Fact Sheets: ***Economics***

General Reasoning: Roy and Sharon's decision to alter or maintain their shoreline may involve immediate and long-term financial costs. Their options differ in terms of installation and permit costs, expected lifespan and maintenance requirements. Additionally, Roy and Sharon's decision may influence the value of their property.

Specific Considerations:

Bulkhead or Seawall:

- Installation cost of $500 per linear meter ($15,000 total cost);
- Permit cost of $250;
- Expected lifespan of 28 years; and
- Annual maintenance requires $875 and 12 days of labor [1,2,3]

Riprap or Rubble Revetment:

- Installation cost of $450 per linear meter ($13,500 total cost);
- Permit cost of $250;
- Expected lifespan of 38 years; and
- Annual maintenance requires $1,000 and 10 days of labor [1,2,3].

Restore Saltmarsh:

- Installation cost of $300 per linear meter ($9,000 total cost);
- No permit required for only planting; and
- Expected lifespan is potentially infinite, but periodic replanting may be needed [1,2,3].

Restore Saltmarsh and Construct Breakwater:

- Installation cost of $600 per linear meter ($18,000 total cost);
- Permit cost of $250;
- Expected lifespan of 38 years, but periodic replanting may be required; and
- Annual maintenance of the breakwater is unknown [3,4].

Do Nothing:

- No installation or permit costs;
- Erosion continues at 0.5 meters per year resulting declined in property value; and
- Annual maintenance requires $425 and 14 days of labor [1].

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Fact Sheets: ***Environmental Impact***

General Reasoning: The Caldwell's, particularly Sharon, are concerned about the environmental impacts of stabilizing their shoreline. Each stabilization option has a different effect on the ecosystem functions and services provided by Roy and Sharon's shoreline. These include the ability of the shoreline to serve as habitat for organisms such as fish, birds, and crabs and to filter out nutrients and pollutants from the bay and stormwater runoff.

Specific Considerations:

Construct bulkhead or seawall: Bulkheads and seawalls provide poor habitat for fish, crabs, and birds [1]. Bulkheads also sever the connection between upland vegetation and the water, eliminating shallow subtidal habitat and increasing stormwater runoff and reducing nutrient and pollution filtration [2,3].

Construct riprap or rubble revetment: Revetments provide complex habitat for fish, shrimp, birds and wildlife [1]. However, the introduction of rock or rubble into the ecosystem can also provide habitat for invasive animals and plants [4]. Like bulkheads, riprap does not filter nutrients or pollution from the water column.

Plant salt marsh: Planting salt marsh restores the shoreline to its previous condition without introducing artificial substrates or features to the shoreline. Salt marshes provide numerous ecological benefits including nutrient and pollution filtration and serving as habitat for a variety of organisms, including fish, crustaceans, and birds [3,5,6].

Plant salt marsh and construct breakwater: Considered to be a hybrid between the natural and engineered approaches [6], planting salt marsh restores the shoreline to its previous condition, while the addition of a breakwater introduces new, artificial structure into the shoreline habitat. Breakwaters can provide complex habitat for marine organisms, but may also serve as habitat for non-native species [4,6,7].

Do Nothing: Some species of fish and mobile crustaceans also utilize open sand or mudflat habitat that is present along eroding, unvegetated shorelines [7,8]. However, organisms that depend on structured habitat, such as salt marsh or oyster reefs, would be reduced in number or completely absent from this type of shoreline [3].

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Fact Sheets: ***Protection from Coastal Hazards***

General Reasoning: Living along the coast subjects waterfront residents to a variety of coastal hazards including erosion and storms. The primary reason the Caldwell's want to stabilize their shoreline is to prevent erosion and loss of their property. This includes erosion caused by storm events, daily waves activity, and boat wakes. Each stabilization option provides a different level of protection from erosion and flooding.

Specific Considerations:

Construct bulkhead or seawall: Bulkheads and seawalls provide some level of protection from waves and flooding for upland properties [1-2]. However, bulkheads and seawalls may cause accelerated rates of erosion. Bulkheads and seawalls can also fail during hurricanes and strong coastal storms and can increase damage to upland properties by releasing large amounts of destabilized sediment upon collapse or failure [3].

