

*Science, Service, Stewardship*



# Construction in the Floodplain

Spring 2011 NMFS/FEMA  
Workshops  
DeeAnn Kirkpatrick

**NOAA  
FISHERIES  
SERVICE**

NOAA



## 3 Case Studies

1. New Development  
(outside Protected Area)
2. Redevelopment  
(outside Protected Area)
3. Redevelopment with greater than 10%  
increase in footprint (inside Protected  
Area)



# General Steps in Making Effects Determinations

1. Review Background/Project Description
2. Analyze Effects (direct, indirect, cumulative)
3. Evaluate BMPs/Mitigation
4. Make Effects Determination



# General Effects Analysis

Determine what habitat features and functions will be affected by the project compared to the environmental baseline

Consider duration, timing, severity, proximity, etc. of effects



## Evaluate BMPS/Mitigation Measures

Consider available options to avoid, rectify, compensate the loss and evaluate the effectiveness of each

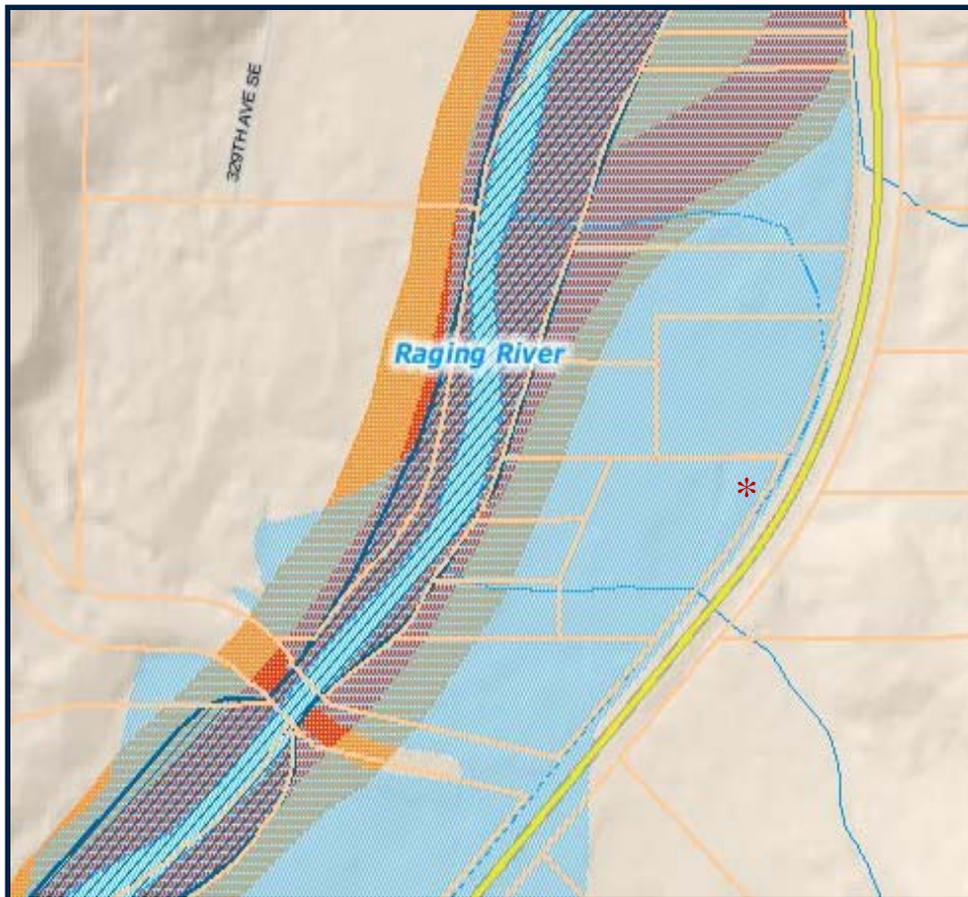


## Case Study 1 Background Information

- Project Area – upper floodplain of large river
- Habitat Conditions – (environmental baseline) disturbed pioneer vegetation species on site, forested off site
- Presence of listed species (including timing and life stage) - steelhead and Chinook



# Case Study 1 - Project Location



## Legend:

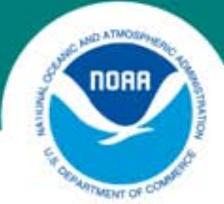
CZM – Orange

100-year Floodplain-  
light blue

Parcel Boundary –  
Beige

Streams – dark blue

House location - \*



# Case Study 1

## Project Description

- Infrastructure - house, yard, driveway, patio, 2,700 ft<sup>2</sup>
- Pin construction
- Grading 700 ft<sup>2</sup>  
(driveway, patio)
- Clearing – 3000 ft<sup>2</sup>  
blackberry, alders  
grasses

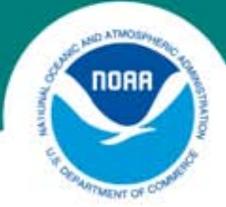




## Case Study 1 - Analyze Effects, Evaluate BMPs

### **Flood Storage and Fish Habitat**

- No flood storage removed
- Project removed 3,000ft<sup>2</sup> fish habitat
- Project created greater area of fish habitat, planting 6,000 ft<sup>2</sup> of diverse vegetation on site



# Case Study 1 - Analyze Effects, Evaluate BMPs

## Stormwater – LID

- Pin construction
- Rain Garden





## Case Study 1 - Analyze Effects, Evaluate BMPS

**Stormwater** - Collecting and dispersing roof-top runoff to rain

barrel and rain garden

Dispersing runoff from  
driveway and patio to  
porous pavers





## Analyze Effects and Evaluate BMPs (cont.)

**Vegetation –**  
Replaced  
function by providing  
2x cleared area,  
Added plant diversity



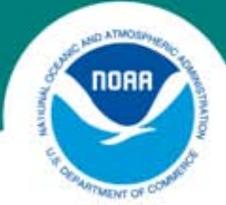


## Analyze Effects and Evaluate BMPs (cont.)

### **Bank Stability –**

No bank stabilization  
needed to protect  
house located  
away from river  
channel and  
direct flow path





