CITY OF
BAINBRIDGE ISLAND

Prepared for:

Groundwater Management Plan Open House

May 27, 2026

Today's Discussion

May 27, 2026

What is the Groundwater Management Plan (GWMP)? How did we get here? How should we plan?

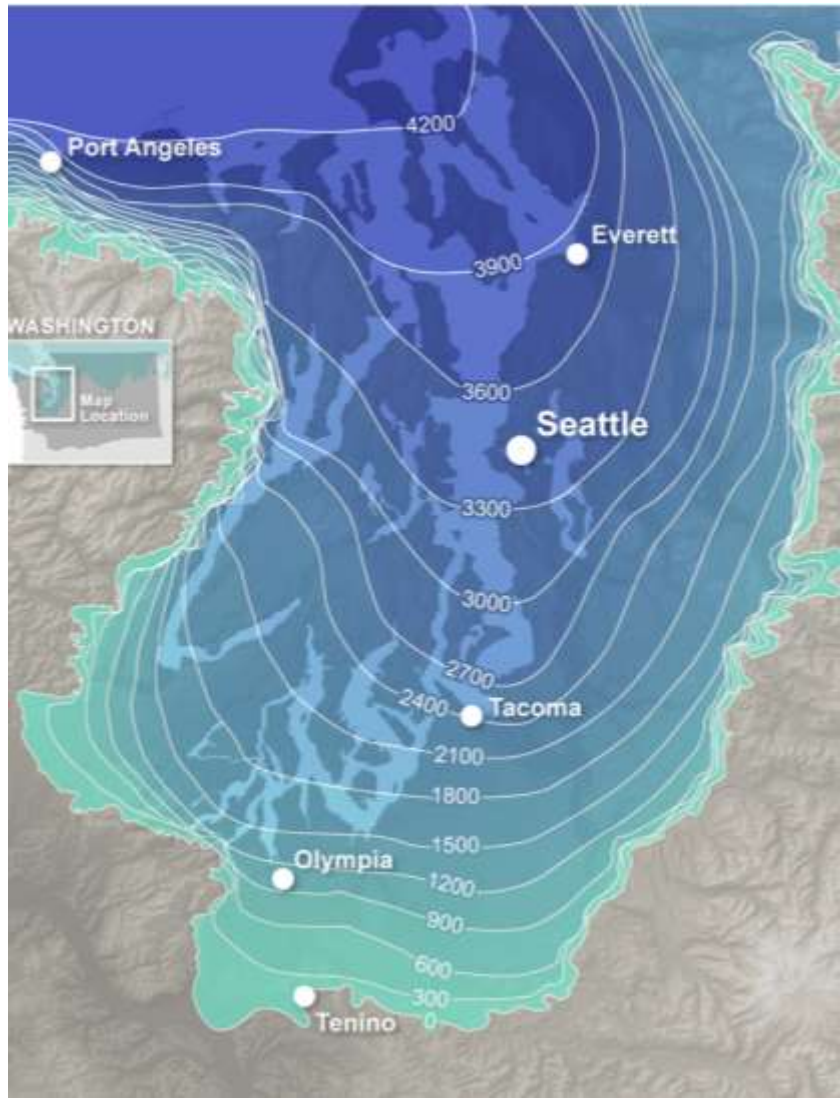
1	2	3	4	5
Groundwater Primer	History of the GWMP	Analysis by EA and Keta Waters	Management Actions	Next Steps

Groundwater Primer

Origins of Bainbridge Island Aquifers

May 27, 2026

- Seattle Fault
- Glaciation



Describing Bainbridge Island Aquifers

May 27, 2026

- 2–12-inch diameter hole in the ground
- 0-1,500 feet deep

Source Driller's Record

Location: State of WASHINGTON
County Kitsap
Area
Map

½SE½SE¼ SE¼ sec. 33 T. 25 N., R. 2 E. W.

Diagram of Section

Drilling Co. Burt Well Drilling Co.
Address Rt. 1 Box 283, Poulsbo, Wash.
Method of Drilling New Well Date June, 1968.
Owner Emanuel Olson
Address Port Blakely Box 264, Bainbridge Is, Wash
Land surface, datum ft. above/below
SWL: 19' Date June, 1968. Dims.: 8" x 125'

Correlation	Material	From (feet)	To (feet)
	Community domestic supply		
	Topsoil	0	3'
	Clay-sand-pebbles	3	14
	Clay, gravel	14	28
	Gravel - some water	28	31
	Clay & gravel	31	60
	Clay, gray	60	90
	Clay, blue	90	100
	Clay with sand water	100	105
	Clay	105	125
	Casing: 8" from 0-125'		

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

WATER WELL REPORT
STATE OF WASHINGTON

David Lown Address 310 West Howe Street Se.
WELL: County Kitsap
section or subdivision corner

E: Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

K: Owner's number of well (if more than one)
well ☒ Method: Dug ☐ Bored ☐
ened ☐ Cable ☒ Driven ☐
nditioned ☐ Rotary ☐ Jetted ☐

Diameter of well 6 inches.
ft. Depth of completed well 181 ft.

N DETAILS:
6 " Diam. from 0 ft. to 181 ft.
" Diam. from ft. to ft.
" Diam. from ft. to ft.

s ☐ No ☒
tor used
ations in. by in.
forations from ft. to ft.
forations from ft. to ft.
forations from ft. to ft.

No ☐
Name Johnson
ss Steel Model No.
Slot size 12 from 175 ft. to 181 ft.
Slot size from ft. to ft.

Yes ☐ No ☒ Size of gravel.
rom ft. to ft.

☒ No ☐ To what depth? 22 ft.
n seal Bentonite
contain unusable water? Yes ☐ No ☐
Depth of strata.
ng strata off

(10) WELL LOG:
Formation: Describe by color, character, size of m
show thickness of aquifers and the kind and natu
stratum penetrated, with at least one entry for e

MATERIAL
Top Soil
Brown Hardpan
Brown Gritty Clay
Brown Silt w/clay Binder
Brown Gritty Hardpan
Brown Sandy Silty Clay
Brown Gravelly Hardpan
Gray Brown Gravelly Hardpan
Brown Sandy Silty Clay Mix
Dirty Brown Sand, Gravel, Wate
Brown Sandy Silty Clay Mixx
Brown Gravelly Hardpan, Water
Dirty Brown Sand, Gravel & Wa
Brown Gravelly Hardpan
Brown Sand, Gravel & Water
Gray Brown Gritty Hardpan
Clean Sand, Gravel & Water
Brown Sandy Silt
Gray Brown Gravelly Hardpan, W
Brownish Blue Sand & Gravel, W
Brown Sand, Gravel & Water

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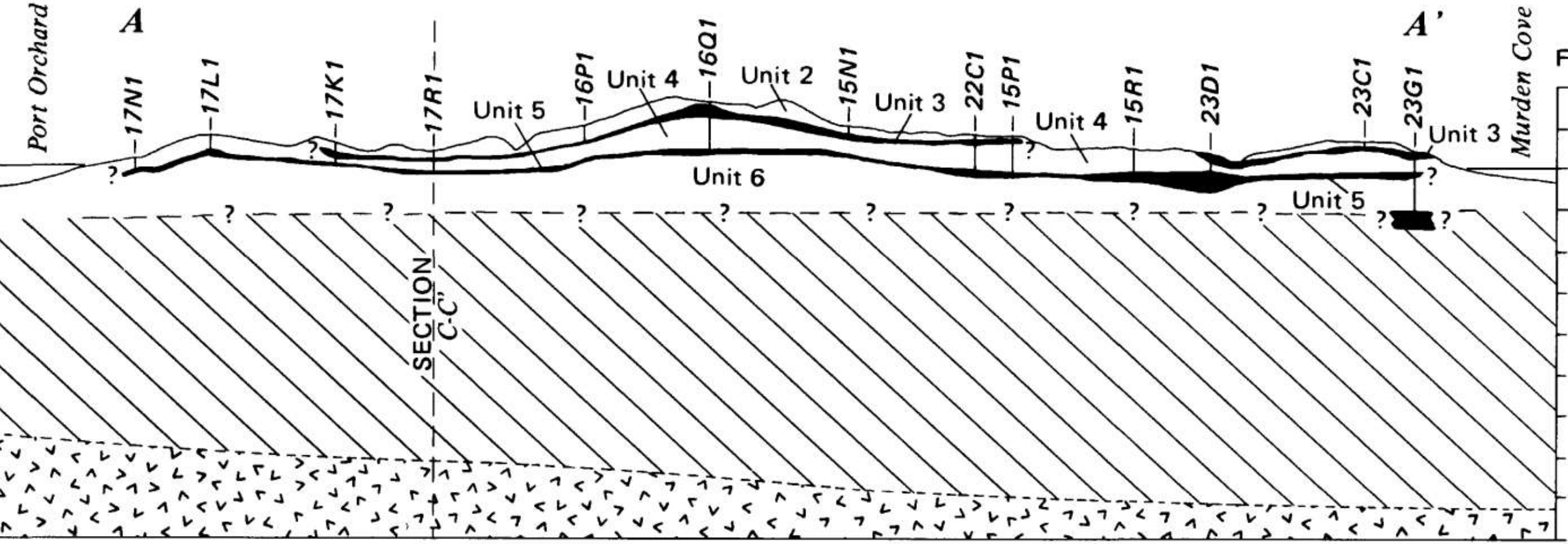
Groundwater Management Plan Open House

