CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT
362 INJUN HOLLOW ROAD • EAST HAMPTON, CT 06424-3099

Docket No. 50-213
CY-05-022

JAN 31 2005

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Haddam Neck Plant
License Termination Plan
Supplemental Information - Survey Areas Potentially Affected by Groundwater Contamination and Capture Zone Analysis

The Haddam Neck Plant (HNP) License Termination Plan (LTP) Section 5.4.7 requires a notification to the NRC for any changes to the survey areas to which the "existing groundwater" dose term of the compliance equation (Equation 5-1 of the LTP) is to be applied. The HNP LTP also requires preparing and making available for NRC inspection, a capture zone analysis. As a result of additional groundwater characterization activities and the completion of the capture zone analysis, changes have resulted in the list of survey areas to which the "existing groundwater" term needs to be considered. The purpose of this letter is to submit these changes.

Connecticut Yankee Atomic Power Company (CYAPCO) hereby provides the attached report (Attachment 1) which presents the results of the capture zone analysis for the Haddam Neck Plant site. Using the largest capture zone determined by the analysis, the zone of influence was confirmed to be no more than the 100 meters currently used in the HNP LTP. A difference was determined concerning the directions in which the capture zone is to be applied from a groundwater monitoring well. The attached report calls for the capture zone to be conservatively applied in all directions from the monitoring well and not just on the flanks of the plume as currently specified in the HNP LTP. The effect of this change is discussed below.

Additional groundwater characterization has been conducted since the determination of which survey areas needed to consider the "existing groundwater" dose term included in the HNP LTP. Sample results have shown some low levels of detectable ground water contamination, as defined in the HNP LTP Section 5.4.7.1 (Hereafter called detections), in additional wells along the flanks of the industrial area plume and in certain wells on the peninsula between

A001

the discharge canal and the Connecticut River. Although the calculated dose to a hypothetical future resident due to these additional detections is very low (i.e., < 0.6 mrem/yr), the affected survey areas will be included in Table 5-3 of the HNP LTP to ensure that the potential for dose is considered.

Discussion

The groundwater monitoring characterization results have shown low level (in some cases intermittent) detections of radiological contaminants in the following additional wells compared to those currently described in the HNP LTP:

Monitoring Well	Location
MW-1	Central Peninsula
MW-2	Central Peninsula
MW-104S	Northern Industrial Area
MW-108S	Southern Industrial Area
MW-113S	Upper Peninsula
MW-117S	Central Peninsula
MW-122S (Installed after LTP Rev 1)	Southern Industrial Area
MW-123 (Installed after LTP Rev 1)	Northern Industrial Area
MW-124 (Installed after LTP Rev 1)	Northern Industrial Area
Supply Well B	Central Peninsula

The attached Figure 5-3 illustrates the capture zones for those monitoring wells listed above located in the industrial area and vicinity along with other monitoring wells in the eastern industrial area that have shown detections of radiological contamination (MW-101S/D, MW-103S/D and MW-102S/D). Although there are other monitoring wells more toward the center of the plume in this area that have shown detections, the monitoring wells illustrated in Figure 5-3 define the perimeter of the zone of influence for the industrial area and the upper peninsula. By reviewing these capture zones, the affected survey areas were determined for this portion of the site and are shown in Table 1 of this submittal.

The attached Figure 5-3.1 illustrates the capture zones for the monitoring wells listed above that are located in the central peninsula area. As with Figure 5-3, these zones have been used to determine the survey areas for which groundwater dose impact needs to be considered. These survey areas are also listed in Table 1 of this submittal.

For the remaining monitoring wells outside the industrial area capture zone perimeter or not listed for the peninsula area, there have been no validated detections. Additional detail on groundwater monitoring results has been, and will continue to be, provided in the semi-annual groundwater monitoring reports submitted to the State of Connecticut DEP in support of the Phase 2

Hydrogeologic Work Plan. Copies of these reports will be provided to the NRC and EPA. As described in the HNP LTP, when CYAPCO requests release of a survey area from the NRC license, an evaluation will be included as to whether there is any groundwater dose impact. CYAPCO will continue to review the list of affected survey areas listed in Table 1 and provide updates to the NRC based on new groundwater characterization information as they occur.

It should be noted that the following survey areas are currently listed in HNP LTP Table 5-3 as being affected by groundwater contamination but are not included in Table 1: 9104, 9108, 9110, 9112, 9114, 9116, 9118, 9120, 9126, 9128, and 9307. These survey areas were deleted during the recent update of the HNP LTP (August 2004 Update of the HNP LTP) but were left inadvertently in Table 5-3. The HNP LTP has been revised to reflect the above described changes and the revised pages of the HNP LTP will be distributed to the controlled copy holders of the HNP LTP in the near future.

If you should have any questions regarding this information, please contact Mr. G. P. van Noordennen at (860) 267-3938.

Sincerely,

G. H. Bouchard 1-31-05

G. H. Bouchard Date
Director Nuclear Safety/Regulatory Affairs

Attachment 1: Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Well in Post-Closure Dose Modeling

cc: S. J. Collins, NRC Region 1 Administrator
T. B. Smith, NRC Project Manager, Haddam Neck Plant
R. R. Bellamy, Chief, Decommissioning and Laboratory Branch, NRC Region1
E. L. Wilds, Jr., Director, CT DEP Monitoring and Radiation Division
P. Hill, CT DEP
M. Rosenstein, US EPA, Region 1

Table 1

Survey Areas Affected by Groundwater Contamination
(All Survey Units Unless Otherwise Noted)