## Analyze Effects and Evaluate BMPs (cont.)

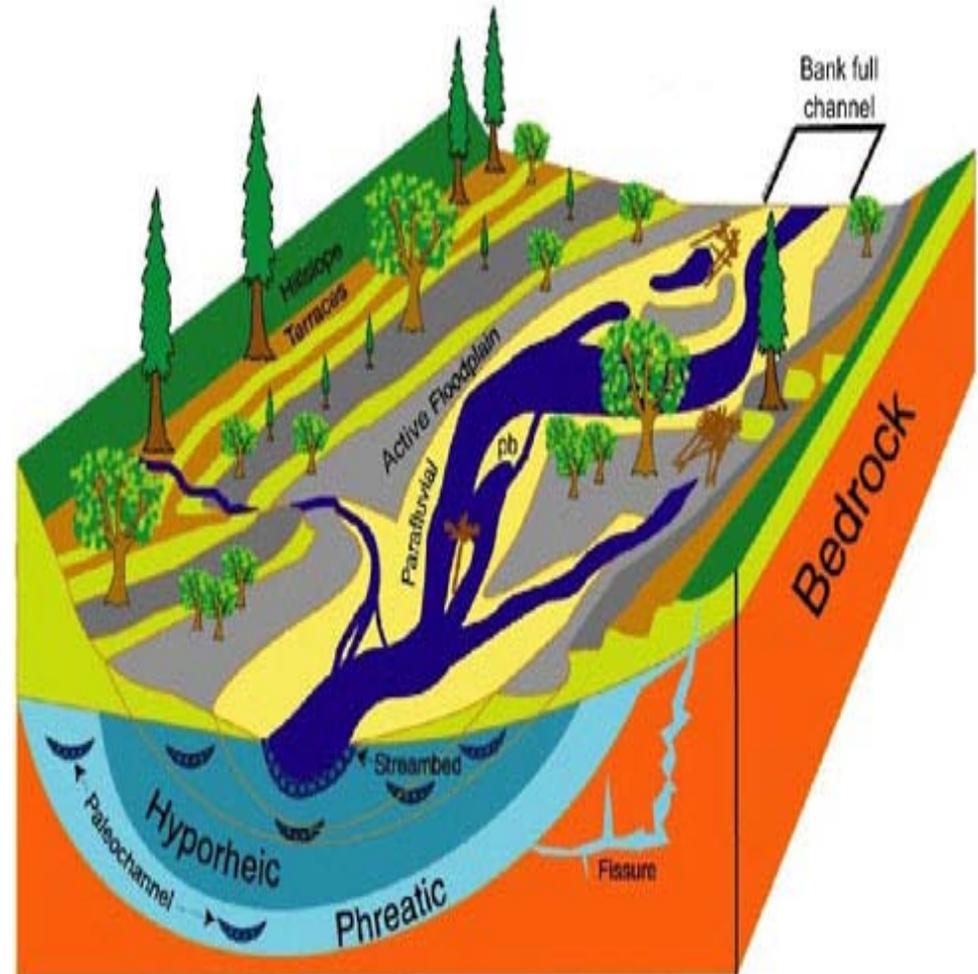
### **Channel Migration** – house sited outside of identified CMZ

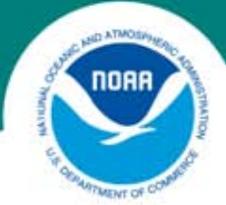




## Analyze Effects and Evaluate BMPs (cont.)

**Hyporheic Zone** –  
Surface, groundwater  
hyporheic zone flow  
exchange main-  
tained due to pin  
construction and sw  
infiltration measures

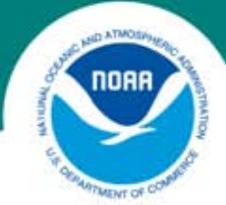




## Analyze Effects and Evaluate BMPs (cont.)

**Wetlands –**  
No wetlands  
affected on site





## Analyze Effects and Evaluate BMPs (cont.)

**Large Wood** – 5 pieces of wood removed  
from building  
site

Replaced on  
site in lower  
floodplain





## Case Study 1 Summary

### Effects:

Clearing 3000 ft<sup>2</sup>

Rooftop runoff 2000 ft<sup>2</sup>

Grading 700 ft<sup>2</sup>  
(driveway, patio)

Hyporheic Zone

Large wood – 5 pieces

Bank stability, CMZ, WL

### BMPs/Mitigation:

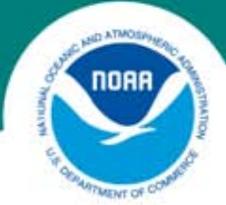
6000 ft<sup>2</sup> planted fish habitat  
all infiltrated

all infiltrated

infiltrated under house

Replaced on site

No change



# Case Study 1 - Effects Determination

NE – No Effect

NLAA – Not Likely to Adversely Affect

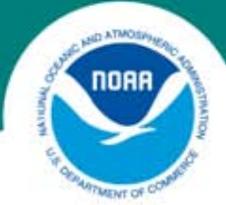
LAA – Likely to Adversely Affect

Your choice???

