

Development Impacts on Groundwater

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Water Quality & Quantity

DNRP Science Seminar

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Outline

- **Why worry** about groundwater? 
- Kinds of **projects** are of concern?
 - **Impacts** of concern?
 - **Assessment** of possible impact?
 - **Conditions** to avoid impact?
 - **Detection** of imminent impact?
 - **Mitigation** of impact?
- **General** issues, then specific to **UPDs**

Why worry about GW?

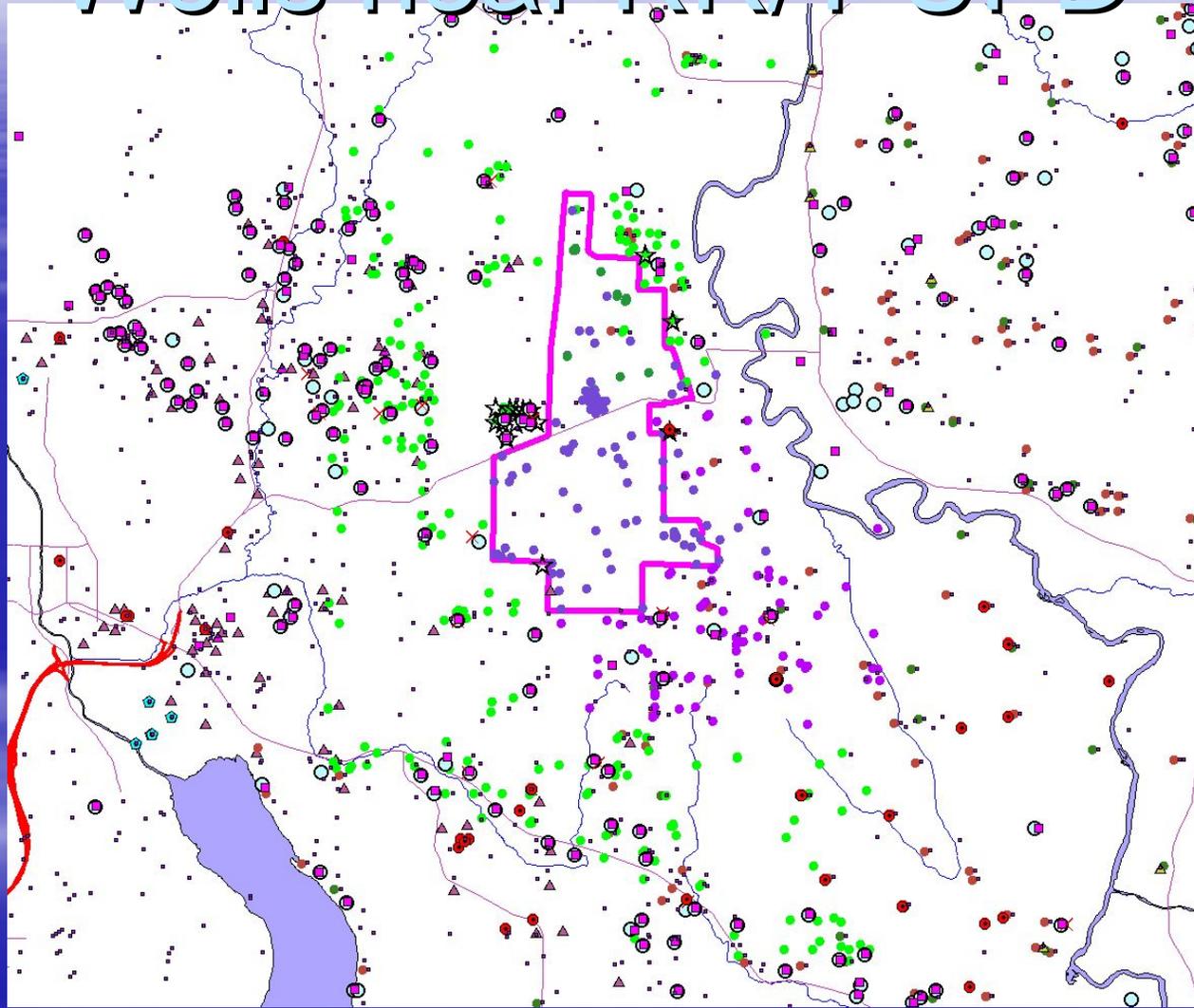
- Many residents rely on groundwater
- Water quantity?
 - Impervious: recharge becomes runoff
 - Mitigate only surface water impacts?
- Water quality?
 - Clearing vegetation, septic systems, yard care, possible worse scenarios
 - Nitrate and nutrients, exotic organics?
- No monitoring? May react too late



Assessment of GW Impacts

- Regional-scale data predict simple problems
 - Usually sufficient for Environmental Review
 - Regional databases: geology, flow, receptors
- Critical conditions can require monitoring
 - Baseline vs. on-going, expensive
 - Impacts may take a long time to show up
 - Can other databases suffice?

