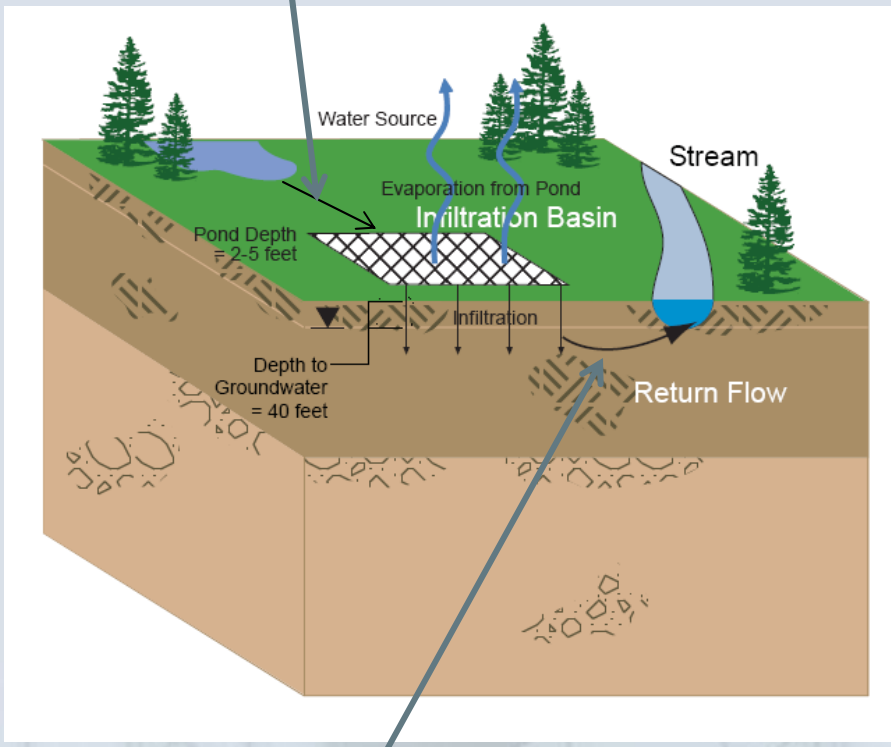
Alluvial Return Flow Profiles

Diversion







Return Flow

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Surface Infiltration Evaluation

- SDF methodology – return flow timing and volume
  - 10,000 AF application (when “available”)
  - Typical alluvial characteristics
- Review land cover – area available
- Highest volume of passive return flow to streams
- Limited dry year return flow
- Large land requirements & operational issues