# Case Study 1 Effects Determination



NLAA – Not Likely to Adversely  
Affect

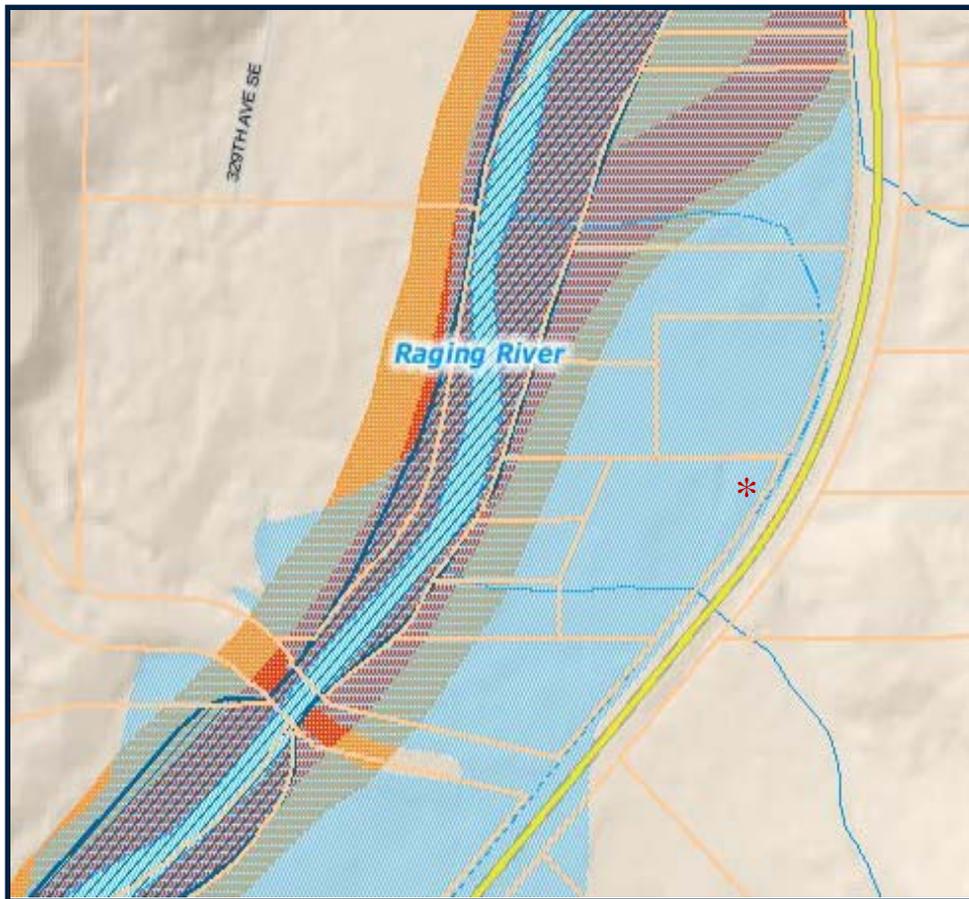


## Case Study 2 : Redevelopment

Outside the protected area, in the  
floodplain



# Case Study 2 Project Location



## Legend:

CZM – Orange

100-year Floodplain-  
light blue

Parcel Boundary –  
Beige

Streams – dark blue

House location - \*



## Case Study 2

### Background Information

- Project Area – upper floodplain of small river
- Habitat Conditions – cleared except for 300 ft<sup>2</sup> wetland, disturbed vegetation off site
- Fish presence – steelhead and Chinook



## Case Study 2 Project Description

- House addition -1,350 ft<sup>2</sup> in upper floodplain on fill
- Clearing - already cleared except 300 ft<sup>2</sup> wetland
- Fill – 150 yds<sup>3</sup> placed to elevate addition and fill 300 ft<sup>2</sup> wetland
- Grading 1,400 ft<sup>2</sup>
- No BMPs or mitigation measures



## Case Study 2 Analyze Effects

- Flood Storage and Fish Habitat – lost 1700 ft<sup>2</sup> /150 yd<sup>3</sup>
- Stormwater – untreated/uncontrolled from 1350 ft<sup>2</sup>
- Vegetation – removed 300 ft<sup>2</sup>
- Wetlands – filled 300 ft<sup>2</sup>
- Hyporheic zone – no infiltration provided
- Bank Stability –no change
- Channel Migration – no change
- Large Wood – no change



## Case Study 2 Effects and BMP Summary

### Effects:

Wetland & House fill 150 yd<sup>3</sup>

C & G (300 ft<sup>2</sup> + 1400 ft<sup>2</sup>)

Roof runoff

Hyporheic Zone

Bank stability

CMZ

LW

### BMPs/Mitigation:

None

None

None

None

No Change

No Change

No Change



## Case Study 2 Effects Determination

NE – No Effect

NLAA – Not Likely to Adversely Affect

LAA – Likely to Adversely Affect

# Case Study 2 Effects Determination



LAA – Likely to Adversely Affect



## Case Study 2A Analyze Effects, Evaluate BMPs

### **Flood Storage and Fish Habitat**

- Project created 1,700 ft<sup>2</sup> (150 yds<sup>3</sup>) of combined floodplain storage and created wetland on site (lower floodplain)
- Project created enhanced area of fish habitat by planting 1,700 ft<sup>2</sup> in the floodplain/wetland storage area

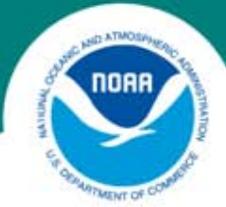


## Case Study 2A - Analyze Effects, Evaluate BMPs



### **Stormwater – Used LID**

Collecting and dispersing roof-top runoff to rain garden and new wetland area



## Analyze Effects and Evaluate BMPs (cont.)

**Vegetation –**  
Enhanced function  
by planting larger  
graded area,  
increasing  
plant diversity





## Analyze Effects and Evaluate BMPs (cont.)

Bank Stability – No bank stabilization  
needed as structure was sited away  
from channel  
and flow  
path





## Analyze Effects and Evaluate BMPs (cont.)

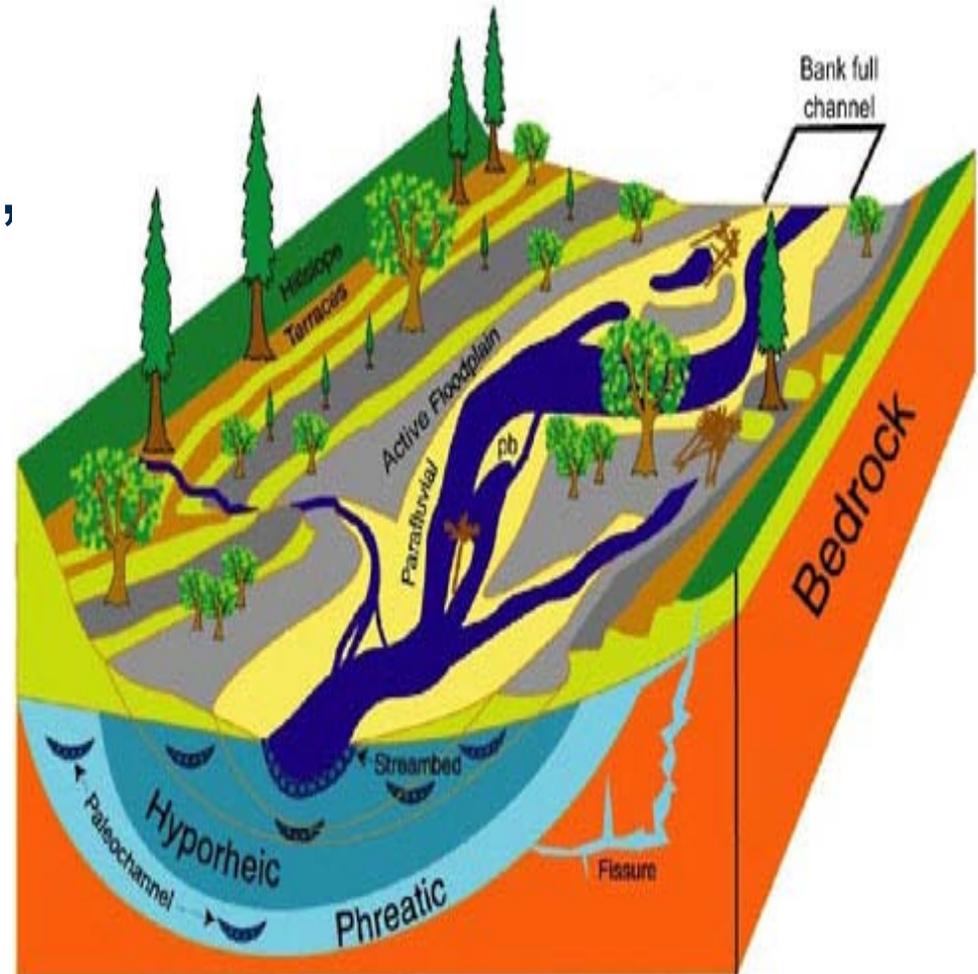
**Channel Migration** – house sited outside  
identified CMZ

