Well Electric Well Station Assessment

Evaluating Options for Increasing its Reliable Production Capacity

AWWA-PNWS Annual Spring Conference

Spokane, WA

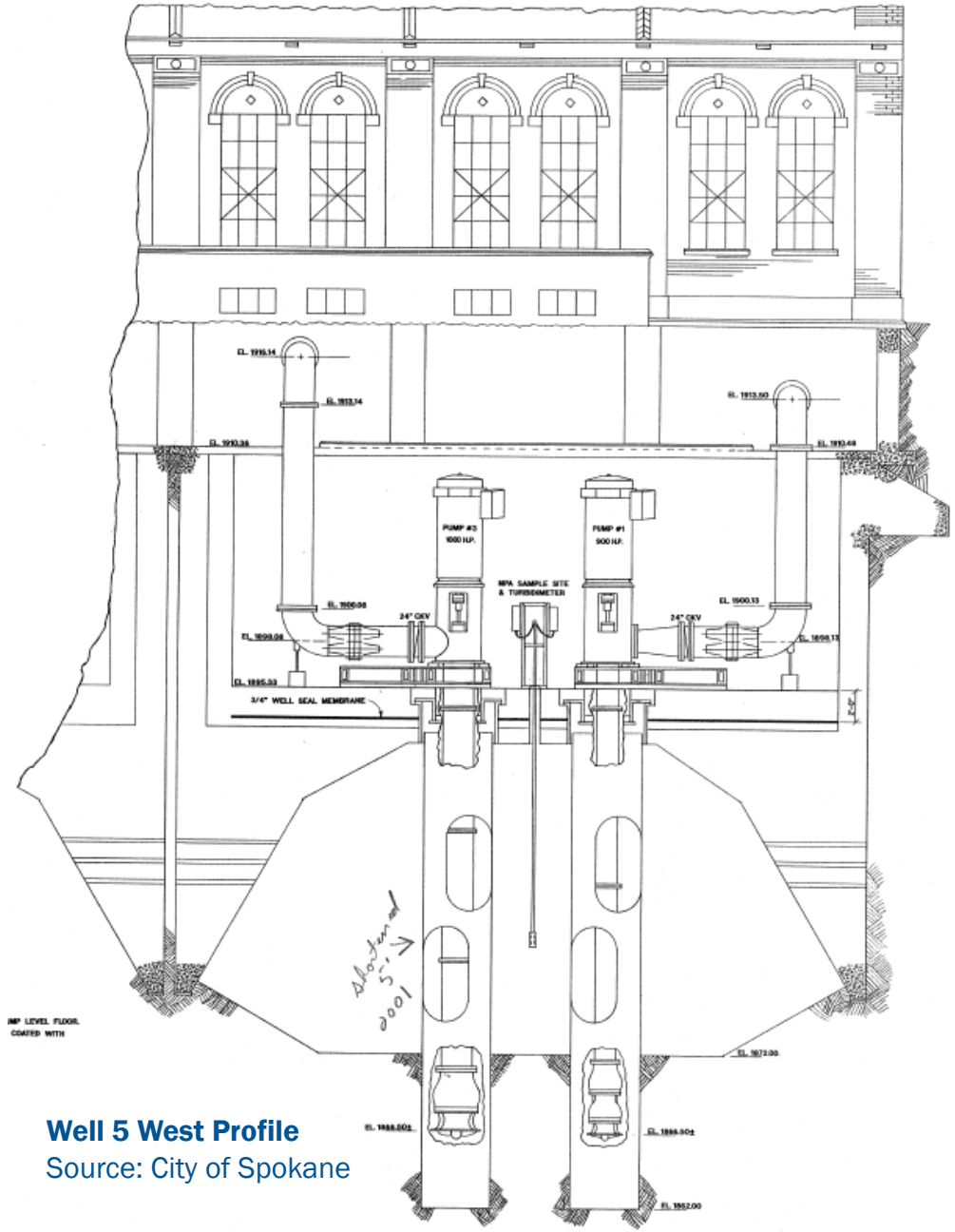
May 1-3, 2024

GSI Water Solutions, Inc.

Source: City of Spokane

Well Electric Well Station Facility

- Five caisson wells constructed 1907-1925
- Wells 4 and 5 remain in operation today
  - Constructed 1921 (Well 4) and 1925 (Well 5)
  - 45 feet diameter
  - 40- to 45-feet-deep
  - Produce approximately 53 mgd (36,500 gpm)
  - Supplies the Low, Intermediate, and North Hill PZs
- Well 5 constructed with two 28- to 36-inch diameter steel casing pump chambers
- Hydraulically connected with the Spokane River



Well 5 West Profile
Source: City of Spokane

Well Electric Well Station Facility

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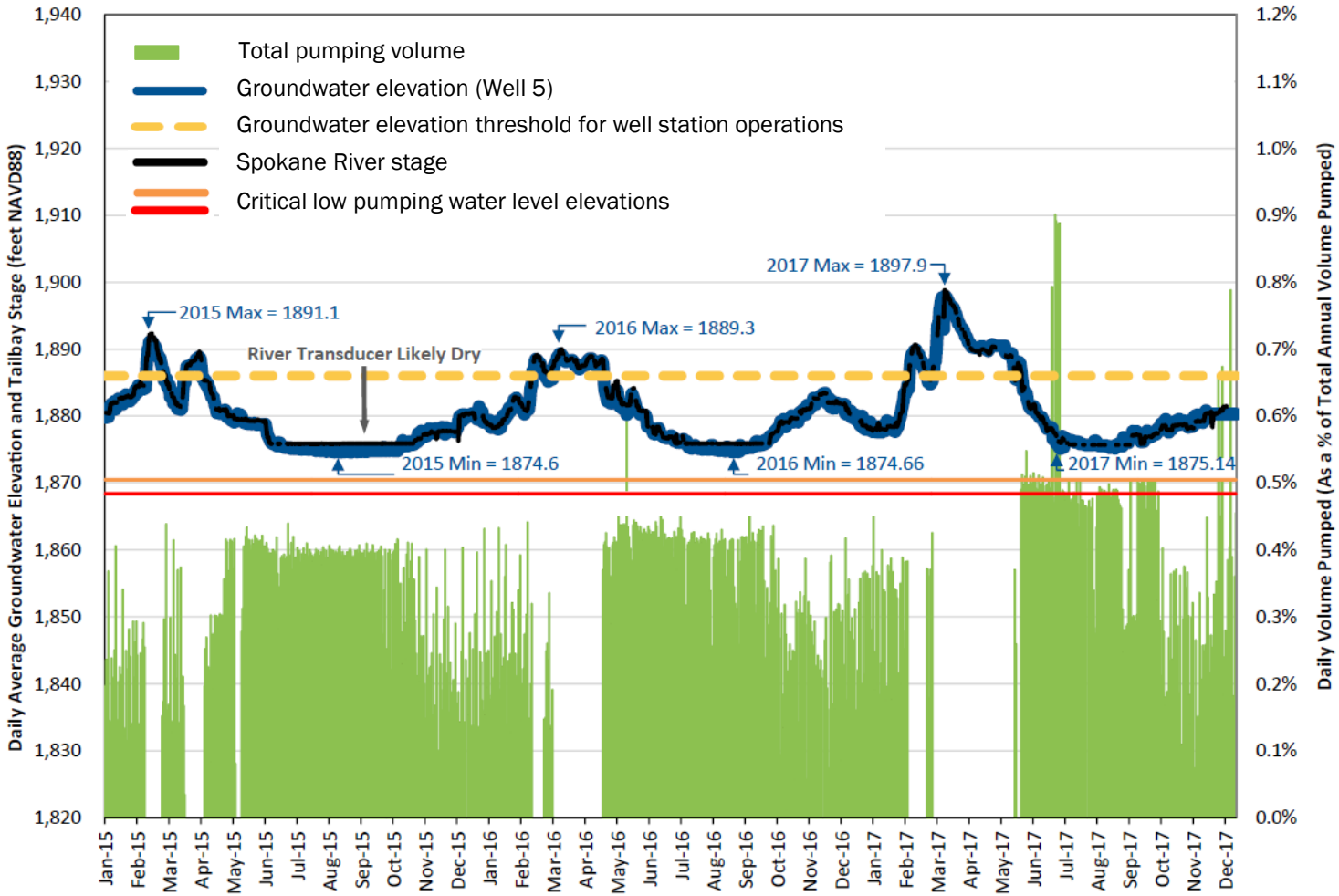
Well Electric Well Station Facility

- Groundwater production capacity is adversely affected each year:
  - Dry years/low river stage → low groundwater level → reduced available drawdown
  - Spring runoff/high river stage → increased potential for surface water to enter caisson wells (GWI) → City shuts down the facility when flow in the river at Post Falls Dam exceeds 15,000 cfs



Well Electric Well Station Facility

- Only well station that supplies water to all three primary pressure zones
- Critical source needed to meet future water system demands

