Final Closeout Report

Army Materials Technology Laboratory

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1.0 INTRODUCTION

This Final Close Out Report documents that the U.S. Army completed construction activities for operable unit (OU)-1, OU-2, and OU-3 at the Army Materials Technology Laboratory (AMTL) in accordance with *Close Out Procedures for National Priorities List Sites, Office of Solid Waste and Emergency Response (OSWER) Directive 9320.2-09A-P, January, 2000.* The Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MADEP) conducted a final inspection on April 14, 2005, and determined that all remedial actions have satisfied requirements of the Record of Decisions (ROD) for OU3, dated June 1996, and for OU1, dated September 1996. In addition, we have determined the remedies at those two OUs are operational and functional and that operation and maintenance is continuing. The work related to OUs 1 and 2 was the last major construction performed at AMTL. In September 2005, the final ROD was signed for the Charles River Sediment Operable Unit or OU3. The ROD called for No Further Action. Therefore, the site now qualifies for inclusion on the Construction Completion List. Both US EPA and MADEP concur that all remedial action has been successfully executed by the Army.

1.1 Acronyms

AMTL	Army materials Technology Laboratory
AOC	Areas of Contamination
AWQC	Ambient Water Criteria
BCT	Base Closure Team
BGS	Below Ground Surface
BRAC 94	Base Realignment and Closure Act of 1994
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COPC	Contaminants of Potential Concern
CRBCA	Charles River Business Center Associates
DCR	Department of Conservation and Recreation
EPA	Environmental Protection Agency
GSA	General Services Administration
HI	Non-cancer hazard indexes
HQ	Hazard Quotients
IC	Institutional Controls
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MOA	Memorandum of Agreement

NCP	National Contingency Plan
NFA	No Further Action
NPL	National Priorities List
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	Poly-aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
POL	Petroleum, Oil and Lubricants
QA	Quality Assurance
QC	Quality Control
RA	Remedial Action
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RME	Reasonable Maximum Exposures
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SVOC	Semi-volatile Organic Compound
TCLP	Toxicity-characteristic Leaching Procedure
TPHC	Total Petroleum Hydrocarbon
TRC	Technical Review Committee
TRV	Toxicity Reference Value
US	United States
USATHAMA	US Army Toxic and Hazardous Material Agency
UST	Underground Storage Tank
VOC	Volatile organic compound
WADC	Watertown Arsenal Development Corporation

2. SUMMARY OF SITE CONDITIONS

2.1 Background

The U.S. Army Materials Technology Laboratory (AMTL) lies in Middlesex County, Massachusetts, 6 miles northwest of Boston, and occupies approximately 48 acres within the city of Watertown. The surrounding city population is approximately 34,000. Developed land adjacent to the Site is a mix of residential and commercial uses. The Site borders the Charles River to the south.

The AMTL facility was established in 1816 and was originally used for the storage, cleaning, repair, and issuance of small arms. During the mid-1800s, the mission was expanded to include ammunition and pyrotechnics production; materials testing and experimentation with paints, lubricants, and cartridges; and the manufacture of breech loading steel guns and cartridges for field and siege guns. The mission, staff, and facilities continued to expand until after World War II, at which time the facility encompassed 131 acres, including 53 buildings and structures, and employed 10,000 people. Arms manufacturing continued until an operational phasedown was initiated in 1967 and much of the property was transferred to the General Services Administration (GSA). In 1968, GSA sold approximately 55 acres to the Town of Watertown. This property was subsequently used for the construction of apartment buildings, the Arsenal Mall, and a public park and playground. AMTL contained 15 major buildings and 15 associated structures. In 1960, the Army's first material research nuclear reactor was completed at AMTL. The reactor was used actively in molecular and atomic structure research activities until 1970 when it was deactivated. The research reactor was decommissioned under the jurisdiction of the Nuclear Regulatory Commission in 1992 and the structure was demolished in 1994. In 1987, the US Army Toxic and Hazardous Material Agency (USATHAMA) initiated preliminary site studies, the first stage of the facility's closure plan. In late 1993, Congress officially recommended the closure of the facility. On September 29, 1995, AMTL was officially closed and reverted to a caretaker status.

The AMTL was placed on the EPA National Priorities List (NPL) as a Superfund Site in May 1994 and in 1995 the Army signed an Interagency Agreement with the EPA stipulating that site investigations and cleanup actions would follow CERCLA/ Superfund Amendments and Reauthorization Act (SARA), under the regulatory guidance of the National Contingency Plan (NCP) 40 CFR Part 300. A Technical Review Committee (TRC) was formed at the time which has subsequently become the Restoration Advisory Board (RAB). In 1994, AMTL was placed on the Base Realignment and Closure (BRAC 94) list.

In August 1998, 36.5 acres of the 48-acre CERCLA site were transferred from the ownership of the US Army. At that time, the Watertown Arsenal Development Corporation (WADC) acquired 29.44 acres of the Site. The Town of Watertown took ownership of 7.21 acres. In March 2005, the remaining 11 acres of the Site were transferred to the Commonwealth of Massachusetts, Department of Conservation and

Recreation (DCR). At the time of each transfer, the United States of America, acting by and through the Secretary of the Army, granted the MADEP a Grant of Environmental Restriction and Easement for each appropriate zone of the AMTL Site. The purpose of the Grants is to provide a mechanism for the creation and enforcement of the necessary land use controls as required by the CERCLA RODs for the Site (August and September 1996). The first Grant redesignated areas into lots for property transfer and future deed tracking. Environmental Zones 1, 2, and 3 (the parcel initially transferred to WADC) were designated as Lot 1. Lot 1 was sold to Charles River Business Center Associates (CRBCA) in December 1998. CRBCA sold the Lot 1 property to the President and Fellows of Harvard College (Harvard) in May 2001. Environmental Zone 4 (the parcel transferred to the Town of Watertown) was designated as Lot 2. Lots 1, 2, 3, and 4 were deleted from the NPL through the partial deletion process on November 22, 1999. Zone 5, the Charles River Park, is the subject of the second Grant. This park was AMTL property, however, it has been managed by the DCR since the 1920's under a lease from the Army. Since then, the land has been maintained as open and recreational space. In 1948, the DCR's predecessor (Metropolitan District Commission) leased approximately two (2) acres of the riverfront property to the Watertown Yacht Club.