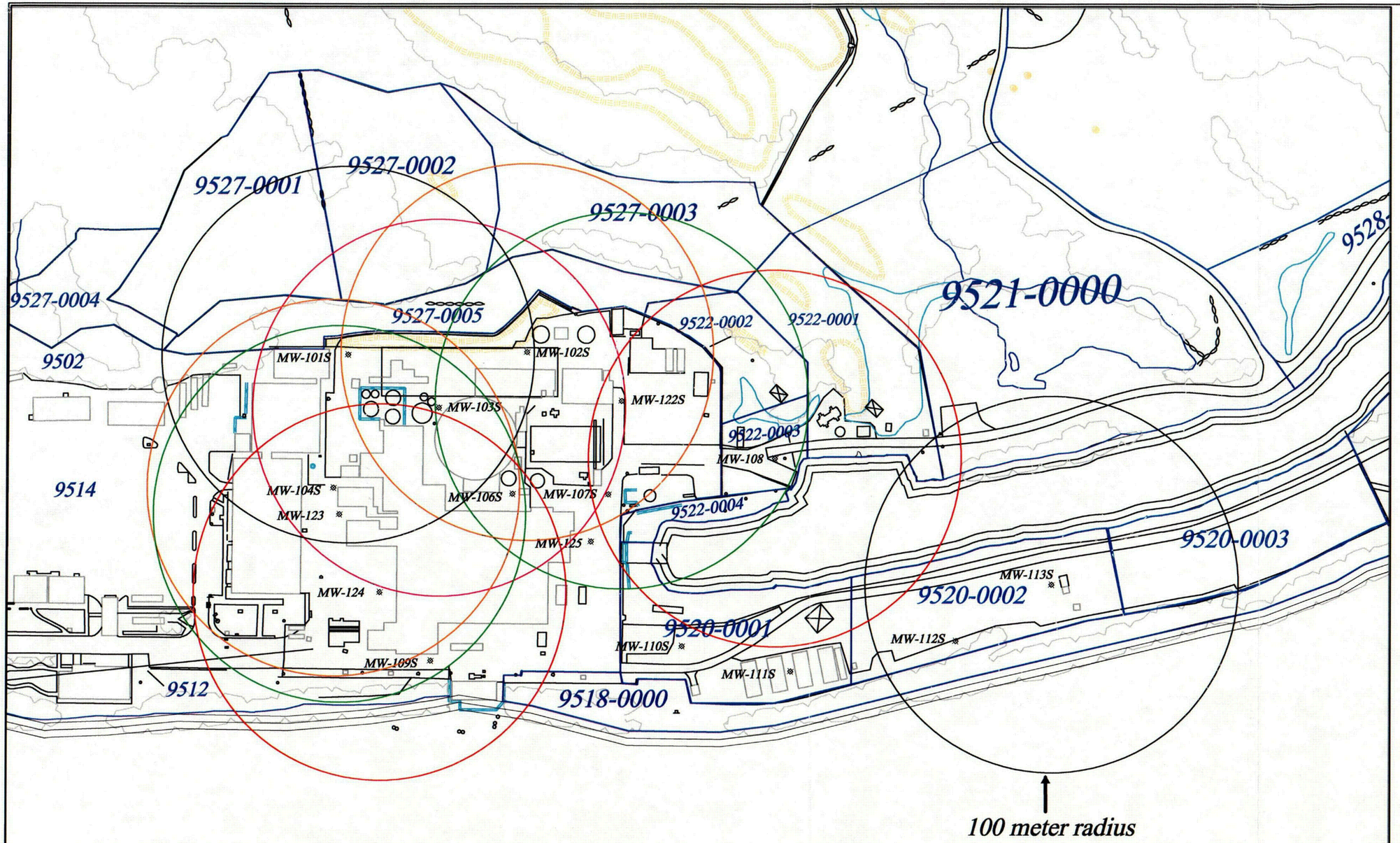
Survey Area		
1000	9306	9522
2000	9308	9527
3000	9310	9528(Units 0,2 &3)
4000	9312	9530 (Units 1,2,3 &
5000	9313	4)
6000	9502	9801
9102	9512	9802
9106	9514	9803
9226	9518	9804
9302	9520	9805
9304	9521	

Docket No. 50-213
CY-05-022

Attachment 1

Haddam Neck Plant
License Termination Plan
Supplemental Information – Survey Areas Potentially Affected by Groundwater Contamination and Capture Zone Analysis
Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Wells in Post-Closure Dose modeling

January 2005



Legend

= Well Location

Notes

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

January 2005

Connecticut Yankee Atomic Power Company
Capture Zone Perimeter for Affected Monitoring Wells
in the Industrial Area and Upper Peninsula

Figure Number	Rev
Figure 5-3	0

C01

9528-0000

9528-0003

100 meter radius

9528-0002

MW-2

Supply Well B

9530-0001

MW-1

9530-0002

9530-0003

9530-0004

MW-117S

9520-0003

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

Legend

= Well Location

Notes

January 2005	Connecticut Yankee Atomic Power Company Capture Zone Perimeter for Affected Monitoring Wells in the Central Peninsula	Figure Number	Rev
		Figure 5-3.1	0

C02

Docket No. 50-213
CY-05-022

Attachment 1

Haddam Neck Plant
License Termination Plan
Supplemental Information – Survey Areas Potentially Affected by Groundwater Contamination and Capture Zone Analysis
Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Wells in Post-Closure Dose modeling

January 2005

Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Wells in Post-Closure Dose Modeling

PREPARED FOR: Mr. Terry Peacock, Connecticut Yankee Atomic Power Company

PREPARED BY: Chuck Miller, CH2M HILL CW Miller

COPIES: Mr. Rich McGrath, CYAPCO

CH2M HILL Project File

DATE: January 11, 2005

Introduction

This technical memorandum describes the analysis of site groundwater characteristics at Connecticut Yankee Atomic Power Company's (CYAPCO) Haddam Neck Plant (HNP) nuclear power station to develop estimated zones of influence, or capture zones, for hypothetical water supply wells at the plant. The hypothetical water supply wells are part of the post-closure dose estimate modeling for the resident farmer scenario performed to determine compliance with Nuclear Regulatory Commission (NRC) license termination criteria.

The capture zone assessment was performed after obtaining results from on-site hydrogeologic testing and studies. These studies include stratigraphic analyses based on geologic logs generated during soil borings for foundation studies and during water supply well and groundwater monitoring well drilling at the facility. Hydrogeologic testing at the site includes long-term water level monitoring in 29 wells on-site and the Connecticut River; performing a pumping test in the unconfined aquifer; and performing packer test pumping in discrete intervals and open-borehole pumping in deep bedrock boreholes.

Groundwater at the HNP is found in both a shallow unconfined and possible semi-confined aquifer within the unconsolidated alluvium and in confined and semi-confined aquifer units within the underlying fractured crystalline bedrock. The unconfined aquifer is expected to exhibit a generally-isotropic capture zone, except where affected by boundary effects, with a radius that is directly proportional to the pumping rate applied to a water supply well. The aquifer pumping test results indicate a capture zone radius for the unconfined aquifer ranging from less than 30 feet at a pumping rate of 0.5 gallons per minute, to approximately 200 feet at a pumping rate of 29 gallons per minute.

The fractured bedrock aquifer exhibits highly variable and directional (i.e., anisotropic) capture zone effects that are dependent on both pumping rates and interception of

transmissive fractures by the borehole. Open borehole pumping tests at HNP revealed hydaulic connectivity ranging from 185 to 462 feet in transmissive near-horizontal fracture sets at open-borehole pumping rates of 1.9 and 6.7 gallons per minute, respectively.

Hydrogeologic Measurements

The capture zone analysis is supported by two sets of hydrologic measurements collected as part of hydrogeologic characterization of the HNP site. These measurement sets are pumping operations supporting bedrock characterization activities and a shallow unconfined aquifer pumping test. Results of these tests are discussed in the following subsections.

Bedrock Pumping Activities

Characterization of the fractured bedrock aquifer was performed through packer testing in one open bedrock borehole (borehole BH-121A) and Hydrophysical™ logging performed in four open bedrock boreholes (boreholes BH-118A, BH-119, BH-120, and B H-121A). Groundwater elevation hydrographs for 29 monitoring wells were evaluated during the bedrock pumping activities to identify pressure transients related to pumping events. Results of the open borehole pumping are used in this capture zone analysis because open borehole construction is considered to be representative of the hypothetical water supply well.