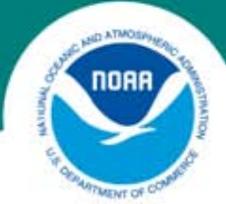




## Analyze Effects and Evaluate BMPs (cont.)

**Hyporheic Zone –**  
Surface, groundwater,  
hyporheic zone  
exchange maintained  
due to rain garden,  
wetland & vegetated  
flood storage area

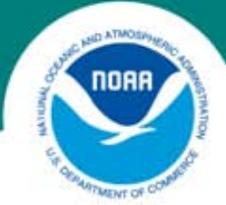




## Analyze Effects and Evaluate BMPs (cont.)

**Wetlands** – 300 ft<sup>2</sup> disturbed reed canary grass wetland replaced with 1,700 ft<sup>2</sup> shrub/meadow wetland/storage area

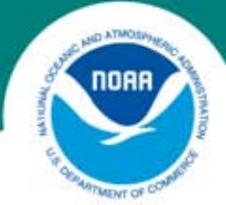




## Analyze Effects and Evaluate BMPs (cont.)

**Large Wood –  
No large wood  
in floodplain.**





## Case Study 2A Summary

### **Effects:**

WL/house fill 150 yd<sup>3</sup>

C &G (300 ft<sup>2</sup> +1400 ft<sup>2</sup>)

Roof runoff

Hyporheic Zone

Bank stability, CMZ, LW

### **BMPs/Mitigation:**

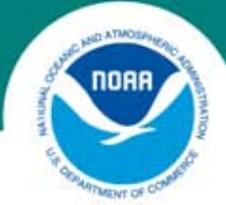
Excavated 150 yd<sup>3</sup>

1700 ft<sup>2</sup> planted fish habitat  
floodplain storage/wetland  
fish habitat (lower FP)

Infiltrated via RG/wetland

Infiltration maintained

No change



## Case Study 2 Effects Determination

NE – No Effect

NLAA – Not Likely to Adversely Affect

LAA – Likely to Adversely Affect

# Case Study 2A Effects Determination



NLAA – Not Likely to Adversely  
Affect

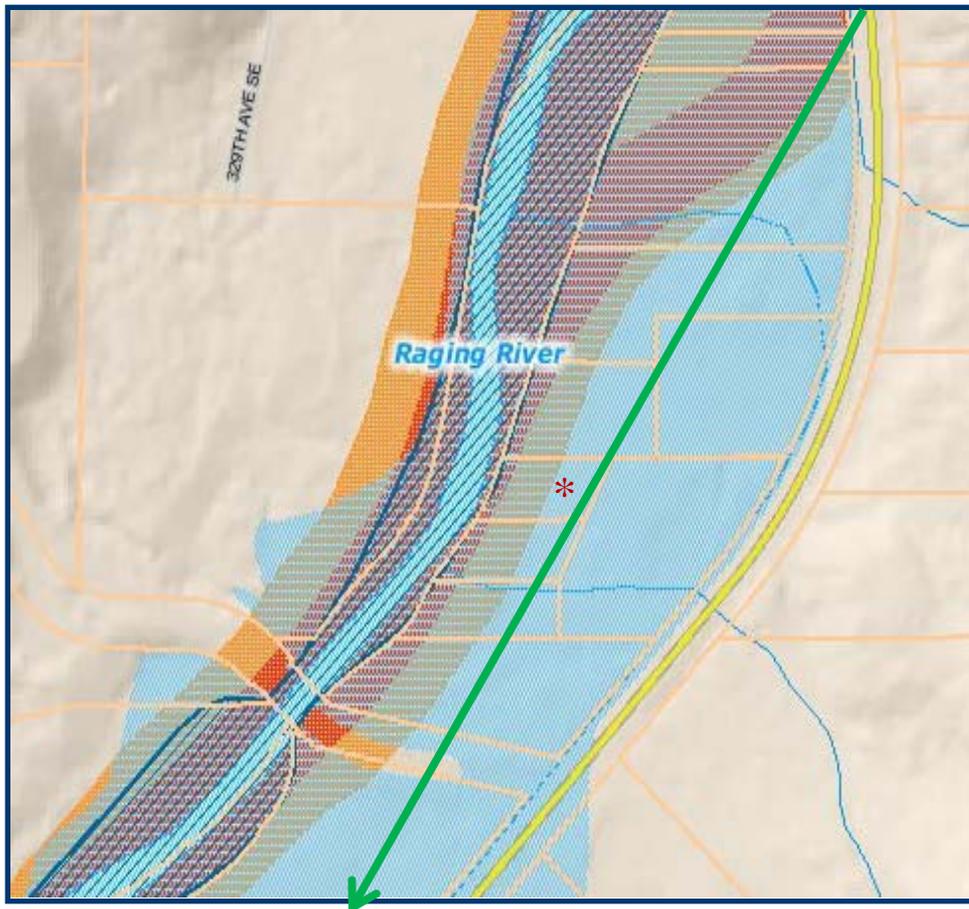


## Case Study 3: Redevelopment > 10% increase in footprint

Inside the Protected Area, in the lower  
floodplain, in the Riparian Buffer



# Case Study 3 - Project Location



## Legend:

CZM – Orange

100-year Floodplain-  
light blue

Parcel Boundary –  
Beige

Streams – dark blue

House location - \*

Riparian buffer -  
green



## Case Study 3 Background Information

- Project Area – lower floodplain of large river
- Habitat Conditions – non-native landscaping. Developed conditions off site.
- Fish presence – Chinook and steelhead



## Case Study 3 Project Description

- Infrastructure – 350 ft<sup>2</sup> addition
- Clearing - 400 ft<sup>2</sup> grass and landscaping
- No fill – structure elevated on pilings.



