A Preliminary Study of the Alluvial Aquifer in Oakridge, OR

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SUMMER 2025
OAKRIDGE

ERTH 406: ADVANCED FIELD HYDROLOGY | COLLEGE OF ARTS AND SCIENCES

UNIVERSITY OF OREGON
Oakridge MOUNTAIN BIKING CAPITAL OF THE NORTHWEST
SCI Sustainable Cities Institute
SCYP Sustainable City Year Program

Acknowledgments

The Field Hydrology students would like to acknowledge the contributions and generosity of the EarthScope Consortium for lending the ERTH 406 students the Noggin 100 and 500 GPRs; the Willamette Fish Hatchery for well access and field support, as well as the residents, City Council of Oakridge, and James Cleavenger, Oakridge City Administrator. This project would not have been possible without their involvement.

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About SCI

The Sustainable Cities Institute (SCI) is an applied think tank focusing on sustainability and cities through applied research, teaching, and community partnerships. We work across disciplines that match the complexity of cities to address sustainability challenges, from regional planning to building design and from enhancing engagement of diverse communities to understanding the impacts on municipal budgets from disruptive technologies and many issues in between.

SCI focuses on sustainability-based research and teaching opportunities through two primary efforts:

1. Our Sustainable City Year Program (SCYP), a massively scaled university-community partnership program that matches the resources of the University with one Oregon community each year to help advance that community's sustainability goals; and

2. Our Urbanism Next Center, which focuses on how autonomous vehicles, e-commerce, and the sharing economy will impact the form and function of cities.

In all cases, we share our expertise and experiences with scholars, policymakers, community leaders, and project partners. We further extend our impact via an annual Expert-in-Residence Program, SCI China visiting scholars program, study abroad course on redesigning cities for people on bicycle, and through our co-leadership of the Educational Partnerships for Innovation in Communities Network (EPIC-N), which is transferring SCYP to universities and communities across the globe. Our work connects student passion, faculty experience, and community needs to produce innovative, tangible solutions for the creation of a sustainable society.

About SCYP

The Sustainable City Year Program (SCYP) is a yearlong partnership between SCI and a partner in Oregon, in which students and faculty in courses from across the university collaborate with a public entity on sustainability and livability projects. SCYP faculty and students work in collaboration with staff from the partner agency through a variety of studio projects and service- learning courses to provide students with real-world projects to investigate. Students bring energy, enthusiasm, and innovative approaches to difficult, persistent problems. SCYP's primary value derives from collaborations that result in on-the-ground impact and expanded conversations for a community ready to transition to a more sustainable and livable future.

Community partnerships are possible in part due to support from U.S. Senators Ron Wyden and Jeff Merkley, as well as former Congressman Peter DeFazio, who secured federal funding for SCYP through Congressionally Directed Spending.

About City of Oakridge

The City of Oakridge, Oregon, is a vibrant community nestled in the foothills of the Western Cascade Mountains, with a population of approximately 3,500 residents within city limits (nearly 5,000 when including nearby Westfir and surrounding areas). Surrounded by the extensive Willamette National Forest, the city provides ample opportunities for activities such as hiking and mountain biking, with nearly 500 miles of trails and five rivers in its vicinity. Oakridge's elevation (1,200-1,700 ft.) results in a favorable climate, characterized by over 300 sunny days annually, while avoiding the fog of the valley and the heavy snowfalls of higher elevations.

Governed by a council-manager system since 1972, Oakridge residents benefit from a robust and supportive municipal administration. The City offers a comprehensive range of services, including street maintenance, water, wastewater, and park utilities, as well as police, fire, and emergency medical services. Additional municipal services include library access, economic development, planning and zoning, and general administrative support. Funding for city operations is derived from property taxes, franchise fees, and other revenue sources, with special projects financed through grants and loans.

In the past decade, Oakridge has secured nearly $11 million in grants and loans for community projects and maintains an annual budget of approximately $10 million.

The citizens of Oakridge cherish their history and cultural heritage, celebrating it through a variety of events and activities throughout the year. The long-standing Tree Planting Festival pays homage to Oakridge’s timber town roots, while the Concerts in the Park series offers free performances at the Banner Bank Amphitheater in Greenwaters Park. Additionally, Oakridge features four art galleries, three nearby hot springs, and is conveniently located just 25 miles from Willamette Pass Ski Resort. The Eugene-Springfield metropolitan area, approximately 35 miles away, further enriches the community’s cultural offerings with its vibrant arts scene, including music, theater, and access to the University of Oregon.

The City of Oakridge is committed to fostering a safe, livable, and sustainable environment for its residents while promoting economic development and community engagement. As part of its ongoing planning initiatives, Oakridge is exploring various strategies to enhance its sustainability and growth, ensuring that the community continues to thrive for generations to come. The partnership between the Sustainable City Year Program and the City of Oakridge is supported by local stakeholders, enabling University of Oregon students and faculty to collaborate on projects and provide recommendations to address city-identified challenges and opportunities.

Course Participants

This course was led by Professor Qusheng Jin and PhD student Gordon Bowman. The students included:

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Course Description

ERTH 406: ADVANCED FIELD GEOLOGY

Field Hydrology offers students practical, on-the-ground experience in applying classroom knowledge to environmental data collection and analysis. This two-week course focuses on four main topics: soils, streams, aquifers, and water quality, with hands-on fieldwork.

Executive Summary

Students in the University of Oregon’s Field Hydrology course investigated local groundwater flow in Oakridge’s alluvial aquifer, chemical variability in the groundwater, and groundwater availability.

