REMEDIAL MEASURES

NORTHROP GRUMMAN DELISTING PLAN

DESIGNATION	BUILDING	STATUS AS OF 2/20/97
A	BUILDING 24	DELISTED 1/18/96
B	BUILDINGS 16,30,35	DELISTED 6/1/95
C	FIRE DEPARTMENT PARKING LOT	DELISTED 8/19/92
D	ACLD BALLFIELD	DELISTED 8/19/92
E	BUILDING 113	DELISTED 8/19/92
F	BFCU	DELISTED 7/28/93
G	BUILDINGS 21,28,37,114,115,116	DELISTED 2/17/95
H	BUILDING 18	DELISTED 8/18/94
I	CREDIT UNION - SOUTH	DELISTED 10/1/96
J	BUILDING 12 EAST	DELISTED 9/30/94
K	RUNWAY	DELISTED 9/30/94
L	LINDEN TREE	DELISTED 8/19/92
M	BANK OF NY/McDONALDS	DELISTED 4/6/93
N	BUILDING 05	DELISTED 2/24/95
O	HANGAR 07	DELISTED 3/11/94
P	CENTRAL AVENUE	DELISTED 9/30/94
Q	BLDGS 04 & 25	DELISTED 11/8/95
R	BUILDING 01	DELISTED 10/1/96
S	SOUTH RUNWAY	DELISTED 4/7/95
T	HEADQUARTERS COMPLEX (BLDGS 26,31,111,14)	DELISTED 6/1/95
U	BUILDING 12 WEST	DELISTED 10/1/96
V	BUILDING 15	DELISTED 10/1/96
W	BOCES	DELISTED 10/1/96
X	BLDG 02 SOUTHWEST PARKING AREA	DELISTED 10/1/96
Y	COMMISARY/DROP HAMMER	DELISTED 10/1/96
Z	BLDG 02 SOUTH/EAST PARKING - CON STOCK	DELISTED 10/1/96
CC	SOUTH RECHARGE BASINS	NO ACTION
DD	BLDG 02	BY OTHERS

LEGEND

- DENOTES MONITOR WELL LOCATION
- DENOTES DELISTED PARCELS
- DENOTES FUTURE SUBMITTALS OR NO ACTION

1-30-003A-DV2 12/2000
Poster Session

WHAT WE DID
DATA COLLECTION
NORTHROP GRUMMAN CORPORATION

Soil Gas Survey Phases 1 and 2

- 13 areas of concern / 97 locations investigated

Soil Sampling

- 33 locations investigated
- 86 samples analyzed

Recharge Basin Water and Sediment Sampling

- 10 water samples analyzed
- 16 sediment samples analyzed

Groundwater Sampling

- Well Drilling
- Remedial Investigation(RI): 120 samples analyzed
- Ongoing: 156 samples analyzed annually

Computer Modeling

- Developed groundwater flow model

Other Investigations

- Delisting
- Various parcel investigations (phase I, II, III)
- Resource Conservation and Recovery Act (RCRA) / Underground Injection Control (UIC) Program Sampling

WHAT WE DID
DATA COLLECTION
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT

Soil Gas Survey Phases 1 and 2

- 109 locations investigated

Soil Sampling

- 66 locations investigated

Recharge Basin Water and Sediment Sampling

- 2 water samples analyzed
- 2 sediment samples analyzed

Groundwater Sampling

- 42 temporary wells installed and sampled
- 26 permanent wells installed and sampled

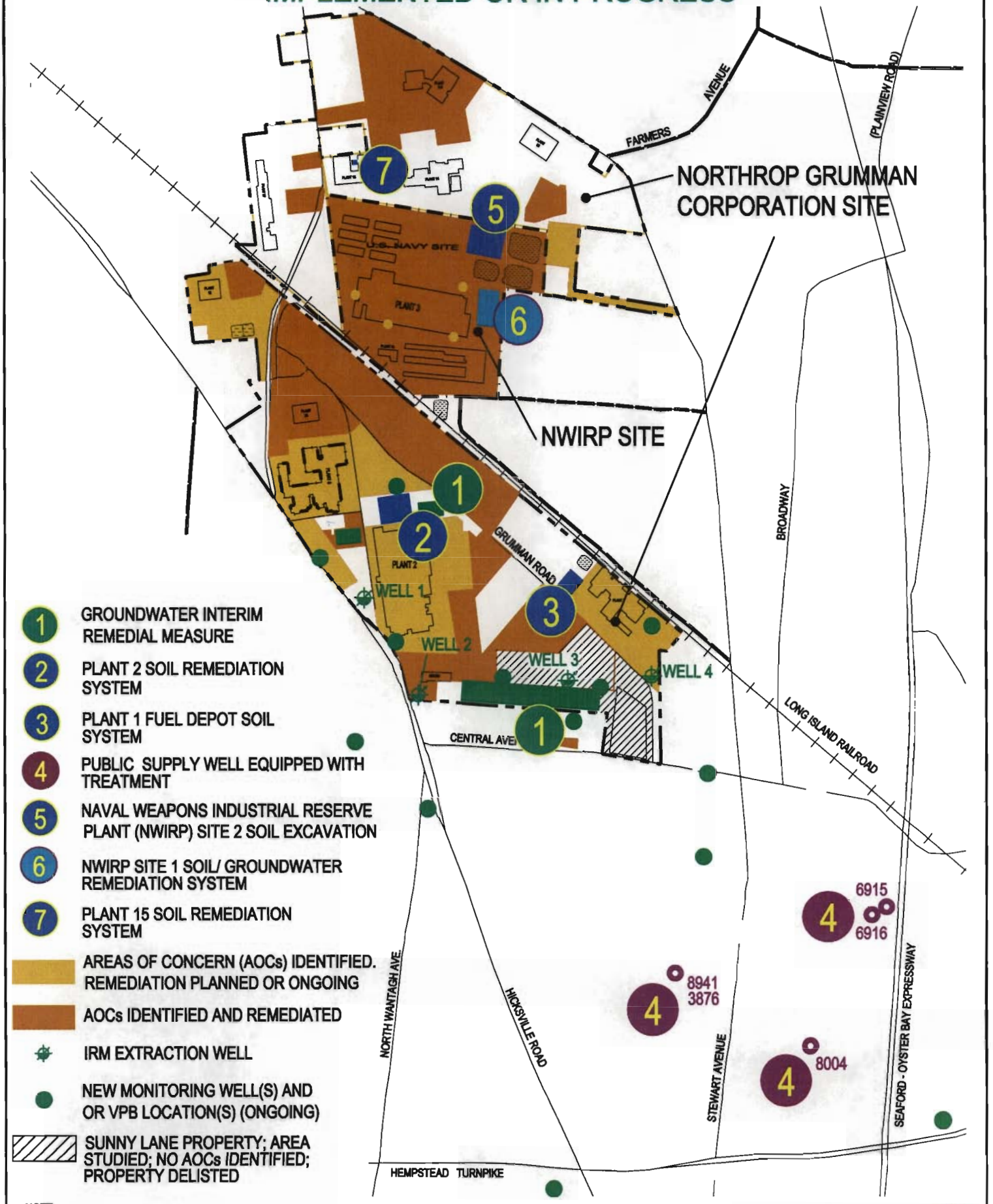
Aquifer Testing

- Two aquifer tests

Computer Modeling

- Develop groundwater flow model

REMEDIAL MEASURES
IMPLEMENTED OR IN PROGRESS



NOTE:
AREAS NOT SHADED INDICATE THAT AREAS OF CONCERN DO NOT EXIST OR AREAS HAVE NOT BEEN STUDIED

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WHAT WE DID

INSTALLATION AND RESTORATION PROGRAM CHRONOLOGY
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT

Dec. 1986	→	Performed Initial Assessment Study (IAS)
Dec. 1987	→	Site listed as NYS Superfund site
May 1992	→	Complete Phase I Remedial Investigation (RI)
Oct. 1993	→	Complete Phase II RI
Mar. 1994	→	Complete Feasibility Study (FS) (soil and groundwater)
Oct. 1994	→	Proposed Remedial Action Plan (PRAP) (soil)
Nov. 1994	→	Public meeting (soil)
Jul. 1995	→	Record of Decision (ROD) (soil)
Jun. 1996	→	Completed soil cleanup at Site 2
Aug. 1996	→	Navy funds treatment system on BWD Plant 5
Jun. 1998	→	Startup of groundwater remediation system at site 1
Mar. 2000	→	Began installation of monitoring well network
Oct. 2000	→	Complete groundwater FS; submit draft FOST/EBS
Dec. 6, 2000	→	Groundwater FS public availability session
Dec. 13, 2000	→	Groundwater PRAP public meeting
Dec. 31, 2000	→	Shutdown of Site 1 soil/shallow groundwater remediation system
Jan. 2001	→	Submit final FOST/EBS
Mid-2001	→	Complete monitoring well network
2002-2003	→	Soil excavation at Site 1 (soil ROD)