Future Supply Needs from Well Electric Well Station (millions of gallons per day)					
Demand Scenario	**Non-Emergency**	**Parkwater Offline**	**Well Electric Offline**	**Parkwater and Well Electric Offline**	**Ray and Havana Offline**
20-Year Demands	**29**	**77**	**0**	**46**	**44**
50-Year Demands (Medium)	**33**	**98**	**0**	**61**	**54**
50-Year Demands (High)	**42**	**125**	**14**	**90**	**74**

Project Objectives

- Enhance resiliency against seasonal or emergency disruptions in operations
- Increase production capacity
- Protect water quality

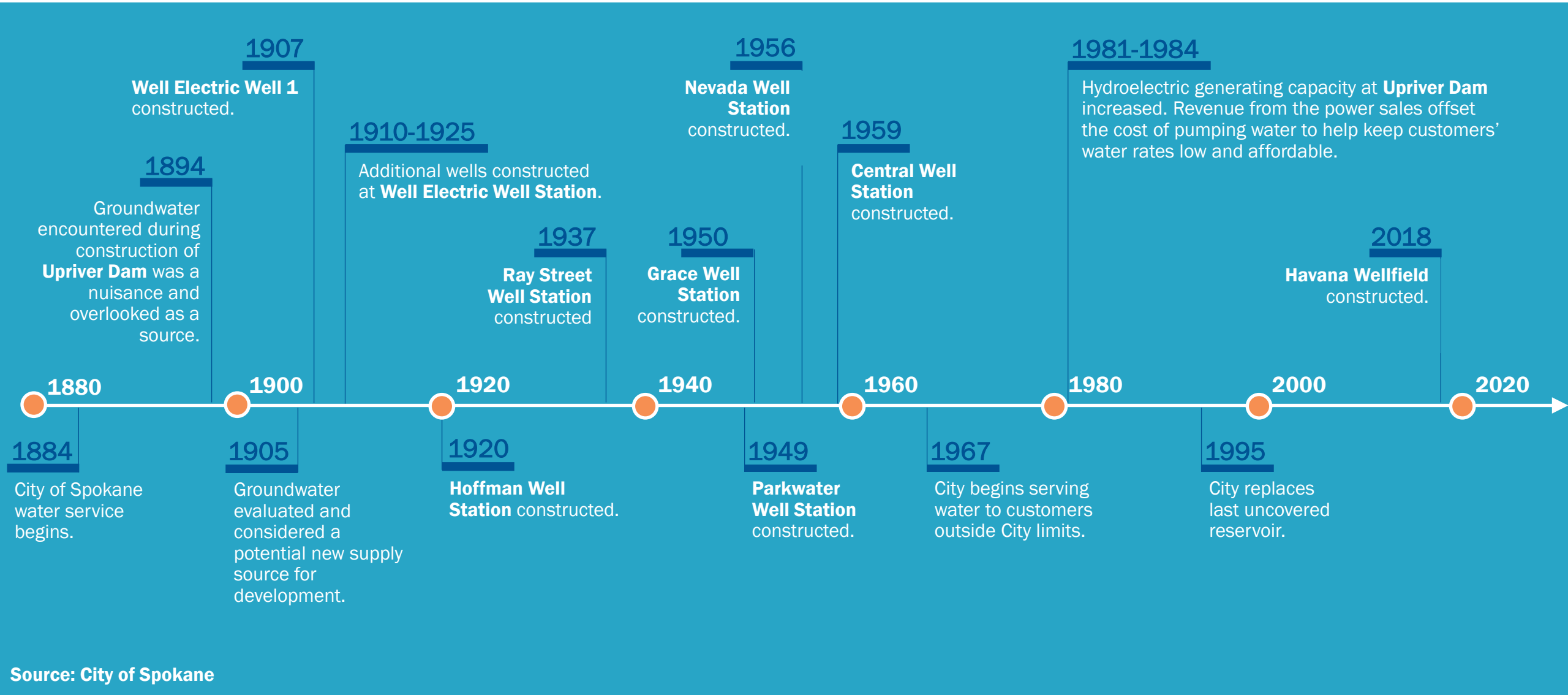
Presentation Outline

- Background
- Alternatives Evaluated
- Concept for Selected Alternative
- Feasibility Study

