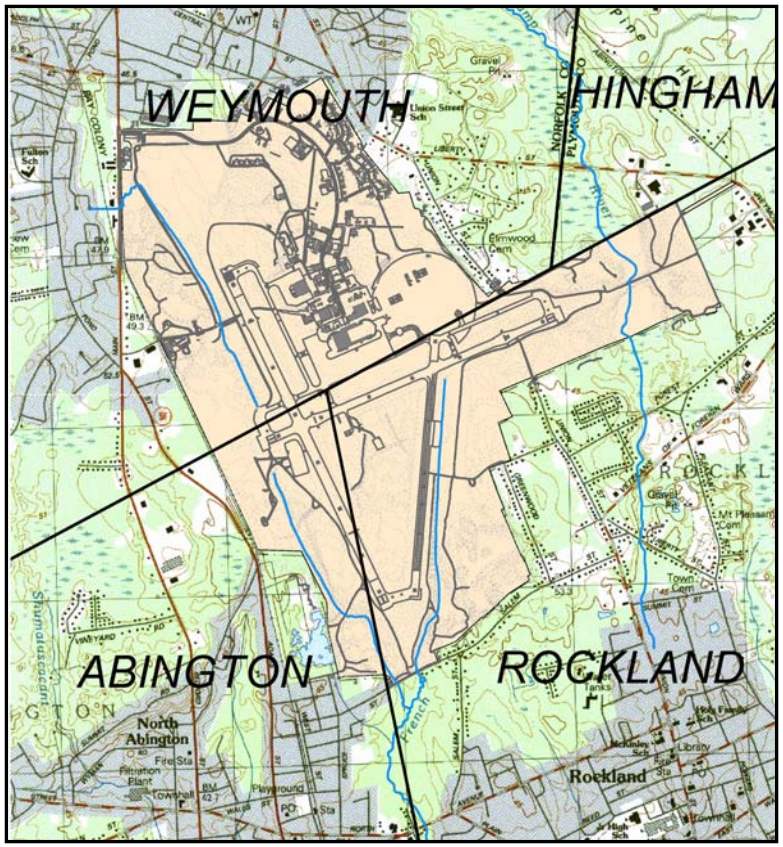
Human Health Risk Assessment
Technical Memorandum Update
Former NAS South Weymouth
Restoration Advisory Board Meeting
April 12, 2007



Objective

- Update the RAB on the Navy's progress on the Basewide Assessment
- Series of Technical Memoranda
  - Basewide Hydrogeological Evaluation
    - December 2006 (in agency review)
  - French Stream Geochemical Evaluation
    - Floc Assessment (French Stream)
    - January 2007 (in agency review)
  - Risk Assessments
    - Human Health (Tonight)
    - Ecological (May/June 2007)
      - French Stream
      - Higher Trophic Level Basewide

Tonight's Objective

- Update the RAB on the results of the Human Health Risk Assessment (HHRA) Technical Memorandum for French Stream
- A draft version of the HHRA was completed in April 2007, and is currently under Agency review

Purpose of HHRA

- Evaluate potential human health risks from exposure to surface water, sediment and iron flocculent material (floc) in the portions of French Stream that flow through NAS South Weymouth
- Previous site risk assessments have evaluated surface water and sediment data; however, floc had not been evaluated as a separate medium

French Stream Floc

- Floc material consists primarily of iron and manganese oxides, organic matter excreted by iron bacteria, and the bacteria themselves
  - Confirmed through chemical and bacterial analyses
  - Certain metals found in floc – mainly iron and manganese
  - Bacteria found in stream are common – not specific to environmental sites or native peat deposits
- French Stream geochemistry technical memorandum currently in agency review

Conceptual Model of Floc Formation

Iron- and manganese-rich groundwater discharges into slow moving stream

Groundwater mixes with oxygenated stream water

Dissolved iron and manganese become oxidized and precipitate out

Precipitate will settle on the streambed or be carried downstream, often forming clumps of orange floc

Both an iron source and organic matter must be present to form floc.

