

The Hazard Ranking System (HRS)

The Surface Water Migration Pathway

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Molly Wenner



The surface water migration pathway evaluates contaminated surface water impacting drinking water, fisheries, sensitive environments, and resources



Surface Water Drinking Water Threat Scoresheet



Likelihood of Release

Observed release

Potential to release



Waste Characteristics

Toxicity

Persistence

Hazardous waste quantity



Targets

Surface water intakes

Population

Resources

TABLE 4-1—SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Drinking Water Threat		
Likelihood of Release:		
1. Observed Release	550	_____
2. Potential to Release by Overland Flow:		
2a. Containment	10	_____
2b. Runoff	25	_____
2c. Distance to Surface Water	25	_____
2d. Potential to Release by Overland Flow (lines 2a[2b + 2c])	500	_____
3. Potential to Release by Flood:		
3a. Containment (Flood)	10	_____
3b. Flood Frequency	50	_____
3c. Potential to Release by Flood (lines 3a × 3b)	500	_____
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	_____
5. Likelihood of Release (higher of lines 1 and 4)	550	_____
Waste Characteristics:		
6. Toxicity/Persistence	(a)	_____
7. Hazardous Waste Quantity	(a)	_____
8. Waste Characteristics	100	_____
Targets:		
9. Nearest Intake	50	_____
10. Population		
10a. Level I Concentrations	(b)	_____
10b. Level II Concentrations	(b)	_____
10c. Potential Contamination	(b)	_____
10d. Population (lines 10a + 10b + 10c)	(b)	_____
11. Resources	5	_____
12. Targets (lines 9 + 10d + 11)	(b)	_____
Drinking Water Threat Score:		
13. Drinking Water Threat Score ([lines 5 × 8 × 12]/82,500, subject to a maximum of 100)	100	_____

Surface Water Human Food Chain Threat Scoresheet



Likelihood of Release

Observed release
Surface water body

Waste Characteristics

Toxicity
Persistence/bioaccumulation
Hazardous waste quantity

Targets

Food chain individual
Population

TABLE 4-1—SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Human Food Chain Threat		
Likelihood of Release:		
14. Likelihood of Release (same value as line 5)	550	_____
Waste Characteristics:		
15. Toxicity/Persistence/Bioaccumulation	(a)	_____
16. Hazardous Waste Quantity	(a)	_____
17. Waste Characteristics	1,000	_____
Targets:		
18. Food Chain Individual	50	_____
19. Population		
19a. Level I Concentrations	(b)	_____
19b. Level II Concentrations	(b)	_____
19c. Potential Human Food Chain Contamination	(b)	_____
19d. Population (lines 19a + 19b + 19c)	(b)	_____
20. Targets (lines 18 + 19d)	(b)	_____
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score (([lines 14 × 17 × 20]/82,500, subject to a maximum of 100)	100	_____

Surface Water Environmental Threat Scoresheet



Likelihood of Release

**Observed release
Surface water body**

Waste Characteristics

**Ecosystem toxicity
Persistence/bioaccumulation
Hazardous waste quantity**

Targets

Sensitive environments

TABLE 4-1—SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

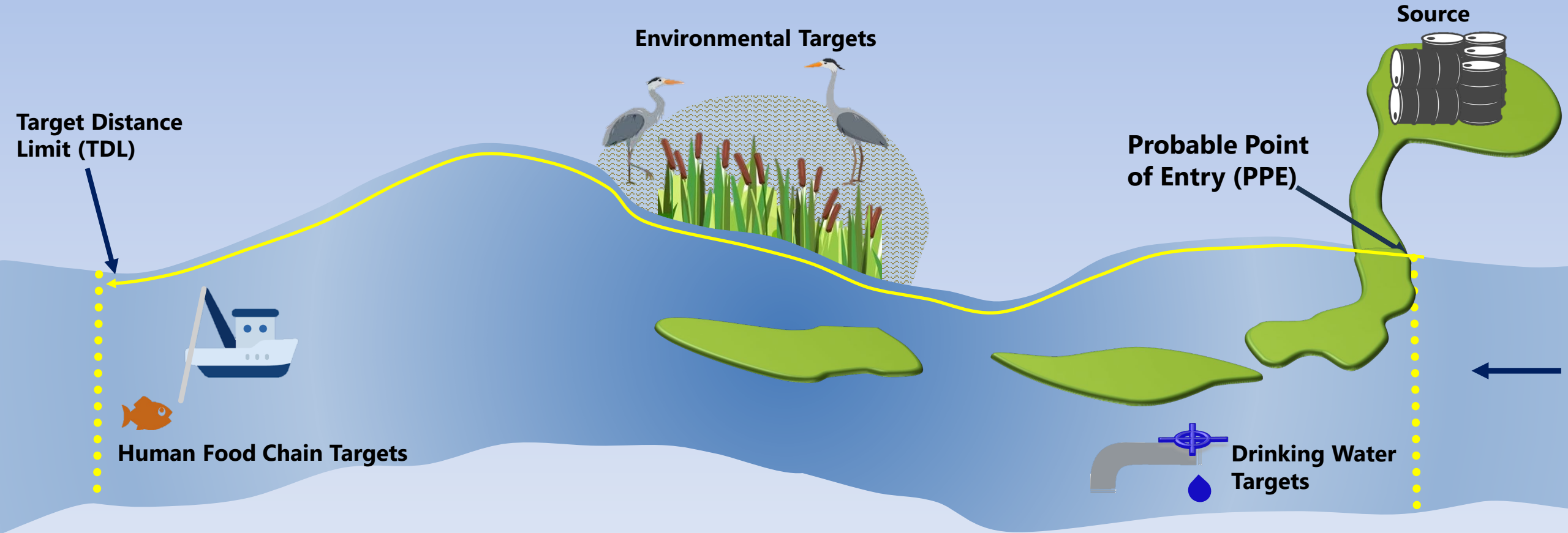
Factor categories and factors	Maximum value	Value assigned
Environmental Threat		
Likelihood of Release:		
22. Likelihood of Release (same value as line 5)	550	_____
Waste Characteristics:		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	_____
24. Hazardous Waste Quantity	(a)	_____
25. Waste Characteristics	1,000	_____
Targets:		
26. Sensitive Environments.		
26a. Level I Concentrations	(b)	_____
26b. Level II Concentrations	(b)	_____
26c. Potential Contamination	(b)	_____
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	_____
27. Targets (value from line 26d)	(b)	_____
Environmental Threat Score:		
28. Environmental Threat Score ((lines 22 × 25 × 27)/82,500, subject to a maximum of 60)	60	_____

Surface Water Migration Pathway

WHAT IS YOUR SITE?

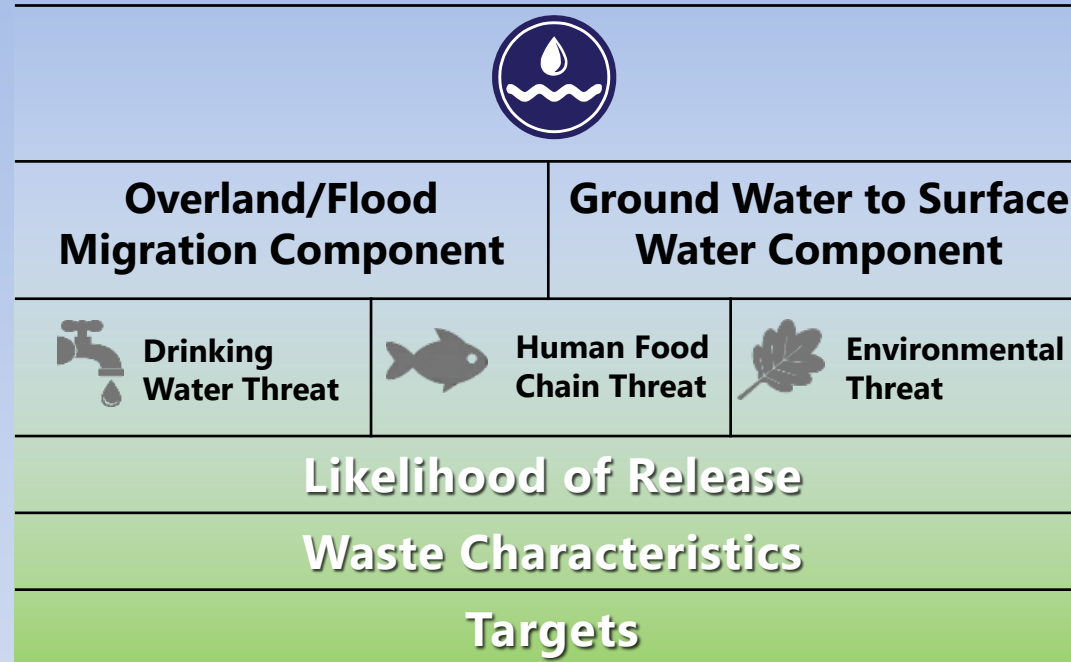
What is Your Site?