## Case Study 3 - Analyze Effects, Evaluate BMPs

### **Flood Storage and Fish Habitat**

- No flood storage removed (350 ft<sup>2</sup> addition on pilings)
- Project removed 400 ft<sup>2</sup> of potential floodplain fish habitat
- 400 ft<sup>2</sup> enhanced floodplain habitat provided



## Case Study 3 - Analyze Effects, Evaluate BMPs



### **Stormwater – Used LID**

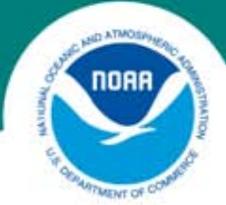
Collecting and dispersing roof runoff to rain garden



## Analyze Effects and Evaluate BMPs (cont.)

**Vegetation –**  
Provided 400 ft<sup>2</sup>  
improved vegetation  
function in riparian  
buffer





## Analyze Effects and Evaluate BMPs (cont.)

Bank Stability – No bank stabilization  
needed

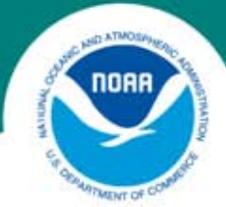




## Analyze Effects and Evaluate BMPs (cont.)

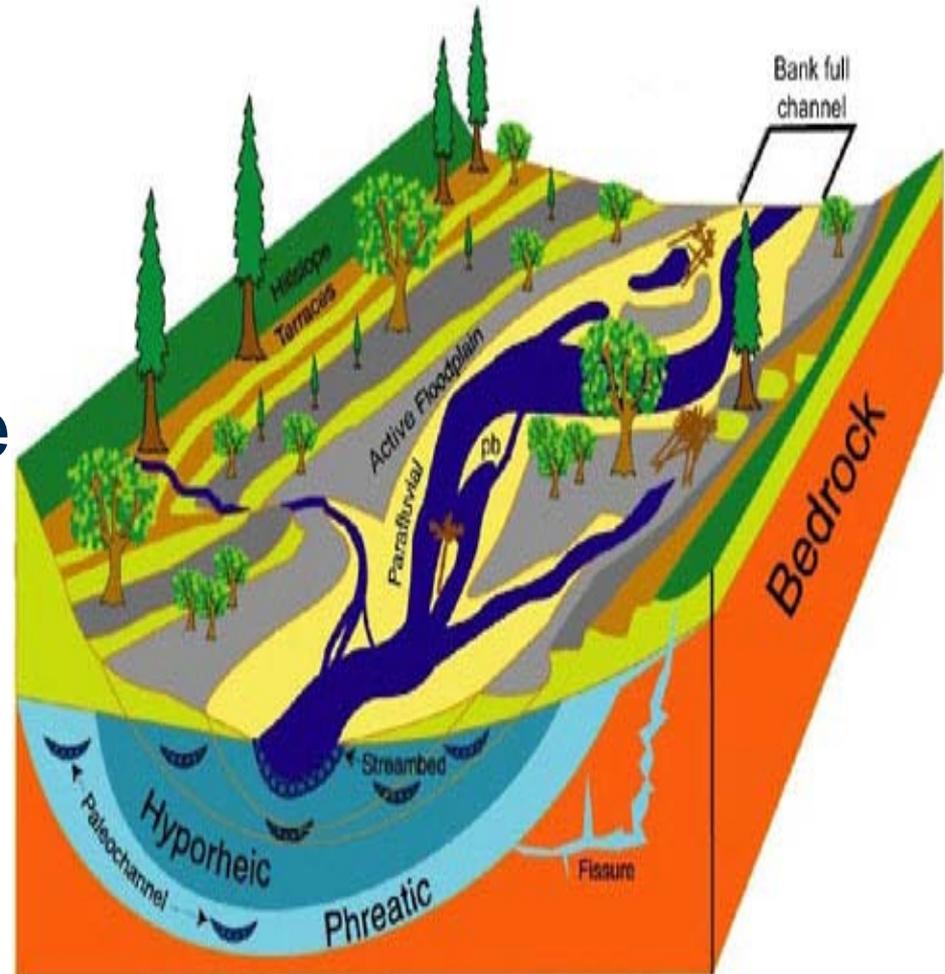
**Channel Migration** – house sited in riparian buffer portion of the Protected Area but outside of identified CMZ

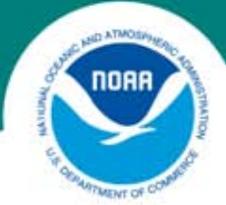




## Analyze Effects and Evaluate BMPs (cont.)

**Hyporheic Zone –**  
Maintain flow between surface, groundwater and hyporheic zone due to rain garden, planted area, and infiltration under house.