Wells near RR/T UPD



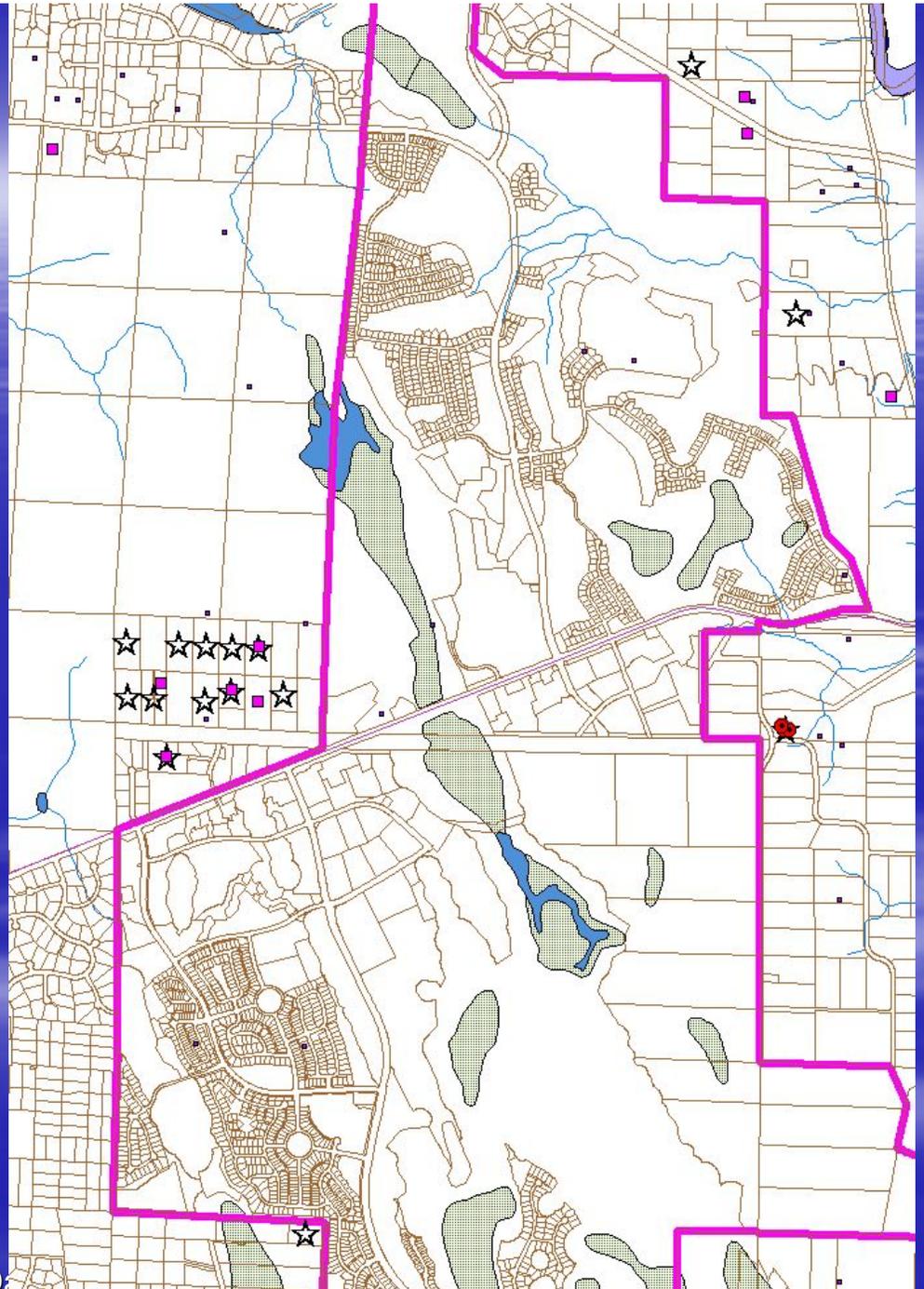
Many databases, though generally with little information