Surface Water Migration Pathway - Conceptual Site Model



HRS Evaluation

Surface Water Pathway Structure



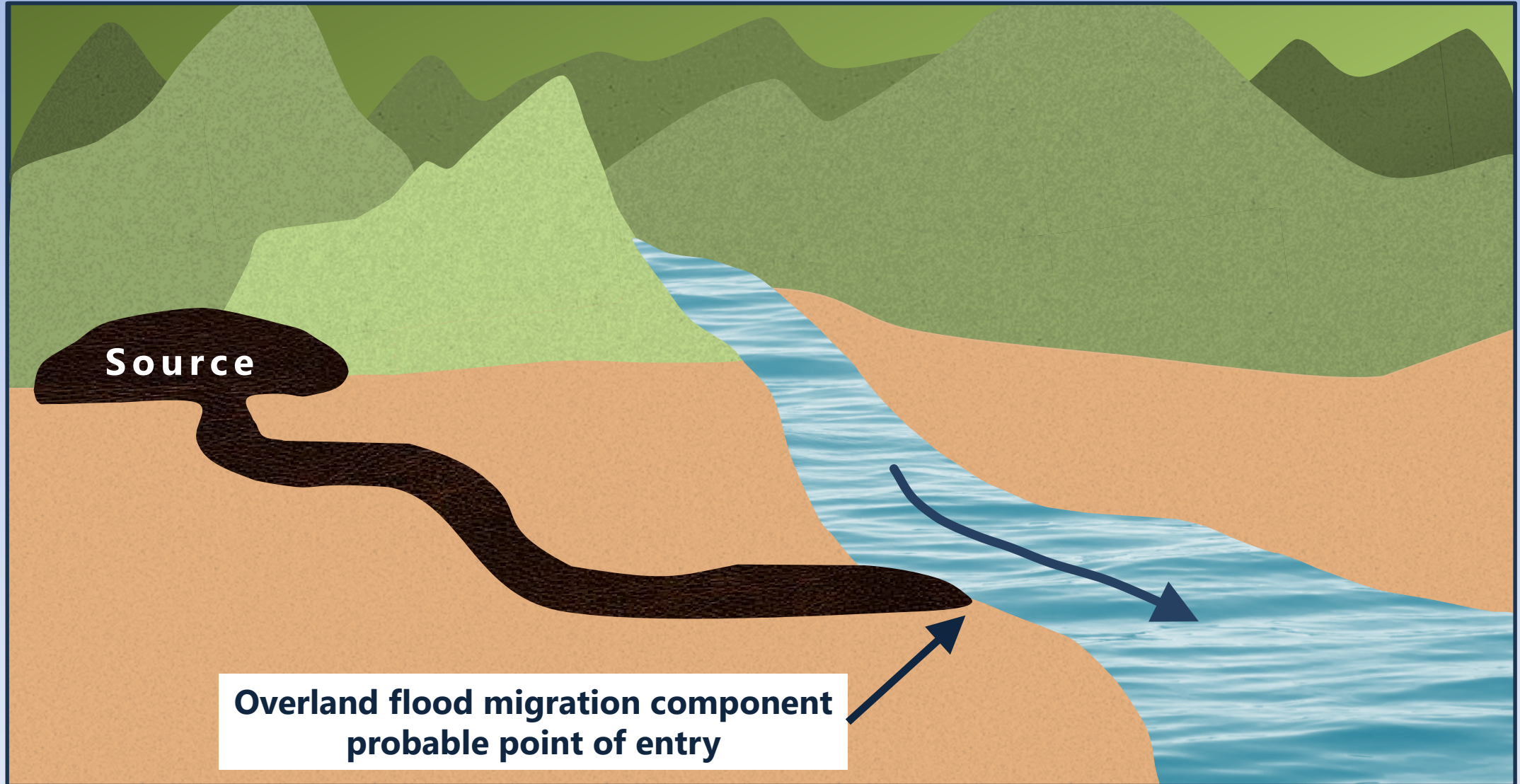
Sampling Matrices

Surface water

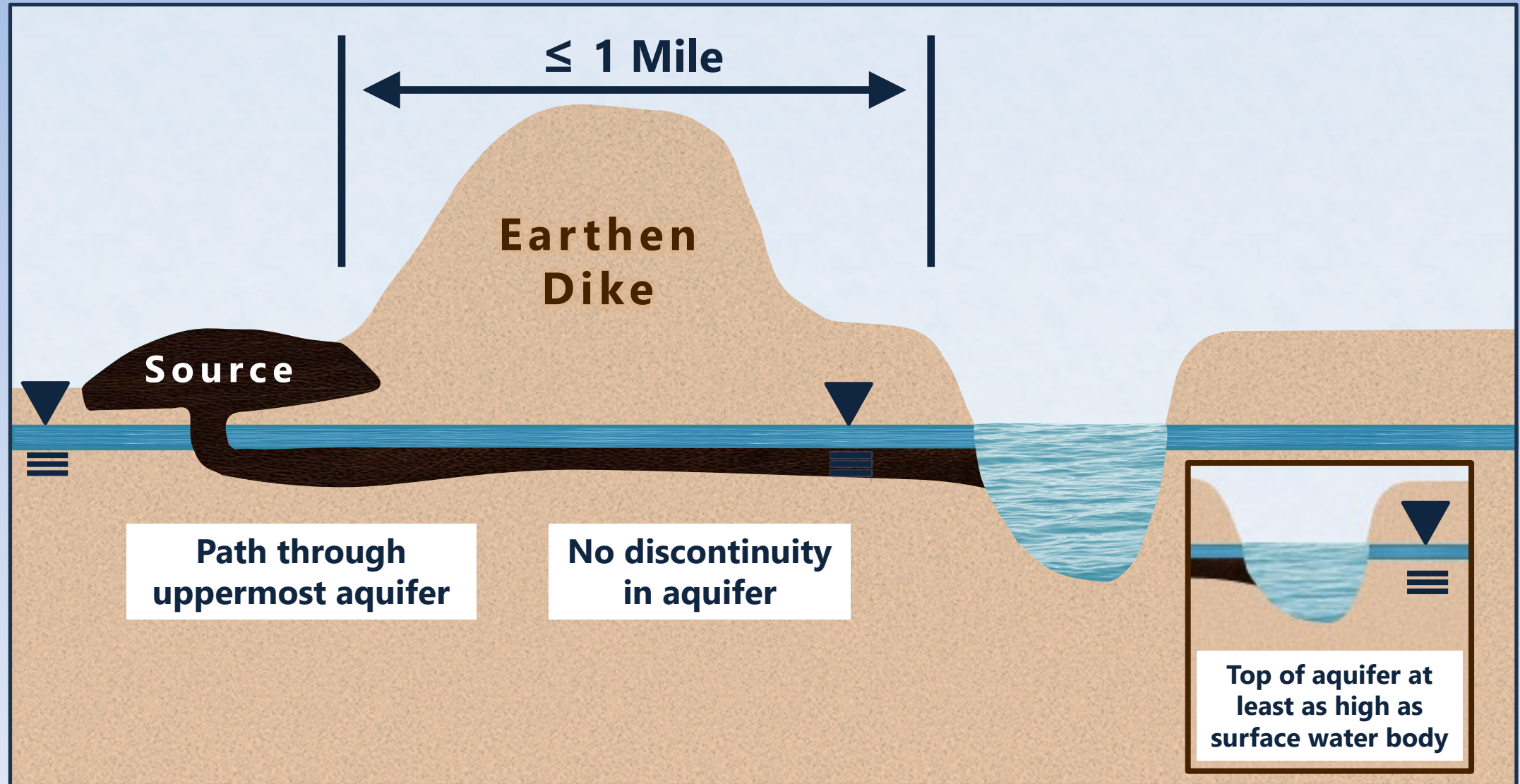
Sediment

Benthic or other tissue

Overland/Flood Migration Component



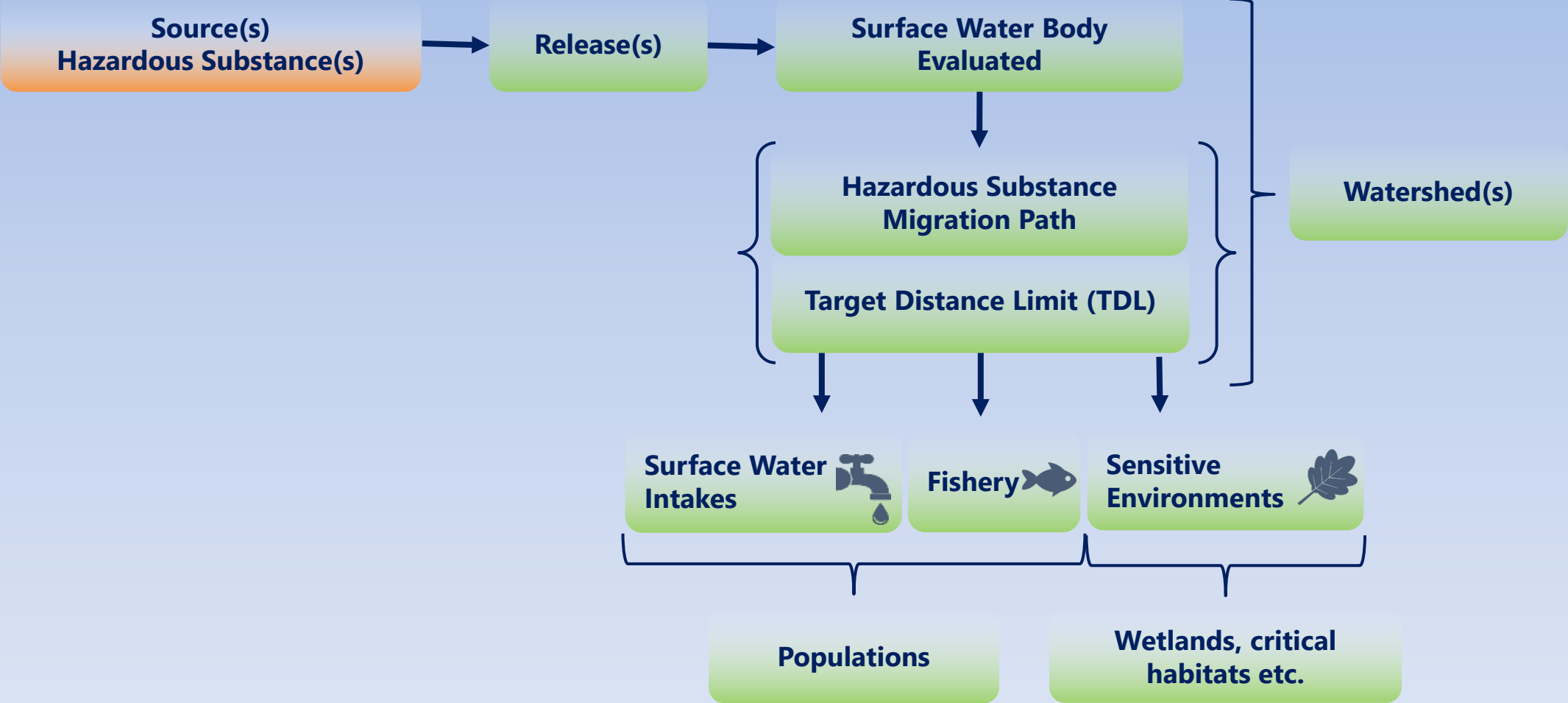
Ground Water to Surface Water Component





ELEMENTS OF SURFACE WATER MIGRATION PATHWAY EVALUATION