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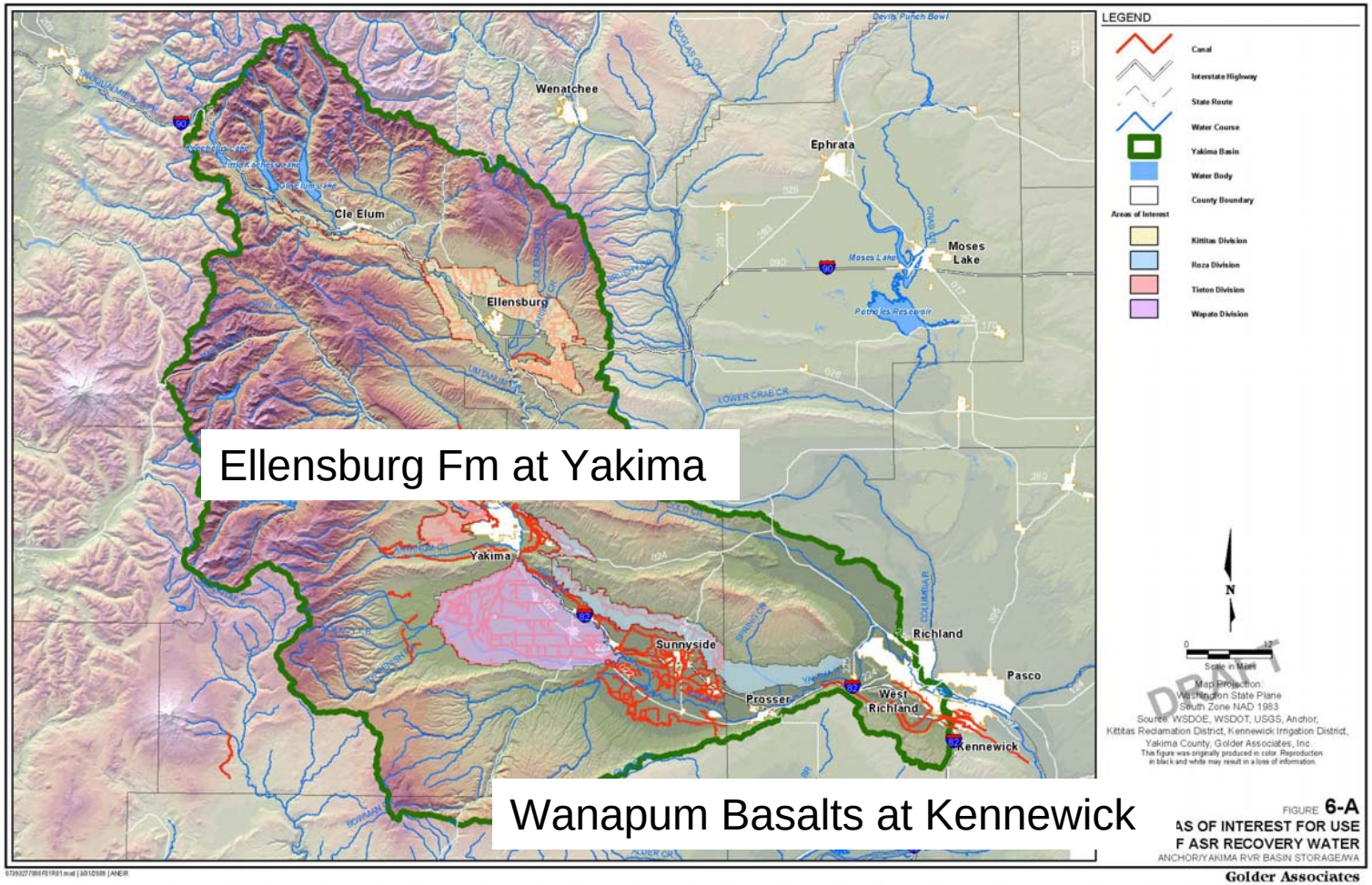
Municipal ASR Target Areas