French Stream

- Linear feature
- Characterized by hard bottom (limited deposition)
- Iron floc is prevalent in much of stream
- No deep swimming holes or fishing likely due to habitat limitations

Geochemistry Conclusions on Floc

- Flocculent forms when water with dissolved iron moves from less to more oxidized environment
- Both iron source and organic matter in sub-surface are required to form floc
- Variety of potential sources of iron and manganese
  - Bedrock (including blast rock)
  - Soils (including wetland soils)
  - Overburden
  - Environmental Sites
- Variety of potential sources of reducing power (organic matter)
  - Filled wetlands from base construction (buried peat and organic matter)
  - Native material (peat)
  - Fill sites (not environmental sites)
  - Environmental sites

Various Floc Deposits

Gelatinous material located at a seep (March 2006)

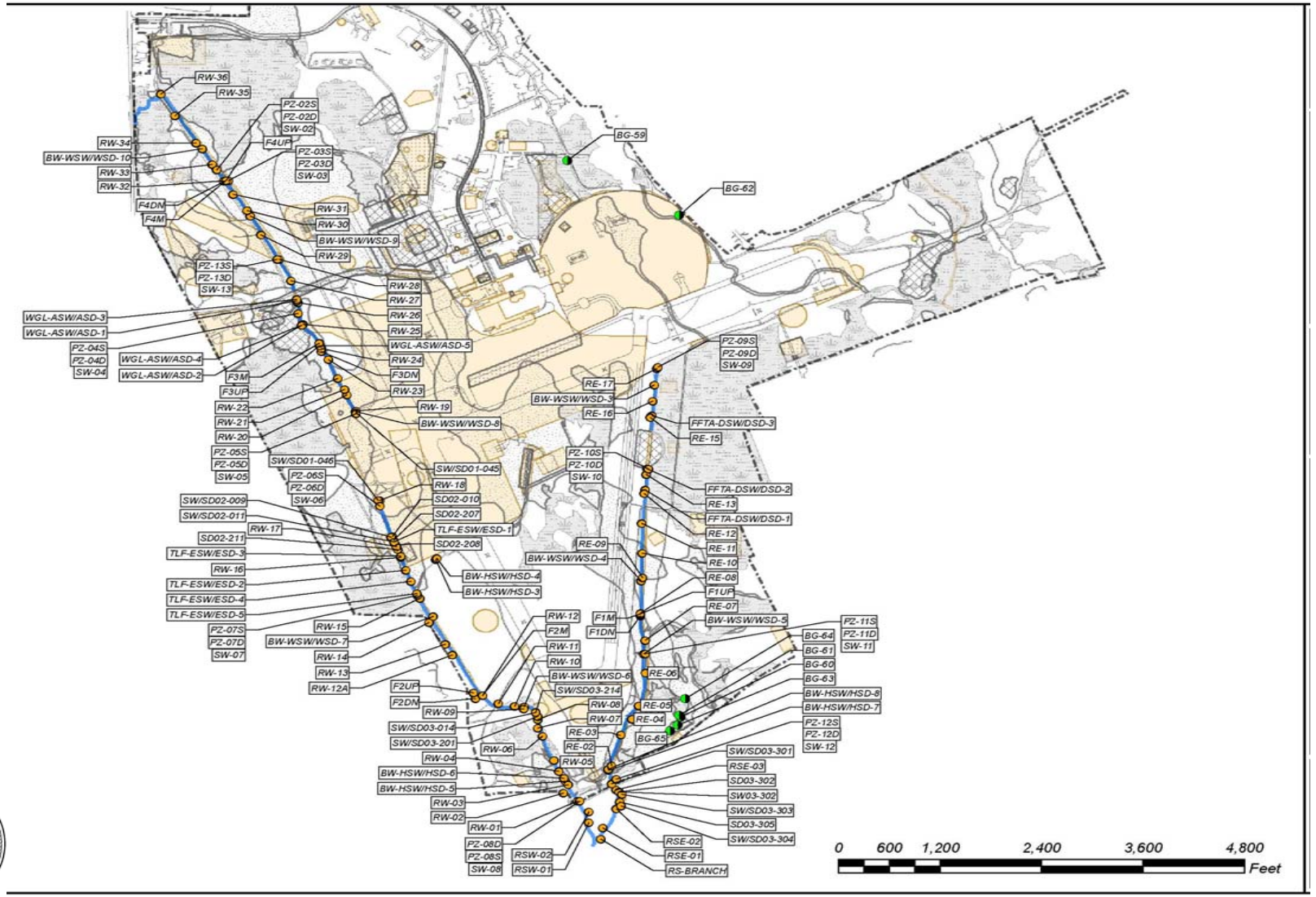
Approach for HHRA

- Followed guidance from EPA Region 1 and MADEP
- Conducted in accordance with relevant portions of the *Streamlined Human Health Risk Assessment Work Plan*
- Navy received feedback from EPA and MADEP on the specific receptors and exposure assumptions

French Stream Data Used in HHRA

- A comprehensive set of samples was included in the HHRA, and included data collected by the Navy under a variety of EBS, MCP and CERCLA site investigation programs
  - Focused on surface water, sediment, and floc
  - Detected chemicals included a variety of semi-volatile organics, hydrocarbon compounds and inorganics
- Floc data collected by the Navy were included

Location of Samples used in the HHRA



Number of sediment, surface water and floc samples used in HHRA

- Sediment – 46 samples collected in various programs (EBS, CERCLA, MCP, basewide)
- Surface water – 58 samples collected in various programs (EBS, CERCLA, MCP, basewide)
- Floc – 4 samples collected by the Navy under the current basewide program

