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Salish Sea Ecosystem Conference

2018 Salish Sea Ecosystem Conference
(Seattle, Wash.)

Apr 4th, 1:45 PM - 2:00 PM

Geomorphic challenges to restoring Puget Sound beaches

Hugh Shipman

Washington State Dept. of Ecology, United States, hugh.shipman@ecy.wa.gov

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Geomorphic Challenges of Beach Restoration

Hugh Shipman
WA Department of Ecology

4 April 2018

Salish Sea Ecosystem Conference
Seattle

Armor Removed: 1980

Beach Restoration

Impairment

- **Shoreline armor**
- Other structures – piers, groins, ramps,
- Historic fill and debris
- Altered stream mouths and tidal inlets

Tools

- **Armor Removal**
- **Beach nourishment**
- Structural elements (often large wood)
- Excavation and regrading
- Vegetation



Armor Removed: 2012

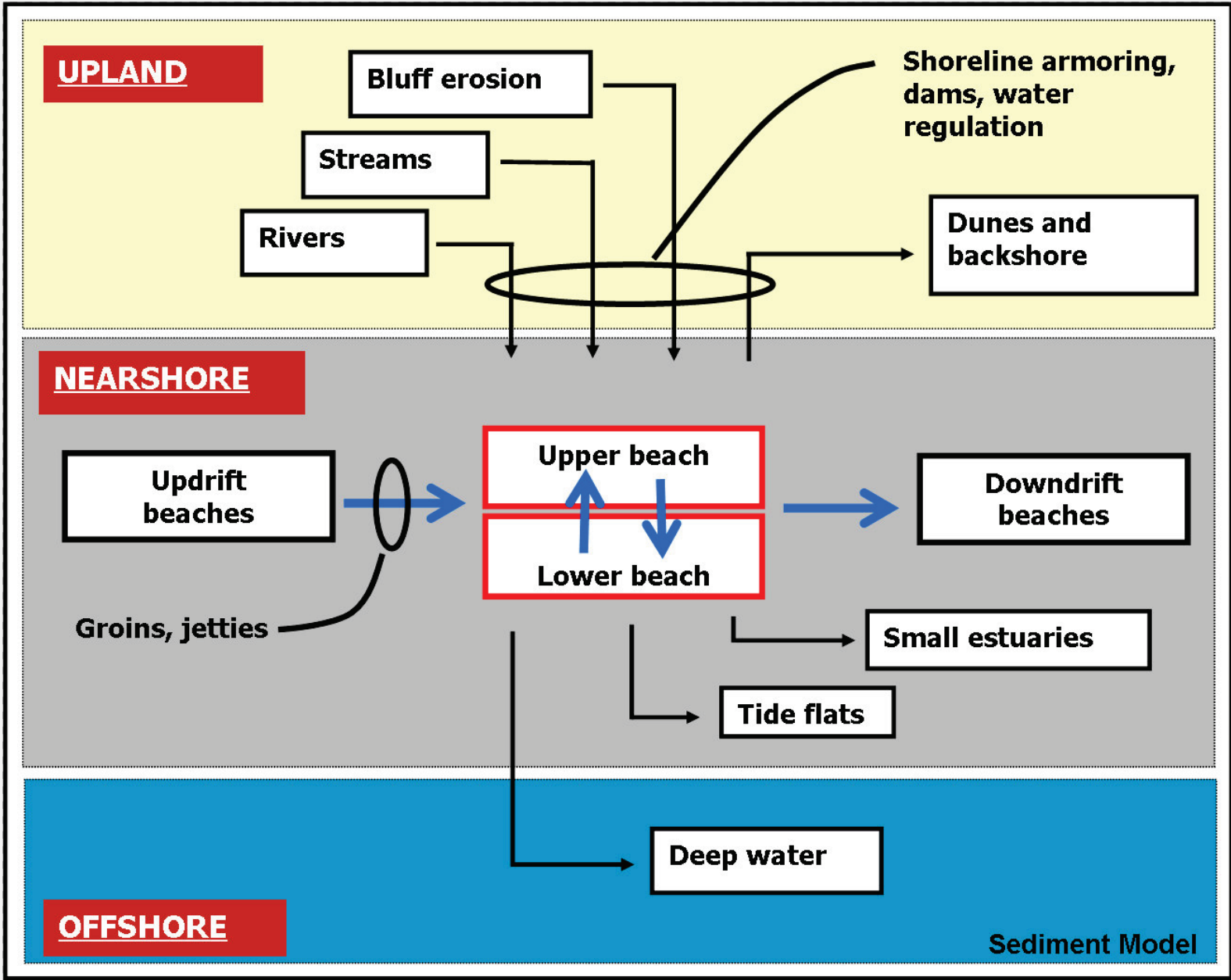
Process-Based Restoration

Geomorphic Process = **SEDIMENT MOVEMENT**

- **Short-term, site scale**
 - Erosion, transport, deposition
 - Scarps and berms
- **Medium-term, reach scale**
 - Bluff erosion and sediment delivery
 - Overwash
 - Shifting stream mouths, tidal inlets
- **Long-term, regional scale**
 - Shoreline retreat, landform migration
 - Drift cell processes
 - Landform evolution, *habitat formation*