Details of the bedrock pumping activities are described in the *Connecticut Yankee Atomic Power Company Haddam Neck Plant Task 2 Supplemental Characterization Report* (CH2M HILL, 2004a). These tests include both discrete-interval pumping using an instrumented straddle packer assembly and open-borehole pumping performed as part of Hydrophysical™ logging of four boreholes. Locations of the bedrock boreholes and the surrounding transducer/data logger-equipped monitoring wells are shown in Figure 1. The anisotropic nature of distant hydraulic responses in the fractured bedrock system is illustrated in Figure 2 (observed responses to open-borehole pumping). The magnitudes of the distant responses to the bedrock pumping events are shown in Table 1. The bedrock pumping activities were short duration activities (e.g., generally more than 8 hours, but less than 12 hours duration) and the hydrographs for distant well responses indicated non-equilibrium conditions (i.e., drawdown curves were not asymptotic).

Unconfined Aquifer Pumping Tests

Characterization of the shallow unconfined aquifer was performed through a variable-rate step-drawdown test followed by a seventy-two hour constant-rate pumping test performed in a test well (well AT-1) located in the northwestern portion of the HNP industrial area. The test well was screened across the saturated thickness of the unconfined aquifer in the test study area and completely within the unconsolidated materials. Groundwater elevation hydrographs for surrounding wells were evaluated for test-related pressure responses.

Details of the unconfined aqufier pumping tests are described in the *Connecticut Yankee Atomic Power Company Haddam Neck Plant Task 2 Supplemental Characterization Report* (CH2M HILL, 2004a) and *Technical Memorandum – Results of the Unconfined Aquifer Pumping Test Conducted in the Industrial Area of the Haddam Neck Plant, East Hampton, Conncticut* (CH2M HILL, 2004b). The test, or production, well and surrounding observation wells that indicated hydraulic responses are shown in Figure 3. Drawdown responses observed in monitoring wells during the step-drawdown test and the constant-rate pumping test are shown in Figures 4 and 5, respectively. The magnitudes of distance drawdown responses to the unconfined aquifer pumping are shown in Table 2.

Extrapolation of Test Measurements and Observations to the HNP Site

The pumping test measurements from the unconfined, confined and semi-confined units are considered sufficiently-representative of hydrogeologic conditions to allow their application for a broader assessment of the apparent capture zones. Pumping test activities have included distance-drawdown responses to groundwater pumping at nearly the rate used for post-closure dose modeling (i.e., 0.45 gallons per minute).

Measurement results expanded to areas beyond those actually tested, however, requires defining assumptions and identifying the apparent range of uncertainty applicable to the extrapolation. The following discussion summarizes the HNP hydrogeologic conceptual site model, describes dividing the HNP site into areas of similar hydrogeologic properties, and explains the applicability of the capture zones to those areas.

HNP Hydrogeologic Conceptual Site Model

The groundwater aquifer system at HNP includes the following features:

- A shallow unconfined aquifer system found in generally-sandy unconsolidated alluvial deposits of varying thickness and engineered fill surrounding plant structures. The shallow unconfined aquifer may be hydraulically connected t othe shallow bedrock in some areas.
- Confined and semi-confined (i.e., "leaky") aquifer systems in fractured bedrock underlying the unconsolidated deposits. The fractured bedrock is encountered at varying depths below ground surface and the bedrock aquifer exhibits varying degrees of confinement. Bedrock aquifer tranmissivity is largely controlled by fracture sets oriented in a generally north-south direction.
- The Connecticut River is adjacent to the site and serves as a groundwater discharge boundary for the aquifer system (confined, semi-confined and unconfined aquifers).
- Groundwater beneath HNP is recharged by local infiltration of precipitation and surface water percolation and by infiltration of precipitation in the upland areas to the north of the power station area, inland of the river.

Additional discussion of the HNP hydrogeologic conceptual site model is found in the *Connecticut Yankee Atomic Power Company Haddam Neck Plant Phase 2 Hydrogeologic Characterization Work Plan Task 1 Summary Report* (CH2M HILL, 2004c).

HNP Capture Zone Functional Areas

The HNP site was divided into three similar functional areas for the capture zone assessment, as shown in Figure 6. The following areas of the HNP site have been identified as comparable to the hydrogeologic test areas based on structural similarity and hydrostratigraphic features:

- The HNP central industrial area. This area includes all of the primary power station structures (e.g., reactor containment, primary auxiliary building, fuel building, service and control buildings, and turbine building) and hydrogeologically consists of a relatively thin layer of alluvial deposits and construction fill overlying a thick fractured crystalline bedrock formation that is encountered relatively shallow below ground surface. Groundwater in this area exhibits varying degrees of plant-related contamination. This area is part of the river terrace of the HNP adjacent to the Connecticut River. The unconsolidated formation generally lies in direct contact with the bedrock in this area and appears to be in communication with semi-confined bedrock sytems. Based on observations during dewatering activities to support structure demolition, it is likely that the unconfined aquifer overlying the bedrock in the central portion of this area will not sustain long-term pumping and may become dewatered. Seasonal variations in local recharge will result in variable amounts of available groundwater in this area.
- The HNP parking lot and peninsula area. This area includes the administration buildng, parking lot, warehouse areas and the EOF on the northern portion (relative to plant north) of the river terrace area. It also includes the discharge canal peninsula to the south of the industrial area, the discharge canal itself, and the river terrace inland of the discharge canal extending to the southern property boundary near the Salmon River. This area consists of a relatively thick layer of unconsolidated alluvial and overbank deposits overlying crystalline bedrock. The unconsolidated formation is separated from the bedrock by a dense layer of sand, silt, and gravel that is interpreted as glacial till and exhibits low transmisivity. Although the shallow unconsolidated aquifer in these areas is in communication with the aquifer underlying the industrial area, the predominant groundwater flow (i.e., northeast to southwest) tends to minimize the distribution of contaminants from the industrial area laterally into these areas. The upper pensinsula (i.e., the area immediately adjacent to the industrial area) exhibits some groundwater contamination that appears continuous with that underlying the industrial area. The lower peninsula (i.e., the southern portion of the peninsula extending from the current waste storage area to the southern terminus of the peninsula at the mouth of the discharge canal) is in hydraulic communication with both the discharge canal and the Connecticut River. There are no defineable contaminant plumes present in the lower peninsula and observed contaminant concentrations do not exceed closure criteria.
- The HNP upland area. This is the largest part of the HNP and consists of steeply-sloping upland area to the east (relative to plant north) of the river terrace. It includes the Independent Spent Fuel Storage Installation (ISFSI) and the former HNP landfill

area. The upland area consists primarily of discontinuous veneers of soil overlying crystalline bedrock. The landfill area near the southern end of the upland area exhibits a relatively thick sandy surface deposit. No groundwater contamination is found in this area. The groundwater in the upland area is in hydraulic communication with the industrial area and the parking lot area via local recharge into the unconsolidated aquifer and through flow of groundwater within the underlying fractured bedrock.

The capture zone dimensions applicable to these functional areas are shown in Table 3. The estimated water supply well capture zones for these areas depend on the following site-specific conditions:

- The aquifer being pumped (i.e., shallow unconfined or bedrock);
- The pumping rate applied to the well;
- The total depth of the well; and
- Interception of specific transmissive fracture sets in the bedrock aquifer.
- Degree of communication between semi-confined units and overlying unconfined units.

Variability of site-specific conditions within each functional area leads to uncertainty in the exact radius of well capture zones. The assumptions used to identify the capture zone radii and apparent uncertainties are also described in Table 3.

