Pre-Design Investigation includes sampling to help us design the cleanup.

Q. Why are sampling locations important for design?

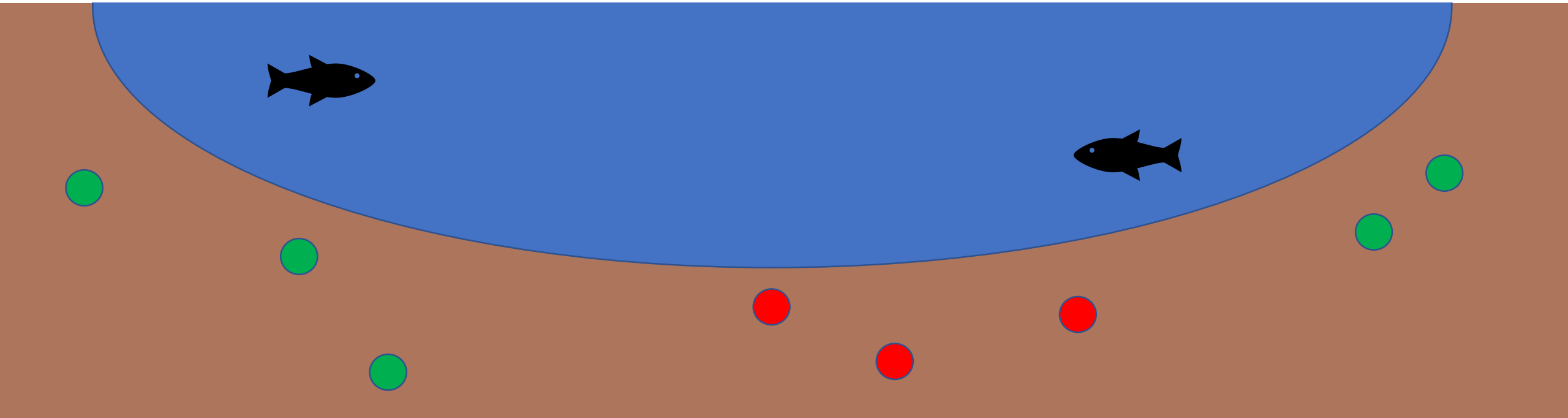
A. Because the results help us decide where <u>active</u> clean-up will happen

Where does Record of Decision (final cleanup plan) say active clean-up is needed?

- **Sample results** are compared to remedial **action** level (RAL) in ROD.

  For example, LDW ROD says: PCB action level is 12 (units: mg/kg OC)

  - Sample 🔴 is above RAL… 13 or 14 or 100 **>** 12
  - Sample 🟢 is below RAL…1 or 4 or 11 **<** 12

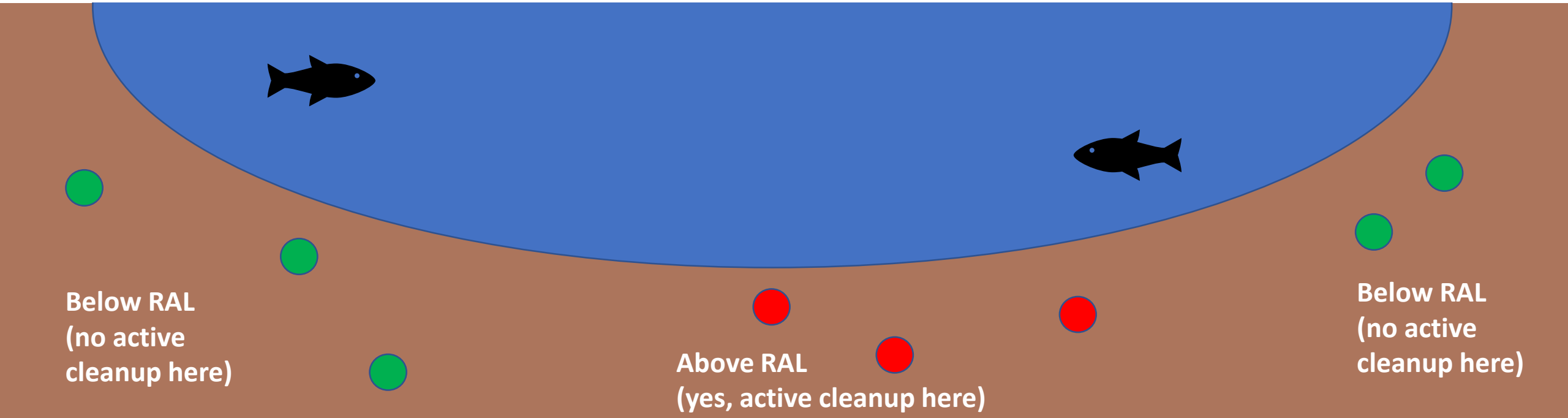


Where does Record of Decision (final cleanup plan) say active clean-up is needed?

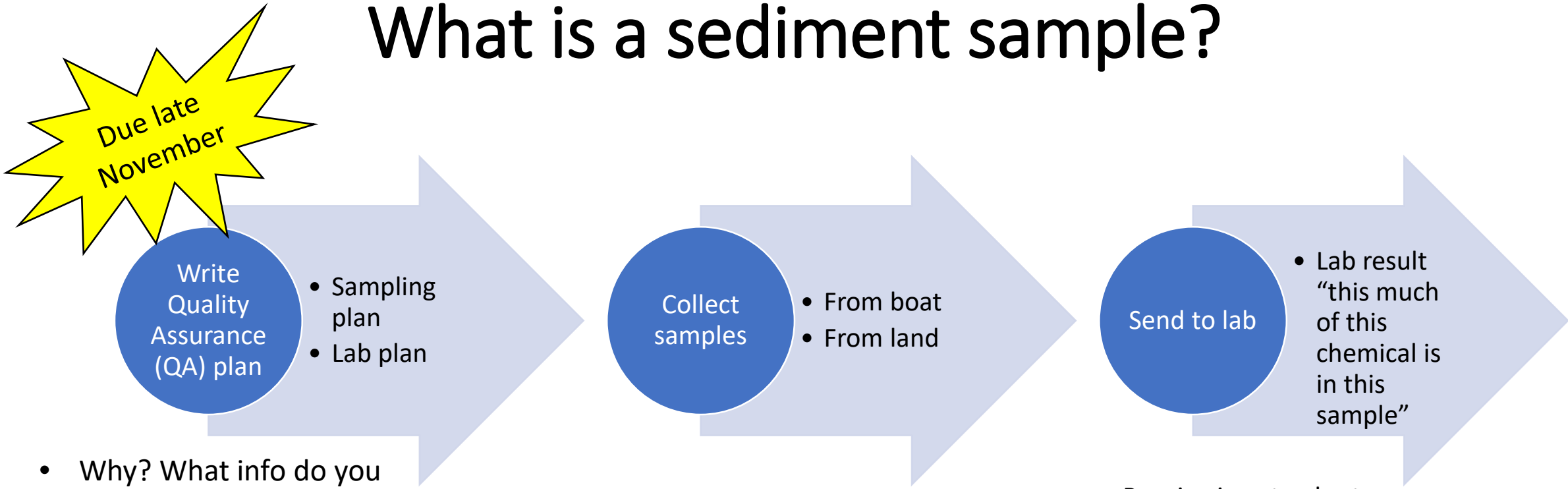
- **Sample results** are compared to remedial **action** level (RAL) in ROD.

  For example, LDW ROD says: PCB action level is 12 (units: mg/kg OC)

  - Sample 🔴 is above RAL… 13 or 14 or 100 **>** 12
  - Sample 🟢 is below RAL…1 or 4 or 11 **<** 12



What is a sediment sample?



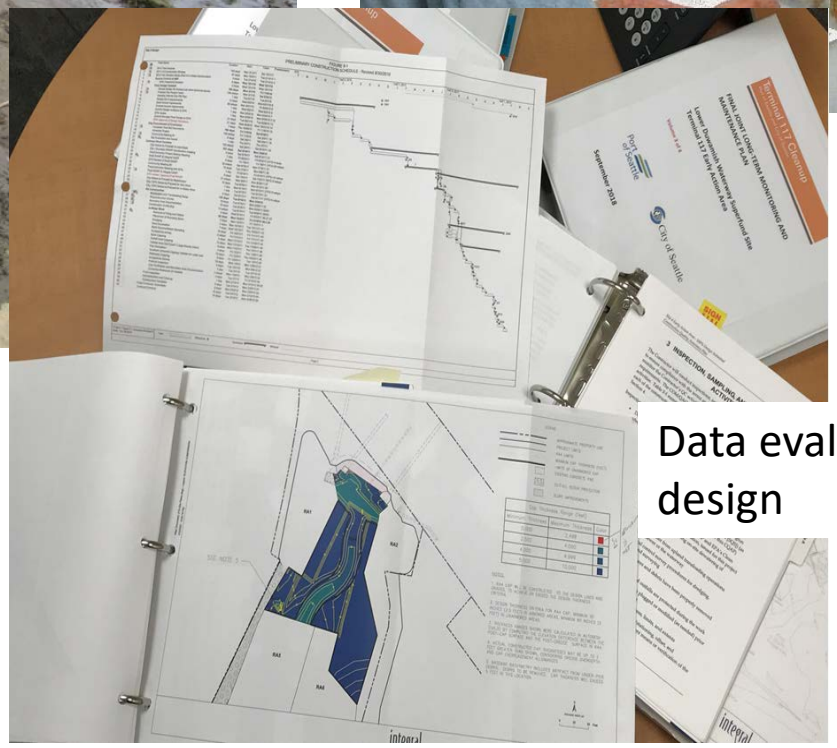
- Why? What info do you need?
- What depth?
- Where?
- How many?
- What field methods?
- What chemicals to test for?
- What Quality Assurance (QA)?
- Health and Safety

- People with experience and training
- Boat, sampling and safety equipment
- Bowls, spoons, jars, bags
- Labels, ice, coolers

- Receive jars, track, store, prepare
- Typical measures: weight, moisture content, organic carbon, grain size
- Dissolve contaminants into liquid, put in jar, and run through analytical instrument
- Output – "raw" data, QA checks
- Reviewer checks if usable, qualifies.