Objective : Direct municipal supply



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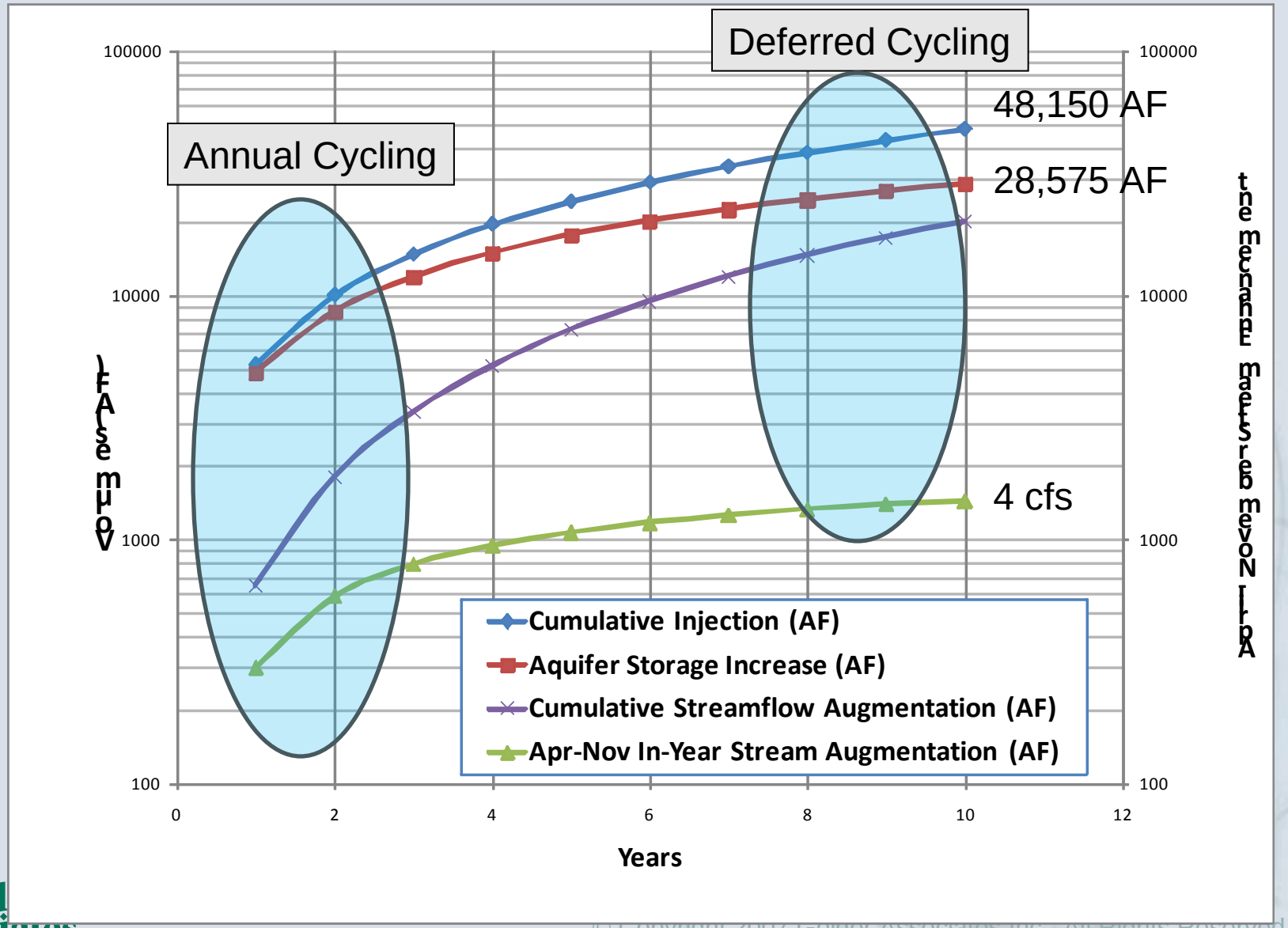
Yakima ASR



Contrasting Recovery Approaches

- Annual Recovery
  - Recovery efficiency is high and most of the previous years water can be recovered (92%)
  - Minor increases in Yakima River flows
- Deferred Recovery
  - Total recoverable amount of water is larger (good drought management tool), but at decreasing efficiency over time
  - Accumulated and “in-year” increases in Yakima River flows are higher (good stream mgmt tool)
  - 7-10 years to get to asymptotic portion of stream enhancement curve

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Municipal ASR

- Banking:
  - Approximately 2X storage volume
  - Increases flow augmentation (>10K cfs/10y)
  - Total recoverable amount of water is larger (good drought management tool), but at decreasing efficiency over time
  - 7-10 years to get to asymptotic portion of stream enhancement curve
- Annual Cycling:
  - Flow augmentation around (4 cfs/10y)
  - Recovery efficiency is high and most of the previous years water can be recovered (92%)