Soil is designated as Operable Unit (OU-1); Groundwater is designated as OU-2

WHAT WE DID

SUPERFUND PROGRAM CHRONOLOGY
NORTHROP GRUMMAN CORPORATION

Dec. 1987	→	Site listed as NYS superfund site
1990	→	Northrop Grumman Corporation funds treatment system for Bethpage Water District Plant 6 (voluntary); startup of well GP-1 groundwater remediation system
Oct. 1990	→	Remedial Investigation(RI) / Feasibility Study (FS) consent order
Dec. 1990	→	Public meeting - RI/FS work plan
Jan. 1992	→	Complete Phase I RI and report
Jun. 1992	→	Public meeting - RI update
Mar. 1994	→	Soil FS
Sep. 1994	→	Complete Phase 2 RI and report; soil Interim Remedial Measure (IRM)
Oct. 1994	→	Public meeting - soil Proposed Remedial Action Plan (PRAP) and groundwater RI
Mar. 1995	→	Soil Record of Decision (ROD)
1996 - 1998	→	Soil remediation; Northrop Grumman funds treatment system for BWD Plant 4 (voluntary); installation of monitoring well network
Sep. 1998	→	Groundwater IRM (voluntary) start-up
Oct. 2000	→	Complete groundwater FS
Dec. 6, 2000	→	Groundwater FS public availability session
Dec. 13, 2000	→	Groundwater PRAP public meeting
To be determined	→	Groundwater consent order
To be determined	→	Groundwater remedial design and construction

Soil is designated as operable unit (OU-1); groundwater is designated as OU-2.

WHY ARE WE HERE ?

NEW YORK STATE SUPERFUND PROCESS (6 NYCRR PART 375)

IDENTIFY POTENTIALLY RESPONSIBLE PARTIES

↓

CONSENT ORDER

↓

WORK PLAN

↓

REMEDIAL INVESTIGATION (RI) → VOLUNTARY REMEDIATION → INTERIM REMEDIAL MEASURE (IRM)

↓

FEASIBILITY STUDY (FS)

↓

PROPOSED REMEDIAL ACTION PLAN (PRAP)

↓

RECORD OF DECISION (ROD)

↓

CONSENT ORDER

↓

REMEDIAL DESIGN (RD) & CONSTRUCTION

↓

OPERATION & LONG-TERM MONITORING

↓

REMEDIATION COMPLETE

VOLUNTARY REMEDIATION

INTERIM REMEDIAL MEASURE (IRM)

↓

REMEDIAL DESIGN

↓

CONSTRUCTION

↓

OPERATION

↓

MONITORING

↓

REMEDIATION COMPLETE

WORK COMPLETED

WORK ONGOING

WORK TO BE PERFORMED

WHY ARE WE HERE ?

US NAVY INSTALLATION AND RESTORATION PROGRAM

PRELIMINARY ASSESSMENT (PA)

↓

SITE INVESTIGATION (SI)

↓

REMEDIAL INVESTIGATION (RI)

↓

FEASIBILITY STUDY (FS)

↓

INTERIM REMEDIAL ACTION (IRA)

↓

PROPOSED REMEDIAL ACTION PLAN (PRAP)

↓

RECORD OF DECISION (ROD)

↓

REMEDIAL DESIGN (RD)

↓

REMEDIAL ACTION (RA)

↓

REMEDY IN-PLACE (RIP)

↓

REMEDIAL ACTION OPERATION (RAO)

↓

RESPONSE COMPLETE (RC)

↓

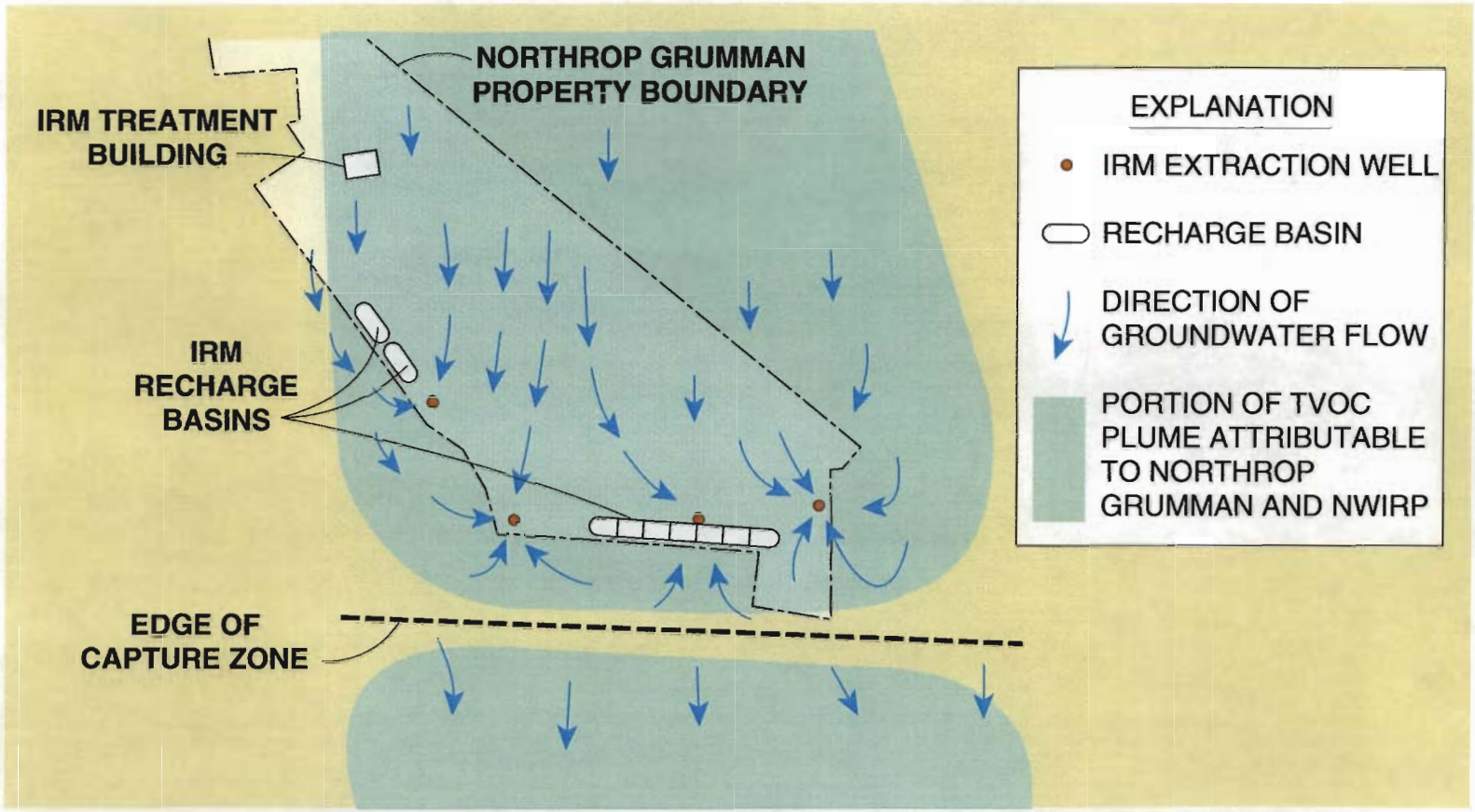
LONG-TERM MONITORING (LTM)

↓

REMEDIATION COMPLETE

REMEDIAL MEASURES

CONCEPTUAL PLAN VIEW OF THE EFFECT OF THE IRM ON THE GROUNDWATER SYSTEM



CAPTURE ZONE: The portion of aquifer around a pumping well within which all groundwater flows toward the well.