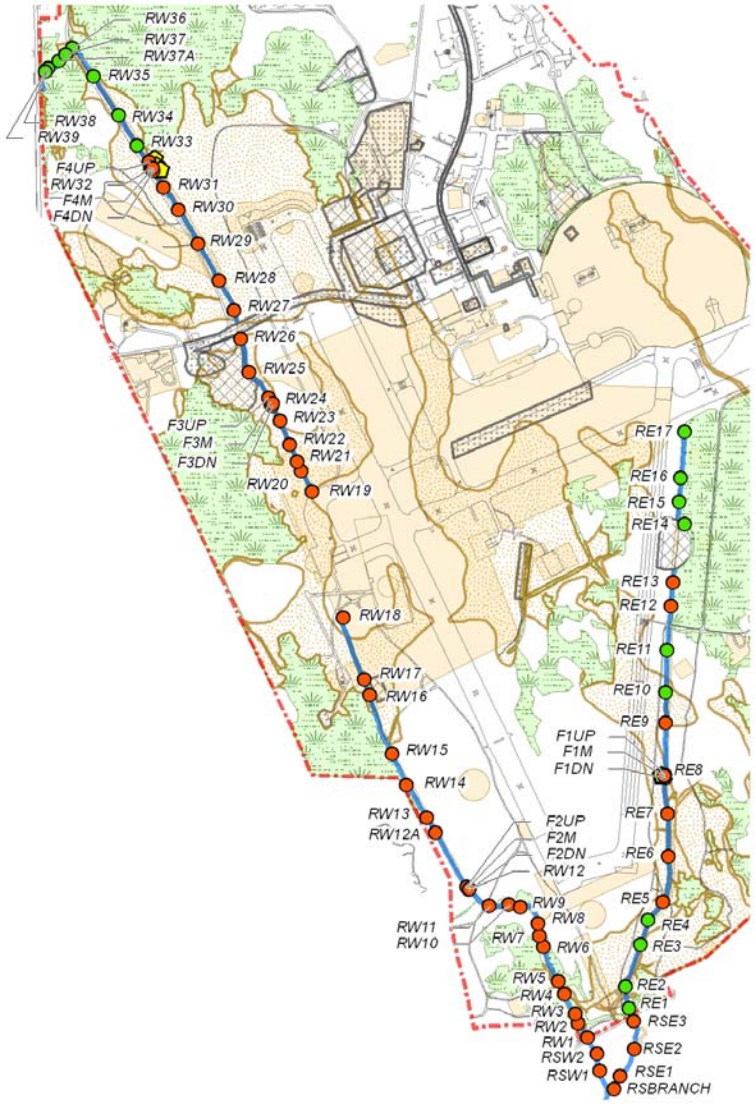
Receptors Evaluated in HHRA

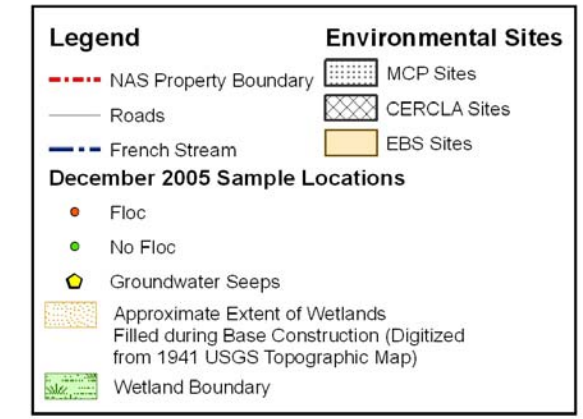
- On-site worker – contact with surface water and sediment
- Trespassing child – contact with surface water, sediment and floc
- Child resident - contact with surface water, sediment and floc
- Adult resident – contact with surface water and sediment

Exposure Assumptions

- Conservative exposure assumptions used in accordance with guidelines and recommendations from EPA and MADEP.