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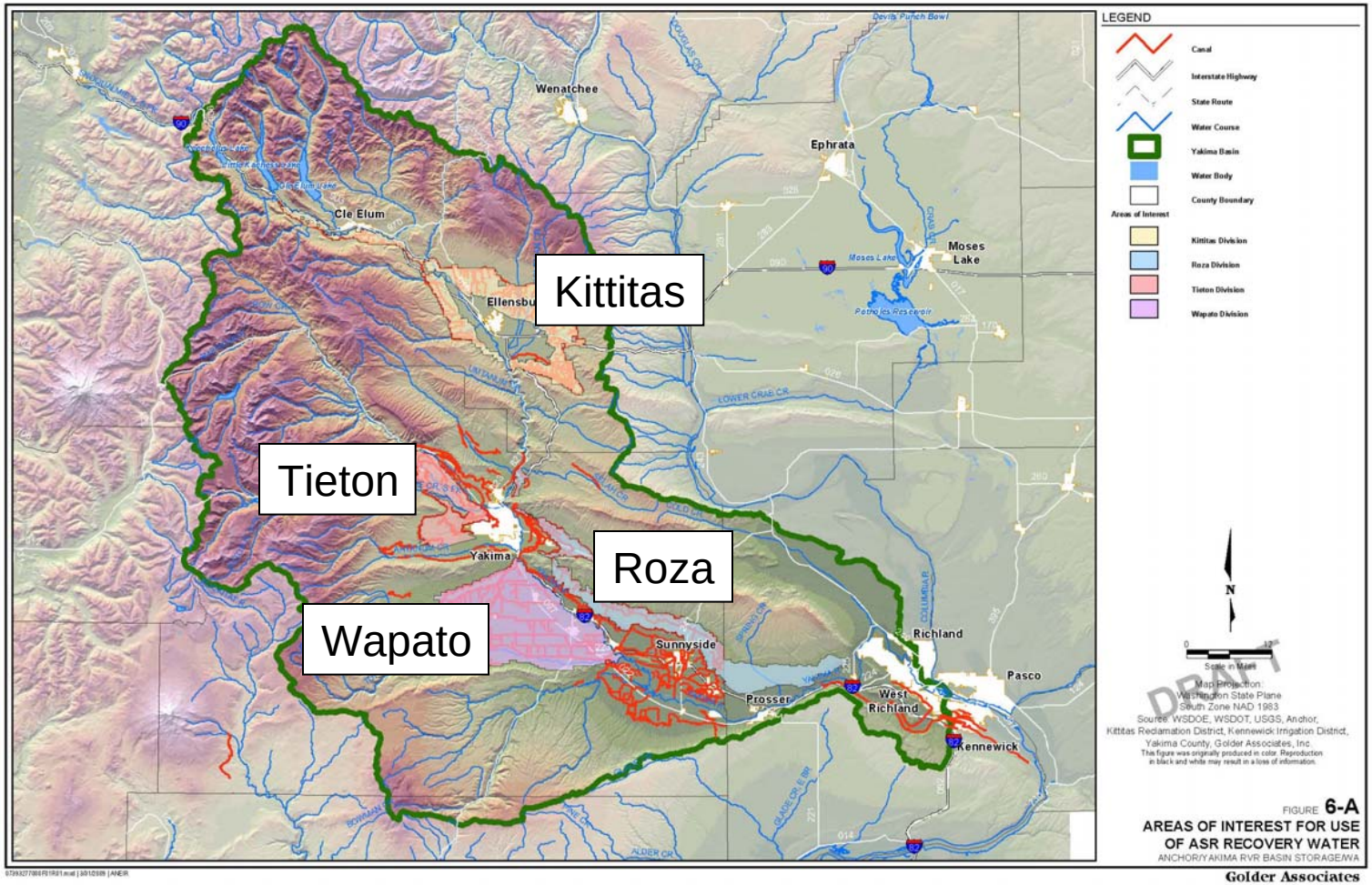
Regional ASR Target Areas

Objective : Direct agricultural supply



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Regional ASR Issues

- Geologic Structure
- Well Capacity
- Aquifer Properties
- Wellfield Design and Interference
- Conveyance
- Treatment requirements
- Water Availability
- Water Quality