Application of Capture Zone Assessment to HNP Post-Closure Dose Modeling for the Resident Farmer Scenario

The HNP license termination plan (LTP) establishes a plume influence boundary at a distance of one-hundred meters from the groundwater contamination plume within the industrial area. The contamination plume is defined as the 1,000 pCi/L plume contour of tritium in groundwater. Post-closure dose estimate modeling assumes the hypothetical water supply well would not capture site-related groundwater contaminants if installed along that boundary. The LTP states that if the capture zone is determined to be greater than one hundred meters, then NRC will be notified. The empirical test measurements used to support determination of the well capture zone are described below.

Unconfined Aquifer Pumping Test Results

For wells completed in the shallow unconfined aquifer, the capture zone of a well pumped at 0.5 gpm was less than 30 feet (<10 meters). This determination is based on the 0.5 gpm portion of the step-drawdown test performed prior to the constant-rate aquifer pumping test conducted in the unconfined aquifer. The test was conducted in a five-inch diameter well that was screened over the entire thickness of the unconfnined aquifer. A near-field monitoring well located 29 feet from the pumping well was equipped with a data-logging pressure transducer to record near-field effects. No response was observed in the near-field monitoring well during the 0.5 gpm pumping activity.

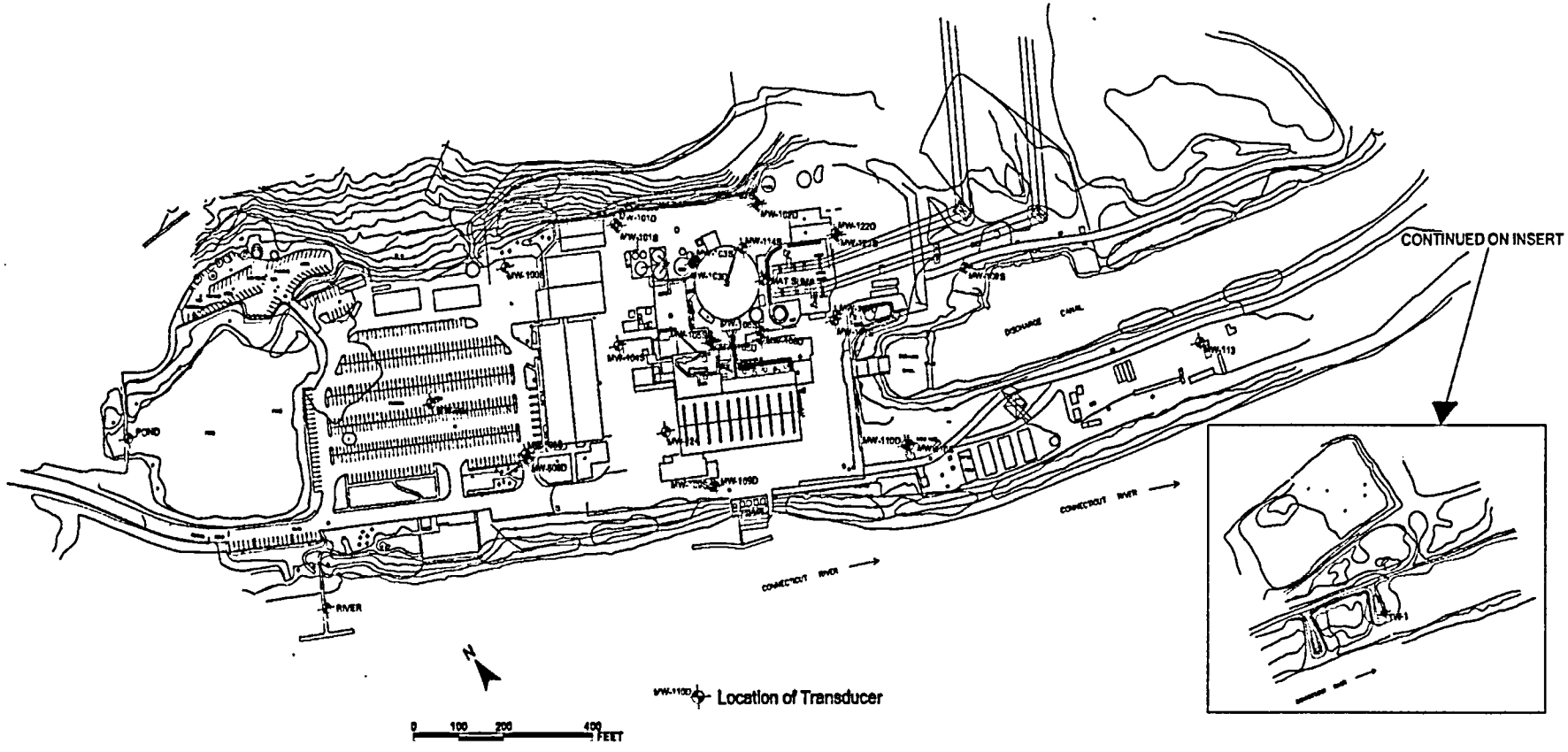
The results of the seventy-two hour constant rate pumping test provide a good upper-level bounding estimate of capture zone in the unconsolidated formation. The test well was pumped at 29 gpm, and at the end of the test period a drawdown response was observed in the near-field monitoring well at 29 feet (8.6 m) from the pumping well and in the next nearest monitoring well at a distance of 100 feet (30 m). A possible hydraulic response (i.e., a downward inflection in the distant well hydrographs late in the pumping test period) attributable to the pumping test was observed in two wells 190 feet (58 m) from the pumping well, delineating a probable maximum capture zone of approximately 200 feet (61 meters) at a pumping rate of 29 gallons per minute in the unconsolidated materials of the shallow unconfined aquifer.

Based on these observations, the capture zone of a hypothetical water supply well completed in the unconfined aquifer is less than the 100 meters stipulated in the post-closure dose model. Based on the similarity of the unconsolidated materials across the site, the capture zone for a hypothetical water supply well under the modeled conditions (i.e., 0.46 gpm) can be assumed to be less than ten meters. The capture zone should be assumedto extend uniformly in all directions around the hypothetical water supply well.

Confined Aquifer/Fractured Bedrock Pumping Test Results

For wells completed in bedrock boreholes that intersect transmissive fractures, pumping from an open borehole is identified as the most representative test measurement for this assessment. Open borehole pumping was conducted during characterization of bedrock hydraulic properties at the site during 2004. Pumping was conducted at various rates in four boreholes. Hydraulic responses were observed in distant wells equipped with data-logging pressure transducers and were evaluated to confirm that the responses were related to the pumping activities. The open borehole capture zone was observed to range from 185 feet (56 meters) at a pumping rate of 1.9 gpm to 462 feet (141 meters) at a pumping rate of 6.7 gpm.

