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RCRA Facility Investigation-Remedial Investigation/ Corrective Measures Study-Feasibility Study Report for the Rocky Flats Environmental Technology Site Appendix A – Comprehensive Risk Assessment

Volume 15B2 of 15

Risk Assessment for the Aquatic Exposure Units: North Walnut Creek Aquatic Exposure South Walnut Creek Aquatic Exposure and Woman Creek Aquatic Exposure Unit

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ADMIN RECORD

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ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AET	apparent effects threshold
AEU	Aquatic Exposure Unit
AT	alternative toxicity
BZ	Buffer Zone
CAD/ROD	Corrective Action Decision/Record of Decision
CD	compact disc
CDH	Colorado Department of Health
CDPHE	Colorado Department of Public Health and Environment
cfs	cubic feet per second
CNHP	Colorado Natural Heritage Program
CRA	Comprehensive Risk Assessment
DOE	U.S. Department of Energy
DQA	data quality assessment
DQO	Data Quality Objective
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ERM	effects range moderate
ESL	ecological screening level

EU	Exposure Unit
HQ	hazard quotient
HRR	Historical Release Report
IA	Industrial Area
IAEU	Industrial Area Exposure Unit
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
K-H	Kaiser-Hill Company, L.L.C.
LEL	lowest effect level
LOAEL	lowest observed adverse effect level
LOE	line of evidence
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MIDEQ	Michigan Department of Environmental Quality
MK AEU	McKay Ditch Aquatic Exposure Unit
NAWQC	National Ambient Water Quality Criteria
NEC	no-effect concentration
NFAA	No Further Accelerated Action
NN AEU	No Name Gulch Aquatic Exposure Unit
NOAEL	no observed adverse effect level
NPDES	National Pollutant Discharge Elimination System
NW AEU	North Walnut Creek Aquatic Exposure Unit
OU	Operable Unit
PAC	Potential Area of Concern

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PCB	polychlorinated biphenyl
pCi/kg	picocuries per kilogram
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PCOC	potential contaminant of concern
PEL	probable effects level
PMJM	Preble's meadow jumping mouse
ppm	parts per million
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QAPjP	Quality Assurance Project Plan
RC AEU	Rock Creek Aquatic Exposure Unit
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SCM	site conceptual model
SE AEU	Southeast Aquatic Exposure Unit
SEC	sediment effect concentration
SID	South Interceptor Ditch
SQG	sediment quality guideline
SW AEU	South Walnut Creek Aquatic Exposure Unit
TCDD	tetrachlorodibenzo-para-dioxin
TEC	threshold effect concentration

TEF	toxicity equivalency factor
TEL	toxic effects level
TEQ	toxicity equivalency quotient
TNRCC	Texas Natural Resource Conservation Commission
UBC	Under Building Contamination
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UTL	upper tolerance limit
WC AEU	Woman Creek Aquatic Exposure Unit
WOE	weight of evidence
WRS	Wilcoxon Rank Sum

EXECUTIVE SUMMARY

Aquatic Exposure Units (AEUs) represent a logical framework for evaluating risks to populations of aquatic receptors from exposure to surface water and sediment within aquatic systems at the Rocky Flats Environmental Technology Site (RFETS). Seven AEUs were defined through the consultative process with the regulatory agencies (Figure 1.1). This report presents the Ecological Risk Assessment (ERA) for three of the Aquatic AEUs located at RFETS: North Walnut Creek AEU (NW AEU), South Walnut Creek AEU (SW AEU), and Woman Creek AEU (WC AEU). Volume 15B2 includes additional characterization and sampling that was completed as part of a pond-specific study. These results were integrated into the data sets evaluated as part of this effort, and the pond-specific findings are also encompassed within this report. The ERA for the other four AEUs (No Name Gulch AEU [NN AEU], Rock Creek AEU [RC AEU], McKay Ditch AEU [MK AEU], and Southeast Area AEU [SE AEU]) is presented in Volume 15B1.

Aquatic habitats at RFETS have been highly modified over the years by the diversion and impoundment of water, which occurred historically for agricultural use and more recently for water control. Prior to agricultural development, Walnut Creek and Woman Creek were seasonally intermittent streams fed primarily by snowmelt and runoff. Aquatic communities were limited by both the periodic lack of flows and generally low flows. Reliable surface flows occurred only near seeps and springs (DOE 1996).

The ERA methods are described in detail in the Final CRA Work Plan and Methodology (DOE 2005), hereafter referred to as the CRA Methodology. The anticipated future land use of RFETS is a wildlife refuge and, consequently, the ephemeral drainages within RFETS represent the aquatic habitat of the refuge. A variety of representative aquatic receptors were evaluated in the ERA, including fish, aquatic invertebrates, and aquatic plants. Waterfowl and wading birds were not evaluated as part of this assessment. However, the results of the 1996 DOE waterfowl and wading bird evaluation were used as a line of evidence within the overall risk charactization for the AEUs.

The overall risk management goal identified for developing this ERA is that residual contamination should not represent significant risk of adverse ecological effects to receptors. For the AEU aquatic species, the assessment endpoints for this goal included the prevention of adverse effects on populations due to lethal, mutagenic, reproductive, systemic, or general toxic effects associated with site contaminants. These assessment endpoints were evaluated by comparing measured contaminant concentrations in surface water and sediment first to ecological screening levels (ESLs), which represent media concentrations at which minimal to no effects are predicted. Risks were further evaluated using alternative toxicity values. In addition, potential effects on pond communities were assessed by integrating contaminant exposure results with a spatial analysis to determine whether contaminants represented depositional areas such as ponds in those habitats.

Sampling data for the following media were used for the AEU ERA:

- Surface water;
- Sediment; and
- Surface soil in close proximity to wetted channels or ponds (a potential future source from where contaminants might migrate to the channel or pond).

The ecological contaminants of potential concern (ECOPC) identification process for the ERA examined ecological contaminants of interest (ECOIs) that were present in AEU surface water and sediment through a sequential, multi-step process. For the ECOPC process, data derived from samples gathered since June 28, 1991, to present were relied upon. In addition, sediment samples collected from all depth fractions were evaluated. Surface soil was evaluated as a line of evidence within the risk characterization, and not within the ECOPC selection process.

As the first step in the ECOPC process, the maximum detected concentrations (MDCs) of ECOIs were screened against ESLs. ECOIs without ESLs were considered to be contaminants of uncertain toxicity, and are discussed further in the uncertainty section. A toxicity equivalent (TEQ) concentration using toxicity equivalency factors (TEFs) was calculated for dioxins, and a total PCB value per sample was calculated for the ECOPC screen.

The ECOPC selection process continued with the exclusion of contaminants with a detection frequency of less than 5 percent and, subsequently, with concentrations not significantly different from background. Infrequently detected ECOIs and those with concentrations not greater than background were determined not to pose a potential for risk to aquatic receptors. The next step of the ECOPC selection process compared the exposure point concentration (EPC), represented by the 95th upper tolerance limit (UTL) (95th upper confidence limit [UCL] of the 90th percentile), to the ESL. ECOIs were determined to pose no risks if an EPC is less than the ESL. These ECOIs were mapped to determine if ESL exceedances might be spatially grouped in depositional areas such as ponds. No such grouping of elevated concentrations was identified in depositional areas, and all ECOIs with low detection frequencies, or those with EPCs less than the ESL, were concluded to pose no significant risk to aquatic receptors.

The final ECOPC selection step in the CRA Methodology was a professional judgment evaluation of each remaining ECOI. However, this step was not applied to the AEU ECOPC process. Therefore, all ECOIs retained to this point were identified as ECOPCs for further consideration within the risk characterization.

The ECOPC identification results are summarized in Tables ES.1 and ES.2 for surface water and sediment, respectively. The following ECOPCs were carried forward for further evaluation in the risk characterization:

- Aluminum (total), ammonia, cadmium (dissolved), cyanide, lithium (total), silver (dissolved), vanadium (total), Aroclor-1254, and radium-228 in surface water at the NW AEU;

- Aluminum, antimony, barium, cadmium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, zinc, 2-methylnaphthalene, 4,4'-DDT, acenaphthene, anthracene, Aroclor-1254, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, TEQ dioxins and total PCBs in sediment at the NW AEU;

- Ammonia, cadmium (dissolved), cyanide, silver (dissolved), and 4,4'-DDT in surface water at the SW AEU;

- Aluminum, antimony, barium, cadmium, copper, fluoride, lead, silver, zinc, acenaphthene, anthracene, Aroclor-1254, Aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bromomethane, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, and total PCBs in sediment at the SW AEU;

- Ammonia, cadmium (dissolved), and silver (dissolved) in surface water at the WC AEU; and

- Aluminum, antimony,barium, cadmium, copper, fluoride, iron, lead, mercury, nickel, selenium, silver, zinc, 4-methylphenol, acenaphthene, anthracene, Aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, heptachlor, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, TEQ dioxins and total PCBs in sediment at the WC AEU.

The risk characterization process involved multiple lines of evidence, each of which evaluated the potential for risk to aquatic receptors from individual ECOPCs and which, together, provided an overall risk conclusion for each ECOPC. Contaminant lines of evidence (LOE) included a hazard quotient (HQ) assessment using the ESLs or site-specific refined ESLs (i.e., hardness-dependent ambient water quality criterion for divalent metals), followed by a screening against additional, literature-derived alternative toxicity (AT) values. Several statistical measures (e.g., 95 UCLs) were also considered as EPCs in the risk characterization contaminant evaluation to provide a measure of the magnitude of the potential for risk. In addition, the frequency of exceedance was evaluated and the spatial extent of contamination was depicted to determine the extent of ECOPC occurrence within specific aquatic habitats. Through the spatial evaluation, it was found that sample results could occur outside true aquatic habitat settings (such as within storm channels, drains or isolated pockets of water or sediment) therefore the exposure to aquatic life would be limited. Further evaluation of refined data sets such as 'post-1999' surface water and surface sediment (0 – 6-inch depth) provided lines of evidence describing current and more realistic exposure conditions. A conservative evaluation of adjacent surface soils was also completed in order to determine the potential future sediment exposure condition. All of the above comprise the various lines of evidence integrated within the chemical risk characterization.

A pond-specific evaluation was also conducted in order to understand contaminant risks associated within ponds A-1, A-2, A-3, A-4, and A-5 (within the NW AEU), B-4 and B-5 (within the SW AEU), and C-1 and C-2 (within the WC AEU). The pond evaluation focused on an assessment of contaminant risks associated with surface sediment. Results were used as a chemical LOE for this evaluation, and as a component of the IHSS NE-1 closure assessment.

The risk characterization continued by reviewing drainage-specific conclusions from previous studies at RFETS. These additional LOE included studies of tissue analyses, aquatic population studies, toxicity bioassays, waterfowl and wading bird exposure studies, and contaminant loading analyses. The specific studies used for this ERA are described in Attachment 7. The combination of findings from the contaminant risk characterization and drainage-specific LOE constitute the weight-of-evidence approach to this ERA.

The weight of evidence (WOE) process is applied within the risk characterization and represents the integrated conclusions from each of the LOEs used in risk characterization. Those basic types of LOEs include contaminant toxicity and exposure information as well as drainage-specific studies on aquatic populations, communities, and habitat characteristics.

Overall WOE conclusions are based on best professional judgment using the preponderance of evidence. If risk conclusions were in disagreement, the multiple LOEs were balanced against each other with weights assigned based on the certainty of the risk characterization. Lower confidence was given to risks driven by single LOEs, while the greatest confidence was given to those conclusions with supportive, multiple LOEs. Greater weight was also given to LOEs that evaluate the habitat and biological conditions onsite, as opposed to chemical LOEs based on modeled calculations with high uncertainty.

The specific LOEs used in the conclusions are as follows:

Chemical

- Comparisons of media-specific concentration profiles to ESLs and ATs. (including magnitude of HQs);
- Frequency of exceedances as compared to ESLs; and
- Spatial and temporal pattern of contamination and exceedances.

Biological and Habitat

- Hydrology of drainage;
- Toxicity studies; and
- Diversity and abundance characterizations.

Findings for specific AEUs are discussed below.

NW AEU

There were nine surface water ECOPCs (seven inorganics, one organic, and one radionuclide) and 35 sediment ECOPCs (14 inorganic and 21 organic) evaluated using multiple LOEs within the contaminant risk characterization.

Conclusions for the NW AEU can be summarized as follows:

Magnitude of ESL or AT exceedances:

- Most surface water contaminants showed low magnitude HQs for either primary ESLs or ATs. The only exceptions were aluminum in a range of uncertainty and PCBs because of detection limits being higher than benchmarks.
- Sediment ESL-HQs were generally low (<10) for UTL and UCL-EPCs except for antimony, fluoride, 4-methylphenol, acenaphthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene, and were less than 5 for all UTL and UCL comparisons to AT benchmarks except antimony and acenaphthene which were less than 10.

Spatial Distribution:

- Most surface water contaminants were primarily found outside the primary aquatic habitats (stream channels and ponds) and within stormwater channels and other non-habitat areas. Ammonia was widely scattered. Only selenium, silver, and vanadium were clustered in aquatic habitats.
- Most sediment contaminants were widely dispersed and rarely concentrated in aquatic habitat areas. Further pond-specific analysis eliminated the spatial concern these chemicals demonstrated. Most were at nondetect or less than ESL concentrations within surface sediment indicating a low risk concern.

Frequency of Exceedances:

- Almost all surface water contaminants had a very low frequency of HQ exceedances. Aluminum, ammonium, vanadium, and radium-228 were notable exceptions.
- Most sediment ECOPCs had fewer than 20 percent of samples (detected) exceeding their ESL, except for fluoride, zinc, acenaphthene, anthracene, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, carbazole, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

Change in Exceedances Over Time:

- Almost all contaminants have improved in concentrations in surface water over time; none have increased, but silver was approximately unchanged.

Surface sediment MDCs were generally not different from the comprehensive sediment database ESLs and did not influence the potential for risk. In only a few cases were the MDCs lower in surface sediments (aluminum, arsenic, barium, cadmium, nickel, naphthalene, and Aroclor-1254).

Drainage-specific habitat and ecological studies:

- Previous studies indicate that aquatic life within the NW AEU is primarily affected by natural conditions associated with the ephemeral and intermittent character of the drainage hydrology. There was no indication that contaminant stressors were affecting the ecology. In addition, the AT values based on acute exposure (instead of chronic) are most appropriate due to the intermittent nature of flows in the drainage. Those AT values yielded the lowest evidence of chemical risk.

- Toxicity was not observed in pond sediment bioassays, indicating that PAHs, PCBs, and metals do not pose a potential for risk in pond habitat.

- Fish tissue residues were below toxicity thresholds for PCBs.

- Benthic macroinvertebrate communities were healthy.

In summary, the conclusions gathered from the risk characterization indicates that there is no significant potential for risk to the aquatic populations within the NW AEU. The evidence suggests and that the seasonal hydrologic regime and local topography were most important in determining the makeup of the local aquatic communities and in mitigating the small potential for chemical-based risk. The lack of toxicity in pond sediment bioassays also had a strong line of evidence within this evaluation.

SW AEU

There were five surface water ECOPCs (four inorganics and one organic chemical) and 27 sediment ECOPCs (nine inorganic and 18 organics) evaluated using multiple LOEs within the contaminant risk characterization.

Conclusions for the SW AEU can be summarized as follows:

Magnitude of ESL or AT exceedances:

- All surface water contaminants showed low-magnitude HQs for either primary ESLs or ATs, with the possible exception of ammonia.

- Sediment ESL-HQs were generally low (<10) for UTL and UCL-EPCs except for fluoride, acenaphthene, benzo(g,h,i)perylene, carbazole, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and Aroclor-1260, and were less than 5 for all UTL and UCL comparisons to AT benchmarks.

Spatial Distribution:

- Most surface water contaminants were minimally distributed and unclustered. Only ammonia and silver were found in aquatic habitats representing media with potentially complete exposure pathways, rather than off-channel puddles and ephemeral pools.

- Most sediment contaminants were associated with the portion of the AEU that overlaps the Industrial Area (IA). Certain ECOPCs were concentrated in ponds; however, the pond-specific analysis of surface sediment often found that few elevated concentrations were present. Most were at nondetect or less than ESL concentrations within surface sediment, indicating a low risk concern.

Frequency of Exceedances:

- Four of the five surface water contaminants had a very low frequency of HQ exceedances. Ammonia more commonly exceeded benchmarks.

- Most sediment ECOPCs had fewer than 20 percent of samples (detected) exceeding their ESL, except for fluoride, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, carbazole, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, Aroclor-1254, phenanthrene, and pyrene.

Change in Exceedances Over Time:

- Most surface water constituents have decreased in concentration in recently-collected samples, including ammonia. Recent changes in 4,4'-DDT concentrations are unknown due to the lack of recent data.

Surface sediment MDCs were generally not different from the comprehensive sediment database ESLs and did not influence the potential for risk. In only a few cases were the MDCs lower in surface sediments (cadmium, silver, and indeno(1,2,3-cd)pyrene).

Drainage-specific habitat and ecological studies:

- Previous studies indicate that aquatic life within the SW AEU is primarily affected by natural conditions associated with the ephemeral and intermittent character of the drainage hydrology. There was no indication that contaminant stressors were affecting the ecology. In addition, the AT values based on acute exposure (instead of chronic) are most appropriate due to the intermittent nature of flows in the drainage. Those AT values yielded the lowest evidence of chemical risk.

- Toxicity was not observed in pond sediment bioassays, indicating that PAHs, PCBs, and metals do not pose a potential for risk in pond habitat.

- Fish tissue residues were below toxicity thresholds for PCBs.

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- Benthic macroinvertebrate communities were healthy.

In summary, the conclusions gathered from the risk characterization indicates that there is no significant potential for risk to the aquatic populations within the SW AEU and that the seasonal hydrologic regime and local topography were most important in determining the makeup of the local aquatic communities and in mitigating the small potential for chemical-based risk. The lack of toxicity in pond sediment bioassays also had a strong line of evidence in this evaluation.

WC AEU

There were three surface water ECOPCs (all inorganic) and 29 sediment ECOPCs (13 inorganic and 16 organic) evaluated using multiple LOEs within the contaminant risk characterization.

Conclusions for the WC AEU can be summarized as follows:

Magnitude of ESL or AT exceedances:

- All surface water contaminants showed low-magnitude HQs for either primary ESLs or ATs.
- Sediment ESL-HQs were generally low (<10) for UTL and UCL-EPCs except for antimony, fluoride, 4-methylphenol, acenaphthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene, and were less than 5 for all UTL and UCL comparisons to AT benchmarks.

Spatial Distribution:

- Most surface water contaminants were not widespread and were unclustered.
- Most sediment contaminants were associated with areas that did not provide true aquatic habitat settings within the AEU (i.e., the South Interceptor Ditch [SID]). Certain ECOPCs were concentrated in ponds; however, the pond-specific analysis of surface sediment often found that few elevated concentrations were present. Most were at nondetect or less than ESL concentrations within surface sediment, indicating a low risk concern.

Frequency of Exceedances:

- Two of the three surface water contaminants had a very low frequency of HQ exceedances. Ammonia was more widespread.
- Most sediment ECOPCs had fewer than 20 percent of samples (detected) exceeding the ESL, except for fluoride and zinc.

Change in surface water Exceedances Over Time:

- Cadmium and silver have decreased to nontoxic levels in recently-collected samples. Recent changes in ammonia concentrations are unknown due to the lack of recent data.

Surface sediment MDCs were generally not different from the comprehensive sediment database ESLs and did not influence the potential for risk. In only a few cases were the MDCs lower in surface sediments (aluminum).

Drainage-specific habitat and ecological studies:

- Previous studies indicate that aquatic life within the WC AEU is primarily affected by natural conditions associated with the ephemeral and intermittent character of the drainage hydrology. There was no indication that contaminant stressors were affecting the ecology. In addition, the AT values based on acute exposure (instead of chronic) are most appropriate due to the intermittent nature of flows in the drainage. Those AT values yielded the lowest evidence of chemical risk.

- Toxicity was not observed in pond sediment bioassays, indicating that PAHs, PCBs, and metals do not pose a potential for risk in pond habitat.

- Fish tissue residues were below toxicity thresholds for PCBs.

- Benthic macroinvertebrate communities were healthy.

- Prey items in the AEU do not pose a risk to avian piscivores and avian insectivores feeding in the WC AEU.

In summary, the conclusions gathered from the risk characterization indicates that there is no significant potential for risk to the aquatic populations within the WC AEU and that the seasonal hydrologic regime and local topography were most important in determining the makeup of the local aquatic communities and in mitigating the small potential for chemical-based risk. The lack of toxicity in pond sediment bioassays also had a strong line of evidence in this evaluation. In contrast, there are no strong risk drivers based strictly on contaminant concentrations.

The overall conclusions drawn from this evaluation indicate that residual risks to aquatic life from RFETS-related operations are not significant. Additional risk, above what is expected to be encountered in the natural environment in the vicinity of the AEUs, is predicted to be not significant for the aquatic life receptors evaluated in this ERA. Overall, the results of chemical risk analysis and previous investigations of the RFETS AEUS have found that aquatic communities are limited by natural environmental conditions (i.e., low flows and poor habitat) characteristic of the Colorado Front Range. Current conditions are not significantly affected by residual chemical exposure.

1.0 AQUATIC EXPOSURE UNITS

The purpose of this Comprehensive Risk Assessment (CRA) is to identify and evaluate ecological risks posed by organics, metals, and radionuclides remaining at the Rocky Flats Environmental Technology Site (RFETS) following accelerated actions.

The Aquatic Exposure Units (AEUs) represent a framework for evaluating population risks to aquatic receptors from exposure to surface water and sediment within aquatic systems at RFETS. The AEUs established for RFETS are the North Walnut Creek AEU (NW AEU), South Walnut Creek AEU (SW AEU), Woman Creek AEU (WC AEU), No Name Gulch AEU (NN AEU), Rock Creek AEU (RC AEU), McKay Ditch AEU (MK AEU), and the Southeast AEU (SE AEU). This volume, 15B2, presents the Ecological Risk Assessment (ERA) for the SW AEU, NW AEU, and WC AEU, (Figure 1.1). This introduction encompasses some information for all of the AEUs because an understanding of sitewide features is critical to the CRA process.

This ERA follows the Final CRA Work Plan and Methodology (DOE 2005), hereafter referred to as the CRA Methodology, and encompasses both ecological contaminant of potential concern (ECOPC) selection and risk characterization. These two processes were applied in the same manner for each AEU. In order to streamline presentation of the ERA for each AEU, this report, Volume 15B2, first presents results common to all three AEUs, followed by AEU-specific results.

1.1 Aquatic Exposure Unit Description

1.1.1 Aquatic Exposure Unit Characteristics and Locations

This section provides a brief description of all the AEUs, including their location at RFETS, historical activities in the area, topography, surface water features, and ecological characteristics. A more detailed description of these features and additional information regarding the geology, hydrology, and soil types at RFETS is included in Section 2.0 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation-Remedial Investigation (RI)/Corrective Measures Study (CMS)-Feasibility Study (FS) Report (hereafter referred to as the RI/FS Report).

The Historical Release Report (HRR) (DOE 1992) and its annual updates provide descriptions of known or suspected releases of hazardous substances that have occurred since the inception of the Rocky Flats Plant. The original HRR organized these known or suspected historical source areas as historical Individual Hazardous Substance Sites (IHSSs), Potential Areas of Concern (PACs), or Under Building Contamination (UBC) sites (hereafter collectively referred to as IHSSs) (Figure 1.2, Table 1.1). Historical IHSSs and groups of historical IHSSs were also designated as Operable Units (OUs). Over the course of cleanup under the 1991 Interagency Agreement (IAG) and the 1996 Rocky Flats Cleanup Agreement (RFCA), the U.S. Department of Energy (DOE) has thoroughly investigated and characterized contamination associated with these historical documented source areas. Historical IHSSs have been dispositioned through appropriate

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remedial actions or by determining that No Further Accelerated Action (NFAA) is required, pursuant to the applicable IAG and RFCA requirements. Some OUs have also been dispositioned in accordance with an OU-specific Corrective Action Decision/Record of Decision (CAD/ROD).

A more detailed description of the OU and IHSS history at RFETS is included in Appendix A, Volume 2 of the RI/FS Report and in Section 1.0, Site Background of the RI/FS Report.

1.1.2 Aquatic Exposure Unit Characteristics and Location

NW AEU

- The 420-acre NW AEU is located in the central portion of RFETS (Figure 1.3). The NW AEU is located both within the Buffer Zone (BZ) OU and the Industrial Area (IA) OU, and encompasses a variety of areas that were historically used for RFETS operations.

- The NW AEU is bounded on all sides by other AEUs, including the MK AEU to the west, NN AEU to the north, SW AEU to the east and south, and a small portion of the WC AEU to the south.

SW AEU

- The SW AEU is located in the central portion of RFETS and contains 712 acres (Figure 1.4). The SW AEU is located both within the BZ OU and the IA OU, encompassing a variety of areas that were historically used for RFETS operations.

- The SW AEU is bounded on three sides by other AEUs, including the NW AEU to the north and west, the WC AEU to the south, and a small portion of the MK AEU to the northeast. The RFETS property boundary and Indiana Avenue adjoin the SW AEU to the east.

WC AEU

- The WC AEU is located in the south-central portion of RFETS and contains 1,266 acres (Figure 1.5). The WC AEU is located in the BZ OU immediately south of the IA OU and encompasses a variety of areas that were used for RFETS operations.

- The WC AEU is bounded by the MK AEU, NW AEU, and SW AEU to the north, the SE AEU to the south, and the RFETS property boundaries to the east and west.

1.1.3 Topography and Surface Water Hydrology

This subsection describes the topography and hydrology for the entire RFETS site for all AEUs to provide context for the NW AEU, SW AEU, and WC AEU.

Within RFETS, streams and seeps are largely ephemeral or intermittent, with stream reaches gaining or losing flow depending on the season and precipitation amounts. Surface water flow across RFETS is primarily from west to east, with four drainages traversing the site (Figure 1.6):

- Walnut Creek – Major drainage in the north-central portion of RFETS, receiving runoff from the majority of the IA EU. The NW AEU, SW AEU, MK AEU and NN AEU are included in this drainage;
- Woman Creek – Major drainage on the southern side of RFETS, receiving runoff from the southern portion of the IA EU. The WC AEU is included in this drainage;
- Rock Creek – Major drainage in the northwestern part of RFETS that receives no runoff from the IA. The RC AEU is included in this drainage; and
- Smart Ditch – Minor drainage in the extreme southern portion of RFETS that receives no runoff from the IA. The SE AEU is included in this drainage.

Even the largest drainages at RFETS typically have defined channels that are relatively narrow, ranging in bottom width from 2 to 10 feet, often with exposed sediments and cobbles, and occasionally with vegetated channels. Vegetation near the streams is dominated by riparian woodland/shrubland community types, with wet meadow and marsh species near seeps and ponds. A brief description of each of these drainages is provided below. Additional details are provided in Appendix A, Volume 2 of the RI/FS Report and Section 2.0, Physical Characteristics of the RI/FS Report.

Walnut Creek Drainage

The Walnut Creek drainage receives runoff from the majority of the IA as well as the northeastern BZ. The Walnut Creek drainage area is approximately 1,878 acres, which includes the area west of the RFETS boundary. The tributaries to Walnut Creek include, from north to south, McKay Ditch, No Name Gulch, North Walnut Creek, and South Walnut Creek. The stream channel downstream of the confluence between North and South Walnut Creeks is known as Walnut Creek.

McKay Ditch

McKay Ditch runs from west to east across the northern BZ and is hydrologically isolated from the IA. The City of Broomfield can divert water from either Coal Creek or the South Boulder Diversion Canal (both west of RFETS) into the open channel of McKay Ditch across the northern RFETS BZ, into an underground pipeline, and underneath Indiana Street. On the eastern side of Indiana Street, the pipeline daylights and the water flows directly to Great Western Reservoir, where it is stored by the City of Broomfield for irrigation. McKay Ditch is generally dry. Flows in the ditch historically occur in the spring when the City of Broomfield is able to exercise its water rights and divert water into the ditch, or when overland runoff is captured and transported by the ditch. Future flows in McKay Ditch are expected to be similar to past flows because site accelerated

actions do not impact the configuration of the ditch and operations are managed by the City of Broomfield.

No Name Gulch

No Name Gulch is located in the northern BZ downstream from the East Landfill Pond. The East Landfill Pond receives runoff and treated leachate from the Present Landfill area as well as the watershed immediately surrounding the pond, and is hydrologically isolated from the IA. No Name Gulch is ephemeral, with periodic runoff occurring most frequently in the spring. Closure of the former Present Landfill entailed construction of a Resource Conservation and Recovery Act (RCRA)-compliant cover constructed over the Present Landfill area. This cover is expected to generate additional runoff compared to the historic runoff pattern (DOE 2004c).

North Walnut Creek

Stormwater runoff from the northern portion of the IA flows into North Walnut Creek, which has four retention ponds (Ponds A-1, A-2, A-3, and A-4). In contrast to many other site drainages, North Walnut Creek has continuous flow, located immediately northeast and downstream from the IA. The hydrology of the North Walnut Creek drainage following closure is expected to be very different than in the past. Removal of buildings and pavement from the IA will significantly reduce the volumes and peak discharge rates of runoff.

South Walnut Creek

Runoff from the central portion of the IA flows into South Walnut Creek, which has five retention ponds (Ponds B-1, B-2, B-3, B-4, and B-5). Similar to North Walnut Creek, South Walnut Creek has continuous flow. The hydrology of the South Walnut Creek drainage following closure is expected to be different than in the past. Removal of buildings, elimination of water historically imported for RFETS operations, elimination of the Sewage Treatment Plant discharge, and removal of pavement from the IA will significantly reduce the volumes and peak discharge rates of runoff in this drainage (K-H 2002).

Walnut Creek

Downstream from terminal ponds A-4 and B-5, North and South Walnut Creeks merge to form Walnut Creek. As previously noted, the flows in Walnut Creek following site closure will be substantially reduced compared to past flows.

Downstream from RFETS, east of Indiana Street, Walnut Creek flows into a splitter box operated by the City of Broomfield. The splitter box is normally configured to divert flows from Walnut Creek into the Broomfield Diversion Ditch, an open channel that runs around the southern side of Great Western Reservoir. Downstream from the reservoir, the Broomfield Diversion Ditch angles northward before rejoining Walnut Creek. Further east, Walnut Creek flows into Big Dry Creek. The Big Dry Creek drainage basin is an 86-square-mile watershed that is a tributary to the South Platte River. The confluence of Big Dry Creek with the South Platte River is located north of Brighton, Colorado, approximately 30 miles northeast of RFETS.

Woman Creek Drainage

Woman Creek traverses the southern side of RFETS and captures runoff from the southern portion of the IA OU as well as the majority of the southern BZ OU. The on-site portion of the Woman Creek watershed is approximately 3.1 square miles.

The tributaries to Woman Creek include the SID, North Woman Creek, Owl Branch (South Woman Creek), and Antelope Springs Gulch. The stream channel downstream of the confluence between North Woman Creek and the Owl Branch is known as Woman Creek.

South Interceptor Ditch

Runoff from the southern portion of the IA flows into the SID, which was constructed to prevent runoff into Woman Creek. The SID, is a grass-lined, trapezoidal channel that flows intermittently and runs off into Pond C-2. Removal of impervious surfaces (buildings and pavement) from the IA will reduce the historic discharge volumes and peak flow rates. In addition, the western 1,500 feet of the SID were eliminated by the cover for the Original Landfill (IHSS 115).

Pond C-2 is batch discharged into Woman Creek. Historically, discharge from Pond C-2 was necessary approximately once per year. However, with the reduced runoff from the IA EU flowing into the SID, Pond C-2 discharges to Woman Creek will be even less frequent and based on normal climatic conditions. Because Pond C-2 discharges were historically a small percentage of the volume measured in Woman Creek, the less frequent discharges should not have a major impact on the overall Woman Creek hydrology.

North Woman Creek

North Woman Creek flows from the west onto the southwest quadrant of the RFETS property and converges with the Owl Branch (South Woman Creek) at a point approximately 1,800 feet east of RFETS' western boundary. North Woman Creek is hydrologically isolated from the IA EU. Changes to the site resulting from accelerated action activities are not expected to alter the watershed or hydrology in North Woman Creek.

Owl Branch

The Owl Branch of Woman Creek (South Woman Creek) flows west onto the southwest quadrant of the RFETS property and roughly parallels North Woman Creek before joining with it. Owl Branch is hydrologically isolated from the IAEU. Changes to the site resulting from accelerated actions are not expected to alter the watershed or hydrology in the Owl Branch of Woman Creek.

Antelope Springs Gulch

Antelope Springs Gulch conveys water from Antelope Springs, which is a seep on the southern side of Woman Creek that normally flows throughout the year. The seep is likely influenced by Rocky Flats Lake, located offsite to the west. Antelope Springs Gulch flows northeast and joins Woman Creek approximately 2,500 feet upstream from

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Pond C-1. The Antelope Springs drainage is hydrologically isolated from the IAEU. The future hydrology of the Antelope Springs Gulch is expected to be similar to the past because accelerated actions are not impacting the hydrology of this undeveloped watershed.

Woman Creek

The stream channel downstream of the confluence between North Woman Creek and Owl Branch (South Woman Creek) is known as Woman Creek. Between the North Woman Creek and Owl Branch confluence and Pond C-2, Woman Creek is largely isolated from the IA EU in terms of surface runoff because the SID intercepts surface flow and diverts it into Pond C-2. However, groundwater from portions of the southern IA discharges into Woman Creek. In the western reach of Woman Creek, the watershed was enlarged when the Original Landfill remediation eliminated the western 1,500 feet of the SID, thereby allowing runoff from the Original Landfill area to flow directly to Woman Creek. However, because the vegetated cover on the Original Landfill will minimize runoff, this change is expected to have a negligible effect on the total flow volume in Woman Creek.

Woman Creek flows through Pond C-1, which was reconfigured as a low-profile, flow-through structure in 2004. Below Pond C-1 and upstream from Pond C-2, Woman Creek is diverted via a concrete diversion wall and channel around the northern side of Pond C-2. Below Pond C-2, the diversion channel rejoins the original Woman Creek channel.

Rock Creek Drainage

The Rock Creek drainage covers the northwestern portion of the site's BZ. The watershed area (measured by gaging station GS04) is approximately 1,499 acres and includes an area west of the RFETS boundary. The Rock Creek drainage does not receive runoff from the IA. The drainage basin is characterized by east-sloping alluvial plains to the west, several small ponds within the creek bed, and multiple steep gullies and stream channels to the east. Flow in Rock Creek is ephemeral. Within the RFETS boundaries, the hydrology of the Rock Creek drainage is not expected to change as a result of accelerated actions.

Smart Ditch Drainage

Smart Ditch is an irrigation ditch in the southern portion of the BZEU owned and operated by the Church Estate. The ditch does not receive runoff from the IA. Smart Ditch fills two ponds (D-1 and D-2) located in the southeastern corner of the site that are used for irrigation. Water from Rocky Flats Lake, located offsite and west of the RFETS boundary, flows through Smart Ditch for approximately 2.5 miles before reaching a splitter box, which diverts water toward the southeast, away from the main channel of Woman Creek and into Ponds D-1 and D-2. Overland runoff is also intercepted and conveyed by Smart Ditch. Smart Ditch is typically dry, although it has an estimated capacity of 10 cubic feet per second (cfs). Because the ditch is hydrologically separated and far removed from the IA, limited flow and water quality data has been collected for this conveyance.

1.1.4 Aquatic Life

Aquatic habitats at RFETS have been highly modified over the years by the diversion and impoundment of water, which occurred historically for agricultural use and more recently for water control. Prior to agricultural development, Walnut Creek and Woman Creek were seasonally intermittent streams fed primarily by snowmelt and runoff. Aquatic communities were limited by both the periodic lack of flows and the generally low flows. Reliable surface flows occurred only near seeps and springs (DOE 1996).

Construction of detention ponds in both watersheds severely altered the natural hydrologic conditions. Creation of the ponds resulted in permanent lentic (standing water) habitats in areas where water previously was present only seasonally. In Walnut Creek, batch release of water from the terminal ponds (Pond A-4 and Pond B-5) has caused stream segments immediately downstream to be dry most of the time. Establishment of aquatic life in these stream segments is limited because batch releases are of short duration and occur at irregular intervals. Much of the water in Woman Creek has historically been diverted to Mower Ditch, leaving the segment below Pond C-2 dry much of the year. Flow in portions of Woman Creek upstream of Pond C-2 is relatively natural, although runoff and some groundwater is intercepted by the SID. This water is diverted into Pond C-2. Water in this pond has historically been delivered to other systems and not into the Mower Ditch. From 1993 to 1997, Pond C-2 water was pump discharged to the Broomfield Diversion Ditch after reaching a pre-designated level. Beginning in January 1997, water from Pond C-2 was sampled and released directly into Woman Creek, which flows to the Woman Creek Reservoir, east of RFETS. Water has typically only been released into Woman Creek once per year.

Stream communities at RFETS are composed of species that are typical of limited-flow or seasonal-flow environments. Under these conditions, assessment of impacts due to contaminant input is difficult because of natural variability of populations (DOE 1996). The potential aquatic habitats within RFETS are shown in Figure 1.7. Any area identified as having intermittent/perennial flows or standing water was identified as a potential habitat area. Other information pertaining to previously observed aquatic species records (i.e., amphibians, fish, and invertebrates) was layered into this map, which represents all potential habitat areas based on historic flow conditions.

The Walnut Creek drainage was modified by adding retention ponds to manage precipitation runoff in the IA. Historically, water levels in Ponds A-3, A-4, B-2, B-3, and B-5 were manipulated for site water management purposes. Ponds A-1, A-2, B-1, and B-2 are relatively shallow (less than 1 meter), have had no regular input besides local runoff, and have had no regular output other than evaporation. As a result, the ponds historically have had abundant aquatic plant life. However, faunal communities are limited, most likely because of high daytime temperatures in summer and low dissolved oxygen at night.

The most common aquatic macroinvertebrates (aquatic insects) found at RFETs are the larvae of the blackfly (*Diptera, Simulidae.*), midge (*Diptera, Chironomidae*), and mayfly (*Ephemeroptera*). Other species include caddisflies (*Trichoptera*), craneflies (*Tipulidae*),

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and damselfly larvae (*Odonata*), as well as snails (*Gastropoda*) and amphipods (*Amphipoda*). Large macroinvertebrates such as crayfish (*Decapoda Astacidae*) and snails are potentially important prey for other fish, waterfowl, and mammal species.

Each of the primary drainages at RFETS contains a variety of pond and stream habitats, varying amounts of habitat modification, and seasonal water flows. A variety of non-native fish species such as rainbow trout (*Salmo gairdneri*), goldfish (*Carassius auratus*), carp (*Cyprinus carpio*), and bass (*Micropterus*), were introduced into the Walnut Creek reservoirs. Although all introductions did not establish reproducing fish populations, bass are present in Pond A-2 and golden shiners (*Notemigonus crysoleucas*) are found in Ponds A-2, A-3, and A-4. Fathead minnows (*Pimephales promelas*) are a native species found in every pond except the East Landfill Pond.

Woman Creek contains a significant amount of stream habitat and holds the majority of RFETS fish species. Native fish species that reproduce within Woman Creek include white suckers (*Catostomus commersoni*), fathead minnows, green sunfish (*Lepomis cyanellus*), stonerollers (*Campostoma anomalum*), and creek chubs (*Semotilus atromaculatus*). A single specimen of long-nosed dace (*Rhinichthys cataractae*) was found in Woman Creek (AAE 2003). Two non-native fish species, golden shiners (*Notemigonus crysoleucas*) and largemouth bass (*Micropterus salmoides*), also are found in the drainage.

1.1.5 Site Conceptual Model

A site conceptual model (SCM) is presented in the CRA Methodology and described in detail in Appendix A, Volume 2 of the RI/FS Report. The SCM presents the pathways of potential exposure from documented historical source areas (IHSSs and PACs) to the receptors of concern. A summary of the SCM components as they pertain to the AEUs is described below.

For the purposes of this evaluation, the targeted receptor representative of the ecological functional group most appropriate for the watershed ERAs is general aquatic life, which includes fish, amphibians, and benthic macroinvertebrates. Wading birds and waterfowl were also considered important receptors, however an assessment of site-related risk had been previously completed by DOE (1996). The results are briefly revisited within this document as a line of evidence. Details regarding the methods (i.e. ingestion rates, exposure and area use assumptions) can be found within the DOE 1996 document. For the purposes of this evaluation, the endpoints for this assessment are the following:

- Assessment Endpoint – Survival, growth, and reproduction adequate to sustain populations at RFETS within the AEU; and
- Measurement Endpoints – Comparison of concentrations of contaminants in environmental media (surface water and sediment), calculated from abiotic data ECOPCs to ESLs and other toxicity criteria, as appropriate.

Aquatic receptors can be exposed to contaminants directly through contact with contaminated media (surface water and sediment) or indirectly through consumption of

organisms that have been exposed to (and bioaccumulated) contaminants. For purposes of the CRA, surface water and sediment were considered to be the media providing the greatest contaminant exposure to aquatic organisms.

Soils in the immediate vicinity of the wetted channels and pond edges were also evaluated as part of this CRA. Adjacent soil was defined as soil within 20 feet of the wetted edge of a given AEU feature such as a stream channel, pond, or seep. Because these soils could erode or transport to a receiving drainage as a result of overland flows, they may represent potential future sediment that would act as a source of exposure to future aquatic life receptors.

The magnitude of exposure to environmental contaminants depends not only on concentration but also frequency and duration of contact. In the case of sediment, concentrations of contaminants are likely static (although varying with depth in the sediment). The exception is areas where active remediation has taken place (i.e., Ponds B-1, B-2, and B-3). Concentrations in surface water may change seasonally and particularly in response to precipitation and snowmelt events or other factors affecting flows and associated contaminant transport. The dominant factor controlling the exposure of aquatic receptors is their behavior and overlap, both spatially and temporally. Daily, weekly, and seasonal use patterns and dietary habits determine the amount of time an organism is in contact with contaminated media and the extent of exposure. In the case of the AEUs, the limited flows often affect aquatic organism distribution, abundance, and behavior. Some aquatic invertebrate communities are adapted to episodic flow conditions, as is typical for these AEUs. Species of fish, however, are less capable of such adjustment and, therefore, are unlikely to occur in areas that do not have sustained flows except through seasonal migrations from permanently wetted areas.

1.1.6 Data Description

Data have been collected at RFETS under regulatory agency-approved Work Plans, Sampling and Analysis Plans (SAPs), and Quality Assurance Project Plans (QAPjPs) to meet data quality objectives (DQOs) and appropriate U.S. Environmental Protection Agency (EPA) and Colorado Department of Public Health and Environment (CDPHE) guidance. Surface water and sediment samples were collected from the AEUs (Table 1.2). The sampling locations for these media are shown on Figures 1.9 through 1.12, and data summaries for detected analytes in each medium are provided in Tables 1.3 through 1.10. Ecological contaminants of interest (ECOIs)s that were analyzed for but not detected are presented in Attachment 1. Similarly, those chemicals detected in less than 5 percent of the samples were also analyzed in Attachment 1. Detection limits are compared to ecological screening levels (ESLs), as discussed in Attachment 1 (Tables A1.1 through A1.10). A detailed description of data storage and processing methods is provided in Appendix A, Volume 2 of the RI/FS Report. The complete data set for the AEUs is provided in Attachment 4 on a compact disc (CD).

In accordance with the CRA Methodology, only data collected on or after June 28, 1991, are used in the CRA. The sampling data available for the assessment of the AEUs are used as follows:

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- Surface water data;
- Sediment data; and
- Surface soil data within 20 feet of the wetted areas (discussed as sediment, below).

The sample results from all samples collected for surface water and sediment media since June 28, 1991 were evaluated within the ECOPC process. Additional data sets of post-1999 surface water, surface sediment (0 – 6"), and adjacent surface soils were evaluated as lines of evidence within the risk characterization. The following describes the data summary by AEU for the data sets used within the ECOPC process.

NW AEU

Surface Water

The surface water data set for NW AEU consists of up to 2,763 samples for various analyte groups. The samples were collected in the NW AEU from June 1991 through August 2005. Sample locations are shown on Figure 1,8.

The NW AEU surface water samples were analyzed for inorganics (up to 2,696 total and 541 dissolved samples), organics (up to 377 total samples), and radionuclides (up to 2,763 total samples and 140 dissolved) (Table 1.2). Detected analytes included many inorganics, organics, and radionuclides (Table 1.3). A summary of analytes that were not detected, or were detected in less than 5 percent of the samples in surface water in the NW AEU is presented and discussed in Attachment 1.

Sediment

The sediment data set for NW AEU consists of up to 134 samples for various analyte groups. The samples were collected in the NW AEU from August 1991 through August 2005. Sample locations are shown on Figure 1.8. Adjacent surface soils were evaluated as potential future sediments as a line of evidence within the risk characterization.

The NW AEU sediment samples were analyzed for inorganics (up to 112 samples), organics (up to 134 samples), and radionuclides (up to 127 samples) (Table 1.2). Detected analytes included many inorganics, organics, and radionuclides (Table 1.4). A summary of analytes that were not detected or were detected in less than 5 percent of the samples in sediment in the NW AEU is presented and discussed in Attachment 1.

SW AEU

Surface Water

The surface water data set for SW AEU consists of up to 6,404 samples for various analyte groups. The samples were collected in the SW AEU from June 1991 through August 2005. Sample locations are shown on Figure 1.9.

The SW AEU surface water samples were analyzed for inorganics (up to 6,404 total and 1,299 dissolved samples), organics (up to 1,411 total samples), and radionuclides (up to

6,355 total samples and 385 dissolved) (Table 1.2). Detected analytes included many inorganics, organics, and radionuclides (Table 1.5). A summary of analytes that were not detected or were detected in less than 5 percent of the samples in surface water in the SW AEU is presented and discussed in Attachment 1.

Sediment

The sediment data set for SW AEU consists of up to 178 samples for various analyte groups. The samples were collected in the SW AEU from September 1991 through August, 2005. Sample locations are shown on Figure 1.9. Adjacent surface soils were evaluated as potential future sediments as a line of evidence within the risk characterization.

The SW AEU sediment samples were analyzed for inorganics (up to 132 samples), organics (up to 128 samples), and radionuclides (up to 178 samples) (Table 1.2). Detected analytes included many inorganics, organics, and radionuclides (Table 1.6). A summary of analytes that were not detected or were detected in less than 5 percent of the samples in sediment in the SW AEU is presented and discussed in Attachment 1.

WC AEU

Surface Water

The surface water data set for WC AEU consists of up to 2,285 samples for various analyte groups. The samples were collected in the WC AEU from June 1991 through August 2005. Sample locations are shown on Figure 1.10.

The WC AEU surface water samples were analyzed for inorganics (up to 862 total and 382 dissolved samples), organics (up to 364 total samples), and radionuclides (up to 2,285 total samples and 147 dissolved) (Table 1.2). Detected analytes included many inorganics, organics, and radionuclides (Table 1.7). A summary of analytes that were not detected or were detected in less than 5 percent of the samples in surface water in the WC AEU is presented and discussed in Attachment 1.

Sediment

The sediment data set for WC AEU consists of up to 117 samples for various analyte groups. The samples were collected in the WC AEU from August 1991 through August 2005. Sample locations are shown on Figure 1.11. Adjacent surface soils were evaluated as potential future sediments as a line of evidence within the risk characterization.

The WC AEU sediment samples were analyzed for inorganics (up to 88 samples), organics (up to 77 samples), and radionuclides (up to 117 samples) (Table 1.2). Detected analytes included many inorganics, organics, and radionuclides (Table 1.8). A summary of analytes that were not detected or were detected in less than 5 percent of the samples in sediment in the WC AEU is presented and discussed in Attachment 1.

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1.2 Data Adequacy

A data adequacy assessment was performed to determine whether the available data sets discussed in the previous section are adequate for risk assessment purposes. The data adequacy assessment guidelines are presented in the CRA Methodology. A detailed data adequacy assessment for the data used in the CRA is presented in Appendix A, Volume 2 of the RI/FS Report. The assessment concludes that the data are well distributed across the site and are sufficient to estimate risks to ecological receptors at RFETS. The data for the AEUs are considered adequate for the CRA because sampling locations for surface water and sediment are generally well distributed within each AEU. Therefore, the data are considered representative for these AEUs and are adequate for a quantitative risk assessment.

There are data sets with minimal samples which were evaluated within this document. For instance, dioxins were sampled in strategic locations where deposition would most likely occur, thus limiting the data set to a select number of samples. This represents a small data set, however it is considered adequate for the purpose of the dioxin evaluation. Further description of these data sets is provided in Volume 2, attachment 1 of the RI/FS Report.

1.3 Data Quality Assessment

A Data Quality Assessment (DQA) of the AEU data sets was conducted to determine whether the data were of sufficient quality for risk assessment use. The AEU-specific DQA is presented in Attachment 2, and an evaluation of the entire RFETS data set is presented in Appendix A, Volume 2 of the RI/FS Report. It was concluded that the data are of sufficient quality for use in this CRA.

2.0 IDENTIFICATION OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN

The ECOPC identification process streamlines the ecological risk characterization by focusing the assessment on ECOIs that are present in surface water and sediment media from each AEU. This process is based on the SCM presented in the CRA Methodology (DOE 2004a) and described in detail in Appendix A, Volume 2 of the RI/FS Report (DOE 2005). Generally, as described in Section 1.1.5, the most significant exposure pathways to aquatic life receptors are through direct contact and ingestion of potentially contaminated surface water and sediment.

2.1 Data Used in the Ecological Risk Assessment

Surface water and sediment media were evaluated for the AEU ERAs. Data used for the AEU ECOPC evaluations represent the AEU data set gathered since June 28, 1991 with post-accelerated action confirmation sample results incorporated as well as the additional pond sampling results gathered July, 2005. Table 1.2 summarizes the number of samples by type of analysis for each AEU. Additional data sets relied upon for the AEU risk characterization included post-1999 surface water, surface sediment (0-6") and

adjacent surface soils (within 20' of the wetted perimeter of the water body). These additional data sets were reviewed as part of the lines of evidence describing chemical risk characterization.

Surface water samples for both total and dissolved fractions were collected. ESLs for inorganics contaminants are based on either dissolved or total metal fractions depending on the underlying data for the ESL. The fraction appropriate for comparison to the ESL was used for the ECOPC process. For instance, many divalent metals have ESLs for the dissolved fraction (e.g., cadmium, copper, chromium, iron, lead, mercury, nickel, silver, and zinc), while the remaining have ESLs for the total fraction. Ammonia presents a unique contaminant for which the ESL is based on the "un-ionized" fraction. Only the total aqueous ammonia fraction was measured, and not the un-ionized fraction; therefore, the un-ionized fraction was calculated from the total aqueous measurement using a temperature and pH dependant conversion factor developed for each AEU (EPA 1985). This calculation method is discussed in Attachment 5. The calculated un-ionized concentrations are shown within the ECOPC summary tables and spatial distribution figures.

Sediment samples collected from all depth fractions were collected. ESLS for inorganic and organic contaminants were compared to the detected sample results. Polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) tend to act in an additive manner because of similar modes of toxic action. To account for this interactive toxicity a total concentration was calculated for PCBs within each sample the total PCB concentrations were determined by:

1. Aroclors detected in greater than 5 percent of the samples were included in the total calculations.
2. A total maximum sum of PCBs was determined for each sample, using ½ the detection limit for nondetected congeners.
3. The total maximum detected value was compared to the "total PCB" Ecological Screening Level (ESL) for the ECOPC screen.
4. The total maximum detected value in surface sediment was compared to the ESL for the risk characterization screen.

Total PAHs were evaluated in a step-wise manner. If individual PAH constituents were identified as ECOPCs, the calculated total PAH concentration was evaluated as a risk characterization chemical line of evidence using conservative assumptions. Total PAHs were not evaluated during the ECOPC screening process.

Additional sampling for dioxins/furan congeners was completed after the CRA Methodology was approved, and integrated into this evaluation. The toxicity evaluation of these chemicals requires the use of toxicity equivalency factors (TEFs) as related to 2,3,7,8-TCDD. The methods are described in Attachment 5. For dioxins/furans, the following steps were taken:

1. Detected congeners were summed, using ½ the detection limit was used for nondetected concentrations, to develop a conservative total dioxin concentration.

2. This total dioxin concentration was then compared to a Total Dioxin ESL for ECOPC screening.
3. If the total dioxin concentration exceeded the ESL and was retained for risk characterization, then a toxicity equivalent quotient (TEQ) was calculated using congener-specific TEFs (WHO 1998).

The results of these analyses were compared to available toxicity benchmarks protective of aquatic life. Values of 0.85 nanogram per kilogram (ng/kg) no observed effects level (NOAEL) and 21.5 ng/kg lowest observed effects level (LOAEL) were used for the comparison (WHO 1998).

Surface water and sediment from NWAEU, SW AEU, and WC AEU included samples from locations considered part of the background data set for RFETS. These background samples were included in the AEU data evaluated in the initial steps of ECOPC identification as a conservative assessment measure. Background samples were then removed from the AEU data set for the comparison of site sample concentrations to background concentrations, and in professional judgment evaluations.

2.2 Identification of Surface Water and Sediment ECOPCs

ECOPCs for surface water and sediment were identified for aquatic receptors in accordance with the sequence presented in the CRA Methodology. The ECOPC identification process for the ERA examined ECOIs that were present in AEU surface water and sediment through a sequential, multi-step process. All ECOIs, including essential nutrients, were evaluated using the following process:

The first step of the ECOPC selection process is a comparison of ECOI maximum detected concentrations (MDCs) in surface water and sediment to their respective ESLs. Those ECOIs for which ESLs are not available are removed from further consideration within the ECOPC process, and are discussed further as ECOIs with uncertain toxicity (Section 6.0). A list of ECOIs with uncertain toxicity is summarized in Attachment 1 for each AEU. Contaminants where the MDCs are greater than the ESL are retained for further analysis in the ECOPC selection process. ESLs are presented in the CRA Methodology based on the most significant exposure pathways and receptors presented in the SCM, and represent concentrations that are predicted to result in either no-adverse effects or minimal or threshold effects to aquatic receptor populations. Additional contaminants beyond those presented in the CRA Methodology were identified as requiring an ECOPC evaluation. Therefore, additional ESLs were derived using the same methods and sources as those described in the CRA Methodology. A summary of these new ESLs is provided in Attachment 5.

A detection frequency screen is performed for those ECOIs that are not eliminated in the MDC-ESL screen to identify ECOIs with less than a 5 percent detection frequency. Infrequently detected ECOIs are not expected to pose a potential for risk to aquatic receptors. However, ECOIs with less than 5 percent detection are mapped and subjected to additional spatial evaluation. The mapping is completed in order to determine if the

few detected concentrations of these ECOIs occur in depositional areas (such as ponds) that could pose a potential risk to aquatic populations areas.

Statistical comparisons against the appropriate background data set are performed for each ECOI that is not eliminated in the detection frequency screen in accordance with the CRA Methodology. The background analyses utilizes two statistical programs: ProUCL (Version 3.0) and S-Plus. The statistical methods used are described in Attachment 3 as well as in Appendix A, Volume 2, Attachment 1 of the RI/FS Report. ProUCL is used to determine the data distributions of the AEU and background data sets. The data distribution types determine the appropriate statistical test for the background comparison. S-Plus is then used to compare the two data sets. Those contaminants found to be statistically greater than background are retained for further analysis in the ECOPC selection process. All other ECOIs are considered to not pose a potential risk to aquatic populations and are eliminated from the ECOPC selection process.

For those ECOIs retained in the ECOPC selection process, the exposure point concentration (EPC), a conservative measure of upper-bound concentrations represented by the 95th upper tolerance limit (UTL) (95th upper confidence limit [UCL] of the 90th percentile), is compared to the ESL. The upper-bound EPC is a conservative measure of potential exposure for organisms with low mobility. Calculation of this statistic uses one-half of the detection limit as a proxy value for nondetected concentrations. Where sufficient data are unavailable to calculate statistical parameters, the MDC is used as the default EPC; or, if the UTL is greater than the MDC, the MDC is used as the EPC. This EPC is compared to the CRA Methodology ESL. ECOIs with UTLs less than their ESLs are removed from further consideration within the ECOPC process. The ECOIs screened out in this step are mapped to determine the spatial extent and to evaluate their potential for posing a risk in depositional areas such as ponds. Those ECOIs that do not present a depositional pattern within ponds and have UTLs less than the ESLs are considered to not pose a potential risk to aquatic populations.

The final ECOPC selection step as per the CRA Methodology is a professional judgment evaluation of each remaining ECOIs. However, professional judgment steps were not applied to the AEU ECOPC process. Therefore any ECOIs identified as ECOPCs to this point, were retained for further evaluation within the risk characterization.

A more detailed discussion of the ECOPC screening procedure and the assumptions inherent in this procedure are provided in Section 7.3 of the CRA Methodology and in Appendix A, Volume 2 of the RI/FS Report.

2.3 Summary of ECOPCs for AEUs

ECOPCs for surface water and sediment were identified for aquatic receptors in accordance with the screening process presented in the CRA Methodology (DOE 2004a). The following subsections present the outcome of the ECOPC process for each AEU. Special consideration was given in each step of the process for ECOIs that are eliminated in order to evaluate their potential to be present in isolated depositional areas which may occur within pond areas that provide unique habitat settings.

A summary of the ECOPC decision process is provided for each AEU by media in Tables 2.1 through 2.11. Within these Tables, summary information for total maximum detected PCB and total dioxin TEQ values in sediment is provided for each AEU. Justification for background decisions is provided in Attachment 3.

2.3.1 ECOPCs for the NW AEU

Surface Water

Table 2.1 summarizes the results of the surface water ECOPC identification process for the NW AEU. There were nine total metals (aluminum, barium, beryllium, cobalt, lithium, selenium, strontium, tin and vanadium), nine dissolved metals (cadmium, chromium, copper, iron, lead, manganese, silver, nickel, and zinc), three inorganics (ammonia, fluoride and cyanide), thirteen organics (4,4'-DDT, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzyl alcohol, bis(2-ethylhexyl)phthalate, carbon disulfide, di-n-butylphthalate, Endosulfan I, Heptachlor epoxide, Aroclor-1254, phenanthrene, and pyrene) and seven radionuclides (americium-241, plutonium – 239/240, radium-226, radium-228, uranium-233/234, uranium-235, and uranium-238) with MDCs greater than ESLs.

Of these ECOIs, 10 were detected in less than 5 percent of the samples:

- 4,4'-DDT detected in one of 123 samples (Figure 2.1);
- Anthracene detected in one of 207 samples (Figure 2.2);
- Benzo(a)anthracene detected in one of 207 samples (Figure 2.3);
- Benzo(a)pyrene detected in one of 207 samples (Figure 2.4);
- Benzyl alcohol detected in five of 182 samples (Figure 2.5);
- Carbon disulfide detected in three of 231 samples (Figure 2.6);
- Endosulfan I detected in two of 123 samples (Figure 2.7);
- Heptachlor epoxide detected in one of 123 samples (Figure 2.8);
- Phenanthrene detected in two of 207 samples (Figure 2.9); and
- Pyrene detected in five of 204 samples (Figure 2.10).

The MDC for these contaminants is greater than their respective ESLs. However, the remaining concentrations were below detection limits for 4,4'-DDT, anthracene, benzo(a)anthracene, benzo(a)pyrene, and heptachlor epoxide. The detected concentrations for benzyl alcohol, carbon disulfide, endosulfan I, phenanthrene and pyrene were primarily located within the IA overlapping portion of the AEU and outside of true aquatic habitat areas.. The occurrence of these contaminants demonstrated spatial distributions that were not concentrated in pond habitat areas. These ECOIs were

eliminated from further consideration in the NW AEU because they are unlikely to present risks to the population of aquatic receptors.

Of the remaining inorganic ECOIs in surface water, copper (dissolved), iron (dissolved), lead (dissolved), zinc (dissolved) and radium-226 were not statistically greater than background. These contaminants were eliminated from further consideration because they are unlikely to present risks to the populations of receptors that inhabit North Walnut Creek. The risk created by these metals would not exceed that posed by normal background conditions.

While the MDCs for barium (total), beryllium (total), chromium (dissolved), cobalt (total), fluoride (total), manganese (dissolved), nickel (dissolved), selenium (total), strontium (total), tin (total), bis-2-ethylhexylphthalate, di-n-butylphthalate, americium-241, plutonium-239/240, uranium-233/234, uranium-235, and uranium,-238 in surface water were greater than their respective ESLs, the UTL EPCs for these ECOIs were less than the ESLs (Table 2.1); therefore, these contaminants were not considered to pose risk to aquatic receptors. However, to ensure that these ECOIs were not a concern in surface water for an isolated aquatic population associated with a pond within North Walnut Creek, the spatial distributions of these ECOIs were evaluated by plotting the concentrations in relation to the ESL. The spatial distributions of these contaminants are shown in Figures 2.11 through 2.27. A summary of their spatial extent as compared to their respective ESLs is described as follows:

- Barium and beryllium occurred with a concentration above their respective CRA Methodology ESLs at two locations within the channel, and at several locations within stormwater or drains systems within the IA overlapping portion of the AEU (Figures 2.11, 2.12). The spatial distribution of these metals is mostly outside of true aquatic habitat. The majority of the detected concentrations occur below the ESL, indicating that these metals are unlikely to present a risk concern to aquatic populations.

- Chromium (dissolved), cobalt (total) occurred with a concentration above their respective CRA Methodology ESLs at one location within the IA overlapping portion of the AEU and is outside of the channel and ponds (Figures 2.13 and 2.14). The spatial distribution is extremely limited and generally outside aquatic habitats. The majority of the measured concentrations occur below the ESL, indicating that these metals are unlikely to present a risk concern to aquatic populations.

- Fluoride (total) occurred at concentrations above the CRA Methodology ESL within the ponds associated with NW AEU (Figure 2.15). Further evaluation of the data (as shown within Figure 2.15) indicates that the majority of measured concentrations (95 percent) did not exceed the ESL. The UTL for fluoride is less than the ESL, indicating a low potential for risk.

- Manganese (dissolved) occurred with a concentration above the CRA Methodology ESL at only one location within the channel (Figures 2.16). The

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spatial distribution is extremely limited in regards to occurrence within aquatic habitat. The majority of the measured concentrations occur below the ESL, indicating that this metal is unlikely to present a risk concern to aquatic populations.

- Nickel (dissolved), strontium (total), and tin (total) occurred with a concentration above the CRA Methodology ESL at one or two locations within the IA overlapping portion of the AEU (Figure 2.17, 2.19 and 2.20). The spatial distribution is extremely limited in regards to true aquatic habitat. In addition, the majority of the measured concentrations occur below the ESL, indicating that these metals are unlikely to present a risk concern to aquatic populations.

- Selenium (total) occurred at seven locations within the channel and one location within Pond A-4 with detected values greater than the ESL (Figure 2.18). The remaining sample results (from 39 locations) within the aquatic habitat areas were less than the ESL or at nondetected levels. Therefore, the nine locations with measured values greater than the ESL represent approximately 19 percent of the data within the true aquatic habitat areas. This metal is unlikely to present a risk concern to aquatic populations.

- Bis(2-ethylhexyl)phthalate occurred with a concentration above the CRA Methodology ESL at only one location within a pond, and the channel, and several locations within stormwater or drains systems within the IA overlapping portion of the AEU (Figure 2.21). The spatial distribution is extremely limited in regards to true aquatic habitat. The majority of the measured concentrations occur below the ESL, indicating that this contaminant is unlikely to present a risk concern to aquatic populations.

- Di-n-butylphthalate occurred with a concentration above the CRA Methodology ESL at only one location within the IA overlapping portion of the AEU (Figure 2.22). The majority of the measured concentrations occur below the ESL, indicating that this contaminant is unlikely to present a risk concern to aquatic populations.

- Americium-241 occurred with a concentration above the CRA Methodology ESL at only one location within the IA overlapping portion of the AEU (Figure 2.23), while plutonium-239/240 occurred with a concentration above the ESL at two locations within the IA overlapping portion of the AEU (Figure 2.24). The UTLs for these radionuclides fell below the ESL, indicating a minimal risk potential. The majority of the measured concentrations of these contaminants occur below their respective ESLs, indicating that these contaminants are unlikely to present a risk concern to aquatic populations.

- Uranium-233/234, uranium-235, and uranium-238 all occurred at measured concentrations above their respective CRA Methodology ESLs at isolated locations within the channel, or pond areas with the predominant occurrence within the IA overlapping drainage areas (Figures 2.25, 2.26, and 2.27). The

UTLs for these radionuclides fell below the ESL, indicating a minimal risk potential. The spatial extent of these contaminants is not concentrated within aquatic habitats. They are unlikely to pose a risk concern to aquatic populations.

Results of the ECOPC screen to this point identified aluminum (total), ammonia, cadmium (dissolved) cyanide, lithium (total), silver (dissolved), vanadium (total), Aroclor-1254, and radium-228 as ECOPCs requiring further evaluation within the risk characterization. The spatial extent of each of these contaminants within the NW AEU is provided in Figures 2.28 through 2.36. Within these Figures, the un-ionized ammonia fraction is compared to the ESL, while sitewide or site-specific ESLs (where appropriate as identified in Attachment 5) are compared to sample results for the remaining ECOPCs.

Sediment

Table 2.2 summarizes the results of the sediment ECOPC identification process. There were 16 metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver and zinc) and 26 organics (2-methylnaphthalene, 4,4'-DDT, acenaphthene, aldrin, anthracene, Aroclor-1254, Aroclor-1260, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, delta-BHC, dibenz(a,h)anthracene, endosulfan I, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) with MDCs greater than ESLs. In addition, the total maximum PCB and TEQ dioxin values were greater than ESLs.

Four of these ECOIs were detected in less than 5 percent of the samples:

- Aldrin detected in one of 78 samples (Figure 2.37);
- Aroclor-1260 detected in two of 121 samples (Figure 2.38)
- Delta-BHC detected in one of 79 samples (Figure 2.39); and
- Endosulfan I detected in one of 79 samples (Figure 2.40).

The measured concentrations of these ECOIs were greater than their ESLs. However, only one or two of the samples for these chemicals actually had detectable concentrations. These chemicals did not demonstrate a spatial trend concentrated in aquatic habitat areas. Given the limited spatial extent of their occurrence, these ECOIs are unlikely to create an unacceptable risk to the aquatic populations within the NW AEU and have been eliminated from further consideration as ECOPCs.

There were no ECOIs eliminated as a result of the statistical background comparison.

The EPC-ESL screen eliminated arsenic, chromium and bis(2-ethylhexyl)phthalate as ECOIs from further consideration as ECOPCs. While the MDCs for these contaminants were greater than their respective ESLs, the UTL EPCs for these ECOIs were less than the ESLs (Table 2.2). Therefore, these contaminants were not considered to pose risk to aquatic receptors. However, to ensure that these ECOIs were not a concern in sediment for an isolated aquatic population associated with a pond within North Walnut Creek, the

spatial distributions of these ECOIs were evaluated by plotting the concentrations in relation to the ESL. The spatial distributions of these contaminants are shown in Figures 2.41 through 2.43. A summary of their spatial extent as compared to their respective ESLs is described as follows:

- Arsenic occurred with concentrations above the ESL at only three locations (Figure 2.41). These locations are dispersed in aquatic habitat areas. However, the majority of the detected results were below the ESL. The spatial distribution of arsenic indicates that while there may be several small areas of elevated concentrations, the spatial extent within the aquatic habitat areas are limited and there does not appear to be an unacceptable risk to isolated aquatic populations.

- Chromium occurred with concentrations above the ESL at only two locations (Figure 2.42). These locations are not spatially concentration in a single aquatic habitat area. The remaining samples throughout the AEU were below the ESL or at nondetect levels. The spatial distribution of chromium does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Bis(2-ethylhexyl)phthalate occurred with a concentration above the ESL at only one location (Figure 2.43). The remaining samples throughout the AEU were below the ESL or at nondetect levels. The spatial distribution of bis(2-ethyhexyl)phthalate does not indicate that there is an unacceptable risk to isolated aquatic populations.

The EPC-ESL screen indicated that aluminum, antimony, barium, cadmium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, zinc, 2-methylnaphthalene, 4,4'-DDT, acenaphthene, anthracene, Aroclor-1254, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene are ECOPCs requiring further evaluation within the risk characterization. In addition, total PCBs were calculated and determined to be an ECOPC for NW AEU sediment. The spatial extent of each of these ECOIs within the NW AEU is provided in Figures 2.44 through 2.78. Total PCBs are also spatially shown within Figure 2.63. Total PAH concentrations by location were also spatially demonstrated (Figure 2.58) however this information was used as a chemical characterization line of evidence for the risk characterization and not used as part of the ECOPC process.

Total PCBs and dioxins using the TEQ process were also retained for further evaluation. The total maximum detected PCB concentration is provided in Table 2.3 and the calculated dioxin TEQ is provided in Table 2.4. These values each exceeded their respective ESL, therefore these chemical groups were retained as ECOPCs for further risk characterization.

2.3.2 ECOPCs for the SW AEU

Surface Water

Table 2.5 summarizes the results of the surface water ECOPC identification process. There were eight total metals (aluminum, antimony, barium, beryllium, lithium, selenium, thallium, and vanadium), four inorganic contaminants (ammonia, cyanide, fluoride, and nitrite) seven dissolved metals (cadmium, copper, iron, lead, mercury, silver, and zinc), seven organic contaminants (1,1,2-trichloro-1,2,2-trifluoroethane, 4,4'-DDD, 4,4'-DDT, 4-methylphenol, bis(2ethylhexyl)phthalate, carbon disulfide, and Aroclor-1254) and four radionuclides (plutonium-239/240, radium-226, uranium-233/234, uranium-238) with MDCs greater than ESLs.

Six of these ECOIs were detected in less than 5 percent of the samples:

- Mercury (dissolved) detected in 36 of 847 samples (Figure 2.79);
- Thallium (total) detected in 63 of 1589 samples (Figure 2.80);
- 4,4'-DDD detected in one of 72 samples (Figure 2.81);
- 4-methylphenol detected in one of 141 samples (Figure 2.82);
- Aroclor-1254 detected in one of 70 samples (Figure 2.83); and
- Carbon disulfide detected in two of 667 samples (Figure 2.84).

For mercury (dissolved), only three of the detected concentrations exceeded the ESL. Similarly, thallium (total) had only six measured concentrations above the ESL. The remaining sample results for these metals fell below the ESL and did not demonstrate a spatial trend concentrated in aquatic habitat areas. Given the minimal exceedance of the measured values as compared to their respective ESLs, and the limited spatial extent of their occurrence, these ECOIs are unlikely to create an unacceptable risk to the aquatic populations within the SW AEU and have been eliminated from further consideration as ECOPCs.

4,4'-DDT, 4-methylphenol, carbon disulfide and Aroclor-1254 had minimal numbers of sample results (one or two) which all occurred within the IA overlapping portion of the AEU. These results represent singular (with the exception of carbon disulfide which had two measured results) occurrences which are unlikely to impact aquatic populations within the SW AEU. They were therefore removed from further consideration as ECOPCs.

Of the remaining inorganic ECOIs in surface water, aluminum (total), copper (dissolved), iron (dissolved), vanadium (total), zinc (dissolved), and radium-226 concentrations were not statistically greater than background. These ECOIs were eliminated from further consideration because they are unlikely to present unacceptable risks to the populations of aquatic receptors that inhabit South Walnut Creek. The potential for risk created by these metals is unlikely to exceed that posed by normal background conditions.

The EPC-ESL screen eliminated antimony (total), barium (total), beryllium (total), fluoride, lead (dissolved), lithium (total), nitrite, selenium (total), 1,1,2-trichloro-1,2,2-trifluoroethane, bis(2-ethylhexyl)phthalate, plutonium-239/240, uranium-233/234, uranium-238 as ECOIs from further consideration as ECOPCs. While the MDCs for these contaminants were greater than their respective ESLs, the UTL EPCs for these ECOIs were less than the ESLs (Table 2.5). Therefore, these contaminants were not considered to pose risk to aquatic receptors. However, to ensure that these ECOIs were not a concern in surface water for an isolated aquatic population associated with a pond within South Walnut Creek, the spatial distributions of these ECOIs were evaluated by plotting the concentrations in relation to the ESL. The spatial distributions of these contaminants are shown in Figures 2.85 through 2.97. A summary of their spatial extent as compared to their respective ESLs is described as follows:

- Antimony occurred with a total concentration above the ESL at only one location (Figure 2.85). The remaining samples throughout the AEU were below the ESL. The spatial distribution of antimony does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Barium (total), beryllium (total) occurred with concentrations above the ESL at several locations dispersed throughout aquatic habitat areas, and within the IA overlapping portion of the AEU (yet outside the channel or other ponds) (Figures 2.86 and 2.87). The remaining samples throughout the AEU were either below the ESL or below detection limits. The concentrations decrease to below ESL and nondetect levels in a down-gradient direction from Pond B-1, indicating that there is no increase in load or additive source areas. The spatial distribution of these metals does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Fluoride had a single measured concentration above the ESL within Pond A-6 (Figure 2.88). Thus, the spatial extent is minimal and unlikely to pose a risk concern to aquatic populations.

- Lead (dissolved) showed elevated concentrations throughout the SW AEU (Figure 2.89). These concentrations exceeded the ESL in the Ponds B-1 to B-5, in the stream channel within the IA, and downgradient of the IA. However, all these exceedances were of low magnitude (HQ<5) except for the MDC (HQ =16). There were also nondetects (83 percent) and detected concentrations below the ESL (11 percent) scattered throughout the SW AEU alongside those that exceeded the ESL. Only 14 detected samples from pond habitats exceeded the ESL by a low magnitude (HQs<2). Therefore, the UTL did not exceed the ESL, and despite six percent of samples (n=849) exceeding the ESL (in detected concentrations), dissolved lead does not represent a spatial grouping that would pose a risk to localized aquatic organisms in SW AEU.

- Lithium occurred with total concentrations above the ESL at four locations (Figure 2.90) within the channel area (and four locations outside the channel within the IA overlapping portion of the AEU). There is no spatial pattern

indicating an increase in concentration going down-gradient within the channel. The remaining locations occur at levels below the ESL or are nondetect. The spatial distribution of lithium does not indicate that there is an unacceptable risk to isolated aquatic populations. The UTL for lithium falls below both the ESL and AT values indicating a minimal risk potential.

- Nitrite had one location with a measured concentration greater than the ESL (Figure 2.91). Nitrite is unlikely to pose a risk to isolated aquatic populations within SW AEU.

- Selenium occurred at total concentrations above the ESL at seven locations (Figure 2.92) along the channel and pond areas within SW AEU. However, the remaining locations occurred at levels below the ESL or were nondetect. Therefore, the aquatic populations associated with the channel area are not at risk. It does not appear that selenium is creating an isolated risk potential.

- 1,1,2-trichloro-122-trifluoroethane occurred at one location, while bis(2-ethylhexyl)phthalate occurred at two locations above the ESL within IA overlapping areas of the AEU, (one within the channel) and not within the pond areas (Figures 2.93 and 2.94). These contaminants are unlikely to pose a risk to isolated aquatic populations within SW AEU.

- Plutonium-239/240 occurred at one location, uranium-233/234 occurred at three locations, while uranium-238 occurred at two locations above the ESL within the channel and the IA overlapping area of the AEU (Figures 2.95, 2,96 and 2.97). Uranium-233/234 and uranium-238 had a singular location with a measured concentration greater than the ESL within the channel. However, given the minimal spatial extent, neither contaminant would pose a risk to isolated aquatic populations within SW AEU. The UTLs for both radionuclides fell below their respective ESLs, indicating a minimal risk potential.

Ammonia, cadmium (dissolved), cyanide, silver (dissolved), and 4,4'-DDT were identified as the ECOPCs requiring further evaluation within the risk characterization. The spatial extent of these ECOPCs as compared to their ESLs are provided in Figures 2.98 through 2.102. These Figures present the results of the un-ionized ammonia fraction as compared to the ESL, and the site-specific hardness developed ESL as compared to the dissolved cadmium and dissolved silver surface water results.

Sediment

Table 2.6 summarizes the results of the sediment ECOPC identification process. There were 16 metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver and zinc) and twenty six organics (2-methylnaphthalene, 4,4-DDE ,4-methylphenol, , acenaphthene, anthracene, Aroclor-1254, Aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzyl alcohol, bis(2-ethylhexyl)phthalate, bromomethane, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, gamma- BHC, heptachlor epoxide, indeno(1,2,3-cd)pyrene, pentachlorophenol,

phenanthrene, and pyrene) with MDCs greater than ESLs. In addition, the total maximum PCB value was greater than ESLs.

Seven of these ECOIs were detected in less than 5 percent of the samples:

- 2-Methylnaphthalene detected in one of 83 samples (Figure 2.103);
- 4,4-DDE detected in one of 66 samples (Figure 2.104);
- 4-Methylphenol detected in one of 84 samples (Figure 2.105);
- Benzyl alcohol detected in one of 67 samples (Figure 2.106);
- Heptachlor epoxide detected in one of 66 samples (Figure 2.107);
- Gamma-BHC detected in one of 65 samples (Figure 2.108); and
- Pentachlorophenol detected in three of 84 samples (Figure 2.109).

The measured concentrations of these ECOIs were greater than their ESLS. However, only one to three of the samples for these chemicals actually had detectable concentrations. These chemicals did not demonstrate a spatial trend concentrated in aquatic habitat areas. Most of the chemicals were detected in non-habitat settings. Given the limited spatial extent of their occurrence, these ECOIs are unlikely to create an unacceptable risk to the aquatic populations within the SW AEU and have been eliminated from further consideration as ECOPCs.

Of the remaining inorganic ECOIs in sediment, manganese concentrations were not statistically greater than background. This ECOI was eliminated from further consideration as an ECOPC because it is unlikely that it presents a risk to the populations of receptors that inhabit South Walnut Creek. The potential for risk posed by this metal is unlikely to exceed that posed by normal background conditions.

The EPC-ESL screen eliminated arsenic, chromium, iron, mercury, nickel, selenium and bis(2-ethylhexyl)phthalate as ECOIs from further consideration as ECOPCs. While the MDCs for these contaminants were greater than their respective ESLs, the UTL EPCs for these ECOIs were less than the ESLs (Table 2.6). Therefore, these contaminants were not considered to pose risk to aquatic receptors. However, to ensure that these ECOIs were not a concern in sediment for an isolated aquatic population associated with a pond within South Walnut Creek, the spatial distributions of these ECOIs were evaluated by plotting the concentrations in relation to the ESL. The spatial distributions of these contaminants are shown in Figures 2.110 through 2.116. A summary of their spatial extent as compared to their respective ESLs is described as follows:

- Arsenic occurred with one concentration above the ESL at a location within the IA overlapping portion and outside of true aquatic habitat areas (Figure 2.110). The remaining samples throughout the AEU were below the ESL. The spatial

distribution of arsenic does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Chromium occurred with concentrations above the ESL at only two locations (Figure 2.111). These locations are not spatially concentration in aquatic habitat areas. The remaining samples throughout the AEU were below the ESL or at nondetect levels. The spatial distribution of chromium does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Iron occurred with concentrations above the ESL at several locations within ponds B-4 and B-5 (Figure 2.112). Further analysis of surface sediment results (as provided in Attachment 8 Figure A8.37) indicates that only three locations have measured concentrations greater than the ESL within B-4. The surface sediment results for Pond B-5 were at concentrations less than the ESL. The limited spatial extent of surface sediment occurrence does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Mercury occurred with concentrations above the ESL at two locations within Pond B-4. The remaining locations throughout the AEU were less than the ESL or at nondetect levels (Figure 2.113). Further analysis of the surface sediment within Pond B-4 (Figure A8.39 within Attachment 8) indicates that the surface sediment concentrations are less than the ESL. The limited spatial extent of surface sediment occurrence does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Nickel occurred with two locations within Pond B-4 and one location within Pond B-5 and one within the channel with measured values greater than the ESL (Figure 2.114). The remaining locations had values below the ESL. The results identify a concentration of nickel within habitat areas (Pond B-4 and B-5) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Pond B-4 (Figure A8.39) indicated nickel was detected at concentrations greater than the ESL at one location within Pond B-4. This spatial extent of nickel does not indicate a potential for risk to benthic populations within the SW AEU.

- Selenium occurred with concentrations above the ESL at only two locations, one within Pond B-4 and one within Pond B-5 (Figure 2.115). These locations are not spatially concentration in a single aquatic habitat area. The remaining samples throughout the AEU were below the ESL or at nondetect levels. The spatial distribution of selenium does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Bis(2-ethylhexyl)phthalate occurred with a concentration above the ESL at only one location within Pond B-4 (Figure 2.116). The remaining samples throughout the AEU were below the ESL or at nondetect levels. The spatial distribution of

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bis(2-ethyhexyl)phthalate does not indicate that there is an unacceptable risk to isolated aquatic populations.

The EPC-ESL screen indicated that aluminum, antimony, barium, cadmium, copper, fluoride, lead, silver, zinc, acenaphthene, anthracene, Aroclor-1254, Aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bromomethane, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene are ECOPCs requiring further evaluation within the risk characterization. The spatial extent of each of these ECOPCs within the SW AEU is provided in Figures 2.117 through 2.144. Total PCBs are also spatially shown within Figure 2.129. Total PAH concentrations by location were also spatially demonstrated (Figure 2.126) however this information was used as a chemical characterization line of evidence for the risk characterization and not used as part of the ECOPC process.

Total PCBs were retained for further evaluation. The total maximum detected PCB concentration is provided in Table 2.7. This value exceeded the ESL, therefore this chemical group was retained as ECOPCs for further risk characterization.

2.3.3 ECOPCs for the WC AEU

Surface Water

Table 2.8 summarizes the results of the surface water ECOPC identification process. There were eight total metals (aluminum, barium, beryllium, cobalt, lithium, selenium, thallium, and vanadium), two inorganic contaminants (ammonia and cyanide), eight dissolved metals (cadmium, copper, iron, lead, manganese, mercury, silver, and zinc), three organic contaminants (4,4'-DDT, carbon disulfide, and pyrene), and four radionuclides (americium-241, plutonium-239/240, uranium-233/234, and uranium-238) with MDCs greater than the ESLs.

- Four of these ECOIs were detected in less than 5 percent of the samples:
- Cyanide detected in four of 174 samples (Figure 2.145);
- 4,4'-DDT detected in five of 129 samples (Figure 2.146);
- Carbon disulfide detected in one of 285 samples (Figure 2.147); and
- Pyrene detected in one of 156 samples (Figure 2.148).

For cyanide, the four detected concentrations exceeded the ESL. Similarly, for 4,4'-DDT all five detected concentrations were above the ESL. The remaining sample results for these contaminants were nondetect and did not demonstrate a spatial trend concentrated in aquatic habitat areas. Given the minimal exceedance of the detected values as compared to their respective ESLS, and the limited spatial extent of their occurrence, these ECOIs are unlikely to create an unacceptable risk to the aquatic populations within the WC AEU and have also been eliminated from further consideration as ECOPCs.

Carbon disulfide and pyrene had single detected sample results which occurred above their respective ESLs. These results indicate that these contaminants are unlikely to impact aquatic populations within the WC AEU. They were therefore removed from further consideration as ECOPCs.

Of the remaining inorganic ECOIs in surface water, aluminum (total), copper (dissolved), iron (dissolved), lead (dissolved), manganese (dissolved), vanadium (total), and zinc (dissolved) concentrations were not statistically greater than background. These ECOIs were eliminated from further consideration as ECOPCs because it is unlikely that they present risks to the populations of receptors that inhabit Woman Creek. The potential for risk posed by these metals is unlikely to exceed that posed by normal background conditions.

The EPC-ESL screen eliminated barium (total), beryllium (total), cobalt (total), lithium (total), mercury (dissolved), selenium (total), thallium (total), americium-241, plutonium-239/240, uranium-233/234, and uranium-238 as ECOIs from further consideration as ECOPCs. While the MDCs for these contaminants were greater than their respective ESLs, the UTL EPCs for these ECOIs were less than the ESLs (Table 2.8). Therefore, these contaminants were not considered to pose risk to aquatic receptors. However, to ensure that these ECOIs were not a concern in surface water for an isolated aquatic population associated with a pond within Woman Creek, the spatial distributions of these ECOIs were evaluated by plotting the concentrations in relation to the ESL. The spatial distributions of these contaminants are shown in Figures 2.149 through 2.159. A summary of their spatial extent as compared to their respective ESLs is described as follows:

- Barium, beryllium, cobalt, and lithium occurred with a total concentration above the ESL at six or fewer locations within WC AEU (Figures 2.149, 2.150, 2.151, and 2.152). The remainder of the locations throughout the AEU were below the ESL or at nondetected concentrations. The spatial distribution of these metals does not indicate that there is a risk to isolated aquatic populations.

- Mercury (dissolved) occurred with two measured concentrations greater than the ESL from locations within the SID (Figure 2.153). The remaining detected values within the channel area etc., all fell below the ESL or were at nondetect values. Mercury (dissolved) would not pose an unacceptable risk to isolated aquatic populations.

Selenium (total) occurred at several locations above the ESL along the WC AEU channel (Figure 2.154). However, there is no spatial concentration of selenium in aquatic habitats and selenium will not pose a risk to aquatic organisms in this drainage.

Thallium (total) occurred at three locations (two within the SID) at a concentration greater than the ESL (Figure 2.155). The remaining concentrations were either below the ESL or at nondetect levels. This metal is unlikely to pose a risk to aquatic populations.

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Americium-241, and plutonium-239/240 had measured concentrations greater than the ESL in the SID or tributaries outside of the main channel of the WC AEU (Figures 2.156 and 2.157). Uranium-233/234 and uranium-238 and had only one measured concentration greater than the ESL within the channel portion of the WC AEU (Figures 2.158 and 2.159). These radionuclides do not demonstrate a spatial trend of concern to aquatic populations. The UTL for each of these radionuclides was less than their respective ESL values, indicating a minimal risk potential.

Ammonia, cadmium (dissolved), and silver (dissolved) were identified as ECOPCs requiring further evaluation within the risk characterization. The spatial extent of these ECOPCs is shown in Figures 2.160, 2.161 and 2.162. Within these figures, the un-ionized ammonia fraction results are compared to the ESL, while the site-specific hardness derived ESL is compared to dissolved cadmium and dissolved silver surface water results.

Sediment

Table 2.9 summarizes the results of the sediment ECOPC identification process. There were 16 metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver and zinc) and twenty three organics (2-butanone, 2-methylnaphthalene, 4-methylphenol, 4,4'-DDT, acenaphthene, anthracene, Aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, gamma- BHC, heptachlor, indeno(1,2,3-cd)pyrene, naphthalene, pentachlorophenol, phenanthrene, and pyrene) with MDCs greater than ESLs. In addition, the total maximum PCB and TEQ dioxin values were greater than ESLs.

Seven of these ECOIs were detected in less than 5 percent of the samples:

- 2-Methylnaphthalene detected in one of 61 samples (Figure 2.163);
- 4,4'-DDT detected in one of 59 samples (Figure 2.164);
- Dibenz(a,h)anthracene detected in two of 60 samples (Figure 2.165);
- Fluorene detected in one of 61 samples (Figure 2.166);
- Gamma-BHC detected in one of 59 samples (Figure 2.167);
- Naphthalene detected in two of 61 samples (Figure 2.168); and
- Pentachlorophenol detected in one of 61 samples (Figure 2.169).

The measured concentrations of these ECOIs were greater than their ESLS (with the exception of one detection for naphthalene). However, only one or two of the samples for these chemicals actually had detectable concentrations. These chemicals did not demonstrate a spatial trend concentrated in aquatic habitat areas. Most of the chemicals were detected in non-habitat settings typically associated with the SID. Given the limited spatial extent of their occurrence, these ECOIs are unlikely to create an unacceptable risk

to the aquatic populations within the WC AEU and have been eliminated from further consideration as ECOPCs.

There were no ECOIs eliminated as a result of the statistical background screen.

The EPC-ESL screen eliminated arsenic, chromium, manganese and 2-butanone as ECOIs from further consideration as ECOPCs. While the MDCs for these contaminants were greater than their respective ESLs, the UTL EPCs for these ECOIs were less than the ESLs (Table 2.9). Therefore, these contaminants were not considered to pose risk to aquatic receptors. However, to ensure that these ECOIs were not a concern in sediment for an isolated aquatic population associated with ponds within Woman Creek, the spatial distributions of these ECOIs were evaluated by plotting the concentrations in relation to the ESL. The spatial distributions of these contaminants are shown in Figures 2.170 through 2.173. A summary of their spatial extent as compared to their respective ESLs is described as follows:

- Arsenic occurred with one concentration above the ESL at a location within Pond C-2 (Figure 2.170), one location within the channel and one location outside of true aquatic habitat areas. The remaining samples throughout the AEU were below the ESL. The spatial distribution of arsenic does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Chromium occurred with concentrations above the ESL at only one location associated with the SID (Figure 2.171). The remaining samples throughout the AEU were below the ESL. The spatial distribution of chromium does not indicate that there is an unacceptable risk to isolated aquatic populations.

- Manganese occurred with three concentrations above the ESL within the channel portion of WC AEU (Figure 2.172). The remaining samples throughout the AEU were below the ESL. The spatial distribution of manganese does not indicate that there is an unacceptable risk to isolated aquatic populations.

- 2-Butanone occurred with two concentrations above the ESL. One locations was within the channel while the second was outside of true aquatic habitat areas (Figure 2.173). The remaining samples throughout the AEU were below the ESL or at nondetect levels. The spatial distribution of 2-butanone does not indicate that there is an unacceptable risk to isolated aquatic populations.

The EPC-ESL screen indicated that aluminum, antimony, barium, cadmium, copper, fluoride, iron, lead, mercury, nickel, selenium, silver, zinc, 4-methylphenol, acenaphthene, anthracene, Aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, heptachlor, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene are ECOPCs requiring further evaluation within the risk characterization. The spatial extent of each of these ECOIs within the WC AEU is provided in Figures 2.174 through 2.202. Total PCBs are also spatially shown within Figure 2.191. Total PAH concentrations by location were also spatially demonstrated (Figure 2.188) however this information was used as a chemical

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characterization line of evidence for the risk characterization and not used as part of the ECOPC process. .

Total PCBs and TEQ dioxins were also retained for further evaluation. Total maximum detected PCB concentration is provided in Table 2.10 while the Dioxin TEQ summary is provided in Table 2.11. These values each exceeded their respective ESL, therefore these chemical groups were retained as ECOPCs for further risk characterization.

3.0 ECOLOGICAL EXPOSURE ASSESSMENT

An exposure pathway describes a specific environmental route by which an individual receptor could be exposed to contaminants present at or originating from a site. A complete exposure pathway includes five elements: source, mechanism of release, transport medium, exposure point, and intake route. If any of these elements are missing, the pathway is considered incomplete. It is assumed that aquatic life may be exposed to surface water and sediment-related ECOPCs via several routes (direct contact, inhalation, and ingestion) for the purposes of the AEU evaluations.

The ECOPC identification steps identified ECOPCs for both surface water and sediment for the AEUs (NW AEU, SW AEU, and WC AEU). The UCL and 95th UTL for each ECOPC (or the MDC, whichever was less) were used as the EPCs for evaluating exposure from each ECOPC within surface water and sediment.

It was assumed that receptors obtain 100 percent of their exposure from each respective AEU and are likely to integrate exposure over suitable habitat across the entire drainage. In the interest of being conservative, it was also assumed that ECOPCs in possible non-habitat areas (which were, nonetheless, sampled due to the presence of surface water and/or sediment, and had a possible connection to the drainage hydrology as a whole) would contribute to possible future exposure conditions to aquatic receptors that reside downgradient. This assumption likely overestimates the exposure of these receptors because the hydrologic connectivity is unknown or unlikely.

In order to evaluate more current and realistic exposure conditions within the risk characterization, surface water data collected 'post-1999' (from 1/1/2000 to present) were evaluated, as well as surface sediment (0 – 6 inches in depth) conditions for the ECOPCs. The post-1999 surface water data results reflect more current and accurate exposure conditions than older data. Similarly, the surface sediment reflects the habitat depth of sediment typically occupied or disturbed by aquatic receptor where the exposure pathway is potentially complete. These two media were evaluated as part of the chemical risk lines of evidence for the risk characterization.

4.0 ECOLOGICAL TOXICITY ASSESSMENT

The ESLs presented in the CRA Methodology are concentrations below which adverse effects are not expected and provide a conservative lower bound indicating concentrations at which the potential for adverse effects are possible.

Several ECOPCs were identified for both surface water and sediment in the AEUs (Section 2.0). Several detected ECOIs were not included in the search for ESLs provided in Appendix B of the CRA Methodology (DOE 2004a). Therefore new ESLs were identified using the steps described in Appendix B of the CRA Methodology where available. These additional ESLs that were identified after completion of the CRA Methodology are provided in Attachment 5.

ESLs are conservative benchmarks that provide an upper-bound estimate of concentrations that are not expected to cause adverse effects. As an additional measure of the potential toxicity, alternative toxicity (AT) values were identified for consideration in the risk characterization of ECOPCs to provide a reasonable estimate of concentrations at which the potential for adverse effects are possible (Attachment 5). AT values represent literature-derived toxicity values for contaminants that reflect upper-bound concentrations above which adverse effects are possible. The ATs were not provided in the CRA Methodology but provide an important role in the description of potential risk to aquatic receptors.

Concentrations between the ESL and AT values are within the range of uncertain toxicity where adverse effects are occasionally observed. The use of both the ESL and AT for each ECOPC brackets the potential for risk from each ECOPC and allows an evaluation of the likelihood of potential risk.

Aquatic ATs vary in their endpoint and receptor of interest. The available literature was reviewed to identify suitable AT values for each ECOPC that are less conservative than the ESL, yet correlative to a lowest observed adverse effect level (LOAEL) or similar measure. The selection process for AT values, their endpoints, and sources are described in Attachment 5.

5.0 AEU-SPECIFIC ECOLOGICAL RISK CHARACTERIZATION

Characterization of risk focuses on weight-of-evidence conclusions from multiple lines of evidence (LOEs) for each assessment endpoint. This includes discussion of the potential for risk for each receptor group and level of biological organization (i.e., individuals and populations), as appropriate for the assessment endpoints. As noted by EPA (EPA 1997), a well-balanced risk characterization should "...present risk conclusions and information regarding the strengths and limitations of the assessment for other risk assessors, EPA decision-makers, and the public." According to the CRA Methodology, the AEU risk characterization process may include the following types of analyses:

Consider the magnitude and frequency of refined site-specific ESLs and ATs as a measure of the likelihood or extent of potential risk;

- Evaluate the spatial variability of ECOPC concentrations by mapping the location and magnitude of concentrations exceeding ESLs;
- Review the relative bioavailability of ECOPCs;

- Evaluate site-specific tissue data as evidence of exposure to selected ECOPCs;
- Review previous risk assessment data;
- Perform tiered geospatial analysis; and
- Use other risk characterization methods as necessary and appropriate to describe the potential for risk.

These types of analyses were incorporated into the approach used for the AEU risk characterization process and, specifically, development of contaminant risk LOEs and review of other/drainage lines of evidence. The LOEs gathered from the contaminant risk characterization were combined with the LOEs from the other/drainage studies to formulate a weight-of-evidence risk conclusion. A single contaminant risk LOE can provide either an overestimate or underestimate of the actual risk conditions. Similarly, aquatic populations may be affected by the physical conditions of the stream, which would hinder definitive recognition or identification of toxic effects. Therefore, multiple LOEs need to be reviewed before a risk characterization can be completed.

5.1 Contaminant Lines of Evidence

Within the contaminant risk LOE evaluation, the identified ECOPCs were further evaluated in a series of steps. The actual steps taken for risk characterization depended on the type of contaminant being evaluated and the media in which it was detected (surface water versus sediment). Contaminant risk characterization generally followed these steps:

ECOPCs were identified based on comparison of the MDC to ESLs. While an MDC less than the ESL indicates that adverse effects associated with exposure to a given analyte are highly unlikely (EPA, 1997a), an MDC greater than or equal to the ESL does not indicate that risks are actually present, only that the potential for adverse effects cannot be excluded. Therefore, the first step in the risk characterization involved a hazard quotient (HQ) assessment, comparing the upper confidence limit on the mean concentration (UCL) and the UTL value to the ESLs (CRA Methodology ESLs or site-specific ESLs) and ATs. The UCL provided a measure of the central tendency of contaminant concentrations, while the UTL provided an upper-bound contaminant concentration.

As described in Section 2.0, the ECOPC identification process used ESLs from the CRA Methodology. For risk characterization, site-specific ESLs and ATs were developed where appropriate using site-specific water quality conditions. These ESLs and ATs were compared to surface water and sediment MDC and EPC values for the HQ process. Site-specific ESLs were developed for certain contaminants when toxicity was found to be dependant upon site-specific surface water quality conditions. Divalent metals, ammonia, pentachlorophenol, and uranium in surface water were all reviewed using available site-specific hardness conditions (for the divalent metals and uranium). Site measurements of pH were included in calculations for ammonia and pentachlorophenol to develop appropriate ESLs. These methods and results are described in greater detail in Attachment 5. If individual PAH constituents were identified as ECOPCs in sediment,

then an evaluation of total PAH risk was completed. The process for evaluating total PAHs was as follows;

1. PAH compounds detected in greater than 5 percent of the samples were included in the total calculations.
2. The sum of PAHs was determined for each sample, using one-half the detection limit for nondetected chemicals.
3. The maximum total PAH value was compared to the "total PAH" ecological screening level (ESL) for the risk characterization screen, and
4. the total detected PAHs for each sample was calculated for surface sediment and compared to the ESL for the risk characterization screen.

Both the total PAH and total detected PAH values were used in the risk characterization screen. The calculated total PAH values by sample, and the total maximum detected values by location are provided in Attachment 6.

The HQs were developed using the following standard equation:

HQ = EPC/ESL or AT

where:

EPC = Media-specific EPC (micrograms per kilogram [µg/kg], picocuries per kilogram [pCi/kg], or milligrams per kilogram [mg/kg] for sediment: µg/L, picocuries per liter [pCi/L], or mg/L for surface water)

ESL = Media-specific ESL (comparable units to the EPC)

AT = Media-specific Ecological AT (comparable units to the EPC)

The second step of contaminant risk characterization was to evaluate the data distribution and frequency of exceedances for each ECOPC. The number of both nondetect and detected sample concentrations greater than the ESL (concentrations at which the potential for adverse effects are unlikely) and AT values (concentrations at which the potential for adverse effects are probable) were shown as a concentration distribution curve for each ECOPC. Adverse effects are possible and cannot be excluded for sample concentrations between the ESL and AT, but it is not known if they will occur. The concentration distribution evaluation calculated the frequency of exceedance for each ECOPC and graphically displaying the individual data results relative to ESL and AT values. An example of a data concentration distribution curve is shown in Figure 5.1. An ESL frequency of exceedance effect level of 20 percent was selected as a screening criteria protective of population-level endpoints such as those identified for this assessment. If 80 percent or more of a population is not likely to be affected, then the risk is not considered biologically significant (Suter et al. 2000). This level is consistent with current EPA regulatory practices (e.g., development of the National Ambient Water Quality Criteria [NAWQC] and effluent discharges regulated by the National Pollutant Discharge Elimination System [NPDES]) and measurement limits for many field and

laboratory tests (Suter et al. 2000). Using available methods, changes in natural populations of less than 20 percent cannot generally be differentiated from background in the measurements. It was concluded that adverse effects to aquatic populations from an ECOPC were not significant if fewer than 20 percent of the samples exceeded the ESL values. For certain organic chemicals, the analytical reporting limits can vary significantly, especially for solid media analysis where the media may cause interference with the analytical method. At times the reported limit can be greater than the ESL and introduce an uncertainty into the risk characterization process. For this assessment, the organic sediment ECOPCs were evaluated to determine if reported limits do occur at levels greater than the ESL and the AT benchmarks. HQ distributions for these all ECOPCs are presented in Section 5.0 tables and differentiate between ESL exceedances by detected and nondetected concentrations.

The third step of contaminant risk characterization was to evaluate the spatial distribution of concentrations of ECOPCs, which involved mapping each measured concentration relative to the ESL. The spatial extent was evaluated to identify any potential areas that could present a localized risk to aquatic organisms. If all measured results were greater than the ESL within a habitat area, then the potential for risk could not be excluded. If, however, ESL exceedances were from samples collected in non-habitat areas (for instance, storm channels, drains or other isolated areas) or were widely dispersed, then there may be a low potential of risk. Figure 1.7 provides a delineation of true aquatic habitat settings within the site. (Note: The maps from Section 2.0 of this volume that are used for the spatial distribution evaluation are based on the CRA Methodology ESLs. For some ECOPCs, a site-specific ESL was used to calculate HQs for the first step of risk characterization. This site-specific ESL may result in HQs less than 1. Therefore, for some ECOPCs, there are exceedances of CRA Methodology ESLs shown on the map used for the spatial distribution evaluation, but there are no exceedances of site-specific ESLs in the data set.)

The fourth step of contaminant risk characterization involved the evaluation of ECOPCs in other applicable fractions of the media in order to understand current conditions or spatial extent. For surface water, a data set for "post-1999" was developed and used for comparison to the comprehensive AEU data sets where appropriate. This fraction represents more current and realistic exposure conditions to aquatic life. For sediment, surface sediment (0 to 6 inches in depth) ECOPC values were reviewed because surface sediment data are more relevant to aquatic organism exposure, the surface sediment data were reviewed for some of the ECOPCs, and the results were compared to ESLs and ATs. In addition, sediment ECOPCs were reviewed in regards to adjacent soils concentrations. This was completed because adjacent surface soils may act as a source for future sediment-related exposure conditions to aquatic receptors through future runoff and erosion. For each sediment ECOPC, an analysis of adjacent surface soil concentrations relative to sediment ESLs was completed to determine potential future risk conditions. Surface soils within 20 feet of the wetted edge of each water body were considered in this evaluation. Attachment 6 provides data summaries for the post-1999 surface water, surface sediment, and adjacent soils data.

5.2 Other/Drainage Specific Lines of Evidence

In addition to the contaminant LOEs, a second component of risk characterization was the review of conclusions from other/drainage reports and studies. The ecological setting of RFETS is a key to understanding the controlling factors other than contaminant concentrations that affect the ecology of each drainage. These LOEs consist of previously collected data from the OU 5/OU 6 Watershed Ecological Risk Assessment (ERA), ecological monitoring data, and others. These studies defined ecological conditions of the site over time and provided insight to the changes, adverse effects, or controlling factors that may have been affecting the site ecology. Each study provided a LOE describing the ecological risk setting.

Attachment 7 provides a summary of other LOEs gathered from previous studies that were conducted within RFETS and which focused on the AEUs. LOEs that can provide information regarding risk conditions to aquatic life can be derived using a number of strategies (measurement endpoints). Previous studies completed within RFETS that encompass aquatic life measurement endpoints fell within the following four categories:

- **Tissue Analyses** – Included sampling and analysis to determine bioaccumulation and bioconcentration trends;
- **Aquatic Population Studies** – Evaluated populations of benthic macroinvertebrates and fish within RFETS;
- **Bioassay Analyses** – Measured direct toxicity effects to laboratory test organisms from potentially contaminated surface water or sediment;
- **Waterfowl/Wading Bird Studies** – Determined the potential impacts to these higher trophic level receptors by assessing their potential exposure to aquatic species as food sources (recording feeding behaviors and ranges); and

Attachment 7 provides a summary of previous studies by type of LOE (i.e., tissue analyses, aquatic population studies, bioassay analyses, waterfowl/wading bird studies, and contaminant loading analyses, etc.) presented in a chronological timeframe. The methods, conclusions, and application to this CRA also are provided. A summary of findings is then presented within the risk characterization in order to draw weight-of-evidence risk conclusions.

5.3 Risk Characterization of the NW AEU

ECOPCs were identified for both surface water and sediment within the NW AEU. A contaminant risk characterization using the various LOEs was completed for these contaminants. The NW AEU has been studied by others in order to define the aquatic ecological setting. The results from these studies were compiled to formulate the other/drainage lines of evidence (Attachment 7). The combination of the contaminant risk characterization and the other/drainage LOEs provides the risk conclusions for this AEU.

This risk characterization begins with a site ecological setting description in order to provide perspective regarding the aquatic ecosystem characteristics associated with the NW AEU. The contaminant risk LOEs and the other/drainage LOEs are then described, followed by a weight-of-evidence summary of these risk descriptors.

5.3.1 Site-Specific Habitat Description

The NW AEU encompasses the watershed components associated with the North Walnut drainage. Runoff from the northern portion of the IA flows into North Walnut Creek, which has a series of retention ponds (Ponds A-1, A-2, A-3, and A-4). North Walnut Creek upstream of Pond A-4 is classified as stream Segment 5 in the Big Dry Creek basin by the Colorado Water Quality Control Commission (WQCC). North Walnut Creek has continuous flow at approximately 150 acre-feet (ac-ft) per year. These flows are likely to diminish with the removal of buildings and pavement from the IA, which will significantly reduce the volumes and peak discharge rates of runoff. Pond A-1 is isolated from North Walnut Creek by design and does not receive runoff from the IA. Historically, it was held in reserve to catch runoff in the event of a hazardous waste spill in the northern portion of the IA.

Fathead minnows (*Pimephales promelas*), a native species, are present in the A ponds and are the dominant fish species found in this AEU. A variety of non-native fish species (rainbow trout (*Salmo Gairdneri*), carp (*Cyprinus carpio*), and bass (*Micropterus sp.*) were inadvertently introduced into the Walnut Creek ponds, although these introductions have not resulted in established reproducing fish populations. Golden shiners (*Notemigonus crysoleucas*), a non-native fish, is also present in the A Ponds.

Within the Walnut Creek area, the most common aquatic macroinvertebrates are the larvae of the blackfly (*Order Diptera, Simulidae* sp.) midge (*Order Diptera, Chironomidae sp*), mayfly (*Order Ephemeroptera*) (DOE, 1997) and scuds (*Hyalella azteca*) (AAI 2003). Other species include caddisflies (*Order Trichoptera*), craneflies (*Tipulidae sp.*), and damselfly larvae (*Order Odonata*), as well as snails (*Class Gastropoda*) and other amphipods (*Order Amphipoda*). Large macroinvertebrates such as crayfish (*Order Decapoda,* Family *Cambaridae*) and snails are potentially important prey for other fish, waterfowl, and mammal species.

5.3.2 Exposure and Risk Characterization

Contaminant Risk Characterization Lines of Evidence

Tables 5.1 and 5.2 provide the HQs for the comprehensive surface water data set and the post-1999 surface water data set. Tables 5.3 and 5.4 provide the HQs for the comprehensive sediment (includes all depth fractions) and surface (0-6 inches) sediment data sets for the sediment ECOPCs, respectively. HQs derived from the ESL and AT values for each contaminant are provided for MDC, UCL, and UTL EPCs for each of the four data sets. Table 5.5 provides the frequency and magnitude of comprehensive surface water and sediment HQs based on ESLs. Concentration distributions of ECOPCs in surface water and sediment media in relation to ESLs and AT benchmarks are presented

in Figures 5.2 through 5.43. The results of the contaminant risk characterization are presented below by medium (surface water and sediment) and by contaminant.

Surface Water ECOPCs

Aluminum (Total)

The MDC for aluminum in NW AEU surface water (442 mg/L) exceeded the screening ESL (0.087 mg/L). A total of 544 samples from NW surface waters exceeded the screening ESL for aluminum. These samples were collected between July 1991 and February 2005. Although the high frequency of exceedances by detected concentrations (86 percent) suggests a potential for adverse effects, there is considerable uncertainty because the use of the chronic screening ESL for evaluation of aluminum toxicity is likely not appropriate for this site.

Aluminum toxicity in surface water is complex and the screening ESL (CDPHE 2005a, EPA 2002) is based on guidance that is not entirely appropriate for surface waters of Colorado. The EPA and the State of Colorado have recognized that total aluminum measurements often measure nontoxic clay fractions in surface water and that the true EPC would fall between the dissolved and total fraction concentrations. Therefore, CDPHE recently indicated that the acute criterion (0.750 mg/L) should be used instead of the chronic value when pH is greater than 6.9 and hardness is greater than 50 ppm, [CO basic standards work group, October 8, 2004]. Because pH and water hardness in the NW AEU meet these requirements, the acute criterion was considered the appropriate refined ESL for evaluation of aluminum toxicity. The guidance does not stipulate whether this refined value should be compared to total or dissolved aluminum; however, the total aluminum fraction was selected as a basis for comparison to the standards as a conservative measure in this assessment (Attachment 5). The UCL and UTL EPCs from the comprehensive surface water data set also exceed the refined ESL with respective HQs of 27 and 41 (Table 5.1). AT-HQs could not be calculated due to a lack of literature-derived AT values.

Aluminum was detected in 95 percent of the samples. Approximately 40 percent of the total aluminum concentrations at the site fall below the refined ESL. The data concentration distribution is provided in Figure 5.2. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.5. As shown, the detected results fell within the HQ range of ≤ 1 to > 10, and a total of 401 detected concentrations of total aluminum (59 percent) exceeded the ESL. Of these, 366 detected samples had HQs less than 5, suggesting a low potential for risk at these locations. However, 41 percent of detects had HQs greater than 5. This indicates that total aluminum concentrations occur within the range of uncertainty where there is the potential for adverse effects.

Because the true aluminum EPC falls somewhere between the total and dissolved aluminum measurements, evaluation of the magnitude and frequency of exceedances for dissolved aluminum provides a lower bound for the true potential risk. Of the 1,146 samples with detected concentrations of dissolved aluminum (1,146 detected of 1,258 samples), only 20 exceeded the refined ESL. Therefore, potential for adverse effects indicated by dissolved aluminum is low, because there is a low frequency of exceedance

of the ESL (only 2 percent). Moreover, the magnitude of exceedance was generally low, with all HQs less than 10, except for four ranging from 15 to 47. These dissolved samples exceeding the ESL represent historic samples collected between July 1991 and June 2002. While both dissolved and total fractions of aluminum in surface water exceed the ESL, it is uncertain whether the potential for adverse effects to water column organisms exists at NW AEU, because of the complexity of aluminum toxicity as it relates to pH and clay particulates in surface waters.

The spatial distribution of aluminum concentrations relative to the ESL is shown in Figure 2.28. Several locations within channel and pond areas had measured concentrations greater than the ESL. However, the majority of locations where the measured concentrations were greater than the ESL occurred outside of channel and habitat settings. The spatial distribution indicates that less than 20 percent of the measured concentrations that were greater than the ESL occur within true aquatic habitat settings. Approximately 14 of the sample locations with concentrations greater than the ESL occur within the channel and pond areas, while 24 occur within storm channels, building drain areas or isolated pockets of surface water and sediment overlapping with the IA portion of the AEU.

Review of the post-1999 (January 2000 through 2005) data set identified an MDC which is less than the AEU comprehensive data set MDC used within this assessment. ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were 31 and 63, respectively (Table 5.2).As both the MDC and UCL values in the post-1999 data were less than for the entire data distribution, it appears that current exposure conditions are similar to the historic conditions.

In summary, there is a lack of available literature from which to understand the frequency and magnitude of HQ exceedances for the true aluminum EPC (i.e., the EPC value lies between the dissolved fraction of aluminum and total aluminum). However, assessment of the frequency of exceedance for total aluminum (57 percent) and dissolved aluminum (2 percent) provide and upper (moderate potential) and lower (low potential) bound for potential for risk. Additionally, the analysis of the spatial distribution of aluminum concentrations indicates that the majority of exceedances occurred outside of channel and habitat settings. These results suggest that risk to water column organisms from exposure to aluminum is low.

Ammonia

The MDC for ammonia in NW AEU surface water (0.204 mg/L) exceeded the screening ESL (0.02 mg/L). A total of 75 detected samples from NW surface water exceeded the screening ESL for unionized ammonia. These samples were collected between July 1991 and May 1997. The high frequency of exceedances by detected concentrations (37 percent) suggests that the potential for adverse effects cannot be excluded; however, the magnitude of these exceedances were not very high (≤10).

The screening ESL for ammonia was derived from CDPHE (2005a), and represents unionized ammonia. The unionized ESL HQs for UCL and UTL EPCs from the comprehensive surface water data set were 2 and 4, respectively (Table 5.1) (the ESL was

unchanged from the screening value). The AT value for ammonia (0.15 mg/L) was the acute water quality criterion, and was pH- and temperature-adjusted using a SW AEU specific average pH of 7.6 and an estimated temperature of 20°C (Attachment 5). The AT ESL HQs for UCL and UTL EPCs were both less than 1, and for the MDC was less than 2. These HQ values indicate a low risk potential attributable to ammonia.

Ammonia was detected in 68 percent of the samples. The concentration distribution is provided in Figure 5.3. As shown in this figure, approximately 60 percent of the values fall below the ESL value, while the average concentration is slightly greater than the ESL. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.5. The detected results were within the HQ range of ≤ 1 to >10. Additionally, the frequency of exceedances by detected concentrations was moderate (37 percent). This indicates that ammonia concentrations occur within the range of uncertainty where there is the potential for adverse effects. However, the unionized ammonia ESL-based HQs are generally low (92 percent are less than 5 and 99 percent are less than 10), indicating a minimal risk potential. There also is a low frequency of exceedances (18 percent; n=37) of the AT (Figure 5.3), providing further support that an unacceptable potential for risk from ammonia in surface water at NW AEU is unlikely.

The spatial distribution of ammonia concentrations relative to the site-specific ESL is shown in Figure 2.29. Several locations within channel and pond areas had measured concentrations greater than the ESL. However, a number of locations within these same settings had measured concentrations less than the ESL or at nondetect levels. The spatial distribution of ammonia is not wide-spread nor consistently elevated as compared to the ESL. Because exceedances occurred in aquatic habitat areas, the potential for risk could not be excluded based on this LOE.

ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set could not be calculated due to the lack of available data (Table 5.2).

Evaluation of the available chemical LOEs for ammonia indicates a low magnitude of exceedance (i.e., 99 percent of HQs < 10 and MDC of only 10.02) and limited spatial extent of the occurrence of exceedances. Additionally, there is a low frequency of exceedance (i.e., < 20 percent) of the AT. Therefore, there is low potential for adverse effects to aquatic life attributable to this ECOPC.

Cadmium (Dissolved)

The MDC for cadmium (dissolved) in NW AEU surface water (0.02 mg/L) exceeded the screening ESL (0.00025 mg/L). A total of 44 samples from NW surface waters exceeded the screening ESL for cadmium. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (8 percent) suggests that potential adverse effects may not be widely distributed.

The cadmium screening ESL is hardness dependant and was calculated after CDPHE (2005a) using an estimated hardness of 100. Site specific hardness in NW AEU was determined to be 241 (Attachment 5); and, a refined ESL based on this site-specific hardness is 0.0043 mg/L. The MDC for cadmium (dissolved) still exceeded this refined

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ESL, but with a low magnitude HQ (5). ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were <1 in both cases (Table 5.1). The AT for cadmium is the acute water quality criterion. This site-specific, hardness adjusted AT value is 0.0111 mg/L. AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 2.

Cadmium was detected in 23 percent of the samples. The concentration distribution is provided in Figure 5.4. As depicted in this figure, the UTL and average fall below the refined ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the refined ESL was 11 of 533 (2 percent) (Table 5.5). Additionally, HQs for all detected samples that exceeded the refined ESL were <1. Given the low frequency and magnitude of exceedances there is a low potential for risk from cadmium to aquatic populations within the NW AEU.

The spatial distribution of cadmium relative to the site-specific refined ESL is shown in Figure 2.30. One location within the channel area exceeded this ESL. The remaining locations within the channel and pond settings were either less than the ESL or at nondetect levels. Several locations outside the aquatic habitat areas, and within the IA overlapping portion of the AEU had measured values greater than the refined ESL. These samples do not represent complete exposure pathways to aquatic receptors in the NW AEU. Because the few exceedances are generally not within aquatic habitat areas, the spatial extent of cadmium does not provide a risk concern to aquatic populations within the NW AEU.

Refined ESL-HQs for MDC, UCL, and UTL EPCs from the post-1999 surface water data set were <1 (Table 5.2). These HQ values indicate that cadmium is not a current risk to aquatic populations within the NW AEU.

Results for the available chemical LOEs for cadmium indicates that UCL and UTL EPCs do not exceed the refined ESL, there is a very low frequency and magnitude of exceedances (i.e., only 2 percent of samples exceeded the refined ESL and the all HQs were < 10), and minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the post-1999 data set do not exceed the refined ESL. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Cyanide

The MDC for cyanide in NW AEU surface water (0.146 mg/L) exceeded the screening ESL (0.0005 mg/L). A total of 24 detected samples from NW surface water exceeded the screening ESL for cyanide. These samples were collected between July 1991 and June 1995. The low frequency of exceedances by detected concentrations (16 percent) suggests that potential adverse effects may not be widely distributed. ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 26 and 44, respectively (Table 5.1). The screening ESL for cyanide was derived from CDPHE (2005a). The chronic ESL, expressed as free cyanide, was estimated from the acute screening value using an uncertainty factor of 10. This is very conservative given that total cyanide was measured at the site, and no measure of the free cyanide fraction is

available. Additionally, cyanide is not predicted to persist in aquatic environments as it readily degrades under normal conditions, with volatilization accounting for most of the free cyanide removal (Eisler, 2000). Alternative screening benchmarks presented in MacDonald et al. (1999) range from 0.003 mg/L for the District of Columbia (EPA 1988) up to 0.04473 mg/L for the Great Lakes final acute value (EPA 1992). An acute surface water benchmark value of 0.005 mg/L was considered the AT value (CDPHE 2005a). AT-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 3 and 4, respectively (Table 5.1). These characteristics are also shown in Figure 5.5.

Screening ESL HQs for individual samples ranged from < 1 to > 10 , with 95 percent of samples (detected and nondetected) exceeding the ESL (Table 5.5). In comparison, only 26 percent (38 samples) of both detected and nondetected concentrations exceeded the AT. Of these, 9 samples had HQs ranging from 1 to 5, and 16 concentrations (all detects) had HQs greater than 10. Because detection limits for cyanide at NW AEU were generally higher than the ESL, there is uncertainty regarding the potential for risk from this ECOPC. However, the conservative nature of the screening ESL (i.e., based on data for free cyanide and derived using an uncertainty factor of 10) and the low magnitude of exceedance of the AT suggest that adverse effects from cyanide in surface water at NW AEU are unlikely.

The spatial distribution of cyanide relative to the ESL is shown in Figure 2.31. One location within the channel, and three within the ponds exceeded the ESL. The remaining 12 locations within the channel and pond settings were below detection limits. Three locations outside the aquatic habitat areas (e.g., puddles), and within the IA overlapping portion of the AEU had measured values greater than the ESL. These samples do not represent complete exposure pathways to aquatic receptors in the NW AEU. Within the NW stream and associated ponds there are no concentrations of elevated cyanide that would drive the potential for risk to aquatic populations within the NW AEU.

ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data could not be calculated due to a lack of available data (Table 5.2). This lack of data precludes an analysis of the current conditions at NW AEU.

The potential risk attributable to cyanide is low given the minimal frequency of detection, low magnitude of AT exceedances (but including nondetect exceedances), and the minimal spatial extent within aquatic habitat areas that are affected by elevated concentrations. Additionally, free cyanide is not predicted to persist in aquatic environments under normal conditions. These results indicate there is low but uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Lithium (Total)

The MDC for lithium in NW AEU surface water (2.97 mg/L) exceeded the screening ESL (0.096 mg/L). A total of 56 detected samples from NW surface water exceeded the screening ESL for lithium. These samples were collected between July 1991 and June 2004. Screening ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were both about 1(Table 5.1).

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The screening ESL for lithium was derived from MIDEQ (2003). The only other screening benchmark presented in MacDonald et al. (1999) was 0.067 mg/L for the Quebec chronic surface water criterion (MDEQ 1996).This value is comparable to the MIDEQ value selected as the screening ESL. An acute surface water benchmark value of 1.7 mg/L was considered the AT value (MIDEQ 2003). AT HQs for UCL and UTL EPCs were both < 1, and the MDC HQ was 2 (Table 5.1). These HQ values indicate a low risk potential attributable to lithium.

Lithium was detected in 93 percent of the samples. The concentration distribution is provided in Figure 5.6. All of the detected values occur below the AT with one exception. The average concentration occurs below the ESL and the AT value. The UTL falls bellow the AT value. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.5. The low frequency of exceedances by detected concentrations (10 percent) suggests that potential adverse effects may not be widely distributed. Also, more than 80 percent of the samples that exceeded the screening ESL had HQs < 5. Thus, the magnitudes of exceedances were generally low. The low frequency of exceedance suggests that lithium (total) concentrations pose low risk to aquatic populations within the NW AEU.