Aquifer Cross Sections

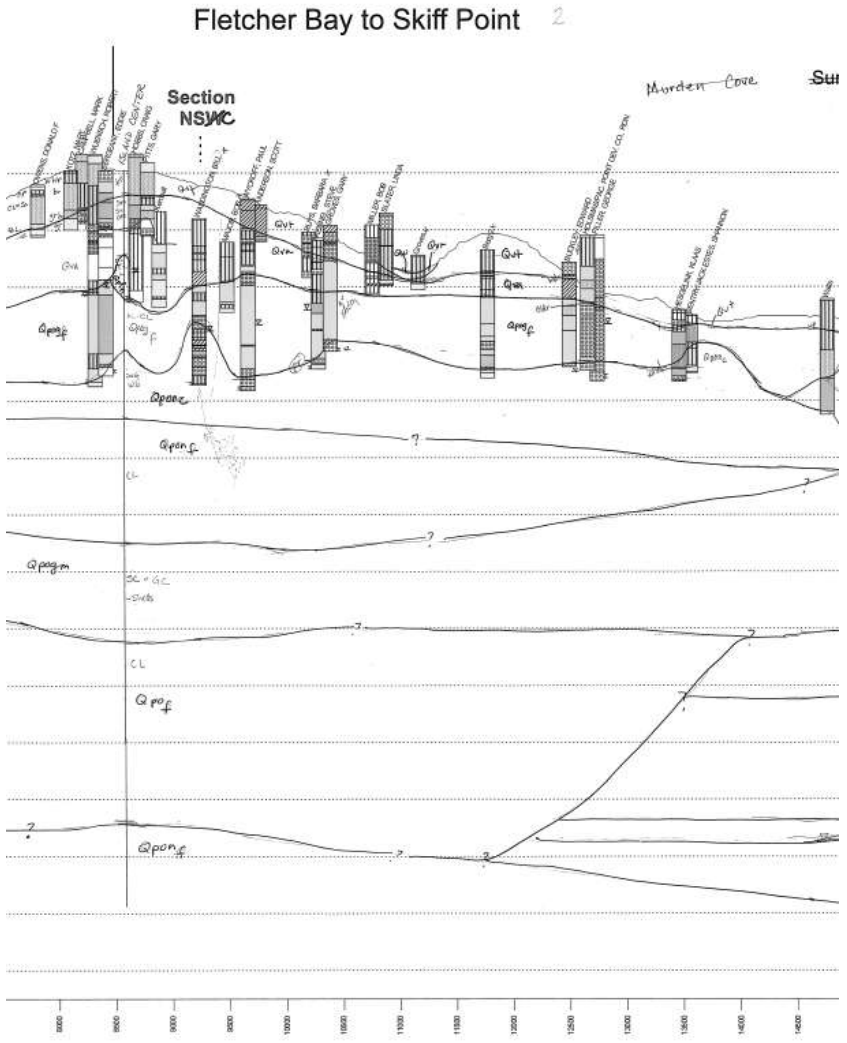
May 27, 2026

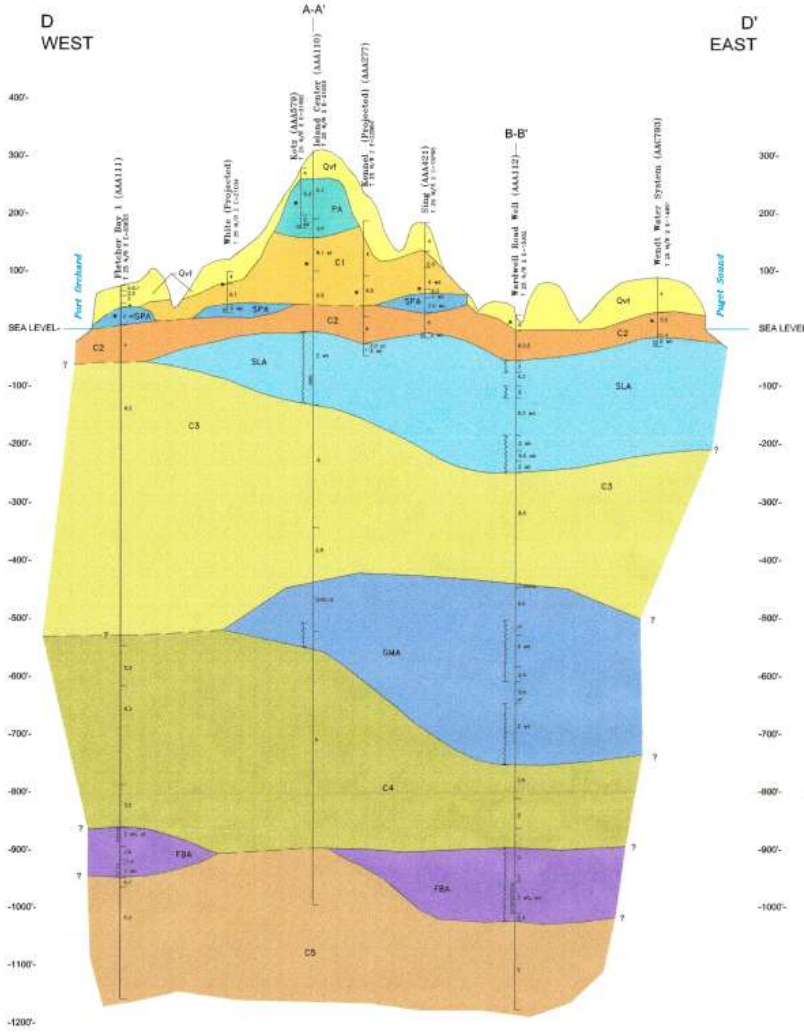


Aquifer Cross Sections

May 27, 2026

- 2005 University of Washington
- 2001 Kato and Warren

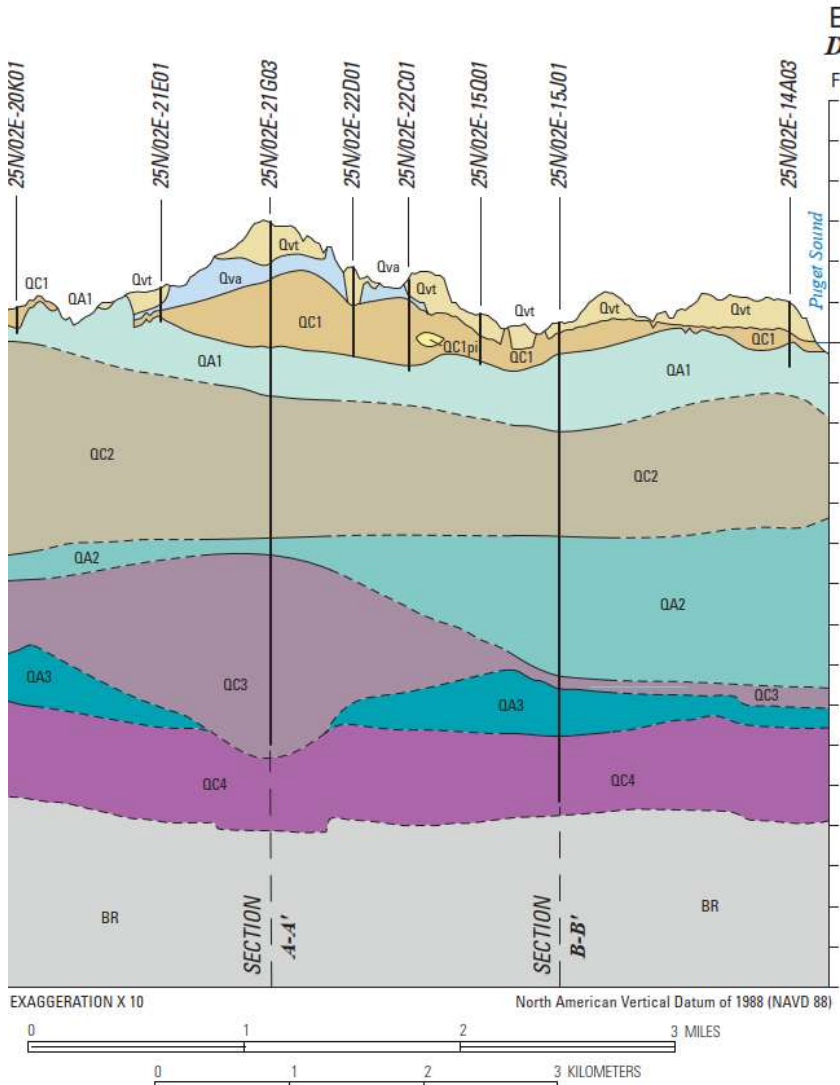




Aquifer Cross Sections Title

May 27, 2026

