



CITY OF
BAINBRIDGE ISLAND

GROUNDWATER MANAGEMENT PLAN
SUB-COMMITTEE MEETING
THURSDAY, SEPTEMBER 12, 2024

11:00 AM

VIRTUAL – ZOOM

JOIN ZOOM MEETING

<https://bainbridgewa.zoom.us/j/87231451243>

AGENDA

1. CALL TO ORDER / ROLL CALL / ACCEPT OR MODIFY AGENDA
2. RE-CAP OF GROUNDWATER MODELING ASSUMPTIONS AND VARIABLES
3. DISCUSSION OF INITIAL FINDINGS FROM PREDICTIVE GROUNDWATER MODELING
4. DISCUSSION OF HIGH-LEVEL MANAGEMENT STRATEGIES
5. QUESTION AND ANSWER
6. NEXT STEPS
7. ADJOURNMENT

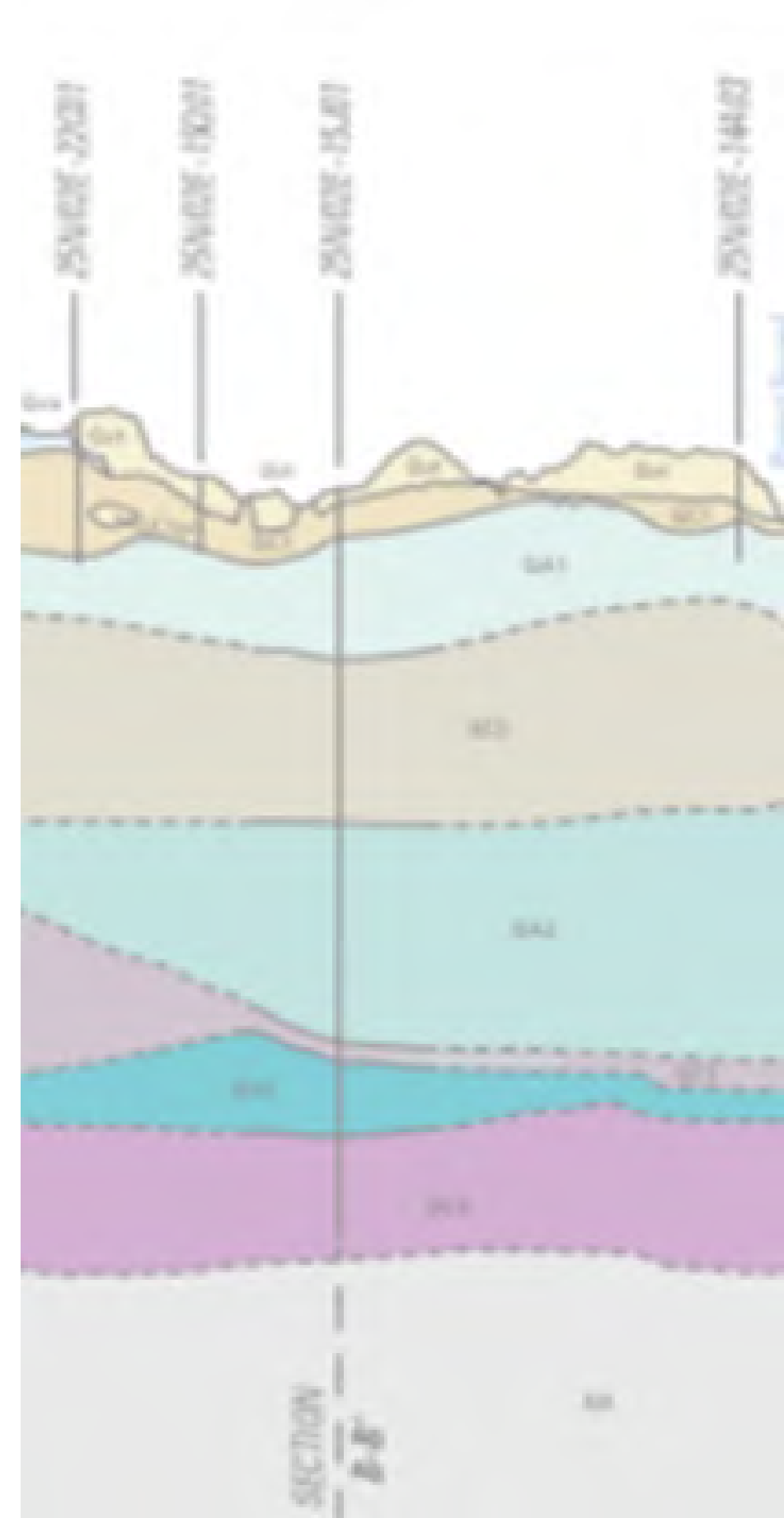
MATERIALS ATTACHED:

- SLIDE SHOW FROM 8/13/24 CITY COUNCIL UPDATE
- SUMMARY OF GROUNDWATER LEVEL STRESSES
- INITIAL INTERPRETATION OF MODELING RESULTS
- 20-YEAR MAPS
- 100-YEAR MAPS

Groundwater Management Plan (GWMP) Update – September 12, 2024

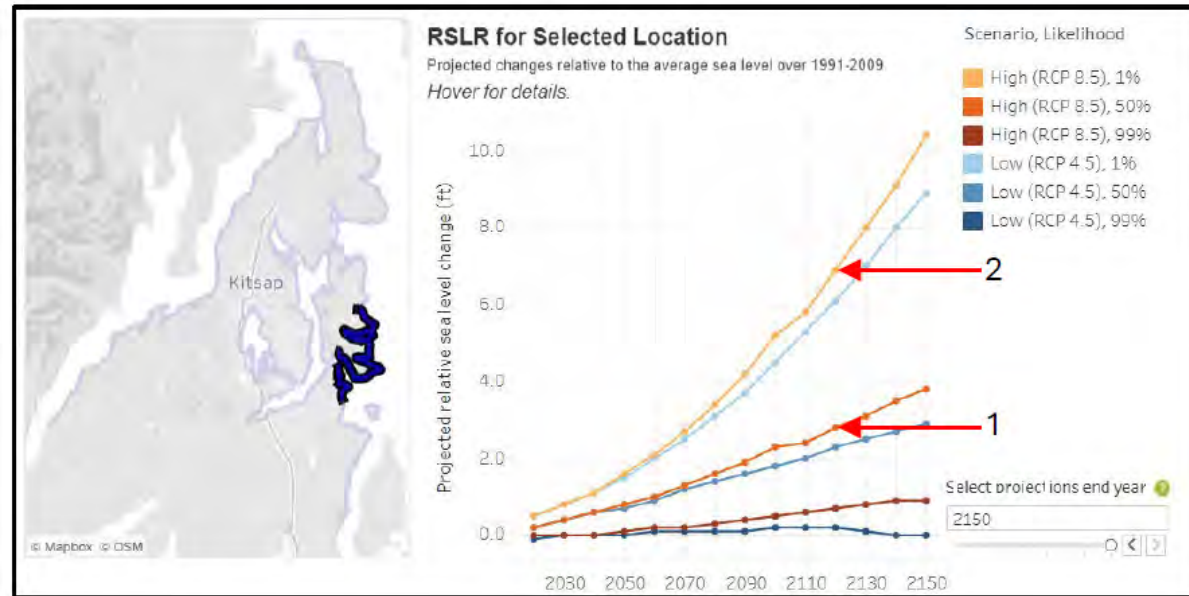
Agenda

1. Recap stress variables
2. Review sensitivity of stress variables
3. Discuss predictive modeling scenarios
4. Scenario preliminary results
5. Discuss impacts and management strategies



Summary of Groundwater Modeling Stresses

Sea Level Rise



RSLR Projections (in feet) Shown Above

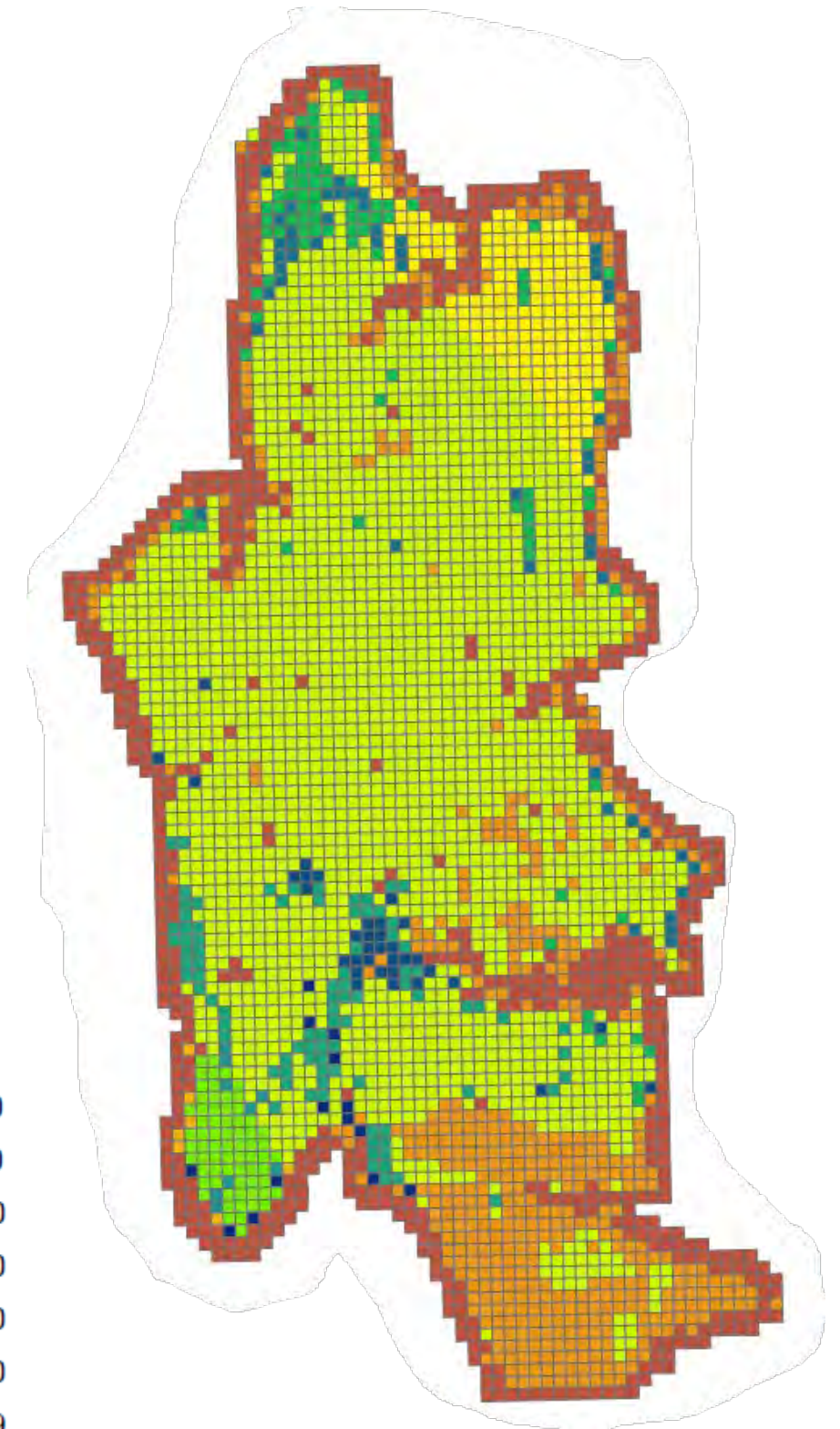
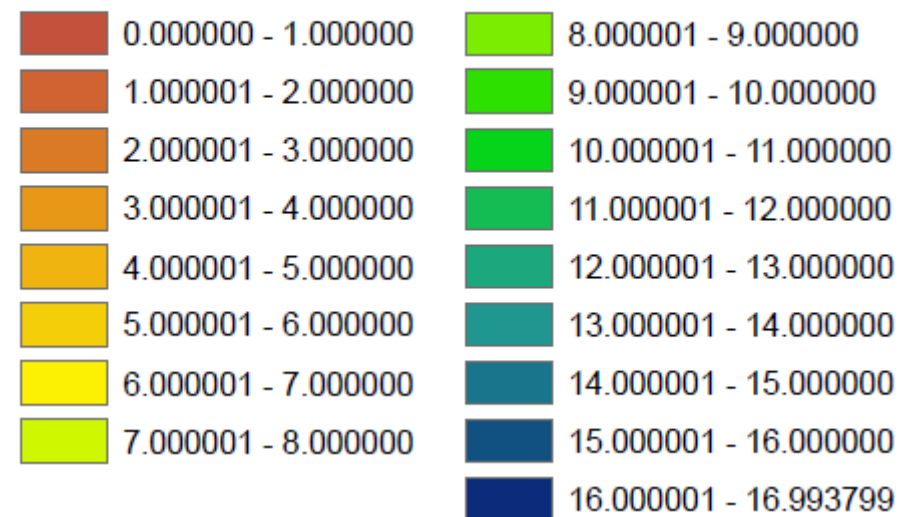
| Year | High (RCP 8.5) | | | Low (RCP 4.5) | | |
|------|----------------|-----|-----|---------------|-----|------|
| | 1% | 50% | 99% | 1% | 50% | 99% |
| 2020 | 0.5 | 0.2 | 0.0 | 0.5 | 0.2 | -0.1 |
| 2030 | 0.8 | 0.4 | 0.0 | 0.8 | 0.4 | 0.0 |
| 2040 | 1.1 | 0.6 | 0.0 | 1.1 | 0.6 | 0.0 |
| 2050 | 1.6 | 0.8 | 0.1 | 1.5 | 0.7 | 0.0 |
| 2060 | 2.1 | 1.0 | 0.2 | 2.0 | 0.9 | 0.1 |
| 2070 | 2.7 | 1.3 | 0.2 | 2.5 | 1.2 | 0.1 |
| 2080 | 3.4 | 1.6 | 0.3 | 3.1 | 1.4 | 0.1 |
| 2090 | 4.2 | 1.9 | 0.4 | 3.7 | 1.6 | 0.1 |
| 2100 | 5.2 | 2.3 | 0.5 | 4.5 | 1.8 | 0.2 |
| 2110 | 5.8 | 2.4 | 0.6 | 5.3 | 2.0 | 0.2 |
| 2120 | 6.9 | 2.8 | 0.7 | 6.1 | 2.3 | 0.2 |
| 2130 | 8.0 | 3.1 | 0.8 | 7.0 | 2.5 | 0.1 |
| 2140 | 9.1 | 3.5 | 0.9 | 8.0 | 2.7 | 0.0 |
| 2150 | 10.4 | 3.8 | 0.9 | 8.9 | 2.9 | 0.0 |

Change in Groundwater Recharge

- 15% <---> +15%

Annual Recharge in 1982

inches



Summary of Groundwater Modeling Stresses

Summary of Population/Water Use Increases for Groundwater Modeling Scenarios

| Location | Water System | Growth Scenario | Usage Growth (ERU/Year)~ | Usage Growth (Connections/Year)~ | Average Total Water Use (Gallons/Day/ERU or Connection)* | Average Outdoor Water Use (Gallons/Day/ERU or Connection)+ | Annual Increase in Outdoor Water Use (Gallons/Day/ERU or Connection)- | Current ERUs | Approved Connections^ | Source of Information | Period of Record | Notes |
|---------------------------------|---------------------------|-----------------|--------------------------|----------------------------------|--|--|---|--------------|-----------------------|---|--|--|
| Bainbridge Island Water Systems | North Bainbridge | Low | 10 | na | 206 | 44 | 0.0308 | 1,948 | Unspecified | Kitsap PUD | 2012 - 2023 | The Usage Growth rate includes population increases of 25, 39, and 50 people per year plus an additional 2% for nonresidential water use. |
| | | Medium | 16 | na | | | | | | | | |
| | | High | 20 | na | | | | | | | | |
| | South Bainbridge | Low | 30 | na | 269 | 107 | 0.0749 | 1,690 | Unspecified | Kitsap PUD | 2016 - 2023 | The Usage Growth rate includes population increases of 68, 101, and 134 people per year plus an additional 12% for nonresidential water use. Includes Island Utility and Bill Point usage statistics. |
| | | Medium | 45 | na | | | | | | | | |
| | | High | 60 | na | | | | | | | | |
| | City of Bainbridge Island | Low | 69 | na | 163 | 1 | 0.0007 | 4,972 | Unspecified | City of Bainbridge Island | 1991 - 2023 | For the high growth scenario, Winslow is estimated to have a growth rate of 361 people/year for the first 20 years, then reduced to 214 people/year for the last 80 years. |
| | | Medium | 104 | na | | | | | | | | |
| | | High | 230; 137 | na | | | | | | | | |
| | Single Domestic | Low | 4 | na | 196 | 31 | 0.0217 | Unspecified | Not Applicable | Washington State Office of Financial Management Census Data | 1990 - 2023 | Average water use (GPD/ERU) based on average consumptive use from North Bainbridge WS because service area represents mostly residential users. |
| Medium | | 6 | na | | | | | | | | | |
| High | | 8 | na | | | | | | | | | |
| Harbor Crest | Medium | 0 | na | 189 | 27 | 0.0189 | 21 | 23 | Kitsap PUD | 2012 - 2023 | | |
| Port Madison | Medium | 0 | na | 283 | 121 | 0.0847 | 105 | 144 | Kitsap PUD | 2012 - 2022 | Northwest Water Systems, Inc. is now managing this water system. | |
| Meadowmeer | Medium | 0 | na | 245 | 83 | 0.0581 | 314 | 335 | Kitsap PUD | 2021 - 2023 | | |
| Off Island Water Systems | North Perry | Medium | na | 27 | 209 | 47 | 0.0329 | 6,593 | Unspecified | North Perry Water District | 2012 - 2023 | |
| | Silverdale | Medium | na | 104 | 325 | 163 | 0.1141 | 6,453 | Unspecified | City of Silverdale | 2012 - 2023 | |
| | Bremerton | Medium | 379 | na | 144 | - | - | >29,000 | Unspecified | City of Bremerton | 2012 - 2023 | Average water use is based on single family residence meter readings. On average, 46% of Bremerton's water supply is from groundwater sources. For modeling purposes, increased groundwater withdrawals will be based on 46% of total water use. |
| | Poulsbo | Medium | na | 81 | 255 | 93 | 0.0651 | 4,272 | Unspecified | City of Poulsbo | 2014 - 2023 | Average water use is based on authorized use and doesn't include system loss |
| | Indianola | Medium | 7 | na | 174 | 12 | 0.0084 | 682 | Unspecified | Kitsap PUD | 2018 - 2023 | |
| | Miller Bay | Medium | 1 | na | 141 | - | - | 429 | 460 | Kitsap PUD | 2015 - 2023 | |
| | Suquamish | Medium | 8 | na | 152 | - | - | 1,551 | Unspecified | Kitsap PUD | 2012 - 2023 | |
| | Keyport | Medium | 0 | na | 396 | 234 | 0.1638 | 434 | 798 | Kitsap PUD | 2012 - 2023 | Water System began serving Keyport Base as one connection in 2021, which added the equivalent of approximately 430 ERUs |

Notes: * With the exception of Bremerton and Poulsbo, water use per ERU is based on total production which includes system loss and other uses such as commercial, industrial and irrigation. ^ Source of information is the Washington Department of Health Sentry Database. ~ 1 ERU is assumed to be equivalent to 2.5 people. + Average outdoor is equal to total water use - indoor use, assumed to be 65 gallons per day per capita x 2.5 people = 162 gallons per day. - Outdoor water use is assumed to increase by 7% between 2020 and 2120 due to climate change.