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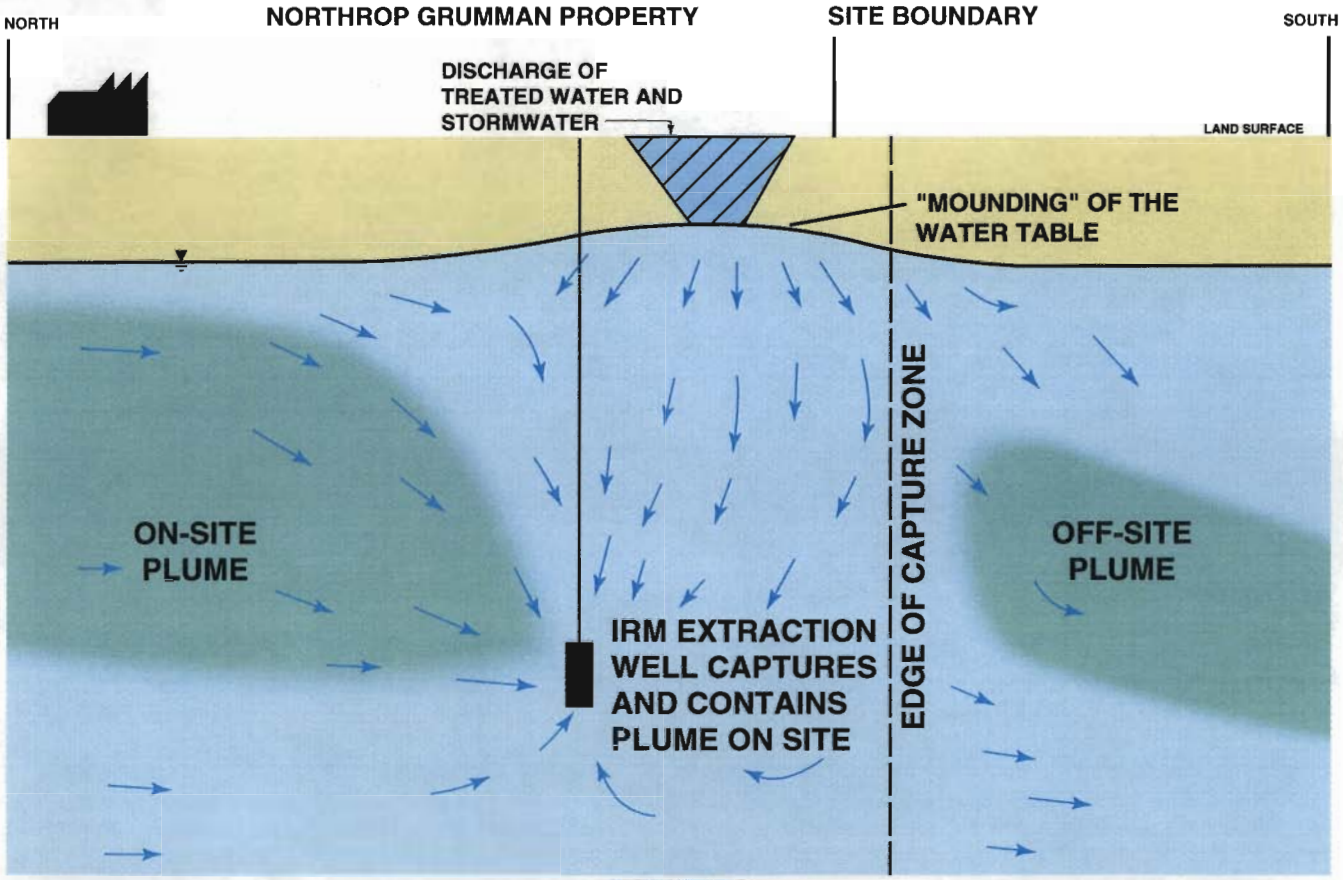
REMEDIAL MEASURES

CONCEPTUAL CROSS-SECTIONAL VIEW OF THE EFFECT OF THE GROUNDWATER INTERIM REMEDIAL MEASURE (IRM) ON THE GROUNDWATER SYSTEM



CAPTURE ZONE: The portion of aquifer around a pumping well within which all groundwater flows toward the well.

RECHARGE BASIN

DIRECTION OF GROUNDWATER FLOW

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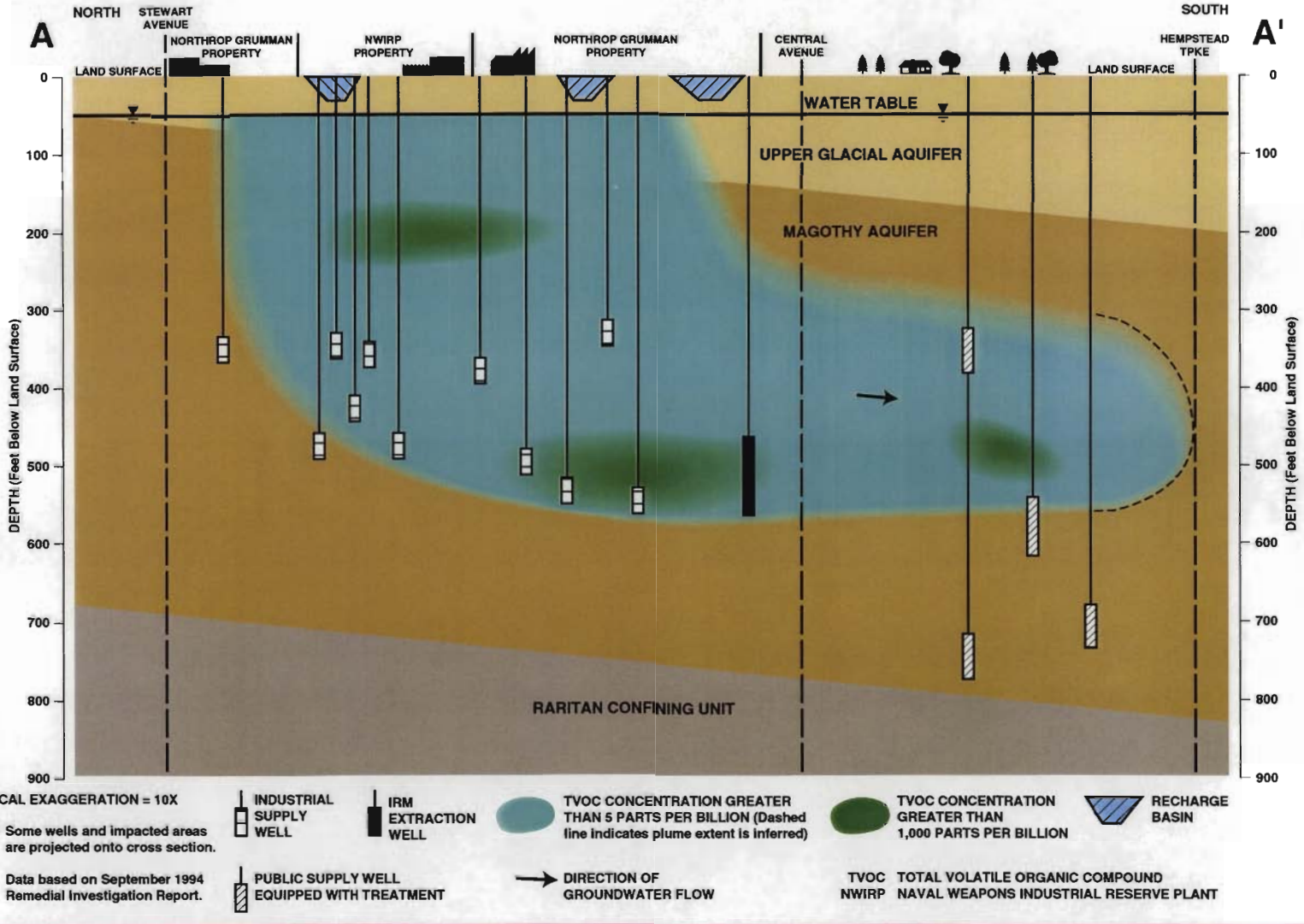
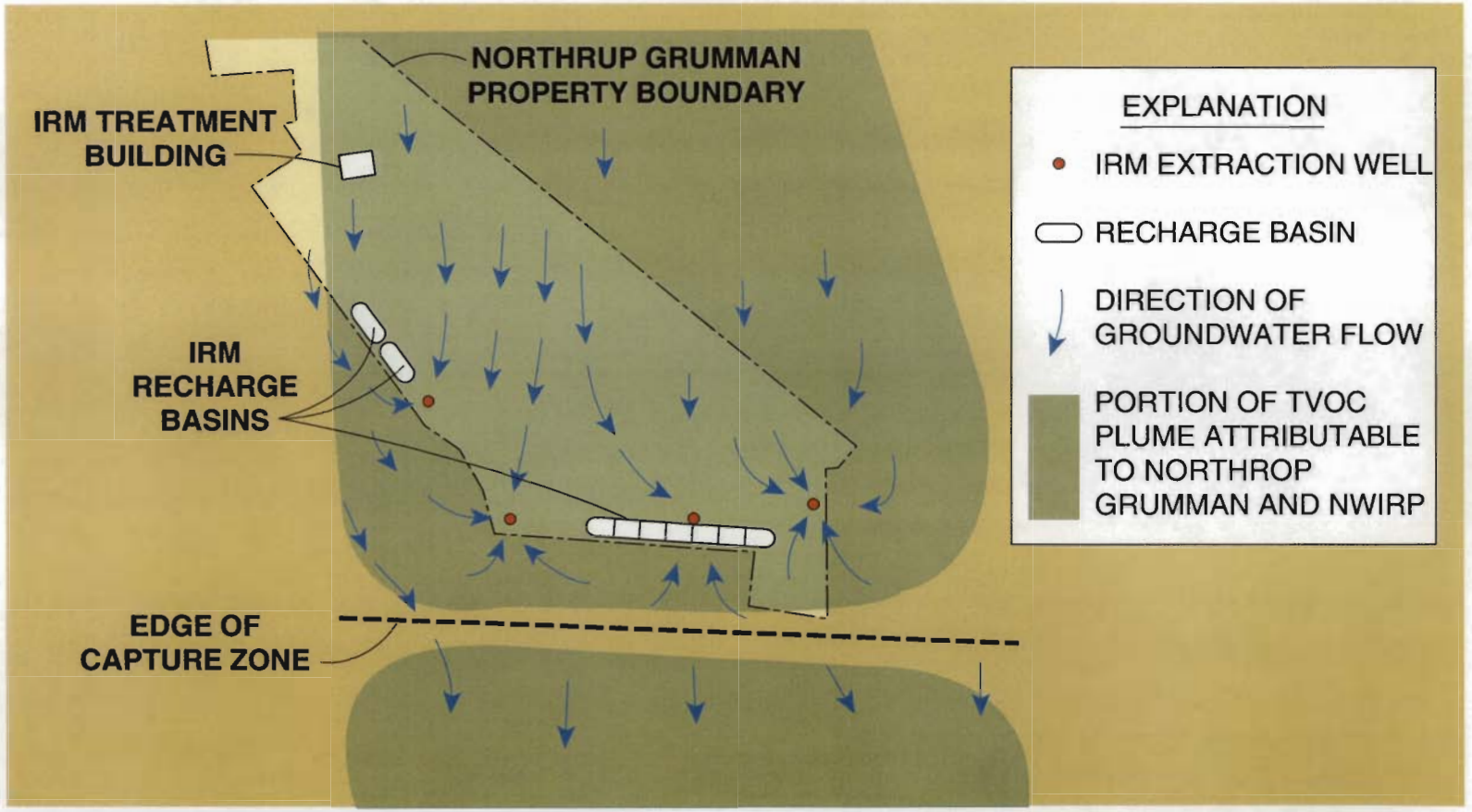
WHAT WE LEARNED