Elements of the Surface Water Migration Pathway

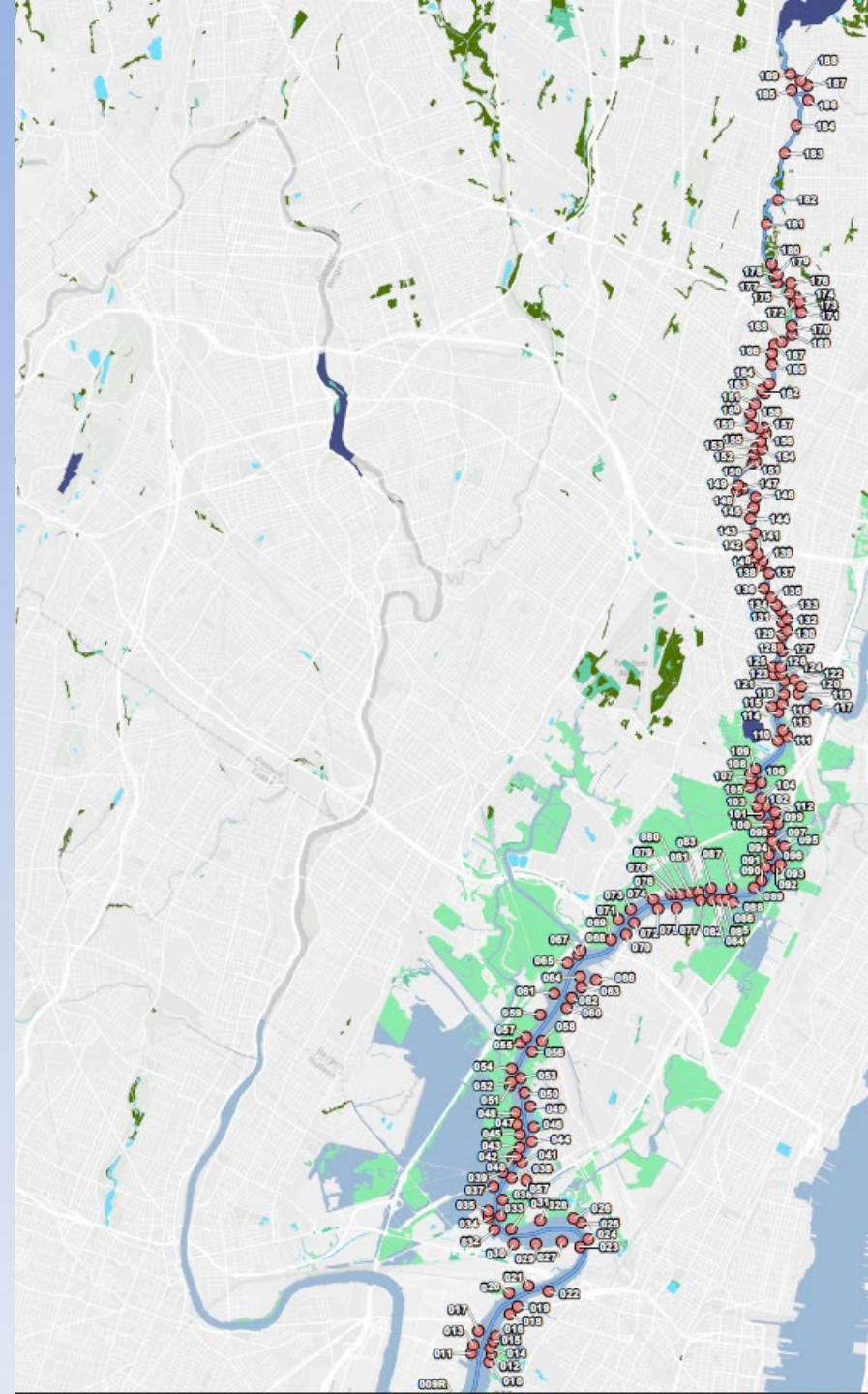


Sources

Sediment Plume with No Identified Source

- *"...Sources do not include those volumes of surface water or surface water sediments that have become contaminated by migration."*

Except: in the case of contaminated surface water sediments with no identified source, the contaminated sediments may be considered a source