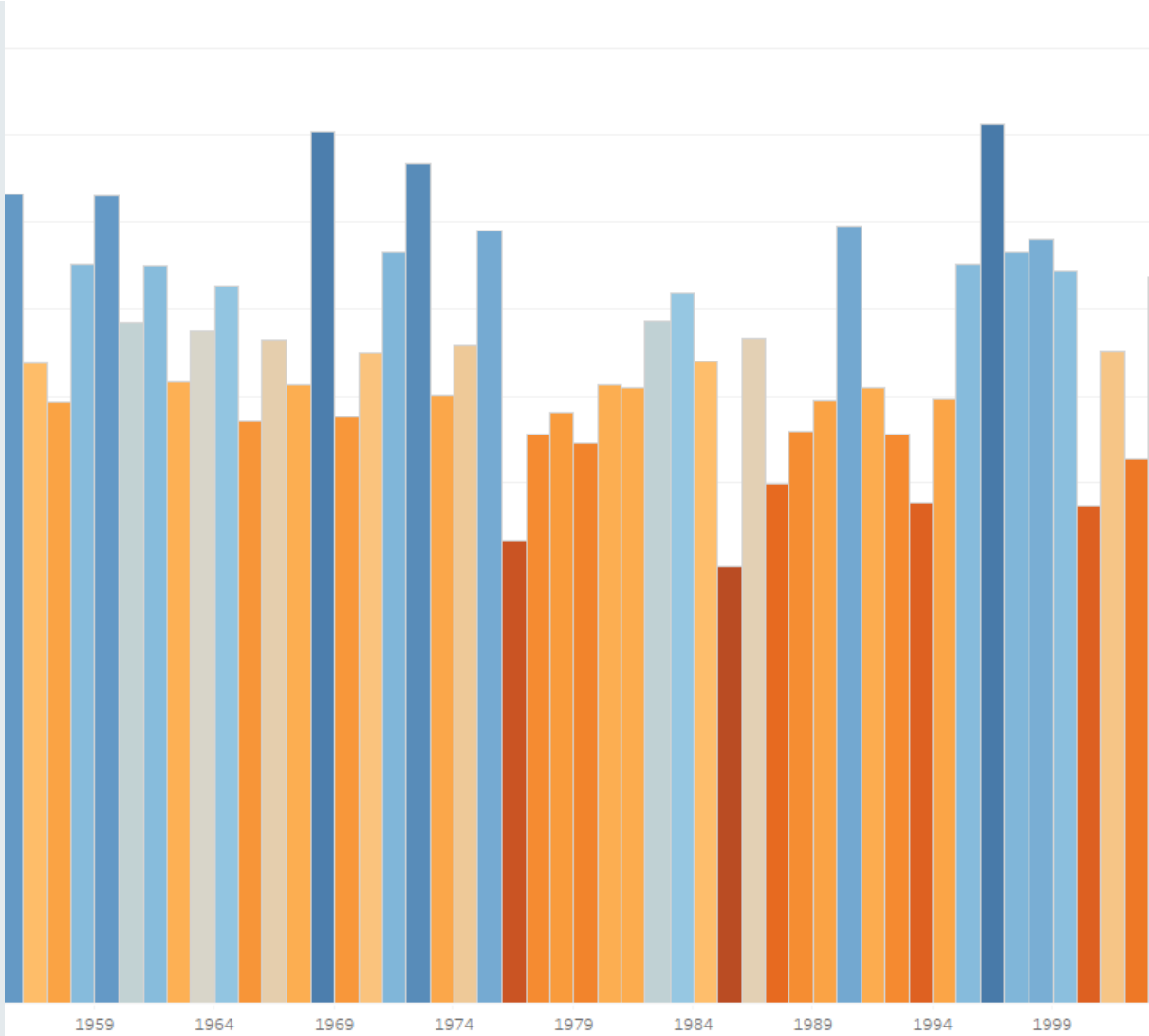
- 2011 U.S. Geologic Service



Recharge

May 27, 2026

- **Average annual rainfall 42 inches**



Recharge

May 27, 2026

- **Rainfall moves through the soil to the aquifer**

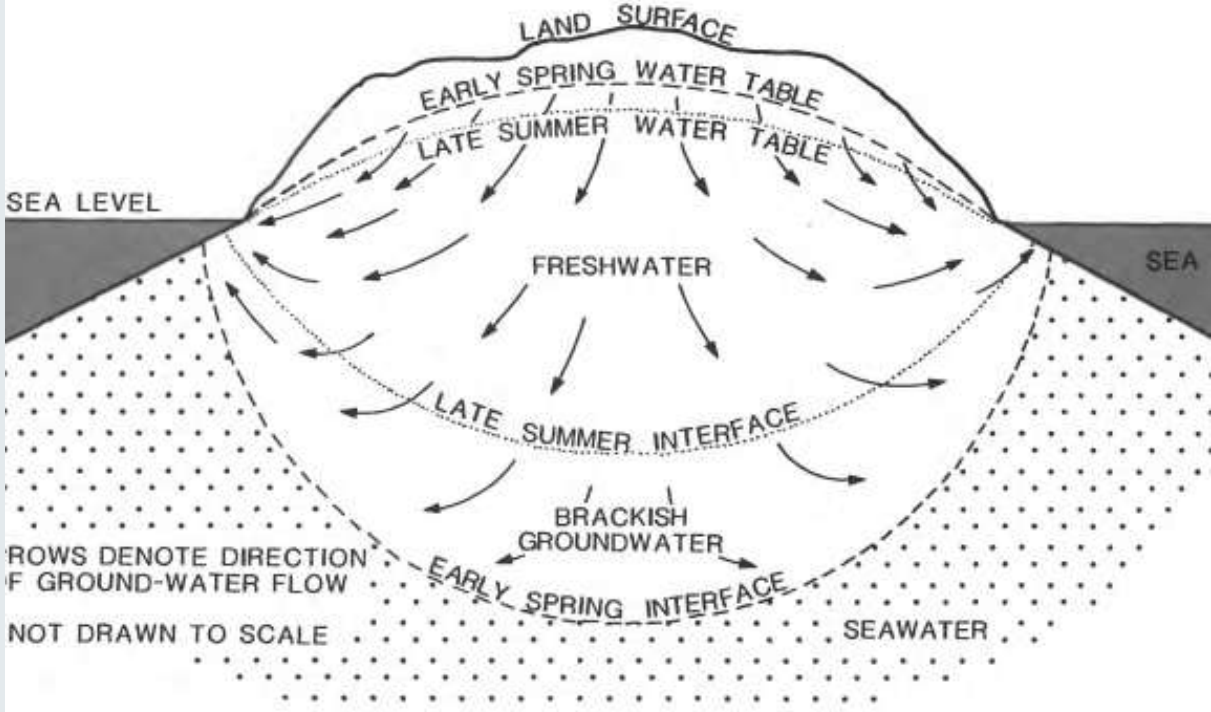
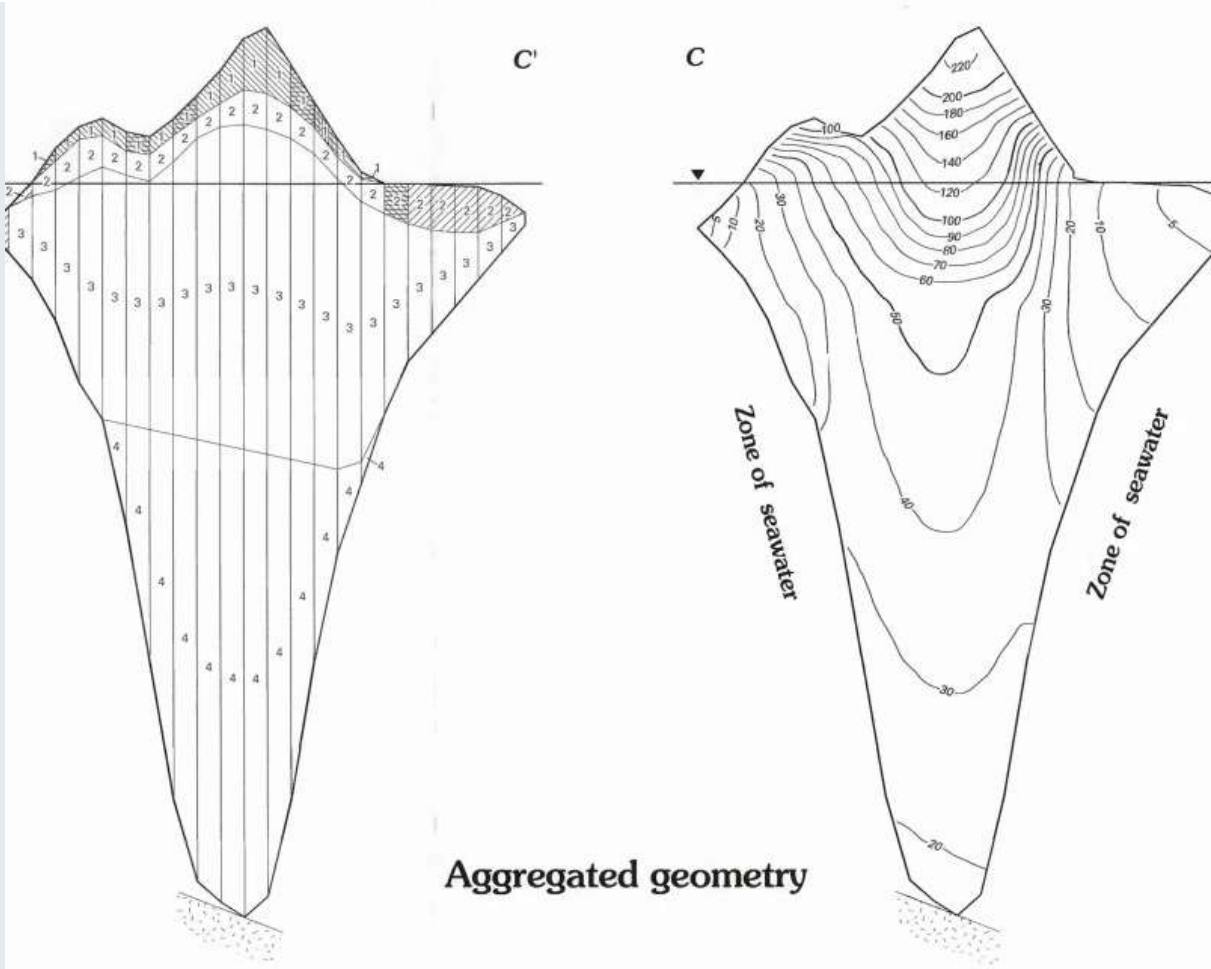