GENERALIZED CROSS-SECTIONAL VIEW OF GROUNDWATER PLUME - 1993



REMEDIAL MEASURES

CONCEPTUAL PLAN VIEW OF THE EFFECT OF THE IRM ON THE GROUNDWATER SYSTEM



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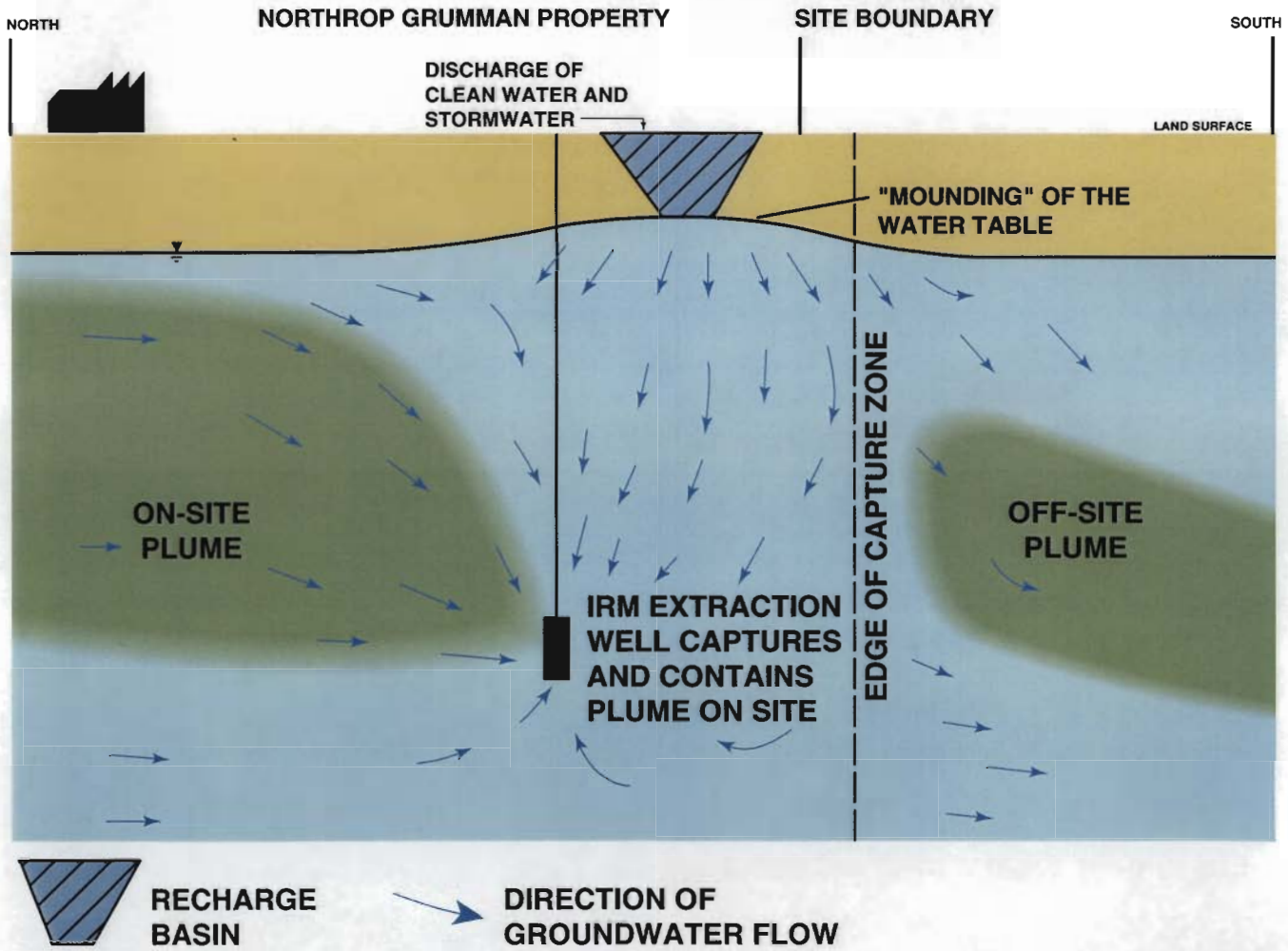
REMEDIAL MEASURES

CONCEPTUAL CROSS-SECTIONAL VIEW OF THE EFFECT OF THE GROUNDWATER IRM ON THE GROUNDWATER SYSTEM



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WHY ARE WE HERE?

HOW WAS CONTAMINATION DISCOVERED?

- In 1976, volatile organic compounds (VOCs) were detected by Grumman Corporation in an on-site industrial supply well. In 1994, Northrop Corporation acquired Grumman Corporation, forming Northrop Grumman Corporation.
- In 1986, the Nassau County Health Department and the US Geological Survey confirmed the presence of a VOC plume.
- In December 1986, the Navy performed an Initial Assessment Study (IAS) at the Naval Weapons Industrial Reserve Plant (NWIRP).
- In October 1990, Grumman Corporation entered into a consent order with the New York State Department of Environmental Conservation (NYSDEC) to perform a Remedial Investigation/Feasibility Study (RI/FS).
- In 1992, the Navy began its RI/FS.