Observed Release

Overland/Flood Migration Component



**Drinking
Water Threat**



**Human Food
Chain Threat**



**Environmental
Threat**



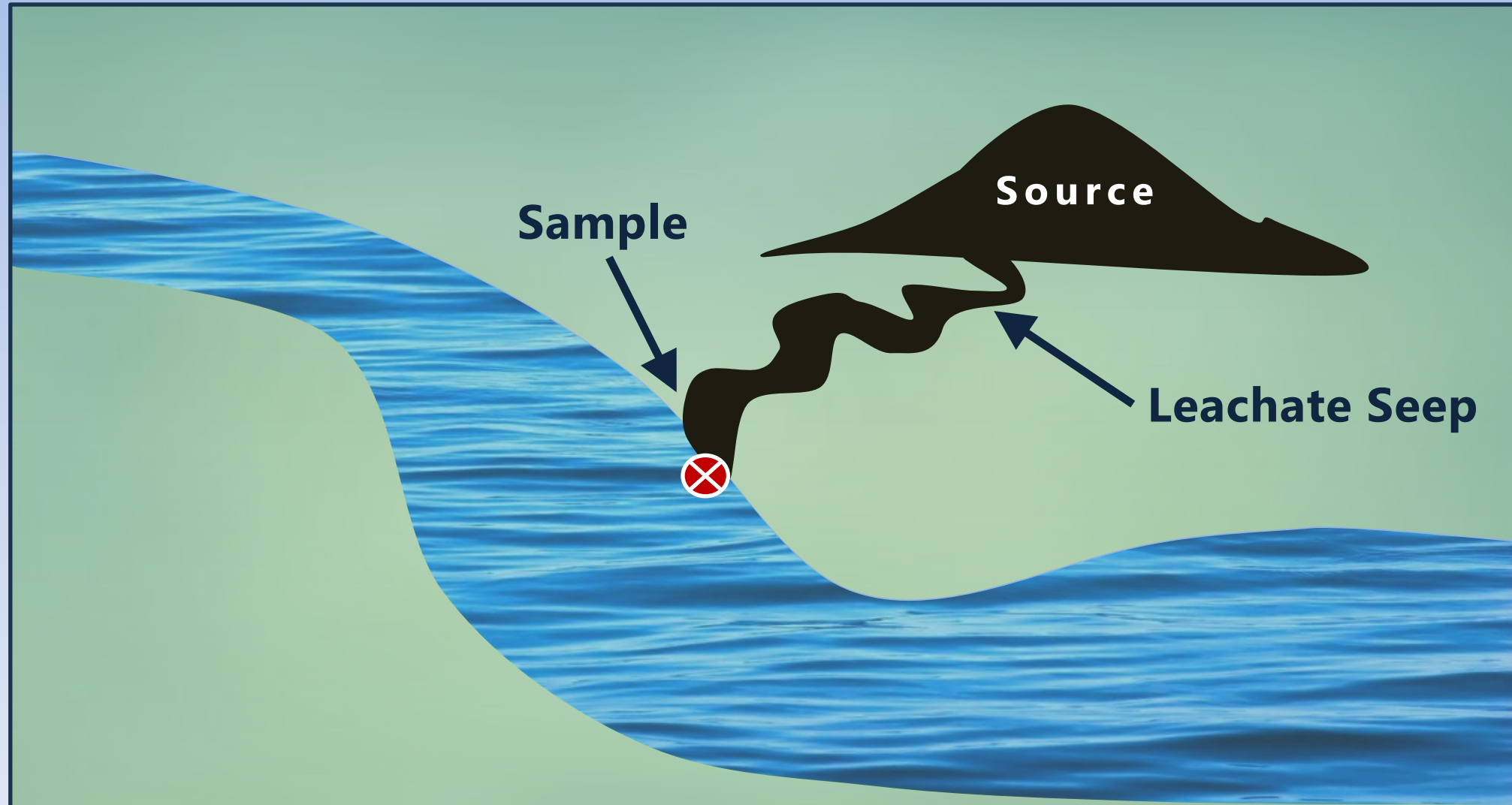
Likelihood of Release

Observed Release

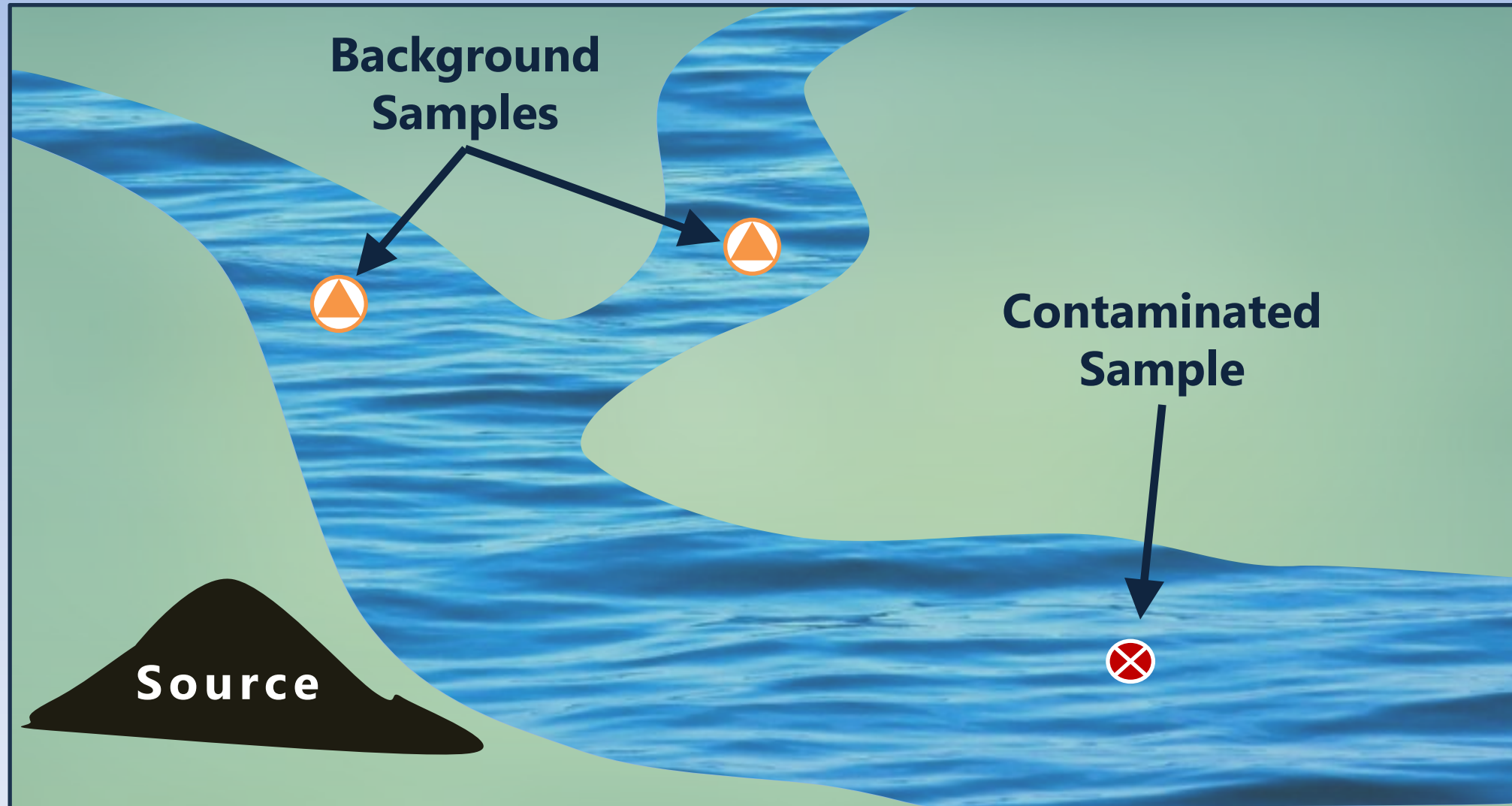
Chemical Analysis

Direct Observation

Observed Release *by Direct Observation*



Observed Release *by Chemical Analysis*



Observed Release

by Chemical Analysis – Sample Similarity



≠



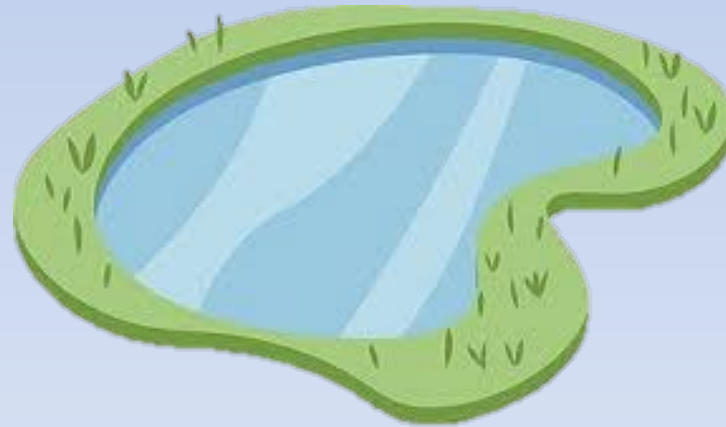
Eligible Surface Water Body

Classified into 4 categories

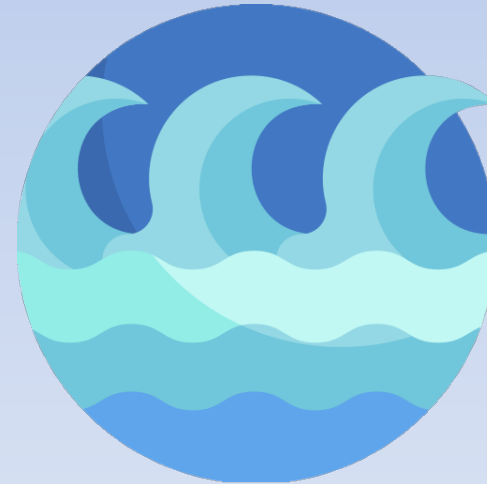
Rivers



Lakes



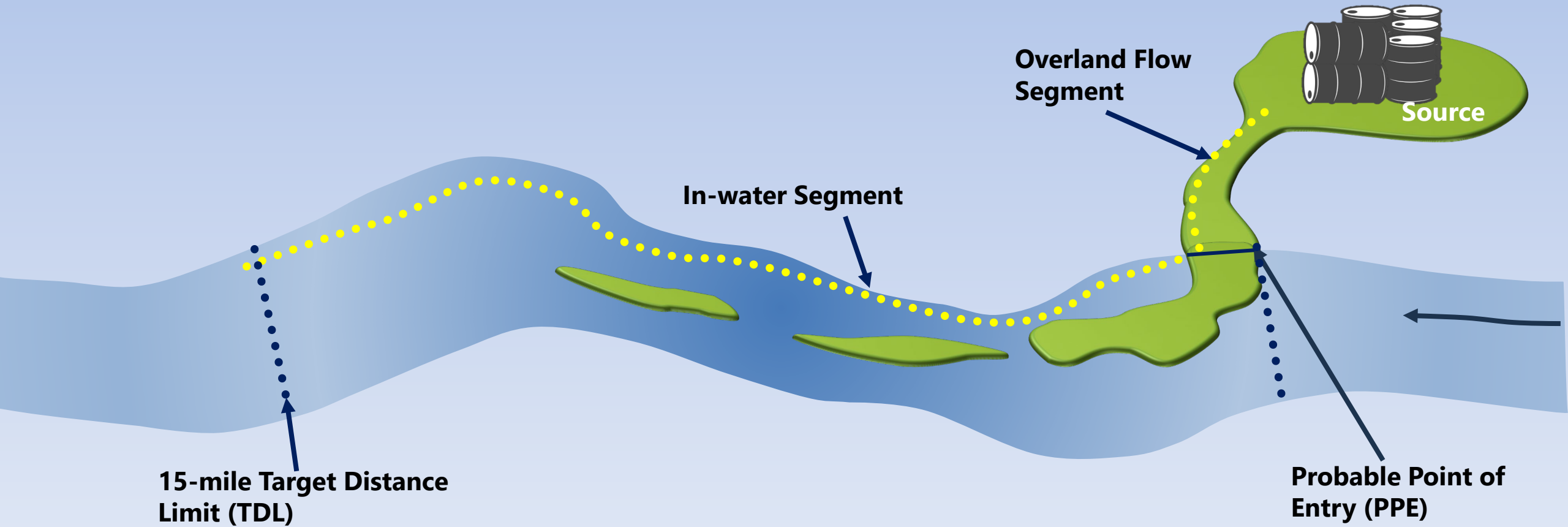
Oceans