Field work – sampling

Laboratories and chemical analysis



Data evaluation and design

SEDIMENT SAMPLING

Core for deeper samples

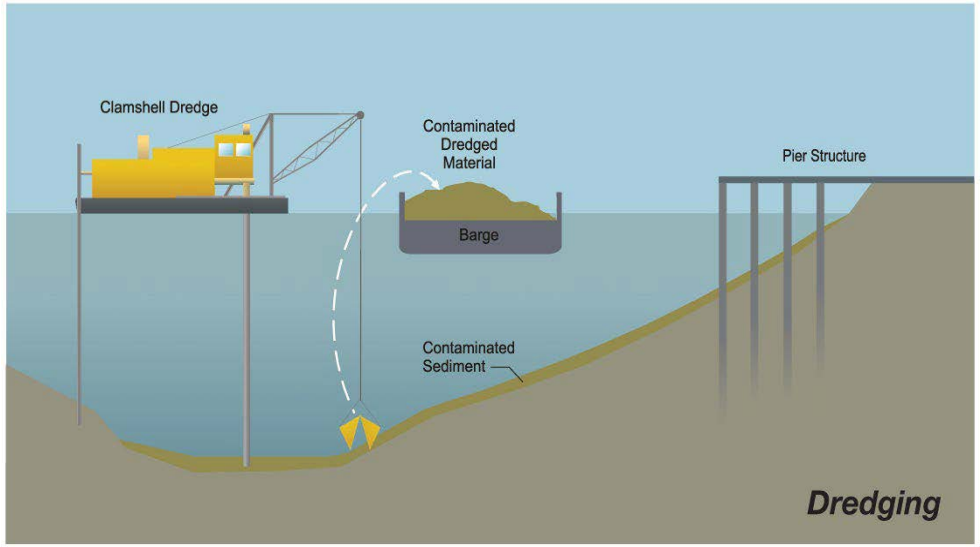
Scoop sediment to depth needed

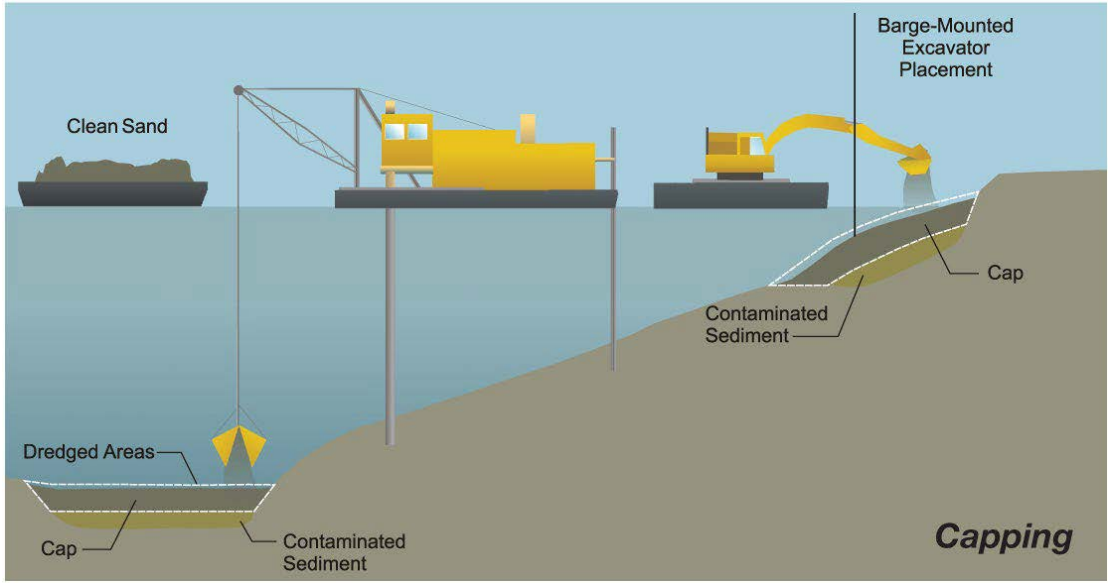
Box corer for shallower samples, collected from boat

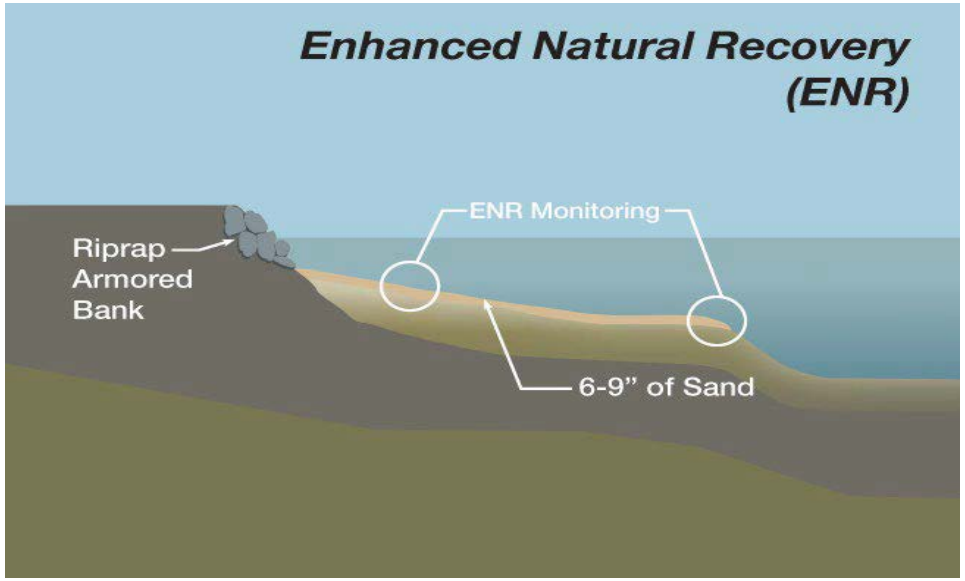
Mix the sediment and put some in clean, labeled jar

Greater than ACTION level?

Take ACTION!







Which action you take also depends on…

- **How MUCH HIGHER than the action level are the contaminants?**

  Enhanced Natural Recovery Upper Limit – below the limit, ENR is okay

- **Is the sediment always under water?**

  Subtidal

- **Or is it sometimes above water – between high and low tide?**

  Intertidal

- **Is it a habitat area?** *Biologically important! Intertidal and shallow subtidal*

Which action you take also depends on…

- **Is the sediment where the law requires a certain water depth for boat traffic?**
  Navigation Channel *depth must be protected.*