Using ground penetrating radar (GPR), students performed imaging on the water table in several areas around the city. The imaging showed that the water table follows topography at a depth of about 20-25 feet, which is expected from an unconfined aquifer. The class performed chemical analyses at two well locations: one on the west end of the city and one at the foot of TV Butte to the east. The analyses showed that groundwater near the butte is more alkaline, has higher specific conductivity, less oxidation reaction potential, and higher levels of ferrous iron and sulfide. These results suggest groundwater interaction and mixing between TV Butte and the alluvial aquifer beneath Oakridge. These chemical interactions would likely manifest as dissolution of mafic (magnesium & iron-rich) minerals and weathering from the igneous butte. Students took an automatic pump test result from Well 2 of the municipal well field and compared it to the 1993 report. The result was a substantially lower level of transmissivity than those shown in the 1993 report. Lower transmissivity indicates that there is not as high a volume of water moving through the aquifer as there was in the past. Taking these results into mind, students recommend further study into the alluvial aquifer to better understand the implications of these findings on the Oakridge municipal water supply and sources.

Introduction

The City of Oakridge has a two-year partnership with the Sustainable City Yearly Program (SCYP) at the University of Oregon (UO). This program establishes connections between local cities and UO faculty and students to consult on issues relating to the environment, sustainability, and development. Students in the University of Oregon's Field Hydrology course partnered with the City of Oakridge to conduct a groundwater study. Students conducted a preliminary groundwater study of the city to investigate groundwater availability and influences.

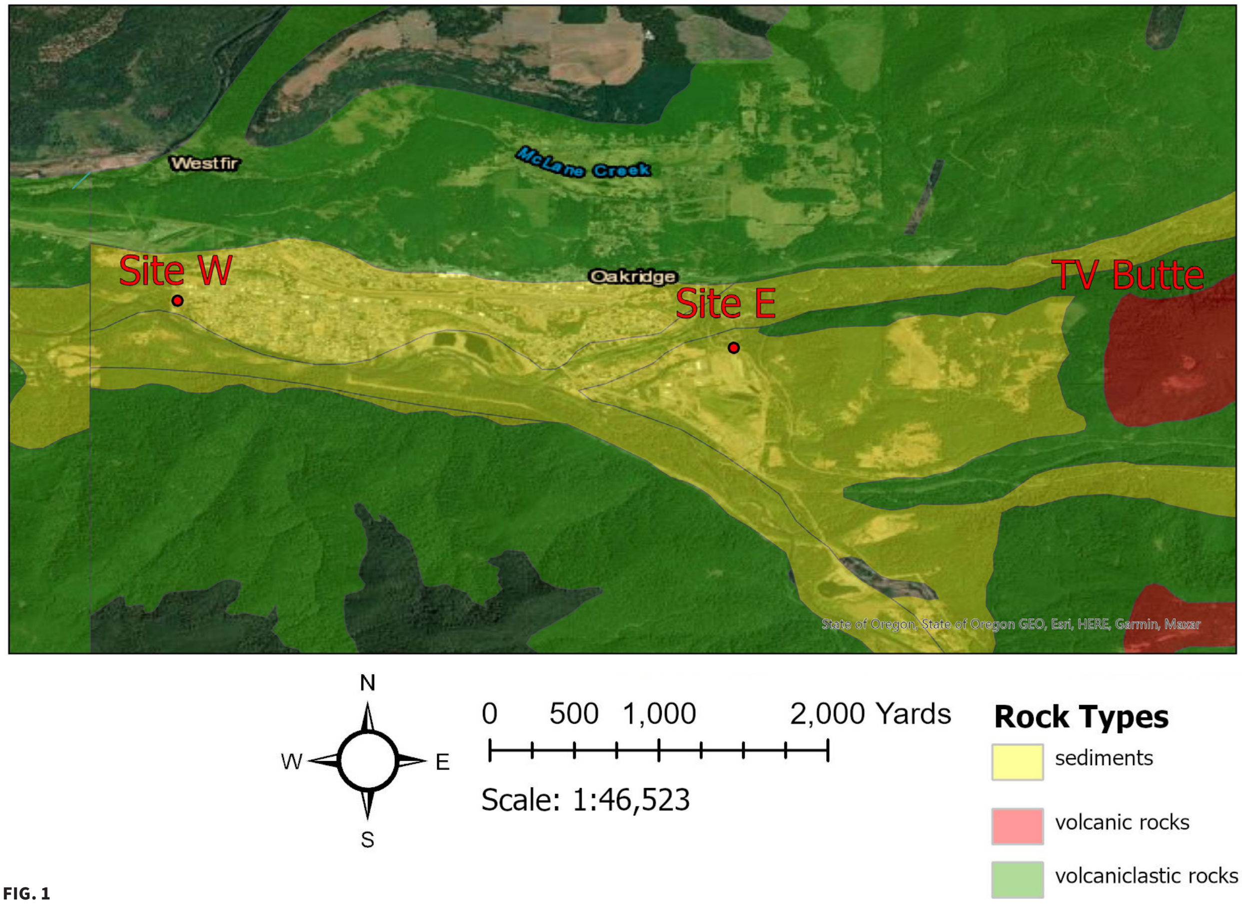
Oakridge's municipal water supply is entirely dependent on groundwater. Their reliance on groundwater makes the structure and water chemistry of Oakridge's alluvial aquifer vital to the city's inhabitants and economy. A shift in the aquifers' transmissivity or water quality has the potential to cause long-term impacts on the Oakridge's ability to provide water to its citizens and businesses. This project aims to improve the city's understanding of the Oakridge alluvial aquifer system, allowing improved sustainable groundwater management and future planning for community water use. Students collaborated with Oakridge city staff to access municipal well logs and perform community outreach with Oakridge residents for both research and educational purposes.