2.1.1 OU1- Outdoor Areas

Because of the complexity of this industrial facility, the Site was divided into three areas for investigation. The first operable unit (OU1) addresses most outdoor soils, except for a small area near Building 131 which was included in OU3 to facilitate re-use, and all underlying groundwater. The indoor areas and petroleum related cleanups are addressed under the Commonwealth of Massachusetts cleanup authority. Environment Zones 1-5 (Areas A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, T, and metal hot spots) are all included in the OU1 ROD. These areas were designated during the remedial investigation due to exceedances of expected future use and/or ecological risk levels for metals, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and pesticides. Two Explanations of Significant Differences (ESD) have been signed for this Site. The first ESD addressed Lot 1 and was signed on January 12, 1998. The second ESD addressed the Charles River Park and was signed on June 7, 2001. The ESDs changed the subsurface PAH cleanup levels to levels protective of construction workers. The revised PAH cleanup goals were applied at Areas B, E, G, and L4 utilizing the first ESD. These cleanup goals were also applied to the Charles River Park (Zone 5-Areas M, N, O, P, and Q) utilizing the second ESD. See section 2.4.2 for more information. The ROD for this OU also documented that no further action was necessary under CERCLA for the groundwater at the entire AMTL site.

2.1.2 OU2 - Charles River

This OU encompasses the portion of the Charles River that is adjacent to the AMTL property which has historically received contaminants from the AMTL site via storm drainage, direct discharges, and erosion.

2.1.3 OU3 - Area I

Area I is located in Zone 3 (see Figure 2-1). It was the subject of a separate ROD signed prior to the OU1 ROD for residential cleanup of soils contaminated with PAHs and pesticides above cleanup levels. This area was segregated from the rest of OU1 for faster redevelopment.

2.2 RI/FS Results

2.2.1 OUs 1 and 3 - RI/FS Results

Remedial Investigations of these two operable units were conducted between 1987 and 1995 and generally found the following contamination across the facility:

Groundwater-With the exception of one well, all upgradient wells showed detectable quantities of chlorinated solvents, which suggests that off-site sources have caused or aggravated on-site groundwater contamination. Based on a site water table map, groundwater flow paths indicate the potential for groundwater to flow away from the site in an area in the northwestern part of the site before flowing toward the Charles River. No evidence of on-site contamination migrating off-site was found in groundwater samples collected from on-site wells because the majority of contamination was detected in the upgradient wells. The on-site, and farthest downgradient, wells bordering the Charles River showed the lowest levels of contamination. Although some contamination is present in certain areas of on-site groundwater, this does not pose a current or future risk because the groundwater is not used as a water supply, and no significant migration of contamination is occurring. The site groundwater meets the Commonwealth of Massachusetts definition of a non-drinking water aquifer (GW-3) as defined in 310 CMR40. Therefore, there is no risk of exposure to human receptors. Groundwater does discharge from the site into the Charles River. A model of contaminant contribution via groundwater to the Charles River was developed. This model, as presented in the FS, shows that no significant concentrations of contaminants migrating to the river from the site groundwater. Hence, there is no apparent risk to human health or the environment from site groundwater and no further action was documented in the OU1 ROD for all groundwater across the AMTL facility

Surface soils- Semivolatiles, pesticides, PCBs and metals were detected at levels exceeding the Massachusetts Contingency Plan (MCP) S-1/GW-1 standards (the most protective). These detections were scattered and in hot spots, as opposed to site-wide distribution. Polychlorinated biphenyls (PCB) were detected at levels above the EPA action level. The analytical results showed that the total uranium activity in all soils was below the federal maximum allowable standards.

Sub-surface soils- Volatile organics, semivolatile organics, poly-aromatic hydrocarbons (PAH), pesticides, and metals were found at many sampling locations above MCP S-1/GW-1 standards.

Surface water and sediments- Surface water contained arsenic and lead above human health Ambient Water Quality Standards. Sediments were contaminated with low levels of metals and pesticides above EPA Region 1 sediment screening values.

Below is a summary of the contaminants of concern for soil and the corresponding cleanup levels.

Soil Contaminant of Concern	Maximum Concentration (mg/kg)	ROD Cleanup Level (mg/kg) (Surface and subsurface soils)	ESD Cleanup Level (mg/kg) (subsurface soils only)	Zone where cleanup level pertains**
Benzo(a)anthracene	3.2E+01	8.5E+00	1.76E+3	2,3,4&CRP
Benzo(a)pyrene	3.7E+01	2.0E+00	1.54E+2	2,3,4&CRP
Benzo(b)fluoranthene	1.5E+01	7.9E+00	1.76E+3	2,3,4&CRP
Benzo(k)fluoranthene	2.4E+01	6.2E+00	1.76E+4	2,3,4&CRP
Chlordane	9.4E+00	1.4E+00*		4&CRP
Chrysene	3.4E+01	1.11E+01	1.76E+5	3, 4 & CRP
DDD	3.5E+00	1.37E+01		4&CRP
DDE	6.3E+00	1.4E-01		4&CRP
DDT	5.2E+00	1.7E-01		4&CRP
Dibenzo(a,h)anthracene	3.3E+00	2.7E-01	1.54E+02	3&CRP
Dieldrin	4.0E+00	3.5E-01		4&CRP
Indeno(1,2,3-cd)pyrene	1.4E+01	3.0E+00	1.76E+3	2,3,4& CRP
Arochlor-1260 (PCB)	4.9+00	1.0E+00		3&4

*Cleanup goal for chlordane in zone 3 was1.5E+00 based on human health risk.
** No cleanup goals were developed in the ROD for Zone 1

Human Health Risks for both OUs 1 and 3 were evaluated for current use and for future use. The future use included a residential scenario, which is the most protective assessment for human health. Risks were unacceptably high under the residential conditions (maximum cancer risks 3E-05 and maximum Hazard Index 0.4) and therefore remediation was required. Some areas were remediated to commercial risk levels and required a Grant of Environmental Restriction. See Table 1.