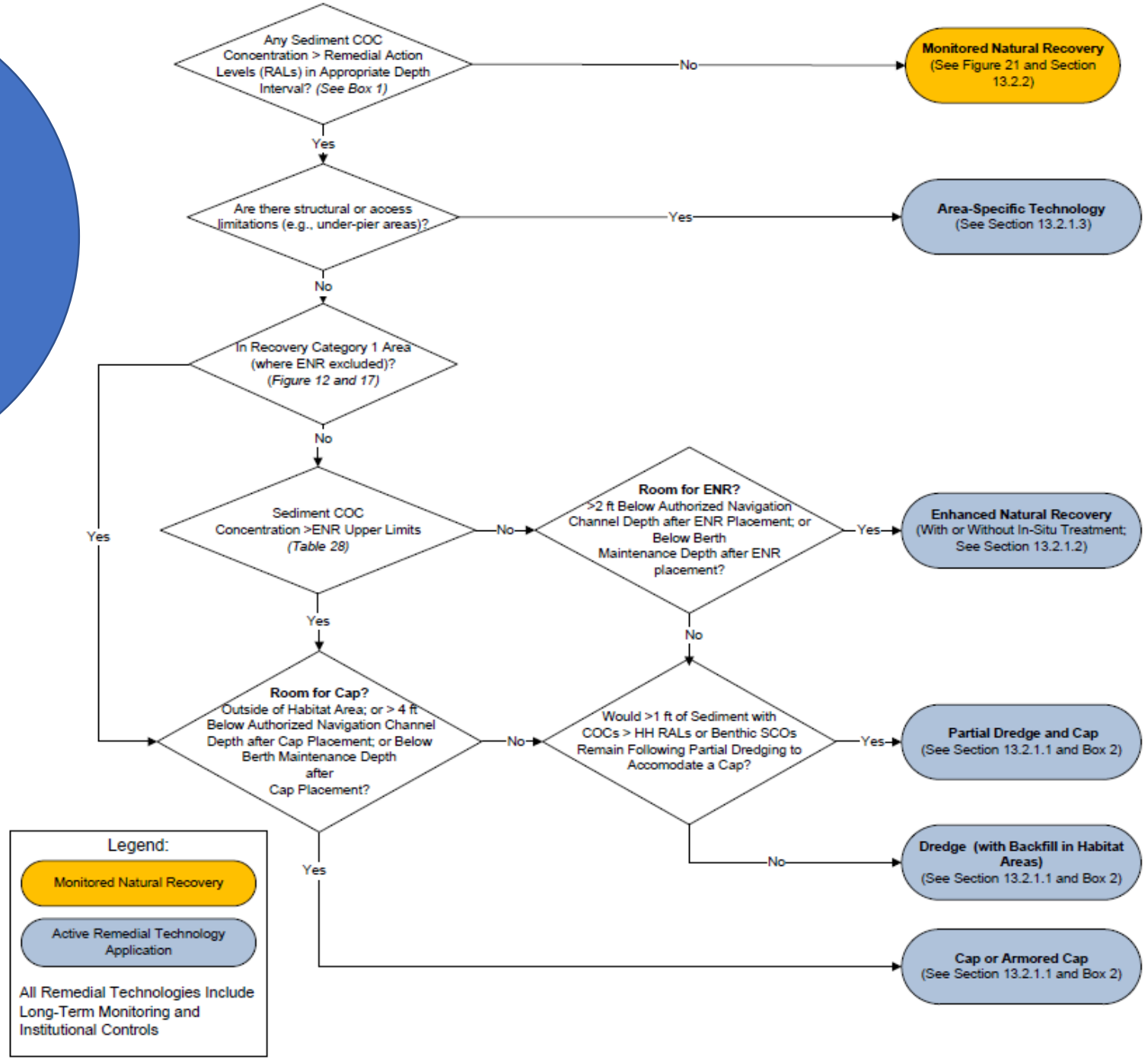
- **Is it where boat traffic or river currents can carry sediment?**
  Erosional or Scour Areas *– Recovery Category 1 not likely to recover without action*

- **Is it in area where new sediment will be added over time?**
  Depositional Area *- Recovery Category 2 or 3 may not need dredging before cover*

- **What action is possible in the area?**
  Steep or tight space for equipment or may cause structures to fail

It's in the ROD!

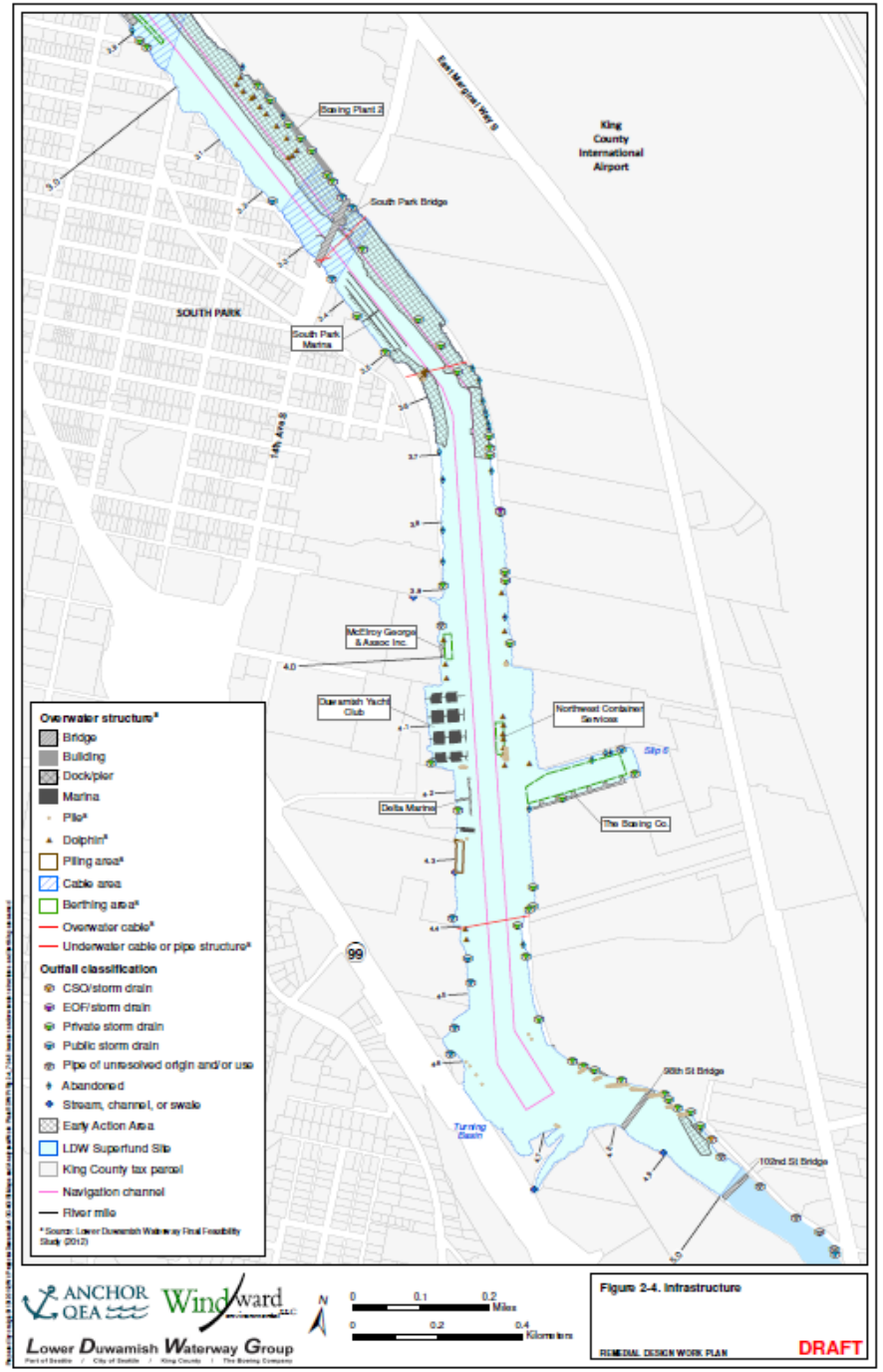
Figure 19, 20 and Table 28



- What physical features and structures must we consider in design? Will they affect access? Will cleanup affect them?

- Bridges, docks and piers, marinas, piles, “dolphins”, cables, berthing areas, pipes and outfalls.

- Slopes, bulkheads, sheet pile walls, rip-rap

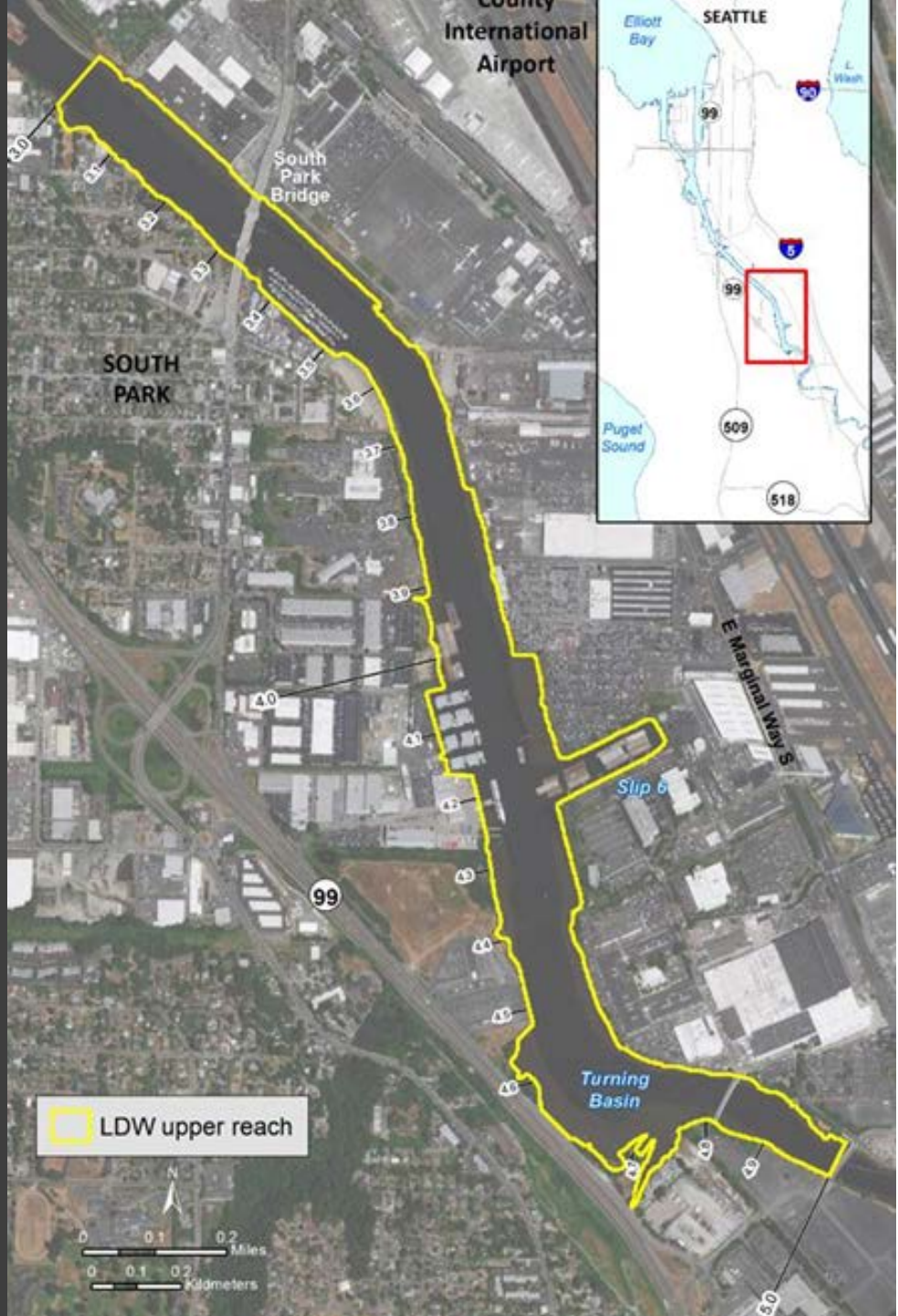


OK, that's the background. Now how to choose where to sample?