Coastal Tidal Waters

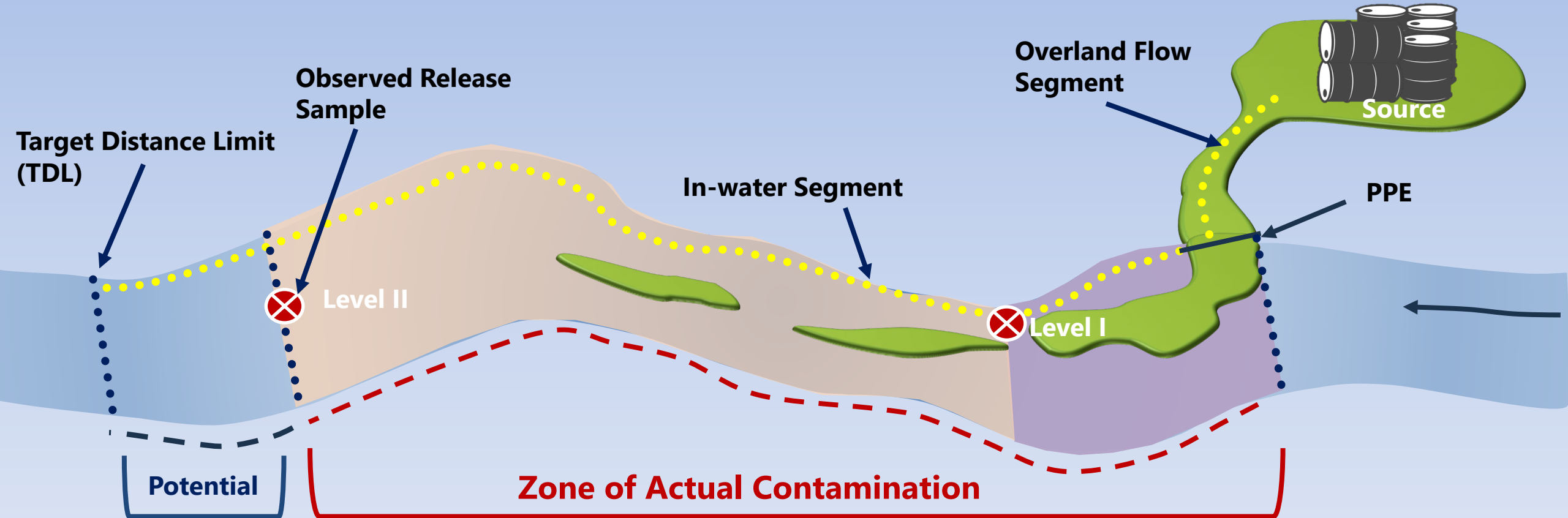


Hazardous Substance Migration Pathway

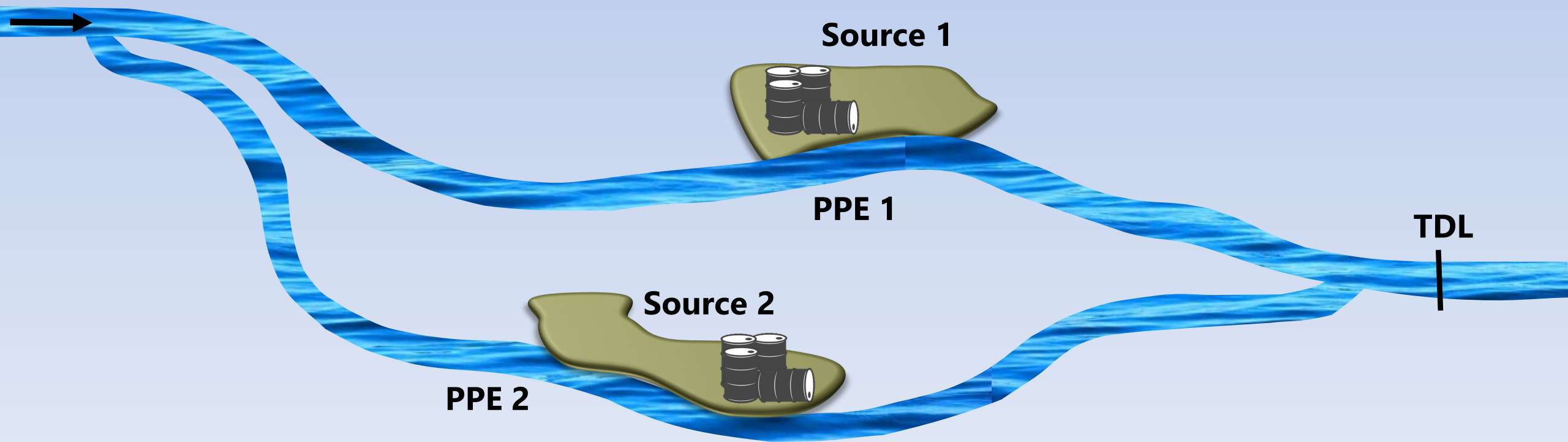
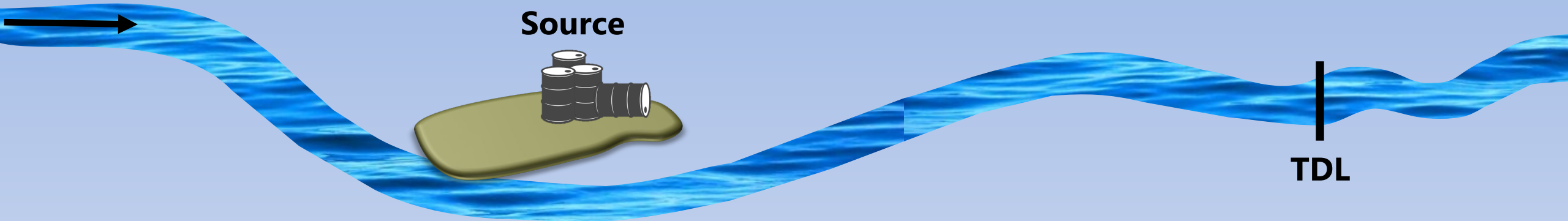


Hazardous Substance Migration Path

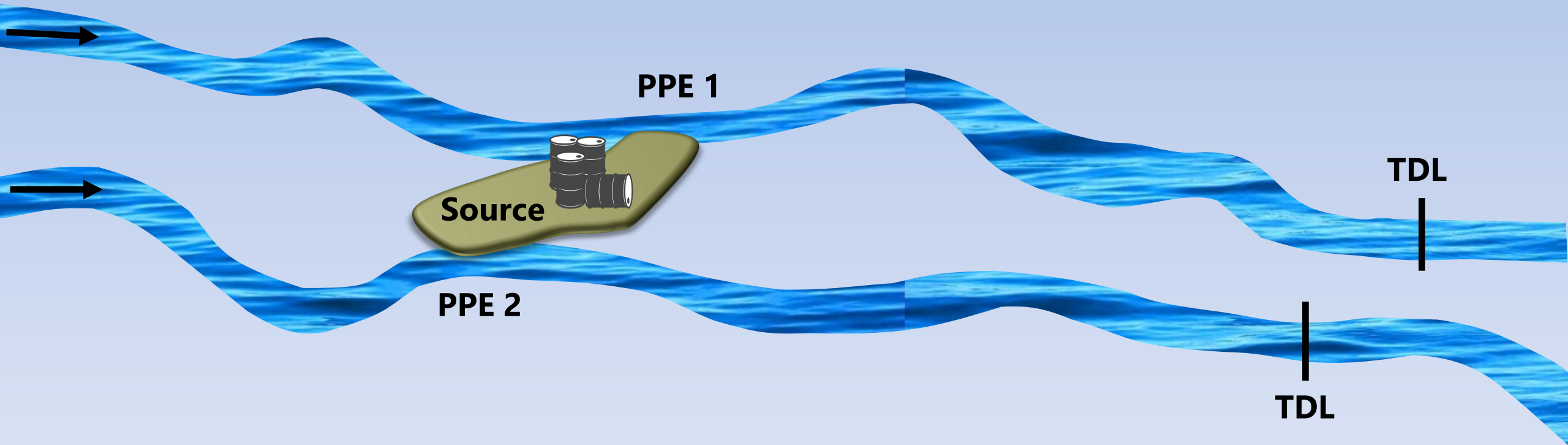
Target Distance Limit



Watersheds



Watersheds



Quiz #1: Hazardous Substance Migration Path

1. The surface water migration pathway TDL starts at the source and ends 15 miles downstream.
 - a) True
 - b) False

Quiz #2: Eligible Surface Water Bodies

2. Which of these is not an HRS surface water body classification:
- a) River
 - b) Lake
 - c) Wetland
 - d) Ocean
 - e) Coastal Tidal Water