SITE CONTEXT

Oakridge is situated within the Western Cascades; a mountain region composed of older volcanic terrain and highly eroded by rivers. The city draws water from an unconfined alluvial aquifer throughout the valley floor. This type of aquifer is called unconfined because it has no overlaying impermeable rock layers, allowing surface water to freely percolate into the aquifer. The alluvial aquifer was created by two main processes: glacial melting and river deposition. Melting streams from retreating glaciers produce glacial outwash, an assortment of sediments of varying size previously trapped in the glacial ice. River-based sediments are known as alluvium and have been deposited much more recently than the glacial sediments.

Oakridge is an intermediate zone of groundwater flow where groundwater moves from the High Cascades to the east towards the Willamette Valley to the west. Surface water follows gravity, flowing from higher elevation to lower elevation. Groundwater flow is more complicated, following differences in pressure known as hydraulic head. In Oakridge, the groundwater also flows regionally from east-to-west. The northernmost edge of the Oakridge alluvial aquifer is bounded by the Eugene-Denio lineament, a fault line that extends from Denio, NV, to Eugene, OR. The impacts of this fault line on the aquifer's flow field are unknown. Figure 1 shows local rock types and well sites that were studied.

Study Area Well Sites and Rock Types



State of Oregon, State of Oregon GEO, Esri, HERE, Garmin, Maxar

FIG. 1

The study area with three main regional rock types. The butte and wells that were tested are also labeled.

PROJECT GOALS

One main goal was to image the structure of Oakridge's aquifer utilizing ground-penetrating radar (GPR). Using GPR, students searched for potential aquifer structures, including confining layers and faults. In Oakridge's alluvial aquifer, confining layers appear as deposits of clay. Clay deposits, known as clay lenses, impede groundwater infiltration due to their low permeability. Faults are large vertical fractures found within rock layers, which cause either side of the fracture to shift relative to one another. Faults generate weak points across the aquifer's stratigraphy, allowing groundwater to flow vertically between aquifer layers at a faster rate. Deeper, older groundwater tends to have a higher conductivity than shallow groundwater, and their interactions have the potential to bring dissolved compounds to shallower portions of the aquifer. The incorporation of groundwater with higher conductivity may negatively impact the quality of shallow groundwater.

The second goal was to perform groundwater chemistry analysis in multiple wells across Oakridge, determining how groundwater chemistry differs throughout the aquifer. Groundwater chemistry can indicate groundwater interactions with surrounding features, such as TV Butte to the east of Oakridge. Unlike the alluvial aquifer, TV Butte consists of young, lightly eroded igneous rock. Since younger igneous rock tends to dissolve more minerals into groundwater than older rock, a higher conductivity in groundwater adjacent to TV Butte may indicate that groundwater interactions are occurring between the butte and the alluvial aquifer.

The third goal was to perform a pump test at the city's municipal well field to analyze how the transmissivity of the aquifer has changed over time. Transmissivity is a measurement of how much water can move laterally through a section of the aquifer in a certain time frame. It is used to measure the productivity of the aquifer and can be used as a rough estimate for groundwater availability.

Materials

Students used several different instruments for this project. For the GPR, students used a Noggin SmartCart GPR cart along with Noggin 100 MHz and 500 MHz transmitters. The class used an Emlid Reach real-time kinematic (RTK) GPS system in tandem with the GPR cart. For the chemical analyses, students made the basic water measurements with an Accumet AP115 pH probe and a HoneForest Total Dissolved Solids (TDS) meter. The contaminant readings were made with a HACH DR1900 spectrophotometer, along with several chemical reagents for contaminant detection and distilled water for calibration. The city conducted both municipal well pump tests analyzed in this project.

FIG. 2

Photo credit: Qusheng Jin

Methods

GROUND PENETRATING RADAR

During the GPR phase of the project, the class split Oakridge into three study areas based on Public Land Survey System (PLSS) township sections. The city, located in township 21, was split into three sections: section 15, section 16, and section 17. The students then designed transects in each section based on their proximity to water wells and potential clay lenses seen in well log reports. The class used the Noggin 100 and 500 GPRs to walk over these transects, creating a 2D cross section. Each cross section displayed the water table depth variation across the aquifer beneath Oakridge.

- Transect one, located in section 15, adjacent to the north end of TV Butte.
- Transect two, located in section 16, between the Oakridge Municipal Well Field and Salmon Creek.
- Transect three, located in section 17 along Garden Road.

Hardware: The Noggin 500 GPR utilizes a 500 MHz radio wave frequency. This frequency is ideal for shallow yet detailed imaging of the alluvial aquifer 15 to 20 feet below the surface. The Noggin 100 GPR uses a 100 MHz radio wave penetrating deeper at a lower resolution; imaging subsurface features up to 150 feet deep. An Emlid Reach RTK global navigation satellite system (GNSS) was equipped to both the Noggin 100 and 500 GPRs. The Emlid Reach associated each GPR reading with an elevation profile, tracking elevation changes along each transect.