Recap Stress Variables – Population Growth/Pumping

Low growth based on 30-yr historic low:

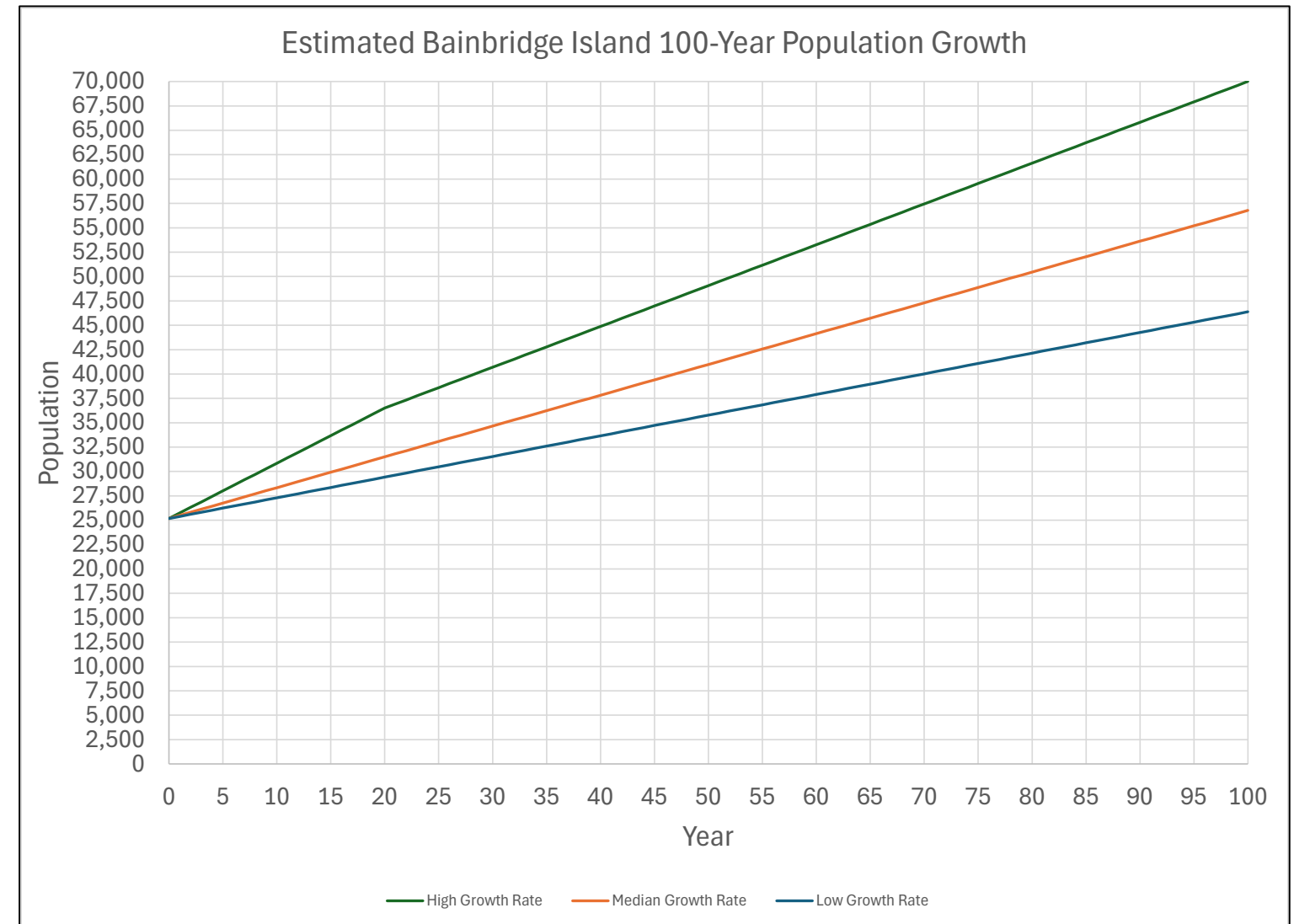
- 100-year population = **46,380 (84%)**

Med. growth based on 30-yr historic high:

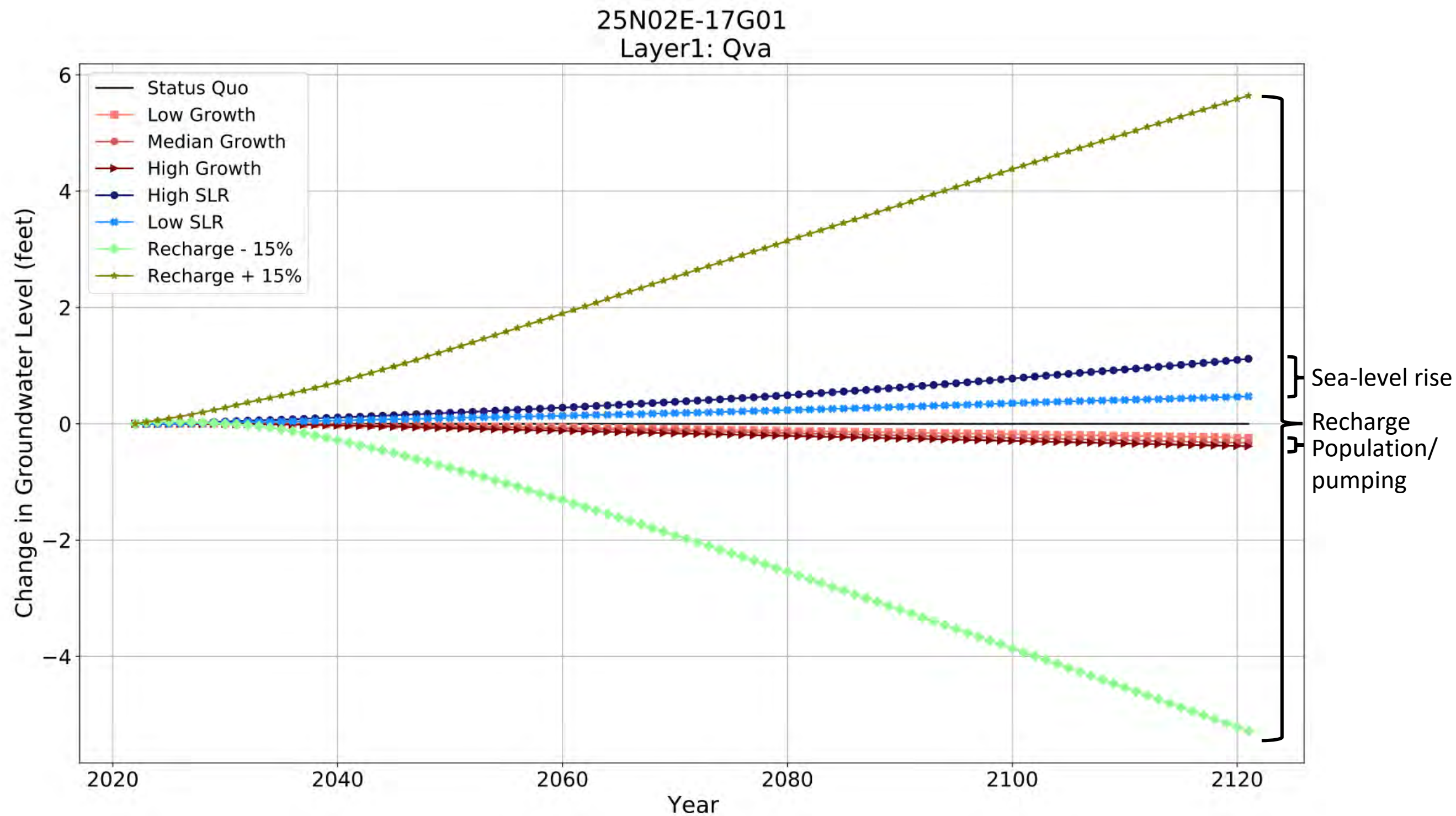
- 100-year population = **56,780 (125%)**

High growth based on 20-year Sub-Area plan projection + med. growth rate:

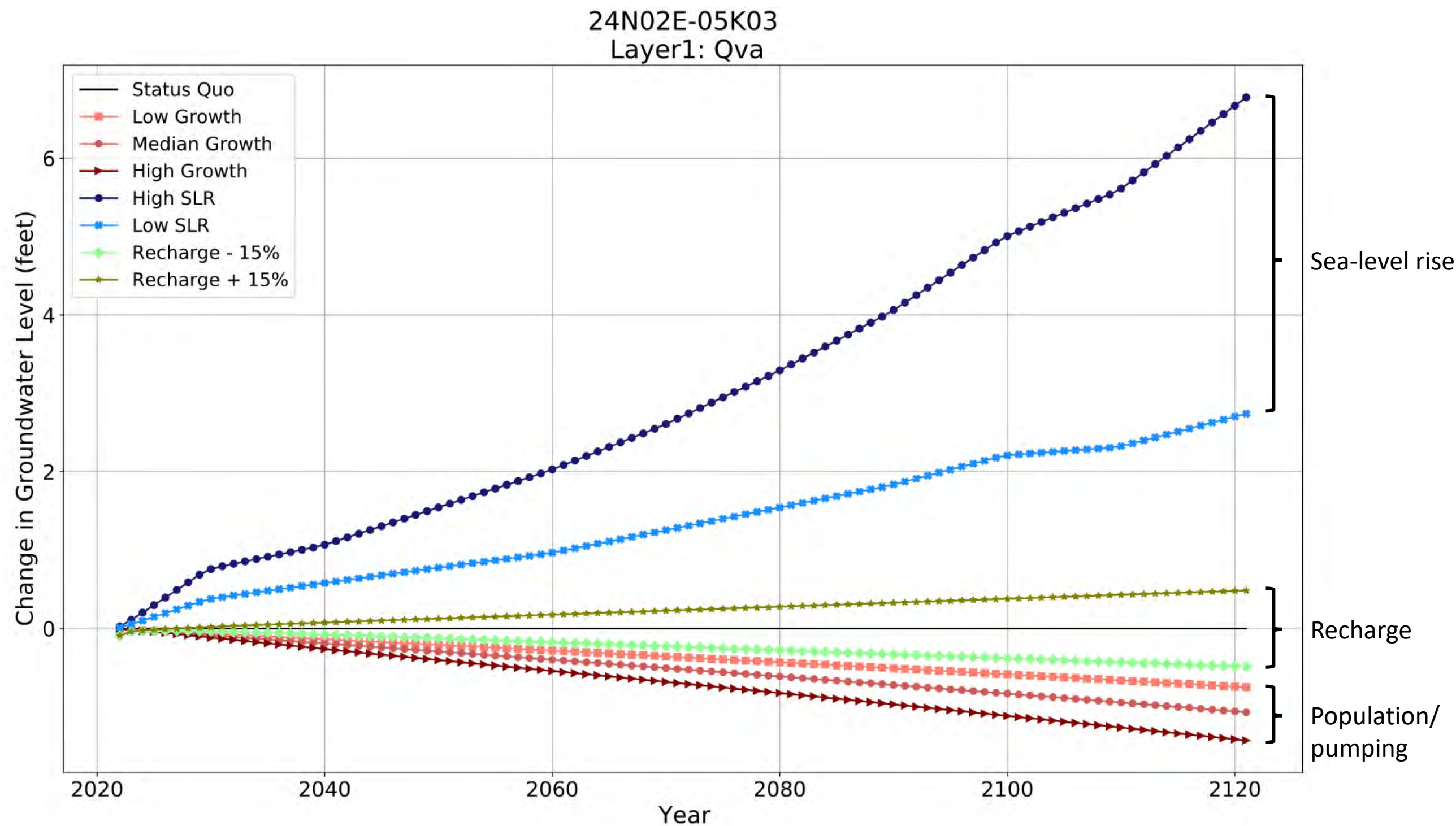
- 100-year population = **70,010 (178%)**



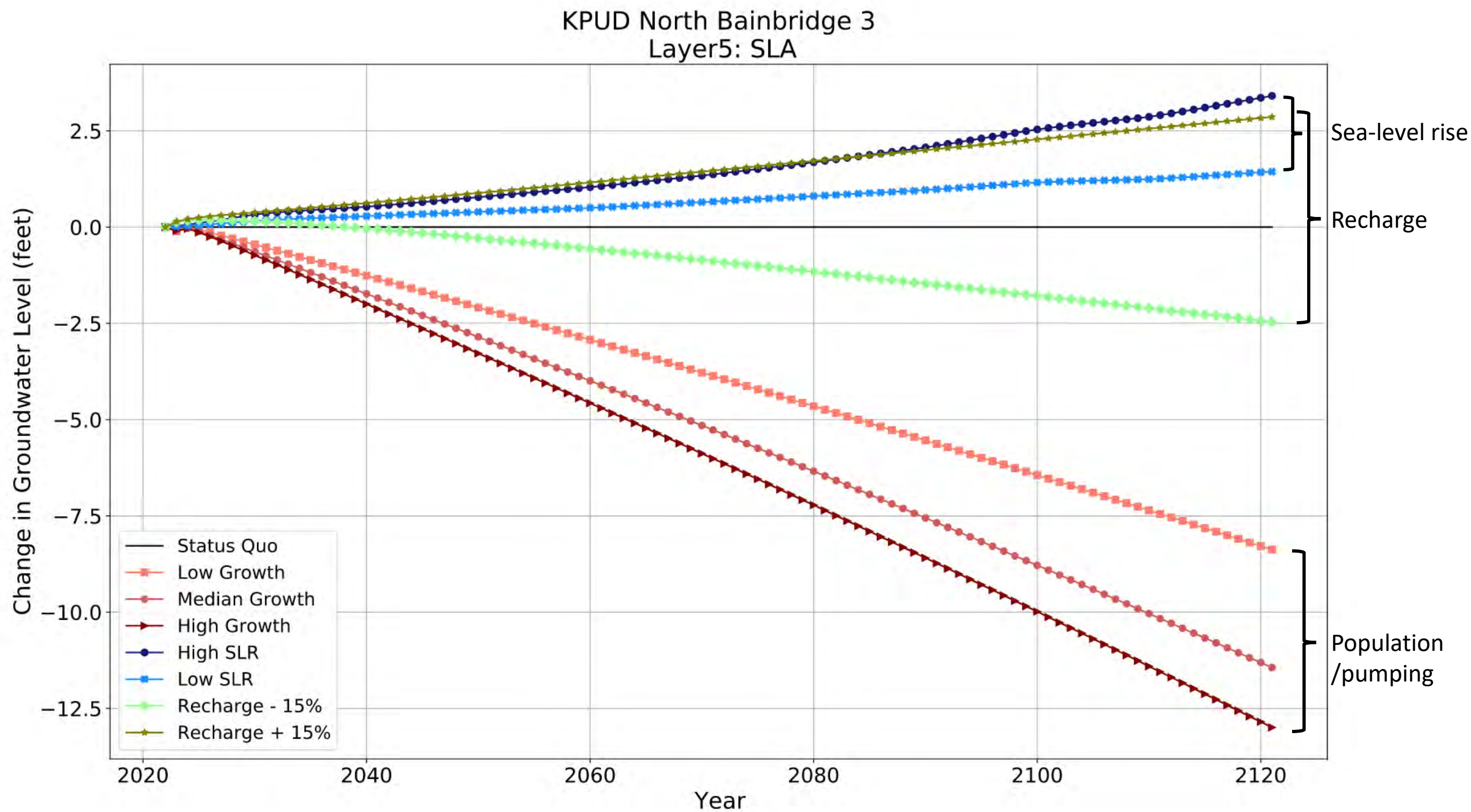
Sensitivity of Stress Variable Examples



Sensitivity of Stress Variable Examples



Sensitivity of Stress Variable Examples



Predictive 100-year Modeling Scenarios

- Worst Case Scenario:
 - Maximum population
 - Maximum sea-level rise
 - Lowest recharge (-15%)
- Best Case Scenario:
 - Minimum population
 - Minimum sea-level rise
 - No change in recharge (0%)
- Likely Case/Planning Scenario:
 - Medium population (+148%)
 - Maximum sea-level rise (6.8 ft)
 - Medium recharge (-7.5%)

Use these to understand where the likely case falls on the spectrum

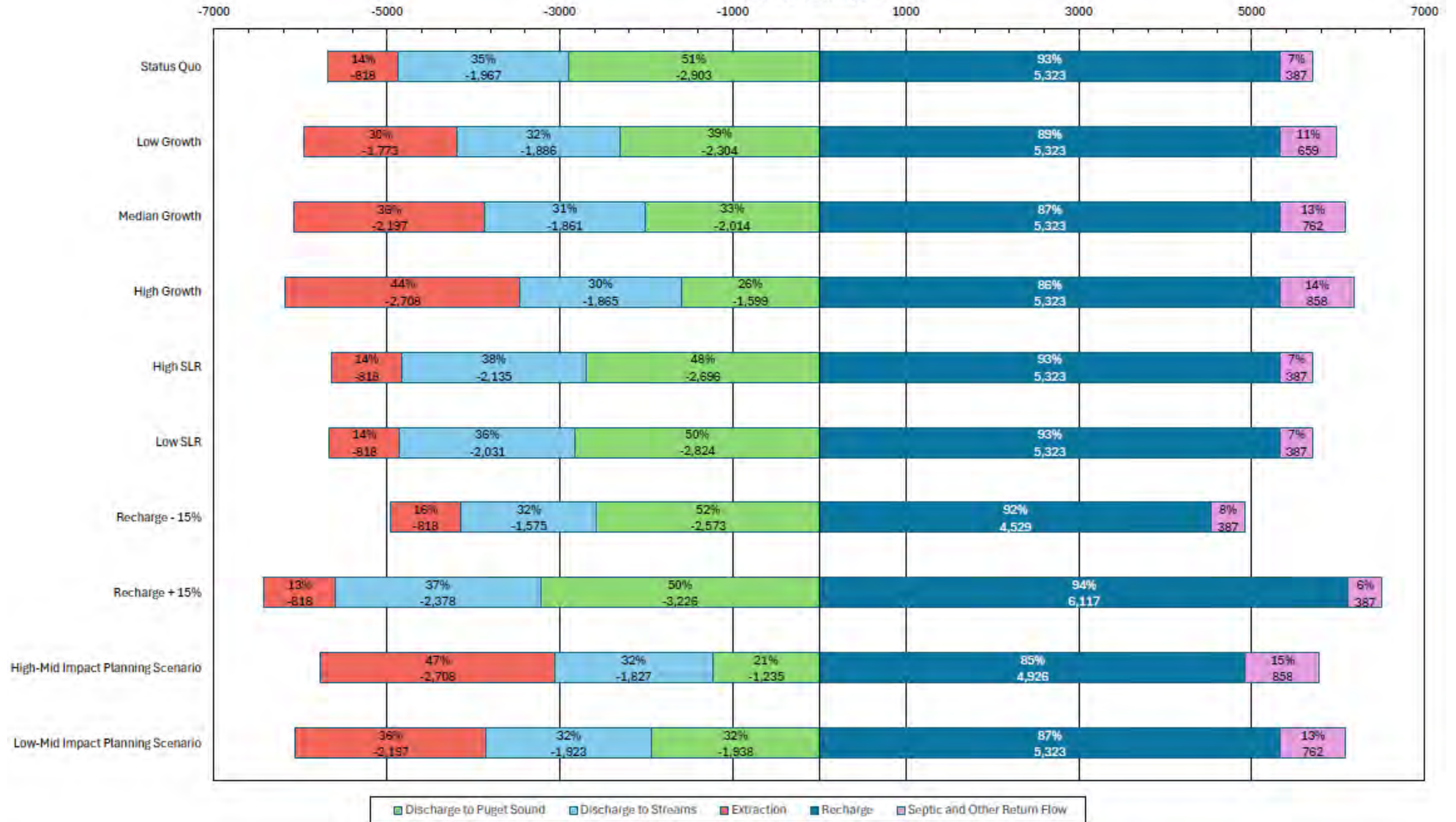
Use this to analyze growth scenario planning