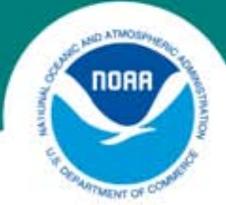


# Analyze Effects and Evaluate BMPs (cont.)

## **Wetlands –**

**No wetlands affected on site**

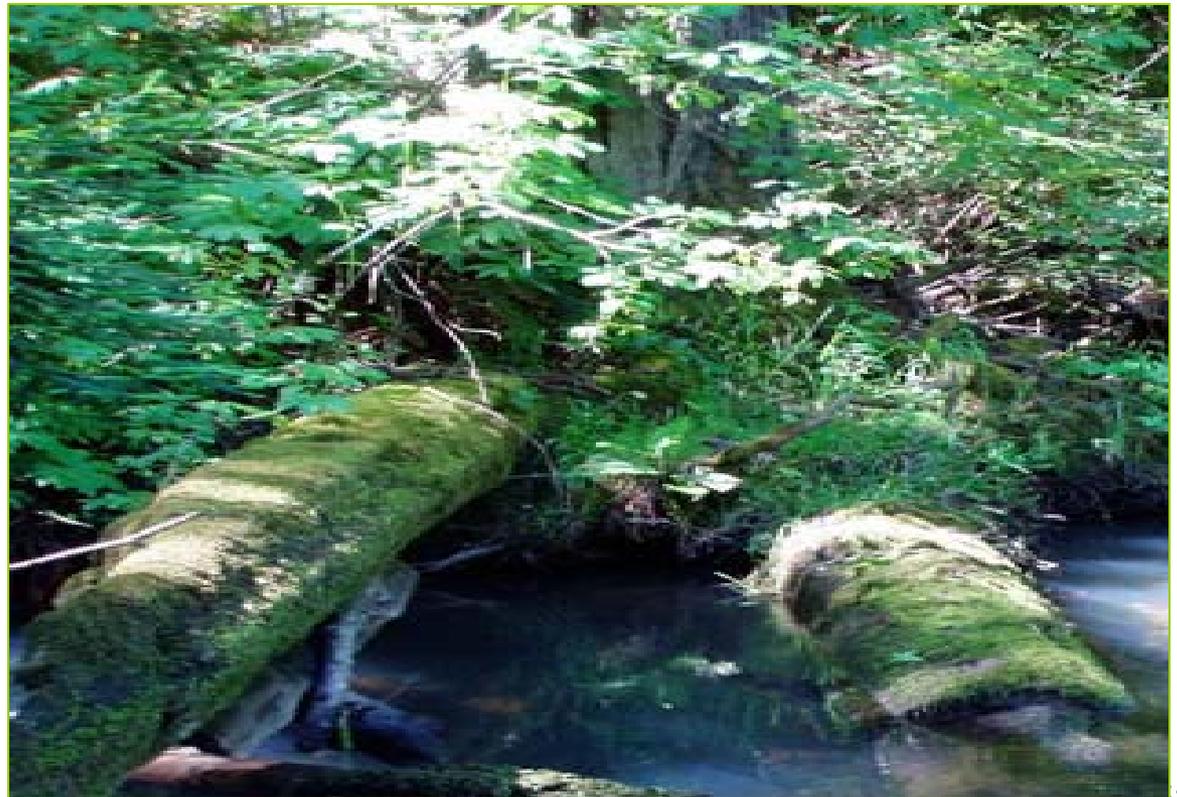




## Analyze Effects and Evaluate BMPs (cont.)

### **Large Wood –**

no wood in  
or removed  
from flood-  
plain





## Case Study 3 Summary

### **Effects:**

House expansion - 350 ft<sup>2</sup>

Clearing - 400 ft<sup>2</sup>

Roof runoff

Hyporheic Zone

Bank stability, CMZ,  
LW,WL

### **BMPs/Mitigation:**

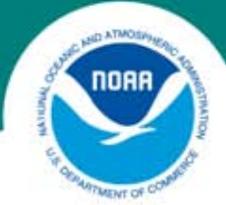
350 ft<sup>2</sup> on pilings

400 ft<sup>2</sup> planted fish habitat,  
flood storage in buffer

infiltrated via rain garden

rain garden, planted area,  
infiltration under house

no change

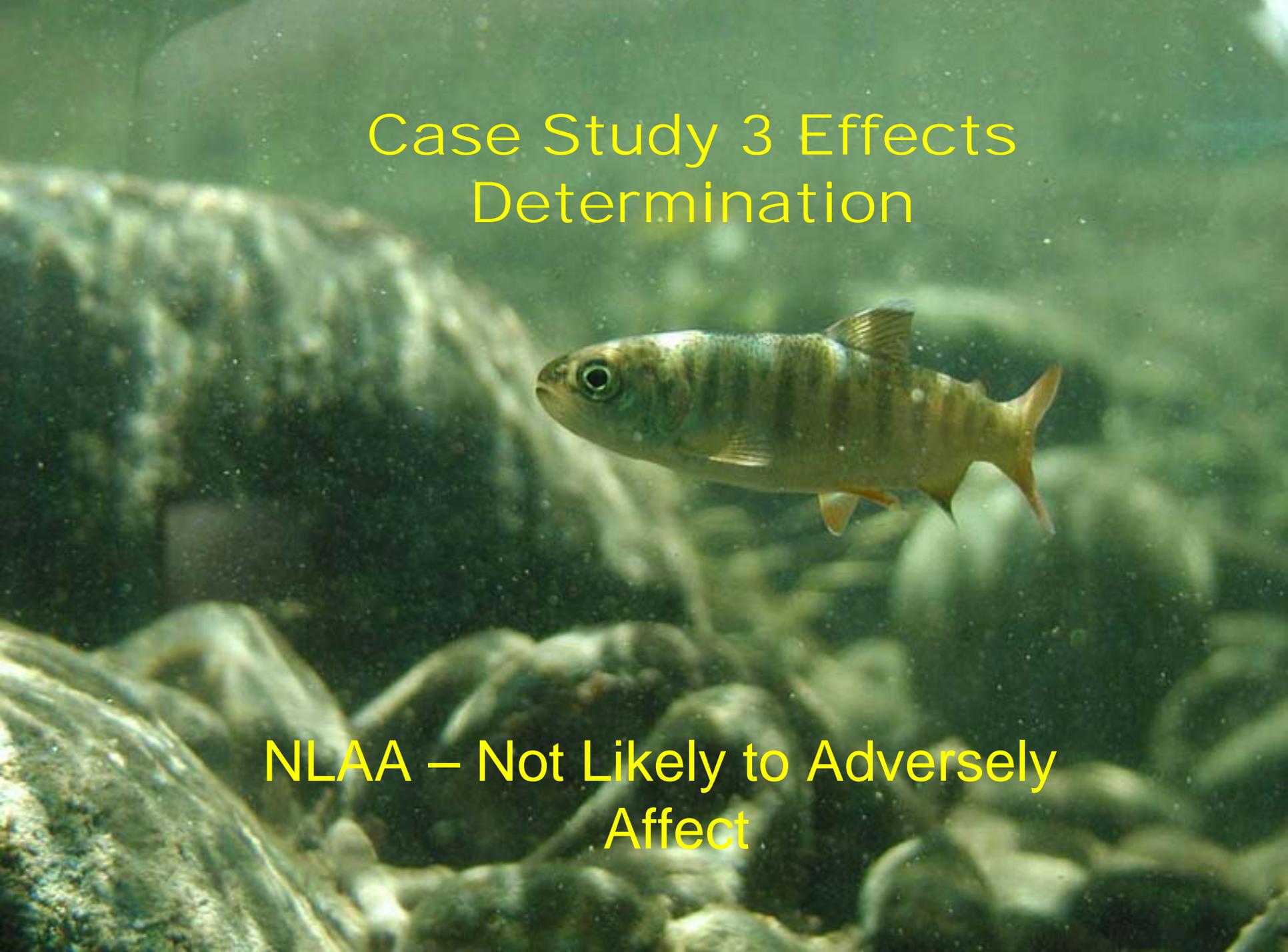


## Case Study 2 Effects Determination

NE – No Effect

NLAA – Not Likely to Adversely Affect

LAA – Likely to Adversely Affect

A photograph of a fish, possibly a trout or salmon, swimming in a stream. The fish is positioned in the center-right of the frame, facing left. The water is clear and greenish, with rocks visible on the bottom. The text "Case Study 3 Effects Determination" is overlaid in yellow at the top, and "NLAA – Not Likely to Adversely Affect" is overlaid in yellow at the bottom.