Upper Reach of the Duwamish Waterway

Length - two miles!

Average width 440 feet!



How are new sample locations being proposed?

- **What do we know already?**

Existing data from past studies are shown on a map and compared to cleanup action levels. (“RALs”, or “remedial action levels”).

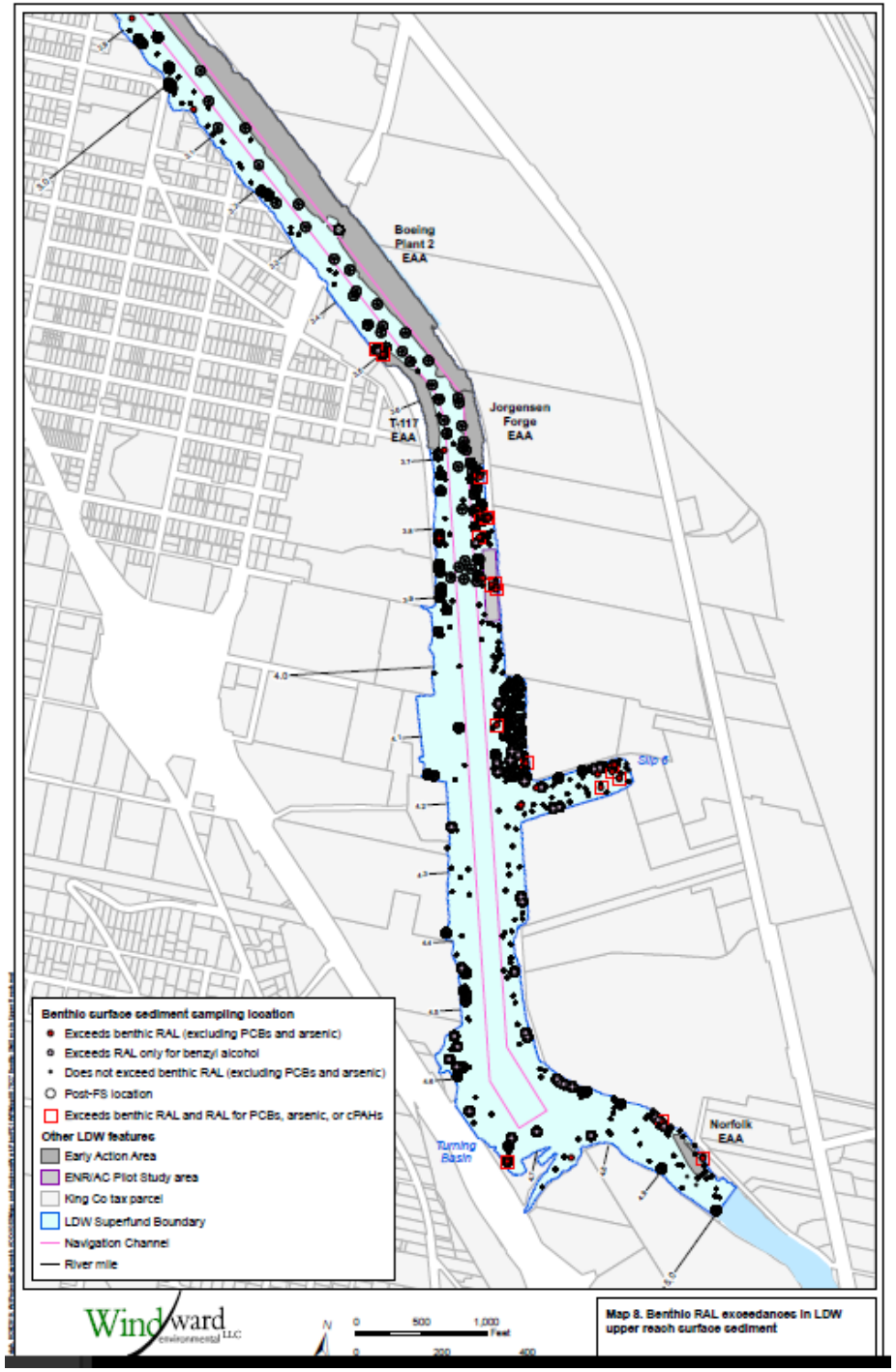
- **Are there “data gaps” to fill?**
  - CONFIRM – Is the sediment still above the RAL? Sample in the same location as before, to check whether conditions have changed.
  - BOUND – We know there’s an area above the RAL. How big an area is it? How deep?
  - DID WE MISS SOMETHING? – Has area been tested? Do we think there’s a reason for concern? (Roundtable input about sources, other info?)
- **Can we get the information we need cost-effectively?**

During the Remedial Investigation and Feasibility Study (RI/FS) and early actions, many samples were collected.

Most RI/FS samples are from the surface layer of sediment (10 cm), where the most biological activity occurs.

Some samples were deeper.

This map shows where 10 cm samples were taken in the upper reach of the Duwamish Waterway.



Phases and Tiers

We don't want to delay cleanup!

But sampling costs money. Laboratory analyses cost money.

We want the right information for design

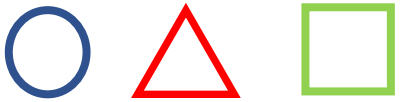
How to balance design needs, costs and time?

Phases and Tiers

PHASES – 1, 2, maybe 3

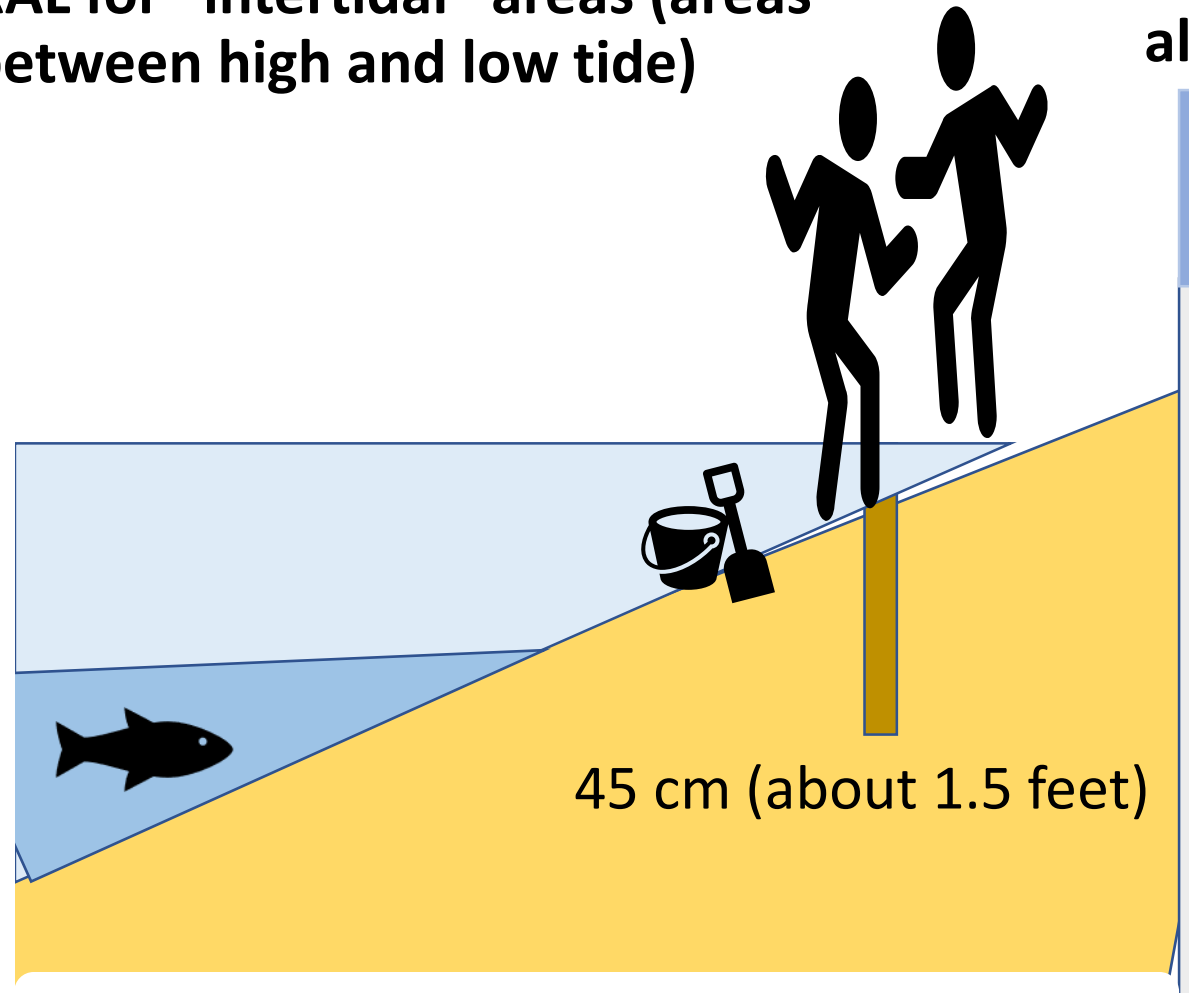
- The first phase of sampling will focus on defining areas better
- The second phase of sampling will fill data gaps for more exact areas and for engineering
- There may not be a third phase, but if so, won't delay design