The spatial distribution of concentrations of lithium relative to the CRA Methodology ESL is shown in Figure 2.32. Two locations within the channel and two locations within Pond A-1 had measured values greater than the ESL. The remaining sample results from 45 locations within the aquatic habitat areas were less than the ESL or at nondetect levels. Therefore, the three locations with measured values greater than the ESL represent approximately 6 percent of the data within the true aquatic habitat areas. There were several locations outside the aquatic habitat areas, and within the IA overlapping portion of the AEU had measured values greater than the ESL. These samples do not represent complete exposure pathways to aquatic receptors in the NW AEU. Therefore, there are no concentrations of elevated lithium within the NW stream and associated ponds that would drive the potential for risk to aquatic populations within the NW AEU.

ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were both less than 1, and the ESL HQ for the MDC EPC was less than 5 (Table 5.2). AT-HQs for MDC, UCL, and UTL EPCs were all less than 1. These HQs are lower than those for the entire distribution data set, and suggest that current concentrations of lithium do not pose a risk to aquatic populations.

Despite several detected exceedances of the ESL, a potential for risk to water column organisms in NW AEU from lithium is low due to the low frequency of exceedances (< 20 percent) and minimal occurrence of exceedances within aquatic habitat areas. Additionally, the UCL and UTL EPCs for the post-1999 data set do not exceed the screening ESL and the MDC ECP has a low magnitude of exceedance of the screening ESL (HQ = 4). These results suggest that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Silver (Dissolved)

The MDC for silver in NW AEU surface water (0.0324 mg/L) exceeded the screening ESL (0.00032 mg/L). A total of 29 detected samples from NW surface waters exceeded the ESL for silver. These samples were collected from July 1991 to May 2004. This low frequency of exceedances (6 percent) suggests that potential adverse effects may not be widely distributed. However, many exceedances were present in nondetect data (Table 5.5).

The silver ESL is hardness dependant and was calculated after CDPHE (2005a) using an estimated hardness of 100. Site specific hardness in NW AEU was determined to be 241 (Attachment 5); and, a refined ESL based on this site-specific hardness is 0.0015 mg/L. The MDC for silver (dissolved) still exceeded this refined ESL, but the refined ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were < 1 and 2, respectively (Table 5.1). An acute surface water benchmark value of 0.0092 mg/L was considered the AT value (CDPHE 2005a). AT-HQs from the comprehensive surface water data set were <1 in both cases. These HQ values indicate a low risk potential attributable to silver.

Silver was detected in only 9 percent of the samples indicating a minimal spatial extent. The data concentration distribution is provided in Figure 5.7. All of the detected values occurred below the AT with one exception. The average concentration is greater than the ESL, but less than the AT value. The UTL is just slightly greater than the ESL and falls bellow the AT value. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.5. Of the detected concentrations that exceeded the refined ESL, HQs were predominantly less than 5, Additionally, these exceedances of detected samples represent only 4 percent of the data set (46 of 529); therefore, this indicates that silver (dissolved) concentrations pose low risk to aquatic populations within the NW AEU.

The spatial distribution of concentrations of silver relative to the site-specific ESL is shown in Figure 2.33. Five locations within the channel and one location within both Ponds A-1 and A-4 have measured values greater than the ESL. The remaining sample results within the aquatic habitat areas were at nondetect levels. Therefore, the seven locations with measured values greater than the ESL represent approximately 18 percent of the data within the true aquatic habitat areas. Two locations outside the aquatic habitat areas and within the IA overlapping portion of the AEU had measured values greater than the ESL. Because exceedances occurred within the aquatic habitat areas, potential risk from silver cannot be excluded based on this LOE. However, the percentage of occurrences within the true aquatic habitat areas is approximately 18 percent. The remaining 82 percent occur below the ESL or were nondetects.

Refined ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were both <1 (Table 5.2). Although the UTL EPC was lower in the post-1999 data set compared to the complete distribution data set, MDC and UCL values were only slightly reduced. This suggests that current concentrations of silver within the NW AEU are relatively unchanged compared to the historic data.

Although potential risk to aquatic life in the NW AEU from silver cannot be excluded based on spatial distribution of exceedances (i.e., some exceedances occur within habitat areas) and concentrations of silver have only slightly decreased over time (i.e., post-1999 data similar to historic data), the low magnitude of exceedance and the very low frequency of exceedance (4 percent) indicate that the potential for risk is low. Additionally, the UCL EPC is lower than both the refined ESL and AT values and the UTL EPC is lower than the AT value and minimally exceeded the refined ESL (HQ = 2). These results indicate there is no or low (but uncertain) potential for adverse effects to aquatic life attributable to this ECOPC.

Vanadium (Total)

The MDC for vanadium in NW AEU surface water (0.892 mg/L) exceeded the screening ESL (0.012 mg/L). A total of 214 detected samples from NW surface water exceeded the screening ESL for vanadium. These samples were collected between July 1991 and February 2005. The moderate frequency of exceedances by detected concentrations (34 percent) suggests that potential adverse effects cannot be excluded. However, ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were only 3 and 6, respectively (Table 5.1).

The screening ESL for vanadium was derived from MIDEQ (2003). Alternative screening benchmarks presented in MacDonald et al. (1999) range from 0.007 mg/L for the Ontario provincial water quality guideline (OMOE 1994) to 0.190 mg/L for the New York State acute water quality guidance value (NYDEC 1998). The AT value represents the MIDEQ (2003) final acute value for vanadium is 0.220 mg/L. AT-HQs from the comprehensive surface water data set were <1 in both cases. These HQ values indicate a low risk potential attributable to vanadium.

Vanadium was detected in 70 percent of the samples. The concentration distribution is provided in Figure 5.8. All of the measured values occur below the AT with one exception. The average concentration is greater than the ESL, but less than the AT value. The UTL is greater than the ESL and falls bellow the AT value. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.5. As shown, the detected results fell within the HQ range of 1 to >10. This indicates that vanadium (total) concentrations occur within the range of uncertainty where there is the potential for adverse effects. Although the frequency of exceedance of detected samples is moderate (34 percent), over 60 percent of the detected exceedances have HQ values less than 5 and 100 percent have HQ values less than 10. This represents a low magnitude of frequency, suggesting low potential for risk. Additionally, only 3 detected concentrations exceeded the AT value, indicating a low potential for risk.

The spatial distribution of concentrations of vanadium relative to the CRA Methodology ESL is shown in Figure 2.34. Ten locations within the channel have measured values greater than the ESL. There were no measured values greater than the ESL within the ponds. The remaining sample results within the aquatic habitat areas inclusive of all of the ponds were less than the ESL or at nondetect levels. Therefore, the ten locations with measured values greater than the ESL represent approximately 18 percent of the data within the true aquatic habitat areas. Several locations (14) outside the aquatic habitat

areas and within the IA overlapping portion of the AEU had measured values greater than the ESL. Because exceedances occurred within the aquatic habitat areas, potential risk from vanadium cannot be excluded based on this LOE. However, the percentage of occurrences within the true aquatic habitat areas is approximately 18 percent. The remaining 82 percent occur below the ESL or were nondetects.

Refined ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were 4 and 7, respectively (Table 5.2). The MDC of the post-1999 data set was about one third the MDC for the complete distribution data set, while the UCL and UTL EPCs were slightly greater. This suggests that concentrations of vanadium within the NW AEU may be declining over time.

Evaluation of the spatial distribution of exceedances indicates that some exceedances occur within habitat areas; therefore, potential risk cannot be excluded based on this LOE. However, the magnitude of exceedances is low (predominantly HQs < 5), the UCL and UTL had low exceedance of the refined ESL (HQs $\leq$ 7) and did not exceed the AT value, and high concentrations of vanadium have decreased over time (i.e., post-1999 MDC is one half the historic MDC). These results indicate there is low potential for adverse effects to aquatic life attributable to this ECOPC.

Aroclor-1254

The MDC for Aroclor-1254 in NW AEU surface water (3.3 µg/L) exceeded the screening ESL (0.014 µg/L). All 6 detected samples (6 detected of 119 samples) from NW surface water exceeded the screening ESL for Aroclor-1254. These samples were collected between October 1991 and May 2002. The low frequency of exceedances by detected concentrations (19 percent) suggests that potential adverse effects may not be widely distributed. Screening ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 52 and 71, respectively (Table 5.1).

The screening ESL for Aroclor-1254 was derived from CDPHE (2005a). Alternate toxicity values for PCBs presented in MacDonald et al. (1999) range from 0.0000079 µg/L for the Missouri surface water criterion (EPA 1998) to 2.0 µg/L for the NAWQC acute criterion (EPA 1993). The NAWQC acute criterion was selected as the AT value. AT-HQs for UCL and UTL EPCs from the comprehensive surface water data set were both <1. Therefore, ESL-HQ values indicate a risk potential attributable to Aroclor-1254, but this risk is not indicated when the AT value is considered.

Aroclor-1254 was detected in just 5 percent of the samples. The concentration distribution is provided in Figure 5.9. All of the detected values occur below the AT (MacDonald, et al. 1999) with one exception. The average concentration is greater than the ESL, but less than the AT value. The UTL is greater than the ESL and falls bellow the AT value. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.5. The detected results all exceeded the screening ESL and all had HQs of 10 or greater. Additionally, all nondetected concentrations exceeded the screening ESL with HQs of 10 or greater. Because the detection limit exceeded the screening ESL, interpretation of the HQ data is uncertain. Comparison to

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the AT suggests a low risk potential as all, but one of the detected concentrations are below the AT value and the magnitude of the one exceedance is low (HQ = 2).

The spatial distribution of concentrations of Aroclor-1254 relative to the CRA Methodology ESL is shown in Figure 2.35. Sample results within the aquatic habitat areas inclusive of all of the ponds were at nondetected levels. Four locations outside the aquatic habitat areas and within the IA overlapping portion of the AEU had measured values greater than the ESL. Although potential risk related to the nondetected values is uncertain, the distribution data suggest that Aroclor-1254 is not a risk concern to aquatic populations within the NW AEU because no detected concentrations were observed within the aquatic habitat areas.

ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were 28 and 50, respectively (Table 5.2). The MDC of the post-1999 data set was less than one-quarter the MDC for the complete distribution data set, while the UCL and UTL EPCs were reduced to a lesser degree. These data suggest that current Aroclor-1254 concentrations within the NW AEU are lower than historic values.

The detection limit for Aroclor-1254 exceeded the screening ESL in all cases; therefore understanding potential risk from this LOE is problematic. It should also be noted that the inability to achieve a sufficient detection limit for PCBs in surface water is not considered a deficiency in the data as it is often impossible to achieve the screening ESL for PCBs due to interference. Therefore, other chemical LOEs must be considered with greater weight. First, the frequency of detection of Aroclor-1254 is quite low (5 percent) which suggests limited spatial distribution of elevated levels. Moreover, only one detected sample exceeded the AT, and the magnitude of this exceedance (HQ = 2) was low. Finally, the detected samples were not within aquatic habitat areas. These results indicate that Aroclor-1254 presents low risk to the aquatic life within NW AEU.

Radium-228

The MDC for radium-228 in NW AEU surface water (28 pCi/L) exceeded the screening ESL (0.849 pCi/L). All three samples (3 of 3 detected) from NW surface water exceeded the screening ESL for radium-228. The high frequency of exceedances by detected concentrations (100 percent) suggests that potential adverse effects cannot be excluded. These few samples, collected between October 1991 and May 1993, were inadequate for calculating a UTL95 lower than the MDC; therefore the MDC was retained as the surrogate UTL. Screening ESL-HQs for the UCL and UTL EPCs were 31 and 33, respectively (Table 5.1).

The screening ESL for radium-228 was derived from DOE (2002) using a Level 1 biota concentration guideline (BCG) for riparian animals from ResRadBiota. DOE (2002) presents a surface water organism specific BCG (Level 3) of 8.49 pCi/L (ResRadBiota v1.1 beta). All three samples also exceed this AT value, but the HQs are low (<5).

Radium-228 was detected in 100 percent of the samples. The concentration distribution is provided in Figure 5.10. All measured values fall above the ESL. The frequency and

magnitude of exceedance of the screening ESL are high (i.e., 100 percent frequency and HQs greater than 10 [ranging from 11 to 33] for individual samples) (Table 5.5). This indicates that radium-228 concentrations occur within the concentration range with the potential for adverse effects. However, the potential for adverse effects may be low because the magnitude of exceedance of the AT value was low (all HQs < 5).These trends are shown in the data concentration distribution (Figure 5.10).

The spatial distribution of concentrations of radium-228 relative to the CRA Methodology ESL is shown in Figure 2.36. Two of the three sample locations were outside the stream channel and represent non-habitat areas (e.g., off channel puddles) where exposure pathways for aquatic receptors are incomplete. These non-habitat areas were within the IA overlapping portion of the AEU. Therefore, the spatial extent of radium-228 is unknown within the NW AEU, due to few samples representing varying habitats.

No data were available from the post-1999 surface water data set to calculate more recent HQs (Table 5.2). This lack of data precludes an analysis of the current conditions at NW AEU.

In summary, the high frequency of exceedances by detected concentrations (100 percent) of radium-228 suggests that potential adverse effects cannot be excluded in NW AEU; however, potential risk is mitigated by the low magnitude of AT exceedances (HQs < 5). It should be noted that the spatial extent of radium-228 within stream habitat of NW AEU is uncertain due to the limited number of samples for this ECOPC. The conclusion based on the available chemical LOEs is that potential risk from radium-228 is low.

Sediment ECOPCs

Aluminum

The MDC for aluminum in NW AEU sediments (49,000 mg/kg) exceeded the screening ESL (15,900 mg/kg) (Table 5.3). A total of 28 of 111 samples from NW sediments exceeded the screening ESL for aluminum. All samples were detected. These samples were collected between July, 1991 and August, 2005. The relatively low frequency of exceedances (25 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 for both (Table 5.3). The AT for aluminum is the ERM value of 58,000 of Ingersoll et al. (1996), representative of a median effect level for benthic invertebrates (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 1.

Aluminum was detected in all samples. The concentration distribution is provided in Figure 5.11. As depicted in this figure, the average falls below the ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the ESL was 28 of 111 (25 percent) (Table 5.5). Additionally, HQs for all 28 samples that exceeded the refined ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from sediment aluminum to aquatic populations within the NW AEU.

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The spatial distribution of aluminum concentrations relative to the CRA Methodology ESL is shown in Figure 2.44. There were several locations within ponds A-1, A-2, A-3, and A-4 that were greater than the ESL. There were three locations within the channel greater than the ESL. The results identify a concentration of aluminum within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.1) indicated aluminum was detected at concentrations greater than the ESL at locations within the ponds. This indicates the need for further analysis of surface sediment conditions within the ponds which is provided below and within Attachment 8.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of aluminum in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicates that the MDC (27,400 mg/kg) is greater than the ESL but less than the AT.

The adjacent surface soil results (Attachment 6) included 119 samples for aluminum, all detected, with an MDC of 28,000 mg/kg. The MDC exceeded the ESL but not the AT.

Aluminum was identified as a surface water ECOPC. Results of the risk characterization suggest that risk to water column organisms from exposure to aluminum is low.

Aluminum was identified as an ECOPC for the pond-specific evaluations of Ponds A-1, A-2, A-3 and A-4. Results of the risk characterization by pond indicate the following;

For Pond A-1, the surface sediment HQ for the ESL is 2, which is within the HQ range where adverse effects are uncertain. The surface sediment HQ for the AT is <1.

Review of the data on a point by point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-1, five of the eight locations had measured values greater than the ESL, the remaining were less than the ESL. Because the measured concentrations all fall below these AT values, the likelihood for risk attributable to aluminum within Pond A-1 would be low.

For Pond A-2, the surface sediment HQ for the ESL is 2, which is within the HQ range where adverse effects are uncertain. The surface sediment HQ for the AT was <1. Review of the data on a point by point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-2, three of the seven locations had measured values greater than the ESL, the remaining were less than the ESL. Because the measured concentrations fall below the AT value, the likelihood for risk attributable to aluminum within Pond A-1 is low.

For Pond A-3, the surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is <1. Review of the data on a point by point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-3, seven of the eight locations had measured values greater than the ESL, the remaining were less than the ESL. Because the

measured concentrations fall below the AT values, the likelihood for risk attributable to aluminum would be low.

For Pond A-4, the surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is <1. Review of the data on a point by point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-4, six of the nine locations had measured values greater than the ESL, the remaining were less than the ESL. Because the measured concentrations fall below these AT values, the likelihood for risk attributable to aluminum is low.

Results for the available chemical LOEs for aluminum indicates that UCL and UTL EPCs do not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 25 percent of samples exceeded the refined ESL and the all HQs were < 5). Aluminum had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Aluminum is an almost universally-present constituent of background soils. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Antimony

The MDC for antimony in NW AEU sediments (41.4 mg/kg) exceeded the screening ESL (2 mg/kg) (Table 5.3). A total of 8 samples (15 detected of 98 samples) from NW sediments exceeded the screening ESL for antimony. These samples were collected between July 1991 and August, 2005. The low frequency of exceedances by detected concentrations (8 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were >1 in both cases (Table 5.3). The AT for antimony is the 3.2 mg/kg, a screening-level criterion (NYSDEC 1994) (Attachment 5). AT HQs for UCL and UTL EPCs were 5 and 13 respectively.

Antimony was detected in 15 percent of the samples. The concentration distribution is provided in Figure 5.12. As depicted in this figure, the UTL and average falls below the refined ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 8 of 98 (8 percent) (Table 5.5). Given the low frequency and magnitude of exceedance there is a low potential for risk from antimony to aquatic populations within the NW AEU.

The spatial distribution of antimony concentrations relative to the CRA Methodology ESL is shown in Figure 2.45. There were several locations within Ponds A-1 (2 locations), A-3 (1 location), and A-4 (3 locations) that had concentrations greater than the ESL. Two locations within the channel had values greater than the ESL. The eight locations with measured values greater than the ESL represent approximately 18 percent of the data within the true aquatic habitat areas. The remaining 82 percent occur below the ESL or were nondetects. The results identify a concentration of antimony within

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habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.2) indicated antimony was below detection limit levels in ponds A-1, A-2 and A-3. Within Pond A-4, there was one location with a measured concentration greater than the ESL, one location less than the ESL and five locations at nondetect levels. This indicates that the spatial extent of antimony is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of antimony in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (41.4 mg/kg) is greater than the ESL and the AT (Table 5.4).

Antimony was not identified as an ECOPC for surface water since it had an MDC less than the ESL.

Antimony was identified as an ECOPC for the pond-specific evaluations of ponds A-3 and A-4. However, further analysis of Pond A-3 indicated antimony had a frequency of detection of 26 percent (detected in 1 of 7 samples collected) indicating a limited spatial extent. The surface sediment HQ for the ESL is 13. The surface sediment HQ for the AT is 8.

Because the measured concentration falls below the AT value, the likelihood for risk attributable to antimony for Pond A-3 is low. For Pond A-4 antimony had a frequency of detection of 25 percent (detected in 4 of 12 samples collected) indicating a limited spatial extent. The surface sediment HQ for the ESL is 21. The surface sediment HQ for the AT is 13. Review of the data on a point by point basis indicated that there was a single measured antimony result that was greater than the ESL, while the remaining six locations had either a measured concentration less than the ESL or were at nondetect levels. Because the measured concentrations fall below AT values, the likelihood for risk attributable to antimony is low.

Results for the available chemical LOEs for antimony indicates that there is a very low frequency and magnitude of exceedances (i.e., only 8 percent of samples exceeded the ESL). Antimony had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Barium

The MDC for barium in NW AEU sediments (390 mg/kg) exceeded the screening ESL (189 mg/kg). A total of 22 samples from NW sediments exceeded the screening ESL for barium. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (20 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 in both cases (Table 5.3). The AT for barium is 287, an average toxicity value from MacDonald et al. (1999) (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 1.

Barium was detected in all of the samples. The concentration distribution is provided in Figure 5.13. As depicted in this figure, the average falls below the ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the ESL was 22 of 111 (20 percent) (Table 5.5). Additionally, HQs for all 22 samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from barium to aquatic populations within the NW AEU.

The spatial distribution of barium concentrations relative to the CRA Methodology ESL is shown in Figure 2.46. There were several locations within ponds A-1, A-2, A-3, and A-4 that were greater than the ESL. There were two locations within the channel greater than the ESL. The total number of results with measured values greater than the ESL within true aquatic habitat areas represents approximately 28 percent of the data. The remaining 72 percent of the results were either below the ESL or nondetect. The results identify a concentration of barium within habitat areas that requires further evaluation. The results presented within this figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.3) indicated barium was below the ESL in ponds A-1 and A-3, while only two locations within Pond A-2 and one location within Pond A-4 had concentrations greater than the ESL. The remaining locations in ponds A-2 and A-4 were less than the ESL. This indicates that the spatial extent of barium is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of barium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations of barium for all of the NW AEU indicate that the MDC (260 mg/kg) is greater than the ESL but less than the AT.

The adjacent surface soil results included 119 samples for barium, all detected, with an MDC of 263 mg/kg (Attachment 6). The MDC exceeded the ESL but not the AT.

Barium was not identified as an ECOPC for surface water since it had an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that barium does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for barium indicate that UCL and UTL EPCs do not exceed the refined ESL, there is a low frequency and magnitude of exceedances (i.e., only 20 percent of samples exceeded the ESL and the all HQs were < 5). Barium had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Therefore,

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the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Cadmium

The MDC for cadmium in NW AEU sediments (8.3 mg/kg) exceeded the screening ESL (0.99 mg/kg). A total of 18 samples (48 detected of 110 samples) from NW sediments exceeded the screening ESL for cadmium. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (16 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 for the UTL and 1 for the UCL (Table 5.3). The AT for cadmium is a consensus-based, probably effects concentration from MacDonald et al. (2000a) (PEC) of 4.98 mg/kg (Attachment 5). AT HQs for UCL and UTL EPCs were both < 1 and the AT HQ for the MDC was < 2.

Cadmium was detected in 44 percent of the samples. The concentration distribution is provided in Figure 5.15. HQs for all 18 detected samples that exceeded the ESL were between 1 and 10. Given the low frequency and magnitude of exceedance there is a low potential for risk from cadmium to aquatic populations within the NW AEU.

The spatial distribution of cadmium concentrations relative to the CRA Methodology ESL is shown in Figure 2.47. There were several locations within ponds A-1 (2 locations), A-2 (2 locations), and Pond A-4 (1 location) that had cadmium concentrations greater than the ESL. Three locations within the channel had values greater than the ESL. The eight locations with measured values greater than the ESL represent approximately 15 percent of the locations within the true aquatic habitat areas. The remaining 85 percent occur below the ESL or were nondetects. The remaining locations with concentrations greater than the ESL occurred outside of true aquatic habitat areas. The results identify a concentration of cadmium within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.5) indicated cadmium was below the ESL in Ponds A-2 and A-3, while only one location within Pond A-1 and one location within Pond A-4 had concentrations greater than the ESL. The remaining locations were less than the ESL or at nondetect levels. This indicates that the spatial extent of cadmium is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of cadmium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (4.4 mg/kg) is greater than the ESL but less than the AT.

The adjacent surface soil results included 117 samples for cadmium, 43 detected, with an MDC of 10.6 mg/kg (Attachment 6). The MDC exceeded both the ESL and the AT.

Cadmium (dissolved) was identified as a surface water ECOPC. Results of the risk characterization indicate that cadmium (dissolved) was detected in 23 percent of the samples. The UTL and average fall below the refined ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the refined ESL was 44 of 533 (2 percent). HQs for all 44 detected samples that exceeded the refined ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from cadmium to aquatic populations within the NW AEU.

Cadmium was identified as an ECOPC for the pond-specific evaluations of Pond A-4. However, the surface sediment HQ for the ESL is 3. The surface sediment HQ for the AT is 1. Review of the data on a point by point basis indicated that there was a single measured cadmium result that was greater than the ESL, while the remaining six locations had either measured concentrations less than the ESL or were at nondetect levels. Given the limited spatial extent of exceedance the risk attributable to cadmium within Pond A-4 is low.

Results for the available chemical LOEs for cadmium indicates that UTL EPCs do not exceed the refined ESL, there is a low frequency and magnitude of exceedances (i.e., only 16 percent of samples exceeded the ESL, and the all except one HQs were < 5). Cadmium had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Copper

The MDC for copper in NW AEU sediments (77.6 mg/kg) exceeded the screening ESL (31.6 mg/kg). A total of 7 samples (109 detected of 111 samples) from NW sediments exceeded the screening ESL for copper. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (6 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 in both cases (Table 5.3). The AT (PEC) for copper (149 mg/kg) is a PEC from MacDonald et al. (2000a). AT HQs for UCL , UTL, and MDC EPCs were < 1.

Copper was detected in 98 percent of the samples. The concentration distribution is provided in Figure 5.15. As depicted in this figure, the average falls below the ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the ESL was 7 of 111 (6 percent) (Table 5.5). Additionally, HQs for all 7 detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from copper to aquatic populations within the NW AEU.

The spatial distribution of copper concentrations relative to the CRA Methodology ESL is shown in Figure 2.48. There were several locations within ponds A-1 (3 locations), A-2 (2 locations), and Pond A-4 (1 location) that had copper concentrations greater than the ESL. The remaining locations with concentrations greater than the ESL occurred outside

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of true aquatic habitat areas. The seven locations with measured values greater than the ESL represent approximately 10 percent of the data within the true aquatic habitat areas. The remaining 90 percent occur below the ESL or were nondetects. The results identify a concentration of copper within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.7) indicated copper was below the ESL in ponds A-1, A-2 and A-3, while only one location within Pond A-4 had a concentration greater than the ESL. The remaining locations were less than the ESL. This indicates that the spatial extent of copper is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of copper in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicates that the MDC (77.6 mg/kg) is greater than the ESL but less than the AT, and the arithmetic average (18.7 mg/kg) is less than the ESL and AT (Attachment 6).

The adjacent surface soil results included 119 samples for copper, 117 detected, with an MDC of 1,340 mg/kg (Attachment 6). The MDC exceeded both the ESL and the AT.

Copper (dissolved) was detected in surface water in 100 of 233 samples, and was eliminated from the surface water ECOPC process due being statistically similar to background levels. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that copper does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for copper indicates that UCL and UTL EPCs do not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 6 percent of samples exceeded the ESL and the all HQs were < 5). Copper had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Fluoride

The MDC for fluoride in NW AEU sediments (16.72 mg/kg) exceeded the screening ESL (0.01 mg/kg). All detected samples (12 detected of 21 samples) from NW sediments exceeded the screening ESL. These samples were collected between July 1991 and March 2004. The high frequency of exceedances by detected (and all nondetected) concentrations suggests that potential adverse effects can not be excluded.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were >1 in both cases (Table 5.3). The AT for fluoride (7 mg/kg) is a Toxic Effect Threshold (TET) at 1 percent OC (Bolton et al., 1985) (Attachment 5). AT HQ for the UCL EPC was < 1 and the AT HQ for the MDC was < 2.

Fluoride was detected in 57 percent of the samples. The concentration distribution is provided in Figure 5.16. As depicted in this figure, all data are above the ESL. The frequency of exceedance for the ESL was 57 percent (Table 5.5). Additionally, HQs for all detected samples that exceeded the ESL were > 10. Given the high frequency and magnitude of exceedance there is a potential for risk from fluoride to aquatic populations within the NW AEU.

The spatial distribution of fluoride concentrations relative to the CRA Methodology ESL is shown in Figure 2.49. The results indicate a spatial distribution of fluoride throughout the IA overlapping portion of the NW AEU that has measured concentrations at both the nondetect, and greater than the ESL levels. There were four locations within channel with measured levels greater than the ESL.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of fluoride in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (16.72 mg/kg) is greater than the ESL and the AT, but the arithmetic average (3.3 mg/kg) is less than the AT (Attachment 6).

The adjacent surface soil results did not yield samples for fluoride (Attachment 6).

Fluoride was detected in surface water in 160 of 194 samples, and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that fluoride does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for fluoride indicates that UCL and UTL EPCs exceed the ESL and AT and the all ESL HQs were > 10. Fluoride had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion, based on ambient chemistry alone, is that there is low to uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Iron

The MDC for iron in NW AEU sediments (55,000 mg/kg) exceeded the screening ESL (20,000 mg/kg). A total of 28 samples (all detected of 111 samples) from NW sediments exceeded the screening ESL for iron. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (25 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for the UCL EPC from the comprehensive sediment data set was 1 for the UTL, and <1 for the UCL(Table 5.3). The AT for iron (280,000 mg/kg) is an effects range moderate (ERM) from Ingersoll et al. (1996) (Attachment 5). AT HQs for UCL and UTL EPCs and MDC were all < 1.

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Iron was detected in all of the samples. The concentration distribution is provided in Figure 5.17. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 28 of 111 (25 percent) (Table 5.5). Additionally, HQs for all 28 detected samples that exceeded the ESL were between 1 and 5. Given the relatively low frequency and magnitude of exceedance there is a low potential for risk from iron to aquatic populations within the NW AEU.

The spatial distribution of iron concentrations relative to the CRA Methodology ESL is shown in Figure 2.50. There were several locations within ponds A-1 (6 locations), A-2 (3 locations), A-3 (7 locations), and A-4 (3 locations) that iron concentrations greater than the ESL. There were five locations within the channel with concentrations greater than the ESL. The locations with measured values greater than the ESL represent approximately 45 percent of the data within the true aquatic habitat areas. The remaining 55 percent occurs below the ESL. The remaining locations with concentrations greater than the ESL (2 locations) occurred outside of true aquatic habitat areas. The results identify a concentration of iron within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.8) indicated iron had three locations within Pond A-1, two within ponds A-2 and A-4, and one location within Pond A-3 with concentrations greater than the ESL. This indicates the need for further analysis of iron risk conditions within surface sediment of pond areas. This information is provided below and described within Attachment 8.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of iron in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (37,100 mg/kg) is greater than the ESL but less than the AT, and the arithmetic average is less than the ESL and AT .

The adjacent surface soil results included 119 samples for iron, all detected, with an MDC of 130,000 mg/kg. The MDC exceeded the ESL but not the AT. Average soil iron values were lower than ESL and AT levels (Attachment 6).

Iron was detected in surface water in 166 of 239 samples, and was eliminated from the surface water ECOPC process due being statistically similar to background levels.

Iron was not identified as an ECOPC for the pond-specific risk evaluations of Ponds A-1, A-2, A-3, A-4, and A-5 (Attachment 8) since surface sediment HQs were equal to 1. In addition, measured values were typically found within the range of background. This indicates that iron does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for iron indicates that UCL EPC does not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 25 percent of samples exceeded the ESL and the all HQs were < 5), iron had spatial

exceedances within aquatic habitat areas, however further analysis indicated the risk potential to be low. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Iron is an almost universally-present constituent of background soils. The weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Lead

The MDC for lead in NW AEU sediments (234 mg/kg) exceeded the screening ESL (35.8 mg/kg). A total of 12 samples (all detected of 111 samples) from NW sediments exceeded the screening ESL for lead. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (11 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQ for UCL EPC from the comprehensive sediment data set was < 1 and UTL only slightly over 1 (Table 5.3). The AT for lead is a PEC value of 128 mg/kg (MacDonald et al. 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 2.

Lead was detected in all of the samples. The concentration distribution is provided in Figure 5.18. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 12 of 111 (11 percent)(Table 5.5). Additionally, HQs for 12 detected samples that exceeded the ESL were between 1 and 10 . Given the low frequency and magnitude of exceedance there is a low potential for risk from lead to aquatic populations within the NW AEU.

The spatial distribution of lead concentrations relative to the CRA Methodology ESL is shown in Figure 2.51. There were several locations within Pond A-1 (2 locations), and one location within Pond A-2 and Pond A-4 that had lead concentrations greater than the ESL. Two locations within the channel had concentrations greater than the ESL. The remaining locations with concentrations greater than the ESL occurred outside of true aquatic habitat areas. The locations with measured values greater than the ESL represent approximately 11 percent of the data within the true aquatic habitat areas. The remaining 89 percent occurs below the ESL. The results identify a concentration of lead within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.9) indicated lead was below the ESL in ponds A-1, A-2 and A-3, while only one location within Pond A-4 had a concentration greater than the ESL. The remaining locations were less than the ESL. This indicates that the spatial extent of lead is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of lead in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (234 mg/kg) is greater than the ESL and AT, but the arithmetic average is less than both the ESL and AT.

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The adjacent surface soil results included 119 samples for lead, all detected, with an MDC of 283 mg/kg (Attachment 6). The MDC exceeded both the ESL and AT.

Lead was detected in surface water in 77 of 245 samples, and was eliminated from the surface water ECOPC process due being statistically similar to background levels. In addition, lead was not identified as an ECOPC for the pond-specific risk evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) since surface sediment HQs were equal to 1.

Results for the available chemical LOEs for lead indicates that the UCL EPC does not exceed the ESL and there is a very low frequency and magnitude of exceedances (i.e., only 11 percent of samples exceeded the ESL and almost all HQs were < 5). Lead had minimal occurrence of exceedances within aquatic habitat areas. However, the MDC, UCL, and UTL EPCs for the surface sediment data set all exceed the ESL. Therefore, the weight-of evidence conclusion is that there is a low and uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Manganese

The MDC for manganese in NW AEU sediments (1,760 mg/kg) exceeded the screening ESL (630 mg/kg). A total of 10 samples (all detected of 111 samples) from NW sediments exceeded the screening ESL for manganese. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (9 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for the UCL EPC from the comprehensive sediment data set was < 1, but was slightly greater than 1 for the UTL (Table 5.3). The AT for manganese (1,700 mg/kg) is a PEC benchmark (MacDonald et al. 2000a). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 2.

Manganese was detected in all of the samples. The concentration distribution is provided in Figure 5.19. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 10 of 111 (9 percent) (Table 5.5). Additionally, HQs for all 10 detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from manganese to aquatic populations within the NW AEU.

The spatial distribution of manganese concentrations relative to the CRA Methodology ESL is shown in Figure 2.52. There were two locations within Pond A-2 and one location within Pond A-1 and Pond A-4 that had manganese concentrations greater than the ESL. There were five locations within the channel area with concentrations greater than the ESL. The remaining locations all had measured levels less than the ESL. The locations with measured values greater than the ESL represent approximately 15 percent of the data within the true aquatic habitat areas. The remaining 85 percent occurs below the ESL. The results identify a concentration of manganese within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all

sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.10) indicated manganese was below the ESL in ponds A-1, A-3 and A-4, while only two locations within Pond A-2 had concentrations greater than the ESL. The remaining locations were less than the ESL. This indicates that the spatial extent of manganese is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of manganese in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicates that the MDC (1,760 mg/kg) is greater than the ESL but almost exactly the same as the AT, and the arithmetic average is less than both the ESL and AT.

The adjacent surface soil results included 119 samples for lead, all detected, with an MDC of 283 mg/kg. The MDC exceeded both the ESL and AT. However, average soil lead values were lower than ESL and AT levels (Attachment 6).

Manganese was detected in surface water in 211 of 250 samples, and was eliminated from the surface water ECOPC process due to having an UTL less than the ESL.

Manganese was identified as an ECOPC for the pond-specific evaluation of Pond A-2. However, further analysis of Pond A-2 surface sediment found manganese to have a surface sediment HQ for the ESL of 2, while the HQ for the AT is 1. In addition, the MDC for manganese was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to manganese is low and within the range of background.

Results for the available chemical LOEs for manganese indicates that the UCL EPC does not exceed the ESL and there is a very low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and the all HQs were < 5). Manganese had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Mercury

The MDC for mercury in NW AEU sediments (0.47 mg/kg) exceeded the screening ESL (0.18 mg/kg). A total of 8 samples (43 detected of 102 samples) from NW sediments exceeded the screening ESL for mercury. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (8 percent) suggests that potential adverse effects may not be widely distributed.

The ESL-HQ for the UCL EPC from the comprehensive sediment data set was < 1 while the UTL HQ was only 1.2 (Table 5.3). The AT for mercury is a PEC of 1.06 mg/kg (MacDonald et al. 2000a)(Attachment 5). AT HQs for the UCL and UTL EPCs and MDC were < 1.

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Mercury was detected in 42 percent of the samples. The concentration distribution is provided in Figure 5.20. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 8 of 102 (8 percent) (Table 5.5). Additionally, HQs for all 8 detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from mercury to aquatic populations within the NW AEU.

The spatial distribution of mercury concentrations relative to the CRA Methodology ESL is shown in Figure 2.53. There were six locations within Pond A-1 and one location within the channel that had mercury concentrations greater than the ESL. The remaining locations all had measured levels less than the ESL or at nondetect levels. The locations with measured values greater than the ESL represent approximately 13 percent of the data within the true aquatic habitat areas. The remaining 87 percent occur below the ESL or were nondetects. The results identify a concentration of mercury within habitat areas (Pond A-1) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.11) indicated mercury was below the ESL in Pond A-1 at three locations, and above the ESL at one location. This indicates that the spatial extent of mercury is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of mercury in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (0.47 mg/kg) is less than the AT, and the arithmetic average is less than both the ESL and AT.

The adjacent surface soil results included 118 samples for mercury, 76 detected, with an MDC of 1.1 mg/kg. The MDC exceeded the ESL but was approximately the same as the AT (Attachment 6).

Mercury was detected in surface water in 25 of 243 samples, and was eliminated from the surface water ECOPC process due to having an MDC less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that mercury does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for mercury indicate that the UCL EPC does not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 8 percent of samples exceeded the ESL and the all HQs were < 5), and mercury had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Nickel

The MDC for nickel in NW AEU sediments (34 mg/kg) exceeded the screening ESL (22.7 mg/kg). A total of 14 detected samples (102 detected of 111 samples) from NW sediments exceeded the screening ESL for nickel. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (13 percent) suggests that potential adverse effects may not be widely distributed.

The ESL-HQs for UCL EPC from the comprehensive sediment data set was < 1 and the ESL-HQ for UTL was only 1.1 (Table 5.3). The AT for nickel is a PEC of 48.6 mg/kg (MacDonald et al., 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs and the MDC were < 1.

Nickel was detected in 92 percent of the samples. The concentration distribution is provided in Figure 5.21. As depicted in this figure, the average falls below the refined ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 14 of 111 (13 percent) (Table 5.5). Additionally, HQs for all 14 detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from nickel to aquatic populations within the NW AEU.

The spatial distribution of nickel concentrations relative to the CRA Methodology ESL is shown in Figure 2.54. There were several locations within ponds A-1, A-2 (2 locations), and A-4 (2 locations), and one location within Pond A-3 that had nickel concentrations greater than the ESL. There were three locations within the channel area with concentrations greater than the ESL. The remaining locations all had measured levels less than the ESL or at nondetect levels. The locations with measured values greater than the ESL represent approximately 19 percent of the data within the true aquatic habitat areas. The remaining 81 percent occur below the ESL or were nondetects. The results identify a concentration of nickel within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.12) indicated nickel was below the ESL in ponds A-1, A-2 and A-3, while only one location within Pond A-4 had a concentration greater than the ESL. The remaining locations were less than the ESL or nondetect. This indicates that the spatial extent of nickel is of low risk to aquatic populations within the isolated habitat areas.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of nickel in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (31.6 mg/kg) is greater than the ESL but less than the AT, and the arithmetic average is less than the ESL and AT.

The adjacent surface soil results included 119 samples for nickel, 116 detected, with an MDC of 64 mg/kg. The MDC exceeded the ESL and AT (Attachment 6).

Nickel was detected in surface water in 66 of 243 samples, and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that nickel does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for nickel indicates that the UCL EPC does not exceed the ESL and there is a very low frequency and magnitude of exceedances (i.e., only 13 percent of samples exceeded the ESL and the all HQs were < 5). Nickel had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Selenium

The MDC for selenium in NW AEU sediments (2.4 mg/kg) exceeded the screening ESL (0.95 mg/kg). A total of 17 detected samples (29 detected of 110 samples) from NW sediments exceeded the screening ESL for selenium. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (15 percent) suggests that potential adverse effects may not be widely distributed.

The ESL-HQ for the UCL EPC from the comprehensive sediment data set were < 1 and the UTL HQ was only 1.9 (Table 5.3). The AT for selenium is a median-effect level SQG of 1.73 mg/kg (MacDonald et al. 1999) (Attachment 5). AT HQs for UCL and UTL EPCs were 1 or < 1 and the AT HQ for the MDC was < 2.

Selenium was detected in 26 percent of the samples. The concentration distribution is provided in Figure 5.22. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 17 of 110 (15 percent) (Table 5.5). Additionally, HQs for all 17 detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from selenium to aquatic populations within the NW AEU.

The spatial distribution of selenium concentrations relative to the CRA Methodology ESL is shown in Figure 2.55. There were several locations within Ponds A-1 (2 locations),and A-4 (3 locations), and one location within Pond A-3 that had selenium concentrations greater than the ESL. There were four locations within the channel area with concentrations greater than the ESL. The remaining locations all had measured levels less than the ESL or at nondetect levels. The locations with measured values greater than the ESL represent approximately 17 percent of the data within the true aquatic habitat areas. The remaining 83 percent occur below the ESL or were nondetects. The results identify a concentration of selenium within habitat areas that requires further

evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.13) indicated selenium was at nondetect levels for ponds A-2 and A-3. Pond A-1 had two locations, and Pond A-4 had three locations within surface sediment with results greater than the ESL. The remaining locations within these ponds were at nondetect levels. The results indicate the need for further evaluation of surface sediment related risk conditions attributable to selenium (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of selenium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (2.4 mg/kg) is greater than the ESL and AT, but the arithmetic average is less than the ESL and AT.

The adjacent surface soil results included 119 samples for selenium, 4 detected, with an MDC of 0.75 mg/kg. The MDC did not exceed the ESL or AT. In addition, average soil selenium values (0.34 mg/kg) were lower than ESL and AT levels (Attachment 6).

Selenium (total) was identified as a surface water ECOPC. Selenium was detected in 42 percent of the samples. All of the measured values occur below the AT with few exceptions. The UTL is also just slightly greater than the ESL and falls bellow the AT value. The low frequency of exceedances by detected concentrations (15 percent) suggests that potential adverse effects may not be widely distributed. Also, more than 97 percent (35 of 36) of the detected samples that exceeded the screening ESL had HQs < 5 and the HQ for the remaining detected exceedance was less than 5 (Table 5.5). Thus, the magnitude of exceedance was generally low. The low frequency and magnitude of exceedance, suggests that selenium (total) concentrations pose low risk to aquatic populations within the NW AEU.

Selenium was identified as an ECOPC for the pond-specific evaluations of Ponds A-1, A-3, and A-4. Results of each pond evaluation are as follows:

For Pond A-1, selenium had a frequency of detection of 27 percent (detected in 3 of 11 samples) indicating minimal spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT was 1. The MDC for selenium was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to selenium would be low and within the range of background.

For Pond A-3, selenium had a frequency of detection of 13 percent (detected in 1 of 8 samples) indicating a minimal spatial extent of occurrence. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. Selenium had a low frequency of detection indicating a minimal exposure potential exists for aquatic receptors. The combined lines of evidence indicate that the risk attributable to selenium is low.

For Pond A-4, selenium had a frequency of detection of 20 percent (detected in 3 of 12 samples) indicating a minimal spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The MDC for selenium was within the range of background values. The combined lines of evidence indicate that the risk attributable to selenium is low and within the range of background.

Results for the available chemical LOEs for selenium indicates that the UCL EPC does not exceed the ESL and there is a very low frequency and magnitude of exceedances (i.e., only 15 percent of samples exceeded the ESL and the all HQs were < 5). Selenium had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the UCL for the sediment data set does not exceed the AT. Therefore, the weight-of evidence conclusion is that there is low and uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Silver

The MDC for silver in NW AEU sediments (5 mg/kg) exceeded the screening ESL (1 mg/kg). A total of 7 detected samples (16 detected of 106 samples) from NW sediments exceeded the screening ESL for silver. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (7 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were < 2 in both cases (Table 5.1). The AT for silver is a TNRCC reservoir guideline, distribution-based benchmark of 1.6 mg/kg (TNRCC 1996 reported in MacDonald et al. 1999) (Attachment 5). The AT HQs for UCL and UTL was < 1 and the AT HQ for the MDC was < 4.

Silver was detected in 15 percent of the samples. The concentration distribution is provided in Figure 5.23. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 7 of 106 (7 percent). Additionally, HQs for all 7 detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from silver to aquatic populations within the NW AEU.

The spatial distribution of silver concentrations relative to the CRA Methodology ESL is shown in Figure 2.56. There was one location within Pond A-1 and Pond A-2, and two locations within the channel with concentrations greater than the ESL. The remaining locations all had measured levels less than the ESL or at nondetect levels. The locations with measured values greater than the ESL represent approximately 8 percent of the data within the true aquatic habitat areas. The remaining 92 percent occur below the ESL or were nondetects. The results identify a concentration of silver within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.14) indicated silver was below the ESL or at nondetect levels for all of the A-series ponds. This spatial extent of silver does not indicate a potential for risk to benthic populations within the NW AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of silver in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (5 mg/kg) is greater than the ESL and AT, and the arithmetic average is less than the ESL and AT. This indicates that realistic exposure conditions are within the uncertain toxicity range but comparable to the ESL, indicating a low risk to aquatic populations.

The adjacent surface soil results included 119 samples for silver, 50 detected, with an MDC of 21.1 mg/kg. The MDC exceeds the ESL or AT (Attachment 6).

Silver was identified as an ECOPC for surface water. Results of the risk characterization indicated that silver was detected in only 9 percent of the samples indicating a minimal spatial extent. All of the detected values occurred below the AT with one exception. The UTL is just slightly greater than the ESL and falls bellow the AT value. Of the detected concentrations that exceeded the refined ESL, HQs were predominantly less than 5 (more than 80 percent), just 3 were between 1 and 5 and 1 was > 10. Additionally, these exceedances of detected samples represent only 4 percent of the data set; therefore, this indicates that silver (dissolved) concentrations pose low risk to aquatic populations within the NW AEU.

Silver was not identified as an ECOPC for the pond-specific evaluations of Ponds A-1, A-2, A-3, A-4, and A-5 (Attachment 8) indicating that silver does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for silver indicates that UCL and UTL EPCs both exceed the ESL, and there is a very low frequency and magnitude of exceedances (i.e., only 7 percent of samples exceeded the ESL and the all HQs were < 5). Silver had minimal occurrence of exceedances within aquatic habitat areas. The MDC, UCL, and UTL EPCs for the surface sediment data slightly exceed the refined ESL, but not the AT. Therefore, the weight-of evidence conclusion is that there is low and uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Zinc

The MDC for zinc in NW AEU sediments (704 mg/kg) exceeded the screening ESL (121 mg/kg). A total of 34 samples (all detected of 111 samples) from NW sediments exceeded the screening ESL for zinc. These samples were collected between July 1991 and March 2004. The relatively frequency of exceedances by detected concentrations (31 percent) suggests that adverse effects can not be excluded.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were > 1 in both cases (Table 5.3). The AT for zinc is a consensus-based PEC of 459 mg/kg (MacDonald et al. 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was 2.

Zinc was detected in all samples. The concentration distribution is provided in Figure 5.24. As depicted in this figure, the average falls below the ESL value, as does the

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majority of the data. Specifically, the frequency of exceedance for the ESL was 34 of 111 (31 percent) (Table 5.5). Additionally, HQs for all 34 detected samples that exceeded the ESL were between 1 and 10. Given the medium frequency and magnitude of exceedance, there is a small potential for risk from zinc to aquatic populations within the NW AEU.

The spatial distribution of zinc concentrations relative to the CRA Methodology ESL is shown in Figure 2.57. There were several locations within Ponds A-1 (6 locations), A-2 (2 locations) and A-3 (7 locations), and one location within Pond A-4 that had zinc concentrations greater than the ESL. There were twelve locations within the channel area with concentrations greater than the ESL. The remaining locations all had measured levels less than the ESL. The locations with measured values greater than the ESL represent approximately 62 percent of the data within the true aquatic habitat areas. The remaining 38 percent occur below the ESL. The results identify a concentration of zinc within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the ponds within the A-series (Figure A8.15) indicated zinc was detected at two locations within Pond A-1, and one location each within ponds A-3 and A-4 at concentrations greater than the ESL. All measured values from within Pond A-2 were less than the ESL. Results of the spatial analysis of zinc in pond surface sediment indicate the need for further analysis which is provided below and within Attachment 8.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of zinc in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the NW AEU indicate that the MDC (704 mg/kg) is greater than the ESL and AT, and the arithmetic average is less than the ESL and AT.

The adjacent surface soil results included 119 samples for zinc, all detected, with an MDC of 1,600 mg/kg. The MDC exceeds the ESL and AT. However, average soil zinc values (122 mg/kg) were the same as the ESL and lower than AT levels (Attachment 6).

Zinc was detected in surface water in 150 of 244 samples, and was eliminated from the surface water ECOPC process due being statistically similar to background levels.

Zinc was identified as an ECOPC for the pond-specific evaluations of Pond A-3 . However, further analysis of Pond A-3 surface sediment found the surface sediment HQ for the ESL is 4, while the HQ for the AT is 1. All of the measured zinc concentrations occurred at or below the AT value indicating low risk. In addition, the MDC for zinc was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background.

Results for the available chemical LOEs for zinc indicate that the UCL and UTL EPCs exceed the ESL and there is a medium frequency and magnitude of exceedances (with some HQs > 5). Zinc had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the UCL, and UTL EPCs for the surface sediment data set do not

exceed the AT. Therefore, the weight-of evidence conclusion is that there is a small potential for adverse effects to aquatic life attributable to this ECOPC.

2-Methylnaphthalene

The MDC for 2-methylnaphthalene in NW AEU sediment (2,000 µg/kg) exceeded the screening ESL (20.2 µg/kg). ESL-HQs for UCL and UTL-EPCs from the comprehensive sediment data set were also greater than 1 in both cases (Table 5.3). The AT for 2-methylnaphthalene is 201 µg/kg, the probable effect level (PEL) from CCME (2002). The AT-HQ for the MDC was > 1. AT-HQs for UCL and UTL-EPCs were also greater than 1 (3 and 4, respectively). The potential for risk to benthic organisms could not be excluded due to these ESL and AT exceedances by 2-methylnaphthalene in sediment at NW AEU.

The concentration distribution for 2-methylnaphthalene is provided in Figure 5.25. As depicted in this figure, the ESL is lower than all reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. All detected samples (104 total samples) exceeded the screening ESL (Table 5.5). These samples were collected between February 1992 and May 2004. Only one of detected concentration had an HQ greater than 10, although 97 (93 percent) concentrations below detection limits also exceeded the ESL with HQs greater than 10. The low frequency of exceedances by detected concentrations (7 percent) suggests there is a low potential for risk from 2-methylnaphthalene to benthic populations within the NW AEU.

The spatial distribution of 2-methylnaphthalene relative to the screening ESL is shown in Figure 2.59. There were six locations with measured concentrations greater than the ESL. Five of these occurred outside of true aquatic habitat areas, while the final location occurred within the channel. The remaining locations were at nondetect concentrations. A review of the uncertainty associated with the reporting limit concentrations is provided in Section 6. The spatial extent of the detected concentrations of 2-methylnaphthalene does not indicate a potential for risk to benthic populations within the NW AEU.

MDC-HQs were unchanged in the surface sediment (0-6 inches) data set (Table 5.4). These HQ values indicate that potential risks to benthic populations within the NW AEU could not be excluded for 2-methylnaphthalene.

The MDC (360 µg/kg) for 2-methylnaphthalene in soil adjacent to North Walnut Creek is greater than the sediment ESL. As a measure of central tendency for this data the arithmetic average (285 µg/kg) also exceeded the ESL (Attachment 6). There is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry. These data suggest that surface soils would be unlikely to reduce the potential for risk to benthic organisms.

2-Methylnaphthalene was not detected in surface water for the NW AEU. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds

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A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that 2-methylnaphthalene does not pose a risk concern to isolated habitat areas.

The chemical comparison to ESL and AT values for UCL and UTL EPCs for 2-methylnaphthalene suggest the potential for risk cannot be excluded. However, the ESL was lower than both detected and nondetected concentrations. The frequency of ESL exceedances by detected concentrations was low, due to the low detection frequency. The frequency of ESL exceedances by reporting limits was high. Further evaluation of the reporting limits as compared to the ESL and AT is provided in Section 6.There is uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. In addition, there was minimal spatial extent of elevated concentrations of 2-methylnaphthalene within aquatic habitat areas. The weight-of evidence conclusion is that there is uncertain to low potential for adverse effects to benthic populations from 2-methylnaphthalene in sediment at NW AEU.

4,4'-DDT

The MDC for 4,4'-DDT in NW AEU sediment (4.9 µg/kg) exceeded the screening ESL (4.16 µg/kg). UCL and UTL-EPCs from the comprehensive sediment data were unchanged from the MDC, so also drove ESL-HQs > 1 (Table 5.3). The AT for 4,4'-DDT is 62.9 µg/kg, a consensus-based probable effect concentration (CB-PEC) (MacDonald, et al. 2000a). The AT-HQ for the MDC was < 1. AT-HQs for UCL and UTL-EPCs were also < 1. The lack of AT exceedances by EPCs suggests that 4,4'-DDT in sediment at NW AEU occurs within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for 4,4'-DDT is provided in Figure 5.26. As depicted in this figure, the ESL is lower than most reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. Only two detected samples (4 detected of 79 samples) exceeded the screening ESL (Table 5.5). These samples were collected between August 1991 and February 1995. Both detected exceedances had HQs less than 2, and 54 concentrations below detection limits also exceeded the ESL. The uncertainty associated with the detection limit exceedances is further described in Section 6. The low frequency of exceedances by detected concentrations (3 percent) suggests there is a low potential for risk attributable to the detected concentrations from 4,4'-DDT to benthic populations within the NW AEU.

The spatial distribution of 4,4'-DDT relative to the ESL is shown in Figure 2.60. 4,4'-DDT was detected at two locations at concentrations greater than the ESL. Both locations were within the channel and not concentrated within a habitat area (such as within a single pond). The remaining locations had concentrations below detection limits. This spatial extent of 4,4'-DDT detected exceedances does not indicate a potential for risk to benthic populations within the NW AEU.

MDC-HQs were unchanged in the surface sediment data set (Table 5.4). These low HQ values suggest that potential risks to benthic populations within the NW AEU are unlikely.

4,4'-DDT in soil adjacent to North Walnut Creek was below detection in all samples (n=12). Nondetected concentrations exceeded the sediment ESL, but represent uncertainty in these data (Attachment 6, Table A6.26).

4,4'-DDT was detected in surface water in one of 123 samples, and was eliminated from the surface water ECOPC process due to a low (<5 percent) frequency of detection. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that 4,4'-DDT does not pose a risk concern to isolated habitat areas.

Chemical toxicity comparisons to sediment samples found a low frequency of detection, low magnitude of exceedances, lack of AT exceedances, and minimal spatial extent of elevated concentrations of 4,4'-DDT within aquatic habitat areas. There is uncertainty regarding the potential for risk due to detection limit exceedances as compared to the ESL. However, the weight-of evidence conclusion is that there is a low and uncertain potential for adverse effects to benthic populations from 4,4'-DDT in sediment at NW AEU.

Atrazine

The MDC for atrazine in NW AEU sediment (120 µg/kg) exceeded the screening ESL (16.8 µg/kg). UCL and UTL-EPCs could not be calculated because there one sediment sample was analyzed for atrazine (Table 5.3). The AT for atrazine is 230 µg/kg, an equilibrium partitioning based (EqP) calculated benchmark (EPA 1997b). The AT-HQ for the MDC was < 1. This lack of an AT exceedance by atrazine in sediment at the NW AEU suggests that concentrations occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The data concentration distribution for atrazine is provided in Figure 5.30. Only one sediment sample was analyzed for atrazine, collected in May 1992. The ESL-HQ for this detected sample is 7 (Table 5.5). The potential for risk from atrazine to benthic populations within the NW AEU is uncertain, due to few data, but could not be excluded. An evaluation of the uncertainty associated with the detection limit of atrazine was also completed within Section 6.

The spatial distribution of atrazine relative to the ESL is shown in Figure 2.65. The single measured value at the terminus of Pond A-4 is shown. This value exceeded the ESL.

MDC-HQs were unchanged in the surface sediment data set (Table 5.4).

Atrazine was not analyzed in any surface soil samples adjacent to North Walnut Creek. Therefore, the potential contribution of atrazine in surface soils to NW AEU sediment is not known.

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Atrazine was not detected in surface water. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that atrazine does not pose a risk concern to isolated habitat areas.

Chemical toxicity comparisons to sediment samples found the single atrazine sample exceeded the ESL by a magnitude of seven, but did not exceed the AT benchmark. There is great uncertainty regarding the potential for risk conclusion due to few samples. Therefore, a weight-of evidence conclusion cannot be made on the basis of one sample.

Carbazole

The MDC for carbazole in NW AEU sediment (300 µg/kg) exceeded the screening ESL (25.2 µg/kg). UCL and UTL-EPCs from the comprehensive sediment data set also drove ESL-HQs > 1 (Table 5.3). The AT for carbazole is 1,600 µg/kg, a Washington State Sediment Quality Guideline (Cubbage et al. 1997). The AT-HQ for the MDC was < 1. AT-HQs for UCL and UTL-EPCs were also > 1. The lack of AT exceedances by EPCs suggests that carbazole in sediment at NW AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for carbazole is provided in Figure 5.35. As depicted in this figure, the ESL is lower than most reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. An evaluation of the uncertainty associated with these detection limits is provided in Section 6. A total of 12detected samples (13 detected of 30 samples) exceeded the screening ESL (Table 5.5). These samples were collected between February 1995 and April 1999. Detected exceedances had HQs ranging from 1 to 12. All 17 nondetected concentrations (57 percent) also exceeded the ESL. The potential for risk from carbazole to benthic populations within the NW AEU could not be excluded due to this moderate frequency of ESL exceedances by detected concentrations (40 percent).

The spatial distribution of carbazole relative to the ESL is shown in Figure 2.70. There were only two locations within aquatic habitat settings with measured concentrations greater than the ESL. The remaining locations were within the IA-overlapping portion of the AEU. This spatial extent of carbazole exceedances does not indicate a potential for risk to benthic populations within the NW AEU.

MDC-HQs were unchanged in the surface sediment data set (Table 5.4). These HQ values suggest that potential risks to benthic populations within the NW AEU cannot be excluded.

The MDC (500 µg/kg) for carbazole in soil adjacent to North Walnut Creek is greater than the sediment ESL. As a measure of central tendency for this data the arithmetic average (340 µg/kg) also exceeded the ESL (Attachment 6, Table A6.26). There is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry; however, these data suggest that potential contribution of surface soils to the NW AEU is unlikely to reduce the potential for risk to benthic organisms.

Carbazole was detected in surface water in one of 25 samples, and was eliminated from the surface water ECOPC process due to having an MDC less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds A-1, A-2, A-3, A-4 and A-5 (Attachment 8) indicating that carbazole does not pose a risk concern to isolated habitat areas.

Chemical toxicity comparisons to sediment samples found a moderate frequency and magnitude of ESL exceedances, although the EPCs did not exceed the AT benchmark and the potential for toxicity is uncertain. In addition, there was minimal spatial extent of elevated concentrations of carbazole within aquatic habitat areas. Pond-specific findings indicate there is no risk potential attributable to carbazole. There is uncertainty regarding the potential for risk due to detection limit exceedances of the ESL. Therefore, the weight-of evidence conclusion is the potential for adverse effects to benthic populations from carbazole in sediment at NW AEU cannot be excluded.

PAHs

The MDC for total PAHs in NW AEU sediment (22,800 µg/kg) exceeded the screening ESL (1,610 µg/kg). UCL and UTL-EPCs also exceeded the ESL (Table 5.3). The AT for total PAHs is 22,800 µg/kg, a CB-PEC (MacDonald, et al. 2000a). The AT-HQ for the MDC was equal to one. The lack of AT exceedances by EPCs suggests that total PAHs in sediment at NW AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible, but not probable.

Further analysis of the MDC in surface sediment (0-6 inches) determined that the reduced MDC (20,310 µg/kg) exceeded the screening ESL, but was less than the AT (Table 5.4).

The number of detected concentrations exceeding the screening ESL for total PAHs is shown in Table 5.5. While there was a high frequency of total PAH concentrations exceeding the ESL (85 percent), only a few of the resulting AT HQs were greater than 10. Therefore, due to the lack of AT exceedances and the relatively low magnitude ESL exceedances, these chemical lines of evidence indicate that the risk attributable to total PAHs in NW AEU sediment cannot be excluded, but is low and uncertain. Total PAHs were evaluated within the pond-specific assessment and eliminated from further analysis because surface sediment concentrations in ponds fell below ESL values. Thus, total PAHs do not pose a risk to isolated aquatic habitat areas within Ponds A-1 through A-5.

The MDCs for 14 individual PAHs (acenaphthene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene) in NW AEU sediment all exceeded their respective screening ESLs. Screening ESL-HQs were also >1 for UCL and UTL-EPCs from the comprehensive sediment data set (Table 5.3). These samples were collected between August 1991 and July 2005.

UCL and UTL-EPCs for seven PAHs did not exceed the AT benchmark (anthracene, benzo[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, naphthalene, and pyrene). Three additional PAHs (benzo[k]fluoranthene, fluorene, and phenanthrene) had UTLs

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that exceeded their AT benchmarks by a low magnitude (HQ < 2), but UCLs did not exceed ATs (except for fluorene and phenanthrene. AT benchmarks were mainly comprised of consensus-based PECs (MacDonald, et al. 2000a) or other sources when CB-PECs were not available. A PEL for acenaphthene (MacDonald, et al. 1999); ERMs for benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene (Ingersoll, et al. 1996); a toxic effect threshold (TET) concentration for benzo(k)fluoranthene (MENVIQ/EC 1992); and an effects range low (ERL) for total PAHs (Ingersoll, et al. 1996) were used as a surrogate for dibenz(a,h)anthracene in the absence of any other benchmark (Attachment 5). The potential for risk from these PAHs is within the range of uncertain toxicity where the potential for adverse effects is possible, but not probable. The final four PAHs (acenaphthene, benzo[g,h,i]perylene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) exceeded their ATs, but with HQs ≤ 6. The potential for risk could not be excluded for these four PAHs.

Concentration distributions for PAHs are provided in Figures 5.27, 5.28, 5.31 through 5.34, and 5.36 through 5.43. ESLs for four PAHs (acenaphthene, benzo[g,h,i]perylene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) are lower than all detected and nondetected concentrations.. ESLs also were lower than many of the detected concentrations of all other PAHs. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contribute to uncertainty regarding the potential for risk.

Surface sediment MDCs for almost all PAHs were not different from those in the comprehensive data set, so MDC-HQs were unchanged (Table 5.4). The MDC for naphthalene was lowered from 320 µg/kg in the comprehensive data to 310 µg/kg in the surface sediment. The ESL-HQ for naphthalene was still exceeded UCL (HQ=2) and the AT-HQ was still <1. UTL-EPCs were also only slightly lower or slightly higher for surface sediments than for the comprehensive data.

The number of detected and nondetected concentrations exceeding the screening ESL are shown in Table 5.5. Four PAHs (benzo[k]fluoranthene, dibenzo[a,h]anthracene, fluorene, and naphthalene) had ≤12 percent of samples exceeding the ESL by detected concentrations. None of these four PAHs had detected concentrations with ESL-HQs greater than 10. There is uncertainty in this conclusion due to the exceedance of detection limits as compared to the ESL[1]. The ESL exceedance frequency of the remaining PAHs (acenaphthene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) were greater than 24 percent and suggest that the potential for risks from these PAHs cannot be excluded.

The spatial distribution of individual PAHs in sediment does not generally indicate a potential for risk to benthic populations within the NW AEU (Figures 2.61, 2.62 and 2.66 through 2.77). Total PAH calculated values by sample location as compared to the ESL is shown within Figure 2.58. Although there were frequent exceedances for some PAHs, these samples were not clustered in small areas that would indicate hot-spots within true

aquatic habitat areas[1]. Results presented within the figures include all sediment depth fractions. Further analyses of ECOPCs in ponds A-1 and A-3, where individual PAHs were found to exceed ESLs, indicated that almost all of these detected concentrations that exceeded ESLs were from sub-surface sediment samples. Sediment from more than 6 inches below the surface is not biologically available and represents an incomplete exposure pathway to benthic organisms. Further analysis of the spatial extent within surface sediment for ponds A-1 and A-3 are presented in Attachment 8, where PAHs were concluded to pose a low likelihood of risk to benthic macroinvertebrates.

The potential contribution to future sediments from surface soils adjacent to North Walnut Creek is unlikely to reduce sediment risks in the NW AEU (Attachment 6). PAH concentrations in surface soils were greater than ESLs for the all 14 individual PAHs. However, there is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry. The extent of surface soil contributions to site sediments cannot be predicted.

Confidence in these individual PAH risk characterizations is reduced when total PAHs do no exceed the ESL or AT. Screening ESLs for individual PAHs are derived from multiple sources with varying endpoints and organisms sensitivities. The consensus-based TEC (MacDonald, et al. 2000a) used as the total PAH-ESL is a more conservative estimate of the toxicity threshold where adverse effects are not expected to occur in most sediment types. There is the highest confidence in this benchmark, which is based on a review of several sources and has a high degree of accurately predicting the absence of toxicity. Likewise, the AT benchmark for total PAHs is a good predictor of likely adverse effects. The potential for adverse effects remains uncertain for concentrations between these benchmarks.

Total PAHs evaluate the potential for effects for all PAHs, not only those with known screening benchmarks. The additive toxicity from PAHs is also addressed by total PAH benchmarks. In these respects the total-PAH screen better identifies risk than individual PAH SEVs.

The weight-of-evidence conclusion for chemical LOEs is that there is a low but uncertain potential for risk to benthic populations from PAHs in NW AEU sediment. Sediment concentration screening against threshold toxicity benchmarks found the magnitude of exceedances for PAHs were greater than 10 for some detected concentrations and for total PAHs; however, there was often a low frequency of these exceedances, and minimal spatial extent of elevated surface sediment concentrations within aquatic habitat areas. There is uncertainty in this conclusion due to the exceedance of detection limits as compared to the ESL.

[1] 'True aquatic habitat areas' include the main stream channel and ponds. Samples from ephemeral habitat, overland flow, and ditches are not considered representative of true habitat (Figure 1.7).

PCBs

The MDC for total PCBs in NW AEU sediment (5,200 µg/kg) exceeded the screening ESL (40 µg/kg). The total PCBs evaluated were based only on Aroclor-1254, the only detected PCB in NW AEU sediment. The screening ESL for total PCBs is more conservative than for Aroclor-1254 and, thus, will serve as a conservative evaluation of this PCB congener. The AT for total PCBs is 676 µg/kg, a CB-PEC (MacDonald, et al. 2000a). The AT-HQ for the MDC was 1 (8). UTL and UCL values exceeded the ESL but not the AT. The lack of AT exceedances suggests that total PCBs in sediment at NW AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The data concentration distribution for Aroclor-1254 is provided in Figure 5.29. As depicted in this figure, the ESL is lower than many reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. A total of 6 detected samples had HQ values of 1 or less (Table 5.5). These samples were collected between October 1992 and July 2005. Detected exceedances had HQs ranging from 1 to 130. A total of 85 nondetected concentrations also exceeded the ESL. The low frequency of exceedances by detected concentrations suggests there is a low potential for risk from Aroclor-1254 to benthic populations within the NW AEU.

The spatial distribution of Aroclor-1254 relative to the ESL is shown in Figure 2.64. Total PCB distribution is provided in Figure 2.63. The spatial distribution demonstrates a concentration of measured values greater than the ESL within Ponds A-1 and A-2. A single measured value greater than the ESL was also found within Pond A-3. The remaining true aquatic habitat settings are devoid of measured values greater than the ESL. The 11 locations with measured values greater than the ESL represent approximately 24 percent of the data within the true aquatic habitat areas. The remaining occur below the ESL or were nondetects. Further analysis of the pond-specific risk is described below and within Attachment 8. This spatial extent of Aroclor-1254 exceedances does not indicate a potential for risk to benthic populations within the NW AEU outside of ponds A-1 and A-2.

Further analysis of maximum total PCB concentrations in surface sediment (Table 5.4) revealed the EPCs (130 µg/kg) exceeded the screening ESL, but were less than the AT. The Aroclor-1254 MDC-HQs in the surface sediment data set were lower than that in the comprehensive data set results, but continued to exceed one. The significantly lower MDC in surface sediment (920 µg/kg) indicates that the potential for adverse effects is lower in the biologically active surface sediments than in lower depths. However, the surface sediment MDC-HQs still exceeded one and the potential risks to benthic populations within the NW AEU cannot be excluded based on this LOE.

The MDC (2,300 µg/kg) for Aroclor-1254 in soil adjacent to North Walnut Creek is greater than the sediment ESL. As a measure of central tendency for this data the arithmetic average (109 µg/kg) also exceeded the ESL (Attachment 6, Table A6.26).

There is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry; however, these data suggest that potential contribution of surface soils to the NW AEU is unlikely to reduce the potential for risk to benthic organisms.

The spatial distribution of concentrations of Aroclor-1254 relative to the CRA Methodology ESL is shown in Figure 2.63 and demonstrates that sample results within the aquatic habitat areas (flowing channels and channels connected to the main step) inclusive of all of the ponds were at nondetected levels.

Total PCBs and Aroclor-1254 were identified as an ECOPCs for the pond-specific evaluations of Ponds A-1 and A-2. For Pond A-1, the surface sediment HQ for the ESL is 1, while the HQ for the AT is <1. For Pond A-2, the surface sediment HQ for the ESL is 2, while the HQ for the AT is <1.These results indicate that Aroclor-1254 presents low risk to the aquatic life within NW AEU.

For Pond A-1, total PCBs were evaluated. Two Aroclor congeners were detected (1254 and 1260); however, Aroclor-1260 was detected in one subsurface sediment sample of 15 collected. Since it was not detected in the surface sediment, it was removed from further consideration. The total maximum surface sediment concentration for total PCBs was compared to the total PCBs ESL and yielded an HQ of 1 while the HQ for the AT is <1. Given the low HQ values (1 to <1) it is unlikely that total PCBs, exceeding the ESL by a low magnitude, poses an unacceptable risk to benthic populations within Pond A-1.

For Pond A-2, total PCBs had a total detected maximum concentration of 130 µg/kg attributable to Aroclor-1254. This value exceeds the total PCB ESL of 40 but is less than the total PCB AT of 676 µg/kg. The surface sediment HQ for the ESL is 3, while the HQ for the AT is <1. Therefore, it is unlikely that total PCBs, exceeding the ESL by a small amount, poses an unacceptable risk to benthic populations that inhabit Pond A-2.

For Pond A-3 total PCBs had a total detected maximum concentration of 45 µg/kg attributable to Aroclor-1254. The results of Aroclor-1254 were greater than the total PCB ESL, yet less than the Aroclor-1254 ESL of 60 µg/kg. In addition, this value is less than the total PCB AT of 676 µg/kg. The surface sediment HQ for the ESL is 1, while the HQ for the AT is <1. Aroclor-1254 had a frequency of detection of 12.5 percent (detected in 1 of 8 samples from the comprehensive sediment data set, and detected in 1 of 5 samples from the surface sediment data set) indicating a limited spatial extent. Therefore, it is unlikely that total PCBs pose an unacceptable risk to benthic populations that inhabit Pond A-3.

Chemical toxicity comparisons to sediment samples found a low frequency of exceedances by detected concentrations of PCBs (Aroclor-1254). There was also minimal spatial extent of elevated concentrations of Aroclor-1254 within aquatic habitat areas outside of ponds A-1 and A-2. Further evaluation of pond-specific results indicates that surface sediment conditions have a low risk potential with HQ values being low. There is uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. However, the weight-of

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evidence conclusion is that there is a low potential for adverse effects to benthic populations from total PCBs (Aroclor-1254) in sediment at NW AEU.

Other/Drainage Specific Lines of Evidence

Table 5.6 summarizes the findings from other/drainage LOEs gathered for the NW AEU by others. Detailed descriptions of these studies are provided in Attachment 7. The types of other/drainage LOEs available for the NW AEU include tissue analysis, aquatic population studies, bioassay analysis and waterfowl/wading bird evaluations. The time periods captured by these efforts coincide with the surface water and sediment AEU sample collection dates. Therefore, these studies represent a snap shot in time that coincides with the contaminant risk evaluation. Most of the studies capture historical conditions that have been altered in ways to remove chemical stressors. Thus, their findings provide a conservative characterization of biological communities and the bioavailability and toxicity of various contaminants.

Results of the other/drainage LOEs indicate that the NW AEU is an aquatic ecological setting largely controlled by limited physical habitat and low flow with little of no evidence of the effects of site chemistry. Discharge measurements along the length of this drainage suggest that the NW AEU has periods of no flow. Seasonal discharge is directly related to conditions of spring snowmelt and rainfall events. Therefore, the aquatic communities within the NW AEU are reflective of opportunistic populations able to utilize transient habitat conditions.

Specifically, PCB concentrations in fish tissue collected from A-series ponds of the NW AEU were lower than maximum recommended body burdens (Eisler 1986) and were determined to pose no risks to fish or avian piscivores (Stiger 1994; DOE 1996). PCBs were also below detection limits in A-series pond sediments from this study. PCBs were also below detection in most benthic invertebrate, fish, and sediment samples reported by DOE (1996). Benthic macroinvertebrate communities were relatively healthy and supported by good water quality in Walnut Creek (Exponent 1998). The presence of pollution intolerant taxa (Ephemeroptera and Trichoptera) indicate the Walnut Creek benthic macroinvertebrate community was relatively rich and diverse (Aquatic Associates Inc. 2003). Sediment toxicity bioassays agree with the findings from these other studies and found no toxicity to *Hyalella azteca* and *Chironomus tentans* in pond sediments (DOE 1996).

The discrepancy between site sediment toxicity and ESL exceedances, particularly by PAHs, may be due to the chemical properties of the sediment. Organic carbon (OC) in sediments binds nonpolar (non-ionic) organic contaminants to render them non-bioavailable (Mahony et al. 1996). If the total organic carbon (TOC) in NW AEU sediments is higher than the 1 percent TOC assumed in the ESLs, then these ESLs will be more conservative than necessary to protect benthic organisms Higher OC in sediments is derived from decomposition of leaves and organic matter, producing a dark spongy soil. Site investigations indicate that stream and pond sediment is darker and richer in OC than the assumed 1 percent. Sediment accumulation areas in the ponds, streams (backwaters and pools), and marshy areas with emergent vegetation are likely to produce TOC-rich (>5 percent) and electrochemically-reduced sediments that will produce sulfide. Acid

volatile sulfides (AVS) bind metals when the sediments are anaerobic (Ankley, et al. 1996). Therefore, sulfide and TOC likely to be present in the soft sediments of low-energy microhabitats, including pond bottoms, will serve to detoxify metals and certain organic contaminants.

The studies all came to the conclusion that the aquatic assemblages within the NW AEU are typical of aquatic settings with similar habitat features along the Front Range. There was no evidence of contaminant stressor controlling factors diversity and abundance of aquatic populations. One set of studies (Kaiser-Hill 1999, 2000, and 2001) indicated that the aquatic community has been stable over time. This provides a LOE that the aquatic community in relatively recent years (1999-2001) is representative of communities within the general area and has not changed in apparent response to changes in chemical stressors.

5.3.3 Weight of Evidence Conclusions

The weight-of-evidence (WOE) process is the integrated conclusions from each of the lines of evidence (LOE) used in risk characterization. Those basic types of LOEs include contaminant toxicity and exposure information as well as drainage-specific studies on aquatic populations, communities, and habitat characteristics.

Overall WOE conclusions are based on best professional judgment based on the preponderance of evidence. If risk conclusions were in disagreement, the multiple LOEs were balanced against each other with weights assigned based on the certainty of the risk characterization. Lower confidence was given to risks driven by single LOEs while the greatest confidence was given to those conclusions with supportive, multiple LOEs. Greater weight was also given to LOEs that evaluate the habitat and biological conditions on-site, as opposed to chemical lines of evidence based on desktop modeling with high uncertainty.

The specific LOEs used in the WOE are as follows:

Chemical

- Comparisons of media-specific concentration profiles to ESLs and ATs. (including magnitude of HQs).
- Frequency of exceedances.
- Spatial and temporal pattern of contamination and exceedances.

Biological and habitat

- Hydrology of drainage
- Toxicity studies
- Diversity and abundance characterizations

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There were 9 surface water ECOPCs (7 inorganics, 1 organic, and 1 radionuclide) and 35 sediment ECOPCs (14 inorganic and 21 organic) evaluated using multiple LOEs within the contaminant risk characterization.

Conclusions for the NW AEU can be summarized as:

Magnitude of ESL or AT exceedances:

- Most surface water contaminants showed low magnitude HQs for either primary ESLs or ATs. The only exceptions were aluminum in a range of uncertainty and total PCBs with detection limit problems (higher than benchmarks).

- Sediment ESL-HQs were generally low (<10) for UTL and UCL-EPCs except for antimony, fluoride, 2-methylnaphthalene, acenaphthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene, and were less than 5 for all UTL and UCL comparisons to AT benchmarks except antimony and acenaphthene.

Spatial Distribution:

- Most surface water contaminants were primarily found outside the primary aquatic habitats (stream channels and ponds). Ammonia was widely scattered. Only selenium, silver, and vanadium were clustered in aquatic habitats.

- Most sediment contaminants were widely dispersed and rarely concentrated in aquatic habitat areas. Further pond-specific analysis eliminated the spatial concern these chemicals demonstrated. Most were at nondetect or less than ESL concentrations within surface sediment indicating a low risk concern.

Frequency of Exceedances:

- Almost all surface water contaminants had a very low frequency of HQ exceedances. Aluminum (total), un-ionized ammonia, cyanide, vanadium (total), and radium-228 were notable exceptions.

- Most sediment ECOPCs had fewer than 20 percent of samples (detected) exceeding their ESL, except for fluoride, zinc, acenaphthene, anthracene, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, carbazole, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

Change in Exceedances over Time:

- Almost all contaminants have improved in concentrations in surface water over time; none are worse, but silver was approximately unchanged.

Surface sediment MDCs were generally not different from the comprehensive sediment database ESLs and did not influence the potential for risk. In only a few cases were the MDCs lower in surface sediments (aluminum, arsenic, barium, cadmium, nickel, naphthalene, and Aroclor-1254).

Drainage-specific habitat and ecological studies:

- Previous studies indicate that aquatic life within the NW AEU is primarily affected by natural conditions associated with the ephemeral and intermittent character of the drainage hydrology. There was no indication that contaminant stressors were affecting the ecology. In addition, the AT values based on acute exposure (instead of chronic) are most appropriate due to the intermittent nature of flows in the drainage. Those AT values yielded the lowest evidence of chemical risk.

- Toxicity was not observed in pond sediment bioassays, indicating that PAHs, PCBs, and metals do not pose a potential for risk in pond habitat.

- Fish tissue residues were below toxicity thresholds for PCBs.

- Benthic macroinvertebrate communities were healthy.

In summary, the weight of evidence gathered from the risk characterization indicates that there is no or low potential for risk to the aquatic populations within the NW AEU caused from contaminant chemistry alone. The seasonal hydrologic regime and local topography are most important in determining the makeup of the local aquatic communities and in mitigating any small potential for chemical-based risk. The lack of toxicity in pond sediment bioassays also had a strong weight in this WOE. In contrast to the strong effects of intermittent flows and seasonal hydrologic regime, the observations indicating the possibility of low, chemically-based risk were mostly based on uncertain toxicological endpoints and low and infrequent exceedances which would be unlikely to produce population and community effects, an observation supported by the various other LOEs and special studies.

5.4 Risk Characterization of the SW AEU

ECOPCs were identified for surface water and sediment within the SW AEU. A contaminant risk characterization using the various LOEs was completed for these contaminants. The SW AEU has seen considerable study by others in areas of other/drainage lines of evidence. This risk characterization begins with a site ecological setting description in order to provide perspective regarding the aquatic ecosystem characteristics associated with the SW AEU. The contaminant risk LOEs and the other/drainage LOE are then described, followed by a weight-of-evidence summary of these risk descriptors.

5.4.1 Site-Specific Habitat Description

South Walnut Creek is a portion of the watershed that provides the major drainage for the north-central portion of RFETS including the majority of the IA. South Walnut Creek has five retention ponds (Ponds B-1, B-2, B-3, B-4, and B-5). The section of the stream upgradient from the B 5 pond is classified as stream Segment 5 in the Big Dry Creek basin by the Colorado Water Quality Control Commission (WQCC). Downstream from Pond B-5, South Walnut Creek is classified as stream Segment 4b. The flow in South

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Walnut Creek has been highly dependant on effluent from former sewage treatment plant, stormwater runoff from the IA, and management of the ponds. South Walnut Creek flows bypass Ponds B-1 and B-2 as these ponds were maintained as isolated ponds for emergency spill control. Pond B-3 had received flows from the sewage treatment plant and flowed into Pond B-4. Correspondingly, South Walnut Creek flows are diverted around Ponds B-1, B-2, and B-3, and into Pond B-4, which flows continuously into Pond B-5. Water is released from the "terminal pond," Pond B-5 periodically, occurring six to eight times per year. Below Pond B 5, the aquatic environment is totally dependent upon periodic releases from the Pond. Between batch releases from the terminal ponds (B-5 and A-4), the lower section of Walnut Creek is often dry. The hydrology of South Walnut Creek is expected to change in response to the ongoing accelerated actions that include removal of buildings within the IA and the elimination of water historically imported for RFETS operations. This includes the elimination of the Sewage Treatment Plant discharge and removal of pavement from within the IA. All of these efforts combined are expected to create a decrease in flows within South Walnut Creek.

Native fish species are found in the Walnut Creek ponds and specific sections of the stream (AAI 2003). Fathead minnows (*Pimephales promelas*), are present in the B ponds, the stream between B 4 and B 5 ponds and in lower Walnut Creek. A variety of non-native fish species including rainbow trout (*Salmo gairdneri*), carp (*Cyprinus carpio*), and bass (*Micropterus* sp.) were introduced into the ponds at various times, however no introductions have led to establishing reproducing fish populations in the B ponds.

Within the Walnut Creek area, the most common aquatic macroinvertebrates are the larvae of the blackfly (Order *Diptera, Simulidae* sp.), midge (Order *Diptera, Chironomidae* sp), mayfly (Order *Ephemeroptera*) (DOE 1997) and scuds (*Hyalella azteca*) (AAI 2003). Other species include caddisflies (Order *Trichoptera*), craneflies (*Tipulidae* ssp.), and damselfly larvae (Order *Odonata*), as well as snails (Class *Gastropoda*) and other amphipods (Order *Amphipoda*). Large macroinvertebrate species such as those present within the Walnut Creek area, such as crayfish (Order *Decapoda,* Family *Cambaridae*) and snails are potentially important prey for other fish, waterfowl, and mammal species.

Characterization of the aquatic habitat provided by North Walnut Creek is of primary consideration with regards to aquatic risk. Currently sustained flows exist, albeit minimal in nature that supports some aquatic species. Given the nature of ongoing accelerated actions, the location and amount of viable aquatic habitat that will be present after accelerated actions are complete is unclear since overland flow may be altered by the IA accelerated actions.

5.4.2 Exposure and Risk Characterization

Contaminant Risk Characterization Lines of Evidence

Tables 5.7 and 5.8 provide the HQs for the comprehensive surface water data set and the post-1999 surface water data set. Tables 5.9 and 5.10 provide the HQs for the comprehensive sediment (includes all depth fractions) and surface (0-6") sediment data sets for the sediment ECOPCs, respectively. HQs derived from the ESL and AT values

for each contaminant are provided for MDC, UCL, and UTL EPCs for each of the four media. Table 5.11 provides the frequency and magnitude of comprehensive surface water and sediment HQs based on ESLs. Concentration distributions of ECOPCs in surface water and sediment media in relation to ESLs and AT benchmarks are presented in Figures 5.44 through 5.74. The results of the contaminant risk characterization are presented below by medium (surface water and sediment) and by contaminant.

Surface Water ECOPCs

Ammonia

The MDC for unionized ammonia in SW AEU surface water (0.78 mg/L) exceeded the screening ESL (0.02 mg/L). A total of 1630 detected samples from SW surface water exceeded the screening ESL for ammonia. These samples were collected between July 1991 and August 2004. The high frequency of exceedances by detected concentrations (63 percent) suggests that the potential for adverse effects cannot be excluded.

The screening ESL for ammonia was derived from CDPHE (2005a). ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 7 and 18 respectively (Table 5.7) (the ESL was unchanged from the screening value). The AT value for ammonia (0.165 mg/L) was the acute water quality criterion, and was pH- and temperature-adjusted using a SW AEU specific average pH of 7.6 and an estimated temperature of 20°C (Attachment 5). The AT-HQs for the UCL and UTL EPCs were both a value of 2. These AT HQ values indicate a low risk potential attributable to ammonia.

Ammonia was detected in 91 percent of the samples. The concentration distribution is provided in Figure 5.44. Approximately 40 percent of the values fall below the ESL value, while the UTL concentration is greater than the ESL and AT. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.11. The detected results were within the HQ range of ≤ 1 to > 10. This indicates that ammonia concentrations occur within the range of uncertainty where there is the potential for adverse effects. Although about 65 percent of the detected exceedances had HQs less than 10, 27 percent had HQs greater than 10 (maximum HQ = 39). Therefore, the potential for adverse effects cannot be excluded for ammonia in surface water at SW AEU based on the comparison of site concentrations to the refined ESL. Comparison to the AT results in an AT HQ for the UTL EPC of 2, which is considered a low magnitude of exceedance.

The spatial distribution of ammonia concentrations relative to the site-specific ESL is shown in Figure 2.98. Several locations within channel and pond areas had measured concentrations greater than the ESL. However, a number of locations within these same settings had measured concentrations less than the ESL. Because exceedance occur within aquatic habitat areas, the potential for risk cannot be excluded based on this LOE.

Refined ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were 2 and 5, respectively (Table 5.8). Although the MDC had a moderate exceedance (HQ = 16), the low HQs for the measures of central tendency of the data distribution suggest that the risk potential is low. Additionally, the MDC for the post-1999 data set is

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nearly half the MDC for the complete data set, and the UTL and UCL values are also reduced. This suggests that current concentrations of ammonia within the SW AEU pose lower risk to aquatic receptors than historic levels. Within the SW AEU, there is a high frequency of exceedance and moderate magnitude of exceedance of the refined ESL. Additionally, exceedances were observed in the aquatic habitat areas, though the spatial distribution of these exceedances did not appear to be widespread or consistent. The limited spatial distribution suggests that risk to aquatic populations may be low. This is further supported by the low magnitude of AT exceedances for the MDC, UTL, and UCL EPCs from the complete distribution of data, and by the low magnitude of ESL and AT exceedances for the UTL and UCL EPCs from the post-1999 data set. The post-1999 data also indicates that current concentrations of ammonia are reduced from historic levels and therefore, risk is reduced. These combined results of the chemical LOEs for ammonia indicate there may be low potential for adverse effects to aquatic life attributable to this ECOPC.

Cadmium (Dissolved)

The MDC for cadmium in SW AEU surface water exceeded the ESL (0.00025 mg/L). A total of 167 samples from SW surface waters exceeded the screening ESL for cadmium. These samples were collected between September 1991 and December 2004. The low frequency of exceedances by detected concentrations (15 percent) suggests that potential adverse effects may not be widely distributed.

The cadmium screening ESL is hardness dependant and was calculated after CDPHE (2005a) using an estimated hardness of 100. Site specific hardness in SW AEU was determined to be 204 (Attachment 5); and, a refined ESL based on this site-specific hardness is 0.0038 mg/L. The MDC for cadmium (dissolved) still exceeded this refined ESL, but with a low magnitude HQ (8). ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were < 1 (Table 5.7).The AT for cadmium is the acute water quality criterion. This site-specific, hardness adjusted AT value is 0.0092 mg/L. AT-HQ values for UCL and UTL EPCs were both <1. These ESL and AT HQ values indicate no or low risk potential attributable to cadmium.

Cadmium was detected in 15 percent of the samples indicating a minimal spatial extent of occurrence. The concentration distribution is provided in Figure 5.45. The detected values fell below the ESL with few exceptions, and the average and UTL values were less than the ESL and AT values. The magnitude and frequency of HQ values for the data set based on the refined ESL are presented in Table 5.11. All HQs for the detected concentrations were ≤ 10 (75 percent were ≤ 5), and the frequency of exceedances of the refined ESL was 1 percent (8 of 1,103 samples). Therefore, there is a very low potential for risk from cadmium in surface water at SW AEU.

The spatial distribution of cadmium relative to the site-specific ESL is shown in Figure 2.99. Three locations within the channel area exceeded the ESL. The remaining locations within the channel and pond settings were either less than the ESL or at nondetect levels. One location outside the aquatic habitat areas and within the IA overlapping portion of the AEU had a measured value greater than the ESL. The three locations with measured values greater than the ESL represent approximately 6 percent of

the data within true aquatic habitat areas. The remaining 94 percent occur below the ESL or were nondetects. Because 3 of the 8 exceedances of detected values occurred within the aquatic habitat areas, the potential for risk cannot be excluded based on this LOE.

Refined ESL- and AT-HQs for MDC, UCL, and UTL EPCs from the post-1999 surface water data set were all <1 (Table 5.8). This indicates that current cadmium concentrations are not a potential risk to aquatic populations within the SW AEU.

Although potential risk could not be excluded based on the spatial distribution of cadmium within the SW AEU, the three other chemical LOEs indicate that there is no or low risk to aquatic populations within this AEU. Specifically, the UCL EPC from the comprehensive data set had an HQ < 1 and the UTL EPC had an HQ of 1; the frequency (1 percent) and magnitude (HQs < 10) of exceedances of the refined ESL are low; and all current data (post-1999) were below the refined ESL (i.e., HQs < 1).

Cyanide

The MDC for cyanide in SW AEU surface water (0.061 mg/L) exceeded the screening ESL (0.0005 mg/L). A total of 19 detected samples from SW surface water exceeded the screening ESL for cyanide. These samples were collected between July 1991 and February 2004. The low frequency of exceedances by detected concentrations (11 percent) suggests that potential adverse effects may not be widely distributed. ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 16 to 20, respectively (Table 5.7). The exceedances by nondetects adds uncertainty to the determination of risk from this chemical (Table 5.11).

The screening ESL for cyanide was derived from CDPHE (2005a). The chronic ESL, expressed as free cyanide, was estimated from the acute screening value using an uncertainty factor of 10. This is very conservative given that total cyanide was measured at the site, and no measure of the free cyanide is available. Additionally, cyanide is not predicted to persist in aquatic environments as it readily degrades under normal conditions, with volatilization accounting for most of the free cyanide removal (Eisler 2000). Alternative screening benchmarks presented in MacDonald et al. (1999) range from 0.003 mg/L for the District of Columbia (EPA 1988) up to 0.04473 mg/L for the Great Lakes final acute value (EPA 1992). An acute surface water benchmark value of 0.005 mg/L was considered the AT value (CDPHE 2005a).). The AT-HQ values suggest that potential risk from cyanide may be low.

Cyanide was detected in 11 percent of the samples indicating a minimal spatial extent. The concentration distribution is provided in Figure 5.46. The average is just slightly greater than the AT, and the UTL is greater than ESL and AT values. The magnitude and frequency of HQ values for the data set based on the refined ESL are presented in Table 5.11. Screening ESL HQs for individual samples ranged from less than 1 to greater than 5, with 99 percent of samples (detected and nondetected) exceeding the ESL. Because detection limits for cyanide at SW AEU were higher than the ESL, there is uncertainty regarding the potential for risk from this ECOPC. However, the conservative nature of the screening ESL (i.e., based on data for free cyanide and derived using an uncertainty factor of 10) and the generally low magnitude of exceedance of the AT (HQs

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< 7 for 97 percent of the detected and nondetected exceedances of the AT) suggest that adverse effects from cyanide in surface water are unlikely at SW AEU.

The spatial distribution of cyanide relative to the ESL is shown in Figure 2.100. Three locations within the channel area, and one within the ponds B-4 and A-5 exceeded the ESL. The remaining locations within the channel and pond settings were at nondetect levels. One location outside the aquatic habitat areas, and within the IA overlapping portion of the AEU had measured values greater than the ESL. Because exceedances occurred within the aquatic habitat areas, potential risk from cyanide cannot be excluded based on this LOE.

Cyanide was measured in only one SW AEU surface water sample collected post-1999. This sample represented the MDC for the comprehensive data surface water data set, with an ESL HQs of 73 and an AT-HQ of 7 (Table 5.8). Although the cyanide concentration in this sample was greater than historic samples, no temporal trends can be inferred to the limited data. Therefore, this LOE adds little to the understanding of potential risk from cyanide.

All detected concentrations of cyanide exceeded both the ESL and AT values; though the magnitude of exceedances of the AT values was low (97 percent of detected exceedance had HQs < 7). Additionally, detected exceedances were observed in aquatic habitat areas within the SW AEU, and the post-1999 data was not sufficient to describe current cyanide concentrations (i.e., only one cyanide measurement available). However, the low frequency of detection and the low magnitude of exceedances of the AT value suggest that risk may be low. Additionally, free cyanide is not predicted to persist in aquatic environments under normal conditions. These results indicate there may be a low but uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Silver (Dissolved)

The MDC for silver in SW AEU surface water (0.0332 mg/L) exceeded the screening ESL (0.00032 mg/L). A total of 21 detected samples from SW surface waters exceeded the ESL for silver. These samples were collected between October 1991 and October 1994. The low frequency of exceedances by detected concentrations (2 percent) suggests that potential adverse effects may not be widely distributed.

The silver screening ESL is hardness dependant and was calculated after CDPHE (2005a) using an estimated hardness of 100. Site specific hardness in SW AEU was determined to be 204 (Attachment 5); and a refined ESL based on this site-specific hardness is 0.0011 mg/L. The MDC for silver (dissolved) still exceeds this refined ESL (HQ=30), but the refined ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were < 1 and 2, respectively (Table 5.7). An acute surface water benchmark value of 0.0069 mg/L was considered the AT value. AT-HQs for UCL and UTL EPCs were <1 in both cases. These HQ values indicate a low risk potential attributable to silver.

Silver was detected in only 5 percent of the samples indicating a minimal spatial extent. The concentration distribution is provided in Figure 5.47. All of the detected values occur below the AT with one exception. The average concentration was less than the ESL and

AT values, and the UTL was greater than the ESL, but less than the AT value. The magnitude and frequency of HQ values for the data set based on the Refined ESL are presented in Table 5.11. Of the detected concentrations that exceeded the refined ESL, HQs were predominantly less than 10 (90 percent), with only 2 detected values having HQs greater than 10. Additionally, these exceedances of detected samples represent only 2 percent of the data set (22 of 1,286); therefore, this indicates that silver (dissolved) concentrations pose low risk to aquatic populations within the SW AEU.

The spatial distribution of concentrations of silver relative to the site-specific ESL is shown in Figure 2.101. Seven locations within the channel and two locations within the ponds have measured values of silver greater than the ESL. The remaining sample results within the aquatic habitat areas were at nondetected levels. One location outside the aquatic habitat areas and within the IA overlapping portion of the AEU had measured values greater than the ESL. The seven locations with measured values greater than the ESL represent approximately 14 percent of the data within the true aquatic habitat areas. The remaining 86 percent occur below the ESL or were nondetects. Because exceedances occurred within the aquatic habitat areas, potential risk from silver cannot be excluded based on this LOE.

Refined ESL-HQs for the MDC, UCL, and UTL EPCs from the post-1999 surface water data set were all <1 (Table 5.8). This suggests that silver is not a potential risk to aquatic populations under the current conditions.

Potential risk to aquatic life in the SW AEU from silver cannot be excluded based on the spatial distribution of exceedances (i.e., some exceedances occurred within habitat areas); however, all three other LOEs support a conclusion of no or low risk. Specifically, there was a low frequency (2 percent) and magnitude of detected exceedances, the UCL EPC was lower than both the refined ESL and AT values and the UTL EPC was lower than the AT value and minimally exceeded the refined ESL (HQ = 2), and the MDC, UCL, and UTL EPCs for the post-1999 data set were all below ESL and AT values. These results indicate there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

4,4'-DDT

The MDC for 4,4'-DDT in SW AEU surface water (0.58 µg/L) exceeded the screening ESL (0.001 mg/L). All 5 detected samples from SW surface waters exceeded the screening ESL for 4,4'-DDT. These samples were collected between September 1991 and April 1995. The low frequency of exceedances by detected concentrations (7 percent) suggests that potential adverse effects may not be widely distributed.

The screening ESL for 4,4'-DDT was derived from CDPHE (2005a). Alternative screening benchmarks presented in MacDonald et al. (1999) ranged from 0.001 µg/L for the NAWQC (USPEA 1998) to 10 µg/L in Europe (CEC 1988). ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 81 and 150, respectively (Table 5.7). The AT for 4,4'-DDT is the acute water quality criterion (0.55 µg/L). AT HQs for UCL and UTL EPCs were < 1. Exceedances of the ESL but not the AT suggests that the potential for risk from 4,4'-DDT in surface water at SW AEU is low.

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4,4'-DDT was detected in 7 percent of samples. The concentration distribution is provided in Figure 5.48. As depicted in this figure, the ESL is lower than all reported values, representing both detected and nondetected concentrations value. Nondetected concentrations greater than the ESL indicates inadequately low detection limits and contributes to uncertainty regarding the potential for risk; however, the low frequency of detected exceedances suggests there is not likely an unacceptable potential for adverse effects from 4,4'-DDT. The UTL and all reported concentrations occur below the AT with one exception. In addition, HQs were >10 for all reported values, although 67 (93 percent) were below detection limits (Table 5.11). The low frequency of exceedances by detected concentrations supports a conclusion of no to low risk from 4,4'-DDT in surface water to aquatic populations within the SW AEU.

The spatial distribution of 4,4'-DDT relative to the ESL is shown in Figure 2.102. Three locations within channel and pond habitat areas had measured concentrations greater than the ESL. The remaining sample results within the aquatic habitat areas were below detection. One location outside the aquatic habitat areas, and within the IA overlapping portion of the AEU had measured values greater than the ESL. This spatial extent of 4,4'-DDT detected exceedances does not indicate a potential for risk to aquatic populations within the SW AEU.

ESL-HQs for post-1999 surface water data set could not be calculated due to the lack of available data (Table 5.8).

Results for the available chemical LOEs for 4,4'-DDT indicate that the potential for risk to aquatic populations from 4,4'-DDT is low.

There was a low frequency of detection, low frequency of ESL exceedances, relatively low magnitude of exceedances, and minimal spatial extent of elevated concentrations of 4,4'-DDT within aquatic habitat areas. There is uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. However, the weight-of evidence conclusion is that there is a low potential for adverse effects to aquatic life from 4,4'-DDT in surface water at SW AEU.

Sediment ECOPCs

Aluminum

The MDC for aluminum in SW AEU sediment (29,000 mg/kg) exceeded the screening ESL (15,900 mg/kg) (Table 5.9). A total of 21 of 126 samples from SW sediments exceeded the screening ESL for aluminum. All samples were detected. These samples were collected between July 1991 and March 2005. The relatively low frequency of exceedances (17 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were < 1 for the UCL and slightly over 1 for the UTL (Table 5.9). The AT for aluminum is the ERM value of 58,000 of Ingersoll et al. (1996), representative of a median effect level for

benthic invertebrates (Attachment 5). AT HQs for the UCL and UTL EPCs as well as the MDC were < 1.

Aluminum was detected in all samples. The concentration distribution is provided in Figure 5.49. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 21 of 126 samples (17 percent) (Table 5.11). Additionally, HQs for all 21 samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from sediment aluminum to aquatic populations within the SW AEU.

The spatial distribution of aluminum concentrations relative to the CRA Methodology ESL is shown in Figure 2.117. As shown within this figure, there were several locations within Pond B-4 (3 locations), B-5 (6 locations) and A-5 (2 locations) with measured concentrations greater than the ESL. The remaining locations within the ponds and channels with true aquatic habitat had levels less than the ESL. The results identify a concentration of aluminum within habitat areas (Ponds B-4, B-5 and A-5) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the B-series ponds (Figure A8.31) indicated aluminum was detected at concentrations greater than the ESL at locations within ponds B-4, and B-5. Therefore, the results indicate the need for further evaluation which is provided below and within Attachment 8.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of aluminum in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicates that the MDC (29,000 mg/kg) is greater than the ESL but lower than the AT. In addition, further analysis of the surface sediment results indicate that aluminum is not statistically different from background (Attachment 6). Therefore, the risk attributable to aluminum in surface sediment would be no greater than the risk associated with background settings.

The adjacent surface soil results included 295 samples for aluminum, all detected, with an MDC of 61,000 mg/kg. The MDC exceeded the ESL and the AT.

Aluminum was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background.

Aluminum was identified as an ECOPC for the pond-specific evaluations of Pond B-4. Results of the pond surface sediment risk analysis identified the surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. In addition, review of the data on a point by point basis indicated that each measured aluminum result was less than the AT value. Within Pond B-4, four of six locations had measured values greater than the ESL (but less than the AT), the remaining

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were less than the ESL. Because the measured concentrations fall below these AT values, the likelihood for risk attributable to aluminum is low.

Results for the available chemical LOEs for aluminum indicates that UCL and EPCs do not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 17 percent of samples exceeded the refined ESL, and the all HQs were < 5). Upon review of pond-specific spatial conditions it was determined that there was a minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC EPCs for the surface sediment data set do not exceed the AT. Aluminum is an almost universally-present constituent of background soils. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Antimony

The MDC for antimony in SW AEU sediments (26 mg/kg) exceeded the screening ESL (2 mg/kg) (Table 5.3). A total of 13 detected samples (27 detected of 118 samples) from SW sediments exceeded the screening ESL for antimony. These samples were collected between July 1991 and March 2005. The low frequency of exceedances by detected concentrations (11 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were > 1 in both cases (Table 5.9). The AT for antimony is the 3.2 mg/kg, a screening-level criterion (NYSDEC 1994) (Attachment 5). AT HQs for UCL and UTL EPCs were also > 1 as was the AT HQ for the MDC. Low level risk from sediment antimony can not be excluded from this drainage on the basis of chemistry.

Antimony was detected in only 26 percent of the samples. The concentration distribution is provided in Figure 5.50. As depicted in this figure, the UTL and average falls above the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 13 of 118 samples (11 percent) (Table 5.11). Given the low frequency but medium magnitude of exceedance (Table 5.11) there is a potential for risk from antimony to aquatic populations within the SW AEU on a strictly chemical basis.

The spatial distribution of antimony concentrations relative to the CRA Methodology ESL is shown in Figure 2.118. As shown within this Figure, there were several locations within the channel, and two locations within Pond B-4 with measured values greater than the ESL. The majority of the measured concentrations greater than the ESL were located within a storm channel and not within aquatic habitat areas. The remaining locations had values either below the ESL or at nondetect levels. This spatial extent of antimony does not indicate a potential for risk to benthic populations within the SW AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of antimony in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicate that the MDC (26 mg/kg) is greater than the ESL and AT.

The adjacent surface soil results included 282 samples for antimony, only 67 detected, with an MDC of 26.5 mg/kg. The MDC exceeded the ESL and AT. However, average soil antimony values (1.9 mg/kg) were lower than ESL and AT levels.

Antimony was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds B-4 and B-5 (Attachment 8) indicating that antimony does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for antimony indicate that UCL and UTL EPCs do not exceed the ESL, but there is a relatively low frequency of exceedances (i.e., only 11 percent of samples exceeded the ESL). However, some HQs exceeded 10. Antimony had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion is that there remains a low but uncertain potential for adverse effects to aquatic life attributable to this ECOPC on the basis of chemical exposure, alone.

Barium

The MDC for barium in SW AEU sediments (240 mg/kg) exceeded the screening ESL (189 mg/kg). A total of 11 samples from SW sediments exceeded the screening ESL for barium. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (9 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 or 1, respectively (Table 5.9). The AT for barium is 287, an average toxicity value from MacDonald et al. (1999) (Attachment 5).AT HQs for UCL and UTL EPCs as well as the MDC were < 1.

Barium was detected in all of the samples. The concentration distribution is provided in Figure 5.51. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 11 of 126 (9 percent) (Table 5.11). Additionally, HQs for all 11 samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from barium to aquatic populations within the SW AEU.

The spatial distribution of barium concentrations relative to the CRA Methodology ESL is shown in Figure 2.119. As shown within this figure, there were several locations within Pond B-4 (4 locations), B-5 (2 locations) and one within A-5 with measured concentrations greater than the ESL. The remaining locations within the ponds and channels with true aquatic habitat had levels less than the ESL. The results identify a concentration of barium within habitat areas (ponds B-4, B-5 and A-5) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the B-series ponds (Figure A8.33) indicated barium was detected at concentrations greater than the ESL at locations within Pond B-4. The measured values

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within B-5 and A-5 were less than the ESL. Results indicate that the spatial extent of barium in surface sediment is limited. This spatial extent of barium does not indicate a potential for risk to benthic populations within the SW AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of aluminum in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations of barium for all of the SW AEU indicate that the MDC (220 mg/kg) is greater than the ESL but less than the AT. In addition, further analysis of the surface sediment results indicate that barium is not statistically different from background (Attachment 6). Therefore, the risk attributable to barium in surface sediment would be no greater than the risk associated with background settings.

The adjacent surface soil results included 295 samples for barium, all but one detected, with an MDC of 350 mg/kg. The MDC exceeded the ESL and AT.

Barium was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds B-4 and B-5 (Attachment 8) indicating that barium does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for barium indicates that UCL and UTL EPCs do not exceed the ESL, there is a low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and the all HQs were < 5). Barium had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC EPCs for the surface sediment data set do not exceed the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Cadmium

The MDC for cadmium in SW AEU sediments (44 mg/kg) exceeded the screening ESL (0.99 mg/kg). A total of 23 detected samples (62 detected of 126 samples) from SW sediments exceeded the screening ESL for cadmium. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (18 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 and 1 for both the UTL and UCL respectively (Table 5.9). The AT for cadmium is a consensus-based, probably effects concentration (PEC) of 4.98 mg/kg (MacDonald et al. 2000a) (Attachment 5) AT HQs for UCL and UTL EPCs were both < 1.

Cadmium was detected in 49 percent of the samples. The concentration distribution is provided in Figure 5.52. As depicted in this figure, the average falls above the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL

was 23 of 126 (18 percent) (Table 5.11). Additionally, HQs for 21 of samples that exceeded the ESL were between 1 and 5, while 2 were higher than 5. Given the relatively low frequency and magnitude of exceedance there is a low potential for risk from barium to aquatic populations within the SW AEU.

The spatial distribution of cadmium concentrations relative to the CRA Methodology ESL is shown in Figure 2.120. As shown within this Figure, there were four locations within Pond B-4 and two locations within the channel with measured values greater than the ESL. The remaining locations had values either below the ESL or at nondetect levels. The results identify a concentration of cadmium within habitat areas (Pond B-4) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Pond B-4 (Figure A8.34) indicated cadmium was detected at concentrations greater than the ESL at three locations within Pond B-4. The results indicate the need for further evaluation which is provided below and within Attachment 8.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of cadmium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicate that the MDC (6 mg/kg) is greater than the ESL and AT.

The adjacent surface soil results included 295 samples for cadmium, 112 detected, with an MDC of 36 mg/kg. The MDC exceeded both the ESL and the AT.

Cadmium (dissolved) was identified as an ECOPC for surface water. Results of the risk analysis identified the MDC for cadmium (dissolved) still exceeded the refined ESL, but with a low magnitude HQ . ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were also low. The AT for cadmium is the acute water quality criterion. This site-specific, hardness adjusted AT value is 0.0092 mg/L. AT-HQ values for UCL and UTL EPCs were both <1. These ESL and AT HQ values indicate no or low risk potential attributable to cadmium.

Cadmium was identified as an ECOPC for the pond-specific evaluations of Pond B-4. Results of the pond evaluation identified the surface sediment HQ for the ESL is 2, while the HQ for the AT is <1. Review of the data on a point by point basis indicated that each measured cadmium result was less than the AT value. Within Pond B-4, three of six locations had measured values greater than the ESL (but less than the AT), the remaining were less than the ESL. Because the measured concentrations fall below these AT values, the likelihood for risk attributable to cadmium is low.

Results for the available chemical LOEs for cadmium indicates that UCL and UTL EPCs slightly exceed the ESL, there is a low frequency and magnitude of exceedances (i.e., only 18 percent of samples exceeded the ESL, and the all except two HQs were < 5). Cadmium had minimal occurrence of exceedances within aquatic habitat areas. Additionally, the EPCs for the surface sediment data set do not exceed the AT. Therefore,

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the weight-of evidence conclusion is that there is low potential for adverse effects to aquatic life attributable to this ECOPC from chemistry, alone.

Copper

The MDC for copper in SW AEU sediments (324 mg/kg) exceeded the screening ESL (31.6 mg/kg). A total of 11 samples (120 detected of 126 samples) from SW sediments exceeded the screening ESL for copper. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (9 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were 1 for both the UCL and the UTL (Table 5.9). The AT for copper is a PEC value of 149 mg/kg (MacDonald et al. 2000a) (Attachment 5). AT HQs for UCL and UTL were < 1 and the MDC HQ was only marginally greater than 1.

Copper was detected in 95 percent of the samples. The concentration distribution is provided in Figure 5.53. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 11 of 126 (9 percent) (Table 5.11). Additionally, HQs for 10 of the detected samples were between 1 and 5 and only 1 was greater than 10. Given the low frequency and magnitude of exceedance there is a low potential for risk from copper to aquatic populations within the SW AEU.

The spatial distribution of copper concentrations relative to the CRA Methodology ESL is shown in Figure 2.121. As shown within this figure, there were three locations within Pond B-4 and three locations within the channel with measured values greater than the ESL. The remaining locations had values below the ESL. The results identify a concentration of copper within habitat areas (Pond B-4) that requires further evaluation. The results presented within this figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Pond B-4 (Figure A8.36) indicated copper was detected at concentrations greater than the ESL at one location within Pond B-4. This spatial extent of copper does not indicate a potential for risk to benthic populations within the SW AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of copper in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicate that the MDC (324 mg/kg) is greater than the ESL and AT, and the arithmetic average (20.2 mg/kg) is less than the ESL and AT (Attachment 6).

The adjacent surface soil results included 295 samples for copper, all detected, with an MDC of 270 mg/kg. The MDC exceeded both the ESL and the AT.

Copper was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds B-4 and B-5

(Attachment 8) indicating that copper does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for copper indicates that the UCL EPC does not exceed the ESL, and there is a very low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and almost all HQs were < 5). Copper had minimal occurrence of exceedances within aquatic habitat areas. However, the MDC for the surface sediment data exceeds the ESL and AT. Therefore, the weight-of evidence conclusion is that there remains a low potential for adverse effects to aquatic life attributable to this ECOPC from chemical effects alone.

Fluoride

The MDC for fluoride in SW AEU sediments (9.3 mg/kg) exceeded the screening ESL (0.01 mg/kg). All detected samples (8 detected of 16 samples) from SW sediments exceeded the screening ESL. These samples were collected between July 1991 and March 2004. The high frequency of exceedances by detected (and all nondetected) concentrations suggests that potential adverse effects can not be excluded.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were >1 in both cases (Table 5.9). The AT for fluoride is 7 mg/kg is a Toxic Effect Threshold (TET) at 1 percent OC (Boton et al. 1985) (Attachment 5). AT HQ for the UCL EPC was < 1 and the AT HQ for the UTL and MDC was < 2.

Fluoride was detected in 50 percent of the samples. The concentration distribution is provided in Figure 5.54. As depicted in this figure, all data are above the ESL. The frequency of exceedance for the ESL was 50 percent (Table 5.11). Additionally, HQs for all 8 detected samples that exceeded the ESL were > 10. Given the high frequency and magnitude of exceedance, there remains a potential for risk from fluoride to aquatic populations within the SW AEU.

The spatial distribution of fluoride concentrations relative to the CRA Methodology ESL is shown in Figure 2.122. As shown within this figure, the spatial distribution of fluoride occurs within the channel and at locations within the IA overlapping portion of the AEU at concentrations greater than the ESL and at nondetect levels. There were three locations within the channel with concentrations greater than the ESL.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of fluoride in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicates that the MDC (9 mg/kg) is greater than the ESL and the AT, but the arithmetic average (3.3 mg/kg) is less than the AT (Attachment 6).

The adjacent surface soil results included 9 samples for fluoride, all detected, with an MDC of 3.61 mg/kg. The MDC exceeded both the ESL but not the AT. Average soil fluoride values (2.41 mg/kg) were lower than AT levels, as well.

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Fluoride was detected in surface water, and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL.

Results for the available chemical LOEs for fluoride indicates that UCL and UTL EPCs exceed the ESL and AT and the all ESL HQs were > 10. Fluoride had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion, based on ambient chemistry alone, is that there is low but uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Lead

The MDC for lead in SW AEU sediments (170 mg/kg) exceeded the screening ESL (35.8 mg/kg). All detected samples (28 of 126 samples) from SW sediments exceeded the screening ESL for lead. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (22 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQ for UCL EPC from the comprehensive sediment data set was < 1 and UTL was 2 (Table 5.9). The AT for lead is a PEC of 128 mg/kg (MacDonald et al 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 2.

Lead was detected in all of the samples. The concentration distribution is provided in Figure 5.55. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 28 of 126 (22 percent) (Table 5.11). Additionally, HQs for all detected samples that exceeded the refined ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from lead to aquatic populations within the SW AEU.

The spatial distribution of lead concentrations relative to the CRA Methodology ESL is shown in Figure 2.123. As shown within this figure, three locations within Pond B-4, one location within Pond B-5, and several locations within the channel had measured values of lead greater than the ESL. The remaining locations had values below the ESL. The results identify a concentration of lead within habitat areas (Pond B-4 and B-5) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Pond B-4 (Figure A8.38) indicated lead was detected at concentrations greater than the ESL at one location within Pond B-4. This spatial extent of lead does not indicate a potential for risk to benthic populations within the SW AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of lead in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicate that the MDC (170 mg/kg) is greater than the ESL and AT, but the arithmetic average (28.5 mg/kg) is less than both the ESL and AT (Attachment 6). This indicates that

realistic exposure conditions are within the uncertain toxicity range but comparable to the ESL, indicating a low risk to aquatic populations.

The adjacent surface soil results included 295 samples for lead, all detected, with an MDC of 426 mg/kg. The MDC exceeded both the ESL and AT.

Lead was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds B-4 and B-5 (Attachment 8) indicating that lead does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for lead indicates that the UCL EPC does not exceed the ESL and there is a relatively low frequency and magnitude of exceedances (i.e., only 22 percent of samples exceeded the ESL and all HQs were < 5). Lead had minimal occurrence of exceedances within aquatic habitat areas. However, the MDC for the surface sediment data set exceeded the ESL and AT. Therefore, the weight-of evidence conclusion is that there is a low and uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Silver

The MDC for silver in SW AEU sediments exceeded the screening ESL (1 mg/kg). A total of 24 samples (32 detected of 124 samples) from SW sediments exceeded the screening ESL for silver. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (19 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for the UCL and UTL from the comprehensive sediment data set were 184 and 7 respectively (Table 5.9). The AT for silver is a TNRCC reservoir guideline, distribution-based, of 1.6 mg/kg (TNRCC 1996 reported in MacDonald et al. 1999) (Attachment 5).The AT HQ for the UCL was 2 and the AT HQ for the UTL was 1.

Silver was detected in 26 percent of the samples. The concentration distribution is provided in Figure 5.56. As depicted in this figure, the average falls above the ESL value. The frequency of exceedance for the ESL was 24 of 124 (19 percent) (Table 5.11). Additionally, HQs for 15 of the 24 detected samples were between 1 and 5, with 7 over 10. Given the low frequency but elevated level of exceedance there remains a low potential for risk from silver to aquatic populations within the SW AEU.

The spatial distribution of silver concentrations relative to the CRA Methodology ESL is shown in Figure 2.124. As shown within this Figure, five locations within Pond B-4, two locations within Pond B-5, one location within Pond A-5, and three locations within the channel had measured values of silver greater than the ESL. The remaining locations had values below the ESL. The results identify a concentration of silver within habitat areas that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Pond B-4 (Figure A8.42) indicated silver was detected at concentrations greater than the ESL at three locations within Pond B-4. This spatial

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extent of silver indicates the need for further evaluation (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of silver in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicate that the MDC (102 mg/kg) is greater than the ESL and AT, and the arithmetic average is also greater than the ESL and AT (Attachment 6).

The adjacent surface soil results included 293 samples for silver, 87 detected, with an MDC of 52.7 mg/kg. The MDC exceeds the ESL or AT.

Silver was identified as an ECOPC for surface water. Further analysis from the risk characterization determine that silver was detected in only 5 percent of the samples indicating a minimal spatial extent. The UTL was greater than the ESL, but less than the AT value. Of the detected concentrations that exceeded the refined ESL, HQs were predominantly less than 10 (90 percent), with only 2 detected values having HQs greater than 10. Additionally, these exceedances of detected samples represent only 2 percent of the data set (21 of 1276); therefore, this indicates that silver (dissolved) concentrations pose low risk to aquatic populations within the SW AEU.

Silver was identified as an ECOPC for the pond-specific evaluations of Pond B-4. Results indicate silver had a frequency of detection of 50 percent (detected in 11 of 22 samples). The surface sediment HQ for the ESL is 3, while the HQ for the AT is 2. Review of the data on a point by point basis indicated that the measured silver results were at or below the AT value. Within Pond B-4, four of six locations had measured values greater than the ESL (but less than the AT), the remaining were at nondetect levels. Because the measured concentrations fall below these AT values, the likelihood for risk attributable to silver is low.

Results for the available chemical LOEs for silver indicates that UCL and UTL EPCs both exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 19 percent of samples exceeded the ESL and most of the HQs were < 5). Silver had minimal occurrence of exceedances within aquatic habitat areas. The MDC for the surface sediment data exceeded ESL and AT benchmarks. Therefore, the weight-of evidence conclusion is that the low and uncertain potential for adverse effects to aquatic life remain attributable to this ECOPC.

Zinc

The MDC for zinc in SW AEU sediments (888 mg/kg) exceeded the screening ESL (121 mg/kg). A total of 60 samples (all detected of 126 detected) from SW sediments exceeded the screening ESL for zinc. These samples were collected between July 1991 and March 2004. The relatively elevated frequency of exceedances by detected concentrations (48 percent) suggests that adverse effects can not be excluded.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were > 1 in both cases (Table 5.9). The AT for zinc is a consensus-based PEC of 459 mg/kg (MacDonald et al. 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and 1 respectively and the AT HQ for the MDC was 2.

Zinc was detected in all samples. The concentration distribution is provided in Figure 5.57. As depicted in this figure, the average falls above the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 60 of 126 (48 percent) (Table 5.11). Additionally, HQs for 54 of the detected samples that exceeded the ESL were between 1 and 5, with only 6 between 5 and 10. Given the medium frequency and magnitude of exceedance there is a small potential for risk from zinc to aquatic populations within the SW AEU.

The spatial distribution of zinc concentrations relative to the CRA Methodology ESL is shown in Figure 2.125. As shown within this figure, there were seven locations within Pond B-4, four locations within Pond B-5, one location within Pond A-5, and several locations within the channel with measured concentrations greater than the ESL. The results identify a concentration of zinc within habitat areas that requires further evaluation. The results presented within this figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for the B-series ponds (Figure A8.43) indicated zinc was detected at concentrations greater than the ESL at six locations within Pond B-4. All measured concentrations in Pond B-5 were less than the ESL. Therefore, the results shown within Figure 2.125 demonstrate that the results exceeding the ESL are at subsurface (greater than 1 ft). This spatial extent of zinc does indicate the need for further evaluation of Pond B-4 surface sediment risk conditions. Results are described below as well as within Attachment 8.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of zinc in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the SW AEU indicate that the MDC (888 mg/kg) is greater than the ESL and AT, and the arithmetic average (166 mg/kg) is less than the AT (Attachment 6).

The adjacent surface soil results included 295 samples for zinc, 292 detected, with an MDC of 11,900 mg/kg. The MDC exceeds the ESL and AT. However, average soil zinc values (153 mg/kg) were slightly higher than the ESL and lower than AT levels.

Zinc was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background.