Ecological Risks center on two scenarios. The scenarios include exposure to site groundwater in the Charles River and exposure to site soils in the limited open space areas. Contaminants in groundwater are possibly migrating toward the Charles River but the level of contamination is not expected to adversely affect aquatic organisms. Most of the AMTL Site is not prime terrestrial habitat due to the lack of open space. Suitable habitat for terrestrial vegetation and wildlife is restricted to the southeastern corner of the site. Major risk drivers were metals and pesticides. Receptors evaluated in the risk

assessment with unacceptable hazard indices were: northern short-tailed shrew, white-footed mouse, American robin, song sparrow and earthworms. Cleanup goals were not determined for metals because on-site metals were found to be generally consistent with normal background levels. Any areas with metals contamination posing an unacceptable localized risk were co-located with pesticides and remediated.

2.2.2 OU2- RI Results

Site Investigation/Remedial Investigation (SI/RI) activities were performed between 1979 and 2005. In 1979, the Army completed a study to verify where storm water pipes were located at the facility, to collect samples, and to identify potential sources of pollutants in the storm water. The study found that seven storm water pipes were present at AMTL that discharged either directly or through the storm water system and into the Charles River.

In 1994, 1998, and 2003 surface water and sediment samples were taken both upstream and downstream of the outfalls. The 2003 sampling event also included biological and toxicological studies of the river conditions. The Charles River was divided into four reaches for the purposes of evaluation in the baseline ecological risk assessment (BERA).

Chemicals detected in surface water at the Charles River OU were found at low concentrations that were either below human health based risk screening levels, consistent with upstream background conditions or indistinguishable from the urban background conditions of the Charles River. There are numerous existing and historical sources of pollutants to this urban riverine system.

Sediments were found to be contaminated by PAHs, inorganics, low levels of pesticides and PCBs, and extremely low levels of several radionuclides.

Potential human receptors included the people engaging in water-related activities along and on the river or eating fish caught from the river. These activities were considered for resident adults and children and park visitors. Based on the nature of contamination and anticipated activities, the exposure routes evaluated for this portion of the Charles River included:

- Ingestion and dermal contact with river water and sediments;
- Ingestion of contaminated fish; and
- External exposure to radiation released from radionuclides in sediments.

Results of the HHRA revealed that both cancer risk and non-cancer risk levels were within the acceptable thresholds specified in the National Contingency Plan.

An advisory concerning the consumption of fish was issued by MDPH in 1996 for the Lower Basin of the Charles River because of the presence of PCBs.

The estimated excess chemical carcinogenic risks to adults ranged from 1×10^{-10} for ingestion of surface water to 2×10^{-6} for ingestion of sediment and the excess

carcinogenic risk from radionuclides ranged from 5×10^{-11} for ingestion of surface water to 8×10^{-10} for ingestion of fish. Chronic hazard index values for children ranged from 0.00003 for ingestion of surface water to 0.01 for ingestion of fish and for dermal exposure to sediment.

The weight of evidence (WOE) concluded that the potential for ecological risks contributed by the former AMTL facility are indistinguishable from the anthropogenic urban background conditions that characterize the Lower Charles River Basin. The WOE was derived from consideration of 1) the weight assigned to each measurement endpoint; 2) the magnitude of the response observed in each measurement endpoint; and 3) the summation of the degree of conflict/agreement among the outcomes of each measurement endpoint. There are elevated levels of many constituents (and a potential for ecological risk) present in all four reaches and the majority of these compounds are present at concentrations consistent with upstream reference locations. In general, the potential for ecological risk to benthic invertebrates was found to be low to moderate, with an even lower potential risk to finfish and vertebrate wildlife, respectively.

A No Further Action (NFA) ROD was signed for this OU because of consistency of the AMTL site conditions with urban background and the similar potential for ecological risks across sampling reaches.

2.3 ROD FINDINGS

2.3.1 OU1 ROD Findings

On September 26, 1996, the Army and EPA signed a Record of Decision (ROD) documenting the remedial action selected for OU 1. The MADEP concurred. The major components included:

- Excavation of areas with contaminated soils that were above cleanup goals;
- Confirmatory soil sampling within excavations after contaminated soil removal;
- Off-site landfill disposal or reuse of the excavated soil;
- Backfilling of clean fill soils into the excavations;
- Institutional controls to limit future use and to restrict site access and five-year reviews.

Two Explanations of Significant Difference (ESD) have been signed for this OU. The first ESD addressed Lot 1 and was signed on January 12, 1998. The second ESD addressed the Charles River Park and was signed on June 7, 2001. The ESDs changed the subsurface PAH cleanup levels to levels protective of construction workers. The revised PAH cleanup goals were applied at Areas B, E, G, and L4 with the first ESD. These cleanup goals were also applied to the Charles River Park (Zone 5-Areas M, N, O, P, and Q) with the second ESD. See section 2.4.2 for more information.

2.3.2 OU 2 ROD Findings

A No Further Action ROD was signed in September 2005. MADEP concurred.

2.3.3 OU 3 ROD Findings

The ROD for OU3 was signed on July 28, 1996. The MADEP concurred. The major components include:

- Excavation of areas with contaminated soils that were above cleanup goals;
- Confirmatory soil sampling within excavations after contaminated soil removal;
- Off-site landfill disposal or reuse of the excavated soil;
- Backfilling of clean fill soils into the excavations.