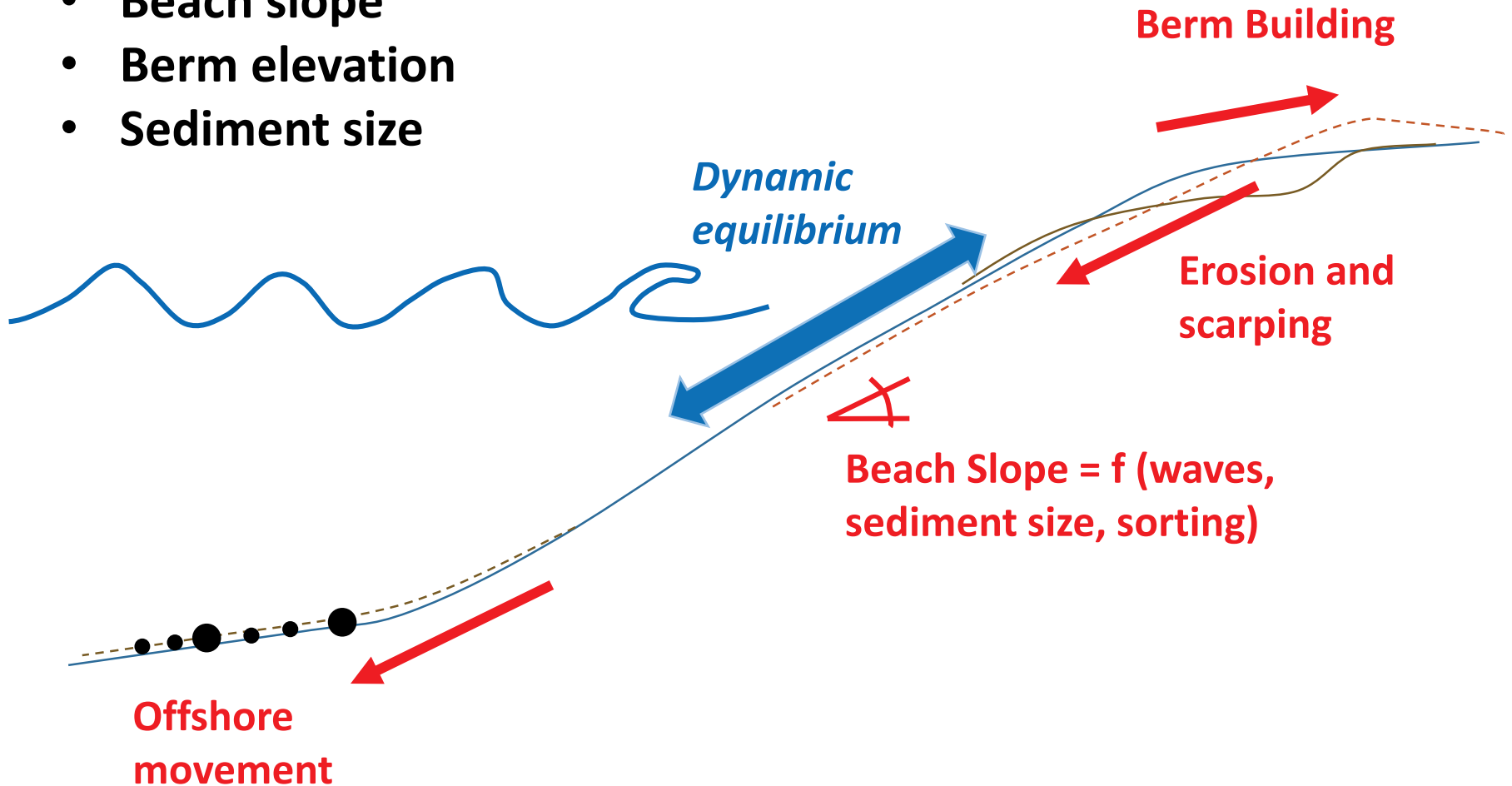


Sediment Budgets



Cross-shore (profile)