Figure 19.--Seasonal fluctuation of water table and freshwater-seawater interface in a homogeneous, unconfined island aquifer.

Recharge

May 27, 2026

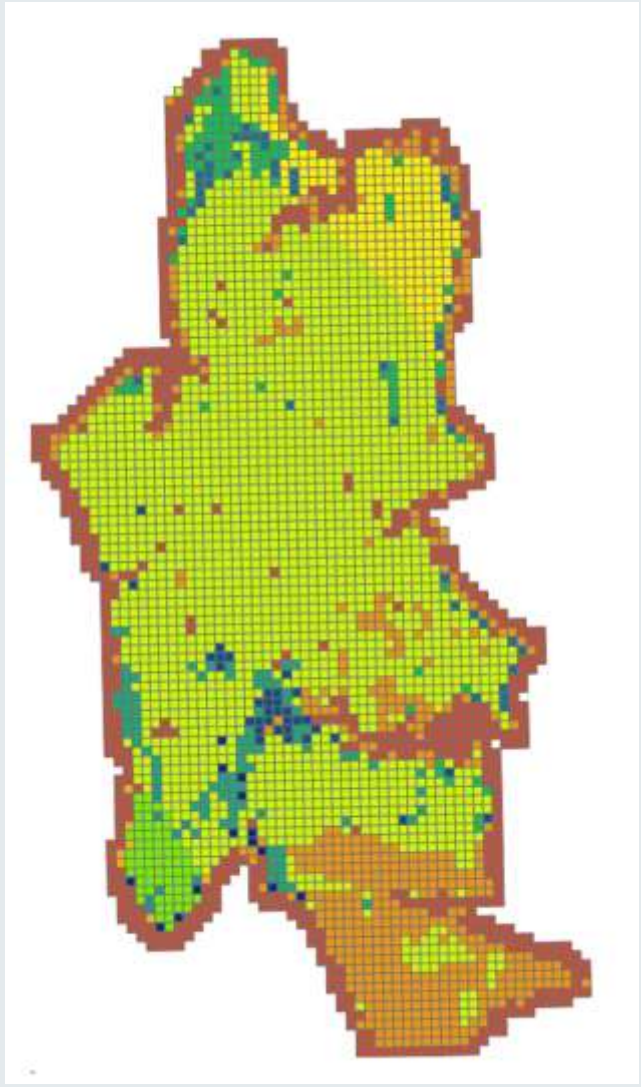
- **Freshwater holds seawater “at bay”**



Section C—C', Bainbridge Island-1

Recharge

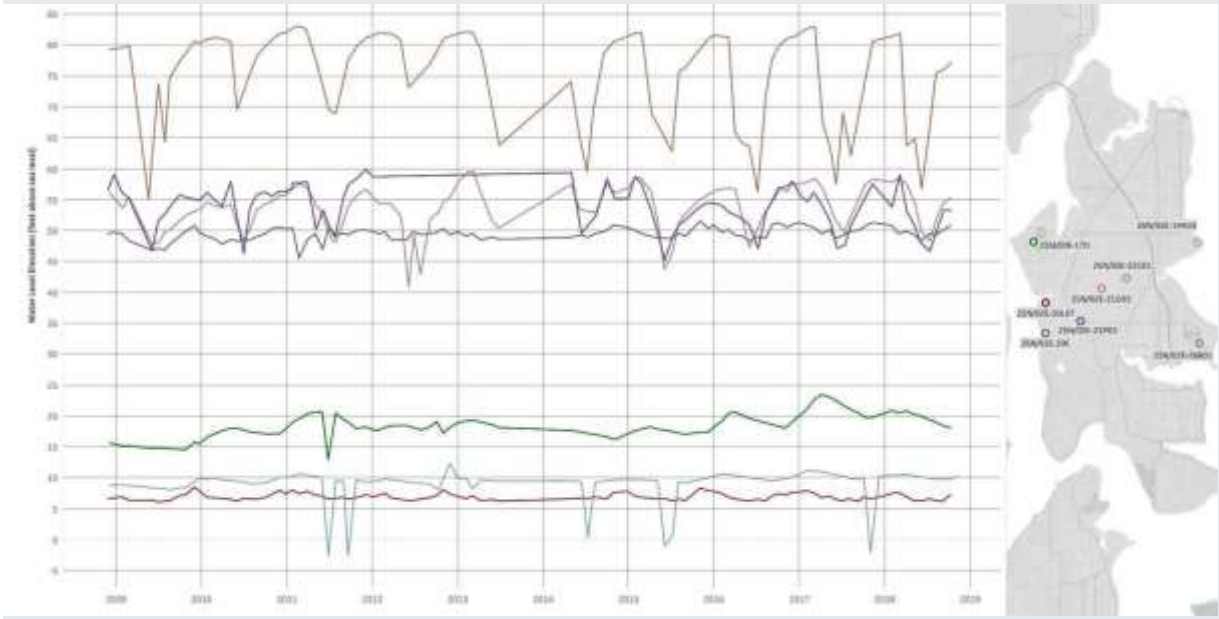
- **Recharge is varied across the Island based on rainfall patterns, geologic variety and land cover.**
- **Estimates range from 7-17 inches annually**



Monitoring

May 27, 2026

- **Water levels are monitoring by the City and KPUD**



GWMP History

Previous Studies and Plans

• U.S. Geologic Service	• 1957-2016
• WA State Department of Ecology	• 1980
• Kitsap County	• 1991
• City of Bainbridge Island	• 2001-present
• U.S. Environmental Protection Agency	• 2013
• WA State Department of Ecology	• 2018-2024

GWMP Timeline

- Plan Conception — 2018
- Scope Development — 2019
- City Staff Hired to Begin Plan — 2021
- EA Engineering Hired to Continue Plan — 2023
- Keta Waters Hired to Complete Plan — 2025

Analysis by EA Engineering and Keta Waters

Groundwater Model

May 27, 2026

- **The Bainbridge Groundwater Model Extent**

Analysis by EA
and Keta Waters

EA Modeling

May 27, 2026

EA Engineering updated and calibrated the groundwater model.