Based on these observations, the capture zone for a hypothetical water supply well completed in fractured bedrock and pumped at the modeled conditions (i.e., 0.46 gpm) is less than the 100 meters evaluated in the post-closure dose model. This estimate is based on the observation that pumping an open bedrock borehole at a rate approximately four times the modeled rate (e.g., 1.9 gpm vs. 0.46 gpm) produced an observed maximum capture zone of only 56 meters. The open boreholes used for the borehole pumping tests were cased from the ground surface to the top of bedrock and are consistent with the expected design of a bedrock water supply well as typically constructed near the site. The containment foundation mat sump and other dewatering activities were active during the bedrock pumping. Although this distant extraction may have reduced the observed magnitude of distant drawdown responses, it is not expected to have substantially reduced the observed radius of influence.



Notes: (1) Transducer locations are approximate locations
(2) Base map obtained from Malcolm Pirnie, April 2002

Figure 1

LOCATION OF WATER LEVEL TRANSDUCERS
HADDAM NECK PLANT (HNP)

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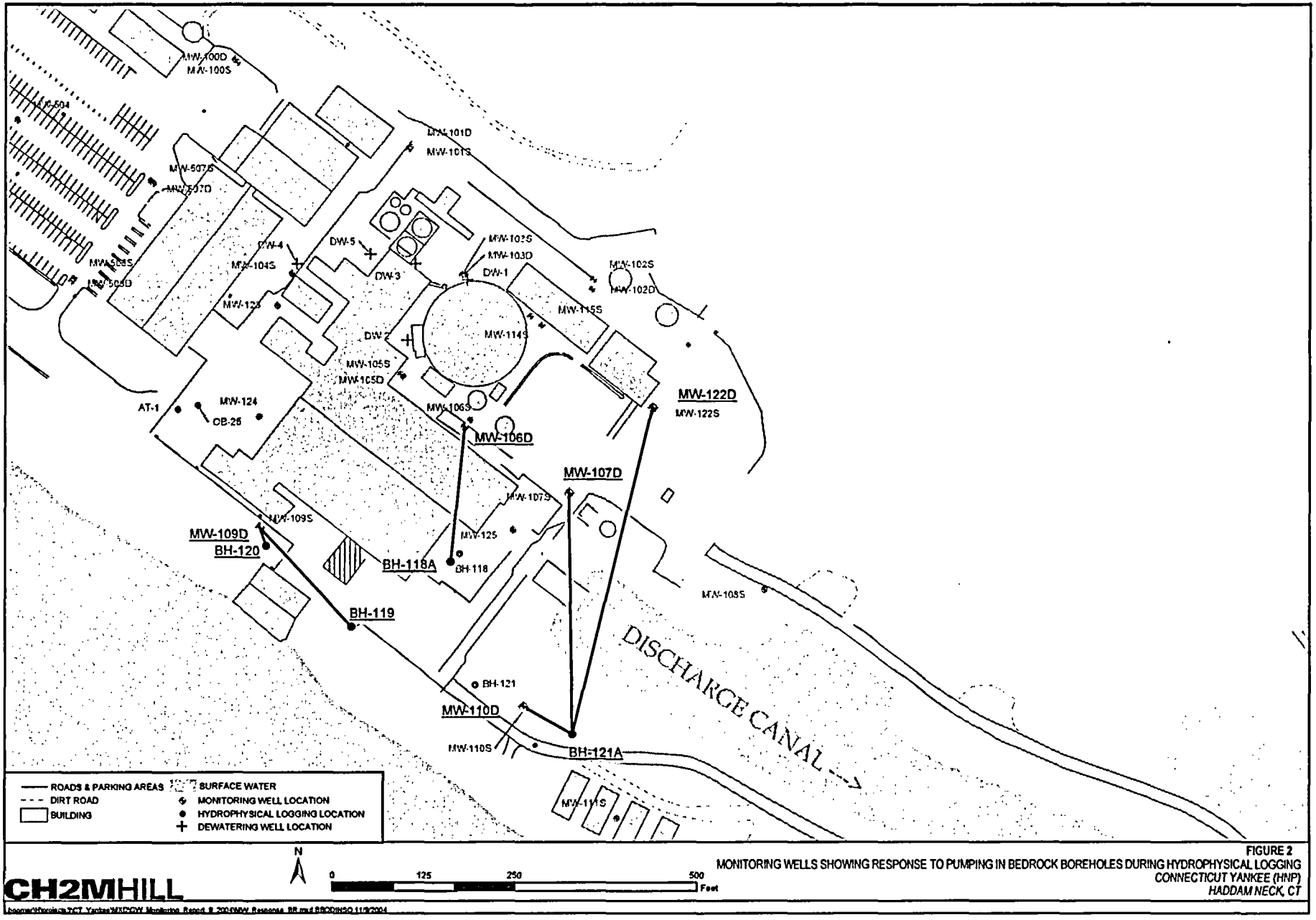

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FIGURE 2

MONITORING WELLS SHOWING RESPONSE TO PUMPING IN BEDROCK BOREHOLES DURING HYDROPHYSICAL LOGGING

CONNECTICUT YANKEE (HNP)

HADDAM NECK, CT

Table 1. Location and Magnitude of Responses to Bedrock Pumping Events in Open Boreholes.

Pumping Location	Pumping Rate	Drawdown in Pumping Well	Well Exhibiting Response	Distance from Pumping Well	Drawdown Observed
BH-118A	5 gpm	4.8 ft	MW-106D	185 ft	0.45
BH-118A	31 gpm	78 ft	MW-106D	185 ft	1.10 ft
BH-119	1.4 gpm	21 ft	MW-109D	185 ft	0.1 ft
BH-120	1.9 gpm	16 ft	MW-109D	28 ft	1.4 ft
BH-121A	6.7 gpm	37 ft	MW-110D	74 ft	1.1 ft
			MW-107D	333 ft	0.1 ft
			MW-122D	462 ft	0.6 ft