Waste Characteristics

Drinking Water Threat



- Human toxicity – Evaluates the toxicity of a substance in drinking water consumed by humans
- Persistence - Reflects the likelihood a hazardous substance will remain undegraded while travelling from PPE to TDL

Human Food Chain Threat



- Human toxicity – Evaluates the toxicity of a substance in fish consumed by humans
- Persistence - Reflects the likelihood a hazardous substance will remain undegraded while travelling from PPE to TDL
- Bioaccumulation - Reflects tendency for a substance to accumulate in the tissue of a human food chain aquatic organism

Environmental Threat



- Ecosystem toxicity – Evaluates the toxicity of a substance to aquatic organisms and wildlife consuming those organisms
- Persistence - Reflects the likelihood a hazardous substance will remain undegraded while travelling from PPE to TDL
- Ecosystem Bioaccumulation - Reflects tendency for a substance to accumulate in the tissue of any aquatic organism, not just human food chain organisms

Surface Water Pathway

DRINKING WATER THREAT



Drinking Water Threat

This threat considers the populations and resources that use surface water for drinking water, agricultural, food production, and recreational purposes.



Drinking Water Threat



Likelihood of Release

Observed release
Potential to release



Waste Characteristics

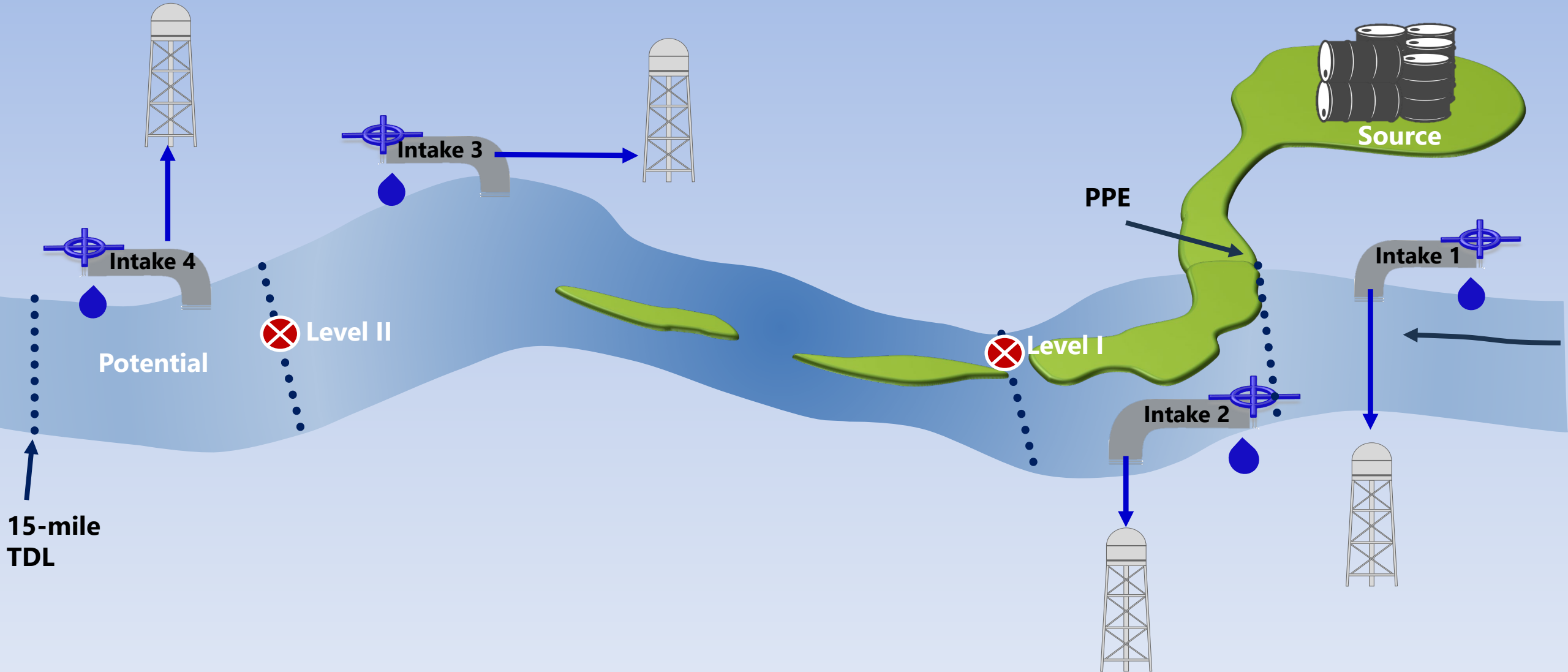
Toxicity
Persistence
Hazardous waste quantity



Targets

Surface water intakes for drinking water
Populations
Resources

Drinking Water Threat





Drinking Water Threat

Level of Contamination

Sample Type	Target	Drinking Water Threat
Level I		
Surface Water	Surface water intake	Must meet observed release criteria and be at or above concentration corresponding to: <ul style="list-style-type: none"> • Non-zero MCLG, • MCL, • Oral 10^{-6} cancer risk, or • Oral RfD
Level II		
Surface Water	Surface water intake	Must meet observed release criteria
Sediment	Surface water intake	Must meet observed release criteria
Sessile Benthic or other tissue	Surface water intake	Must meet observed release criteria
Potential for Contamination		
n/a	Surface water intake	Within 15-mile TDL and outside any zone of actual contamination

Resource targets within the TDL

Surface Water Pathway

HUMAN FOOD CHAIN THREAT

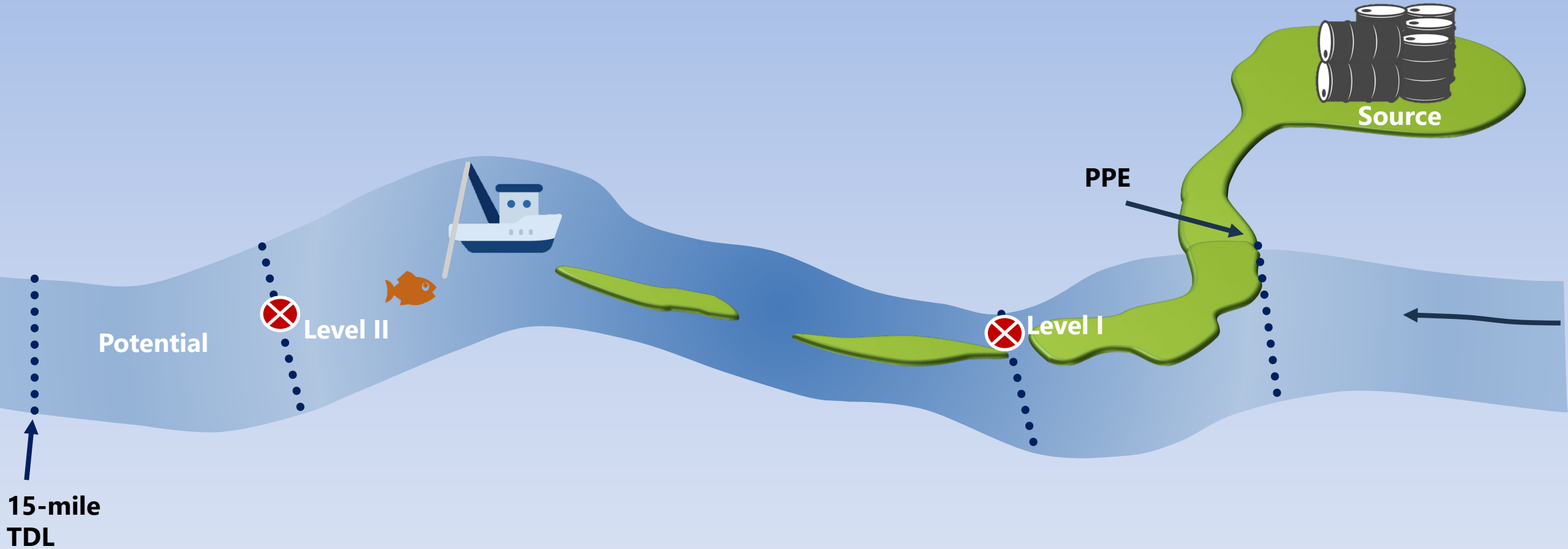


Human Food Chain Threat

This threat considers human consumption of fish and other aquatic organisms. The population factor estimates the amount of pounds of aquatic organisms that are produced annually for human consumption