Predictive 100-year Modeling Scenarios

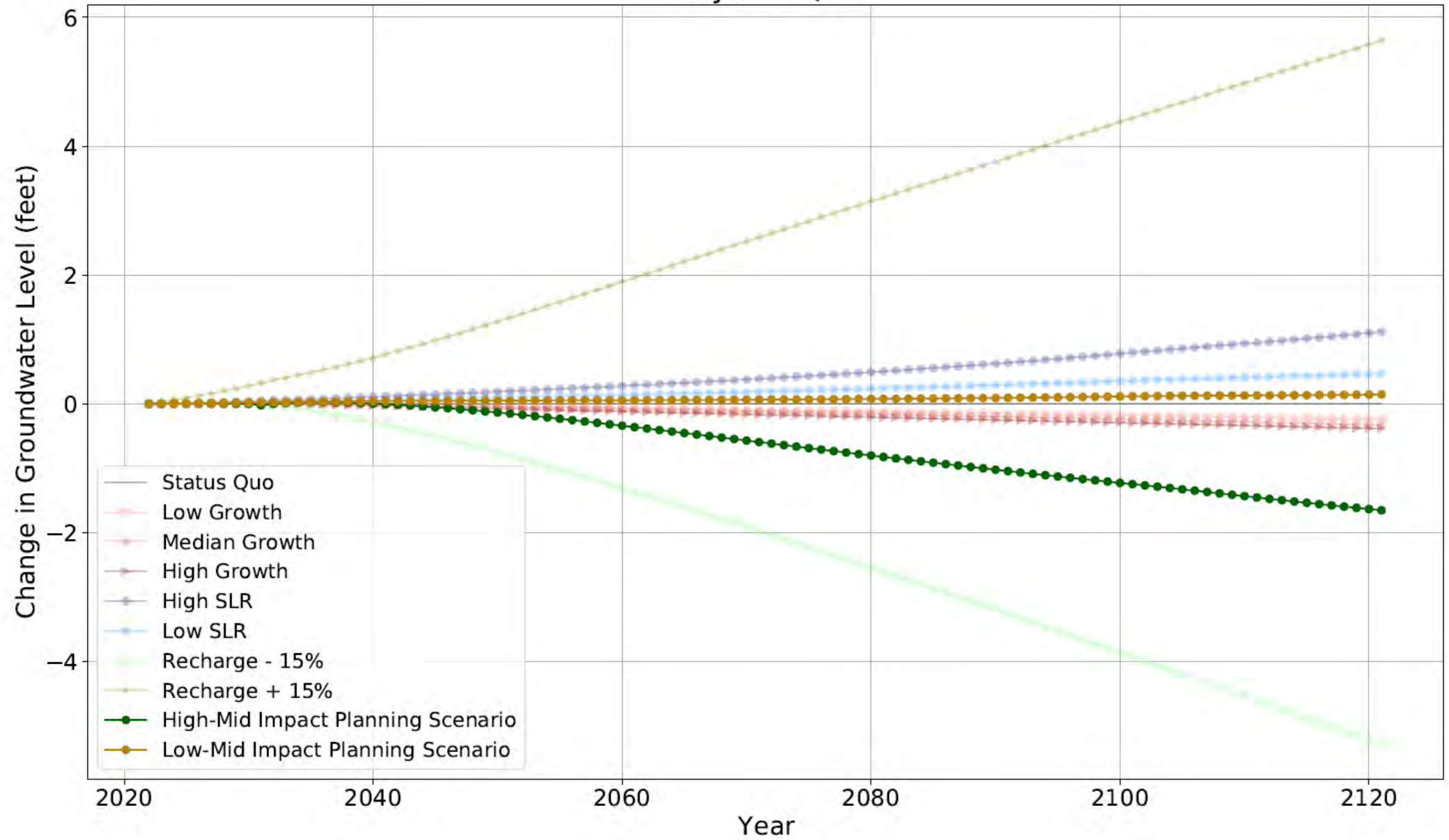
- High-Mid Impact Planning Scenario:
 - Maximum population growth (+178%)
 - Maximum sea-level rise (+6.9 ft)
 - Medium recharge (-7.5%)
- Low-Mid Impact Planning Scenario :
 - Medium population growth (+148%)
 - Minimum sea-level rise (+2.8 ft)
 - No change in recharge (0%)

Simulated Water Budget in Year 2121

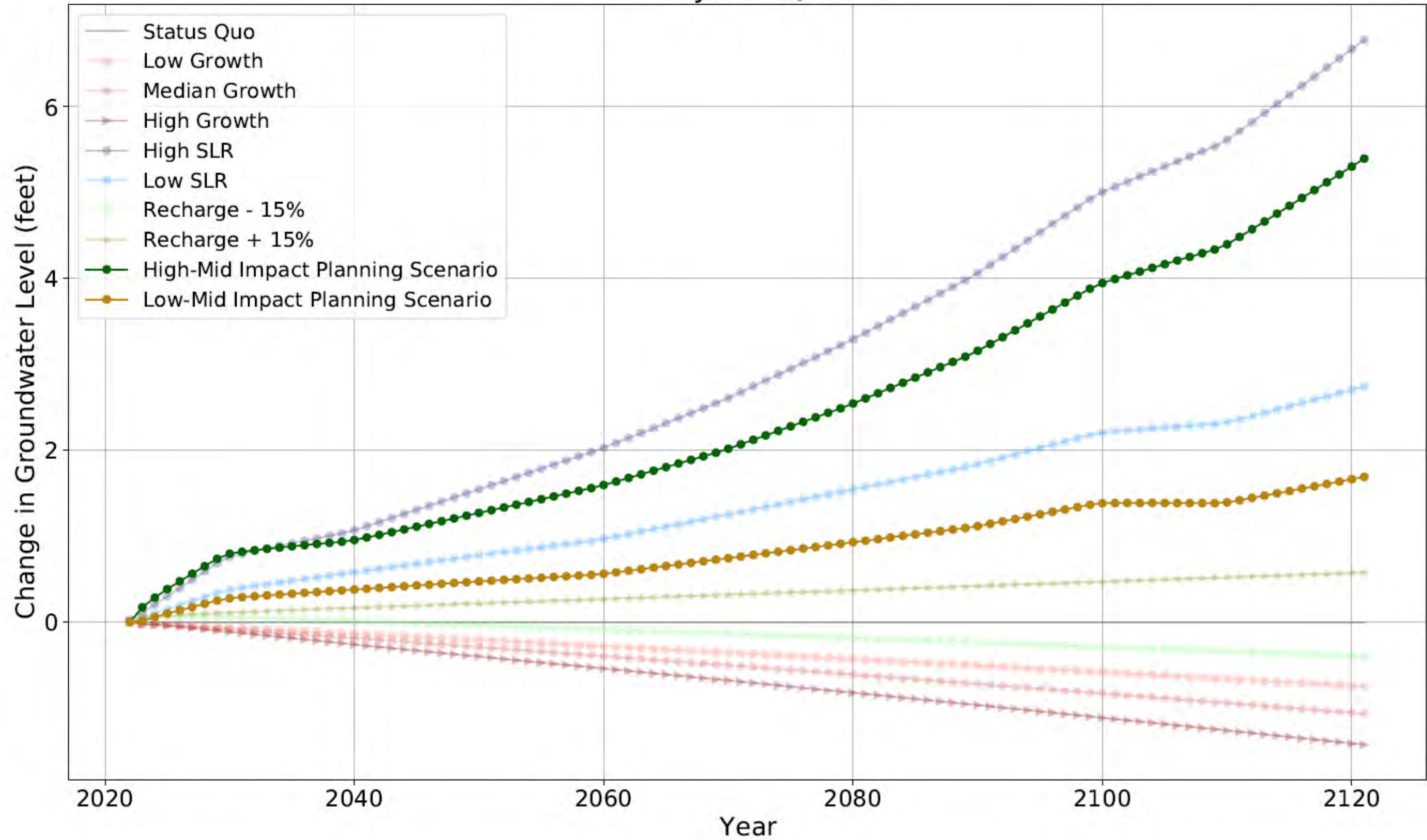
Millions of Gallons per Year

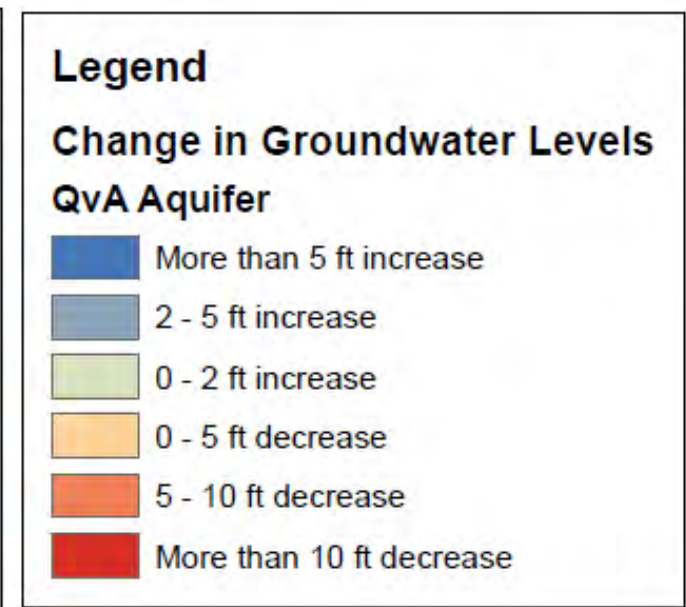
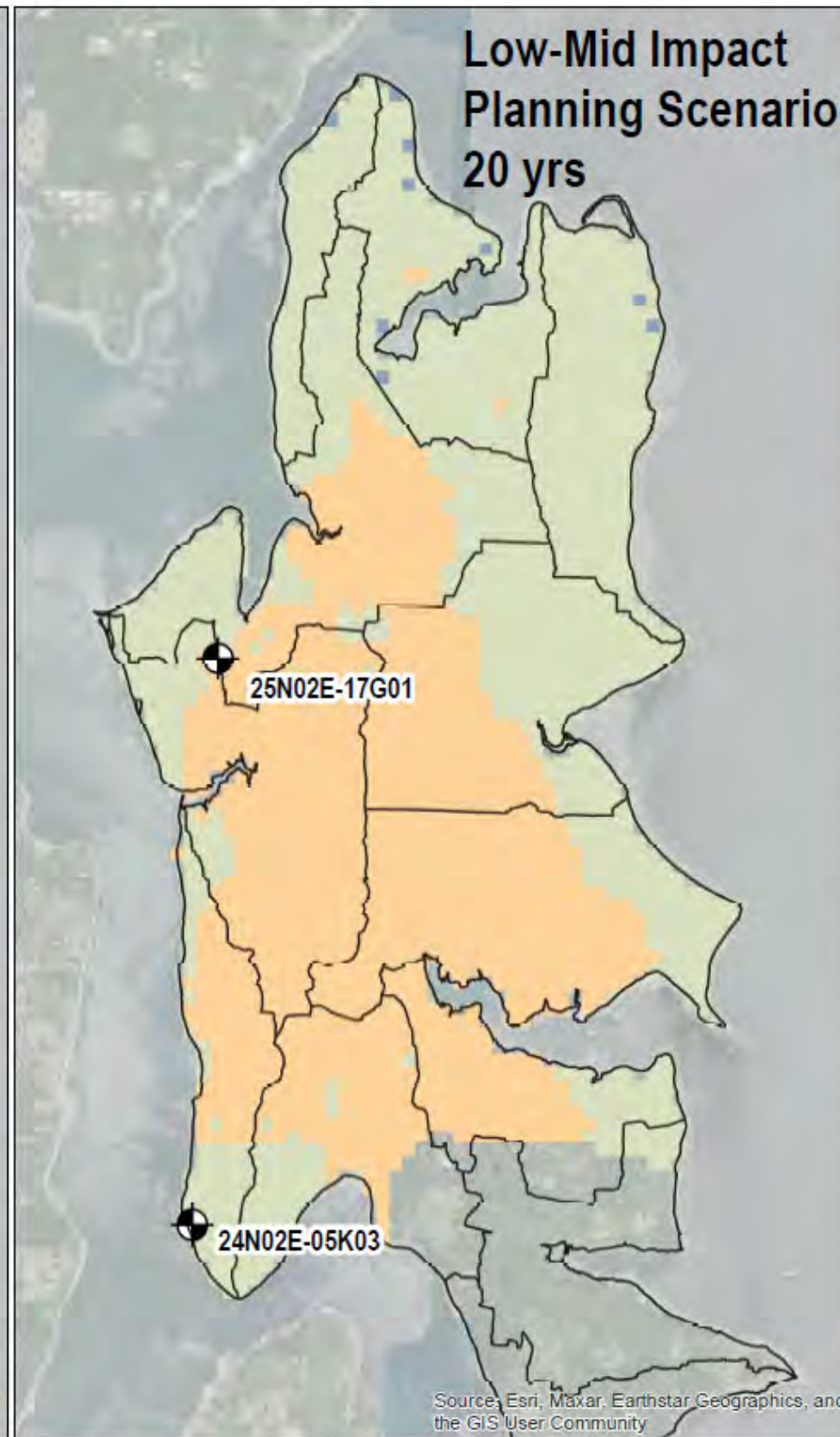
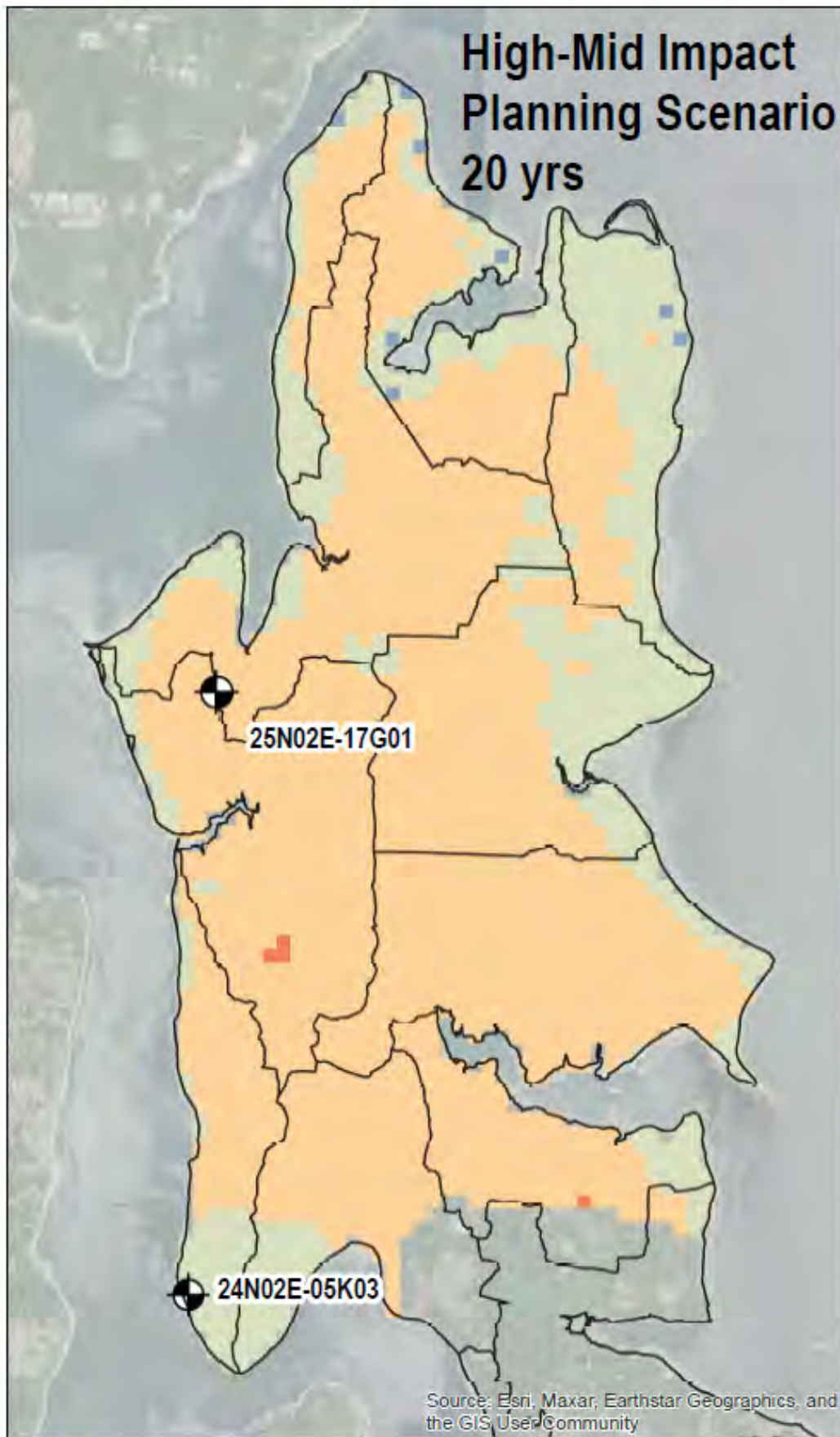


25N02E-17G01
Layer 1: QvA



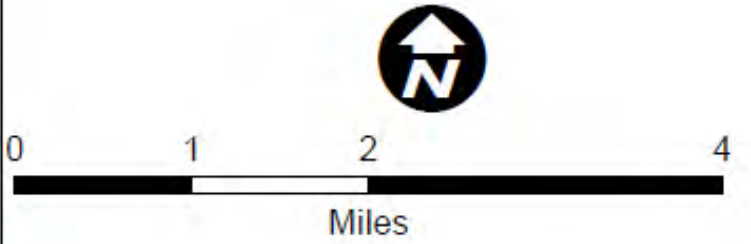
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Layer 1: QvA