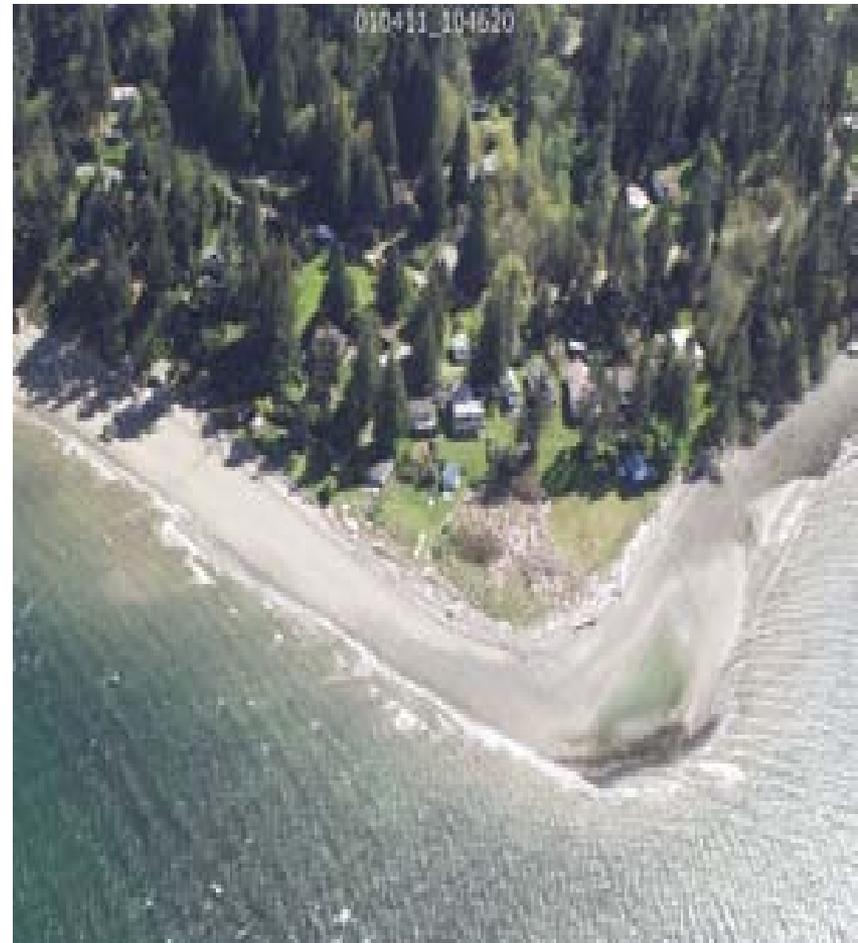
## Case Study 3 Effects Determination

NLAA – Not Likely to Adversely  
Affect



## Case Study 4: Redevelopment > 10% increase in footprint

In the Riparian Buffer  
of the Puget Sound  
marine shoreline





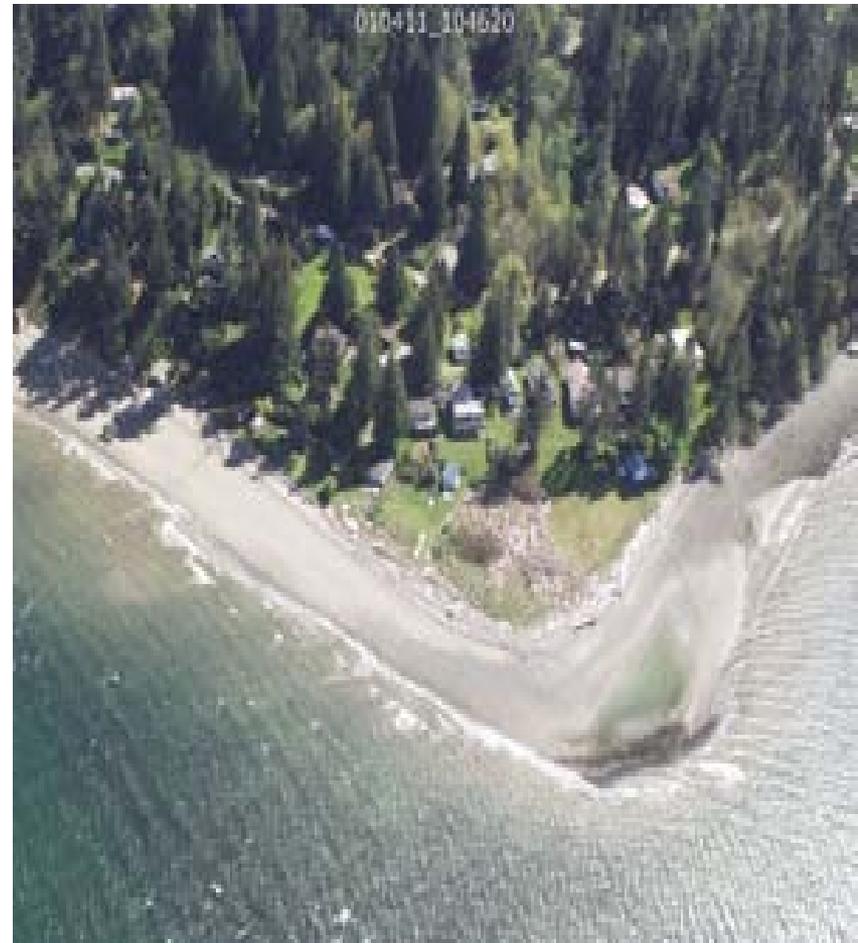
## Case Study 4 Background Information

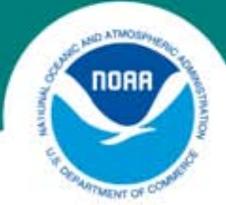
- Project Area – marine shoreline of Puget Sound
- Habitat Conditions – non-native landscaping. Mixed native vegetation and developed conditions off site.
- Fish presence – Chinook, steelhead summer chum, and forage fish



## Case Study 4 Project Description

- Infrastructure –  
350 ft<sup>2</sup> addition
- Clearing - 400 ft<sup>2</sup>  
grass and landscaping
- No fill – structure  
elevated on pilings.