Human Food Chain Threat





Human Food Chain Threat

Documenting Presence of a Fishery within the TDL



e.g., Fish census data,
catch data, stocking data

and



e.g., interviews of
fisherman, expert
written statements

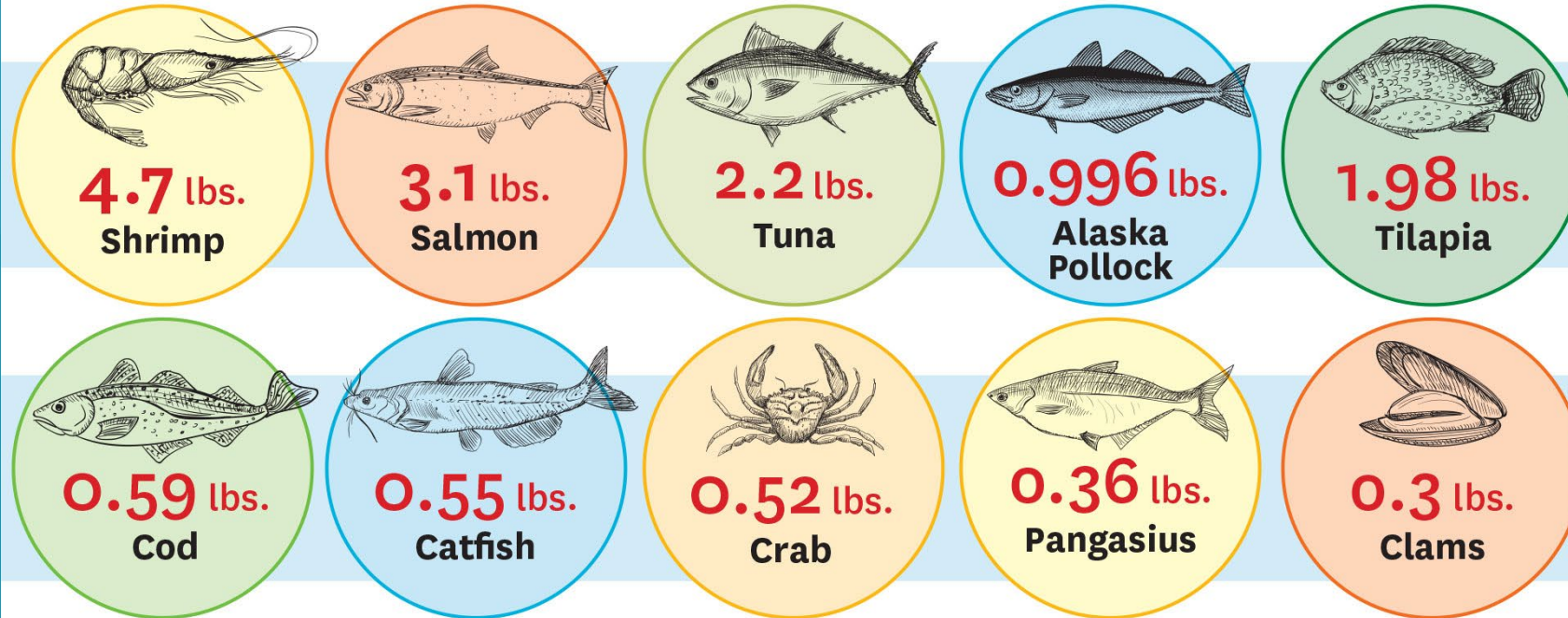


Closed due to site hazardous substances (e.g.,
do not eat advisory)

Human Food Chain Threat

Determining Fishery Production

America's Most Popular Seafood 2019 • National Fisheries Institute



**TOTAL
TOP 10**
14.28
lbs.

**PER CAPITA
CONSUMPTION**
19.2
lbs.

**TOP 10
ACCOUNTS FOR**
74%
of total demand



Human Food Chain Threat

Level of Contamination

Sample Type	Target	Human Food Chain Threat
Level I		
Sessile Benthic or other tissue	Fishery	Must meet observed release criteria and be at or above concentrations corresponding to: <ul style="list-style-type: none"> • FDAAL for fish or shellfish, • Oral 10^{-6} cancer risk, or • Oral RfD
Level II		
Surface Water	Fishery	Must meet observed release criteria
Sediment	Fishery	Must meet observed release criteria
Sessile Benthic or other tissue	Fishery	Must meet observed release criteria
Potential for Contamination		
n/a	Fishery	Within 15-mile TDL and outside any zone of actual contamination

Surface Water Pathway

ENVIRONMENTAL THREAT



Environmental Threat

This threat evaluates sensitive environments, such as wetlands, critical habitat for endangered species, and many other types of unique environments.



Human Food Chain Threat



Likelihood of Release

Observed release
Potential to release



Waste Characteristics

Ecosystem Toxicity
Persistence
Ecosystem Bioaccumulation
Hazardous waste quantity



Targets

Sensitive Environments



Environmental Threat

Sensitive Environments

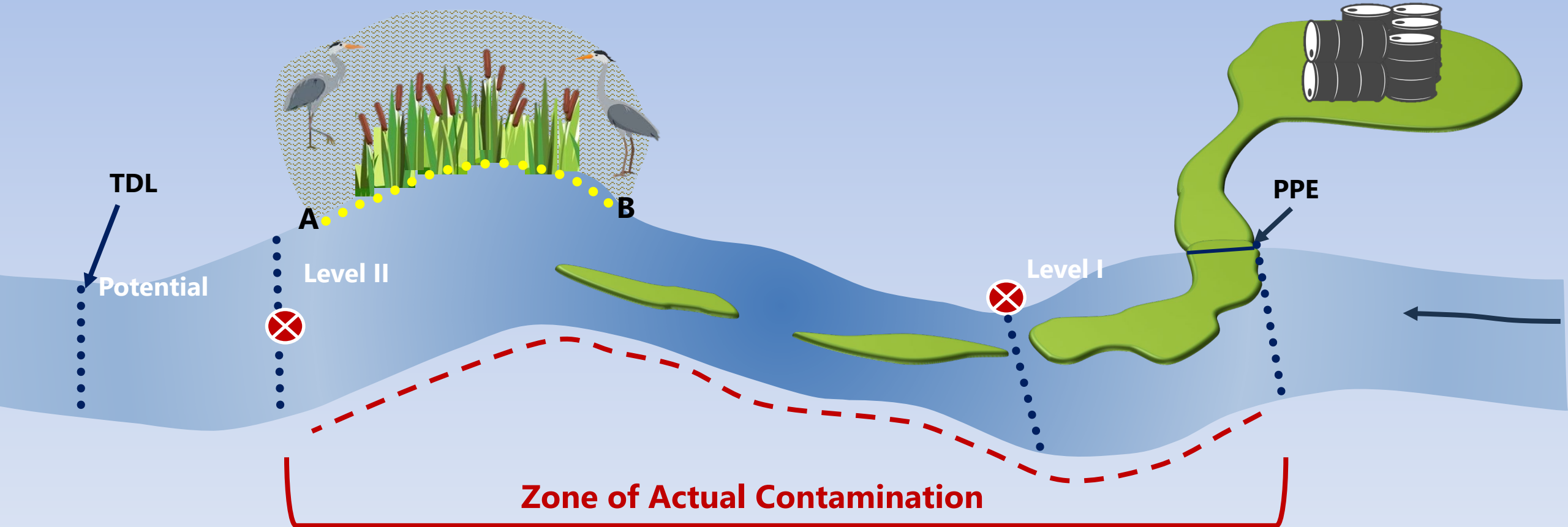
TABLE 4-23—SENSITIVE ENVIRONMENTS RATING VALUES

Sensitive environment	Assigned value
Critical habitat ^a for Federal designated endangered or threatened species Marine Sanctuary National Park Designated Federal Wilderness Area Areas identified under Coastal Zone Management Act ^b Sensitive areas identified under National Estuary Program ^c or Near Coastal Waters Program ^d Critical areas identified under the Clean Lakes Program ^e National Monument ^f National Seashore Recreational Area National Lakeshore Recreational Area	100
Habitat known to be used by Federal designated or proposed endangered or threatened species National Preserve National or State Wildlife Refuge Unit of Coastal Barrier Resources System Coastal Barrier (undeveloped) Federal land designated for protection of natural ecosystems Administratively Proposed Federal Wilderness Area Spawning areas critical ^g for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time Terrestrial areas utilized for breeding by large or dense aggregations of animals ^h National river reach designated as Recreational	75
Habitat known to be used by State designated endangered or threatened species Habitat known to be used by species under review as to its Federal endangered or threatened status Coastal Barrier (partially developed) Federal designated Scenic or Wild River	50
State land designated for wildlife or game management State designated Scenic or Wild River State designated Natural Areas Particular areas, relatively small in size, important to maintenance of unique biotic communities	25
State designated areas for protection or maintenance of aquatic life ⁱ	5