- For floc, assumed a similar ingestion rate as surface water
- Floc exposure frequency was determined by estimating floc distribution in French Stream.
  - It was estimated that floc is present in approximately 38% of the streambed

December 2005 Floc Recon Results





December 2005 Floc Survey
French Stream

Former NAS South Weymouth
Weymouth, MA

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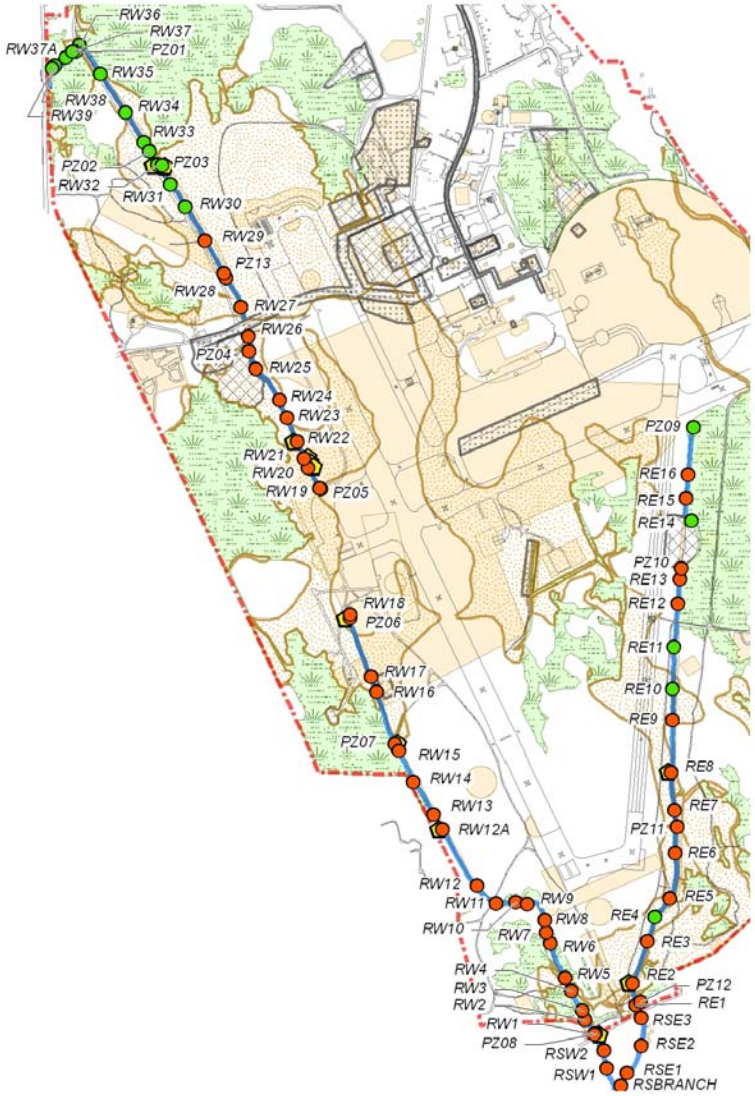
May 2006 Floc Recon Results