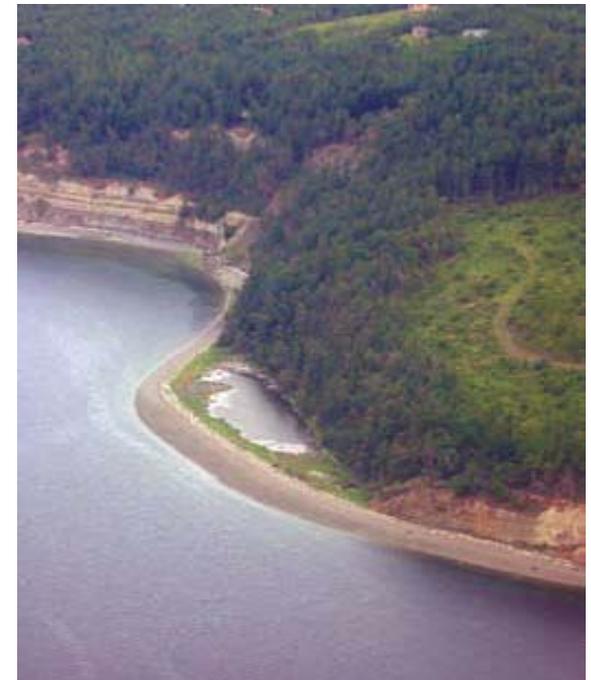




## Case Study 4 - Analyze Effects, Evaluate BMPs

### Flood Storage and Fish Habitat

- 350 ft<sup>2</sup> addition on pilings, no effect on flood storage
- No aquatic fish habitat in floodplain e.g., saltwater lagoons



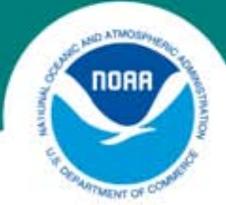


## Case Study 4 - Analyze Effects, Evaluate BMPs



### **Stormwater – Used LID**

Collecting and dispersing roof runoff to created native vegetation area



## Analyze Effects and Evaluate BMPs (cont.)

**Vegetation –**  
Provided 400 ft<sup>2</sup>  
improved vegetation  
function in riparian  
buffer





## Analyze Effects and Evaluate BMPs (cont.)

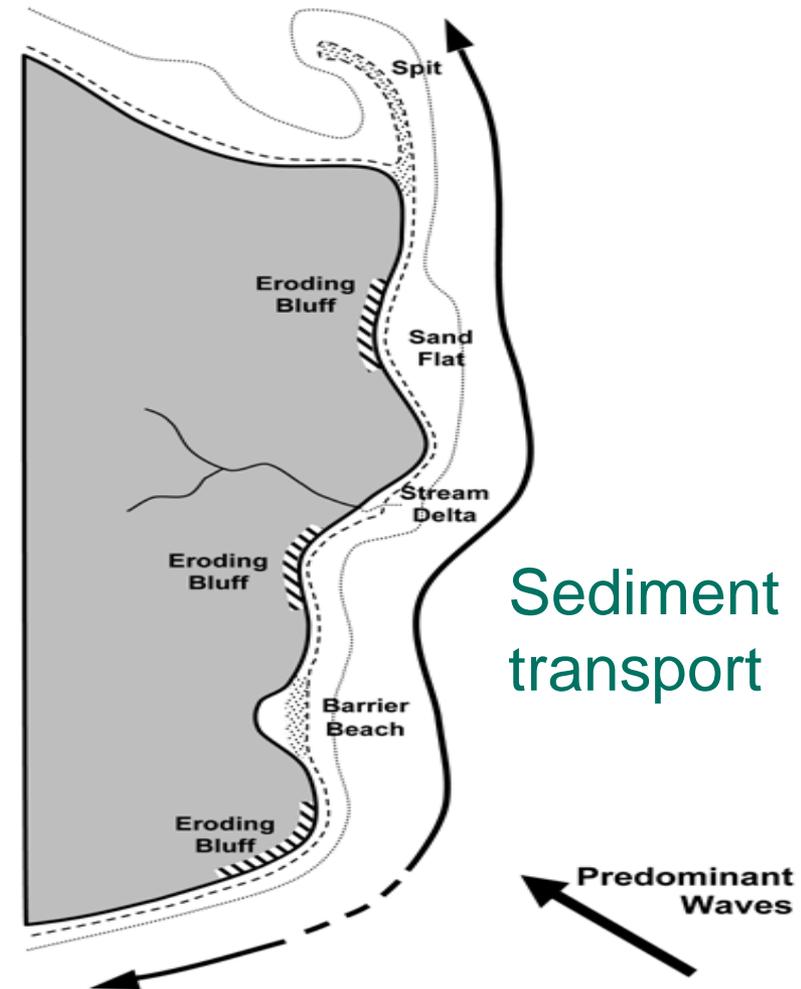
**Shoreline  
Armoring –  
None  
needed**

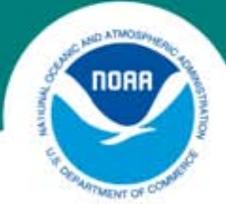




## Analyze Effects and Evaluate BMPs (cont.)

**Longshore sediment transport** – house sited in riparian buffer of shoreline but above beach sediment processes

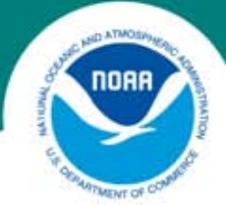




## Analyze Effects and Evaluate BMPs (cont.)

### **Groundwater –**

Maintain flow between surface and ground-water due to created native vegetation planted area, and infiltration under house.

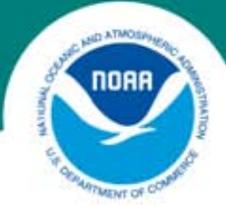


# Analyze Effects and Evaluate BMPs (cont.)

## **Wetlands –**

**No wetlands affected on site**





## Analyze Effects and Evaluate BMPs (cont.)

**Large Wood** –  
no wood in  
or removed  
from shoreline/  
riparian buffer





## Case Study 4 Summary

### **Effects:**

House expansion - 350 ft<sup>2</sup>

Clearing - 400 ft<sup>2</sup>

Roof runoff

Groundwater Recharge

Bank stability, LST,  
LW,WL

### **BMPs/Mitigation:**

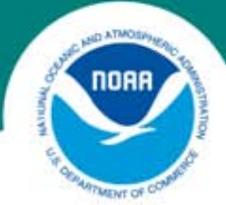
350 ft<sup>2</sup> on pilings

400 ft<sup>2</sup> planted native  
vegetation in buffer

infiltrated in vegetated area

planted area, infiltration  
under house

no change



## Case Study 4 Effects Determination

NE – No Effect

NLAA – Not Likely to Adversely Affect

LAA – Likely to Adversely Affect

# Case Study 4 Effects Determination



NLAA – Not Likely to Adversely  
Affect



# Questions?