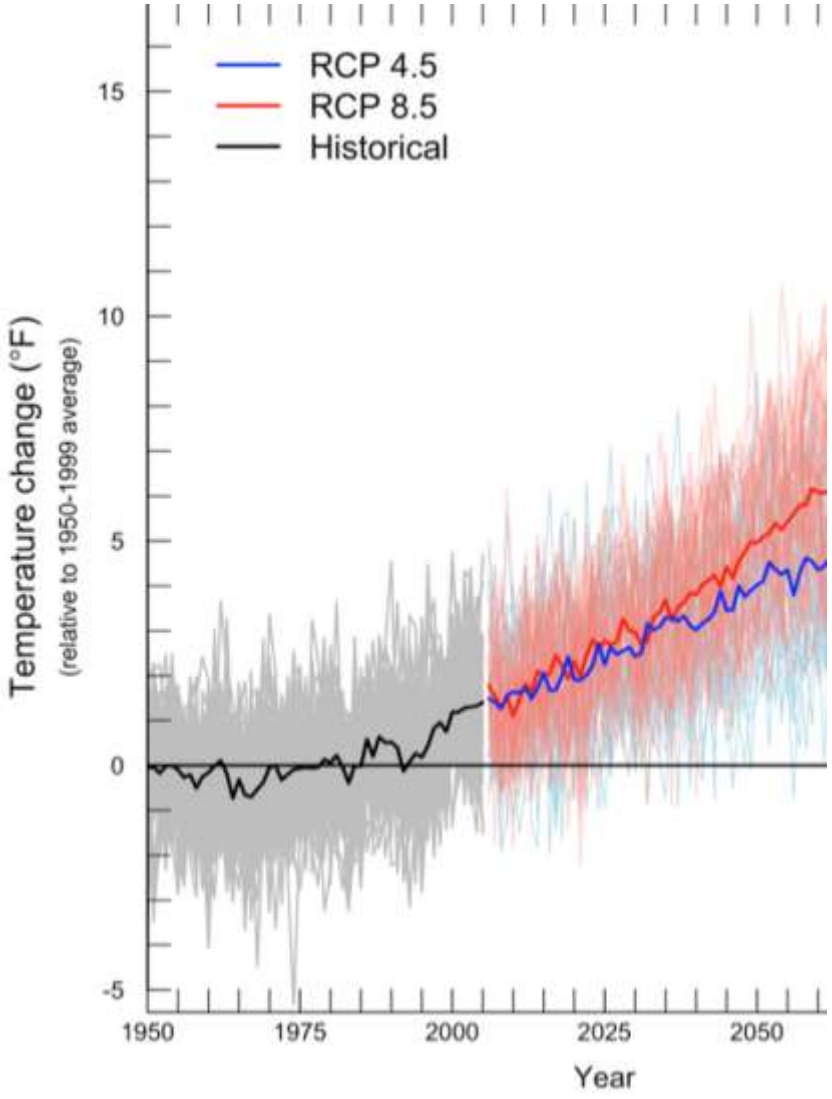
With committee input, EA ran 3 predictive scenarios to test the aquifer under stress until the year 2121.

Scenarios increased population (pumping) and decreased recharge.

Analysis by EA
and Keta Waters

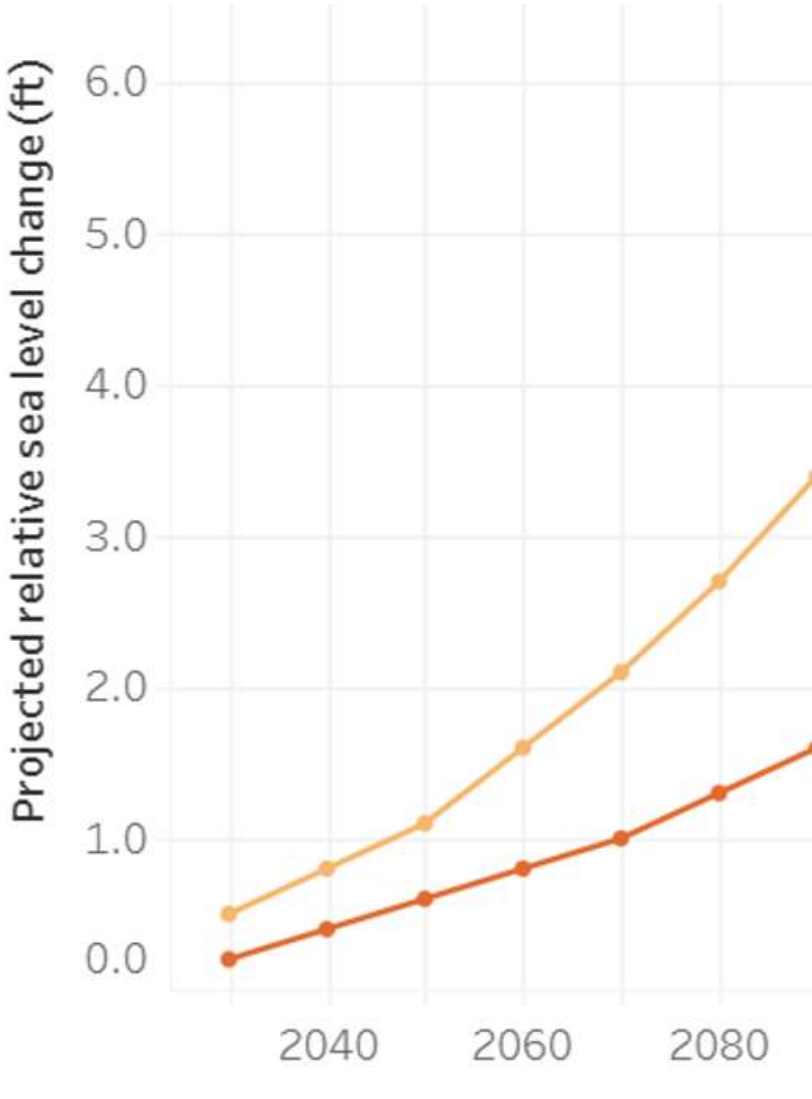
EA Modeling

May 27, 2026



Water use estimates were increased based on predicted temperature increase.

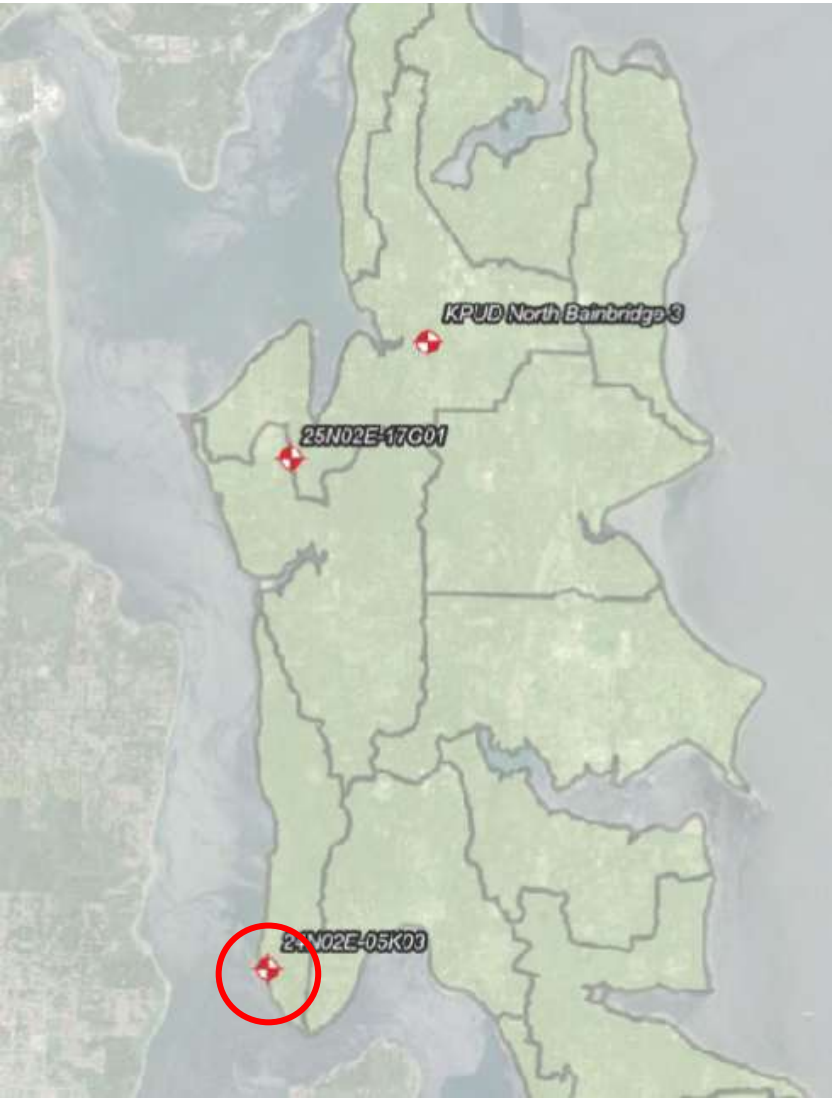
Sea level was increased based on 2 model projections.