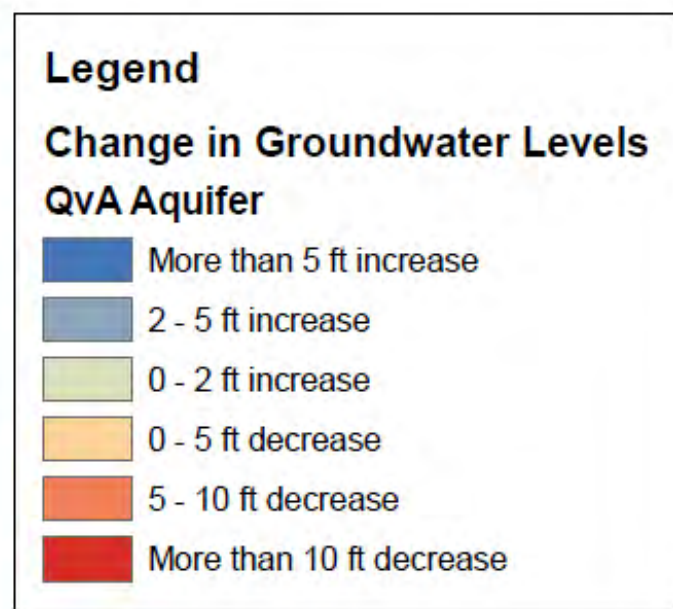
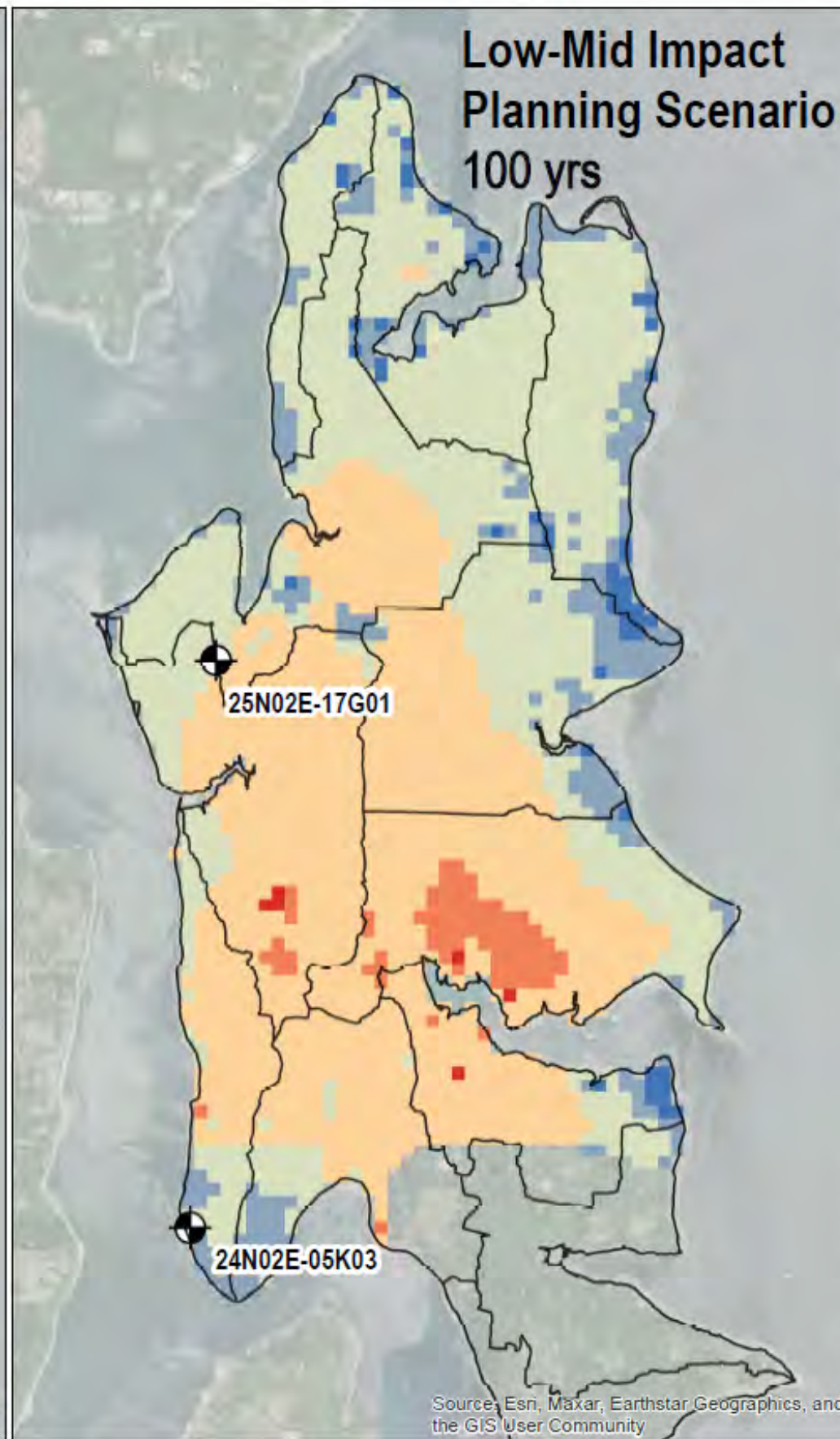
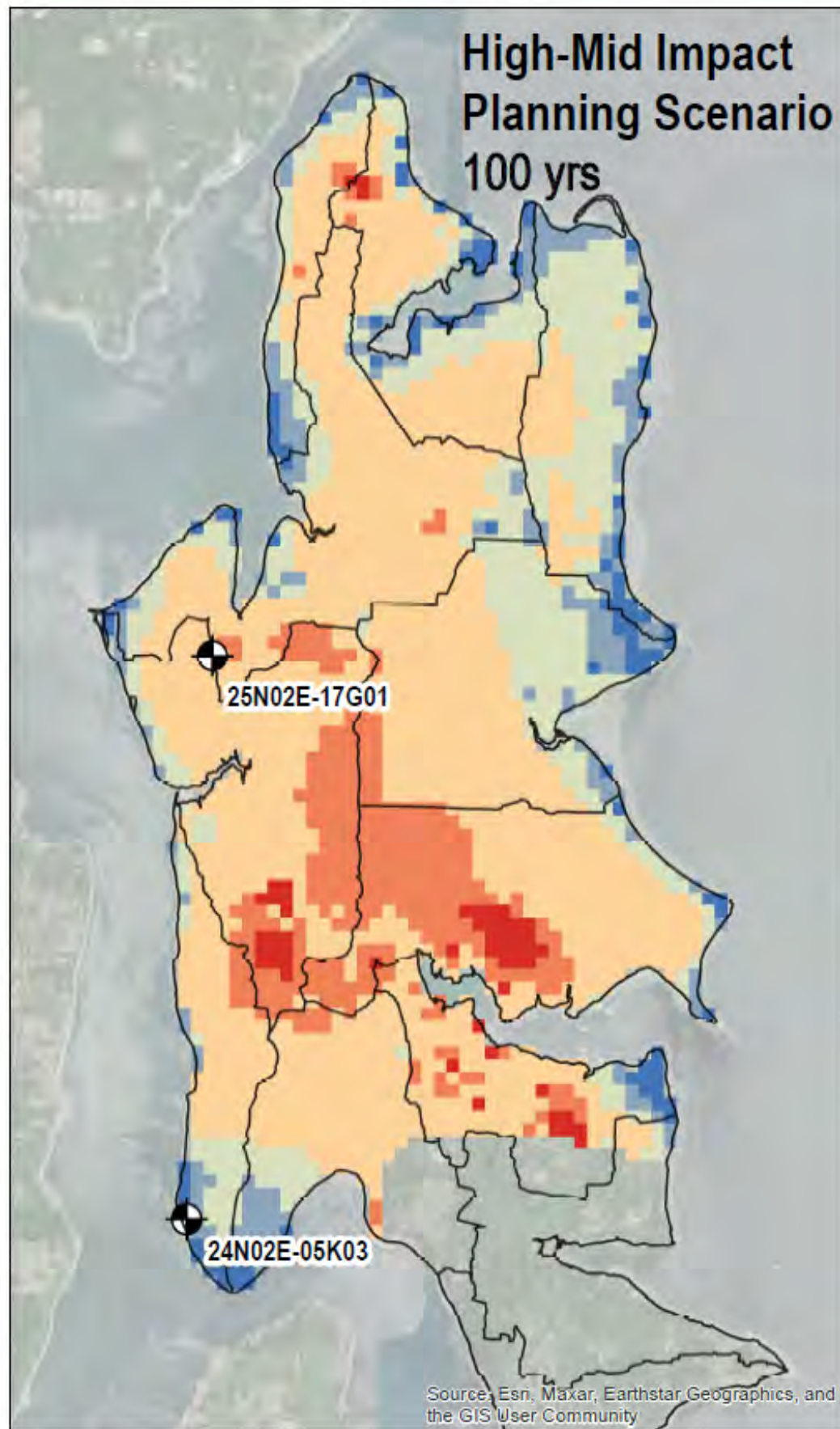




Notes:
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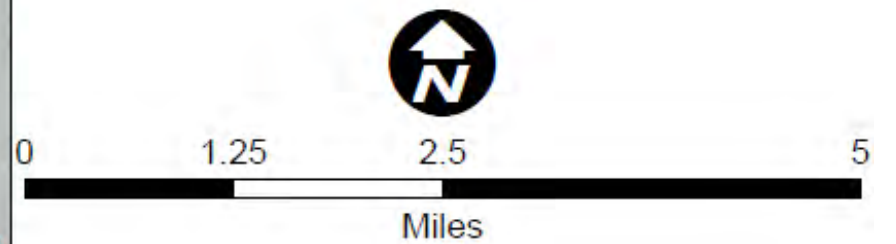




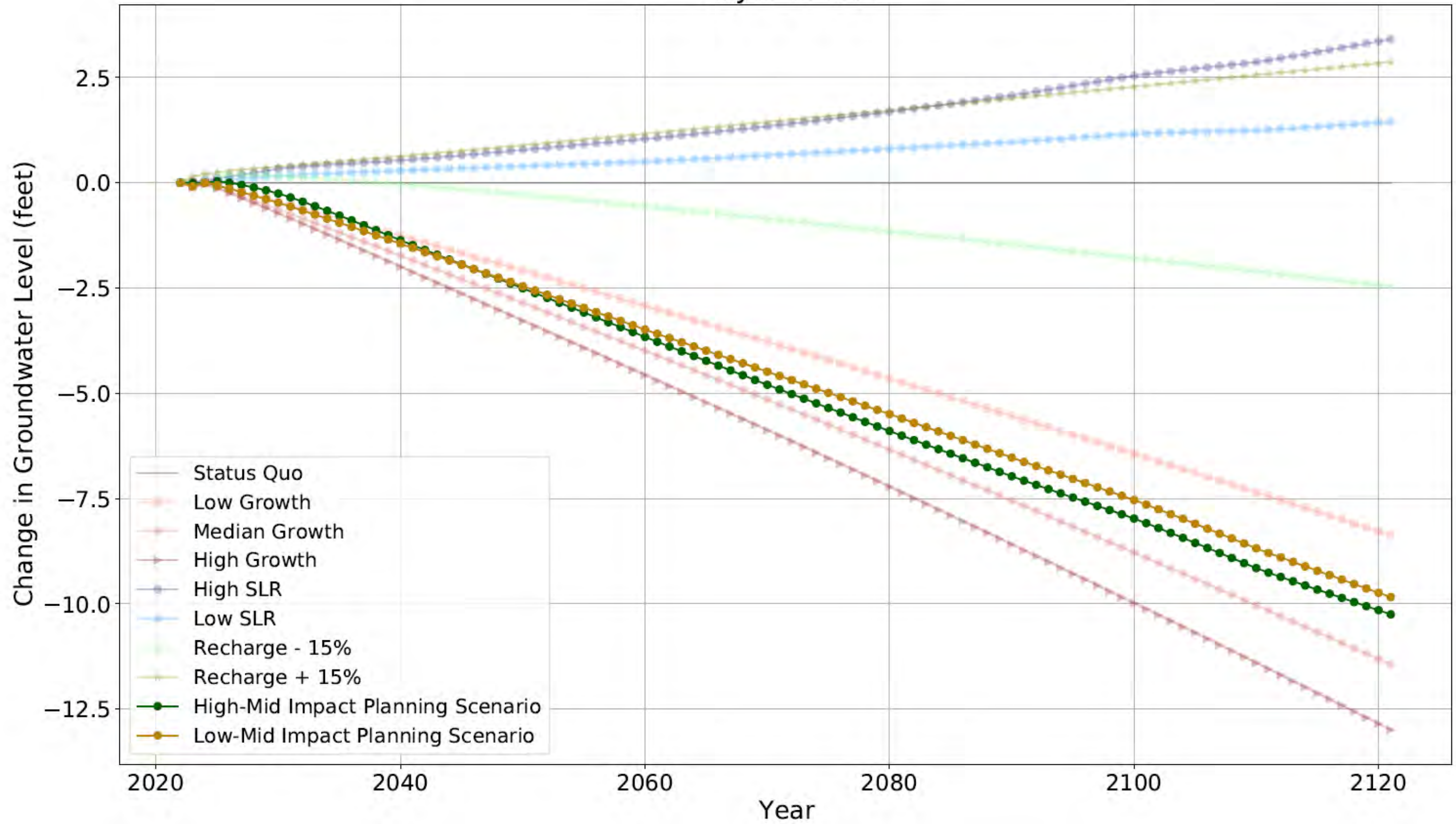
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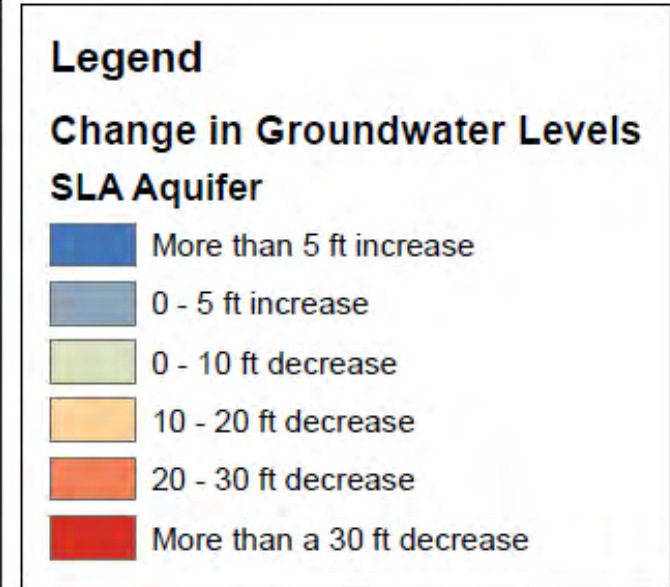
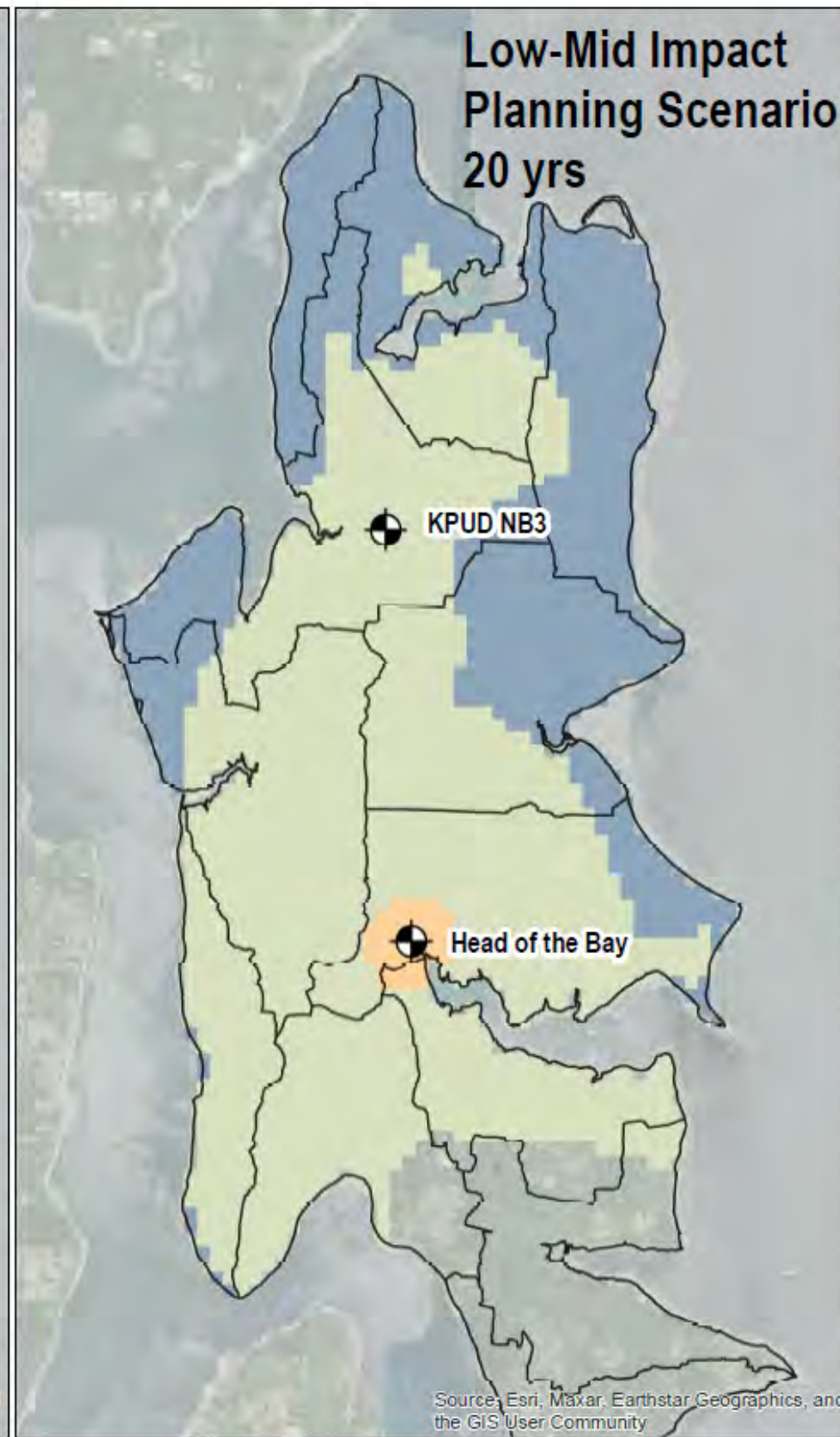
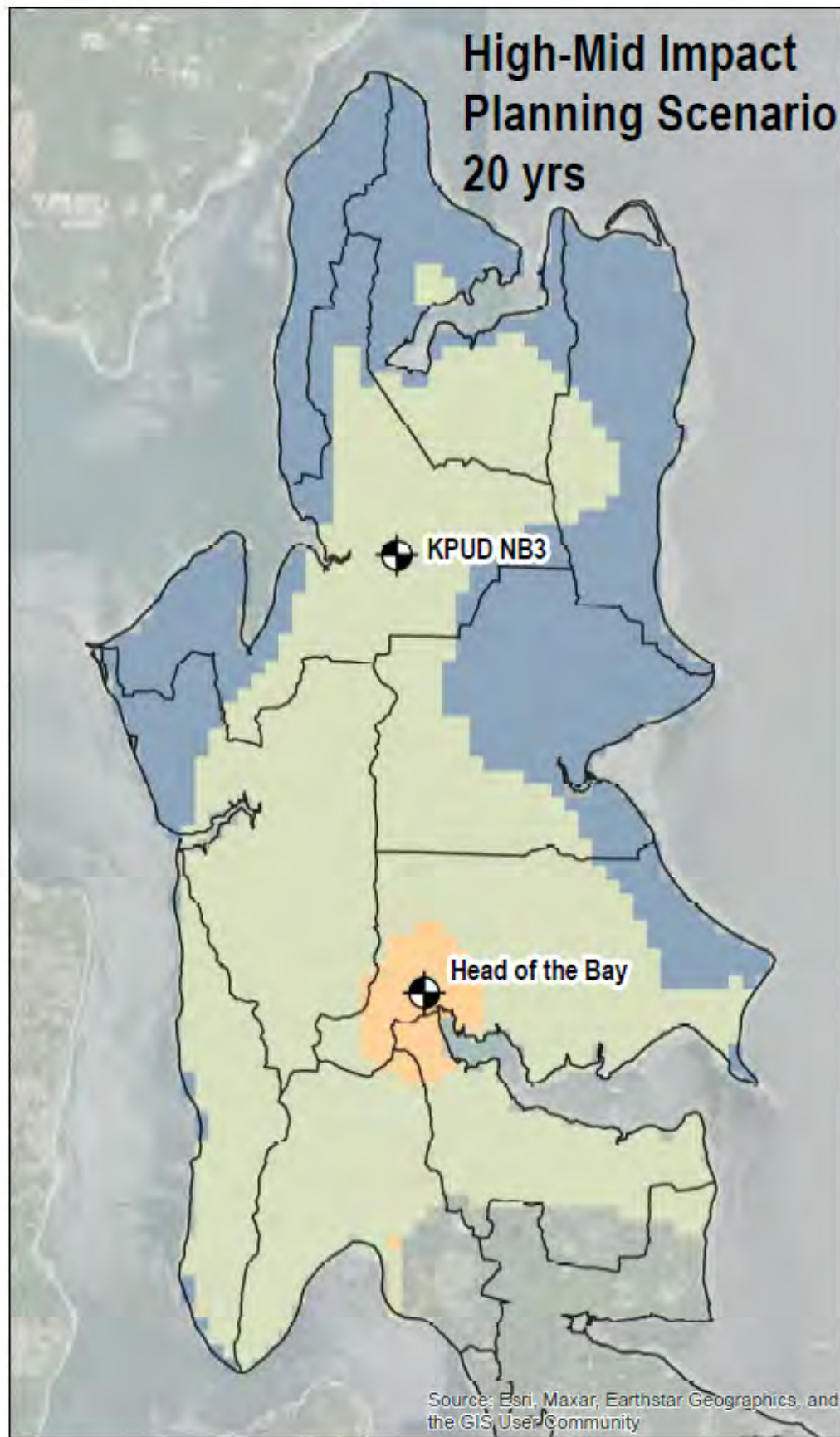
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KPUD North Bainbridge 3 Layer 5: SLA