Environmental Threat

Wetlands Characterization





Environmental Threat

Level of Contamination

Sample Type	Target	Environmental Threat
Level I		
Surface Water	<ul style="list-style-type: none">Listed sensitive environmentWetland	Must meet observed release criteria and be at or above concentrations corresponding to: <ul style="list-style-type: none">AWQC/NRWQC for protection of aquatic life, orAALAC
Level II		
Surface Water	<ul style="list-style-type: none">Listed sensitive environmentWetland	Must meet observed release criteria
Sediment	<ul style="list-style-type: none">Listed sensitive environmentWetland	Must meet observed release criteria
Benthic or other tissue	<ul style="list-style-type: none">Listed sensitive environmentWetland	Must meet observed release criteria
Potential for Contamination		
n/a	<ul style="list-style-type: none">Listed sensitive environmentWetland	Within 15-mile TDL and outside any zone of actual contamination

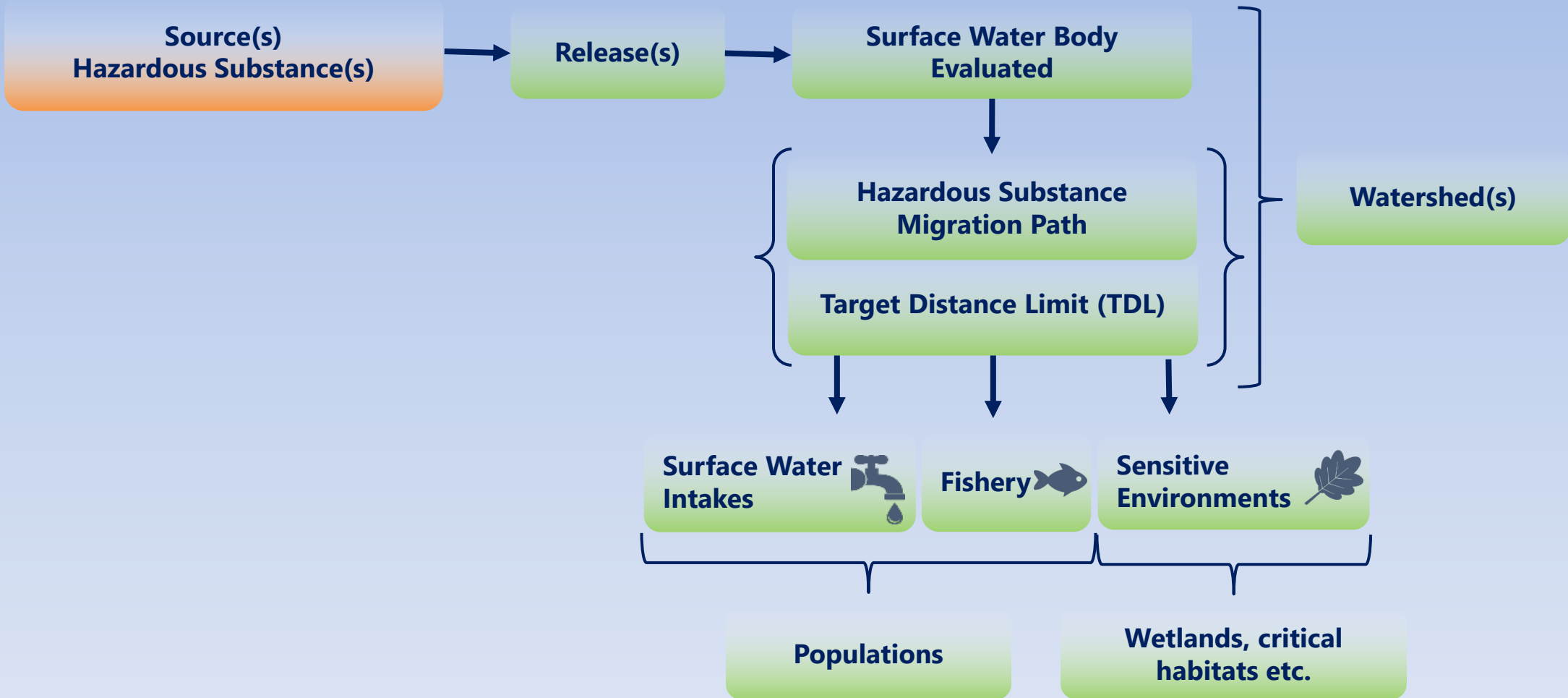
Quiz Question on Surface Water Migration Pathway Threats

5. The Sensitive Environments Threat only scores wetlands:
- a) True
 - b) False

Surface Water Migration Pathway

**FITTING THE PIECES TOGETHER FOR THE
HRS EVALUATION**

Elements of the Surface Water Pathway Migration



Elements of the Surface Water Pathway Migration

Mapped to Factor Categories

Source(s)
Hazardous Substance(s)

Release(s)

Eligible Surface Water Bodies

Watershed (s)

Hazardous Substance Migration Path (TDL)

Target Distance Limit

Factor Category

Toxicity/Persistence/
Bioaccumulation

Ecosystem Toxicity/
Persistence/
Bioaccumulation

Surface water
intakes

Fisheries

Listed Sensitive
Environments

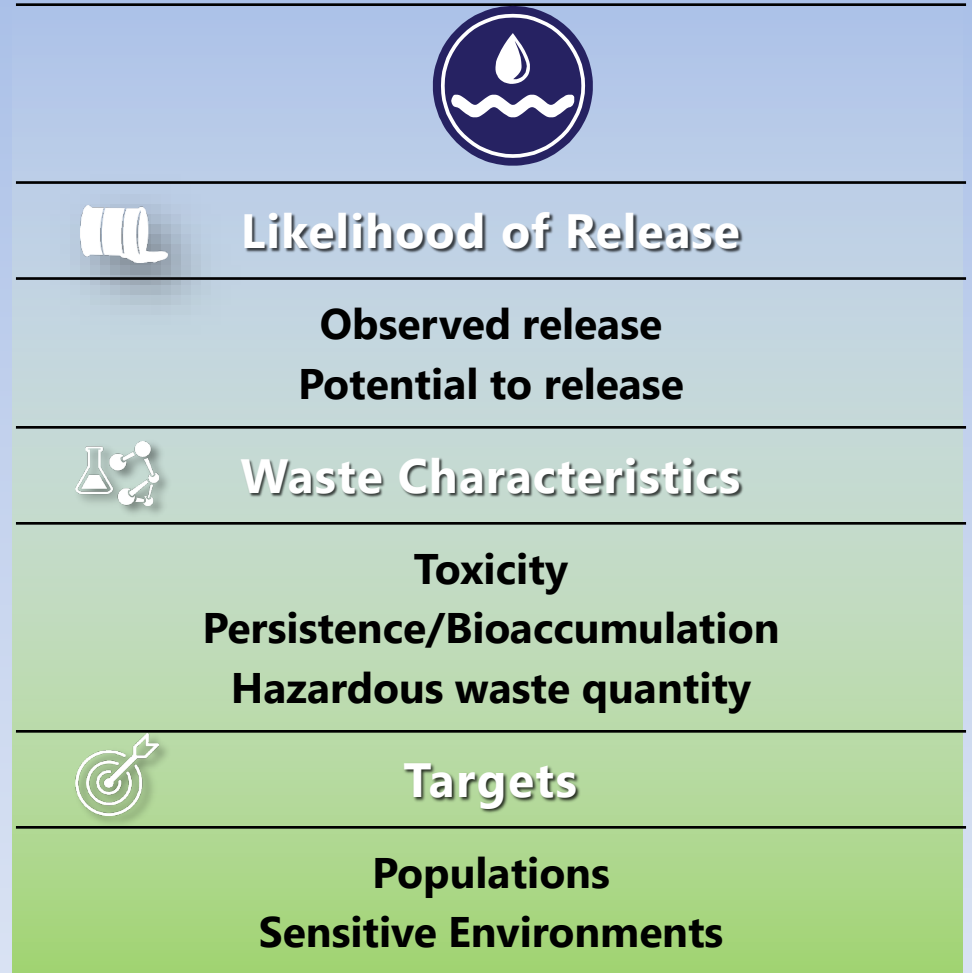
Populations

Wetlands, critical
habitats etc.



Summary of Surface Water Migration Pathway Threat

- When you have a **source** with a hazardous substance that could or already has entered (released into) into surface water
- When the contamination **has impacted**, or **threatens to impact**, one or more **surface water bodies**
- When you have **enough contamination** that is also **toxic enough** to impact **surface water**
- **People** are **actually ingesting** contaminated surface or ingesting contaminated fish; contaminated wetlands or other sensitive environments



Key Points for Information Gathering

Drinking Water Threat



- Surface water intakes in TDL
- Service connections
- Number of people served by each connection
- Resources that use surface water within TDL
- Water flow information at intakes in cubic feet per second
- Standby intakes, pumpage data, information on blended systems

Human Food Chain Threat



- Fisheries in TDL - an area of a surface water body from which food chain organisms are taken
- Documentation of the catching and consumption of fish from the fishery is required
- Pounds of fish production per year for human consumption needs to be estimated

Environmental Threat



- Terrestrial or aquatic resource, fragile natural setting or other area with unique or highly valued environmental or cultural features
- Wetland frontage or perimeter
- Sensitive environments and point values in HRS rule and guidance



Q & A