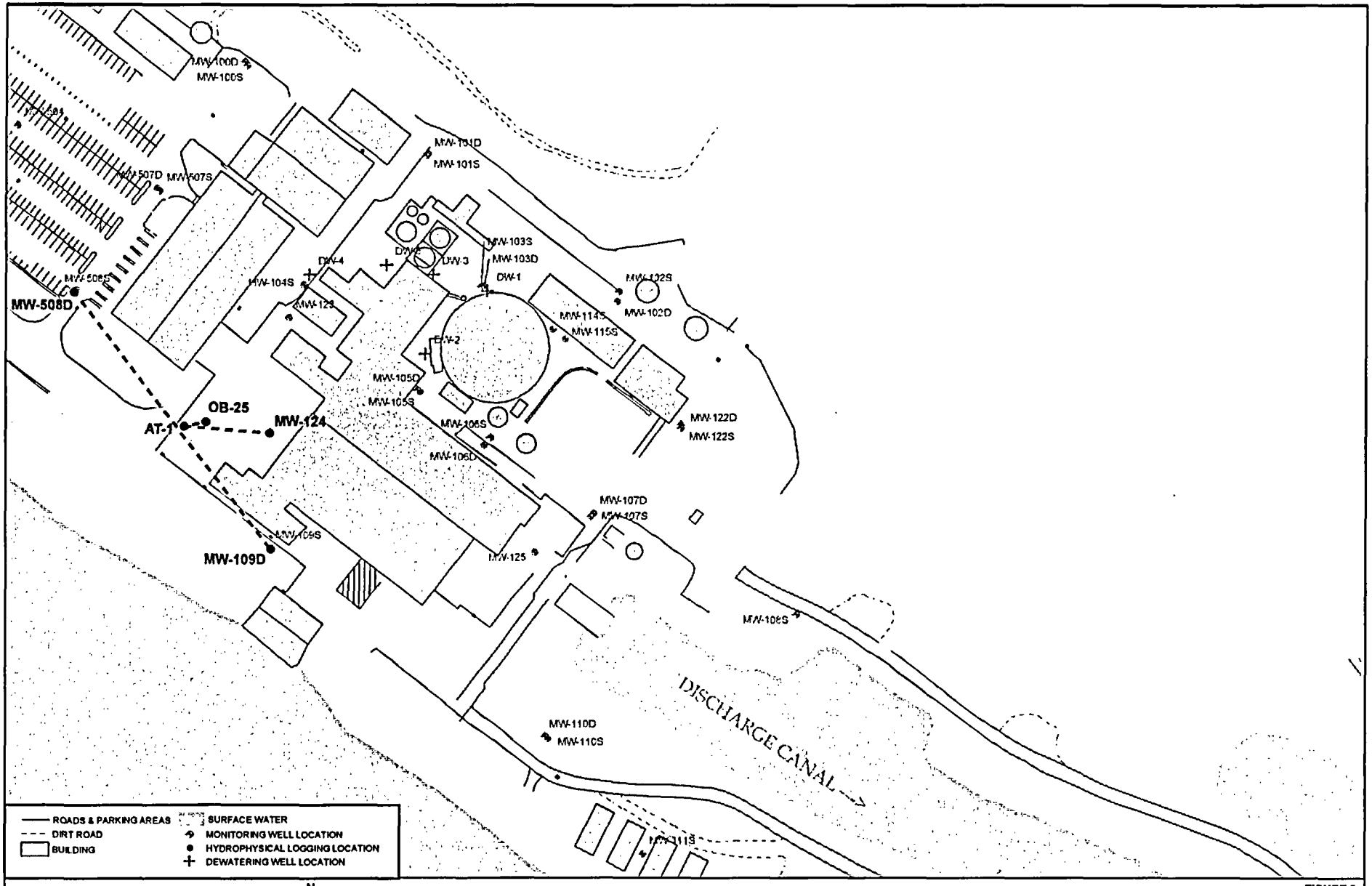

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FIGURE 3
MONITORING WELLS SHOWING HYDRAULIC RESPONSES TO PUMPING DURING SHALLOW WATER AQUIFER TESTS
CONNECTICUT YANKEE (HNP)
HADDAM NECK, CT