There are no institutional controls in place that are applicable to this OU.

2.4 Remedial Actions

2.4.1 OU1 Remedial Action

Soil clean-up goals were established in the ROD for different zones at AMTL based on the intended future use of particular areas, (See table in Section 2.2.1). The clean-up goals were developed to provide for a mix of future uses at the site, including residential, commercial, and recreational scenarios. The only exception was for the contaminants of concern and for the Zone 3-chlordane where the residential cleanup level was slightly higher than the ecologically protective level. In addition, during remediation and excavation activities, the Army and regulators determined that a construction worker scenario was a more realistic and appropriate exposure scenario for soils at a depth greater than one (1) foot below ground surface (bgs) at Zones 1 & 2. Because the Baseline Risk Assessment did not include the construction worker exposure scenario, additional risk assessment work was preformed. The construction worker exposure scenario recognized that periodic maintenance and/or installation of subsurface utilities/structures would be required in the future. In general, the construction worker exposure scenario differs from the commercial exposure scenario by evaluating risks from contaminated soils below one (1) foot bgs using an exposure duration that mimics the potential need to perform periodic subsurface utility work. The top one foot of soil meets the appropriate risk-based clean-up goals and no changes were made to the cleanup goals in the surface soils. In addition, the subsurface soil construction worker exposure scenario is recognized as an appropriate risk scenario for the public benefit reuse areas (Zone 4) because the "open space" user will not be excavating below one foot and will be protected by the one foot of soil meeting its risk-based clean-up goals. The Revised clean-up goals were documented in an Explanation of Significant Differences (ESD),

dated January 12, 1998. Remedial action objectives remained the same; mitigate the risks to human health and the environment posed by direct contact with and incidental ingestion of contaminated soils. The revised cleanup goals were applied at Areas B, E, G, J, and L. The confirmation samples taken prior to the revision of the clean-up goals indicated that the soils below one foot met these goals and the excavations were considered complete.

Remedial Action for the northern zone of the AMTL site was started on November 20, 1996, and completed on July 27, 1998. All soils were disposed of off-site in accordance with state and federal requirements. Implementation of the required Institutional Controls took place during the transfer (see Section 5.3).

During 1997, the Army began remedial activities within the Charles River Park parcel. Two areas within the approximate 11-acre Park parcel were remediated (Areas N & O) but remedial work in the remainder of the Park was suspended. The excavation volumes required to achieve soil clean-up levels specified in the ROD were significantly larger than previously estimated. This resulted in a significant potential increase in estimated costs of the remedy for the Charles River Park parcel.

The Army applied the revised cleanup goals (previously documented in the January 1998 ESD) to the Charles River Park parcel at elevations greater two (2) foot bgs level since several areas required the removal of the top two-feet of soil in order to address elevated ecological risks. This change was documented in an ESD, dated June 7, 2001.

Riverbank excavations at areas P, Q, & M were terminated at two (2) feet bgs since no revised clean-up goals were exceeded. A terraced wetland was constructed in Areas P & Q to provide protection from boat wakes and wind-driven waves. A breakwater structure was constructed at the toe of the bank. Vegetated plugs, shrubs, and trees were planted above the breakwater and erosion matting was placed on the slope.

The entire Charles River Park zone was mulched, seeded, and fertilized. Remedial Action for the Charles River Park zone was completed on December 22, 2003. All soils were disposed of off-site in accordance with state and federal requirements. Implementation of Institutional Controls for this zone took place during the transfer process. See Section 5.3.

The RA contractor submitted the Final Project Close-Out Reports (dated May 1998 and March 2002, respectively) which were approved by both EPA and Massachusetts DEP. The NCP requirement of a joint EPA and MADEP inspection (40 CFR §400.515(g)) was conducted on June 23, 2003. As a result of the inspection, EPA determined that the remedy was operational and functional (40 CFR §400.435).

2.4.2 OU3 Remedial Action

Remedial Action (RA) for Area I started on August 26, 1996, and was completed on January 10, 1997. The RA contractor submitted a Final Project Close-Out Report, dated December 1996, which was approved by both EPA and Massachusetts DEP. All soils

were disposed of off-site in accordance with state and federal requirements. No institutional controls were needed as the ROD specified clean-up goals (Zone 3) were protective of residential exposure to soils. No OU1 subsurface soil clean-up goals (documented in the two ESDs) were used for this OU. See the table in Section 2.2.1.

2.5 Community Involvement Activities Performed

In addition to the regular community meetings discussed below, community relations activities for the Army Materials Testing Laboratory NPL Site have included the following: development of a community relations plan, public meetings and site tours during the RI and remedy selection process, public comment periods on proposed plans, and publication and distribution of fact sheets updating the status of site cleanup.

In 1989, Army Materials Testing Laboratory established a Technical Review Committee (TRC) to enhance community involvement. In 1993 this transitioned into a Restoration Advisory Board (RAB). The purpose of the TRC and RAB was to serve as a forum where representatives of the community, regulators and the Army could meet to discuss and exchange information on environmental cleanup issues and progress at the Site. The TRC and RAB provided an opportunity for stakeholders to participate in the decision-making process by reviewing and commenting on documents and proposed remedial actions. Through the TRC and RAB, cleanup decisions were discussed and approved.

During fiscal year 2006, a fact sheet will be distributed and discussed with the RAB announcing the intention to delete the site from the NPL. In addition, a fact sheet and public notice will announce the deletion of the Site from the NPL once the deletion has been completed.

3. DEMONSTRATION OF CLEANUP ACTIVITY QUALITY ASSURANCE AND QUALITY CONTROL

Activities at the site were consistent with the investigative work plans, the RODs and the RD/RA work plans as approved by the U.S. Army, U.S. Environmental Protection Agency and the Commonwealth of Massachusetts Department of Environmental Protection. These documents governed the scope, materials and quality assurance/quality control. Frequency of RPM site visits generally coincided with monthly RAB meetings.