Zinc was identified as an ECOPC for the pond-specific evaluations of ponds B-4 and B-5. Results of the Pond B-4 risk characterization determined the surface sediment HQ for the ESL is 4, while the HQ for the AT is <1. In addition, the MDC for zinc was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background. Results of the Pond B-5

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analysis indicated the surface sediment HQ for the ESL is 2, while the HQ for the AT is <1. The MDC for zinc was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background.

Results for the available chemical LOEs for zinc indicate that the UCL and UTL EPCs exceed the ESL and there is a medium frequency and magnitude of exceedances (with some HQs > 5). Zinc had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion is that there is a small potential for adverse effects to aquatic life attributable to this ECOPC based on chemistry, alone.

Bromomethane

The MDC for bromomethane in SW AEU sediment (5 µg/kg) exceeded the screening ESL (3.43 µg/kg). The UTL-EPC from the comprehensive sediment data set also drove an ESL-HQ > 1, whereas a UCL was <1 (Table 5.9). The AT for bromomethane is 62.72 µg/kg, a calculated EqP benchmark based on the acute surface water criteria (EPA 1997b). All AT-HQs were < 1. The lack of AT exceedances by EPCs suggests that bromomethane in sediment at SW AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for bromomethane is provided in Figure 5.66. As depicted in this figure, the ESL is lower than most reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. An evaluation of the uncertainty associated with the detection limits is provided in Section 6. Only one detected sample exceeded the screening ESL (Table 5.11). This sample was collected in January 2001 and had an HQ of 2. Fifty-seven nondetected concentrations also exceeded the ESL. The low frequency of exceedances by detected concentrations (1 percent) suggests there is a low potential for risk from detected bromomethane to benthic populations within the SW AEU.

The spatial distribution of bromomethane relative to the ESL is shown in Figure 2.136. The results indicate that all sample measurements within true aquatic habitat settings were at nondetect levels. This spatial evaluation of exceedances does not indicate a potential for risk to benthic populations within the SW AEU.

MDC-HQs were unchanged in the surface sediment data set (Table 5.10). The low magnitude ESL-HQ and lack of an AT exceedance suggests that the potential for risks to benthic populations within the SW AEU is unlikely.

Bromomethane was below detection limits in all soil samples collected adjacent to South Walnut Creek (Attachment 6). Therefore, the potential contribution of bromomethane in surface soils to SW AEU sediment is uncertain.

Bromomethane was not detected in surface water. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations of ponds B-4 and B-5

(Attachment 8) indicating that bromomethane does not pose a risk concern to isolated habitat areas.

Chemical toxicity comparisons to sediment samples found a low magnitude of ESL and AT exceedances, a low frequency of these exceedances, and lack of AT exceedances from the single detected concentration greater than the ESL. In addition, there was a minimal spatial extent of elevated concentrations of bromomethane within aquatic habitat areas. There is also uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. The weight-of evidence conclusion for chemical LOEs is that there is a no-to-low potential for risk to benthic populations from bromomethane in sediment at SW AEU.

Carbazole

The MDC for carbazole in SW AEU sediment (290 µg/kg) exceeded the screening ESL (25.2 µg/kg). UCL and UTL-EPCs from the comprehensive sediment data set also drove ESL-HQs > 1 (Table 5.9). The AT for carbazole is 1,600 µg/kg, a Washington State Sediment Quality Guideline (Cubbage et al. 1997). All AT-HQs were < 1. The lack of AT exceedances by EPCs suggests that carbazole in sediment at SW AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for carbazole is provided in Figure 5.67. As depicted in this figure, the ESL is lower than most reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. An evaluation of the uncertainty associated with the detection limits is provided in Section 6. A total of 5 detected samples exceeded the screening ESL (Table 5.11). These samples were collected in February 1995. Detected exceedances had HQs ranging from 1 to 12. All nondetected concentrations also exceeded the ESL. The potential for risk from carbazole to benthic populations within the SW AEU could not be excluded due to this moderate frequency of ESL exceedances by detected concentrations (31 percent).

The spatial distribution of carbazole relative to the ESL is shown in Figure 2.137. The results indicate that there was one location with a measured concentration greater than the ESL in the channel area. The remaining results were either less than the ESL or at nondetect levels. This spatial evaluation of exceedances does not indicate a potential for risk to benthic populations within the SW AEU.

MDC-HQs were unchanged in the surface sediment data set (Table 5.10). The lack of an AT exceedance by the MDC contributes to the uncertain potential for risks to benthic populations within the SW AEU.

Carbazole was not analyzed in any soil samples collected adjacent to South Walnut Creek (Attachment 6). Therefore, the potential contribution of bromomethane in surface soils to SW AEU sediment is not known.

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Carbazole was not detected in surface water. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that carbazole does not pose a risk concern to isolated habitat areas.

Chemical toxicity comparisons to sediment samples found a moderate frequency and magnitude of ESL exceedances, although the EPCs did not exceed the AT benchmark and the potential for toxicity is uncertain. In addition, there was minimal spatial extent of elevated concentrations of carbazole within aquatic habitat areas. There is further uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. Therefore, the weight-of evidence conclusion is the potential for adverse effects to benthic populations from carbazole in sediment at SW AEU cannot be excluded.

PAHs

The MDC for total PAHs in SW AEU sediment (23,400 µg/kg) exceeded the screening ESL (1,610 µg/kg). UCL and UTL-EPCs also exceeded the ESL (Table 5.9). The AT for total PAHs is 22,800 µg/kg, a CB-PEC (MacDonald, et al. 2000a). The MDC was greater than the AT benchmark, indicating a potential for adverse effects from the sampling area for the highest concentration. However, the lack of AT exceedances by the UTL and UCL suggests that total PAHs in sediment at SW AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible, but not probable.

Further analysis of maximum detected total concentrations in surface sediment (0-6 inches) determined that the reduced MDC (15,880 µg/kg) exceeded the screening ESL, but was less than the AT (Table 5.10).

The number of detected concentrations exceeding the screening ESL for total PAHs is shown in Table 5.11. There was a relatively high frequency of total PAH concentrations exceeding the ESL (50 percent). However due to the lack of AT exceedances, and relatively low magnitude ESL exceedances, these chemical lines of evidence indicate that the risk attributable to total PAHs in SW AEU sediment cannot be excluded, but is low.

Total PAHs were further evaluated for the surface sediment samples collected within Pond B-4. Concentrations from the four locations with detected PAH ranged from 360 to 3,620 µg/kg. This MDC resulted in an ESL-HQ of 2, and the AT-HQ was <1. These chemical LOEs support the conclusion that the potential for risk attributable to total PAHs in ponds is low.

The MDCs for 13 individual PAHs (acenaphthene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) in SW AEU sediment all exceeded their respective screening ESLs. Screening ESL-HQs were also > 1 for UCL and UTL-EPCs from the comprehensive sediment data set, and ranged from 3 to (fluoranthene) to 58 (acenaphthene) (Table 5.9). These samples were collected between August 1991 and July 2005.

AT benchmarks were mainly comprised of consensus-based PECs (MacDonald, et al. 2000a) or other sources when CB PECs were not available: a PEL for acenaphthene (MacDonald et al. 1999), ERMs for benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene (Ingersoll et al. 1996), a toxic effect threshold (TET) concentration for benzo(k)fluoranthene (MENVIQ/EC 1992), and an effects range low (ERL) for total PAHs (Ingersoll, et al. 1996) used as a surrogate for dibenz(a,h)anthracene in the absence of any other benchmark (Attachment 5).

UCL and UTL-EPCs for eight PAHs did not exceed the AT benchmark (benzo[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, fluorene, phenanthrene, and pyrene). Benzo(k)fluoranthene also had a UTL that exceeded the AT benchmark by a low magnitude (HQ =1), but the UCL did not exceed the AT. The potential for risk from these nine PAHs is within the range of uncertain toxicity where the potential for adverse effects is possible, but not probable. The final four (acenaphthene, benzo[g,h,i]perylene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) exceeded their ATs, but with HQs ≤ 4. The potential for risk could not be excluded for these final four PAHs.

Concentration distributions for PAHs are provided in Figures 5.58, 5.59, 5.62 through 5.65, and 5.68 through 5.74. ESLs for four PAHs (acenaphthene, benzo[g,h,i]perylene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) are lower than almost all detected and nondetected concentrations (one detected concentration of dibenzo[a,h]anthracene was lower than the ESL). ESLs were also lower than many of the detected concentrations of all other PAHs. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk.

Surface sediment MDCs for all PAHs were not different from those in the comprehensive data, so MDC-HQs were unchanged (Table 5.10). UTL-EPCs were also only slightly lower or slightly higher for surface sediments than for the comprehensive data. These changes were not significant enough to change the HQs.

The number of detected and nondetected concentrations exceeding the screening ESL is shown in Table 5.11. Ten PAHs had <20 percent of samples exceeding the ESL by detected concentrations. Benzo(k)fluoranthene HQs were all less than five. This low frequency and low magnitude of exceedances by detected concentrations suggests there is a low potential for risk from benzo(k)fluoranthene, dibenzo(a,h)anthracene, fluorene, and naphthalene to benthic populations within the SW AEU. However, there is uncertainty in this conclusion due to the exceedances of detection limits[2] as compared to the ESL. The ESL exceedance frequencies for the remaining PAHs were greater than 25 percent, and suggest that the potential for risks from these PAHs cannot be excluded.

The spatial distribution of individual PAHs in sediment does not generally indicate a potential for risk to benthic populations within the SW AEU (Figures 2.127, 2.128, 1.132 through 2.135, and 2.138 through 2.144). Total PAH calculated results for each sample

[2] Sample interference is common in PAH chemical analyses of sediment media, and it is difficult to achieve detection limits below ESLs without requesting targeted methods.

location as compared to the ESL is provided in Figure 2.126. Although there were frequent exceedances for some PAHs, these samples were not clustered in small areas that would indicate hot-spots, and were limited within true aquatic habitat areas[3]. Results presented within the figures include all sediment depth fractions. Further analyses of ECOPCs in ponds B-4 and B-5, where individual PAHs were found to exceed ESLs, indicated that almost all of these detected concentrations that exceeded ESLs were from sub-surface sediment samples. Sediment from more than 6 inches below the surface is not biologically available and represents an incomplete exposure pathway to benthic organisms. A detailed analysis of the spatial extent within surface sediment for ponds A B-4 and B-5 are presented in Attachment 8, where PAHs were concluded to pose a low likelihood of risk to benthic macroinvertebrates.

The potential contribution to future sediments from surface soils adjacent to South Walnut Creek is unlikely to reduce sediment risks in the SW AEU (Attachment 6). PAH concentrations in surface soils were greater than sediment ESLs for the individual PAHs. However, there is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry. The extent of surface soil contributions to site sediments is not known.

Confidence in these individual PAH risk characterizations is also low when total PAHs do not exceed the ESL or AT. Screening ESLs for individual PAHs are derived from multiple sources with varying endpoints and organisms sensitivities. The consensus-based TEC (MacDonald et al. 2000a) used as the total PAH-ESL is a conservative estimate of the toxicity threshold where adverse effects are not expected to occur in most sediment types. There is the highest confidence in this benchmark, which is based on a review of several sources and has a high degree of accurately predicting the absence of toxicity. Likewise, the AT benchmark for total PAHs is a good predictor of when adverse effects are likely. The potential for adverse effects is uncertain for concentrations between these benchmarks.

Total-PAHs evaluate the potential for effects for all PAHs, not only those with known screening benchmarks. The additive toxicity from PAHs is also addressed by total-PAH benchmarks. In these respects the total-PAH screen has less uncertainty than individual PAH SEVs.

The weight-of evidence conclusion for chemical LOEs is that there is a low but uncertain potential for risk to benthic populations from PAHs in SW AEU sediment. Sediment concentration screening against threshold toxicity benchmarks found the magnitude of exceedances for PAHs were greater than 10 for some detected concentrations and for total PAHs; however, there was often a low frequency of these exceedances, and minimal spatial extent of elevated surface sediment concentrations within aquatic habitat areas. There is low confidence in this conclusion due to uncertainty from inadequate detection limits driving ESL exceedances for nondetected concentrations.

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[3] 'True aquatic habitat areas' include the main stream channel and ponds. Samples from ephemeral habitat, overland flow, and ditches are not considered representative of true habitat (Figure 1.7).

PCBs

The MDC for total PCBs in SW AEU sediment (3,700 µg/kg) exceeded the screening ESL (40 µg/kg). UCL and UTL-EPCs were 16 and 19 respectively (Table 5.9). The AT for total PCBs is 676 µg/kg, a CB-PEC (MacDonald et al. 2000a). The AT-HQ for the MDC was > 1 (5). This AT exceedance by the MDC suggests that the potential for risk from total PCBs in sediment at SW AEU cannot be excluded.

Further analysis of the MDC in surface sediment (Table 5.10) determined that the reduced MDC (220 µg/kg) exceeded the screening ESL, but was less than the AT. This suggests that total PCBs in sediment occur within the range of uncertain toxicity.

Total PCB concentrations within ponds were evaluated in the pond-specific assessment (Attachment 8). Results of the ECOPC screen identified total PCBs in Pond B-4 as potential risk drivers. Total PCBs in Pond B-4 had an MDC of 220 µg/kg, attributable to Aroclor-1254. This value exceeds the total PCB ESL, but is less than the total PCB and results in an AT-HQ <1. The ESL was based on a consensus-based TEC (MacDonald et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (676 µg/kg). Therefore, there is a low potential for total PCBs to pose an unacceptable risk to benthic populations in Pond B-4.

The MDCs for individual PCBs (Aroclor-1254 and Aroclor-1260) in SW AEU sediment both exceeded their respective screening ESLs (60 and 5 µg/kg, respectively). Screening ESL-HQs were also > 1 for UCL and UTL-EPCs from the comprehensive sediment data set, and ranged from 7 (for the UCL) to 41 (Aroclor-1260) (Table 5.9). These samples were collected between September 1991 and July 2005. AT benchmarks were TETs of 300 µg/kg (Aroclor-1254) and 200 µg/kg (Aroclor-1260) from MacDonald, et al. (2000b) (Attachment 5). AT-HQs for MDCs and UTLs were > 1, while the UCL for Aroclor-1254 was only marginally exceeded (HQ=1) and was not exceeded for Aroclor-1260. The potential for risk to benthic organisms from both Aroclor-1254 and -1260 are possible and cannot be excluded.

Concentration distributions for Aroclor-1254 is provided in Figure 5.94, respectively. The ESL for Aroclor-1260 is lower than all detected and nondetected concentrations. For Aroclor-1254 the ESL was lower than most concentrations. Both PCBs had few detected concentrations that exceeded the ESL and many nondetected values above the ESL. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk.

Surface sediment MDCs for Aroclor-1254 were lower than the MDCs from the comprehensive data, but the Aroclor-1260 MDC in surface sediment was unchanged. All Aroclor ESL and AT-HQs still exceeded one (Table 5.10).

The number of detected and nondetected PCB concentrations exceeding the screening ESL is shown in Table 5.11. Both Aroclor congeners had detected concentrations with HQs >10. There was a lower frequency of detected concentrations exceeding the ESL for Aroclor-1260 (5 percent) than for Aroclor-1254 (24%), but this was largely due to a lower detection frequency. For Aroclor-1254, there were 23 of 26 detected concentrations) that exceeded the ESL, whereas 5 of 5 detected concentrations exceeded the ESL for Aroclor-1260. These exceedance frequencies suggest there is a low potential for risk from Aroclor-1260 and a higher potential for risk from Aroclor-1254. However, there is low confidence in both conclusions due to the uncertainty from inadequately low detection limits[4] for a significant proportion of samples that exceeded ESLs. Therefore, the potential for risks from these PCBs cannot be excluded.

The spatial distribution of individual PCBs in sediment does not generally indicate a potential for risk to benthic populations within the SW AEU (Figures 2.35 and 2.38). Total PCB calculated values for each sample location as compared to the ESL is provided in Figure 2.63. Samples with concentrations exceeding ESLs were not clustered in small areas that would indicate hot-spots, and were limited within true aquatic habitat areas[5]. Results presented within the figures include all sediment depth fractions. Further analyses of these PCBs in Pond B-4, where individual PCBs were found to exceed ESLs, indicated that detected concentrations that exceeded ESLs were from sub-surface sediment samples. Sediment from more than 6 inches below the surface is not biologically available and represents an incomplete exposure pathway to benthic organisms. A detailed analysis of the spatial extent within surface sediment for Pond A B-4 are presented in Attachment 8, where PCBs were concluded to pose a low likelihood of risk to benthic macroinvertebrates.

The potential contribution to future sediments from surface soils adjacent to South Walnut Creek is unlikely to reduce sediment risks in the SW AEU (Attachment 6). PCB concentrations in surface soils were greater than sediment ESLs for Aroclor-1254 and Aroclor-1260. However, there is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry. The extent of surface soil contributions to site sediments is not known.

Confidence in these individual PCB risk characterizations is also low when total PCBs do not exceed the ESL or AT. Screening ESLs for individual PCBs are derived from multiple sources with varying endpoints and organisms sensitivities. The total PCB benchmark evaluates the potential for effects for all PCBs, not only those with known screening benchmarks. The additive toxicity from PCBs is also addressed by the total PCB benchmark. In these respects the total-PCB screen has less uncertainty than individual PCB SEVs.

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[4] Sample interference is common in PCB chemical analyses of sediment media, and it is difficult to achieve detection limits below ESLs without requesting targeted methods.

[5] 'True aquatic habitat areas' include the main stream channel and ponds. Samples from ephemeral habitat, overland flow, and ditches are not considered representative of true habitat (Figure 1.7).

The weight-of evidence conclusion for chemical LOEs is that the risks to benthic invertebrates from PCBs in SW AEU sediments cannot be excluded, but is uncertain. Sediment concentration screening against threshold toxicity benchmarks found the magnitude of exceedances for PCBs required further evaluation; however, there was a low frequency of these exceedances for Aroclor-1260, and there was minimal spatial extent of elevated surface sediment concentrations within aquatic habitat areas. There is low confidence in this conclusion due to uncertainty from inadequate detection limits driving ESL exceedances for nondetected concentrations.

Other/Drainage Specific Lines of Evidence

Table 5.12 provides a summary of the other/drainage LOEs gathered by previous studies. The SW AEU has been extensively studied. Studies were completed which encompassed several types of lines of evidence including tissue analysis, aquatic population measures, bioassay analysis and waterfowl/wading bird evaluations. Results provide a LOE regarding the aquatic ecosystem condition within the SW AEU. Most of the studies capture historical conditions that have been altered in ways to remove chemical stressors. Thus, their findings provide a conservative characterization of biological communities and the bioavailability and toxicity of various contaminants.

The Kaiser-Hill studies evaluated aquatic ecological conditions throughout RFETS over time (1999 through 2001). Results indicate that aquatic species are affected by habitat variables but not by site contaminants. The limiting environmental factor is low surface water discharge. The SW AEU undergoes periods where flows are completely absent from portions of the system. The SW AEU predominantly provides seasonal habitat following periods of snowmelt or high rainfall events. Otherwise, habitat and aquatic communities are extremely limited.

Specifically, PCB concentrations in fish tissue collected from B-series ponds of the SW AEU were lower than maximum recommended body burdens (Eisler 1986) in bass samples and all but three fathead minnow samples collected from Pond B-4 (Stiger 1994). Only one other fathead minnow sample from Pond B-4 exceeded the fish tissue benchmark (DOE 1996). Despite elevated tissue and/or sediment concentrations PCBs were determined to pose no risks to avian piscivores (Stiger 1994; DOE 1996). B-series Ponds also contained the highest benthic macroinvertebrates abundances (DOE 1996). Benthic macroinvertebrate communities were relatively healthy and supported by good water quality in Walnut Creek (Exponent 1998). The presence of pollution intolerant taxa (Ephemeroptera and Trichoptera) indicate the Walnut Creek benthic macroinvertebrate community was relatively rich and diverse (Aquatic Associates Inc. 2003). Sediment toxicity bioassays agree with the findings of no effects from these other studies and did not observe toxicity to *C. tentans* in any pond sediments (DOE 1996). Only Pond B-2 showed a low toxicity to *H. azteca* in this study.

The discrepancy between site sediment toxicity and ESL exceedances, particularly by PAHs, may be due to the chemical properties of the sediment. Organic carbon (OC) in sediments binds nonpolar (non-ionic) organic contaminants to render them non-bioavailable (Mahony et al. 1996). If the total organic carbon (TOC) in SW AEU sediments is higher than the 1 percent TOC assumed in the ESLs, then these ESLs will be

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more conservative than necessary to protect benthic organisms Higher OC in sediments is derived from decomposition of leaves and organic matter, producing a dark spongy soil. Site investigations indicate that stream and pond sediment is darker and richer in OC than the assumed 1 percent. Sediment accumulation areas in the ponds, streams (backwaters and pools), and marshy areas with emergent vegetation are likely to produce TOC-rich (>5 percent) and electrochemically-reduced sediments that will produce sulfide. Acid volatile sulfides (AVS) bind metals when the sediments are anaerobic (Ankley et al. 1996). Therefore, sulfide and TOC likely to be present in the soft sediments of low-energy microhabitats, including pond bottoms, will serve to detoxify metals and certain organic contaminants.

The studies determined that aquatic conditions have been consistent over time and represent good ecological conditions relative to reference sites. There appeared to be no controlling factor affecting community structure with the exception of habitat and low flow.

5.4.3 Weight-of-Evidence Conclusions

There were 5 surface water ECOPCs (5 inorganics) and 27 sediment ECOPCs (10 inorganic and 17 organics) evaluated using multiple LOEs within the contaminant risk characterization. The WOE analysis method was as stated in Section 5.1.3, above.

Weight of evidence conclusions for the SW AEU can be summarized as:

Magnitude of ESL or AT exceedances:

- All surface water contaminants showed low magnitude HQs for either primary ESLs or ATs, with the possible exception of ammonia.
- Sediment ESL-HQs were generally low (<10) for UTL and UCL-EPCs except for fluoride, acenaphthene, benzo(g,h,i)perylene, carbazole, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1254 and Aroclor-1260, and were less than 5 for all UTL and UCL comparisons to AT benchmarks.

Spatial Distribution:

- Most surface water contaminants were minimally distributed and unclustered, except for ammonia and silver which were found in aquatic habitats.
- Most sediment contaminants were associated with the IA overlapping portion of the AEU. Certain ECOPCs were concentrated in ponds, however the pond-specific analysis of surface sediment often found that few measured concentrations were present. Most were at nondetect or less than ESL concentrations within surface sediment indicating a low risk concern.

Frequency of Exceedances:

- Four of the five surface water contaminants had a very low frequency of HQ exceedances. Ammonia more commonly exceeded benchmarks.

- Most sediment ECOPCs had fewer than 20 percent of samples (detected) exceeding their ESL, except for fluoride, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, carbazole, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, Aroclor-1254, phenanthrene, and pyrene.

Change in Exceedances over Time:

- Most surface water constituents have decreased in toxicity in recently-collected samples, including ammonia. Recent changes in 4,4'-DDT concentrations are unknown.

- - Surface sediment MDCs were generally not different from the comprehensive sediment database ESLs and did not influence the potential for risk. In only a few cases were the MDCs lower in surface sediments (cadmium, silver, indeno[1,2,3-cd]pyrene).

Drainage-specific habitat and ecological studies:

- Previous studies indicate that aquatic life within the SW AEU is primarily affected by natural conditions associated with the ephemeral and intermittent character of the drainage hydrology. There was no indication that contaminant stressors were affecting the ecology. In addition, the AT values based on acute exposure (instead of chronic) are most appropriate due to the intermittent nature of flows in the drainage. Those AT values yielded the lowest evidence of chemical risk.

- Toxicity was not observed in pond sediment bioassays, indicating that PAHs, PCBs, and metals do not pose a potential for risk in pond habitat.

- Fish tissue residues were below toxicity thresholds for PCBs.

- Benthic macroinvertebrate communities were healthy.

In summary, the weight of evidence gathered from the risk characterization indicates that there is no or low potential for risk to the aquatic populations within the SW AEU caused from contaminant chemistry alone. The seasonal hydrologic regime and local topography are most important in determining the makeup of the local aquatic communities and in mitigating any small potential for chemical-based risk. The low toxicity in pond sediment bioassays also had a strong weight in this WOE. In contrast to the strong effects of intermittent flows and seasonal hydrologic regime, the observations indicating the possibility of low, chemically-based risk were mostly based on uncertain toxicological endpoints and low and infrequent exceedances which would be unlikely to produce population and community effects, an observation supported by the various other LOEs and special studies.

5.5 Risk Characterization of the WC AEU

ECOPCs were identified for surface water and sediment within the WC AEU. A contaminant risk characterization using the various LOEs was completed for these contaminants. The WC AEU has seen considerable study by others in areas of other/drainage lines of evidence. This risk characterization begins with a site ecological setting description in order to provide perspective regarding the aquatic ecosystem characteristics associated with the WC AEU. The contaminant risk LOEs and the other/drainage LOE are then described, followed by a weight-of-evidence summary of these risk descriptors.

5.5.1 Site-Specific Habitat Description

Woman Creek traverses the south side of the site, and captures runoff from the southern portion of the IA, as well as the majority of the southern buffer zone. Several tributaries to Woman Creek exist within the RFETS boundaries, and include, from north-to-south: 1) the South Interceptor Ditch (SID), 2) North Woman Creek, 3) Owl Branch, and 4) Antelope Springs. The hydrology in the Woman Creek tributaries is expected to remain unchanged between the historic and future configuration of RFETS with the exception of the SID in which flows are anticipated to be reduced. Woman Creek flows through Pond C-1, which was reconfigured as a low-profile, flow through structure in 2005. Woman Creek is isolated from IA surface runoff by the SID which intercepts surface flow and diverts it to Pond C-2. Woman Creek is diverted around Pond C-2 via a concrete diversion wall and channel, rejoining the original Woman Creek channel downstream of Pond C-2.

Woman Creek is designated as stream segment 4a in the Big Dry Creek basin by the Colorado WQCC. The mean annual discharge volume measured at the site boundary near Indiana Street, is approximately 269 ac-ft per year, with a peak flow of 80 cfs. Woman Creek flows into Woman Creek reservoir after exiting RFETS.

Aquatic habitats within the Woman Creek aquatic EU are restricted to the head waters of Woman Creek and its tributaries (i.e., the area above the C-2 pond). Intermittent stream flow alternate with areas of persistent flow within the headwaters. Intermittent segments contain isolated pools that provide important habitat for many aquatic species during the late summer and early fall when flow ceases. Persistent flows originate from seeps and springs and provide year-round aquatic habitats. Pond C-1 is the only pond associated with Woman Creek directly since Pond C-2 is hydrologically isolated from the Creek and receives flows from the SID. The SID provides only marginal ephemeral habitats. These ephemeral habitats comprise a few small pools where water collects during storm events. These areas dry out quickly. Below Pond C-2 only one or two small pools remain most of the year in Lower Woman Creek. The rest of this reach is dry the majority of the year.

Woman Creek retains a significant amount of stream habitat and holds the majority of RFETS fish species. Native fish species that reproduce within Woman Creek include white suckers (*Catostomus commersoni*), fathead minnows, green sunfish (*Lepomis cyanellus*), stonerollers (*Capostoma anomalus*) and creek chubs (*Semotilus*

atromaculatus). Two none-native fish species, golden shiners (*Notemigonus crysoleucas* and largemouth bass (*Micropterus salmoides*), also are found in the drainage.

Within Woman Creek, the most common aquatic macroinvertebrates are Oligochaetes (tubificid worms) (AAI 2003), the larvae of the blackfly (Order *Diptera, Simulidae* sp.) midge (Order *Diptera, Chironomidae* sp) and mayfly (Order *Ephemeroptera*) (DOE, 1997). Other species include caddisflies (Order *Trichoptera*), craneflies (*Tipulidae* ssp.), damselfly larvae (Order *Odonata*), stonefly larva (Order *Plecoptera*) as well as snails (Class *Gastropoda*) and amphipods (Order *Amphipoda*). Large macroinvertebrates such as crayfish (Order *Decapoda,* Family *Astacidae*) and snails are potentially important prey for other fish, waterfowl and mammal species

5.5.2 Exposure and Risk Characterization

Tables 5.13 and 5.14 provide the HQs for the comprehensive surface water data set and the post-1999 surface water data set. Tables 5.15 and 5.16 provide the HQs for the comprehensive sediment (includes all depth fractions) and surface (0-6") sediment data sets for the sediment ECOPCs, respectively. HQs derived from the ESL and AT values for each contaminant are provided for MDC, UCL, and UTL EPCs for each of the four media. Table 5.17 provides the frequency and magnitude of comprehensive surface water and sediment HQs based on ESLs. Concentration distributions of ECOPCs in surface water and sediment media in relation to ESLs and AT benchmarks are presented in Figures 5.75 through 5.104. The results of the contaminant risk characterization are presented below by medium (surface water and sediment) and by contaminant.

5.5.3 Contaminant Risk Characterization Lines of Evidence

Surface Water ECOPCs

Ammonia

The MDC for ammonia in WC AEU surface water (0.0939 mg/L) exceeded the screening ESL (0.02 mg/L). A total of 3 detected samples from WC surface water exceeded the screening ESL for unionized ammonia. These samples were collected between March 1993 and August 1994. The low frequency of exceedances by detected concentrations (4 percent) suggests that potential adverse effects may not be widely distributed

The screening ESL for ammonia was derived from CDPHE (2005a), and represents unionized ammonia. The unionized ESL HQs for UCL and UTL EPCs from the comprehensive surface water data set were both < 1 (Table 5.13) (the ESL was unchanged from the screening value). The AT value for ammonia (0.104 mg/L) was the acute water quality criterion, and was pH- and temperature-adjusted using a WC AEU specific average pH of 7.2 and an estimated temperature of 20°C (Attachment 5). The AT ESL HQs for the MDC, UCL, and UTL EPCs were all less than 1. These HQ values indicate no to low risk potential attributable to ammonia.

Ammonia was detected in 38 percent of the samples. The concentration distribution is provided in Figure 5.75. As shown in this figure, approximately 96 percent of the values fall below the ESL value, including the mean and 95 UCL. The magnitude and frequency

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of HQ values for the data set based on the refined ESL are presented in Table 5.17. HQs for detected results were all ≤ 5. This indicates that ammonia concentrations are unlikely to pose a risk to aquatic organisms.

The spatial distribution of ammonia concentrations relative to the site-specific ESL is shown in Figure 2.160. One location within Pond C-2 had a measured value greater than the ESL. The remaining sample locations within the channel and pond areas had measured values less than the ESL. The spatial distribution of ammonia samples is not wide-spread nor is ammonia consistently elevated in any specific location.

ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set could not be calculated due to the lack of available data (Table 5.14).

Evaluation of the available chemical LOEs for ammonia indicates a low magnitude of exceedance (i.e., 96 percent of HQs < 1 and MDC of only 5) and unclustered spatial extent of exceedances. Additionally, there were no AT exceedance that would indicate the occurrence of acute exposures. Therefore, there is no to low potential for adverse effects to aquatic life attributable to ammonia in WC AEU.

Cadmium (Dissolved)

The MDC for cadmium (dissolved) in WC AEU surface water (0.0268 mg/L) exceeded the screening ESL (0.00025 mg/L). A total of 2 samples from WC surface waters exceeded the screening ESL for cadmium. These samples were collected between July 1991 and November 1997. The low frequency of exceedances by detected concentrations (7 percent) suggests that potential adverse effects may not be widely distributed.

The cadmium screening ESL is hardness dependant and was calculated after CDPHE (2005a) using an estimated hardness of 100. Site specific hardness in WC AEU was determined to be 162 (Attachment 5); and, a refined ESL based on this site-specific hardness is 0.0032 mg/L. The MDC for cadmium (dissolved) still exceeded this refined ESL, but with a low magnitude HQ (8.4). ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were <1 in both cases (Table 5.13). The AT for cadmium is the acute water quality criterion. This site-specific, hardness adjusted AT value is 0.0072 mg/L. AT HQs for UCL and UTL EPCs were < 1. The absence of exceedances by these EPCs indicates a low potential for risk from cadmium in surface water at WC AEU.

Cadmium was detected in 13 percent of samples. The concentration distribution is provided in Figure 5.76. As depicted in this figure, the UTL and average fall below the refined ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the refined ESL was 2 of 364 (<1 percent) (Table 5.17). HQs for the two detected samples exceeding the refined ESL were <1 or 1. The low frequency and magnitude of exceedance indicate a low potential for risk from cadmium to aquatic populations within the WC AEU.

The spatial distribution of cadmium relative to the site-specific refined ESL is shown in Figure 2.161. One location within the SID, and one within the channel area exceeded the

ESL. The remaining locations within the channel and pond settings were either less than the ESL or at nondetect levels. The spatial extent of cadmium does not indicate a risk concern to aquatic populations within the WC AEU.

Refined ESL-HQs for MDC, UCL, and UTL EPCs from the post-1999 surface water data set were <1 (Table 5.14). These HQ values indicate that cadmium is not a current risk to aquatic populations within the WC AEU.

Results for the available chemical LOEs for cadmium indicate that UCL and UTL EPCs do not exceed the refined ESL, there is a very low frequency and magnitude of exceedances (i.e., <1 percent of samples exceeded the refined ESL), and there were few exceedances within aquatic habitat areas. Additionally, the MDC from post-1999 data did not exceed the refined ESL. Therefore, the weight-of evidence conclusion is that there is no potential for adverse effects to aquatic life attributable to this ECOPC.

Silver (dissolved)

The MDC for silver (dissolved) in WC AEU surface water (0.0063 mg/L) exceeded the screening ESL (0.00032 mg/L). A total of 21 detected samples from WC surface waters exceeded the ESL for silver. These samples were collected from July 1991 to April 2004. This low frequency of exceedances (6 percent) suggests that potential adverse effects may not be widely distributed.

The silver (dissolved) ESL is hardness dependant and was calculated after CDPHE (2005a) using an estimated hardness of 100. Site specific hardness in WC AEU was determined to be 162 (Attachment 5); and, a refined ESL based on this site-specific hardness is 0.0007 mg/L. The MDC for silver (dissolved) still exceeded this refined ESL, but the refined ESL-HQs for UCL and UTL EPCs from the comprehensive surface water data set were 1 and 4, respectively (Table 5.13). An acute surface water benchmark value of 0.0047 mg/L was considered the AT value (CDPHE 2005a). AT-HQs from the comprehensive surface water data set were <1 for both the ESL and UCL. These HQ values indicate a low risk potential attributable to silver with uncertainty attributed to the exceedances of nondetects (Table 5.17).

Silver (dissolved) was detected in only 7 percent of the samples indicating a minimal spatial extent. The concentration distribution is provided in Figure 5.77. Most of the measured values occurred below the AT with only 6 exceptions. The UTL and average concentrations are greater than the ESL, but less than the AT value. The magnitude and frequency of HQ values for each sample are presented in Table 5.17. Of the detected concentrations that exceeded the refined ESL, HQs either were all less than 10. Additionally, these exceedances of detected samples represent only 6 percent of the data set (27 of 365); therefore, this indicates that silver (dissolved) concentrations pose no or low risk to aquatic populations within the WC AEU.

The spatial distribution of concentrations of silver (dissolved) relative to the site-specific ESL is shown in Figure 2.162. Several locations within the channel, and one location within Pond C-1, had measured values greater than the ESL. The remaining sample results within the aquatic habitat areas were below detection. Several locations outside

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the aquatic habitat areas and within the SID and surrounding IA areas had measured values greater than the ESL. The infrequent and unclustered spatial extent of exceedances does not indicate a potential for risk to aquatic populations within the WC AEU from silver.

Refined ESL-HQs for UCL and UTL EPCs from the post-1999 surface water data set were both <1 (Table 5.14). These HQ values indicate that silver (dissolved) is not a current risk to aquatic populations within the WC AEU.

Although the concentrations of silver (dissolved) in the WC AEU surface water are statistically greater than background, the MDC for silver (dissolved) is less than the background maximum concentration. This indicates that the occurrence of silver (dissolved) is within the range of background levels. Any risk associated with this metal would be no greater than the risk associated with background concentrations.

The potential risk attributable to silver (dissolved) is low given the low frequency of detection, minimal frequency of site-specific ESL exceedances, and the lack of spatial trends for elevated concentrations within aquatic habitat areas. The potential risk attributable to silver is also within the range of risk attributable to background. . Therefore, the weight-of evidence conclusion is that there is low but uncertain potential for adverse effects to aquatic life from this ECOPC.

Sediment ECOPCs

Aluminum

The MDC for aluminum in WC AEU sediments (32,000 mg/kg) exceeded the screening ESL (15,900 mg/kg) (Table 5.15). A total of 16 of 88 samples from WC sediments exceeded the screening ESL for aluminum. All samples were detected. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances (18 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were < 1 for the UCL and slightly over 1 for the UTL (Table 5.15). The AT for aluminum is the ERM value of 58,000 of Ingersoll et al. (1996), representative of a median effect level for benthic invertebrates (Attachment 5). AT HQs for the UCL and UTL EPCs as well as the MDC were < 1.

Aluminum was detected in all samples. The concentration distribution is provided in Figure 5.78. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 16 of 88 samples (18 percent) (Table 5.17). Additionally, HQs for all 16 samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from sediment aluminum to aquatic populations within the WC AEU.

The spatial distribution of aluminum concentrations relative to the CRA Methodology ESL is shown in Figure 2.174. As shown within this figure, there were several locations

within Ponds C-1 (4 locations) and C-2 (3 locations) with measured concentrations greater than the ESL. In addition, there are two locations within channel areas with measured concentrations greater than the ESL. The nine locations with measured values greater than the ESL represent approximately 32 percent of the data within the true aquatic habitat areas. The remaining 68 percent occurs below the ESL. The results identify a concentration of aluminum within habitat areas (Ponds C-1 and C-2) that requires further evaluation. The results presented within this figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for ponds C-1 and C-2 (Figure A8.59) indicated aluminum was detected at concentrations less than the ESL at all locations except one within Pond C-2, while four locations within Pond C-1 were all greater than the ESL. This spatial extent of aluminum indicates the need for further analysis of pond surface sediment risk conditions in regards to aluminum (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of aluminum in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (31,000 mg/kg) is greater than the ESL but lower than the AT.

The adjacent surface soil results included 71 samples for aluminum, all detected, with an MDC of 45,000 mg/kg. The MDC exceeded the ESL but not the AT. Average soil values (11,268) were lower than ESL and AT levels.

Aluminum was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background levels.

Aluminum was identified as an ECOPC for the pond-specific evaluations of Pond C-1. However, further analysis of Pond C-1 surface sediment identified an HQ for the ESL of 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is 1. Because the measured concentrations fall below these AT values, the likelihood for risk attributable to aluminum is low.

Results for the available chemical LOEs for aluminum indicates that the UCL EPC does not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 18 percent of samples exceeded the ESL, and the all HQs were < 5), and there was a minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC EPCs for the surface sediment data set do not exceed the AT. Aluminum is an almost universally-present constituent of background soils. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Antimony

The MDC for antimony in WC AEU sediments (51.3 mg/kg) exceeded the screening ESL (2 mg/kg) (Table 5.15). A total of 6 detected samples (8 detected of 82 samples) from WC sediments exceeded the screening ESL for antimony. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected

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concentrations (7 percent) suggests that potential adverse effects may not be widely distributed but is uncertain.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were > 1 in both cases (Table 5.15). The AT for antimony is the 3.2 mg/kg, screening criterion from NYSDEC (1994) (Attachment 5). AT HQs for UCL and UTL EPCs were also > 1 as was the AT HQ for the MDC. Low level risk from sediment antimony can not be excluded from this drainage on the basis of this information.

Antimony was detected in only 10 percent of the samples. The concentration distribution is provided in Figure 5.79. As depicted in this figure, the UTL and average falls above the ESL value, as does the majority of the data. Given the low frequency but medium magnitude of exceedance (Table 5.17) there remains a small potential for risk from antimony to aquatic populations within the WC AEU on a strictly chemical basis.

The spatial distribution of antimony concentrations relative to the CRA Methodology ESL is shown in Figure 2.175. As shown within this figure, there are only two locations within true aquatic habitat areas within the channel that have concentrations greater than the ESL. The remaining locations associated with the channel and Ponds C-1 and C-2 were either below the ESL or at nondetect levels. The two locations with measured values greater than the ESL represent approximately 8 percent of the data within the true aquatic habitat areas. The remaining 92 percent occur below the ESL or were nondetects. This spatial extent of antimony does not indicate a potential for risk to benthic populations within the WC AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of antimony in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (51.3 mg/kg) is greater than the ESL and AT.

The adjacent surface soil results included 70 samples for antimony, only 13 detected, with an MDC of 3.3 mg/kg. The MDC exceeded the ESL and AT (but only slightly). However, average soil antimony values (1.2 mg/kg) were lower than ESL and AT levels.

Antimony was detected in surface water in 95 of 573 samples, and was eliminated from the surface water ECOPC process due to being statistically similar to background levels. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that antimony does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for antimony indicates that UCL and UTL EPCs exceed the ESL, but there is a relatively low frequency of exceedances (i.e., only 7 percent of the detected samples exceeded the ESL). However, some HQs exceeded 10. Antimony had minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion is that there remains a low but uncertain

potential for adverse effects to aquatic life attributable to this ECOPC on the basis of chemical exposure, alone.

Barium

The MDC for barium in WC AEU sediments (404 mg/kg) exceeded the screening ESL (189 mg/kg). A total of 15 samples from WC sediments exceeded the screening ESL for barium. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (17 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were 4 and 1 respectively (Table 5.15). The AT for barium is 287, an average toxicity value from MacDonald et al (1999) (Attachment 5). AT HQs for UCL and UTL EPCs were <1 and the MDC was 1.

Barium was detected in almost all of the samples (87 out of 88). The concentration distribution is provided in Figure 5.80. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 15 of 88 (17 percent)(Table 5.17). Additionally, HQs for all 15 samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from barium to aquatic populations within the WC AEU.

The spatial distribution of barium concentrations relative to the CRA Methodology ESL is shown in Figure 2.176. As shown within this figure, there were several locations within Ponds C-1 (3 locations) and C-2 (2 locations) with measured concentrations greater than the ESL. In addition, there are three locations within channel areas with measured concentrations greater than the ESL. The eight locations with measured values greater than the ESL represent approximately 27 percent of the data within the true aquatic habitat areas. The remaining 73 percent occur below the ESL or were nondetects. The results identify a concentration of barium within habitat areas (Ponds C-1 and C-2) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Ponds C-1 and C-2 (Figure A8.61) indicated barium was detected at concentrations less than the ESL at all locations except two within Pond C-2, while four locations within Pond C-1 were all greater than the ESL. This spatial extent of barium indicates the need for further analysis of pond surface sediment risk conditions in regards to barium (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of barium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations of barium for all of the WC AEU indicates that the MDC (404 mg/kg) is greater than the ESL and AT

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The adjacent surface soil results included 71 samples for barium, all detected, with an MDC of 220 mg/kg. The MDC exceeded the ESL but not the AT. However, average soil barium values (80.5) were lower than ESL and AT levels.

Barium was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL.

Barium was identified as an ECOPC for the pond-specific evaluations of Pond C-1. However, further analysis of Pond C-1 surface sediment identified an HQ for the ESL is 2, while the HQ for the AT is 1. Toxicity from barium in sediment is not well documented and there are no other applicable screening criteria available for this metal. Comparison to toxicity-based values provide an indication of when the potential for risk to sediment organisms is likely to be absent, but do not adequately evaluate when risks exist. Therefore, because of the lack of an appropriate ESL for barium, it is considered an uncertainty; although, barium is not considered a priority pollutant by the EPA and for this reason is unlikely to pose a significant risk to benthic receptors. The combined lines of evidence indicate that the risk attributable to barium is low.

Results for the available chemical LOEs for barium indicate that the UCL EPC does not exceed the ESL, there is a low frequency and magnitude of exceedances (i.e., only 17 percent of samples exceeded the ESL and the all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. However, the MDC EPCs for the surface sediment data set exceed the AT. Therefore, the weight-of evidence conclusion is that there is low potential for adverse effects to aquatic life attributable to this ECOPC.

Cadmium

The MDC for cadmium in WC AEU sediments (3.6 mg/kg) exceeded the screening ESL (0.99 mg/kg). A total of 7 detected samples (24 detected of 83 samples) from WC sediments exceeded the screening ESL for cadmium. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (8 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were 4 and 1, respectively (Table 5.15). The AT for cadmium is a consensus-based, probably effects concentration (PEC) of 4.98 mg/kg (MacDonald et al. 2000a) (Attachment 5) AT HQs for UCL and UTL EPCs and the MDC were all < 1.

Cadmium was detected in only 29 percent of the samples. The concentration distribution is provided in Figure 5.81. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 7 of 83 (8 percent)(Table 5.17). Additionally, HQs for the 7 samples that exceeded the ESL were between 1 and 5. Given the relatively low frequency and magnitude of exceedance there is a low potential for risk from barium to aquatic populations within the WC AEU.

The spatial distribution of cadmium concentrations relative to the CRA Methodology ESL is shown in Figure 2.177. As shown within this figure, there are only two locations within true aquatic habitat areas within the channel that have concentrations greater than the ESL. The remaining locations associated with the channel and Ponds C-1 and C-2 were either below the ESL or at nondetect levels. The two locations with measured values greater than the ESL represent approximately 7 percent of the data within the true aquatic habitat areas. The remaining 93 percent occur below the ESL or were nondetects. This spatial extent of cadmium does not indicate a potential for risk to benthic populations within the WC AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of cadmium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicates that the MDC (3.6 mg/kg) is greater than the ESL but not the AT. This indicates that realistic exposure conditions are within an uncertain toxicity range, indicating a potential low risk to aquatic populations.

The adjacent surface soil results included 69 samples for cadmium, 27 detected, with an MDC of 2.4 mg/kg. The MDC exceeded the ESL but not the AT. However, average soil cadmium values (0.26 mg/kg) were lower than both the ESL and AT levels.

Cadmium (dissolved) was identified as an ECOPC for surface water. Results of the risk characterization of cadmium indicate that cadmium was detected in 13 percent of samples. The UTL and average fall below the refined ESL value, as do the majority of the data. Specifically, the frequency of exceedance for the refined ESL was 2 of 363 (<1 percent). Additionally, HQs for the two detected samples exceeding the refined ESL were between 1 and 10. The low frequency and magnitude of exceedance indicate a low potential for risk from cadmium to aquatic populations within the WC AEU.

Cadmium was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that cadmium does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for cadmium indicates that UCL and UTL EPCs slightly exceed the ESL, there is a low frequency and magnitude of exceedances (i.e., only 8 percent of samples exceeded the ESL, and the all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. Additionally, the EPCs for the surface sediment data set do not exceed the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Copper

The MDC for copper in WC AEU sediments (212 mg/kg) exceeded the screening ESL (31.6 mg/kg). A total of 8 samples (83 detected of 88 samples) from WC sediments exceeded the screening ESL for copper. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (9 percent) suggests that potential adverse effects may not be widely distributed.

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ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 and 2, respectively for the UCL and UTL (Table 5.15). The AT (PEC) for copper is a PEC value of 149 mg/kg (MacDonald et al. 2000a) (Attachment 5). AT HQs for UCL and UTL were < 1 and the MDC HQ was < 2.

Copper was detected in 94 percent of the samples. The concentration distribution is provided in Figure 5.82. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 8 of 88 (9 percent) (Table 5.17). Additionally, HQs for 6 of the detected samples were between 1 and 5 and only 2 were greater than 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from copper to aquatic populations within the WC AEU.

The spatial distribution of copper concentrations relative to the CRA Methodology ESL is shown in Figure 2.178. As shown within this figure, there is only one location within Pond C-2, and one location within the channel that has a concentration greater than the ESL. The remaining locations with measured concentrations greater than the ESL are associated with the SID and the IA overlapping portion of the AEU are outside of true aquatic habitat settings. The two locations with measured values greater than the ESL represent approximately 7 percent of the data within the true aquatic habitat areas. The remaining 93 percent occur below the ESL or were nondetects.

This spatial extent of copper does not indicate a potential for risk to benthic populations within the WC AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of copper in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicates that the MDC (212 mg/kg) is greater than the ESL and AT, and the arithmetic average (21.7 mg/kg) is less than the ESL and AT (Attachment 6).

The adjacent surface soil results included 71 samples for copper, all detected, with an MDC of 43.8 mg/kg. The MDC exceeded both the ESL but not the AT. Average soil copper values (21.7 mg/kg) were lower than ESL and AT levels.

Copper was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background levels. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that copper does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for copper indicates that although the UCL and UTL EPCs exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and almost all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. However, the MDC for the surface sediment data slightly exceeds the ESL and AT. Therefore, the weight-of

evidence conclusion is that there remains a low potential for adverse effects to aquatic life attributable to this ECOPC from chemical effects, alone.

Fluoride

The MDC for fluoride in WC AEU sediments (20.3 mg/kg) exceeded the screening ESL (0.01 mg/kg). All detected samples (1 detected of 4 samples) from WC sediments exceeded the screening ESL. These samples were collected between July 1991 and March 2004. The high frequency of exceedances by detected (and all nondetected) concentrations suggests that potential adverse effects can not be excluded.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were >1 in both cases (Table 5.15). The AT for fluoride is 7 mg/kg, is a TET (Bolton et al. 1985) (Attachment 5). AT HQs for the UCL, UTL and MDC EPC were 3.

Fluoride was detected in 25 percent of the samples. The concentration distribution is provided in Figure 5.83. As depicted in this figure, all data are above the ESL. The frequency of exceedance for the ESL was 25 percent (Table 5.17). Additionally, HQs for the single detected sample that exceeded the ESL was > 10. Given the medium frequency but high magnitude of exceedance there remains a potential for risk from fluoride to aquatic populations within the WC AEU.

The spatial distribution of fluoride concentrations relative to the CRA Methodology ESL is shown in Figure 2.179. As shown within this figure, fluoride was detected in one location within the SID with a concentration greater than the ESL. The rest of the sample location results were at nondetect levels.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of fluoride in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (20.3 mg/kg) is greater than the ESL and the AT but the arithmetic average (3.3 mg/kg) is less than the AT (Attachment 6).

The adjacent surface soil results were not sampled for fluoride and can not be used as an LOE.

Fluoride was detected in surface water and was eliminated from the surface water ECOPC process due to having an MDC less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that fluoride does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for fluoride indicate that UCL and UTL EPCs exceed the ESL and AT and the all ESL HQs were > 10. Fluoride had a minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion, based on ambient chemistry alone, is that there is low to uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

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Iron

The MDC for iron in WC AEU sediments (38,800 mg/kg) exceeded the screening ESL (20,000 mg/kg). A total of 20 samples (all detected of 88 samples) from WC sediments exceeded the screening ESL for cadmium. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (23 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for the UCL EPC from the comprehensive sediment data set was < 1 but not for the UTL (Table 5.15). The AT for iron is 280,000 mg/kg as an ERM from Ingersoll et al. (1996) (Attachment 5). AT HQs for UCL, UTL and MDC EPCs were < 1.

Iron was detected in all of the samples. The concentration distribution is provided in Figure 5.84. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 20 of 88 (23 percent)(Table 5.17). Additionally, HQs for all 20 detected samples that exceeded the ESL were between 1 and 5. Given the relatively low frequency and magnitude of exceedance there is a low potential for risk from iron to aquatic populations within the WC AEU.

The spatial distribution of iron concentrations relative to the CRA Methodology ESL is shown in Figure 2.180. As shown within this figure, there were several locations within Ponds C-1 (4 locations) and C-2 (4 locations), and four locations within the channel with measured concentrations greater than the ESL. The locations with measured values greater than the ESL represent approximately 37 percent of the data within the true aquatic habitat areas. The remaining 63 percent occur below the ESL or were nondetects. The results identify a concentration of iron within habitat areas (Ponds C-1 and C-2) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Ponds C-1 and C-2 (Figure A8.63) indicated iron was detected at concentrations less than the ESL at all locations except four within Pond C-2, while all four locations within Pond C-1 were all greater than the ESL. This spatial extent of iron indicates the need for further analysis of pond surface sediment risk conditions in regards to iron (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of cadmium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicates that the MDC (38,800 mg/kg) is greater than the ESL but less than the AT, and the arithmetic average (16,652 mg/kg) is less than the ESL and AT (Attachment 6).

The adjacent surface soil results included 71 samples for iron, all detected, with an MDC of 29,000 mg/kg. The MDC exceeded the ESL but not the AT. Average soil iron values (13,472 mg/kg) were lower than ESL and AT levels.

Iron was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background levels.

Iron was identified as an ECOPC for the pond-specific evaluations of Pond C-1. Iron was not identified as an ECOPC for Pond C-2. However, further analysis of Pond C-1 surface sediment identified an HQ for the ESL is 2, while the HQ for the AT is <1. Low frequencies of AT exceedances suggest that the potential for adverse effects to benthic macroinvertebrate receptors from iron in sediments at Pond C-1 is unlikely. In addition, the MDC for iron was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to iron would be low and within the range of background.

Results for the available chemical LOEs for iron indicates that UCL EPC does not exceed the ESL, there is a very low frequency and magnitude of exceedances (i.e., only 23 percent of samples exceeded the ESL and the all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. Additionally, the MDC, UCL, and UTL EPCs for the surface sediment data set do not exceed the AT. Iron is an almost universally-present constituent of background soils. The weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Lead

The MDC for lead in WC AEU sediments (118 mg/kg) exceeded the screening ESL (35.8 mg/kg). A total of 13 samples (all detected of 88 samples) from WC sediments exceeded the screening ESL for lead. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (15 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQ for UCL EPC from the comprehensive sediment data set was < 1 and UTL only slightly over 1 (Table 5.15). The AT for lead is a PEC value of 128 mg/kg (MacDonald et al. 2000a) (Attachment 5). AT HQs for UCL, UTL and MDC EPCs were < 1 .

Lead was detected in all of the samples. The concentration distribution is provided in Figure 5.85. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 13 of 88 (15 percent) (Table 5.17). Additionally, HQs for all detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from lead to aquatic populations within the WC AEU.

The spatial distribution of lead concentrations relative to the CRA Methodology ESL is shown in Figure 2.181. As shown within this Figure, six locations within the channel and one within Pond C-1 had measured concentrations greater than the ESL. The remaining locations were all below the ESL. The seven locations with measured values greater than the ESL represent approximately 23 percent of the data within the true aquatic habitat areas. The remaining 77 percent occur below the ESL or were nondetects. This spatial extent of lead does not indicate a potential for risk to benthic populations within the WC AEU.

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The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of cadmium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (118 mg/kg) is greater than the ESL but not the AT, and the arithmetic average (24.8 mg/kg) is less than both the ESL and AT (Attachment 6).

The adjacent surface soil results included 71 samples for lead, all detected, with an MDC of 300 mg/kg. The MDC exceeded both the ESL and AT. However, average soil lead values (18 mg/kg) were lower than ESL and AT levels.

Lead was detected in surface water and was eliminated from the surface water ECOPC process due to being statistically similar to background levels. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that lead does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for lead indicates that the UCL EPC does not exceed the ESL and there is a relatively low frequency and magnitude of exceedances (i.e., only 15 percent of samples exceeded the ESL and all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. The MDC for the surface sediment data set exceeded the ESL but not the AT. Therefore, the weight-of evidence conclusion is that there is a no or low and uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Mercury

The MDC for mercury in WC AEU sediments (3.8 mg/kg) exceeded the screening ESL (0.18 mg/kg). A total of 8 samples (24 detected of 86 samples) from WC sediments exceeded the screening ESL for mercury. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (9 percent) suggests that potential adverse effects may not be widely distributed.

The ESL-HQ for the UCL and UTL EPCs from the comprehensive sediment data set were > 1 (Table 5.15). The AT for mercury is a PEC of 1.06 mg/kg (MacDonald et al 2000a) (Attachment 5).The AT HQ for the UCL was < 1.

Mercury was detected in 28 percent of the samples. The concentration distribution is provided in Figure 5.86. As depicted in this figure, the average is very similar to the ESL value, and the majority of the data fall below the ESL. Specifically, the frequency of exceedance for the ESL was 8 of 86 (8 percent) (Table 5.17). Additionally, HQs for 3 detected samples that exceeded the ESL were between 1 and 5 and 5 were greater than 5. Given the low frequency but higher magnitude of exceedance there remains a low potential for risk from mercury to aquatic populations within the WC AEU.

The spatial distribution of mercury concentrations relative to the CRA Methodology ESL is shown in Figure 2.182. As shown within this figure, there were three locations within Pond C-1 and three locations within Pond C-2 with measured concentrations greater than the ESL. The six locations with measured values greater than the ESL represent

approximately 21 percent of the data within the true aquatic habitat areas. The remaining 79 percent occur below the ESL or were nondetects. The results identify a concentration of mercury within habitat areas (Ponds C-1 and C-2) that requires further evaluation. The results presented within this figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Ponds C-1 and C-2 (Figure A8.66) indicated mercury was detected at concentrations less than the ESL at all locations except three within Pond C-2, while all four locations within Pond C-1 were less than the ESL. This spatial extent of mercury indicates the need for further analysis of pond surface sediment risk conditions in regards to mercury (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of mercury in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (3.8 mg/kg) is greater than the AT, but the arithmetic average (0.196 mg/kg) is less than the AT (Attachment 6).

The adjacent surface soil results included 70 samples for mercury, 40 detected, with an MDC of 0.21 mg/kg. The MDC only slightly exceeded the ESL but was less than the AT. In addition, average soil mercury values were lower than both the ESL and AT levels.

Mercury was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL.

Mercury was identified as an ECOPC for the pond-specific evaluations of Pond C-1 and C-2. However, further analysis of Pond C-1 surface sediment identified an HQ for the ESL is 8, while the HQ for the AT is 1. The surface sediment HQ for the Pond C-2 ESL is 4, while the HQ for the AT is 1. The potential for adverse effects is also uncertain at concentrations greater than this ESL, and below the consensus based probable effects concentration (PEC; 1.06 mg/kg). Given the uncertainty associated with mercury ESLs the potential for risks can not be excluded; however, it is not considered likely if fewer than 20 percent of samples exceed the ESL. Review of the data on a point by point basis indicated that each measured mercury result was equal or less than the AT value. Within Pond C-1, three of the eight locations had measured values greater than the ESL, the remaining were less than the ESL. Within Pond C-2, three of the eight locations had measured values greater than the ESL, the remaining were less than the ESL. The combined lines of evidence indicate that the risk attributable to mercury is low and within the range of background. The combined lines of evidence indicate that the risk attributable to mercury is low.

Results for the available chemical LOEs for mercury indicate that the UCL and UTL EPCs exceed the ESL but only the UTL exceeds the AT. There is a very low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and the most HQs were < 10), and minimal occurrence of exceedances within aquatic habitat areas. The surface sediment MDC exceeds the AT, but the adjacent soils do not.

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Therefore, the weight-of evidence conclusion is that there remains a low potential for adverse effects to aquatic life attributable to this ECOPC.

Nickel

The MDC for nickel in WC AEU sediments (33 mg/kg) slightly exceeded the screening ESL (22.7 mg/kg). A total of only 8 samples (76 detected of 88 samples) from WC sediments exceeded the screening ESL for nickel. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (9 percent) suggests that potential adverse effects may not be widely distributed.

The ESL-HQs for UCL EPC from the comprehensive sediment data set was < 1 and the ESL-HQ for UTL was only 1.1 (Table 5.15). The AT for nickel is a PEC of 48.6 mg/kg (MacDonald et al., 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs and the MDC were all < 1.

Nickel was detected in 86 percent of the samples. The concentration distribution is provided in Figure 5.87. As depicted in this figure, the average falls below the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 8 of 88 (9 percent) (Table 5.17). Additionally, HQs for all of the detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from nickel to aquatic populations within the WC AEU.

The spatial distribution of nickel concentrations relative to the CRA Methodology ESL is shown in Figure 2.183. As shown within this Figure only three locations with measured concentrations greater than the ESL occurred within true aquatic habitat areas (two locations within the channel and one within Pond C-1). The remaining sample locations all had measured concentrations less than the ESL. The three locations with measured values greater than the ESL represent approximately 10 percent of the data within the true aquatic habitat areas. The remaining 90 percent occur below the ESL or were nondetects. This spatial extent of nickel does not indicate a potential for risk to benthic populations within the WC AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of nickel in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (33 mg/kg) is greater than the ESL but not the AT, and the arithmetic average (13.2 mg/kg) is less than both the ESL and AT (Attachment 6).

The adjacent surface soil results included 71 samples for nickel, 69 detected, with an MDC of 68 mg/kg. The MDC exceeded the ESL and AT. However, average soil nickel values (12 mg/kg) were lower than ESL and AT levels.

Nickel was detected in surface water in 32 of 294 samples, and was eliminated from the surface water ECOPC process due to having an MDC less than the ESL. In addition, this

chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that nickel does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for nickel indicates that the UCL EPC does not exceed the ESL and there is a very low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. The MDC for the surface sediment data set exceeds the ESL but not the AT. Therefore, the weight-of evidence conclusion is that there is no or low potential for adverse effects to aquatic life attributable to this ECOPC.

Selenium

The MDC for selenium in WC AEU sediments (3.8 mg/kg) exceeded the screening ESL (0.95 mg/kg). A total of 12 samples (33 detected of 80 samples) from WC sediments exceeded the screening ESL for selenium. These samples were collected between July 1991 and March 2004. The low frequency of exceedances by detected concentrations (15 percent) suggests that potential adverse effects may not be widely distributed.

The ESL-HQ for the UCL EPC from the comprehensive sediment data set were < 1 and the UTL HQ was only 2 (Table 5.15). The AT for selenium is a median-effect level SQG of 1.73 mg/kg (MacDonald et al., 2000a) (Attachment 5). AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was < 3.

Selenium was detected in 41 percent of the samples. The concentration distribution is provided in Figure 5.88. Specifically, the frequency of exceedance for the ESL was 12 of 88 (15 percent) (Table 5.17). Additionally, HQs for all of the detected samples that exceeded the ESL were between 1 and 5. Given the low frequency and magnitude of exceedance there is a low potential for risk from selenium to aquatic populations within the WC AEU.

The spatial distribution of selenium concentrations relative to the CRA Methodology ESL is shown in Figure 2.184. As shown within this figure, there were five locations within Pond C-1 and one location within Pond C-2 with measured concentrations greater than the ESL. In addition, there are five within channel areas with measured concentrations greater than the ESL. The locations with measured values greater than the ESL represent approximately 37 percent of the data within the true aquatic habitat areas. The remaining 63 percent occur below the ESL or were nondetects. The results identify a concentration of selenium within habitat areas (Pond C-1) that requires further evaluation. The results presented within this figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Ponds C-1 and C-2 (Figure A8.68) indicated selenium was detected at concentrations less than the ESL at all locations except two within Pond C-2, while two of the four locations within Pond C-1 were all greater than the ESL. This spatial extent of selenium indicates the need for further analysis of pond surface sediment risk conditions (provided below and within Attachment 8).

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The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of selenium in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (3.8 mg/kg) is greater than the ESL and AT, but the arithmetic average (0.638 mg/kg) is less than the ESL and AT (Attachment 6).

The adjacent surface soil results included 71 samples for selenium, 6 detected, with an MDC of 2 mg/kg. The MDC exceeded the ESL but not the AT. In addition, average soil selenium values (0.39 mg/kg) were lower than ESL and AT levels.

Selenium was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL.

Selenium was identified as an ECOPC for the pond-specific evaluations of Pond C-1. However, further analysis of Pond C-1 surface sediment identified an HQ for the ESL is 3, while the HQ for the AT is 1. Review of the data on a point by point basis indicated that each measured selenium, result was less than the AT value. Within Pond C-1, two of the four locations had measured values greater than the ESL, the remaining were nondetect. The combined lines of evidence indicate that the risk attributable to selenium is low.

Results for the available chemical LOEs for selenium indicates that the UCL EPC does not exceed the ESL and there is a very low frequency and magnitude of exceedances (i.e., only 9 percent of samples exceeded the ESL and the all HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. However, the MDC for the surface sediment data set exceeds the ESL and AT. Therefore, the weight-of evidence conclusion is that there remains a low and uncertain potential for adverse effects to aquatic life attributable to this ECOPC.

Silver

The MDC for silver in WC AEU sediments (7.7 mg/kg) exceeded the screening ESL (1 mg/kg). A total of 9 detected samples (11 detected of 83 samples) from WC sediments exceeded the screening ESL for silver. These samples were collected between July 1991 and March 2004. The relatively low frequency of exceedances by detected concentrations (11 percent) suggests that potential adverse effects may not be widely distributed.

ESL-HQs for the UCL from the comprehensive sediment data set was < 1 (Table 5.15). The AT for silver is a TNRCC reservoir guideline, distribution-based benchmark, of 1.6 mg/kg (TNRCC 1996 reported in MacDonald et al. 1999) (Attachment 5). The AT HQ for the UCL was < 1 and the AT HQ for the UTL was < 2.

Silver was detected in only 13 percent of the samples. The concentration distribution is provided in Figure 5.89. As depicted in this figure, the average falls below the ESL value as do most of the values. The frequency of exceedance for the ESL was 9 of 83 (11 percent) (Table 5.17). Additionally, HQs for 7 of the 9 detected samples were between 1 and 5, with only 2 over 5. Given the low frequency and only slightly level of

exceedance there remains only a low potential for risk from silver to aquatic populations within the WC AEU. Risk uncertainty can be attributed to the exceedances by nondetects (Table 5.17).

The spatial distribution of silver concentrations relative to the CRA Methodology ESL is shown in Figure 2.185. As shown within this figure, only three locations within true aquatic habitat settings (one within Pond C-1 and two within the channel) had measured concentrations greater than the ESL. The remaining locations had values at nondetect levels. The three locations with measured values greater than the ESL represent approximately 11 percent of the data within the true aquatic habitat areas. The remaining 89 percent occur below the ESL or were nondetects. This spatial extent of selenium does not indicate a potential for risk to benthic populations within the WC AEU.

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of silver in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (7.7 mg/kg) is greater than the ESL and AT, but the arithmetic average (0.852 mg/kg) is also lower than the ESL and AT (Attachment 6).

The adjacent surface soil results included 71 samples for silver, 25 detected, with an MDC of 3 mg/kg. The MDC exceeds the ESL or AT slightly. However, average soil silver values (0.47 mg/kg) were lower than both the ESL and AT.

Silver was detected in surface water and was eliminated from the surface water ECOPC process due to having an EPC (UTL) less than the ESL. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that silver does not pose a risk concern to isolated habitat areas.

Results for the available chemical LOEs for silver indicated that the UCL and UTL EPCs both exceeded the ESL slightly, there is a very low frequency and magnitude of exceedances (i.e., only 11 percent of samples exceeded the ESL and most of the HQs were < 5), and minimal occurrence of exceedances within aquatic habitat areas. The MDC for the surface sediment data exceeded ESL and AT benchmarks. Therefore, the weight-of evidence conclusion is that low and uncertain potential for adverse effects to aquatic life remains attributable to this ECOPC.

Zinc

The MDC for zinc in WC AEU sediments (2,080 mg/kg) exceeded the screening ESL (121 mg/kg). A total of 22 samples (all detected of 88 samples) from WC sediments exceeded the screening ESL for zinc. These samples were collected between July 1991 and March 2004. The relatively elevated frequency of exceedances by detected concentrations (25 percent) suggests that adverse effects can not be excluded.

ESL-HQs for UCL and UTL EPCs from the comprehensive sediment data set were <1 and 1, respectively (Table 5.15). The AT for zinc is a consensus-based PEC of 459 mg/kg

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(MacDonald et al. 2000a) (Attachment 5).AT HQs for UCL and UTL EPCs were < 1 and the AT HQ for the MDC was 5.

Zinc was detected in all samples. The concentration distribution is provided in Figure 5.90. As depicted in this figure, the average falls above the ESL value, as does the majority of the data. Specifically, the frequency of exceedance for the ESL was 22 of 88 (25 percent) (Table 5.17). Additionally, HQs for 18 of the 22 detected samples that exceeded the ESL were between 1 and 5, with 3 between 5 and 10 and only 1 over 10. Given the medium frequency and magnitude of exceedance there remains a small potential for risk from zinc to aquatic populations within the WC AEU.

The spatial distribution of zinc concentrations relative to the CRA Methodology ESL is shown in Figure 2.186. As shown within this figure, there is one location within Pond C-1 and three locations within Pond C-2 with measured concentrations greater than the ESL. There were three locations within the channel that also had measured concentrations greater than the ESL. The seven locations with measured values greater than the ESL represent approximately 23 percent of the data within the true aquatic habitat areas. The remaining 77 percent occur below the ESL or were nondetects. The results identify a concentration of zinc within habitat areas (Ponds C-1 and C-2) that requires further evaluation. The results presented within this Figure represent the findings from all sediment analysis (all depth fractions). Further analysis of the spatial extent within surface sediment for Ponds C-1 and C-2 (Figure A8.69) indicated zinc was detected at concentrations less than the ESL at all locations except three within Pond C-2, while only one location within Pond C-1 was less than the ESL. This spatial extent of zinc indicates the need for further analysis of pond surface sediment risk conditions in regards to barium (provided below and within Attachment 8).

The surface sediment fraction (excluding fractions greater than 6 inches deep) is more relevant as an exposure medium for aquatic organisms than deeper sediments and concentrations of zinc in surface sediments were reviewed as part of the risk characterization. Surface sediment concentrations for all of the WC AEU indicate that the MDC (2,080 mg/kg) is greater than the ESL and AT, but the arithmetic average (139 mg/kg) is less than the AT (Attachment 6).

The adjacent surface soil results included 71 samples for zinc, all detected, with an MDC of 489 mg/kg. The MDC exceeds the ESL and but the AT only slightly.

Zinc was detected in surface water was eliminated from the surface water ECOPC process due to being statistically similar to background levels.

Zinc was identified as an ECOPC for the pond-specific evaluations of Pond C-2. However, further analysis of Pond C-2 surface sediment identified an HQ for the ESL is 2, while the HQ for the AT is <1. Review of the data on a point by point basis indicated that each measured zinc result was less than the AT value. Within Pond C-2, three of the eight locations had measured values greater than the ESL, the remaining were less than the ESL. In addition, the MDC for zinc was within the range of background conditions.

The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background.

Results for the available chemical LOEs for zinc indicates that the UCL and UTL EPCs exceed the ESL and there is a medium frequency and magnitude of exceedances (with some HQs > 5), but with minimal occurrence of exceedances within aquatic habitat areas. Therefore, the weight-of evidence conclusion is that there remains a small potential for adverse effects to aquatic life attributable to this ECOPC based on chemistry, alone.

4-Methylphenol

The MDC for 4-methylphenol in WC AEU sediment (510 µg/kg) exceeded the screening ESL (12.3 µg/kg). ESL-HQ for UTL-EPCs from the comprehensive sediment data set was greater than 1 (Table 5.15). The AT for 4-methylphenol is 670 µg/kg, Washington State Sediment Quality Guideline (Ginn and Pastorak, 1992). All AT-HQs were < 1. The lack of AT exceedances by EPCs suggests that 4-methylphenol in sediment at WC AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for 4-methylphenol is provided in Figure 5.91. As depicted in this figure, the ESL is lower than all reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. An evaluation of the uncertainty associated with the detection limits is provided in Section 6. All 4 detected samples (61 total samples) exceeded the screening ESL (Table 5.17). These samples were collected between August 1991 and July 1992. Two of these detected concentrations had HQs greater than 10. In addition, 57 concentrations (93 percent) below detection limits also exceeded the ESL with HQs greater than 10. The low frequency of exceedances by detected concentrations (7 percent) suggests there is a low potential for risk from 4-methylphenol to benthic populations within the WC AEU.

The spatial distribution of this ECOPC does not indicate a potential for risk to benthic populations within the WC AEU (Figure 2.187). Concentrations exceeding the ESL are isolated outside of true aquatic habitat areas with the exception of one location within Pond C-1 and one within the channel. The two locations with measured values greater than the ESL represent approximately 11 percent of the data within the true aquatic habitat areas. The remaining 89 percent occur below the ESL or were nondetects. This spatial extent of detected measures of 4-methylphenol does not indicate a potential for risk to benthic populations within the WC AEU.

MDC-HQs were unchanged in the surface sediment (0-6 inches) data set (Table 5.16).

The potential contribution of 4-methylphenol in surface soils to WC AEU sediment is uncertain because concentrations were below detection limits in all soil samples collected adjacent to Woman Creek (Attachment 6, Table A6.28).

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4-Methylphenol was not detected in surface water. In addition, this chemical was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that 4-methylphenol does not pose a risk concern to isolated habitat areas.

Chemical toxicity comparisons to sediment samples found the magnitude of exceedances was greater than 10 for some detected concentrations; however, there was a low frequency of these exceedances, lack of AT exceedances, and minimal spatial extent of elevated concentrations of acenaphthene within aquatic habitat areas. There is also uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. The weight-of evidence conclusion for chemical LOEs is that there is a low but uncertain potential for risk to benthic populations from 4-methylphenol in sediment at WC AEU.

Heptachlor

The MDC for heptachlor in WC AEU sediment (3.1 µg/kg) exceeded the screening ESL (0.132 µg/kg). UCL and UTL-EPCs were 4 and 189, respectively (Table 5.15). The AT for heptachlor is 16 µg/kg, a TET (MacDonald, et al. 2000b). The AT-HQ for the MDC was not > 1. The lack of AT exceedances by EPCs suggests that heptachlor in sediment at WC AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for heptachlor is provided in Figure 5.101. As depicted in this figure, the ESL is lower than almost all reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. An evaluation of the uncertainty associated with the detection limits are provided in Section 6. Only one detected sample (3 detected of 59 samples) exceeded the screening ESL (Table 5.17). This sample was collected in February 1992 and had an ESL-HQ of 23. A total of 53 nondetected concentrations (95 percent) also exceeded the ESL. The low frequency of exceedances by detected concentrations (2 percent) suggests there is a low potential for risk from heptachlor to benthic populations within the WC AEU.

The spatial distribution of this ECOPC does not indicate a potential for risk to benthic populations within the WC AEU (Figure 2.199). Concentrations exceeding the ESL are isolated outside of true aquatic habitat settings with the exception of one location within the channel. This spatial extent of heptachlor does not indicate a potential for risk to benthic populations within the WC AEU.

MDC-HQs were unchanged in the surface sediment data set (Table 5.16).

The potential contribution of heptachlor in surface soils to WC AEU sediment is uncertain because concentrations were below detection limits in all soil samples collected adjacent to Woman Creek (Attachment 6).

Heptachlor was not identified as an ECOPC for the pond-specific evaluations (Attachment 8) indicating that heptachlor does not pose a risk concern to isolated habitat

areas . In addition, this chemical was not detected in surface water. This indicates that there is an incomplete fate and transport pathway between the sediment and surface water media.

Chemical toxicity comparisons to sediment samples found a low frequency of ESL exceedances and the MDC did not exceed the AT benchmark. In addition, there was minimal spatial extent of elevated concentrations of heptachlor within aquatic habitat areas. There is further uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. The weight-of evidence conclusion for chemical LOEs is that there is a low but uncertain potential for risk to benthic populations from heptachlor in sediment at WC AEU.

PAHs

The MDC for total PAHs in WC AEU sediment (17,130 µg/kg) exceeded the screening ESL (1,610 µg/kg). UTL-EPCs also exceeded the ESL (Table 5.15). The AT for total PAHs is 22,800 µg/kg, a CB-PEC (MacDonald, et al. 2000a).The lack of AT exceedances by EPCs suggests that total PAHs in sediment at WC AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible, but not probable.

Further analysis revealed the MDC in surface (0-6 inches) sediment (17,130 µg/kg) was identical to the comprehensive data MDC and therefore exceeded the screening ESL, but was less than the AT (Table 5.16). Total PAHs in surface sediment samples from Pond C-1 were detected at four locations, ranging from 790 to 2,510 µg/kg. The MDC-HQ for Pond C-1 surface sediments was slightly greater than one (2), but the AT-HQ was <1.

The number of detected concentrations exceeding the screening ESL for total PAHs is shown in Table 5.17. While there were a high frequency of total PAH concentrations exceeding the ESL (75 percent), these HQs were all less than 10. Therefore, due to the lack of AT exceedances, and low magnitude ESL exceedances, these chemical lines of evidence indicate that the risk attributable to total PAHs in WC AEU sediment is low.

The MDC for 11 individual PAHs (acenaphthene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) in WC AEU sediment exceeded their respective screening ESLs.

Screening ESL-HQs were also > 1 UTL-EPCs from the comprehensive sediment data set for all PAHs (Table 5.15). These samples were collected between August 1991 and July 2005. UCL and UTL-EPCs for eight PAHs did not exceed the AT benchmark (anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[k]fluoranthene, chrysene, fluoranthene, phenanthrene, pyrene). The other three (acenaphthene, benzo[g,h,i]perylene, and indeno[1,2,3-cd]pyrene) exceeded the AT, but with HQs ≤ 6. The low or lack of AT exceedances by EPCs indicates that PAHs in sediment at WC AEU generally occur within the range of uncertain toxicity where the potential for adverse effects is possible, but not probable.

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Concentration distributions for PAHs are provided in Figures 5.92. 5.93, 5.95 through 5.100 and 5.102 through 5.104.. Nondetected concentrations greater than the ESLs identify an uncertainty regarding the potential for risk.

Surface sediment MDCs for all PAHs were not different from those in the comprehensive data, so MDC-HQs were unchanged (Table 5.16). UCL and UTL-EPCs were also only slightly lower or slightly higher than for the comprehensive data.

The number of detected and nondetected concentrations exceeding the screening ESL is shown in Table 5.17. All PAHs had fewer than 14 percent of samples exceeding the ESL by detected concentrations. Anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene did not have detected concentrations with ESL-HQs greater than 10. All but benzo[k]fluoranthene, and fluoranthene had detected concentrations with ESL-HQs greater than 5. The low frequency of exceedances by detected concentrations suggests there is a low potential for risk from PAHs to benthic populations within the WC AEU. However, there is low confidence in this conclusion due to the uncertainty from inadequately low detection limits for a significant proportion of samples that exceeded ESLs.

The spatial distribution of individual PAHs in sediment does not generally indicate a potential for risk to benthic populations within the WC AEU (Figures 2.189, 2.190, 2.193 through 2.198 and 2.200 through 2.202). Total PAH calculated values by sample location as compared to the ESL is provided in Figure 2.188. Infrequent exceedances for some PAHs were not clustered in small areas that would indicate hot-spots and were limited within true aquatic habitat areas[6]. Results presented within the figures include all sediment depth fractions. Further analyses of ECOPCs in Pond C-1, where individual PAHs were found to exceed ESLs, indicated that almost all of these detected concentrations that exceeded ESLs were from sub-surface sediment samples. Sediment from more than 6 inches below the surface is not biologically available and represents an incomplete exposure pathway to benthic organisms. Further evaluation of sediment ECOPCs occurring in WC AEU ponds is provided in Attachment 8, where it was concluded that PAHs pose a low likelihood of risk to benthic invertebrates in WC AEU ponds.

The potential contribution to future sediments (from adjacent surface soils) from six PAHs (acenaphthene, anthracene, benzo[a]anthracene, benzo[g,h,i]perylene, benzo[k]fluoranthene, and indeno[1,2,3-cd]pyrene) in surface soils adjacent to WC AEU is uncertain, because concentrations were below detection limits (Attachment 6). PAH concentrations in surface soils were less than the ESLs for the remaining 5 PAHs (benzo[a]anthracene, chrysene, fluoranthene, phenanthrene, and pyrene). There is much uncertainty in extrapolating potential future sediment contamination issues based on

[6] 'True aquatic habitat areas' include the main stream channel and ponds. Samples from ephemeral habitat, overland flow, and ditches are not considered representative of true habitat (Figure 1.7).

nearby soil chemistry; however, these data suggest that potential contribution of surface soils to the WC AEU is unlikely to adversely affect benthic organisms.

Chemical toxicity comparisons to sediment samples found the magnitude of exceedances was greater than 10 for some detected concentrations; however, there was a low frequency of these exceedances, and minimal spatial extent of elevated concentrations within aquatic habitat areas. There is uncertainty regarding the potential for risk conclusion due to detection limit exceedances as compared to the ESL. The weight-of evidence conclusion for chemical LOEs is that there is a low but uncertain potential for risk to benthic populations from individual PAHs in sediment at WC AEU.

Confidence in these individual PAH risk characterizations is also low when total PAHs do no exceed the ESL or AT. Screening ESLs for individual PAHs are derived from multiple sources with varying endpoints and organisms sensitivities. The consensus-based TEC (MacDonald et al. 2000a) used as the total PAH-ESL is a conservative estimate of the toxicity threshold where adverse effects are not expected to occur in most sediment types. There is the highest confidence in this benchmark, which is based on a review of several sources and has a high degree of accurately predicting the absence of toxicity. Likewise, the AT benchmark for total PAHs is a good predictor of when adverse effects are likely. The potential for adverse effects is uncertain for concentrations between these benchmarks.

Total-PAHs evaluate the potential for effects for all PAHs, not only those with known screening benchmarks. The additive toxicity from PAHs is also addressed by total-PAH benchmarks. In these respects the total-PAH screen has less uncertainty than individual PAH constituent evaluations.

The weight-of evidence conclusion for chemical LOEs is that there is a low potential for risk to benthic macroinvertebrates from PAHs in sediment at WC AEU. There is low confidence in this conclusion due to the uncertainty associated with a large number of samples with nondetected concentrations above the ESL. However, no total-PAHs and few individual PAHs exceeded the AT benchmark where the potential for risks is probable. The majority of ESL exceedances from individual PAHs were found in pond C-1; although these exceedances were widely dispersed and associated with sub-surface sediments.

PCBs

The MDC for total PCBs in WC AEU sediment (250 µg/kg) exceeded the screening ESL (40 µg/kg). UCL and UTL-EPCs were <1 and 13, respectively (Table 5.15). The AT for total PCBs is 676 µg/kg, a CB-PEC (MacDonald et al. 2000a). The AT-HQ for the MDC was less than 1. The lack of AT exceedances suggests that total PCBs in sediment at WC AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

Further analysis of maximum detected total concentrations in surface sediment (Table 5.16) reveal the MDC (94 µg/kg) exceeded the screening ESL, but was less than

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the AT. This suggests that total PCBs in sediment occur within the range of uncertain toxicity.

Total PCBs were evaluated for Pond C-1 and found to have a total detected maximum concentration of 94 µg/kg attributable to Aroclor-1254. This value exceeds the total PCB ESL of 40 but is less than the total PCB AT of 676 µg/kg. The surface sediment HQ for the ESL is 2, while the HQ for the AT is <1. The ESL was based on a consensus-based TEC (MacDonald et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (676 µg/kg). Therefore, it is unlikely that total PCBs pose an unacceptable risk to benthic populations that inhabit Pond C-1.

The MDC for Aroclor-1254 in WC AEU sediment (250 µg/kg) exceeded the screening ESL (60 µg/kg). UCL and UTL-EPCs from the comprehensive sediment data set equaled the MDC and so all were 4 (Table 5.15). The AT for Aroclor-1254 is 300 µg/kg, a TET (MacDonald, et al. 2000b). The AT-HQs were < 1. The lack of AT exceedances suggests that Aroclor-1254 in sediment at WC AEU occur within the range of uncertain toxicity where the potential for adverse effects is possible.

The concentration distribution for Aroclor-1254 is provided in Figure 5.9. As depicted in this figure, the ESL is lower than most reported values, which include both detected and nondetected concentrations. Nondetected concentrations greater than the ESL indicate inadequately low detection limits and contributes to uncertainty regarding the potential for risk. A total of 9 detected samples (12 detected of 69 samples) exceeded the screening ESL (Table 5.17). These samples were collected between September 1991 and July 2005. Detected exceedances had HQs ranging from 2 to 65. A total of 55 nondetected concentrations (80 percent) also exceeded the ESL. The low frequency of exceedances by detected concentrations (13 percent) suggests there is a low potential for risk from Aroclor-1254 to benthic populations within the WC AEU.

The spatial distribution of this ECOPC does not indicate a potential for risk to benthic populations within the WC AEU (Figure 2.192). Total PCB calculated sample location results as compared to the ESL is provided in Figure 2.191. Concentrations exceeding the ESL occur only occur within Pond C-1 indicating the need for further evaluation of surface sediment risk conditions. Results of surface sediment spatial extent (are shown in Figure A8.81) indicate there are four locations within Pond C-1 with concentrations greater than the ESL. Further evaluation is provided below and within Attachment 8.

MDC-HQs in the surface sediment data set were unchanged from the comprehensive data set (Table 5.16).

The MDC for Aroclor-1254 in soil adjacent to Woman Creek (8.2 µg/kg) is less than the sediment ESL (Attachment 6, Table A6.28). There is much uncertainty in extrapolating potential future sediment contamination issues based on nearby soil chemistry; however,

these data suggest that potential contribution of Aroclor-1254 in surface soils to the WC AEU is unlikely to adversely affect benthic organisms.

Aroclor-1254 was not detected in surface water. This indicates that there is an incomplete fate and transport pathway between the sediment and surface water media.

Aroclor-1254 was identified as an ECOPC for the pond-specific evaluations of Pond C-1. However, further analysis of Pond C-1 surface sediment identified an HQ for the ESL is 2, while the HQ for the AT is <1. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (300 µg/kg). Therefore, it is unlikely that Aroclor-1254, exceeding the ESL by a small amount, poses an unacceptable risk to benthic populations that inhabit Pond C-1.

PCB concentration comparisons to sediment samples found a low frequency of ESL exceedances and EPCs did not exceed the AT benchmark. Therefore, the potential for adverse effects could not be excluded, but are uncertain. In addition, there was minimal spatial extent of elevated concentrations of PCBs within aquatic habitat areas. There is further uncertainty regarding the potential for risk conclusion due to inadequate detection limits driving ESL exceedances based nondetected concentrations. The weight-of evidence conclusion for chemical LOEs is that there is a low but uncertain potential for risk to benthic populations from PCBs in sediment at WC AEU.

Other/Drainage Specific Lines of Evidence

Table 5.18 provides a summary of the other/drainage LOEs gathered by previous studies. The WC AEU has been extensively studied. Studies were completed which encompassed several types of lines of evidence including tissue analysis, aquatic population measures, bioassay analysis and waterfowl/wading bird evaluations. Results provide a LOE regarding the aquatic ecosystem condition within the WC AEU. Most of the studies capture historical conditions that have been altered in ways to remove chemical stressors. Thus, their findings provide a conservative characterization of biological communities and the bioavailability and toxicity of various contaminants.

The Kaiser-Hill studies evaluated aquatic ecological conditions throughout RFETS over time (1999 through 2001). Results indicate that aquatic species are affected by habitat variables, but not by site contaminants. The limiting environmental factor is low surface water discharge. The WC AEU undergoes periods where flows are completely absent from portions of the system. The WC AEU predominantly provides seasonal habitat following periods of snowmelt or high rainfall events. Otherwise, habitat and aquatic ecology are extremely limited.

Specifically, PCB concentrations in fish tissue collected from C-series ponds of the WC AEU were lower than maximum recommended body burdens (Eisler 1986) and were determined to pose no risks to fish or avian piscivores (Stiger 1994; DOE 1996). PCBs were also below detection limits in C-1 and C2 pond sediments from this study. PCBs were also below detection in most benthic invertebrate, fish, and sediment samples reported by DOE (1996). The Woman Creek benthic macroinvertebrate community was relatively rich and diverse with pollution sensitive taxa (Ephemeroptera) that indicate an

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absence of adverse effects on benthic organisms (Ebasco 1992; Aquatic Associates Inc. 2003). Sediment toxicity bioassays agree with the findings of low risk from these other studies, and found no toxicity to *Hyalella azteca* and *Chironomus tentans* in pond sediments (DOE 1996).

The discrepancy between site sediment toxicity and ESL exceedances, particularly by PAHs, may be due to the chemical properties of the sediment. Organic carbon (OC) in sediments binds nonpolar (non-ionic) organic contaminants to render them non-bioavailable (Mahony, et al. 1996). If the total organic carbon (TOC) in WC AEU sediments is higher than the 1 percent TOC assumed in the ESLs, then these ESLs will be more conservative than necessary to protect benthic organisms Higher OC in sediments is derived from decomposition of leaves and organic matter, producing a dark spongy soil. Site investigations indicate that stream and pond sediment is darker and richer in OC than the assumed 1 percent. Sediment accumulation areas in the ponds, streams (backwaters and pools), and marshy areas with emergent vegetation are likely to produce TOC-rich (>5 percent) and electrochemically-reduced sediments that will produce sulfide. Acid volatile sulfides (AVS) bind metals when the sediments are anaerobic (Ankley, et al. 1996). Therefore, sulfide and TOC likely to be present in the soft sediments of low-energy microhabitats, including pond bottoms, will serve to detoxify metals and certain organic contaminants.

There were no signs of contaminant stressors affecting the aquatic ecology. The studies determined that aquatic conditions were consistent over time and represent good ecological conditions relative to reference sites. There appeared to be no controlling factor affecting the ecology with the exception of habitat and low flow.

5.5.4 Weight-of-Evidence Conclusions

There were 3 surface water ECOPCs (all inorganic) and 30 sediment ECOPCs (15 inorganic and 15 organic) evaluated using multiple LOEs within the contaminant risk characterization. The WOE analysis method was as stated in Section 5.1.3, above.

Weight-of-evidence conclusions for the WC AEU can be summarized as:

Magnitude of ESL or AT exceedances:

- All surface water contaminants showed low magnitude HQs for either primary ESLs or ATs.
- Sediment ESL-HQs were generally low (<10) for UTL and UCL-EPCs except for antimony, fluoride, 4-methylphenol, acenaphthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene, and were less than 5 for all UTL and UCL comparisons to AT benchmarks.

Spatial Distribution:

- Most surface water contaminants were not widespread and were unclustered.

- Most sediment contaminants were associated with areas that did not provide true aquatic habitat settings within the AEU (i.e. the SID). Certain ECOPCs were concentrated in ponds, however the pond-specific analysis of surface sediment often found that few measured concentrations were present. Most were at nondetect or less than ESL concentrations within surface sediment indicating a low risk concern.

Frequency of Exceedances:

- Two of the three surface water contaminants had a very low frequency of HQ exceedances. Ammonia was more widespread.

- Most sediment ECOPCs had fewer than 20 percent of samples (detected) exceeding the ESL, except for fluoride and zinc.

Change in surface water Exceedances over Time:

- Cadmium and silver have decreased to nontoxic levels in recently-collected samples. Recent changes in ammonia concentrations are unknown.

- Surface sediment MDCs were generally not different from the comprehensive sediment database ESLs and did not influence the potential for risk. In only a few cases were the MDCs lower in surface sediments (Al).

Drainage-specific habitat and ecological studies:

- Previous studies indicate that aquatic life within the WC AEU is primarily affected by natural conditions associated with the ephemeral and intermittent character of the drainage hydrology. There was no indication that contaminant stressors were affecting the ecology. In addition, the AT values based on acute exposure (instead of chronic) are most appropriate due to the intermittent nature of flows in the drainage. Those AT values yielded the lowest evidence of chemical risk.

- Toxicity was not observed in pond sediment bioassays, indicating that PAHs, PCBs, and metals do not pose a potential for risk in pond habitat.

- Fish tissue residues were below toxicity thresholds for PCBs.

- Benthic macroinvertebrate communities were healthy.

- Prey items in the AEU does not pose a risk to avian piscivores and avian invertivores feeding in the WC AEU.

In summary, the weight of evidence gathered from the risk characterization indicates that there is no or low potential for risk to the aquatic populations within the WC AEU caused from contaminant chemistry alone. The seasonal hydrologic regime and local topography are most important in determining the makeup of the local aquatic communities and in mitigating any small potential for chemical-based risk. The lack of toxicity in pond sediment bioassays also had a strong weight in this WOE. In contrast to the strong effects of intermittent flows and seasonal hydrologic regime, the observations indicating the

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possibility of low, chemically-based risk were mostly based on uncertain toxicological endpoints and low and infrequent exceedances which would be unlikely to produce population and community effects, an observation supported by the various other LOEs and special studies.

6.0 UNCERTAINTIES ASSOCIATED WITH THE ECOLOGICAL RISK ASSESSMENT

Quantitative evaluation of ecological risks is limited by uncertainties regarding the assumptions used to predict risk and the data available for quantifying risk. These limitations are usually circumvented by making estimates based on the data available or by making assumptions based on professional judgment when data are limited. Because of these assumptions and estimates, the results of the risk calculations themselves are uncertain, and it is important for risk managers and the public to view the results of the risk assessment with this in mind. The following sections summarize the various sources of uncertainty in the CRA, along with a qualitative estimate of the direction and magnitude of the likely errors attributable to the uncertainty.

6.1 Uncertainties Associated With Data Adequacy and Quality

Volume 2 of the RI/FS will discuss the general data adequacy and data quality, respectively, for the AEUs. Data of sufficient quality for ERA purposes were collected in surface water and sediment for each AEU.

6.2 Uncertainties Associated with the Ecological Contaminants of Potential Concern Identification Process

The ECOPC process was designed to eliminate contaminants that are not likely to be of ecological concern within the AEUs. This procedure included a comparison of MDCs to ESLs, a frequency of detection evaluation, a comparison to background, and an EPC screen against the ESL. Use of this ECOPC identification process ensures that only those ECOIs related to historic site operations of toxicological significance are retained for additional quantitative evaluation.

6.2.1 Uncertainties Associated with Exposure Assumptions

Exposure was quantified using conservative assumptions regarding the life history and behavioral parameters for this group of receptors. These parameters were used to estimate the amount of contact a receptor may have with contaminated media by various exposure routes. The following parameters were assumed as part of the exposure assessment:

Aquatic receptors are exposed throughout their life cycle to ECOIs present within surface water and sediment within a given AEU; and

Aquatic habitat is available year-round within a given AEU; therefore, receptors do not migrate to other areas (i.e., OU 3) in absence of suitable habitat and, thereby, integrate exposure elsewhere.

The use of these assumptions adds uncertainty to the CRA because they may not reflect actual site-related conditions. For example, flows within at least portions of all of the AEUs are seasonal. Because no species-specific studies were conducted to determine site-specific habitat use patterns for aquatic receptors, conservative assumptions had to be applied. Aquatic receptors were assumed to spend 100 percent of their life cycle within a given AEU. Therefore, there is uncertainty involved with estimating exposure to ECOPCs by using these techniques that could overestimate the actual risk to the receptors.

Finally, the relative bioavailability of ECOPCs in surface water and sediment can create significant uncertainty in the risk characterization process. Such uncertainty can affect the EPCs used to estimate bioavailable forms (for example, dissolved metal in solution) as well as the toxicity endpoints used to derive AT values (ATs). Surface water ATs for divalent metals, for example, are generally based on toxicity associated with the bioavailable forms, which is assumed to be represented by the contaminant in dissolved soluble form. ECOIs associated with the site, however, are in forms that may not be as readily absorbed by ecological receptors.

Bioavailability and ecotoxicity of environmental contaminants are integrally linked to their environmental concentrations and contaminant forms (EPA 1999). The toxicity of a contaminant is controlled by:

- Its environmental concentration;
- Its site-specific chemistry (especially its ionic solubility and speciation if a metal or metalloid);
- The physical matrix in which the contaminant is found; and
- The uptake pathway(s) into a target organism from its physical matrix.

Organic carbon in sediments binds nonpolar (non-ionic) organic contaminants to render them non-bioavailable (Mahony et al. 1996). If the TOC in NN AEU sediments is higher than the 1% TOC assumed in the ESLs, then these ESLs will be more conservative than necessary to protect benthic organisms. TOC at RFETS waterbodies ranged from 0.05 to 5.4 % (1.1 ± 0.9 %; n=176). Higher OC in sediments is derived from decomposition of leaves and organic matter, producing a dark spongy soil. Site investigations indicate that pond sediment, averaging of 1.4 ± 1.1 % TOC (n=58), is generally darker and richer in OC than the assumed 1%. Sediment accumulation areas in the ponds, streams (backwaters and pools), and marshy areas with emergent vegetation can produce TOC-rich sediment (>5%) and electrochemically-reduced sediments that will produce sulfide. Acid volatile sulfides (AVS) bind metals when the sediments are anaerobic (Ankley et al. 1996). Therefore, sulfide and TOC likely to be present in the soft sediments of low-energy microhabitats, including pond bottoms, will serve to detoxify metals and certain organic contaminants.

All of these factors helped determine the exposure matrix for organisms in the field. Because the interplay of these factors determines the site-specific bioavailability and,

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thus, the potential expression of ecologically relevant effects, predictions of toxicity based solely on total concentrations in various environmental media have questionable scientific validity (EPA 1999). Therefore, assessment of ecological risks and the potential adverse effects of a contaminant required an understanding of the exposure matrix that may lead to actual uptake by a receptor species. The overall effect of the uncertainties related to unknown bioavailability may overestimate or underestimate the calculated risks.

6.2.2 Uncertainties Associated with Development of Ecological Screening Levels

ESLs are typically based on information gained from laboratory and other carefully controlled experimental exposures described in the literature. This information is then used to extrapolate conditions likely to exist in the natural environment. The laboratory information often does not provide adequate background for these extrapolations. Consequently, assessment factors are often used to compensate for the many uncertainties inherent in the extrapolation from laboratory effects data to effects in natural ecosystems (Warren-Hicks and Moore 1998). Uncertainties can arise (Calabrese and Baldwin 1993) when extrapolations are made from:

- Acute to chronic endpoints;
- One life stage to an entire life cycle;
- Individual effects to effects at the population level or higher;
- One species to many species;
- Laboratory to field conditions;
- One to all exposure routes;
- Direct to indirect effects;
- One ecosystem to all ecosystems; and/or
- One location or time to others.

The net effect of these uncertainties may result in either an overestimation or underestimation of risk, depending on RFETS-specific conditions, the types of receptors included in the evaluation, and the particular ECOIs.

The CRA Methodology presents a strict set of rules for applying toxicity data to develop ESLs for the ECOIs and to minimize uncertainty related to the extrapolations listed above. No procedures for the identification of toxicity data and eventual development of ESLs can eliminate the uncertainty inherent in the overall development process for ESLs.

6.3 Uncertainties Associated with ECOPCs with Elevated Reporting Limits

For certain organic chemicals, the analytical reporting limits can vary significantly, especially for solid media analysis where the media may cause interference with the analytical method. At times the reported limit can be greater than the ESL and introduce an uncertainty into the risk characterization process. For this assessment, the organic sediment ECOPCs were evaluated to determine if reported limits do occur at levels greater than the ESL and the AT benchmarks. HQ distributions for these all ECOPCs are presented in Section 5 tables and differentiate between ESL exceedances by detected and nondetected concentrations. The evaluation of organic chemical ECOPC (in sediment) detection limit uncertainty was further assessed by completing an HQ distribution using the AT values. Table 6.1 provides a summary of the AT HQ distribution for these chemicals. As shown within this Table, the distribution is below an HQ of 10 for each chemical evaluated for each AEU (except for bromomethane in SW AEU with two values having HQs greater than 10). This demonstrates that the range of risk remains uncertain, however unlikely given the conservative nature of this comparison. When the detected value distribution is evaluated as compared to the detection limit distribution, the range of HQs can be put into perspective. The detected value distribution for these chemicals demonstrate HQs of less than 5 in all cases. The risk attributable to the detected values would be considered low. The risk attributable to the detection limits is also likely to be low.

6.4 Uncertainties Associated with the Lack of Toxicity Data for Ecological Contaminants of Interest

Several ECOIs detected in the AEUs did not have adequate toxicity data available in the published literature for the derivation of ESLs (CRA Methodology). The ECOPC identification process identified ECOIs of uncertain toxicity for each AEU (Tables 6.2 and 6.3).

Several of these surface water ECOIs are not expected to pose a risk to aquatic organisms. Calcium, iron, magnesium, potassium, and sodium are considered macronutrients or rock-forming elements, and are not generally considered toxic to aquatic life. Radionuclide ESLs are available for all detected individual radionuclides and, therefore, the lack of ESLs for gross alpha and gross beta activities is not expected to affect the ERA. The potential for risk from these ECOPCs is uncertain.

Benthic macroinvertebrate sediment ESLs were not available for certain inorganic, organic and radionuclide chemicals. Of these chemicals, calcium, iron, magnesium, potassium, and sodium are considered macronutrients or rock-forming elements, and are not generally considered toxic to aquatic life. Radionuclide ESLs are available for all detected individual radionuclides and, therefore, the lack of ESLs for gross alpha and gross beta activities is not expected to affect the ERA. The potential for risk from these ECOPCs is uncertain, but is likely to be low.

This evaluation focused upon the assessment of ECOPCs within surface water and sediment exposure media to aquatic receptors. ECOPCs associated with one media can

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transport to the other through various biological and physico-contaminant processes. It is possible that one media can act as a source of contamination to another. Of particular interest and concern to aquatic receptors is the possible dissolution of sediment associated ECOPCs to surface water. Because there was a lack of available ESLs for certain sediment contaminants for which there were surface water ESLs, it is possible that potentially toxic sediment-related contaminants could have been overlooked, despite being identified as surface water ECOPCs. In order to address this potential data gap, an evaluation of sediment ECOIs that lack ESLs, but not surface water ESLs, was completed.

Tables 6.4 through 6.6 present the sediment ECOIs for each AEU that lacked ESLs and were identified as uncertainties. Within these tables, the AEU-specific surface water information is presented. For many of these contaminants, there was also a lack of surface water ESL information; therefore, these will remain contaminants of uncertain toxicity. Others had low frequencies of detection (less than 10 percent) in either surface water or sediment, occurred below background levels, were common elements with low toxicity and considered nontoxic, or were not identified as surface water ECOPCs as part of the screening process. The results for each AEU are as follows:

For NW AEU there were inorganic, organic and radionuclide sediment ECOIs of uncertain toxicity (Table 6.4). Several of the inorganic and organic ECOIs had surface water ESLs available (beryllium, boron, chloride, cobalt, lithium, molybdenum, nitrite, strontium, thallium, tin, uranium, vanadium, 1,2-dichloroethane, 1,2-dichloroethene, 4-isopropyltoluene, 4-methyl-2-pentanone, acetone, benzoic acid and methylene chloride) to evaluate risks to aquatic organisms for the same ECOI in surface water. These ECOIs, for which there were surface water ESLs, were not identified as surface water ECOPCs. The uncertain contaminants for which there was no available surface water or sediment ESLs were calcium, cesium, magnesium, nitrate/nitrite, potassium, silica, silicon, sodium, sulfate, titanium, benzo(b)fluoranthene, di-n-octylphthalate, cesium-134, gross alpha and gross beta. The contaminants for which surface water ESLs were available were not identified as surface water ECOPCs as part of the screening process (with the exception of vanadium). Since the surface water data set from which this evaluation is comprehensive and represents surface water conditions since 1991, there is confidence in the conclusion that the sediment ECOIs of uncertain toxicity, do not pose a potential for risk to surface water organisms. Vanadium was addressed within the risk characterization as having a low risk to aquatic populations. No further evaluation of this pathway and the potential risk associated with these contaminants is necessary.

For SW AEU there were inorganic, organic and radionuclide sediment ECOIs of uncertain toxicity (Table 6.5). Several of the inorganic and organic ECOIs had surface water ESLs available (beryllium, boron, chloride, cobalt, cyanide, lithium, manganese, molybdenum, nitrite, strontium, thallium, tin, vanadium, 1,1-dichloroethene, 1,2-dichloroethene, acetone, methylene chloride, and vinyl chloride) to evaluate risks to aquatic organisms for the same ECOI in surface water. These ECOIs, for which there were surface water ESLs, were not identified as surface water ECOPCs. The uncertain contaminants for which there were no available surface water or sediment ESLs included calcium, cesium, magnesium, nitrate/nitrite, potassium, silica, silicon, sodium, titanium,

benzo(b)fluoranthene, benzoic acid, dimethylphthalate, di-n-octylphthalate, trichlorofluoromethane, cesium-134, gross alpha and gross beta. The contaminants for which surface water ESLs were available were not identified as surface water ECOPCs as part of the screening process (with the exception of cyanide). Since the surface water data set from which this evaluation is comprehensive and represents surface water conditions since 1991, there is confidence in the conclusion that the sediment ECOIs of uncertain toxicity, do not pose a potential for risk to surface water organisms. Cyanide was addressed within the risk characterization as having a low risk to aquatic populations. No further evaluation of this pathway and the potential risk associated with these contaminants is necessary.

For WC AEU there were inorganic, organic and radionuclide sediment ECOIs of uncertain toxicity (Table 6.6). Several of the inorganic and organic ECOIs had surface water ESLs available (beryllium, boron, cobalt, lithium, strontium, thallium, tin, vanadium, acetone, benzoic acid and methylene chloride) to evaluate risks to aquatic organisms for the same ECOI in surface water. These ECOIs, for which there were surface water ESLs, were not identified as surface water ECOPCs. These contaminants were not identified as surface water ECOPCs as part of the screening process. Since the surface water data set from which this evaluation was completed is comprehensive and represents surface water conditions since 1991, there is confidence in the conclusion that these contaminants not pose a potential for risk to surface water organisms. The uncertain contaminants for which there were no available surface water or sediment ESLs included boron, calcium, cesium, magnesium, molybdenum, nitrate/nitrite, potassium, silica, silicon, sodium, titanium, 2,4-dinitrophenol, 4-methyl-2-pentanone, 4,6-dinitro-2-methylphenol, benzo(b)fluoranthene, di-n-octylphthalate, cesium-134, gross alpha and gross beta. No further evaluation of this pathway and the potential risk associated with these contaminants is necessary.

Because the surface water data set from which this evaluation was completed is comprehensive and represents surface water conditions since 1991, there is confidence in the conclusion that the sediment ECOIs of uncertain toxicity do not pose a potential for risk to surface water organisms. No further evaluation of this pathway and the potential risk associated with these contaminants is necessary.

6.5 Uncertainties Associated with Eliminating Ecological Contaminants of Potential Concern Based on Professional Judgment

Professional judgment was not applied as part of the NW AEU, SW AEU and WC AEU ECOPC evaluation process. Therefore there is no uncertainty introduced as a result of this process.

7.0 SUMMARY AND CONCLUSIONS

This section provides a summary of conclusions drawn in regards to risk to aquatic life gathered from this report, and a summary of risk conclusions for waterfowl and wading bird receptors as identified from the DOE 1996 report.

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7.1 Aquatic Life Receptors

Multiple LOEs were gathered to evaluate the aquatic risk conditions within the NW AEU, SW AEU and WC AEU. An evaluation of the contaminant risk potential was conducted using a standard HQ approach as well as other contaminant risk lines of evidence. Additional LOEs gathered from other/drainage studies were also compiled with the contaminant risk evaluation in order to formulate a risk conclusion.

The ECOPCs carried through the contaminant risk characterization process were characterized as having no or low risk potential. The HQ evaluation was a conservative approach that included both surface water and sediment ECOPCs. The spatial distribution evaluation indicated similar trends among the ECOPCs evaluated. There were few locations where observed concentrations exceeded ESL values. Detailed analysis of certain contaminants indicates the frequency and magnitude of the ECOPCs is not substantial compared to the ESLs and ATs indicating a low risk potential.

The methods applied within the contaminant risk characterization likely overestimate risk conditions because data was evaluated on a point-by-point basis and conservative ESLs were applied throughout the process. Toxicity bioassays have confirmed that comparisons between site ECOPC concentrations and ESLs are a conservative assessment, because these bioassays found no to low toxicity in site sediment media (with the exception of Pond B-2 which would be an over conservative result given the accelerated action remedy that was implemented after the time period of the bioassay analysis). Refined ESLs and more realistic exposure considerations were integrated as final lines of evidence in order to provide a more realistic risk characterization.

The aquatic conditions within the AEUs indicate that these drainages are limited by flow conditions and habitat. The aquatic life within the system is highly susceptible to changes in flow and, in turn, is represented as an opportunistic assemblage of aquatic invertebrates. There have been no studies to indicate water quality is a controlling factor to the ecology.

In summary, the multiple LOEs support the weight-of-evidence conclusion that there is no significant risk to aquatic life within NW AEU, SW AEU and WC AEU attributable to ECOPCs. Past conditions in these watersheds determined through several habitat and risk evaluations support the conclusion that aquatic life is not significantly affected by residual chemical exposure.

7.2 Waterfowl and Wading Bird Receptors

The results of this assessment provide conclusions in regards to NW AEU, SW AEU and WC AEU risk settings for aquatic life species of fish, invertebrates and aquatic plants. Waterfowl and wading birds are also important receptors in regards to AEU exposure, however the purpose of this assessment did not encompass these receptors. The risk to waterfowl and wading birds had been previously evaluated within DOE 1996. The ECOPC process identified a small set of surface water ECOPCs requiring further evaluation. The risk characterization provided lines of evidence that found the surface

water ECOPCs to provide insignificant risk to aquatic life. The results of the DOE 1996 waterfowl and wading bird evaluations were used as a line of evidence within the risk characterization. Findings from the DOE 1996 report are summarized within Attachment 7 and provided below.

An evaluation of sediment-related ecological contaminants of concern (ECOCs) was completed in order to determine the potential exposure and risk conditions to two target receptor organisms representative of waterfowl and wading birds. The Great blue heron and Mallard were chosen as the target receptors for this evaluation. Standard methods for the determination of exposure, dose and risk were applied and are thoroughly described within the DOE 1996 document.

ECOCs identified for these receptors included aroclor-1254, di-n-butylphthalate and mercury. Aroclor-1254 was detected in sediments from the DOE 1996 investigative studies (occurred pre-remedy of ponds B-1, B-2 and B-3) within the A- and B-series ponds with the highest concentrations in Ponds B-1 and B-2. Available data on PCB content of aquatic biota indicated negligible levels for birds feeding on fish, amphibians, or invertebrates from the ponds. However, biological tissue data were not available to evaluate the potential risk from all the ponds for which PCBs were detected in sediments. Therefore, site-specific data on uptake of PCBs by aquatic species were used to estimate the maximum concentration in sediments that would ultimately result in exposures of herons and mallards that are equal to or less than the toxicity reference value (TRV). Estimates were based on the organic carbon content of sediments and calculated for a range of levels of site use by the birds.

Risk estimates also accounted for the effects of food chain length on biomagnificiation. Accumulation of PCBs in upper level consumers is proportional to the length of the food chain through which PCBs are transferred from sediments to top consumers. Calculations were made for two hypothetical food chains: 1) one in which a species such as fathead minnows that feed primarily on zooplankton and algae is the primary prey of aquatic-feeding birds, and 2) one in which the main food source is a piscivorous species such as largemouth bass.

Results indicate that risks to herons or mallards are negligible if they feed on fish or invertebrates from lower trophic levels. However, herons may experience toxic exposures if they feed on upper level consumers from Ponds B-1, B-2, or B-3 more than about 40 percent of the time. The communities in these ponds lack the upper trophic levels, but possible future introduction of predaceous fish or other upper level consumers could result in increased exposure to aquatic birds feeding there.

Given that Ponds B-1, B-2, and B-3 have had an accelerated action closure where the sediments were removed and capped, the current and future exposure conditions to waterfowl and wading birds would be negligible. The findings from the DOE 1996 report in combination with the site remedy status for these ponds indicates that the risk to waterfowl and wading birds would be insignificant.

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TABLES

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Table ES.1

Surface Water ECOPCs in the AEUs

ECOPC	North Walnut	South Walnut	Woman Creek
Inorganics			
Aluminum (T)	x		
Ammonia (T)	x	x	x
Antimony (T)			
Barium (T)			
Beryllium (T)			
Cadmium (D)	x	x	x
Chromium (D)			
Cobalt (D)			
Copper (D)			
Cyanide (T)	x	x	
Fluoride (T)			
Iron (D)			
Lead (D)			
Lithium (T)	x		
Manganese (D)			
Mercury (D)			
Nickel (D)			
Nitrite			
Selenium (T)			
Silver (D)	x	x	x
Strontium (T)			
Tin (T)			
Vanadium (T)	x		
Zinc (D)			
Organics			
4,4'-DDT		x	
Aroclor-1254	x		
Radium-228	x		
Total ECOPCs	**9**	**5**	**3**

T = Total

D = Dissolved

The ECOPC selection was conducted on the MDC, either dissolved or total.

x = ECOPC.

Table ES.2

Sediment ECOPCs in the AEUs

ECOPC	North Walnut	South Walnut	Woman Creek
Inorganics			
Aluminum	x	x	x
Antimony	x	x	x
Arsenic			
Barium	x	x	x
Cadmium	x	x	x
Chromium			
Copper	x	x	x
Fluoride	x	x	x
Iron	x		x
Lead	x	x	x
Manganese	x		
Mercury	x		x
Nickel	x		x
Selenium	x		x
Silver	x	x	x
Zinc	x	x	x
Organics			
2-Methylnaphthalene	x		
4-Methylphenol			x
4,4-DDT	x		
Acenaphthene	x	x	x
Anthracene	x	x	x
Aroclor-1254	x	x	x
Aroclor-1260		x	
Atrazine	x		
Benzo(a)anthracene	x	x	x
Benzo(a)pyrene	x	x	x
Benzo(g,h,i)perylene	x	x	x
Benzo(k)fluoranthene	x	x	x
Bromomethane		x	
Carbazole	x	x	
Chrysene	x	x	x
Dibenz(a,h)anthracene	x	x	
Fluoranthene	x	x	x
Fluorene	x	x	
Heptachlor			x
Indeno(1,2,3-cd)pyrene	x	x	x
Naphthalene	x		
Pentachlorophenol			
Phenanthrene	x	x	x
Pyrene	x	x	x
TEQ Dioxins	x		x
Total PCBs	x	x	x
Total ECOPCs	**35**	**27**	**29**

x = ECOPC.

Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
000-2	IA	Original Process Waste Lines (OPWL)	000-121		Underground network pipes/tanks; multiple breaks and leaks
	IA	Valve Vault West of Building 707	700-123.2	2,476	Process waste migration along containment pipe and into ditch
	IA	Building 123 Process Waste Line Break	100-602	14,514	Line, valve vault, bedding material (conduit) between Buildings 123 and 443
	IA	Tank 29 – OPWL	000-121		Aboveground waste process tank; possible leaks
	IA	Tank 31 – OPWL	000-121		Below-grade, open-top sewage tank
	IA	Low-Level Radioactive Waste Leak	700-127	2,500	Multiple line breaks and leaks
	IA	Process Waste Line Leaks	700-147.1	16,427	Multiple line breaks and leaks; diverse release paths
	IA	Radioactive Site 700 Area	700-162	141,294	Residual hot spots along 8th Street
000-3	IA	Sanitary Sewer System	000-500		Routine and incidental waste discharges to sinks, sumps, lines
	IA	Storm Drains	000-505		
	IA	Old Outfall – Building 771	700-143	6,167	Contaminated waste water outfall area; one hot spot in nearby culvert
	IA	Central Avenue Ditch Caustic Leak	000-190	186,016	Caustic release to Central Ave. Ditch, Walnut Creek, and B-1
000-4	IA	New Process Waste Lines (NPWL)	000-504		
100-1	IA	UBC 122 – Medical Facility	UBC 122	9,768	Drum leaks and possible line leaks
	IA	Tank 1 – OPWL – Underground Stainless Steel Waste Storage Tank	000-121		Overflows and leaks from underground tank
100-2	IA	UBC 125 – Standards Laboratory	UBC 125	17,736	Possible spills from calibration lab (mercury)
100-3	IA	Building 111 Transformer polychlorinated biphenyl (PCB) Leak	100-607	356	Transformer leak
100-4	IA	UBC 123 – Health Physics Laboratory	UBC 123	18,885	Disposal out windows and waste line leaks
	IA	Waste Leaks	100-148	14,143	Unlocated waste spills, OPWL leaks
	IA	Building 123 Bioassay Waste Spill	100-603	356	OPWL leaks
	IA	Building 123 Scrubber Solution Spill	100-611	294	Process waste leak
100-5	IA	Building 121 Security Incinerator	100-609	599	Incinerator; accepted PCB-laden paper
300-1	IA	Oil Burn Pit #1	300-128	914	Burn and airborne contamination area
	IA	Lithium Metal Site	300-134(N)	7,126	Burn area
	IA	Solvent Burning Grounds	300-171	11,412	Burn area
300-2	IA	UBC 331 – Maintenance	UBC 331	4,986	Possible spills from maintenance activities
	IA	Lithium Metal Destruction Site	300-134(S)	23,728	Lithium burn areas (two)
300-3	IA	UBC 371 – Plutonium Recovery	UBC 371	114,147	Known spills of wastewater and process solutions
300-4	IA	UBC 374 – Waste Treatment Facility	UBC 374	27,131	Multiple spills and potential leaks from waste lines
300-5	IA	Inactive D-836 Hazardous Waste Tank	300-206	627	Condensate water spill from line to tank
300-6	IA	Pesticide Shed	300-702	4,380	Herbicide/pesticide spills/leaks in shed and surrounding area
400-1	IA	UBC 439 – Radiological Survey	UBC 439	5,107	Possible spills from machining operations
400-2	IA	UBC 440 – Modification Center	UBC 440	40,166	Possible spills from machining operations
400-3	IA	UBC 444 – Fabrication Facility	UBC 444	123,113	Overflows and leaks of process solutions
	IA	UBC 447 – Fabrication Facility	UBC 447	19,182	Possible spills and leaks from ongoing processes
	IA	West Loading Dock Building 447	400-116.1	2,009	Spills and leaks impacting soil and groundwater beneath dock
	IA	Cooling Tower Pond West of Building 444	400-136.1	7,654	Evaporation holding pond
	IA	Cooling Tower Pond East of Building 444	400-136.2	7,097	Cooling tower blowdown pond
	IA	Buildings 444/453 Drum Storage	400-182	3,465	Leaking drums and oil spills
	IA	Inactive Building 444 Acid Dumpster	400-207	1,288	Known spills to containment berm (possible leakage)
	IA	Inactive Buildings 444/447 Waste Storage	400-208	864	Possible leakage from drum storage
	IA	Transformer, Roof of Building 447	400-801	1,597	Transformer leakage via downspouts possibly to storm drain
	IA	Beryllium Fire – Building 444	400-810	15,073	Drainage, holding basin, and airborne contamination from fire
	IA	Tank 4 – OPWL Process Waste Pits	000-121		Potential leaks and overflows
	IA	Tank 5 – OPWL Process Waste Tanks	000-121		Potential leaks and overflows

Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
	IA	Tank 6 – OPWL Process Waste Floor Sump and Foundation Drain Floor	000-121		Potential leaks and overflows
	IA	South Loading Dock Building 444	400-116.2	1,113	Windblown, drum leakage, dumping
400-4	IA	Miscellaneous Dumping, Building 460 Storm Drain	400-803	18,932	Dumping to storm drain, extending along open ditch
	IA	Road North of Building 460	400-804	1,393	Hot spots covered w/asphalt from falling ingots
400-5	IA	Sump #3 Acid Site (Southeast of Building 460)	400-205	1,693	Leakage from container overflows in berm area
	IA	RCRA Tank Leak in Building 460	400-813	356	Pipe leakage beneath building
	IA	RCRA Tank Leak in Building 460	400-815	356	Possible leakage from spills to secondary containment
400-6	IA	Radioactive Site South Area	400-157.2	438,409	Dumping, surface runoff, air releases, open surface storage
400-7	IA	UBC 442 – Filter Test Facility	UBC 442	2,583	Leaking barrels, discharges
	IA	Radioactive Site North Area	400-157.1	51,169	Leaking drums, drainage to ditches
	IA	Building 443 Oil Leak	400-129	6,434	Leaks and spills from underground tanks (six)
	IA	Sulfuric Acid Spill Building 443	400-187	20,206	Multiple leaks and sprays from storage tank
400-8	IA	UBC 441 – Office Building	UBC 441		
	IA	Underground Concrete Tank	400-122		Overflows and leaking from tanks
	IA	Tank 2 – Concrete Waste Storage Tank	000-121		Potential leaks and overflows
	IA	Tank 3 – Concrete Waste and Steel Waste Storage Tanks	000-121		Potential leaks and overflows
400-10	IA	Sandblasting Area	400-807	9,583	Open air sandblasting
	IA	Fiberglass Area West of Building 664	600-120.2	5,449	Multiple spills around work area (resin and solvents)
	IA	Radioactive Site West of Building 664	600-161	53,346	Punctured and leaking drums, hydraulic leaks
500-1	IA	Valve Vaults 11, 12, 13	300-186	48,345	Leaks and discharges from transfer pipes and vaults
	IA	Scrap Metal Storage Site	500-197	89,320	Residual contamination from removal of process and building scrap
	IA	North Site Chemical Storage Site	500-117.1	115,489	Surface storage of contaminated material, uranium chips
500-2	IA	Radioactive Site Building 551	500-158	62,166	Wastebox leakage, exterior contaminated drums transferred
500-3	IA	UBC 559 – Service Analytical Laboratory	UBC 559	34,544	Plutonium waste line leaks and breaks
	IA	UBC 528 – Temporary Waste Holding Building	UBC 528	432	OPWL leaks/valve vault overflows
	IA	Radioactive Site Building 559	500-159	5,363	Broken process waste lines
	IA	Tank 7 – OPWL - Active Process Waste Pit	000-121		Potential leaks and overflows
	IA	Tank 33 – OPWL - Process Waste Tank	000-121		Potential leaks and overflows
	IA	Tank 34 – OPWL - Process Waste Tank	000-121		Potential leaks and overflows
	IA	Tank 35 – OPWL - Building 561 Concrete Floor Sump	000-121		Potential leaks and overflows
500-4	IA	Middle Site Chemical Storage	500-117.2	91,616	Minor leaks and spills, partial asphalt cover
500-5	IA	Transformer Leak - 558-1	500-904	356	PCB-oil leaks to concrete pad
500-6	IA	Asphalt Surface Near Building 559	500-906	356	1-gallon F001 spill from liquid hose transfer
500-7	IA	Tanker Truck Release of Hazardous Waste from Tank 231B	500-907	859	Liquid and solid sludge release to soil
600-1	IA	Temporary Waste Storage - Building 663	600-1001	42,803	Leaking, punctured, and spilled drums (concrete pad)
600-2	IA	Storage Shed South of Building 334	400-802	63,641	Leaking and spilled drums to concrete pad
600-3	IA	Fiberglass Area North of Building 664	600-120.1	4,650	Multiple spills around work area
600-4	IA	Radioactive Site Building 444 Parking Lot	600-160	143,752	Releases from drums and boxes stored on ground
600-5	IA	Central Avenue Ditch Cleaning	600-1004	14,885	Soil spreading from ditch to area around tanks

Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
600-6	IA	Former Pesticide Storage Area	600-1005	356	Pesticide spills to dirt floor
700-1	IA	Identification of Diesel Fuel in Subsurface Soil	700-1115		Subsurface fuel leak
700-2	IA	UBC 707 – Plutonium Fabrication and Assembly	UBC 707	107,710	Process line leaks/breaks
	IA	UBC 731 – Building 707 Process Waste	UBC 731	4,000	Process spills/OPWL leaks and breaks
	IA	Tank 11 – OPWL - Building 731	000-121		Potential leaks and overflows
	IA	Tank 30 – OPWL - Building 731	000-121		Potential leaks and overflows
700-3	IA	UBC 776 – Original Plutonium Foundry	UBC 776	142,889	Airborne/tracked contamination fires and explosions/liquid waste spills
	IA	UBC 777 – General Plutonium Research and Development	UBC 777		Process spills/OPWL leaks/fire contamination
	IA	UBC 778 – Plant Laundry Facility	UBC 778	26,609	Laundry water spills/OPWL leaks and breaks
	IA	UBC 701 – Waste Treatment Research and Development	UBC 701	5,645	Possible spills from Research and Development (R&D) laboratory
	IA	Solvent Spills West of Building 730	700-118.1	246	Carbon tetrachloride overflows and line leaks
	IA	Radioactive Site 700 Area No.1	700-131	7,072	Fire and explosion resulting in soil contamination
	IA	Radioactive Site West of Buildings 771/776	700-150.2(S)	27,113	Airborne and tracked contamination from fire, cleanup, and rain
	IA	Radioactive Site South of Building 776	700-150.7	18,589	Airborne and tracked contamination from fire, cleanup, and rain
	IA	French Drain North of Buildings 776/777	700-1100	1,567	Possible pathway for contamination from explosion and fire
	IA	Tank 9 – OPWL – Two 22,500-Gallon Concrete Laundry Tanks	000-121		Potential leaks and overflows
	IA	Tank 10 – OPWL – Two 4,500-Gallon Process Waste Tanks	000-121		Potential leaks and overflows
	IA	Tank 18 – OPWL – Concrete Laundry Waste Lift Sump	000-121		Potential leaks and overflows
	IA	Solvent Spills North of Building 707	700-118.2	633	Tank leaks and rupture
	IA	Sewer Line Overflow	700-144(N)	1,710	Pressurized sewer line breaks and overflows
	IA	Sewer Line Overflow	700-144(S)	2,330	Pressurized sewer line breaks and overflows
	IA	Transformer Leak South of Building 776	700-1116	356	Dielectric fluid leak to pad, gravel, and soil
	IA	Radioactive Site Northwest of Building 750	700-150.4	394	Leaks and backups of stored decontamination fluid
700-4	IA	UBC 771 – Plutonium and Americium Recovery Operations	UBC 771	97,553	Fire, sewer line breaks, process waste line leaks
	IA	UBC 774 – Liquid Process Waste Treatment	UBC 774	15,776	Tank overflows, drain breaks
	IA	Radioactive Site West of Buildings 771/776	700-150.2(N)	27,113	Fire, explosion, tank overflows
	IA	Radioactive Site 700 North of Building 774 (Area 3) Wash Area	700-163.1	18,613	Contaminated equipment wash area
	IA	Radioactive Site 700 Area 3 Americium Slab	700-163.2	2,270	Buried contaminated Americium slab 8'x8'x10"
	IA	Abandoned Sump Near Building 774 Unit 55.13 T-40	700-215	960	Mixed waste storage tank
	IA	Hydroxide Tank, KOH, NaOH Condensate	700-139(N)(b)	342	Overflows/spills from aboveground KOH/NaOH tanks
	IA	30,000-Gallon Tank (68)	700-124.1	1,133	Overflows/leaks from tank
	IA	14,000-Gallon Tank (66)	700-124.2		Overflows/leaks from tank
	IA	14,000-Gallon Tank (67)	700-124.3		Overflows/leaks from tank

Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
	IA	Holding Tank	700-125		Tank overflows
	IA	Westernmost Out-of-Service Process Waste Tank	700-126.1	383	Below-grade leaks/overflows
	IA	Easternmost Out-of-Service Process Waste Tank	700-126.2	370	Below-grade leaks/overflows
	IA	Tank 8 – OPWL – East and West Process Tanks	000-121		Potential leaks and overflows
	IA	Tank 12 – OPWL – Two Abandoned 20,000-Gallon Underground Concrete Tanks	000-121		Potential leaks and overflows
	IA	Tank 13 – OPWL – Abandoned Sump - 600 Gallons	000-121		Potential leaks and overflows
	IA	Tank 14 – OPWL – 30,000-Gallon Concrete Underground Storage Tank (68)	000-121		Potential leaks and overflows
	IA	Tank 15 – OPWL – Two 7,500-Gallon Process Waste Tanks (34W, 34E)	000-121		Potential leaks and overflows
	IA	Tank 16 – OPWL – Two 30,000-Gallon Concrete Underground Storage Tanks (66,	000-121		Potential leaks and overflows
	IA	Tank 17 – OPWL – Four Concrete Process Waste Tanks (30, 31, 32, 33)	000-121		Potential leaks and overflows
	IA	Tank 36 – OPWL – Steel Carbon Tetrachloride Sump	000-121		Potential leaks and overflows
	IA	Tank 37 – OPWL – Steel-Lined Concrete Sump	000-121		Potential leaks and overflows
	IA	Caustic/Acid Spills Hydrofluoric Tank	700-139.2	918	Spills and leaks infiltrating surrounding soil
	IA	Concrete Process 7,500-Gallon Waste Tank (31)	700-146.1	1,507	Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (32)	700-146.2		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (34W)	700-146.3		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (34E)	700-146.4		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (30)	700-146.5		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (33)	700-146.6		Frequent tank overflows and leakage
	IA	Radioactive Site North of Building 771	700-150.1	24,779	Airborne, leaking drums, tracked contamination
	IA	Radioactive Site Between Buildings 771 and 774	700-150.3	5,037	Broken process waste line
700-5	IA	UBC 770 – Waste Storage Facility	UBC 770	3,111	Possible leakage from stored waste containers
700-6	IA	Buildings 712/713 Cooling Tower Blowdown	700-137	14,962	Ground placement of tower sludge/blowdown water leaks
	IA	Caustic/Acid Spills Hydroxide Tank Area	700-139.1(S)	923	Multiple spills and leaks

Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
700-7	IA	UBC 779 – Main Plutonium Components Production Facility	UBC 779	43,360	Building over original Solar Pond/water spills and leaks
	IA	Building 779 Cooling Tower Blowdown	700-138	14,962	Underground cooling tower water line break
	IA	Radioactive Site South of Building 779	700-150.6	4,435	Tracked contamination
	IA	Radioactive Site Northeast of Building B779	700-150.8	13,054	Tracked contamination
	IA	Transformer Leak - 779-1/779-2	700-1105	712	PCB oil released from transformer
	IA	Tank 19 – OPWL - Two 1,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	IA	Tank 20 – OPWL - Two 8,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	IA	Tank 38 – OPWL - 1,000-Gallon Steel Tanks	000-121		Potential leaks and overflows
700-8	IA	750 Pad – Pondcrete/Saltcrete Storage	700-214	139,658	Pondcrete/saltcrete spills/pad runoff not contained
700-10	IA	Laundry Tank Overflow – Building 732	700-1101	1,856	Wastewater tank overflow
700-11	IA	Bowman's Pond	700-1108	4,741	Tanks/process line leaks/footing drain accumulation area
	IA	Hydroxide Tank, KOH, NaOH Condensate	700-139.1(N)(a)	2,520	Multiple spills and leaks
700-12	IA	Process Waste Spill – Portal 1	700-1106	356	Valve vault water spilled onto street
800-1	IA	UBC 865 – Materials Process Building	UBC 865	41,558	OPWL leaks/spills from coating ops and R&D activities
	IA	Building 866 Spills	800-1204	2,623	Vent pipe and tank overflows
	IA	Building 866 Sump Spill	800-1212	364	Leak from sump pump
	IA	Tank 23 – OPWL	000-121		Potential leaks and overflows
800-2	IA	UBC 881 – Laboratory and Office	UBC 881	79,222	Multiple leaks/broken waste lines
	IA	Building 881, East Dock	800-1205	2,426	Possible unknown contamination/condensate spill
	IA	Tank 24 – OPWL – Seven 2,700-Gallon Steel Process Waste Tanks	000-121		Potential leaks and overflows
	IA	Tank 32 – OPWL – 131,160-Gallon Underground Concrete Secondary	000-121		Potential leaks and overflows
	IA	Tank 39 – OPWL – Four 250-Gallon Steel Process Waste Tanks	000-121		Potential leaks and overflows
800-3	IA	UBC 883 - Roll and Form Building	UBC 883	49,325	Process waste water leaks and overflows
	IA	Valve Vault 2	800-1200	4,541	Transfer line leak
	IA	Tank 25 – OPWL – 750-Gallon Steel Tanks (18, 19)	000-121		Potential leaks and overflows
	IA	Tank 26 – OPWL – 750-Gallon Steel Tanks (24, 25, 26)	000-121		Potential leaks and overflows
	IA	Radioactive Site South of Building 883	800-1201	1,500	Multiple areas of contamination from Plant operations
800-4	IA	UBC 886 – Critical Mass Laboratory	UBC 886	13,517	Leaks and spills from criticality experiments
	IA	Tank 21 – OPWL – 250-Gallon Concrete Sump	000-121		Potential leaks and overflows
	IA	Tank 22 – OPWL – Two 250-Gallon Steel Tanks	000-121		Potential leaks and overflows
	IA	Tank 27 – OPWL – 500-Gallon Portable Steel Tank	000-121	31,400	Potential leaks and overflows

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Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
	IA	Radioactive Site #2 800 Area, Building 886 Spill	800-164.2	31,400	Tank leak
800-5	IA	UBC 887 – Process and Sanitary Waste Tanks	UBC 887	378	Leaks and breaks in process waste lines
	IA	Building 885 Drum Storage	800-177	1,064	Possible releases from waste storage
800-6	IA	UBC 889 – Decontamination and Waste Reduction	UBC 889	2,603	Radiological car wash area/OPWL leaks/waste tank breaches
	IA	Radioactive Site 800 Area Site #2 Building 889 Storage Pad	800-164.3	28,944	Leaks/spills/rainwater transport from storage area
	IA	Tank 28 – Two 1,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	IA	Tank 40 – Two 400-Gallon Underground Concrete Tanks	000-121		Potential leaks and overflows
900-1	IA	UBC 991 – Weapons Assembly and R&D	UBC 991	59,849	Potential line leaks/valve vault breaches and overflows
	IA	Radioactive Site Building 991	900-173	5,970	Small spills and equipment wash area
	IA	Radioactive Site 991 Steam Cleaning Area	900-184	4,125	Equipment cleaning area
	IA	Building 991 Enclosed Area	900-1301	3,939	Possible leaks from waste containers/material storage
900-2	BZ	Oil Burn Pit No. 2	900-153	6,403	Oil contaminated with uranium was burned in two parallel trenches
	BZ	Pallet Burn Site	900-154	3,152	Wooden pallet burn area
900-3	IA	904 Pad, Pondcrete Storage	900-213	127,334	Spillage and rainwater runoff of stored pondcrete/saltcrete
900-4&5	IA	S&W Building 980 Contractor Storage Facility	900-175	5,819	Leaks and spills from drum storage
	IA	Gasoline Spill Outside Building 980	900-1308	356	Gas overflow during filling
900-11	BZ	903 Pad	900-112	146,727	Leaks and spills from drum storage
	BZ	Hazardous Disposal Area	900-140	65,498	Reactive metal destruction and disposal site
	BZ	East Firing Range	SE-1602	465,173	Dispersal of lead and depleted uranium from routine weapons firing
900-12	BZ	Trench T-5	900-111.2	19,235	Disposal of sanitary waste sludge
	BZ	Trench T-6	900-111.3	4,089	Disposal of sanitary waste sludge
	BZ	Trench T-8	900-111.5	7,297	Disposal of sanitary waste sludge
	BZ	Trench T-9	900-111.6	14,705	Disposal of sanitary waste sludge, scrap metal, and junk
	BZ	Trench T-10	900-111.7	4,271	Disposal of sanitary waste sludge
	BZ	Trench T-11	900-111.8	5,776	Disposal of sanitary waste sludge and asphalt planking
NE/NW	BZ	Property Utilization and Disposal (PU&D) Yard – Drum Storage	174a	4,342	Leaks and spills from RCRA drum storage
	BZ	OU 2 Treatment Facility	NE-1407	356	Leaks and spills from process operations
	BZ	Trench T-12 Located at OU 2 East Trenches	NE-1412	7,449	Disposal of sanitary waste sludge and flattened drums
	BZ	Trench T-13 Located at OU 2 East Trenches	NE-1413	5,090	Disposal of sanitary waste sludge and flattened drums
NE-1	BZ	Pond A-1	142.1	39,294	Received wastewater effluent from the IA spill control
	BZ	Pond C-2	142.11	168,524	Received discharge from the South Interceptor Ditch (SID)
	BZ	Pond A-2	142.2	61,373	Received wastewater effluent from the IA spill control
	BZ	Pond A-3	142.3	122,909	Received wastewater effluent from the IA
	BZ	Pond A-4	142.4	254,102	Received wastewater effluent from the IA
	BZ	Pond B-1	142.5	11,396	Flow-through retention pond, received treated sanitary effluent and process waste
	BZ	Pond B-2	142.6	33,761	Flow-through retention pond, received treated sanitary effluent and process waste

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Table 1.1
AEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft2)	Brief Description
	BZ	Pond B-3	142.7	18,422	Flow-through retention pond, received treated sanitary wastewater effluent discharge
	BZ	Pond B-4	142.8	11,731	Flow-through retention pond, received treated sanitary effluent and process waste
	BZ	Pond B-5	142.9	129,515	Flow-through retention pond, received treated sanitary effluent and process waste
	BZ	Pond C-1	142.1	39,294	Retention and monitoring pond, received sanitary sewage discharge and runoff from the 903 Pad Area
NE-2	BZ	Trench T-7	111.4	15,565	Disposal of sanitary waste sludge
SW-1	BZ	Ash Pit 1	133.1	13,960	Disposal of combustible waste ash and noncombustible trash
	BZ	Ash Pit 2	133.2	26,624	Disposal of combustible waste ash and noncombustible trash
	BZ	Ash Pit 3	133.3	13,023	Disposal of combustible waste ash and noncombustible trash
	BZ	Ash Pit 4	133.4	10,749	Disposal of combustible waste ash and noncombustible trash
	BZ	Recently identified ash pit (also referred to as TDEM-1)	SW-1701	11,066	Disposal of combustible waste ash, depleted uranium and metallic debris
	BZ	Recently identified ash pit (also referred to as TDEM-2)	SW-1702	5,588	Disposal of combustible waste ash, depleted uranium and metallic debris
	BZ	Ryan's Pit (Trench 2)	109	261	Disposal of VOCs and drum carcasses
	BZ	Trench T-3	110	7,823	Disposal of sanitary waste sludge and debris

Table 1.2
Number of Samples Collected in Each AEU by Medium and Analyte Suite

AEU	Analyte Suite	Surface Water		Sediment
		Total	Dissolved	
NW AEU	Inorganics	2,696	541	112
	Organics	377	N/A	134
	Radionuclides	2,763	140	127
SW AEU	Inorganics	6,404	1,299	132
	Organics	1,411	N/A	128
	Radionuclides	6,355	385	178
WC AEU	Inorganics	862	382	88
	Organics	364	N/A	77
	Radionuclides	2,285	147	117

N/A = Not available or applicable.

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Table 1.3
Summary of Surface Water ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/L) (Total)								
Aluminum	644	674	95.5	2.50E-04 - 0.200	0.00655	442	10.0	26.1
Ammonia[1]	139	205	67.8	0.0500 - 50	0	16.5	1.79	3.06
Antimony	283	677	41.8	5.00E-05 - 0.0600	4.80E-04	0.117	0.00879	0.0152
Arsenic	462	677	68.2	3.20E-04 - 0.0111	4.80E-04	0.0691	0.00502	0.00875
Barium	667	678	98.6	2.00E-05 - 0.200	1.50E-04	4.52	0.169	0.236
Beryllium	438	956	45.8	0 - 0.00500	1.00E-05	0.0270	5.70E-04	0.00129
Boron	1	1	100	0.00830 - 0.00830	0.180	0.180	0.180	N/A
Bromide	1	2	50	2 - 2	0.820	0.820	0.535	0.403
Cadmium	331	683	48.4	4.00E-05 - 0.00500	7.00E-05	0.131	0.00131	0.00550
Calcium	677	679	99.7	0.00160 - 5	0.0381	252,000	441	9,668
Cerium	6	6	100	2.00E-04 - 0.00110	4.90E-04	0.117	0.0473	0.0503
Cesium	25	210	11.9	1.00E-04 - 1	6.60E-04	0.130	0.0984	0.106
Chloride	217	218	99.5	0.100 - 40	3	390	71.1	60.9
Chromium	648	1125	57.6	4.00E-05 - 0.0100	5.20E-06	0.434	0.00921	0.0226
Chromium VI	2	38	5.26	0.0100 - 0.0200	0.0200	0.0400	0.00895	0.00606
Cobalt	380	676	56.2	2.00E-05 - 0.0500	1.70E-04	0.253	0.00430	0.0117
Copper	518	666	77.7	8.00E-05 - 0.0250	3.00E-04	0.623	0.0203	0.0392
Cyanide	25	148	16.9	0.00500 - 0.0500	0	0.146	0.00766	0.0148
Fluoride	160	194	82.5	0.100 - 0.500	0.100	2.90	0.635	0.583
Iron	663	667	97.9	0.00150 - 0.110	0.00520	481	9.49	26.2
Lead	488	678	71.9	5.00E-05 - 0.0200	2.40E-04	0.596	0.0123	0.0327
Lithium	550	592	92.9	2.00E-05 - 0.100	8.00E-05	2.97	0.0652	0.217
Magnesium	677	679	99.7	1.00E-04 - 5	0.00833	300	17.3	26.2
Manganese	668	677	98.7	2.00E-05 - 0.0150	7.00E-05	7.31	0.286	0.597
Mercury	101	619	16.3	1.30E-05 - 0.00370	1.00E-04	0.0131	1.38E-04	6.12E-04
Molybdenum	402	652	61.6	1.00E-04 - 0.200	3.20E-04	0.0285	0.00388	0.00358
Nickel	439	673	65.1	2.00E-05 - 0.0400	3.70E-04	0.479	0.0126	0.0259
Nitrate / Nitrite	1,730	1832	94.4	0.00300 - 250	0.0240	8,820	43.9	272
Nitrite	58	122	47.5	0.0100 - 10	0.0200	3.43	0.311	0.882
Ortho-phosphate	12	51	23.5	0.0100 - 0.0500	0.0280	0.110	0.0351	0.0230
Phosphate	35	56	62.5	0.0100 - 0.0300	0.0100	0.760	0.0537	0.108
Phosphorus	57	93	61.3	5.00E-05 - 0.500	0.0200	0.650	0.100	0.130
Potassium	664	676	98.2	2.50E-04 - 21.5	0.00720	1,530	19.6	80.2
Selenium	285	673	42.3	2.00E-04 - 0.0222	4.20E-04	0.0350	0.00225	0.00428
Silica	27	27	100	0.0670 - 0.400	2.60	8.50	5.87	1.84
Silicon	209	212	98.6	0.00530 - 1	0.196	208	10.9	23.2
Silver	77	675	11.4	4.00E-05 - 0.0250	4.00E-05	0.913	0.00327	0.0381
Sodium	674	675	99.9	4.00E-04 - 6	0.0512	6,460	201	481
Strontium	647	648	99.8	2.00E-05 - 0.200	2.00E-04	8.59	0.488	0.775
Sulfate	215	219	98.2	0.200 - 100	2.33	680	78.0	88.4
Sulfide	27	123	22	0.0500 - 4	0.0360	36	1.27	4.56
Thallium	46	673	6.80	2.00E-05 - 0.0100	3.70E-04	0.0125	0.00202	0.00942
Tin	74	571	12.9	4.80E-04 - 5	5.50E-04	0.315	0.00609	0.0170
Titanium	5	7	71.4	9.40E-04 - 9.40E-04	0.00310	0.00720	0.00366	0.00198
Uranium	43	291	14.7	2.00E-05 - 0.0378	5.96E-04	0.0756	0.00390	0.00852
Vanadium	476	675	70.5	2.00E-05 - 0.0500	1.30E-04	0.892	0.0221	0.0517
Zinc	603	677	89.1	8.00E-05 - 1	0.00279	16.4	0.365	1.15
Inorganics (mg/L) (Dissolved)								
Aluminum	122	235	51.9	3.99E-04 - 0.200	0.00860	11.6	0.0940	0.760

Table 1.3

Summary of Surface Water ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Antimony	46	245	18.8	5.00E-05 - 0.0600	5.50E-04	0.101	0.0138	0.0193
Arsenic	92	249	36.9	1.47E-04 - 0.200	6.40E-04	0.0116	0.00230	0.00492
Barium	240	244	98.4	1.00E-05 - 0.200	0.00250	0.844	0.104	0.111
Beryllium	12	246	4.88	1.52E-05 - 0.00500	3.00E-05	0.00400	4.17E-04	5.60E-04
Cadmium	122	533	22.9	1.60E-05 - 0.00500	1.60E-05	0.0200	6.93E-04	0.00170
Calcium	242	243	99.6	0.00200 - 5	3	856	86.0	120
Cerium	2	6	33.3	1.00E-04 - 1.00E-04	1.40E-04	3.10E-04	1.08E-04	1.05E-04
Cesium	28	177	15.8	1.00E-04 - 1	5.31E-04	0.130	0.0912	0.0996
Chloride	1	1	100	N/A - N/A	29.8	29.8	29.8	N/A
Chromium	59	246	24	1.00E-04 - 0.0100	2.70E-04	0.0868	0.00428	0.0102
Cobalt	41	244	16.8	7.00E-06 - 0.0500	1.10E-04	0.0230	0.00203	0.00239
Copper	100	233	42.9	1.60E-05 - 0.0250	9.70E-04	0.205	0.00562	0.0180
Fluoride	1	1	100	N/A - N/A	0.700	0.700	0.700	N/A
Iron	166	239	69.5	0.00310 - 0.100	0.00450	9.57	0.132	0.700
Lead	77	245	31.4	1.60E-05 - 0.150	1.50E-04	0.111	0.00256	0.0118
Lithium	188	219	85.8	2.00E-05 - 0.100	0.00110	2.33	0.101	0.312
Magnesium	240	243	98.8	1.00E-04 - 5	1.13	299	23.4	38.4
Manganese	211	250	84.4	2.00E-05 - 0.0150	6.60E-04	2.13	0.0873	0.205
Mercury	25	243	10.3	1.40E-05 - 2.00E-04	1.40E-05	6.60E-04	1.04E-04	8.86E-05
Molybdenum	102	237	43	2.50E-05 - 0.200	6.30E-04	0.0202	0.00449	0.00340
Nickel	66	243	27.2	2.00E-05 - 0.0400	3.00E-04	0.170	0.00604	0.0124
Potassium	234	243	96.3	0.00510 - 5	1.29	1,270	27.1	101
Selenium	85	245	34.7	3.30E-04 - 0.150	7.00E-04	0.0172	0.00224	0.00288
Silica	4	5	80	0.400 - 0.400	1.90	5.30	3.10	2.03
Silicon	151	152	99.3	0.0100 - 1	0.192	26.4	3.77	2.66
Silver	46	529	8.70	5.00E-06 - 0.0250	2.00E-05	0.0324	8.32E-04	0.00188
Sodium	242	243	99.6	0.00448 - 5	2	2,350	140	309
Strontium	232	237	97.9	5.00E-06 - 0.200	0.0521	8.50	0.642	1.16
Sulfate	1	1	100	N/A - N/A	52	52	52	N/A
Thallium	8	243	3.29	5.00E-06 - 0.350	1.20E-05	0.0142	0.00267	0.00953
Tin	15	199	7.54	1.00E-05 - 5	0.00220	0.206	0.0116	0.0208
Uranium	13	31	41.9	3.00E-06 - 0.0680	0.00231	0.0756	0.0129	0.0173
Vanadium	77	242	31.8	9.51E-05 - 0.0500	4.20E-04	0.0719	0.00379	0.00709
Zinc	150	244	61.5	3.50E-05 - 0.0200	0.00200	0.831	0.0195	0.0652
Organics (ug/L)								
1,1,1-Trichloroethane	14	339	4.13	0.0100 - 10	0.100	3	1.54	1.32
1,1,2,2-Tetrachloroethane	1	338	0.296	0.0100 - 10	0.100	0.100	1.51	1.33
1,1,2-Trichloro-1,2,2-trifluoroethane	4	42	9.52	0.110 - 5	4	19.8	2.14	3.83
1,1-Dichloroethane	3	339	0.885	0.0300 - 10	0.300	2	1.53	1.32
1,1-Dichloroethene	5	339	1.47	0.0400 - 10	0.200	3	1.53	1.32
1,2,3-Trichlorobenzene	1	157	0.637	0.0500 - 5	0.700	0.700	0.367	0.321
1,2,4-Trimethylbenzene	1	157	0.637	0.0200 - 5	0.120	0.120	0.367	0.317
1,2-Dichloroethene	1	187	0.535	5 - 10	6	6	2.75	0.759
1,2-Dichloropropane	1	339	0.295	0.0300 - 10	1	1	1.52	1.32
1,3-Dichlorobenzene	1	275	0.364	0.0200 - 18	0.820	0.820	1.94	2.18
1,4-Dichlorobenzene	4	275	1.45	0.0300 - 18	0.200	0.500	1.94	2.18
2-Butanone	2	206	0.971	0.930 - 100	2	16	4.95	0.920
2-Hexanone	2	225	0.889	0.700 - 50	1	4	4.89	0.572
4,4'-DDE	1	123	0.813	0.0200 - 1	0.0210	0.0210	0.0621	0.0624
4,4'-DDT	1	123	0.813	0.0200 - 1	0.280	0.280	0.0643	0.0653

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Table 1.3
Summary of Surface Water ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
4-Methyl-2-pentanone	1	225	0.444	0.790 - 50	3	3	4.90	0.528
4-Nitroaniline	1	203	0.493	20 - 59	1.10	1.10	19.3	6.57
Acenaphthene	2	207	0.966	1 - 18	0.500	1	4.10	1.39
Acetone	39	215	18.1	1.90 - 100	2	490	8.53	34.1
alpha-BHC	1	123	0.813	0.0100 - 0.520	0.0100	0.0100	0.0312	0.0318
alpha-Chlordane	1	117	0.855	0.0100 - 5.20	0	0	0.247	0.355
Anthracene	1	207	0.483	0.0288 - 18	2	2	3.72	1.73
Atraton	1	60	1.67	0.0600 - 0.760	1	1	0.318	0.0914
Atrazine	27	93	29	0.0500 - 1	0.0800	1.60	0.332	0.232
Benzene	2	339	0.590	0.0100 - 10	2	4.70	1.54	1.32
Benzo(a)anthracene	1	207	0.483	0.130 - 18	8	8	3.75	1.72
Benzo(a)pyrene	1	207	0.483	0.134 - 18	9	9	3.75	1.76
Benzo(b)fluoranthene	2	207	0.966	0.144 - 18	2	10	3.77	1.75
Benzo(g,h,i)perylene	2	207	0.966	0.588 - 18	4	7	3.81	1.61
Benzo(k)fluoranthene	3	207	1.45	0.0768 - 18	0.700	8	3.73	1.75
Benzoic Acid	4	170	2.35	46 - 90	3	17.5	20.3	6.69
Benzyl Alcohol	5	182	2.75	9 - 22.5	23	860	15.0	83.5
beta-BHC	5	123	4.07	0.0100 - 0.520	0.0200	0.0400	0.0315	0.0317
bis(2-ethylhexyl)phthalate	65	206	31.6	9 - 18	0.300	200	8.27	21.4
Bromochloromethane	3	154	1.95	0.0100 - 5	4	6.50	0.538	0.740
Bromodichloromethane	10	327	3.06	0.100 - 10	0.290	2	1.49	1.32
Butylbenzylphthalate	12	207	5.80	9 - 18	0.300	6	4.16	1.43
Carbazole	1	25	4	9 - 12	3	3	4.94	0.507
Carbon Disulfide	3	231	1.30	0.190 - 10	0.100	5	2.43	1.01
Carbon Tetrachloride	28	338	8.28	0.0200 - 10	0.110	310	4.69	25.8
Chlorobenzene	1	339	0.295	0.0200 - 10	0.100	0.100	1.52	1.32
Chloroform	60	339	17.7	0.0100 - 10	0.0800	120	3.55	11.1
Chrysene	2	207	0.966	0.499 - 18	4	11	3.81	1.72
cis-1,2-Dichloroethene	11	158	6.96	0.0300 - 10	0.200	2	0.411	0.415
Dalapon	1	25	4	5.80 - 10.5	0.990	0.990	4.60	1.03
Dibenz(a,h)anthracene	1	207	0.483	0.300 - 18	2	2	3.82	1.53
Dibromochloromethane	1	339	0.295	0.0500 - 10	1	1	1.52	1.32
Dicamba	5	25	20	0.100 - 10	0.0800	0.210	2.29	2.45
Dichlorodifluoromethane	2	178	1.12	0.200 - 20	0.720	1.43	0.520	0.827
Dichloroprop	2	25	8	0.500 - 10	0.270	0.290	2.39	2.36
Diethylphthalate	16	207	7.73	9 - 18	0.300	7	4.13	1.49
Dimethoate	1	2	50	0.520 - 20	0.620	0.620	5.31	6.63
Dimethylphthalate	2	207	0.966	9 - 18	0.790	0.800	4.22	1.28
Di-n-butylphthalate	46	207	22.2	9 - 18	0.200	11	3.83	1.75
Di-n-octylphthalate	1	207	0.483	9 - 18	7	7	4.26	1.26
Dinoseb	1	26	3.85	0.0700 - 10	0.340	0.340	2.21	2.43
Endosulfan I	2	123	1.63	0.0100 - 0.520	0.0100	5.60	0.0770	0.503
Endrin	1	123	0.813	0.0200 - 1	0.0210	0.0210	0.0623	0.0623
Ethylbenzene	1	339	0.295	0.0400 - 10	0.430	0.430	1.53	1.32
Fluoranthene	2	207	0.966	0.595 - 18	0.900	16	3.80	1.87
Fluorene	1	207	0.483	0.294 - 18	0.900	0.900	3.74	1.67
gamma-Chlordane	1	50	2	0.0100 - 2.60	0	0	0.304	0.222
Heptachlor epoxide	1	123	0.813	0.0100 - 0.830	0.0500	0.0500	0.0348	0.0469
Hexachlorobutadiene	1	255	0.392	0.0500 - 18	0.290	0.290	2.01	2.22
Hexazinone	1	1	100	1 - 1	1.30	1.30	1.30	N/A

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Table 1.3
Summary of Surface Water ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Indeno(1,2,3-cd)pyrene	1	207	0.483	0.294	-	18	7	7	3.77	1.67
Isophorone	1	207	0.483	9	-	18	0.300	0.300	4.24	1.27
Isopropylbenzene	1	157	0.637	0.0200	-	5	0.500	0.500	0.383	0.304
Methylene Chloride	56	336	16.7	0.0100	-	10	0.100	90	2.61	7.19
Naphthalene	4	255	1.57	0.0200	-	18	0.110	1	2.05	2.20
n-Butylbenzene	1	157	0.637	0.0300	-	5	0.640	0.640	0.384	0.303
PCB-1254	6	119	5.04	0.0740	-	5.20	0.260	3.30	0.573	0.399
Phenanthrene	2	207	0.966	0.672	-	18	10	11	3.82	1.78
Propazine	1	76	1.32	0.0300	-	0.380	0.350	0.350	0.135	0.0522
Pyrene	5	204	2.45	0.588	-	18	0.200	12	3.76	1.73
Simazine	1	93	1.08	0.0600	-	1	0.0800	0.0800	0.264	0.0936
Tetrachloroethene	15	338	4.44	0.0200	-	10	0.0600	7	1.57	1.39
Toluene	11	339	3.24	0.0200	-	10	0.300	10	1.57	1.40
Trichloroethene	26	339	7.67	0.0300	-	10	0.0400	29	1.64	2.03
Trichlorofluoromethane	6	178	3.37	0.200	-	20	0.500	7	0.543	0.914
Vinyl Chloride	1	339	0.295	0.0100	-	10	0.500	0.500	2.61	2.31
Xylene	1	283	0.353	0.140	-	10	3	3	2.01	1.18
Radionuclides (pCi/L)										
Americium-241	1,303	1,303	100	0	-	10.5	-0.0430	84	0.294	2.71
Cesium-137	153	153	100	0.150	-	7.10	-0.510	9	0.286	1.04
Curium-244	25	25	100	0.00300	-	0.0620	-0.0120	0.0120	-4.00E-05	0.00455
Gross Alpha	1,172	1,172	100	0.340	-	301	-0.600	1,200	8.91	53.6
Gross Beta	1,176	1,176	100	1	-	77.8	-3.20	1,600	13.8	62.1
Neptunium-237	30	30	100	0.0120	-	1.02	-0.263	0.238	0.00538	0.0862
Plutonium-238	205	205	100	0.00299	-	5.37	-0.00754	5.93	0.0454	0.437
Plutonium-239/240	1,336	1,336	100	0	-	5.40	-0.110	259	0.617	7.95
Radium-226	12	12	100	0.0800	-	1	0.110	21	2.62	5.86
Radium-228	3	3	100	3.10	-	16	10	28	17.3	9.45
Strontium-89/90	132	132	100	0.0600	-	1.30	-0.130	1.54	0.380	0.302
Thorium-230	11	11	100	0.0270	-	0.200	-0.0210	0.460	0.123	0.173
Thorium-232	11	11	100	0.00900	-	0.300	-0.0400	0.690	0.0756	0.210
Tritium	1,243	1,243	100	48.8	-	710	-351	7,800	108	450
Uranium-233/234	1,492	1,492	100	0	-	24.5	-0.0280	1,161	6.36	39.2
Uranium-235	1,474	1,474	100	0	-	24.1	-0.120	31.0	0.228	1.16
Uranium-238	1,492	1,492	100	0	-	24.6	-0.0170	1,214	4.69	33.8

N/A = Not available or not applicable.

[1] Total ammonia reported.

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Table 1.4

Summary of Sediment ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)										
Aluminum	111	111	100	1.30	-	200	1,290	49,000	12,173	7,841
Antimony	15	98	15.3	0.190	-	17	0.230	41.4	5.06	8.24
Arsenic	109	111	98.2	0.150	-	10	0.570	12	5.39	2.28
Barium	111	111	100	0.00800	-	200	22	390	128	65.5
Beryllium	75	111	67.6	0.00800	-	5	0.190	2.50	0.715	0.421
Boron	30	30	100	1	-	6	2.90	26	8.81	4.75
Cadmium	48	110	43.6	0.0270	-	5	0.0500	8.30	0.817	1.04
Calcium	111	111	100	0.550	-	5,000	950	140,000	12,450	15,211
Cesium	16	71	22.5	4.51	-	1,000	1.70	5.80	21.4	41.5
Chloride	12	17	70.6	25	-	25	48.9	394	105	113
Chromium	107	111	96.4	0.0500	-	10	2	66.5	14.0	9.36
Chromium VI	6	21	28.6	0.00500	-	0.00500	0.00500	0.00800	0.00374	0.00209
Cobalt	106	111	95.5	0.0500	-	50	1.80	20.1	7.72	3.46
Copper	109	111	98.2	0.0450	-	25	5.60	77.6	18.7	9.86
Fluoride	12	21	57.1	2.50	-	2.50	2.38	16.7	3.30	3.56
Iron	111	111	100	1.20	-	100	4,770	55,000	16,652	7,150
Lead	111	111	100	0.150	-	3	4.70	234	23.6	23.3
Lithium	85	111	76.6	0.0200	-	100	1.80	37	8.83	6.23
Magnesium	111	111	100	0.300	-	5,000	595	11,000	3,210	1,561
Manganese	111	111	100	0.0200	-	15	72	1,760	373	277
Mercury	43	102	42.2	0.00500	-	0.200	0.0160	0.470	0.0812	0.0828
Molybdenum	38	111	34.2	0.0100	-	200	0.330	6.20	1.86	1.38
Nickel	102	111	91.9	0.0900	-	40	3.20	34	14.7	6.77
Nitrate / Nitrite	23	56	41.1	0.200	-	2.50	0.257	89.3	5.48	14.4
Nitrite	1	17	5.88	2.50	-	2.50	5.61	5.61	1.36	1.17
Potassium	105	111	94.6	0.960	-	5,000	402	6,500	1,937	1,060
Selenium	29	110	26.4	0.230	-	5	0.380	2.40	0.611	0.513
Silica	30	30	100	1.50	-	23	590	4,900	1,368	915
Silicon	34	34	100	0	-	12	64.9	1,960	640	431
Silver	16	106	15.1	0.0700	-	10	0.0900	5	0.757	0.762
Sodium	103	111	92.8	0.270	-	5,000	60.3	2,100	479	381
Strontium	111	111	100	0.00800	-	200	5.50	526	64.7	58.9
Sulfate	4	17	23.5	25	-	25	7.98	95.9	20.4	23.8
Thallium	10	110	9.09	0.270	-	10	0.350	1.60	0.371	0.262
Tin	17	109	15.6	0.220	-	200	0.920	15.5	6.30	6.48
Titanium	30	30	100	0.0870	-	0.880	36	310	128	55.2
Uranium	3	40	7.50	1	-	39	4.30	20	5.00	4.52
Vanadium	111	111	100	0.0500	-	50	6.50	96	32.3	14.5
Zinc	111	111	100	0.0500	-	43	19.2	704	120	111
Organics (ug/kg)										
1,1,2,2-Tetrachloroethane	1	79	1.27	1.70	-	21	2	2	15.1	89.5
1,2-Dichloroethane	1	75	1.33	1.50	-	21	5	5	15.6	91.8
1,2-Dichloroethene	1	67	1.49	5	-	21	3	3	17.2	97.1
1234678-HpCDF	3	4	75	0.00184	-	0.00474	0.00251	0.0298	0.00931	0.0137
1234789-HpCDF	3	4	75	0.00184	-	0.00474	7.40E-04	0.00243	0.00134	7.92E-04
123478-HxCDD	1	4	25	0.00184	-	0.00474	0.00126	0.00126	0.00179	5.29E-04
123478-HxCDF	3	4	75	0.00184	-	0.00474	5.50E-04	0.00371	0.00173	0.00151
123678-HxCDD	2	4	50	0.00184	-	0.00474	0.00122	0.00455	0.00256	0.00142
123678-HxCDF	1	4	25	0.00184	-	0.00474	0.00250	0.00250	0.00210	4.77E-04

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Table 1.4

Summary of Sediment ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
123789-HxCDD	2	4	50	0.00184	-	0.00474	0.00106	0.00329	0.00220	9.18E-04
123789-HxCDF	1	4	25	0.00184	-	0.00474	5.53E-04	5.53E-04	0.00132	7.88E-04
12378-PeCDF	1	4	25	0.00184	-	0.00474	0.00197	0.00197	0.00197	3.95E-04
234678-HxCDF	1	4	25	0.00184	-	0.00474	0.00199	0.00199	0.00197	3.95E-04
23478-PeCDF	1	4	25	0.00184	-	0.00474	0.00429	0.00429	0.00255	0.00123
2378-TCDD	1	4	25	7.35E-04	-	0.00190	0.00278	0.00278	0.00129	0.00101
2378-TCDF	1	4	25	7.35E-04	-	0.00190	0.00612	0.00612	0.00212	0.00267
2-Butanone	15	78	19.2	7	-	180	2	71	29.9	175
2-Methylnaphthalene	7	104	6.73	20	-	2,700	46	2,000	367	324
2-Methylphenol	1	104	0.962	31	-	2,700	200	200	363	274
4,4'-DDT	4	79	5.06	3.50	-	180	2.90	4.90	11.0	11.9
4-Isopropyltoluene	1	12	8.33	2.30	-	8.99	39	39	6.73	10.9
4-Methyl-2-pentanone	1	79	1.27	6.10	-	89.9	6	6	28.4	174
Acenaphthene	25	104	24.0	18	-	2,700	24	620	253	144
Acetone	12	77	15.6	5.10	-	180	6	400	55.1	194
Aldrin	1	78	1.28	1.80	-	89	54	54	6.27	8.09
Anthracene	40	104	38.5	18	-	2,700	20	970	241	176
Atrazine	1	1	100	50	-	50	120	120	120	
Benzene	1	79	1.27	1.40	-	21	3	3	15.1	89.5
Benzo(a)anthracene	61	104	58.7	21	-	2,700	26	1,400	306	322
Benzo(a)pyrene	51	104	49.0	21	-	2,700	23	1,300	330	314
Benzo(b)fluoranthene	53	104	51.0	30	-	2,700	25	1,500	343	323
Benzo(g,h,i)perylene	33	104	31.7	17	-	2,700	35	900	319	279
Benzo(k)fluoranthene	38	104	36.5	33	-	2,700	35	1,200	330	300
Benzoic Acid	9	71	12.7	300	-	4,100	95	2,700	1,808	1,419
bis(2-ethylhexyl)phthalate	51	104	49.0	33	-	2,700	1	47,000	868	4,647
Butylbenzylphthalate	3	104	2.88	45	-	2,700	34	120	358	278
Carbazole	13	30	43.3	350	-	2,700	20	300	184	119
Chrysene	70	104	67.3	28	-	2,700	22	1,500	320	343
delta-BHC	1	79	1.27	1.80	-	89	13	13	5.74	5.97
Dibenz(a,h)anthracene	6	104	5.77	20	-	2,700	41	330	346	260
Dibenzofuran	6	104	5.77	21	-	2,700	26	300	358	278
Diethylphthalate	1	104	0.962	27	-	2,700	25	25	361	276
Di-n-butylphthalate	25	104	24.0	21	-	2,700	31	190	325	294
Di-n-octylphthalate	3	104	2.88	25	-	2,700	45	130	357	278
Endosulfan I	1	79	1.27	1.80	-	89	20	20	5.53	5.48
Fluoranthene	75	104	72.1	23	-	2,700	44	3,100	494	547
Fluorene	17	104	16.3	19	-	2,700	21	650	337	271
Heptachlorodibenzo-p-dioxin	3	4	75	0.00184	-	0.00474	0.0198	0.0946	0.0341	0.0412
Indeno(1,2,3-cd)pyrene	36	104	34.6	23	-	2,700	23	890	309	281
Methylene Chloride	8	78	10.3	1.30	-	21	3.70	9.30	61.2	469
Naphthalene	10	106	9.43	0.950	-	2,700	1.10	320	287	234
OCDD	4	4	100	0.00368	-	0.00948	0.0178	0.539	0.208	0.229
OCDF	3	4	75	0.00368	-	0.00948	0.00583	0.0409	0.0149	0.0174
PCB-1254	34	124	27.4	4.50	-	1,800	7.30	5,200	166	479
PCB-1260	2	121	1.65	1.50	-	1,800	150	180	107	109
Pentachlorophenol	1	104	0.962	120	-	6,800	39	39	1,595	1,390
Phenanthrene	70	104	67.3	18	-	2,700	26	3,300	419	522
Phenol	2	104	1.92	19	-	2,700	22	54	357	277
Pyrene	67	104	64.4	140	-	2,700	37	3,900	495	574

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Table 1.4

Summary of Sediment ECOI Data in the NW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Tetrachloroethene	1	79	1.27	1.50	-	21	2	2	15.1	89.5
Toluene	22	79	27.8	1.20	-	21	2	860	36.8	126
Trichloroethene	3	79	3.80	1.40	-	21	3	13	15.2	89.5
Radionuclides (pCi/g)										
Americium-241	117	117	100	0	-	0.225	-0.0147	13.2	0.933	2.23
Cesium-134	47	47	100	0.0300	-	0.200	-0.157	0.200	0.0809	0.0756
Cesium-137	81	81	100	0.0220	-	0.200	0.00300	0.685	0.225	0.178
Gross Alpha	78	78	100	1.60	-	56	-6.20	70.7	21.2	13.6
Gross Beta	82	82	100	2.23	-	21	8.02	39.3	27.0	5.93
Plutonium-239/240	126	126	100	0	-	0.415	-0.00879	36.2	2.46	5.86
Radium-226	40	40	100	0.120	-	0.510	-0.340	3.08	1.06	0.811
Radium-228	29	29	100	0.0500	-	0.630	0.0400	2.40	1.57	0.425
Strontium-89/90	71	71	100	0.0300	-	1	-0.140	1.80	0.274	0.385
Uranium-233/234	118	118	100	0	-	0.779	0.140	3.87	1.38	0.761
Uranium-235	118	118	100	0	-	0.993	-0.0523	0.352	0.0767	0.0685
Uranium-238	118	118	100	0	-	0.709	0.190	6.10	1.66	1.22

Table 1.5

Summary of Surface Water ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/L) (Total)								
Aluminum	1,341	1,582	84.8	0.00025 - 0.2	0.00930	325	3.48	13.0
Ammonia[1]	2,360	2,581	91.4	0.015 - 5	0	50	7.91	9.47
Antimony	495	1,606	30.8	0.00005 - 0.06	2.80E-04	0.604	0.0139	0.0363
Arsenic	697	1,590	43.8	0.00032 - 0.0179	4.50E-04	0.139	0.00472	0.0108
Barium	1,570	1,600	98.1	0.00002 - 0.2	2.20E-04	2.30	0.123	0.140
Beryllium	466	1,840	25.3	0 - 0.005	2.00E-05	0.0159	4.76E-04	6.46E-04
Boron	1	1	100	0.0052 - 0.0052	0.0650	0.0650	0.0650	N/A
Cadmium	497	1,611	30.9	0.00001 - 0.005	5.00E-05	0.181	0.00156	0.00500
Calcium	1,588	1,603	99.1	0.00008 - 5	0.0614	1,118	68.1	55.0
Cerium	6	6	100	0.0002 - 0.0011	0.00356	0.124	0.0584	0.0529
Cesium	41	580	7.07	0.0001 - 1	2.30E-04	0.100	0.0750	0.0952
Chloride	615	619	99.4	0.2 - 50	1.10	820	73.2	66.5
Chromium	1,029	2,285	45.0	0.00004 - 0.0278	5.20E-06	0.248	0.00463	0.0107
Chromium VI	2	37	5.41	0.01 - 0.02	0.0100	0.0300	0.00865	0.00435
Cobalt	480	1,600	30	0.00002 - 0.05	1.20E-04	0.0781	0.00238	0.00417
Copper	987	1,584	62.3	0.00008 - 0.025	4.80E-04	0.549	0.00963	0.0221
Cyanide	19	179	10.6	0.00172 - 0.05	0.00300	0.0610	0.00555	0.00703
Fluoride	545	576	94.6	0.035 - 0.5	0.0500	9.60	0.766	0.507
Iron	1,389	1,597	87.0	0.0002 - 0.11	0.00620	245	3.64	12.0
Lead	752	1,597	47.1	0.00005 - 0.15	1.20E-04	0.356	0.00736	0.0186
Lithium	1,022	1,156	88.4	0.00002 - 0.1	3.90E-04	2.83	0.0195	0.0995
Magnesium	1,593	1,603	99.4	0.00002 - 5	0.0117	92.9	14.4	11.2
Manganese	1,434	1,605	89.3	0.00002 - 0.0636	6.20E-04	4.30	0.146	0.337
Mercury	125	1,542	8.10	0 - 0.0037	0	0.00140	1.01E-04	1.41E-04
Molybdenum	576	1,316	43.8	0.00002 - 0.2	2.80E-04	0.606	0.00475	0.0175
Nickel	604	1,598	37.8	0.00002 - 0.04	5.40E-04	0.224	0.00631	0.0102
Nitrate / Nitrite	3,948	4,051	97.5	0.01 - 6	0.0110	1,200	3.81	23.9
Nitrite	705	759	92.9	0.001 - 0.5	0.0200	6.60	0.632	0.928
Ortho-phosphate	21	61	34.4	0.05 - 0.05	0.0520	0.350	0.0692	0.0818
Phosphate	12	42	28.6	0.01 - 0.1	0.0100	0.170	0.0229	0.0369
Phosphorus	1,572	1,647	95.4	0.01 - 2.5	0.0200	20	1.88	1.78
Potassium	1,486	1,600	92.9	0.0001 - 5	0.0801	94.8	5.74	7.56
Selenium	555	1,599	34.7	0.0002 - 0.817	3.00E-04	0.0339	0.00293	0.00918
Silica	4	4	100	0.023 - 0.4	3.40	9.30	6.48	2.67
Silicon	698	700	99.7	0.00005 - 0.1111	0.0284	78.6	5.64	7.16
Silver	232	1,625	14.3	0.000011 - 0.025	1.60E-05	0.0736	0.00121	0.00266
Sodium	1,565	1,600	97.8	0.00022 - 5	0.115	3,240	91.9	201
Strontium	1,303	1,314	99.2	0.00002 - 0.2	2.90E-04	3.51	0.389	0.323
Sulfate	608	611	99.5	0.1 - 100	3	697	47.3	53.7
Sulfide	2	86	2.33	0.05 - 2	0.850	0.920	0.493	0.116
Thallium	63	1,589	3.97	0.00002 - 0.0346	2.00E-04	0.176	0.00455	0.0175
Tin	98	1,127	8.69	0.00002 - 5	5.20E-04	0.0311	0.00566	0.00664
Titanium	4	6	66.7	0.00097 - 0.00097	0.00620	0.0276	0.00940	0.00966
Total Petroleum Hydrocarbons	6	7	85.7	0.36 - 1.4	0.170	0.550	0.333	0.158
Uranium	56	304	18.4	0.00002 - 0.0703	0.00290	0.0402	0.00489	0.00931
Vanadium	927	1,596	58.1	0.00002 - 0.05	1.60E-04	0.527	0.0106	0.0276
Zinc	1,348	1,601	84.1	0.00008 - 0.02	0.00240	8.07	0.160	0.345
Inorganics (mg/L) (Dissolved)								
Aluminum	257	834	30.8	0.00025 - 0.2	0.00510	1.89	0.0297	0.0990
Antimony	138	850	16.2	0.0001 - 0.06	8.30E-04	0.219	0.0107	0.0109

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Table 1.5
Summary of Surface Water ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Arsenic	152	833	18.2	0.000111 - 0.01	3.20E-04	0.0192	0.00104	0.00158
Barium	838	849	98.7	0.00002 - 0.2	0.00140	0.592	0.107	0.0703
Beryllium	27	850	3.18	0 - 0.005	4.00E-05	0.00160	4.27E-04	2.43E-04
Cadmium	172	1113	15.5	0.00003 - 5	5.00E-05	0.0305	0.00116	0.00204
Calcium	848	850	99.8	0.0016 - 5	8.11	421	84.8	42.4
Cerium	4	6	66.7	0.0001 - 0.0005	1.20E-04	7.20E-04	2.82E-04	2.92E-04
Cesium	58	505	11.5	0.0001 - 1	1.08E-04	0.120	0.0737	0.0906
Chloride	1	1	100	5 - 5	76.8	76.8	76.8	N/A
Chromium	178	852	20.9	0.00005 - 0.01	2.20E-04	0.0440	0.00204	0.00251
Cobalt	68	850	8	0.000035 - 0.05	1.10E-04	0.0103	0.00154	8.66E-04
Copper	312	836	37.3	0.00008 - 0.025	3.10E-04	0.0440	0.00234	0.00349
Fluoride	1	1	100	0.2 - 0.2	0.500	0.500	0.500	N/A
Iron	368	838	43.9	0.00111 - 0.1	0.00250	1.55	0.0334	0.101
Lead	144	849	17.0	0.00005 - 0.005	1.10E-04	0.0409	0.00111	0.00518
Lithium	540	616	87.7	0.00002 - 0.2	0.00120	1.59	0.0144	0.0642
Magnesium	846	850	99.5	0.0007 - 5	0.271	52	17.6	9.45
Manganese	678	859	78.9	0.00002 - 0.015	2.00E-04	1.40	0.0508	0.117
Mercury	36	847	4.25	0.000023 - 0.0002	6.30E-05	8.50E-04	1.01E-04	5.32E-05
Molybdenum	150	619	24.2	0.0001 - 0.2	3.70E-04	0.0188	0.00363	0.00470
Nickel	130	845	15.4	0.000205 - 0.04	5.20E-04	0.0303	0.00367	0.00242
Potassium	803	849	94.6	0.00144 - 5	0.469	49.8	3.88	4.30
Selenium	348	848	41.0	0.000111 - 0.0078	2.30E-04	0.0150	0.00183	0.00152
Silica	4	4	100	0.4 - 0.4	1	2.90	1.83	0.826
Silicon	536	539	99.4	0.0067 - 0.1	0.217	8.69	3.57	1.66
Silver	66	1,286	5.13	0.000011 - 0.01	1.40E-05	0.0332	9.30E-04	0.00135
Sodium	848	850	99.8	0.0027 - 5	4.63	2,020	72.8	105
Strontium	616	620	99.4	0.00002 - 0.3	0.0401	1.54	0.452	0.234
Sulfate	1	1	100	2.5 - 2.5	32.7	32.7	32.7	N/A
Thallium	21	842	2.49	0.00004 - 0.01	5.30E-04	0.0179	0.00117	0.00358
Tin	23	600	3.83	0.000111 - 5	0.00150	0.0640	0.00812	0.00737
Uranium	11	36	30.6	0.000015 - 0.0703	0.00300	0.0120	0.00875	0.0103
Vanadium	326	849	38.4	0.00002 - 0.05	1.90E-04	0.0790	0.00372	0.00546
Zinc	426	838	50.8	0.00008 - 0.02	0.00180	0.760	0.0354	0.0672
Organics (ug/L)								
1,1,1-Trichloroethane	277	1,376	20.1	0.01 - 10	0.100	20	1.95	2.44
1,1,2,2-Tetrachloroethane	2	1,378	0.145	0.01 - 10	1	4	1.30	1.35
1,1,2-Trichloro-1,2,2-trifluoroetha	5	88	5.68	0.11 - 5	1.31	39	2.32	4.09
1,1-Dichloroethane	317	1,378	23.0	0.03 - 10	0.100	7	1.44	1.34
1,1-Dichloroethene	134	1,375	9.75	0.04 - 10	0.100	11	1.48	1.56
1,2,3-Trichlorobenzene	1	747	0.134	0.05 - 5	0.100	0.100	0.326	0.626
1,2,3-Trichloropropane	1	680	0.147	0.02 - 5	0.600	0.600	0.448	0.784
1,2,4-Trichlorobenzene	2	835	0.240	0.06 - 11	0.100	0.130	0.821	1.46
1,2,4-Trimethylbenzene	1	747	0.134	0.02 - 5	0.100	0.100	0.325	0.626
1,2-Dibromo-3-chloropropane	1	260	0.385	0.16 - 5	0.600	0.600	0.888	1.15
1,2-Dichloroethane	9	1,352	0.666	0.03 - 10	0.500	10	1.35	1.33
1,2-Dichloroethene	142	582	24.4	5 - 10	1	370	10.9	32.0
1,3,5-Trimethylbenzene	1	747	0.134	0.03 - 5	0.200	0.200	0.325	0.626
1,3-Dichlorobenzene	2	915	0.219	0.02 - 11	0.440	0.570	0.747	1.40
1,4-Dichlorobenzene	48	915	5.25	0.03 - 11	0.100	4.10	0.803	1.41
2-Butanone	44	633	6.95	0.93 - 100	0.900	32	5.36	4.62
2-Chloroethyl vinyl ether	7	71	9.86	0 - 10	0	0	2.11	1.80

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Ta[illegible]1.5

Summary of Surface Water ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
2-Hexanone	6	660	0.909	0.7 - 50	1	12	5.06	2.02
4,4'-DDD	1	72	1.39	0.099 - 0.52	0.0990	0.0990	0.0573	0.0277
4,4'-DDE	1	72	1.39	0.099 - 0.52	0.0130	0.0130	0.0561	0.0277
4,4'-DDT	5	72	6.94	0.099 - 0.52	0.0110	0.580	0.0673	0.0719
4-Bromofluorobenzene	3	3	100	N/A - N/A	9.46	9.92	9.62	0.260
4-Methyl-2-pentanone	4	663	0.603	0.79 - 50	2	11	5.08	2.00
4-Methylphenol	1	141	0.709	1.3 - 11	28	28	4.48	2.30
4-Nitroaniline	1	153	0.654	1.7 - 84	5.30	5.30	20.9	6.36
Acetone	205	652	31.4	1 - 100	1	530	22.8	60.0
alpha-BHC	4	72	5.56	0.05 - 0.26	0	0.0100	0.0273	0.0146
alpha-Chlordane	2	67	2.99	0.05 - 2.6	0	0	0.214	0.190
Aroclor-1254	1	70	1.43	0.99 - 5.2	24	24	0.897	2.81
Atrazine	15	52	28.8	0.05 - 1	0.0700	1.90	0.384	0.339
Benzene	5	1,378	0.363	0.01 - 10	0.100	4	1.30	1.36
beta-BHC	3	72	4.17	0.05 - 0.26	0	0.0510	0.0284	0.0142
bis(2-ethylhexyl)phthalate	40	153	26.1	1.4 - 11	0.500	98	5.28	8.19
Bromodichloromethane	36	1,375	2.62	0.1 - 10	0.100	6	1.31	1.35
Bromoform	4	1,356	0.295	0.09 - 10	0.100	0.800	1.35	1.32
Bromomethane	3	1,369	0.219	0.19 - 10	2	3	2.31	2.30
Butylbenzylphthalate	8	155	5.16	1.6 - 33	0.400	1.60	4.37	1.64
Carbon Disulfide	2	667	0.300	0.19 - 10	3	4	2.61	0.842
Carbon Tetrachloride	401	1,373	29.2	0.02 - 12	0.100	220	10.1	29.0
Chlorobenzene	2	1,378	0.145	0.02 - 10	0.200	1	1.30	1.35
Chlorodifluoromethane	5	5	100	-	3	98	34.6	44.4
Chloroform	727	1,378	52.8	0.01 - 10	0.100	100	3.47	6.11
Chloromethane	3	1,375	0.218	0.1 - 10	0.740	17	2.30	2.37
Chrysene	1	155	0.645	0.52 - 33	0.400	0.400	3.62	2.12
cis-1,2-Dichloroethane	1	1	100	1 - 1	18	18	18	N/A
cis-1,2-Dichloroethene	409	746	54.8	0.03 - 25	0.100	210	6.76	16.6
delta-BHC	2	72	2.78	0.05 - 0.26	0.0100	0.0100	0.0280	0.0139
Dibromochloromethane	13	1,375	0.945	0.05 - 10	0.240	3	1.31	1.34
Dichlorodifluoromethane	4	827	0.484	0.2 - 10	0.270	2.18	0.414	0.882
Diethylphthalate	3	155	1.94	0.74 - 33	2	2	4.35	1.15
Dimethoate	1	2	50	0.51 - 0.52	67	67	33.6	47.2
Dimethylphthalate	2	155	1.29	0.65 - 33	0.930	3.60	4.43	1.50
Di-n-butylphthalate	25	155	16.1	1 - 33	0.300	6	3.97	1.60
Di-n-octylphthalate	3	155	1.94	1.2 - 33	3	10	4.49	1.55
Fluorene	1	155	0.645	0.297 - 33	1.15	1.15	3.64	2.08
gamma-BHC (Lindane)	2	72	2.78	0.05 - 0.26	0	0	0.0277	0.0143
gamma-Chlordane	2	37	5.41	0.5 - 2.6	0	0	0.298	0.199
Heptachlor	1	72	1.39	0.05 - 0.26	0	0	0.0281	0.0139
Hexachlorobutadiene	5	835	0.599	0.05 - 11	0.100	0.200	0.777	1.47
m,p-Xylene	7	538	1.30	0.02 - 0.5	0.100	0.300	0.166	0.153
Methylene Chloride	339	1,377	24.6	0.01 - 10	0.100	37	2.03	3.44
Naphthalene	5	835	0.599	0.02 - 11	0.340	4	0.781	1.47
n-Butylbenzene	1	747	0.134	0.03 - 5	0.100	0.100	0.328	0.626
N-Nitrosomorpholine	1	2	50	10 - 33	1	1	8.75	11.0
Phenanthrene	1	155	0.645	0.7 - 33	1	1	3.62	2.11
Propazine	3	49	6.12	0.03 - 0.09	0.420	1	0.163	0.185
Simazine	1	52	1.92	0.06 - 1	0.180	0.180	0.251	0.104
Styrene	5	1,299	0.385	0.093 - 10	0.100	0.400	1.35	1.39

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Table 1.5

Summary of Surface Water ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Tetrachloroethene	445	1,374	32.4	0.02 - 50	0.0500	280	6.44	17.9
Toluene	120	1,378	8.71	0.02 - 10	0.100	11	1.34	1.46
trans-1,2-Dichloroethene	11	827	1.33	0.03 - 5	0.100	1.10	0.337	0.599
Trichloroethene	456	1,377	33.1	0.03 - 50	0.0400	970	8.47	36.9
Trichlorofluoromethane	4	827	0.484	0.1 - 5	0.400	2	0.376	0.594
Vinyl Chloride	75	1,378	5.44	0.01 - 10	0.100	37	2.40	2.85
Xylene	3	784	0.383	0.14 - 10	1	2	2.27	1.13
Radionuclides (pCi/L)								
Americium-241	2,574	2,574	100	0 - 2.466	-0.200	27.3	0.146	1.08
Cesium-134	3	3	100	1.01 - 2.38	-0.0575	0.227	0.127	0.160
Cesium-137	242	242	100	0.1 - 2.62	-0.734	5.40	0.236	0.591
Curium-244	24	24	100	0.003 - 0.14	-0.0510	0.0260	1.67E-04	0.0158
Gross Alpha	3,969	3,969	100	0.29 - 41	-3.60	330	2.27	8.11
Gross Beta	4,001	4,001	100	0.15 - 31.1	-14	860	9.67	15.2
Neptunium-237	17	17	100	0.014 - 0.26	-0.0320	0.100	0.0176	0.0333
Plutonium-238	396	396	100	0.002401 - 12.95	-0.00897	14.2	0.0972	0.988
Plutonium-239/240	2,732	2,732	100	0 - 5.396	-0.190	90	0.357	3.59
Radium-226	34	34	100	0.001 - 1	-0.190	3	0.369	0.520
Strontium-89/90	350	350	100	0.07 - 1.4	-0.350	1.37	0.199	0.238
Thorium-230	22	22	100	0.014 - 1.1	-0.200	0.560	0.121	0.185
Thorium-232	22	22	100	0.014 - 1.3	-0.130	0.910	0.129	0.276
Tritium	2,807	2,807	100	60 - 3168	-668	31,690	60.5	620
Uranium-233/234	2,118	2,118	100	0 - 3.141	-0.157	211	1.32	5.18
Uranium-235	2,102	2,102	100	0 - 1.628	-0.0654	7.11	0.0564	0.177
Uranium-238	2,118	2,118	100	0 - 3.192	-0.504	170	1.21	4.40

N/A = Not available or not applicable.

[1] Total ammonia reported.

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Table 1.6
Summary of Sediment ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	126	126	100	0.740 - 200	763	29,000	9,238	6,650
Antimony	27	118	22.9	0.170 - 60	0.270	25.6	3.39	4.58
Arsenic	119	125	95.2	0.150 - 10	0.690	21.6	4.35	2.75
Barium	126	126	100	0.0200 - 200	7.20	240	101	59.9
Beryllium	85	126	67.5	0.00900 - 5	0.110	2.20	0.585	0.444
Boron	32	35	91.4	0.390 - 2.60	1.20	30	6.06	5.34
Cadmium	62	126	49.2	0.0300 - 5	0.0360	44	1.03	3.93
Calcium	126	126	100	0.570 - 5,000	653	95,700	11,880	14,193
Cesium	18	69	26.1	2 - 1,000	1.40	13.6	7.91	12.7
Chloride	10	13	76.9	25 - 25	13	206	58.4	65.1
Chromium	119	126	94.4	0.0590 - 10	1.30	140	14.7	13.8
Chromium VI	6	16	37.5	0.00500 - 0.00500	0.00500	0.0130	0.00431	0.00295
Cobalt	112	126	88.9	0.0800 - 50	1.60	13.3	5.88	3.17
Copper	120	126	95.2	0.0480 - 25	4.30	324	20.2	30.3
Cyanide	1	7	14.3	0.0870 - 0.190	0.230	0.230	0.829	1.14
Fluoride	8	16	50	2.50 - 2.50	0.831	9.27	2.41	2.67
Iron	126	126	100	1 - 100	1,680	24,000	12,228	5,002
Lead	126	126	100	0.170 - 4	2.90	170	28.5	25.0
Lithium	106	126	84.1	0.00900 - 100	1.60	27	7.30	5.01
Magnesium	126	126	100	0.620 - 5,000	263	22,900	2,671	2,182
Manganese	126	126	100	0.00900 - 15	39.1	639	200	92.4
Mercury	35	107	32.7	0.00130 - 0.212	0.0130	1.70	0.0642	0.163
Molybdenum	44	126	34.9	0.0800 - 200	0.260	7.70	1.45	1.28
Nickel	118	126	93.7	0.0800 - 40	2.90	216	14.0	19.5
Nitrate / Nitrite	17	43	39.5	0.200 - 2.50	0.157	12.9	1.58	2.23
Potassium	124	126	98.4	1.90 - 5,000	321	3,900	1,543	847
Selenium	14	125	11.2	0.140 - 5	0.330	3.60	0.456	0.403
Silica	35	35	100	2.80 - 12	259	2,000	974	410
Silicon	21	21	100	0 - 11.8	79.2	836	380	189
Silver	32	124	25.8	0.0610 - 130	0.160	3,100	27.6	278
Sodium	111	126	88.1	0.230 - 5,000	62.7	2,240	371	329
Strontium	126	126	100	0.00680 - 200	4.60	150	43.8	31.6
Sulfate	6	13	46.2	25 - 25	3.81	25.9	12.4	6.05
Sulfide	1	1	100	50 - 50	37	37	37	N/A
Thallium	22	126	17.5	0.250 - 10	0.240	1.20	0.382	0.204
Tin	13	126	10.3	0.180 - 200	1.20	39.5	4.76	6.43
Titanium	35	35	100	0.0820 - 0.370	43	330	136	58.9
Vanadium	118	126	93.7	0.0600 - 50	2.30	63	25.2	13.4
Zinc	126	126	100	0.0400 - 20	18.6	888	166	167
Organics (ug/kg)								
1,1-Dichloroethene	1	79	1.27	5 - 1,300	2	2	12.0	72.7
1,2,3-Trichlorobenzene	1	26	3.85	5 - 8	2	2	2.27	1.19
1,2,4-Trichlorobenzene	1	103	0.971	5 - 690	2	2	260	279
2-Butanone	11	80	13.8	2.70 - 1,300	2	51	23.5	101
2-Methylnaphthalene	1	83	1.20	23 - 720	41	41	336	266
4,4'-DDE	1	66	1.52	1.80 - 26	4.10	4.10	9.19	4.63
4-Methylphenol	1	84	1.19	17 - 720	47	47	332	266

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Table 1.6
Summary of Sediment ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Acenaphthene	12	83	14.5	21	-	720	26	180	235	126
Acetone	10	80	12.5	3.40	-	1,300	7.60	210	37.1	104
Anthracene	28	83	33.7	21	-	720	19	430	213	130
Benzo(a)anthracene	47	83	56.6	24	-	720	25	1,400	294	284
Benzo(a)pyrene	44	83	53.0	24	-	720	41	1,300	327	275
Benzo(b)fluoranthene	48	83	57.8	32	-	720	37	1,500	391	362
Benzo(g,h,i)perylene	33	83	39.8	19	-	720	43	1,100	300	279
Benzo(k)fluoranthene	41	83	49.4	35	-	720	31	920	311	285
Benzoic Acid	7	67	10.4	320	-	2,700	110	1,400	1,664	1,538
Benzyl Alcohol	1	67	1.49	83	-	720	41	41	570	640
beta-BHC	1	66	1.52	1.80	-	13	28	28	5.08	3.76
bis(2-ethylhexyl)phthalate	55	83	66.3	38	-	720	28	25,000	1,169	3,104
Bromomethane	6	80	7.50	5	-	1,300	2	5	21.7	101
Butylbenzylphthalate	10	83	12.0	36	-	720	21	1,700	334	313
Carbazole	6	16	37.5	350	-	690	25	290	186	85.4
Carbon Tetrachloride	2	80	2.50	5	-	1,300	390	440	14.1	64.8
Chloroform	5	80	6.25	5	-	1,300	1	2	19.8	102
Chrysene	52	83	62.7	31	-	720	23	1,400	332	296
cis-1,2-Dichloroethene	1	26	3.85	5	-	8	48	48	4.17	9.01
Dibenz(a,h)anthracene	14	83	16.9	23	-	720	21	360	304	269
Dibenzofuran	4	83	4.82	24	-	720	20	65	331	271
Dieldrin	1	66	1.52	3	-	26	4.60	4.60	9.20	4.63
Diethylphthalate	1	83	1.20	32	-	720	53	53	336	266
Dimethylphthalate	4	83	4.82	22	-	720	75	490	329	268
Di-n-butylphthalate	19	82	23.2	23	-	720	28	220	311	285
Di-n-octylphthalate	17	83	20.5	29	-	720	21	9,800	575	1,211
Ethylbenzene	2	80	2.50	5	-	1,300	1.40	9	20.1	102
Fluoranthene	57	83	68.7	25	-	720	33	2,700	540	526
Fluorene	10	83	12.0	22	-	720	21	180	317	272
gamma-BHC (Lindane)	1	65	1.54	1.80	-	13	25	25	4.95	3.49
Heptachlor epoxide	1	66	1.52	1.80	-	13	33	33	5.84	6.59
Hexachlorobutadiene	1	103	0.971	5	-	690	2	2	260	279
Indeno(1,2,3-cd)pyrene	37	83	44.6	25	-	720	30	910	277	276
Methoxychlor	1	66	1.52	0.940	-	130	2.70	2.70	45.2	23.6
Methylene Chloride	22	80	27.5	0.410	-	1,300	2	420	20.5	64.7
Naphthalene	5	103	4.85	5	-	690	2	59	256	281
PCB-1254	26	97	26.8	6.50	-	430	27	3,100	181	380
PCB-1260	5	97	5.15	1.60	-	430	53	2,000	114	210
Pentachlorophenol	3	84	3.57	73	-	2,700	420	1,100	1,490	1,410
Phenanthrene	51	83	61.4	21	-	720	35	1,800	373	338
Phenol	1	83	1.20	22	-	720	110	110	336	266
Pyrene	53	83	63.9	43	-	720	20	1,700	466	395
Tetrachloroethene	3	80	3.75	5	-	1,300	3	7	20.0	102
Toluene	19	79	24.1	0.220	-	1,300	0.420	360	20.5	82.9
trans-1,2-Dichloroethene	1	26	3.85	5	-	8	2	2	2.44	1.01
Trichloroethene	1	79	1.27	5	-	1,300	1.10	1.10	12.0	72.7
Trichlorofluoromethane	13	26	50	5	-	8	1	5	2.13	1.16
Vinyl Chloride	1	80	1.25	5	-	1,300	16.8	16.8	22.0	101
Xylene	3	80	3.75	5	-	1,300	6	68	21.0	102

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Table 1.6

Summary of Sediment ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[2]	Standard Deviation
Radionuclides (pCi/g)										
Americium-241	176	176	100	0	-	0.802	-0.0140	56.5	0.802	4.56
Cesium-134	41	41	100	0.0185	-	0.200	-0.201	0.200	0.0492	0.0920
Cesium-137	62	62	100	0.0190	-	0.200	0.00300	0.959	0.137	0.165
Gross Alpha	70	70	100	1.60	-	56	3.20	160	20.0	19.4
Gross Beta	70	70	100	1.94	-	21	18.7	125	30.1	13.6
Plutonium-239/240	176	176	100	0	-	0.666	-0.0160	217	2.55	17.0
Radium-226	35	35	100	0.160	-	0.625	-9.84	1.59	0.302	1.82
Radium-228	27	27	100	0.0710	-	0.610	0.888	2.08	1.45	0.307
Strontium-89/90	47	47	100	0.0100	-	1.18	-0.110	1.06	0.116	0.196
Uranium-233/234	146	146	100	0	-	1.54	0.294	9.81	1.19	1.00
Uranium-235	146	146	100	0	-	1.96	-0.0147	0.852	0.0685	0.0850
Uranium-238	146	146	100	0	-	1.76	0	59	1.64	4.89

N/A = Not available or not applicable.

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Table 1.7
Summary of Surface Water ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/L) (Total)								
Aluminum	536	595	90.08	0.00025 - 0.2	0.0093	415	6.965	29.934
Ammonia[1]	32	84	38.095238	0.05 - 1	0.07	15	0.569	1.771
Antimony	95	592	16.01	0.00005 - 0.06	0.00048	0.08	0.008	0.008
Arsenic	222	583	38.07	0.00032 - 10	0.0004	0.147	0.008	0.110
Barium	582	598	96.984924	0.00002 - 0.2	0.0178	2.56	0.143	0.183
Beryllium	153	666	22.97	0 - 0.005	0.00003	0.0255	0.001	0.002
Cadmium	144	597	24.161074	0.00001 - 0.005	0.000056	0.0049	0.001	0.001
Calcium	599	599	100	0.0016 - 5	1.22	185	55.920	32.507
Cerium	2	2	100	0.0002 - 0.0002	0.0012	0.00128	0.001	0.000
Cesium	43	308	13.96104	0.0001 - 1	0.00022	0.11	0.123	0.112
Chloride	387	390	99.230766	0.1 - 50	-1.7	170	44.329	32.011
Chromium	285	728	39.14	0.00004 - 0.01	0.0000051	0.348	0.006	0.023
Chromium VI	3	25	12	0.01 - 0.02	0.02	0.06	0.011	0.012
Cobalt	193	595	32.43	0.00002 - 0.05	0.00017	0.112	0.003	0.008
Copper	380	591	64.9	0.00008 - 0.025	0.00086	0.259	0.010	0.022
Cyanide	4	174	2.2988505	0.005 - 0.1	0.004	0.0489	0.006	0.005
Fluoride	363	378	96.031746	0.03 - 5	0.09	1.8	0.493	0.252
Iron	574	598	95.979897	0.00095 - 0.1	0.0082	398	6.629	27.943
Lead	357	593	60.2	0.00005 - 5	0.000081	5.9	0.017	0.243
Lithium	498	545	78.71	0.00002 - 0.1	0.0012	0.277	0.012	0.019
Magnesium	597	599	99.66	0.0001 - 5	0.31	54.3	12.582	7.798
Manganese	568	598	94.98	0.00002 - 0.015	0.00086	7.77	0.178	0.517
Mercury	52	578	8.99	0 - 0.0002	0	0.0019	0.000	0.000
Molybdenum	203	561	36.18	0.0002 - 0.2	0.000407	0.0167	0.003	0.003
Nickel	248	584	42.46	0.00002 - 0.04	0.00043	0.272	0.008	0.020
Nitrate / Nitrite	221	387	57.105942	0.01 - 200	0.02	2253.9	12.743	159.477
Nitrite	19	172	11.046512	0.01 - 5	0.022	0.54	0.024	0.050
Ortho-phosphate	9	128	7.03125	0.02 - 10	0.052	0.47	0.033	0.047
Phosphate	16	46	34.782608	0.01 - 0.05	0.01	0.16	0.024	0.032
Phosphorus	105	223	47.085201	0.01 - 0.5	-0.01	1.9	0.086	0.179
Potassium	565	596	94.79	0.0021 - 5	0.27	50	3.516	3.834
Selenium	150	582	25.77	0.0002 - 5	0.00046	0.0485	0.006	0.093
Silica	10	10	100	0.4 - 2	0.0104	26.4	13.771	9.384
Silicon	318	318	100	0.0053 - 0.1111	0.477	114	8.813	11.290
Silver	45	593	7.58	0.00004 - 0.025	0.00005	0.0476	0.001	0.002
Sodium	597	597	100	0.00038 - 5	0.642	1430	44.728	96.556
Strontium	559	564	99.1119	0.00002 - 0.2	0.007	1.31	0.349	0.223
Sulfate	381	393	96.946564	0.1 - 50	3.9	350	32.259	28.706
Sulfide	15	190	7.8947363	1 - 25	0.016	17	0.639	1.293
Thallium	33	594	5.55	0.00002 - 10	0.00023	0.02	0.006	0.107
Tin	44	515	8.54	0.00048 - 5	0.00083	0.0703	0.007	0.009
Uranium	42	169	24.85	0.00002 - 0.0703	0.00105	0.077	0.009	0.018
Vanadium	314	595	52.77	0.00002 - 0.05	0.00022	0.747	0.015	0.056
Zinc	430	594	72.39	0.0001 - 0.02	0.00095	2.19	0.088	0.188
Inorganics (mg/L) (Dissolved)								
Aluminum	124	288	43.055553	0.00025 - 0.2	0.00035	0.77	0.025	0.049
Antimony	43	294	14.625851	0.00005 - 0.06	0.00021	0.0561	0.011	0.008
Arsenic	52	282	18.439716	0.000111 - 0.2	0.00017	0.0058	0.002	0.010
Barium	288	296	97.297302	0.00002 - 0.2	0.0111	0.297	0.096	0.048

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Table 1.7
Summary of Surface Water ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Beryllium	17	294	5.7823129	0	-	0.005	0.00002	0.0015	0.000	0.000
Cadmium	48	364	13.186814	0.000016	-	0.005	0.00005	0.0268	0.001	0.002
Calcium	296	296	100	0.0029	-	5	1.22	155	57.173	27.985
Cerium	0	2	0	0.0001	-	0.0001	N/A	N/A	0.000	0.000
Cesium	45	240	18.75	0.0001	-	1	0.000374	0.08	0.123	0.110
Chromium	27	296	9.1216211	0.00005	-	0.01	0.00027	0.063	0.002	0.004
Cobalt	16	296	5.4054055	0.00001	-	0.05	0.00011	0.0037	0.001	0.001
Copper	112	289	38.754326	0.00004	-	0.025	0.00049	0.023	0.003	0.003
Iron	198	300	66	0.00111	-	0.1	0.0033	9.02	0.099	0.557
Lead	100	289	34.602077	0.00003	-	0.15	0.0001	0.0267	0.002	0.005
Lithium	214	276	77.536232	0.00002	-	0.2	0.0011	0.129	0.009	0.011
Magnesium	293	296	98.986488	0.0001	-	5	0.337	50.9	13.094	7.169
Manganese	279	309	90.29126	0.00001	-	0.015	0.00088	1.77	0.048	0.136
Mercury	16	284	5.6338029	0.000014	-	0.0002	0.000052	0.001	0.000	0.000
Molybdenum	44	285	15.438597	0.00003	-	0.2	0.00047	0.0138	0.003	0.002
Nickel	32	294	10.884354	0.00002	-	0.04	0.00041	0.037	0.004	0.003
Potassium	273	295	92.542374	0.000496	-	5	0.27	12.2	2.742	1.760
Selenium	65	294	22.108845	0.000111	-	0.15	0.0009	0.0485	0.002	0.005
Silicon	245	245	100	0.0053	-	0.1	0.408	13.1	5.988	2.552
Silver	25	366	6.8306012	0.000005	-	0.025	0.00015	0.0063	0.001	0.001
Sodium	296	296	100	0.001	-	5	0.577	122	31.314	19.452
Strontium	284	286	99.300697	0.00002	-	0.3	0.007	1.18	0.357	0.212
Thallium	7	288	2.4305556	0.00005	-	0.35	0.00459	0.0171	0.002	0.007
Tin	3	243	1.2345679	0.000111	-	5	0.00085	0.03	0.009	0.010
Uranium	5	11	45.454548	0.000005	-	0.2	0.0033	0.00908	0.015	0.014
Vanadium	60	294	20.408163	0.00015	-	0.05	0.00071	0.0162	0.002	0.002
Zinc	161	294	54.761906	0.00008	-	0.02	0.0021	0.516	0.018	0.049
Organics (ug/L)										
1,1,1-Trichloroethane	3	347	0.8645533	0.01	-	10	0.2	0.5	1.990	1.148
1,1,2-Trichloro-1,2,2-trifluoroethane	3	25	12	0.2	-	5	0.2	0.3	1.469	1.101
1,1-Dichloroethene	1	347	0.2881844	0.04	-	10	1	1	1.991	1.145
1,2-Dichloroethane	2	345	0.5797102	0.03	-	10	3	14	2.033	1.316
1,2-Dichloroethene	7	260	2.6923077	5	-	10	1	21	2.737	1.328
1,4-Dichlorobenzene	3	213	1.4084507	0.03	-	16	0.2	0.5	2.844	2.370
2-Butanone	7	239	2.9288704	0.93	-	100	2	17	5.232	3.116
4,4'-DDD	1	129	0.7751938	0.098	-	0.5	0.046	0.046	0.056	0.027
4,4'-DDE	2	129	1.5503876	0.098	-	0.5	0.019	0.049	0.056	0.027
4,4'-DDT	5	129	3.8759689	0.098	-	0.5	0.01	0.073	0.055	0.028
4-Bromofluorobenzene	2	2	100		-		9.49	9.91	9.700	0.297
Acetone	38	244	15.57377	1.9	-	100	2.8	210	8.918	19.625
Atrazine	10	40	25	0.05	-	1.1	0.04	0.77	0.253	0.153
Benzene	2	347	0.5763689	0.01	-	10	0.1	0.2	1.990	1.147
Benzoic Acid	2	137	1.459854	49	-	78	6	42	24.245	4.987
Benzyl Alcohol	1	142	0.7042254	10	-	22	3	3	5.365	1.964
beta-BHC	4	129	3.1007752	0.049	-	0.25	0.01	0.17	0.029	0.016
bis(2-ethylhexyl)phthalate	29	157	18.471338	10	-	16	0.6	26	6.170	12.205
Bromodichloromethane	1	347	0.2881844	0.1	-	10	0.96	0.96	1.993	1.144
Bromoform	1	347	0.2881844	0.09	-	10	1.9	1.9	2.003	1.129
Butylbenzylphthalate	2	157	1.2738854	10	-	16	0.7	0.8	4.834	0.953
Carbon Disulfide	1	285	0.3508772	0.19	-	10	8	8	2.557	0.766

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Table 1.7

Summary of Surface Water ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Carbon Tetrachloride	10	341	2.9325514	0.02	-	10	0.7	76	2.500	5.112
Chlorobenzene	1	347	0.2881844	0.02	-	10	1	1	1.993	1.143
Chlorodifluoromethane	5	5	100		-		3	43	11.800	17.484
Chloroform	21	347	6.0518732	0.01	-	10	0.2	22	2.187	2.035
Chloromethane	1	345	0.2898551	0.1	-	10	0.2	0.2	3.683	2.072
cis-1,2-Dichloroethene	30	95	31.578945	0.03	-	5	0.39	8	0.755	1.017
delta-BHC	1	129	0.7751938	0.049	-	0.25	0.02	0.02	0.028	0.013
Dichlorodifluoromethane	1	100	1	0.2	-	5	0.26	0.26	0.457	0.329
Diethylphthalate	5	157	3.1847134	10	-	16	2	16	4.939	1.355
Di-n-butylphthalate	12	157	7.6433125	10	-	16	0.3	5	4.699	1.219
Isophorone	1	157	0.6369427	10	-	16	8	8	4.875	0.909
Methylene Chloride	52	343	15.160351	0.01	-	10	0.1	80	3.196	5.659
m-Xylene	1	1	100	0.2	-	0.2	0.2	0.2	0.200	N/A
Naphthalene	2	208	0.9615385	0.02	-	16	0.1	1	2.897	2.374
Pentachlorophenol	1	155	0.6451613	25	-	78	5	5	23.058	5.592
Prometon	1	35	2.8571429	0.03	-	0.3	0.31	0.31	0.118	0.063
p-Xylene	1	1	100	0.2	-	0.2	0.2	0.2	0.200	N/A
Pyrene	1	156	0.6410257	0.594	-	16	2	2	4.514	1.384
Tetrachloroethene	66	347	19.020172	0.02	-	10	0.2	47	4.541	7.886
Toluene	13	348	3.7356322	0.02	-	10	0.1	9	2.010	1.223
Trichloroethene	45	347	12.9683	0.03	-	10	0.19	30	2.443	2.444
Trichlorofluoromethane	1	100	1	0.1	-	5	0.2	0.2	0.416	0.272
Xylene	2	327	0.6116208	0.19	-	10	1.3	3	2.210	0.985
Radionuclides (pCi/L)										
Americium-241	1,107	1,107	100	0	-	0.6167	-0.018	48	0.176	1.783
Cesium-137	198	198	100	0.2	-	1.44	-0.52	16	0.323	1.189
Curium-244	13	13	100	0.005	-	0.19	-0.076	0.026	-0.003	0.024
Gross Alpha	1,300	1,300	100	0.32	-	13	-0.71	41	2.776	2.742
Gross Beta	1,320	1,320	100	0.568	-	9	-8.1	58	4.242	3.813
Neptunium-237	13	13	100	0.017	-	0.14	-0.009	0.095	0.031	0.035
Plutonium-238	289	289	100	0.002201	-	0.08783	-0.0108	0.275	0.005	0.021
Plutonium-239/240	1,149	1,149	100	0	-	0.1616	-0.023	250	1.141	10.396
Radium-226	10	10	100	0.0391	-	0.27	0.11	0.5172	0.264	0.144
Strontium-89/90	165	165	100	0.08	-	1.2	-0.19	1.192	0.340	0.276
Strontium-90	1	1	100	0.64	-	0.64	0.3908	0.3908	0.391	N/A
Thorium-230	15	15	100	0.022	-	0.3	-0.013	0.89	0.095	0.222
Thorium-232	15	15	100	0.022	-	0.34	-0.006	1	0.116	0.251
Tritium	676	676	100	97	-	764.1	-247.5	2097	69.888	174.979
Uranium-233/234	958	958	100	0	-	2.656	-0.1425	193.8	1.755	7.662
Uranium-235	933	933	100	0	-	2.211	-0.096	8.117	0.079	0.364
Uranium-238	958	958	100	0	-	2.706	-0.1336	138.1	1.819	6.568

N/A = Not available or not applicable.

[1] Total ammonia reported.

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Table 1.8

Summary of Sediment ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	88	88	100	1.10 - 200	1,140	32,000	10,962	6,819
Antimony	8	82	9.76	0.160 - 60	0.210	51.3	5.72	8.97
Arsenic	86	88	97.7	0.120 - 10	0.480	27.9	4.88	3.60
Barium	87	88	98.9	0.0300 - 200	14.6	404	134	78.8
Beryllium	63	85	74.1	0.0300 - 5	0.110	6.70	0.737	0.774
Boron	15	15	100	1.10 - 2.30	2.30	14	7.45	3.08
Cadmium	24	83	28.9	0.0270 - 5	0.130	3.60	0.618	0.568
Calcium	88	88	100	1.10 - 5,000	673	48,200	9,697	9,761
Cesium	10	63	15.9	2 - 1,000	0.680	5.20	33.7	33.0
Chromium	87	88	98.9	0.0400 - 10	1.50	70.1	12.8	8.99
Chromium VI	1	4	25	0.00500 - 0.00500	0.0120	0.0120	0.00488	0.00475
Cobalt	84	87	96.6	0.0400 - 50	1.30	13.1	7.12	3.20
Copper	83	88	94.3	0.0630 - 25	2.20	212	21.6	29.7
Fluoride	1	4	25	2.50 - 2.50	20.3	20.3	5.93	9.58
Iron	88	88	100	0.680 - 100	2,660	38,800	15,648	7,483
Lead	88	88	100	0.120 - 6.60	2.60	118	24.8	17.3
Lithium	73	84	86.9	0.320 - 100	1.70	28	8.84	5.67
Magnesium	88	88	100	1.20 - 5,000	448	6,600	2,701	1,487
Manganese	88	88	100	0.0300 - 15	53	1,580	303	213
Mercury	24	86	27.9	0.00500 - 0.339	0.0140	3.80	0.196	0.522
Molybdenum	29	84	34.5	0.280 - 200	0.380	11.7	2.06	1.96
Nickel	76	88	86.4	0.0300 - 40	2.20	33	13.2	7.23
Nitrate / Nitrite	45	62	72.6	0.0200 - 7.40	0.429	32	3.11	5.55
Potassium	78	87	89.7	1.20 - 5,000	276	4,200	1,638	961
Selenium	33	80	41.3	0.180 - 5	0.260	3.80	0.638	0.609
Silica	15	15	100	4.70 - 11	610	1,600	1,078	365
Silicon	44	44	100	0 - 32.3	83.8	1,890	446	393
Silver	11	83	13.3	0.0400 - 10	0.850	7.70	0.852	1.10
Sodium	73	86	84.9	5.27 - 5,000	23.3	2,060	198	253
Strontium	86	87	98.9	0.0690 - 400	4.80	167	52.0	35.9
Thallium	12	82	14.6	0.250 - 10	0.230	10	0.604	1.35
Tin	21	86	24.4	0.920 - 200	3.40	77.2	10.1	13.4
Titanium	15	15	100	0.120 - 0.330	41	300	153	81.3
Vanadium	88	88	100	0.0600 - 50	4.90	68.6	28.2	13.4
Zinc	88	88	100	0.0300 - 20	10.6	2,080	139	262
Organics (ug/kg)								
1234678-HpCDF	2	2	100	0.00226 - 0.00271	8.07E-04	0.00158	0.00119	5.47E-04
123478-HxCDF	1	2	50	0.00226 - 0.00271	0.00127	0.00127	0.00131	6.01E-05
123678-HxCDF	1	2	50	0.00226 - 0.00271	5.62E-04	5.62E-04	9.59E-04	5.61E-04
2,4-Dinitrophenol	1	57	1.75	150 - 4,100	890	890	1,614	958
234678-HxCDF	1	2	50	0.00226 - 0.00271	7.81E-04	7.81E-04	0.00107	4.06E-04
23478-PeCDF	1	2	50	0.00226 - 0.00271	0.00143	0.00143	0.00139	5.30E-05
2-Butanone	7	51	13.7	10 - 140	3	380	19.2	56.9
2-Methylnaphthalene	1	61	1.64	24 - 820	110	110	336	194
4,4'-DDT	1	59	1.69	3.80 - 200	18	18	17.9	16.8
4,6-Dinitro-2-methylphenol	1	59	1.69	150 - 4,100	750	750	1,594	948
4-Methyl-2-pentanone	1	54	1.85	10 - 70	3	3	7.81	2.86
4-Methylphenol	4	61	6.56	17 - 820	68	510	331	200
Acenaphthene	4	61	6.56	21 - 820	74	510	306	163

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Summary of Sediment ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Acetone	15	58	25.9	10	-	140	3	890	46.9	126
Aldrin	2	59	3.39	1.90	-	99	0	0	8.82	8.99
alpha-Chlordane	2	59	3.39	1.90	-	990	0	0	87.2	90.7
Anthracene	6	61	9.84	21	-	820	90	470	309	163
Benzo(a)anthracene	11	61	18.0	25	-	820	22	1,200	299	224
Benzo(a)pyrene	8	61	13.1	25	-	820	37	970	314	209
Benzo(b)fluoranthene	6	61	9.84	66	-	820	84	1,500	335	239
Benzo(g,h,i)perylene	4	61	6.56	20	-	820	45	630	330	197
Benzo(k)fluoranthene	5	61	8.20	50	-	820	72	690	328	198
Benzoic Acid	6	57	10.5	350	-	3,900	190	660	1,487	925
beta-BHC	2	59	3.39	1.90	-	99	0	0	8.82	8.99
bis(2-ethylhexyl)phthalate	32	62	51.6	39	-	1,200	49	2,600	393	461
Butylbenzylphthalate	3	62	4.84	53	-	1,200	57	210	329	197
Chrysene	14	62	22.6	34	-	1,200	41	1,200	294	221
delta-BHC	2	59	3.39	1.90	-	99	0	0	8.82	8.99
Dibenz(a,h)anthracene	2	60	3.33	24	-	820	220	530	332	189
Dibenzofuran	1	61	1.64	25	-	820	230	230	338	192
Diethylphthalate	1	62	1.61	32	-	1,200	79	79	336	194
Di-n-butylphthalate	14	62	22.6	36	-	1,200	39	390	298	218
Di-n-octylphthalate	3	62	4.84	30	-	1,200	21	210	329	197
Endosulfan I	2	59	3.39	1.90	-	190	0	0	9.07	9.12
Fluoranthene	19	62	30.6	45	-	1,200	31	2,900	314	380
Fluorene	1	61	1.64	22	-	820	400	400	340	192
gamma-BHC (Lindane)	1	59	1.69	1.90	-	99	4.40	4.40	9.32	9.53
gamma-Chlordane	2	30	6.67	16	-	990	0	0	112	117
Heptachlor	3	59	5.08	1.90	-	99	0	3.10	8.72	9.02
Heptachlor epoxide	2	59	3.39	1.90	-	99	0	0	8.82	8.99
Heptachlorodibenzo-p-dioxin	2	2	100	0.00226	-	0.00271	0.00285	0.00509	0.00397	0.00158
Indeno(1,2,3-cd)pyrene	5	61	8.20	27	-	820	24	500	326	182
Methylene Chloride	14	58	24.1	5	-	41	2	220	13.7	32.4
Naphthalene	2	61	3.28	7	-	820	2	300	336	196
OCDD	2	2	100	0.00452	-	0.00542	0.0133	0.0306	0.0220	0.0122
OCDF	2	2	100	0.00452	-	0.00542	0.00128	0.00176	0.00152	3.39E-04
PCB-1254	12	69	17.4	8.20	-	2,000	19	250	166	186
Pentachlorodibenzo-p-dioxin	1	2	50	0.00226	-	0.00271	3.72E-04	3.72E-04	8.64E-04	6.95E-04
Pentachlorophenol	1	61	1.64	79	-	4,100	950	950	1,598	931
Phenanthrene	16	62	25.8	21	-	1,200	24	2,900	325	375
Phenol	1	61	1.64	22	-	820	150	150	328	188
Pyrene	14	62	22.6	69	-	1,200	45	3,100	354	408
Tetrachloroethene	2	54	3.70	5	-	15	1	1	4.13	1.53
Toluene	14	58	24.1	5	-	15	2	520	49.0	126
Trichloroethene	1	55	1.82	5	-	34	23	23	4.50	2.95
Xylene	1	54	1.85	5	-	15	5	5	4.23	1.43
Radionuclides (pCi/g)										
Americium-241	109	109	100	0	-	0.222	-0.0130	5.06	0.162	0.500
Cesium-134	35	35	100	0.0196	-	0.300	-0.0674	0.300	0.0837	0.0793
Cesium-137	52	52	100	0.0196	-	0.200	-0.00176	0.564	0.152	0.127
Gross Alpha	78	78	100	1.50	-	56	-9.70	320	28.7	39.8
Gross Beta	79	79	100	2.30	-	21	4.95	74.9	29.5	12.1
Plutonium-239/240	116	116	100	0	-	0.182	0	30	0.961	3.21

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Table 4.8
Summary of Sediment ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Radium-226	19	19	100	0.100 - 0.545	-1.90	2.19	0.833	0.899
Radium-228	20	20	100	0.0400 - 0.530	0.732	2.90	1.41	0.584
Strontium-89/90	52	52	100	0.0200 - 1.12	-0.300	4.86	0.455	0.941
Uranium-233/234	100	100	100	0 - 0.278	0.230	4.78	1.35	0.869
Uranium-235	100	100	100	0 - 0.355	-0.0140	0.405	0.0780	0.0726
Uranium-238	100	100	100	0 - 0.289	0.300	10.1	1.45	1.29

N/A = Not available or not applicable.

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Table 2.1

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the NW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency 5%?	> Bkg?	AEU UTL	95th UTL > ESL?	ECOPC?
Inorganic (Total) (mg/L)											
Aluminum	442	0.087	674	644	Yes	95	Yes	Yes	30.4	Yes	**Yes**
Ammonia[1]	0.2044	0.02	205	139	Yes	68	Yes	N/A	0.0817	Yes	**Yes**
Antimony	0.117	0.24	677	283	No	42	--	--	--	--	No
Barium	4.52	0.438	676	667	Yes	99	Yes	Yes	0.373	No	No
Beryllium	0.027	0.0024	956	438	Yes	46	Yes	N/A	0.001	No	No
Boron	0.18	1.9	1	1	No	100	--	--	--	--	No
Bromide	0.82	N/A	2	1	N/A	50	--	--	--	--	N/A
Calcium	252,000	N/A	679	677	N/A	100	--	--	--	--	N/A
Cerium	0.117	N/A	6	6	N/A	100	--	--	--	--	N/A
Cesium	0.13	N/A	210	25	N/A	12	--	--	--	--	N/A
Chloride	390	230,000	218	217	No	100	--	--	--	--	No
Chromium VI	0.04	N/A	38	2	N/A	5.3	--	--	--	--	N/A
Cobalt	0.253	0.1	676	380	Yes	56	Yes	N/A	0.01	No	No
Cyanide	0.146	0.0005	148	25	Yes	17	Yes	N/A	0.022	Yes	**Yes**
Fluoride	2.9	2.12	194	160	Yes	82	Yes	Yes	1.7	No	No
Lithium	2.97	0.096	592	550	Yes	93	Yes	Yes	0.125	Yes	**Yes**
Magnesium	300	N/A	679	677	N/A	100	--	--	--	--	N/A
Molybdenum	0.0285	0.8	652	402	No	62	--	--	--	--	No
Nitrate / Nitrite	8820	N/A	1,832	1,730	N/A	94	--	--	--	--	N/A
Nitrite	3.43	4.47	122	58	No	48	--	--	--	--	No
Ortho-phosphate	0.11	N/A	51	12	N/A	24	--	--	--	--	N/A
Phosphate	0.76	N/A	56	35	N/A	62	--	--	--	--	N/A
Phosphorus	0.65	N/A	93	57	N/A	61	--	--	--	--	N/A
Potassium	1530	N/A	676	664	N/A	98	--	--	--	--	N/A
Selenium	0.035	0.0046	673	285	Yes	42	Yes	N/A	0.0046	No	No
Silica	8.5	N/A	27	27	N/A	100	--	--	--	--	N/A
Silicon	208	N/A	212	209	N/A	99	--	--	--	--	N/A
Sodium	6460	N/A	675	674	N/A	100	--	--	--	--	N/A
Strontium	8.59	8.3	648	647	Yes	100	Yes	Yes	1.04	No	No
Sulfate	680	N/A	219	215	N/A	98	--	--	--	--	N/A
Sulfide	36	N/A	123	27	N/A	22	--	--	--	--	N/A
Thallium	0.0125	0.010	673	46	No	6.7	--	--	--	--	No
Tin	0.315	0.073	571	74	Yes	13	Yes	N/A	0.019	No	No
Titanium	0.0072	N/A	7	5	N/A	71	--	--	--	--	N/A
Vanadium	0.892	0.012	675	476	Yes	70	Yes	Yes	0.068	Yes	**Yes**
Inorganic (Dissolved) (mg/L)											
Arsenic	0.0116	0.15	249	92	No	37	--	--	--	--	No
Cadmium	0.02	0.00025	533	122	Yes	23	Yes	N/A	0.002	Yes	**Yes**
Chromium	0.0868	0.074	246	59	Yes	24	Yes	N/A	0.013	No	No
Copper	0.205	0.009	233	100	Yes	43	Yes	No	--	--	No
Iron	9.57	1	239	166	Yes	69	Yes	No	--	--	No
Lead	0.111	0.0025	245	77	Yes	31	Yes	No	--	--	No
Manganese	2.13	1.65	250	211	Yes	84	Yes	Yes	0.334	No	No
Mercury	0.00066	0.00077	243	25	No	10	--	--	--	--	No
Nickel	0.17	0.052	243	66	Yes	27	Yes	N/A	0.011	No	No
Silver	0.0324	0.00032	529	46	Yes	8.7	Yes	N/A	0.003	Yes	**Yes**
Uranium	0.0756	1.501	31	13	No	42	--	--	--	--	No
Zinc	0.831	0.118	244	150	Yes	61	Yes	No	--	--	No

Table 2.1

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the NW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency < 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Organic (Total) (ug/L)											
1,1,1-Trichloroethane	3	89	339	14	No	4.1	--	--	--	--	No
1,1,2,2-Tetrachloroethane	0.1	2,400	338	1	No	0.3	--	--	--	--	No
1,1,2-Trichloro-1,2,2-trifluoroethane	19.8	32	42	4	No	9.5	--	--	--	--	No
1,1-Dichloroethane	2	740	339	3	No	0.88	--	--	--	--	No
1,1-Dichloroethene	3	65	339	5	No	1.5	--	--	--	--	No
1,2,3-Trichlorobenzene	0.7	8	157	1	No	0.64	--	--	--	--	No
1,2,4-Trimethylbenzene	0.12	17	157	1	No	0.64	--	--	--	--	No
1,2-Dichloroethene	6	1,100	187	1	No	0.53	--	--	--	--	No
1,2-Dichloropropane	1	5,700	339	1	No	0.29	--	--	--	--	No
1,3-Dichlorobenzene	0.82	28	275	1	No	0.36	--	--	--	--	No
1,4-Dichlorobenzene	0.5	16	275	4	No	1.5	--	--	--	--	No
2-Butanone	16	2,200	206	2	No	0.97	--	--	--	--	No
2-Hexanone	4	99	225	2	No	0.89	--	--	--	--	No
4,4'-DDE	0.021	105	123	1	No	0.81	--	--	--	--	No
4,4'-DDT	0.28	0.001	123	1	Yes	0.81	No	--	--	--	No
4-Methyl-2-pentanone	3	170	225	1	No	0.44	--	--	--	--	No
4-Nitroaniline	1.1	N/A	203	1	N/A	0.49	--	--	--	--	N/A
Acenaphthene	1	520	207	2	No	0.97	--	--	--	--	No
Acetone	490	1,500	215	39	No	18	--	--	--	--	No
alpha-BHC	0.01	2.2	123	1	No	0.81	--	--	--	--	No
alpha-Chlordane	0	N/A	117	1	N/A	0.85	--	--	--	--	N/A
Anthracene	2	0.73	207	1	Yes	0.48	No	--	--	--	No
Aroclor-1254	3.3	0.014	119	6	Yes	5	Yes	N/A	1	Yes	Yes
Atraton	1	N/A	60	1	N/A	1.7	--	--	--	--	N/A
Atrazine	1.6	7.3	93	27	No	29	--	--	--	--	No
Benzene	4.7	530	339	2	No	0.59	--	--	--	--	No
Benzo(a)anthracene	8	0.027	207	1	Yes	0.48	No	--	--	--	No
Benzo(a)pyrene	9	0.014	207	1	Yes	0.48	No	--	--	--	No
Benzo(b)fluoranthene	10	N/A	207	2	N/A	0.97	--	--	--	--	N/A
Benzo(g,h,i)perylene	7	N/A	207	2	N/A	0.97	--	--	--	--	N/A
Benzo(k)fluoranthene	8	N/A	207	3	N/A	1.4	--	--	--	--	N/A
Benzoic Acid	17.5	42	170	4	No	2.4	--	--	--	--	No
Benzyl Alcohol	860	8.6	182	5	Yes	2.7	No	--	--	--	No
beta-BHC	0.04	2.2	123	5	No	4.1	--	--	--	--	No
bis(2-ethylhexyl)phthalate	200	28.5	206	65	Yes	32	Yes	N/A	12	No	No
Bromochloromethane	6.5	N/A	154	3	N/A	1.9	--	--	--	--	N/A
Bromodichloromethane	2	1,100	327	10	No	3.1	--	--	--	--	No
Butylbenzylphthalate	6	67	207	12	No	5.8	--	--	--	--	No
Carbazole	3	4	25	1	No	4	--	--	--	--	No
Carbon Disulfide	5	0.92	231	3	Yes	1.3	No	--	--	--	No
Carbon Tetrachloride	310	3,520	338	28	No	8.3	--	--	--	--	No
Chlorobenzene	0.1	47	339	1	No	0.29	--	--	--	--	No
Chloroform	120	1,240	339	60	No	18	--	--	--	--	No
Chrysene	11	N/A	207	2	N/A	0.97	--	--	--	--	N/A
cis-1,2-Dichloroethene	2	620	158	11	No	7	--	--	--	--	No
Dalapon	0.99	N/A	25	1	N/A	4	--	--	--	--	N/A
Dibenz(a,h)anthracene	2	N/A	207	1	N/A	0.48	--	--	--	--	N/A
Dibromochloromethane	1	N/A	339	1	N/A	0.29	--	--	--	--	N/A

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Table 2.1
Summary of ECOPC Screening Steps for Surface Water ECOPCs in the NW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Dicamba	0.21	10	25	5	No	20	--	--	--	--	No
Dichlorodifluoromethane	1.43	N/A	178	2	N/A	1.1	--	--	--	--	N/A
Dichloroprop	0.29	N/A	25	2	N/A	8	--	--	--	--	N/A
Diethylphthalate	7	110	207	16	No	7.7	--	--	--	--	No
Dimethoate	0.62	N/A	2	1	N/A	50	--	--	--	--	N/A
Dimethylphthalate	0.8	N/A	207	2	N/A	0.97	--	--	--	--	N/A
Di-n-butylphthalate	11	9.7	207	46	Yes	22	Yes	N/A	5.5	No	No
Di-n-octylphthalate	7	N/A	207	1	N/A	0.48	--	--	--	--	N/A
Dinoseb	0.34	0.48	26	1	No	3.8	--	--	--	--	No
Endosulfan I	5.6	0.056	123	2	Yes	1.6	No	--	--	--	No
Endrin	0.021	0.036	123	1	No	0.81	--	--	--	--	No
Ethylbenzene	0.43	3200	339	1	No	0.29	--	--	--	--	No
Fluoranthene	16	398	207	2	No	0.97	--	--	--	--	No
Fluorene	0.9	12	207	1	No	0.48	--	--	--	--	No
gamma-Chlordane	0	N/A	50	1	N/A	2	--	--	--	--	N/A
Heptachlor epoxide	0.05	0.0038	123	1	Yes	0.81	No	--	--	--	No
Hexachlorobutadiene	0.29	9.3	255	1	No	0.39	--	--	--	--	No
Hexazinone	1.3	N/A	1	1	N/A	100	--	--	--	--	N/A
Indeno(1,2,3-cd)pyrene	7	N/A	207	1	N/A	0.48	--	--	--	--	N/A
Isophorone	0.3	1,300	207	1	No	0.48	--	--	--	--	No
Isopropylbenzene	0.5	N/A	157	1	N/A	0.64	--	--	--	--	N/A
Methylene Chloride	90	940	336	56	No	17	--	--	--	--	No
Naphthalene	1	620	255	4	No	1.6	--	--	--	--	No
n-Butylbenzene	0.64	N/A	157	1	N/A	0.64	--	--	--	--	N/A
Phenanthrene	11	2.4	207	2	Yes	0.97	No	--	--	--	No
Propazine	0.35	N/A	76	1	N/A	1.3	--	--	--	--	N/A
Pyrene	12	0.025	204	5	Yes	2.5	No	--	--	--	No
Simazine	0.08	10	93	1	No	1.1	--	--	--	--	No
Tetrachloroethene	7	840	338	15	No	4.4	--	--	--	--	No
Toluene	10	1,750	339	11	No	3.2	--	--	--	--	No
Trichloroethene	29	21,900	339	26	No	7.7	--	--	--	--	No
Trichlorofluoromethane	7	N/A	178	6	N/A	3.4	--	--	--	--	N/A
Vinyl Chloride	0.5	930	339	1	No	0.29	--	--	--	--	No
Xylene	3	35	283	1	No	0.35	--	--	--	--	No
Radionuclides (pCi/L)											
Americium-241	84	43.8	1303	1303	Yes	100	Yes	Yes	0.48	No	No
Cesium-137	9	42.6	153	153	No	100	--	--	--	--	No
Curium-244	0.012	N/A	25	25	N/A	100	--	--	--	--	N/A
Gross Alpha	1200	N/A	1172	1172	N/A	100	--	--	--	--	N/A
Gross Beta	1600	N/A	1176	1176	N/A	100	--	--	--	--	N/A
Neptunium-237	0.238	N/A	30	30	N/A	100	--	--	--	--	N/A
Plutonium-238	5.932	N/A	205	205	N/A	100	--	--	--	--	N/A
Plutonium-239/240	259	18.7	1336	1336	Yes	100	Yes	Yes	0.312	No	No
Radium-226	21	1.02	12	12	Yes	100	Yes	No	--	--	No
Radium-228	28	0.849	3	3	Yes	100	Yes	N/A	28	Yes	Yes
Strontium-89/90	1.541	278	132	132	No	100	--	--	--	--	No
Thorium-230	0.46	N/A	11	11	N/A	100	--	--	--	--	N/A
Thorium-232	0.69	N/A	11	11	N/A	100	--	--	--	--	N/A
Tritium	7800	N/A	1243	1243	N/A	100	--	--	--	--	N/A

Table 2.1

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the NW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Uranium-233/234	1161	20.1	1492	1492	Yes	100	Yes	Yes	14.7	No	No
Uranium-235	31.02	21.7	1474	1474	Yes	100	Yes	Yes	0.518	No	No
Uranium-238	1214	22.3	1492	1492	Yes	100	Yes	Yes	9.98	No	No

N/A = Not available or not applicable.

-- = ECOI was eliminated from ECOPC process, or retained for further evaluation within the uncertainty analysis due to lack of an ESL.

Bold "Yes" = ECOPC for the AEU

[1] The values presented represent the un-ionized concentrations derived using the site-specific conversion factor of 1.24% (refer to Attachment 5).

Summary of ECOPC Screening Steps for Sediment ECOPCs in the NW AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detections	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Inorganics (mg/kg)											
Aluminum	49,000	15,900	111	111	Yes	100	Yes	Yes	25,800	Yes	Yes
Antimony	41.4	2	98	15	Yes	15	Yes	N/A	26.3	Yes	Yes
Arsenic	12	9.79	111	109	Yes	98	Yes	--	8.83	No	No
Barium	390	189	111	111	Yes	100	Yes	Yes	227	Yes	Yes
Beryllium	2.50	N/A	111	75	N/A	68	--	--	--	--	N/A
Boron	26	N/A	30	30	N/A	100	--	--	--	--	N/A
Cadmium	8.30	0.990	110	48	Yes	44	Yes	N/A	2	Yes	Yes
Calcium	140,000	N/A	111	111	N/A	100	--	--	--	--	N/A
Cesium	5.80	N/A	71	16	N/A	23	--	--	--	--	N/A
Chloride	394	N/A	17	12	N/A	71	--	--	--	--	N/A
Chromium	66.5	43.4	111	107	Yes	96	Yes	--	28	No	No
Chromium VI	0.00800	43.4	21	6	No	29	--	--	--	--	No
Cobalt	20.1	N/A	111	106	N/A	95	--	--	--	--	N/A
Copper	77.6	31.6	111	109	Yes	98	Yes	Yes	32	Yes	Yes
Fluoride	16.7	0.0100	21	12	Yes	57	Yes	N/A	16.7	Yes	Yes
Iron	55,000	20,000	111	111	Yes	100	Yes	Yes	26,000	Yes	Yes
Lead	234	35.8	111	111	Yes	100	Yes	Yes	40.6	Yes	Yes
Lithium	37	N/A	111	85	N/A	77	--	--	--	--	N/A
Magnesium	11,000	N/A	111	111	N/A	100	--	--	--	--	N/A
Manganese	1,760	630	111	111	Yes	100	Yes	Yes	848	Yes	Yes
Mercury	0.470	0.180	102	43	Yes	42	Yes	N/A	0.220	Yes	Yes
Molybdenum	6.20	N/A	111	38	N/A	34	--	--	--	N/A	No
Nickel	34	22.7	111	102	Yes	92	Yes	Yes	25	Yes	Yes
Nitrate / Nitrite	89.3	N/A	56	23	N/A	41	--	--	--	--	N/A
Nitrite	5.61	N/A	17	1	N/A	5.90	--	--	--	--	N/A
Potassium	6,500	N/A	111	105	N/A	95	--	--	--	--	N/A
Selenium	2.40	0.950	110	29	Yes	26	Yes	Yes	1.80	Yes	Yes
Silica	4,900	N/A	30	30	N/A	100	--	--	--	--	N/A
Silicon	1,960	N/A	34	34	N/A	100	--	--	--	--	N/A
Silver	5	1	106	16	Yes	15	Yes	N/A	1.80	Yes	Yes
Sodium	2,100	N/A	111	103	N/A	93	--	--	--	--	N/A
Strontium	526	N/A	111	111	N/A	100	--	--	--	--	N/A
Sulfate	95.9	N/A	17	4	N/A	24	--	--	--	--	N/A
Thallium	1.60	N/A	110	10	N/A	9.10	--	--	--	--	N/A
Tin	15.5	N/A	109	17	N/A	16	--	--	--	--	N/A
Titanium	310	N/A	30	30	N/A	100	--	--	--	--	N/A
Uranium	20	N/A	40	3	N/A	7.50	--	--	--	--	N/A
Vanadium	96	N/A	111	111	N/A	100	--	--	--	--	N/A
Zinc	704	121	111	111	Yes	100	Yes	Yes	250	Yes	Yes
Organics (ug/kg)											
1,1,2,2-Tetrachloroethane	2	1,900	79	1	No	1.30	--	--	--	--	No
1,2-Dichloroethane	5	N/A	75	1	N/A	1.30	--	--	--	--	N/A
1,2-Dichloroethene	3	N/A	67	1	N/A	1.50	--	--	--	--	N/A
1234678-HpCDF	0.0298	N/A	4	3	N/A	75	--	--	--	--	N/A
1234789-HpCDF	0.00243	N/A	4	3	N/A	75	--	--	--	--	N/A
123478-HxCDD	0.00126	N/A	4	1	N/A	25	--	--	--	--	N/A
123478-HxCDF	0.00371	N/A	4	3	N/A	75	--	--	--	--	N/A
123678-HxCDD	0.00455	N/A	4	2	N/A	50	--	--	--	--	N/A
123678-HxCDF	0.00250	N/A	4	1	N/A	25	--	--	--	--	N/A
123789-HxCDD	0.00329	N/A	4	2	N/A	50	--	--	--	--	N/A
123789-HxCDF	5.53E-04	N/A	4	1	N/A	25	--	--	--	--	N/A
12378-PeCDF	0.00197	N/A	4	1	N/A	25	--	--	--	--	N/A
234678-HxCDF	0.00199	N/A	4	1	N/A	25	--	--	--	--	N/A
23478-PeCDF	0.00429	N/A	4	1	N/A	25	--	--	--	--	N/A
2378-TCDD	0.00278	0.00850	4	1	No	25	--	--	--	--	No
2378-TCDF	0.00612	N/A	4	1	N/A	25	--	--	--	--	N/A
2-Butanone	71	84.2	78	15	No	19	--	--	--	--	No
2-Methylnaphthalene	2,000	20.2	104	7	Yes	6.70	Yes	N/A	850	Yes	Yes
2-Methylphenol	200	6,970	104	1	No	0.960	--	--	--	--	No
4,4'-DDT	4.90	4.16	79	4	Yes	5.10	Yes	N/A	18.5	Yes	Yes

Summary of ECOPC Screening Steps for Sediment ECOPCs in the NW AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detections	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
4-Isopropyltoluene	39	N/A	12	1	N/A	8.30	--	--	--	--	N/A
4-Methyl-2-pentanone	6	N/A	79	1	N/A	1.30	--	--	--	--	N/A
Acenaphthene	620	6.71	104	25	Yes	24	Yes	N/A	495	Yes	**Yes**
Acetone	400		77	12	N/A	16	--	--	--	--	N/A
Aldrin	54	8.25	78	1	Yes	1.30	No	--	--	--	No
Anthracene	970	57.2	104	40	Yes	38	Yes	N/A	495	Yes	**Yes**
Aroclor-1254	5,200	40	124	34	Yes	27	Yes	N/A	350	Yes	**Yes**
Aroclor-1260	180	40	121	2	No	1.70	--	--	--	--	No
Atrazine	120	16.8	1	1	Yes	100	Yes	N/A	N/A	N/A	**Yes**
Benzene	3	260	79	1	No	1.30	--	--	--	--	No
Benzo(a)anthracene	1,400	108	104	61	Yes	59	Yes	N/A	880	Yes	**Yes**
Benzo(a)pyrene	1,300	150	104	51	Yes	49	Yes	N/A	920	Yes	**Yes**
Benzo(b)fluoranthene	1,500	N/A	104	53	N/A	51	--	--	--	--	N/A
Benzo(g,h,i)perylene	900	13	104	33	Yes	32	Yes	N/A	800	Yes	**Yes**
Benzo(k)fluoranthene	1,200	240	104	38	Yes	37	Yes	N/A	850	Yes	**Yes**
Benzoic Acid	2,700	N/A	71	9	N/A	13	--	--	--	--	N/A
bis(2-ethylhexyl)phthalate	47,000	24,900	104	51	Yes	49	Yes	--	950	No	No
Butylbenzylphthalate	120	11,400	104	3	No	2.90	--	--	--	--	No
Carbazole	300	25.2	30	13	Yes	43	Yes	N/A	470	Yes	**Yes**
Chrysene	1,500	166	104	70	Yes	67	Yes	N/A	818	Yes	**Yes**
delta-BHC	13	2.37	79	1	Yes	1.30	No	--	--	--	No
Dibenz(a,h)anthracene	330	33	104	6	Yes	5.80	Yes	N/A	800	Yes	**Yes**
Dibenzofuran	300	325	104	6	No	5.80	--	--	--	--	No
Diethylphthalate	25	108	104	1	No	0.960	--	--	--	--	No
Di-n-butylphthalate	190	612	104	25	No	24	--	--	--	--	No
Di-n-octylphthalate	130	N/A	104	3	N/A	2.90	--	--	--	--	N/A
Endosulfan I	20	0.690	79	1	Yes	1.30	--	--	--	--	No
Fluoranthene	3,100	423	104	75	Yes	72	Yes	N/A	1,272	Yes	**Yes**
Fluorene	650	77.4	104	17	Yes	16	Yes	N/A	800	Yes	**Yes**
Heptachlorodibenzo-p-dioxin	0.0946	N/A	4	3	N/A	75	--	--	--	--	N/A
Indeno(1,2,3-cd)pyrene	890	17	104	36	Yes	35	Yes	N/A	800	Yes	**Yes**
Methylene Chloride	9.30	N/A	78	8	N/A	10	--	--	--	--	N/A
Naphthalene	320	176	106	10	Yes	9.40	Yes	N/A	500	Yes	**Yes**
OCDD	0.539	N/A	4	4	N/A	100	--	--	--	--	N/A
OCDF	0.0409	N/A	4	3	N/A	75	--	--	--	--	N/A
Pentachlorophenol	39	255	104	1	No	0.960	--	--	--	--	No
Phenanthrene	3,300	204	104	70	Yes	67	Yes	N/A	1,500	Yes	**Yes**
Phenol	54	773	104	2	No	1.90	--	--	--	--	No
Pyrene	3,900	195	104	67	Yes	64	Yes	N/A	1,500	Yes	**Yes**
Tetrachloroethene	2	3,050	79	1	No	1.30	--	--	--	--	No
Toluene	860	1,660	79	22	No	28	Yes	--	--	--	No
Trichloroethene	13	22,800	79	3	No	3.80	--	--	--	--	No
Total PAH	23700	1,610	N/A	N/A	Yes	N/A	N/A	N/A	12,493	Yes	**Yes**
Total PCB	5,200	40	N/A	N/A	Yes	N/A	N/A	N/A	350	Yes	**Yes**
Radionuclides (pCi/g)											
Americium-241	13.2	5,150	117	117	No	100	--	--	--	--	No
Cesium-134	0.110	N/A	47	47	N/A	100	--	No	--	N/A	No
Cesium-137	0.685	3,120	81	81	No	100	--	--	--	--	No
Gross Alpha	70.7	N/A	78	78	N/A	100	--	--	--	--	No
Gross Beta	39.3	N/A	82	82	N/A	100	--	--	--	--	No
Plutonium-239/240	36.2	5,860	126	126	No	100	--	--	--	--	No
Radium-226	3.08	101	40	40	No	100	--	--	--	--	No
Radium-228	2.40	87.8	29	29	No	100	--	--	--	--	No
Strontium-89/90	1.80	582	71	71	No	100	--	--	--	--	No
Uranium-233/234	3.87	5,280	118	118	No	100	--	--	--	--	No
Uranium-235	0.352	3,730	118	118	No	100	--	--	--	--	No
Uranium-238	6.10	2,490	118	118	No	100	--	--	--	--	No

N/A = Not available or not applicable.