WHY ARE WE HERE TODAY?

- Public input is a required component of the NYS superfund process.
- In 1987, the Northrop Grumman Corporation Bethpage facility and the NWIRP were listed as NYS superfund sites. Superfund is a program to clean up sites where past practices may have affected the environment.
- The FS was approved by the NYSDEC in October 2000. This public availability session is being conducted voluntarily by all parties.

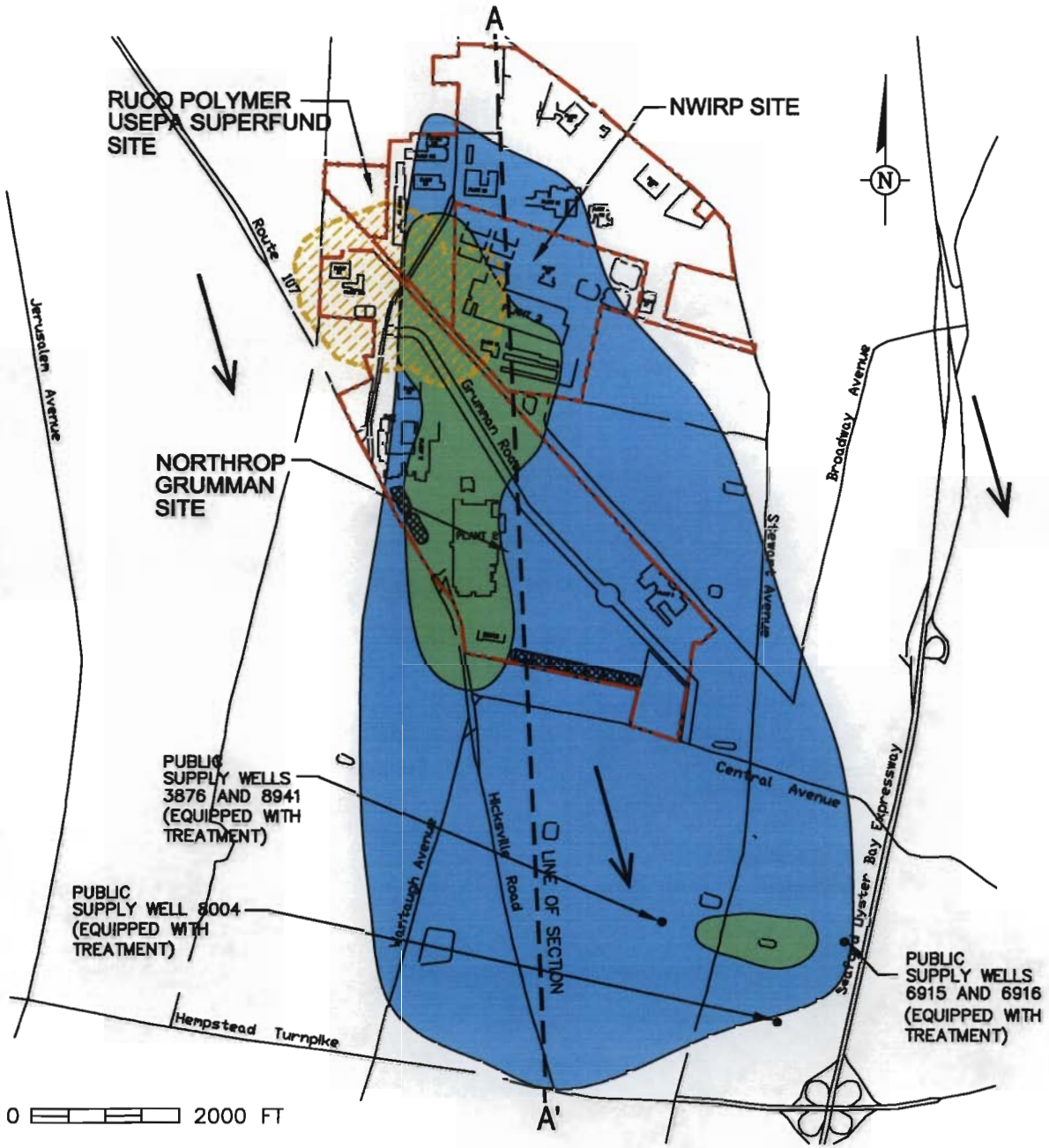
WHO ARE THE PARTIES INVOLVED? *

- Northrop Grumman Corporation
- U.S. Navy
- Regulatory agencies: NYSDEC, Department of Health (NYSDOH), and U.S. Environmental Protection Agency (USEPA)

* the adjacent Ruco Polymer/Occidental Chemical Corporation site, is a federal superfund site which contributes to the regional groundwater contamination, this site is not part of this presentation. A record of decision, dated September 2000, was recently released by the usepa for the Ruco Site.

WHAT WE LEARNED

MAXIMUM GROUNDWATER PLUME EXTENT



EXPLANATION

- TVOCs GREATER THAN 1,000 PARTS PER BILLION
- TVOCs GREATER THAN 5 PARTS PER BILLION
- FOOTPRINT OF VCM SUBPLUME ATTRIBUTABLE TO RUCO POLYMER USEPA SUPERFUND SITE
- PROPERTY BOUNDARY OF THE NWIRP SITE
- PROPERTY BOUNDARY OF THE RUCO POLYMER SITE
- FORMER PROPERTY BOUNDARY OF FORMER GRUMMAN AEROSPACE CORPORATION SITE

TVOC	TOTAL VOLATILE ORGANIC COMPOUNDS
NWIRP	NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
VCM	VINYL CHLORIDE MONOMER

- GENERALIZED LINE OF SECTION WITH IMPACTED AREAS AND KEY WELLS PROJECTED ONTO LINE
- DIRECTION OF GROUNDWATER FLOW

WHAT IS ONE PART PER BILLION?

One part per billion (1 ppb) could be expressed in the following terms:

1 cent in $10,000,000
1 minute in 2,000 years
1 pound in 500,000 tons
1 inch in 16,000 miles
1 can of soda in 42 million cases of soda
1 acre in 1.6 million square miles

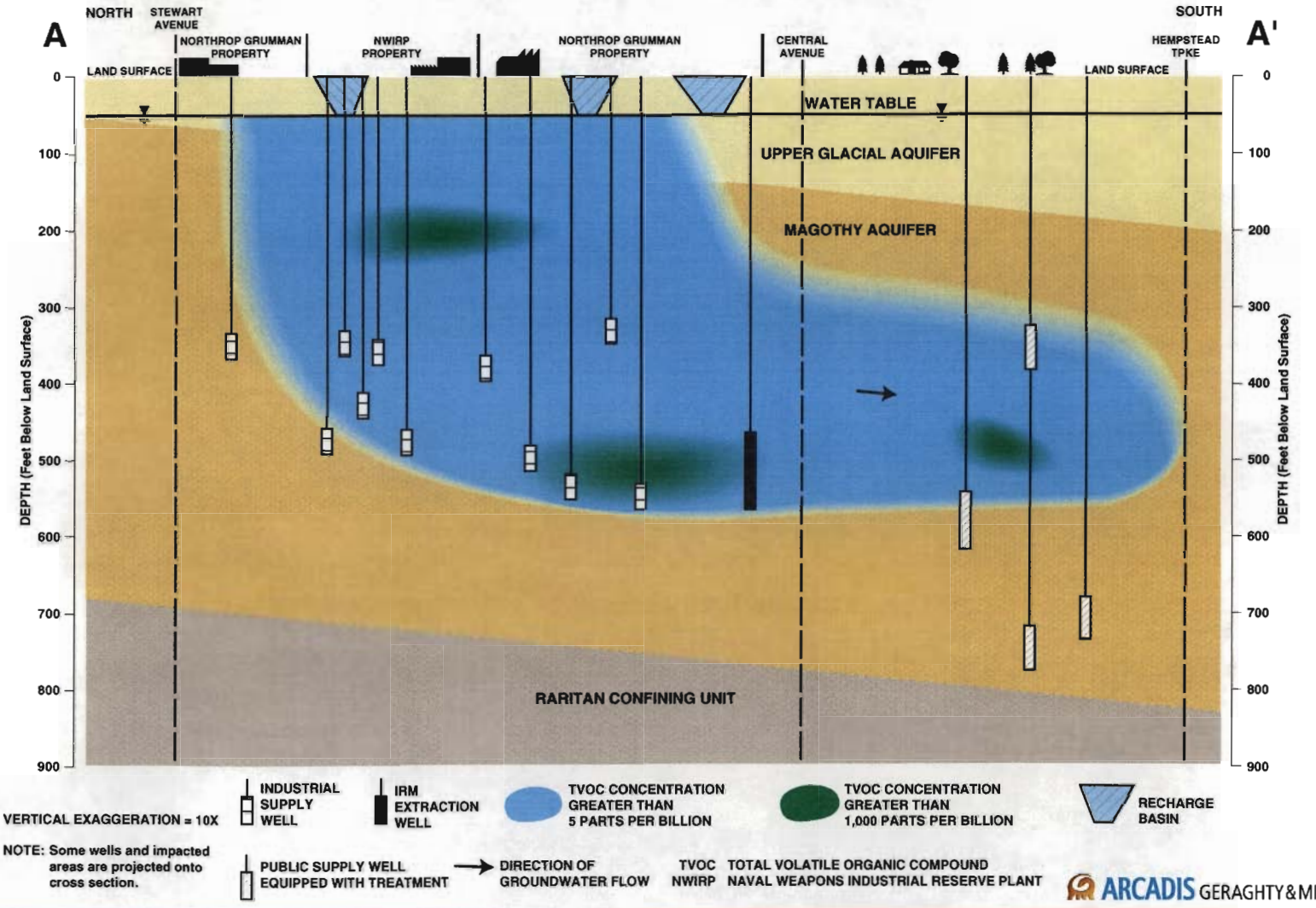
42 million cases of soda would fill a lake that is about 500 meters long, 150 meters wide, and 5 meters deep.