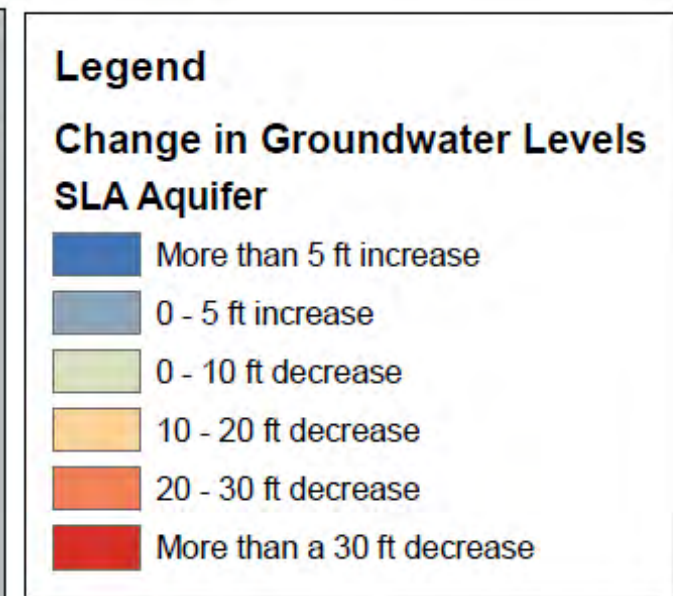
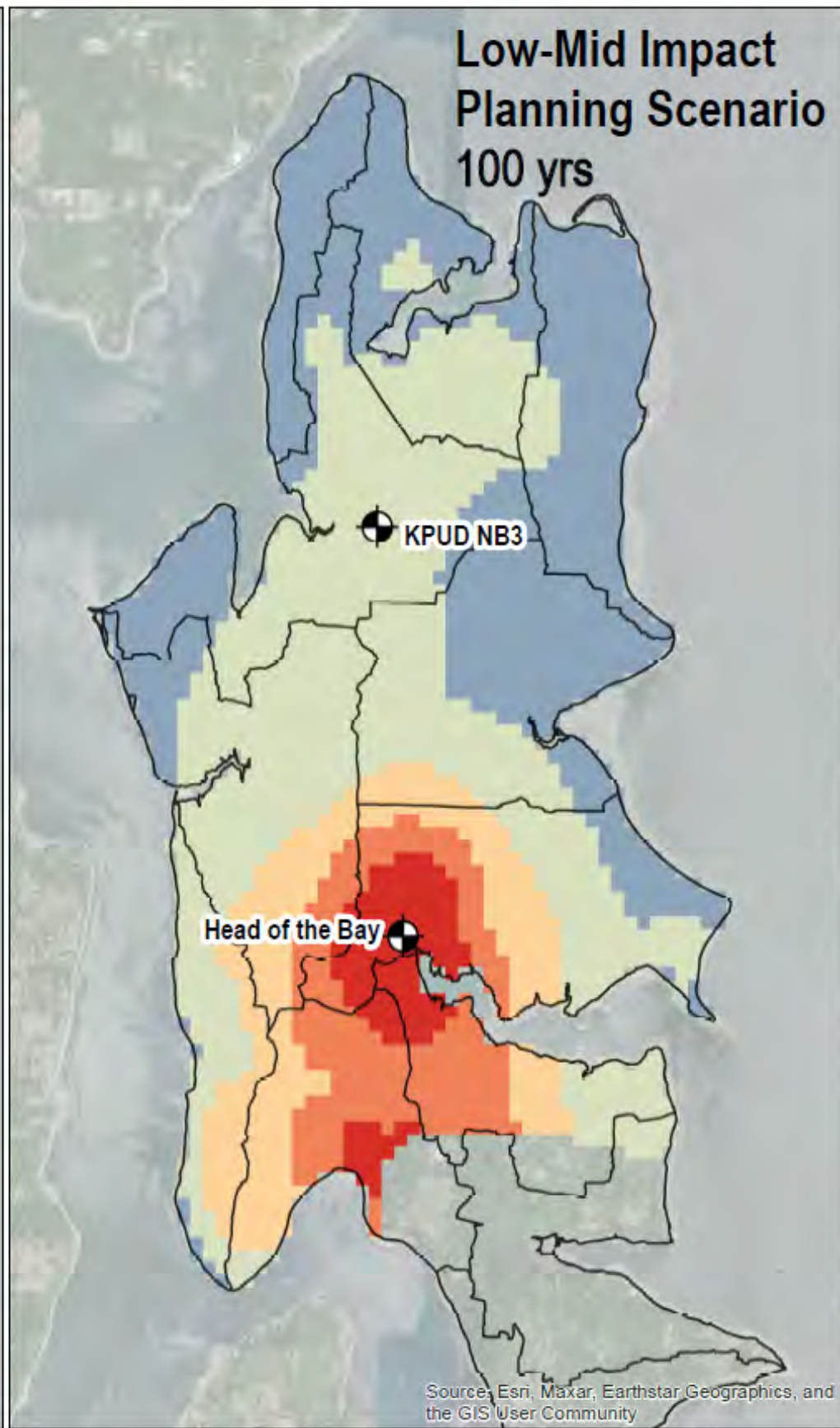
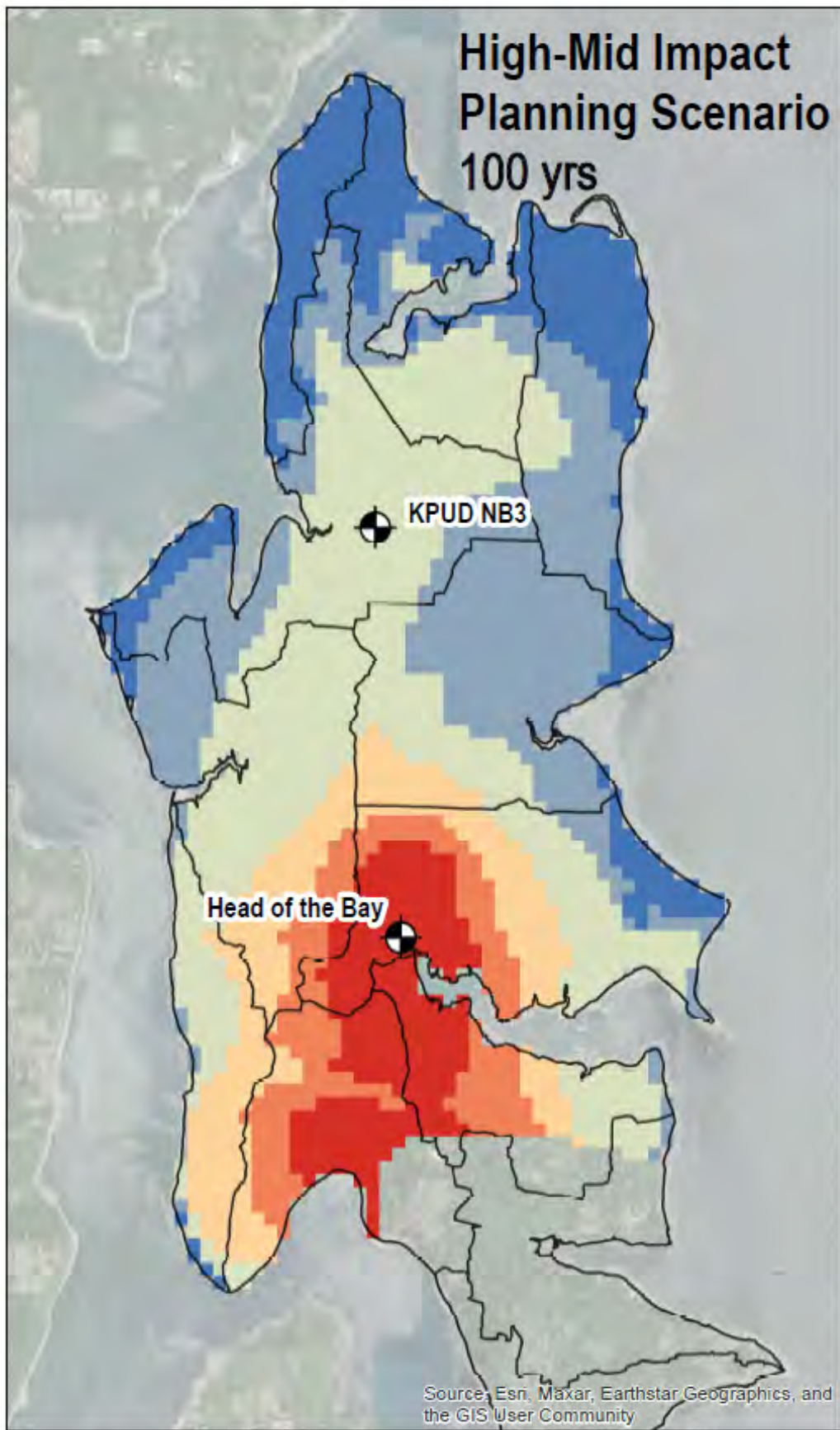




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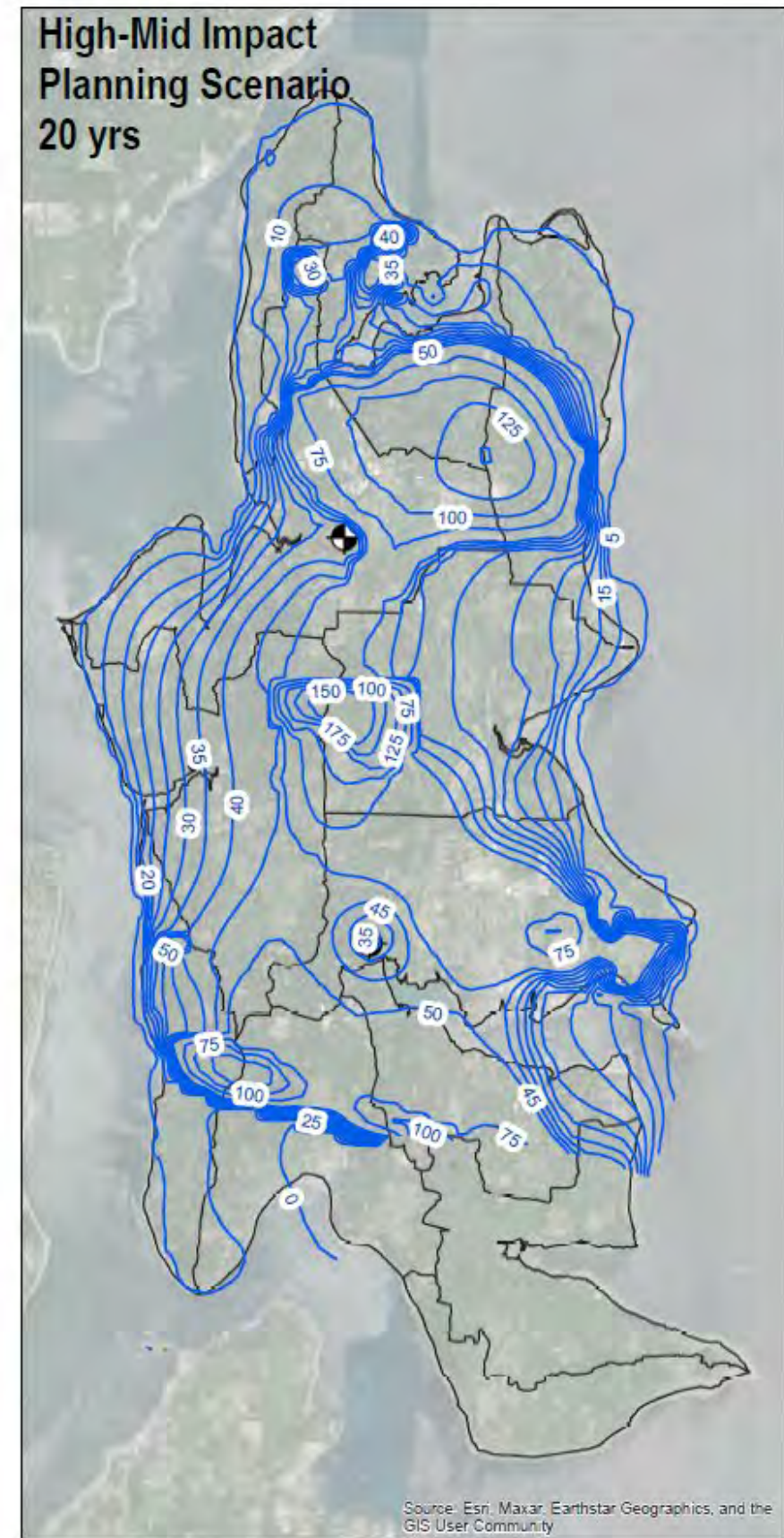
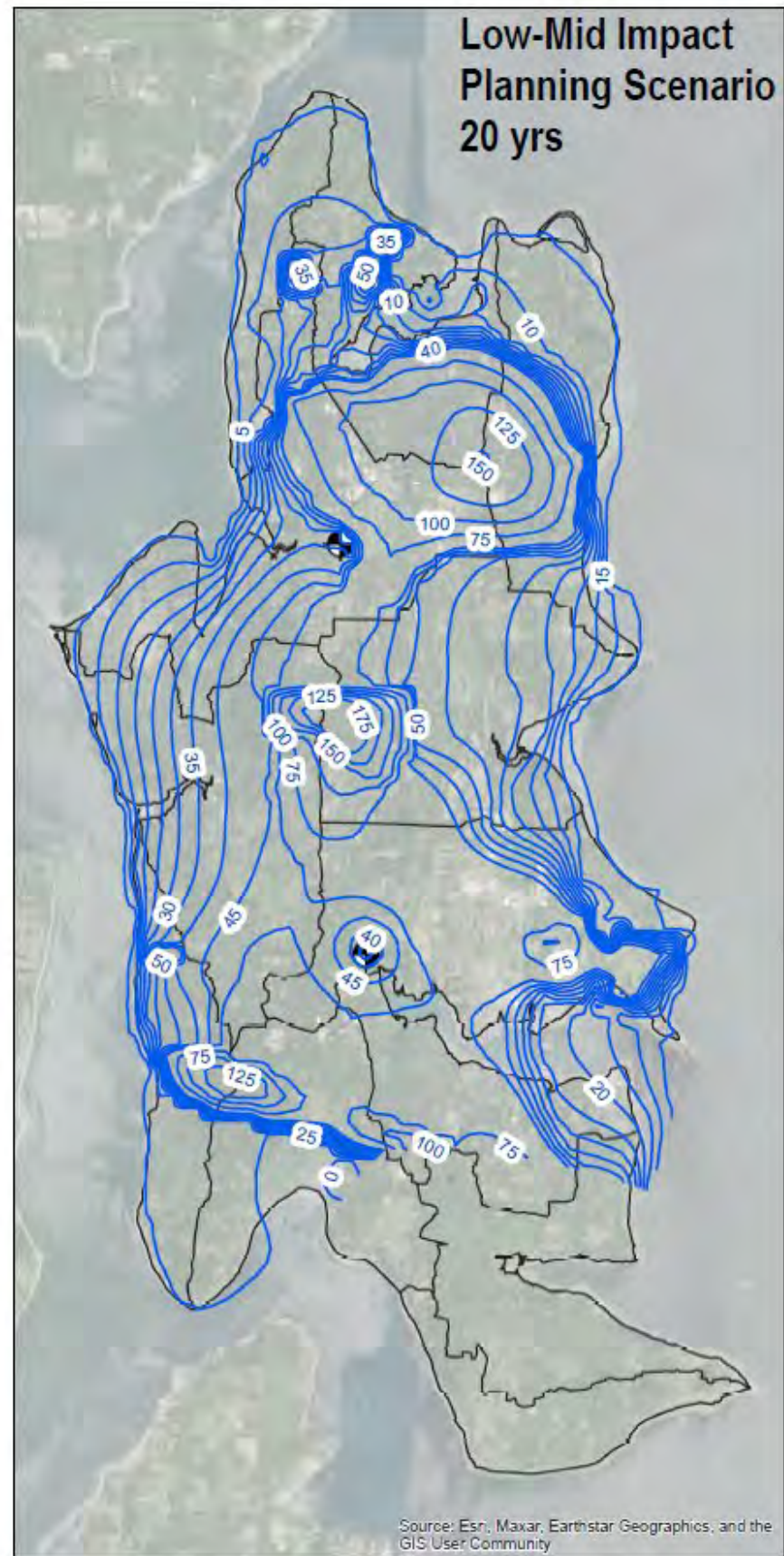
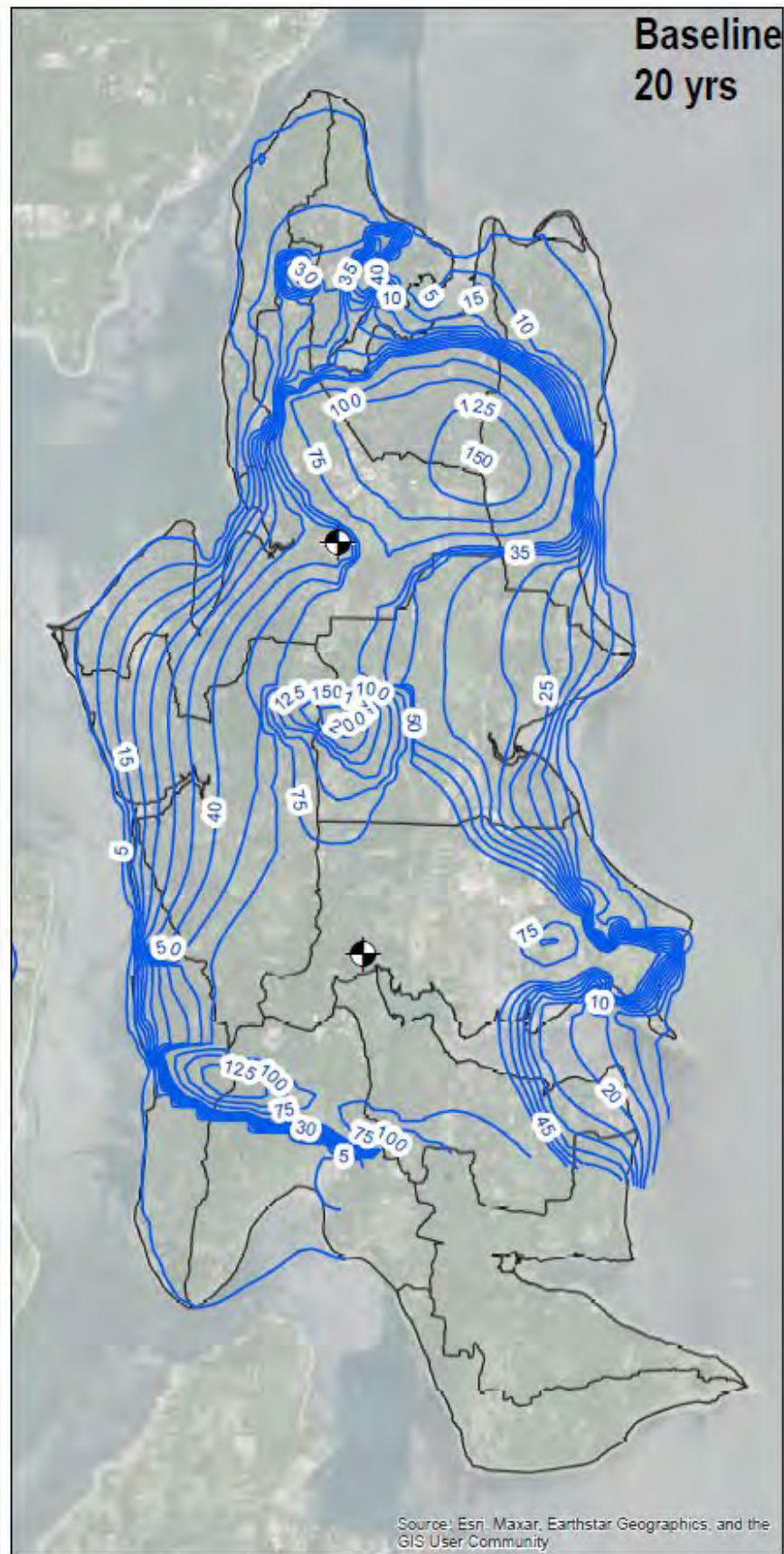