-- = ECOI was eliminated from ECOPC process, or retained for further evaluation within the uncertainty analysis due to lack of an ESL.

Bold "Yes" = ECOPC for the AEU

Table 2.3
Total Maximum Detected PCB Values for the NW AEU

Pond or Channel	Location	Sample Number	Aroclor-1254	Total PCB
A-1	CS53-002	05F0792-005	5,200	5,200
A-1	CS53-003	05F0792-007	55	55
A-1	SED60092	SD00009ST	86	86
A-1	SED60092	SD60000WC	590	590
A-1	SED60192	SD00008ST	73	73
A-1	SED60192	SD60001WC	330	330
A-1	SED60292	SD00011ST	86	86
A-1	SED60292	SD60002WC	460	460
A-1	SED60392	SD00010ST	88	88
A-1	SED60392	SD60003WC	350	350
A-2	CW54-000	05F0275-002	34	34
A-2	CW54-000	05F0275-003	36	36
A-2	SED60692	SD00003ST	130	130
A-2	SED60792	SD00002ST	89	89
A-3	SED61192	SD00030ST	45	45
Channel	10199	99A6847-001	78	78
Channel	CG49-018	04F1603-001	8.1	8.1
Channel	CG49-018	04F1603-002	11	11
Channel	CG49-021	04F1603-003	140	140
Channel	CG49-021	04F1603-004	26	26
Channel	CH49-017	04F1373-014	120	120
Channel	CH49-017	04F1373-015	21	21
Channel	CH49-019	04F1373-005	160	160
Channel	CH49-019	04F1373-006	14	14
Channel	CH49-025	04F1594-004	7.3	7.3
Channel	CH49-025	04F1594-005	28	28
Channel	SED07095	SDG0268JE	920	920
Channel	SED07595	SDG0293JE	50	50
Channel	SED07695	SDG0294JE	140	140
Channel	SED09195	SDG0319JE	25	25
Channel	SED60492	SD00006ST	44	44
Channel	SED60492	SD60004WC	320	320
Channel	SED60592	SD60005WC	590	590
Channel	SED60992	SD00005ST	160	160
		Maximum	5,200	5,200

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Table 2.4
Total Dioxin TEQ Values for the NW AEU

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic	
							TEF [a]	TEQ Concentration [b]
Sediment (ug/kg)								
CS53-000	05F0348-002	A-1	1234678-HpCDF	0.0298	Yes	V1	0.0100	2.98E-04
CS53-000	05F0348-002	A-1	1234789-HpCDF	0.00243	Yes	V1	0.0100	2.43E-05
CS53-000	05F0348-002	A-1	123478-HxCDD	0.00126	Yes	V1	0.500	6.30E-04
CS53-000	05F0348-002	A-1	123478-HxCDF	0.00371	Yes	V1	0.100	3.71E-04
CS53-000	05F0348-002	A-1	123678-HxCDD	0.00455	Yes	V1	0.0100	4.55E-05
CS53-000	05F0348-002	A-1	123678-HxCDF	0.00250	Yes	V1	0.100	2.50E-04
CS53-000	05F0348-002	A-1	123789-HxCDD	0.00329	Yes	V1	0.0100	3.29E-05
CS53-000	05F0348-002	A-1	123789-HxCDF	0.00184	No	V1	0.100	0
CS53-000	05F0348-002	A-1	12378-PeCDF	0.00197	Yes	V1	0.0500	9.85E-05
CS53-000	05F0348-002	A-1	234678-HxCDF	0.00199	Yes	V1	0.100	1.99E-04
CS53-000	05F0348-002	A-1	23478-PeCDF	0.00429	Yes	V1	0.500	0.00215
CS53-000	05F0348-002	A-1	2378-TCDD	0.00278	Yes	V1	1	0.00278
CS53-000	05F0348-002	A-1	2378-TCDF	0.00612	Yes	J1	0.0500	3.06E-04
CS53-000	05F0348-002	A-1	Heptachlorodibenzo-p-dioxin	0.0946	Yes	V1	0.00100	9.46E-05
CS53-000	05F0348-002	A-1	OCDD	0.539	Yes	V1	1.00E-04	5.39E-05
CS53-000	05F0348-002	A-1	OCDF	0.0409	Yes	V1	1.00E-04	4.09E-06
CS53-000	05F0348-002	A-1	Pentachlorodibenzo-p-dioxin	0.00184	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0348-002:[c]								**0.00733**
CW54-000	05F0275-001	A-2	1234678-HpCDF	0.00251	Yes	V1	0.0100	2.51E-05
CW54-000	05F0275-001	A-2	1234789-HpCDF	0.00286	No	V1	0.0100	0
CW54-000	05F0275-001	A-2	123478-HxCDD	0.00286	No	V1	0.500	0
CW54-000	05F0275-001	A-2	123478-HxCDF	5.66E-04	Yes	V1	0.100	5.66E-05
CW54-000	05F0275-001	A-2	123678-HxCDD	0.00122	Yes	V1	0.0100	1.22E-05
CW54-000	05F0275-001	A-2	123678-HxCDF	0.00286	No	V1	0.100	0
CW54-000	05F0275-001	A-2	123789-HxCDD	0.00106	Yes	V1	0.0100	1.06E-05
CW54-000	05F0275-001	A-2	123789-HxCDF	0.00286	No	V1	0.100	0
CW54-000	05F0275-001	A-2	12378-PeCDF	0.00286	No	V1	0.0500	0
CW54-000	05F0275-001	A-2	234678-HxCDF	0.00286	No	V1	0.100	0
CW54-000	05F0275-001	A-2	23478-PeCDF	0.00286	No	V1	0.500	0
CW54-000	05F0275-001	A-2	2378-TCDD	0.00114	No	V1	1	0
CW54-000	05F0275-001	A-2	2378-TCDF	0.00114	No	V1	0.0500	0
CW54-000	05F0275-001	A-2	Heptachlorodibenzo-p-dioxin	0.0199	Yes	V1	0.00100	1.99E-05
CW54-000	05F0275-001	A-2	OCDD	0.161	Yes	V1	1.00E-04	1.61E-05
CW54-000	05F0275-001	A-2	OCDF	0.00883	Yes	V1	1.00E-04	8.83E-07
CW54-000	05F0275-001	A-2	Pentachlorodibenzo-p-dioxin	0.00286	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-001:[c]								**1.41E-04**
CW54-000	05F0275-002	A-2	1234678-HpCDF	0.00419	No	V1	0.0100	0
CW54-000	05F0275-002	A-2	1234789-HpCDF	7.40E-04	Yes	V1	0.0100	7.40E-06
CW54-000	05F0275-002	A-2	123478-HxCDD	0.00419	No	V1	0.500	0
CW54-000	05F0275-002	A-2	123478-HxCDF	0.00419	No	V1	0.100	0
CW54-000	05F0275-002	A-2	123678-HxCDD	0.00419	No	V1	0.0100	0
CW54-000	05F0275-002	A-2	123678-HxCDF	0.00419	No	V1	0.100	0
CW54-000	05F0275-002	A-2	123789-HxCDD	0.00419	No	V1	0.0100	0
CW54-000	05F0275-002	A-2	123789-HxCDF	5.53E-04	Yes	V1	0.100	5.53E-05
CW54-000	05F0275-002	A-2	12378-PeCDF	0.00419	No	V1	0.0500	0
CW54-000	05F0275-002	A-2	234678-HxCDF	0.00419	No	V1	0.100	0
CW54-000	05F0275-002	A-2	23478-PeCDF	0.00419	No	V1	0.500	0
CW54-000	05F0275-002	A-2	2378-TCDD	0.00168	No	V1	1	0

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Table 2.4
Total Dioxin TEQ Values for the NW AEU

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic TEF[a]	Aquatic TEQ Concentration[b]
Sediment (ug/kg)								
CW54-000	05F0275-002	A-2	2378-TCDF	0.00168	No	V1	0.0500	0
CW54-000	05F0275-002	A-2	Heptachlorodibenzo-p-dioxin	0.00419	No	V1	0.00100	0
CW54-000	05F0275-002	A-2	OCDD	0.0178	Yes	V1	1.00E-04	1.78E-06
CW54-000	05F0275-002	A-2	OCDF	0.00838	No	V1	1.00E-04	0
CW54-000	05F0275-002	A-2	Pentachlorodibenzo-p-dioxin	0.00419	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-002:[c]								**6.45E-05**
CW54-000	05F0275-003	A-2	1234678-HpCDF	0.00283	Yes	V1	0.0100	2.83E-05
CW54-000	05F0275-003	A-2	1234789-HpCDF	7.70E-04	Yes	V1	0.0100	7.70E-06
CW54-000	05F0275-003	A-2	123478-HxCDD	0.00474	No	V1	0.500	0
CW54-000	05F0275-003	A-2	123478-HxCDF	5.50E-04	Yes	V1	0.100	5.50E-05
CW54-000	05F0275-003	A-2	123678-HxCDD	0.00474	No	V1	0.0100	0
CW54-000	05F0275-003	A-2	123678-HxCDF	0.00474	No	V1	0.100	0
CW54-000	05F0275-003	A-2	123789-HxCDD	0.00474	No	V1	0.0100	0
CW54-000	05F0275-003	A-2	123789-HxCDF	0.00474	No	V1	0.100	0
CW54-000	05F0275-003	A-2	12378-PeCDF	0.00474	No	V1	0.0500	0
CW54-000	05F0275-003	A-2	234678-HxCDF	0.00474	No	V1	0.100	0
CW54-000	05F0275-003	A-2	23478-PeCDF	0.00474	No	V1	0.500	0
CW54-000	05F0275-003	A-2	2378-TCDD	0.00190	No	V1	1	0
CW54-000	05F0275-003	A-2	2378-TCDF	0.00190	No	V1	0.0500	0
CW54-000	05F0275-003	A-2	Heptachlorodibenzo-p-dioxin	0.0198	Yes	V1	0.00100	1.98E-05
CW54-000	05F0275-003	A-2	OCDD	0.114	Yes	V1	1.00E-04	1.14E-05
CW54-000	05F0275-003	A-2	OCDF	0.00583	Yes	V1	1.00E-04	5.83E-07
CW54-000	05F0275-003	A-2	Pentachlorodibenzo-p-dioxin	0.00474	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-003:[c]								**1.23E-04**
2,3,7,8-TCDD TEQ Concentration used in Sediment ESL Screen[c]:								**0.00733**

a : Toxicity Equivalency Factor (WHO, 1997).
b : TEQ (Toxicity Equivalence) Concentration = Sediment Concentration x TEF. For non-detects, the TEQ Concentration equals zero.
c: The TEQ concentration used in the ESL screen is the maximum of all sampling locations for the medium.

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Table 2.5

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the SW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detections	MDC > ESL?	% Detect	Detection Frequency >5%?	> Bkg	AEU UTL	95th UTL>ESL?	ECOPC?
Inorganics (Total) (mg/L)											
Aluminum	325	0.087	1,582	1,341	Yes	85	Yes	No	10.4	--	No
Ammonia[1]	0.78	0.02	2,581	2,360	Yes	91	Yes	N/A	0.36816	Yes	**Yes**
Antimony	0.604	0.24	1,606	495	Yes	31	Yes	N/A	0.023	No	No
Barium	2.3	0.438	1,600	1,570	Yes	98	Yes	Yes	0.24	No	No
Beryllium	0.0159	0.0024	1,840	466	Yes	25	Yes	N/A	0.0008	No	No
Boron	0.065	1.9	1	1	No	100	--	--	--	--	No
Calcium	1118	N/A	1,603	1,588	N/A	99	--	--	--	--	N/A
Cerium	0.124	N/A	6	6	N/A	100	--	--	--	--	N/A
Cesium	0.1	N/A	580	41	N/A	7.1	--	--	--	--	N/A
Chloride	820	230000	619	615	No	99	--	--	--	--	No
Chromium VI	0.03	N/A	37	2	N/A	5.4	--	--	--	--	N/A
Cobalt	0.0781	0.1	1,600	480	No	30	--	--	--	--	No
Cyanide	0.061	0.0005	179	19	Yes	11	Yes	N/A	0.01	Yes	**Yes**
Fluoride	9.6	2.12	576	545	Yes	95	Yes	Yes	1.2	No	No
Lithium	2.83	0.096	156	1,022	Yes	88	Yes	Yes	0.028	No	No
Magnesium	92.9	N/A	1,603	1,593	N/A	99	--	--	--	--	N/A
Molybdenum	0.606	0.8	1,316	576	No	44	--	--	--	--	No
Nitrate / Nitrite	1200	N/A	4,051	3,948	N/A	97	--	--	--	--	N/A
Nitrite	6.6	4.47	759	705	Yes	93	Yes	N/A	1.9	No	No
Ortho-phosphate	0.35	N/A	61	21	N/A	34	--	--	--	--	N/A
Phosphate	0.17	N/A	42	12	N/A	29	--	--	--	--	N/A
Phosphorus	20	N/A	1,647	1,572	N/A	95	--	--	--	--	N/A
Potassium	94.831	N/A	1,600	1,486	N/A	93	--	--	--	--	N/A
Selenium	0.0339	0.0046	1,599	555	Yes	35	Yes	N/A	0.004	No	No
Silica	9.3	N/A	4	4	N/A	100	--	--	--	--	N/A
Silicon	78.6419	N/A	700	698	N/A	100	--	--	--	--	N/A
Sodium	3240	N/A	1,600	1,565	N/A	98	--	--	--	--	N/A
Strontium	3.51	8.3	1,314	1,303	No	99	--	--	--	--	No
Sulfate	697	N/A	611	608	N/A	100	--	--	--	--	N/A
Sulfide	0.9203	N/A	86	2	N/A	2.3	--	--	--	--	N/A
Thallium	0.176	0.010	1,589	63	Yes	4	No	--	--	--	No
Tin	0.0311	0.073	1,127	98	No	8.7	--	--	--	--	No
Titanium	0.0276	N/A	6	4	N/A	67	--	--	--	--	N/A
Vanadium	0.527	0.012	1,596	927	Yes	58	Yes	No	0.027	--	No
Inorganics (Dissolved) (mg/L)											
Arsenic	0.0192	0.15	833	152	No	18	--	--	--	--	No
Cadmium	0.0305	0.00025	1,113	172	Yes	15	Yes	N/A	0.002	Yes	**Yes**
Chromium	0.044	0.074	852	178	No	21	--	--	--	--	No
Copper	0.044	0.009	836	312	Yes	37	Yes	No	--	--	No
Iron	1.55	1	838	368	Yes	44	Yes	No	--	--	No
Lead	0.0409	0.0025	849	144	Yes	17	Yes	N/A	0.002	No	No
Manganese	1.4	1.65	859	678	No	79	--	--	--	--	No
Mercury	0.00085	0.00077	847	36	Yes	4.3	No	--	--	--	No
Nickel	0.0303	0.052	845	130	No	15	--	--	--	--	No
Silver	0.0332	0.00032	1,286	66	Yes	5.1	Yes	N/A	0.002	Yes	**Yes**
Uranium	0.012	1.501	36	11	No	31	--	--	--	--	No
Zinc	0.76	0.118	838	426	Yes	51	Yes	No	--	--	No
Organics (Total) (ug/L)											

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Table 2.5

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the SW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detections	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL>ESL?	ECOPC?
1,1,1-Trichloroethane	20	89	1,376	277	No	20	--	--	--	--	No
1,1,2,2-Tetrachloroethane	4	2,400	1,378	2	No	0.15	--	--	--	--	No
1,1,2-Trichloro-1,2,2-trifluoroethane	39	32	88	5	Yes	5.7	Yes	N/A	2.5	No	No
1,1-Dichloroethane	7	740	1,378	317	No	23	--	--	--	--	No
1,1-Dichloroethene	11	65	1,375	134	No	9.7	--	--	--	--	No
1,2,3-Trichlorobenzene	0.1	8	747	1	No	0.13	--	--	--	--	No
1,2,3-Trichloropropane	0.6	N/A	680	1	N/A	0.15	--	--	--	--	N/A
1,2,4-Trichlorobenzene	0.13	50	835	2	No	0.24	--	--	--	--	No
1,2,4-Trimethylbenzene	0.1	17	747	1	No	0.13	--	--	--	--	No
1,2-Dibromo-3-chloropropane	0.6	N/A	260	1	N/A	0.38	--	--	--	--	N/A
1,2-Dichloroethane	10	20,000	1,352	9	No	0.67	--	--	--	--	No
1,2-Dichloroethene	370	1,100	582	142	No	24	--	--	--	--	No
1,3,5-Trimethylbenzene	0.2	45	747	1	No	0.13	--	--	--	--	No
1,3-Dichlorobenzene	0.57	28	915	2	No	0.22	--	--	--	--	No
1,4-Dichlorobenzene	4.1	16	915	48	No	5.2	--	--	--	--	No
2-Butanone	32	2,200	633	44	No	7	--	--	--	--	No
2-Chloroethyl vinyl ether	0	N/A	71	7	N/A	9.9	--	--	--	--	N/A
2-Hexanone	12	99	660	6	No	0.91	--	--	--	--	No
4,4'-DDD	0.099	0.06	72	1	Yes	1.4	No	--	--	--	No
4,4'-DDE	0.013	105	72	1	No	1.4	--	--	--	--	No
4,4'-DDT	0.58	0.001	72	5	Yes	6.9	Yes	N/A	0.15	Yes	Yes
4-Bromofluorobenzene	9.92	N/A	3	3	N/A	100	--	--	--	--	N/A
4-Methyl-2-pentanone	11	170	663	4	No	0.6	--	--	--	--	No
4-Methylphenol	28	25	141	1	Yes	0.71	No	--	--	--	No
4-Nitroaniline	5.3	N/A	153	1	N/A	0.65	--	--	--	--	N/A
Acetone	530	1,500	652	205	No	31	--	--	--	--	No
alpha-BHC	0.01	2.2	72	4	No	5.6	--	--	--	--	No
alpha-Chlordane	0	N/A	67	2	N/A	3	--	--	--	--	N/A
Atrazine	1.9	7.3	52	15	No	29	--	--	--	--	No
Benzene	4	530	1,378	5	No	0.36	--	--	--	--	No
beta-BHC	0.051	2.2	72	3	No	4.2	--	--	--	--	No
bis(2-ethylhexyl)phthalate	98	28.5	153	40	Yes	26	Yes	N/A	6	No	No
Bromodichloromethane	6	1,100	1,375	36	No	2.6	--	--	--	--	No
Bromoform	0.8	320	1,356	4	No	0.29	--	--	--	--	No
Bromomethane	3	35	1,369	3	No	0.22	--	--	--	--	No
Butylbenzylphthalate	1.6	67	155	8	No	5.2	--	--	--	--	No
Carbon Disulfide	4	0.92	667	2	Yes	0.3	No	--	--	--	No
Carbon Tetrachloride	220	3,520	1,373	401	No	29	--	--	--	--	No
Chlorobenzene	1	47	1,378	2	No	0.15	--	--	--	--	No
Chlorodifluoromethane	98	N/A	5	5	N/A	100	--	--	--	--	N/A
Chloroform	100	1,240	1,378	727	No	53	--	--	--	--	No
Chloromethane	17	N/A	1,375	3	N/A	0.22	--	--	--	--	N/A
Chrysene	0.4	N/A	155	1	N/A	0.65	--	--	--	--	N/A
cis-1,2-Dichloroethane	18	N/A	1	1	N/A	100	--	--	--	--	N/A
cis-1,2-Dichloroethene	210	620	746	409	No	55	--	--	--	--	No
delta-BHC	0.01	2.2	72	2	No	2.8	--	--	--	--	No
Dibromochloromethane	3	N/A	1,375	13	N/A	0.95	--	--	--	--	N/A
Dichlorodifluoromethane	2.18	N/A	827	4	N/A	0.48	--	--	--	--	N/A
Diethylphthalate	2	110	155	3	No	1.9	--	--	--	--	No
Dimethoate	67	N/A	2	1	N/A	50	--	--	--	--	N/A

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Table 2.5

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the SW AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detections	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL>ESL?	ECOPC?
Dimethylphthalate	3.6	N/A	155	2	N/A	1.3	--	--	--	--	N/A
Di-n-butylphthalate	6	9.7	155	25	No	16	--	--	--	--	No
Di-n-octylphthalate	10	N/A	155	3	N/A	1.9	--	--	--	--	N/A
Fluorene	1.15	12	155	1	No	0.65	--	--	--	--	No
gamma-BHC (Lindane)	0	0.08	72	2	No	2.8	--	--	--	--	No
gamma-Chlordane	0	N/A	37	2	N/A	5.4	--	--	--	--	N/A
Heptachlor	0	0.0038	72	1	No	1.4	--	--	--	--	No
Hexachlorobutadiene	0.2	9.3	835	5	No	0.6	--	--	--	--	No
m,p-Xylene	0.3	35	538	7	No	1.3	--	--	--	--	No
Methylene Chloride	37	940	1,377	339	No	25	--	--	--	--	No
Naphthalene	4	620	835	5	No	0.6	--	--	--	--	No
n-Butylbenzene	0.1	N/A	747	1	N/A	0.13	--	--	--	--	N/A
N-Nitrosomorpholine	1	N/A	2	1	N/A	50	--	--	--	--	N/A
Aroclor-1254	24	0.014	70	1	Yes	1.4	No	--	--	--	No
Phenanthrene	1	2.4	155	1	No	0.65	--	--	--	--	No
Propazine	1	N/A	49	3	N/A	6.1	--	--	--	--	N/A
Simazine	0.18	10	52	1	No	1.9	--	--	--	--	No
Styrene	0.4	160	1,299	5	No	0.38	--	--	--	--	No
Tetrachloroethene	280	840	1,374	445	No	32	--	--	--	--	No
Toluene	11	1,750	1,378	120	No	8.7	--	--	--	--	No
trans-1,2-Dichloroethene	1.1	1,500	827	11	No	1.3	--	--	--	--	No
Trichloroethene	970	21,900	1,377	456	No	33	--	--	--	--	No
Trichlorofluoromethane	2	N/A	827	4	N/A	0.48	--	--	--	--	N/A
Vinyl Chloride	37	930	1,378	75	No	5.4	--	--	--	--	No
Xylene	2	35	784	3	No	0.38	--	--	--	--	No
Radionuclides (pCi/L)[1]											
Americium-241	27.33	43.8	2,574	2,574	No	100	--	--	--	--	No
Cesium-134	0.2272	N/A	3	3	N/A	100	--	--	--	--	N/A
Cesium-137	5.4	42.6	242	242	No	100	--	--	--	--	No
Curium-244	0.026	N/A	24	24	N/A	100	--	--	--	--	N/A
Gross Alpha	330	N/A	3,969	3,969	N/A	100	--	--	--	--	N/A
Gross Beta	860	N/A	4,001	4,001	N/A	100	--	--	--	--	N/A
Neptunium-237	0.1	N/A	17	17	N/A	100	--	--	--	--	N/A
Plutonium-238	14.24	N/A	396	396	N/A	100	--	--	--	--	N/A
Plutonium-239/240	90	18.7	2,732	2,732	Yes	100	Yes	Yes	0.23	No	No
Radium-226	3	1.02	34	34	Yes	100	Yes	No	--	--	No
Strontium-89/90	1.374	278	350	350	No	100	--	--	--	--	No
Thorium-230	0.56	N/A	22	22	N/A	100	--	--	--	--	N/A
Thorium-232	0.91	N/A	22	22	N/A	100	--	--	--	--	N/A
Tritium	31,690	N/A	2,807	2,807	N/A	100	--	--	--	--	N/A
Uranium-233/234	211	20.1	2,118	2,118	Yes	100	Yes	Yes	3.1	No	No
Uranium-235	7.11	21.7	2,102	2,102	No	100	--	--	--	--	No
Uranium-238	170	22.3	2,118	2,118	Yes	100	Yes	Yes	2.7	No	No

N/A = Not available or not applicable.

-- = ECOI was eliminated from ECOPC process, or retained for further evaluation within the uncertainty analysis due to lack of an ESL.

Bold "Yes" = ECOPC for the AEU

[1] The values presented represent the un-ionized concentrations derived using the site-specific conversion factor of 1.56% (refer to Attachment 5)

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Table 2.6

Summary of ECOPC Screening Steps for Sediment ECOPCs in the SW AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Inorganic (mg/kg)											
Aluminum	29,000	15,900	126	126	Yes	100.000	Yes	Yes	21,000	Yes	**Yes**
Antimony	25.6	2	118	27	Yes	22.881	Yes	N/A	10	Yes	**Yes**
Arsenic	21.6	9.79	125	119	Yes	95.200	Yes	Yes	8.6	No	No
Barium	240	189	126	126	Yes	100.000	Yes	Yes	194	Yes	**Yes**
Beryllium	2.2	N/A	126	85	N/A	67.460	--	--	--	--	N/A
Boron	30	N/A	35	32	N/A	91.429	--	--	--	--	N/A
Cadmium	44	0.99	126	62	Yes	49.206	Yes	N/A	1.900	Yes	**Yes**
Calcium	95,700	N/A	126	126	N/A	100.000	--	--	--	--	N/A
Cesium	13.6	N/A	69	18	N/A	26.087	--	--	--	--	N/A
Chloride	206.31	N/A	13	10	N/A	76.923	--	--	--	--	N/A
Chromium	140	43.4	126	119	Yes	94.444	Yes	Yes	27	No	No
Chromium VI	0.013	43.4	16	6	No	37.500	Yes	N/A	--	--	No
Cobalt	13.3	N/A	126	112	N/A	88.889	--	--	--	--	N/A
Copper	324	31.6	126	120	Yes	95.238	Yes	Yes	38.400	Yes	**Yes**
Cyanide	0.23	N/A	7	1	N/A	14.286	--	--	--	--	N/A
Fluoride	9.27	0.01	16	8	Yes	50.000	Yes	N/A	9.270	Yes	**Yes**
Iron	24,000	20,000	126	126	Yes	100.000	Yes	Yes	19,717	No	No
Lead	170	35.8	126	126	Yes	100.000	Yes	Yes	66	Yes	**Yes**
Lithium	27	N/A	126	106	N/A	84.127	--	--	--	--	N/A
Magnesium	22,900	N/A	126	126	N/A	100.000	--	--	--	--	N/A
Manganese	639	630	126	126	Yes	100.000	Yes	No	338	--	No
Mercury	1.7	0.18	107	35	Yes	32.710	Yes	N/A	0.100	No	No
Molybdenum	7.7	N/A	126	44	N/A	34.921	--	--	--	--	N/A
Nickel	216	22.7	126	118	Yes	93.651	Yes	Yes	22	No	No
Nitrate / Nitrite	12.9	N/A	43	17	N/A	39.535	--	--	--	--	N/A
Potassium	3,900	N/A	126	124	N/A	98.413	--	--	--	--	N/A
Selenium	3.6	0.95	125	14	Yes	11.200	Yes	N/A	0.940	No	No
Silica	2,000	N/A	35	35	N/A	100.000	--	--	--	--	N/A
Silicon	836	N/A	21	21	N/A	100.000	--	--	--	--	N/A
Silver	3,100	1	124	32	Yes	25.806	Yes	N/A	7.400	Yes	**Yes**
Sodium	2,240	N/A	126	111	N/A	88.095	--	--	--	--	N/A
Strontium	150	N/A	126	126	N/A	100.000	--	--	--	--	N/A
Sulfate	25.9	N/A	13	6	N/A	46.154	--	--	--	--	N/A
Sulfide	37	N/A	1	1	N/A	100.000	--	--	--	--	N/A
Thallium	1.2	N/A	126	22	N/A	17.460	--	--	--	--	N/A
Tin	39.5	N/A	126	13	N/A	10.317	--	--	--	--	N/A
Titanium	330	N/A	35	35	N/A	100.000	--	--	--	--	N/A
Vanadium	63	N/A	126	118	N/A	93.651	--	--	--	--	N/A
Zinc	888	121	126	126	Yes	100.000	Yes	Yes	507.000	Yes	**Yes**
Organics (ug/kg)											
1,1-Dichloroethene	2	N/A	79	1	N/A	1.266	--	--	--	--	N/A
1,2,3-Trichlorobenzene	2	58.6	26	1	No	3.846	--	--	--	--	No
1,2,4-Trichlorobenzene	2	429	103	1	No	0.971	--	--	--	--	No
2-Butanone	51	84.194	80	11	No	13.750	--	--	--	--	No
2-Methylnaphthalene	41	20.2	83	1	Yes	1.205	No	--	--	--	No
4,4'-DDE	4.1	3.16	66	1	Yes	1.515	No	--	--	--	No
4-Methylphenol	47	12.3	84	1	Yes	1.190	No	--	--	--	No
Acenaphthene	180	6.71	83	12	Yes	14.458	Yes	N/A	390	Yes	**Yes**
Acetone	210	N/A	80	10	N/A	12.500	--	--	--	--	N/A

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Table 2.6
Summary of ECOPC Screening Steps for Sediment ECOPCs in the SW AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Anthracene	430	57.2	83	28	Yes	33.735	Yes	N/A	420	Yes	Yes
Aroclor-1254	3,100	40	97	26	Yes	26.804	Yes	N/A	630	Yes	Yes
Aroclor-1260	2,000	40	97	5	Yes	5.155	Yes	N/A	205	Yes	Yes
Benzo(a)anthracene	1,400	108	83	47	Yes	56.627	Yes	N/A	820	Yes	Yes
Benzo(a)pyrene	1,300	150	83	44	Yes	53.012	Yes	N/A	810	Yes	Yes
Benzo(b)fluoranthene	1,500	N/A	83	48	N/A	57.831	--	--	--	--	N/A
Benzo(g,h,i)perylene	1,100	13	83	33	Yes	39.759	Yes	N/A	730	Yes	Yes
Benzo(k)fluoranthene	920	240	83	41	Yes	49.398	Yes	N/A	900	Yes	Yes
Benzoic Acid	1,400	N/A	67	7	N/A	10.448	--	--	--	--	N/A
Benzyl Alcohol	41	1.34676	67	1	Yes	1.493	No	--	--	--	No
beta-BHC	28	93.6	66	1	No	1.515	--	--	--	--	No
bis(2-ethylhexyl)phthalate	25,000	24900	83	55	Yes	66.265	Yes	N/A	5,000	No	No
Bromomethane	5	3.43	80	6	Yes	7.500	Yes	N/A	10.5	Yes	Yes
Butylbenzylphthalate	1,700	11,400	83	10	No	12.048	--	--	--	--	No
Carbazole	290	25	16	6	Yes	37.500	Yes	N/A	360	Yes	Yes
Carbon Tetrachloride	440	7,890	80	2	No	2.500	--	--	--	--	No
Chloroform	2	N/A	80	5	N/A	6.250	--	--	--	--	N/A
Chrysene	1,400	166	83	52	Yes	62.651	Yes	N/A	841.9143577	Yes	Yes
cis-1,2-Dichloroethene	48	N/A	26	1	N/A	3.846	--	--	--	--	N/A
Dibenz(a,h)anthracene	360	33	83	14	Yes	16.867	Yes	N/A	700	Yes	Yes
Dibenzofuran	65	325	83	4	No	4.819	--	--	--	--	No
Dieldrin	4.6	5.936	66	1	No	1.515	--	--	--	--	No
Diethylphthalate	53	108	83	1	No	1.205	--	--	--	--	No
Dimethylphthalate	490	N/A	83	4	N/A	4.819	--	--	--	--	N/A
Di-n-butylphthalate	220	612	82	19	No	23.171	--	--	--	--	No
Di-n-octylphthalate	9,800	N/A	83	17	N/A	20.482	--	--	--	--	N/A
Ethylbenzene	9	16569.6	80	2	No	2.500	--	--	--	--	No
Fluoranthene	2,700	423	83	57	Yes	68.675	Yes	N/A	1,400	Yes	Yes
Fluorene	180	77.4	83	10	Yes	12.048	Yes	N/A	700	Yes	Yes
gamma-BHC (Lindane)	25	2.37	65	1	Yes	1.538	No	--	--	--	No
Heptachlor epoxide	33	2.47	66	1	Yes	1.515	No	--	--	--	No
Hexachlorobutadiene	2	23	103	1	No	0.971	--	--	--	--	No
Indeno(1,2,3-cd)pyrene	910	17	83	37	Yes	44.578	Yes	N/A	700	Yes	Yes
Methoxychlor	2.7	24	66	1	No	1.515	--	--	--	--	No
Methylene Chloride	420	N/A	80	22	N/A	27.500	--	--	--	--	N/A
Naphthalene	59	176	103	5	No	4.854	--	--	--	--	No
Pentachlorophenol	1,100	255	84	3	Yes	3.571	No	--	--	--	No
Phenanthrene	1,800	204	83	51	Yes	61.446	Yes	N/A	996	Yes	Yes
Phenol	110	773	83	1	No	1.205	--	--	--	--	No
Pyrene	1,700	195	83	53	Yes	63.855	Yes	N/A	1200	Yes	Yes
Tetrachloroethene	7	3,050	80	3	No	3.750	--	--	--	--	No
Total PCBs	3,700	40	N/A	N/A	Yes	N/A	N/A	N/A	745	Yes	Yes
Toluene	360	1,660	79	19	No	24.051	--	--	--	--	No
trans-1,2-Dichloroethene	2	657	26	1	No	3.846	--	--	--	--	No
Trichloroethene	1	22,800	79	1	No	1.266	--	--	--	--	No
Trichlorofluoromethane	5	N/A	26	13	N/A	50.000	--	--	--	--	N/A
Vinyl Chloride	16.8	N/A	80	1	N/A	1.250	--	--	--	--	N/A
Xylene	68	91	80	3	No	3.750	--	--	--	--	No
Radionuclides (pCi/kg)											
Americium-241	56.5	5150	175	129	No	73.714	--	--	--	--	No

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Table 2.6

Summary of ECOPC Screening Steps for Sediment ECOPCs in the SW AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Cesium-134	0.12	N/A	41	18	N/A	43.902	--	--	--	--	N/A
Cesium-137	0.9586	3120	62	39	No	62.903	--	--	--	--	No
Gross Alpha	160	N/A	70	70	N/A	100.000	--	--	--	--	N/A
Gross Beta	125.2	N/A	70	70	N/A	100.000	--	--	--	--	N/A
Plutonium-239/240	217	5860	175	145	No	82.857	--	--	--	--	No
Radium-226	1.593	101	35	35	No	100.000	--	--	--	--	No
Radium-228	2.082	87.8	27	27	No	100.000	--	--	--	--	No
Strontium-89/90	1.06	582	47	30	No	63.830	--	--	--	--	No
Uranium-233/234	9.807	5280	145	145	No	100.000	--	--	--	--	No
Uranium-235	0.8517	3730	145	81	No	55.862	--	--	--	--	No
Uranium-238	59	2490	145	145	No	100.000	--	--	--	--	No

N/A = Not available or not applicable.

-- = ECOI was eliminated from ECOPC process, or retained for further evaluation within the uncertainty analysis due to lack of an ESL.

Bold "Yes" = ECOPC for the AEU

Table 2.7
Total Maximum Detected PCB Values for the SW AEU

Pond or Channel	Location	Sample Number	Aroclor-1254	Aroclor-1260	Total PCBs
B-4	DB47-001	05F0597-002	210	ND	210
B-4	DB47-002	05F0599-001	160	ND	160
B-4	DB47-002	05F0599-002	220	ND	220
B-4	DB47-002	05F0599-003	3,100	ND	3,100
B-4	DB47-004	05F0618-007	820	ND	820
B-4	SED63592	SD00014ST	210	ND	210
B-4	SED63592	SD60035WC	230	ND	230
B-4	SED63692	SD00012ST	120	ND	120
B-4	SED63792	SD00015ST	190	ND	190
B-4	SED63792	SD60037WC	440	ND	440
B-4	SED63792	SD60114WC	560	ND	560
B-4	SED63892	SD00016ST	200	ND	200
B-4	SED63892	SD60110WC	1,100	ND	1,100
B-4	SED63992	SD00013ST	220	ND	220
B-4	SED63992	SD60039WC	300	ND	300
Channel	CJ42-006	04F2195-002	33	ND	33
Channel	DC45-000	02E0055-003	47	53	100
Channel	SED011	SD00242WC	91	ND	91
Channel	SED011	SD00282WC	78	ND	78
Channel	SED011	SD00306WC	750	ND	750
Channel	SED011	SD00331WC	340	ND	340
Channel	SED011	SD00537WC	630	ND	630
Channel	SED04395	SDG0209JE	37	ND	37
Channel	SED04895	SDG0287JE	90	ND	90
Channel	SED05095	SDG0242JE	1,700	2,000	3,700
Channel	SED07295	SDG0318JE	27	ND	27
Channel	SED20493	SDG0079JE	ND	310	310
Channel	SED20593	SDG0080JE	ND	630	630
Channel	SED20993	SDG0084JE	ND	200	200
		Maximum	3,100	2,000	3,700

ND = Not detected.

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Table 2.8

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the WC AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	> Bkg	% Detect	Detection Frequency > 5%	MDC > BKG	AEU UTL	95th UTL > ESL?	ECOPC?
Inorganics (Total) (mg/L)											
Aluminum	415	0.087	594	535	Yes	90	Yes	No	--	--	No
Ammonia[1]	0.094	0.02	84	32	Yes	38	Yes	N/A	2	Yes	**Yes**
Antimony	0.08	0.24	591	95	No	16	--	--	--	--	No
Barium	2.56	0.438	597	579	Yes	97	Yes	Yes	0.223	No	No
Beryllium	0.0255	0.0024	665	152	Yes	23	Yes	N/A	0.002	No	No
Calcium	185	N/A	598	598	N/A	100	--	--	--	--	N/A
Cerium	0.00128	N/A	2	2	N/A	100	--	--	--	--	N/A
Cesium	0.11	N/A	308	43	N/A	14	--	--	--	--	N/A
Chloride	170	230000	390	387	No	99	--	--	--	--	No
Chromium VI	0.06	N/A	25	3	N/A	12	--	--	--	--	N/A
Cobalt	0.112	0.1	594	192	Yes	32	Yes	N/A	0.005	No	No
Cyanide	0.0489	0.0005	174	4	Yes	2.3	No	--	--	--	No
Fluoride	1.8	2.12	378	363	No	96	--	--	--	--	No
Lithium	0.277	0.096	544	428	Yes	79	Yes	Yes	0.024	No	No
Magnesium	54.3	N/A	598	596	N/A	100	--	--	--	--	N/A
Molybdenum	0.0167	0.8	560	202	No	36	--	--	--	--	No
Nitrate / Nitrite	2253.9	N/A	387	221	N/A	57	--	--	--	--	N/A
Nitrite	0.54	4.47	172	19	No	11	--	--	--	--	No
Ortho-phosphate	0.47	N/A	128	9	N/A	7	--	--	--	--	N/A
Phosphate	0.16	N/A	46	16	N/A	35	--	--	--	--	N/A
Phosphorus	1.9	N/A	223	105	N/A	47	--	--	--	--	N/A
Potassium	50	N/A	595	564	N/A	95	--	--	--	--	N/A
Selenium	0.0485	0.0046	581	150	Yes	26	Yes	N/A	0.003	No	No
Silica	26.4	N/A	10	10	N/A	100	--	--	--	--	N/A
Silicon	114	N/A	318	318	N/A	100	--	--	--	--	N/A
Sodium	1430	N/A	596	596	N/A	100	--	--	--	--	N/A
Strontium	1.31	8.3	563	558	No	99	--	--	--	--	No
Sulfate	350	N/A	393	381	N/A	97	--	--	--	--	N/A
Sulfide	17	N/A	190	15	N/A	7.9	--	--	--	--	N/A
Thallium	0.02	0.010	593	33	Yes	5.6	Yes	N/A	0.003	No	No
Tin	0.0703	0.073	514	44	No	8.6	--	--	--	--	No
Vanadium	0.747	0.012	594	313	Yes	53	Yes	No	--	--	No
Inorganics (Dissolved) (mg/L)											
Arsenic	0.0058	0.15	282	52	No	18	--	--	--	--	No
Cadmium	0.0268	0.00025	364	48	Yes	13	Yes	N/A	0.002	Yes	**Yes**
Chromium	0.063	0.074	296	27	No	9.1	--	--	--	--	No
Copper	0.023	0.009	289	112	Yes	39	Yes	No	--	--	No
Iron	9.02	1	300	198	Yes	66	Yes	No	--	--	No
Lead	0.0267	0.0025	289	100	Yes	35	Yes	No	--	--	No
Manganese	1.77	1.65	309	279	Yes	90	Yes	No	0.129	--	No
Mercury	0.001	0.00077	284	16	Yes	5.6	Yes	N/A	0.0001	No	No
Nickel	0.037	0.052	294	32	No	11	--	--	--	--	No
Silver	0.0063	0.00032	366	25	Yes	6.8	Yes	N/A	0.003	Yes	**Yes**
Uranium	0.00908	1.501	11	5	No	45	--	--	--	--	No
Zinc	0.516	0.118	294	161	Yes	55	Yes	No	--	--	No
Organics (Total) (ug/L)											
1,1,1-Trichloroethane	0.5	89	347	3	No	0.86	--	--	--	--	No
1,1,2-Trichloro-1,2,2-trifluoroethane	0.3	32	25	3	No	12	--	--	--	--	No

Table 2.8

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the WC AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	> Bkg	% Detect	Detection Frequency > 5%	MDC > BKG	AEU UTL	95th UTL > ESL?	ECOPC?
1,1-Dichloroethene	1	65	347	1	No	0.29	--	--	--	--	No
1,2-Dichloroethane	14	20,000	345	2	No	0.58	--	--	--	--	No
1,2-Dichloroethene	21	1,100	260	7	No	2.7	--	--	--	--	No
1,4-Dichlorobenzene	0.5	16	213	3	No	1.4	--	--	--	--	No
2-Butanone	17	2,200	239	7	No	2.9	--	--	--	--	No
4,4'-DDD	0.046	0.06	129	1	No	0.78	--	--	--	--	No
4,4'-DDE	0.049	105	129	2	No	1.6	--	--	--	--	No
4,4'-DDT	0.073	0.001	129	5	Yes	3.9	No	--	--	--	No
4-Bromofluorobenzene	9.91	N/A	2	2	N/A	100	--	--	--	--	N/A
Acetone	210	1500	244	38	No	16	--	--	--	--	No
Atrazine	0.77	7.3	40	10	No	25	--	--	--	--	No
Benzene	0.2	530	347	2	No	0.58	--	--	--	--	No
Benzoic Acid	42	42	137	2	No	1.5	--	--	--	--	No
Benzyl Alcohol	3	8.6	142	1	No	0.7	--	--	--	--	No
beta-BHC	0.17	2.2	129	4	No	3.1	--	--	--	--	No
bis(2-ethylhexyl)phthalate	26	28.5	157	29	No	18	--	--	--	--	No
Bromodichloromethane	0.96	1,100	347	1	No	0.29	--	--	--	--	No
Bromoform	1.9	320	347	1	No	0.29	--	--	--	--	No
Butylbenzylphthalate	0.8	67	157	2	No	1.3	--	--	--	--	No
Carbon Disulfide	8	0.92	285	1	Yes	0.35	No	--	--	--	No
Carbon Tetrachloride	76	3520	341	10	No	2.9	--	--	--	--	No
Chlorobenzene	1	47	347	1	No	0.29	--	--	--	--	No
Chlorodifluoromethane	43	N/A	5	5	N/A	100	--	--	--	--	N/A
Chloroform	22	1240	347	21	No	6.1	--	--	--	--	No
Chloromethane	0.2	N/A	345	1	N/A	0.29	--	--	--	--	N/A
cis-1,2-Dichloroethene	8	620	95	30	No	32	--	--	--	--	No
delta-BHC	0.02	2.2	129	1	No	0.78	--	--	--	--	No
Dichlorodifluoromethane	0.26	N/A	100	1	N/A	1	--	--	--	--	N/A
Diethylphthalate	16	110	157	5	No	3.2	--	--	--	--	No
Di-n-butylphthalate	5	9.7	157	12	No	7.6	--	--	--	--	No
Isophorone	8	1,300	157	1	No	0.64	--	--	--	--	No
Methylene Chloride	80	940	343	52	No	15	--	--	--	--	No
m-Xylene	0.2	35	1	1	No	100	--	--	--	--	No
Naphthalene	1	620	208	2	No	0.96	--	--	--	--	No
Pentachlorophenol	5	6.73	155	1	No	0.65	--	--	--	--	No
Prometon	0.31	N/A	35	1	N/A	2.9	--	--	--	--	N/A
p-Xylene	0.2	35	1	1	No	100	--	--	--	--	No
Pyrene	2	0.025	156	1	Yes	0.64	No	--	--	--	No
Tetrachloroethene	47	840	347	66	No	19	--	--	--	--	No
Toluene	9	1,750	348	13	No	3.7	--	--	--	--	No
Trichloroethene	30	21,900	347	45	No	13	--	--	--	--	No
Trichlorofluoromethane	0.2	N/A	100	1	N/A	1	--	--	--	--	N/A
Xylene	3	35	327	2	No	0.61	--	--	--	--	No
Radionuclides (Total) (pCi/L)											
Americium-241	48	43.8	1,108	1,108	Yes	100	Yes	Yes	0.143	No	No
Cesium-137	16	42.6	200	200	No	100	--	--	--	--	No
Curium-244	0.026	N/A	13	13	N/A	100	--	--	--	--	N/A
Gross Alpha	41	N/A	1,300	1,300	N/A	100	--	--	--	--	N/A
Gross Beta	58	N/A	1,320	1,320	N/A	100	--	--	--	--	N/A
Neptunium-237	0.095	N/A	13	13	N/A	100	--	--	--	--	N/A

Table 2.8

Summary of ECOPC Screening Steps for Surface Water ECOPCs in the WC AEU

Analyte	MDC	Surface Water ESL	Number of Samples	Number of Detects	≥ Bkg	% Detect	Detection Frequency > 5%	MDC > BKG	AEU UTL	95th UTL > ESL?	ECOPC?
Plutonium-238	0.275	N/A	289	289	N/A	100	--	--	--	--	N/A
Plutonium-239/240	250	18.7	1,151	1,151	Yes	100	Yes	Yes	0.784	No	No
Radium-226	0.5172	1.02	10	10	No	100	--	--	--	--	No
Strontium-89/90	1.192	278	165	165	No	100	--	--	--	--	No
Strontium-90	0.3908	278	1	1	No	100	--	--	--	--	No
Thorium-230	0.89	N/A	15	15	N/A	100	--	--	--	--	N/A
Thorium-232	1	N/A	15	15	N/A	100	--	--	--	--	N/A
Tritium	2,097	N/A	676	676	N/A	100	--	--	--	--	N/A
Uranium-233/234	193.8	20.1	958	958	Yes	100	Yes	N/A	3.5	No	No
Uranium-235	8.117	21.7	933	933	No	100	--	--	--	--	No
Uranium-238	138.1	22.3	958	958	Yes	100	Yes	N/A	2.72	No	No

N/A = Not available or not applicable.

-- = ECOI was eliminated from ECOPC process, or retained for further evaluation within the uncertainty analysis due to lack of an ESL.

Yes = is an ECOPC

[1] The values presented represent the un-ionized concentrations derived using the site-specific conversion factor of 0.626 (refer to Attachment 5).

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Table 2.9
Summary of ECOPC Screening Steps for Sediment ECOPCs in the WC AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Inorganics (mg/kg)											
Aluminum	32,000	15,900	88	88	Yes	100	Yes	Yes	2300	Yes	**Yes**
Antimony	51.3	2	82	8	Yes	9.8	Yes	N/A	19.6	Yes	**Yes**
Arsenic	27.9	9.79	88	86	Yes	98	Yes	Yes	8.9	No	No
Barium	404	189	88	87	Yes	99	Yes	Yes	280	Yes	**Yes**
Beryllium	6.7	N/A	85	63	N/A	74	--	--	--	--	N/A
Boron	14	N/A	15	15	N/A	100	--	--	--	--	N/A
Cadmium	3.6	0.99	83	24	Yes	29	Yes	N/A	1.4	Yes	**Yes**
Calcium	48200	N/A	88	88	N/A	100	--	--	--	--	N/A
Cesium	5	N/A	63	10	N/A	16	--	--	--	--	N/A
Chromium	70.1	43.4	88	87	Yes	99	Yes	Yes	26.7	No	No
Chromium VI	0.012	43.4	4	1	No	25	--	--	--	--	No
Cobalt	13.1	N/A	87	84	N/A	97	--	--	--	--	N/A
Copper	212	31.6	88	83	Yes	94	Yes	Yes	38.3	Yes	**Yes**
Fluoride	20.3	0.01	4	1	Yes	25	Yes	N/A	20.3	Yes	**Yes**
Iron	38,800	20,000	88	88	Yes	100	Yes	Yes	27208	Yes	**Yes**
Lead	118	35.8	88	88	Yes	100	Yes	Yes	52.7	Yes	**Yes**
Lithium	28	N/A	84	73	N/A	87	--	--	--	--	N/A
Magnesium	6,600	N/A	88	88	N/A	100	--	--	--	--	N/A
Manganese	1,580	630	88	88	Yes	100	Yes	Yes	60.7	No	No
Mercury	3.8	0.18	86	24	Yes	28	Yes	N/A	1.3	Yes	**Yes**
Molybdenum	11.7	N/A	84	29	N/A	35	--	--	--	--	N/A
Nickel	33	22.7	88	76	Yes	86	Yes	Yes	24.4	Yes	**Yes**
Nitrate / Nitrite	32	N/A	62	45	N/A	73	--	--	--	--	N/A
Potassium	4,200	N/A	87	78	N/A	90	--	--	--	--	N/A
Selenium	3.8	0.95	80	33	Yes	41	Yes	Yes	1.51	Yes	**Yes**
Silica	1,600	N/A	15	15	N/A	100	--	--	--	--	N/A
Silicon	1,890	N/A	44	44	N/A	100	--	--	--	--	N/A
Silver	7.7	1	83	11	Yes	13	Yes	N/A	2.3	Yes	**Yes**
Sodium	2,060	N/A	86	73	N/A	85	--	--	--	--	N/A
Strontium	167	N/A	87	86	N/A	99	--	--	--	--	N/A
Thallium	10	N/A	82	12	N/A	15	--	--	--	--	N/A
Tin	77.2	N/A	86	21	N/A	24	--	--	--	--	N/A
Titanium	300	N/A	15	15	N/A	100	--	--	--	--	N/A
Vanadium	68.6	N/A	88	88	N/A	100	--	--	--	--	N/A
Zinc	2,080	121	88	88	Yes	100	Yes	Yes	32.3	Yes	**Yes**
Organics (ug/kg)											
1234678-HpCDF	0.00158	N/A	2	2	N/A	100	--	--	--	--	N/A
123478-HxCDF	0.00127	N/A	2	1	N/A	50	--	--	--	--	N/A
123678-HxCDF	0.000562	N/A	2	1	N/A	50	--	--	--	--	N/A
2,4-Dinitrophenol	890	N/A	57	1	N/A	1.8	--	--	--	--	N/A
234678-HxCDF	0.000781	N/A	2	1	N/A	50	--	--	--	--	N/A
23478-PeCDF	0.00143	N/A	2	1	N/A	50	--	--	--	--	N/A
2-Butanone	380	84.194	51	7	Yes	14	Yes	N/A	63	No	No
2-Methylnaphthalene	110	20.2	61	1	Yes	1.6	No	--	--	--	No
4,4'-DDT	18	4.16	59	1	Yes	1.7	No	--	--	--	No
4,6-Dinitro-2-methylphenol	750	N/A	59	1	N/A	1.7	No	--	--	--	N/A
4-Methyl-2-pentanone	3	N/A	54	1	N/A	1.9	No	--	--	--	N/A
4-Methylphenol	510	12.3	61	4	Yes	6.6	Yes	N/A	700	Yes	**Yes**
Acenaphthene	510	6.71	61	4	Yes	6.6	Yes	N/A	510	Yes	**Yes**

Table 2.9

Summary of ECOPC Screening Steps for Sediment ECOPCs in the WC AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Acetone	890	N/A	58	15	N/A	26	--	--	--	--	N/A
Aldrin	0	8.25	59	2	No	3.4	--	--	--	--	No
alpha-Chlordane	0	3.24	59	2	No	3.4	--	--	--	--	No
Anthracene	470	57.2	61	6	Yes	9.8	Yes	N/A	500	Yes	**Yes**
Aroclor-1254	250	40	69	12	Yes	17	Yes	N/A	500	Yes	**Yes**
Benzo(a)anthracene	1,200	108	61	11	Yes	18	Yes	N/A	800	Yes	**Yes**
Benzo(a)pyrene	970	150	61	8	Yes	13	Yes	N/A	800	Yes	**Yes**
Benzo(b)fluoranthene	1,500	N/A	61	6	N/A	9.8	--	--	--	--	N/A
Benzo(g,h,i)perylene	630	13	61	4	Yes	6.6	Yes	N/A	700	Yes	**Yes**
Benzo(k)fluoranthene	690	240	61	5	Yes	8.2	Yes	N/A	700	Yes	**Yes**
Benzoic Acid	660	N/A	57	6	N/A	11	--	--	--	--	N/A
beta-BHC	0	93.6	59	2	No	3.4	--	--	--	--	No
bis(2-ethylhexyl)phthalate	2,600	24,900	62	32	No	52	--	--	--	--	No
Butylbenzylphthalate	210	11,400	62	3	No	4.8	--	--	--	--	No
Chrysene	1,200	166	62	14	Yes	23	Yes	N/A	800	Yes	**Yes**
delta-BHC	0	2.37	59	2	No	3.4	--	--	--	--	No
Dibenz(a,h)anthracene	530	33	60	2	Yes	3.3	No	--	--	--	No
Dibenzofuran	230	325	61	1	No	1.6	--	--	--	--	No
Diethylphthalate	79	108	62	1	No	1.6	--	--	--	--	No
Di-n-butylphthalate	390	612	62	14	No	23	--	--	--	--	No
Di-n-octylphthalate	210	N/A	62	3	N/A	4.8	--	--	--	--	N/A
Endosulfan I	0	0.69	59	2	No	3.4	--	--	--	--	No
Fluoranthene	2,900	423	62	19	Yes	31	Yes	N/A	729	Yes	**Yes**
Fluorene	400	77.4	61	1	Yes	1.6	No	--	--	--	No
gamma-BHC (Lindane)	4.4	2.37	59	1	Yes	1.7	No	--	--	--	No
gamma-Chlordane	0	3.24	30	2	No	6.7	--	--	--	--	No
Heptachlor	3.1	0.132	59	3	Yes	5.1	Yes	N/A	25	Yes	**Yes**
Heptachlor epoxide	0	2.47	59	2	No	3.4	--	--	--	--	No
Heptachlorodibenzo-p-dioxin	0.00509	N/A	2	2	N/A	100	--	--	--	--	N/A
Indeno(1,2,3-cd)pyrene	500	17	61	5	Yes	8.2	Yes	N/A	700	Yes	**Yes**
Methylene Chloride	220	N/A	58	14	N/A	24	--	--	--	--	N/A
Naphthalene	300	176	61	2	Yes	3.3	No	--	--	--	No
OCDD	0.0306	N/A	2	2	N/A	100	--	--	--	--	N/A
OCDF	0.00176	N/A	2	2	N/A	100	--	--	--	--	N/A
Pentachlorodibenzo-p-dioxin	0.000372	N/A	2	1	N/A	50	--	--	--	--	N/A
Pentachlorophenol	950	255	61	1	Yes	1.6	No	--	--	--	No
Phenanthrene	2,900	204	62	16	Yes	26	Yes	N/A	700	Yes	**Yes**
Phenol	150	773	61	1	No	1.6	--	--	--	--	No
Pyrene	3,100	195	62	14	Yes	23	Yes	N/A	800	Yes	**Yes**
Tetrachloroethene	1	3050	54	2	No	3.7	--	--	--	--	No
Total PCBs	1,000	40	N/A	N/A	Yes	N/A	N/A	N/A	500	Yes	**Yes**
Toluene	520	1,660	58	14	No	24	--	--	--	--	No
Trichloroethene	23	22,800	55	1	No	1.8	--	--	--	--	No
Xylene	5	91	54	1	No	1.9	--	--	--	--	No
Radionuclides (pCi/kg)											
Americium-241	5.06	5150	109	109	No	100	--	--	--	--	No
Cesium-134	0.3	N/A	35	35	N/A	100	--	--	--	--	N/A
Cesium-137	0.5643	3120	52	52	No	100	--	--	--	--	No
Gross Alpha	320	N/A	78	78	N/A	100	--	--	--	--	N/A
Gross Beta	74.93	N/A	79	79	N/A	100	--	--	--	--	N/A

Table 2.9

Summary of ECOPC Screening Steps for Sediment ECOPCs in the WC AEU

Analyte	MDC	Sediment ESL	Number of Samples	Number of Detects	MDC > ESL?	% Detect	Detection Frequency > 5%?	> Bkg	AEU UTL	95th UTL > ESL?	ECOPC?
Plutonium-239/240	30	5,860	116	116	No	100	--	--	--	--	No
Radium-226	2.19	101	19	19	No	100	--	--	--	--	No
Radium-228	2.9	87.8	20	20	No	100	--	--	--	--	No
Strontium-89/90	4.86	582	52	52	No	100	--	--	--	--	No
Uranium-233/234	4.775	5,280	100	100	No	100	--	--	--	--	No
Uranium-235	0.405	3,730	100	100	No	100	--	--	--	--	No
Uranium-238	10.13	2,490	100	100	No	100	--	--	--	--	No

N/A = Not available or no applicable.

-- = ECOI was eliminated from ECOPC process, or retained for further evaluation within the uncertainty analysis due to lack of an ESL.

Bold "Yes" = ECOPC for the AEU.

Table 2.10
Total Maximum Detected PCB Values for the WC AEU

Pond or Channel	Location	Sample Number	Aroclor-1254	Total PCB
C-1	CR31-008	05F0630-001	94	94
C-1	CR31-008	05F0630-002	120	120
Channel	SED016	SD00243WC	19	19
Channel	SED028	SD00254WC	40	40
Channel	SED029	SD00255WC	160	160
Channel	SED029	SD00271WC	220	220
Channel	SED037	SD00274WC	86	86
Channel	SED038	SD00272WC	84	84
Channel	SED08295	SDG0324JE	110	110
Channel	SED126	SD00267WC	26	26
Channel	SW030	SW70168JE	95	95
Channel	SW036	SW70167JE	250	250
		Maximum	250	250

Table 2.11

Total Dioxin TEQ Values for the WC AEU

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic	
							TEF[a]	TEQ Concentration[b]
Sediment (ug/kg)								
CR31-004	05F0140-005	C-1	1234678-HpCDF	0.000807	Yes	V	0.01	0.00000807
CR31-004	05F0140-005	C-1	1234789-HpCDF	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123478-HxCDD	0.00271	No	V	0.5	0
CR31-004	05F0140-005	C-1	123478-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	123678-HxCDD	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123678-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	123789-HxCDD	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123789-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	12378-PeCDF	0.00271	No	V	0.05	0
CR31-004	05F0140-005	C-1	234678-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	23478-PeCDF	0.00271	No	V	0.5	0
CR31-004	05F0140-005	C-1	2378-TCDD	0.00108	No	V	1	0
CR31-004	05F0140-005	C-1	2378-TCDF	0.00108	No	V	0.05	0
CR31-004	05F0140-005	C-1	Heptachlorodibenzo-p-dioxin	0.00509	Yes	V	0.001	0.00000509
CR31-004	05F0140-005	C-1	OCDD	0.0306	Yes	V	0.0001	0.00000306
CR31-004	05F0140-005	C-1	OCDF	0.00128	Yes	V	0.0001	0.000000128
CR31-004	05F0140-005	C-1	Pentachlorodibenzo-p-dioxin	0.00271	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0140-005:[c]								**0.000016348**
CR31-004	05F0140-006	C-1	1234678-HpCDF	0.00158	Yes	V	0.01	0.0000158
CR31-004	05F0140-006	C-1	1234789-HpCDF	0.00226	No	V	0.01	0
CR31-004	05F0140-006	C-1	123478-HxCDD	0.00226	No	V	0.5	0
CR31-004	05F0140-006	C-1	123478-HxCDF	0.00127	Yes	V	0.1	0.000127
CR31-004	05F0140-006	C-1	123678-HxCDD	0.00226	No	V	0.01	0
CR31-004	05F0140-006	C-1	123678-HxCDF	0.000562	Yes	V	0.1	0.0000562
CR31-004	05F0140-006	C-1	123789-HxCDD	0.00226	No	V	0.01	0
CR31-004	05F0140-006	C-1	123789-HxCDF	0.00226	No	V	0.1	0
CR31-004	05F0140-006	C-1	12378-PeCDF	0.00226	No	V	0.05	0
CR31-004	05F0140-006	C-1	234678-HxCDF	0.000781	Yes	V	0.1	0.0000781
CR31-004	05F0140-006	C-1	23478-PeCDF	0.00143	Yes	V	0.5	0.000715
CR31-004	05F0140-006	C-1	2378-TCDD	0.000904	No	V	1	0
CR31-004	05F0140-006	C-1	2378-TCDF	0.000904	No	V	0.05	0
CR31-004	05F0140-006	C-1	Heptachlorodibenzo-p-dioxin	0.00285	Yes	V	0.001	0.00000285
CR31-004	05F0140-006	C-1	OCDD	0.0133	Yes	V	0.0001	0.00000133
CR31-004	05F0140-006	C-1	OCDF	0.00176	Yes	V	0.0001	0.000000176
CR31-004	05F0140-006	C-1	Pentachlorodibenzo-p-dioxin	0.000372	Yes	V	1	0.000372
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0140-006:[c]								**0.001368456**
2,3,7,8-TCDD TEQ Concentration used in Sediment ESL Screen[c]:								**0.001368456**

[a]Toxicity Equivalency Factor (WHO, 1997).

[b]TEQ (Toxicity Equivalence) Concentration = Sediment Concentration x TEF. For non-detects, the TEQ Concentration equals zero.

[c]The TEQ concentration used in the ESL screen is the maximum of all sampling locations for the medium.

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Table 5.1

Hazard Quotient Evaluation of Surface Water ECOPCs in NW AEU

ECOPC	Units	ESL	Alternative Toxicity Value	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
				MDC	ESL-HQ	AT-HQ	EPC-95 UTL	ESL-HQ	AT-HQ	EPC-95 UCL	ESL-HQ	AT-HQ
Inorganics												
Aluminum-total	mg/L	0.75 (1)	N/A	442	**589**	--	30.4	**41**	--	20	**27**	--
Ammonia-unionized	mg/L	0.02	0.15	0.204	**10**	<1	0.0817	**4**	1	0.0338	**2**	<1
Cadmium-dissolved	mg/L	0.0043 (1)	0.0111 (1)	0.02	**5**	**2**	0.002	<1	<1	0.001	<1	<1
Cyanide-total	mg/L	0.0005	0.005	0.146	**292**	**29**	0.022	**44**	**4**	0.013	**26**	**3**
Lithium-total	mg/L	0.096	1.7	2.97	**31**	**2**	0.125	**1**	<1	0.121	**1**	<1
Silver-dissolved	mg/L	0.0015 (1)	0.0092 (1)	0.0324	**22**	**4**	0.003	**2**	<1	0.001	<1	<1
Vanadium-total	mg/L	0.012	0.22	0.892	**74**	**4**	0.068	**6**	<1	0.035	**3**	<1
Organics												
Aroclor-1254	ug/L	0.014	2.0	3.3	**236**	**2**	1.0	**71**	<1	0.732	**52**	<1
Radionuclides												
Radium-228	pCi/L	0.849	8.49	28	**33**	**3**	(28)	**33**	**3**	N/A	**31**	**3**

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

(1) A site-specific ESL was developed using site-specific water quality considerations of hardness (Attachment 5).

-- = Could not be calculated due to lack of EPC.

N/A = Not applicable or not appropriate.

Table 5.2

Hazard Quotient Evaluation of Surface Water ECOPCs Using a Post-1999 Data in NW AEU

ECOPC	Units	ESL	Alternative Toxicity Value	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
				MDC	ESL-HQ	AT-HQ	EPC-95 UTL	ESL-HQ	AT-HQ	EPC-95 UCL	ESL-HQ	AT-HQ
Inorganics												
Aluminum-total	mg/L	0.75 (1)	N/A	217	**289**	--	47.6	**63**	--	23.4	**31**	--
Ammonia	mg/L	0.02	0.15	N/A	--	--	N/A	--	--	N/A	--	--
Cadmium-dissolved	mg/L	0.0043 (1)	0.0111 (1)	0.002	<1	<1	0.00021	<1	<1	0.000137	<1	<1
Cyanide-total	mg/L	0.0005	0.005	N/A	--	--	N/A	--	--	N/A	--	--
Lithium-total	mg/L	0.096	1.7	0.499	**5**	<1	0.088	<1	<1	0.047	<1	<1
Silver-dissolved	mg/L	0.0015 (1)	0.0092 (1)	0.032	**21**	**3**	0.000175	<1	<1	0.001	<1	<1
Vanadium-total	mg/L	0.012	0.22	0.434	**36**	**2**	0.084	**7**	<1	0.047	**4**	<1
Organics												
Aroclor-1254	ug/L	0.014	2	0.7	**50**	<1	(0.7)	**50**	<1	0.394	**28**	<1
Radionuclides												
Radium-228	pCi/L	0.849	8.49	N/A	--	--	N/A	--	--	N/A	--	--

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

(1) A site-specific ESL was developed using site-specific water quality considerations of hardness (Attachment 5).

-- = Could not be calculated due to lack of EPC.

N/A = Not applicable or not appropriate.

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Table 5.3
Hazard Quotient Evaluation of Sediment ECOPCs in NW AEU

ECOPC	ESL	Alternative Toxicity Value	Units	MDC EPC Hazard Quotients			95UTL EPC Hazard Quotients			95UCL Hazard Quotients		
				MDC	ESL-HQ	AT-HQ	EPC-95UTL	ESL-HQ	AT-HQ	EPC-95UCL	ESL-HQ	AT-HQ
Inorganics												
Aluminum	15,900	58,000	mg/kg	49,000	**3**	<1	25,800	<1	<1	13,471	<1	<1
Antimony	2	3.2	mg/kg	41.4	**21**	**13**	26.3	**13**	**8**	10.3	**5**	3
Barium	189	287	mg/kg	390	**2**	**1**	227	<1	<1	139	<1	<1
Cadmium	0.99	4.98	mg/kg	8.3	**8**	**2**	2	<1	<1	1.3	**1**	<1
Copper	31.6	149	mg/kg	77.6	**2**	<1	32	<1	<1	20	<1	<1
Fluoride	0.01	7	mg/kg	16.7	**1,672**	**2**	(16.7)	**1672**	**2**	4.7	**469**	<1
Iron	20,000	280,000	mg/kg	55,000	**3**	<1	26,000	**1**	<1	17,778	<1	<1
Lead	35.8	128	mg/kg	234	**7**	**2**	40.6	**1**	<1	33	<1	<1
Manganese	630	1700	mg/kg	1,760	**3**	**1**	848	**1**	<1	488	<1	<1
Mercury	0.18	1.06	mg/kg	0.47	**3**	<1	0.22	**1**	<1	0.12	<1	<1
Nickel	22.7	48.6	mg/kg	34	**1**	<1	25.0	**1**	<1	16	<1	<1
Selenium	0.95	1.73	mg/kg	2.4	**3**	**1**	1.8	**2**	**1**	0.8	<1	<1
Silver	1	1.6	mg/kg	5	**5**	**3**	1.8	**2**	**1**	1.2	**1**	<1
Zinc	121	459	mg/kg	704	**6**	**2**	250	**2**	<1	131	**1**	<1
Organics												
2-Methylnaphthalene	20.2	201	ug/kg	2,000	**99**	**10**	850	**42**	**4**	506	**25**	**3**
4,4'-DDT	4.16	62.9	ug/kg	4.9	**1**	<1	(4.9)	**1**	<1	(4.9)	**1**	<1
Acenaphthene	6.71	89	ug/kg	620	**92**	**7**	495	**74**	**6**	315	**47**	**4**
Anthracene	57.2	845	ug/kg	970	**17**	**1**	495	**9**	<1	316	**6**	<1
Aroclor-1254	60	300	ug/kg	5,200	**87**	**17**	350	**6**	**1**	435	**7**	**1**
Atrazine	16.8	230	ug/kg	120	**7**	<1	N/A	--	--	N/A	--	--
Benzo(a)anthracene	108	1,050	ug/kg	1,400	**13**	**1**	880	**8**	<1	444	**4**	<1
Benzo(a)pyrene	150	1,450	ug/kg	1,300	**9**	<1	920	**6**	<1	464	**3**	<1
Benzo(g,h,i)perylene	13	280	ug/kg	900	**69**	**3**	800	**62**	**3**	438	**34**	**2**
Benzo(k)fluoranthene	240	750	ug/kg	1,200	**5**	**2**	850	**4**	**1**	458	**2**	<1
Carbazole	25.2	1,600	ug/kg	300	**12**	<1	(300)	**12**	<1	279	**11**	<1
Chrysene	166	1,290	ug/kg	1,500	**9**	**1**	818	**5**	<1	379	**2**	<1
Dibenz(a,h)anthracene	33	240	ug/kg	330	**10**	**1**	(330)	**10**	**1**	(330)	**10**	**1**
Fluoranthene	423	2,230	ug/kg	3,100	**7**	**1**	1272	**3**	<1	586	**1**	<1
Fluorene	77.4	536	ug/kg	650	**8**	**1**	(650)	**8**	**1**	453	**6**	<1
Indeno(1,2,3-cd)pyrene	17	250	ug/kg	890	**52**	**4**	800	**47**	**3**	429	**25**	**2**
Naphthalene	176	561	ug/kg	320	**2**	<1	(320)	**2**	<1	(320)	**2**	<1
Phenanthrene	204	1,170	ug/kg	3,300	**16**	**3**	1,500	**7**	**1**	642	**3**	<1
Pyrene	195	1,520	ug/kg	3,900	**20**	**3**	1,500	**8**	<1	740	**4**	<1
TEQ Dioxins	0.00085	0.0215	ug/kg	0.0073	**9**	<1	1.57	**1,847**	**73**	1	**768**	**30**
Total PAHs	1,610	22,800	ug/kg	22,800	**14**	**1**	12,493	**8**	<1	7,466	**5**	<1
Total PCBs	40	676	ug/kg	5,200	**130**	**8**	350	**9**	<1	435	**11**	<1

95UCLs based on proxy values which include NDs at 1/2 DL.
Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.
HQ = Hazard Quotient, rounded to nearest whole number.
Values in bold indicate HQs > 1.
N/A = Not applicable or not appropriate.
-- = Could not be calculated due to lack of EPC.

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Table 5.4

Hazard Quotient Evaluation of Surface Sediment ECOPCs in NW AEU

ECOPC	ESL	Alternative Toxicity Value	Units	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95UCL Hazard Quotients		
				MDC	ESL-HQ	AT-HQ	EPC-95UTL	ESL-HQ	AT-HQ	EPC-95UCL	ESL-HQ	AT-HQ
Inorganics												
Aluminum	15,900	58,000	mg/kg	26,000	**2**	<1	25,000	**2**	<1	12,891	<1	<1
Antimony	2	3.2	mg/kg	41.4	**20**	**13**	9.6	**5**	**3**	8.4	**4**	**3**
Barium	189	287	mg/kg	260	**1**	<1	212	**1**	<1	130	<1	<1
Cadmium	0.99	4.98	mg/kg	4.4	**4**	<1	1.65	**2**	<1	1.1	**1**	<1
Copper	31.6	149	mg/kg	77.6	**2**	<1	28.4	<1	<1	19.8	<1	<1
Fluoride	0.01	7	mg/kg	16.72	**1,672**	**2**	16.7	**1,670**	**2**	4.69	**469**	<1
Iron	20,000	280,000	mg/kg	37,100	**2**	<1	25,226	**1**	<1	17,040	<1	<1
Lead	35.8	128	mg/kg	234	**7**	**2**	41	**1**	<1	38	**1**	<1
Manganese	630	1,700	mg/kg	1,760	**3**	**1**	839	**1**	<1	433	<1	<1
Mercury	0.18	1.06	mg/kg	0.26	1	<1	0.16	<1	<1	0.094	<1	<1
Nickel	22.7	48.6	mg/kg	31.6	**1**	<1	24.2	**1.1**	<1	15.6	<1	<1
Selenium	0.95	1.73	mg/kg	2.4	**3**	**1**	1.8	**2**	**1**	0.842	<1	<1
Silver	1	1.6	mg/kg	5	**5**	**3**	1.9	**2**	**1**	1.41	**1**	<1
Zinc	121	459	mg/kg	704	**6**	**2**	318	**3**	1	158	**1**	<1
Organics												
2-Methylnaphthalene	20.2	201	ug/kg	2,000	**99**	**10**	1,350	**67**	**7**	580	**29**	**3**
4,4'-DDT	4.16	62.9	ug/kg	4.9	**1**	<1	4.9	**1**	<1	(4.9)	**1**	<1
Acenaphthene	6.71	89	ug/kg	620	**92**	**7**	620	**92**	**7**	337	**50**	**4**
Anthracene	57.2	845	ug/kg	970	**17**	**1**	970	**17**	**1**	355	**6**	<1
Aroclor-1254	60	300	ug/kg	920	**15**	**3**	920	**15**	**3**	235	**4**	<1
Atrazine	16.8	230	ug/kg	N/A	--	--	N/A	--	--	N/A	--	--
Benzo(a)anthracene	108	1,050	ug/kg	1,400	**13**	**1**	1,400	**13**	**1**	383	**4**	<1
Benzo(a)pyrene	150	1,450	ug/kg	1,300	**9**	<1	1,300	**9**	<1	439	**3**	<1
Benzo(g,h,i)perylene	13	280	ug/kg	900	**69**	**3**	900	**69**	**3**	473	**36**	**2**
Benzo(k)fluoranthene	240	750	ug/kg	1,200	**5**	**2**	1,200	**5**	**2**	507	**2**	<1
Carbazole	25.2	1,600	ug/kg	300	**12**	<1	300	**12**	<1	296	**12**	<1
Chrysene	166	1,290	ug/kg	1,500	**9**	**1**	1,500	**9**	**1**	432	**3**	<1
Dibenz(a,h)anthracene	33	240	ug/kg	330	**10**	**1**	330	**10**	**1**	(330)	**10**	-1
Fluoranthene	423	2,230	ug/kg	3,100	**7**	**1**	3,100	**7**	**1**	650	**2**	<1
Fluorene	77.4	536	ug/kg	650	**8**	**1**	650	**8**	**1**	484	**6**	<1
Indeno(1,2,3-cd)pyrene	17	250	ug/kg	890	**52**	**4**	890	**52**	**4**	466	**27**	**2**
Naphthalene	176	561	ug/kg	310	**2**	<1	310	**2**	<1	(310)	**2**	<1
Phenanthrene	204	1,170	ug/kg	3,300	**16**	**3**	3,300	**16**	**3**	559	**3**	<1
Pyrene	195	1,520	ug/kg	3,900	**20**	**3**	3,900	**20**	**3**	885	**5**	<1
TEQ Dioxins	0.00085	0.022	ug/kg	0.0073	**9**	<1	0.0073	**9**	<1	N/A	--	--
Total PAHs	1,610	22,800	ug/kg	20,310	**13**	<1	20,310	**13**	<1	8,695	**5**	<1
Total PCBs	40	676	ug/kg	130	**3**	<1	(130)	**3**	<1	(130)	**3**	<1

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

N/A = Not applicable or not appropriate.

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Table 5.5
Frequency and Magnitude of Aquatic Receptor HQs for NW AEU Surface Water and Sediment ECOPCs

ECOPC and Media	Number of Samples	HQs				Frequency of Detected Exceedances
		<= 1	> 1 - 5	> 5 - 10	> 10	
Surface Water ECOPCs						
Inorganic						
Aluminum-total	674	243 (30)	123	85	193	57%
Ammonia-unionized	205	5 (16)	14 (48)	5	115 (2)	37%
Cadmium-dissolved	533	122 (311)	0	0	0	2%
Cyanide-total	148	1 (6)	1 (37)	7 (48)	16 (12)	16%
Lithium-total	592	491 (42)	49	1	9	10%
Silver-dissolved	529	23 (398)	23 (85)	0	0	4%
Vanadium-total	675	235 (196)	175 (3)	46	20	34%
Organic						
Aroclor-1254	119	0	0	0 (5)	6 (108)	5%
Radionuclide						
Radium-228	3	0	0	0	3	100%
Sediment ECOPCs						
Inorganic						
Aluminum	111	83	28	0	0	25%
Antimony	98	7 (53)	0 (23)	1 (7)	7	8%
Barium	111	89	22	0	0	20%
Cadmium	110	30 (59)	17 (3)	1	0	16%
Copper	111	102 (2)	7	0	0	6%
Fluoride	21	0	0	0	12 (9)	57%
Iron	111	83	28	0	0	25%
Lead	111	99	11	1	0	11%
Manganese	111	101	10	0	0	9%
Mercury	102	35 (8)	0 (86)	0	0	8%
Nickel	111	88 (9)	14	0	0	13%
Selenium	110	12 (77)	17 (4)	0	0	15%
Silver	106	9 (74)	7 (16)	0	0	7%
Zinc	111	77	32	2	0	31%
Organic						
2-Methylnaphthalene	104	0	4	2	1 (97)	7%

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Table 5.5
Frequency and Magnitude of Aquatic Receptor HQs for NW AEU Surface Water and Sediment ECOPCs

ECOPC and Media	Number of Samples	HQs				Frequency of Detected Exceedances
		<=1	> 1 - 5	> 5 - 10	> 10	
4,4'-DDT	79	2 (21)	2 (50)	0 (2)	0 (2)	3%
Acenaphthene	104	0	3	10	12 (79)	24%
Anthracene	104	12	22 (44)	4 (17)	2 (3)	27%
Aroclor-1254	124	10 (27)	16 (54)	3 (7)	5 (2)	19%
Atrazine	1	0	0	1	0	100%
Benzo(a)anthracene	104	24	31 (37)	4 (3)	2 (3)	36%
Benzo(a)pyrene	104	24	23 (47)	4 (5)	0 (5)	26%
Benzo(g,h,i)perylene	104	0	5	9	19 (71)	32%
Benzo(k)fluoranthene	104	26 (27)	12 (36)	0 (3)	0	12%
Carbazole	30	1	8	3 (14)	1 (3)	40%
Chrysene	104	35	31 (29)	4 (4)	0	34%
Dibenz(a,h)anthracene	104	0	4	2 (66)	0 (32)	6%
Fluoranthene	104	47 (21)	25 (8)	3	0	27%
Fluorene	104	8	7 (64)	2 (16)	0 (7)	9%
Indeno(1,2,3-cd)pyrene	104	0	9	13	14 (68)	35%
Naphthalene	106	7 (9)	3 (87)	0	0	3%
Phenanthrene	104	36 (3)	26 (28)	6 (3)	2	33%
Pyrene	104	26 (3)	32 (30)	6 (4)	3	39%
TEQ Dioxins	4	3	0	1	0	25%
Total PAHs	106	0	8	9	63	68%
Total PCBs	119 (113)	6	0	0	0	0%

Samples below detection limits are in parentheses.

Risk Conclusions for this LOE:

None = Sample concentrations do not exceed the ESL.

Low = Low potential for Risk. Detected concentrations only exceed the ESL by low magnitude (HQs < 5) or exceedances

Retained = Potential for risk could not be excluded and further evaluation is required; Detected HQs > 5 and exceedances

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Table 5.6
Summary of Other/Drainage Lines of Evidence for the NW AEU

Line of Evidence Category and	Summary of Results	Uncertainty	Conclusions
Tissues Analysis			
Stiger, 1994	PCB in the A-Series Ponds decrease downstream to where no PCBs were detected in Pond A-4. It is unlikely that sediments from RFETS would contribute PCBs to offsite reservoirs. In the A- and B- Series Ponds, four types of whole body tissues were analyzed: large mouth bass (40-58 ug/kg), fathead minnows (14-479 ug/kg), tiger salamanders (26-134 ug/kg), and crayfish (BDL-9.5 ug/kg). For the A-Series Ponds no consistent trends were observed for bioaccumulation.	The time period from which this study was completed represents an historic condition associated with RFETS.	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. It is likely that any current or future bioaccumulation associated with PCBs left in place within the AEU would reflect those results observed from this study.
DOE, 1996	Concentrations of Aroclor-1254 ranged from BDL to average concentrations of 17 ug/kg for fathead minnows in Pond A-4, to 73 ug/kg in fathead minnows in Pond A-5. The highest concentrations in tissues were not detected in samples from the ponds with the highest sediment concentrations. Largemouth bass in Pond A-2 had a BSF of 0.6. The sediments within the upper 15 cm had generally lower PCB concentrations than the deeper sediments, suggesting a lower risk to aquatic life than indicated by the earlier data.	The time period from which this study was completed represents an historic condition associated with RFETS.	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. It is likely that any current or future bioaccumulation associated with PCBs left in place within the AEU would reflect those results observed from this study. Results occur at levels below tissue-effect thresholds (400 ug/kg) for aquatic life.
Aquatic Population Studies			
Ebasco, 1992	Nine species of fish were collected at RFETS; most in the *Cyprinidae* (minnow) family (6 species). Several ponds had very high populations of golden shiners and fathead minnows. Many aquatic organisms that are classified as "tolerant" were present. Two species of fish were collected from the A-Series Ponds, fathead minnow and golden shiner.	The time period from which this study was completed represents an historic condition associated with RFETS. The flows of water into and out of certain ponds have been altered. Therefore, the results of current conditions are likely different from those described within the study.	Aquatic habitats at RFETS have a high density of benthic macroinvertebrates. Fish species diversity in is naturally low, due to the harsh environmental conditions (e.g, intermittent streams). Most species were found in pools that offer refuge from drought conditions. The most disruptive factor to aquatic communities is the natural semiarid conditions.

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Table 5.6

Summary of Other/Drainage Lines of Evidence for the NW AEU

Line of Evidence Category and	Summary of Results	Uncertainty	Conclusions
DOE, 1996	A total of 81 taxa were identified in the pond benthos samples. Ponds A-1 and A-3 had the least pollution-tolerant communities of all ponds, including the D-Series Reference Ponds. Ponds A-2 and B-2 had the most pollution-tolerant communities. Ponds D-1 and D-2 (reference ponds) exhibited a wide range of community characteristics including the second lowest (Pond D-1) and highest (Pond D-2) diversity values. Data indicates that Pond A-4 may have been under the most persistent stress. Oligochaetes and dipterans were the dominant taxa from habitats with high physical variability. The highly variable environmental (physicochemical) conditions at RFETS may account for the dominance of these organisms.	The time period from which this study was completed represents an historic condition associated with RFETS.	The populations measured in this study were comparable to reference conditions, and better in certain cases. It appears that the benthic macroinvertebrate populations studied within the A-Series Ponds are typical of what this watershed would be able to sustain and are not limited by chemical stressors.
Exponent, 1998	Aquatic life in Walnut Creek is limited by stream flow, which has been modified from natural flow conditions. The findings indicated good habitat and a relatively healthy macroinvertebrate community, which typically equates to good water quality. There are no indications that pollution is limiting aquatic life. The species are controlled by the intermittent flows.	The findings of this study describe the aquatic condition within the lower portions of the Walnut Creek watershed. They do not reflect conditions within RFETS, but rather the conditions just inside the boundary, to off-site downgradient areas. In addition, findings reflect one sampling event in the spring of 1998.	This study provides more evidence that RFETS aquatic communities in lower Walnut Creek are limited by physical conditions of the streams and ponds due to very limited or manipulated flows. Water management onsite and the general arid conditions of the stream types found in the general area control the types of aquatic communities that are possible.
Aquatic Assoc., 1998	Seven study sites along Big Dry Creek identified a total of 17 species of fish. Nine species of fish were native. In a recent inventory of streams in the Front Range and eastern plains streams conducted by the CDOW, most were classified as either abundant or common. The aquatic community of Big Dry Creek was represented by 18 orders of macroinvertebrates including a total of 113 taxa.	Streams at RFETS may be more limited by flows than Big Dry Creek, which receives perennial flows from Standley Reservoir. Fish populations may be more limited by flow at RFETS and make comparisons somewhat uncertain. The study of Big Dry Creek represents only one year of aquatic community data. Additionally, Big Dry Creek is influenced by adjacent real estate development and changing stormwater conditions.	Conclusions suggested a low risk for most native fish species. Streams at RFETS are the same stream type, Transitional foothills-plains, as the upper portion of Big Dry Creek. Comparisons can be made to the aquatic health to Woman and Walnut Creeks and further emphasize that the limiting factors for aquatic systems in the Transitional foothills-plains stream type is habitat availability and limited flows.

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Table 5.6

Summary of Other/Drainage Lines of Evidence for the NW AEU

Line of Evidence Category and	Summary of Results	Uncertainty	Conclusions
Kaiser-Hill, 1999; 2000, and 2001	Fish surveys in streams/ponds were completed over three years to determine whether previously recorded fish species were still present. Fathead minnow (*Pimephales promelas*) were captured in all drainages. With the exception of bass, all fish species from the baseline study were observed again and found in the same general locations as they were in 1992.	This survey was conducted during drought conditions. No analysis is presented on the abundance of fish over time. A declining trend in fish abundance could indicate chemical stressors or declining habitat conditions. Trends in relative abundance are unknown for RFETS streams and ponds.	These studies indicate that all the RFETS streams are intermittent and illustrate that perennial flows and better aquatic habitats occur in the upper reaches. It is unrealistic to expect that vibrant aquatic communities, especially fish communities, can occur in the lower reaches. Overall, fish species richness is very low.
Aquatic Assoc., 2003	Streams at RFETS are flow limited. In the effluent-dominated reach of Upper Walnut Creek and the discharge dependent lower section of Walnut Creek, poor bank stability and sediment inputs to the stream are the main problems that negatively affect habitat and aquatic life. The macroinvertebrate community across all drainages was rich and diverse, comprised of hardy and tolerant species. The dominant organisms were similar in each drainage, with dipterans most abundant in Walnut Creek. *Ephemeroptera* were abundant and included moderate to tolerant taxa. Trichoptera (*caddisflies*) in Walnut Creek were generally present in higher numbers compared to other RFETS drainages, likely due to the effluent-dominated flows. *Amphipods* are also found in higher numbers in Walnut Creek, found in the slower moving or standing water environments provided by the ponds.	This study did not sample the detention ponds. The RBP methods are not intended to sample large ponds. Therefore, conclusions about the aquatic health of the ponds cannot be made without some uncertainty. Only one sampling location was established in North Walnut Creek and was located above the A-series ponds. This greatly limits discussion of aquatic health in North Walnut Creek.	Fish are limited due to the obvious lack of permanent water. The macroinvertebrate community across all drainages was rich and diverse, and comprised of hardy and tolerant species. Within Walnut Creeks, past studies provide evidence that aquatic communities persist through time and are comparable to other communities found on site and in other areas within the region. The manipulated nature of ponds and streams obviously precludes the establishment of viable fish populations. Macroinvertebrate populations appear not as affected due to their ability to re-colonize newly inundated habitats and their comparatively shorter life cycles. Macroinvertebrate communities in Walnut Creek are similar to those found in Rock Creek.

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Table 5.6
Summary of Other/Drainage Lines of Evidence for the NW AEU

Line of Evidence Category and	Summary of Results	Uncertainty	Conclusions
WWE, Inc., 2003	This study developed an understanding of the factors influencing aquatic life in Big Dry Creek and to determine if a more stringent unionized ammonia standard was necessary to protect the Johnny darter (*Etheostoma nigrum*). The levels of unionized ammonia concentrations did not appear to be affecting the fish or macroinvertebrate communities. Upper reaches of the creek have higher quality fish and benthic communities than downstream locations. This is mainly attributed by the effects of flow and associated parameters on the health of aquatic communities.	Although the conditions of a transitional foothills-plains stream is illustrated in this memorandum, the conditions of lower sections of streams at RFETS compared to conditions in Big Dry Creek is different. Flows on RFETS decrease with downstream locations to the point where water disappears. Flows increase in downstream locations along Big Dry Creek. This physical limitation at RFETS is the overriding limitation on aquatic communities.	Big Dry Creek illustrates many of the conditions seen at RFETS. Stream habitat quality and corresponding benthic and fish communities are higher and healthier in the upper reaches of streams compared to lower sections. Water entering into the Big Dry Creek drainage via Walnut and Woman Creeks is of good quality albeit influenced by the large buffering affect of Standley Reservoir and Great Western Reservoir. Not until greater flows occur and runoff is received from surrounding urban land uses that the negative affects of flows including increased TSS is observed.
Bioassay Analysis			
DOE, 1996	Sediment bioassay tests indicated no toxicity associated with sediments gathered from the A-Series Ponds. Results of the bioassay tests do not reflect the high levels of toxicity indicated by HQs and HIs, especially in Pond A-1.	The time period from which this study was completed represents an historic condition associated with RFETS.	Tests indicated no toxicity associated with sediments gathered from the A-Series Ponds. The results of the bioassays did not correlate to predicted toxicity associated with chemicals of concern using standard ecological risk tools of hazard quotient and hazard index assessment.
Waterfowl/Wading Bird Evaluations			
Stiger, 1994	Results of the deer mice and vole tissue analysis revealed that no PCBs were detected in any of the small mammal tissue samples (whole body) collected from around Ponds A-1 and A-3. Comparison to PCB food threshold values for birds revealed that PCB levels in fish do not exceed food concentration threshold values prescribed by DOE. These results suggest that PCBs have not bioaccumulated up the food chain further than the fish species collected at RFETS and that both the PMJM and predatory birds are not threatened with PCB contamination from RFETS.	The time period from which this study was completed represents an historic condition associated with RFETS.	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. It is likely that any current or future bioaccumulation associated with PCBs left in place within the AEU would mimic those results observed from this study. Therefore, the risk potential attributable to PCBs as related to bioaccumulation would be low. This indicates that receptors such as wading birds and waterfowl that are exposed via ingestion of potentially contaminated prey are at minimal risk in regards to PCBs.

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Table 5.6
Summary of Other/Drainage Lines of Evidence for the NW AEU

Line of Evidence Category and	Summary of Results	Uncertainty	Conclusions
DOE, 1996	Results of the exposure estimation indicated potential significant risk to the great blue heron attributable to the ponds. Di-n-butylphthalate was identified as being of potential concern within the A-Series Ponds.	The co-located sediment, surface water and biota analysis completed for this study, represent a set of historic conditions. It is unlikely that current conditions would be comparable. This study likely represents worst-case conditions given that the analysis was completed pre-accelerated action.	The results of this study provide a screening measure of potential chemicals of concern to wading birds and waterfowl. The results were compared to this CRA ECOPC risk characterization process. If for instance, di-n-butylphthalate were identified in this CRA as being a risk issue, the information from this study would provide a line of evidence for those chemicals in particular.
Chemical Loading Analysis			
DOE, 2004	Site-wide surface water studies are routinely completed by DOE in order to understand chemical loading and release to offsite areas. These efforts involve significant amounts of sampling and interpretation for a given objective. The information gained from these studies helped to identify if a given ECOPC would demonstrate source-related release patterns (increased load downgradient of a source), or whether a given ECOPC demonstrates a pattern representative of background conditions (thus, not source related).	The data were collected for a defined purpose not necessarily in-line with ecological risk assessment needs. Loading analysis serves to identify sources and chemical patterns. The information does not always lend itself to toxicological interpretation.	The results from this document were summarized by ECOPC and are provided in the professional judgment section of the CRA (Attachment 4).

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Table 5.7

Hazard Quotient Evaluation of Surface Water ECOPCs in SW AEU

ECOPC	Units	ESL	Alternative Toxicity Value	n	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
					MDC	ESL-HQ	AT-HQ	EPC-95 UTL	ESL-HQ	AT-HQ	EPC-95 UCL	ESL-HQ	AT-HQ
Inorganics													
Ammonia-unionized	mg/L	0.02	0.165	2,581	0.78	**39**	**5**	0.368	**18**	**2**	0.136	**7**	**2**
Cadmium-dissolved	mg/L	0.0038 (1)	0.0092 (1)	1,113	0.0305	**8**	**3**	0.002	**1**	<1	0.002	<1	<1
Cyanide-total	mg/L	0.0005	0.005	179	0.061	**122**	**12**	0.01	**20**	**2**	0.008	**16**	**2**
Silver-dissolved	mg/L	0.0011 (1)	0.0069 (1)	1,286	0.0332	**30**	**5**	0.002	**2**	<1	0.001	<1	<1
Organics													
4,4-DDT	ug/L	0.001	0.55	72	0.58	**580**	**1**	0.15	**150**	<1	0.081	**81**	<1

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number

Values in bold indicate HQs > 1

(1) A site-specific ESL was developed using site-specific water quality considerations of hardness (Attachment 5).

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Table 5.8

Hazard Quotient Evaluation of Surface Water ECOPCs using Post-1999 Data in SW AEU

				MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
ECOPC	Units	ESL	Alternative Toxicity Value	MDC	ESL-HQ	AT-HQ	EPC-95 UTL	ESL-HQ	AT-HQ	EPC-95 UCL	ESL-HQ	AT-HQ
Inorganics												
Ammonia-unionized	mg/L	0.02	0.165	0.3276	**16**	**2**	0.09984	**5**	1	0.038	**2**	<1
Cadmium-dissolved	mg/L	0.0038 (1)	0.0092 (1)	0.0021	<1	<1	0.00049	<1	<1	0.00024	<1	<1
Cyanide-total	mg/L	0.0005	0.005	0.0365	**73**	**7**	0.037	**74**	**7**	N/A	--	--
Silver-dissolved	mg/L	0.0011 (1)	0.0069 (1)	0.00075	<1	<1	0.000165	<1	<1	0.00012	<1	<1
Organics												
4,4-DDT	ug/L	0.001	0.55	N/A	--	--	N/A	--	--	N/A	--	--

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number

Values in bold indicate HQs > 1

(1) A site-specific ESL was developed using site-specific water quality considerations of hardness (Attachment 5).

N/A = Not applicable or not appropriate.

-- = Could not be calculated due to lack of EPC.

Table 5.9

Hazard Quotient Evaluation of Sediment ECOPCs in SW AEU

ECOPC	ESL	Alternative Toxicity Value	Units	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
				MDC	ESL-HQ	AT-HQ	EPC-95UTL	ESL-HQ	AT-HQ	EPC-95UCL	ESL-HQ	AT-HQ
Inorganics												
Aluminum	15,900	58,000	mg/kg	29,000	**2**	<1	21,000	**1**	<1	11,820	<1	<1
Antimony	2	3.2	mg/kg	26	**13**	**8**	10	**5**	**3**	6	**3**	**2**
Barium	189	287	mg/kg	240	**1**	<1	194	**1**	<1	124	<1	<1
Cadmium	0.99	4.98	mg/kg	44	**44**	**9**	1.9	**2**	<1	3	**3**	<1
Copper	31.6	149	mg/kg	324	**10**	**2**	38	**1**	<1	32	**1**	<1
Fluoride	0.01	7	mg/kg	9.3	**927**	**1**	9.3	**927**	**1**	5	**532**	<1
Lead	35.8	128	mg/kg	170	**5**	**1**	66.1	**2**	<1	33	<1	<1
Silver	1	1.6	mg/kg	3,100	**3,100**	**1,938**	7.4	**7**	**5**	184	**184**	**115**
Zinc	121	459	mg/kg	888	**7**	**2**	507	**4**	**1**	231	**2**	<1
Organics												
Acenaphthene	6.71	89	ug/kg	180	**27**	**2**	(180)	**58**	**4**	(180)	**27**	**2**
Anthracene	57.2	845	ug/kg	430	**8**	<1	420	**7**	<1	275	**5**	<1
Aroclor-1254	60	300	ug/kg	3,100	**52**	**10**	630	**11**	**2**	423	**7**	**1**
Aroclor-1260	5	200	ug/kg	2,000	**400**	**10**	205	**41**	**1**	207	**41**	**1**
Benzo(a)anthracene	108	1,050	ug/kg	1,400	**13**	**1**	820	**8**	<1	430	**4**	<1
Benzo(a)pyrene	150	1,450	ug/kg	1,300	**9**	<1	810	**5**	<1	458	**3**	<1
Benzo(g,h,i)perylene	13	280	ug/kg	1,100	**85**	**4**	730	**56**	**3**	434	**33**	**2**
Benzo(k)fluoranthene	240	750	ug/kg	920	**4**	**1**	900	**4**	**1**	448	**2**	<1
Bromomethane	3.43	62.72	ug/kg	5	**1**	<1	(5)	**3**	<1	(5)	<1	<1
Carbazole	25.2	1,600	ug/kg	290	**12**	<1	(290)	**14**	<1	224	**9**	<1
Chrysene	166	1,290	ug/kg	1,400	**8**	**1**	850	**5**	<1	383	**2**	<1
Dibenz(a,h)anthracene	33	240	ug/kg	360	**11**	**2**	(360)	**21**	**3**	(360)	**11**	**2**
Fluoranthene	423	2,230	ug/kg	2,700	**6**	**1**	1,400	**3**	<1	900	**2**	<1
Fluorene	77.4	536	ug/kg	180	**2**	<1	(180)	**9**	1	(180)	**2**	<1
Indeno(1,2,3-cd)pyrene	17	250	ug/kg	910	**54**	**4**	700	**41**	**3**	409	**24**	**2**
Phenanthrene	204	1,170	ug/kg	1,800	**9**	**2**	966	**5**	<1	457	**2**	<1
Pyrene	195	1,520	ug/kg	1,700	**9**	**1**	1,200	**6**	<1	655	**3**	<1
Total PAHs	1,610	22,800	ug/kg	23,400	**15**	**1**	8,624	**5**	<1	4,974	**3**	<1
Total PCBs	40	676	ug/kg	3,700	**93**	**5**	745	**19**	**1**	623	**16**	<1

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

N/A = Not applicable or not appropriate.

-- = Could not be calculated due to lack of EPC.

Table 5.10
Hazard Quotient Evaluation of Surface Sediment ECOPCs in SW AEU

ECOPC	ESL	Alternative Toxicity Value	Units	MDC EPC Hazard Quotients		
				MDC	ESL-HQ	AT-HQ
Inorganics						
Aluminum	15,900	58,000	mg/kg	29,000	**2**	<1
Antimony	2	3.2	mg/kg	16	**8**	**5**
Barium	189	287	mg/kg	220	**1**	<1
Cadmium	0.99	4.98	mg/kg	6	**6**	**1**
Copper	31.6	149	mg/kg	324	**10**	**2**
Fluoride	0.01	7	mg/kg	9	**927**	**1**
Lead	35.8	128	mg/kg	170	**5**	**1**
Silver	1	1.6	mg/kg	39	**39**	**24**
Zinc	121	459	mg/kg	888	**7**	**2**
Organics						
Acenaphthene	6.71	89	ug/kg	180	**27**	**2**
Anthracene	57.2	845	ug/kg	430	**8**	<1
Aroclor-1254	60	300	ug/kg	1,700	**28**	**6**
Aroclor-1260	5	200	ug/kg	2,000	**400**	**10**
Benzo(a)anthracene	108	1,050	ug/kg	1,400	**13**	**1**
Benzo(a)pyrene	150	1,450	ug/kg	1,300	**9**	<1
Benzo(g,h,i)perylene	13	280	ug/kg	1,100	**85**	**4**
Benzo(k)fluoranthene	240	750	ug/kg	920	**4**	**1**
Bromomethane	3.43	62.72	ug/kg	5	**1**	<1
Carbazole	25.2	1,600	ug/kg	290	**12**	<1
Chrysene	166	1,290	ug/kg	1,400	**8**	**1**
Dibenz(a,h)anthracene	33	240	ug/kg	360	**11**	**2**
Fluoranthene	423	2,230	ug/kg	2,700	**6**	**1**
Fluorene	77.4	536	ug/kg	180	**2**	<1
Indeno(1,2,3-cd)pyrene	17	250	ug/kg	910	**54**	**4**
Phenanthrene	204	1,170	ug/kg	1,800	**9**	**2**
Pyrene	195	1,520	ug/kg	1,700	**9**	**1**
Total PAHs	1,610	22,800	ug/kg	15,880	**10**	1
Total PCBs	40	676	ug/kg	220	**6**	**<1**

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95
HQ = Hazard Quotient, rounded to nearest whole number.
Values in bold indicate HQs > 1.
N/A = Not applicable or not appropriate.

Table 5.11
Frequency and Magnitude of Aquatic Receptor HQs for SW AEU Surface Water and Sediment ECOPCs

ECOPC and Media	Number of Samples	HQs				Frequency of Detected Exceedances
		<=1	> 1 - 5	> 5 - 10	> 10	
Surface Water ECOPCs						
Inorganic						
Ammonia-unionized	2,581	730 (220)	594 (1)	352	684	63%
Cadmium-dissolved	1,113	172 (941)	0	0	0	1%
Cyanide-total	179	0 (1)	0 (66)	9 (72)	10 (21)	11%
Silver-dissolved	1,286	44 (823)	22 (397)	0	0	2%
Organic						
4,4-DDT	72	0	0	0	5 (67)	7%
Sediment ECOPCs						
Inorganic						
Aluminum	126	105	21	0	0	17%
Antimony	118	14 (57)	10 (30)	1 (4)	2	11%
Barium	126	115	11	0	0	9%
Cadmium	126	39 (63)	21 (1)	1	1	18%
Copper	126	109 (6)	10	0	1	9%
Fluoride	16	0	0	0	8 (8)	50%
Lead	126	98	28	0	0	22%
Silver	124	8 (76)	15 (16)	2	7	19%
Zinc	126	66	54	6	0	48%
Organic						
Acenaphthene	83	0	1	4	7 (71)	14%
Anthracene	83	7	18 (45)	3 (8)	0 (2)	25%
Aroclor-1254	97	3 (28)	8 (41)	7 (2)	8	24%
Aroclor-1260	97	0 (35)	2 (54)	1 (3)	2	5%
Benzo(a)anthracene	83	16	27 (34)	2	2 (2)	37%
Benzo(a)pyrene	83	14	27 (37)	3 (1)	0 (1)	36%
Benzo(g,h,i)perylene	83	0	4	7	22 (50)	40%
Benzo(k)fluoranthene	83	25 (17)	16 (23)	0 (2)	0 (2)	19%
Bromomethane	80	5 (17)	1 (55)	0	0 (2)	1%
Carbazole	16	1	2	2 (9)	1 (1)	31%
Chrysene	83	19	30 (29)	3 (1)	0 (2)	40%
Dibenz(a,h)anthracene	83	1	10	2 (50)	1 (19)	16%
Fluoranthene	83	27 (3)	28 (26)	2 (2)	0	36%
Fluorene	83	5	5 (53)	0 (16)	0 (4)	6%
Indeno(1,2,3-cd)pyrene	83	0	11	10	16 (46)	45%
Phenanthrene	83	19 (10)	30 (20)	2 (2)	0	39%
Pyrene	83	13 (3)	32 (25)	8 (2)	0 (2)	48%
Total PAHs	103	1 (19)	6	4	48 (35)	50%
Total PCBs	70	1 (69)	0	0	0	0%

Samples below detection limits are in parentheses.

Risk Conclusions for this LOE:

None = Sample concentrations do not exceed the ESL.

Low = Low potential for Risk. Detected concentrations only exceed the ESL by low magnitude (HQs > 5) or exceedances >20%.

Retained = Potential for risk could not be excluded and further evaluation is required; Detected HQs > 5 and exceedances >20%.

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Table 5.12
Summary of Other/Drainage Lines of Evidence for the SW AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Tissues Analysis			
Stiger, 1994	PCB concentrations in the B ponds decrease with distance downstream to the point where no PCBs were detected in the terminal pond; B 5. It is unlikely that sediments from RFETS would contribute PCBs to any offsite reservoirs. Sediments from Pond B2 had higher mean concentrations than Pond B1 or B3. It was speculated that this was due to the presence of an outfall that historically entered into Pond B2, bypassing B 1. In the A and B ponds, four types of whole body tissues were analyzed: large mouth bass (40-58 ug/kg), fathead minnows (14-479 ug/kg), tiger salamanders (26 – 134 ug/kg), and crayfish (BDL – 9.5 ug'kg). From these data for the B ponds, the PCB concentrations increased in tiger salamanders from the B1 to B 2 ponds with no further specimens being found downstream, increased in plants from B 1 to B 4, and decreased in fathead minnows from B 4 to B 5. PCB in fathead minnows from the Walnut Creek terminal pond at Indiana Street were even lower than concentrations in B 5.	The time period from which this study was completed represents an historic condition associated with RFETS.	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. It is likely that any current or future bioaccumulation associated with PCBs left in place within the AEU would mimic those results observed from this study. Therefore, the risk potential attributable to PCBs as related to bioaccumulation would be low.
DOE, 1996	Aroclor-1254 was the only PCB congener consistently detected in biota and sediments. Aroclor-1260 was detected in only one biota sample from B 3, and was not detected in sediment samples. Concentrations of Aroclor-1254 ranged from below detection limits to average concentrations of 480 ug/kg for fathead minnows in pond B 4, to 160 ug/kg in fathead minnows in pond B 5. The highest concentrations in tissues were not detected in samples from the ponds with the highest sediment concentrations. The ratio of Aroclor-1254 content in biota to that in sediments was calculated for ponds in which Aroclor-1254 was detected in both sediments and biological samples. Tiger salamanders in Pond B1, had a BSF of 0.1, and 0.2 for Pond B 2. Fathead minnows had a BSF of 3.3 ion pond B 4. These values were comparable to BSFs estimated for aquatic biota in other studies (Rassmussen et al., 1990, Macdonald et al., 1993). The sediments within the upper 15 cm had generally lower PCB concentrations than the deeper sediments suggesting a lower risk to aquatic life than indicated by the earlier data.	The time period from which this study was completed represents an historic condition associated with RFETS	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. It is likely that any current or future bioaccumulation associated with PCBs left in place within the AEU would mimic those results observed from this study. Therefore, the risk potential attributable to PCBs as related to bioaccumulation would be low. Results occur at levels below tissue-effect thresholds (400 ug/kg) for aquatic life.
Aquatic Population Studies			

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Table 5.12

Summary of Other/Drainage Lines of Evidence for the SW AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Ebasco, 1992	Nine species of fish were collected at RFETS; most in the family Cyprinidae (minnow family, 6 species). Several ponds had very high populations of golden shiners and fathead minnows. Many aquatic organisms present are adapted to low stream flow conditions. These organisms are often classified as "tolerant" considering general water quality. One species of fish were collected from the B-series ponds; fathead minnows. No predatory fish were found.	The time period from which this study was completed represents an historic condition associated with RFETS. The flows of water into and out of certain ponds has been altered. The B-series ponds receive less water and the upper B-ponds have been remediated by having sediments removed. Therefore, the results of current conditions are likely different from those described within the study.	The report documents that aquatic habitats at RFETS have a high density of benthic macroinvertebrates. Fish species diversity in the semiarid climate is naturally low, due to the harsh environmental conditions (e.g, intermittent streams) and the larger pools and ponds required to support fish populations. Most species were found in pools or impoundments that offer refuge from annual drought conditions. The authors report that the most disruptive environmental factor to aquatic communities at RFETS is the natural semiaird conditions. All streams have sections that are intermittent while others are fed by groundwater seeps that keep sections perennial. Aquatic communities on RFETS thrive despite the environmental limitations.
DOE, 1996	A total of 81 taxa were identified in the pond benthos samples. The B-series ponds contained the highest abundance of all taxa except Pelecypoda (snails), which were most abundant in the A-series ponds. Ponds D 1 and D 2 (reference ponds) exhibit a wide range of community characteristics including the second lowest (Pond D 1) and highest (Pond D 2) diversity values. A cursory review of the benthic community data indicates that Pond B 3, may be under the most persistent chemical or physical stress. In this pond, oligochaetes and dipterans are the dominant taxa. These organisms are good colonizers and frequently are the dominant taxa from habitats with high physical variability. The highly variable environmental (physicochemical) conditions at RFETS may account for the dominance of colonizers.	The time period from which this study was completed represents an historic condition associated with RFETS.	These measures were gathered at a time when sediment conditions were likely at their worst in regards to potential chemical load. Given the fact that accelerated actions have occurred (removal of pond B 3 sediments) that would likely improve the current sediment quality, it can be anticipated that the benthic macroinvertebrate populations would be at least as good as those measured in this study, if not better. The populations measured in this study were comparable to reference conditions, and better in certain cases. It appears that the benthic macroinvertebrate populations studied within the B- series ponds are typical of what this watershed would be able to sustain and are not limited by chemical stressors.
Exponent., 1998	Aquatic life in Walnut Creek is limited by stream flow, which has been modified from natural flow conditions. However the assessment presented findings of good habitat and a relatively healthy macroinvertebrate community, which typically equates to good water quality. There are no indications that pollution is limiting aquatic life. The observed species are controlled/affected by the intermittent flows in the Creek.	The findings of this study describe the aquatic condition within the lower portions of the Walnut Creek watershed. They do not reflect conditions within RFETS, but rather the conditions just inside the boundary, to off-site downgradient areas. In addition, findings must be taken with caution as there was only one sampling event in the spring of 1998.	This study provides more evidence that RFETS aquatic communities in lower Walnut Creek are limited by physical conditions of the streams and ponds due to very limited or manipulated flows. Water management onsite and the general arid conditions of the stream types found in the general area control the types of aquatic communities that are possible.

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Table 5.12

Summary of Other/Drainage Lines of Evidence for the SW AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Aquatic Assoc., 1998	Seven study sites along Big Dry Creek were evaluated to determine aquatic ecology characteristics. A total of 17 species of fish were collected over the two seasons. Nine of the fish species collected are native to streams in the South Platte River Basin. Five species (longnose dace, creek chub, white sucker, longnose sucker, and johnny darter) are common to cool water environments in transition-foothill/plains stream types. Most of the native fish were classified as either abundant or common in a recent inventory of streams in the Front Range and eastern plains streams conducted by the Colorado Division of Wildlife. The aquatic community of Big Dry Creek was	Streams at RFTES may be more limited by flows than Big Dry Creek which receives perennial flows from Standley Reservoir. Fish populations may be more limited by flow at RFETS and make comparisons somewhat uncertain. The study of Big Dry Creek represents only one year of aquatic community data. Additionally, Big Dry Creek is influenced by adjacent real estate development and changing stormwater conditions. These conditions are not present at RFETS.	Conclusions suggested a relatively low risk of imperilment for most native fish species. The fauna present upstream of the Broomfield Treatment Plant was representative of a transitional foothills-plains stream, while in downsteam areas the aquatic community was more representative of plains stream habitats. Physical habitat and fluctuating stream flows are most likely limit the macroinvertebrate community in Big Dry Creek. Streams at RFETS are the same stream type, Transitional foothills-plains, as the upper portion of Big Dry Creek. Comparisons can be made to the aquatic health to Woman and Walnut Creek and further emphasizes that the limiting factors for aquatic systems in the Transitional foothills-plains stream type is habitat availability and limited flows.
Kaiser-Hill, 1999; 2000, and 2001	Fish surveys were preformed using minnow traps in streams and ponds over three consecutive years. The purpose of these survey efforts was to determine whether previously recorded fish species (Ebasco 1992) were still present within RFETS streams. Fathead minnow (*Pimephales promelas*) were captured in all major drainages at RFETS. This included locations in Lower Walnut Creek. Pond and impoundment surveys in 1999 revealed fathead minnows in all locations though it is unclear if all ponds and impoundments were surveyed. With the exception of the bass observations, all fish species observed during the baseline study (Ebasco 1992) were observed again over this three year survey	This survey was essentially conducted during drought conditions. 1998 through 2000 were very dry years in terms of precipitation. No analysis is presented on the abundance of fish over time. A declining trend in fish abundance could indicate chemical stressors or declining habitat conditions. Trends in relative abundance are unknown for RFETS streams and ponds.	With the exception of the bass observations, all fish species observed during the baseline study (Ebasco 1992) were observed again over this three year survey and found in the same general locations as they were in 1992 These studies indicate that all the RFETS streams are intermittent and illustrate the points that perennial flows and better aquatic habitats occur in the upper reaches of these streams. It is unrealistic to expect that vibrant aquatic communities, especially fish communities can occur in the lower reaches. Overall, fish species richness is very low.

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Table 5.12

Summary of Other/Drainage Lines of Evidence for the SW AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Aquatic Assoc., 2003	Findings from the study indicated that all of the streams at Rocky Flats are flow limited. In the effluent-dominated reach of Upper Walnut Creek and the discharge-dependent lower section of Walnut Creek, bank erosion which results in poor bank stability and sediment inputs to the stream is the main problem that negatively affects physical habitat and aquatic life. Fish abundance and distribution in these streams is severely limited due to the obvious lack of permanent water. Naturally self sustaining populations of fathead minnows were found at site WC3 in South Walnut Creek between Ponds B-4 and B-5 and site RC2 below the Lindsey Pond. The macroinvertebrate community across all drainages was observed as being rich and diverse, and comprised mainly of hardy and tolerant species The dominant organisms were similar in each drainage, with dipterans most abundant in Walnut Creek. Ephemeroptera were relatively abundant throughout the drainages, and included moderate to tolerant taxa. Trichoptera (caddisflies) in Walnut Creek were generally present in higher numbers comp Comparisons of study results to other, earlier studies c	This study did not sample the detention ponds. The RBP methods are not intended to sample large ponds. Therefore, conclusions about the aquatic health of the ponds cannot be made without some uncertainty.	Fish abundance and distribution in these streams is severely limited due to the obvious lack of permanent water. The macroinvertebrate community across all drainages was observed as being rich and diverse, and comprised mainly of hardy and tolerant species. Within the aquatic habitats that are present in Walnut Creeks, past studies provide a body of evidence that aquatic communities persist through time and are comparable to other communities found on site and in other areas within the region. While only one fish species is prevalent (i.e., fathead minnows), the manipulated nature of ponds and streams obviously precludes the establishment of viable fish populations. However, macroinvertebrate populations appear not as affected due to their ability to re-colonize newly inundated habitats and their comparatively shorter life cycles. Macroinvertebrate communities in Walnut Creek are similar to those found in Rock Creek
WWE, Inc., 2003.	The purpose of the WWE assessment was to develop an understanding of the factors influencing aquatic life in the creek and to determine whether a more stringent unionized ammonia standard was necessary to protect the Johnny darter (*Etheostoma nigrum*). The levels of unionized ammonia concentrations do not appear to be affecting the fish or macroinvertebrate communities, based on concentrations present in the creek during the last five years. Unionized ammonia concentrations on the creek are generally below the stream water quality standard. Overall in Big Dry Creek, upper reaches of the creek generally have higher quality fish and benthic communities than downstream locations. Upstream locations also generally have higher habitat scores, better water quality, and lower flows. This mainly is attributed by the effects of flow and associated parameters on the health of aquatic communities.	Although the conditions of a transitional foothills-plains stream is illustrated in this memorandum, the conditions of lower sections of streams at RFETS compared to conditions in Big Dry Creek is different. Flows on RFETS decrease with downstream locations to the point where water disappears. Flows increase in downstream locations along Big Dry Creek. This physical limitation at RFETS is the overriding limitation on aquatic communities.	This technical memorandum and review of data from areas downstream from RFETS in Big Dry Creek illustrate many of the conditions seen at RFETS. Stream habitat quality and corresponding benthic and fish communities are higher/healthier in the upper reaches of streams compared to lower sections. Water entering into the Big Dry Creek drainage via Walnut and Woman Creeks is of good quality albeit influenced by the large buffering affect of Standley Reservoir and Great Western Reservoir. It is not until greater flows occur and runoff is received from surrounding urban land uses that the negative affects of flows including increased TSS is observed.
Bioassay Analysis			

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Table 5.12
Summary of Other/Drainage Lines of Evidence for the SW AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
DOE, 1996	Sediment bioassay tests indicated no toxicity associated with sediments gathered from ponds B 1, B 3, B 4 and B 5. Results from Pond B 2 were significantly lower than in controls. These results are not consistent with the toxicity indicated by the concurrent HI analysis.	The time period from which this study was completed represents an historic condition associated with RFETS.	Tests indicated no toxicity associated with sediments gathered from the A- series ponds. The results of the bioassays did not correlate to predicted toxicity associated with chemicals of concern using standard ecological risk tools of hazard quotient and hazard index assessment.
Waterfowl/Wading Bird Evaluations			
Stiger, 1994	Results of the deer mice and vole tissue analysis revealed that no PCBs were detected in any of the small mammal tissue samples (whole body) collected from around ponds B 1 and B 4. Comparison to PCB food threshold values for birds, revealed that PCB levels in fish do not exceed food concentration threshold values prescribed by DOE. These results suggest that PCBs have not bioaccumulated up the food chain further than the fish species collected at RFETS and that both the PMJM and predatory birds are not threatened with PCB contamination from RFETS.	The time period from which this study was completed represents an historic condition associated with RFETS.	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. It is likely that any current or future bioaccumulation associated with PCBs left in place within the AEU would mimic those results observed from this study. Therefore, the risk potential attributable to PCBs as related to bioaccumulation would be low. This indicates that receptors such as wading birds and waterfowl that are exposed via ingestion of potentially contaminated prey are at minimal risk in regards to PCBs.
DOE, 1996	Results of the exposure estimation indicated potential significant risk to the great blue heron attributable to the ponds. Di-n-butylphthalate and mercury were identified as being of potential concern within the B ponds.	The co-located sediment, surface water and biota analysis completed for this study, represent a set of historic conditions. It is unlikely that current conditions would be comparable. This study likely represents worst-case conditions given that the analysis were completed pre-accelerated action.	The results of this study provide a screening measure of potential chemicals of concern to wading birds and waterfowl. The results were compared to this CRA ECOPC risk characterization process. If for instance, mercury and di-n-butylphthalate were identified in this CRA as being a risk issue, the information from this study would provide a line of evidence for those chemicals in particular.
Chemical Loading Analysis			
DOE, 2004	Site-wide surface water studies are routinely completed by DOE in order to understand chemical loading and release to offsite areas. These efforts involve significant amounts of sampling and interpretation for a given objective. The information gained from these studies helped to identify if a given ECOPC would demonstrate source-related release patterns (increased load down-gradient of a source), or whether a given ECOPC demonstrates a pattern representative of background conditions (thus, not source related).	The data were collected for a defined purpose not necessarily in-line with ecological risk assessment needs. Loading analysis serves to identify sources and chemical patterns. The information does not always lend itself to toxicological interpretation.	The results from this document were summarized by ECOPC and are provided within the professional judgment portion of the CRA (Attachment 4).