Legend

- NAS Property Boundary
- Roads
- French Stream

Environmental Sites

- MCP Sites
- CERCLA Sites
- EBS Sites

May 2006 Sample Locations

- Floc
- No Floc
- Groundwater Seeps
- Approximate Extent of Wetlands Filled during Base Construction (Digitized from 1941 USGS Topographic Map)
- Wetland Boundary

0 650 1,300 2,600 3,900 5,200 Feet

May 2006 Floc Survey
French Stream

Former NAS South Weymouth
Weymouth, MA

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Approach for Risk Characterization

- EPA has grouped chemicals into potential carcinogens and noncarcinogens.
- The potential cancer risk is expressed as the likelihood of cancer over the background cancer rate.
- Estimated cancer risks are compared to EPA's risk range of 1 in 10,000 to 1 in 1,000,000.
- Background cancer rate in the US is 1 in 2 for men and 1 in 3 for women.

Approach for Risk Characterization

- For noncarcinogens it is assumed that there is a threshold below which health effects would not be seen.
- The noncancer risk is expressed as the ratio of the estimated chemical dose over the threshold dose, called the Hazard Index.
- A Hazard Index of 1 or less indicates noncancer risks are not expected.

HHRA Results

- Potential cancer risk – For each receptor, potential cancer risks are within the range of 1 in 10,000 to 1 in 1,000,000
- Noncancer risk – For each receptor, the Hazard Index is less than 1
- Risk estimates for floc were negligible

Results of French Stream Human Health Risk Assessment

Receptor	Medium	Carcinogenic Risk	Non-Carcinogenic Hazard Index
On-Site Worker	Sediment	1.2E-06	1.6E-02
	Surface Water	8.3E-06	7.1E-03
	Total Risk/HI:	9.5E-06	2.3E-02
Trespassing Child	Sediment	1.2E-06	5.4E-02
	Surface Water	6.2E-06	1.3E-02
	Floc	9.8E-08	1.8E-02
	Total Risk/HI:	7.5E-06	8.6E-02
Adult Resident	Sediment	2.8E-07	1.1E-03
	Surface Water	4.7E-06	4.1E-03
	Total Risk/HI:	5.0E-06	5.1E-03
Child Resident	Sediment	3.9E-06	3.3E-01
	Surface Water	1.5E-05	5.4E-02
	Floc	3.8E-07	1.2E-01
	Total Risk/HI:	1.9E-05	5.0E-01

Notes:
HI - Hazard Index.

Summary

- Navy has determined that potential exposure to chemicals in French Stream surface water, sediment, and floc is unlikely to pose health risks to a variety of possible receptors
  - Report currently in agency review

Pathway Forward

- Three Draft Technical Memoranda have been submitted to agencies
  - Geochemical
  - Hydrogeological
  - Human Health Risk Assessment
- Navy is awaiting agency comments
- Spring 2007
  - Ecological Risk Assessment
    - French Stream
    - Higher Trophic Level Risk