TIERS:

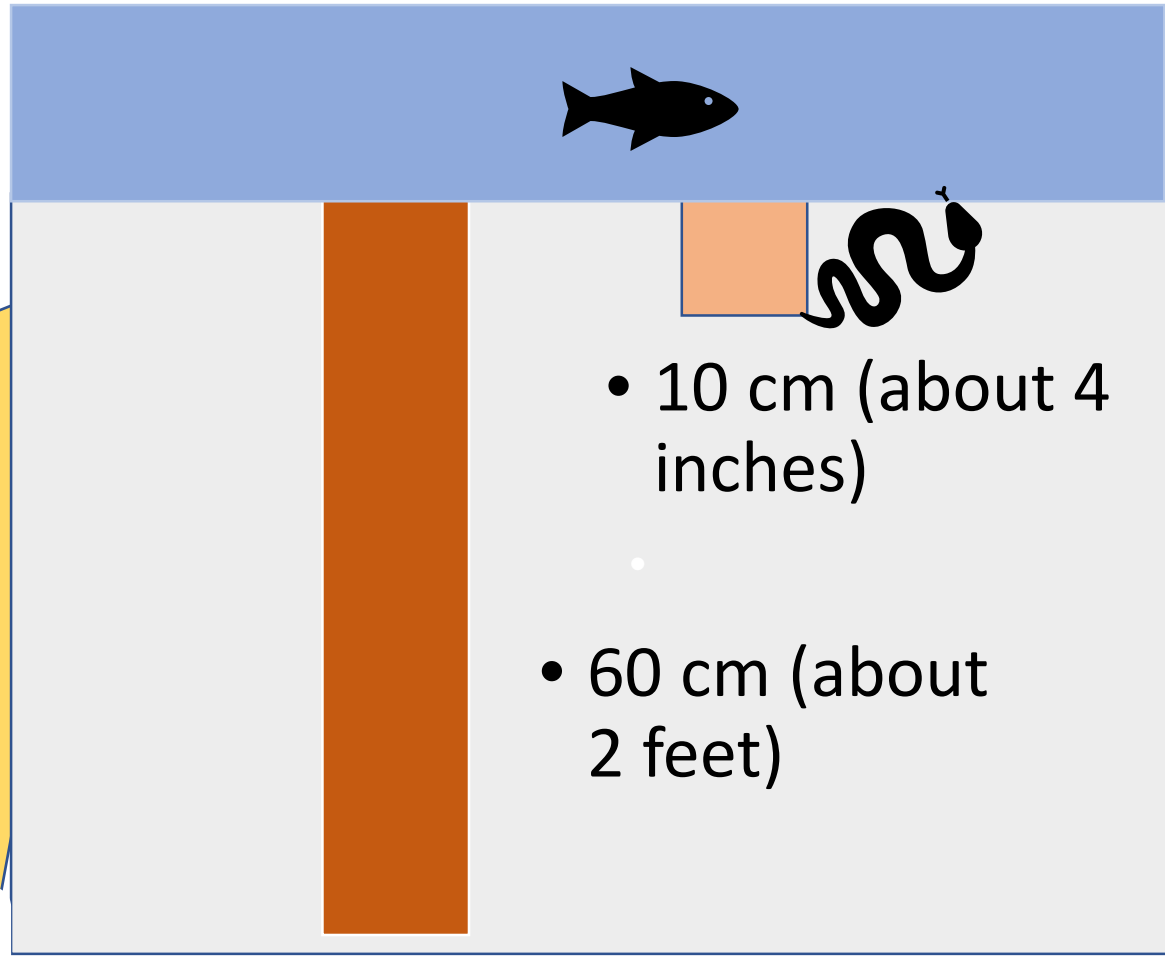
- Some samples will be analyzed right away. 
- Some will be stored at the lab ("archived") unless a decision is made to analyze them. A
- The decision to analyze archived samples depends on the results of the primary samples and on gaps.

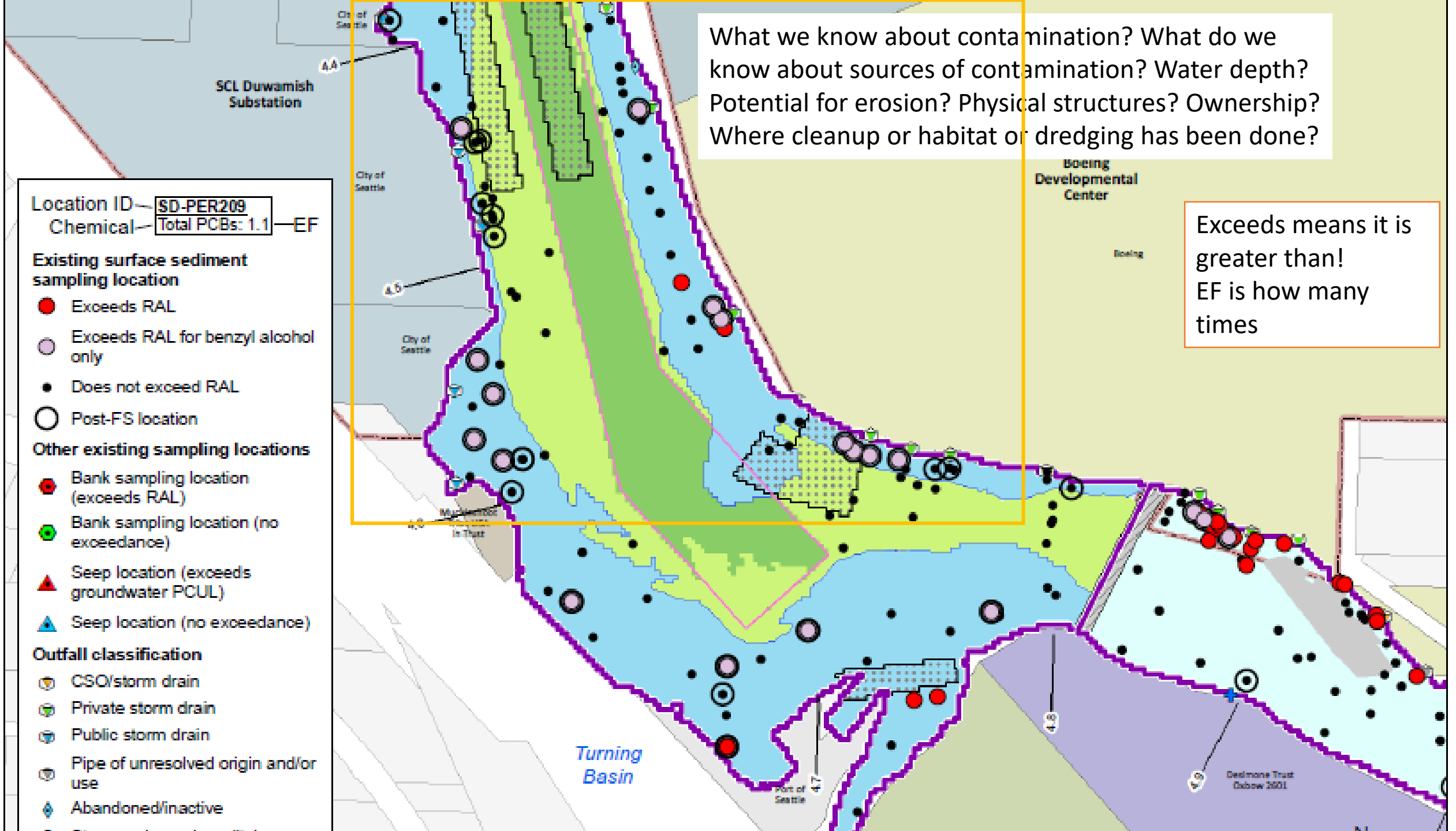
How deep in the mud must the samples be?