- Wave energy
- Beach slope
- Berm elevation
- Sediment size



Beach Profile

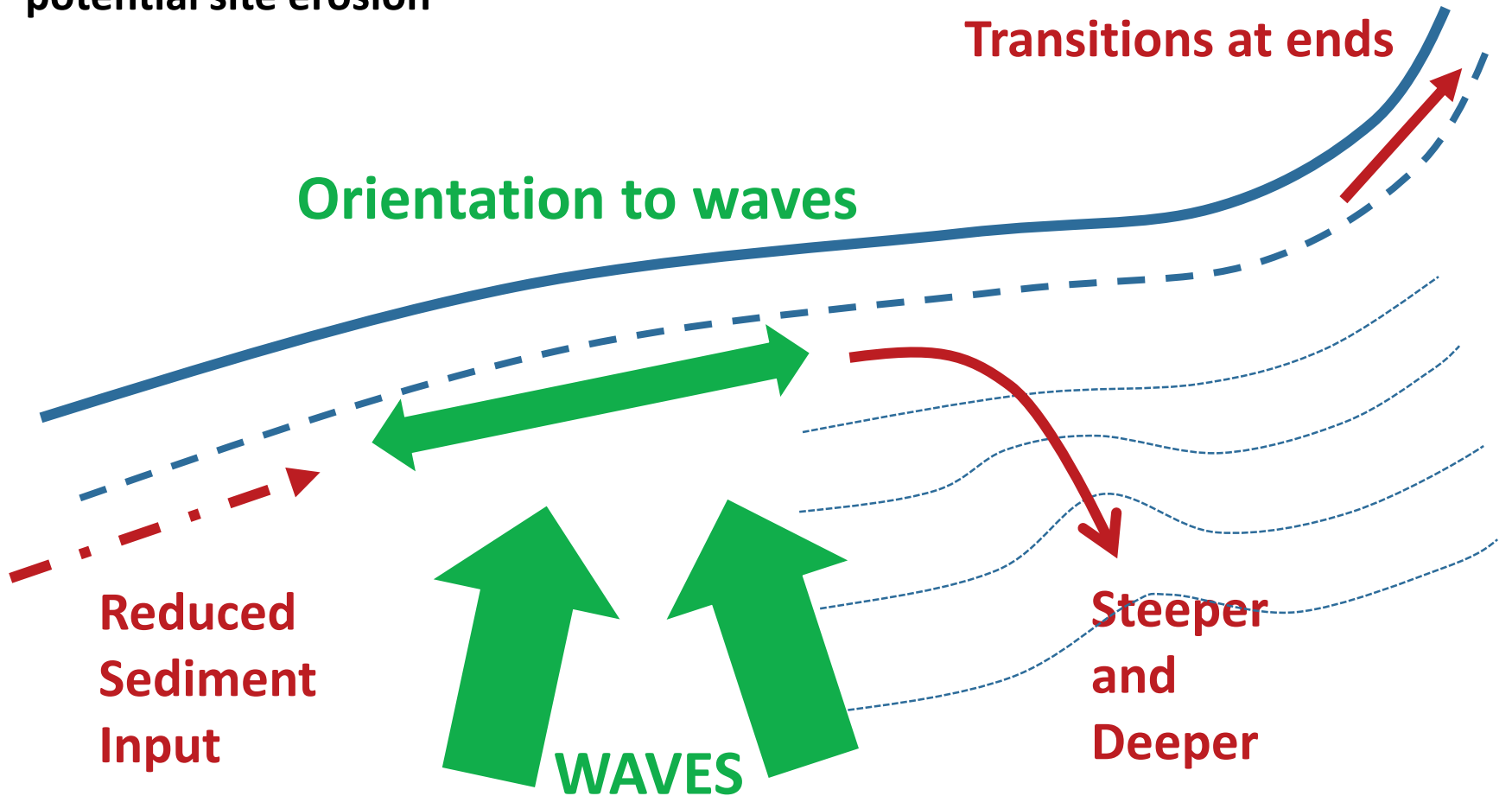


Longshore (plan view)