Analysis by EA
and Keta Waters

EA Modeling

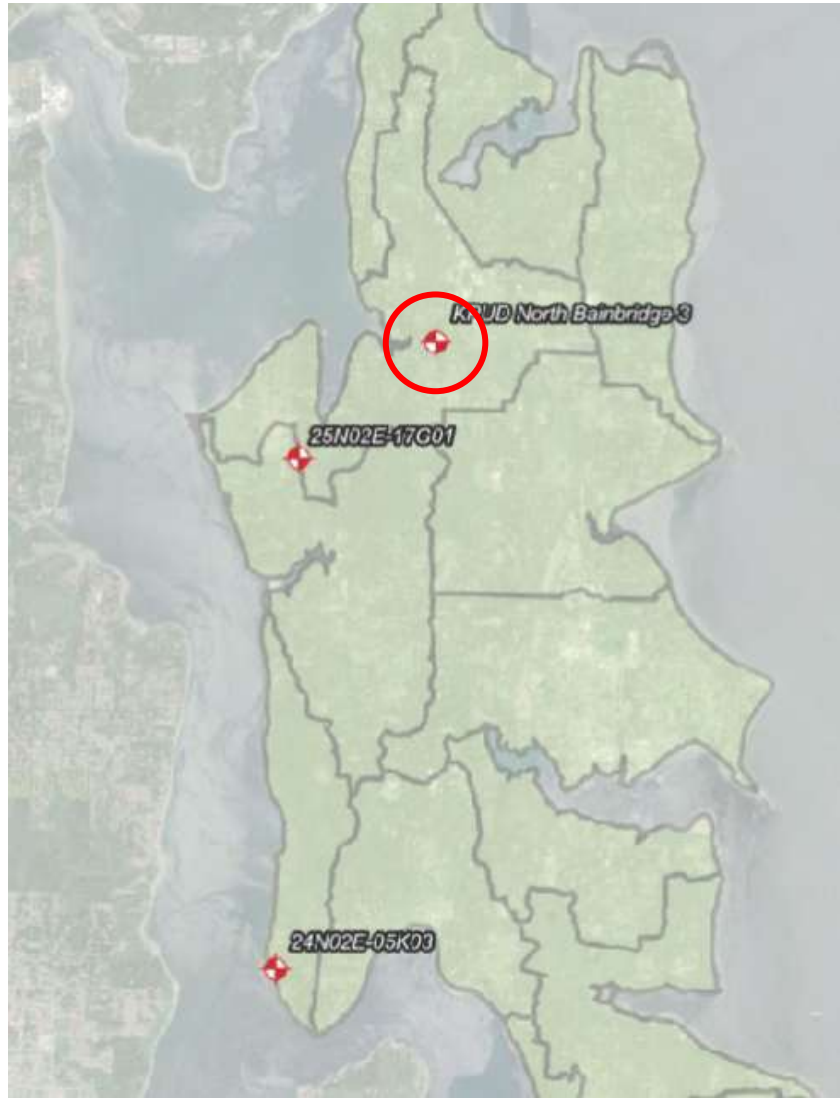
May 27, 2026



Sensitivity analysis showed us how different variables have different effects at different locations and depth.

Shallow, coastal wells are most influenced by sea level rise.

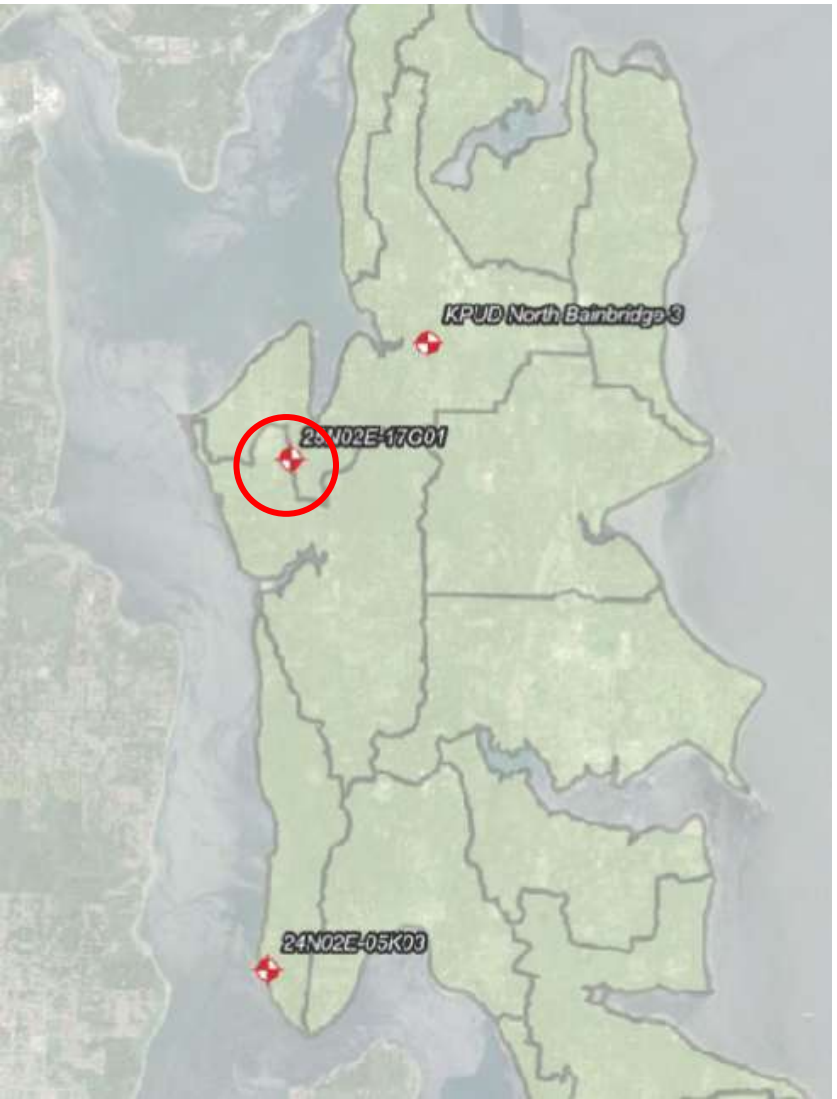
Deep, inland wells are most influenced by pumping rates.



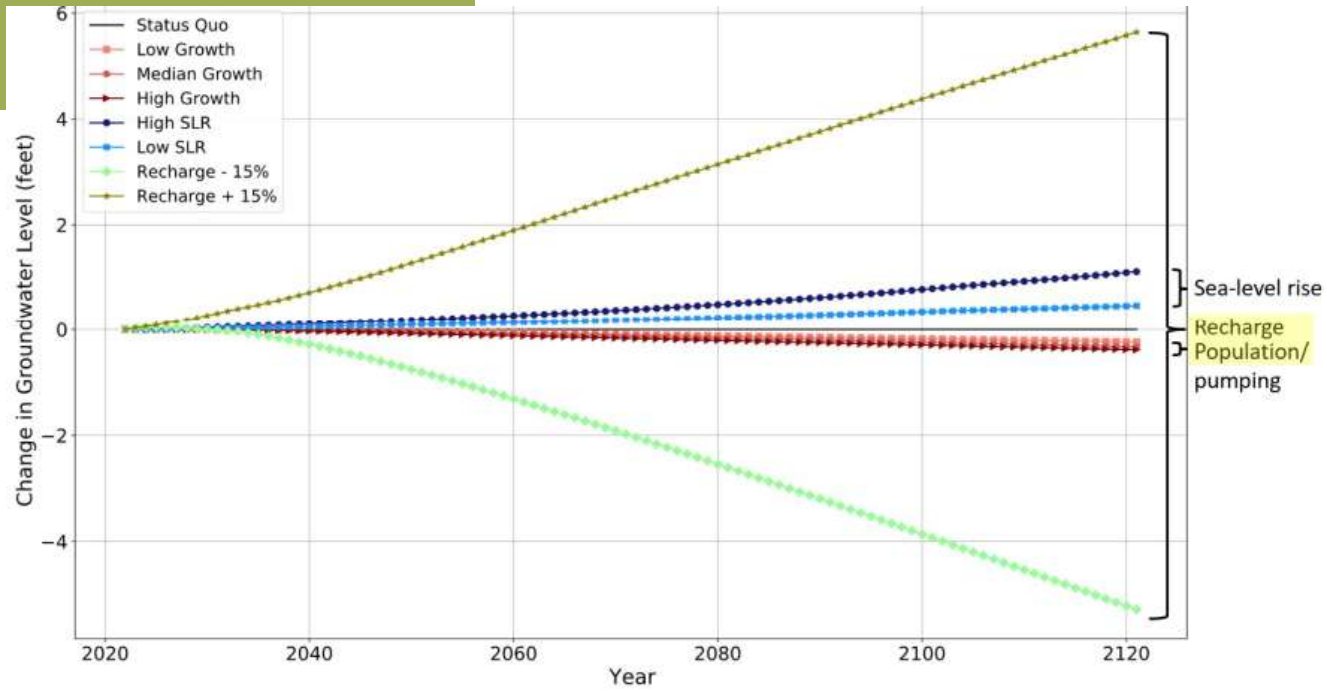
Analysis by EA
and Keta Waters

EA Modeling

May 27, 2026



Shallow, inland wells are most influenced by recharge.