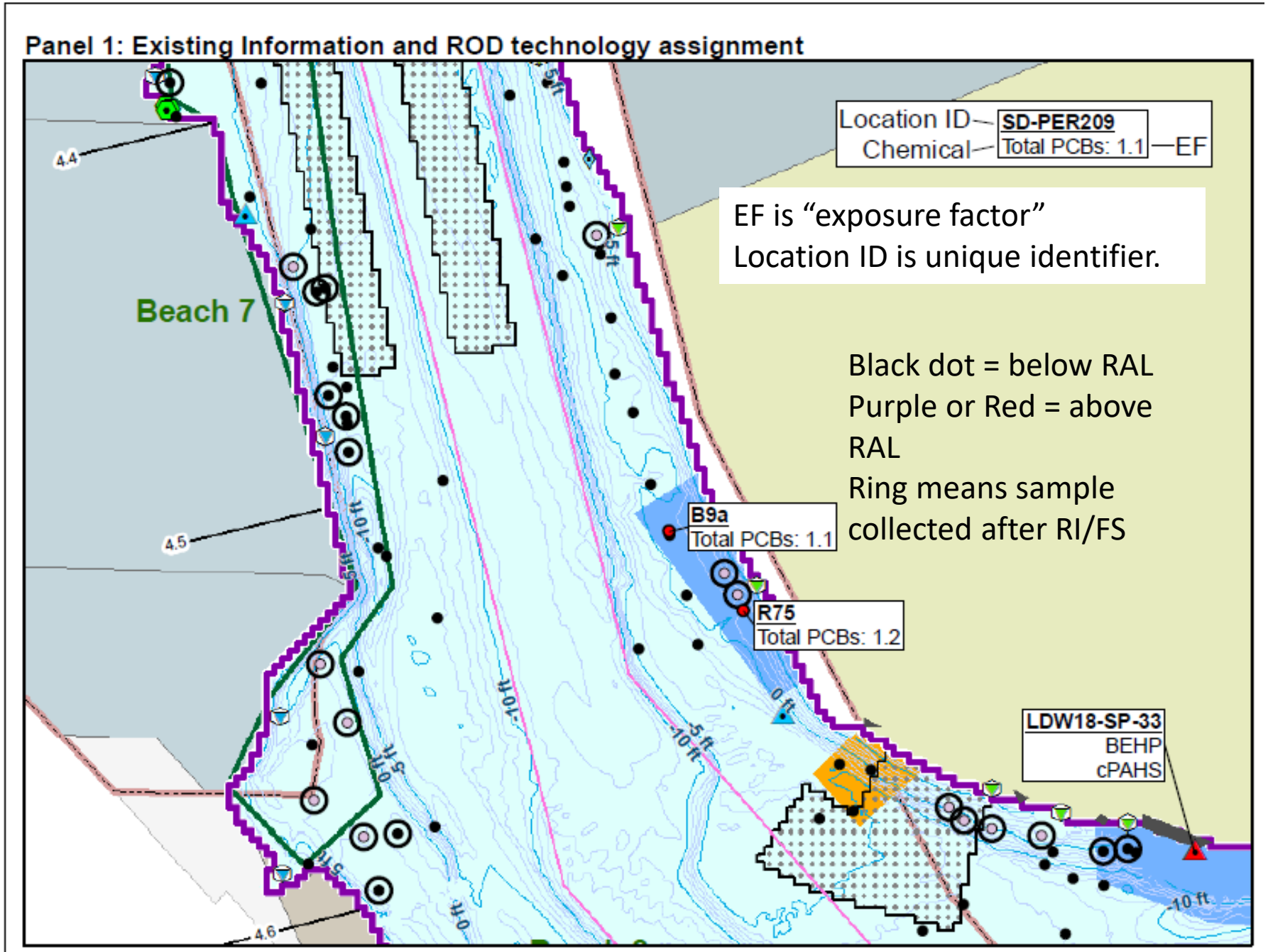
RAL for "intertidal" areas (areas between high and low tide)



RAL for subtidal areas (areas that are always underwater)

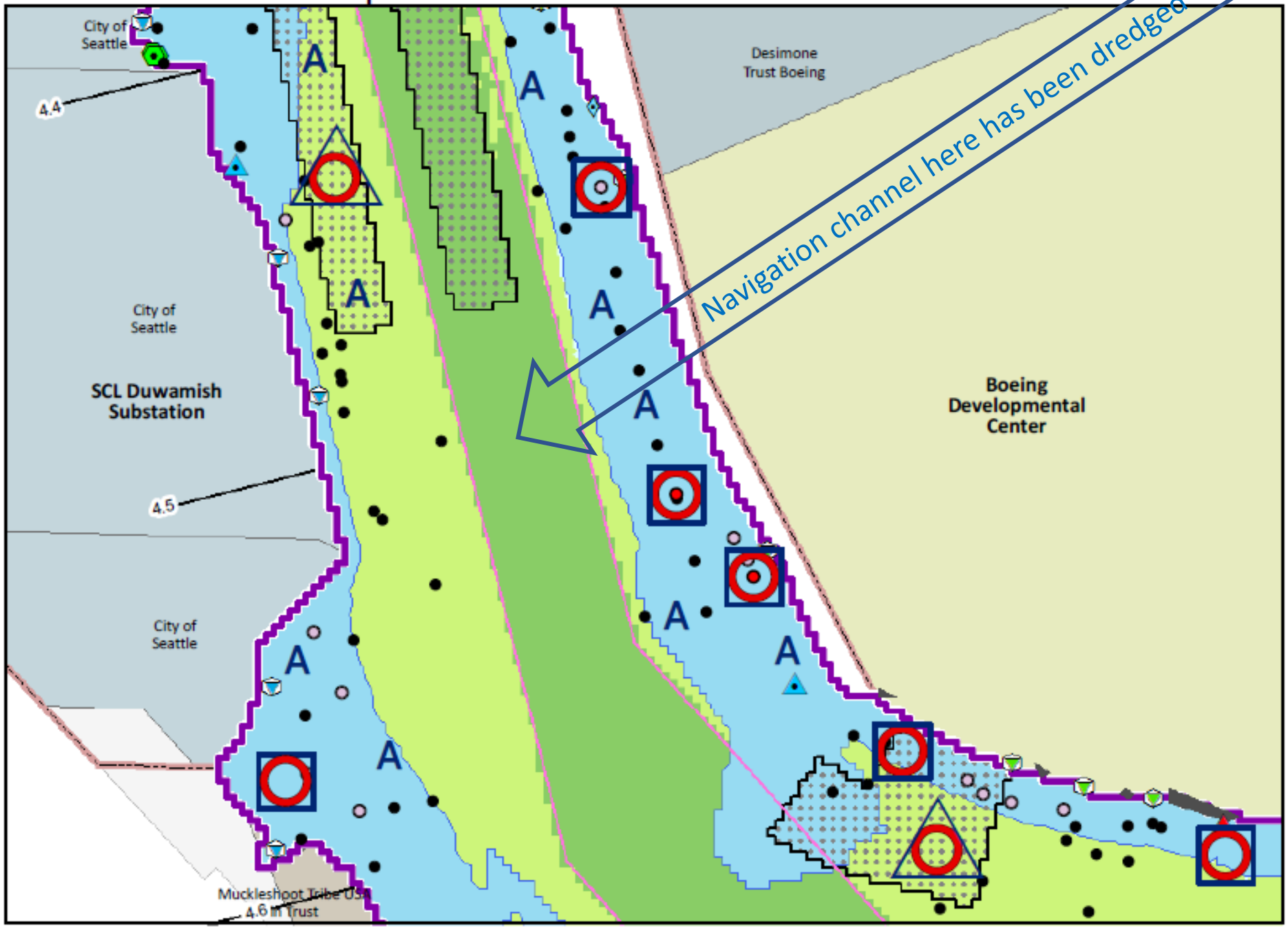



What we know about contamination? What do we know about sources of contamination? Water depth? Potential for erosion? Physical structures? Ownership? Where cleanup or habitat or dredging has been done?
Exceeds means it is greater than!
EF is how many times
Location ID SD-PER209
Chemical Total PCBs: 1.1 EF
Existing surface sediment sampling location
Exceeds RAL
Exceeds RAL for benzyl alcohol only
Does not exceed RAL
Post-FS location
Other existing sampling locations
Bank sampling location (exceeds RAL)
Bank sampling location (no exceedance)
Seep location (exceeds groundwater PCUL)
Seep location (no exceedance)
Outfall classification
CSO/storm drain
Private storm drain
Public storm drain
Pipe of unresolved origin and/or use
Abandoned/inactive
SCL Duwamish Substation
Boeing Developmental Center
Turning Basin
City of Seattle
Port of Seattle
4A
4.5
4.7
4.8
4.9



Hypothetical Example!! Where would you put new samples? Which would be archived?