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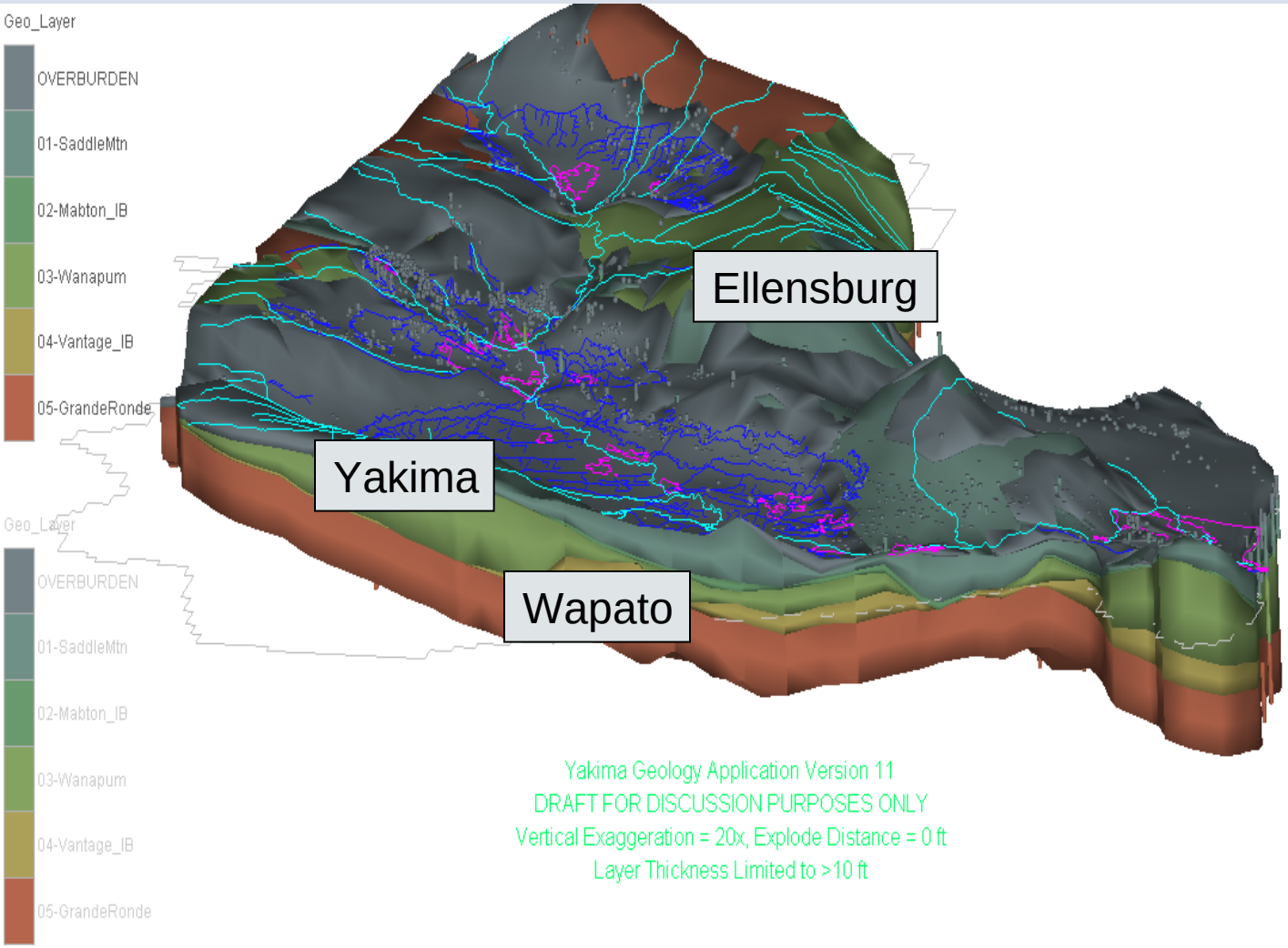
Yakima Basalt Geologic Structure