Source: City of Spokane

Background

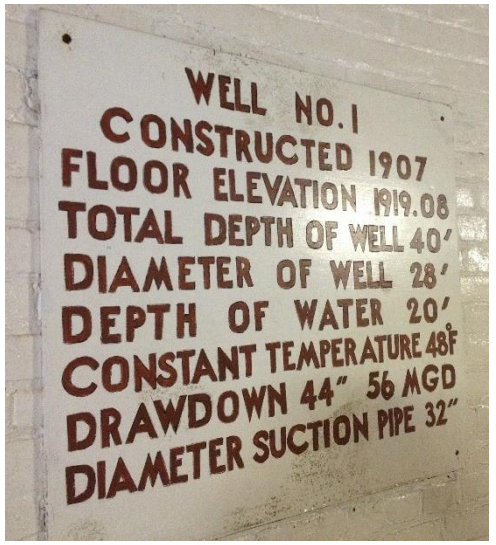
History of the City's Water System

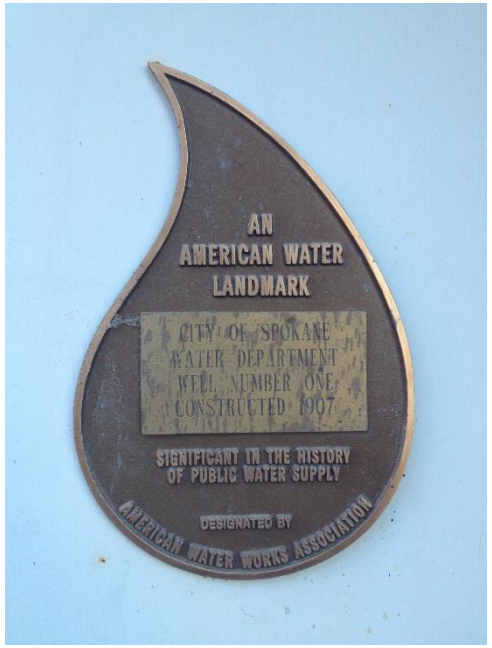


Source: City of Spokane

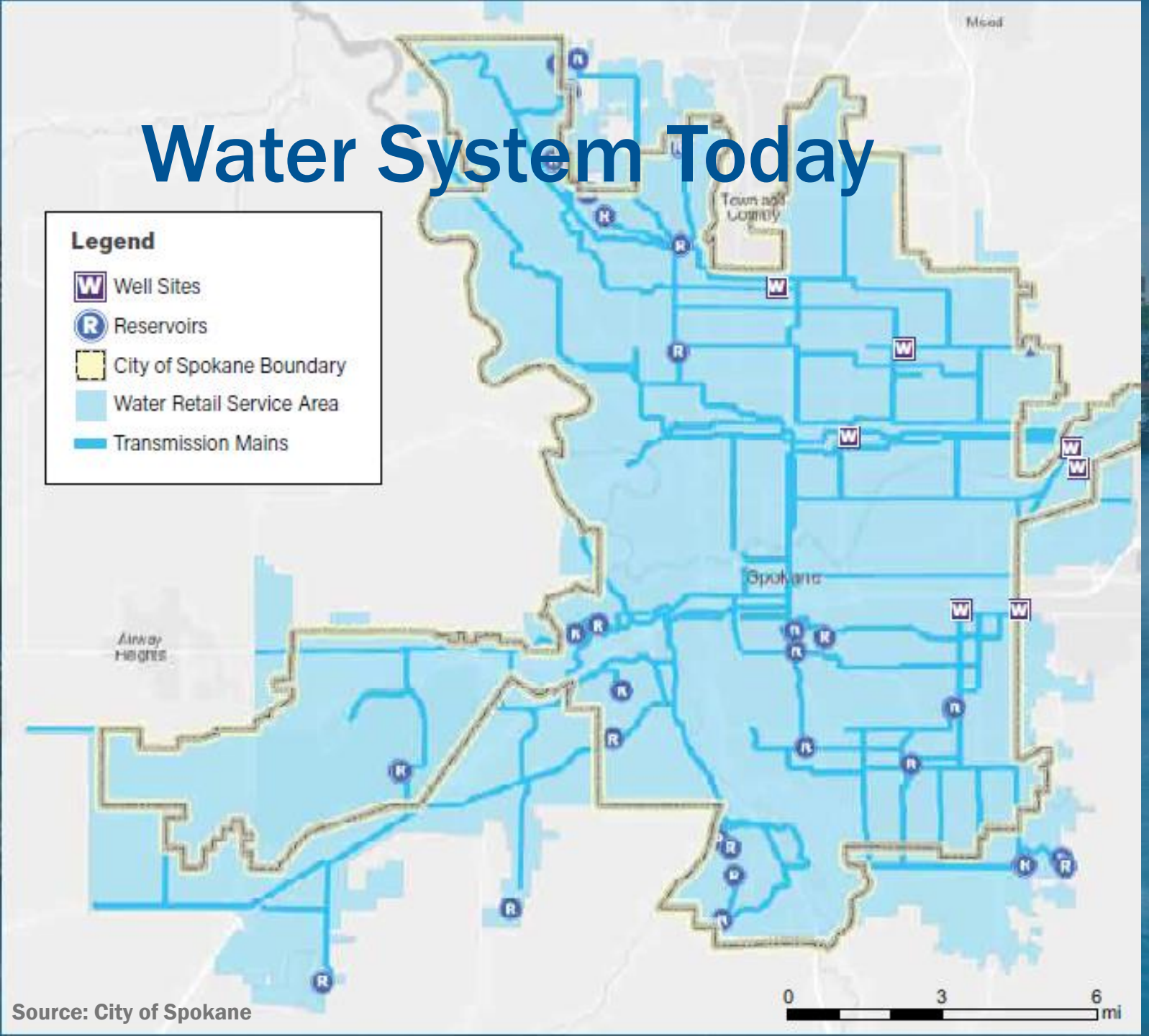
Well Electric Well Station - Well 1

- Constructed 1907
- Currently offline and preserved as an educational/historical display
- Capacity = 56 mgd
- Performance = 10,600 gpm/foot of drawdown
- City permanently discontinued use of the Spokane River as its supply source