Panel 2: Phase 1 Tier 1 Sample Locations



Conceptual sampling locations

Interval sampled
- 0-10 cm
- 0-45 cm
- 0-60 cm

- Conceptual sampling location: RAL exceedance(s)
- Conceptual sampling location: no exceedances
- A Archive - appropriate intervals

Existing surface sediment sampling location
- Exceeds RAL
- Exceeds RAL for benzyl alcohol only
- Does not exceed RAL

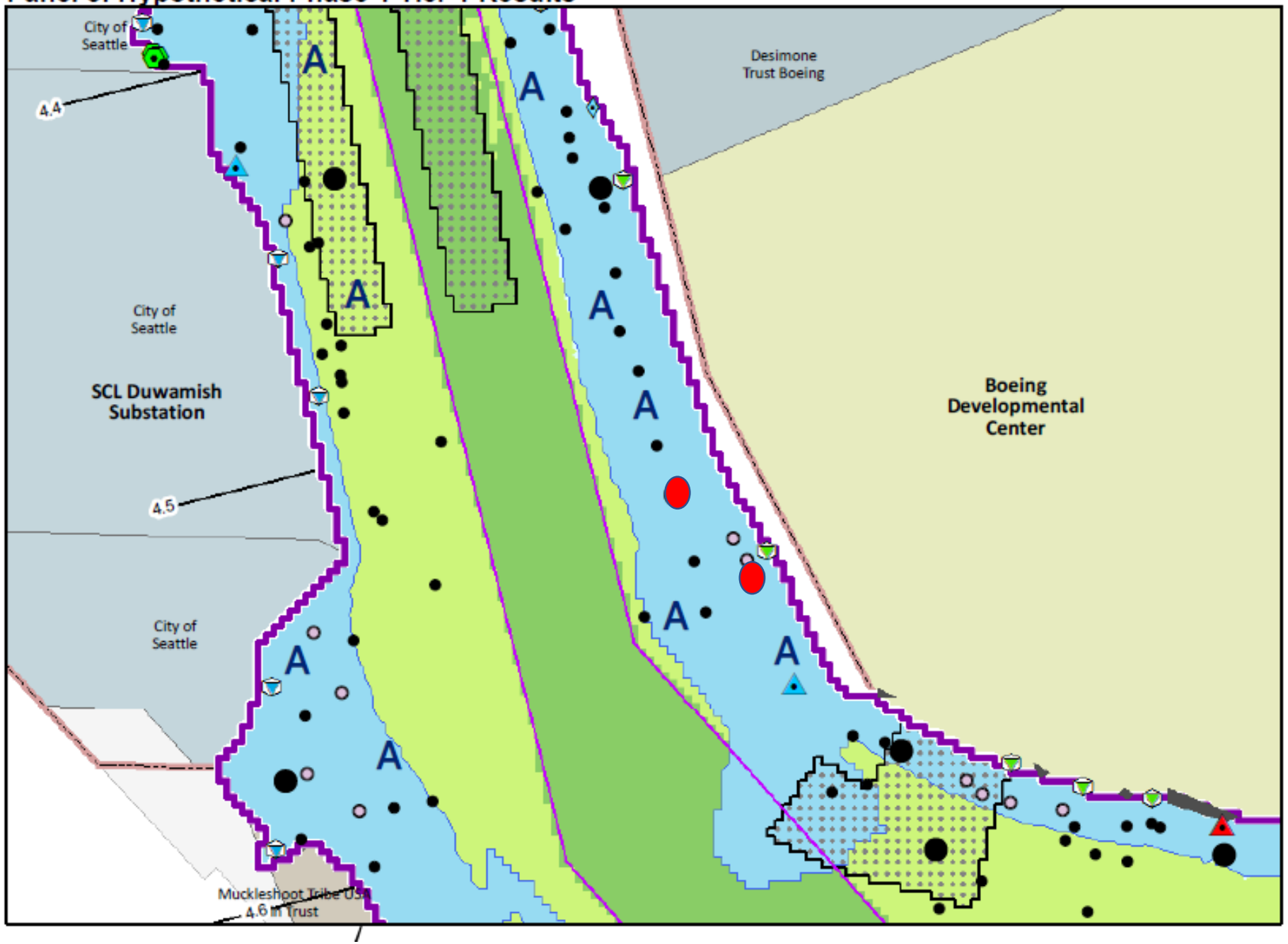
Other existing sampling locations
- Bank sampling location (no exceedance)
- Seep location (exceeds groundwater PCUL)
- Seep location (no exceedance)

Outfall classification
- Private storm drain
- Public storm drain
- Abandoned/inactive

Technology assignment
- Dredge
- Monitored Natural Recovery (MNR > SCO)

Other LDW features
- Recovery Category 1
- Intertidal area
- Potential tug scour area
- Potential tug scour area and shoal area
- Beach play area
- Dock/pier/marina
- Upper Reach listed site
- Segment boundary
- King Co tax parcel
- Navigation Channel
- River mile

Panel 3: Hypothetical Phase 1 Tier 1 Results



Conceptual sampling locations

Interval sampled
- 0-10 cm
- 0-45 cm
- 0-60 cm

- Conceptual sampling location: RAL exceedance(s)
- Conceptual sampling location: no exceedances
- A Archive - appropriate intervals

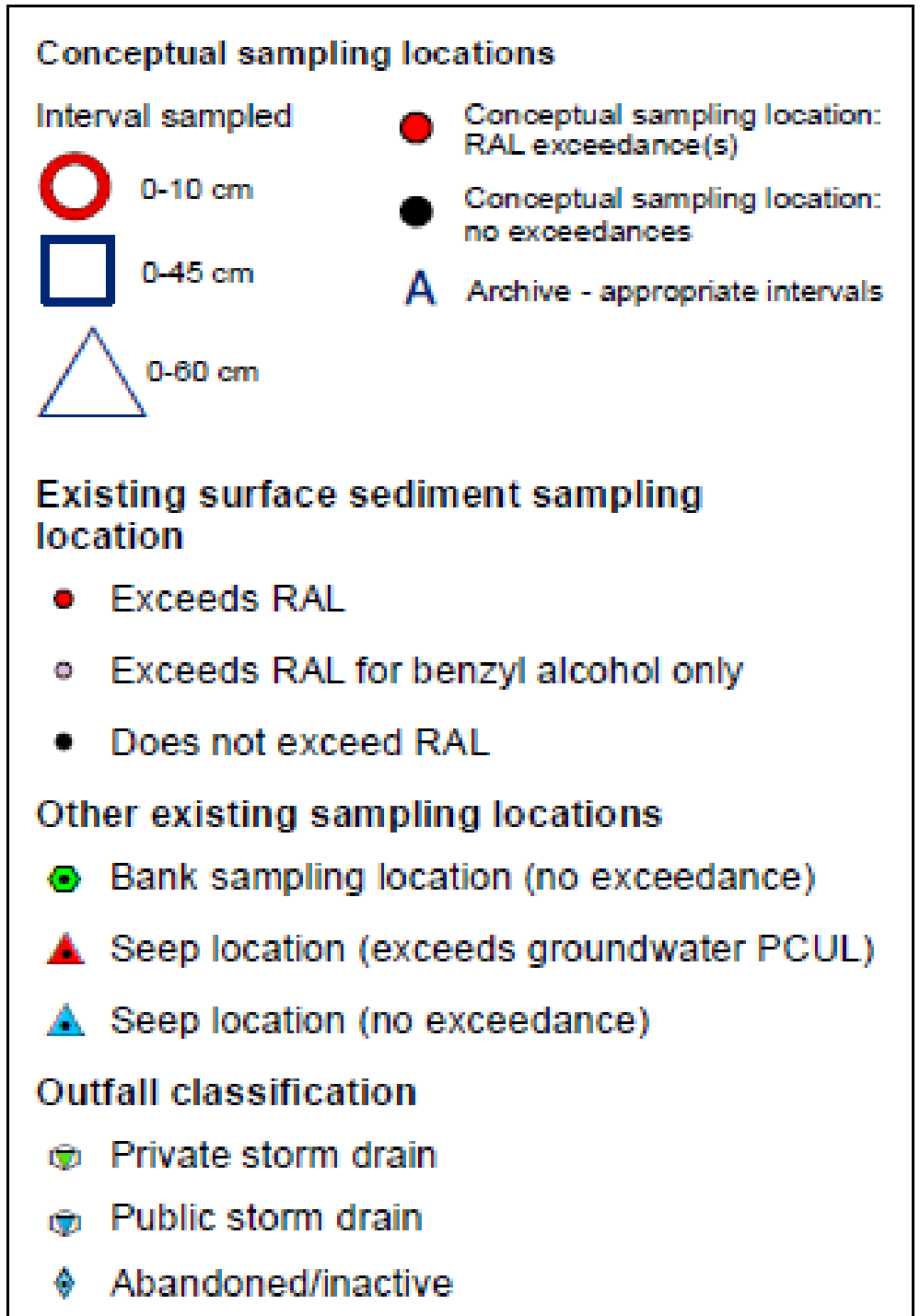
Existing surface sediment sampling location
- Exceeds RAL
- Exceeds RAL for benzyl alcohol only
- Does not exceed RAL