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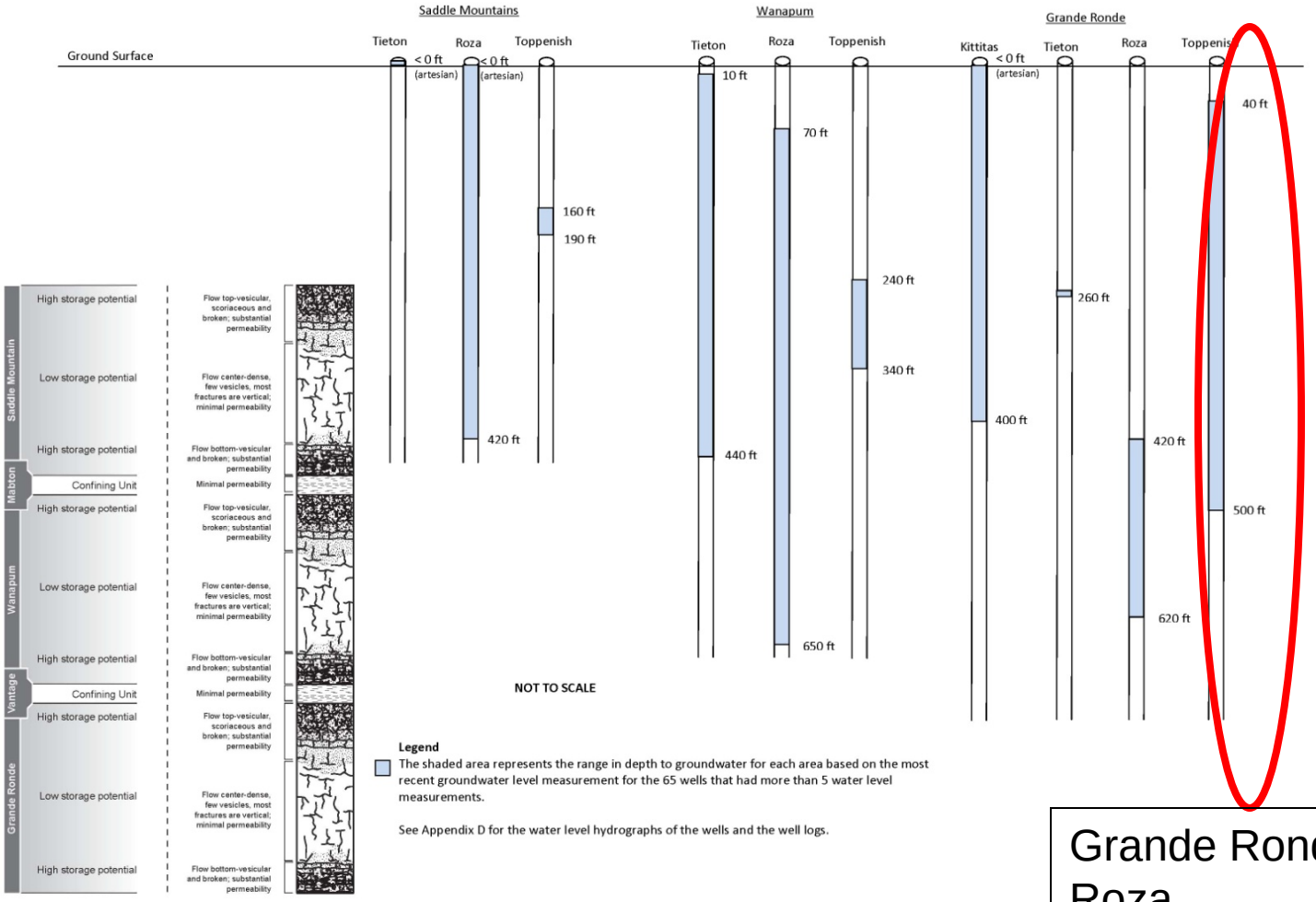
Basalt Water-Levels



Grande Ronde
Roza

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Well Capacity and Buildup

- Used USGS aquifer property measurements.
- Well capacity based on reported short term specific capacity tests on 36 wells.
- Predicted build-up using 2,500 gpm injection rate:
  - Maximum : >1,000 ft
  - Average : 473 ft
  - Median : 171 ft
  - Minimum : <20 ft