EPA analytical methods were used for all investigation, confirmation, validation and monitoring samples. The QA/QC program was rigorous and in conformance with EPA and Massachusetts standards. Therefore, EPA and Massachusetts determined that all analytical results were accurate to the degree needed to assure satisfactory execution of the investigations, removal actions, and remedial actions. The NCP requirement of a joint EPA and MADEP inspection (40 CFR §400.515(g)) was conducted on June 23, 2003, for the OU1 ROD. Joint inspections were also held during construction activities.

4. Monitoring Results

The Army developed and EPA approved a monitoring program for remedial activities that would protect the off-site public, protect on-site workers, and confirm compliance with the remedial action objectives established in the RODs for OU1 and OU3 respectively. Confirmation sampling was performed at each of the excavated areas. The results of the sampling indicated that the remedial action objectives were met. Therefore, no long-term soil monitoring is planned for this site.

QA/QC sampling and validation of analytical sampling indicated that the data was of good quality. The Final Closeout Reports (December 1996, May 1998 and March 2002) contain documentation of the complete results and accuracy of the confirmatory sampling program.

No long-term groundwater monitoring is planned for this site due to the finding of no further action for groundwater in the 1996 ROD for OU1.

No long-term sediment monitoring is planned for this site due to the finding of no action in the 2005 ROD for OU2.

5. SUMMARY OF OPERATION AND MAINTENANCE

5.1 Grant of Environmental Restriction (Grant) and Institutional Control Memorandum of Agreement (MOA)

The Grant outlines the enforceable land use and soil exposure restrictions required by the OU1 ROD. The MOA provides the inspection criteria and frequency. The Army will oversee and the new owners of the AMTL facility will conduct inspections and maintain the integrity of the benchmarks and the 1-2 foot soil caps. The Army will conduct five-year site reviews to assess whether the remedy remains protective of human health and the environment. The inspection and maintenance schedule for those areas where ESD subsurface cleanup goals were met are given in the attached Table 1. All other remedial actions at this site have been completed and do not require long-term operation and maintenance. ROD surface and subsurface cleanup goals were met in Area I (OU3 ROD), Areas N & O (CRP-OU1 ROD), and in all of Zone 3.

5.2 Reporting

The MOA requires annual reporting of the institutional controls (IC) until the second five-year review. During the second five-year review, the Army, EPA and the Commonwealth of Massachusetts may decide to decrease the frequency of the reports.

5.3 Institutional Controls (ICs)

ICs at this facility include restrictions preventing future use of portions of the AMTL facility as residential areas; restrictions on future excavation below one or two feet due to

contamination above commercial use levels at various areas; restrictions on the management of soils excavated from below slabs, foundations, and 1-2 feet below ground surface; and restrictions on the disturbance of soils underneath asphalt caps or building slabs and foundations. The United States of America, acting by and through the Secretary of the Army, granted the Commonwealth of Massachusetts Department of Environmental Protection (MADEP) a Grant of Environmental Restriction and Easement for the northern zone of the AMTL facility in August 1998 and for the Charles River Park (southern zone of the AMTL facility) in March 2005. This Grant is the legal mechanism for implementation of the institutional controls noted above. In addition to the Grant, the Army, EPA, and Commonwealth of Massachusetts entered into an Institutional Controls Memorandum of Agreement (IC MOA) for the northern zone of AMTL in August1998 and for the Charles River Park in September 2003. The IC MOA requires annual inspections of the institutional controls and provides a checklist for the inspector to follow. The inspections will be performed by the new owners of the property (with an Army representative present) on an annual basis. IC language was included in the transfer documents.

6.0 SUMMARY OF REMEDIATION COSTS

	OU1	OU2	OU3
ROD Date	9-26-96	September 2005	6-28-96
ROD Estimated Cost of Construction	$5,741,000	No Action ROD 0	$523,000
Actual Cost	$5,221,234	0	$30,600*
O&M Cost	$27,000	0	Residential Cleanup
Approx. Cost of IC Monitoring	$10,000	0	No IC monitoring 0

*Costs were reduced because soils were shipped off-site for disposal as non-hazardous materials. The ROD estimated all soils would be disposed of as hazardous.

6.1 Investigative Total Costs

All investigations were funded by the Army. Total costs for the investigation at OU2 were $1,450,000. Investigative costs for OUs1 and 3 were $10,407,000.

7. PROTECTIVENESS

The remedies that have been implemented achieve the degree of cleanup and protection specified in the RODs for all pathways of exposure and no further Superfund response is needed to protect human health and the environment. All human and ecological exposure pathways, as well as all contaminants of concern, have been addressed. Institutional controls have been implemented to ensure land use criteria remains the same. All cleanup actions specified in the RODs for OU1 and OU3 have been implemented. The asphalt and one or two feet of clean soil and building foundations provide assurance that

the site poses no threats to human health or the environment. The only remaining activities to be performed are institutional control inspections that the Army will oversee.

The site now qualifies for inclusion on the Construction Completion List. During fiscal year 2006, the United States Environmental Protection Agency will issue a Notice of Intent to Delete the Army Materials Testing Laboratory from the National Priorities List.

All AOCs described in the NPL listing have been adequately addressed. The bibliography is included after Table 1. These documents are available at the information repositories at the Watertown Free Public Library, 123 Main Street, Watertown, MA (617) 972-6431 or by calling the Army at (978) 318-8236 to set up an appointment to view the Administrative Record.

8. FIVE YEAR REVIEW

Since hazardous substances will remain on site above levels allowing for unlimited use and unrestricted exposure, a statutory five year review will be conducted by the Army pursuant to CERCLA section 121 C and as provided in OSWER Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance.* Hazardous substances remain at OU-1.