On a smaller scale, one drop in a 10 meter by 5 meter by 1 meter swimming pool would equal 1 ppb.

5

WHAT WE LEARNED

GENERALIZED CROSS-SECTIONAL VIEW OF GROUNDWATER PLUME



VERTICAL EXAGGERATION = 10X

NOTE: Some wells and impacted areas are projected onto cross section.

TVOC TOTAL VOLATILE ORGANIC COMPOUND
NWIRP NAVAL WEAPONS INDUSTRIAL RESERVE PLANT

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REMEDIAL MEASURES

NORTHROP GRUMMAN DELISTING PLAN

DESIGNATION	BUILDING	STATUS AS OF 2/20/97
A	BUILDING 24	DELISTED 1/18/96
B	BUILDINGS 16,30,35	DELISTED 6/1/95
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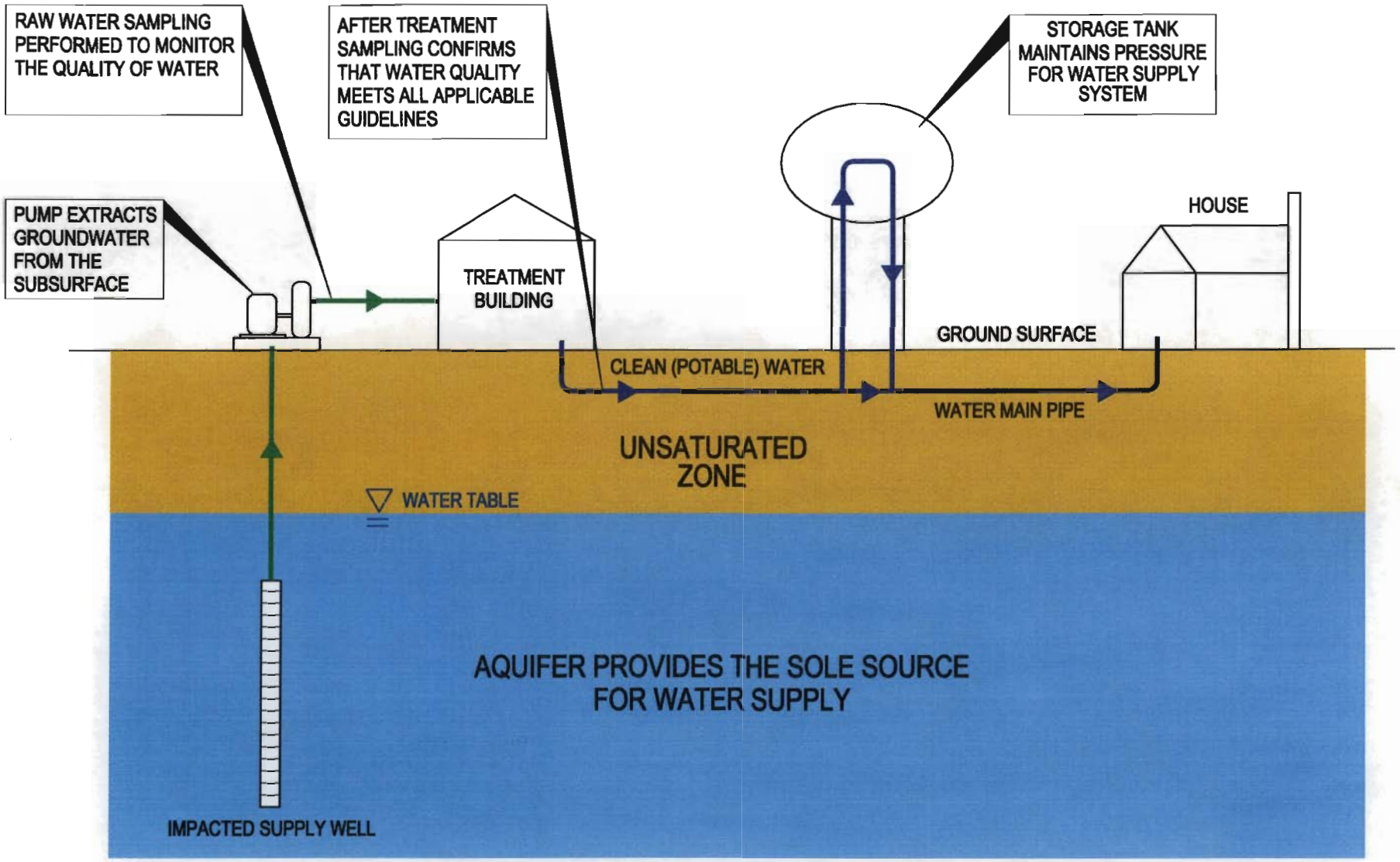
V	BUILDING 15	DELISTED 10/1/96
W	BOCES	DELISTED 10/1/96
X	BLDG 02 SOUTHWEST PARKING AREA	DELISTED 10/1/96
Y	COMMISARY/DROP HAMMER	DELISTED 10/1/96
Z	BLDG 02 SOUTH/EAST PARKING - CON STOCK	DELISTED 10/1/96
CC	SOUTH RECHARGE BASINS	NO ACTION
DD	BLDG 02	BY OTHERS