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Table 5.13

Hazard Quotient Evaluation of Surface Water ECOPCs in WC AEU

ECOPC	Units	ESL	Alternative Toxicity Value	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
				MDC	ESL-HQ	AT-HQ	EPC-95 UTL	ESL-HQ	AT-HQ	EPC-95 UCL	ESL-HQ	AT-HQ
Inorganics												
Ammonia-unionized	mg/L	0.02	0.104	0.0939	5	<1	(0.0939)	5	<1	0.011	<1	<1
Cadmium-dissolved	mg/L	0.0032 (1)	0.0072 (1)	0.0268	8	4	0.002	<1	<1	0.001	<1	<1
Silver-dissolved	mg/L	0.0007 (1)	0.0047 (1)	0.0063	9	1	0.003	4	<1	0.001	1	<1

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

(1) A site-specific ESL was developed using site-specific water quality considerations of hardness (Attachment 5).

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Table 5.14

Hazard Quotient Evaluation of Surface Water ECOPCs using Post-1999 Data in WC AEU

ECOPC	Units	ESL	Alternative Toxicity Value	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95 UCL		
				MDC	ESL-HQ	AT-HQ	EPC-95 UTL	ESL-HQ	AT-HQ	EPC-95 UCL	ESL-HQ	AT-HQ
Inorganics												
Ammonia-unionized	mg/L	0.02	0.104	N/A	--	--	N/A	--	--	N/A	--	--
Cadmium-dissolved	mg/L	0.0032 (1)	0.0072 (1)	0.0005	<1	<1	0.000325	<1	<1	0.000137	<1	<1
Silver-dissolved	mg/L	0.0007 (1)	0.0047 (1)	0.002	3	<1	0.0005	<1	<1	0.000286	<1	<1

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

(1) A site-specific ESL was developed using site-specific water quality considerations of hardness (Attachment 5).

N/A = Not applicable.

-- = Could not be calculated due to the lack of an available EPC.

Table 5.15

Hazard Quotient Evaluation of Sediment ECOPCs in WC AEU

ECOPC	ESL	Alternative Toxicity Value	Units	MDC EPC Hazard Quotients			95 UTL EPC Hazard Quotients			95UCL Hazard Quotients		
				MDC	ESL-HQ	AT-HQ	EPC-95UTL	ESL-HQ	AT-HQ	EPC-95UCL	ESL-HQ	AT-HQ
Inorganics												
Aluminum	15,900	58,000	mg/kg	32,000	**2**	<1	21,497	**1**	<1	10,311	<1	<1
Antimony	2	3.2	mg/kg	51.3	**26**	**16**	19.6	**10**	**6**	6	**3**	**2**
Barium	189	287	mg/kg	404	**2**	**1**	256	**1**	<1	127	<1	<1
Cadmium	0.99	4.98	mg/kg	3.6	**4**	<1	1.4	**1**	<1	1	<1	<1
Copper	31.6	149	mg/kg	212	**7**	**1**	67.6	**2**	<1	17	<1	<1
Fluoride	0.01	7	mg/kg	20.3	**2,030**	**3**	20.3	**2,030**	**3**	(20.3)	**2,030**	**3**
Iron	20,000	280,000	mg/kg	38,800	**2**	<1	27,208	**1**	<1	15,230	<1	<1
Lead	35.8	128	mg/kg	118	**3**	<1	51.5	**1**	<1	22	<1	<1
Mercury	0.18	1.06	mg/kg	3.8	**21**	**4**	1.3	**7**	**1**	0	<1	<1
Nickel	22.7	48.6	mg/kg	33	**1**	<1	24	**1**	<1	13	<1	<1
Selenium	0.95	1.73	mg/kg	3.8	**4**	**2**	1.51	**2**	<1	1	<1	<1
Silver	1	1.6	mg/kg	7.7	**8**	**5**	2.3	**2**	**1**	1	<1	<1
Zinc	121	459	mg/kg	2,080	**17**	**5**	528	**4**	**1**	88	<1	<1
Organics												
4-Methylphenol	12.3	670	ug/kg	510	**41**	<1	(510)	**41**	<1	443	<1	<1
Acenaphthene	6.71	89	ug/kg	510	**76**	**6**	510	**76**	**6**	341	**4**	**4**
Anthracene	57.2	845	ug/kg	470	**8**	<1	(470)	**8**	<1	344	<1	<1
Aroclor-1254	60	300	ug/kg	250	**4**	<1	(250)	**4**	<1	(250)	<1	<1
Benzo(a)anthracene	108	1,050	ug/kg	1,200	**11**	**1**	800	**7**	<1	424	<1	<1
Benzo(a)pyrene	150	1,450	ug/kg	970	**6**	<1	800	**5**	<1	431	<1	<1
Benzo(g,h,i)perylene	13	280	ug/kg	630	**48**	**2**	(630)	**48**	**2**	440	**2**	**2**
Benzo(k)fluoranthene	240	750	ug/kg	690	**3**	<1	(630)	**3**	<1	438	<1	<1
Chrysene	166	1,290	ug/kg	1,200	**7**	<1	800	**5**	<1	416	<1	<1
Fluoranthene	423	2,230	ug/kg	2,900	**7**	**1**	729	**2**	<1	361	<1	<1
Heptachlor	0.132	16	ug/kg	3.1	**23**	<1	25	**189**	**2**	13.8	<1	<1
Indeno(1,2,3-cd)pyrene	17	250	ug/kg	500	**29**	**2**	(500)	**2**	**2**	427	**2**	**2**
Phenanthrene	204	1,170	ug/kg	2,900	**14**	**2**	700	**3**	<1	533	<1	<1
Pyrene	195	1,520	ug/kg	3,100	**16**	**2**	800	**4**	<1	580	<1	<1
TEQ Dioxins	0.00085	0.0215	ug/kg	0.00136	**2**	<1	(0.00136)	**2**	<1	N/A	--	--
Total PAHs	1,610	22,800	ug/kg	17,130	**11**	1	9208	**6**	<1	3,171	<1	<1
Total PCBs	40	676	ug/kg	250	**6**	<1	500	**13**	<1	263	<1	<1

95UCLs based on proxy values which include NDs at 1/2 DL.

Values denoted in parenthesis represent the MDC, used as the EPC when the MDC < the 95 UTL and/or 95 UCL.

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

N/A = Not applicable or not appropriate.

-- = Could not be calculated due to a lack of an available EPC.

Table 5.16
Hazard Quotient Evaluation of Surface Sediment ECOPCs in WC AEU

ECOPC	ESL	Alternative Toxicity Value	Units	MDC EPC Hazard Quotients		
				MDC	ESL-HQ	AT-HQ
Inorganics						
Aluminum	15,900	58,000	mg/kg	31,000	**1.9**	<1
Antimony	2	3.2	mg/kg	51.3	**26**	**16**
Barium	189	287	mg/kg	404	**2.1**	**1.4**
Cadmium	0.99	4.98	mg/kg	3.6	**3.6**	<1
Copper	31.6	149	mg/kg	212	**6.7**	**1.4**
Fluoride	0.01	7	mg/kg	20.3	**2,030**	**2.9**
Iron	20,000	280,000	mg/kg	38,800	**1.9**	<1
Lead	35.8	128	mg/kg	118	**3.3**	<1
Mercury	0.18	1.06	mg/kg	3.8	**21**	**4**
Nickel	22.7	48.6	mg/kg	33	**1**	<1
Selenium	0.95	1.73	mg/kg	3.8	**4**	**2**
Silver	1	1.6	mg/kg	7.7	**8**	**5**
Zinc	121	459	mg/kg	2,080	**17**	**5**
Organics						
4-Methylphenol	12.3	670	ug/kg	510	**41**	<1
Acenaphthene	6.71	89	ug/kg	510	**76**	**6**
Anthracene	57.2	845	ug/kg	470	**8**	<1
Aroclor-1254	60	300	ug/kg	250	**4**	<1
Benzo(a)anthracene	108	1,050	ug/kg	1,200	**11**	**1**
Benzo(a)pyrene	150	1,450	ug/kg	970	**6**	<1
Benzo(g,h,i)perylene	13	280	ug/kg	630	**48**	**2**
Benzo(k)fluoranthene	240	750	ug/kg	690	**3**	<1
Chrysene	166	1,290	ug/kg	1,200	**7**	<1
Fluoranthene	423	2,230	ug/kg	2,900	**7**	**1**
Heptachlor	0.132	16	ug/kg	3.1	**23**	<1
Indeno(1,2,3-cd)pyrene	17	250	ug/kg	500	**29**	**2**
Phenanthrene	204	1,170	ug/kg	2,900	**14**	**2**
Pyrene	195	1,520	ug/kg	3,100	**16**	**2**
TEQ Dioxins	0.00085	0.0215	ug/pg	0.00136	**2**	**<1**
Total PAHs	1610	22,800	ug/kg	17,130	**11**	1
Total PCBs	40	676	ug/kg	94	**2**	**<1**

HQ = Hazard Quotient, rounded to nearest whole number.

Values in bold indicate HQs > 1.

N/A = Not applicable or not appropriate.

Table 5.17
Frequency and Magnitude of Aquatic Receptor HQs for WC AEU Surface Water and Sediment ECOPCs

ECOPC and Media	Number of Samples	HQs				Frequency of Detected Exceedances
		<= 1	> 1 - 5	> 5 - 10	> 10	
Surface Water ECOPCs						
Inorganic						
Ammonia-unionized	84	48 (316)	3	0	0	4%
Cadmium-dissolved	364	46 (315)	0	0	0	1%
Silver-dissolved	366	5 (106)	20 (235)	7	0	6%
Sediment ECOPCs						
Inorganic						
Aluminum	88	72	16	0	0	18%
Antimony	82	2 (29)	2 (43)	0	4	7%
Barium	88	72 (1)	15	0	0	17%
Cadmium	83	17 (57)	7 (2)	0	0	8%
Copper	88	75 (5)	6	0	0	9%
Fluoride	4	0	0	0	1 (4)	25%
Iron	88	68	20	0	0	23%
Lead	88	75	13	0	0	15%
Mercury	86	16 (62)	3	4	1	9%
Nickel	88	68 (12)	8	0	0	9%
Selenium	80	21 (32)	12 (15)	0	0	15%
Silver	83	2 (42)	7 (30)	2	0	11%
Zinc	88	66	18	3	1	25%
Organic						
4-Methylphenol	61	0	0	2	2 (57)	7%
Acenaphthene	61	0	0	0	4 (57)	7%
Anthracene	61	0	1	5 (39)	(16)	10%
Aroclor-1254	69	3 (10)	7 (35)	2 (6)	0 (6)	13%
Benzo(a)anthracene	61	8	2 (46)	0 (4)	1	5%
Benzo(a)pyrene	61	6	1 (50)	1 (3)	0	3%
Benzo(g,h,i)perylene	61	0	2	0	2 (57)	7%
Benzo(k)fluoranthene	61	4 (19)	1 (37)	0 (6)	0	2%
Chrysene	62	10	3 (46)	1 (2)	0 (2)	6%
Fluoranthene	62	18 (37)	0 (6)	1	0	2%
Heptachlor	59	2	0	0	1 (53)	2%
Indeno(1,2,3-cd)pyrene	61	0	1	0	4 (56)	8%
Phenanthrene	62	9 (5)	6 (40)	0 (1)	1	11%
Pyrene	62	10 (4)	3 (43)	0 (1)	1	6%
TEQ Dioxins	2	1	1	0	0	50%
Total PAHs	62	1	5	5	11 (51)	82%
Total PCBs	127	3 (10)	7 (35)	2 (6)	0 (6)	13%

Samples below detection limits are in parentheses.

Risk Conclusions for this LOE:

None = Sample concentrations do not exceed the ESL.

Low = Low potential for Risk. Detected concentrations only exceed the ESL by low magnitude (HQs < 5) or exceedances <20%.

Retained = Potential for risk could not be excluded and further evaluation is required; Detected HQs > 5 and exceedances >20%.

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Table 5.18
Summary of Other/Drainage Lines of Evidence for the WC AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Tissues Analysis			
Stiger, 1994	There were no PCB concentrations detected in Ponds C-1 and C-2. It is unlikely that sediments from RFETS would contribute PCBs to any offsite reservoirs. Fish tissue samples collected from Ponds C-1 and C-2 contained only low levels of PCBs (<100 ug/kg).	The time period from which this study was completed represents an historic condition associated with RFETS.	The observed PCB concentrations from this study are comparable to the measured concentrations evaluated in the CRA. Therefore, the risk potential attributable to PCBs as related to bioaccumulation is low. Results occur at levels below tissue-effect thresholds (400 ug/kg) for aquatic life.
Aquatic Population Studies			
Ebasco, 1992	Nine species of fish were collected at RFETS; most in the *Cyprinidae* (minnow) family (6 species). Several ponds had very high populations of golden shiners and fathead minnows. Many aquatic organisms present are adapted to low stream flow conditions. The benthic macroinvertebrate community of WC AEU is relatively rich and diverse. Species richness for mayflies and caddisflies increase from headwater segments to the area east of Pond C-2 where flow decreases due to loss to groundwater. Fish communities are influenced by the presence of suitable substrates. The most common species included the golden shiner, white sucker and largemouth bass found in Pond C-1. Aquatic vertebrates in Pond C-2 were comprised of fathead minnows and tiger salamanders.	The time period from which this study was completed represents an historic condition associated with RFETS. The flows of water into and out of certain ponds have been altered. Therefore, the results of current conditions are likely different from those described within the study.	Aquatic habitats at RFETS have a high density of benthic macroinvertebrates. Fish species diversity is naturally low, due to the harsh environmental conditions (e.g, intermittent streams) and the larger pools and ponds are required to support fish populations. The most disruptive environmental factor to aquatic communities at RFETS is the natural semiarid conditions. All streams have sections that are intermittent while others are fed by groundwater seeps that keep sections perennial. Aquatic communities on RFETS thrive despite the environmental limitations.

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Table 5.18

Summary of Other/Drainage Lines of Evidence for the WC AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
DOE, 1996	A total of 81 taxa were identified in the pond benthos samples. The C-Series Ponds did not support a wide variety of organisms other than oligochaetes and dipterans. Ponds D-1 and D-2 (reference ponds) exhibit a wide range of community characteristics including the second lowest (Pond D-1) and highest (Pond D-2) diversity values. A review of the benthic community data indicates that Pond C-1 may be under the most persistent stress. In this pond, oligochaetes and dipterans are the dominant taxa. These organisms are good colonizers and frequently are the dominant taxa from habitats with high physical variability. The highly variable environmental (physicochemical) conditions at RFETS may account for the dominance of colonizers.	The time period from which this study was completed represents an historic condition associated with RFETS.	The populations measured in this study were comparable to reference conditions, and better in certain cases. It appears that the benthic macroinvertebrate populations studied within the C-Series Ponds are typical of what this watershed would be able to sustain and are not limited by chemical stressors.
Aquatic Assoc., 1998	Seven study sites along Big Dry Creek were evaluated to determine aquatic ecology characteristics. A total of 17 species of fish were collected over the two seasons. Nine species were native to streams in the South Platte River Basin. Five species (longnose dace, creek chub, white sucker, longnose sucker, and johnny darter) are common to cool water environments in transition-foothill/plains stream types. Most of the native fish were classified as either abundant or common in a recent inventory of streams in the Front Range and eastern plains streams conducted by the CDOW. The aquatic community of Big Dry Creek was represented by 18 orders of macroinvertebrates including a total of 113 taxa.	Streams at RFETS may be more limited by flows than Big Dry Creek which receives perennial flows from Standley Reservoir. Fish populations may be more limited by flow at RFETS and make comparisons somewhat uncertain. The study of Big Dry Creek represents only one year of aquatic community data. Additionally, Big Dry Creek is influenced by adjacent real estate development and changing stormwater conditions. These conditions are not present at RFETS.	Conclusions suggested a relatively low risk of imperilment for most native fish species. The fauna present upstream of the Broomfield Treatment Plant was representative of a transitional foothills-plains stream, while in downsteam areas the aquatic community was more representative of plains stream habitats. Physical habitat and fluctuating stream flows are most likely limit the macroinvertebrate community in Big Dry Creek. Streams at RFETS are the same stream type, Transitional foothills-plains, as the upper portion of Big Dry Creek. Comparisons can be made to the aquatic health to Woman and Walnut Creek and further emphasizes that the limiting factors for aquatic systems in the Transitional foothills-plains stream type is habitat availability and limited flows.

Table 5.18
Summary of Other/Drainage Lines of Evidence for the WC AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Kaiser-Hill, 1999; 2000, and 2001	Fish surveys in streams and ponds were performed over three consecutive years. In order to determine whether previously recorded fish species (Ebasco 1992) were still present within RFETS streams. Fathead minnow (*Pimephales promelas*) were captured in all major drainages at RFETS, including Upper Woman Creek. Additionally, creek chub (*Semotilus atromaculatus*) and stoneroller (*Campostoma anomalum*) were captured. The greater variety of fish species in Woman Creek was attributed to the relatively large seep-wetland complexes that discharge into the Woman Creek drainage. Pond and impoundment surveys in 1999 revealed fathead minnows in all locations In Pond C-1, fathead minnows were captured along with smallmouth bass (*Micropterus dolomieui*) and creek chubs. Largemouth bass were collected just below Pond C-1 during the baseline study. It may suggest that the bass observed in 1999 may have been misidentified. This study along with the earlier stream survey demonstrates the higher species richness in Woman Creek compared to other RFETS drainages.	This survey was conducted during drought conditions. 1998 through 2000 were very dry years in terms of precipitation. No analysis is presented on the abundance of fish over time. A declining trend in fish abundance could indicate chemical stressors or declining habitat conditions. Trends in relative abundance are unknown for RFETS streams and ponds.	With the exception of the bass observations, all fish species observed during the baseline study (Ebasco 1992) were observed again over this three year survey and found in the same general locations as they were in 1992These studies indicate that all the RFETS streams are intermittent and illustrate the points that perennial flows and better aquatic habitats occur in the upper reaches of these streams. It is unrealistic to expect that vibrant aquatic communities, especially fish communities can occur in the lower reaches. Overall, fish species richness is very low.

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Table 5.18
Summary of Other/Drainage Lines of Evidence for the WC AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
Aquatic Assoc., 2003	Woman Creek has more natural flows in the upper reaches whereas below the C-2 pond, flows are greatly reduced and heavily influenced by pond releases and water management. The natural flows in the upper reaches are seep-fed and also influenced by seasonal precipitation. A stable and healthy creek chub population was found at the upper portion of Woman Creek. A single specimen of longnose dace was also collected. The dominant benthic macroinvertebrate organisms were similar in each drainage, with oligochaetes being dominant in Woman Creek. Comparisons of study results to other, earlier studies showed that community structure and abundance were somewhat similar to that found in Walnut, Woman and Rock Creeks during the 2001- 2002 study and are similar to other transitional foothills-plains and plains type streams.	This study did not sample the detention ponds. The RBP methods are not intended to sample large ponds. Therefore, conclusions about the aquatic health of the ponds cannot be made without some uncertainty.	Fish are severely limited due to the obvious lack of permanent water. The macroinvertebrate community across all drainages was observed as being rich and diverse, and comprised mainly of hardy and tolerant species. Within the aquatic habitats that are present in Woman Creeks, past studies describe aquatic communities that persist through time and are comparable to other communities found on site and in other areas within the region. While only one fish species is prevalent (i.e., fathead minnows), the manipulated nature of ponds and streams obviously precludes the establishment of viable fish populations. However, macroinvertebrate populations appear not as affected due to their ability to re-colonize newly inundated habitats and their comparatively shorter life cycles. Macroinvertebrate communities in Woman Creek are similar to those found in Rock Creek.
WWE, Inc., 2003	This study developed an understanding of the factors influencing aquatic life in the creek and whether a more stringent unionized ammonia standard was necessary to protect the Johnny darter (*Etheostoma nigrum*). The levels of unionized ammonia concentrations do not appear to be affecting the fish or macroinvertebrate communities. Unionized ammonia concentrations on the creek are generally below the stream water quality standard. Overall, upper reaches of the creek generally have higher quality fish and benthic communities than downstream locations. Upstream locations also generally have higher habitat scores, better water quality, and lower flows. This mainly is attributed by the effects of flow on the health of aquatic communities.	Although the conditions of a transitional foothills-plains stream is illustrated in this memorandum, the conditions of lower sections of streams at RFETS compared to conditions in Big Dry Creek is different. Flows on RFETS decrease with downstream locations to the point where water disappears. Flows increase in downstream locations along Big Dry Creek. This physical limitation at RFETS is the overriding limitation on aquatic communities.	This technical memorandum and review of data from areas downstream from RFETS in Big Dry Creek illustrate many of the conditions seen at RFETS. Stream habitat quality and corresponding benthic and fish communities are higher and healthier in the upper reaches of streams compared to lower sections. Water entering into the Big Dry Creek drainage via Walnut and Woman Creeks is of good quality albeit influenced by the large buffering affect of Standley Reservoir and Great Western Reservoir. It is not until greater flows occur and runoff is received from surrounding urban land uses that the negative affects of flows including increased TSS is observed.
Bioassay Analysis			

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Table 5.18

Summary of Other/Drainage Lines of Evidence for the WC AEU

Line of Evidence	Summary of Results	Uncertainty	Conclusions
DOE, 1996	Sediment bioassay tests indicated no toxicity associated with sediments gathered from Ponds C-1 and C-2. These results are not consistent with the toxicity indicated by the concurrent HI analysis.	The time period from which this study was completed represents an historic condition associated with RFETS.	Tests indicated no toxicity associated with sediments gathered from the C-Series Ponds. The results of the bioassays did not correlate to predicted toxicity associated with chemicals of concern using standard ecological risk tools of hazard quotient and hazard index assessment.
Waterfowl/Wading Bird Evaluations			
DOE, 1996	Results of the exposure estimation indicated potential significant risk to the great blue heron attributable to the ponds. Mercury was identified as being of potential concern within the C-Series Ponds.	The co-located sediment, surface water and biota analysis completed for this study, represent a set of historic conditions. It is unlikely that current conditions would be comparable. This study likely represents worst-case conditions given that the analysis was completed pre-accelerated action.	The results of this study provide a screening measure of potential chemicals of concern to wading birds and waterfowl. The results were compared to this CRA ECOPC risk characterization process. If for instance, mercury was identified in this CRA as being a risk issue, the information from this study would provide a line of evidence for those chemicals in particular.
Chemical Loading Analysis			
DOE, 2004	Site-wide surface water studies are routinely completed by DOE in order to understand chemical loading and release to offsite areas. These efforts involve significant amounts of sampling and interpretation for a given objective. The information gained from these studies helped to identify if a given ECOPC would demonstrate source-related release patterns (increased load down-gradient of a source), or whether a given ECOPC demonstrates a pattern representative of background conditions (thus, not source related).	The data were collected for a defined purpose not necessarily in-line with ecological risk assessment needs. Loading analysis serves to identify sources and chemical patterns. The information does not always lend itself to toxicological interpretation.	The results from this document were summarized by ECOPC and are provided in the professional judgment section of the CRA (Attachment 4).

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Table 6.1
Frequency and Magnitude of Aquatic Receptor AT HQs for Sediment ECOPCs with Uncertain Detection Limits

AEU and ECOPC	No. of Samples	No. of Detects	Detected Value Distribution				Reported Value (Detection Limit) Distribution			
			HQ <= 1	HQ > 1 - 5	HQ > 5 - 10	HQ > 10	HQ <= 1	HQ > 1 - 5	HQ > 5 - 10	HQ > 10
NW AEU										
2-Methylnaphthalene	104	7	6	0	1	0	15	84	5	0
4,4'-DDT	79	4	4	0	0	0	78	1	0	0
Atrazine	1	1	1	0	0	0	1	0	0	0
Carbazole	30	13	13	0	0	0	30	0	0	0
Naphthalene	106	10	10	0	0	0	101	5	0	0
SW AEU										
Bromomethane	80	6	6	0	0	0	78	0	0	2
Carbazole	16	6	6	0	0	0	16	0	0	0
WC AEU										
4-Methylphenol	61	4	4	0	0	0	54	7	0	0
Heptachlor	59	3	3	0	0	0	51	8	0	0

Table 6.2
Summary of Surface Water ECOIs Without ESLs

ECOI	NW AEU	SW AEU	WC AEU
Cations/Anions and Inorganics			
Bromide	x	N/A	N/A
Calcium	x	x	x
Cerium	x	x	x
Cesium	x	x	x
Chloride	N/A	N/A	N/A
Chromium VI	x	x	x
Magnesium	x	x	x
Nitrate/Nitrite	x	x	x
Nitrite	x	x	N/A
Orthophosphate	x	x	x
Phosphate	x	x	x
Phosphorous	x	x	x
Potassium	x	x	x
Silica	x	x	x
Silicon	x	x	x
Sodium	x	x	x
Sulfate	x	x	x
Sulfide	x	x	x
Thallium	N/A	N/A	N/A
Titanium	x	x	N/A
Organics			
Alpha-Chlordane	x	x	N/A
Atraton	x	N/A	N/A
Benzo(b)fluoranthene	x	N/A	N/A
Benzo(k)fluoranthene	x	N/A	N/A
Benzo(g,h,i)perylene	x	N/A	N/A
Benzoic acid	x	N/A	N/A
Bromochloromethane	x	N/A	N/A
4-Bromofluorobenzene	N/A	x	x
n-Butylbenzene	x	x	N/A
Chloroethane	N/A	N/A	N/A
2-Chloroethyl vinyl ether	N/A	x	N/A
Chloromethane	N/A	x	x
Chlorodifluoromethane	N/A	x	x
4-Chlorotoluene	N/A	N/A	N/A
Chrysene	x	x	N/A
Dalapon	x	N/A	N/A
Dibenz(a,h)anthracene	x	N/A	N/A
1,2-Dibromo-3-chloropropane	N/A	x	N/A
Dibromochloromethane	x	x	N/A
Dicamba	x	N/A	N/A
Dichlorodifluoromethane	x	x	x
1,2-dichloroethane	N/A	x	N/A
Dichlorodifluoromethane	N/A	N/A	N/A
Dichloroprop	x	N/A	N/A
Dimethoate	x	x	N/A
Dimethylphthalate	x	x	N/A
Di-n-octylphthalate	x	x	N/A
gamma-Chlordane	x	x	N/A
Hexazinone	x	N/A	N/A
Indeno(1,2,3-cd)pyrene	x	N/A	N/A
Isopropylbenzene	x	N/A	N/A
4-Nitroanaline	x	x	N/A
n-Nitrosomorpholine	N/A	x	N/A
Prometon	N/A	N/A	x
Propazine	x	x	N/A
Total Petroleum Hydrocarbons		x	N/A

Table 6.2
Summary of Surface Water ECOIs Without ESLs

ECOI	NW AEU	SW AEU	WC AEU
Trichlorofluoromethane	x	x	x
1,2,3-Trichloropropene	N/A	x	N/A
Radionuclides			
Cesium-134	N/A	x	N/A
Curium-241	N/A	N/A	N/A
Curium-244	x	x	x
Gross Alpha	x	x	x
Gross Beta	x	x	x
Neptunium-237	x	x	x
Plutonium-238	x	x	x
Thorium-230	x	x	x
Thorium-232	x	x	x
Tritium	x	x	N/A

x = Indicates ESL is unavailable.
N/A = Indicates that the ECOI was not analyzed in the AEU.

Table 6.3
Summary of Sediment ECOIs Without ESLs

ECOI	NW AEU	SW AEU	WC AEU
Cations/Anions and Inorganics			
Beryllium	x	x	x
Boron	x	x	x
Calcium	x	x	x
Cesium	x	x	x
Chloride	x	x	x
Cobalt	x	x	x
Cyanide	N/A	x	N/A
Lithium	x	x	x
Magnesium	x	x	x
Molybdenum	x	x	x
Nitrate/Nitrite	x	x	x
Nitrite	x	N/A	N/A
Orthophosphate	N/A	N/A	N/A
Phosphate	N/A	N/A	N/A
Potassium	x	x	x
Silica	x	x	x
Silicon	x	x	x
Sodium	x	x	x
Strontium	x	x	x
Sulfate	x	x	N/A
Sulfide	N/A	x	N/A
Thallium	x	x	x
Tin	x	x	x
Titanium	x	x	x
Uranium	x	N/A	N/A
Vanadium	x	x	x
Organics			
1,1-Dichlorethene	N/A	x	N/A
1,2-Dichloroethane	x	N/A	N/A
1,2-Dichloroethene	x	x	N/A
2-Butanone	N/A	N/A	N/A
2-Hexanone	N/A	N/A	N/A
2,4-Dinitrophenol	N/A	x	x
4,6-Dinitro-2-methylphenol	N/A	N/A	x
4-Isopropyltoluene	x	N/A	N/A
4-Methyl-2-pentanone	x	N/A	x
Acetone	x	x	x
Benzo(b)fluoranthene	x	x	x
Benzoic acid	x	x	x
Chlorodifluoromethane	N/A	N/A	N/A
Chloroform	N/A	x	N/A
Dimethylphenol	N/A	x	N/A
Dimethylphthalate	N/A	x	N/A
Di-n-octylphthalate	x	x	x
Methylene chloride	x	x	x
Trichlorofluoromethane	N/A	x	N/A
Vinyl chloride	N/A	x	N/A
Radionuclides			
Cesium-134	x	x	x
Gross Alpha	x	x	x
Gross Beta	x	x	x

x = Indicates ESL is unavailable.
N/A = Indicates that the ECOI was not analyzed in the AEU.

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Table 6.4

Summary of Uncertain Sediment ECOIs as Compared to Surface Water ECOPCs for NW AEU

Analyte	MDC	% Detect in Sediment	>Background in Sediment	SW ESL Available?	% Detect in Surface Water	> Background in Surface Water	SW ECOPC?	Risk Concern?	Rationale
Inorganics (mg/kg or mg/L)									
Beryllium	2.5	68	Yes	Yes	46	N/A	No	No	Not a SW ECOPC
Boron	26	100	N/A	Yes	100	N/A	No	No	Not a SW ECOPC
Calcium	140,000	100	Yes	No	100	Yes	N/A	No	CE
Cesium	5.8	23	N/A	No	12	N/A	N/A	No	FD
Chloride	394	71	N/A	Yes	100	Yes	No	No	CE, Not a SW ECOPC
Cobalt	20.1	95	Yes	Yes	56	N/A	No	No	Not a SW ECOPC
Lithium	37	76	No	Yes	93	Yes	Yes	No	BB
Magnesium	11,000	100	Yes	No	100	Yes	N/A	No	CE
Molybdenum	6.2	34	No	Yes	62	No	No	No	BB
Nitrate / Nitrite	89.3	41	N/A	No	94	N/A	N/A	No	UC
Nitrite	5.61	6	N/A	Yes	48	N/A	No	No	FD, Not a SW ECOPC
Potassium	6,500	94	Yes	No	98	Yes	N/A	No	CE
Silica	4,900	100	Yes	No	100	No	N/A	No	BB
Silicon	1,960	100	N/A	No	99	N/A	N/A	No	CE
Sodium	2,100	93	Yes	No	100	Yes	N/A	No	CE
Strontium	526	100	Yes	Yes	100	Yes	No	No	Not a SW ECOPC
Sulfate	96	24	N/A	No	98	Yes	N/A	No	CE
Thallium	1.6	9	N/A	Yes	7	N/A	No	No	FD, Not a SW ECOPC
Tin	15.5	16	N/A	Yes	13	N/A	No	No	FD, Not a SW ECOPC
Titanium	310	100	N/A	No	71	N/A	N/A	No	UC
Uranium	20	8	N/A	Yes	42	N/A	No	No	Not a SW ECOPC
Vanadium	96	100	Yes	Yes	70	Yes	Yes	No	Not a SW Risk Concern
Organics (µg/kg or µg/L)									
1,2-Dichloroethane	05.0	1.3	N/A	Yes	ND	N/A	No	No	ND
1,2-Dichloroethene	03.0	1.5	N/A	Yes	0.5	N/A	No	No	FD
4-Isopropyltoluene	39.0	8	N/A	Yes	ND	N/A	No	No	ND
4-methyl-2-pentanone	6	1	N/A	Yes	0.4	N/A	No	No	FD, Not a SW ECOPC
Acetone	400	16	N/A	Yes	18	N/A	No	No	Not a SW ECOPC
Benzo(b)fluoranthene	1,500	51	N/A	No	1	N/A	N/A	No	FD
Benzoic Acid	2,700	13	N/A	Yes	2.4	N/A	No	No	FD, Not a SW ECOPC
Di-n-octylphthalate	130	3	N/A	No	0.5	N/A	N/A	No	FD
Methylene Chloride	9.3	10	N/A	Yes	17	N/A	No	No	Not a SW ECOPC
Radionuclides (pCi)									
Cesium-134	0.1	100	N/A	No	ND	N/A	No	No	ND
Gross Alpha	71	100	No	No	100	Yes	N/A	No	BB
Gross Beta	39	100	No	No	100	Yes	N/A	No	BB

BB = Observed sediment or surface water MDC was less than the appropriate background level.

CE = Common element that is associated with low toxicity.

FD = was detected in less than 10% of the surface water or sediment samples.

ND = was not detected in the surface water samples.

Not a SW ECOPC = was not identified as an ECOPC for surface water as per the selection process.

Not a SW Risk Concern = The risk characterization determined that this chemical would not create an unacceptable risk to aquatic populations.

UC = Uncertain toxicity due to a lack of both surface water and sediment ESLs.

N/A = Not available or not applicable.

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Table 6.5

Summary of Uncertain Sediment ECOIs as Compared to Surface Water ECOPCs for SW AEU

Analyte	MDC	% Detect in Sediment	> Background in Sediment	SW ESL Available?	% Detect in Surface Water	> Background in Surface Water	SW ECOPC?	Risk Concern?	Rationale
Inorganics (mg/kg or mg/L)									
Beryllium	2.2	67	Yes	Yes	35	N/A	No	No	Not a SW ECOPC
Boron	30	91	N/A	Yes	100	N/A	No	No	Not a SW ECOPC
Calcium	95,700	100	Yes	No	73	Yes	N/A	No	CE
Cesium	13.6	26	N/A	No	6.5	N/A	N/A	No	FD
Chloride	206	77	N/A	Yes	99	Yes	No	No	CE, Not a SW ECOPC
Cobalt	13.3	88	No	Yes	44	N/A	No	No	BB, Not a SW ECOPC
Cyanide	0.23	14	N/A	Yes	11	N/A	Yes	No	Not a SW ECOPC
Lithium	27	84	No	Yes	67	Yes	Yes	No	BB
Magnesium	22,900	100	Yes	No	73	Yes	N/A	No	CE
Manganese	639	100	No	Yes	100	Yes	No	No	Not a SW ECOPC
Molybdenum	7.7	35	No	Yes	44	No	No	No	Not a SW ECOPC
Nitrate / Nitrite	12.9	39	N/A	No	94	N/A	N/A	No	UC
Potassium	3,900	98	Yes	No	72	Yes	N/A	No	CE
Silica	2,000	100	Yes	No	84	No	N/A	No	BB
Silicon	836	100	N/A	No	57	N/A	N/A	No	CE
Sodium	2,240	89	Yes	No	73	Yes	N/A	No	CE
Strontium	150	100	Yes	Yes	73	Yes	No	No	Not a SW ECOPC
Sulfate	26	46	N/A	N/A	2.3	Yes	N/A	No	FD
Sulfide	31	100	N/A	N/A	100	N/A	N/A	No	CE
Thallium	1.2	17	N/A	Yes	4	N/A	No	No	FD, Not a SW ECOPC
Tin	39	10	N/A	Yes	9	N/A	No	No	FD, Not a SW ECOPC
Titanium	330	100	N/A	No	71	N/A	N/A	No	UC
Vanadium	63	93	Yes	Yes	51	Yes	No	No	BB, Not a SW ECOPC
Organics (ug/kg or ug/L)									
1,1-Dichloroethene	2	1	N/A	Yes	10	N/A	No	No	Not a SW ECOPC
1,2-Dichloroethene	48	4	N/A	Yes	24	N/A	No	No	Not a SW ECOPC
Acetone	210	13	N/A	Yes	31	N/A	No	No	Not a SW ECOPC
Benzo(b)fluoranthene	1500	58	N/A	No	ND	N/A	No	No	ND
Benzoic acid	1400	10	N/A	No	ND	N/A	No	No	ND
Dimethylphthalate	490	5	N/A	No	1	N/A	N/A	No	FD
Di-n-octylphthalate	9800	20	N/A	No	2	N/A	N/A	No	FD
Methylene chloride	420	28	N/A	Yes	25	N/A	No	No	Not a SW ECOPC
Trichlorofluoromethane	5	50	N/A	No	0.5	N/A	N/A	No	FD
Vinyl chloride	16.8	1	N/A	Yes	5	N/A	No	No	Not a SW ECOPC
Radionuclides (pCi/g)									
Cesium-134	0.1	100	No	No	ND	N/A	No	No	ND, BB
Gross Alpha	160	100	No	No	96	Yes	N/A	No	BB
Gross Beta	39	100	No	No	96	Yes	N/A	No	BB

BB = Observed sediment or surface water MDC was less than the appropriate background level.
CE = Common element that is associated with low toxicity.
FD = was detected in less than 10% of the surface water or sediment samples.
ND = was not detected in the surface water samples.
Not a SW ECOPC = was not identified as an ECOPC for surface water as per the selection process.
Not a SW Risk Concern = The risk characterization determined that this chemical would not create an unacceptable risk to aquatic populations.
UC = Uncertain toxicity due to a lack of both surface water and sediment ESLs.
N/A = Not available or not applicable.
ND = Not detected.

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Table 6.6
Summary of Uncertain Sediment ECOIs as Compared to Surface Water ECOPCs for WC AEU

Analyte	MDC	% Detect in Sediment	> Background in Sediment?	SW ESL Available?	% Detect in Surface Water	> Background in Surface Water	SW ECOPC?	Risk Concern?	Rationale
Inorganics (mg/kg or mg/L)									
Beryllium	6.70	74	Yes	Yes	23	N/A	No	No	Not a SW ECOPC
Boron	14.00	100	N/A	No	ND	N/A	No	No	ND
Calcium	48,200	100	Yes	No	100	Yes	N/A	No	CE
Cesium	5.2	16	N/A	No	14	N/A	N/A	No	FD
Cobalt	13.1	97	Yes	Yes	32	N/A	No	No	Not a SW ECOPC
Lithium	28	87	Yes	Yes	79	Yes	No	No	BB, Not a SW ECOPC
Magnesium	6,600	100	Yes	No	100	Yes	N/A	No	CE
Molybdenum	11.7	35	No	No	36	No	No	No	BB, Not a SW ECOPC
Nitrate / Nitrite	32	73	N/A	No	57	N/A	N/A	No	UC
Potassium	4,200	90	Yes	No	95	Yes	N/A	No	CE
Silica	1,600	100	Yes	No	100	Yes	N/A	No	CE
Silicon	1,890	100	N/A	No	100	N/A	N/A	No	CE
Sodium	2,060	85	No	No	100	Yes	N/A	No	BB
Strontium	167	99	Yes	Yes	99	Yes	No	No	Not a SW ECOPC
Thallium	10	15	N/A	Yes	6	N/A	No	No	FD, Not a SW ECOPC
Tin	77.2	24	Yes	Yes	9	N/A	No	No	BB, FD, Not a SW ECOPC
Titanium	300	100	N/A	No	ND	N/A	N/A	No	ND
Vanadium	68.6	100	Yes	Yes	53	No	No	No	BB, Not a SW ECOPC
Organics (µg/kg or ug/L)									
2,4-Dinitrophenol	890.0	2	N/A	No	ND	N/A	No	No	ND
4-Methyl-2-pentanone	3	2	N/A	No	ND	N/A	N/A	No	ND
4,6-Dinitro-2-methylphenol	750	2	N/A	No	ND	N/A	No	No	ND
Acetone	890	26	N/A	Yes	16	N/A	No	No	Not a SW ECOPC
Benzo(b)fluoranthene	1,500	10	N/A	No	ND	N/A	N/A	No	ND
Benzoic Acid	660	11	N/A	Yes	1.5	N/A	No	No	FD, Not a SW ECOPC
Di-n-octylphthalate	210	5	N/A	No	ND	N/A	N/A	No	ND
Methylene Chloride	220	24	N/A	Yes	15	N/A	No	No	Not a SW ECOPC
Radionuclides (pCi/g)									
Cesium-134	0.3	100	No	No	ND	N/A	N/A	No	ND
Gross Alpha	320	100	No	No	100	Yes	N/A	No	BB
Gross Beta	74.93	100	No	No	100	Yes	N/A	No	BB

BB = Observed sediment or surface water MDC was less than the appropriate background level.
CE = Common element that is associated with low toxicity.
FD = was detected in less than 10% of the surface water or sediment samples.
ND = was not detected in the surface water samples.
Not a SW ECOPC = was not identified as an ECOPC for surface water as per the selection process.
UC = Uncertain toxicity due to a lack of both surface water and sediment ESLs.
N/A = Not available or not applicable.

FIGURES

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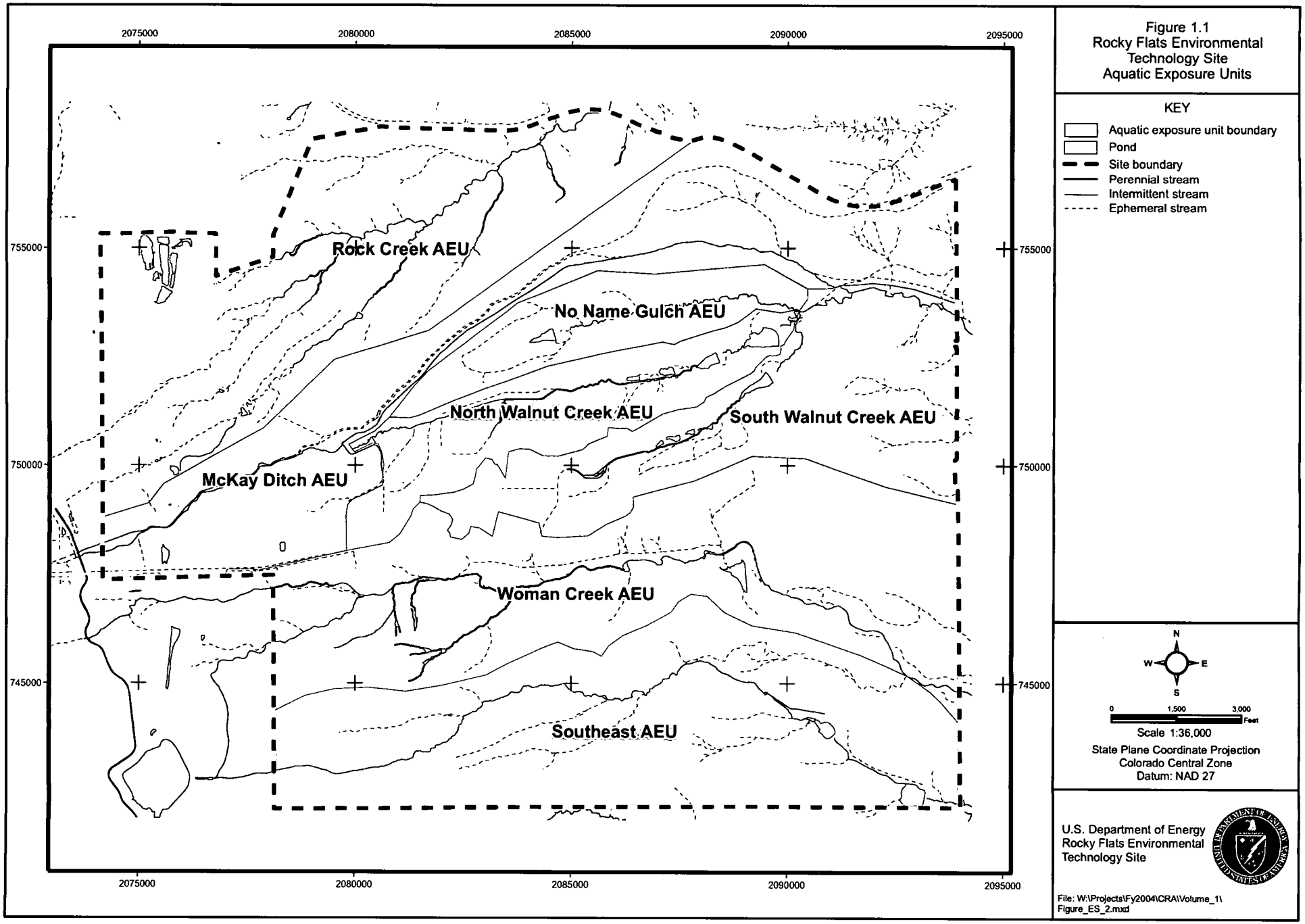

Figure 1.1
Rocky Flats Environmental
Technology Site
Aquatic Exposure Units

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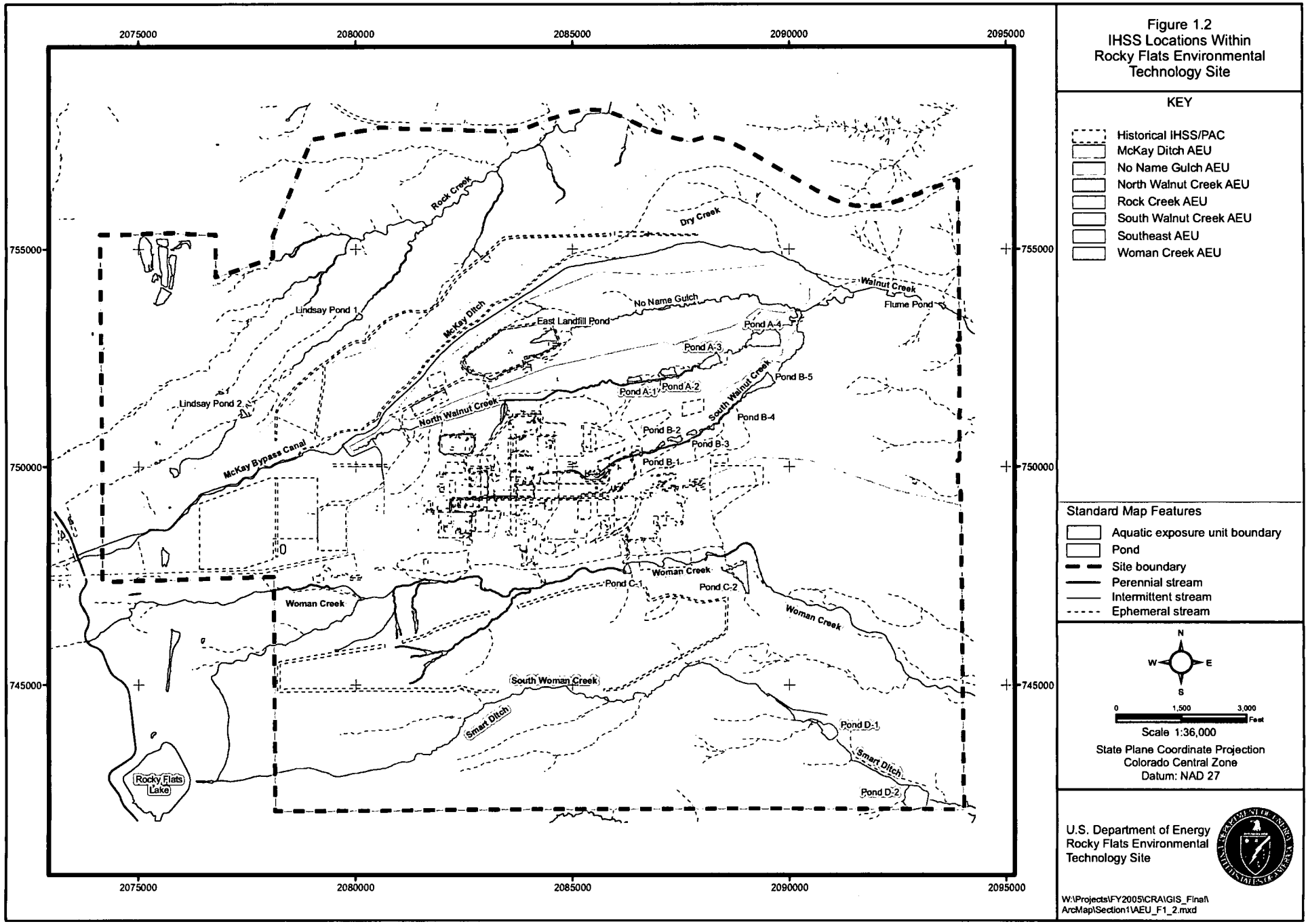
2075000
2080000
2085000
2090000
2095000
755000
750000
745000
Rock Creek
Dry Creek
Walnut Creek
Flume Pond
No Name Gulch
East Landfill Pond
Pond A-4
Pond A-3
Pond A-1
Pond A-2
Pond B-5
Pond B-4
Pond B-2
Pond B-3
Pond B-1
South Walnut Creek
North Walnut Creek
McKay Ditch
Lindsay Pond 1
Lindsay Pond 2
McKay Bypass Canal
Woman Creek
Pond C-1
Pond C-2
South Woman Creek
Smart Ditch
Pond D-1
Pond D-2
Rocky Flats Lake
Figure 1.2
IHSS Locations Within
Rocky Flats Environmental
Technology Site
KEY
Historical IHSS/PAC
McKay Ditch AEU
No Name Gulch AEU
North Walnut Creek AEU
Rock Creek AEU
South Walnut Creek AEU
Southeast AEU
Woman Creek AEU
Standard Map Features
Aquatic exposure unit boundary
Pond
Site boundary
Perennial stream
Intermittent stream
Ephemeral stream
N
W
E
S
0
1,500
3,000
Feet
Scale 1:36,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental
Technology Site
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189

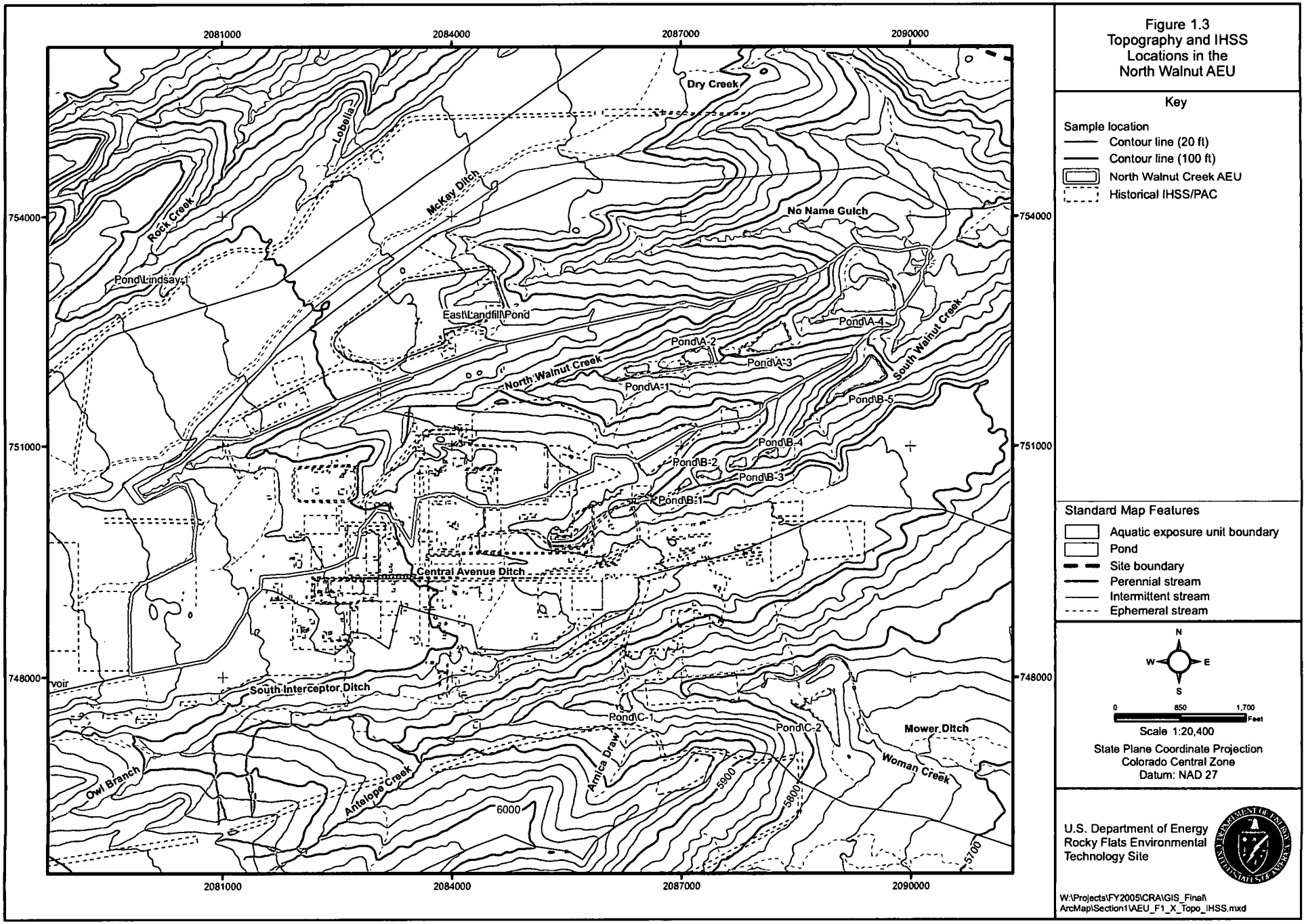

Figure 1.3
Topography and IHSS
Locations in the
North Walnut AEU

190

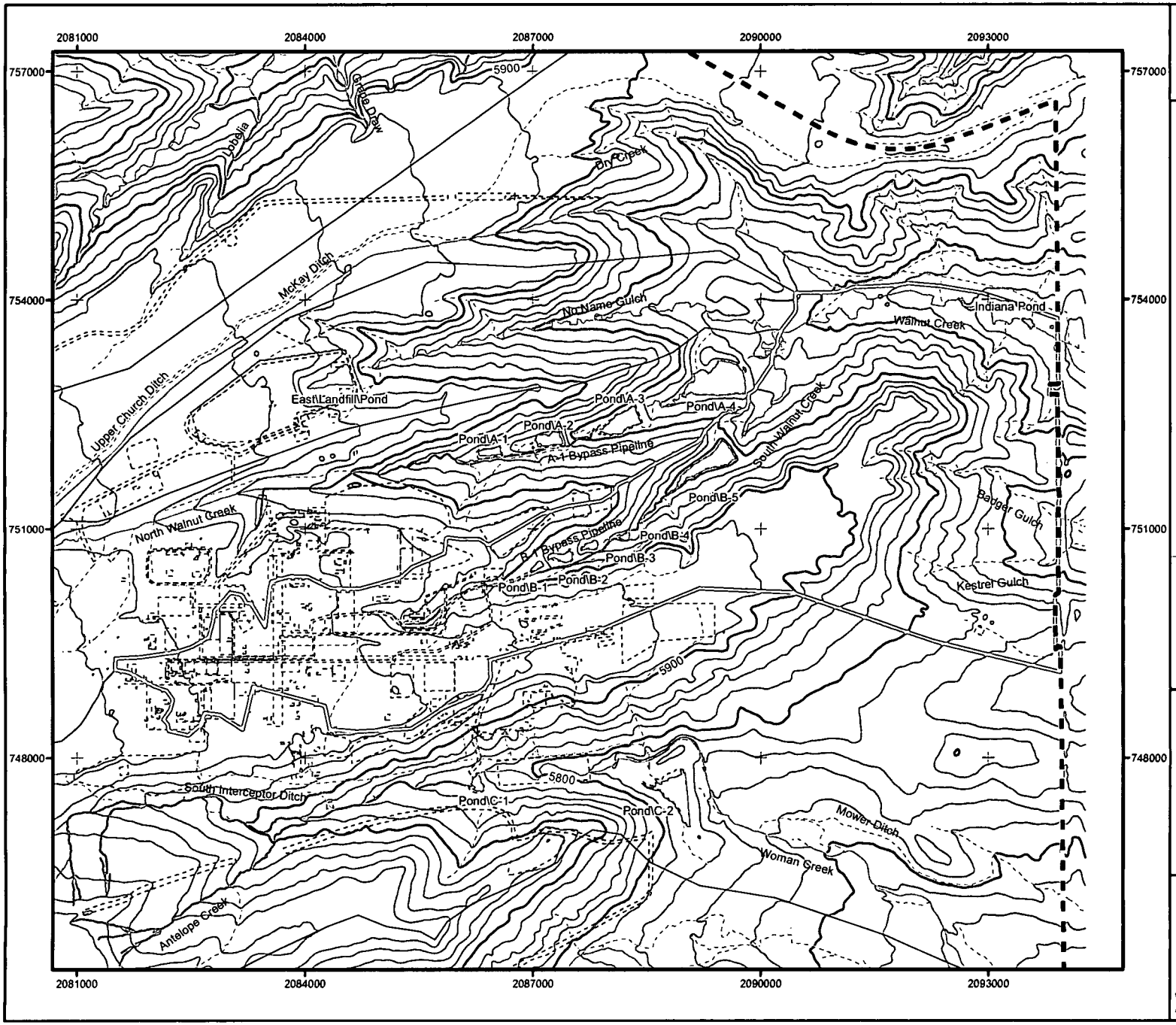

Figure 1.4
Topography and IHSS Locations in the South Walnut Creek AEU

Key

Sample location
- Contour line (20 ft)
- Contour line (100 ft)
- North Walnut Creek AEU
- Historical IHSS/PAC

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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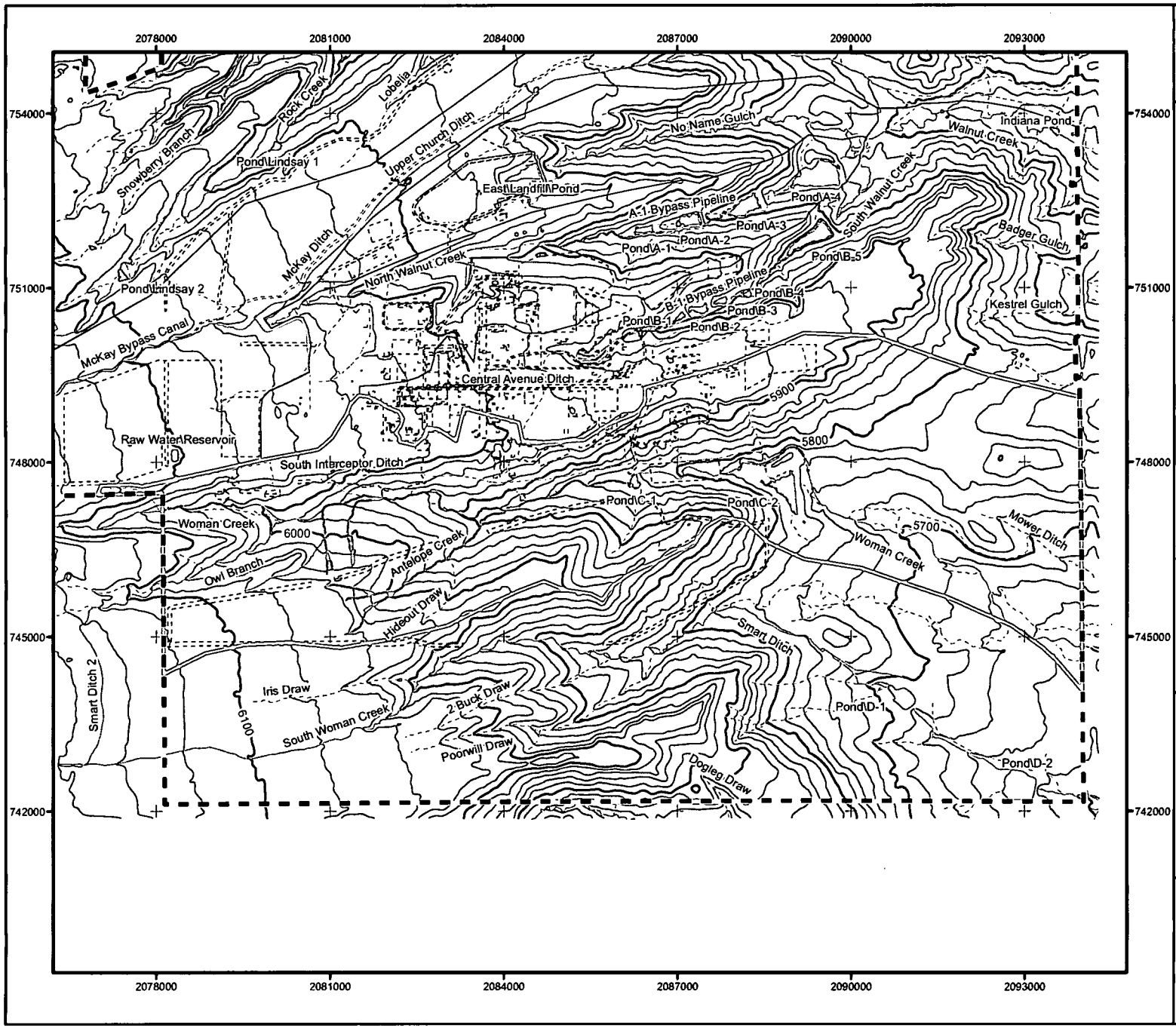

Figure 1.5
Topography and IHSS Locations in the Woman Creek AEU

Key

Sample location
- Contour line (20 ft)
- Contour line (100 ft)
- North Walnut Creek AEU
- Historical IHSS/PAC

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,250 2,500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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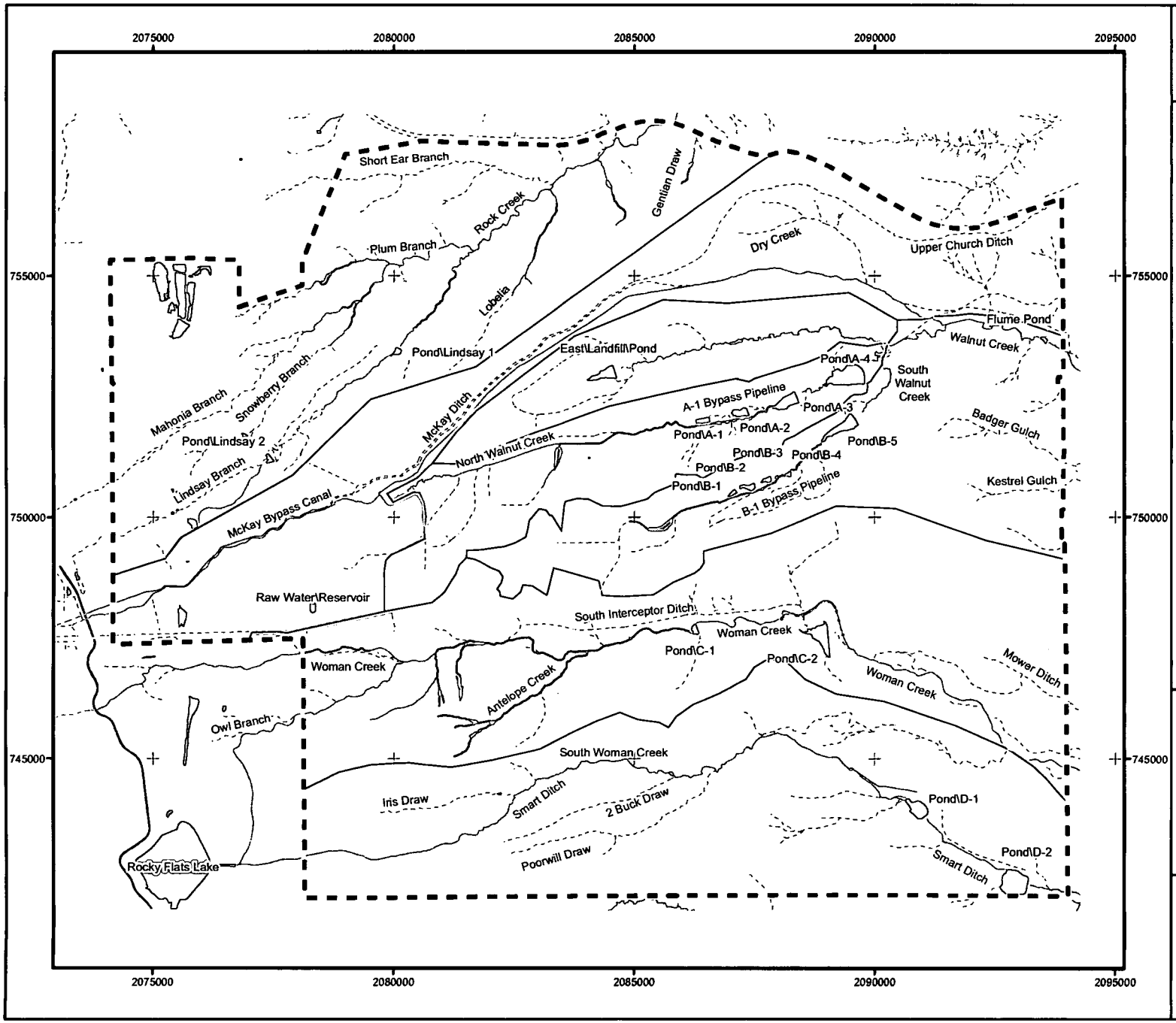

Figure 1.6
Surface Water Hydrology of RFETS

Key

- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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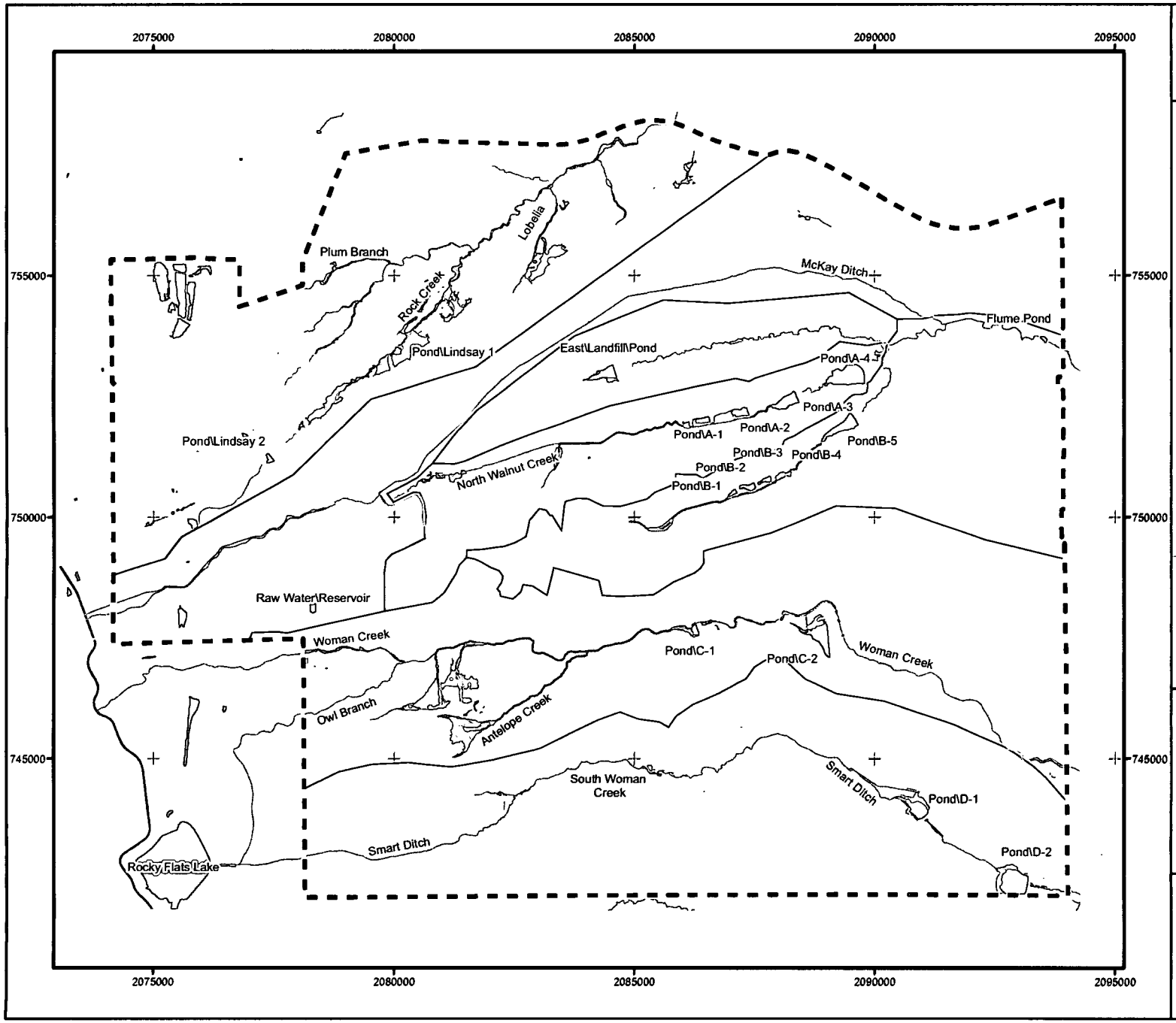

Figure 1.7
Potential Aquatic Habitat Types Within RFETS

Key

Aquatic habitat

Standard Map Features

- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,250 2,500 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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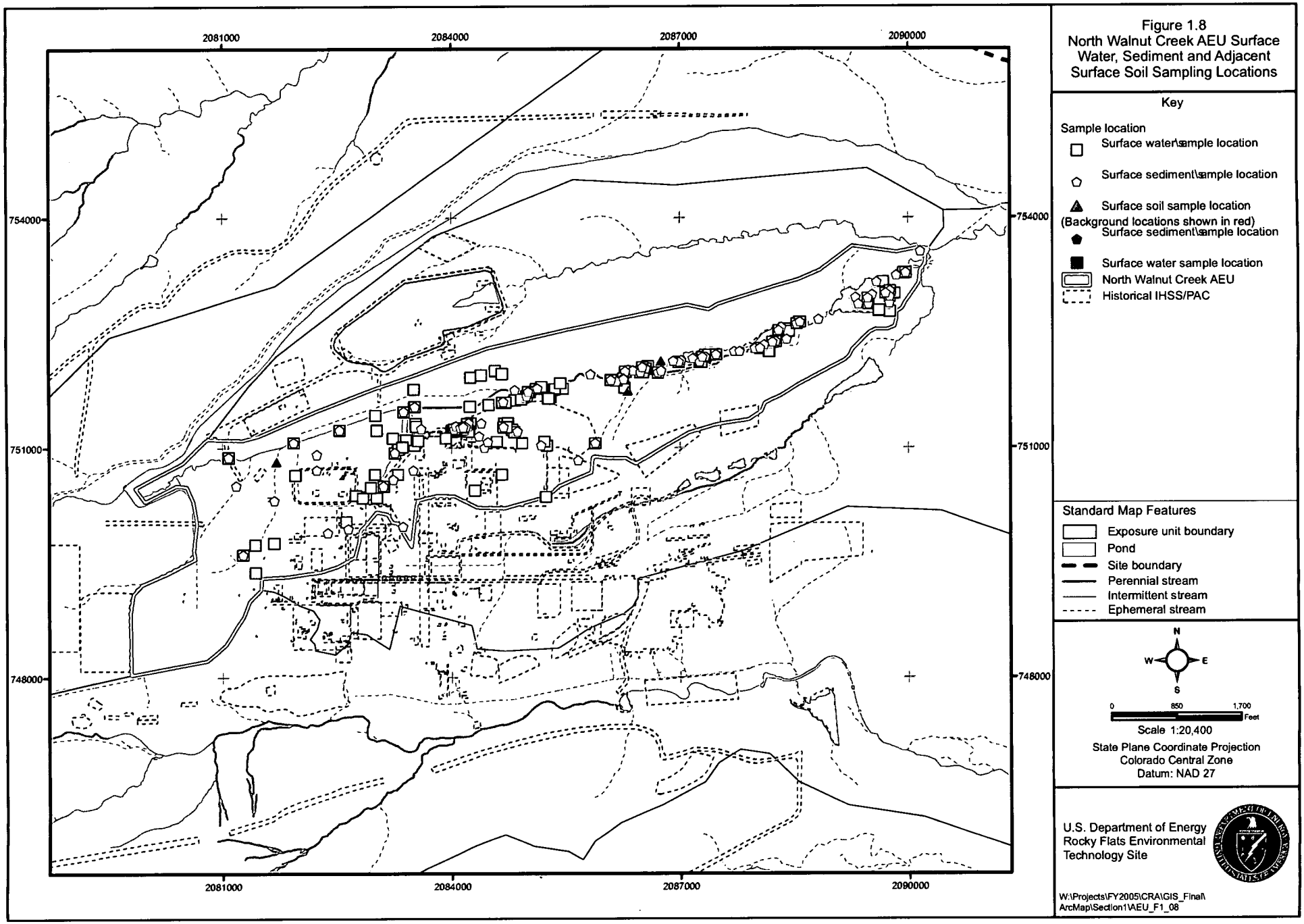

Figure 1.8
North Walnut Creek AEU Surface Water, Sediment and Adjacent Surface Soil Sampling Locations

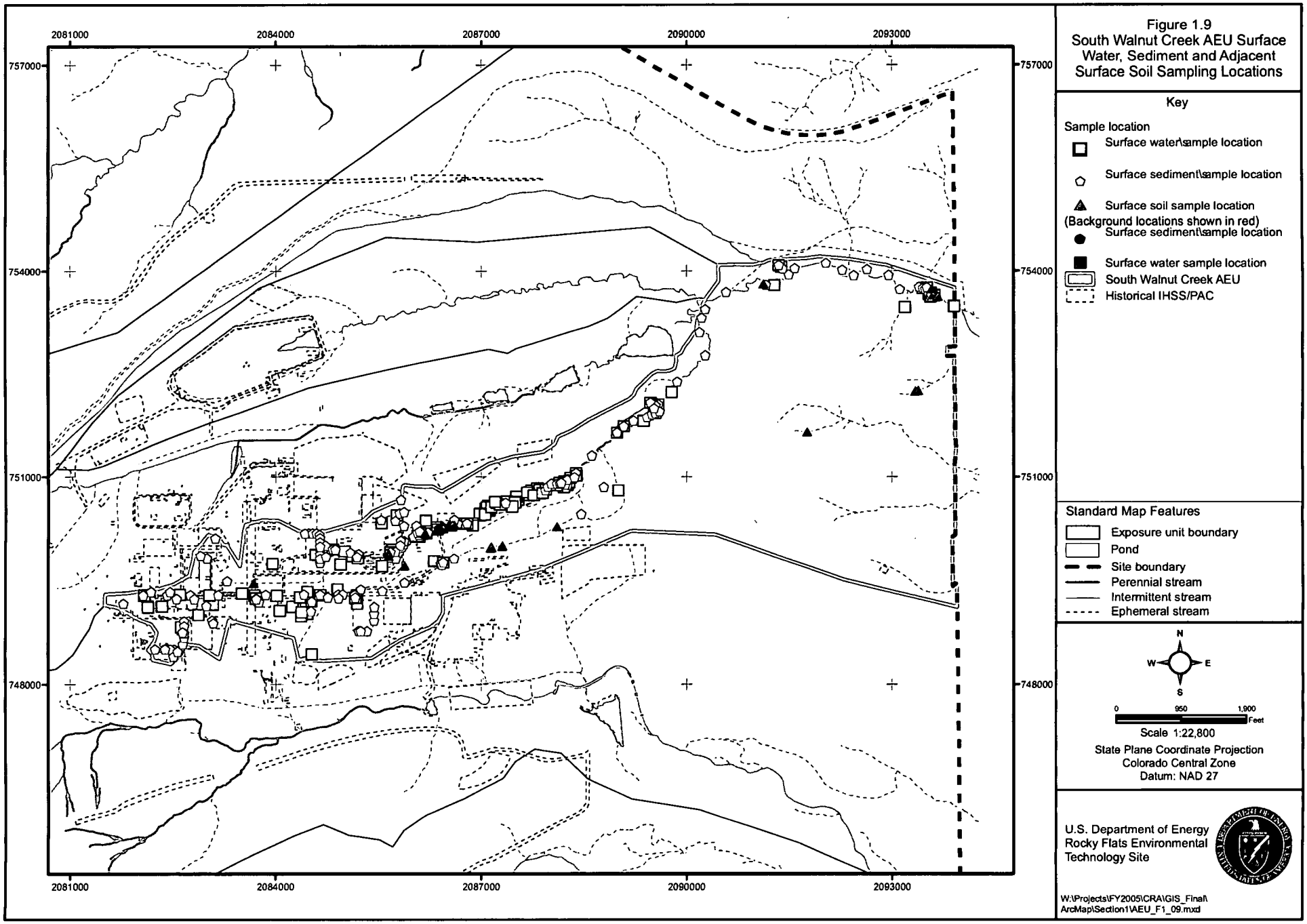

Figure 1.9
South Walnut Creek AEU Surface Water, Sediment and Adjacent Surface Soil Sampling Locations

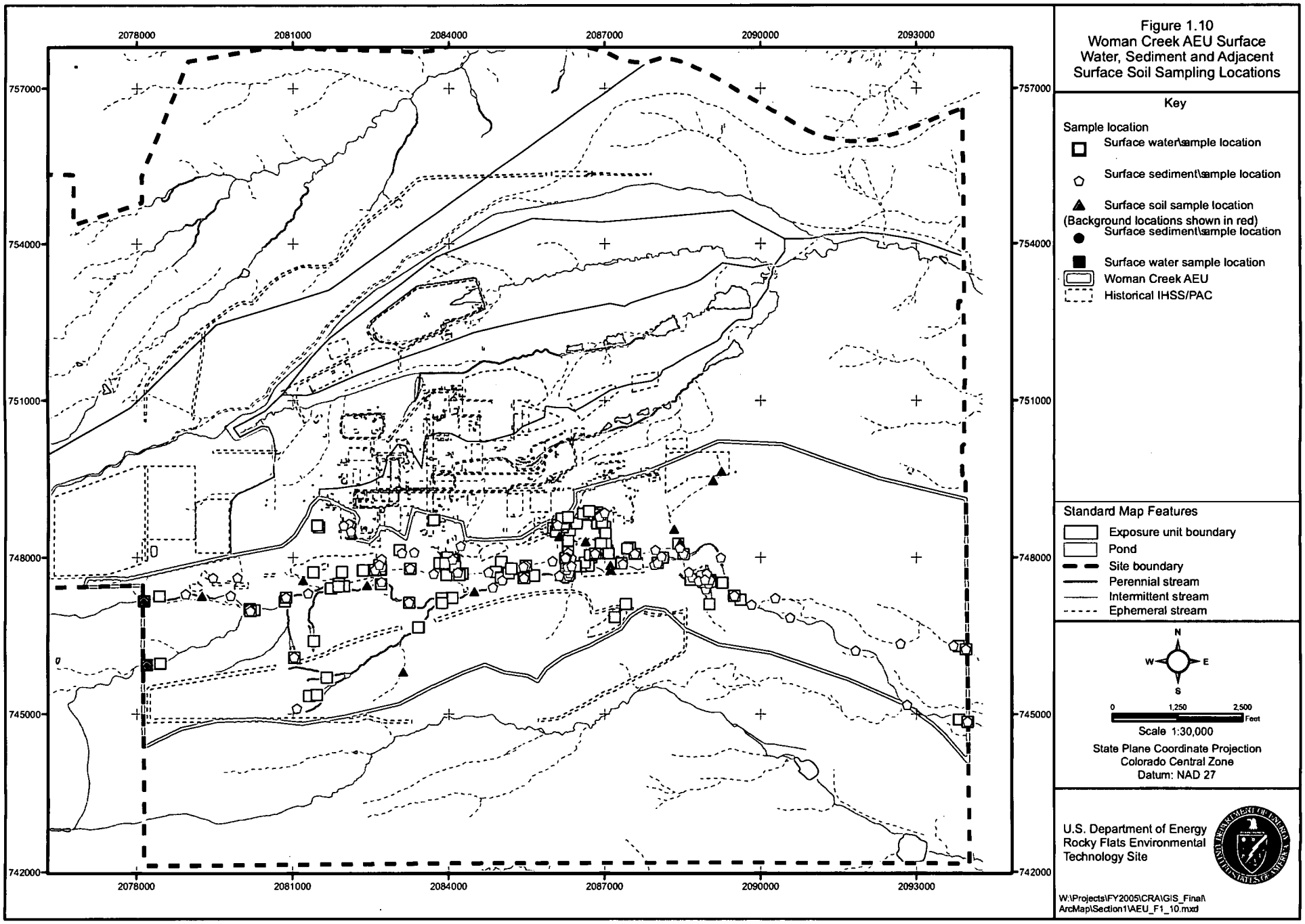

Figure 1.10
Woman Creek AEU Surface Water, Sediment and Adjacent Surface Soil Sampling Locations

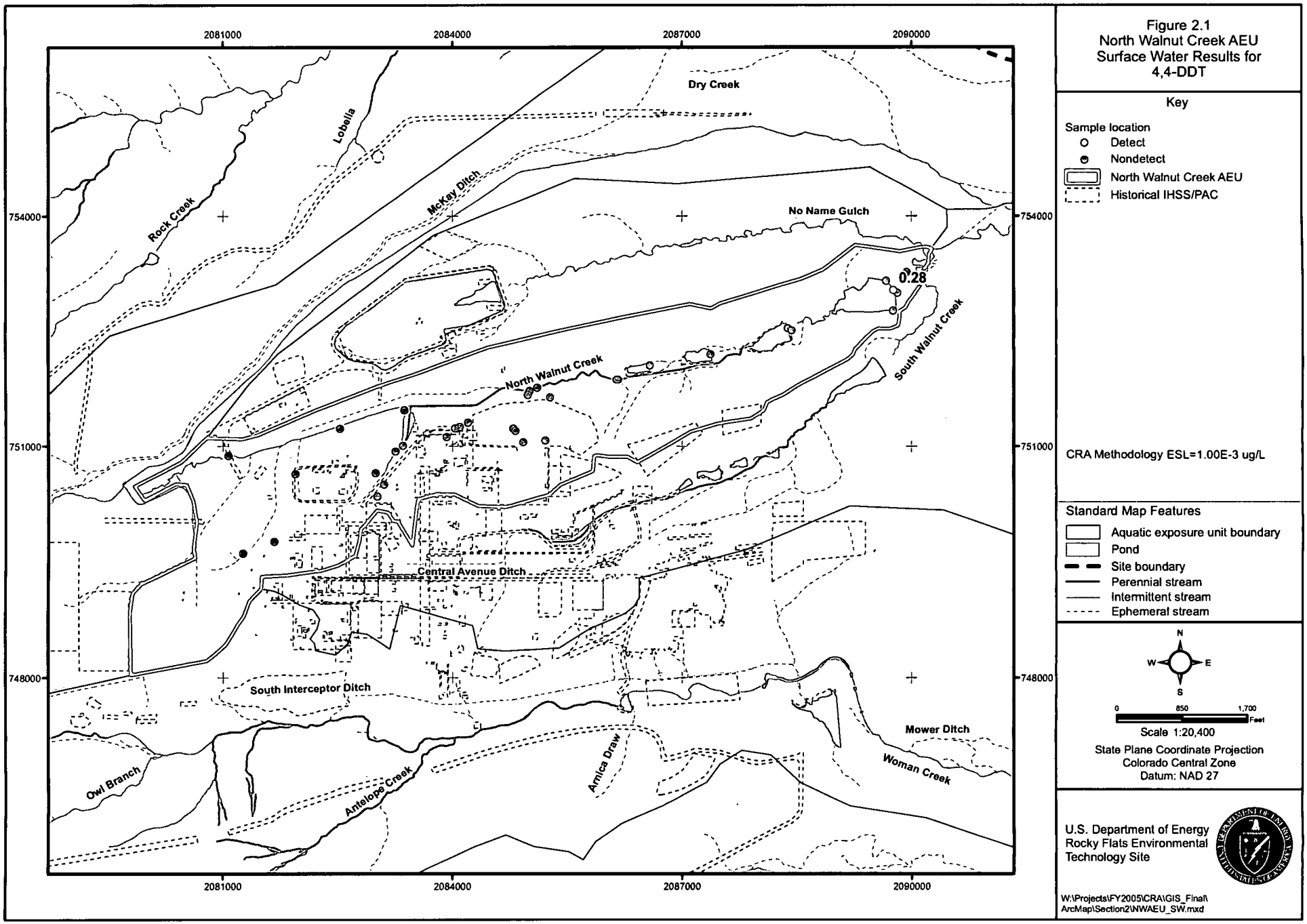

Figure 2.1
North Walnut Creek AEU
Surface Water Results for
4,4-DDT

198

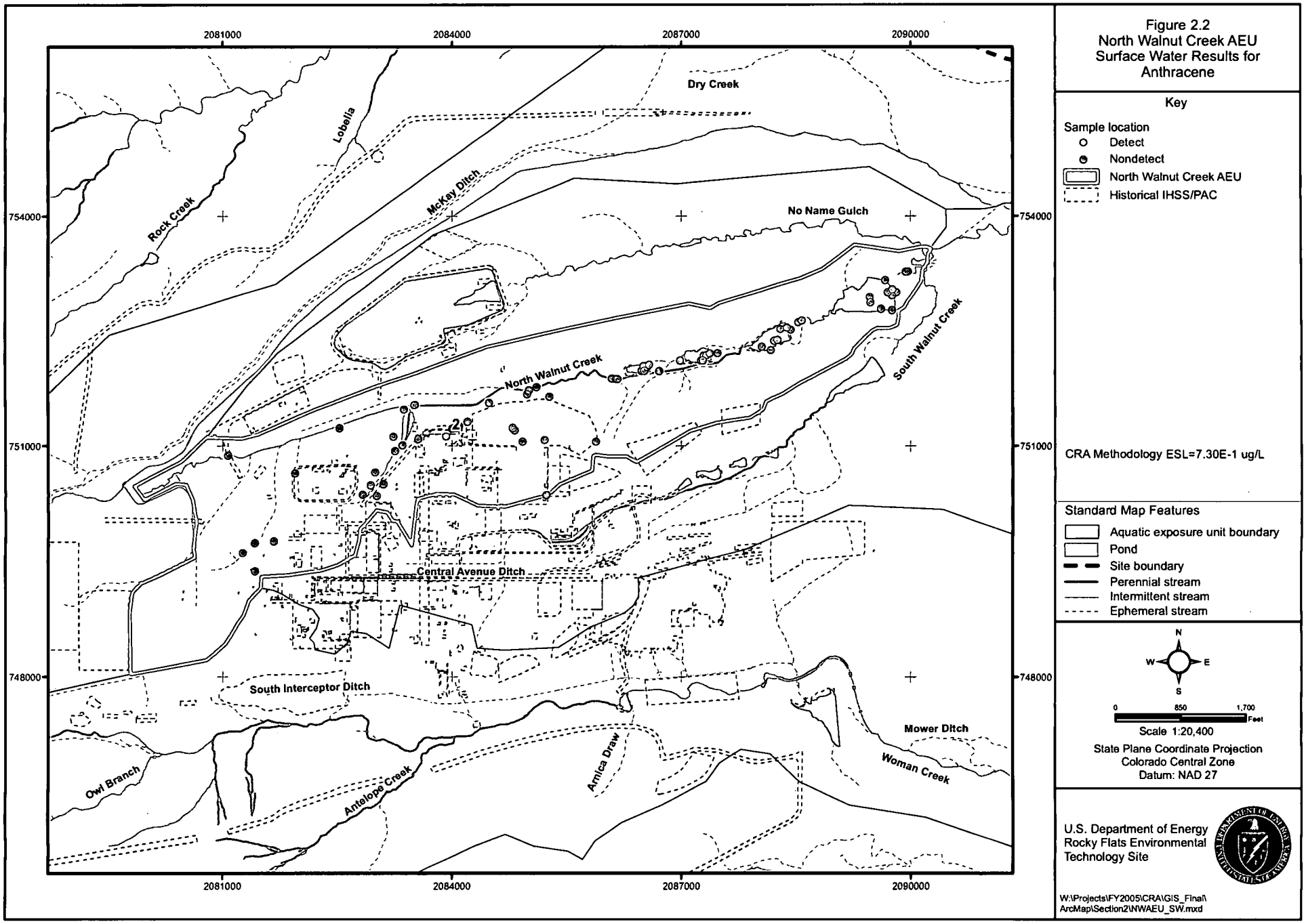

Figure 2.2
North Walnut Creek AEU
Surface Water Results for
Anthracene

199

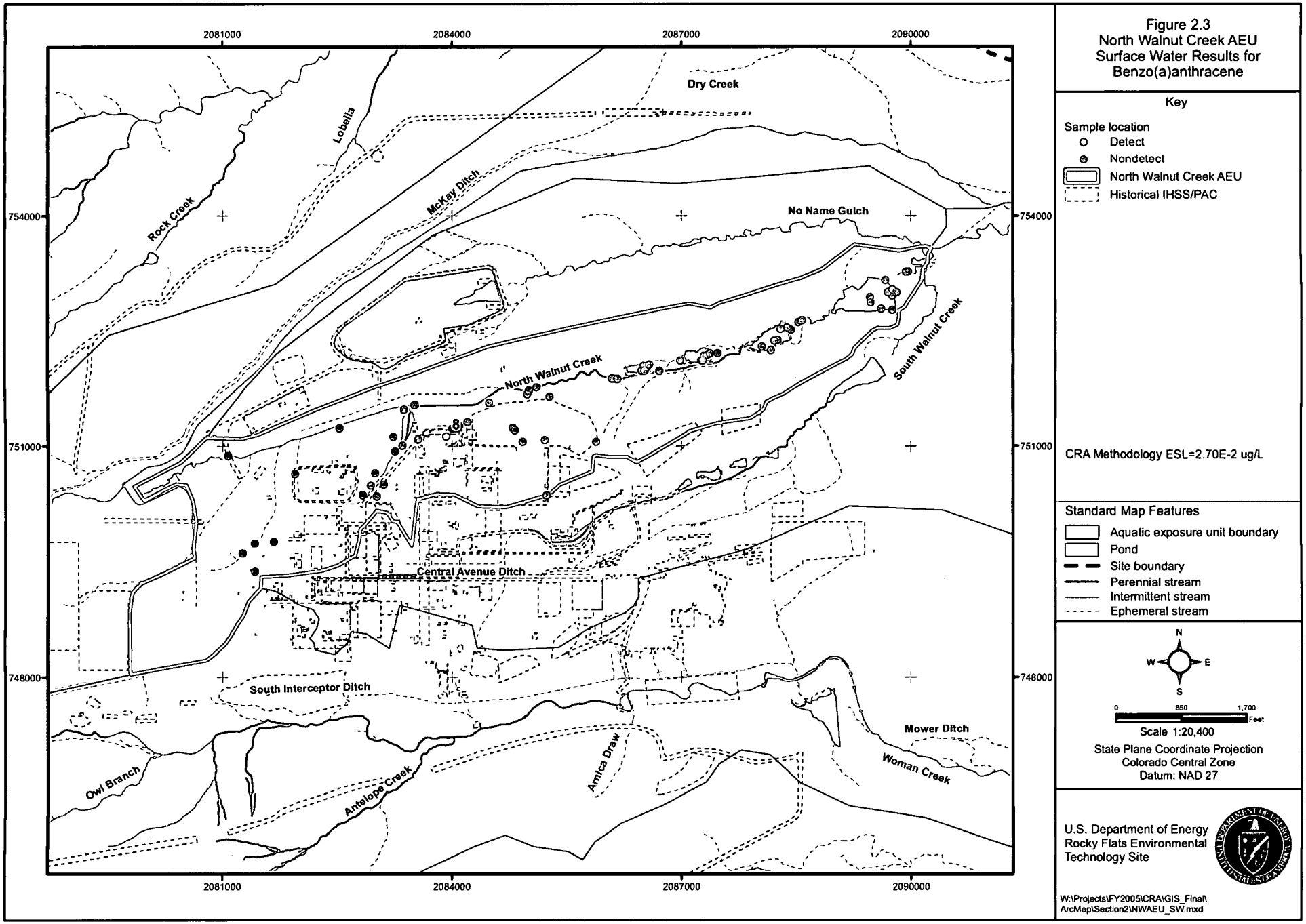

Figure 2.3
North Walnut Creek AEU
Surface Water Results for
Benzo(a)anthracene

200

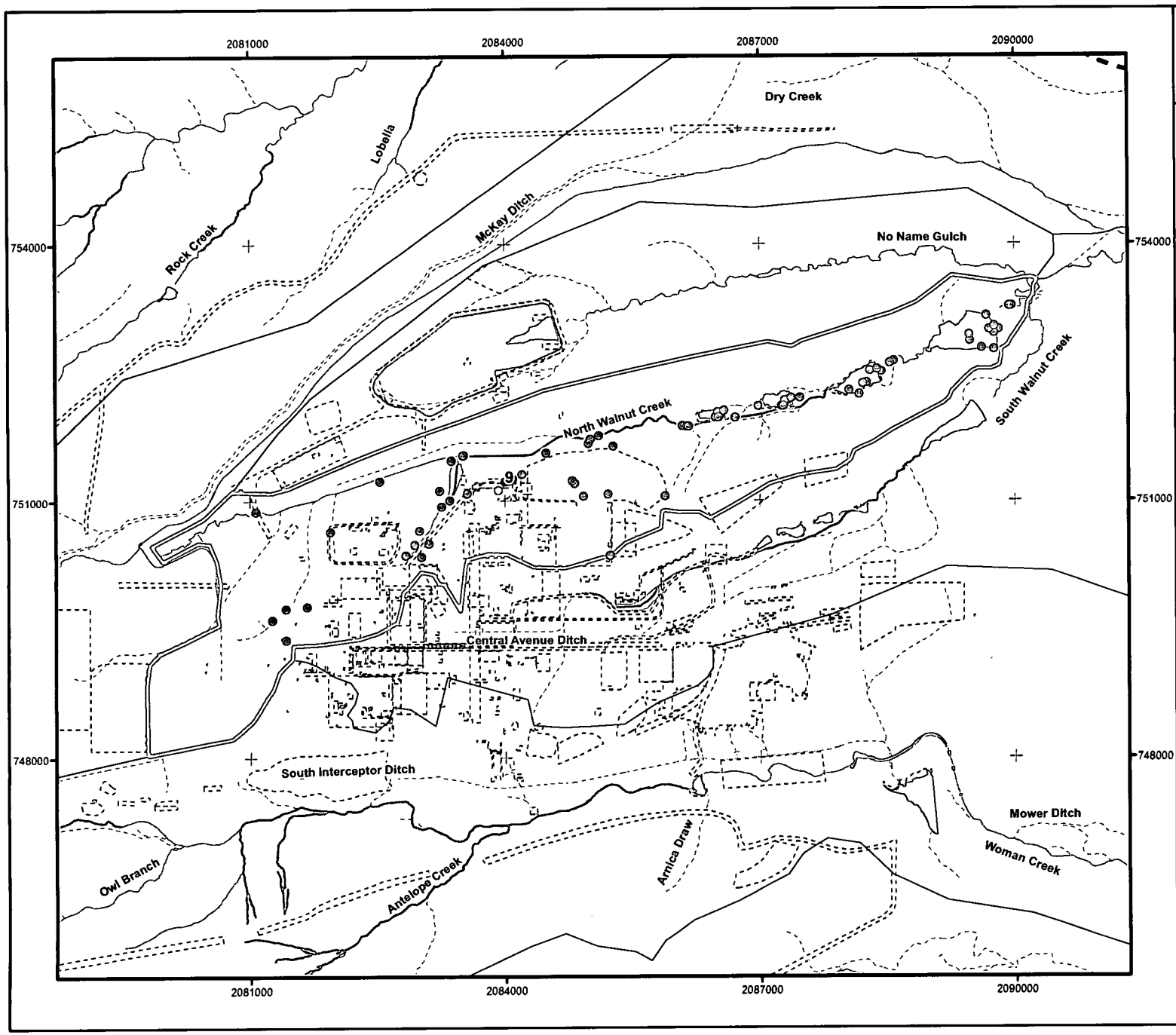

Figure 2.4
North Walnut Creek AEU
Surface Water Results for
Benzo(a)pyrene

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=1.40E-2 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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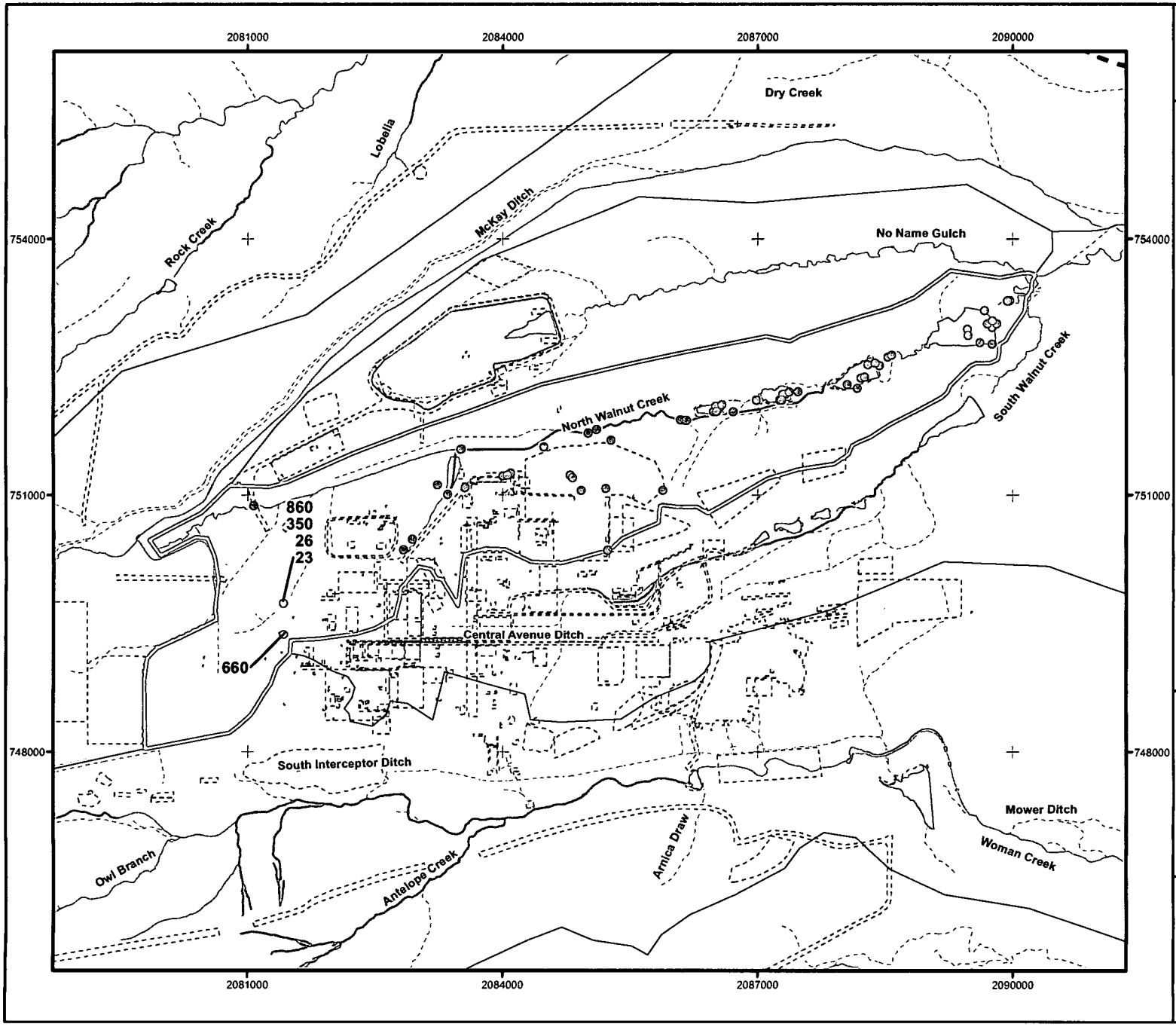

Figure 2.5
North Walnut Creek AEU
Surface Water Results for
Benzyl alcohol

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=8.60 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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202

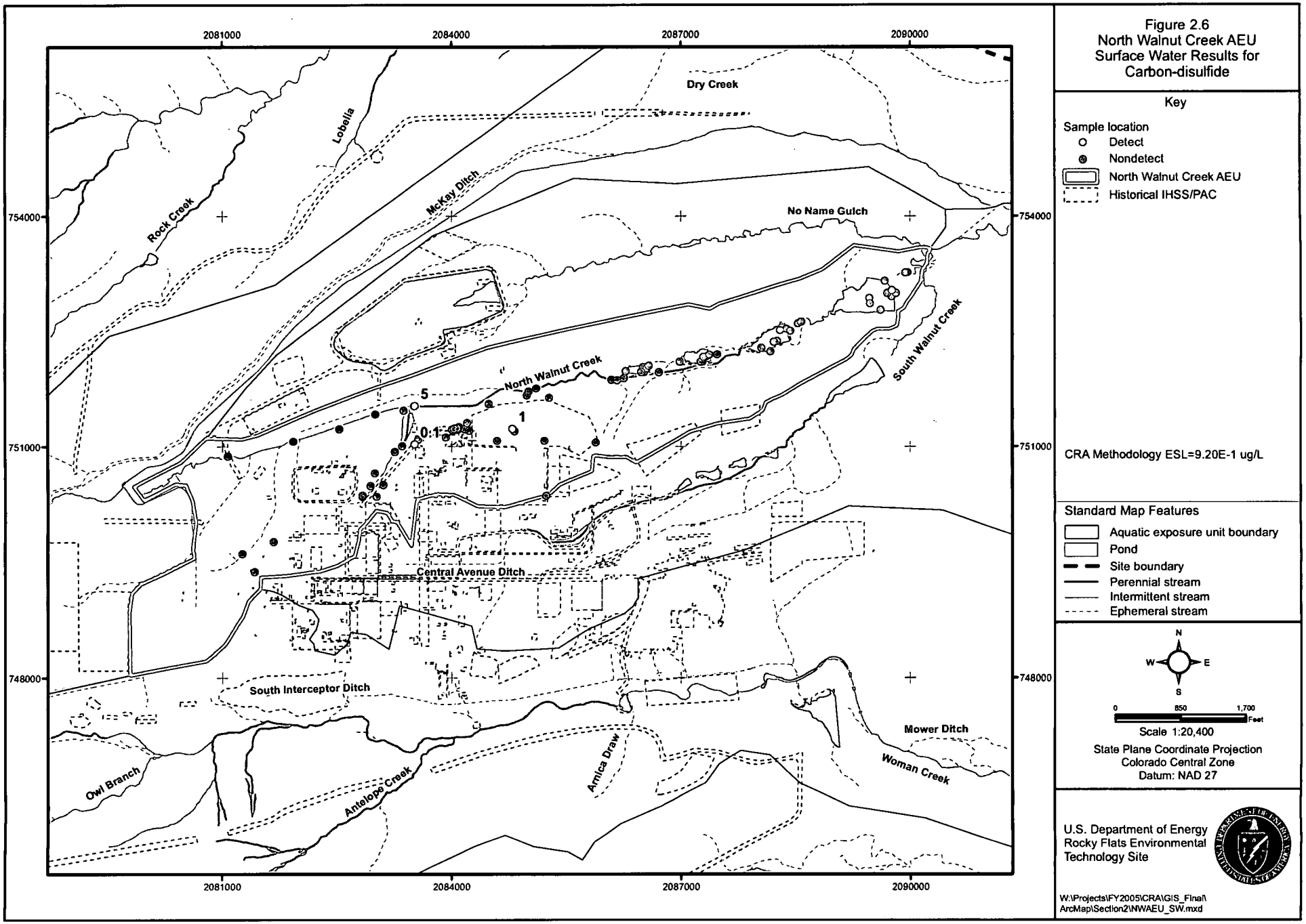

Figure 2.6
North Walnut Creek AEU
Surface Water Results for
Carbon-disulfide

203

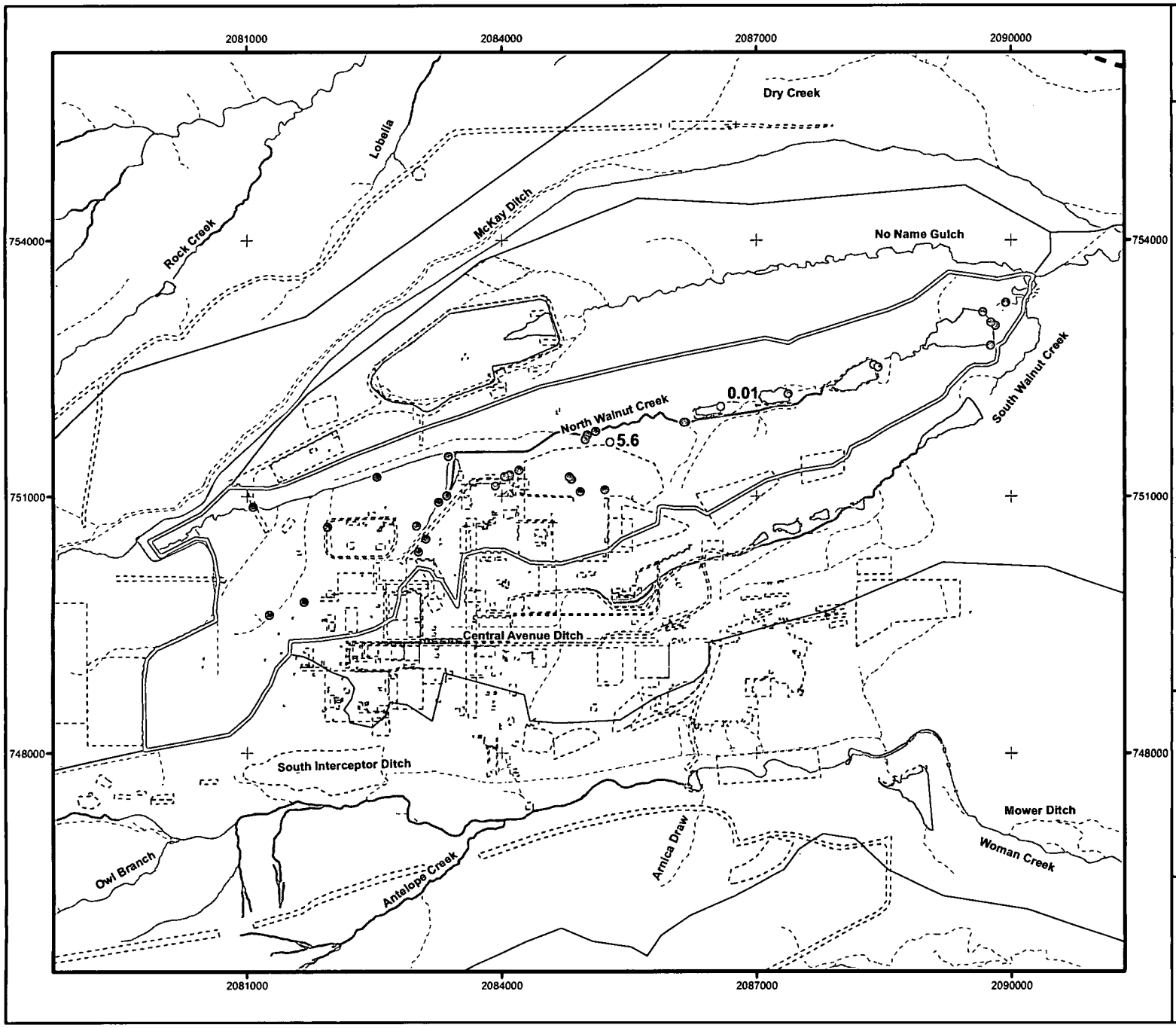

Figure 2.7
North Walnut Creek AEU
Surface Water Results for
Endosulfan I

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=5.60E-2 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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204

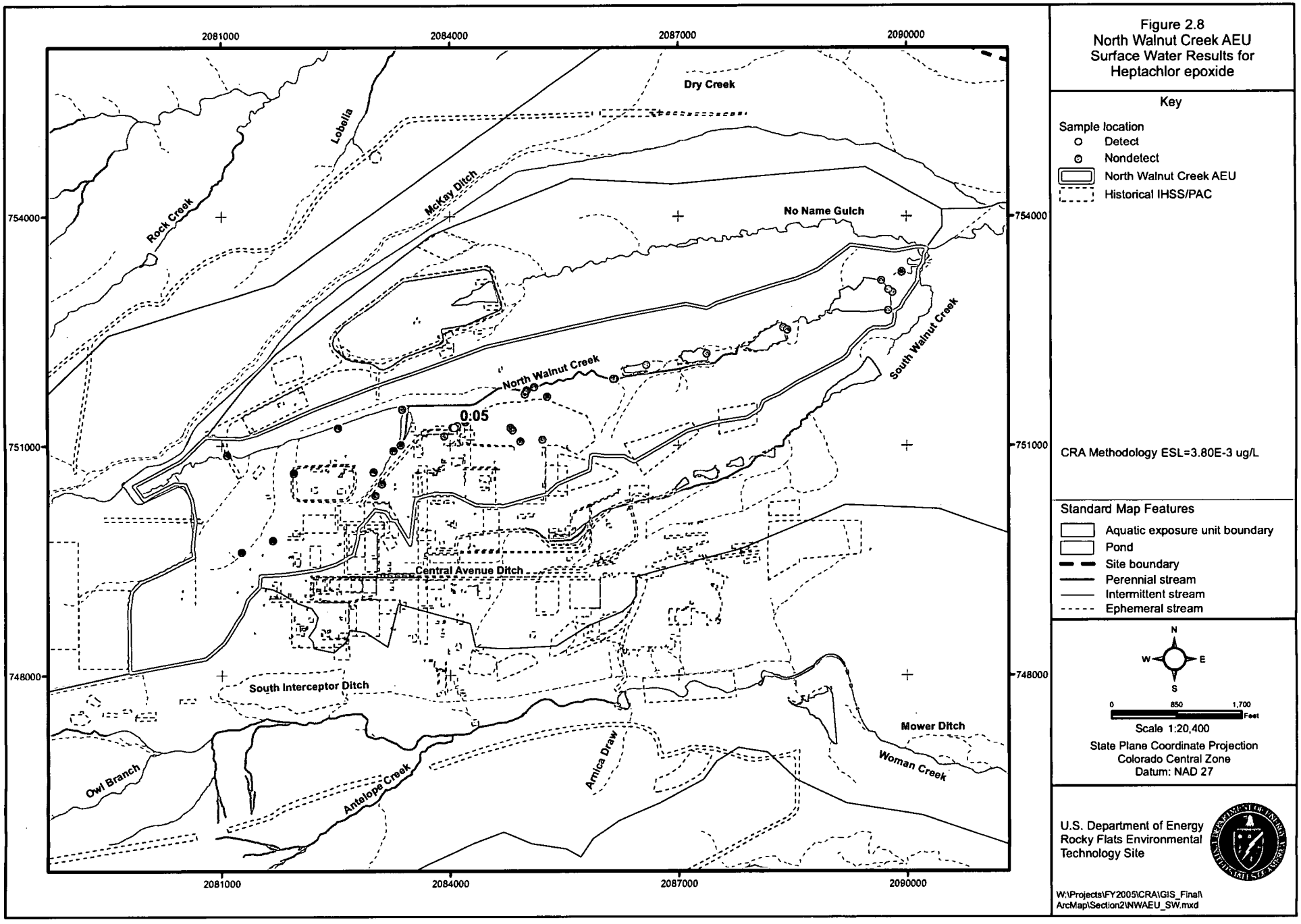

Figure 2.8
North Walnut Creek AEU
Surface Water Results for
Heptachlor epoxide

205

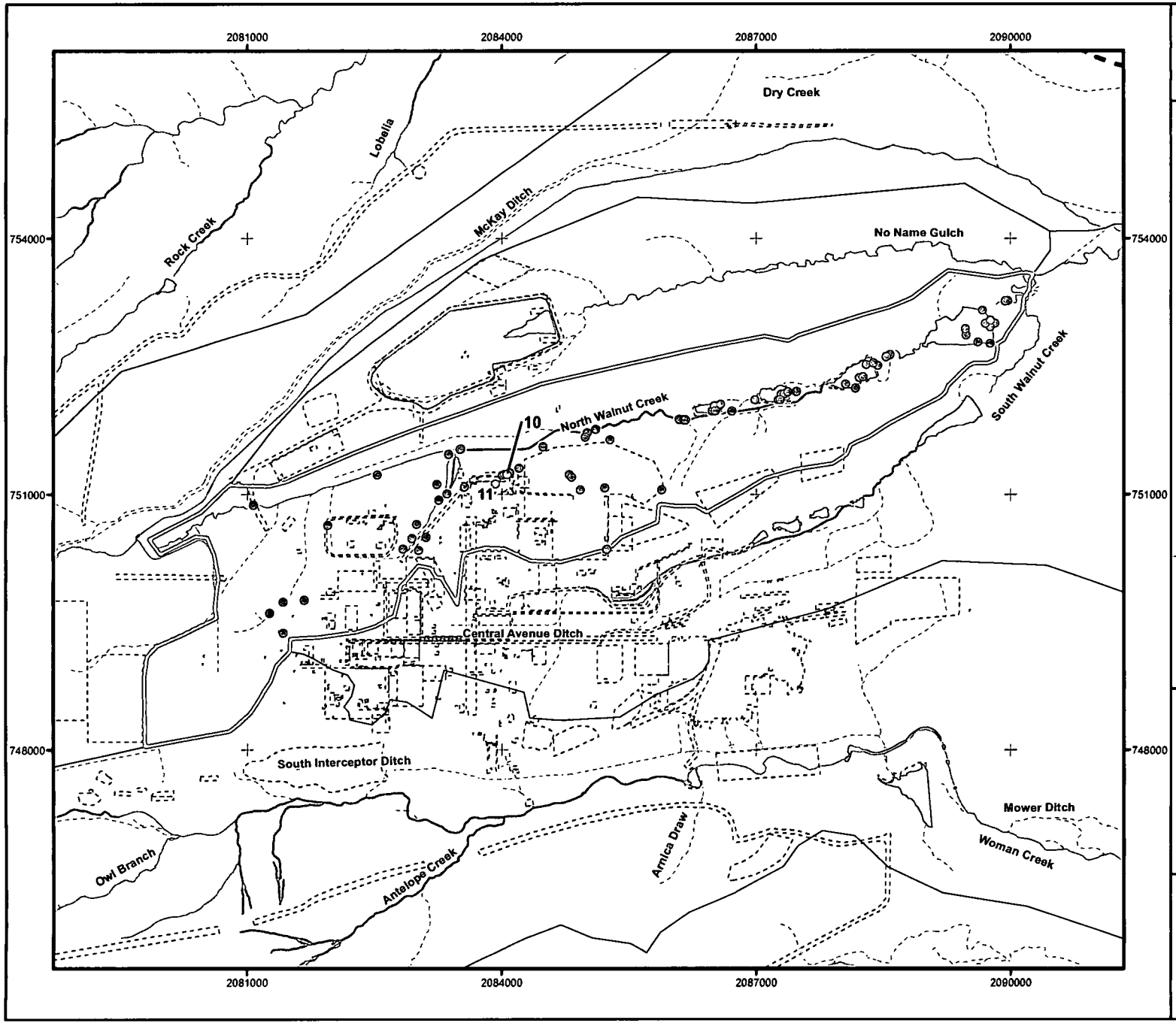

Figure 2.9
North Walnut Creek AEU
Surface Water Results for
Phenanthrene

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=2.40 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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206

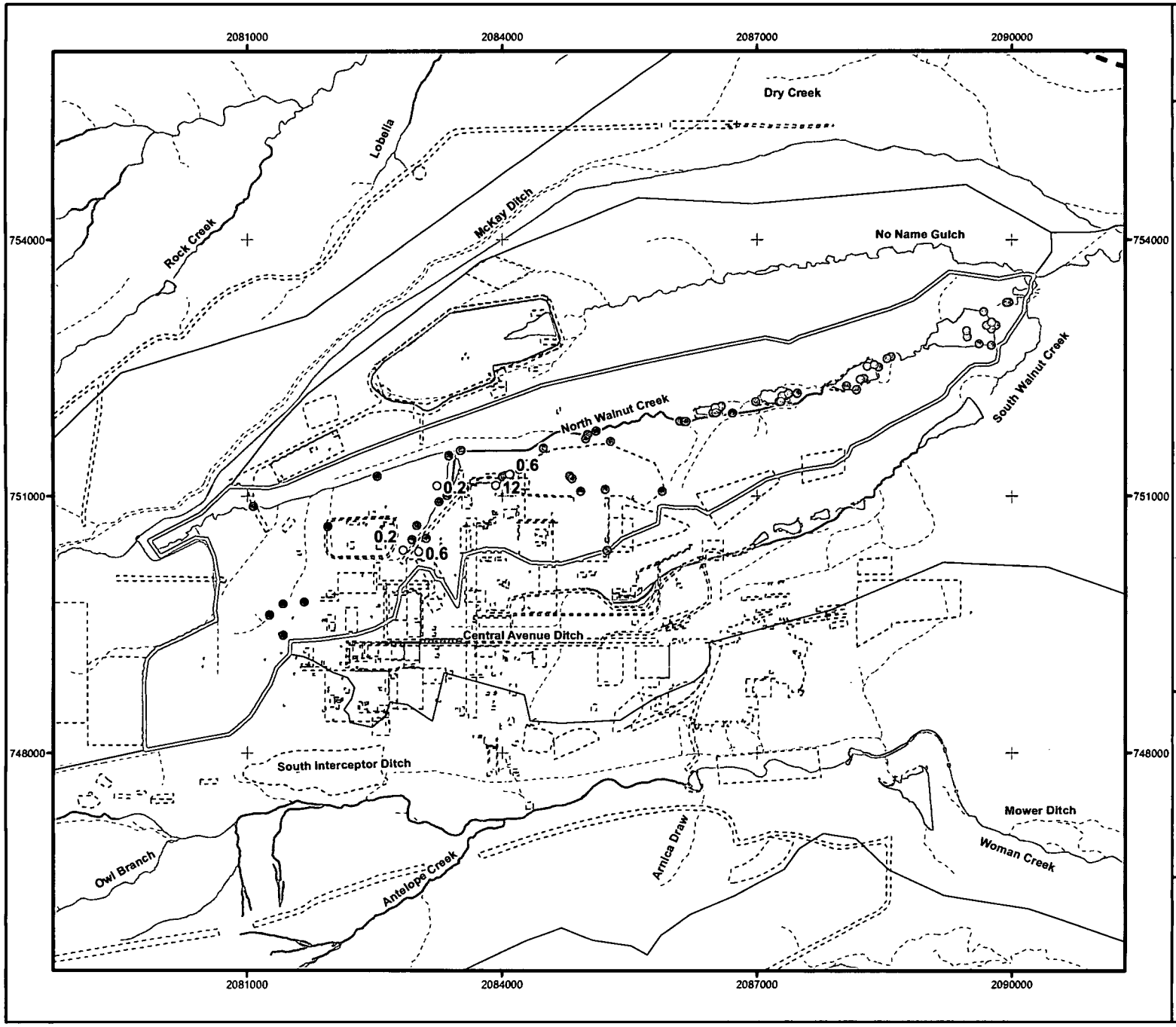

Figure 2.10
North Walnut Creek AEU
Surface Water Results for
Pyrene

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=2.50E-2 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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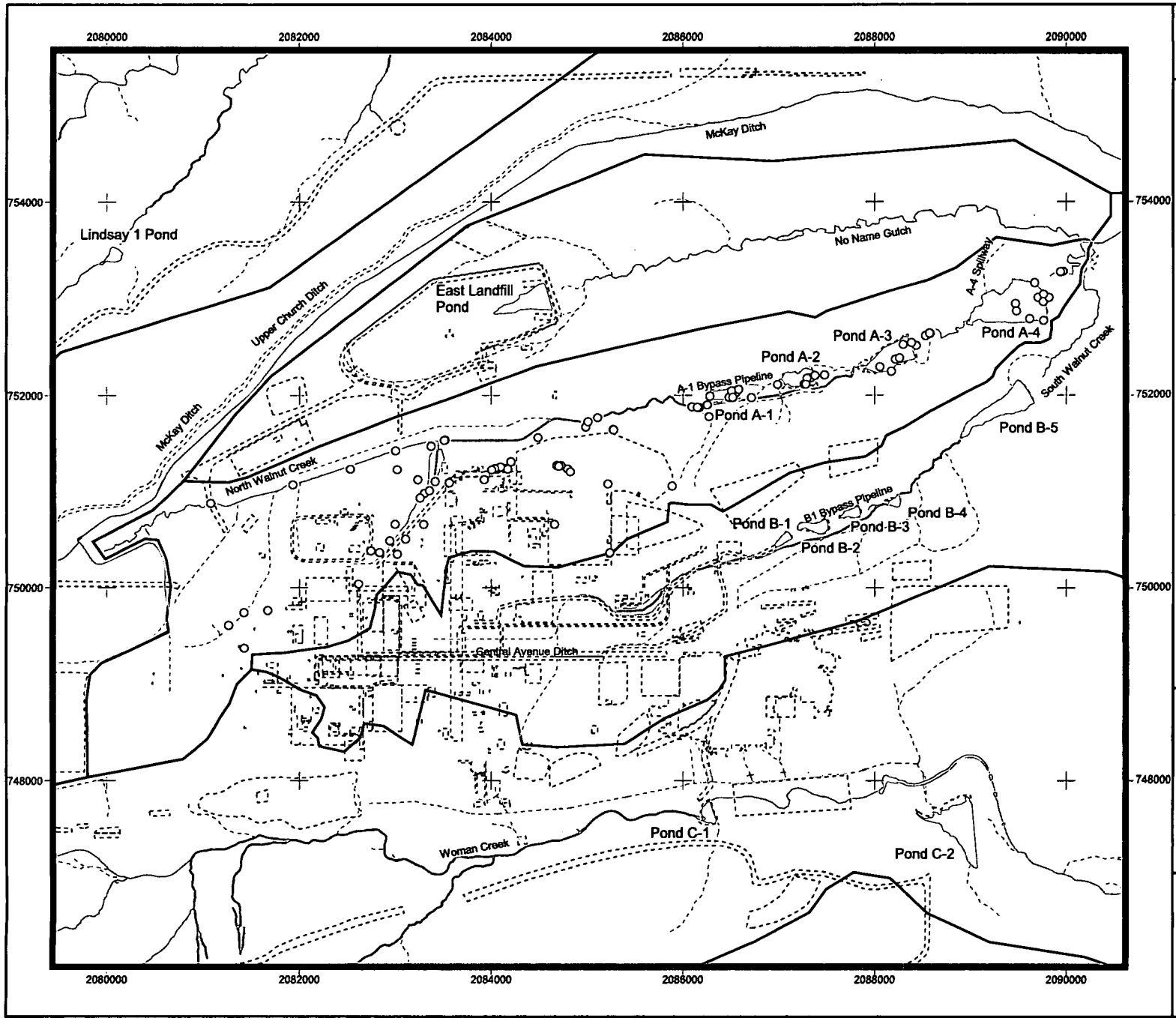