Figure 4
Step Drawdown Test Response in AT-1 and OB-25
September 2004

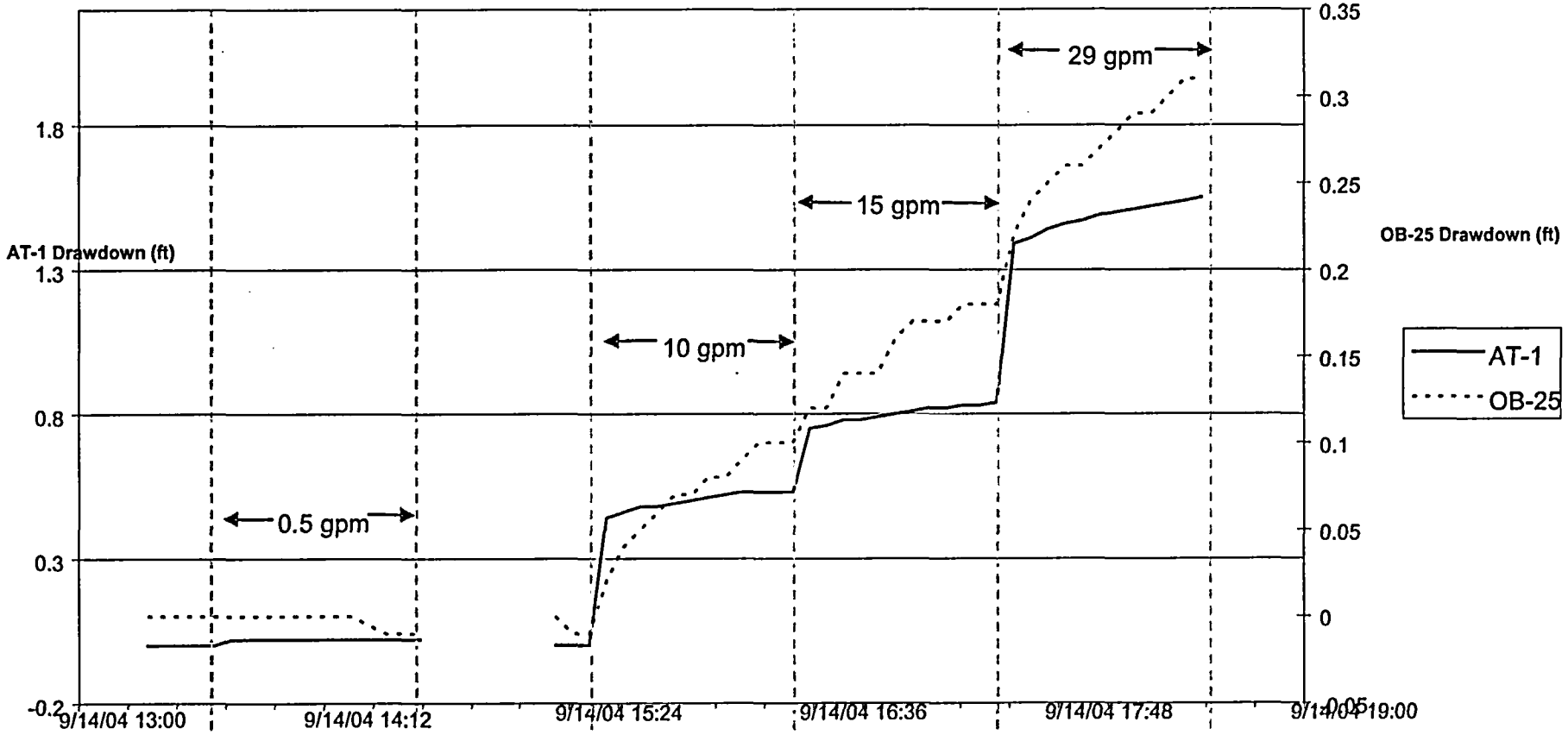
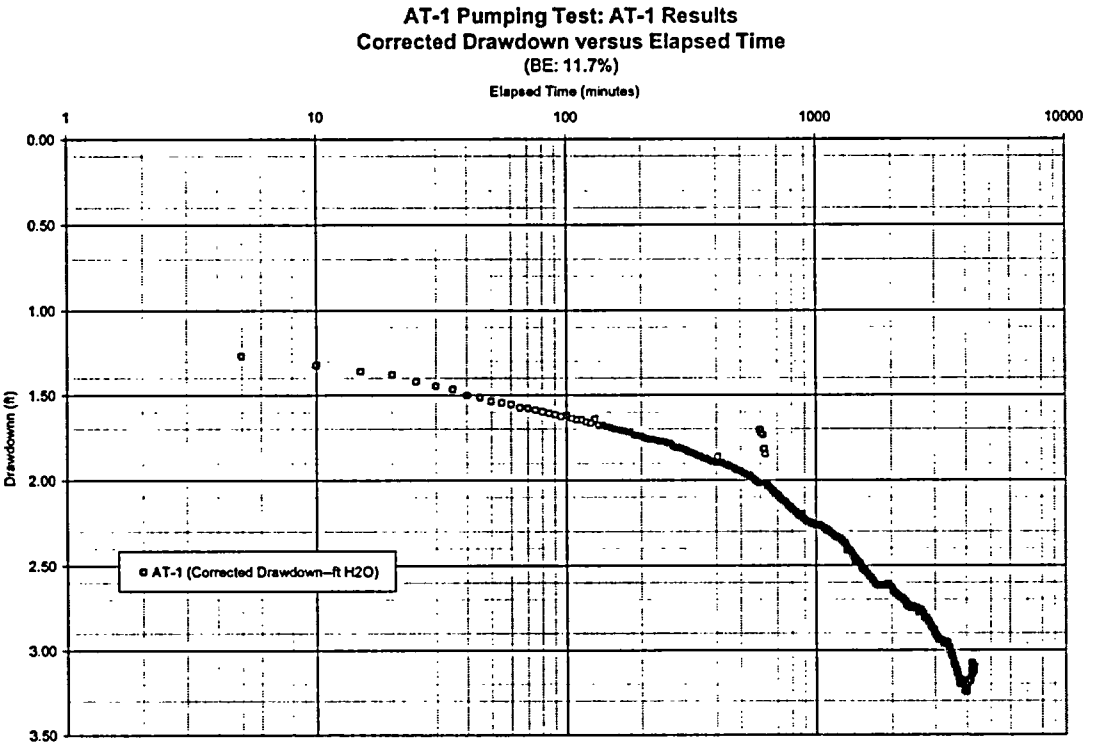
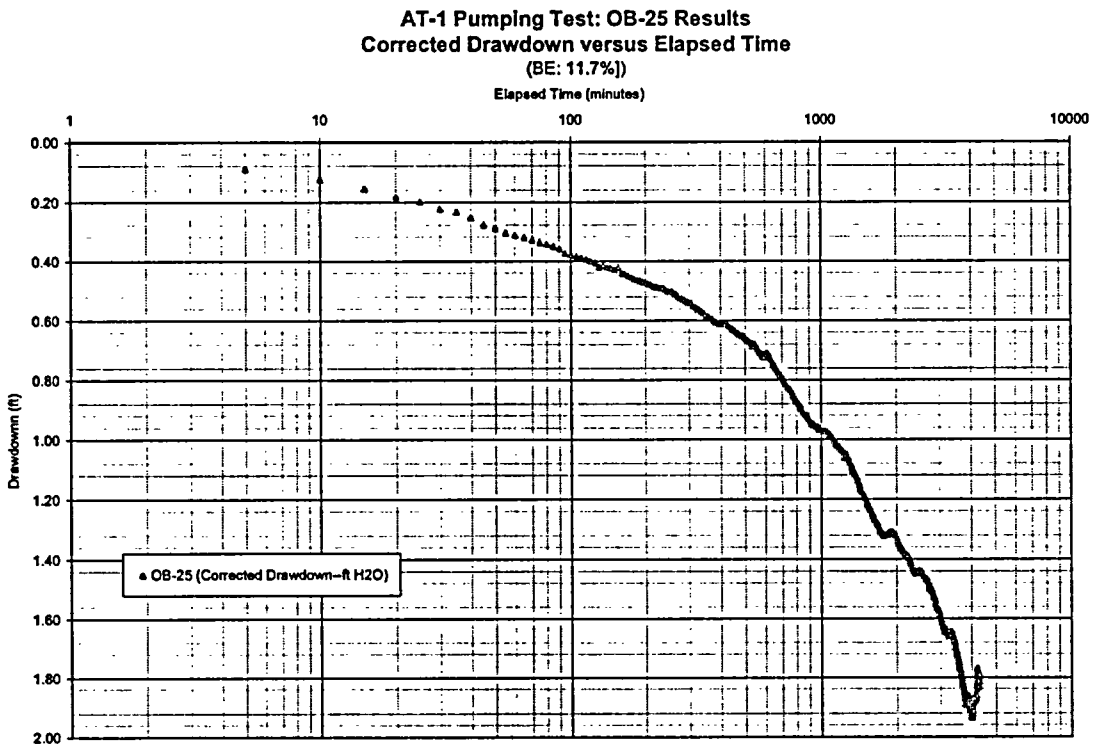


Figure 5. Drawdown Responses During Constant Rate Pumping Test.





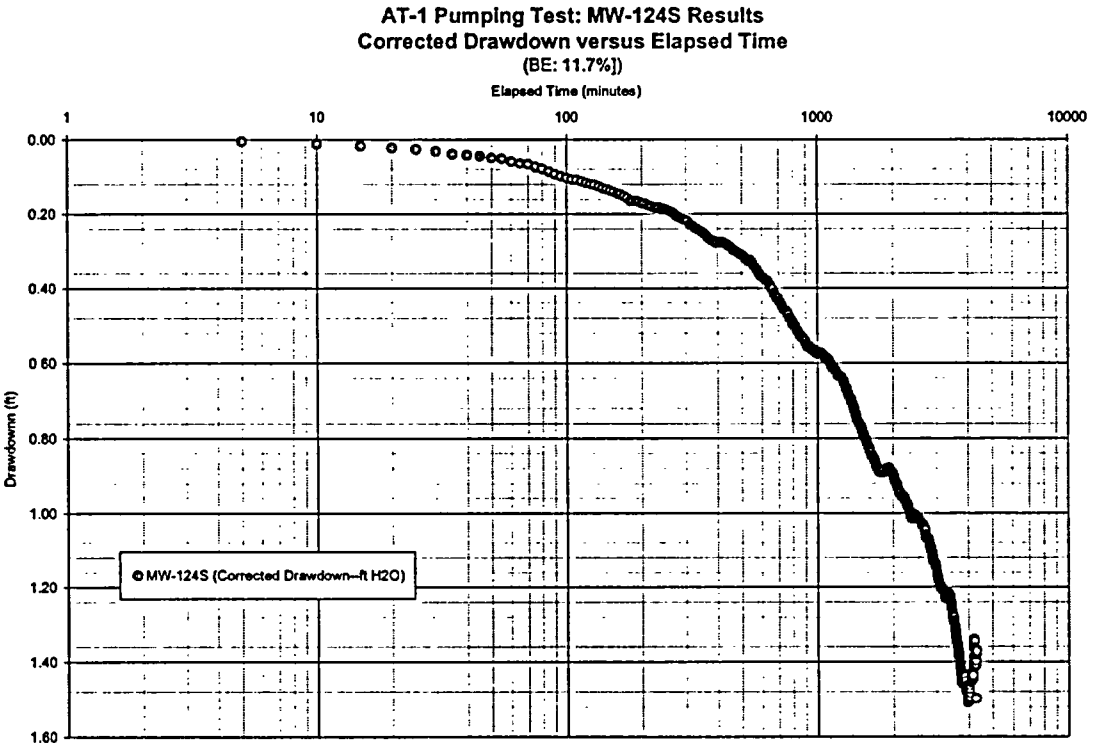

AT-1 Pumping Test: MW-124S Results
Corrected Drawdown versus Elapsed Time
(BE: 11.7%])
Elapsed Time (minutes)
1
10
100
1000
10000
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Drawdown (ft)
MW-124S (Corrected Drawdown--ft H2O)

Table 2. Location and Magnitude of Responses to Unconfined Aquifer Pumping Events.

