



11.0 FACTSHEET

OVERVIEW WHIDBEY GEOLOGY

There is a profound strategic risk in attempting to manage 21st-century water demand using 20th-century data. The hydrogeologic baseline for Whidbey Island was established in a different climatic and demographic era, rendering current decision-making fragile and reactive.

WHIDBEY GEOLOGY Whidbey Island's Water: A Guide to Our Underground Resources

1. Introduction: The Hidden Water System

Whidbey and Camano Islands rely on a unique and finite underground water system that is fundamentally different from the mainland. For most residents, the islands are **hydrologically isolated**. This means there is no "underground pipe" or hidden aquifer bringing freshwater from the Cascade Mountains to the islands. Instead, nearly all the water available comes from local precipitation that soaks into the ground.

With the exception of Oak Harbor, Whidbey Island Naval Air Station and a portion of northeast Camano Island that get their water supply off-island. For the rest of our community, the groundwater system is entirely self-contained, making our water supply highly sensitive to local pumping and environmental conditions.

2. The Geological Foundation: Bedrock vs. Glacial Deposits

The island's ability to store and provide water is dictated by its geological "floor" and the thick layers of debris left behind by ancient glaciers. Understanding these boundaries is vital: we cannot simply "drill deeper" if our primary sources run dry, as the bottom of the system consists of non-water-bearing rock.

Feature	Glacial Deposits	Pre-Tertiary Bedrock (Basalt)
Composition	Unconsolidated layers of sand, gravel, silt, and clay.	Hard, dense, and solid volcanic rock.
Thickness	Reaches depths of up to 3,000 feet .	Forms the "bottom" or "floor" of the entire system.
Water Role	These layers act as the primary storage tanks (aquifers) for the island's freshwater.	Yields little to no water ; acts as a dense boundary that prevents further downward movement.
Visibility	Makes up the majority of the island's subsurface.	Notably exposed at the surface at Deception Pass and Rocky Point .

3. The Five-Layered Aquifer System

The U.S. Geological Survey (USGS) has identified five distinct aquifer units beneath the islands. These layers vary in productivity and depth.

Aquifer Unit	Composition	Key Characteristics
Unit E (Youngest)	Sand and gravel	Up to 160 ft thick; occurs in upland areas. It is "locally discontinuous," meaning it may be present on one property but absent a mile away.
Unit D	Sand	Up to 335 ft thick; described as " very productive " and a primary source for wells.
Unit C	Sand	Up to 440 ft thick. Along with Unit D, this is where most recharge eventually discharges back to the sea.
Unit B	Sand	Up to 180 ft thick; locally contains saline (salty) water.
Unit A (Oldest Known)	Sand and gravel	Up to 50 ft thick; the deepest level (300 to 600 ft below sea level). Deeper aquifers may exist, but no data is currently available.

4. The Path of Water: Recharge and Movement

A hydrogeologist looks at the island as a dynamic system of pressure and flow. Based on USGS simulations, water follows a specific lifecycle:

- **Vertical and Lateral Flow:** Groundwater generally moves downward through the upper layers. However, there is a significant depth limit: most water stays within the top three layers (Units E, D, and C). Only a very small fraction ever moves deeper than Aquifer C.
- **Subsea Discharge:** Instead of sitting still, freshwater moves laterally toward the shores and discharges as **springs below sea level** into Puget Sound.
- **The Pressure Barrier:** The **freshwater-seawater interface** is a pressure-based boundary. Because freshwater is lighter than saltwater, it "pushes" outward against the sea. If we pump too much freshwater, we lose that outward pressure, allowing the denser saltwater to move inland.
- **Island Isolation:** Between Whidbey and Camano Islands, this interface intersects the bottom of Puget Sound, creating a physical barrier that prevents fresh groundwater from moving between the two islands.

5. The Risk: Seawater Intrusion and Chloride Contamination

Because we are surrounded by the sea, our freshwater supply exists in a delicate balance. When we over-pump, we invite the Sound into our wells.

Seawater intrusion occurs when the "push" of the freshwater system drops, allowing saltwater to enter our aquifers.

Key Data Points:

- **Chloride Indicator:** A chloride concentration exceeding **100 mg/L** is the primary signal of seawater intrusion.
- **Historical Impact:** In 1981, **24% of wells** drilled below sea level showed chloride concentrations above 100 mg/L.
- **Scale of the Problem:** While most affected wells did **not exceed 1,000 mg/L**, any level over 100 mg/L indicates the freshwater-seawater balance has been compromised.

6. Resident Takeaways

1. **A Self-Contained System:** With the exception of the City of Oak Harbor, WINAS, northeast Camano's connection to mainland flow, our water is entirely local. We are the stewards of a closed system.
2. **Bedrock is the Limit:** The dense Pre-Tertiary bedrock seen at Deception Pass forms a definitive floor. Drilling into this rock will not yield sustainable water.
3. **Monitor Your Well:** Residents with wells, especially those drilled below sea level, must monitor for chloride. Concentrations above 100 mg/L are a clear warning sign.
4. **Productivity and Protection:** Unit D is our most productive aquifer, but because it also serves as a major discharge point to the sea, it requires careful management to maintain the pressure needed to keep saltwater out.
5. **Depth Nuance:** While Aquifer A is the deepest known unit, the lack of data on deeper layers and the presence of saline water in Unit B suggest that "deeper" is not always "better" or "fresher."