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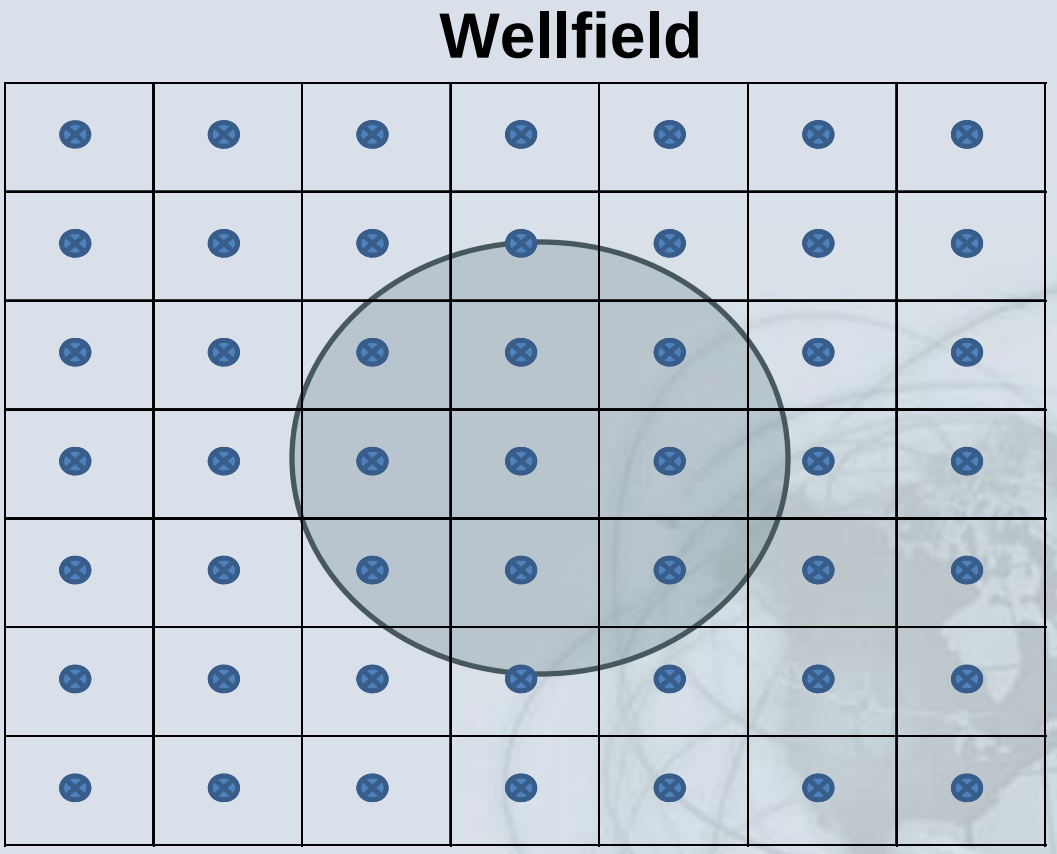
Conceptual Wellfield Design



Over a range of aquifer parameters, a wellfield should see appx. 200 to 400 feet of buildup. 400 to 600 available at Roza.