The first 5-year review, dated March 7, 2002 concluded:

- For OU1, the remedy was determined to be protective of human health and the environment as long as a limited amount of soil in Area E exceeding the applicable cleanup goals was removed. The soils were since excavated at Area E, shipped offsite, and used as landfill daily cover. All confirmation samples met ROD criteria. The excavation was backfilled with clean soils and new benchmarks were installed to identify the area.

- The protectiveness of OU2 was not determined because the remedy had not yet been chosen.

- For OU3, the remedy was determined to be protective of human health and the environment.

The second 5 year review is due in March 2007.

US Environmental Protection Agency

Susan Studlien, Director
Office of Site Remediation and Restoration

9-29-05
Date

Table 1.0 Inspection and Maintenance Schedule

Restricted Area	Inspection Description	Frequency
Charles River Park Open Area	Inspect to determine the use is restricted to no residential, daycare or school activities except those incidental to recreational park activities Inspect area to ensure no excavation, drilling or otherwise disturbance of the soils located (2) feet or more below surface grade have occurred, to include river bank erosion. Cut and maintain grass Inspect bench marks for eroded areas and reduction in grade and repair as necessary Breakwater Treatment Inspection: • Inspect rock toe for separation and/or settlement • Inspect coir fascine for proper anchoring • Inspect for scour between plant carpets and coir fascine • Remove debris and flotsam trapped behind breakwater Inspect for wetland invasive species encroachment	Annually in June
Charles River Park Wooded Area	Inspect to determine use is restricted to no residential , daycare, or school activities except those activities incidental to recreational park activities	Annually in June

Table 1.0 Inspection and Maintenance Schedule

Restricted Area	Inspection Description	Frequency
Watertown Yacht Club (WYC) Open Area	Inspect to determine use is restricted to no residential , daycare, or school activities except those activities incidental to recreational park activities Inspect bench marks for eroded areas and reduction in grade and repair as necessary Inspect area to ensure no excavation, drilling or otherwise disturbance of the soils located (2) feet or more below surface grade have occurred	Annually in June
Structures at the WYC	Inspect to determine use is restricted to no residential , daycare, or school activities except those activities incidental to recreational park activities Inspect area to ensure no excavation, drilling or otherwise disturbance of the soils located below the building foundations and slabs have occurred Inspect area to ensure no excavation, drilling or otherwise disturbance of the building foundations and slabs in a manner which would likely result in human contact with underlying soils have occurred	Annually in June

Table 1.0 Inspection and Maintenance Schedule

Restricted Area	Inspection Description	Frequency
North Beacon Street	Inspect to determine use is restricted to no residential , daycare, or school activities except those activities incidental to recreational park activities Inspect area to ensure no disturbance of the roadway or sidewalk pavement which would compromise their integrity in a manner that would or would be likely to result in human contact with the underlying soils has occurred	Annually in June
North Beacon Street Wooded Area	Inspect to determine use is restricted to no residential , daycare, or school activities except those activities incidental to recreational park activities	Annually in June
Buildings: 142, 224, 225, 111,	Inspect to determine use is restricted to no residential, daycare or school uses Inspect to determine that no transportation, disposal, or deposition of soils from within the parcel, unless in compliance with the Soil Management Protocol set forth in Paragraph 4 of the Grant Inspect area to ensure no excavation, drilling or otherwise disturbance of the building foundations and slabs in a manner which would likely result in human contact with underlying soils have occurred	Annually in June

Table 1.0 Inspection and Maintenance Schedule

Restricted Area	Inspection Description	Frequency
Areas: L4, E, B and G	Inspect to determine use is restricted to no residential, daycare or school (for children under 18 years of age), hotel, motel, community center (for children under 18 years of age), and/or recreational uses or activities uses Inspect benchmarks for eroded areas and reduction in grade and repair as necessary Inspect to determine no soils, located at a depth of one(1) foot or more below the surface grade, were removed unless disposed of as required in the Grant	Annually in June
Buildings: 97, 60, 652, 311, and 312,	Inspect to determine use is restricted to no residential, daycare or school (for children under 18 years of age), hotel, motel, community center (for children under 18 years of age), and/or recreational uses or activities uses Inspect to determine that no transportation, disposal, or deposition of soils from within the parcel, unless in compliance with the Soil Management Protocol set forth in Paragraph 4 of the Grant Inspect area to ensure no excavation, drilling or otherwise disturbance of the building foundations and slabs in a manner which would likely result in human contact with underlying soils have occurred	Annually in June

Table 1.0 Inspection and Maintenance Schedule

Restricted Area	Inspection Description	Frequency
Building 39	Inspect to determine use is restricted to no residential, daycare or school (for children under 18 years of age), hotel, motel, community center (for children under 18 years of age), and/or recreational uses or activities uses	Annually in June
Buildings 131, 117, &, 313-S	Inspect area to ensure no excavation, drilling or otherwise disturbance of the building foundations and slabs in a manner which would likely result in human contact with underlying soils have occurred	Annually in June

BIBLIOGRAPHY: PHYSICAL INVESTIGATIONS AND REMEDIAL ACTION CLOSEOUT REPORTS

I. E G&G Idaho Inc, Preliminary Assessment Site Inspection, March 1988.

II. E G&G Idaho Inc, USAMTL Remedial Investigation (Volume I and II), September 1989.

III. ENSR Corporation, Screening Level Ecological Risk Assessment, Charles River Operable Unit, Army Materials Technology Laboratory, Watertown, Massachusetts, April 2002.

IV. ENSR Corporation, Final Baseline Ecological Risk Assessment, Charles River Operable Unit, Army Materials Technology Laboratory, Watertown, Massachusetts, February 2005.

V. Foster Wheeler Environmental Corporation, Draft Final Feasibility Study Addendum Report for the Charles River Park of the Army Research Laboratory-Watertown, Watertown, Massachusetts, February 2000.