Bainbridge Island Groundwater Management Plan

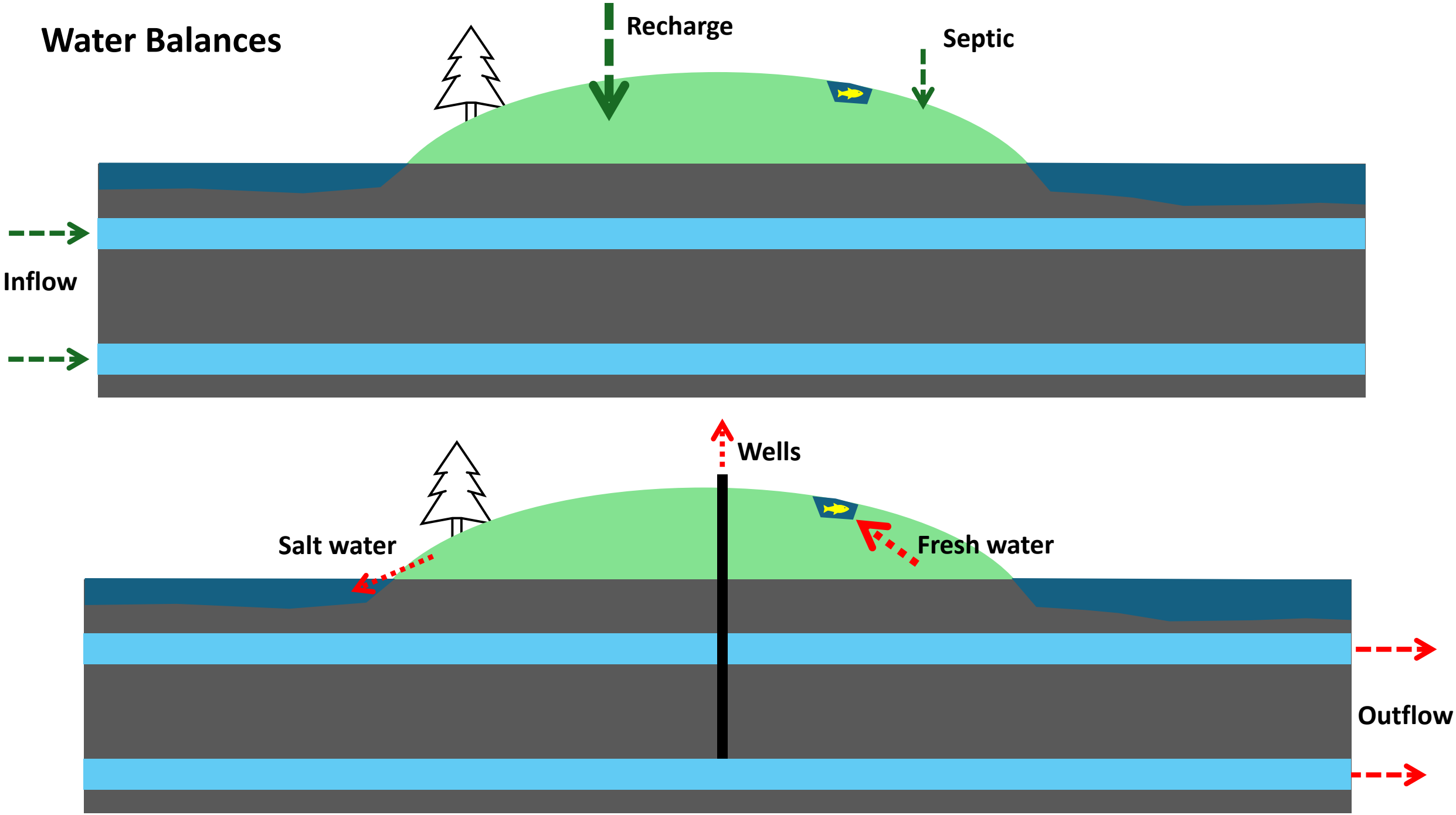
Water Balances and Sustainability

May 27, 2026

Joel Massmann
Adam Massmann

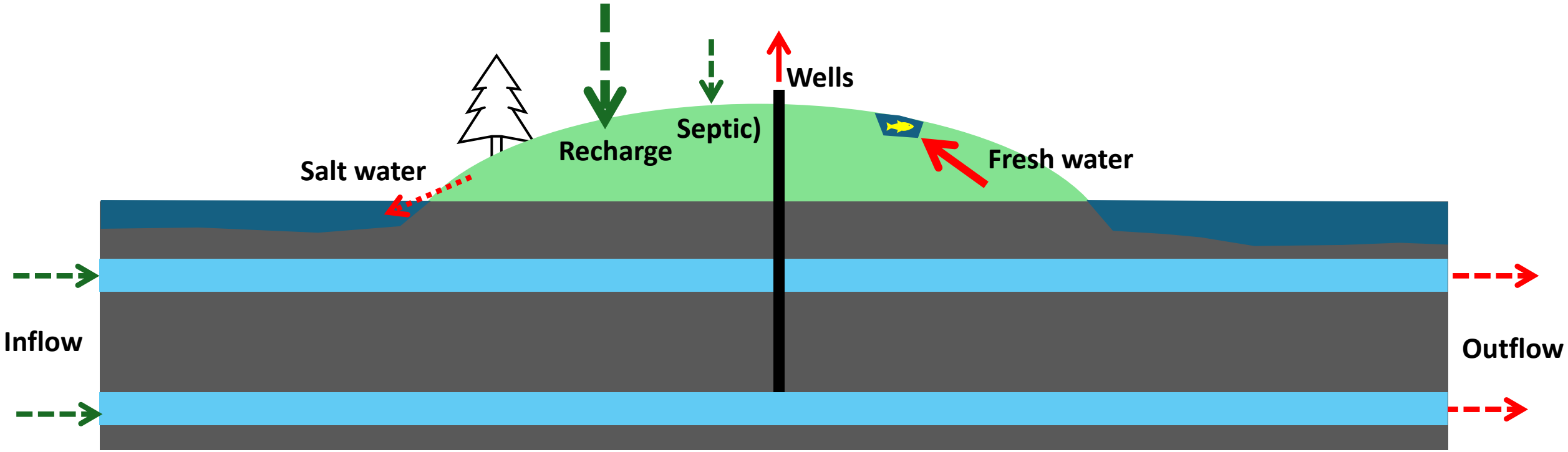
Keta Waters LP

Water Balances



Modeled Equilibrium Water Balances

	EA Model	
	% of inflow	Acre-ft/yr
Recharge	85.0%	17,337
Septic	6.7%	1,361
Inflow from off-island	8.4%	1,709
Outflow to wells	-11.1%	-2,267
Outflow to freshwater	-47.9%	-9,782
Outflow to saltwater	-9.5%	-1,940
Outflow through aquifers	-31.4%	-6,417



Some results from equilibrium models

Changes in recharge have a roughly 1:1 impact on changes in groundwater flow to surface waters.

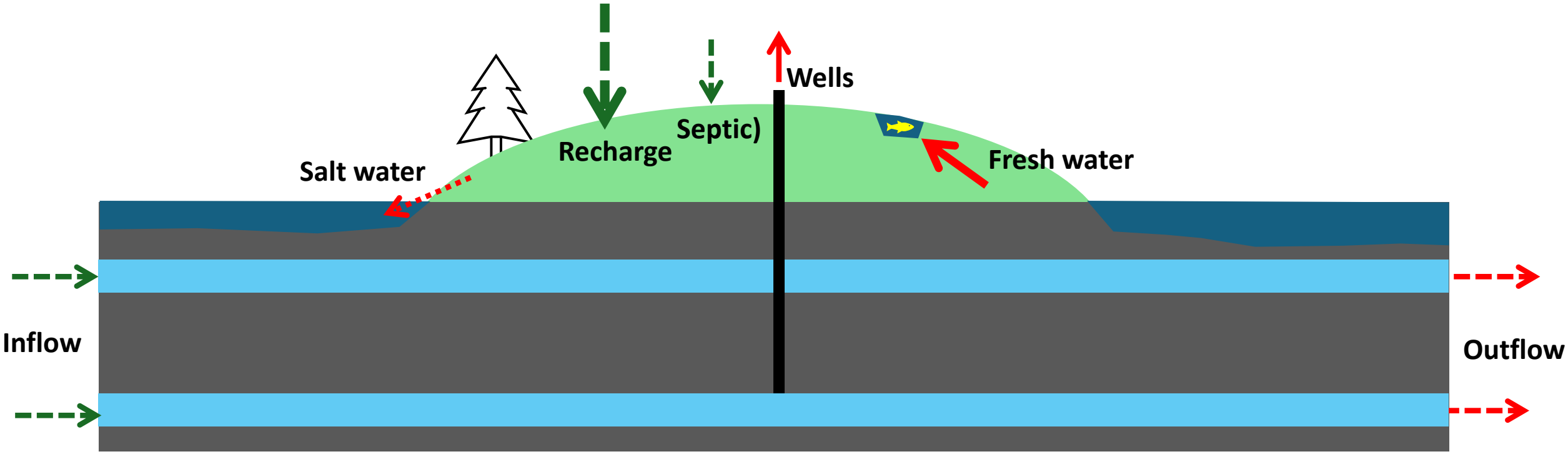
Eliminating all septic return flow causes groundwater flow to surface waters to be reduced by approximately 8-10%.