Loss of sediment leading to potential site erosion

Transitions at ends

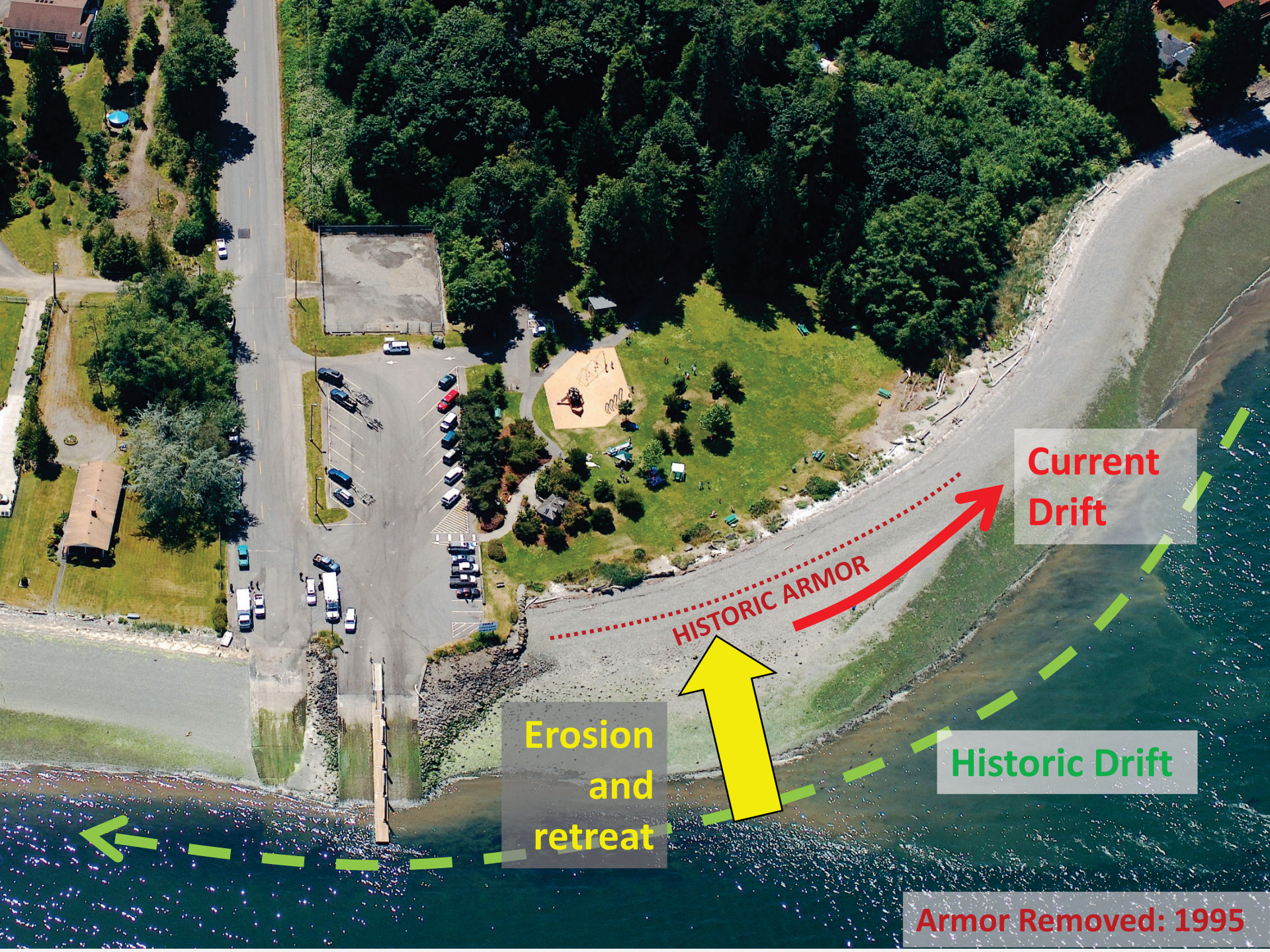
Orientation to waves



Reduced
Sediment
Input

WAVES

Steeper
and
Deeper