VI. Foster Wheeler Environmental Corporation, Final Remedial Action Report for the Charles River Park Parcel Soil and Groundwater Operable Unit of the Army Materials Technology Laboratory, Watertown, Massachusetts, March 2002.

VII. Plexus Scientific Corporation, Final Supplemental Phase 2 Remedial Investigation Charles River, Prepared for the US Army Environmental Center, March 1998.

VIII. Roy F. Weston, Phase I Remedial Investigation Report, April 1991.

IX. Roy F. Weston, Final Phase II Remedial Investigation Report (Volume I through V), May 1994

X. Roy F. Weston, Baseline Risk Assessment Environmental Evaluation, December 1993.

XI. Roy F. Weston, Final Phase II Remedial Investigation Report (Volume I through III), December 1993.

XII. Roy F. Weston, Final Terrestrial Risk Assessment, August 1995.

XIII. Roy F. Weston, Final Feasibility Study Report (Outdoor) (Volume I and II), January 1996.

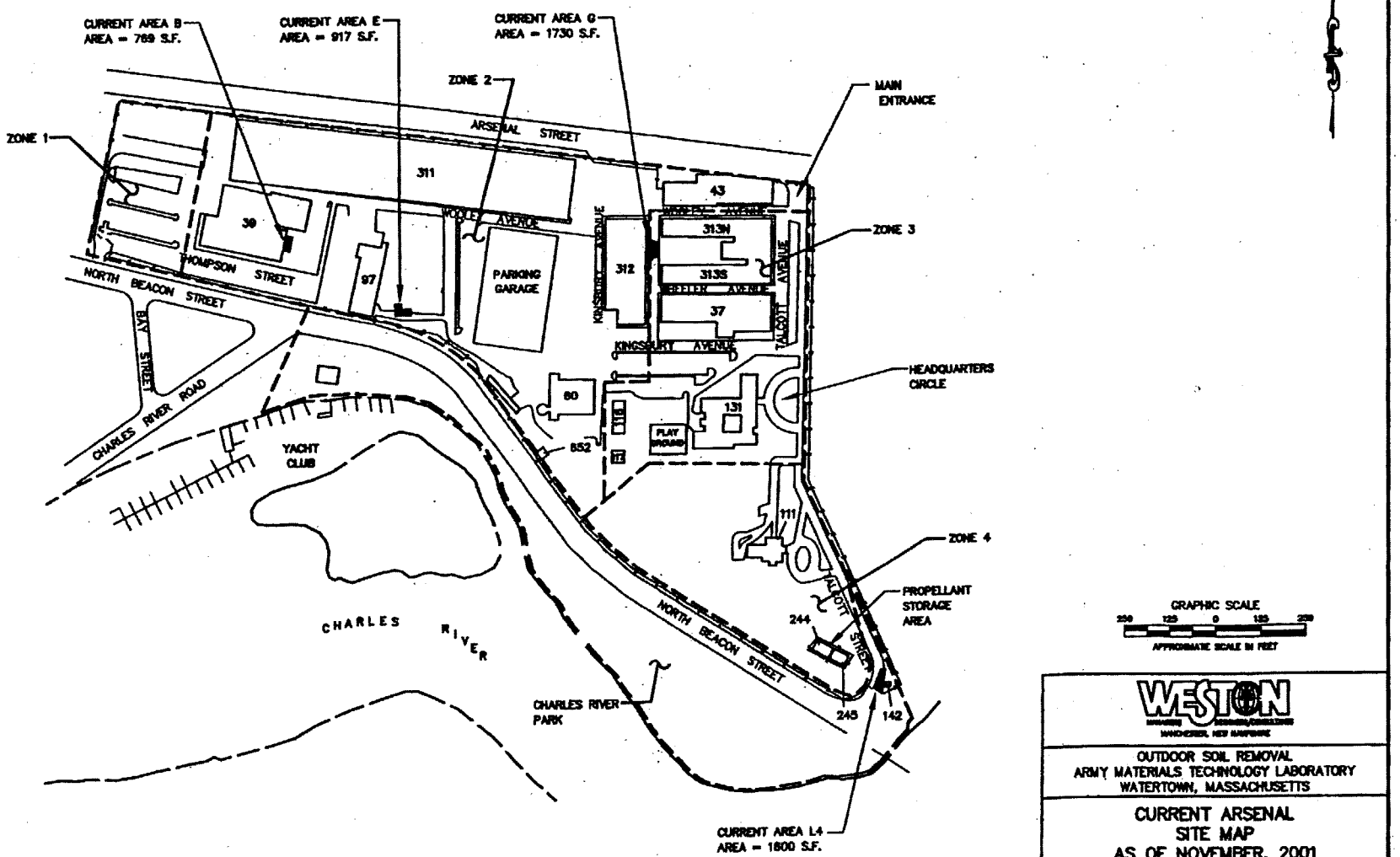
XIV. Roy F. Weston, Draft Addendum to Human Health Evaluation, February 1996.

XV. WESTON, (Roy.F.Weston, Inc.), Final Remedial Action Completion Report for Outdoor Soils Remediation-Building 131 Army Research Laboratory-Watertown, Watertown, Massachusetts. December 1996.

XVI. WESTON, (Roy.F.Weston, Inc.), Supplemental Risk Assessment for Polycyclic Aromatic Hydrocarbons in Soil Samples, Army Research Laboratory, Watertown, Massachusetts, May 28, 1997.

XVII. WESTON, (Roy.F.Weston, Inc.), Final Remedial Action Report: Zones 1-4 Outdoor Soil Removal Army Materials Technology Laboratory, Watertown, Massachusetts. Prepared for the US Army Corps of Engineers, New England District. May 1998.

XVIII. WESTON, (Roy.F.Weston, Inc.), Final Remedial Action Report for Charles River Park Army Materials Technology Laboratory, Watertown, Massachusetts. Prepared for the US Army Corps of Engineers, New England District. April 1999.