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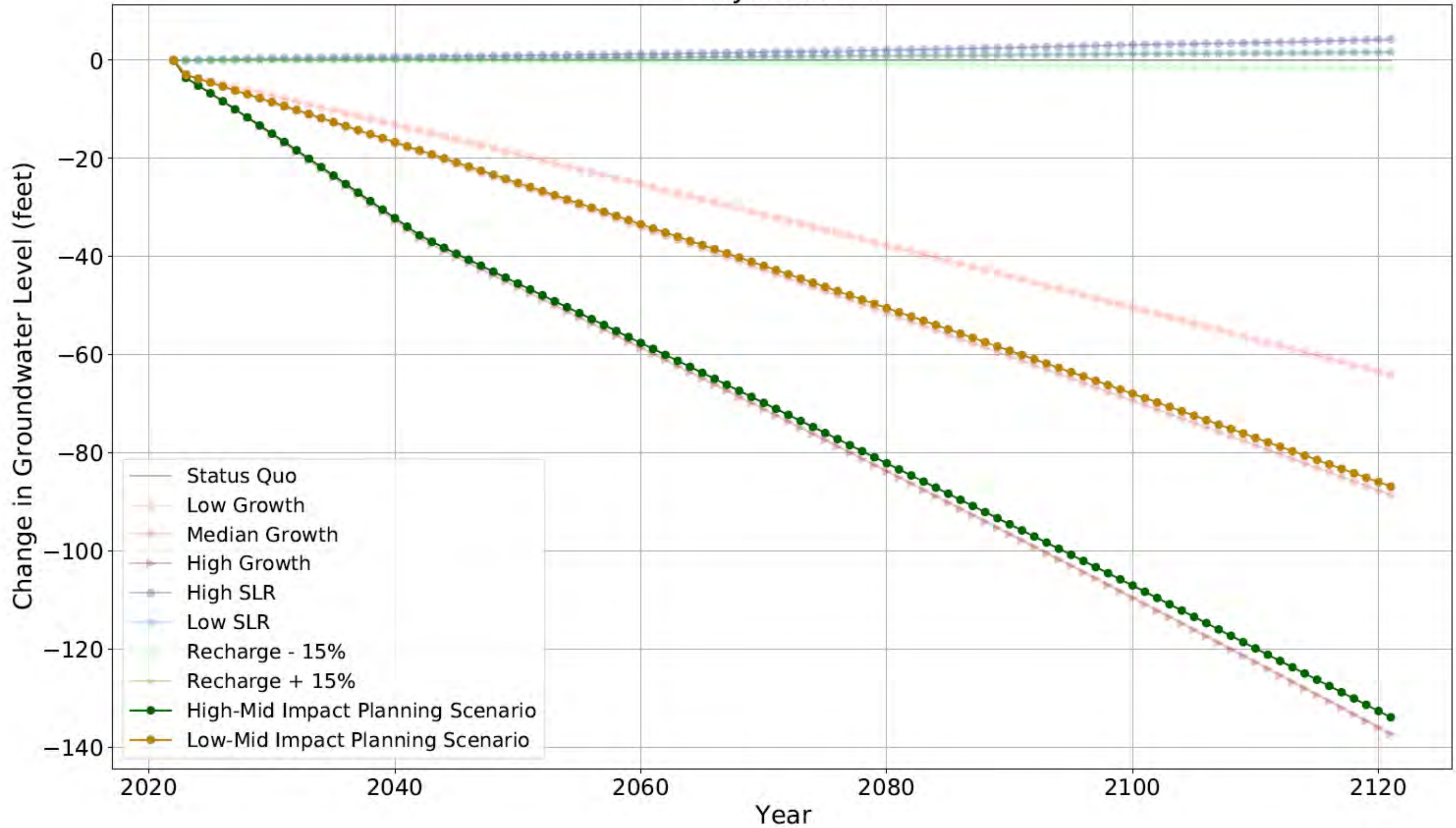


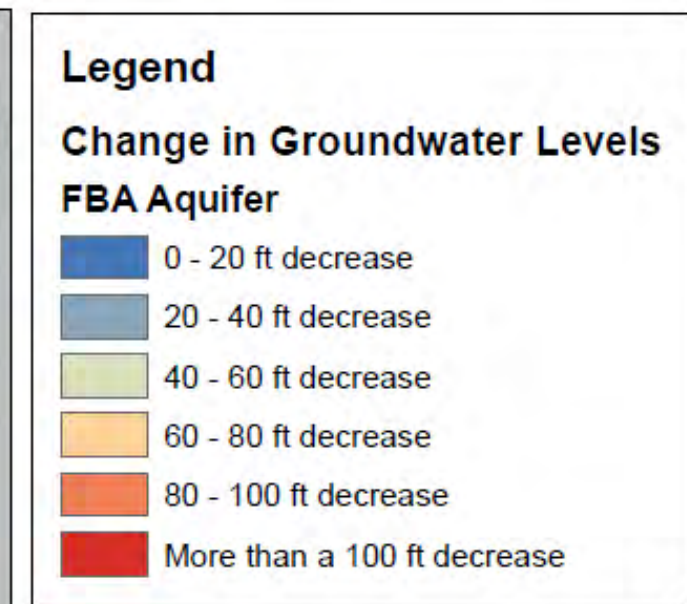
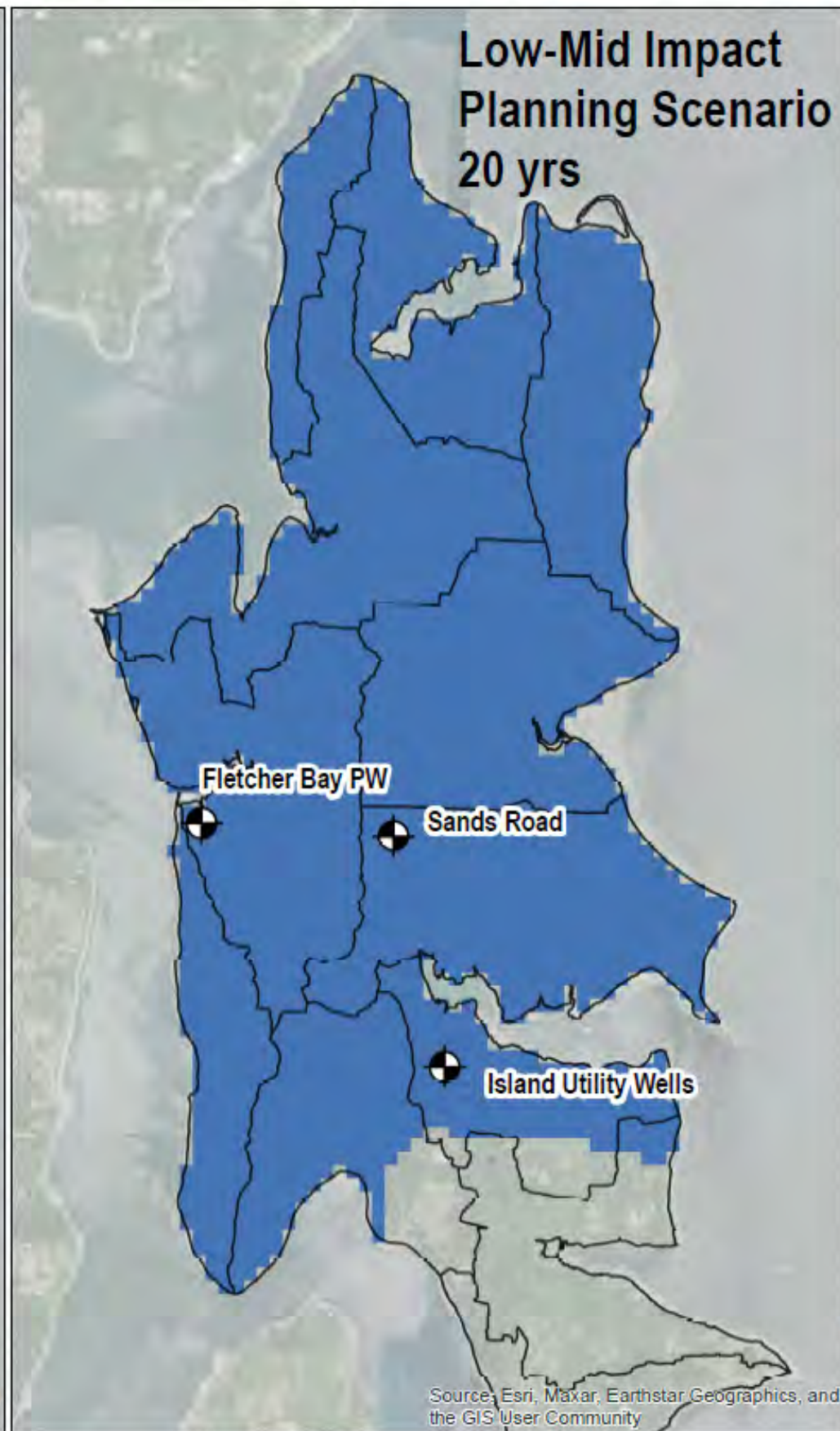
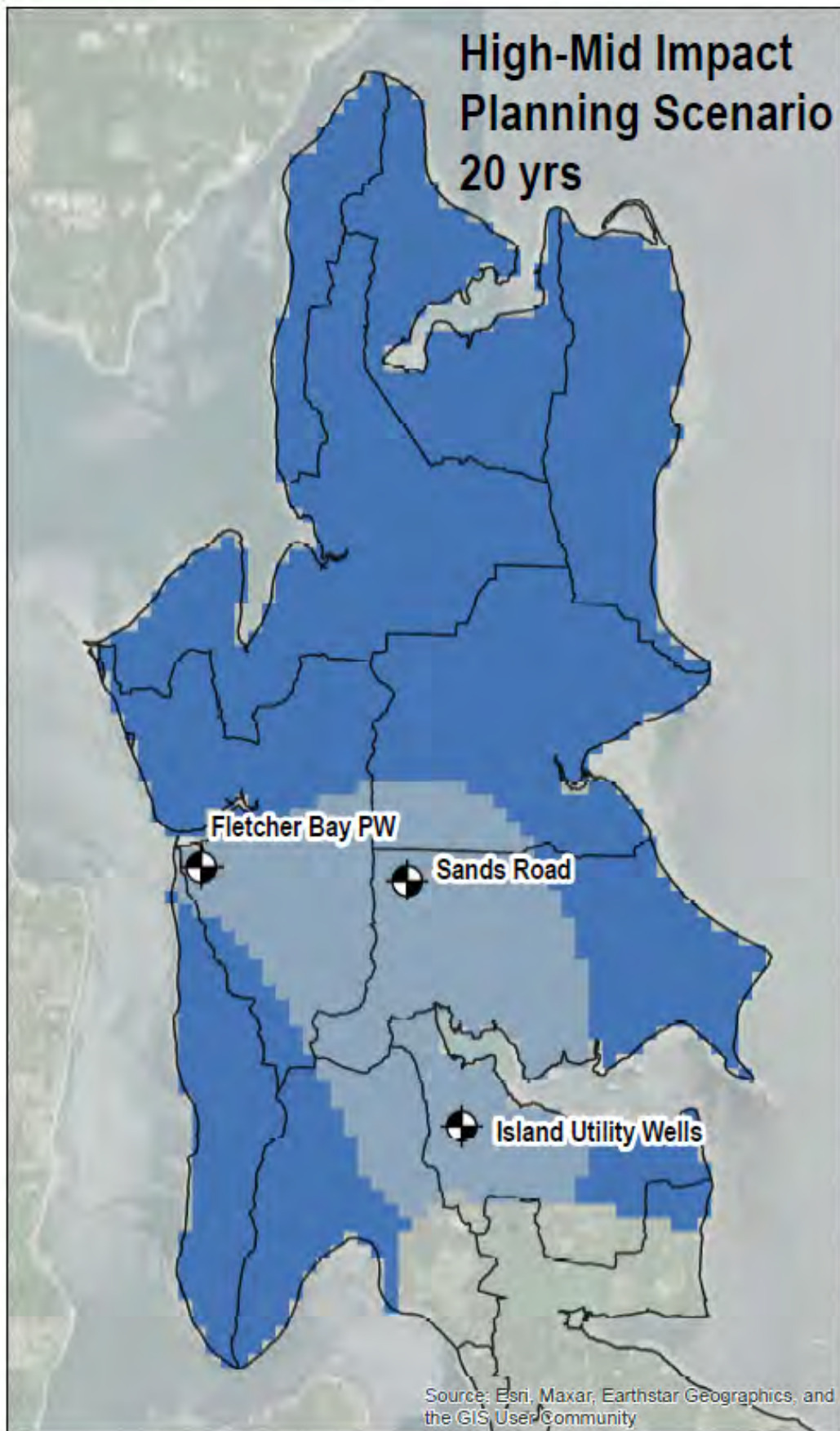


Groundwater Management Plan Update

September 12, 2024

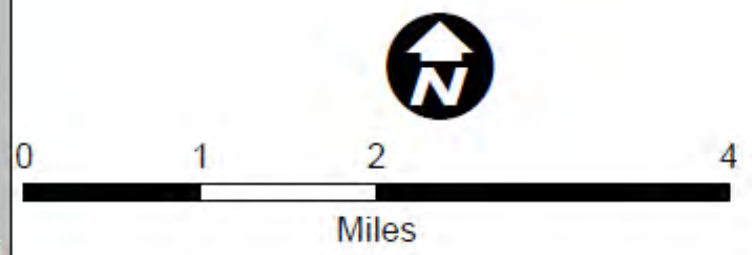
Sands Road Layer 9: FBA

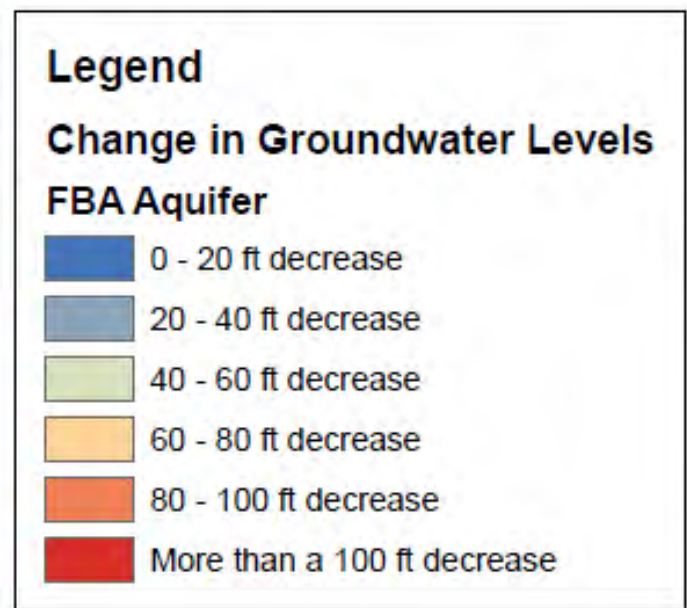
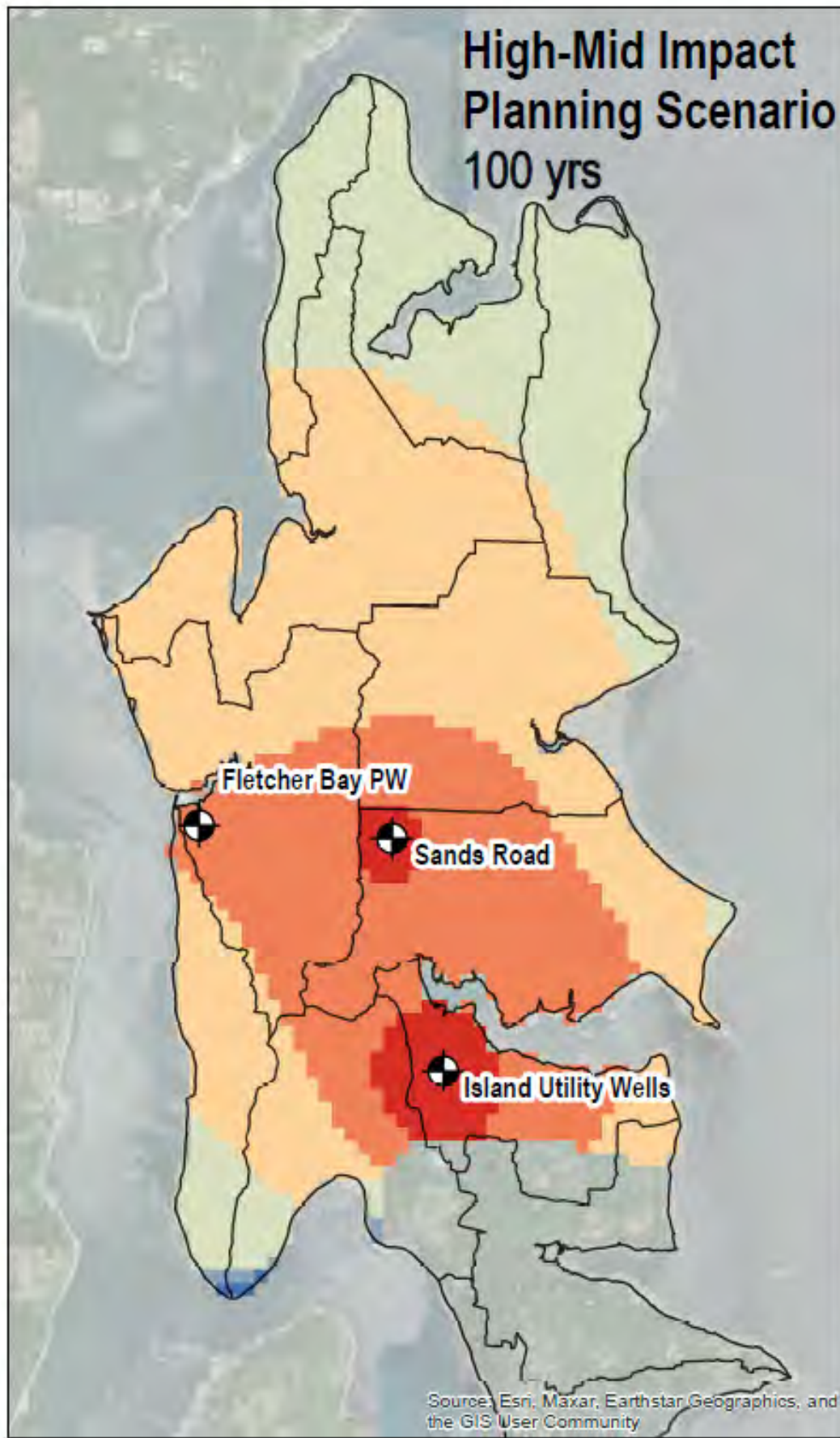