Figure 2.11
North Walnut Creek AEU
Surface Water Sampling Locations
for Barium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.438 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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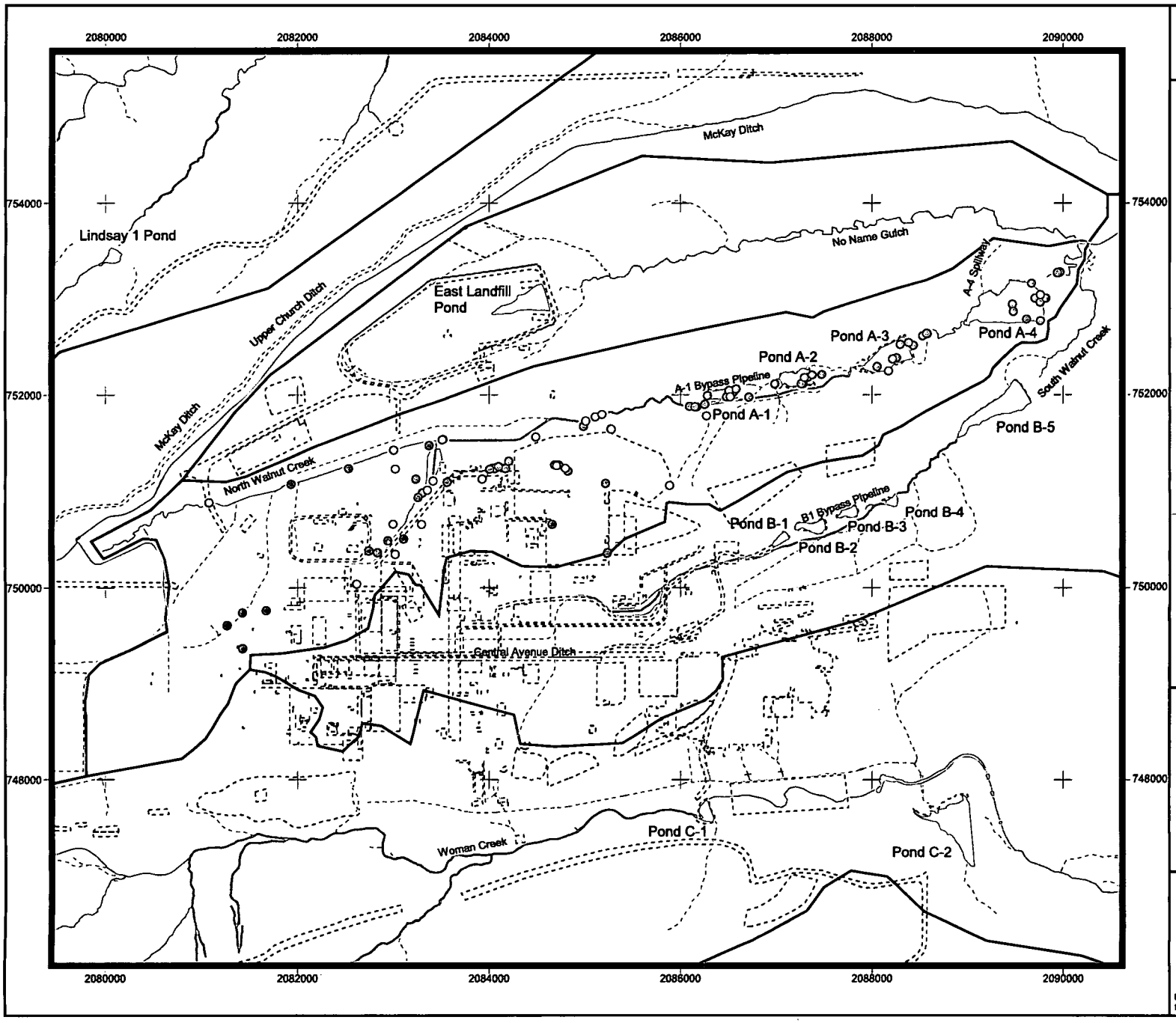

Figure 2.12
North Walnut Creek AEU
Surface Water Sampling Locations
for Beryllium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.0024 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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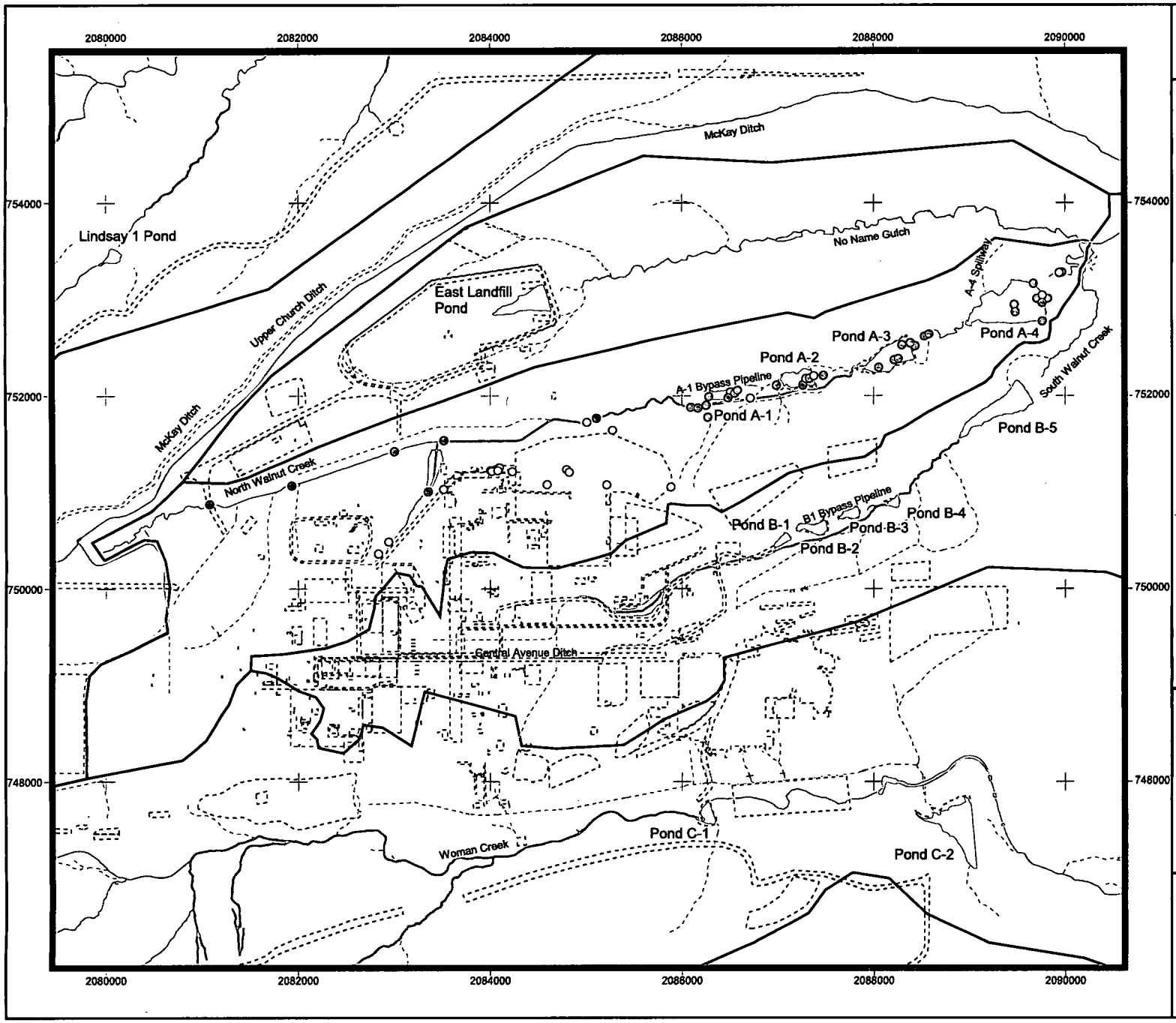

Figure 2.13
North Walnut Creek AEU
Surface Water Sampling Locations
for Chromium (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.074 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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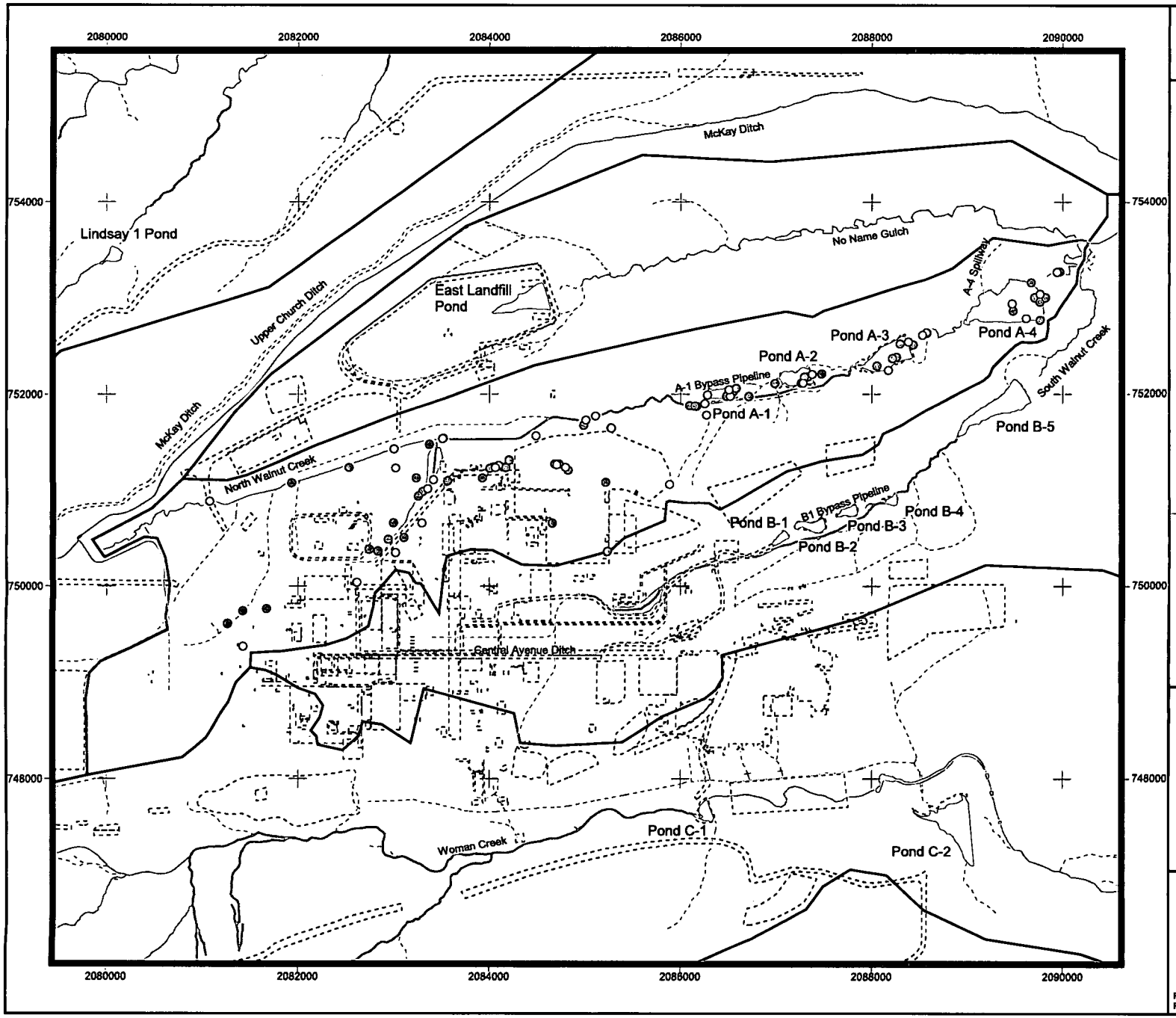

Figure 2.14
North Walnut Creek AEU
Surface Water Sampling Locations for Cobalt (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.1 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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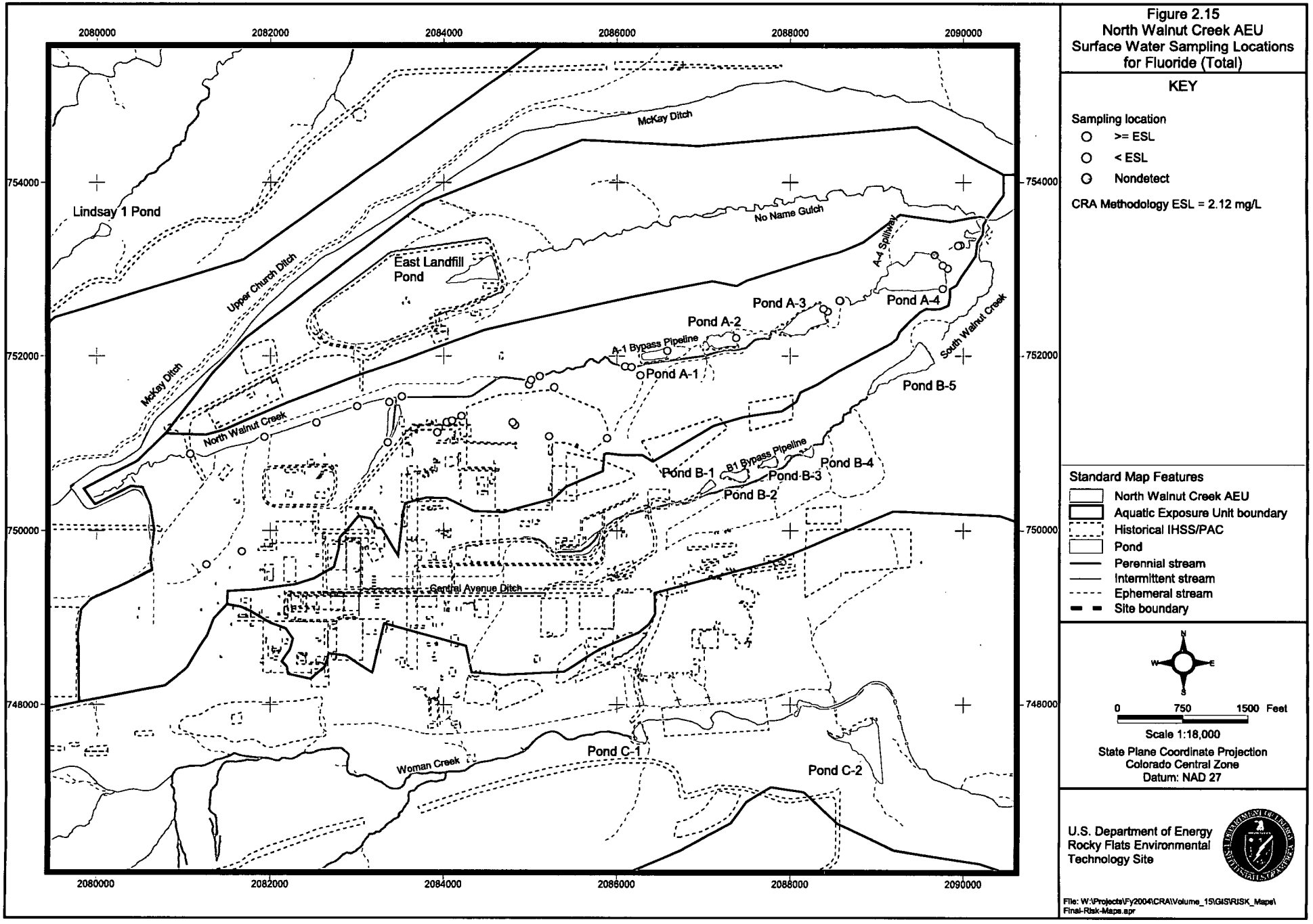

Figure 2.15
North Walnut Creek AEU
Surface Water Sampling Locations
for Fluoride (Total)

212

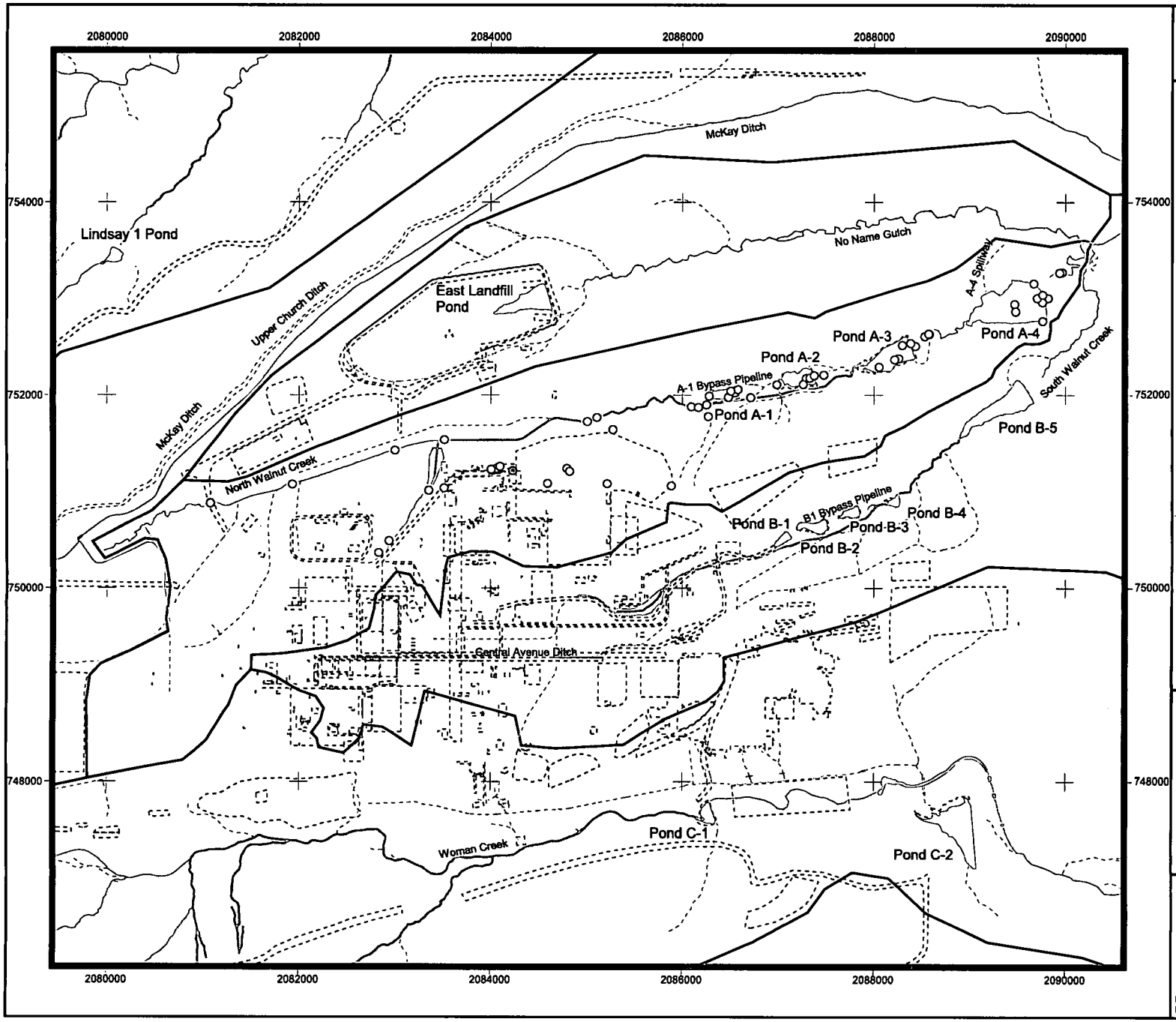

Figure 2.16
North Walnut Creek AEU
Surface Water Sampling Locations
for Manganese (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 1.65 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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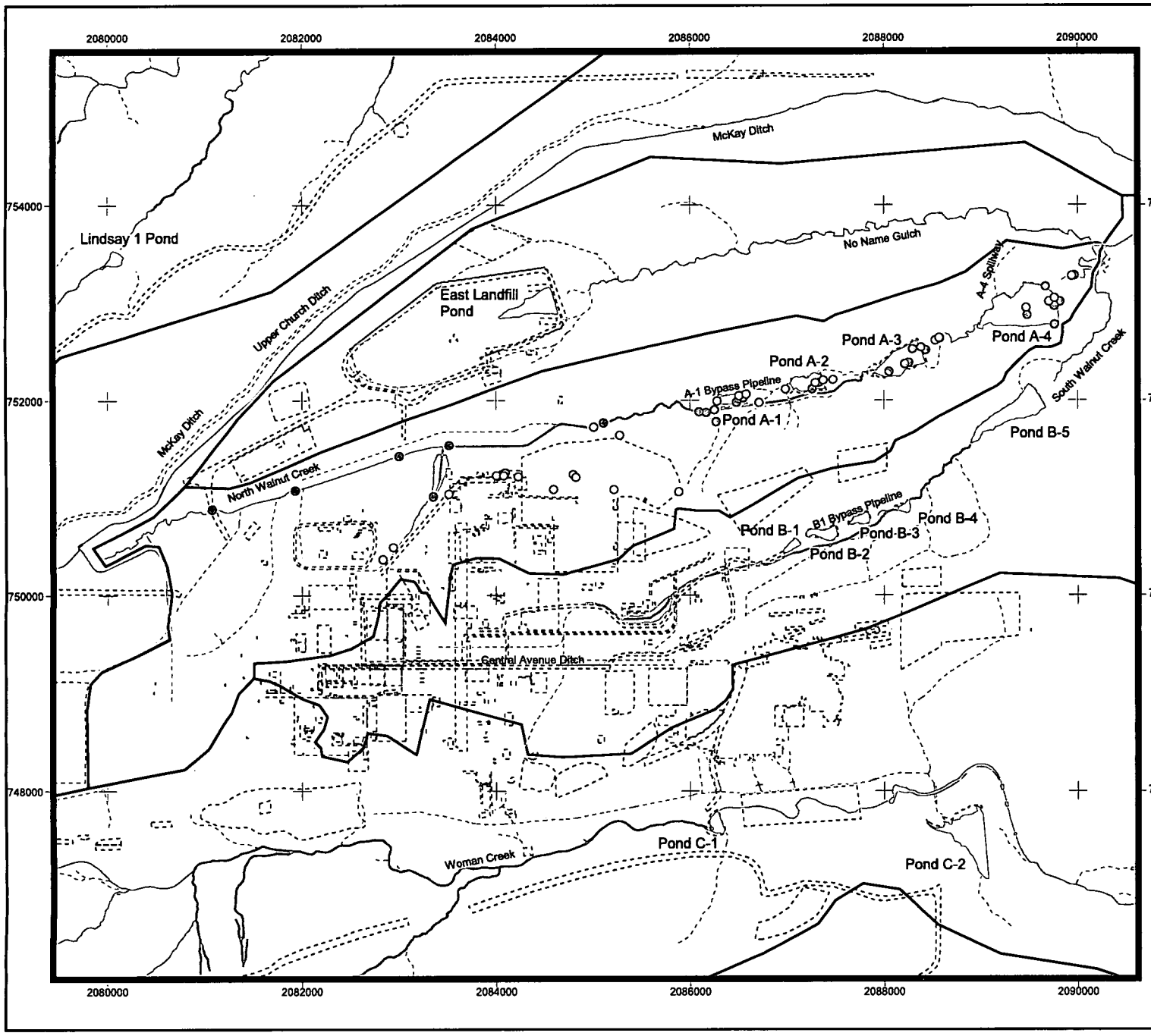

Figure 2.17
North Walnut Creek AEU
Surface Water Sampling Locations
for Nickel (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.052 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Technology Site

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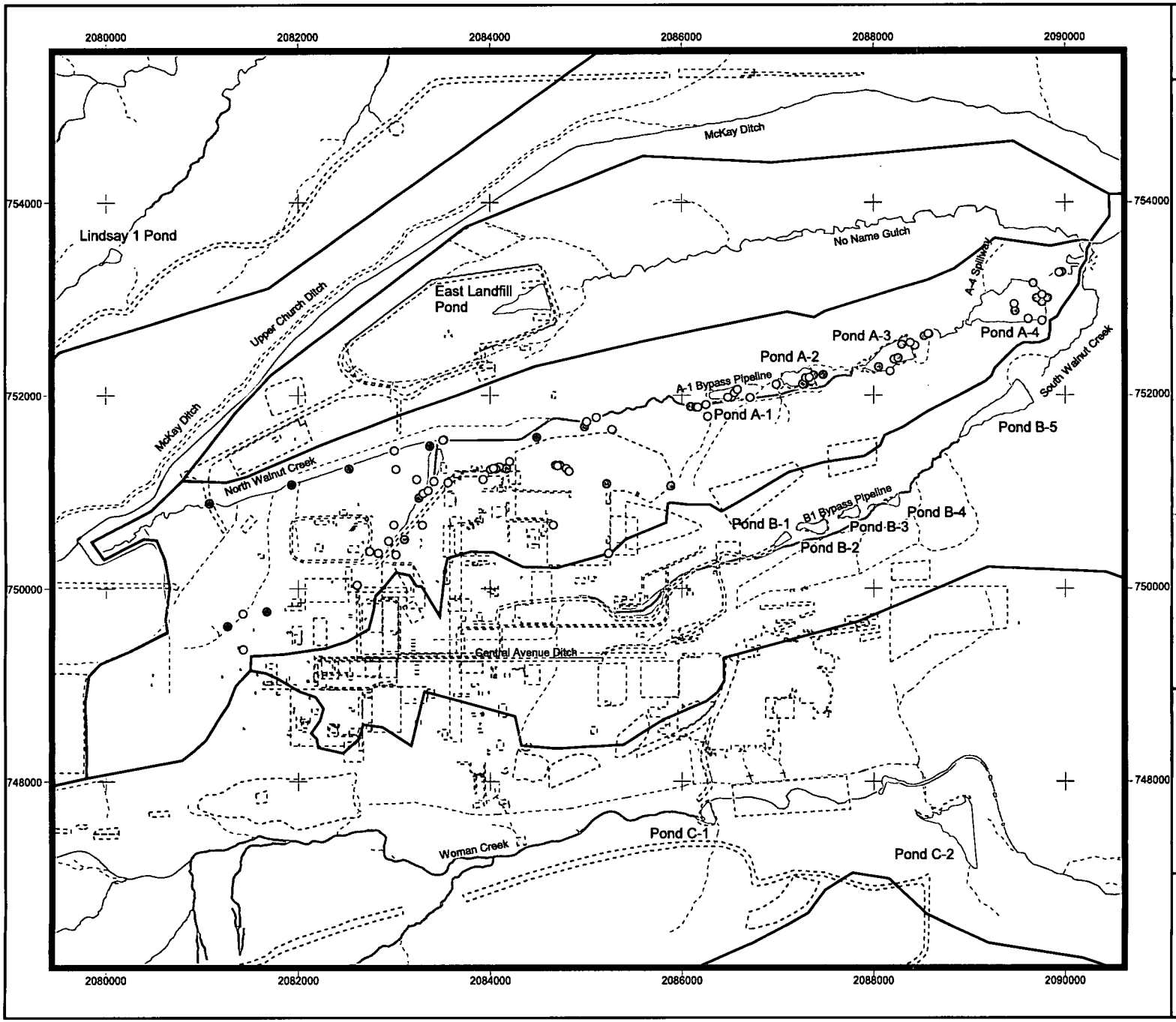

Figure 2.18
North Walnut Creek AEU
Surface Water Sampling Locations
for Selenium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-wide ESL = 0.0046 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Technology Site

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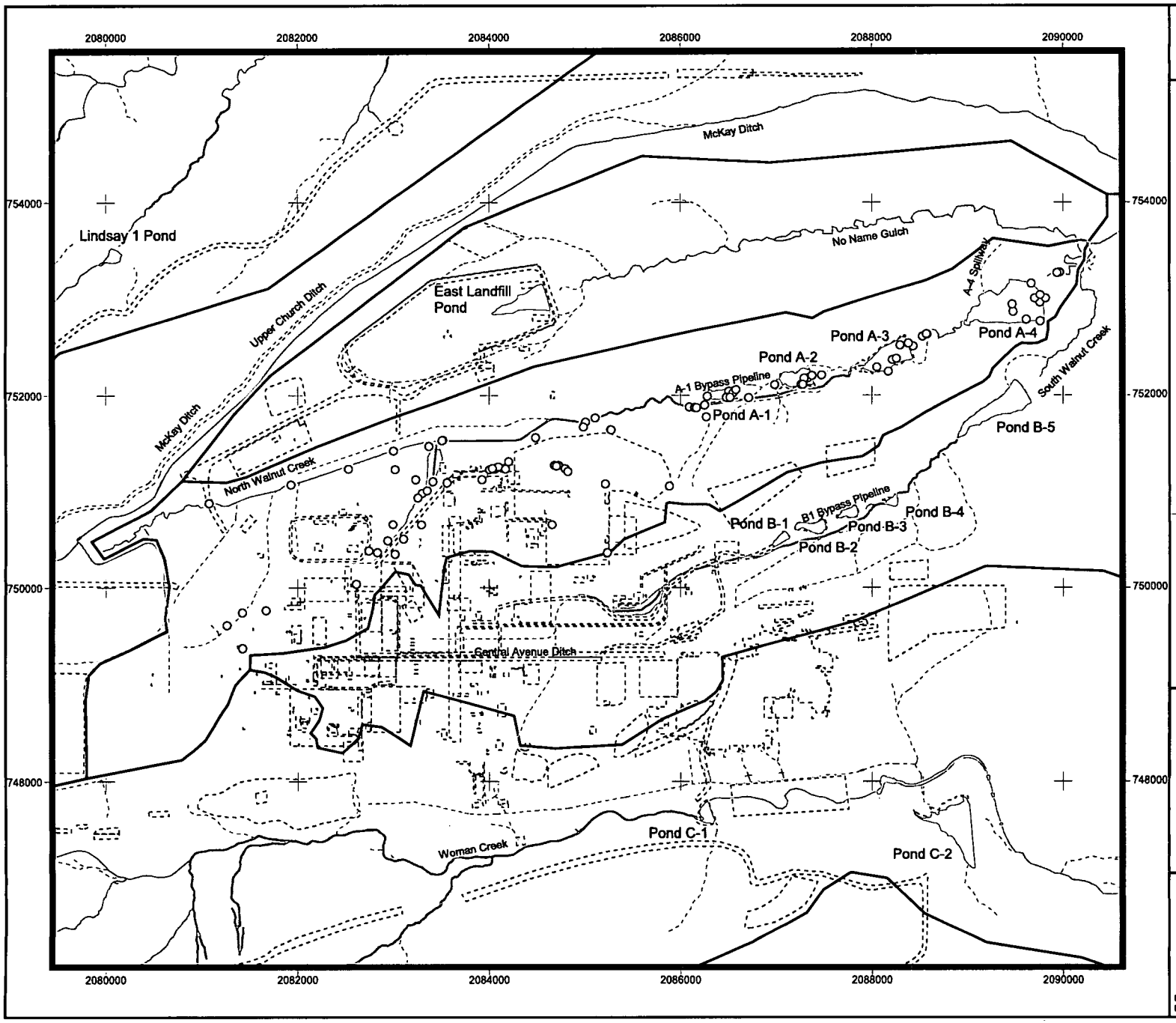

Figure 2.19
North Walnut Creek AEU
Surface Water Sampling Locations
for Strontium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 8.3 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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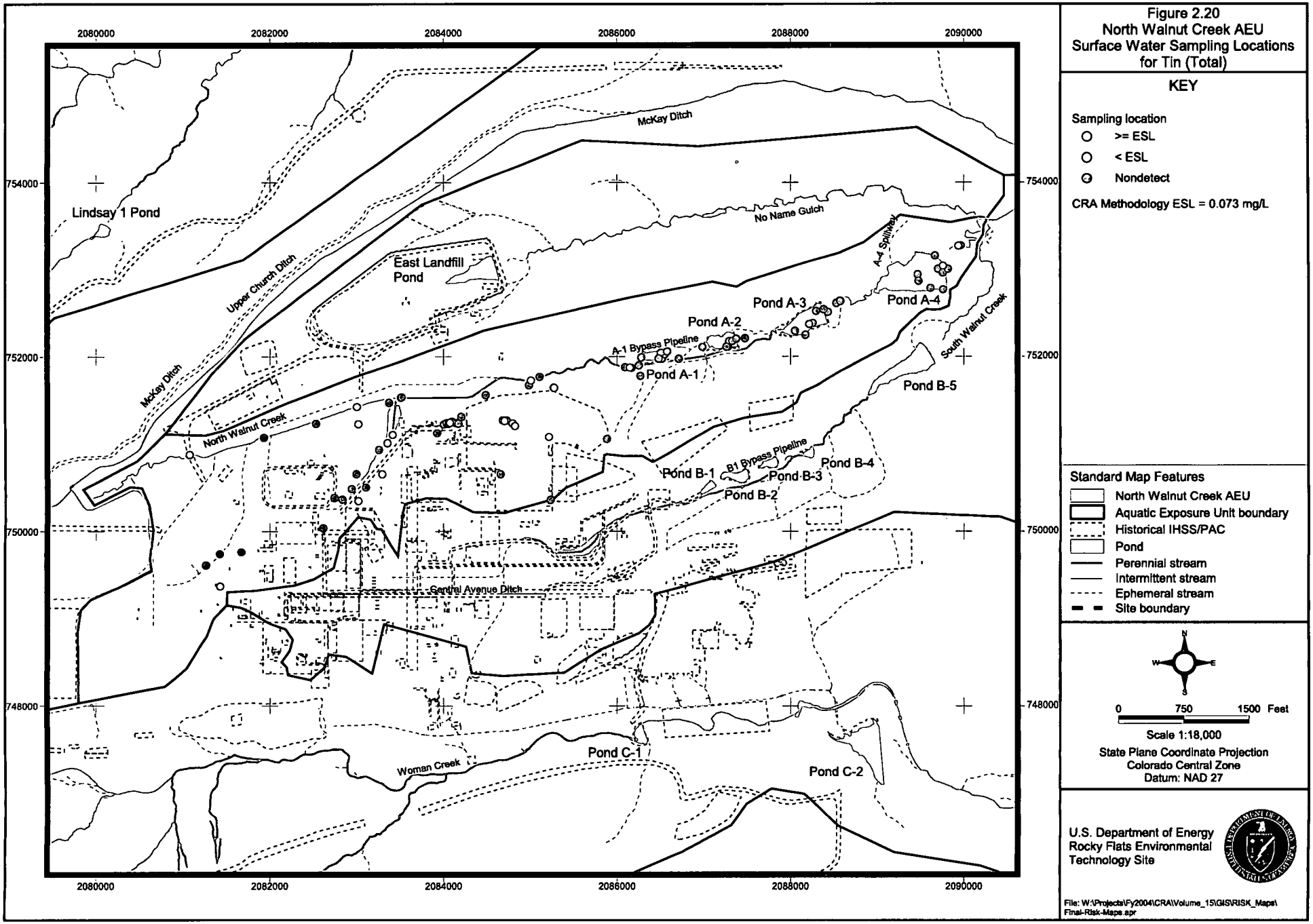
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2082000
2084000
2086000
2088000
2090000
754000
752000
750000
748000
McKay Ditch
Lindsay 1 Pond
Upper Church Ditch
East Landfill Pond
No Name Gulch
A-4 Spillway
Pond A-3
Pond A-4
Pond A-2
A-1 Bypass Pipeline
Pond A-1
South Walnut Creek
Pond B-5
McKay Ditch
North Walnut Creek
B1 Bypass Pipeline
Pond B-1
Pond B-3
Pond B-4
Pond B-2
Central Avenue Ditch
Woman Creek
Pond C-1
Pond C-2
Figure 2.20
North Walnut Creek AEU
Surface Water Sampling Locations
for Tin (Total)
KEY
Sampling location
>= ESL
< ESL
Nondetect
CRA Methodology ESL = 0.073 mg/L
Standard Map Features
North Walnut Creek AEU
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary
N
W
E
S
0
750
1500 Feet
Scale 1:18,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
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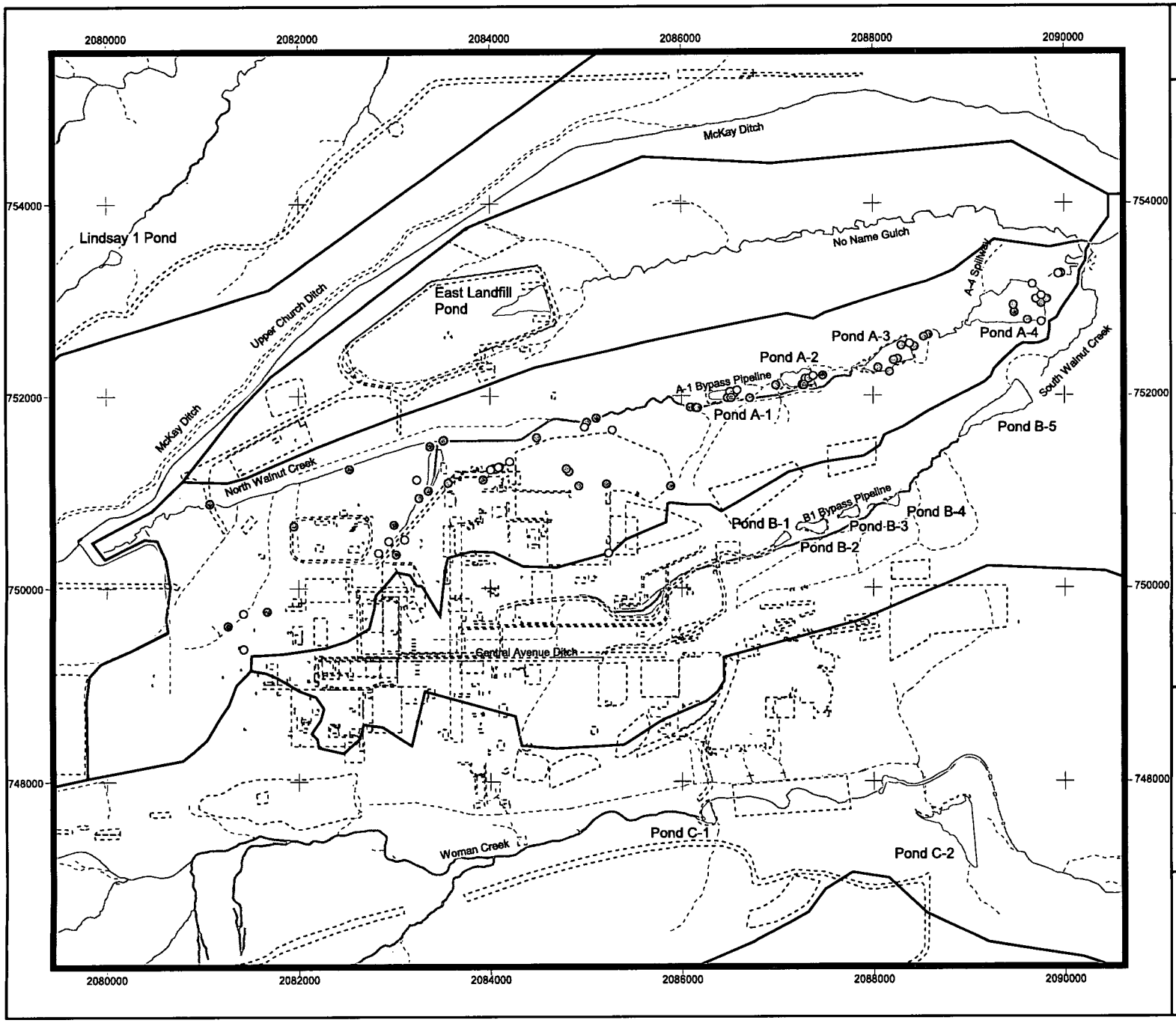

Figure 2.21
North Walnut Creek AEU
Surface Water Sampling Locations
for Bis(2-ethylhexyl)phthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 28.5 ug/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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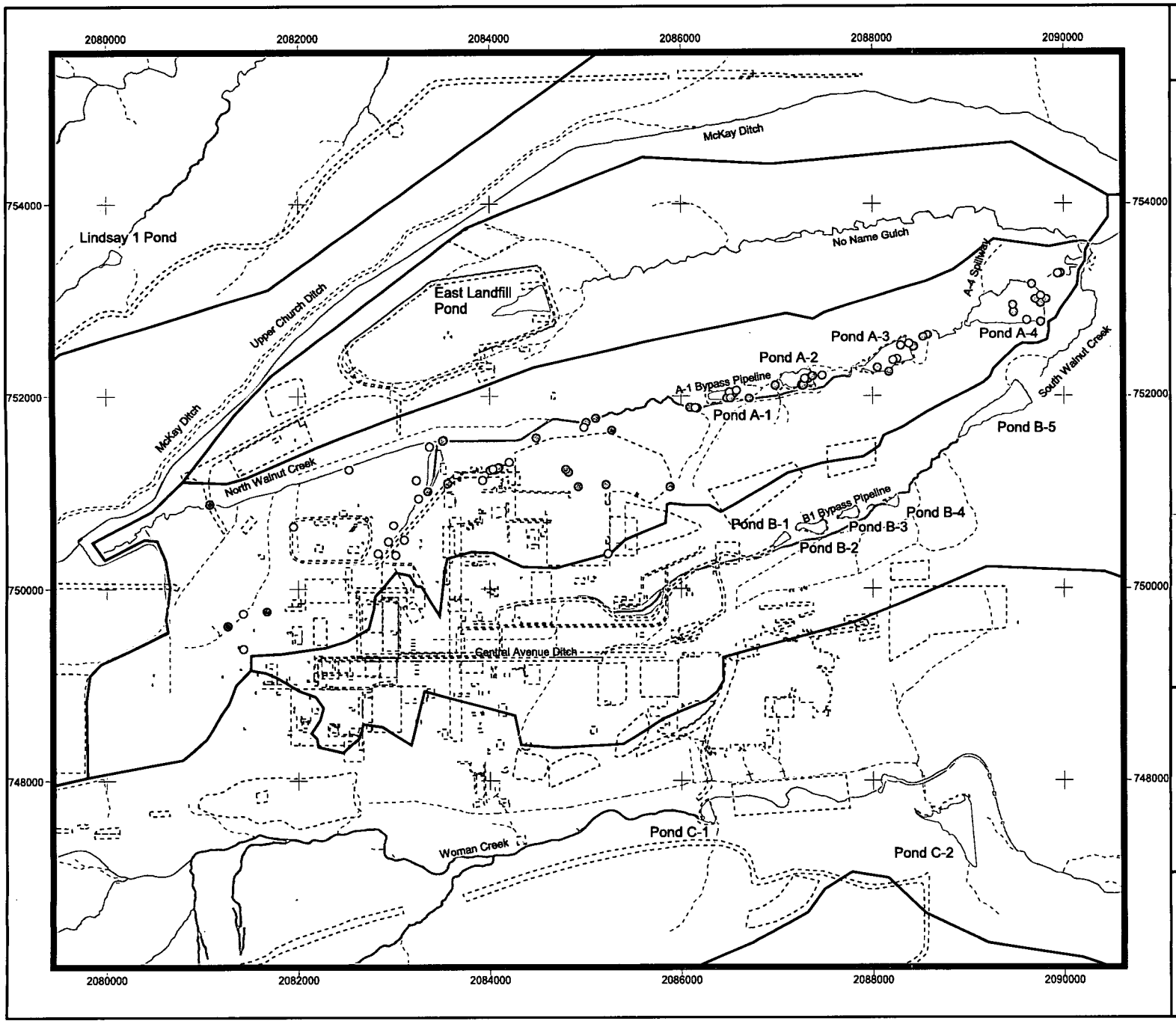

Figure 2.22
North Walnut Creek AEU
Surface Water Sampling Locations
for Di-n-butylphthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 9.7 ug/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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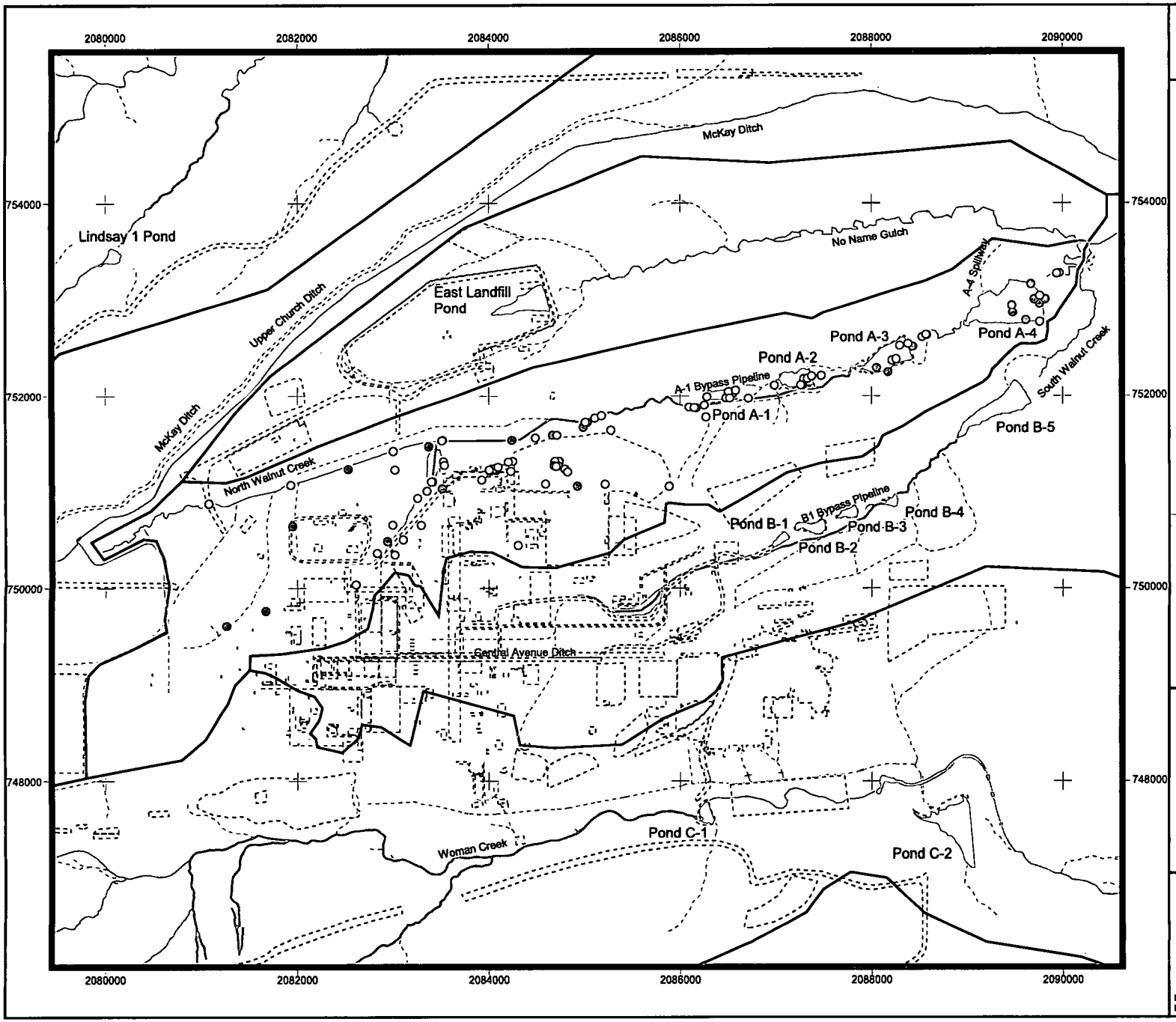

Figure 2.23
North Walnut Creek AEU
Surface Water Sampling Locations
for Americium-241

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 43.8 pCi/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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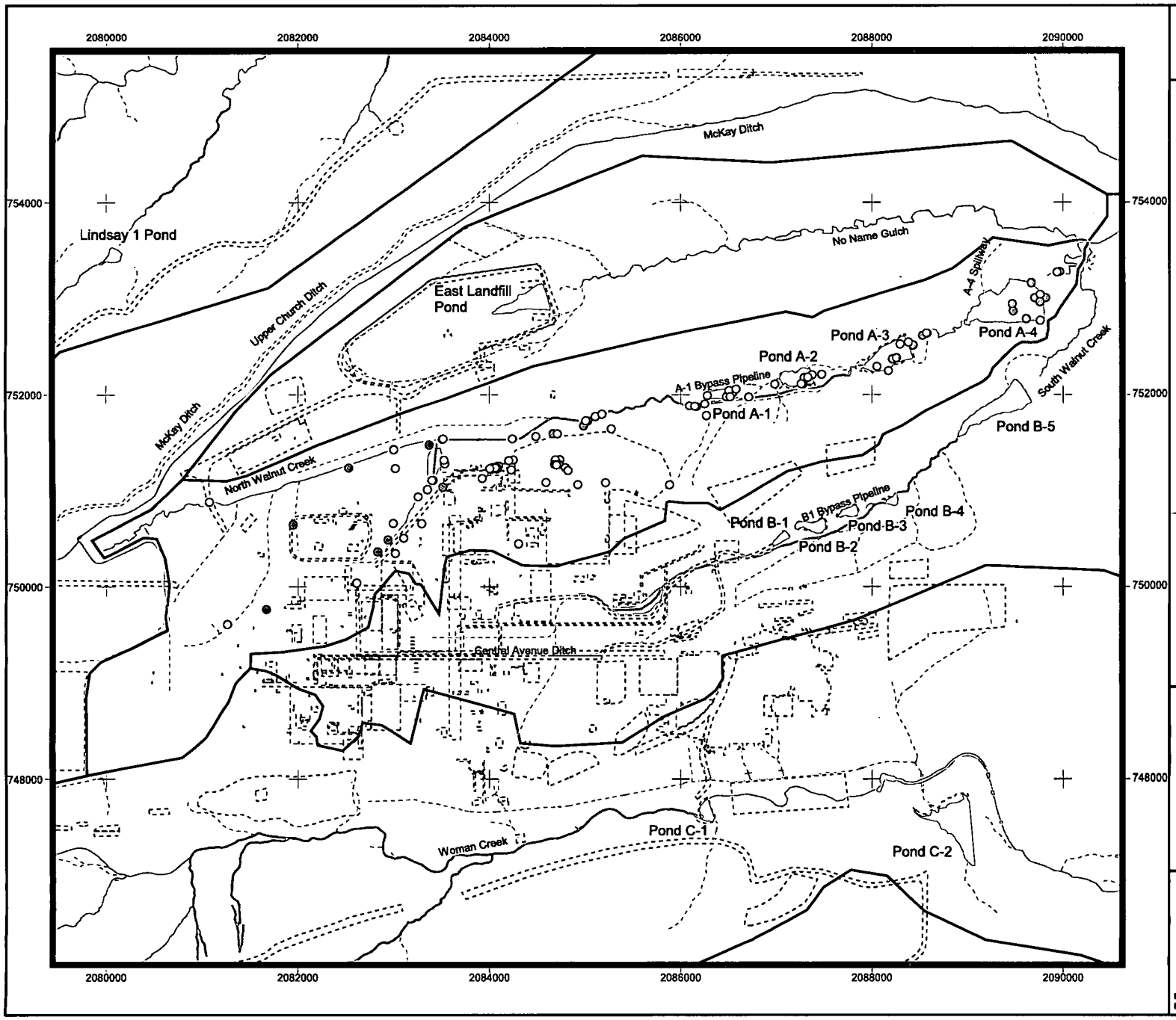

Figure 2.24
North Walnut Creek AEU
Surface Water Sampling Locations
for Plutonium-239/240

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 18.7 pCi/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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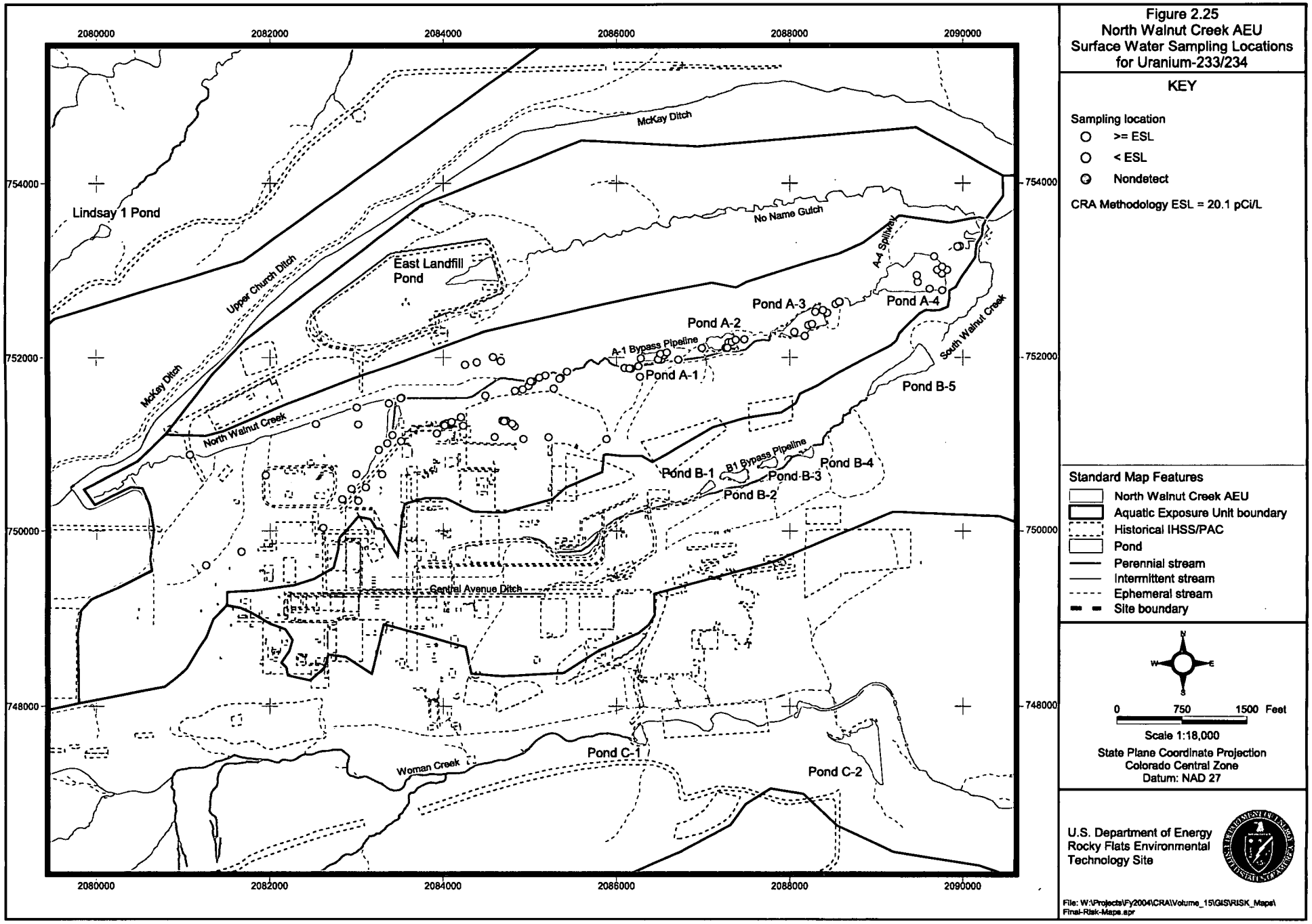

Figure 2.25
North Walnut Creek AEU
Surface Water Sampling Locations
for Uranium-233/234

222

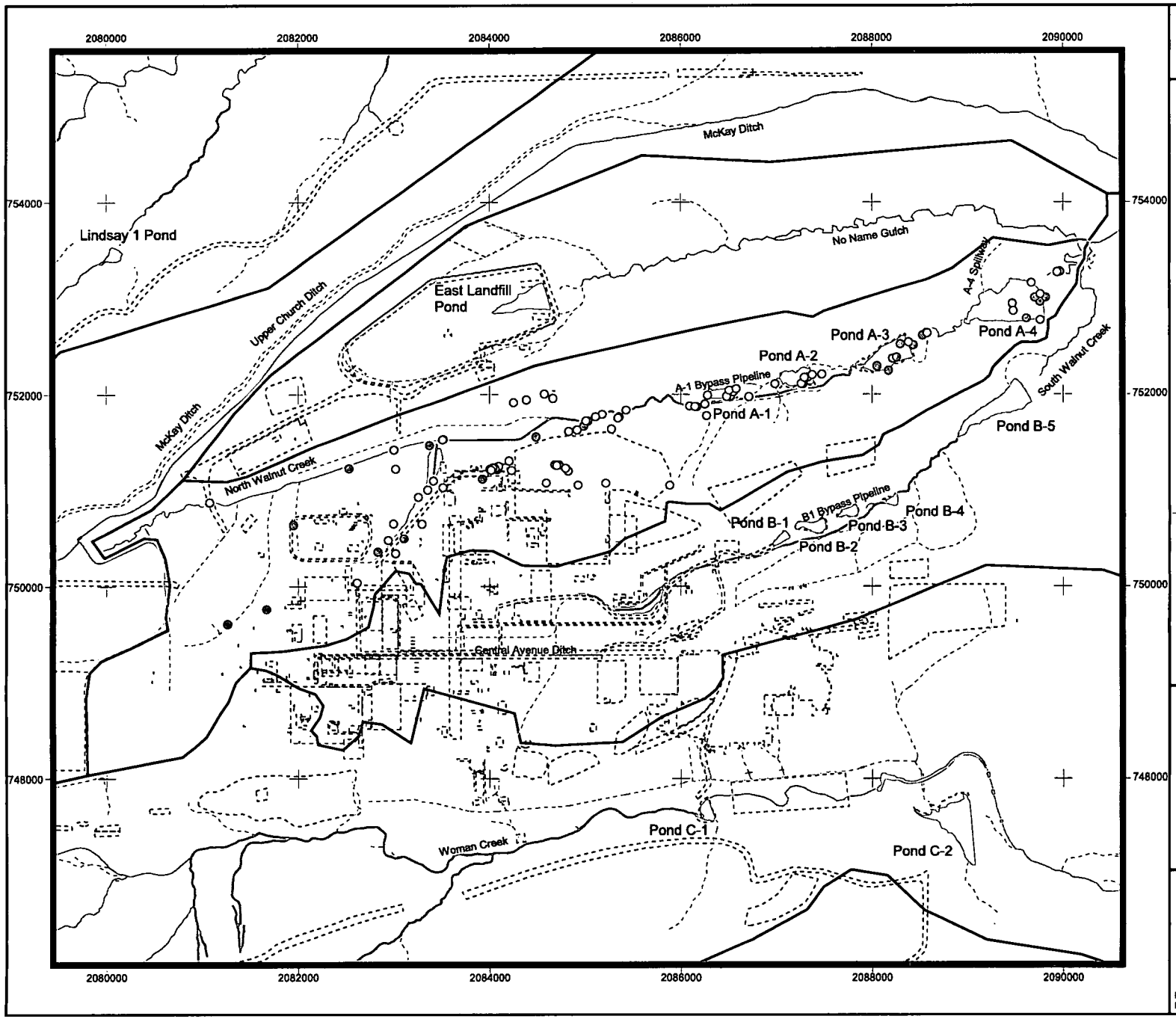

Figure 2.26
North Walnut Creek AEU
Surface Water Sampling Locations
for Uranium-235

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 21.7 pCi/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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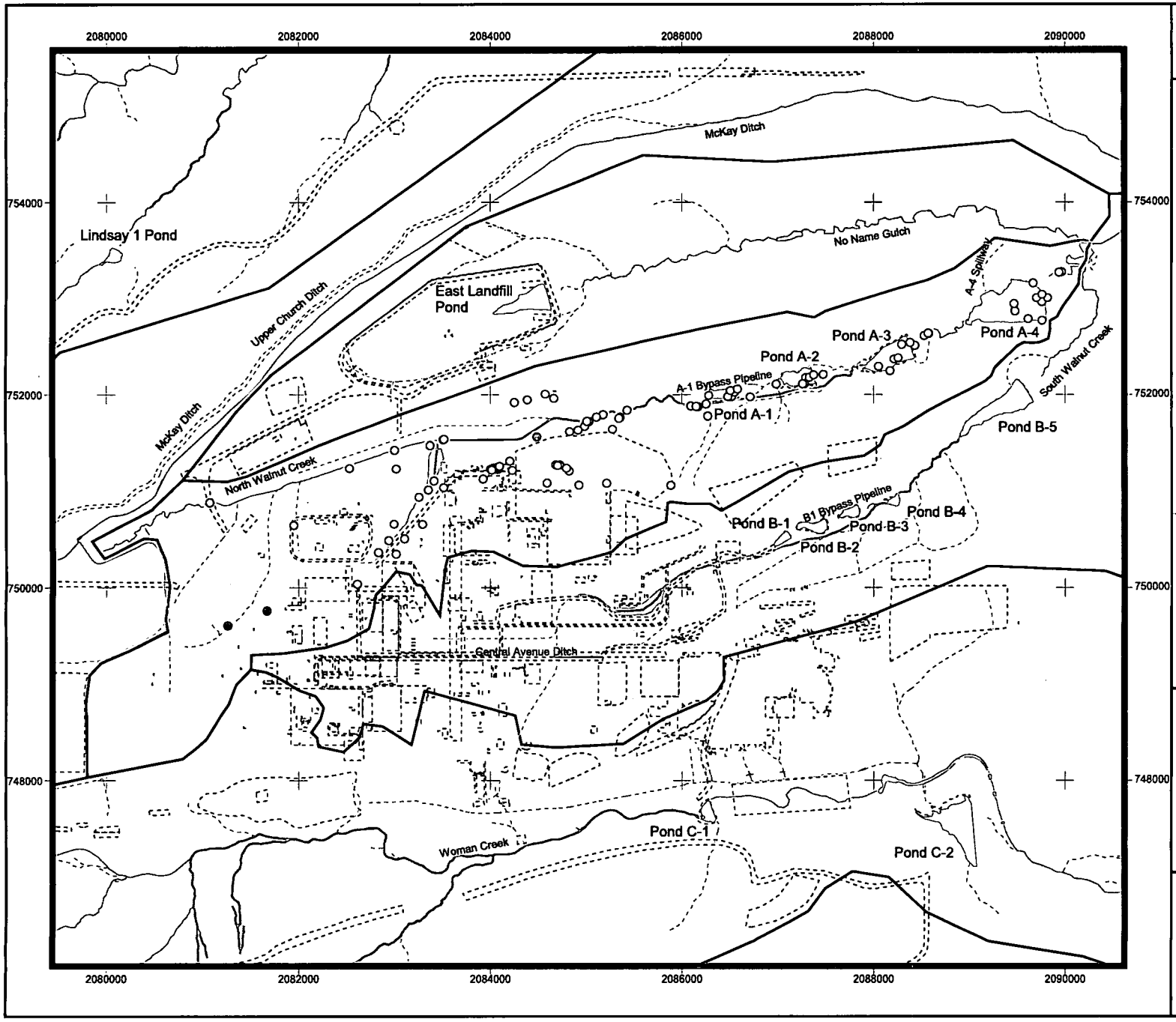

Figure 2.27
North Walnut Creek AEU
Surface Water Sampling Locations
for Uranium-238

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 22.3 pCi/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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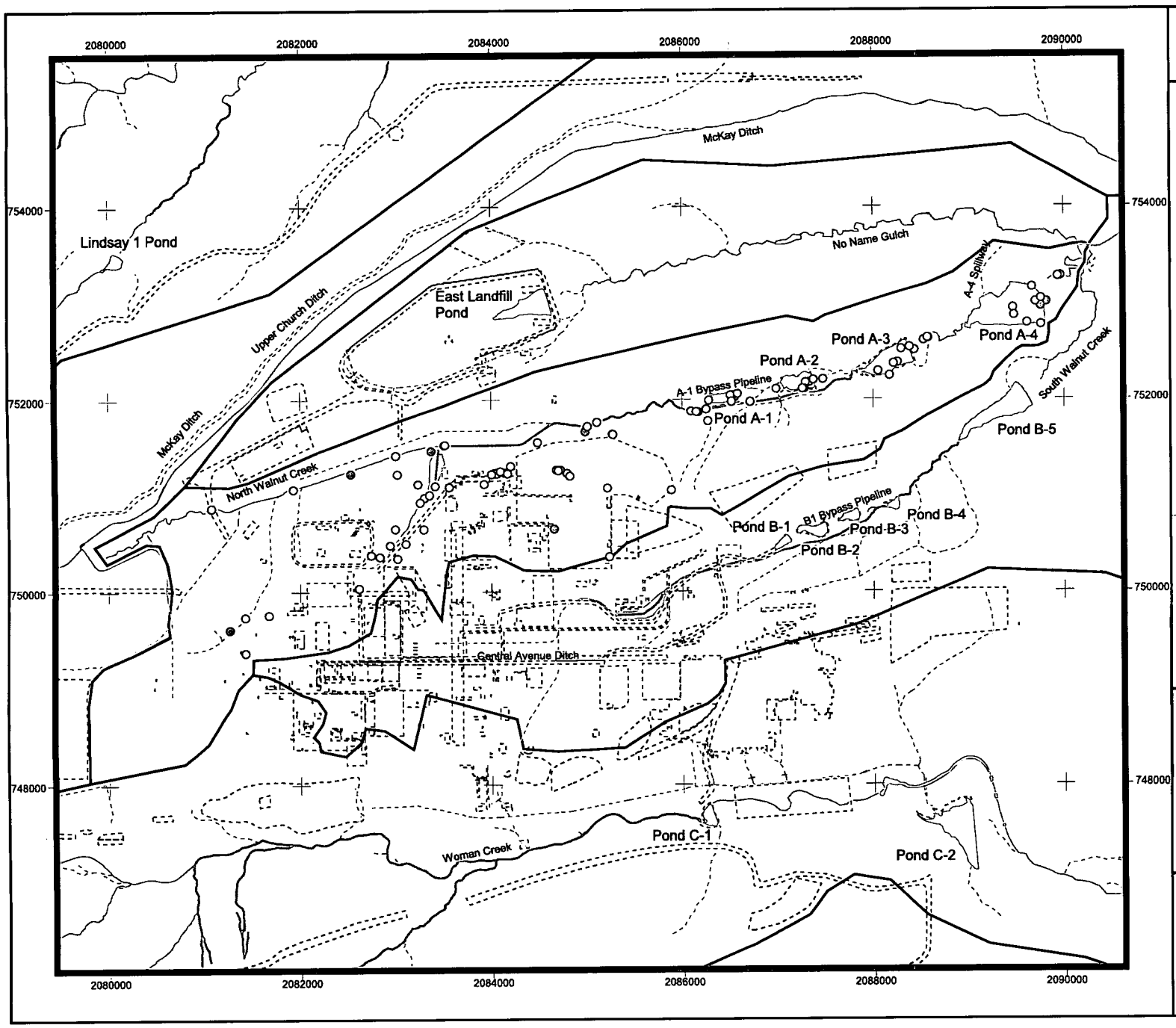

Figure 2.28
North Walnut Creek AEU
Surface Water Sampling Locations
for Aluminum (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Adjusted ESL = 0.75 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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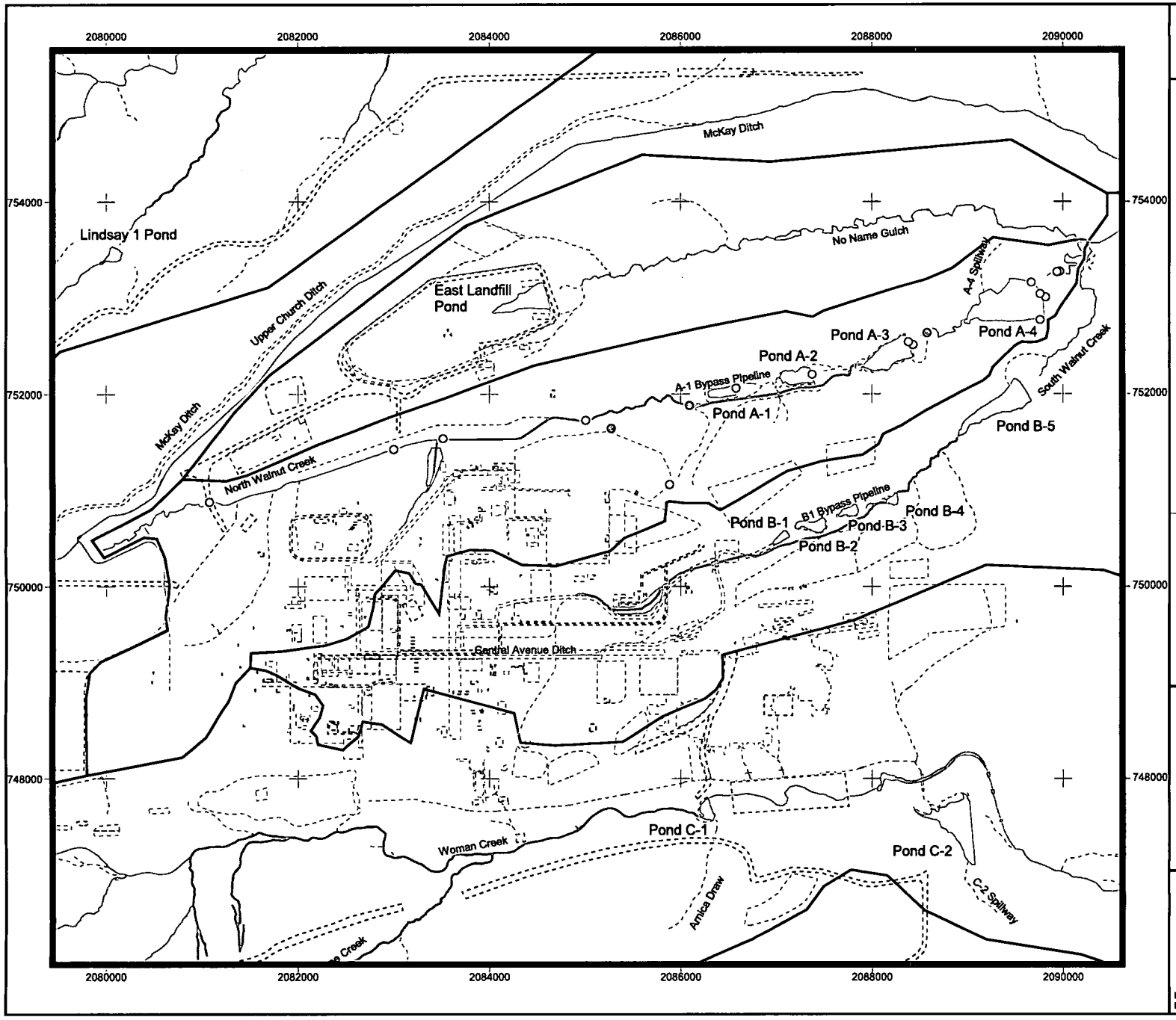

Figure 2.29
North Walnut Creek AEU
Surface Water Sampling Locations
for non-ionized Ammonia

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.02 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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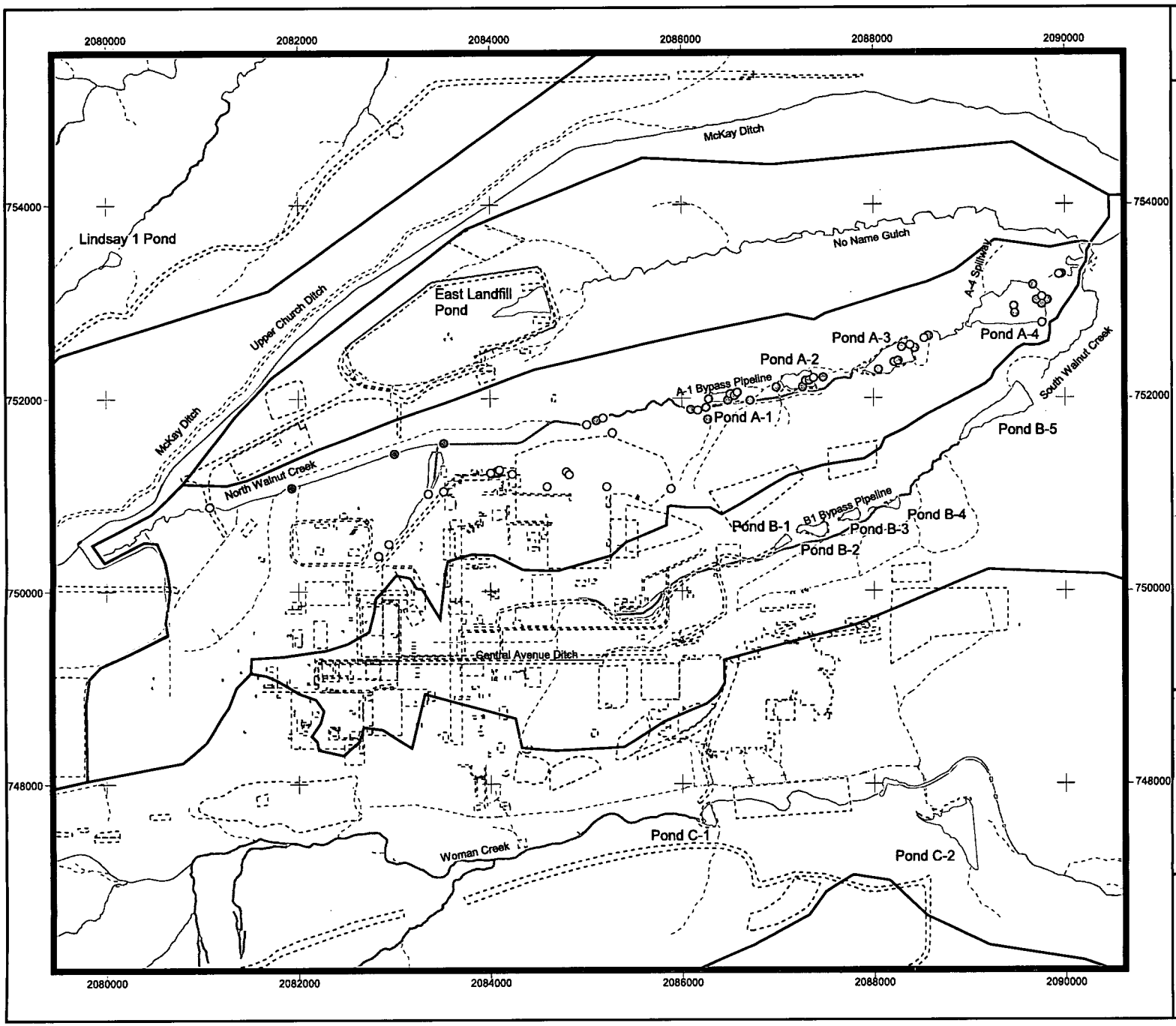

Figure 2.30
North Walnut Creek AEU
Surface Water Sampling Locations for Cadmium (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.0043 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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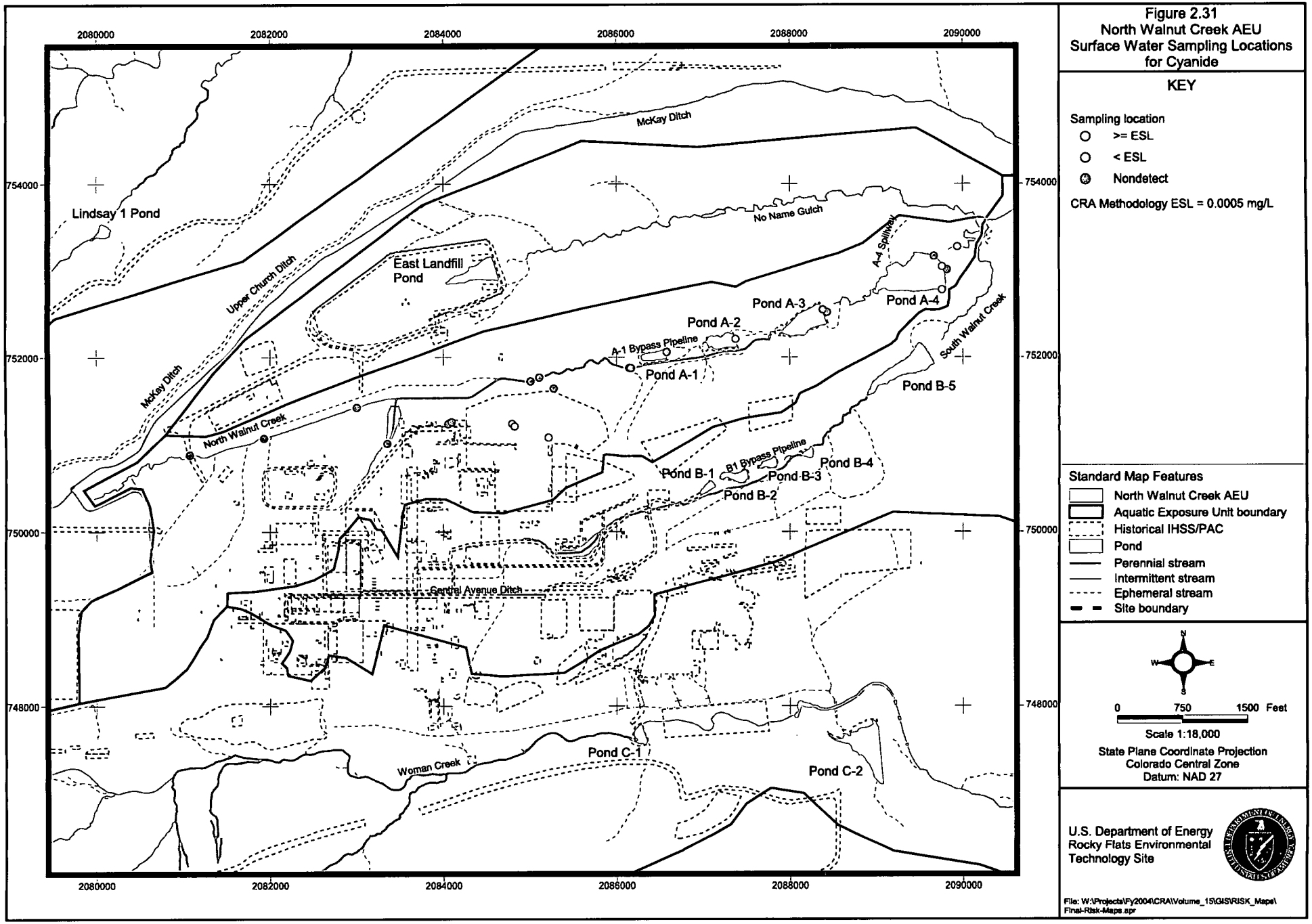

Figure 2.31
North Walnut Creek AEU
Surface Water Sampling Locations
for Cyanide

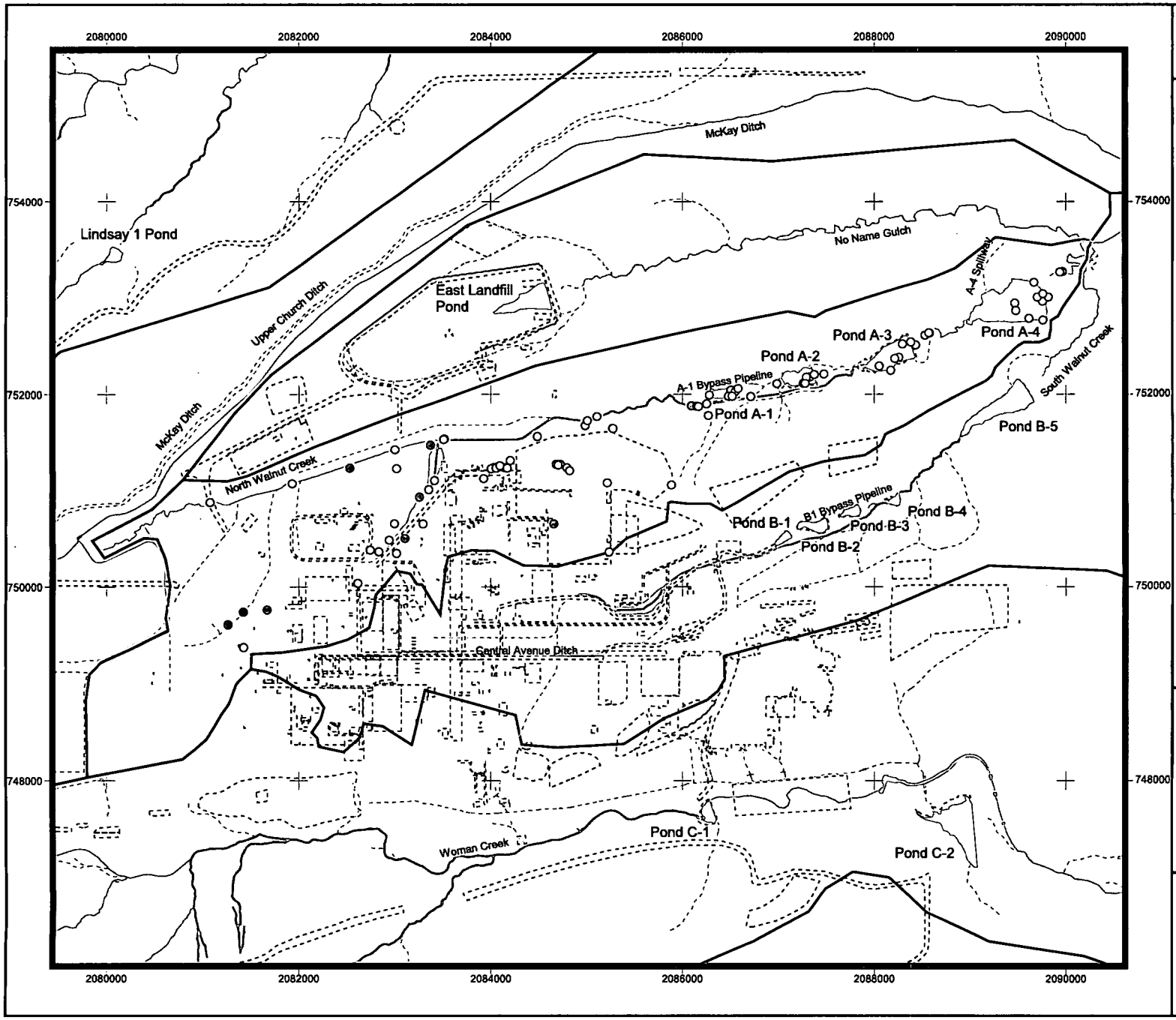

Figure 2.32
North Walnut Creek AEU
Surface Water Sampling Locations for Lithium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-wide ESL = 0.096 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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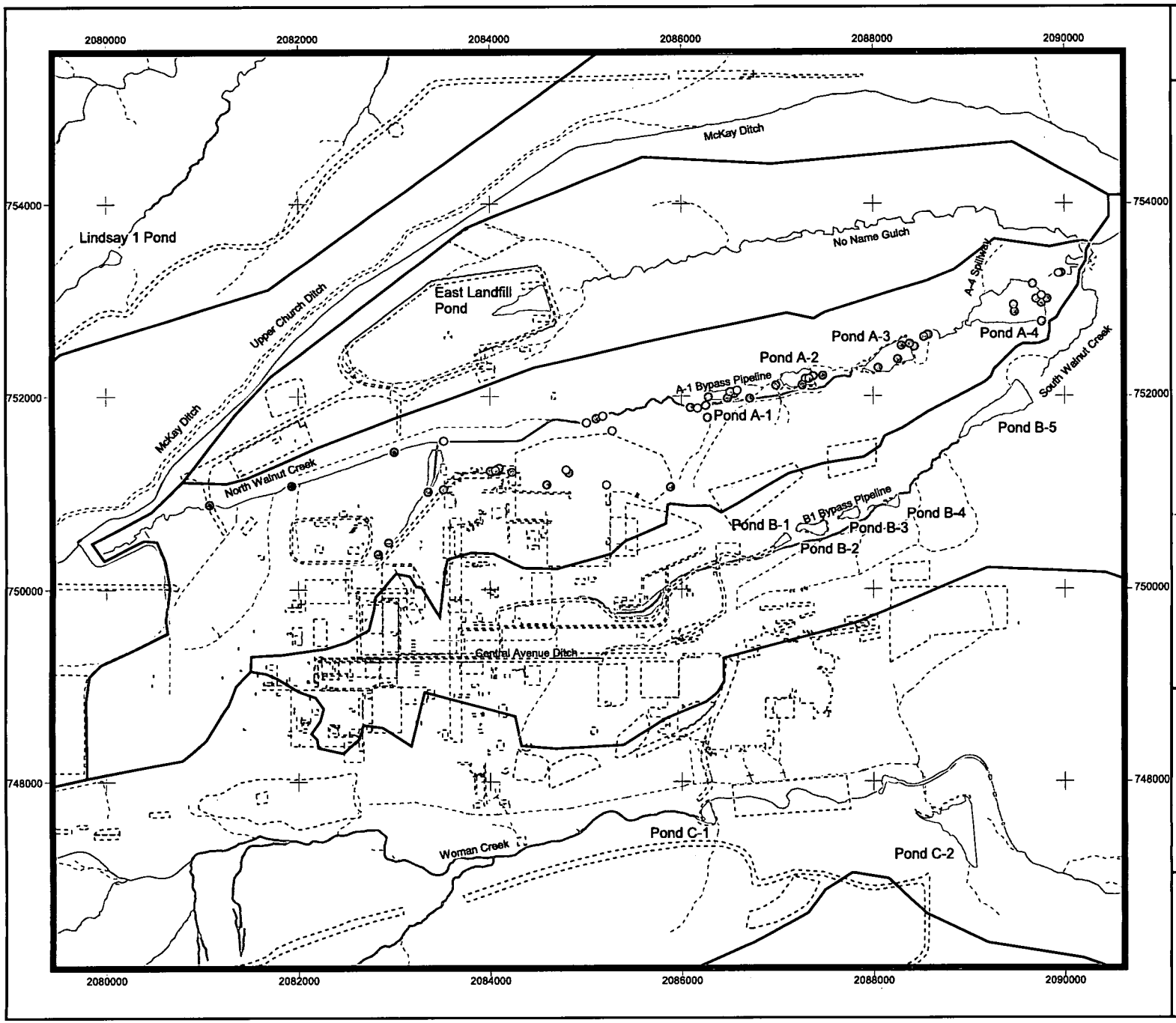

Figure 2.33
North Walnut Creek AEU
Surface Water Sampling Locations
for Silver (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.0015 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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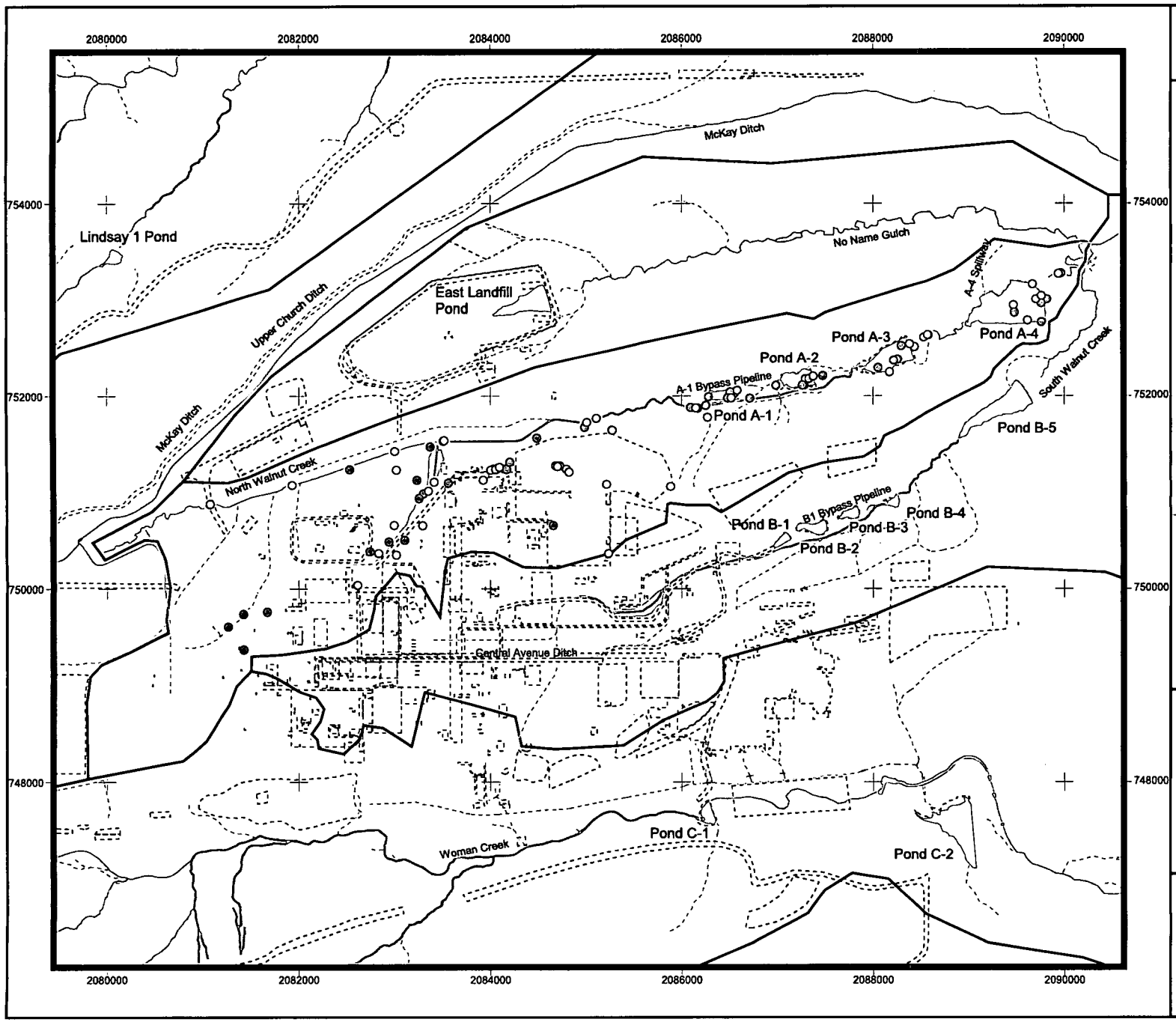

Figure 2.34
North Walnut Creek AEU
Surface Water Sampling Locations
for Vanadium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-wide ESL = 0.012 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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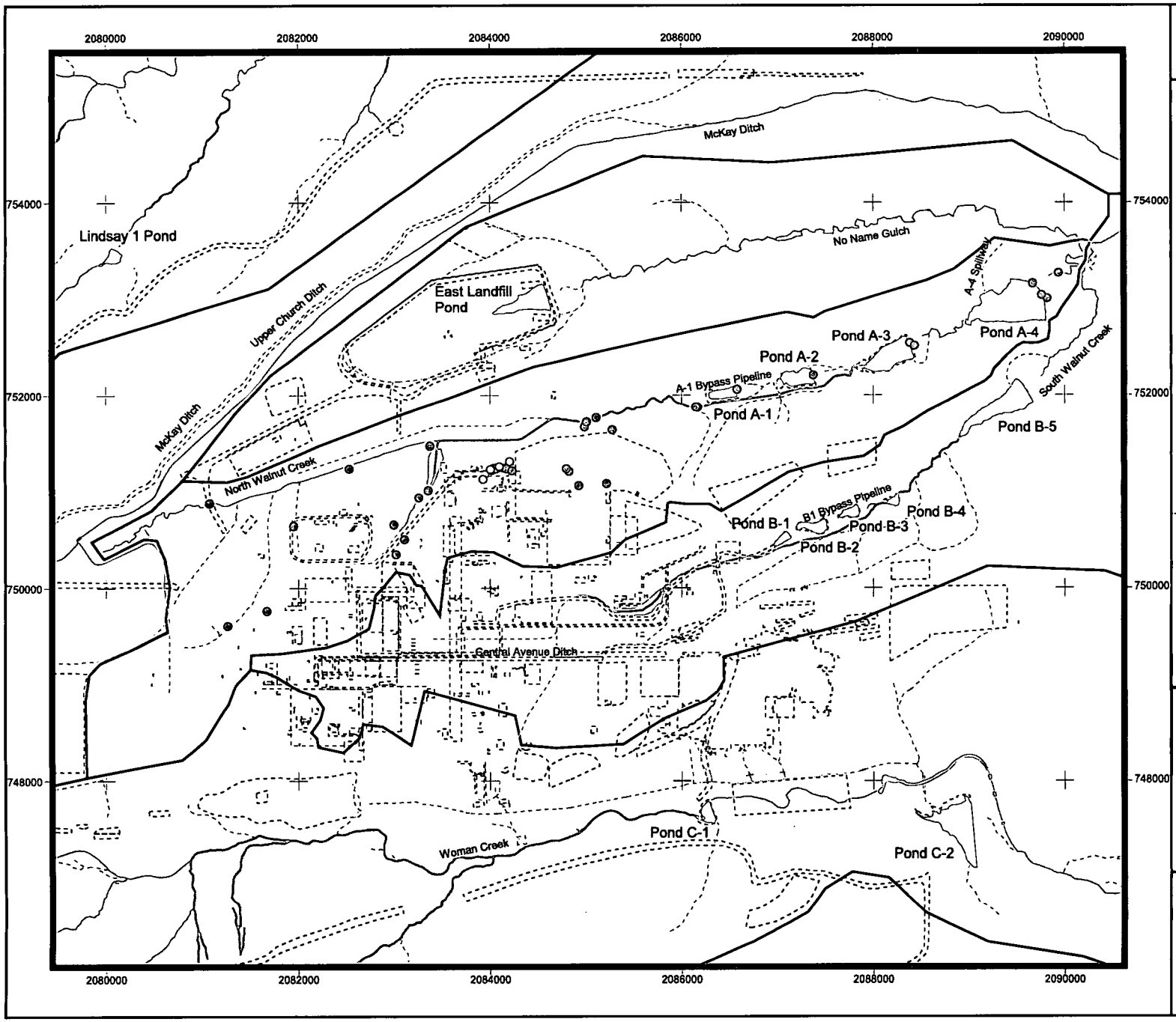

Figure 2.35
North Walnut Creek AEU
Surface Water Sampling Locations
for Aroclor-1254

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-wide ESL = 0.014 ug/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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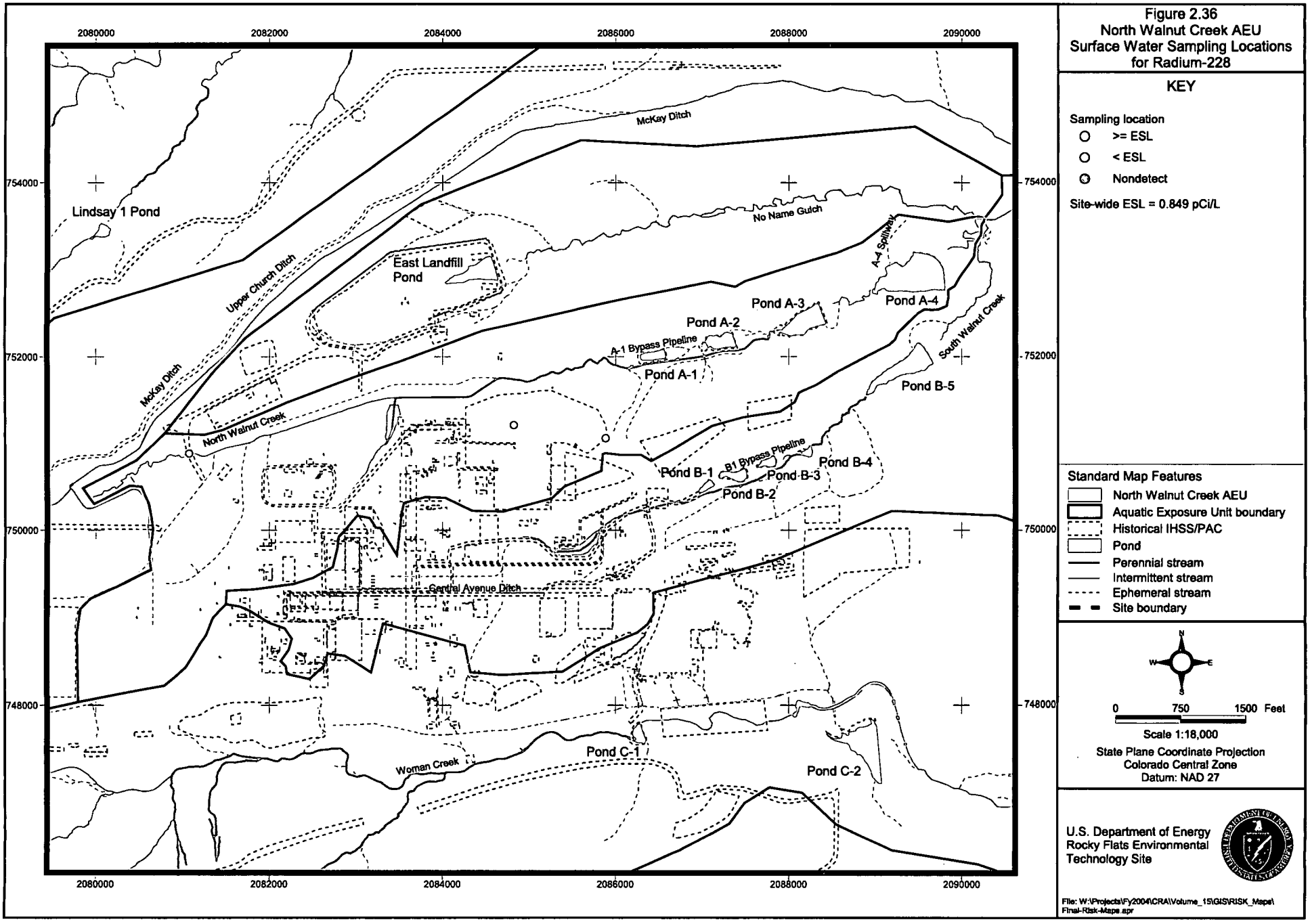

Figure 2.36
North Walnut Creek AEU
Surface Water Sampling Locations
for Radium-228

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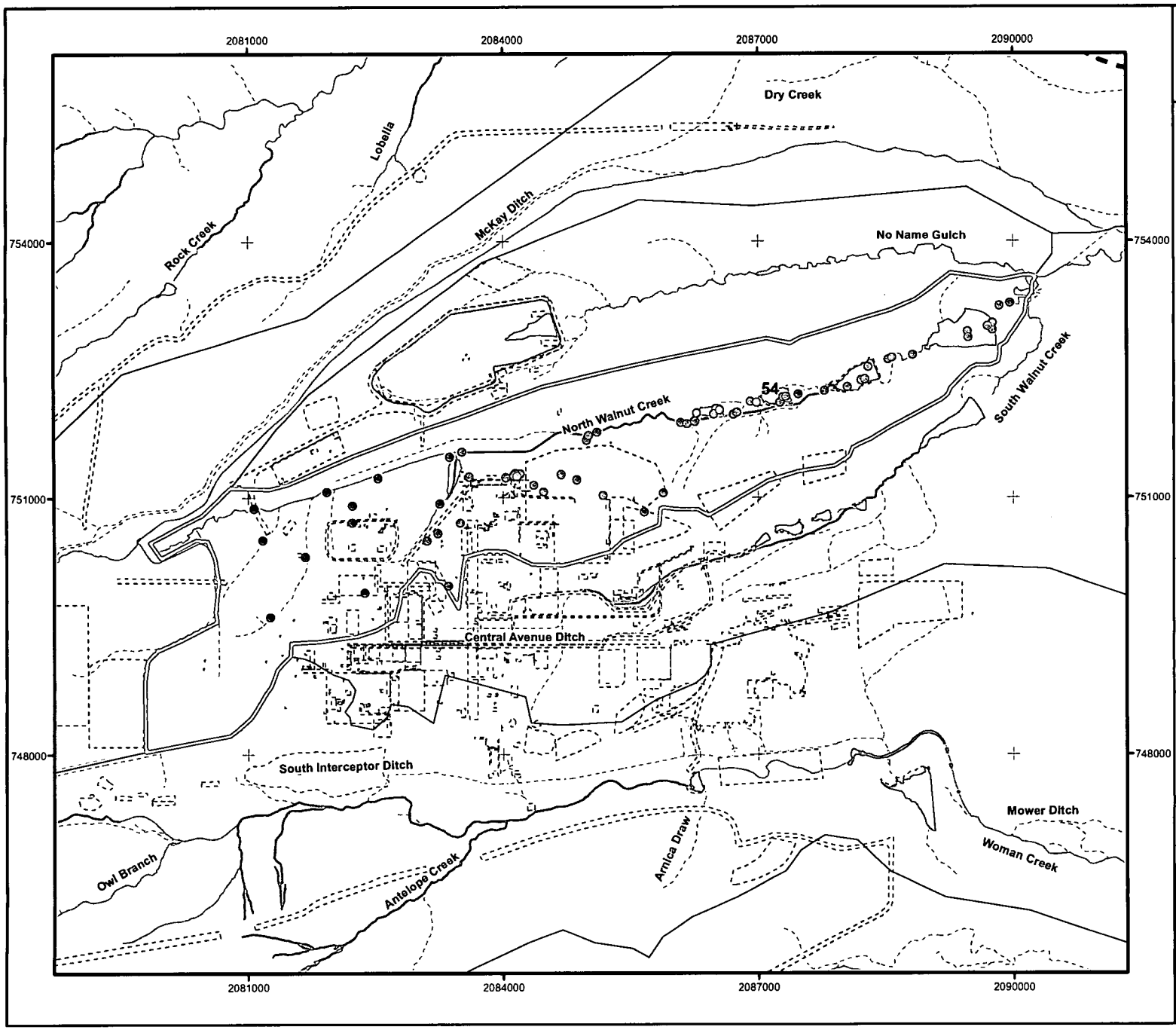

Figure 2.37
North Walnut Creek AEU
Sediment Results for
Aldrin

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 8.25 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
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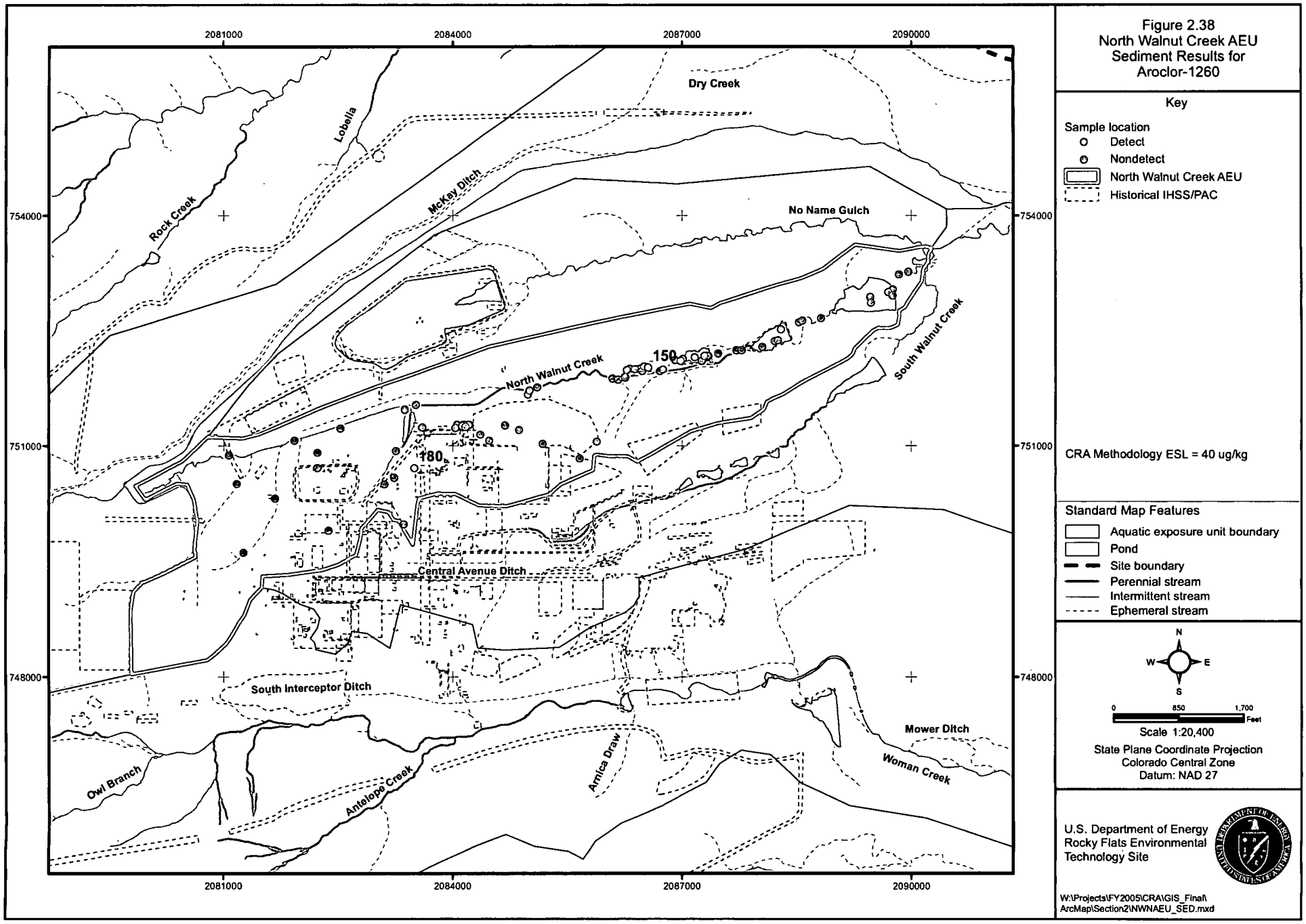

Figure 2.38
North Walnut Creek AEU
Sediment Results for
Aroclor-1260

235

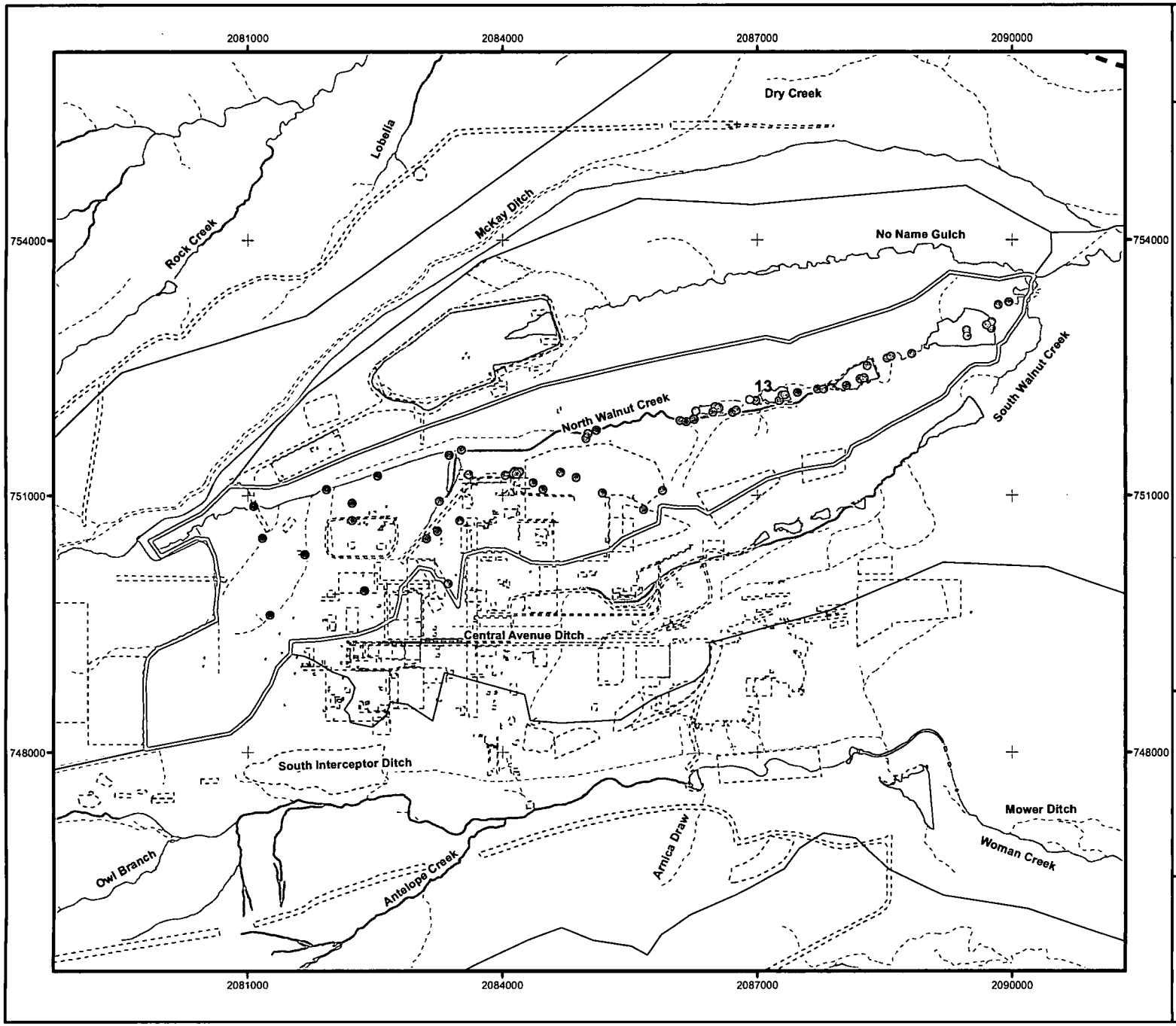

Figure 2.39
North Walnut Creek AEU
Sediment Results for
Delta-BHC (Lindane)

Key

Sample location
- Detect
- Nondetect
- North Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 2.37 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 850 1,700 Feet

Scale 1:20,400

State Plane Coordinate Projection
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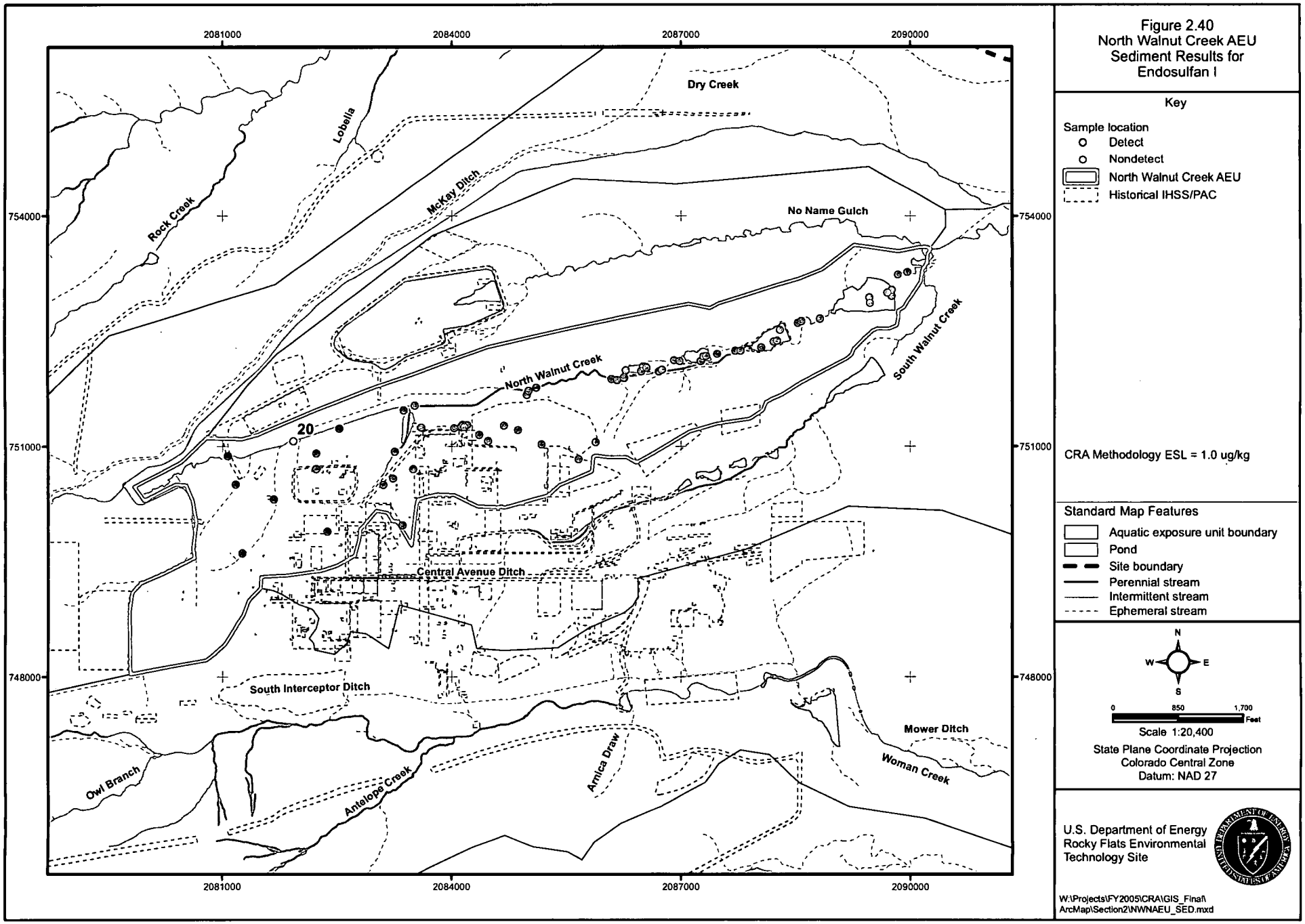

Figure 2.40
North Walnut Creek AEU
Sediment Results for
Endosulfan I

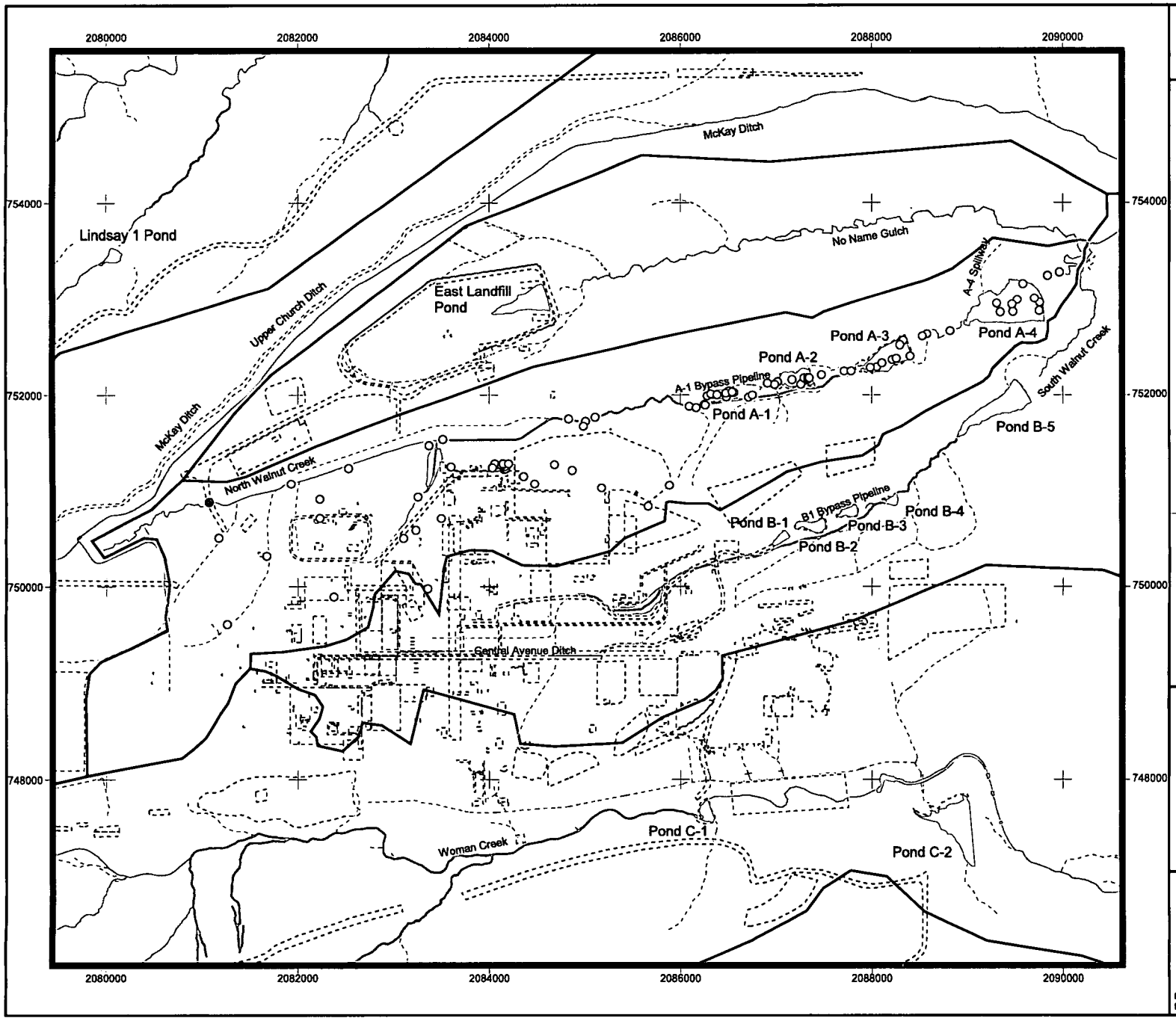

Figure 2.41
North Walnut Creek AEU
Sediment Sampling Locations
for Arsenic

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 9.79 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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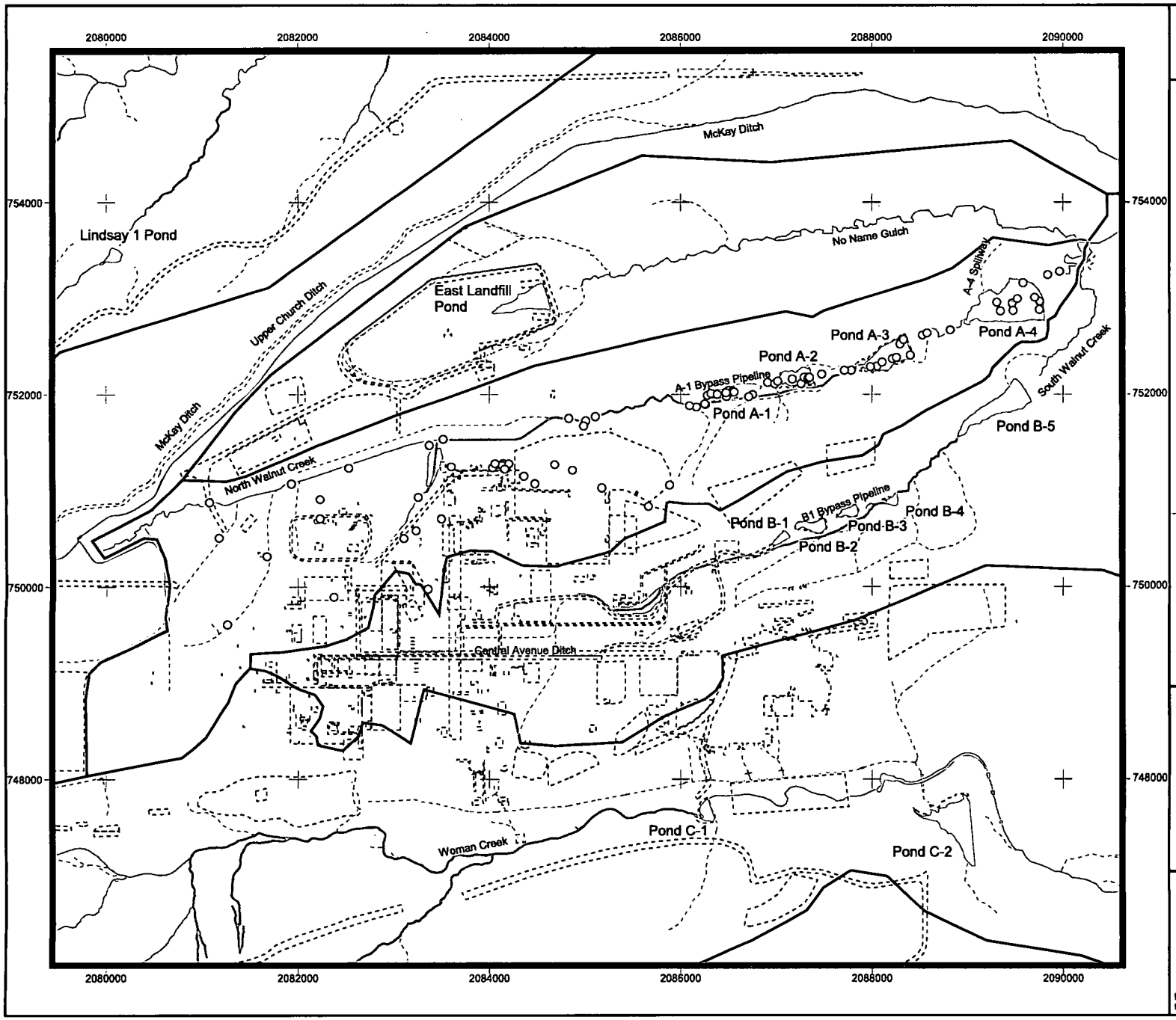