REMEDIAL MEASURES

CONCEPTUAL OVERVIEW OF A PUBLIC WATER SUPPLY SYSTEM



REMEDIAL MEASURES

NORTHROP GRUMMAN CORPORATION AND U.S. NAVY FUND WELLHEAD TREATMENT FOR BETHPAGE WATER DISTRICT (BWD) PLANTS 4, 5, AND 6

BWD PLANT 4

TWO PUBLIC SUPPLY WELLS EQUIPPED WITH TREATMENT

BWD PLANT 5

ONE PUBLIC SUPPLY WELL EQUIPPED WITH TREATMENT

BWD PLANT 6

TWO PUBLIC SUPPLY WELLS EQUIPPED WITH TREATMENT

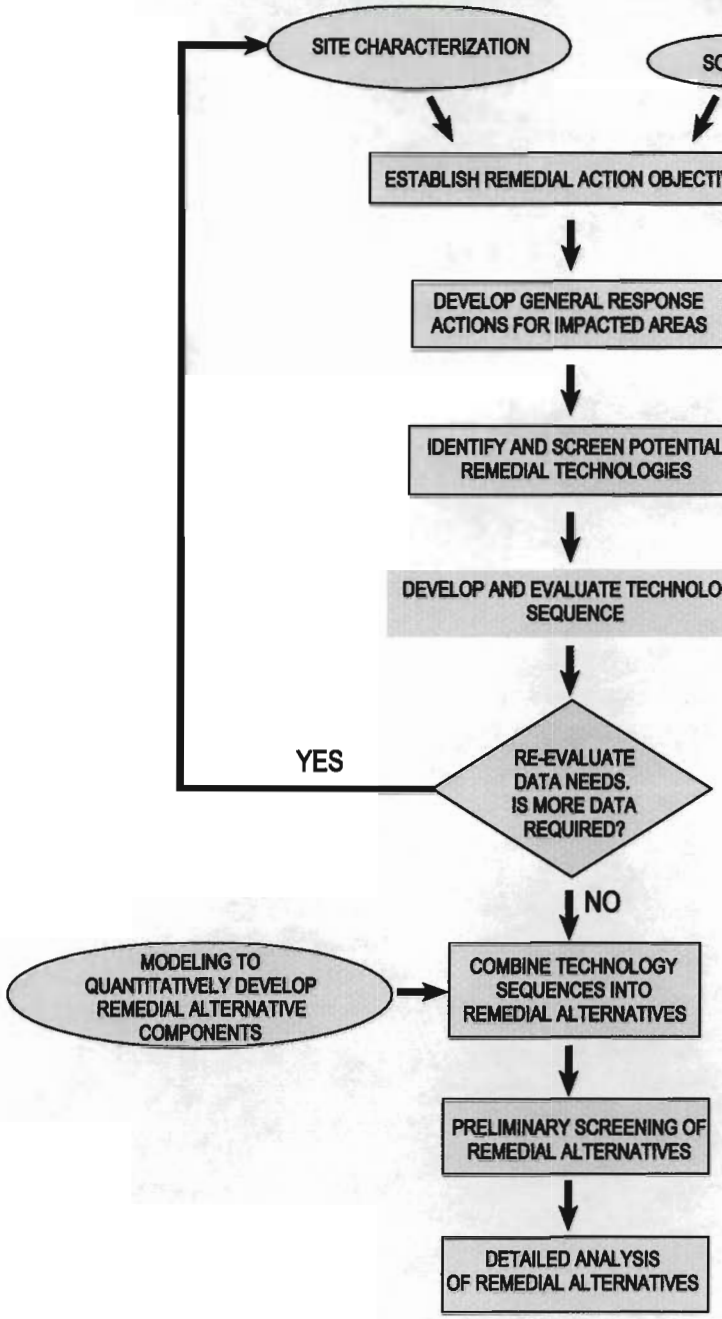
- Treatment funded by Northrop Grumman and Navy consists of removal of volatile organic compounds (VOCs) through the use of air strippers.

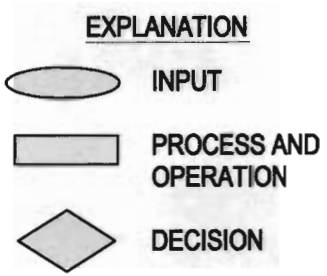
- Additional treatment provided by BWD consists of chlorination and pH control.

- Nassau County Department of Health (NCDOH) requires that VOCs be monitored on a monthly basis. VOCs are monitored by BWD on a monthly basis. NYS Department of Health (NYSDOH) requires that VOCs be monitored on a quarterly basis.

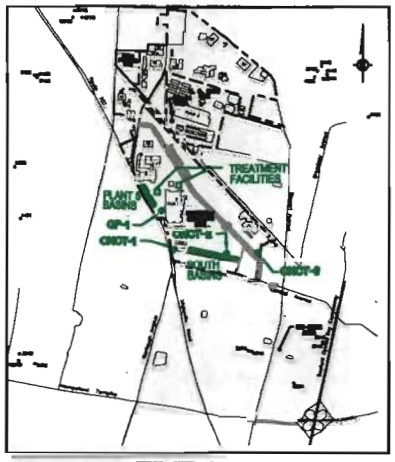
- ***Since startup of Northrop Grumman and Navy-funded treatment, VOCs have not been detected above drinking water standards in water provided to the public.***

FEASIBILITY STUDY
PROCESS UNDER 6 NYCRR PART 375

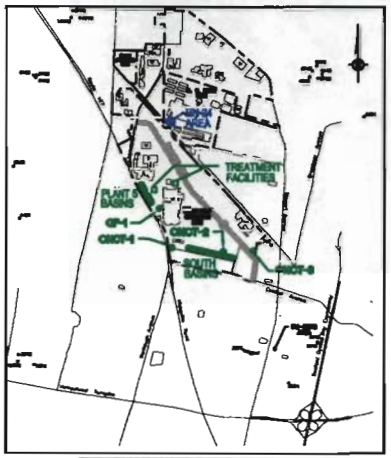




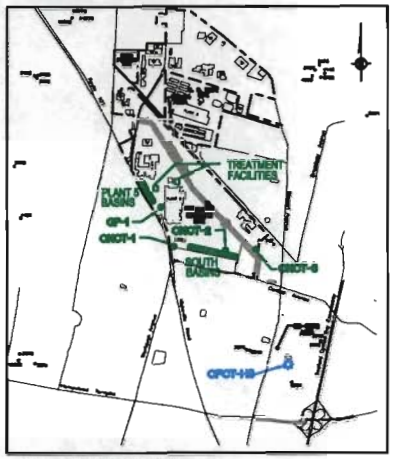
FEASIBILITY STUDY
EIGHT REMEDIAL ALTERNATIVES



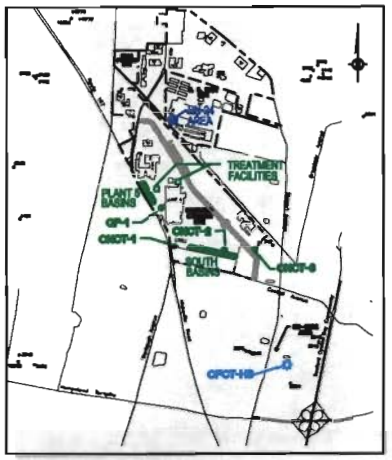
ALTERNATIVE 1:
CONTINUE OPERATION OF IRM



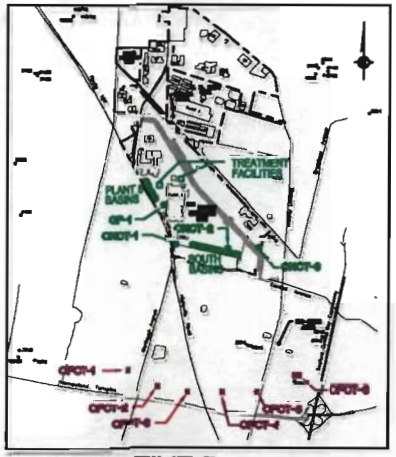
ALTERNATIVE 2:
CONTINUE OPERATION OF IRM, PLUS
TREATMENT OF ON-SITE HN-24 AREA



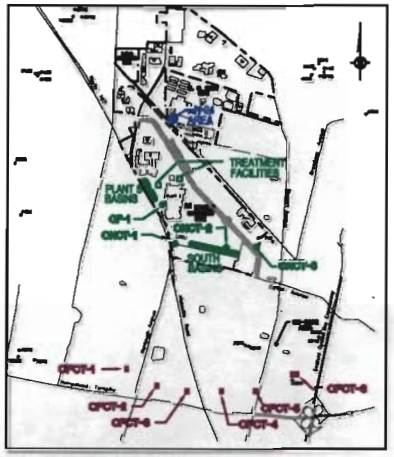
ALTERNATIVE 3:
CONTINUE OPERATION OF IRM, PLUS
TREATMENT OF OFF-SITE GM-38D2 AREA



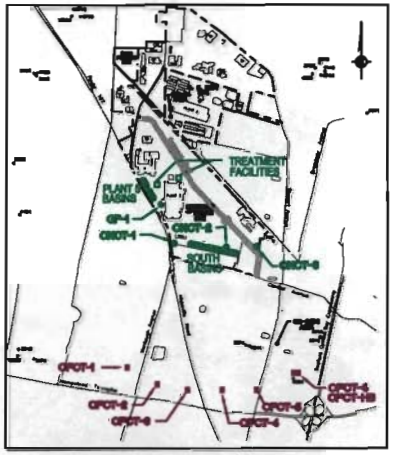
ALTERNATIVE 4:
CONTINUE OPERATION OF IRM, PLUS
TREATMENT OF ON-SITE HN-24 AREA
AND OFF-SITE GM-38D2 AREA