Groundwater pumping affects flow to surface waters. The impacts from aquifers deeper than sea level are significantly less than the impacts from aquifers at or above sea level.

Saltwater intrusion into aquifers will eventually occur if groundwater levels fall below sea level. In most scenarios that have been considered, groundwater levels in deeper aquifers remain higher than sea level.

The connection with off-island aquifers is uncertain and inconclusive.

Sustainable yield: can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences.



A rough estimate of sustainable yield is 1,200-3,000 ac-ft/yr. This is roughly 43 to 107 gal/person/day for a population of 25,000.

Current consumptive use is 1,000-1,800 ac-ft/yr (pumping: 2,000-3,000 ac-ft/yr, return flow 40-50%). This usage could be sustainable or unsustainable.

Permitted water rights and private well usage from ~1700 wells almost certainly exceed sustainable yield. Permitted groundwater and surface water rights are 7,561 ac-ft/yr, as of 2000. This does not include permit exempt usage.

Current Bainbridge Island water systems have reduced water usage to 39 gal/person/day. If this water usage was achieved island-wide, residential consumptive use would be 540-650 ac-ft/yr (pumping: 1,085 ac-ft/yr). This water usage is almost certainly sustainable.

Management Actions

High Priority Actions

May 27, 2026

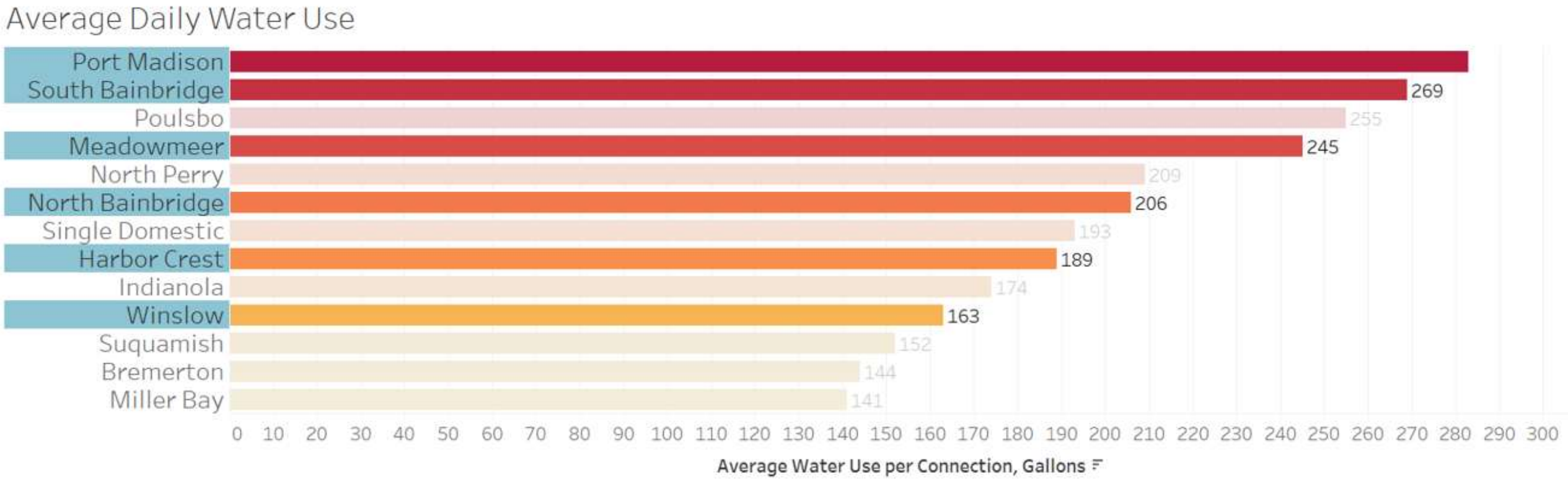
- **Water Conservation**
- **Enhancing Storm and Surface Water Management**
- **Evaluating and Implementing Managed Aquifer Recharge**

Management Actions

Water Conservation

May 27, 2026

- Water use is typically higher on Bainbridge Island than nearby areas
- Significant opportunity exists for reductions in use



Management Actions

Water Conservation

May 27, 2026

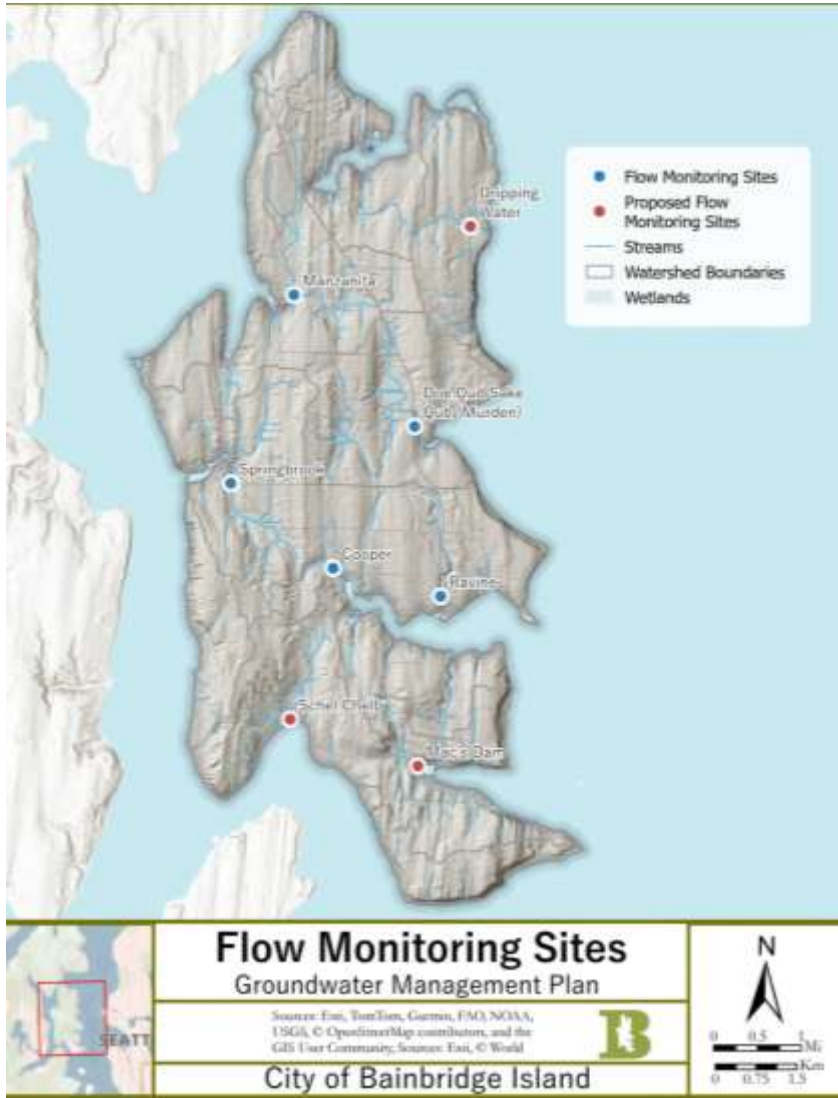
High Priority Actions

- Spreading out Production Wells
- Consolidating Smaller Water Systems
- Evaluating Interties Between Large Systems

High Priority Actions

May 27, 2026

- Expand Groundwater Monitoring
- Increase Data on Water Use
- Expand Surface Water Monitoring
- Create a Dashboard for Results



Next Steps

Plan Completion

May 27, 2026

- Your feedback tonight
- Present again to City Council in June
- Once adopted, move forward with budget development and implementation
- Continued community engagement and education

Thank You

CITY OF
BAINBRIDGE ISLAND

Submitted by:

Christian Berg (City)

Joel Massmann (Keta Waters)