SOFTWARE

The interval at which radio wave frequencies are returned to the GPR is determined by the number of “stacks” the user chooses. A lower stack number allows for fast, shallow data retrieval, while a high stack number allows for high resolution data retrieval at a slower speed. Initially, the GPRs utilized Dyna-Q software, which automatically adjusts the stack number to the speed of the cart in real-time. On the second transect runs, the Noggin 100 was set to high, manual stack values. Transect one used the 2048 stack setting while transects two and three used 1024 stacks. These high stack settings allow for increased data clarity.

GROUNDWATER CHEMISTRY ANALYSIS

The class performed chemical analyses on groundwater pumped from two separate wells to test for any substantial variations in groundwater chemistry. Students chose two well sites at the eastern and western ends of Oakridge. Site W was in the western part of the city, away from TV Butte while Site E was located along the foot of the butte. These sites were ideal for testing differences in water chemistry and groundwater-butte interactions because Site E's groundwater lies within 1000 feet of TV Butte while Site W's distance isolates the site from potential groundwater chemistry alterations related to the butte. The standing water column in each well was allowed to purge for ~40 minutes. This ensured that tested water was being drawn from the aquifer, not the borehole. Water flow was directed into a glass jar to act as a flow cell. The Accumet pH probe was inserted into this cell, and measurements were taken once the reading stabilized. This device reads the pH, temperature, and oxygen reduction potential (ORP) of the water. For specific conductivity, students used the HoneForest TDS meter. The HACH spectrophotometer was used to measure the levels of sulfide, ferrous iron, and manganese in the water. The machine was calibrated upon every test with distilled water to maintain accuracy.

PUMP TEST

The City of Oakridge's Public Works Sector provides public access to automatic pressure transducer pump test data from the City of Oakridge's municipal well field. The five pump tests data examined in this project came from municipal Well 2 on September 3rd, 2025. Students calculated transmissivity for Well 2 by following the standard procedures of the Cooper-Jacob Line Method.

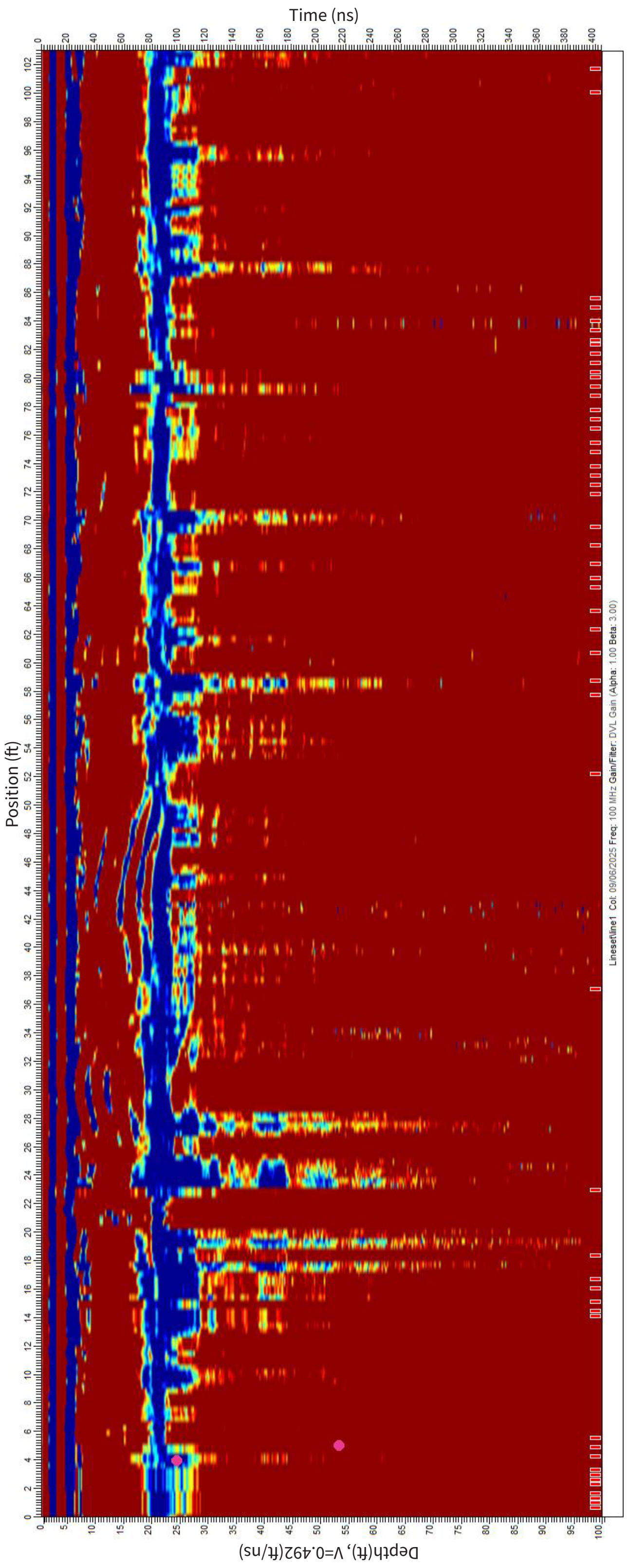
FIG. 3

Photo credit: Qusheng Jin

GROUND PENETRATING RADAR

FIG. 4

2D Cross-section of Transect One, located along the northern end of TV Butte.