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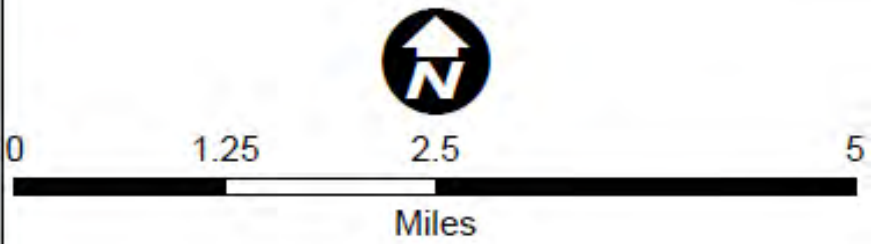
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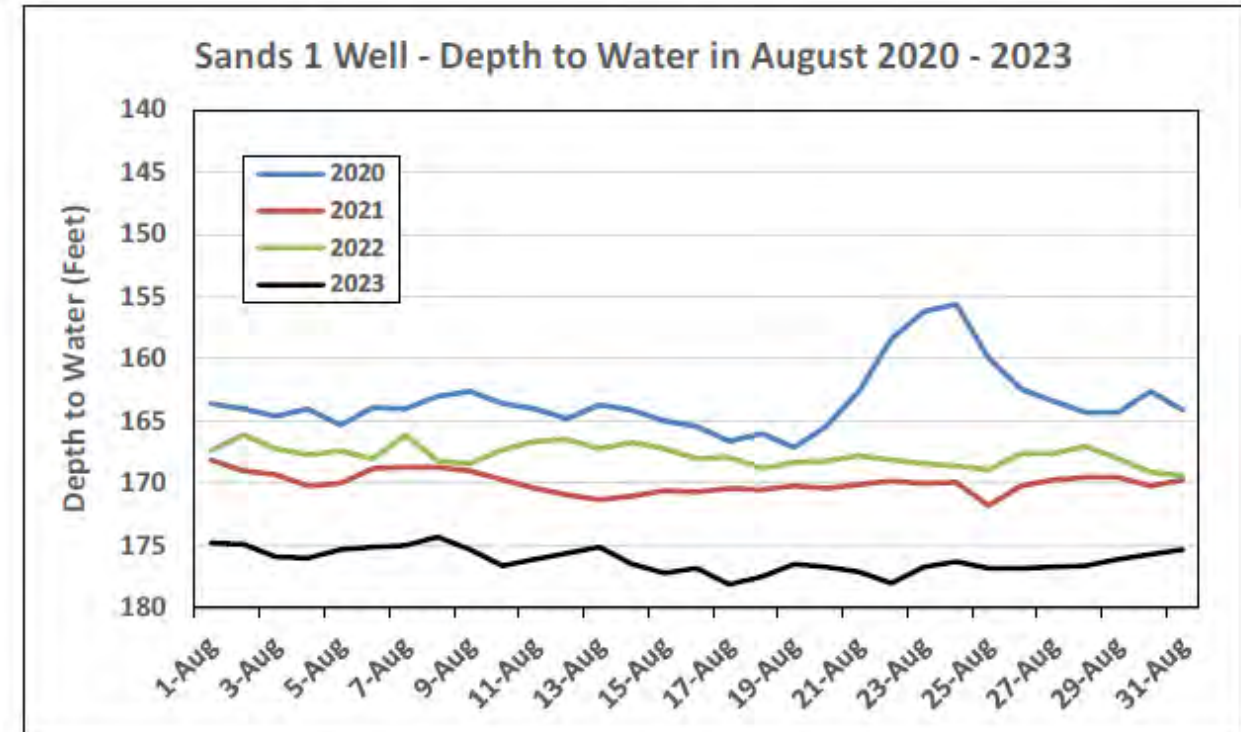
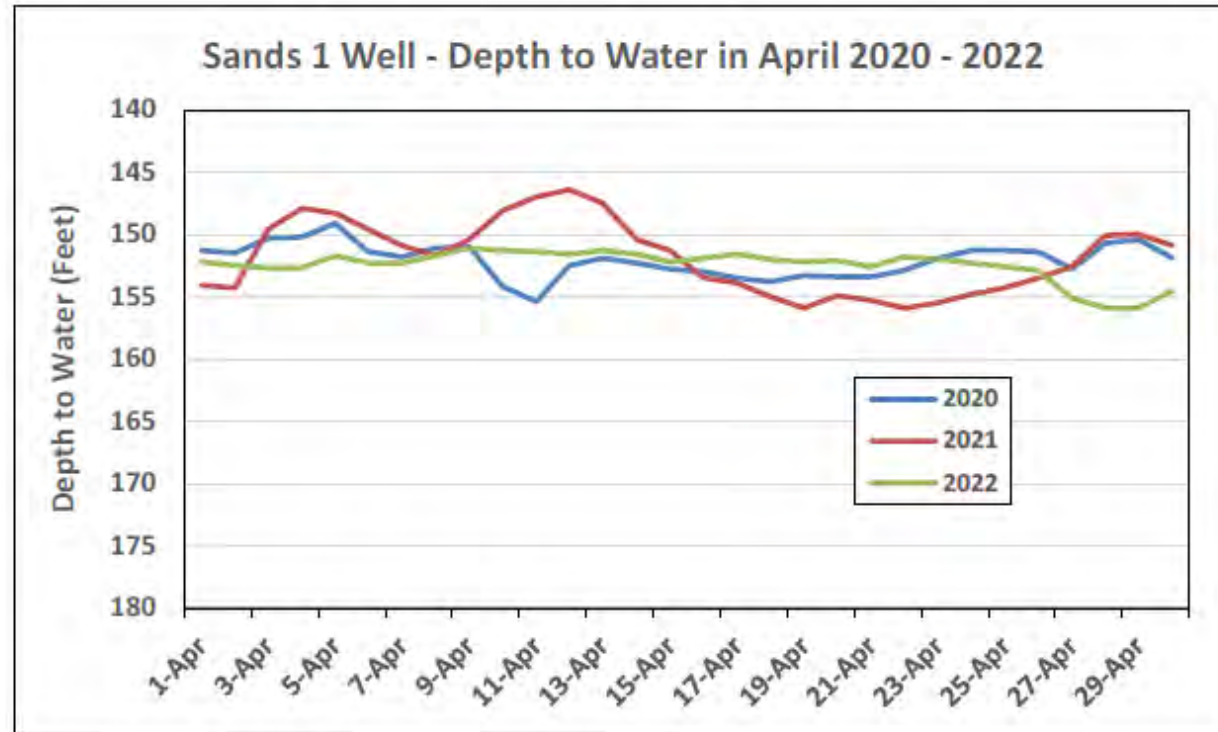


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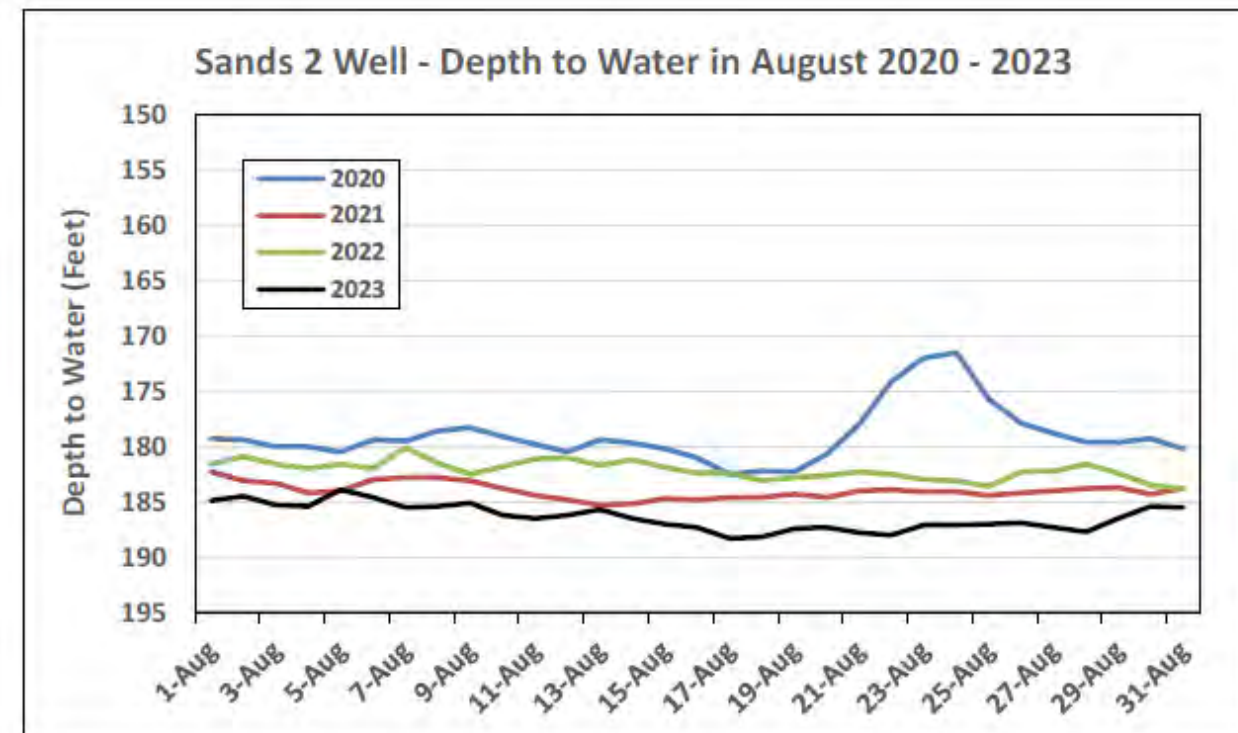
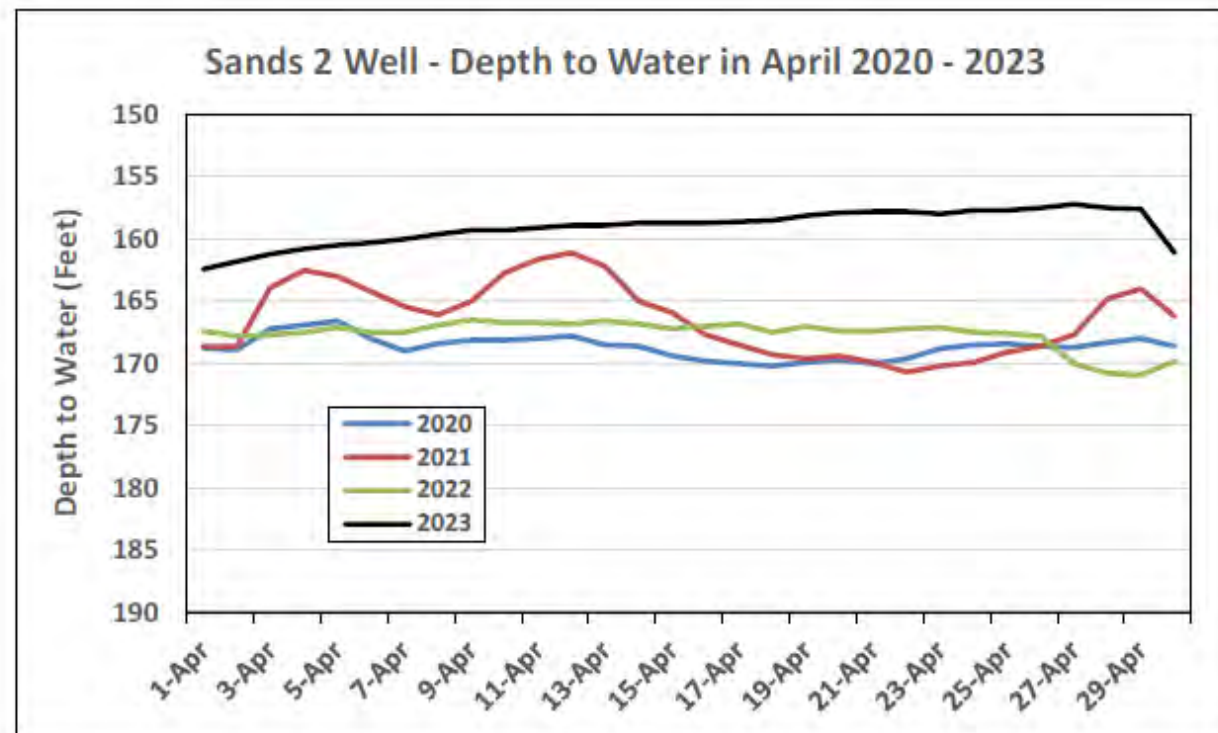
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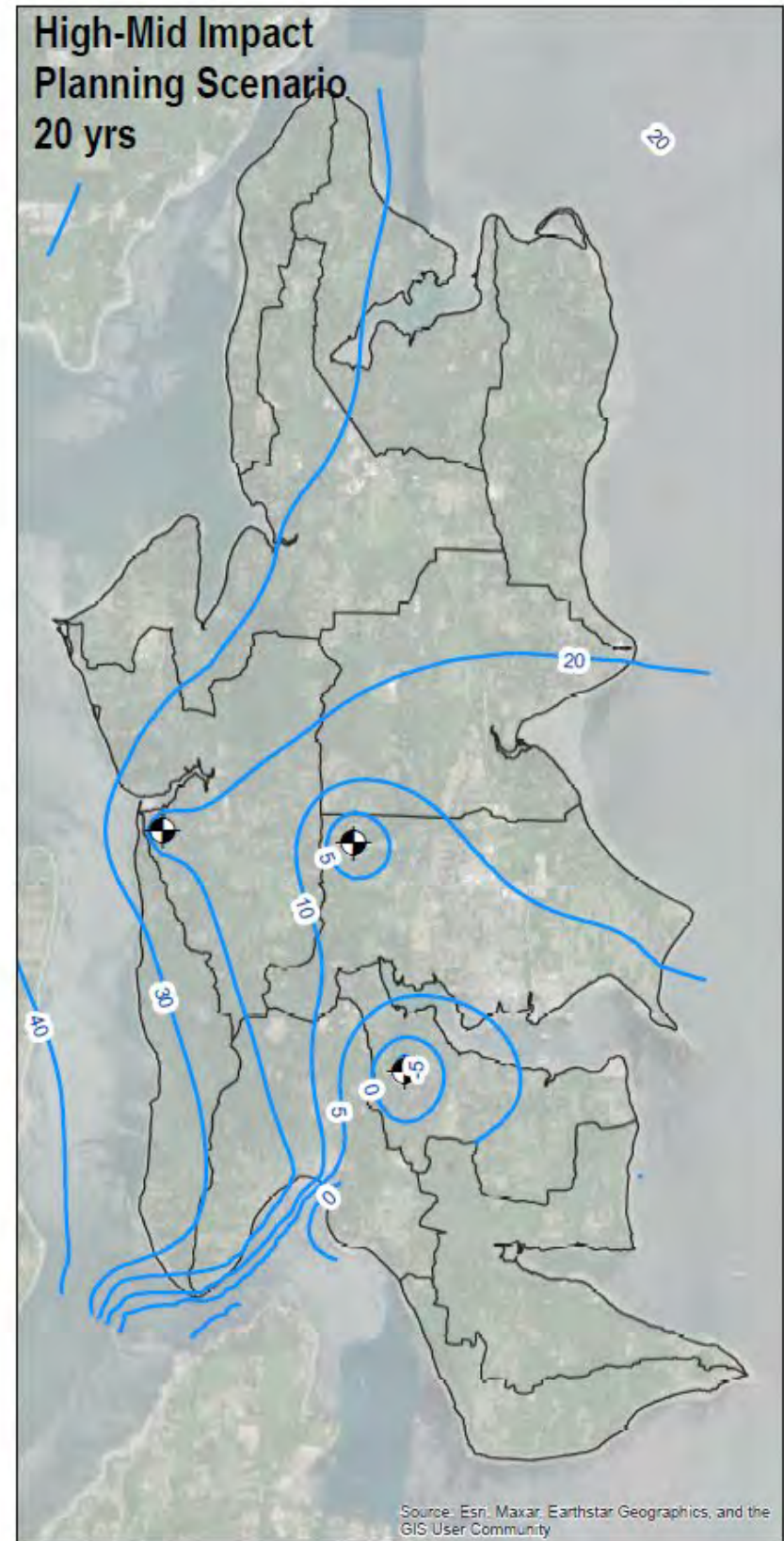
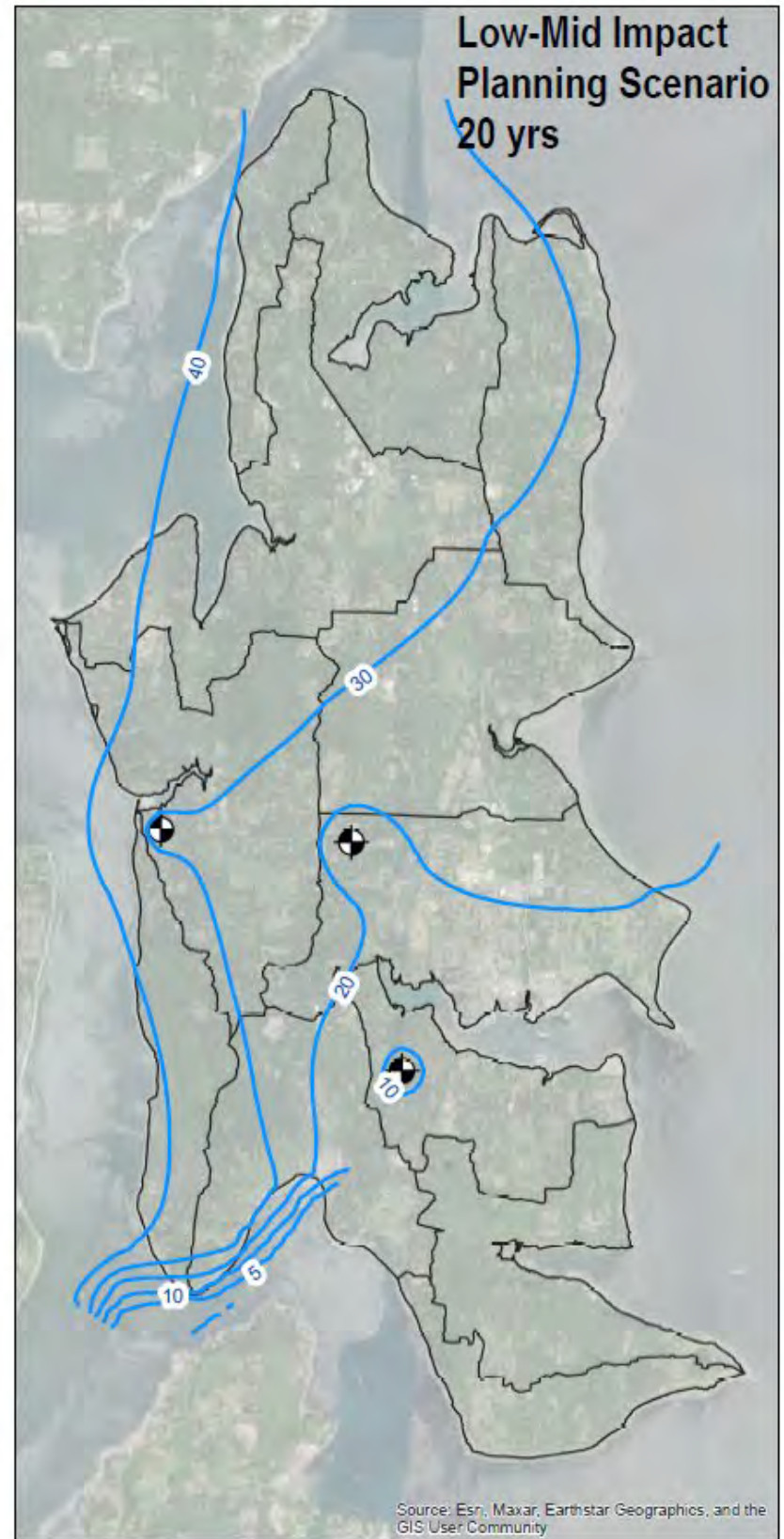
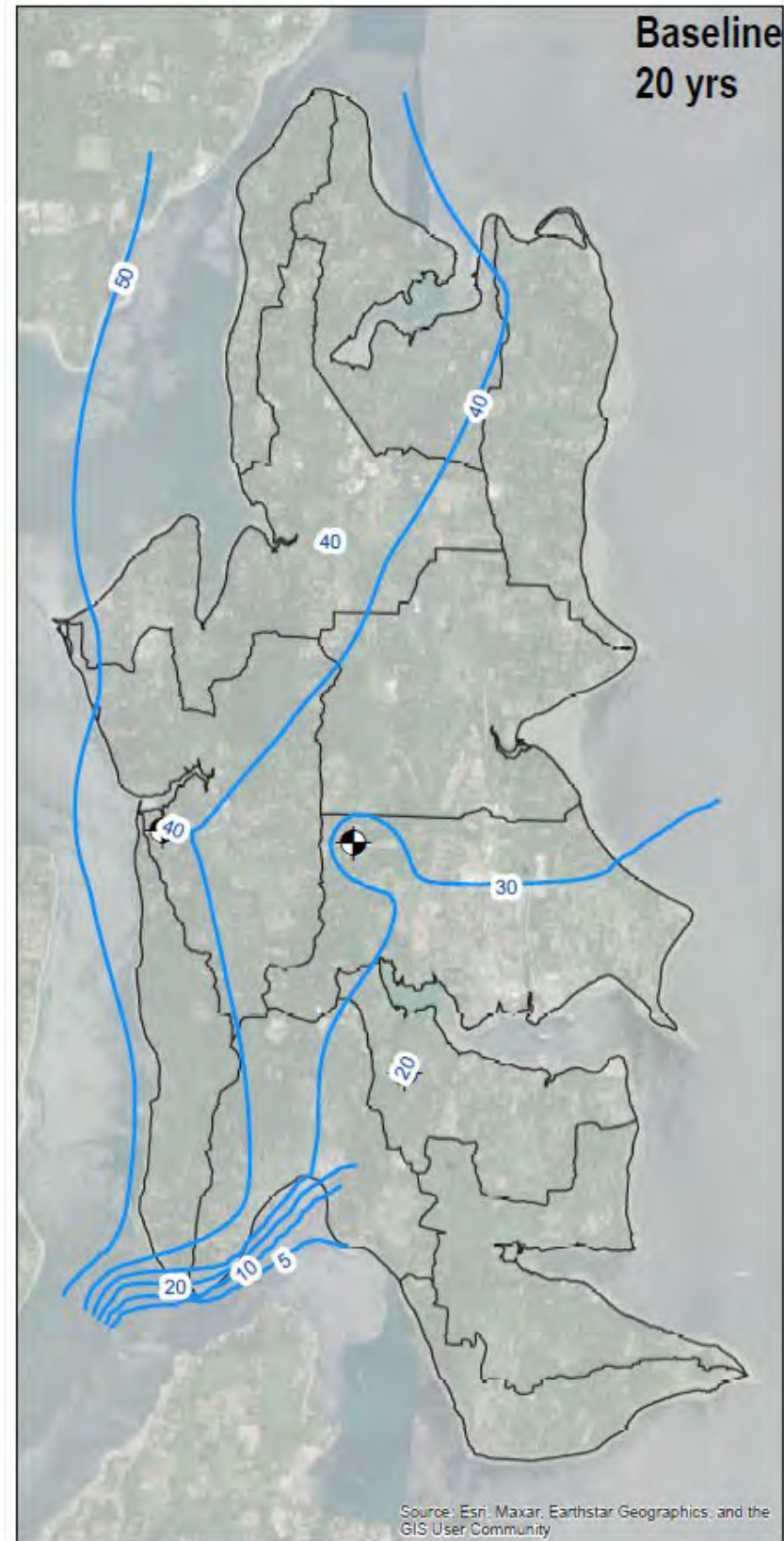