Current Drift

HISTORIC ARMOR

Historic Drift

Erosion and retreat

Armor Removed: 1995

Stream/Tidal Flow

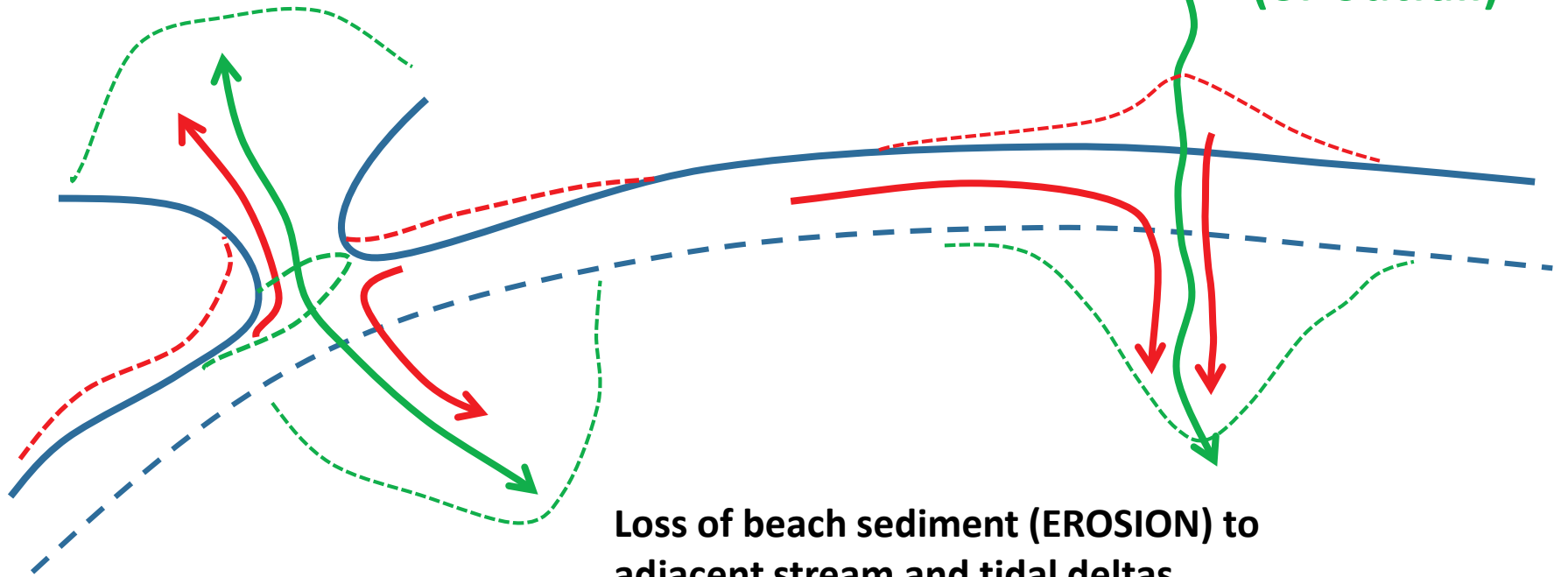
UPLAND

Tidal Inlet

Stream Mouth
(or outfall)