Redmond Ridge / Trilogy UPD

- GW impacts controversial from beginning
- Special **conditions** set in permit:
 - Groundwater level monitoring
 - Protection for registered wells
 - Mid-point review
- On-going meetings with Union Hill Water
- Redmond Ridge East SEPA review

Registration of wells

- Existing wells:
 - < 1000' away
 - < 150' deep
 - (< 2000' from infiltration facility)
- Protection against increase in pollutant concentrations
- No claims (5 years)



Assessment: GW impacts from UPD

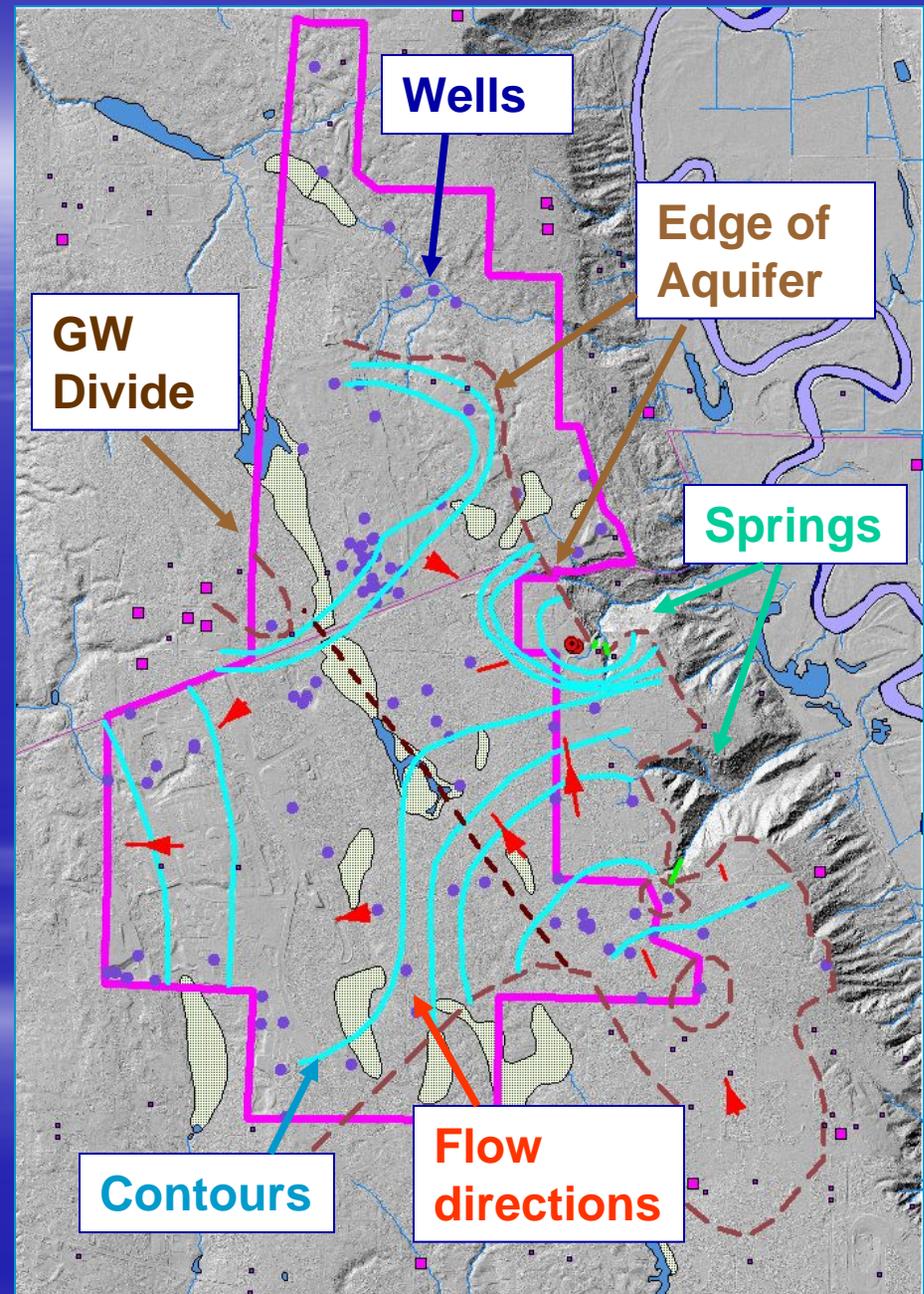
- Available data:
 - KC DNRP Ambient Monitoring
 - Public Water Systems compliance monitoring
- Redmond Ridge area GW Monitoring / Redmond Ridge East area SEPA