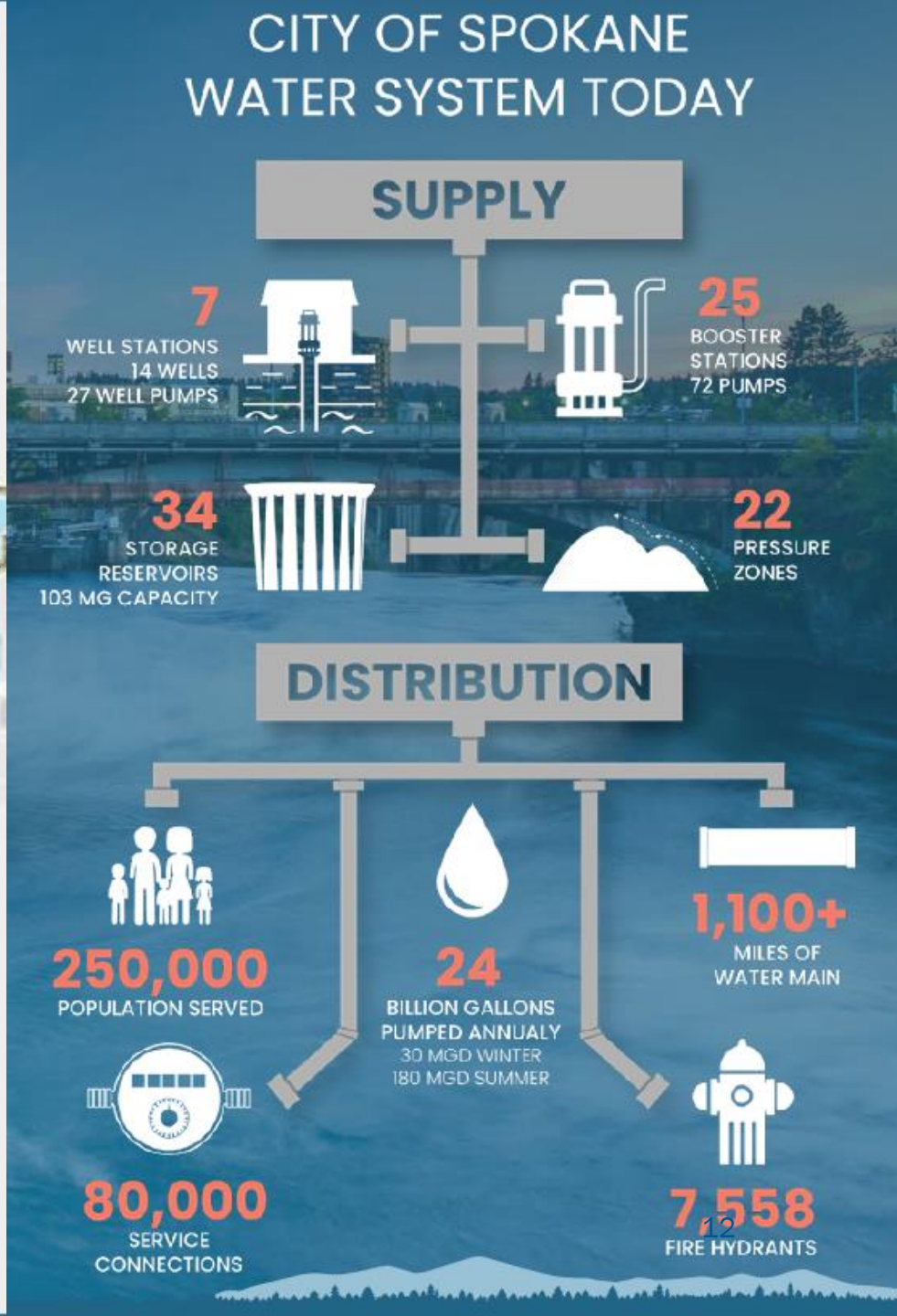




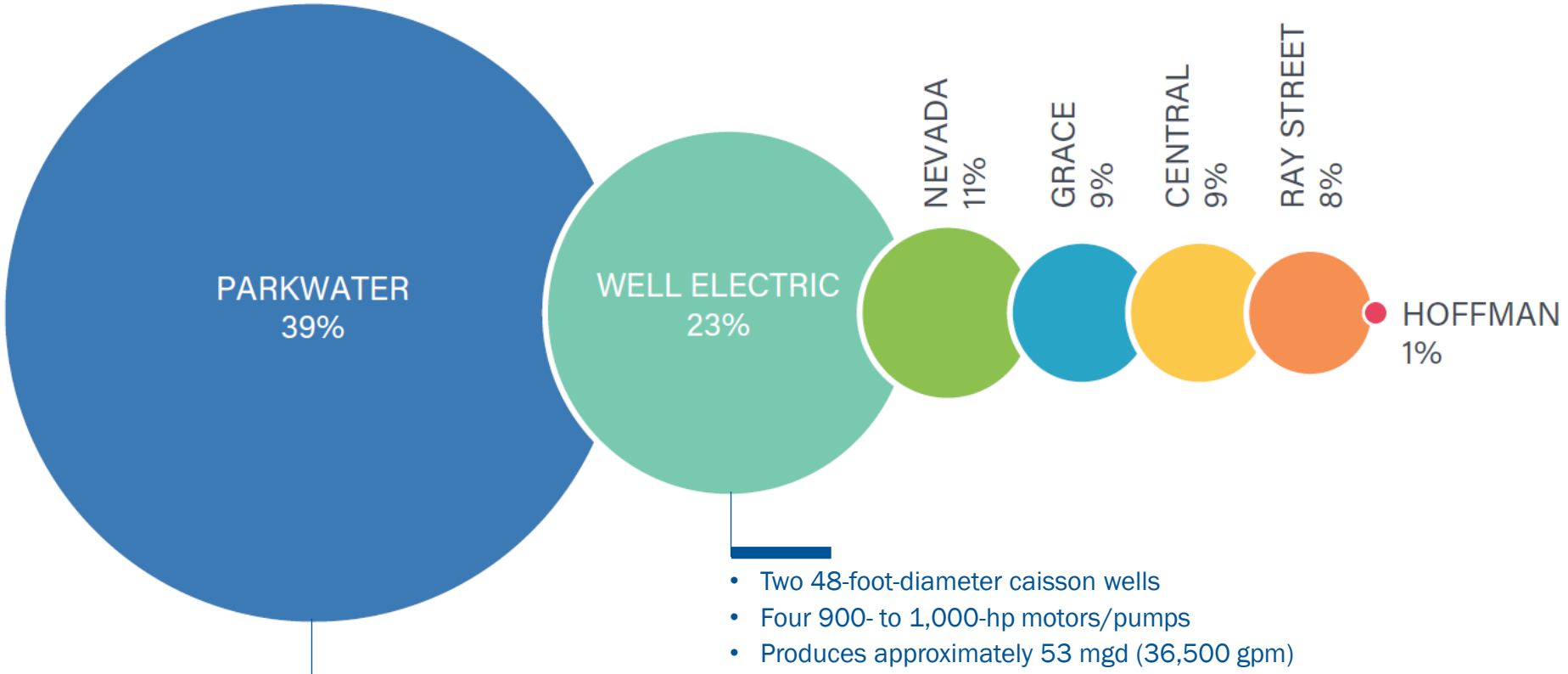
Water System Today



Source: City of Spokane



Average percent of water supply produced by City well stations



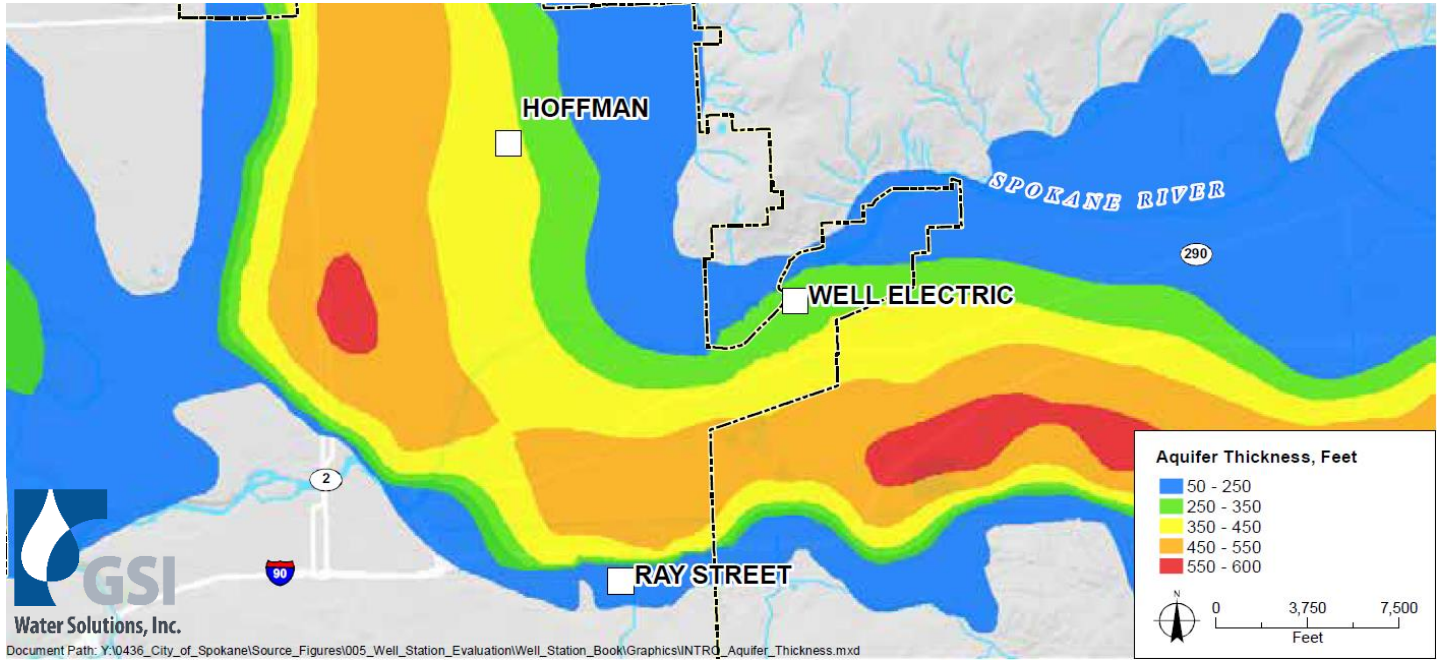
- Four 18-foot-diameter caisson wells
- Eight 600- to 1,000-hp motors/pumps
- Produces approximately 90 mgd (62,500 gpm)

- Two 48-foot-diameter caisson wells
- Four 900- to 1,000-hp motors/pumps
- Produces approximately 53 mgd (36,500 gpm)

Source: City of Spokane

SVRP Aquifer

- Spokane Valley – Rathdrum Prairie (SVRP) Aquifer
- Exclusive source of water supply for City
- Unconfined, highly productive, and highly transmissive
- Underlain and laterally bounded by bedrock and low-permeability clay (Latah FM)
- Recharge primarily from infiltration of rainfall and snowmelt runoff and seepage from surface water bodies