Loss of beach sediment (EROSION) to
adjacent stream and tidal deltas

PUGET SOUND





Stream Delta

Armor Removed: 2016

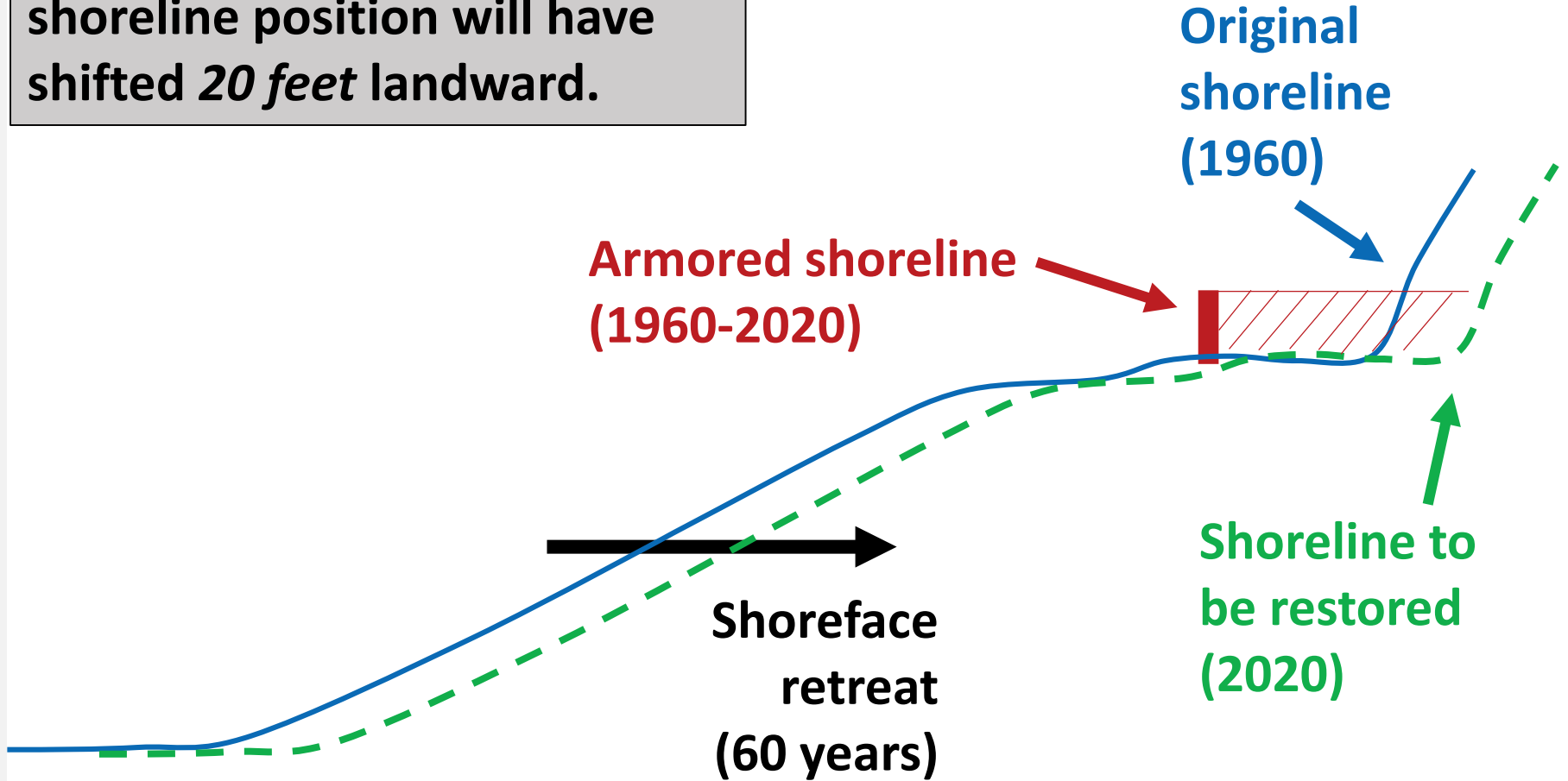


Tidal Inlet

Armor Removed: 2008

Chronic retreat

60 years @ 4"/year, natural shoreline position will have shifted *20 feet* landward.