GRAPHIC SCALE

250 125 0 125 250

APPROXIMATE SCALE IN FEET

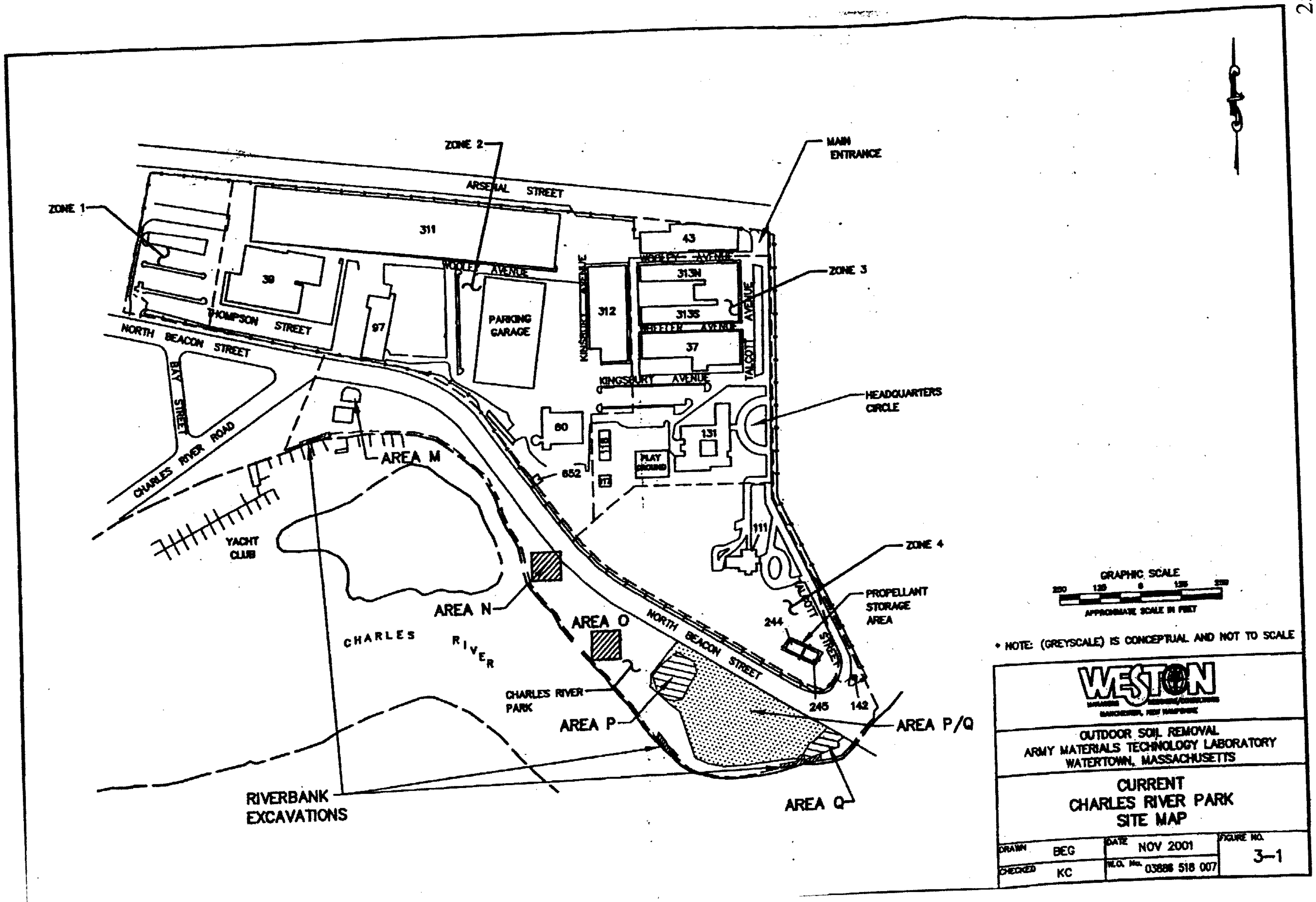
WESTON

MANCHESTER, NEW HAMPSHIRE

OUTDOOR SOIL REMOVAL
ARMY MATERIALS TECHNOLOGY LABORATORY
WATERTOWN, MASSACHUSETTS

CURRENT ARSENAL
SITE MAP
AS OF NOVEMBER, 2001

DRAWN	BEG	DATE	NOV 2001	FIGURE NO.
CHECKED	KC	W.O. No.	01888.518.007	2-1


ZONE 1
ZONE 2
MAIN ENTRANCE
ARSENAL STREET
311
43
39
WOOLEY AVENUE
313N
313S
ZONE 3
THOMPSON STREET
NORTH BEACON STREET
97
PARKING GARAGE
312
KINGSBURY AVENUE
WHEELER AVENUE
37
TALCOTT AVENUE
BAY STREET
HEADQUARTERS CIRCLE
60
131
CHARLES RIVER ROAD
AREA M
652
PLAY GROUND
YACHT CLUB
111
ZONE 4
PROPELLANT STORAGE AREA
AREA N
AREA O
244
TALCOTT STREET
NORTH BEACON STREET
CHARLES RIVER
CHARLES RIVER PARK
AREA P
245
142
AREA P/Q
RIVERBANK EXCAVATIONS
AREA Q
GRAPHIC SCALE
APPROXIMATE SCALE IN FEET
* NOTE: (GREYSCALE) IS CONCEPTUAL AND NOT TO SCALE
WESTON
MANCHESTER, NEW HAMPSHIRE
OUTDOOR SOIL REMOVAL
ARMY MATERIALS TECHNOLOGY LABORATORY
WATERTOWN, MASSACHUSETTS
CURRENT
CHARLES RIVER PARK
SITE MAP
DRAWN BEG
CHECKED KC
DATE NOV 2001
W.O. No. 03886 518 007
FIGURE NO. 3-1