Monitoring of UPD GW

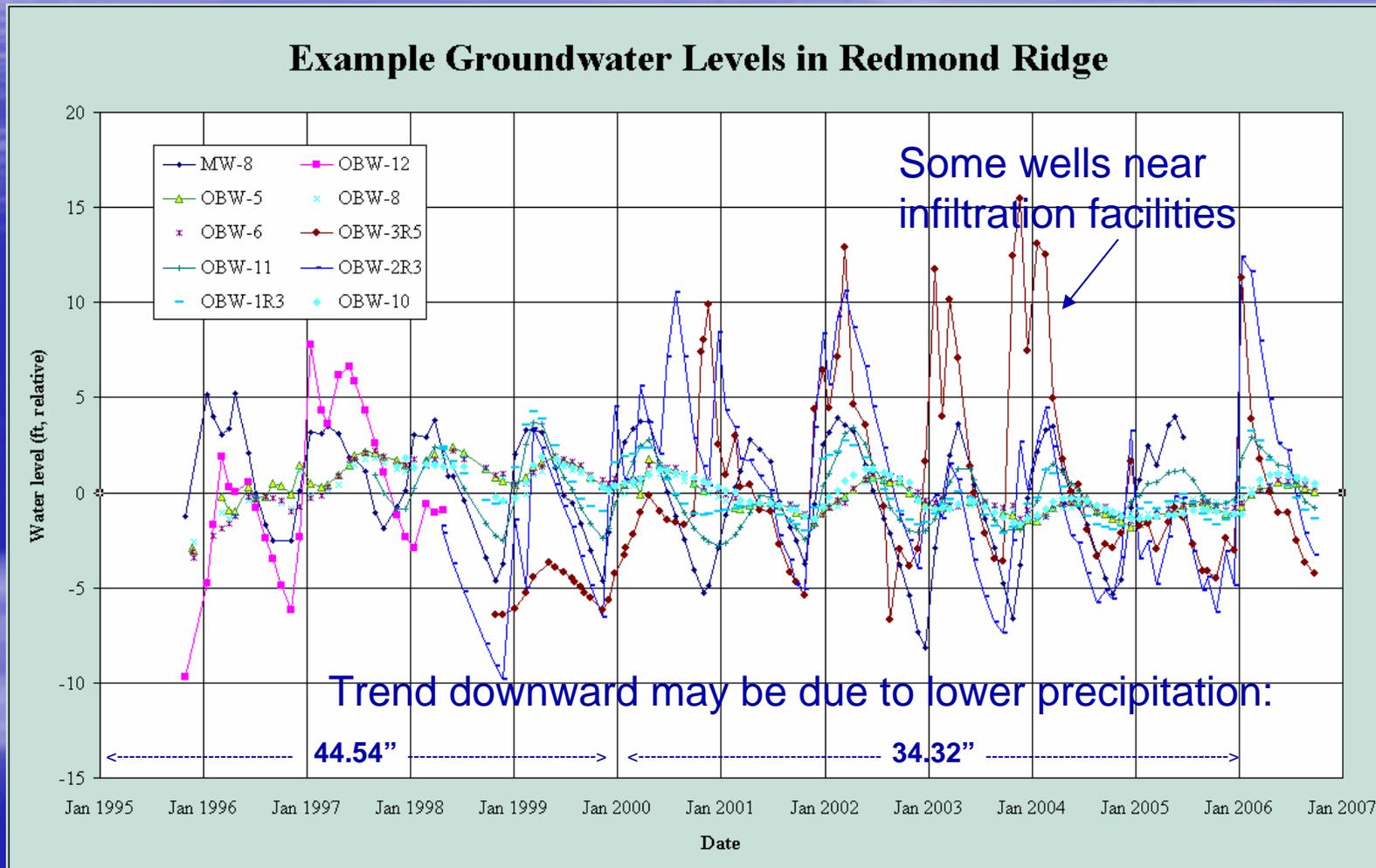
- Conducted by Associated Earth Sciences, Inc. (**AESI**), consultant to Quadrant Corp
- **Water levels** in monitoring wells (in Qva)
- Quarterly **reporting**, Mid-point sampling
- Meetings with potentially affected systems
- Extensive **hydrogeologic studies** for Redmond Ridge East SEPA EIS

Wells and flow

- AESI interpretation
- For **RR East** EIS
- **Qva** aquifer
- **29 wells** installed
- Water balance
- Outlets at **springs**
- Age dated strata