Depth to Groundwater in Sands Wells 1 and 2, April and August 2020 – 2023



*2023 Data not available because of well maintenance

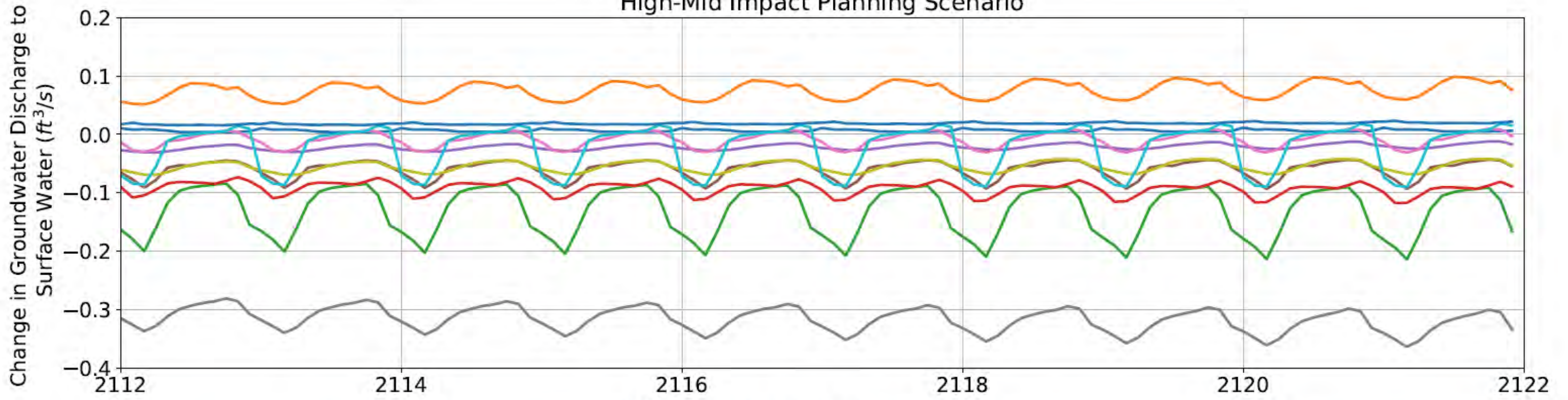




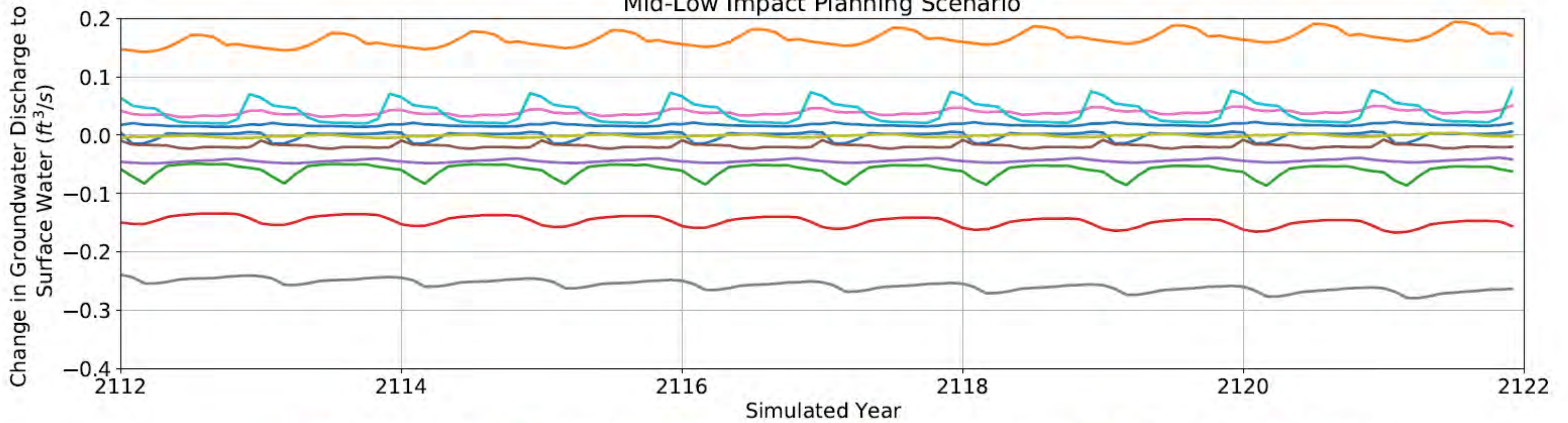
Groundwater Management Plan Update

September 12, 2024

High-Mid Impact Planning Scenario

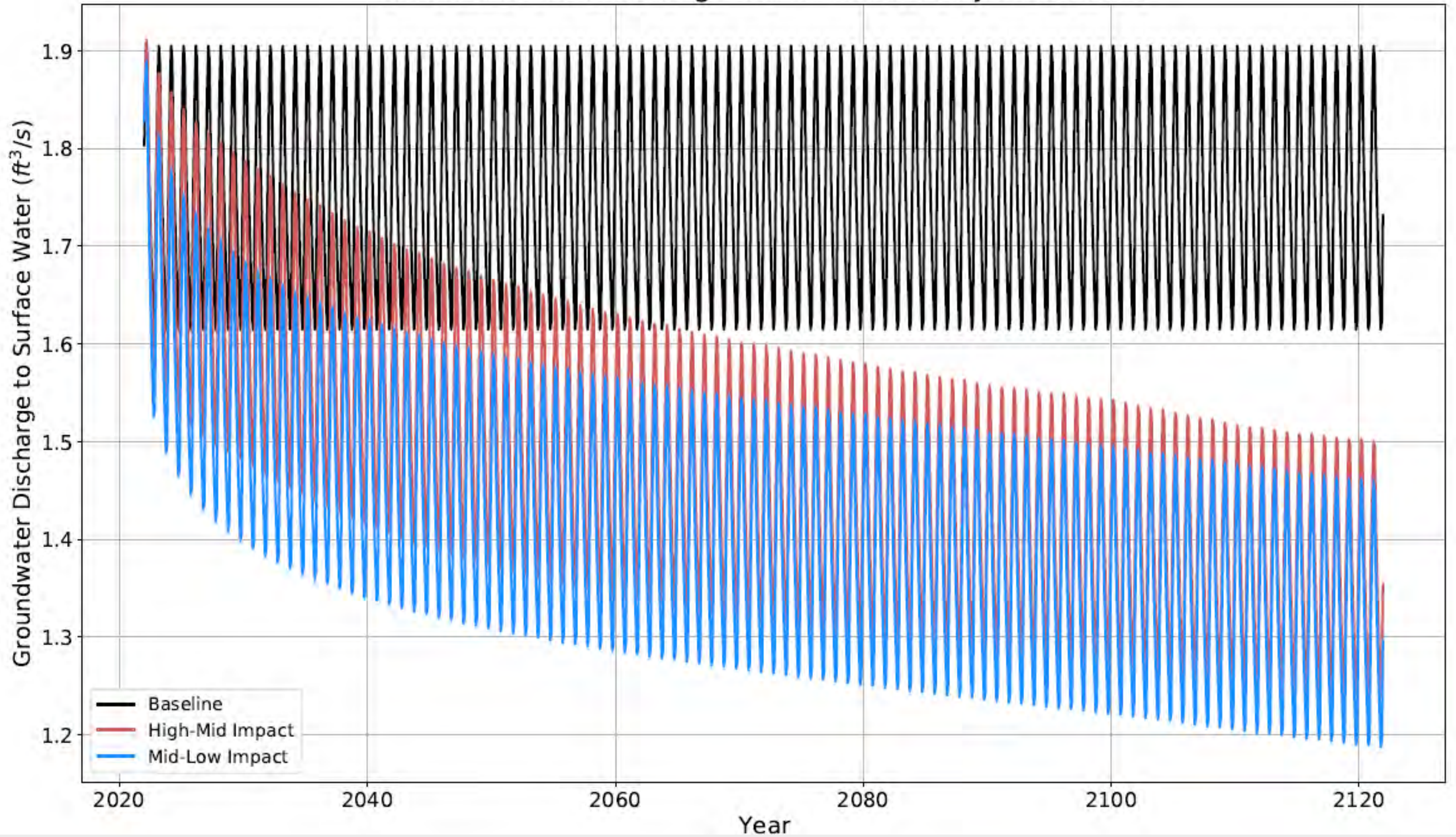


Mid-Low Impact Planning Scenario

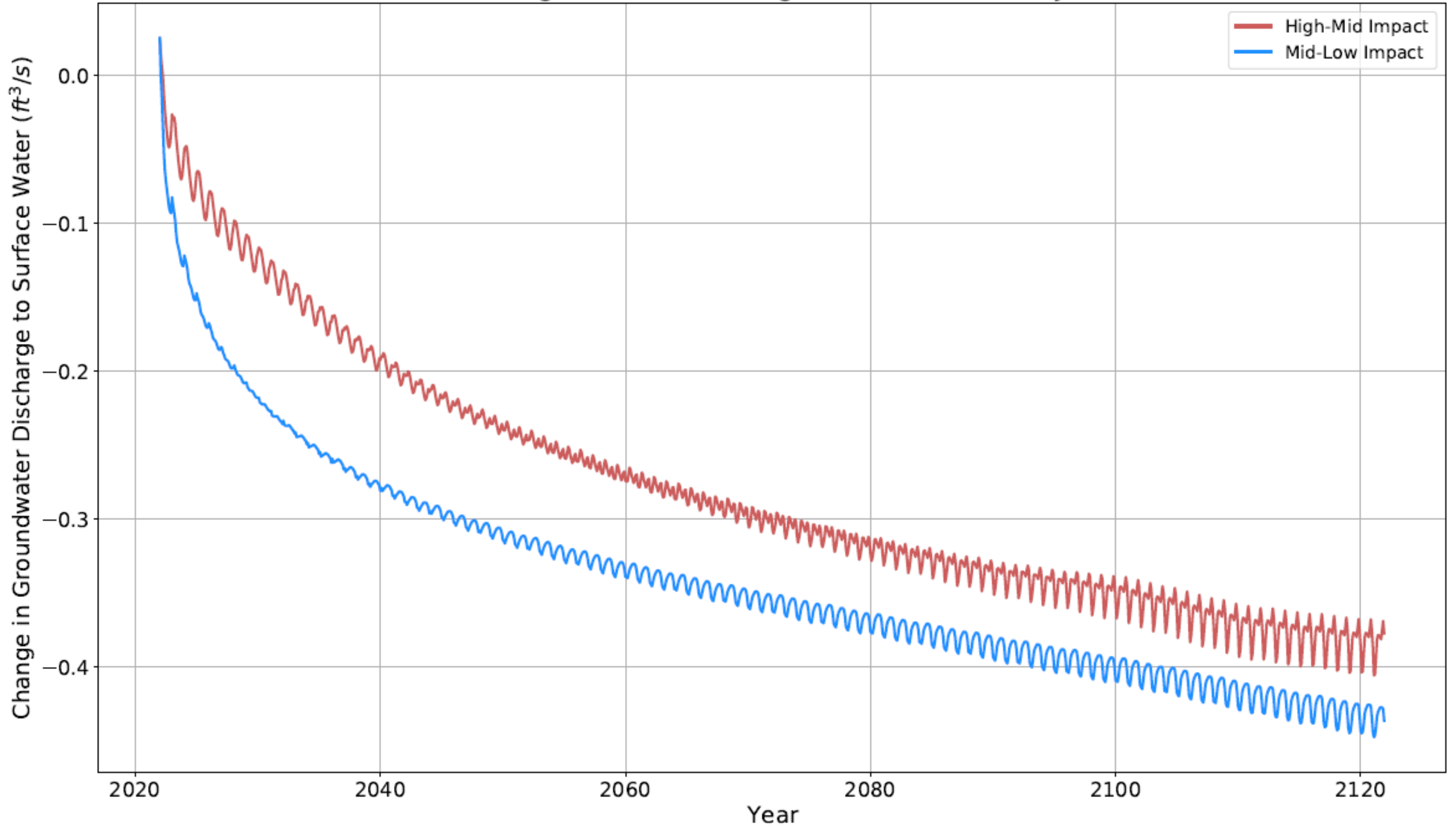


- Agate Passage
- Blakely Harbor
- Eagledale
- Fletcher Bay
- Gazzam Lake
- Manzanita Bay
- Murden Cove
- North Eagle Harbor
- Pleasant Beach
- Port Madison
- Sunrise

Simulated GW Discharge within Flecter Bay Watershed



Simulated Change in GW Discharge within Flecter Bay Watershed



Impacts and Management Strategies

Improving future modeling

- Collect more frequent well data
- Install/identify more monitoring wells

Mitigating surface water impacts

- Prioritize basins for monitoring
- Identify stream mitigation projects
- Identify growth limitations

Mitigating salt-water intrusion

- Prioritize monitoring locations
- Identify growth limitations or infrastructure expansion

Planning for water system capacity

- Identify milestones/break points for expanding infrastructure

Planning for water system coordination

- Identify opportunities for inter-ties between systems

Groundwater Management Plan Update

Discussion