Retreating Spit



Retreating Bluff



Armor Removed: 2011

Armor Removed: 2017

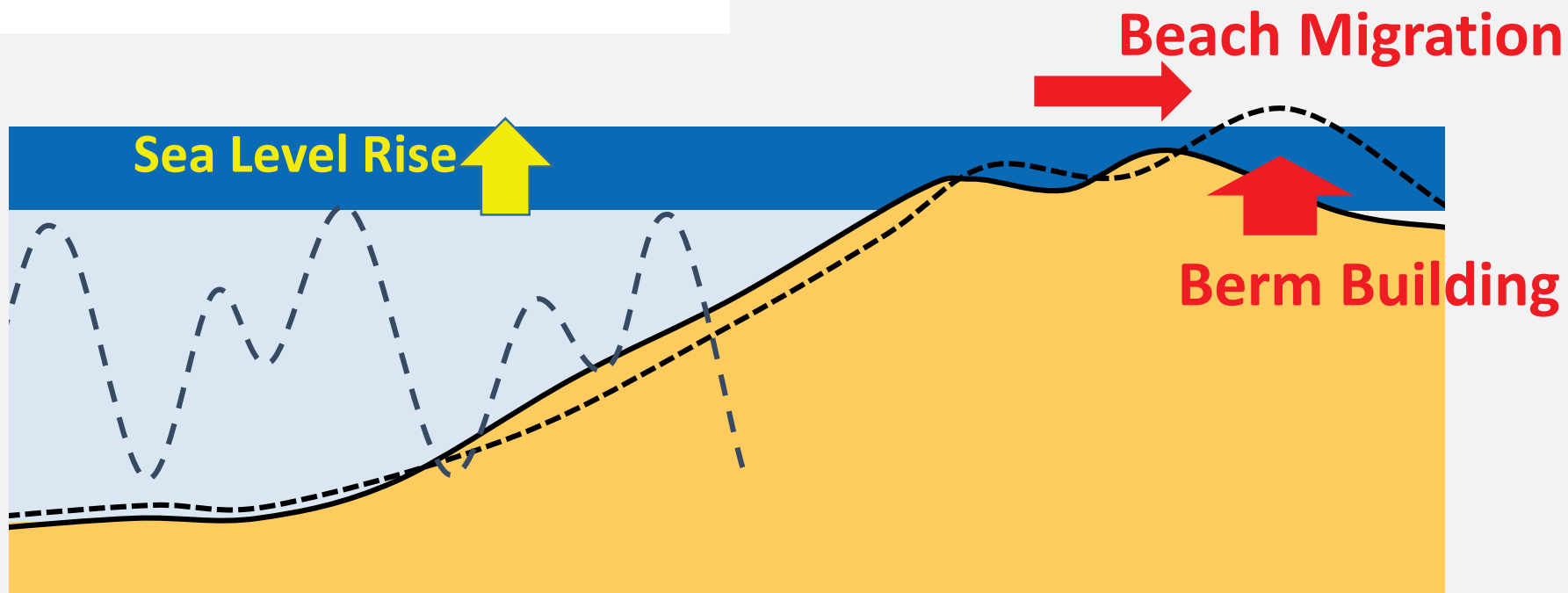
Challenges

- **Importance of sediment movement**
 - Understand local sediment budget
 - Anticipate significant sediment sinks
- **Need for space**
 - Shoreline may need to shift
 - Flexibility to allow landform to evolve
- **Restoration may be a moving target**
 - Shoreline continues to change
 - Future conditions ~~may~~ will be very different
- **Restore processes; not configuration**

Looking Ahead

- What does restoration mean, when nothing will be the same as it was!
- Even the *natural* condition will be different.
- Resilience of beaches (and marshes, too) will require sediment AND space.

Armor Removed: 2006?



Summary

- Beach restoration:
 - Supply sediment
 - Provide space
 - Allow system to evolve
 - There will always be constraints:
 - Introduce structural elements *cautiously and creatively*

Armor Removed: 2006