Source: City of Spokane

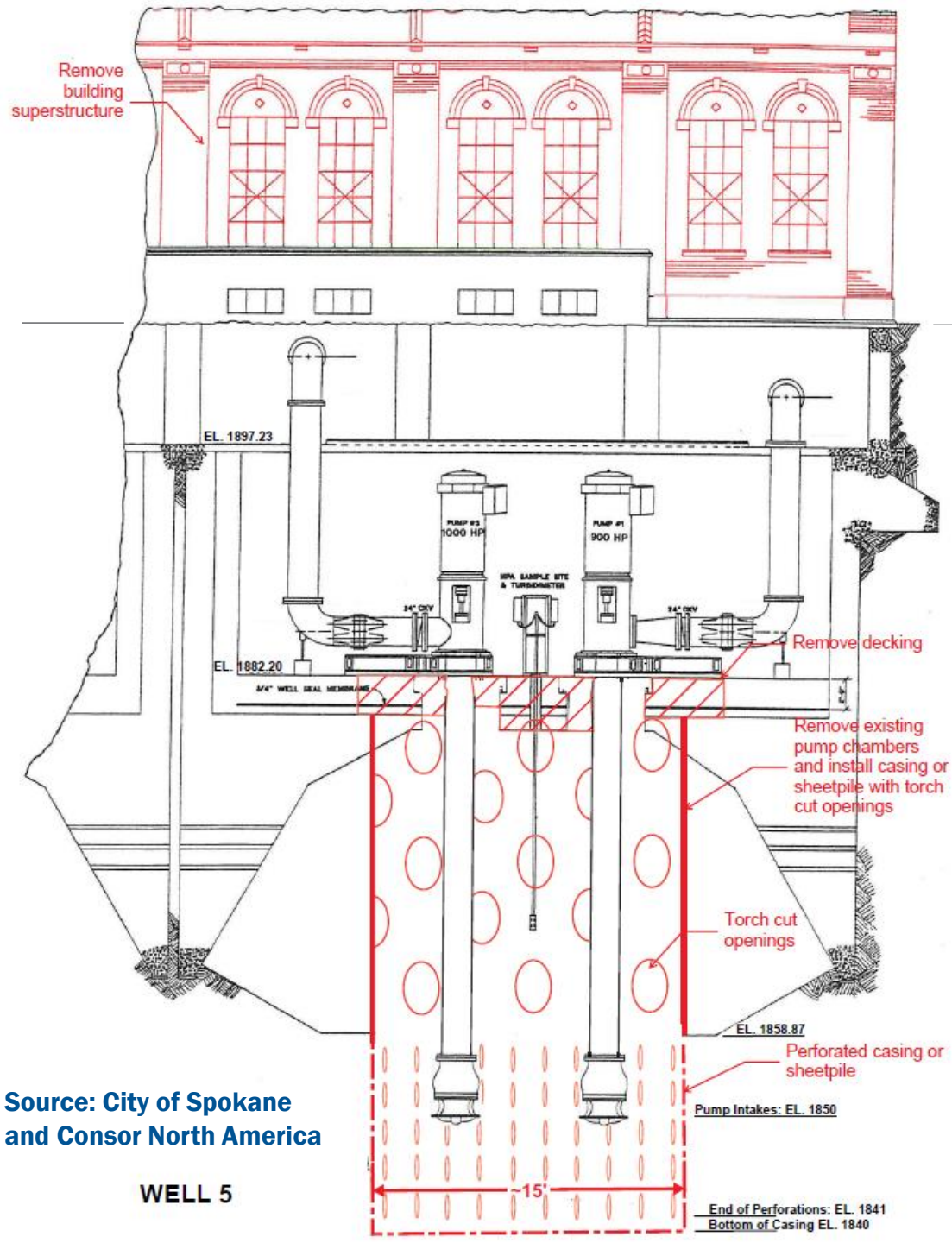
Alternatives Evaluated

Alternative No. 1 – Deepen Existing Caisson Wells

Estimated cost: $11-23M

Estimated increase in yield: 6 mgd

Estimated cost: $2-4M/mgd



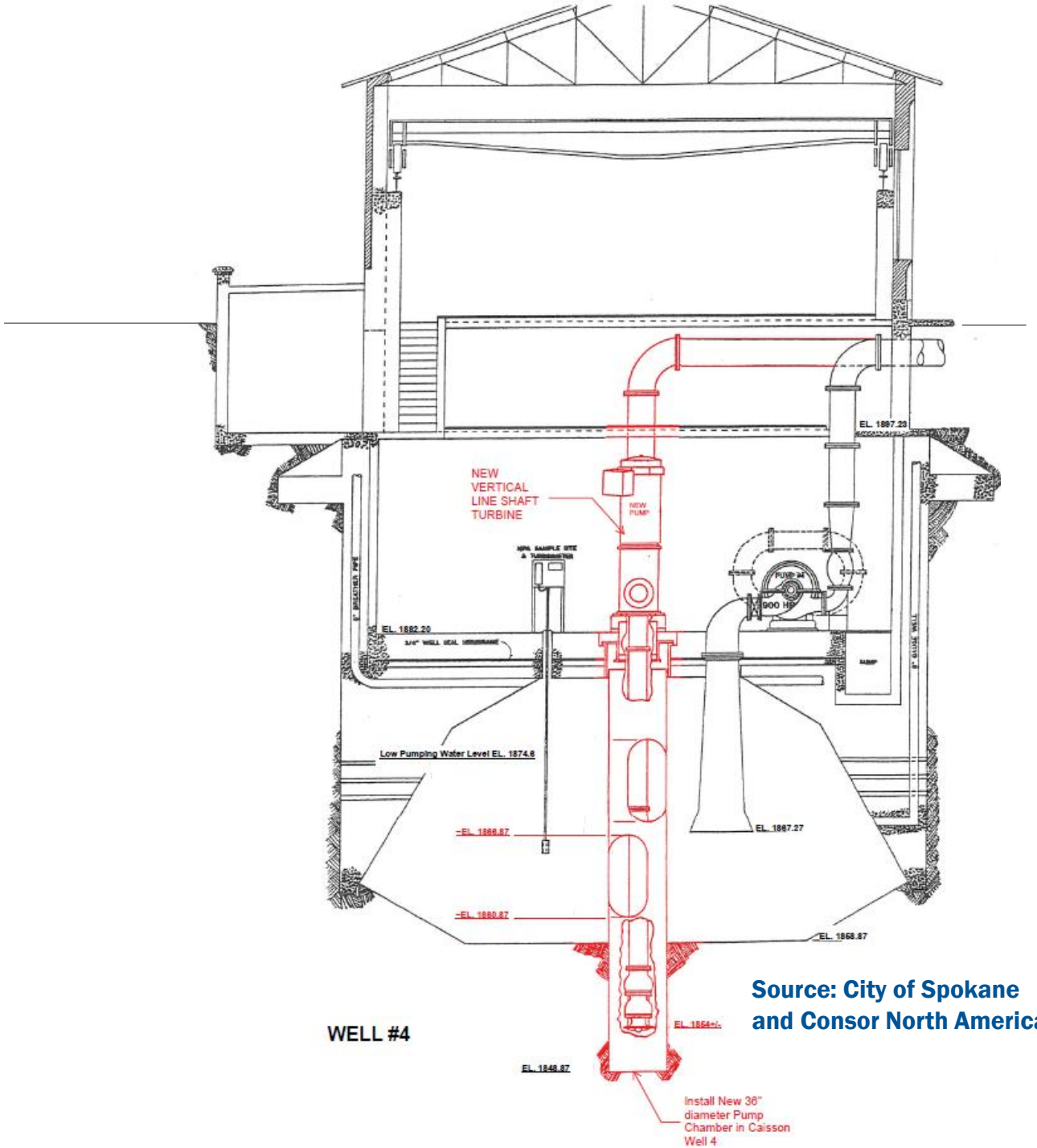
Source: City of Spokane and Consor North America

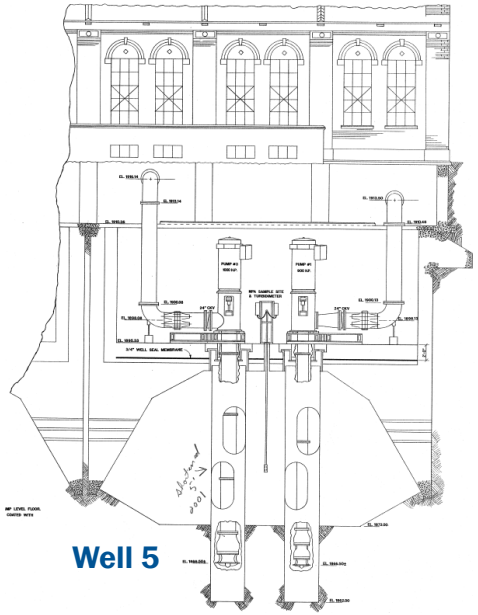
Alternative No. 2 – Install Pump Chamber

Estimated cost: $2-3M

Estimated increase in yield: 6 mgd

Estimated cost: $250-500K/mgd





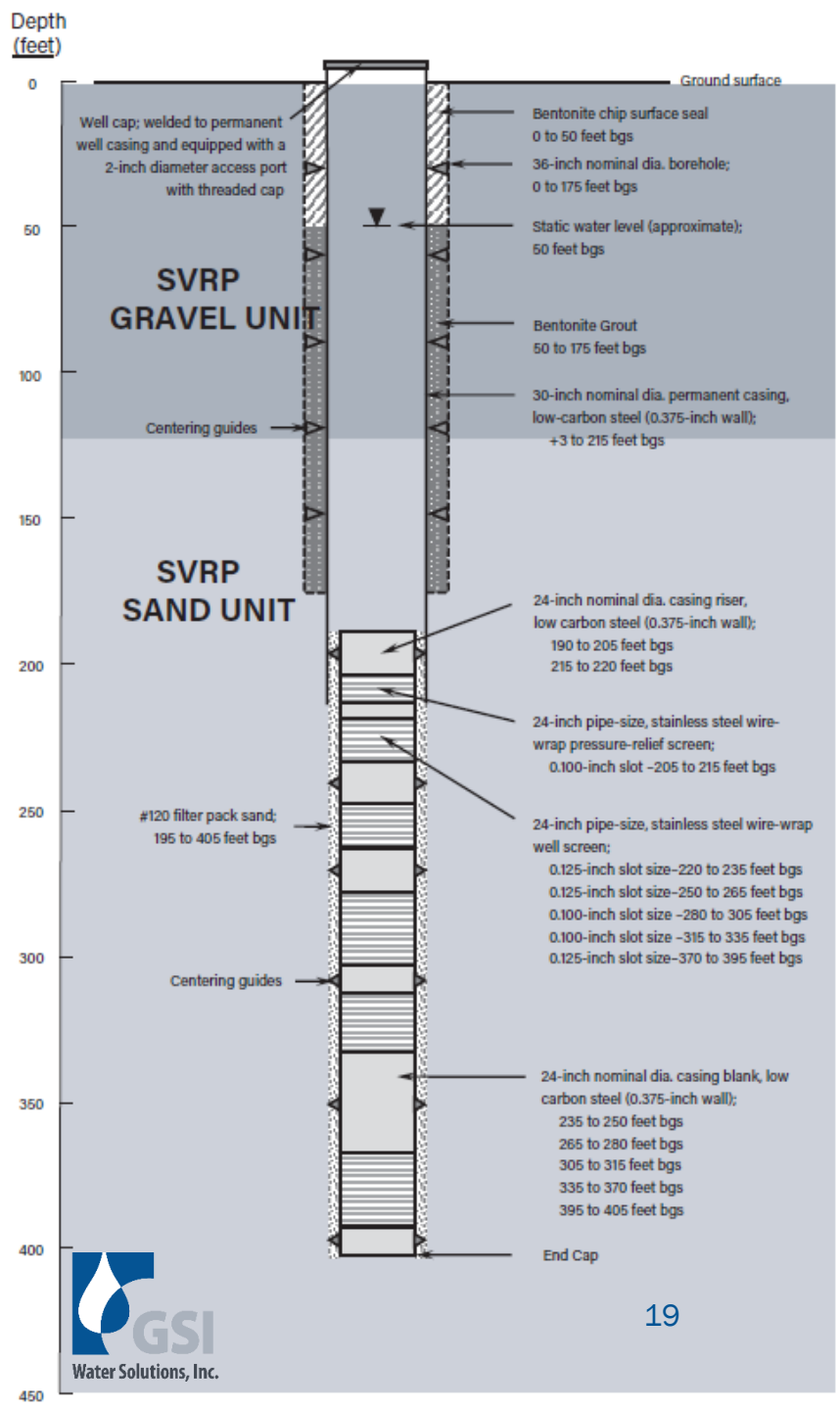
Well 5

Source: City of Spokane and Consor North America

Alternative No. 3 – New Wellfield

- Evaluated setback requirements for municipal production wells
- Drilled exploratory borehole and converted to monitoring well
- Collected and analyzed drill cuttings and water quality samples