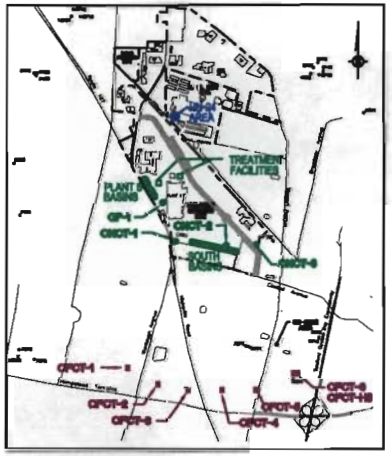
ALTERNATIVE 5:
CONTINUE OPERATION OF IRM, PLUS
OFF-SITE PLUME CONTAINMENT,



ALTERNATIVE 6:
CONTINUE OPERATION OF IRM, PLUS
OFF-SITE PLUME CONTAINMENT, AND
TREATMENT OF ON-SITE HN-24 AREA



ALTERNATIVE 7:
CONTINUE OPERATION OF IRM, PLUS
OFF-SITE PLUME CONTAINMENT, AND
TREATMENT OF OFF-SITE GM-38D2 AREA



ALTERNATIVE 8:
CONTINUE OPERATION OF IRM, PLUS
OFF-SITE PLUME CONTAINMENT, AND
TREATMENT OF ON-SITE HN-24 AREA AND
OFF-SITE GM-38D2 AREA

NOTE:
ALL ALTERNATIVES INCLUDE PREPARATION OF A WELL HEAD CONTINGENCY PLAN, GROUNDWATER MONITORING, NATURAL ATTENUATION OF GROUNDWATER, AND CONTAINMENT AND TREATMENT AT IMPACTED SUPPLY WELLS.

FEASIBILITY STUDY
NINE EVALUATION CRITERIA

Threshold criteria

1. Protection of human health and the environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Primary balancing criteria

3. Short-term effectiveness
4. Long-term effectiveness and permanence
5. Reduction of toxicity, mobility, and volume through treatment
6. Implementability
7. Cost

Modifying criteria

8. State acceptance
9. Community input

FEASIBILITY STUDY
EVALUATION CRITERIA DEFINITIONS

Threshold Criteria (Two Criteria)

- These must be satisfied for a remedial alternative to be eligible for selection.

Primary Balance Criteria (Five Criteria)

- These are used to compare and contrast the positive and negative aspects of the various remedial alternatives that meet the threshold criteria.

Cost (the seventh criteria) is used to differentiate between alternatives that are similarly ranked using the above six criteria

Modifying Criteria (Two Criteria)

- These are taken into account after evaluating the above seven criteria.

FEASIBILITY STUDY

RESULTS OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

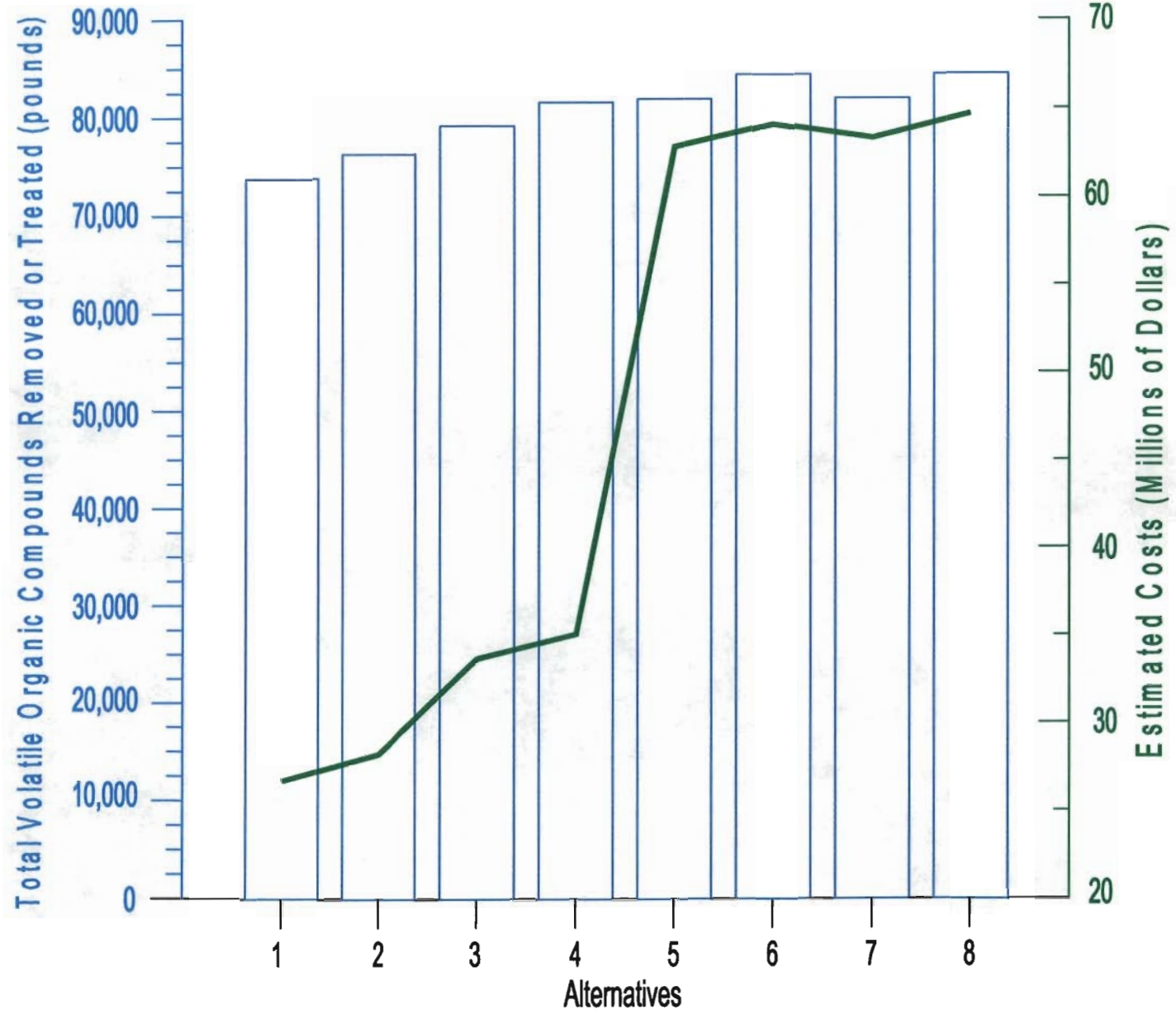
EVALUATION CRITERIA	ALTERNATIVES 1	2	3	4	5	6	7	8
PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	●	●	●	●	●	●	●	●
COMPLIANCE WITH ARARs	●	●	●	●	●	●	●	●
SHORT-TERM EFFECTIVENESS	●	●	●	●	●	●	●	●
LONG-TERM EFFECTIVENESS AND PERMANENCE	●	●	●	●	●	●	●	●
REDUCTION OF TOXICITY, MOBILITY AND VOLUME	●	●	●	●	●	●	●	●
IMPLEMENTABILITY	●	●	●	●	●	●	●	●
COST	$	$$	$$$	$$$	$$$$$	$$$$$	$$$$$	$$$$$
STATE ACCEPTANCE	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS
COMMUNITY ACCEPTANCE	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS

● SATISFIED → ◑ PARTIALLY SATISFIED → ○ NOT SATISFIED

$ VERY LOW COST
$$ LOW COST
$$$ MODERATE COST
$$$$ HIGH COST
$$$$$ VERY HIGH COST

FEASIBILITY STUDY

REMEDIAL COSTS VERSUS CONTAMINANTS TREATED



The On-Site HN-24 Area Remediation occurs during years 1 through 4 for Alternatives 2, 4, 6, and 8.

The Off-Site GM-38D2 Area Remediation is active during years 1 through 15 for Alternatives 3, 4, 7, and 8.

ARCADIS GERAGHTY & MILLER

SUMMARY AND CONCLUSIONS

- All remedial alternatives protect human health and the environment and satisfy the evaluation criteria
- Numerous remedial measures have been implemented voluntarily by both Northrop Grumman and the Navy

NEXT STEPS

Public meeting for PRAP	→	December 13, 2000
Record of Decision	→	First quarter 2001 (estimated)
Consent order	→	First quarter 2001 (estimated)
Pre-design studies	→	On-going
Remedial design	→	To be determined
Construction and operation	→	To be determined

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