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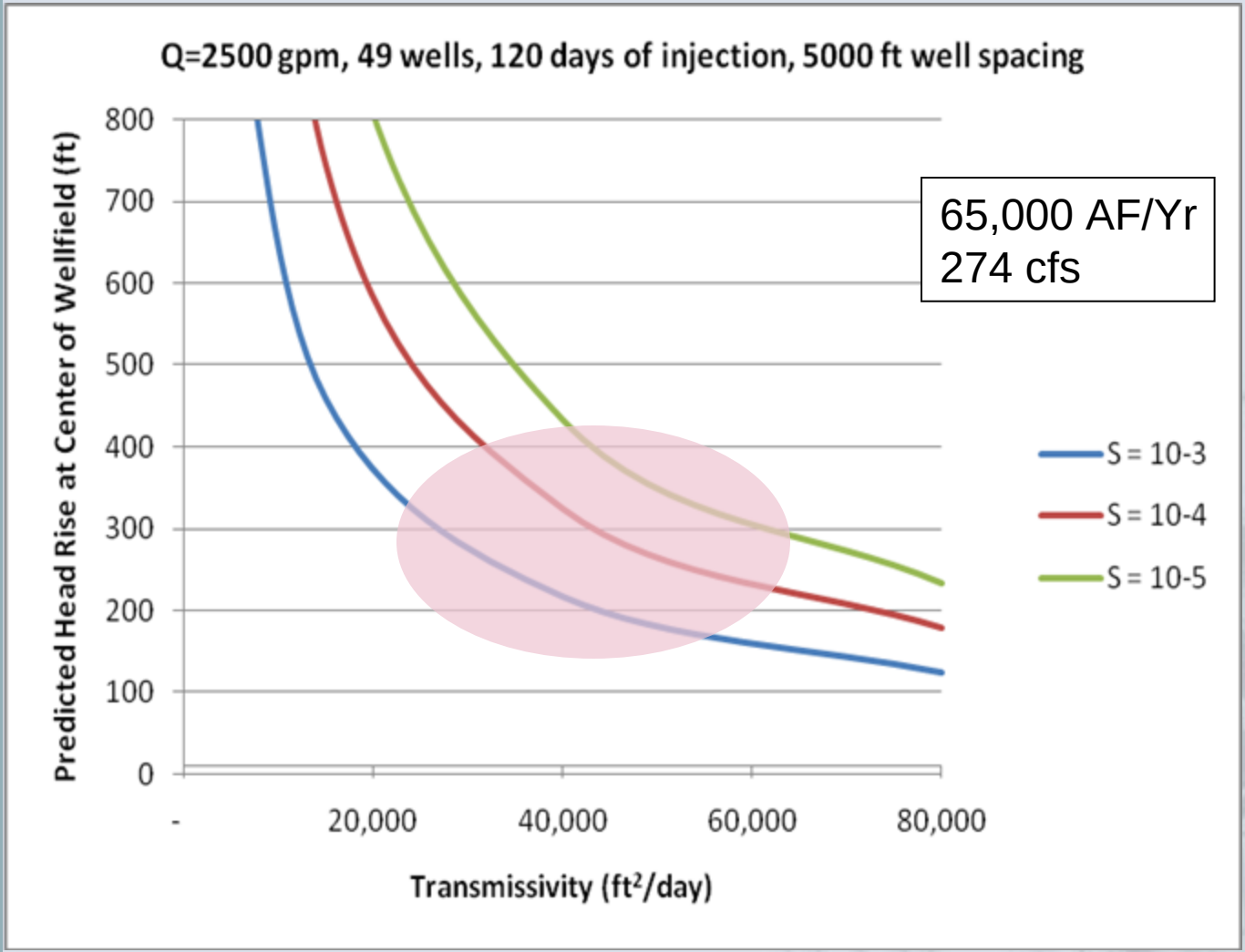
Conceptual Wellfield Design



Over a range of aquifer parameters, a wellfield should see appx. 200 to 400 feet of buildup. 400 to 600 available at Roza.

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Option Summary

- Surface Infiltration
  - 10,000 AF/Yr
  - Limited dry year return flow
  - Large land requirements & operational issues
- Municipal ASR
  - 6,000 AF/Yr
  - Indirect return flow & avoided diversions
  - Annual vs delayed use & WTP constraints
- Regional/Irrigation ASR
  - >60,000 AF/yr per well field
  - Replace/enhance agricultural diversions
  - Complex/costly infrastructure and operations

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Conclusions

- EIS Level Information is sufficient – a good foundation for further investigation
- More detailed feasibility testing is necessary for all alternatives
- Additional modeling of ASR alternatives may be beneficial

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Approach

- Identify one or more objectives, develop demonstration projects to address prioritized objectives:
  - Aquifers
  - Sources
  - Benefits

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Alternative Objectives

- Optimizing Aquifers
  - Alluvial aquifer: direct return flow
  - Clastic aquifer: indirect leakage
  - Basalt aquifer: boundaries & porosity
- Optimizing Sources
  - Surface diversions: availability & conveyance
  - ASR capacity: WTP capacity, wellfields
  - Climate Change: hydrologic timing & magnitude
- Optimizing Benefits
  - In-stream
  - Out-of-stream agriculture
  - Out-of-stream municipal

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Thank You

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