Pumping Location	Pumping Rate (gpm)	Drawdown in Pumping Well (feet)	Well Exhibiting Response	Distance from Pumping Well (feet)	Drawdown Observed (feet)
AT-1 (Step-drawdown test observations at the end of each 1-hour duration step)	0.5	0.05	OB-25	29	0
	10	0.5	OB-25	29	0.1
	15	0.85	OB-25	29	0.18
	29	1.5	OB-25	29	0.32
AT-1 (Final drawdown at end of 72-hour constant rate pumping test)	29	3.25	OB-25	29	1.95
			MW-124	100	1.5
			MW-109D	190	Inflection response only*
			MW-508D	190	Inflection response only*
*Note: No measureable drawdown response was observed in hydrographs for these two wells, however, a downward inflection the hydrograph of each wells was observed late in the constant rate pumping test period.					

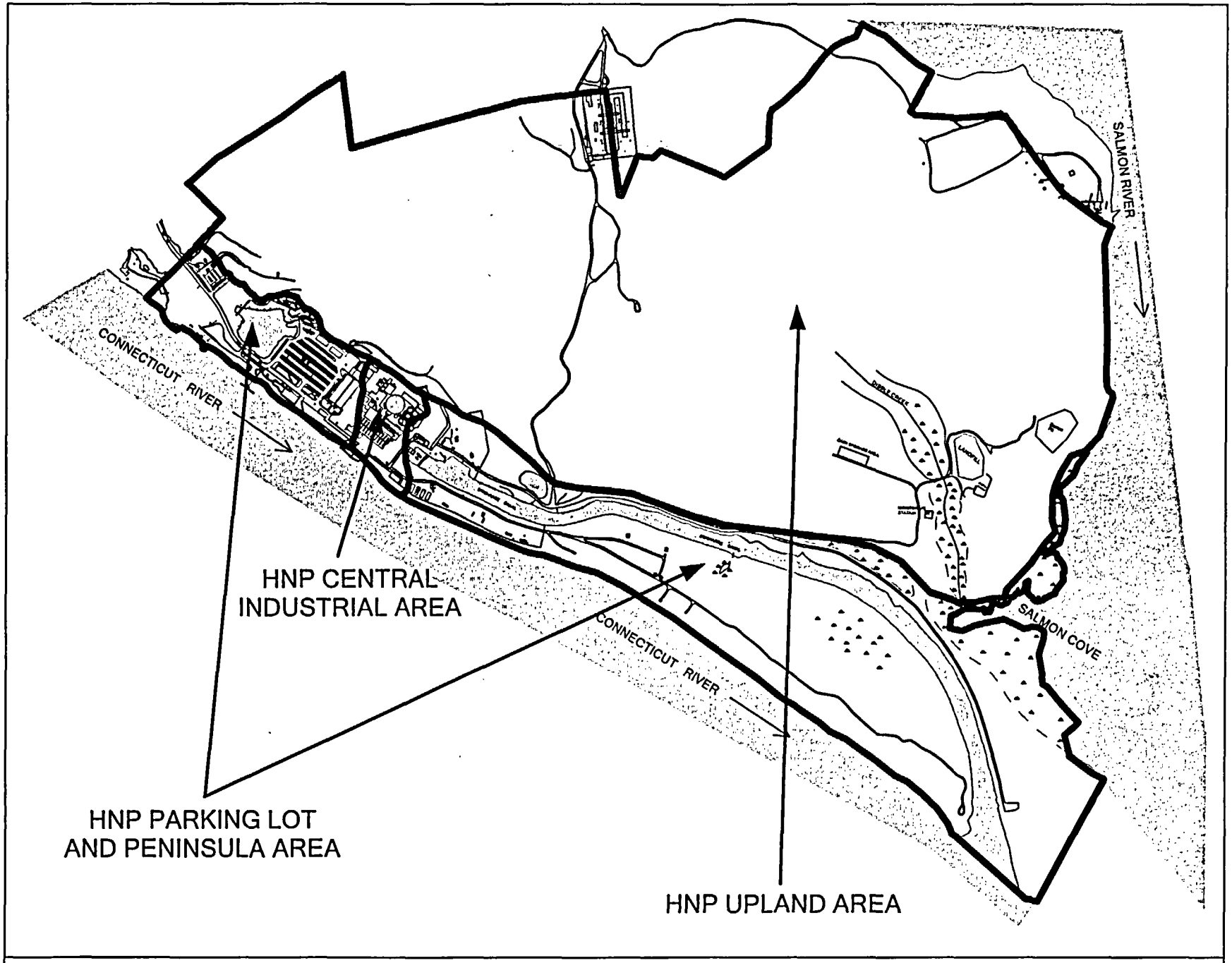


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FIGURE 6
HNP CAPTURE ZONE FUNCTIONAL AREAS
HADDAM NECK, CT

27feb04_CY Site Map of HNP

Table 3. Capture Zone Dimensions Applied to Functional Areas.

Functional Area	Unconsolidated Formation Capture Zone Radius (feet/meters)	Pumping Rate (gpm)	Bedrock Formation Capture Zone Radius (feet/meters)	Pumping Rate (gpm)	Applicable Assumptions	Uncertainties and Comments
HNP Industrial Area	< 30 ft/< 10 m	0.5	< 200 ft/< 62 m	0.5	a. Unconfined aquifer well(s) are completed above the bedrock interface. b. Bedrock wells are cased from surface to bedrock and open hole below. c. The pumping rate is applied on a continuous basis.	a. The unconfined aquifer in the central portion of this area may not sustain this pumping rate over time and may become dewatered. b. The magnitude of observed hydraulic responses in distant bedrock wells may be affected by operation of the containment mat sump.
River Terrace (Parking Lot and Peninsula)	< 30 ft/< 10 m	0.5	< 200 ft/< 62 m	0.5	a. Unconfined aquifer well(s) are completed above the bedrock interface. b. Bedrock wells are cased from surface to bedrock and open hole below. c. The pumping rate is applied on a continuous basis.	
Upland Area (Including ISFSI and landfill)	< 30 ft/< 10 m	0.5	< 200 ft/< 62 m	0.5	a. Unconfined aquifer well(s) are completed above the bedrock interface. b. Bedrock wells are cased from surface to bedrock and open hole below. c. The pumping rate is applied on a continuous basis.	a. With the exception of the landfill vicinity, most of the upland area exhibits only a very thin veneer of unconsolidated material over bedrock, thus precluding construction of shallow wells in the unconfined aquifer.

Notes:

"<" = Less Than

gpm = gallons per minute