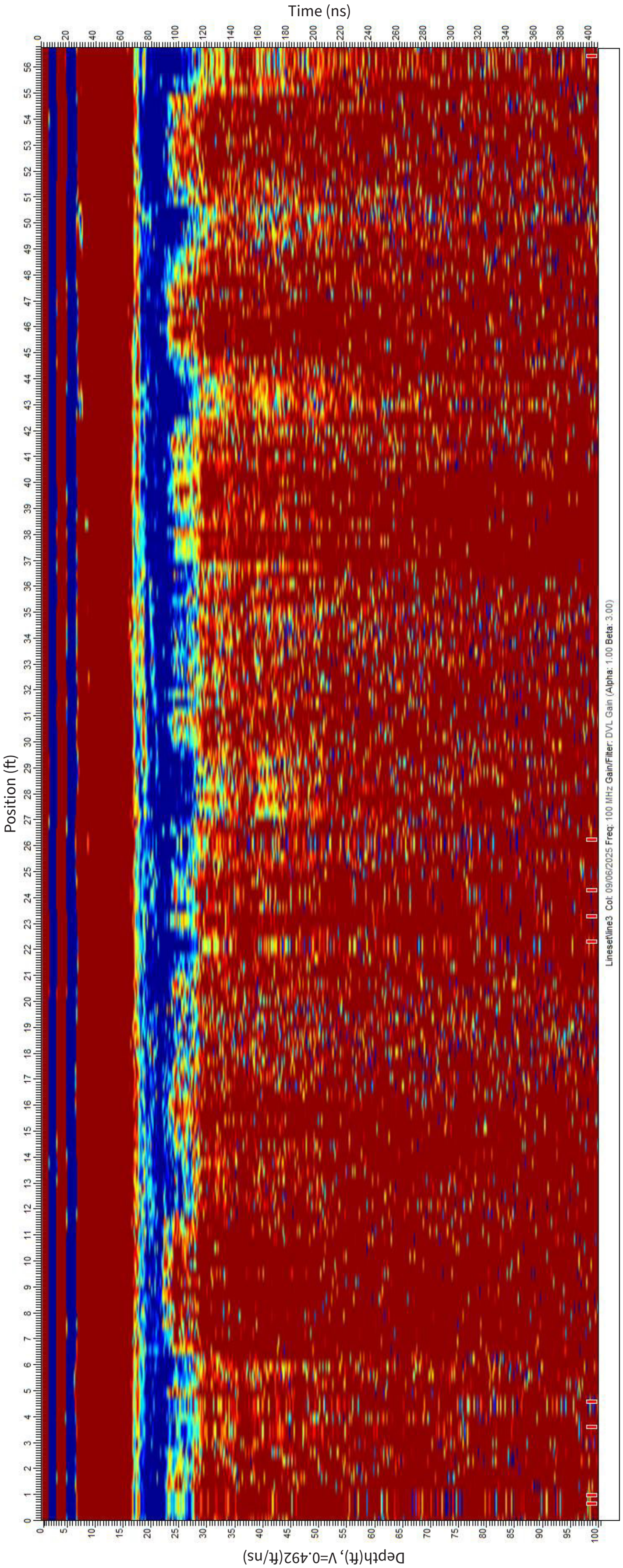
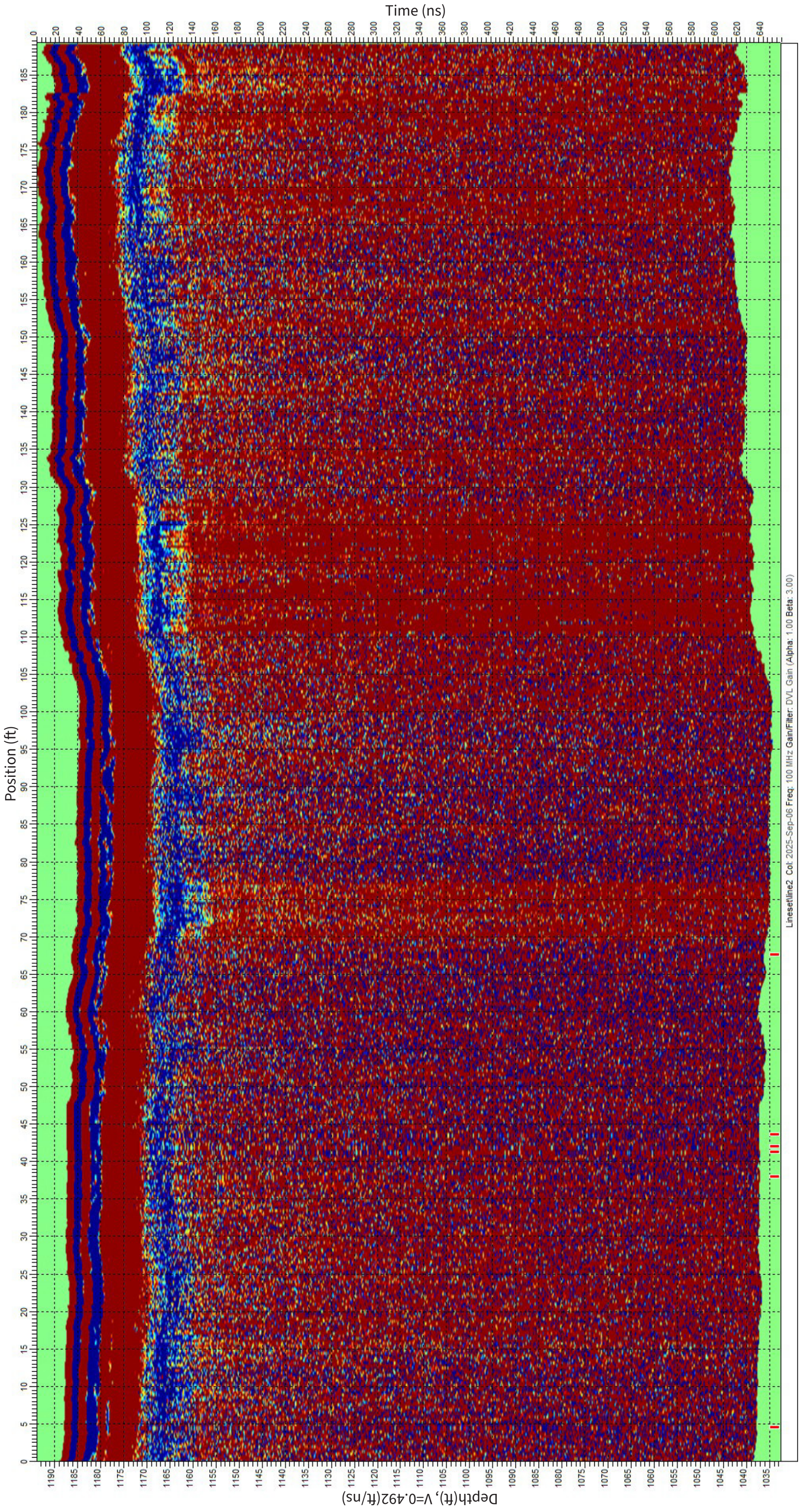