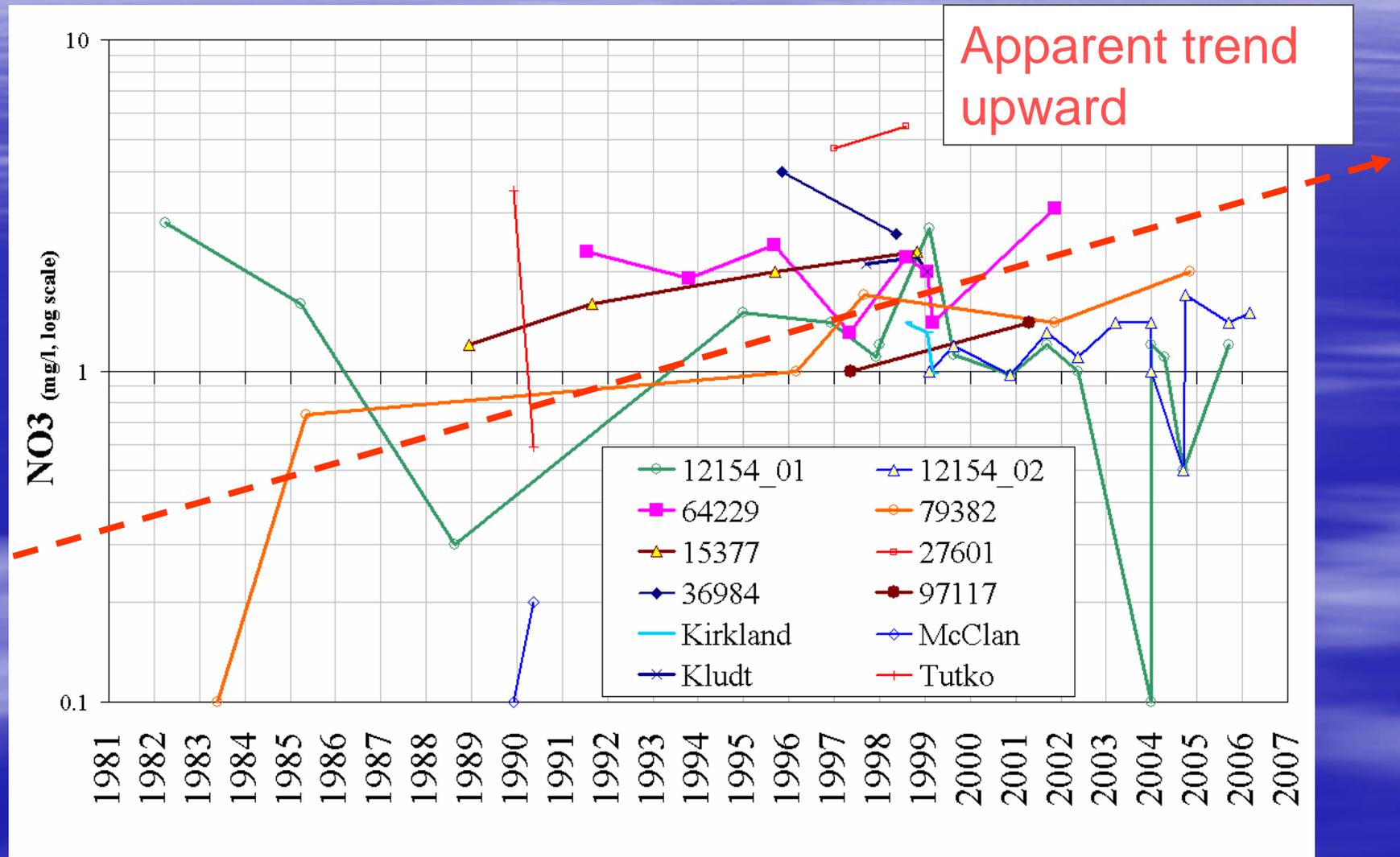
Hydrographs



Water Quality

- Off-site
 - Public Water Systems (PWS) compliance
 - Mainly nitrate, coliform bacteria
 - Large systems – more parameters, frequency
- On-site -- Limited
- Nitrate:
 - Higher NO₃ concentration in shallow wells
 - Apparent trend upwards
 - Not associated with downgradient from UPD

Nitrate concentrations over time



Conclusions

- Monitoring large projects → reassure
- UPD Permit Conditions appear successful
 - Also: brought water supply from Redmond, removed wastewater treatment offsite
- Analysis complicated by other causes:
 - Lower precipitation since year 2000
 - Effect of existing residences' septic systems
- Mid-point review