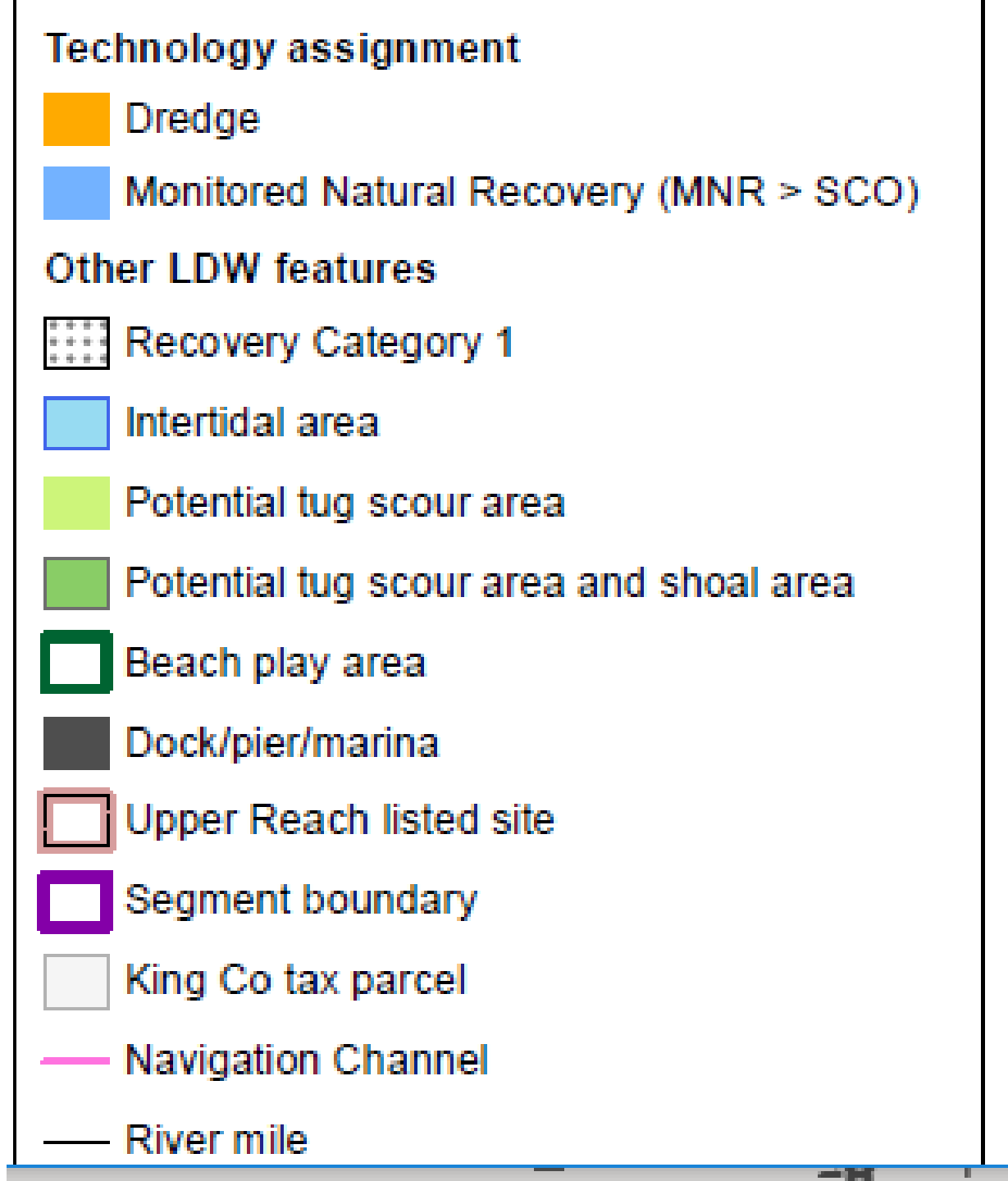
Other existing sampling locations
- Bank sampling location (no exceedance)
- Seep location (exceeds groundwater PCUL)
- Seep location (no exceedance)

Outfall classification
- Private storm drain
- Public storm drain
- Abandoned/inactive

Technology assignment
- Dredge
- Monitored Natural Recovery (MNR > SCO)

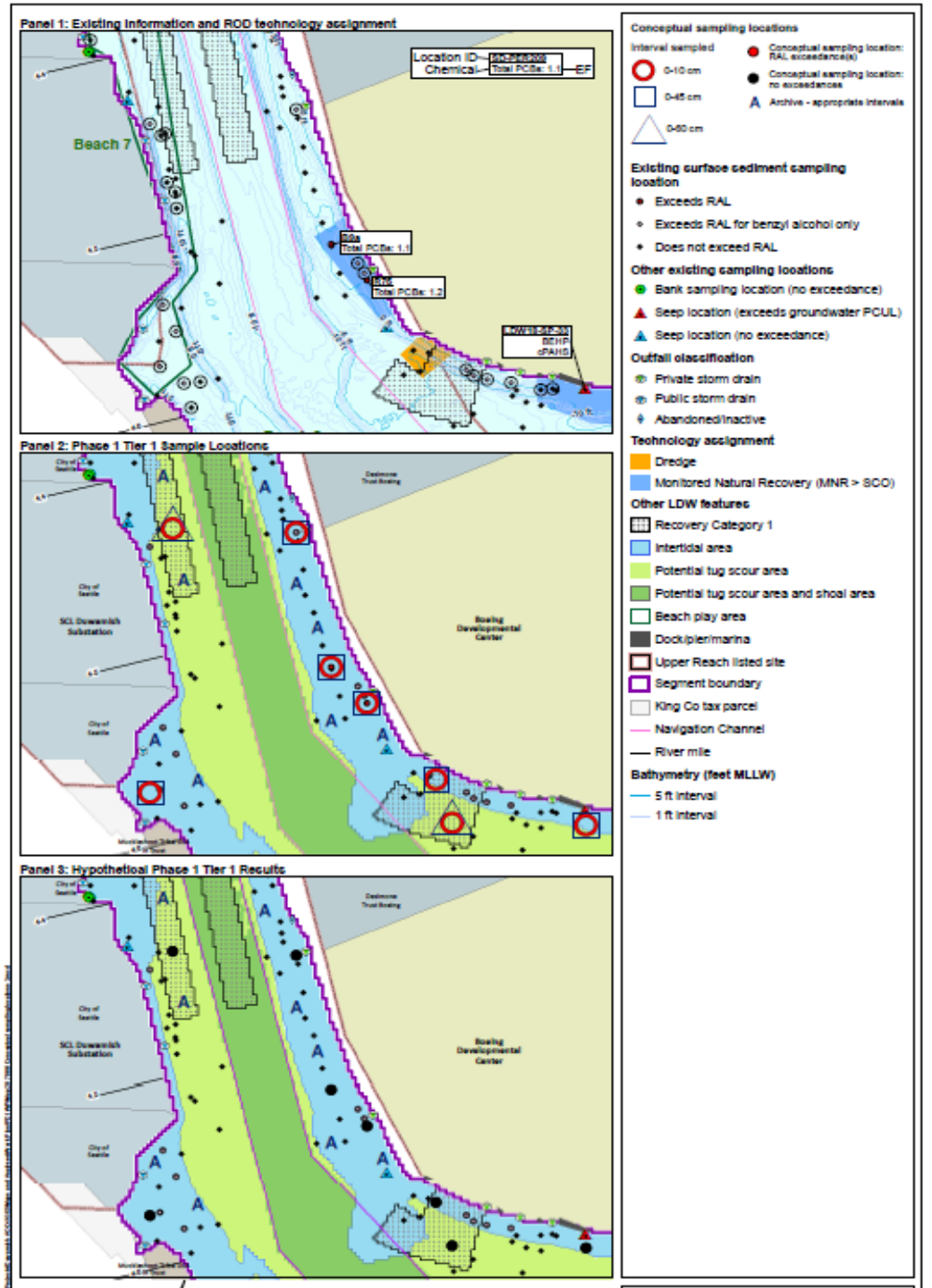
Other LDW features
- Recovery Category 1
- Intertidal area
- Potential tug scour area
- Potential tug scour area and shoal area
- Beach play area
- Dock/pier/marina
- Upper Reach listed site
- Segment boundary
- King Co tax parcel
- Navigation Channel
- River mile


Conceptual sampling locations
Interval sampled
0-10 cm
0-45 cm
0-60 cm
Conceptual sampling location: RAL exceedance(s)
Conceptual sampling location: no exceedances
A
Archive - appropriate intervals
Existing surface sediment sampling location
Exceeds RAL
Exceeds RAL for benzyl alcohol only
Does not exceed RAL
Other existing sampling locations
Bank sampling location (no exceedance)
Seep location (exceeds groundwater PCUL)
Seep location (no exceedance)
Outfall classification
Private storm drain
Public storm drain
Abandoned/inactive


Technology assignment
Dredge
Monitored Natural Recovery (MNR > SCO)
Other LDW features
Recovery Category 1
Intertidal area
Potential tug scour area
Potential tug scour area and shoal area
Beach play area
Dock/pier/marina
Upper Reach listed site
Segment boundary
King Co tax parcel
Navigation Channel
River mile

Hypothetical Example

- Existing information
- Phase 1, Tier 1 samples
- Possible results – now, which archived samples should you analyze?



EXTRA SLIDE - What does sampling involve?

- A clear description of the goals and how the samples fit the goal
- A plan for field work and laboratory work, called a Quality Assurance Project Plan (QAPP).
- Trained field crew collects samples following the plan, keep records of the field conditions, make sure the samples are properly labeled and kept safe and cool until the lab receives them.
- At the lab, the samples are extracted (so the contamination in the sediment becomes dissolved in liquid) and the liquid (“extract”) is placed in the appropriate sampling equipment.