FIG. 5

2D Cross-Section of Transect Two, located between the Oakridge Municipal Well Field and Salmon Creek

FIG. 6

2D elevation-tracked cross-section of Transect Two.



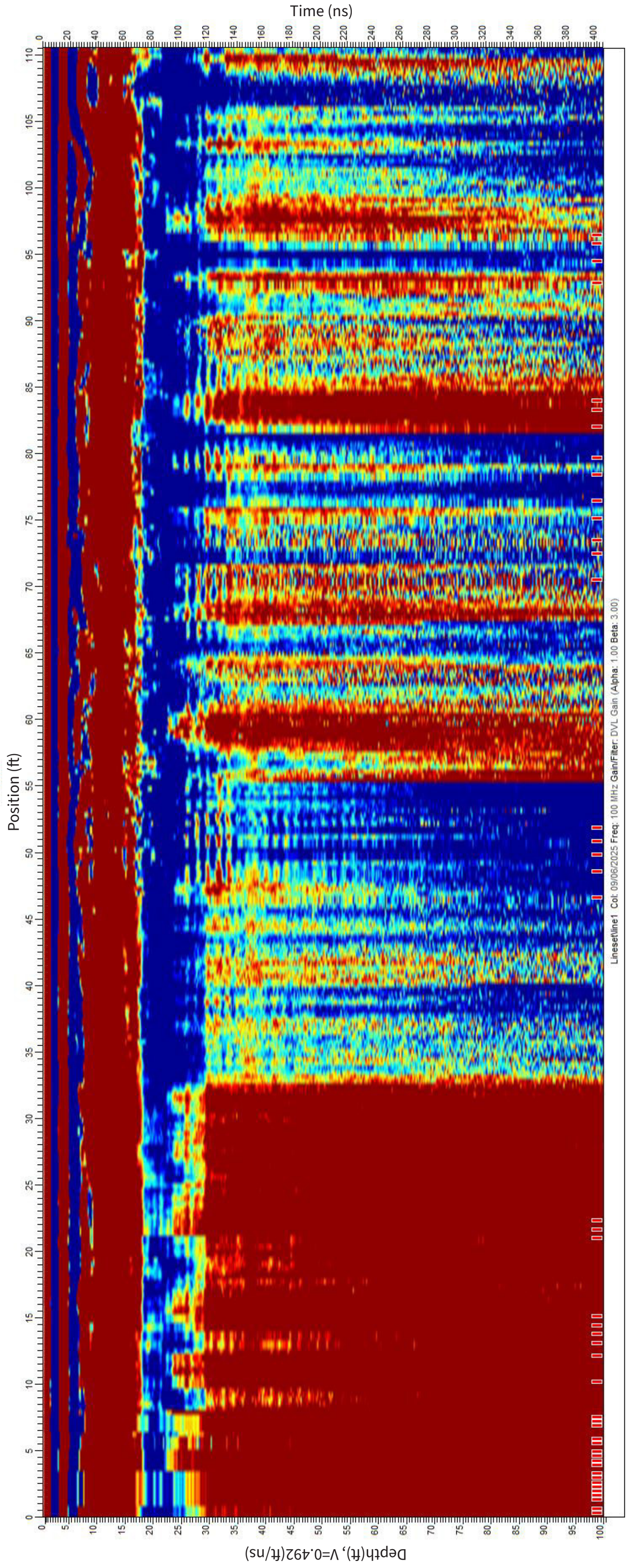


FIG. 7

2D Cross-Section of Transect Three along Garden Road.

Based on the data collected, the water table, denoted by a blue color in the GPR cross sections, follows surface topography at a depth of 20 to 25 feet. This depth is typical and expected for an unconfined aquifer such as the one in Oakridge. Students interpreted a hydraulic gradient of 0.026 ft/ft based on the elevation changes in the elevation-tracked transect two (Fig. 5). This hydraulic gradient is steeper than expected for an alluvial aquifer and may point to the presence of a clay lens. A more plausible reason for the high hydraulic gradient is transect two's proximity to the municipal well field. Wells tend to impact hydraulic gradients by decreasing hydraulic head, leading to an unnatural change in the water table.