Alternative No. 3 – New Wellfield

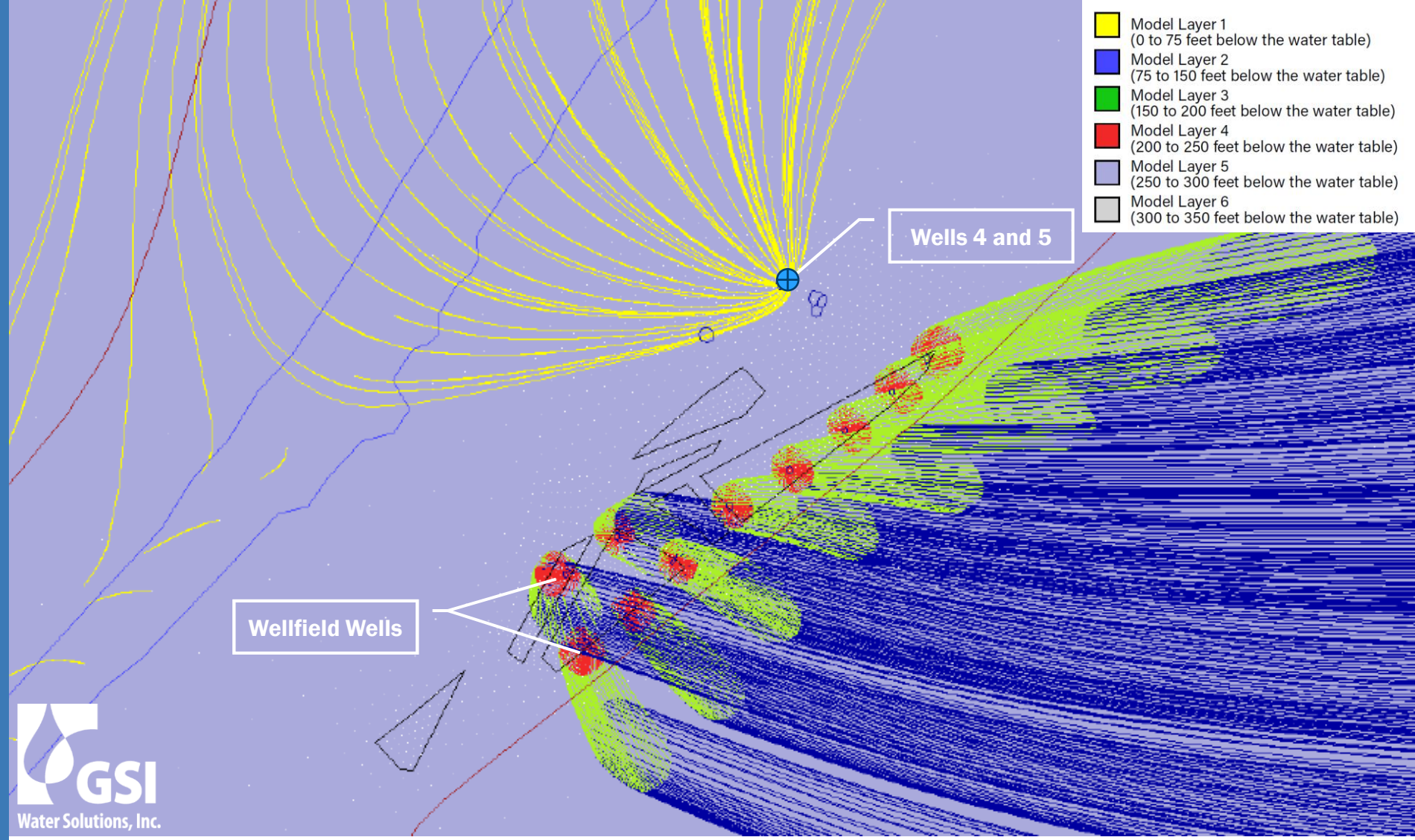


Alternative No. 3 – New Wellfield

Estimated cost: $20-42M

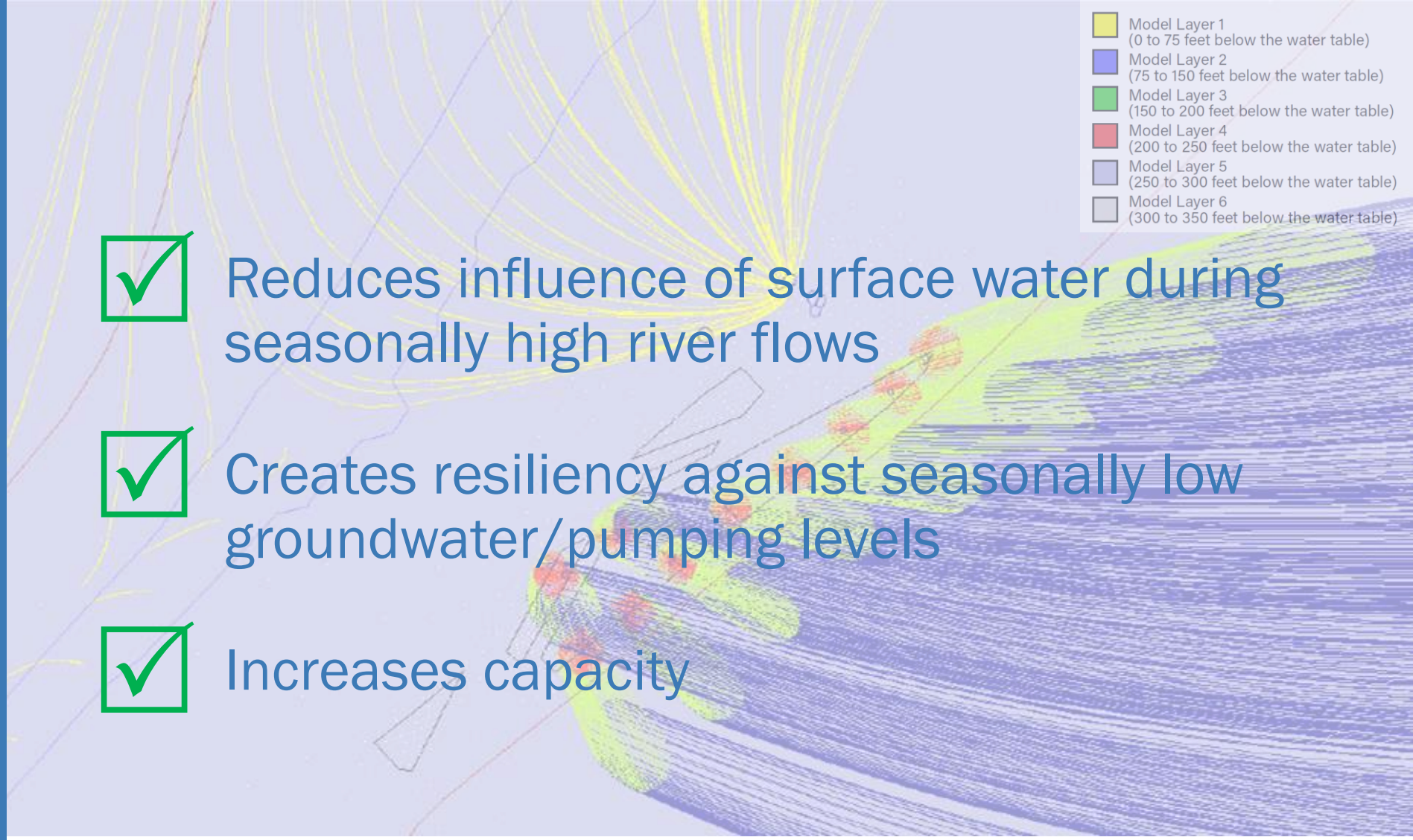
Estimated increase in yield: 115 mgd

Estimated cost: $175-375K/mgd



- Wellfield Layout and Estimated Capacity
  - 16, 400-foot-deep, high-capacity production wells completed in the deep sand unit
  - 80,000 gpm (115 mgd)
- Groundwater captured from areas east of the wellfield rather than the shallow gravel unit adjacent to the river when pumping the caisson wells

Alternative No. 3 – New Wellfield



- ☑ Reduces influence of surface water during seasonally high river flows
- ☑ Creates resiliency against seasonally low groundwater/pumping levels
- ☑ Increases capacity