Construct riprap or rubble revetment: Riprap or rubble revetments can protect the landward shoreline from erosion and reduce wave energy [4-5], but do very little to reduce flooding. There is some evidence that revetments can perform better than bulkheads during hurricanes [3], however; revetments can also fail when the wave action is high enough during a storm event.

Plant salt marsh: Planting salt marsh will stabilize the shoreline and will also maintain a low, stable slope to the shoreline, reducing the potential for erosion [5]. Salt marshes can be resistant to erosion and buffer flooding during some storm events [4,6], but major storms can cause significant scouring and erosion requiring replanting.

Plant salt marsh and construct breakwater: Planting salt marsh and constructing a breakwater will stabilize the shoreline sediments, as well as reduce wave energy at the shoreline. Salt marshes can be resistant to erosion and buffer flooding during some storm events [4,6].However, stronger storms could cause significant scouring of the marsh and require replanting.

Do Nothing: Erosion of the shoreline will continue and the remaining sediment and vegetation along the shoreline will be lost over time. The shoreline will be vulnerable to high rates of erosion and flooding during storm events, particularly when those storms include a storm surge and large waves [6].

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Fact Sheets: ***Legal Concerns***

General Reasoning: Considering the recent threat of a lawsuit made by their neighbor, the Caldwells are very concerned about the legal implications of their decision. According to their attorney, the major factor they Caldwell's should be concerned with is how their shoreline condition directly affects their neighbors' shorelines.

Specific Considerations:

Bulkhead or Seawall: Bulkheads and seawalls reflect wave energy and accelerate erosion rates on adjacent shorelines [1-3].

Riprap or Rubble Revetment: Riprap or rubble revetments are unlikely to have a negative effect on neighboring shorelines [1].

Restore Saltmarsh: Restored saltmarsh is unlikely to have a negative effect on neighboring shorelines if it is effective at preventing further erosion [1].

Restore Saltmarsh and Construct Breakwater: It uncertain how the breakwaters could influence neighboring shorelines. Additionally, submerged breakwaters may create a navigational hazard for recreational boaters.

Do Nothing: If no action is taken, the Caldwell's shoreline will likely continue to erode. At least one neighbor claims this erosion is damaging his property.

References:

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Fact Sheets: ***Recreational & Sociocultural***

General Reasoning: Roy and Sharon spend most of their free time kayaking, fishing, photographing birds and wildlife, and swimming in the bay waters of their backyard. For Roy, the ability to harvest flounder and blue crabs is very important so that he can teach his children how to respect and enjoy the bay the same way his father and grandfather taught him. For Sharon, observing and photographing birds and listening to waves crash on the shore connects her to outdoors as she watches the kids play on their shore. Roy and Sharon are very concerned that their decision may negatively affect their ability to enjoy the bay.

Specific Consideration:

Bulkhead or Seawall: Bulkheads and seawalls prevent waves from crashing on the shore and alter the nearshore bottom from a sloping shore to a deeper more uniform depth [1]. All of these changes will likely result in fewer fish, crustaceans, and birds, which need shallow shore habitat) near the Caldwell's shore [2]. These changes will also result in a loss of the shallow, low-sloped shoreline that provides easy access to the bay and where the Caldwell's children used to play.

Riprap or Rubble Revetment: Riprap or rubble revetments make it challenging to access the water, but the natural slope of the shoreline remains largely the same and waves crash onto the shore [3]. Fish, crustaceans, and birds will still likely utilize the nearshore habitat [2].

Restore Saltmarsh: Saltmarsh habitat was the natural condition of the shoreline and will buffer waves crashing on the shore. Saltmarsh creates a natural barrier to accessing the water, provides excellent habitat for fish, crustaceans, and birds [4].

Restore Saltmarsh and Construct Breakwater: The combination of planted saltmarsh and a breakwater restores the shoreline to its natural condition and the breakwater provides added protection for the shore by buffering offshore waves [5]. Accessing the water is challenging because of the marsh, but the presence of the breakwater and potentially oysters could result in clearer and calmer waters [6]. However, the breakwater could also provide an obstacle or hazard for boating or swimming near the shore. The complex structure of the breakwater and the marsh provide excellent habitat for fish, crustaceans, and birds.

Do Nothing: The current condition of the Caldwell's shoreline allows easy access to the water, but the lack of complex habitats means fewer fish, crustaceans, and birds.

References:

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