Despite difficulties penetrating the water table with the GPR, students imaged subsurface features intermittently in transect one (Figure 1). The feature denoted by a white dashed line in Figure 1 between 37 and 45 feet represents a potential clay lens. The presence of a clay lens adjacent to the well field may highly alter the flow field beneath the wells, with groundwater concentrating around the clay lens as the impermeable layer diverts flow.

It should be noted that the blue lines extending down from the water table between the 33 and 110 foot positions on transect three are not representative of the aquifer structure. The blue lines are likely the result of interference from the water table.

GROUNDWATER CHEMICAL ANALYSIS

Parameter	**Site W**	**Site E**
Temperature	15.9 °C	13.5 °C
pH	6.70	7.99
Redox Potential	7.4 mV	-56.4 mV
Specific Conductivity	157 µS/cm	317 µS/cm
Manganese	0.051 mg/L	0.002 mg/L
Ferrous Iron	undetectable	0.09 mg/L
Sulfide	undetectable	17 µg/L

Well W had a lower pH and specific conductivity than Well E. It also had negligible levels of ferrous iron and sulfide. Well E had lower Oxidation-Reduction Potential (ORP) and manganese levels, as well as detectable ferrous iron and sulfide. The water in Well E was slightly colder than Well W. Most notably, Well E had higher levels of conductivity than Well W. The differences in readings show that there is a substantial difference in groundwater chemistry from the east and west parts of the alluvial aquifer. While the differing concentrations of iron, sulfide, and manganese are consistent with reaction orders found along the redox ladder. The higher levels of conductivity, higher pH, and higher salinity in Well E may suggest groundwater interaction between TV Butte and the alluvial aquifer. Downstream groundwater is often more conductive than groundwater upstream as it has had more time to incorporate dissolved minerals. Since higher values are found upstream at Well E, it can be inferred that mineral compounds are entering the aquifer through groundwater interactions with an eroding mafic rock, such as the relatively young andesite composing TV Butte. While igneous rocks tend to have low permeability, groundwater transport can be aided by fractures and faults within the rock.

PUMP TEST

A transmissivity of 125.1 ± 87.6 m2/d (10,073 ± 7,055 gal/d/ft) and a hydraulic conductivity of 4.7 ± 3.3 m/d were calculated from Well 2 based on the methods above.

Compared to the 1993 well report at the Oakridge Municipal Well Field, the results of the September 3, 2025, pump test suggest that groundwater availability has declined in Oakridge. The 1993 report sites calculated early-time slope transmissivity values of 58,850, 26,400, 85,800, and 60,060 gal/d/ft depending on the year and municipal well. A 1965 datum reports an estimated transmissivity of 30,303 gal/d/ft for Well 2. Although these values are scattered, the 2025 calculation yielded a substantially lower transmissivity. The lower transmissivity suggests a decrease in hydraulic conductivity and/or saturated thickness. A decreasing saturated thickness implies that the groundwater availability of the Oakridge alluvial aquifer is decreasing over time. Decreases in hydraulic conductivity are much less likely, as this would indicate land subsidence and compaction of the aquifer. In the future, this decreasing transmissivity has the potential to threaten Oakridge's municipal water supply.

Reflection

Collecting data using the GPR was a trial-and-error process. The initial GPR data collection process revealed the limitations of the Noggin GPR and its system settings. Some difficulties included issues with the Emlid Reach GNSS, Dyna-Q system settings, and post-process imaging. Furthermore, making more conclusive interpretations on the groundwater interactions between TV Butte and the alluvial aquifer would require more well tests, as a shift in groundwater chemistry between two points may be caused by several factors.

GROUND PENETRATING RADAR

The students initially began collecting GPR data using the Dyna-Q stack setting. While this stack setting allowed for quick data retrieval, it was soon realized that this setting was not optimal for revealing deeper surface features. After multiple runs, the students determined that a stacking number of 2048 was the most optimal for this project. While this stacking number required a very slow walking speed, the GPR was able to penetrate down to 200 feet, allowing the students to image both the water table and potential clay lenses.

Post Processing

In the post-processing stage, the jet color setting allowed for optimal viewing of the water table. Filtering the data using a DVL gain filter and a Beta value of 3.00 allowed for clearer imaging of the water table.

Emlid Reach

For transects one and three, the Emlid Reach data was not captured due to connection issues. This prevented the students from understanding the hydraulic gradient across the entire aquifer and may have contributed to the unusually deep gradient calculated from transect two.

WATER CHEMISTRY ANALYSIS

The groundwater chemistry analysis for this project utilized two wells at opposite ends of the city. While these tests allow for a general understanding of groundwater chemistry and may point to interactions between TV Butte and the alluvial aquifer taking place, it is possible that unidentified faults or varying localized geology played a role in the differing chemistries. Further well testing would provide a more robust and definitive explanation for the high specific conductivity.

PUMP TEST

The pump tests carried out on municipal Well 2 differ seasonally, with the 2025 well test carried out in the late summer, and the 1990 well test carried out in the winter. The extent that these seasonal changes impact transmissivity is uncertain; however, the difference may exaggerate the apparent decrease in transmissivity. Additional tests carried out seasonally would provide a more accurate change in transmissivity between 1990 and present.

SUGGESTIONS

Despite the difficulties faced, the outcome of this project provides useful insights into the alluvial aquifer below Oakridge, and a more comprehensive understanding of water table imaging using GPR. Table 1 shares how each stack setting impacts imaging results.