Estimated cost: $20-42M

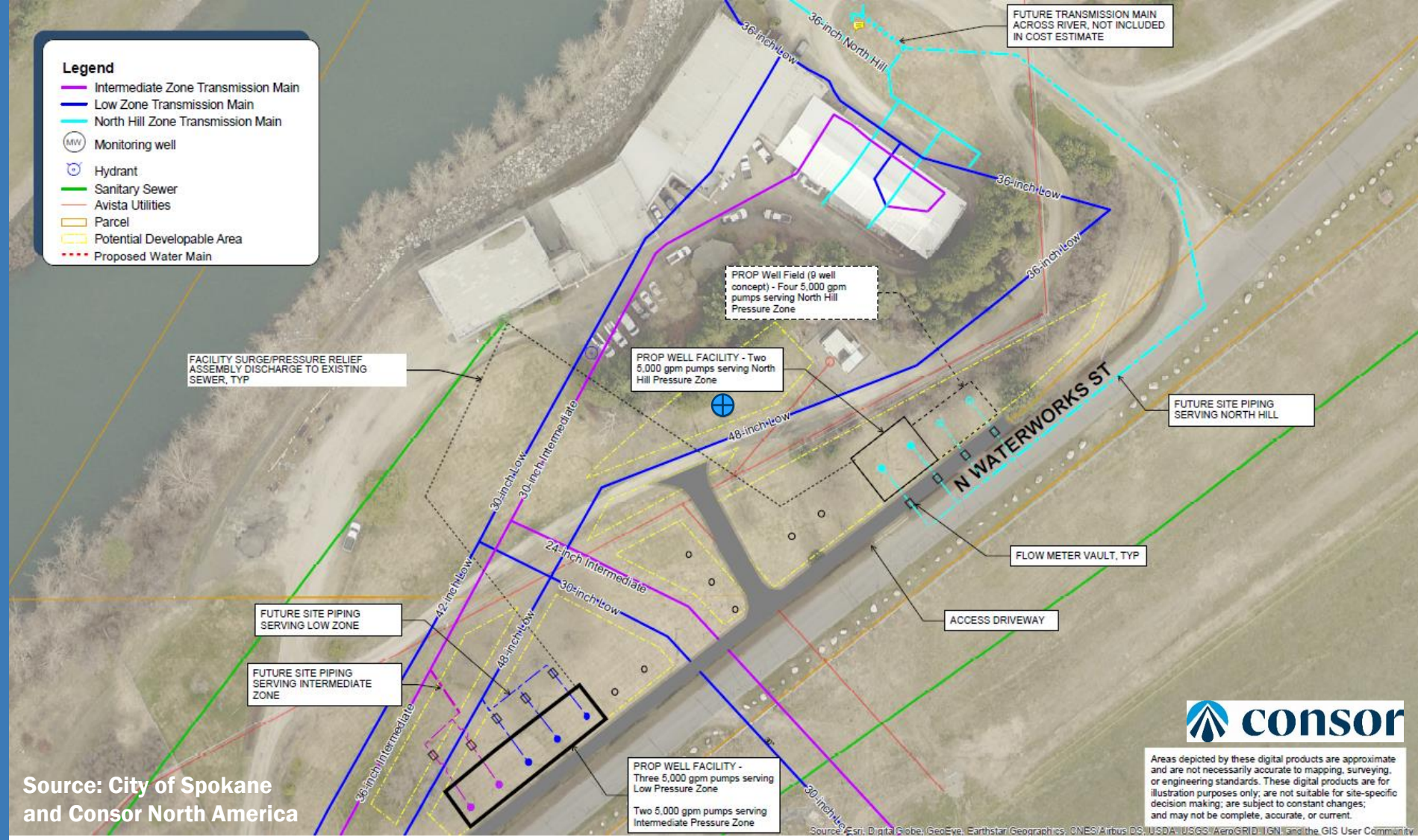
Estimated increase in yield: 115 mgd

Estimated cost: $175-375K/mgd

Source: City of Spokane

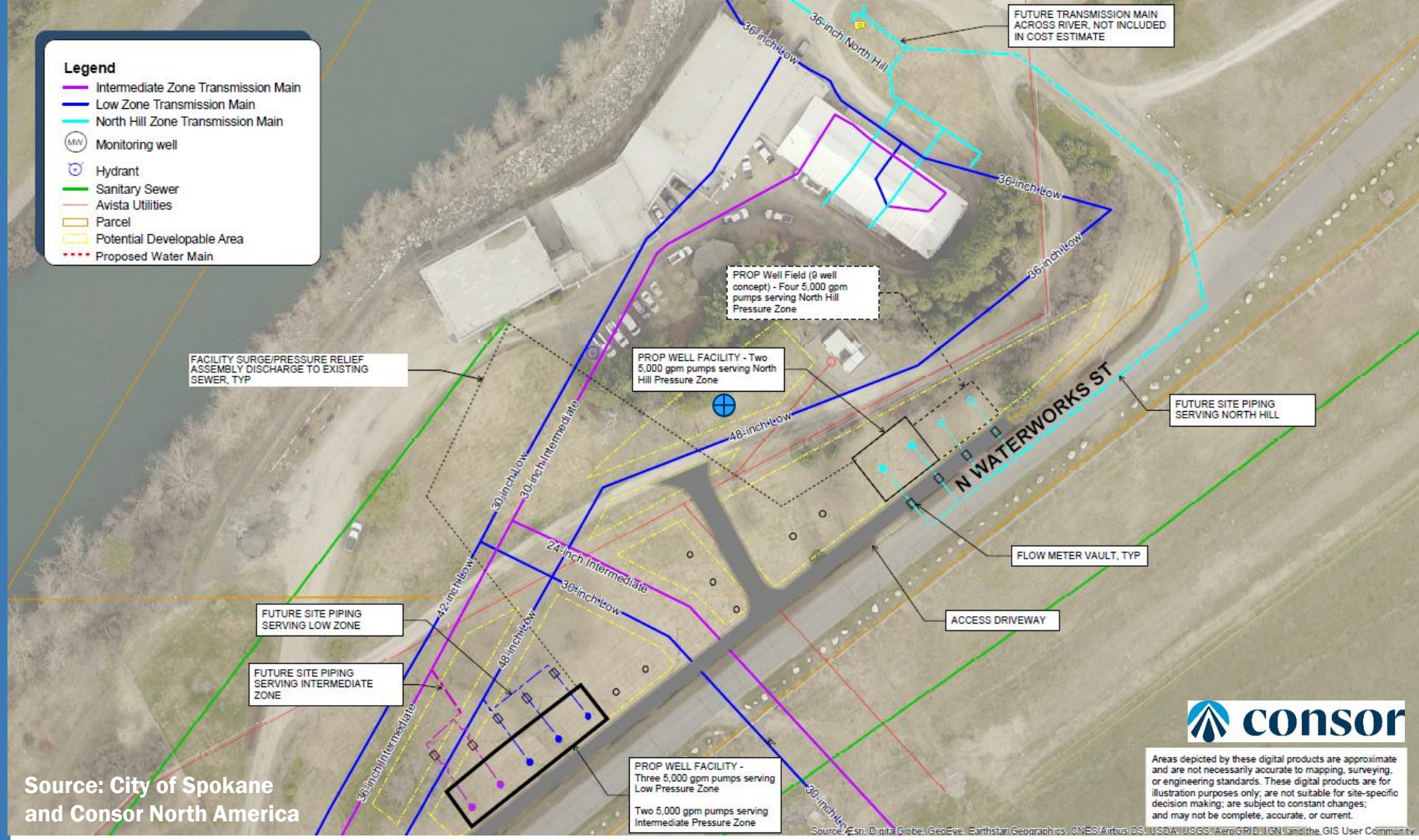
Concept for Selected Alternative

New Wellfield Concept



- Phase I – Four 5,000 gpm wells to serve North Hill PZ
- Phase II – Five 5,000 gpm wells (3 wells to serve Low PZ and 2 for Intermediate PZ)
- Future Phases: Full wellfield buildout (80,000 gpm, or 115 mgd)
  - Current facility produces approximately 36,500 gpm (56 mgd)

New Wellfield Concept



- Limitations and Uncertainties
  - Spatial variability of deep sand unit (only one exploratory borehole)
  - Hydraulic characteristics of deep sand unit (no deep wells or high-stress pumping)
  - Will need new transmission main across river to serve NHPZ

Source: City of Spokane

Feasibility Study

New Wellfield Feasibility Study

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New Wellfield Feasibility Study

COMPLETED:

- Drilled exploratory boreholes
- Converted to monitoring wells
- Collected and analyzed drill cuttings and water quality samples
- Began developing conceptual test well design options

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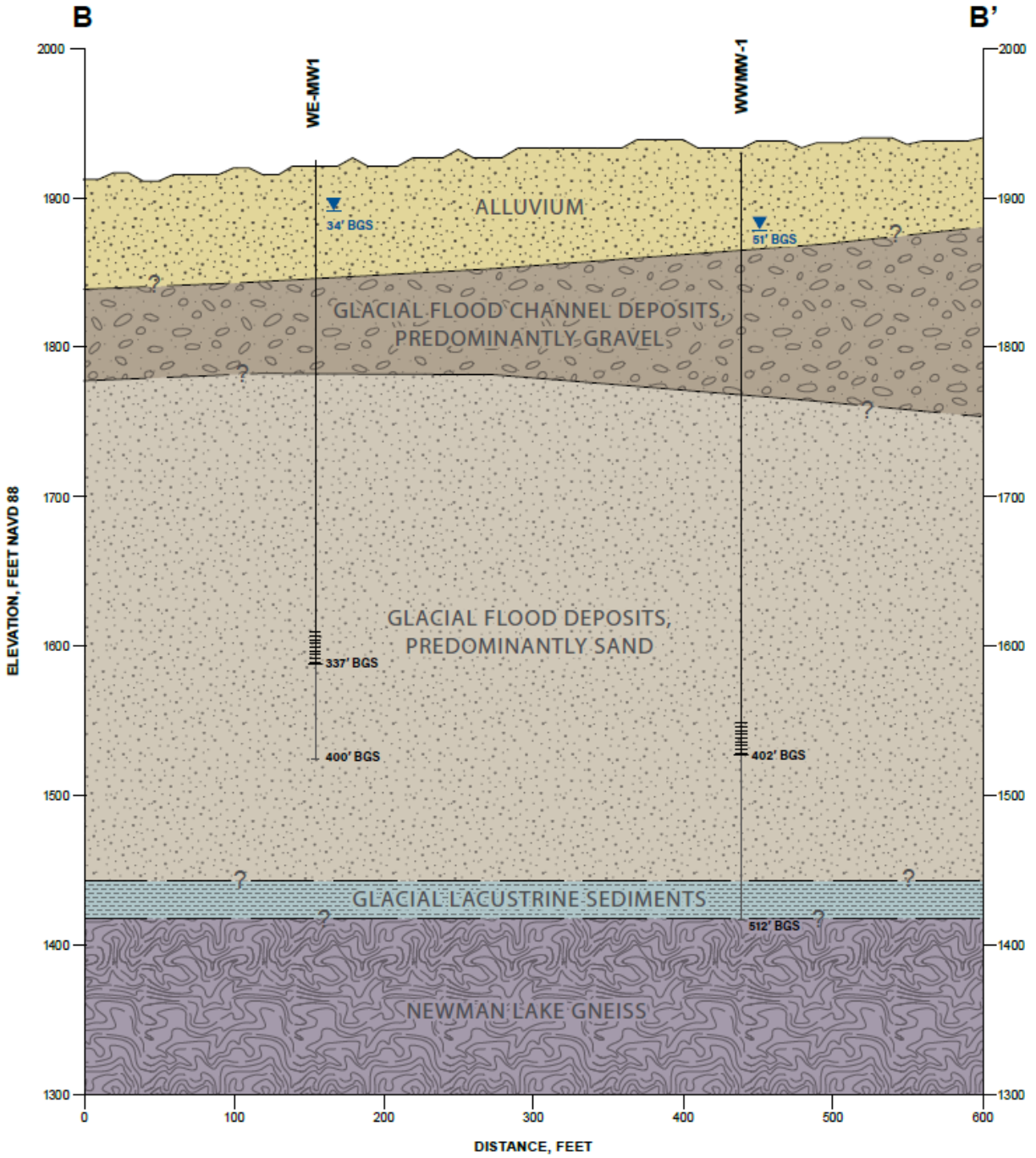
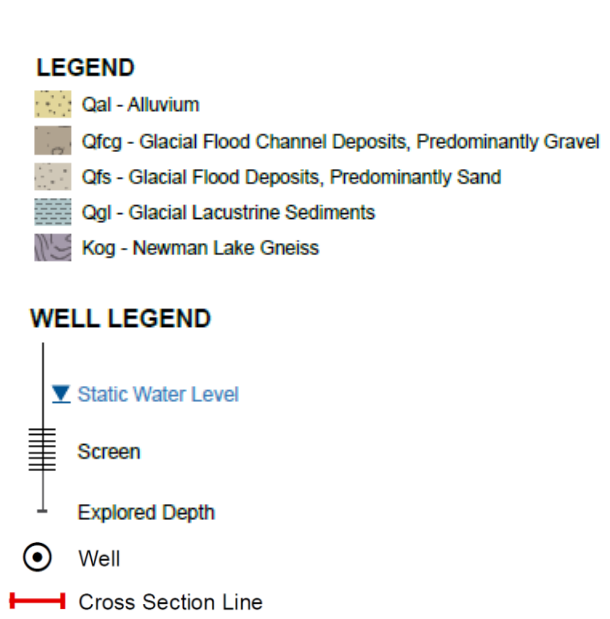
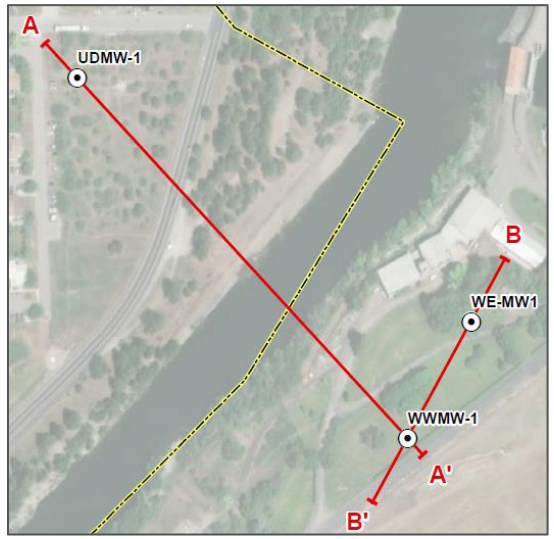
New Wellfield Feasibility Study







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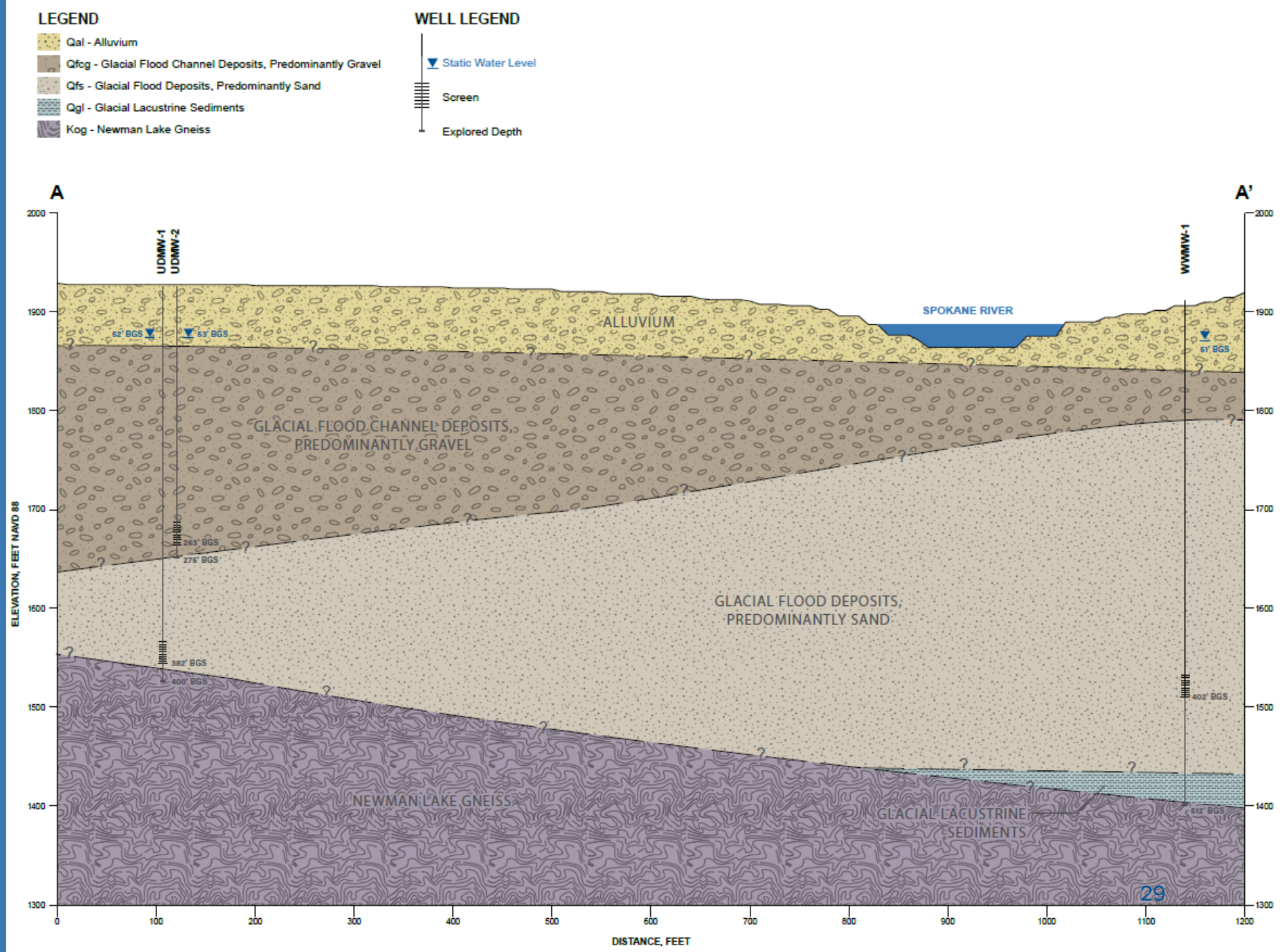
New Wellfield Feasibility Study



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New Wellfield Feasibility Study

NEXT STEPS:

- Collect wet-season MPA samples
- Model wellfield pumping scenarios at alternative site
- Recommend a site for the test well
- Drill and test a test production well

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Source: City of Spokane

Questions?

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