TABLE 1

GPR stack setting results.

Stack Setting	Results
Dyna-Q	Automatically changes stack number depending on the speed of the cart. This setting may be difficult to manage as it does not capture specified depths.
32	Produces similar results to a stack setting of 4. This setting does not penetrate the water table.
256	Produces mixed results, with unclear imaging below the water table. This stack setting requires slow walking speed.
1024	Penetrates the water table, reaching depths of up to 200 feet. This setting requires a walking speed of 3ft/min.
2048	Produces similar results to a stack setting of 1024. This setting would require a smooth surface and walking speed below 3ft/min to avoid data skips and errors.

Conclusion

The collected data indicate that the water table follows surface topography. This is to be expected of an unconfined aquifer. The chemistry readings suggest interaction between the butte and groundwater, causing variances in groundwater chemistry around the city. The substantially lower transmissivity suggests declining groundwater availability for the city.

A more comprehensive study of the Oakridge Alluvial Aquifer will require additional water well sampling and GPR grid scanning. These additional surveys would provide the City of Oakridge with more insights into how the city's municipal water supply may change in the coming years as well as clarity regarding interactions between the aquifer and the andesite beneath TV Butte. Performing surveys across multiple seasons would also reveal the extent of seasonal recharge and water table elevation fluctuations.

While the well sampling performed in this project provided a broad understanding of the water chemistry across Oakridge, additional sampling from wells beyond the two used in this study would provide more accurate interpretations of interactions between TV Butte and the alluvial aquifer beneath Oakridge. If samples taken in proximity to TV Butte show a similar high specific conductivity trend compared to samples taken further downstream, a link between the aquifer and butte can be interpreted.

The three GPR transects, or line scans, allowed for water table imaging and a limited hydraulic gradient analysis within the aquifer. Analyzing the hydraulic gradient adjacent to TV Butte utilizing another elevation-tracked GPR line scan would provide a more definitive understanding of TV Butte-Oakridge alluvial aquifer interactions. However, unlike grid scans, line scans do not generate a 3D image of the aquifer structure or water table. A 3D image would provide enough data to map the flow field beneath Oakridge. The addition of GPR microplot grid scans adjacent to TV Butte and on the west end of Oakridge would produce highly detailed potentiometric surface maps. A potentiometric surface map would provide insight into groundwater sources and groundwater interactions with subsurface features, as subsurface objects and groundwater sources can be interpreted by contour shapes.

Glossary

Alluvium: Deposits of gravel, silt, sand, and clay from sediments carried within a river.

Aquifer: A rock layer or series of rock layers that contain enough water within its pore spaces to be economically extracted.

Glacial Outwash: Sedimentary deposits originating from glacial melt.

Hydraulic Conductivity: A measure of a rock's ability to transmit fluid, typically in units of meters/day.

Hydraulic Gradient: Change in hydraulic head over a given distance, given as a slope.

Hydraulic Head: Groundwater pressure based on elevation and water column pressure. Hydraulic head determines groundwater flow direction, with flows directed towards areas with lower Hydraulic Head. Hydraulic Head can also be used as a direct estimate for water table elevation.

Igneous: Rock formed through the solidification of magma.

Infiltration: The absorption of surface water into the ground. Infiltration is how aquifers recharge their water supply.

Permeability: The ability of a material to allow fluid to pass through.

Potentiometric Surface Map: A contour map representing the elevation of a water table.

Purge: To release stagnant water from within a well. Purging allows testing of water directly from the aquifer.

Specific Conductivity: The ability of a substance to conduct an electric current. Directly correlated to the number of ions or dissolved compounds in water. See "total dissolved solids."

Standing Water Column: Standing water within a well.

Static Water Level: Depth of water within a well when undisturbed by a pump.

Stratigraphy: The vertical sequencing of rock or sediment layers.

Topography: Land surface indicated by elevation.

Total Dissolved Solids (TDS): A measure of the total amount of dissolved material in water. Has a large impact on specific conductivity.

Transmissivity: The amount of water able to be transferred through a unit area of an aquifer.

Appendix

COOPER-JACOB LINE METHOD

The drawdown per logarithmic cycle was determined by applying linear regression to the Cooper-Jacob line, yielding the equation:

$$D(x) = -10.8 \cdot \ln(x) + 40.814$$

Where D(x) is drawdown at a given time x. The drawdown was calculated at the one-minute and ten-minute mark for each well test, ensuring a 10x time difference, giving us our logarithmic cycle. Solving this equation resulted in drawdowns of 40.8 feet and 16.0 feet, respectively. The drawdown per logarithmic cycle results were then used to calculate transmissivity.

$$T = \frac{2.3Q}{4\pi\, \Delta(h_0 - h)}$$

In this equation, T is transmissivity, Q is the well discharge (pumping) rate in gal/min and $4\pi\, \Delta(h_0 - h)$ is the drawdown per logarithmic cycle. Given a Q value of 450 gal/min, the average transmissivity of well 2 was calculated across the five well tests before being converted into metric units.

Hydraulic Conductivity: Hydraulic conductivity of the aquifer beneath well 2 was found using the equation:

$$K = T / b$$

Where K is hydraulic conductivity, T is transmissivity, and b is the saturated thickness of the aquifer. The saturated thickness estimate for the aquifer is 100 feet, taken from Table 3 of the 1993 Wellfield Hydrologic Assessment.

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