Figure 2.42
North Walnut Creek AEU
Sediment Sampling Locations
for Chromium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 43.4 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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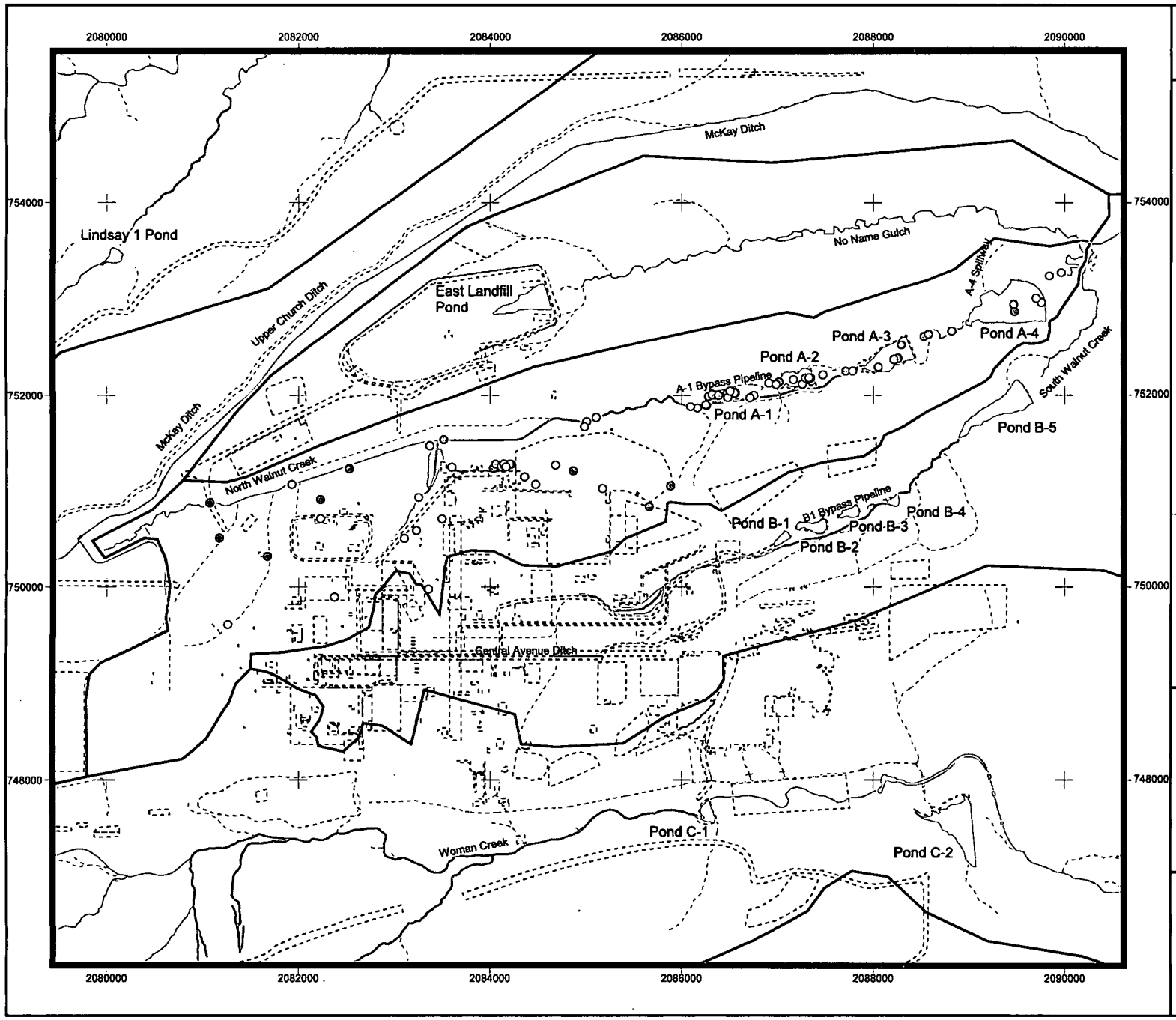

Figure 2.43
North Walnut Creek AEU
Sediment Sampling Locations
for Bis(2-ethylhexyl)phthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 24900 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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Datum: NAD 27

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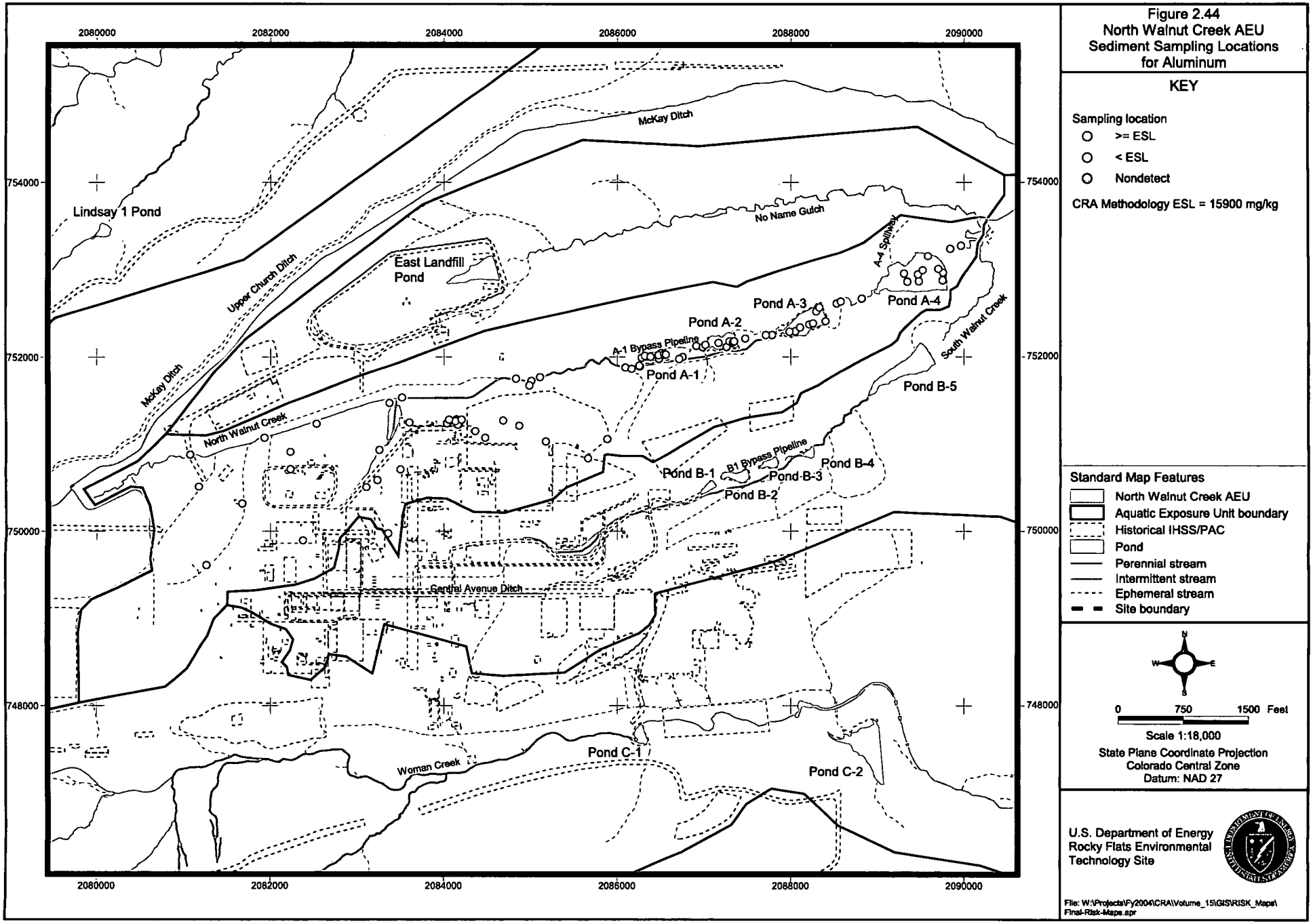
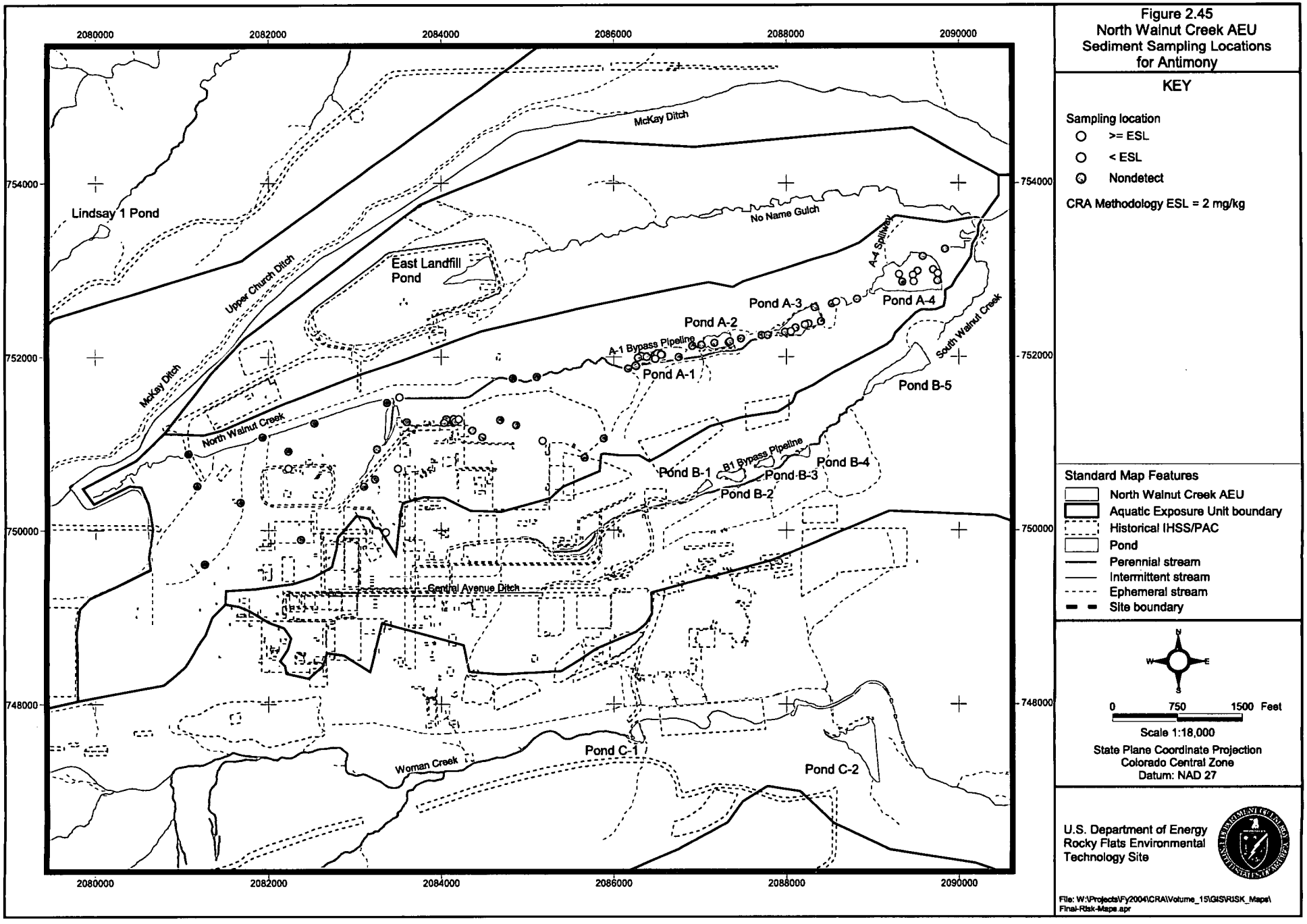


Figure 2.44
North Walnut Creek AEU
Sediment Sampling Locations
for Aluminum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2082000
2084000
2086000
2088000
2090000
754000
752000
750000
748000
McKay Ditch
Lindsay 1 Pond
Upper Church Ditch
East Landfill Pond
No Name Gulch
A-4 Spillway
Pond A-3
Pond A-4
Pond A-2
A-1 Bypass Pipeline
Pond A-1
South Walnut Creek
Pond B-5
McKay Ditch
North Walnut Creek
B1 Bypass Pipeline
Pond B-1
Pond B-3
Pond B-4
Pond B-2
Central Avenue Ditch
Woman Creek
Pond C-1
Pond C-2
Figure 2.45
North Walnut Creek AEU
Sediment Sampling Locations
for Antimony
KEY
Sampling location
>= ESL
< ESL
Nondetect
CRA Methodology ESL = 2 mg/kg
Standard Map Features
North Walnut Creek AEU
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary
N
W
E
S
0
750
1500 Feet
Scale 1:18,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
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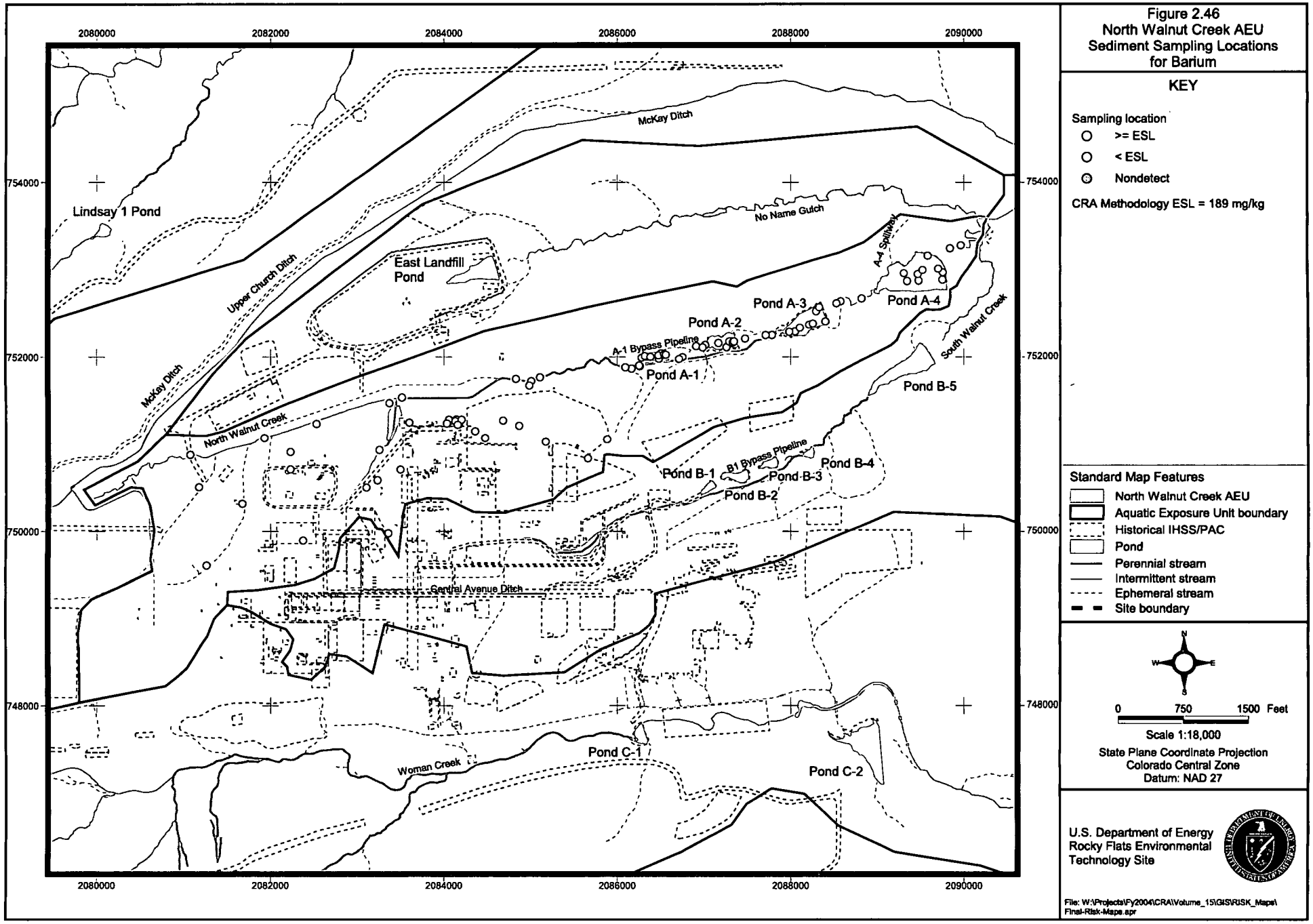

Figure 2.46
North Walnut Creek AEU
Sediment Sampling Locations
for Barium

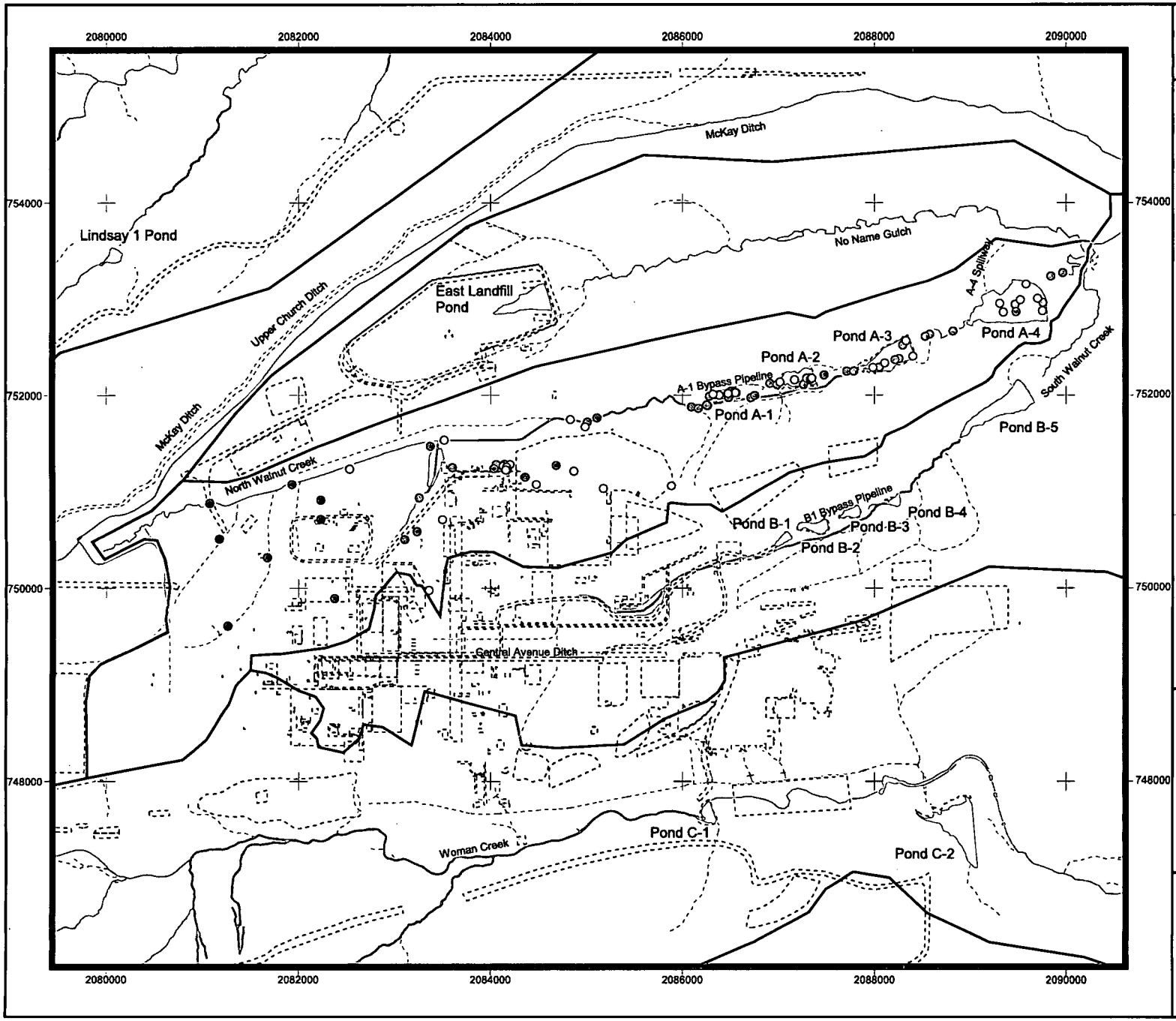

Figure 2.47
North Walnut Creek AEU
Sediment Sampling Locations
for Cadmium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.99 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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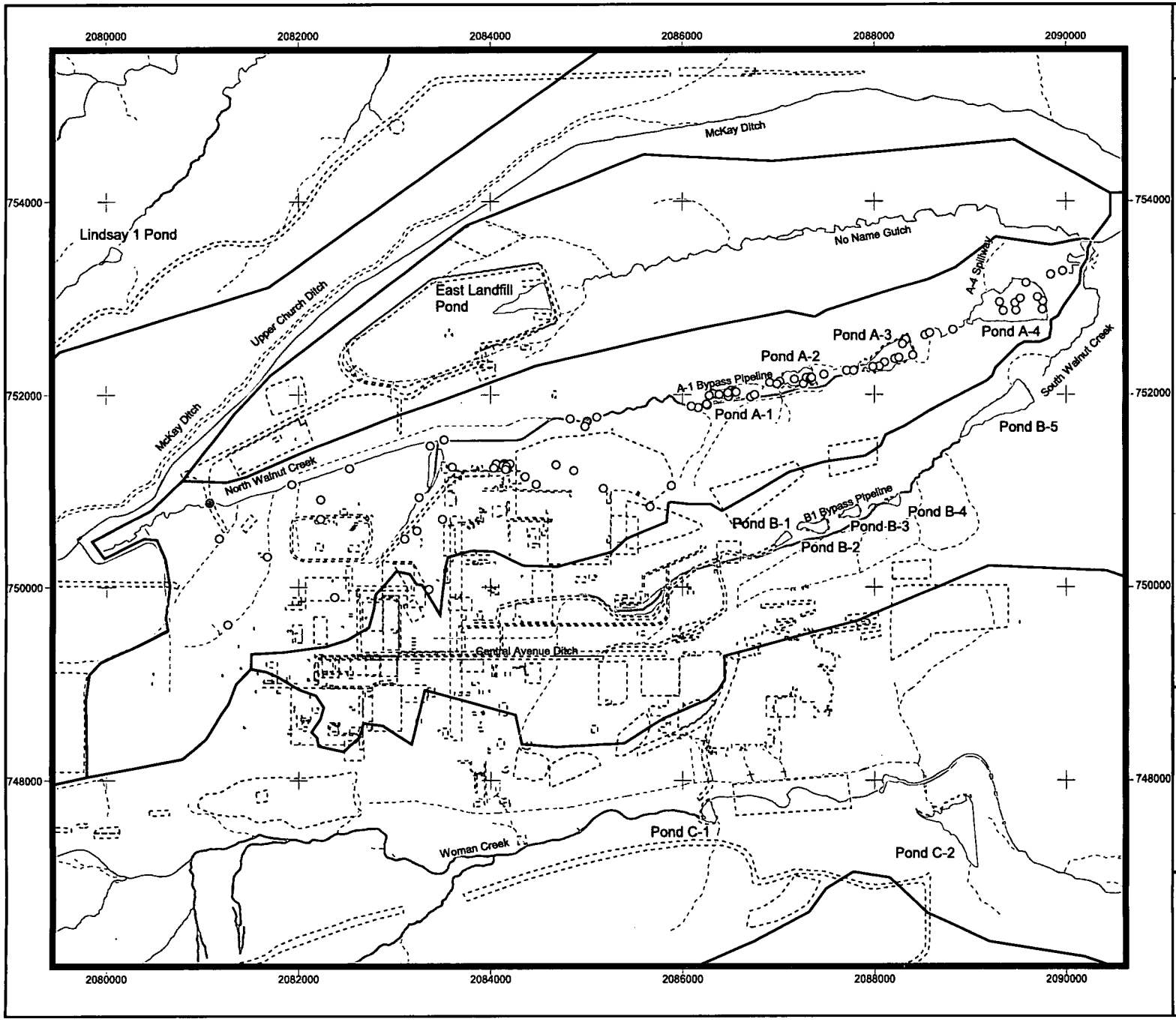

Figure 2.48
North Walnut Creek AEU
Sediment Sampling Locations
for Copper

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 31.6 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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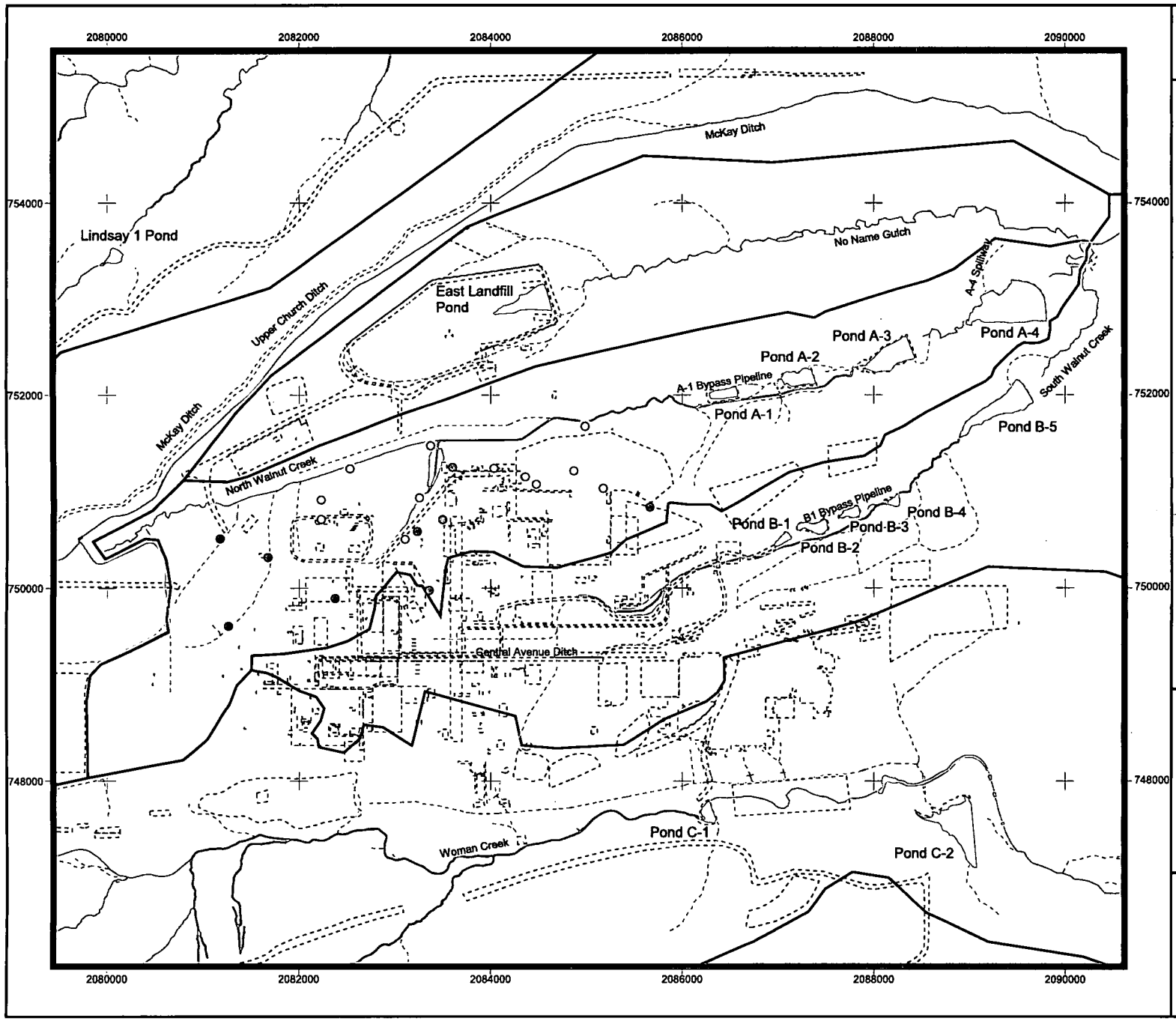

Figure 2.49
North Walnut Creek AEU
Sediment Sampling Locations
for Fluoride

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.01 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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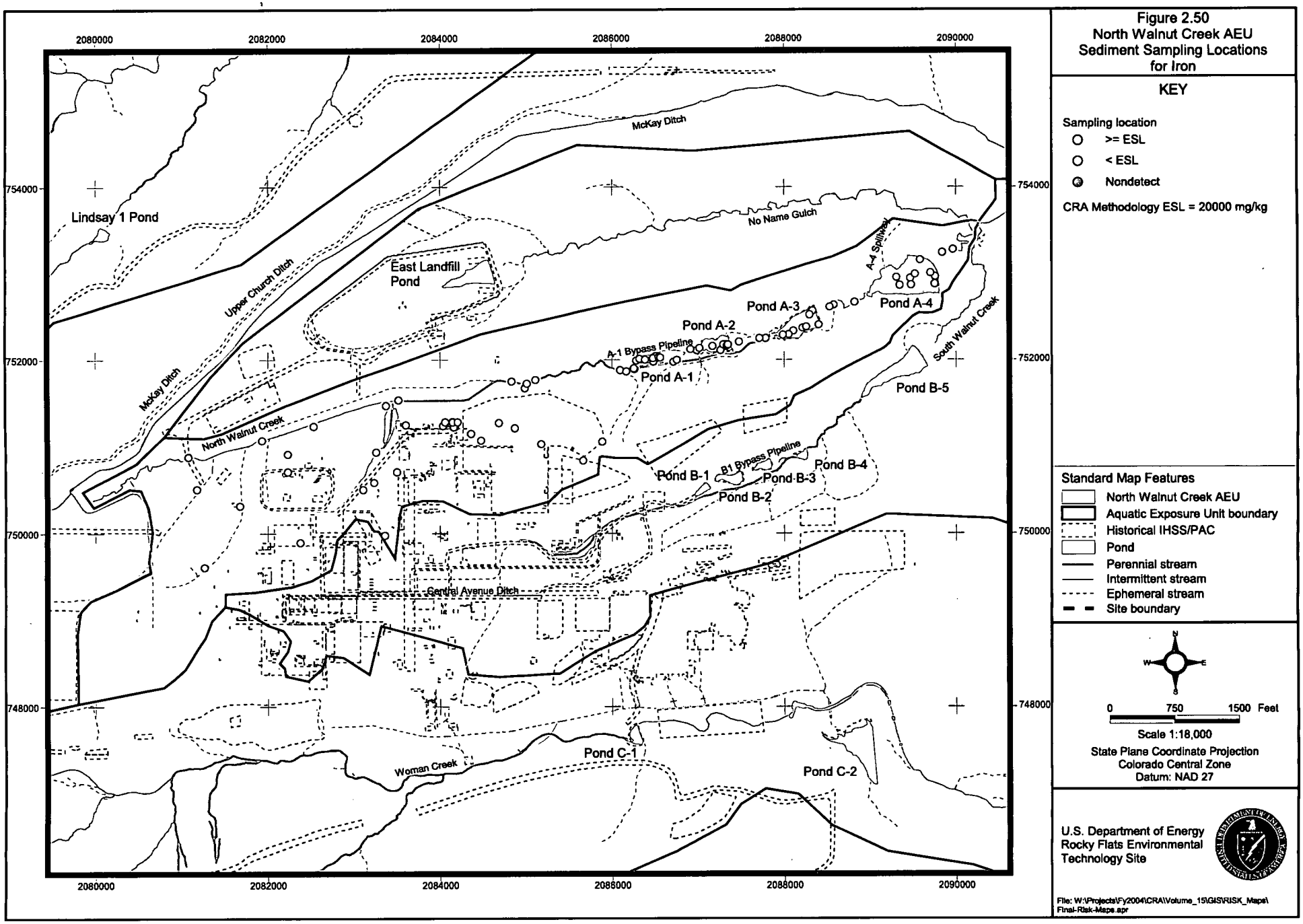

Figure 2.50
North Walnut Creek AEU
Sediment Sampling Locations
for Iron

247

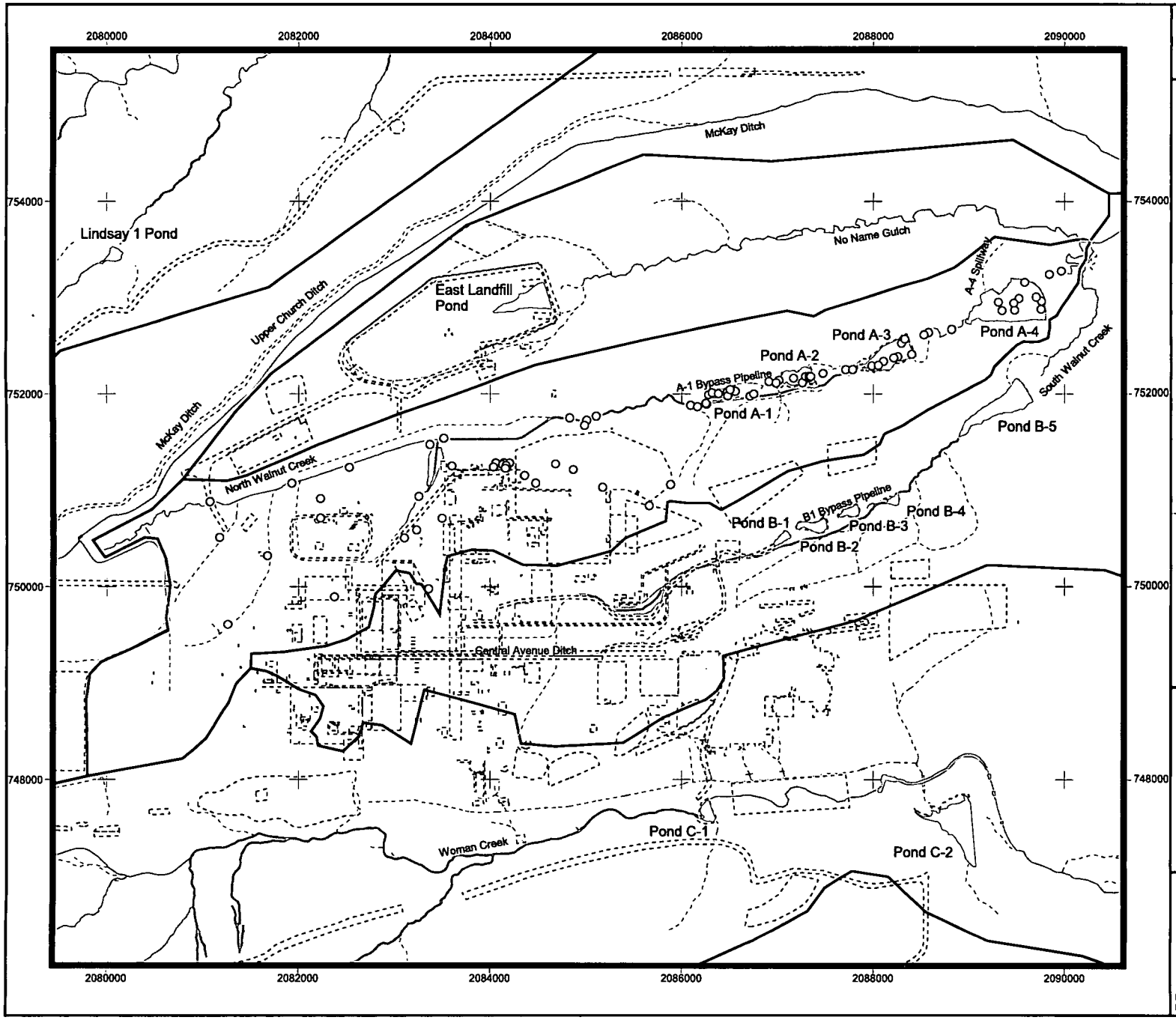

Figure 2.51
North Walnut Creek AEU
Sediment Sampling Locations
for Lead

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 35.8 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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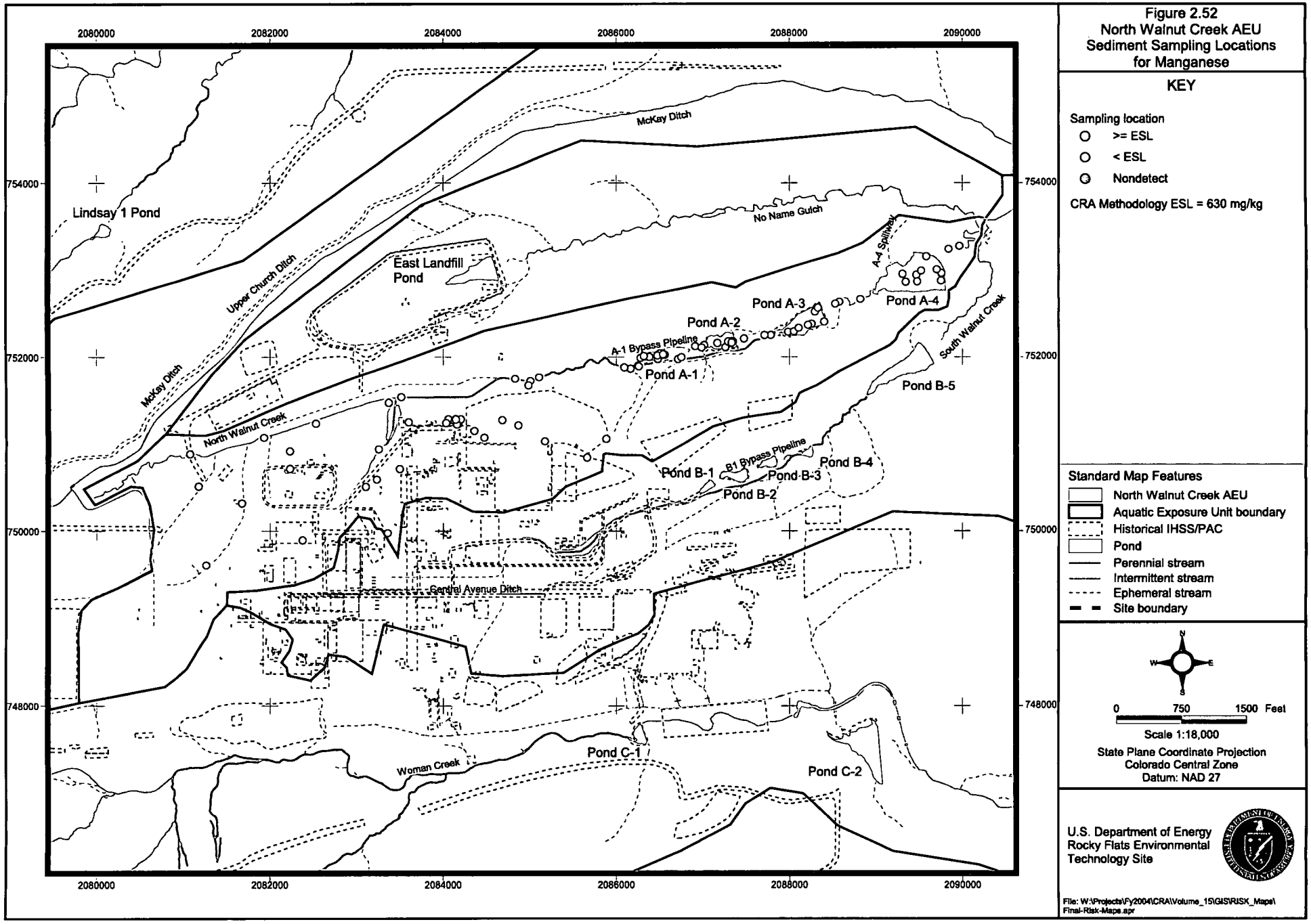
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2084000
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2090000
754000
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750000
748000
McKay Ditch
Lindsay 1 Pond
Upper Church Ditch
East Landfill Pond
No Name Gulch
A-4 Spillway
Pond A-3
Pond A-4
Pond A-2
A-1 Bypass Pipeline
Pond A-1
South Walnut Creek
Pond B-5
McKay Ditch
North Walnut Creek
B1 Bypass Pipeline
Pond B-1
Pond B-3
Pond B-4
Pond B-2
Central Avenue Ditch
Woman Creek
Pond C-1
Pond C-2
Figure 2.52
North Walnut Creek AEU
Sediment Sampling Locations
for Manganese
KEY
Sampling location
>= ESL
< ESL
Nondetect
CRA Methodology ESL = 630 mg/kg
Standard Map Features
North Walnut Creek AEU
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary
N
W
E
S
0
750
1500 Feet
Scale 1:18,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
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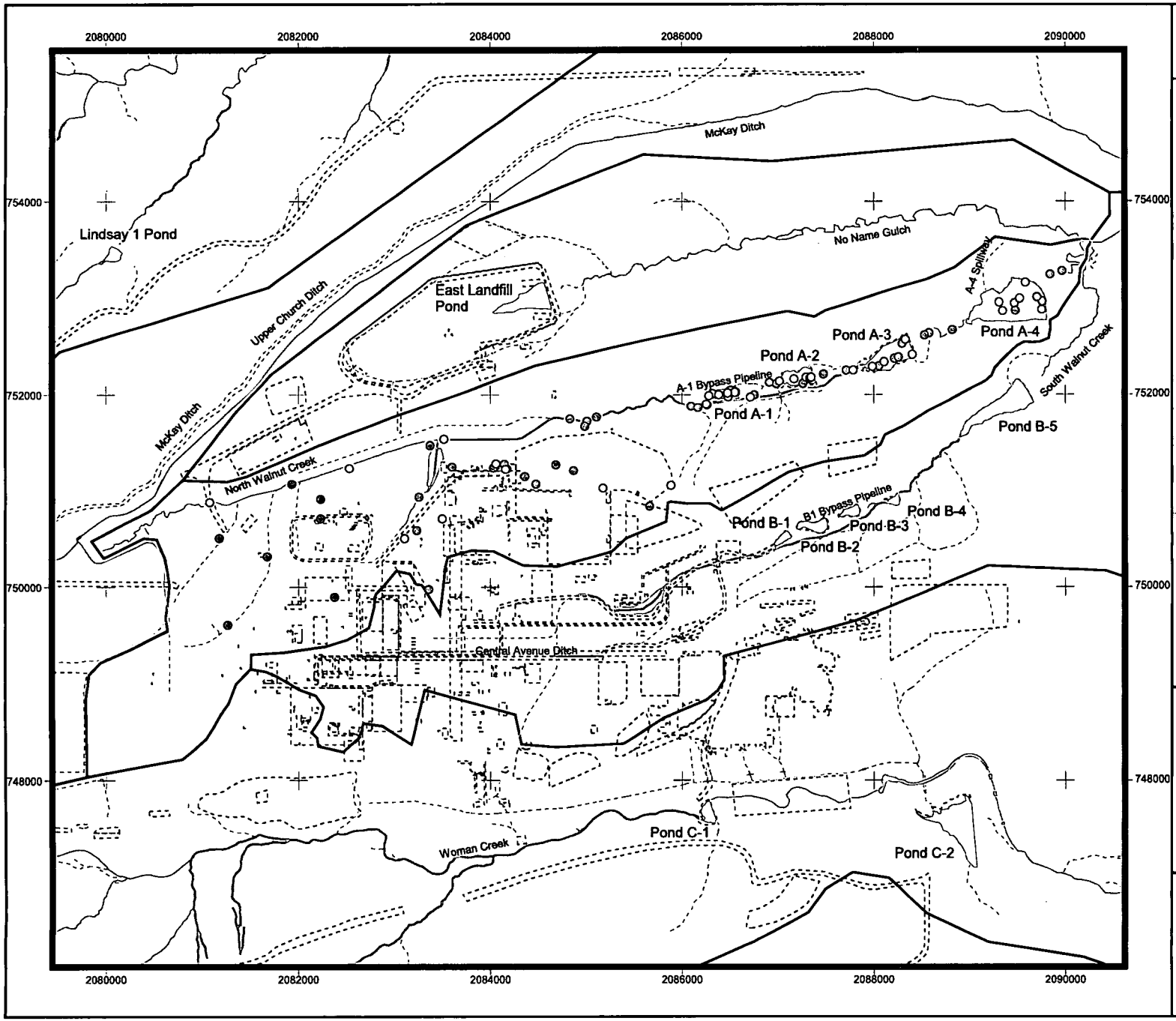

Figure 2.53
North Walnut Creek AEU
Sediment Sampling Locations
for Mercury

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.18 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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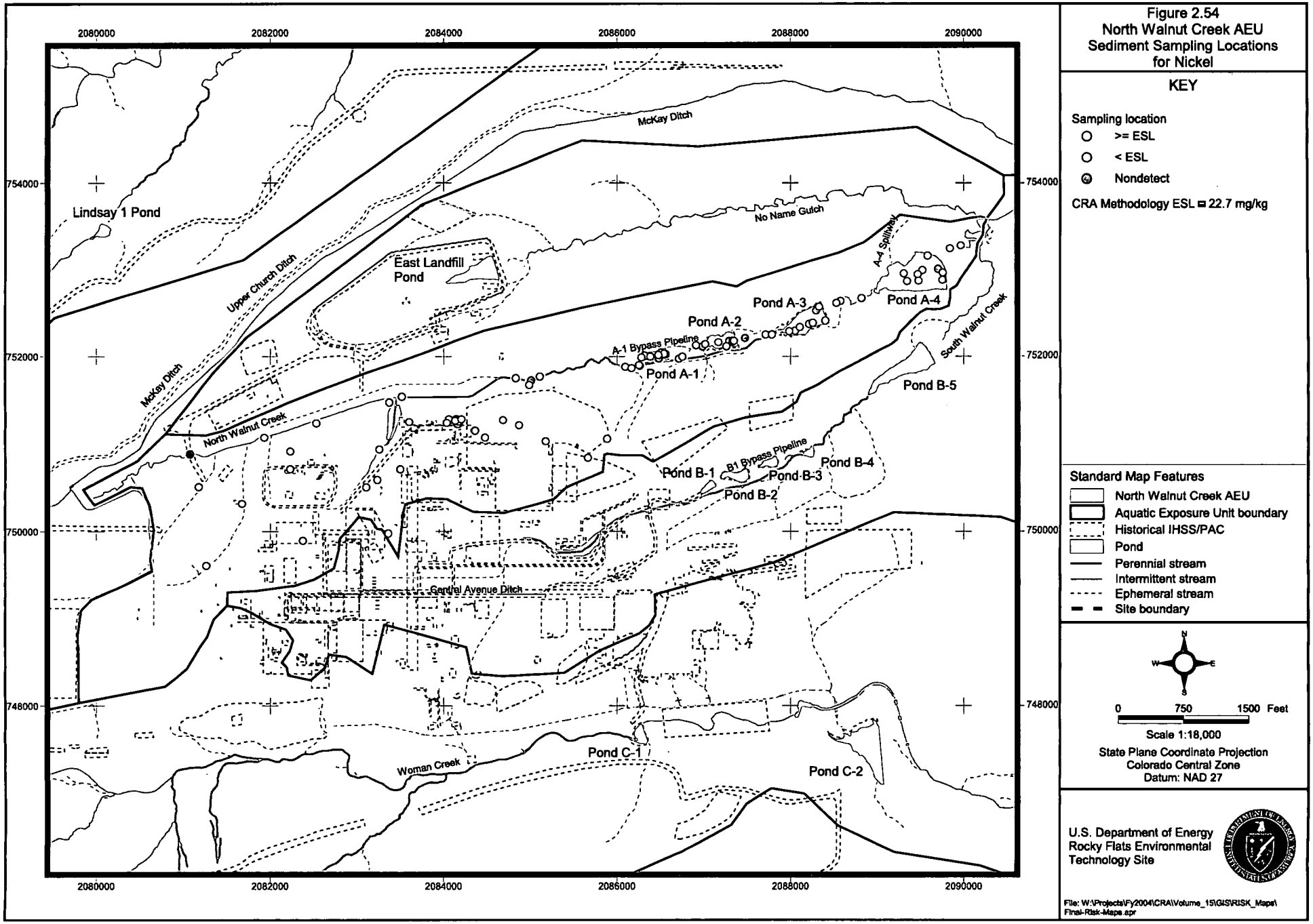

Figure 2.54
North Walnut Creek AEU
Sediment Sampling Locations
for Nickel

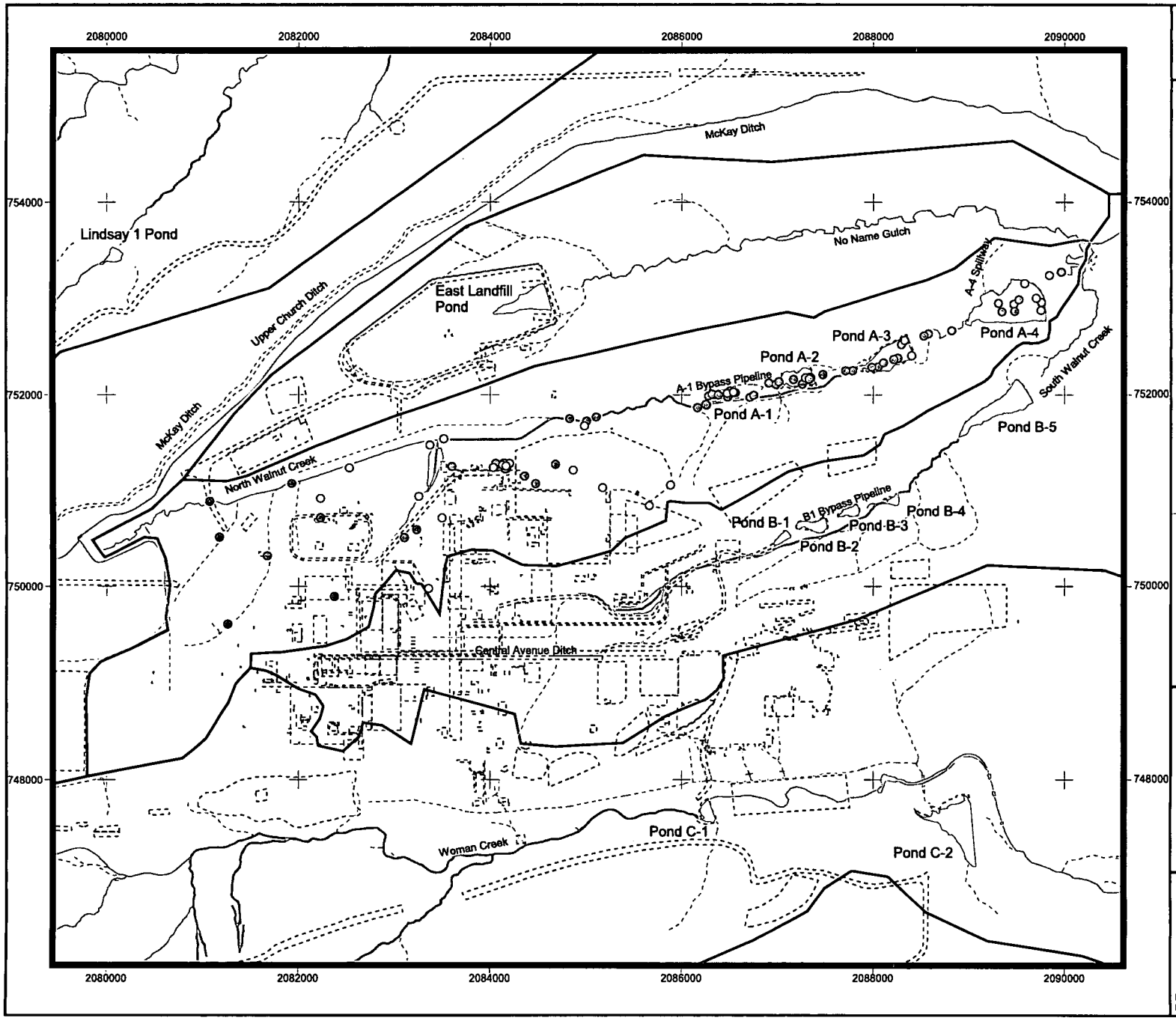

Figure 2.55
North Walnut Creek AEU
Sediment Sampling Locations
for Selenium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.95 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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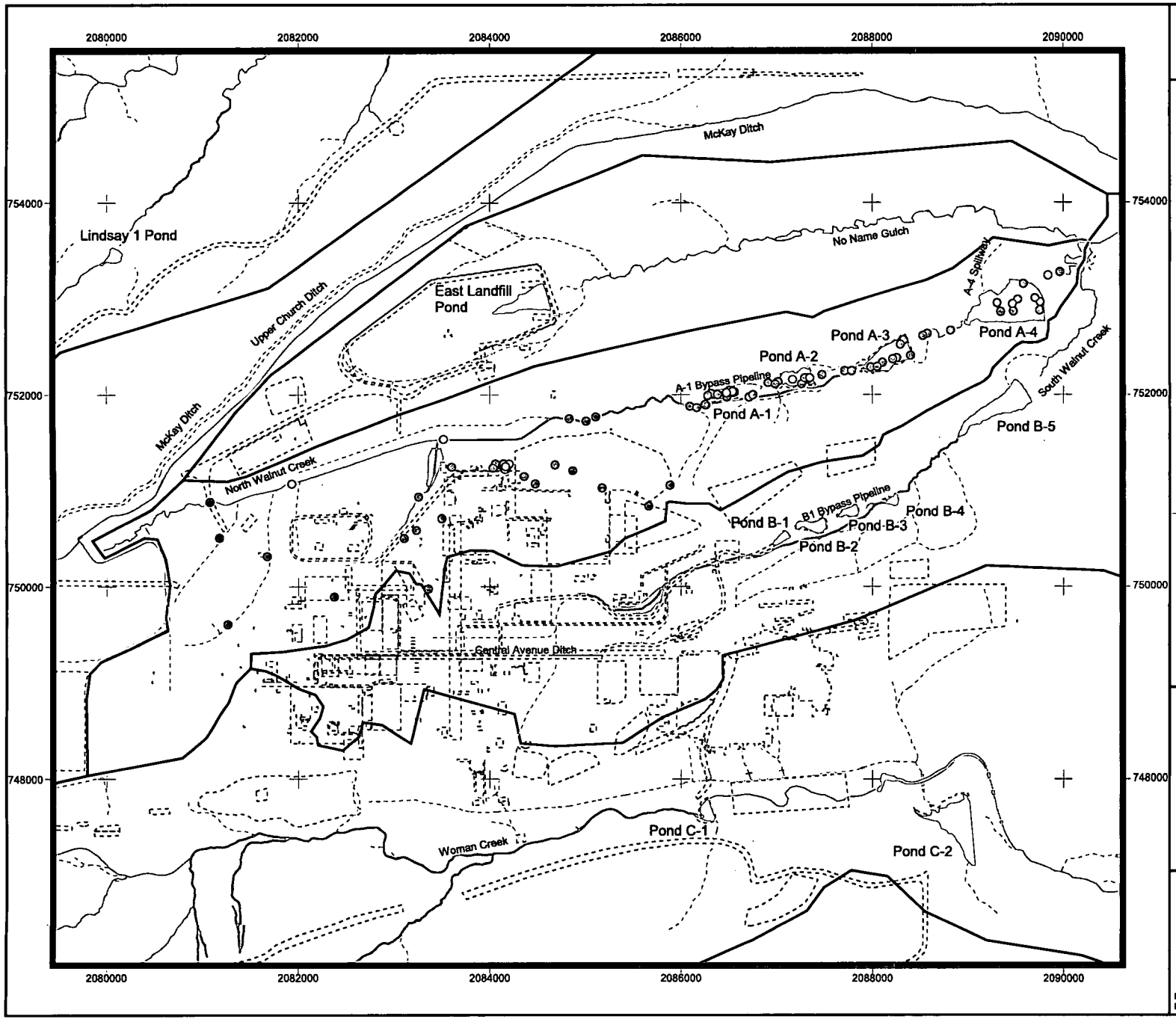

Figure 2.56
North Walnut Creek AEU
Sediment Sampling Locations
for Silver

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 1 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

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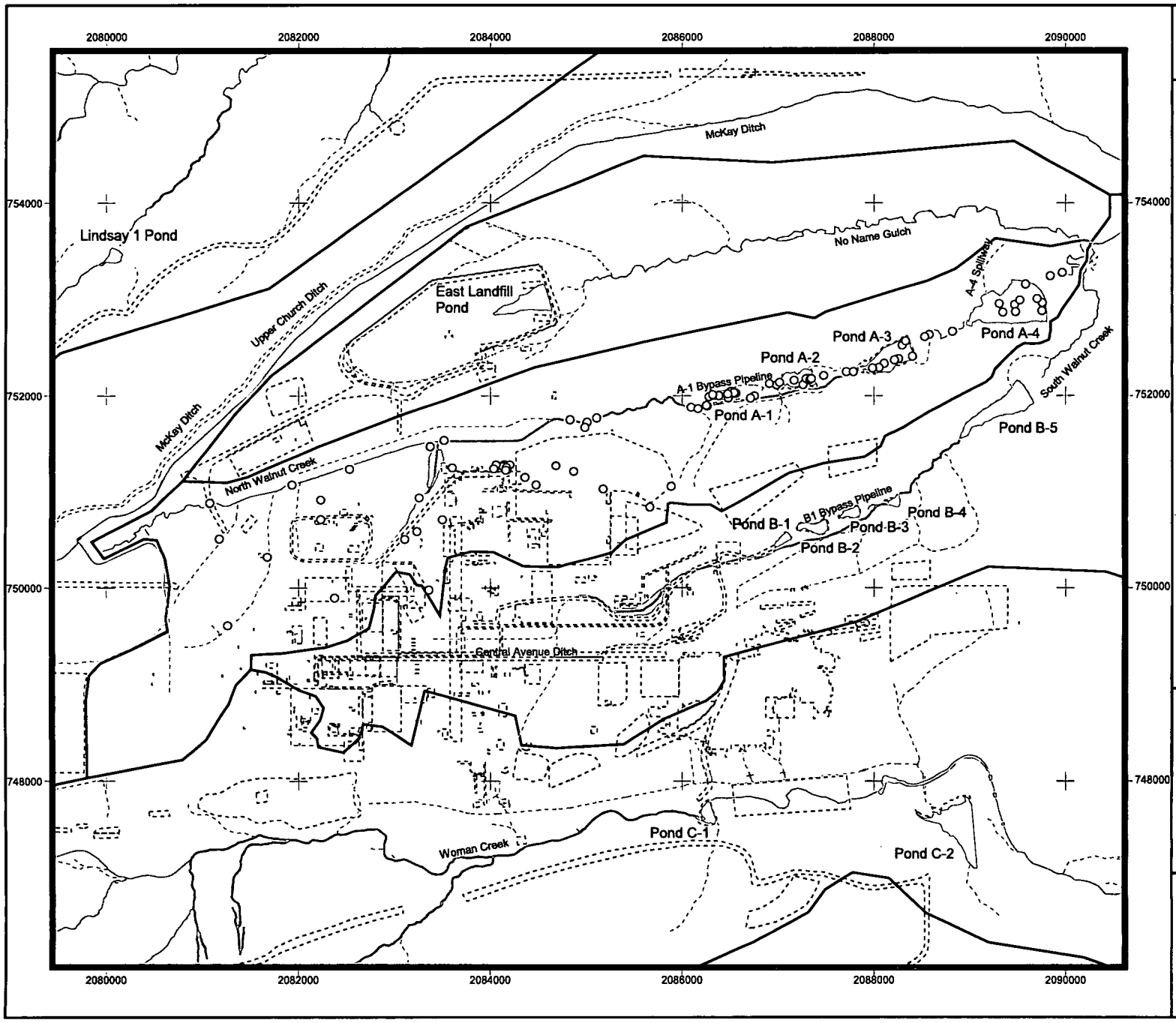

Figure 2.57
North Walnut Creek AEU
Sediment Sampling Locations
for Zinc

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 121 mg/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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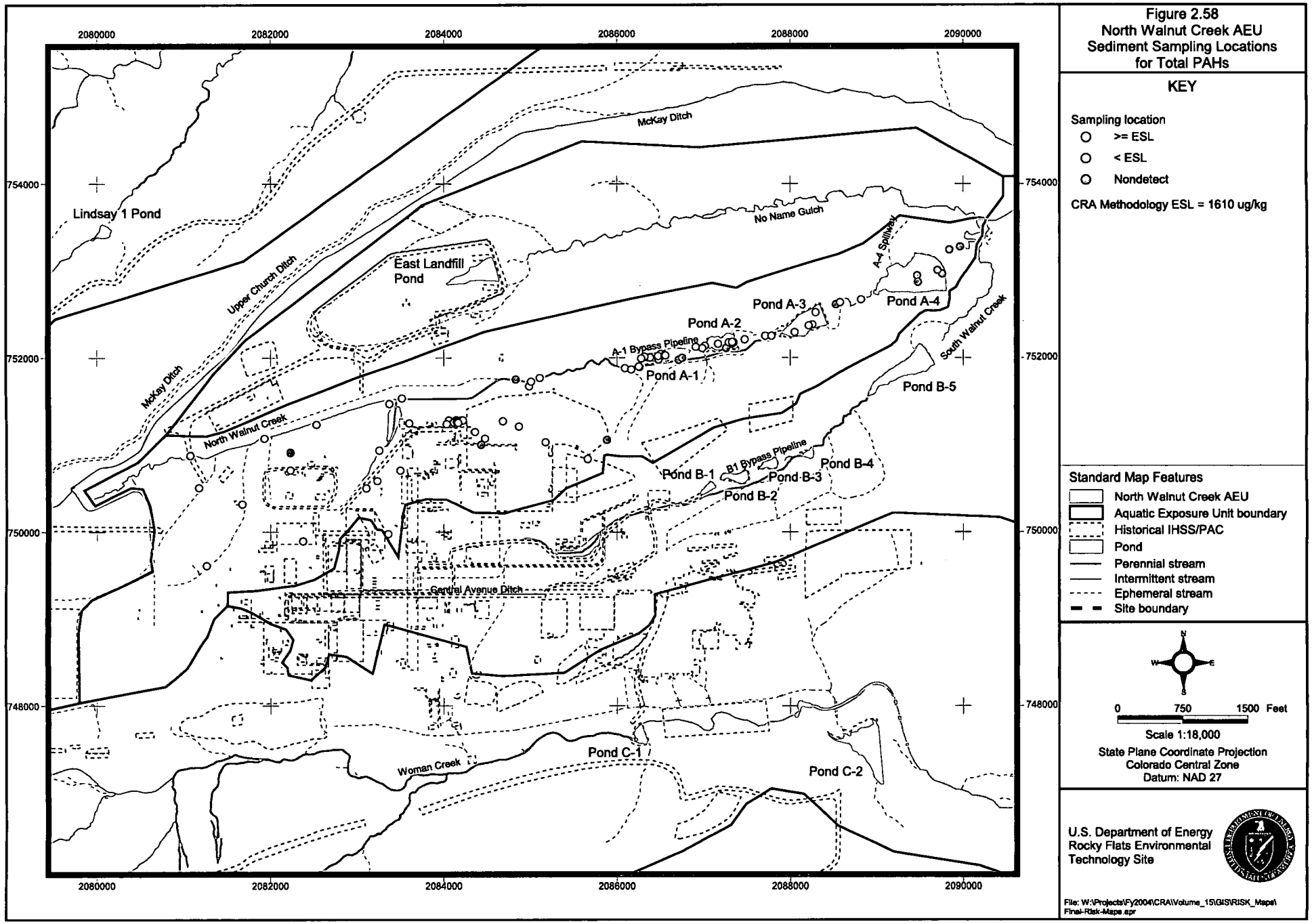
254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2082000
2084000
2086000
2088000
2090000
754000
752000
750000
748000
McKay Ditch
Lindsay 1 Pond
Upper Church Ditch
East Landfill Pond
No Name Gulch
A-4 Spillway
Pond A-3
Pond A-4
Pond A-2
A-1 Bypass Pipeline
Pond A-1
South Walnut Creek
Pond B-5
McKay Ditch
North Walnut Creek
B1 Bypass Pipeline
Pond B-1
Pond B-3
Pond B-4
Pond B-2
Central Avenue Ditch
Woman Creek
Pond C-1
Pond C-2
Figure 2.58
North Walnut Creek AEU
Sediment Sampling Locations
for Total PAHs
KEY
Sampling location
>= ESL
< ESL
Nondetect
CRA Methodology ESL = 1610 ug/kg
Standard Map Features
North Walnut Creek AEU
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary
N
W
E
S
0
750
1500 Feet
Scale 1:18,000
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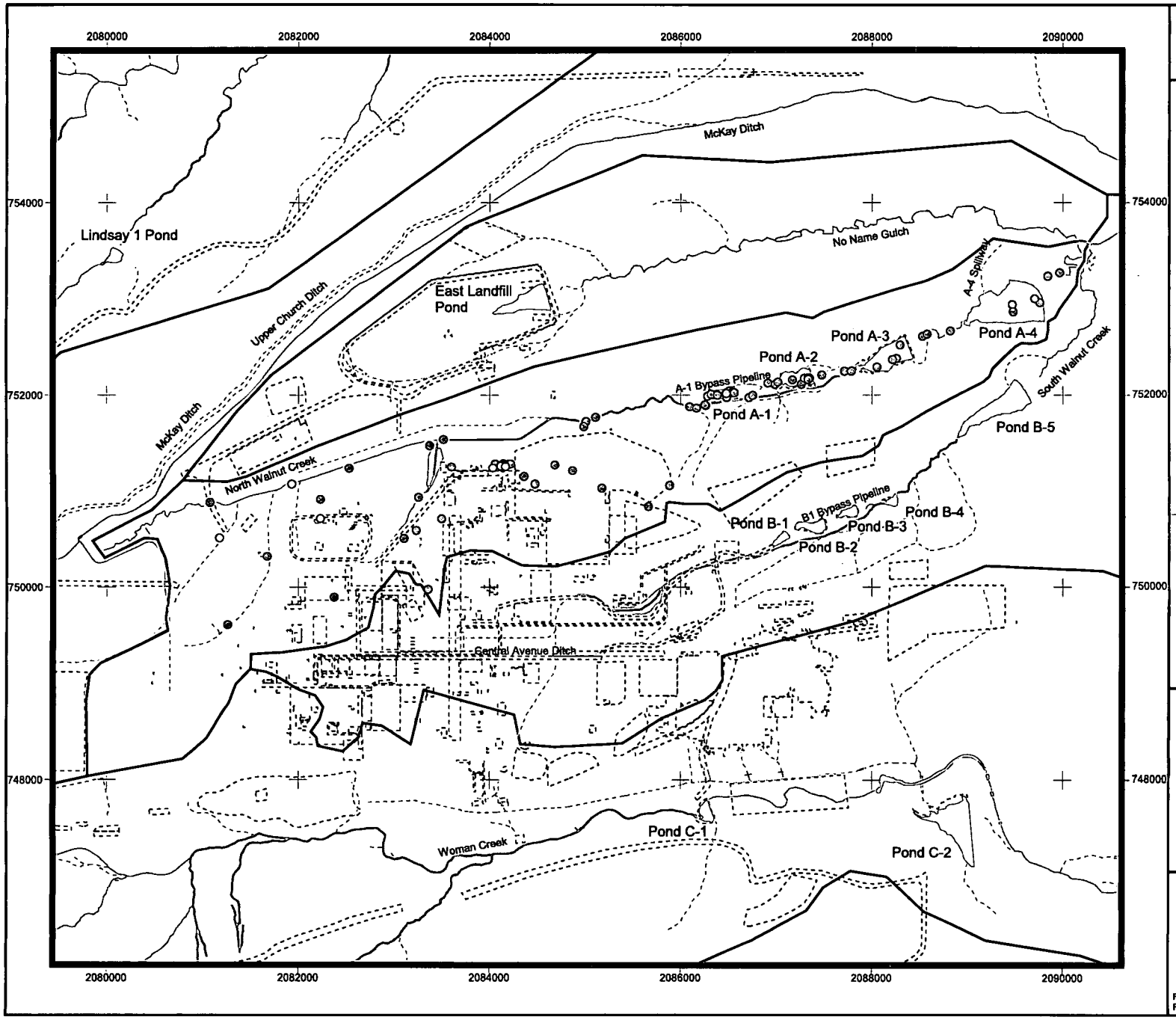

Figure 2.59
North Walnut Creek AEU
Sediment Sampling Locations
for 2-Methylnaphthalene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 20.2 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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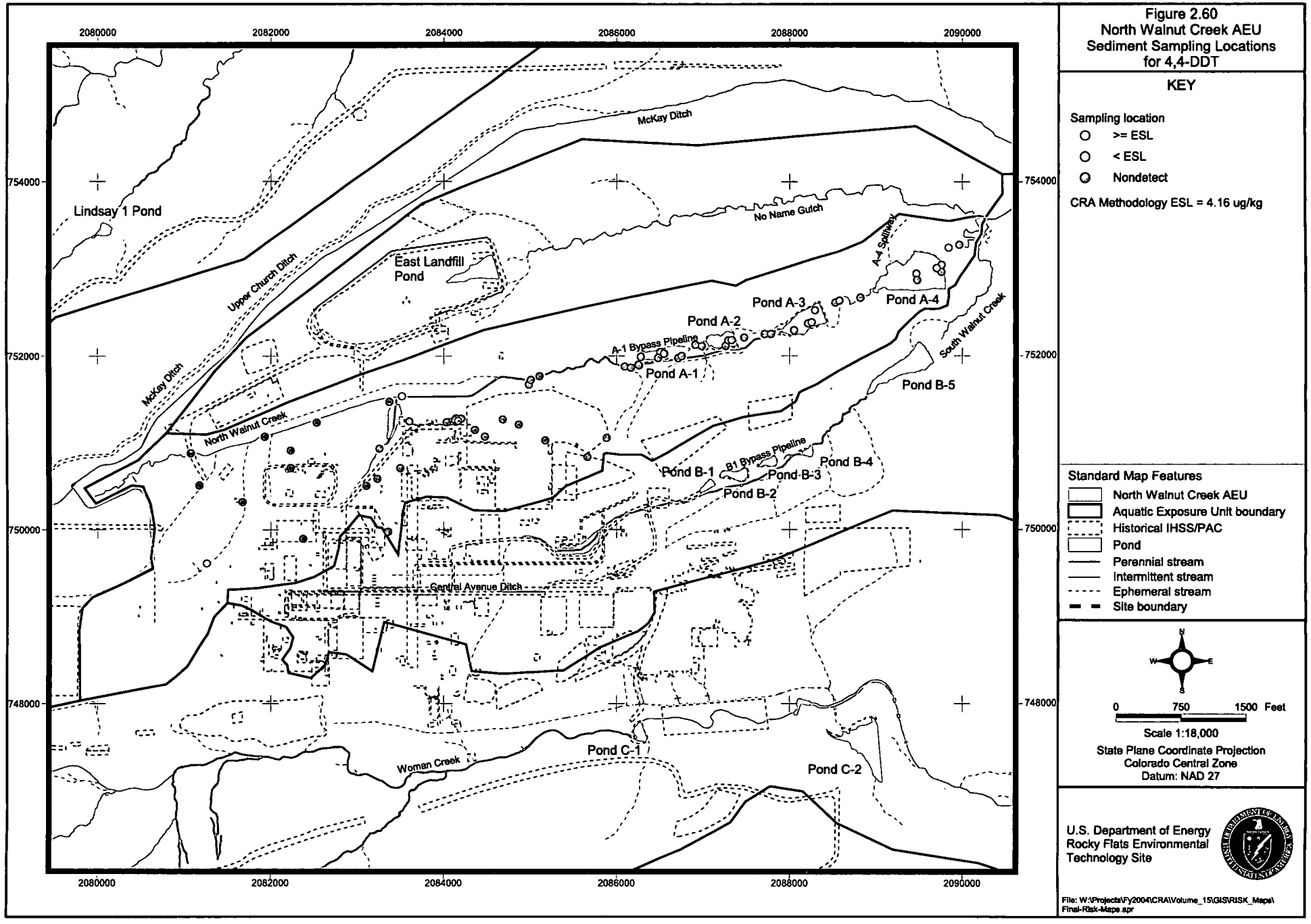

Figure 2.60
North Walnut Creek AEU
Sediment Sampling Locations
for 4,4-DDT

257

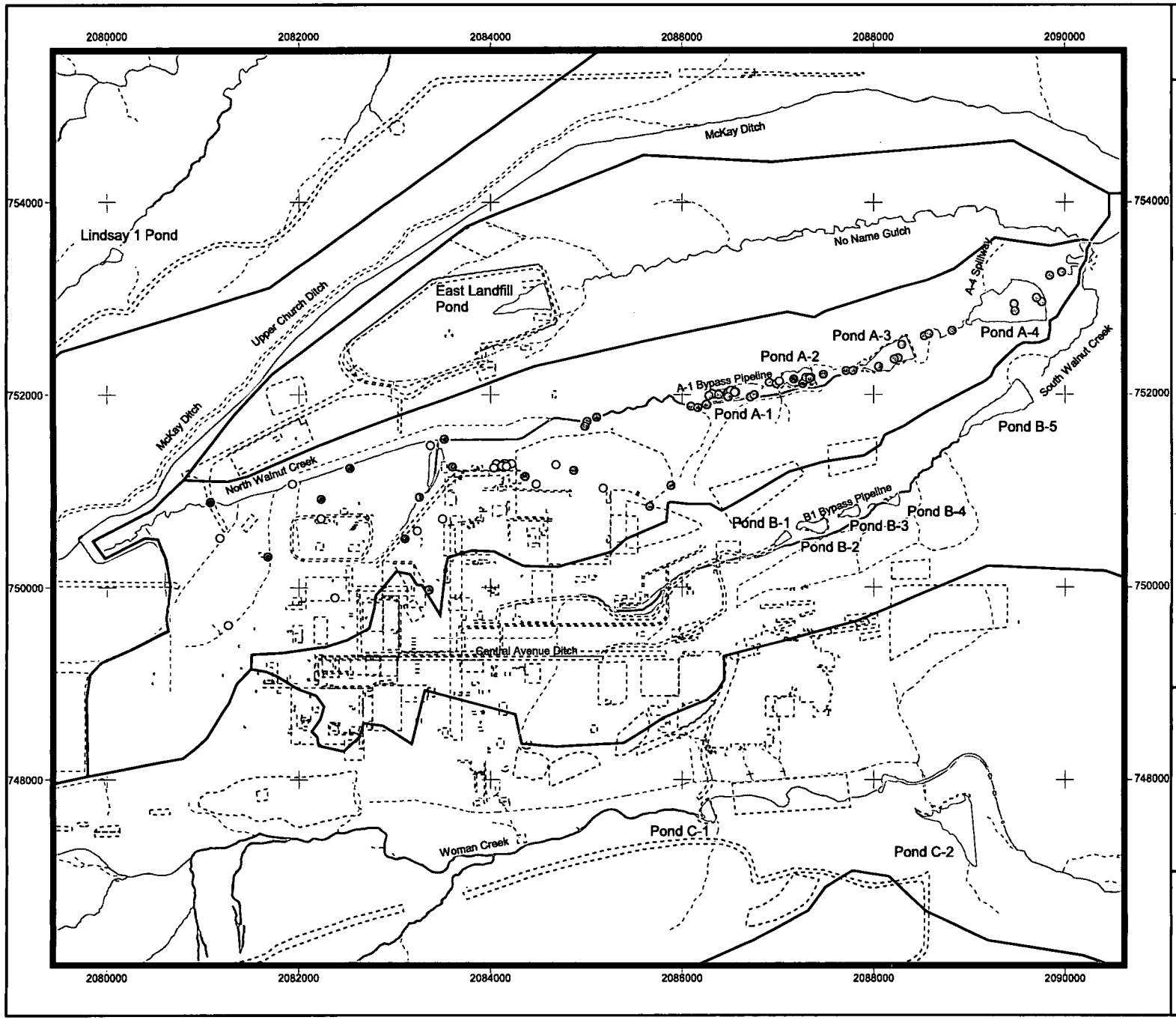

Figure 2.61
North Walnut Creek AEU
Sediment Sampling Locations
for Acenaphthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 6.71 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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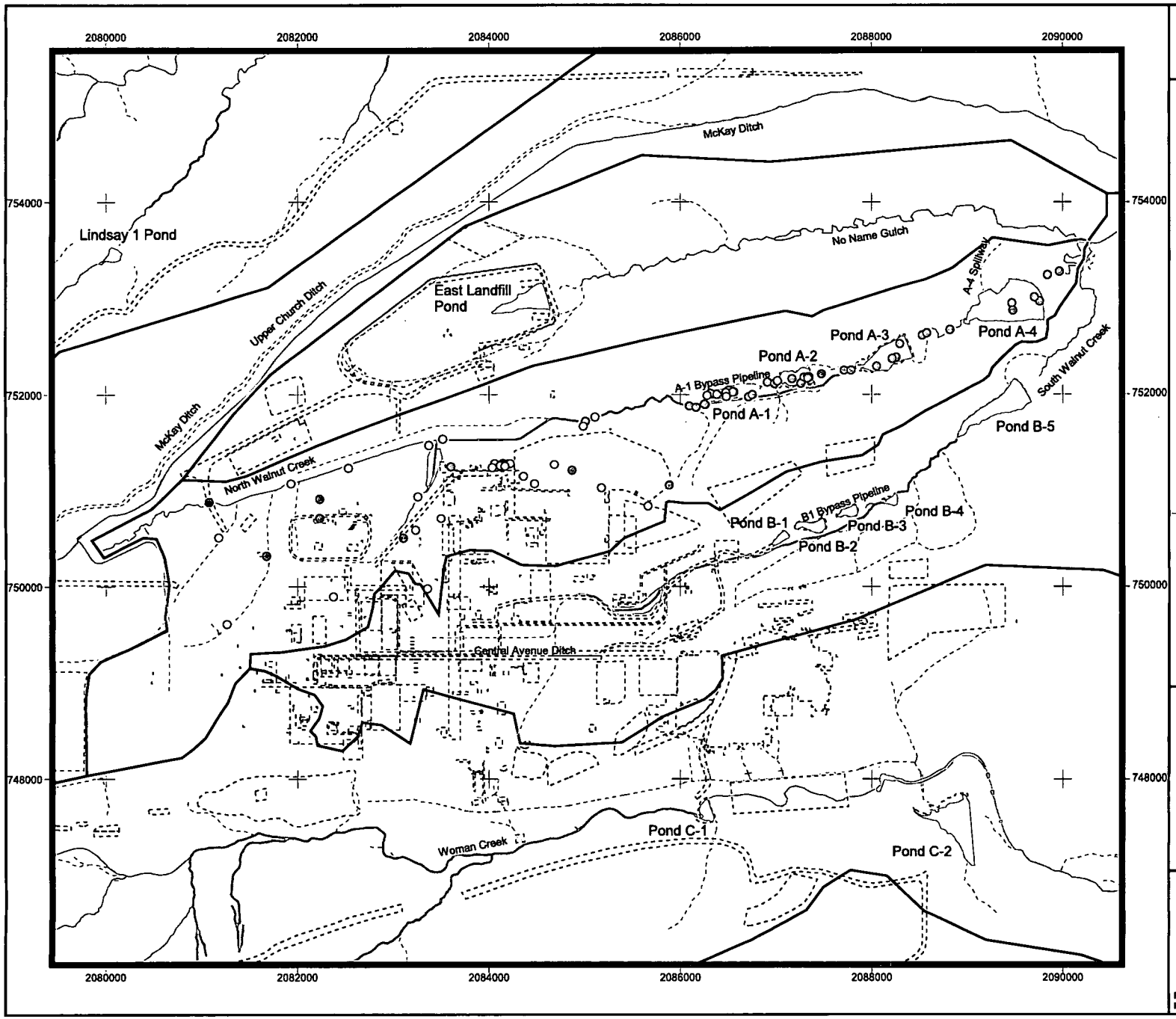

Figure 2.62
North Walnut Creek AEU
Sediment Sampling Locations
for Anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 57.2 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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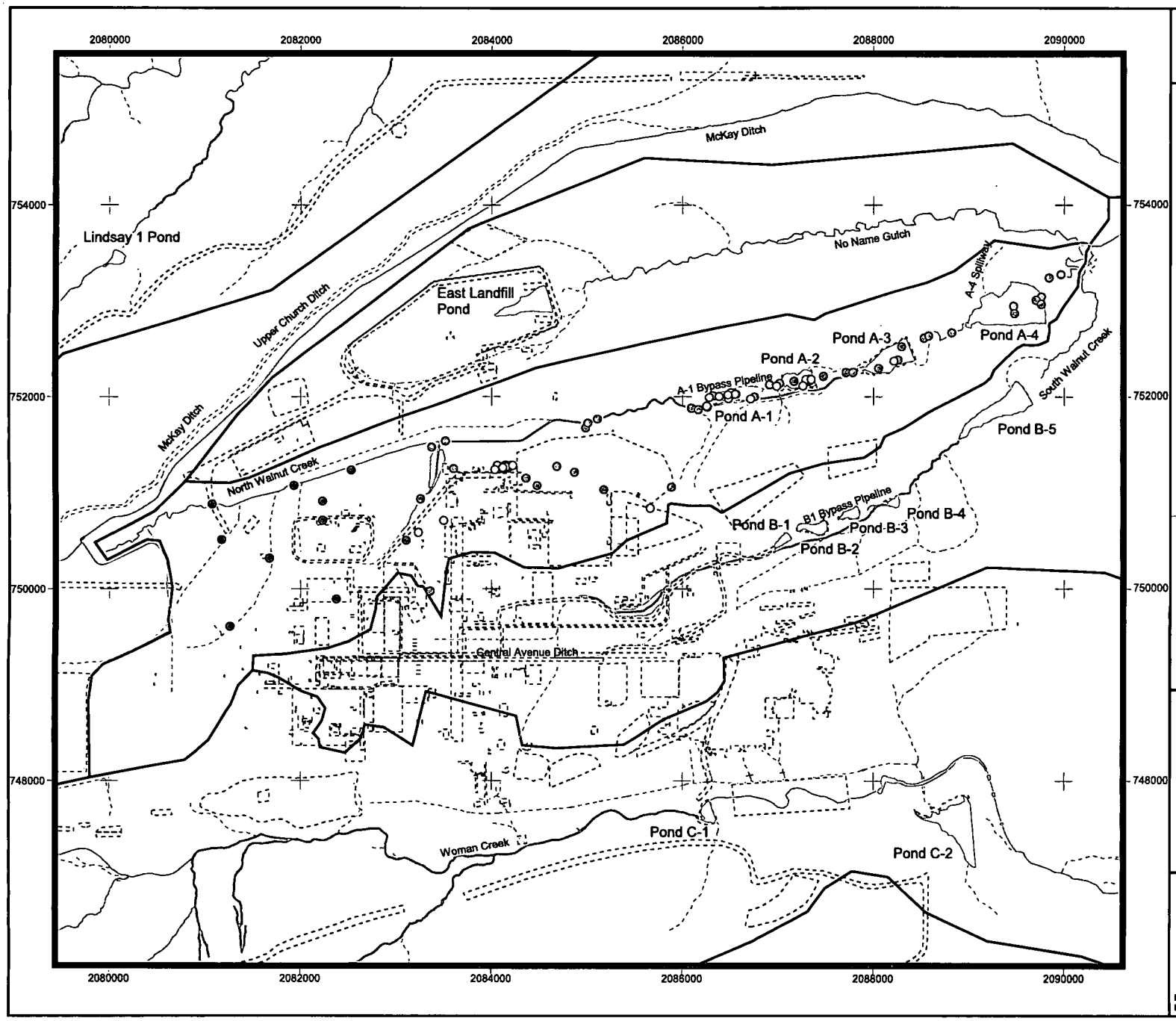

Figure 2.63
North Walnut Creek AEU
Sediment Sampling Locations
for Total PCBs

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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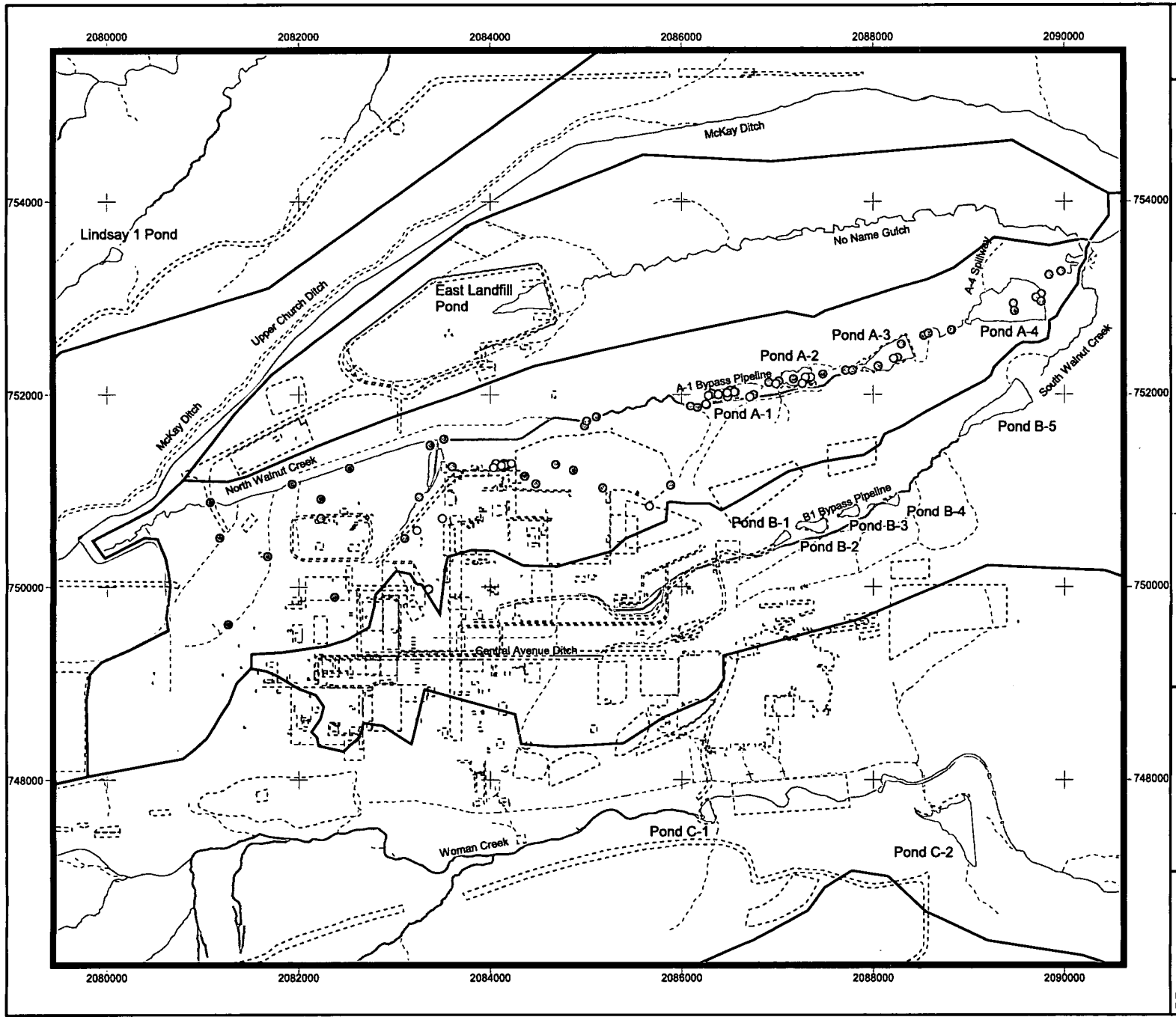

Figure 2.64
North Walnut Creek AEU
Sediment Sampling Locations
for Aroclor-1254

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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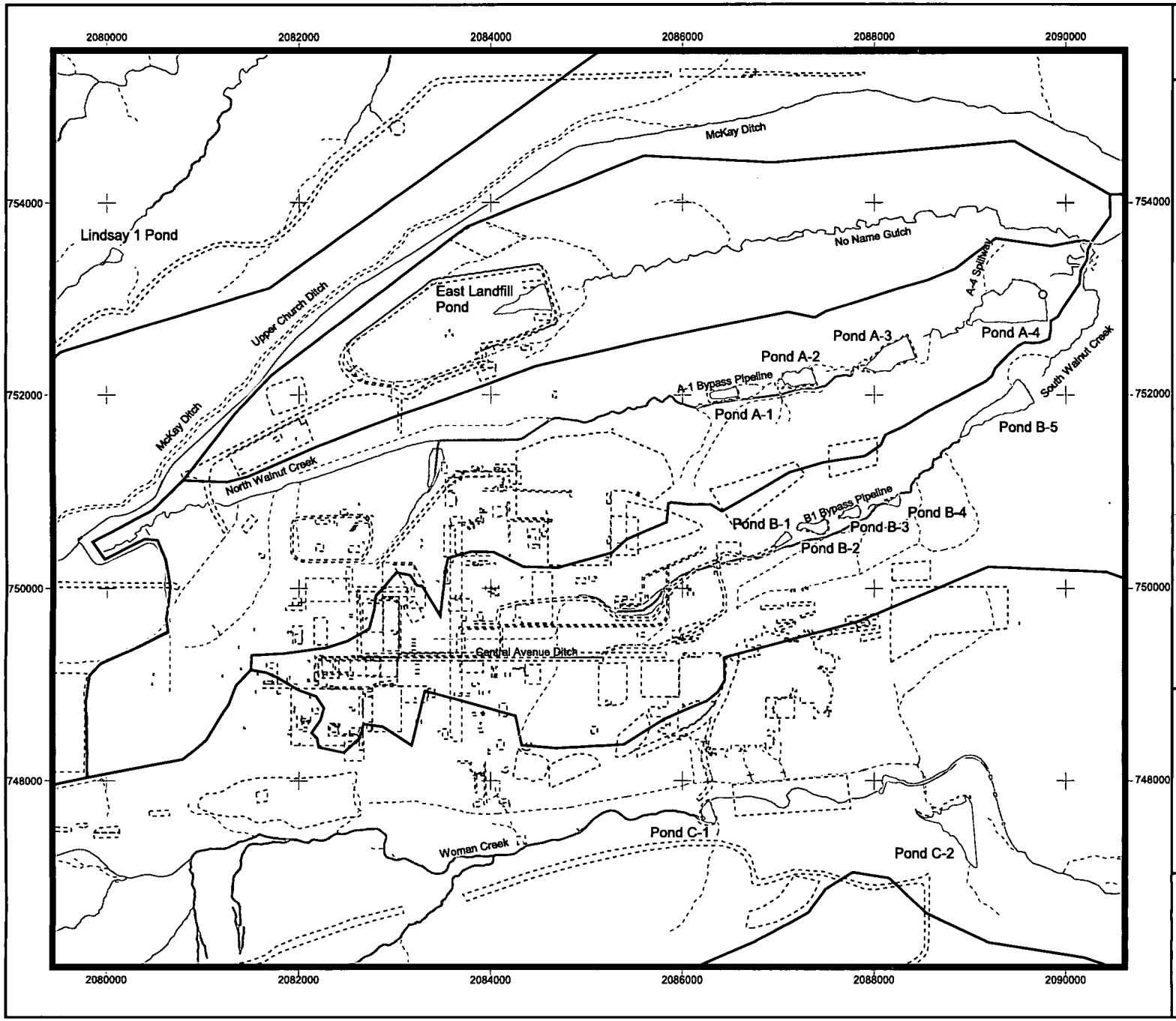

Figure 2.65
North Walnut Creek AEU
Sediment Sampling Locations
for Atrazine

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 16.8192 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

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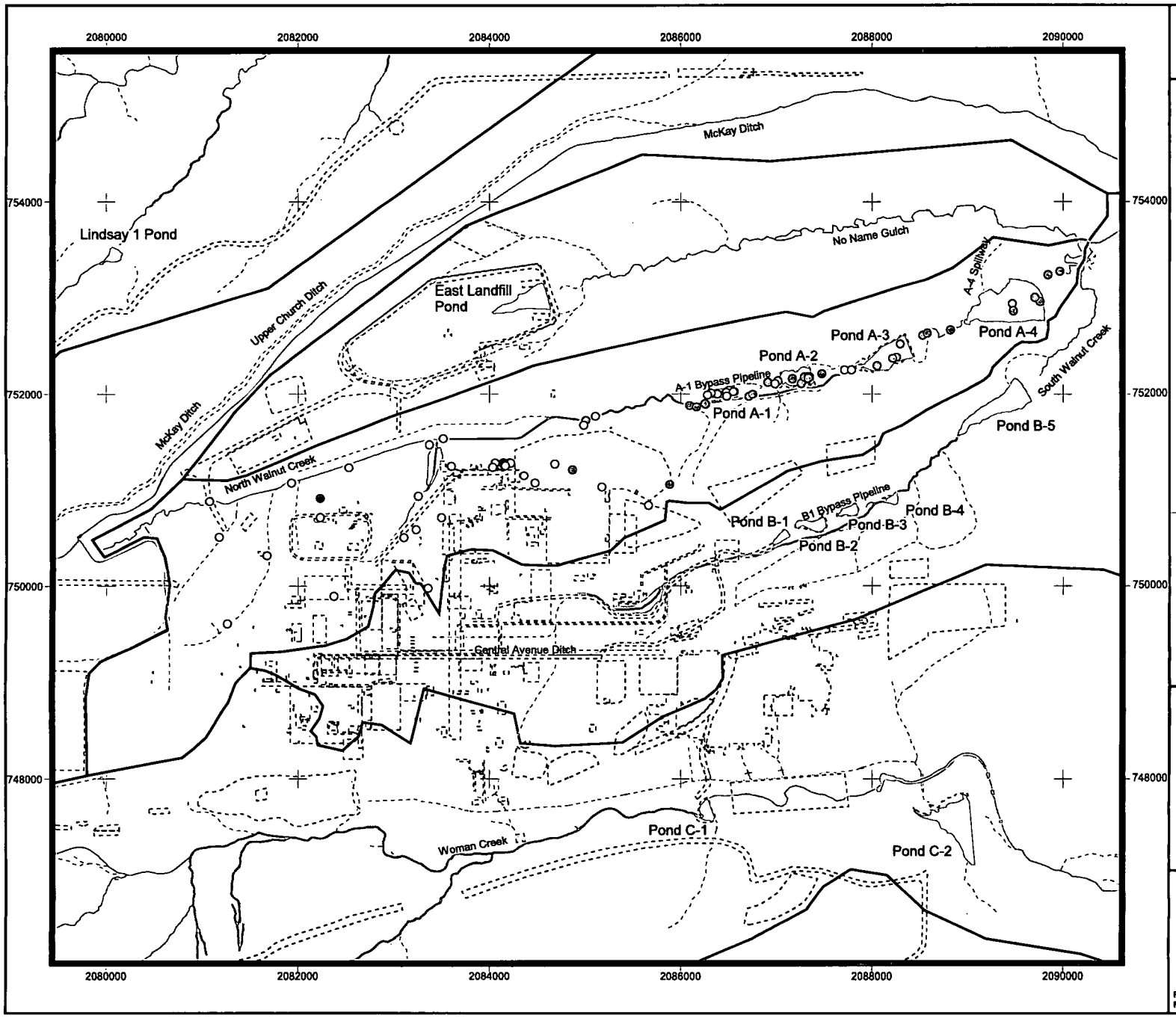

Figure 2.66
North Walnut Creek AEU
Sediment Sampling Locations
for Benzo(a)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 108 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

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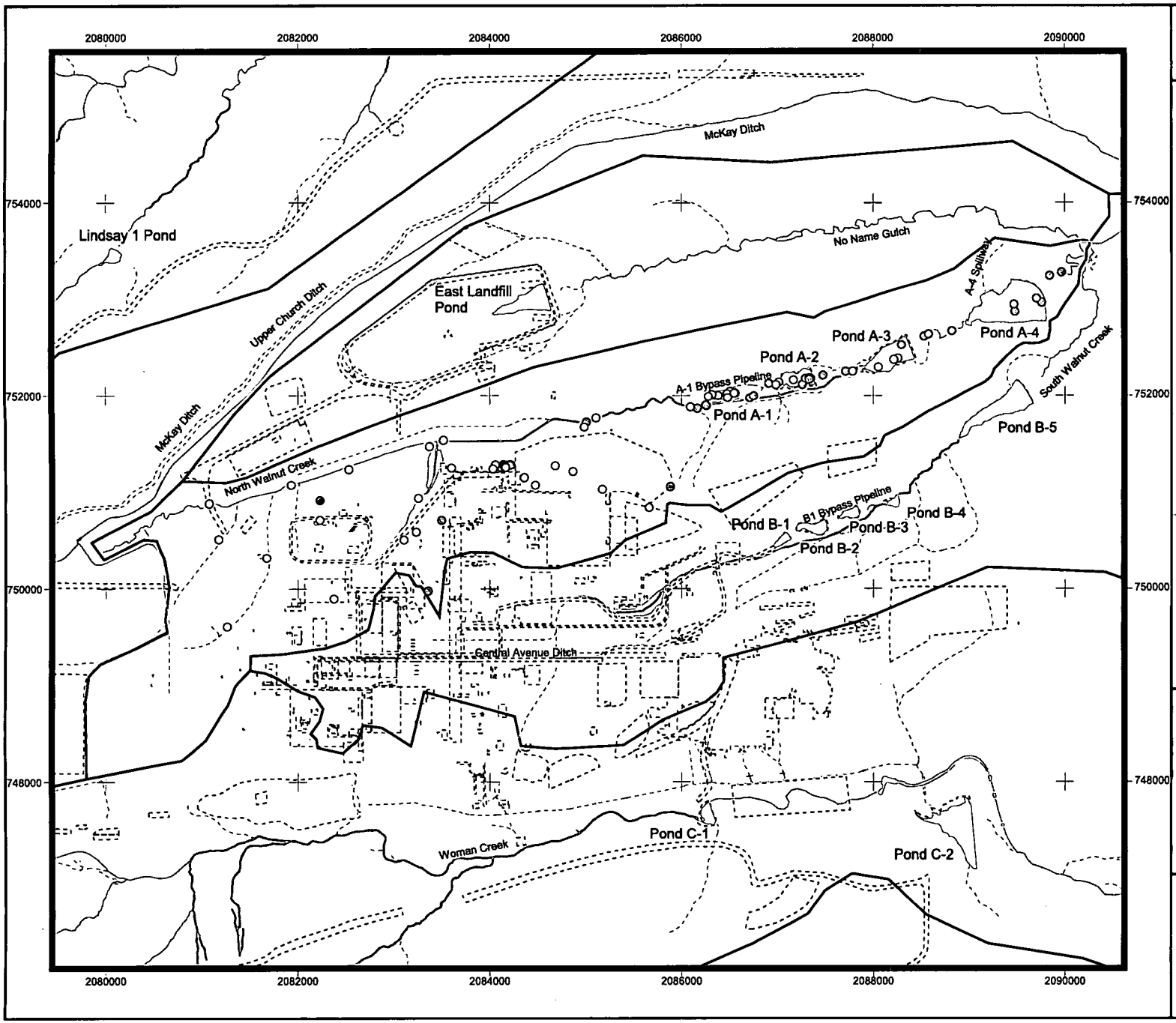

Figure 2.67
North Walnut Creek AEU
Sediment Sampling Locations
for Benzo(a)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 150 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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264

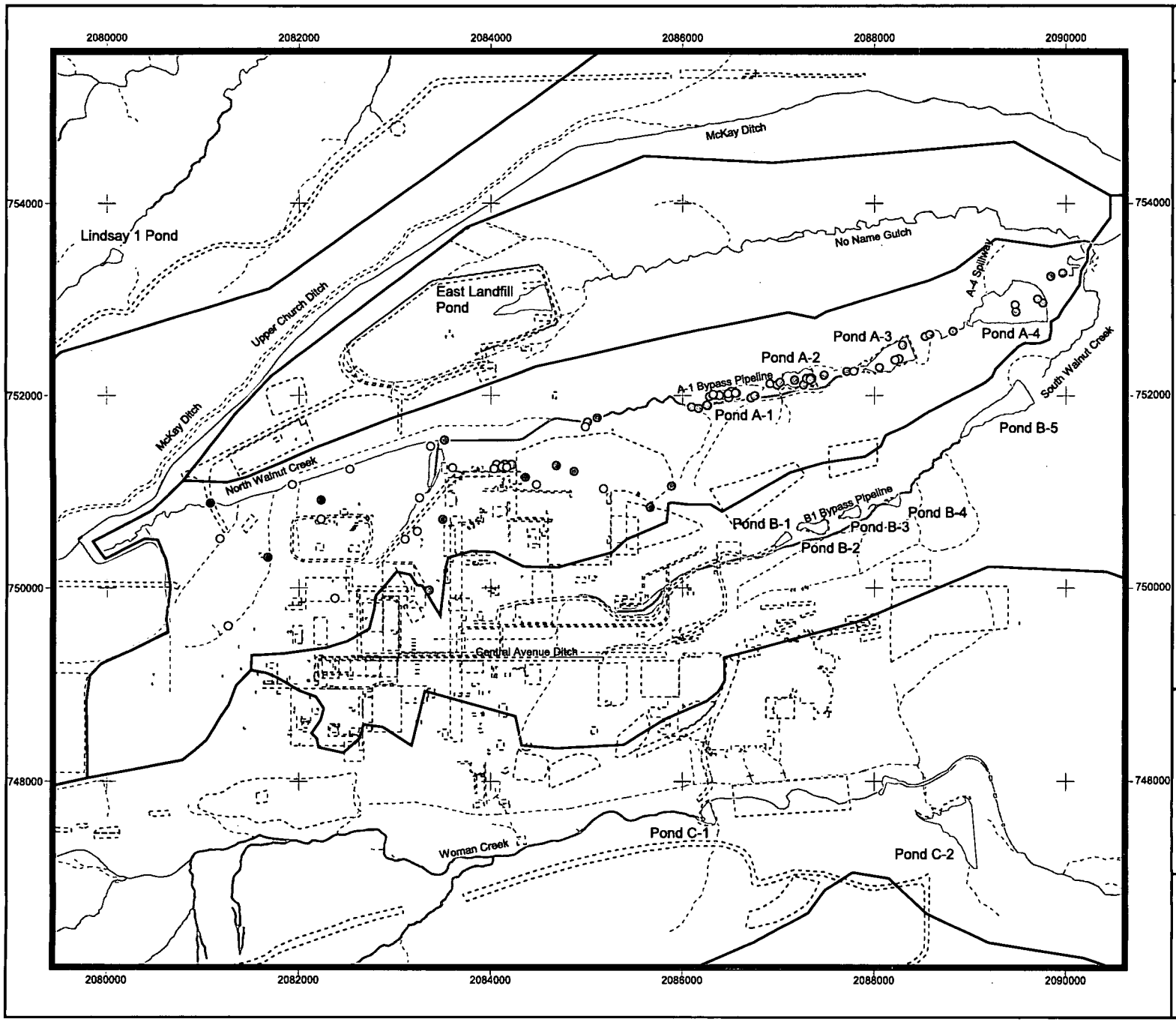

Figure 2.68
North Walnut Creek AEU
Sediment Sampling Locations
for Benzo(g,h,i)perylene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 13 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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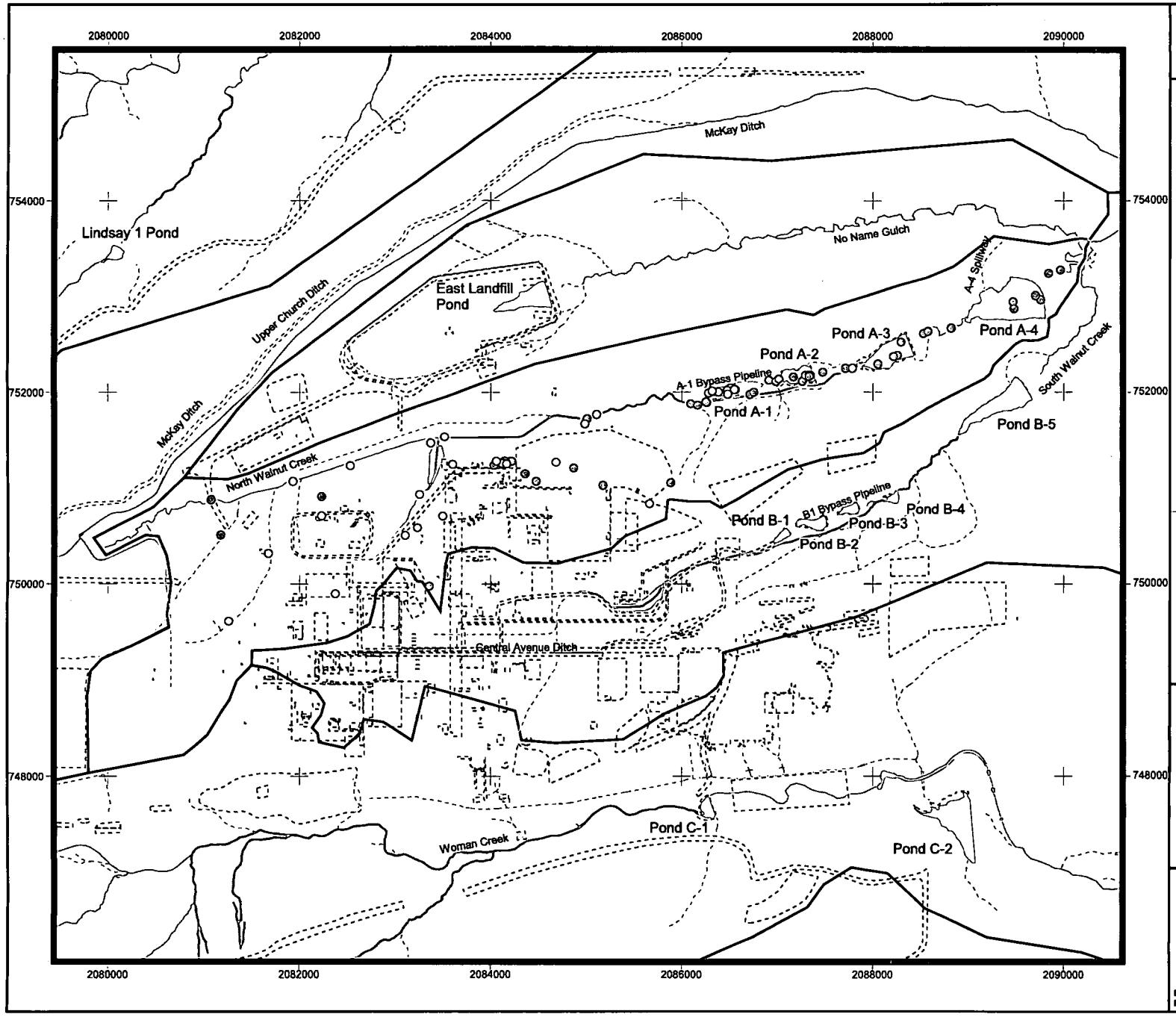

Figure 2.69
North Walnut Creek AEU
Sediment Sampling Locations
for Benzo(k)fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 240 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
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0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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266

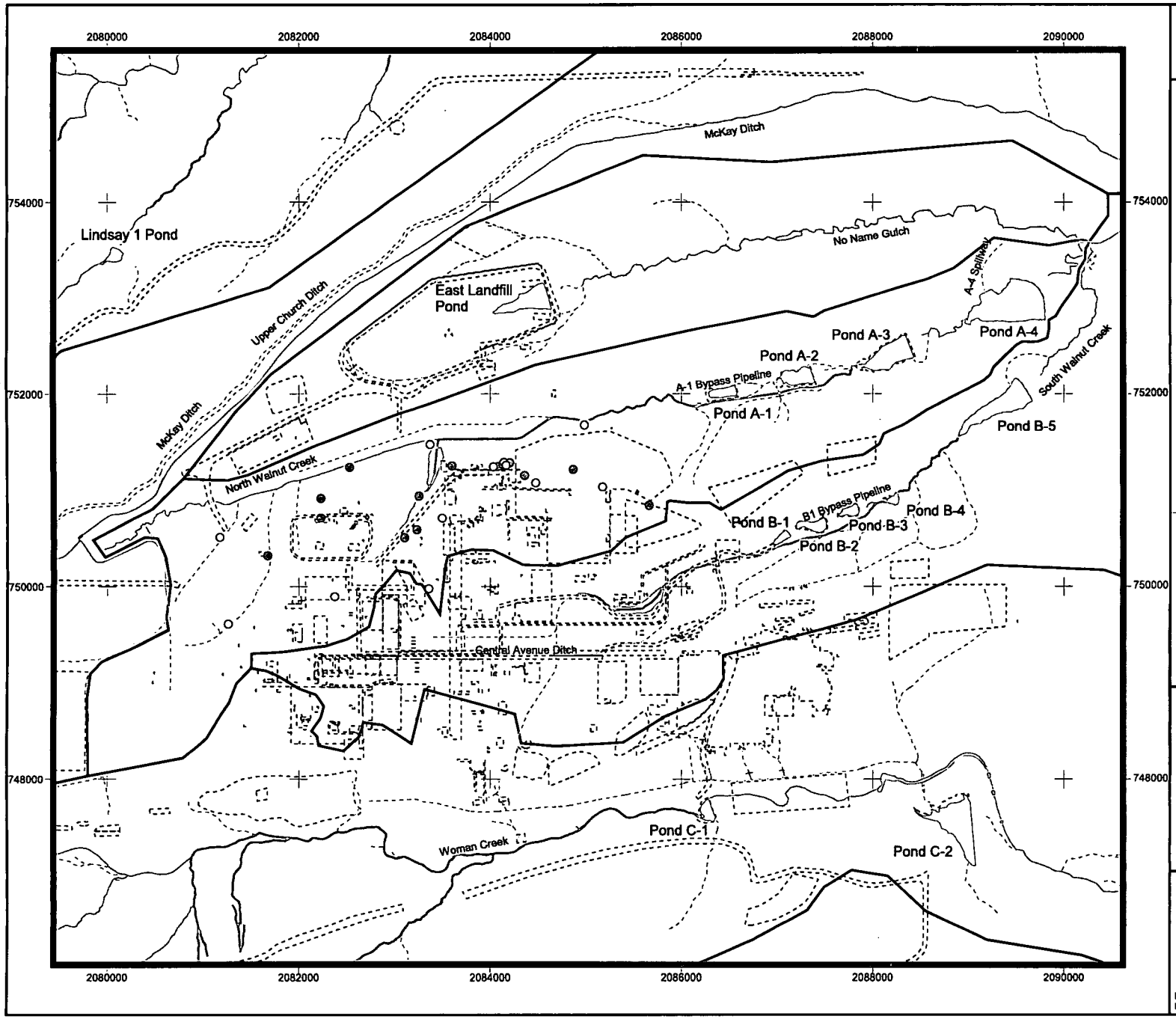

Figure 2.70
North Walnut Creek AEU
Sediment Sampling Locations
for Carbazole

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 25.2 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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267

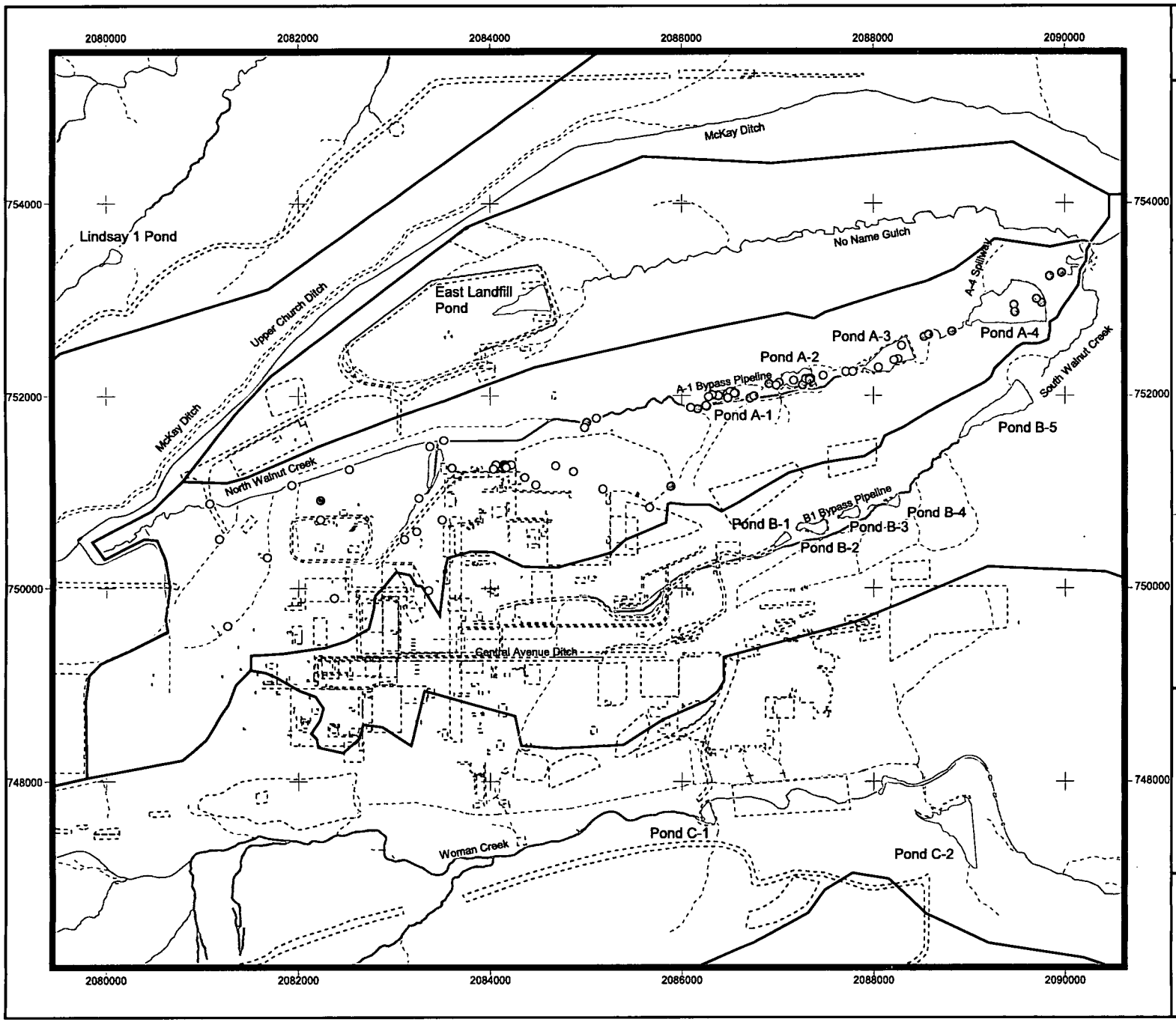

Figure 2.71
North Walnut Creek AEU
Sediment Sampling Locations
for Chrysene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 166 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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268

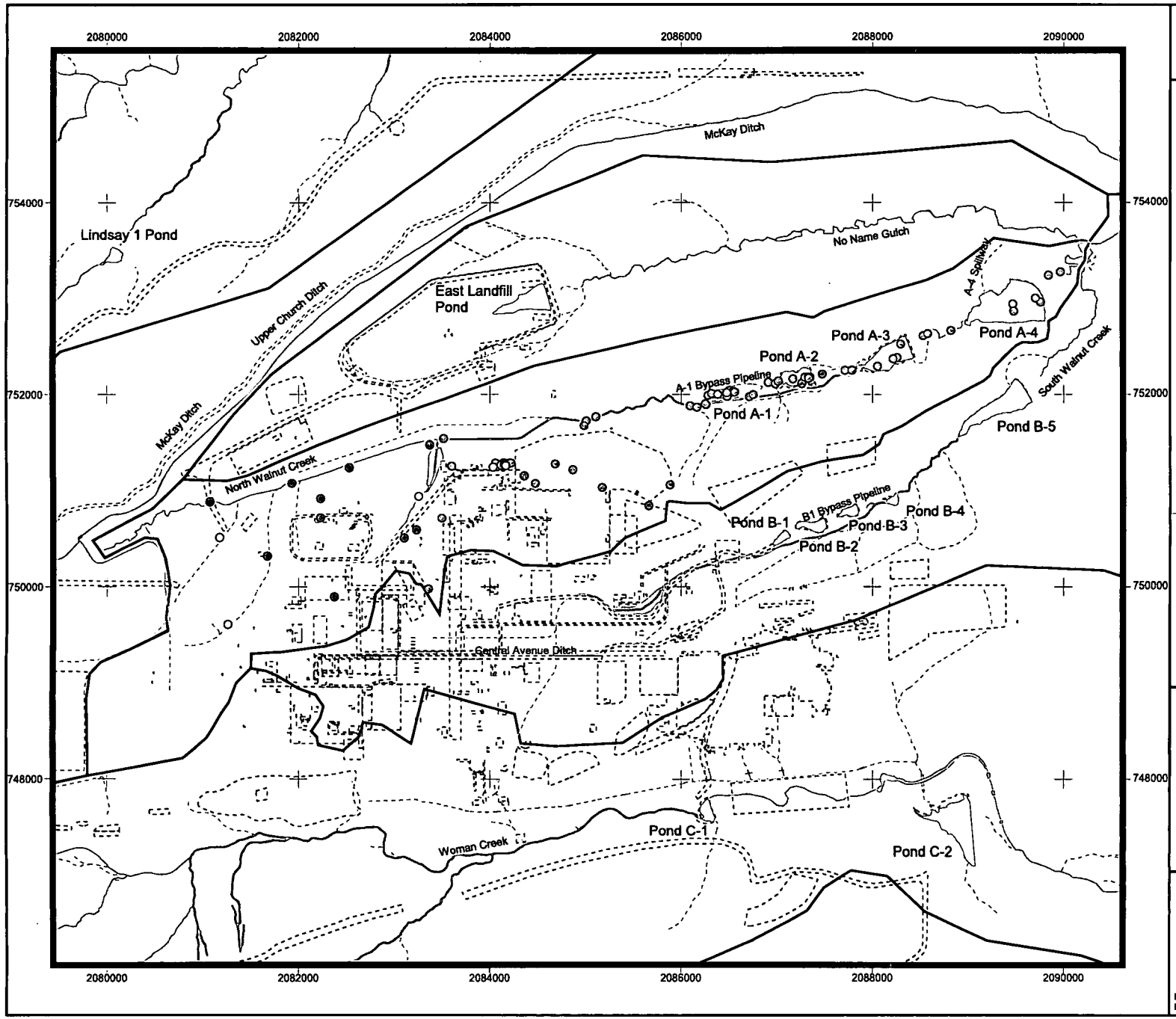

Figure 2.72
North Walnut Creek AEU
Sediment Sampling Locations
for Dibenz(a,h)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 33 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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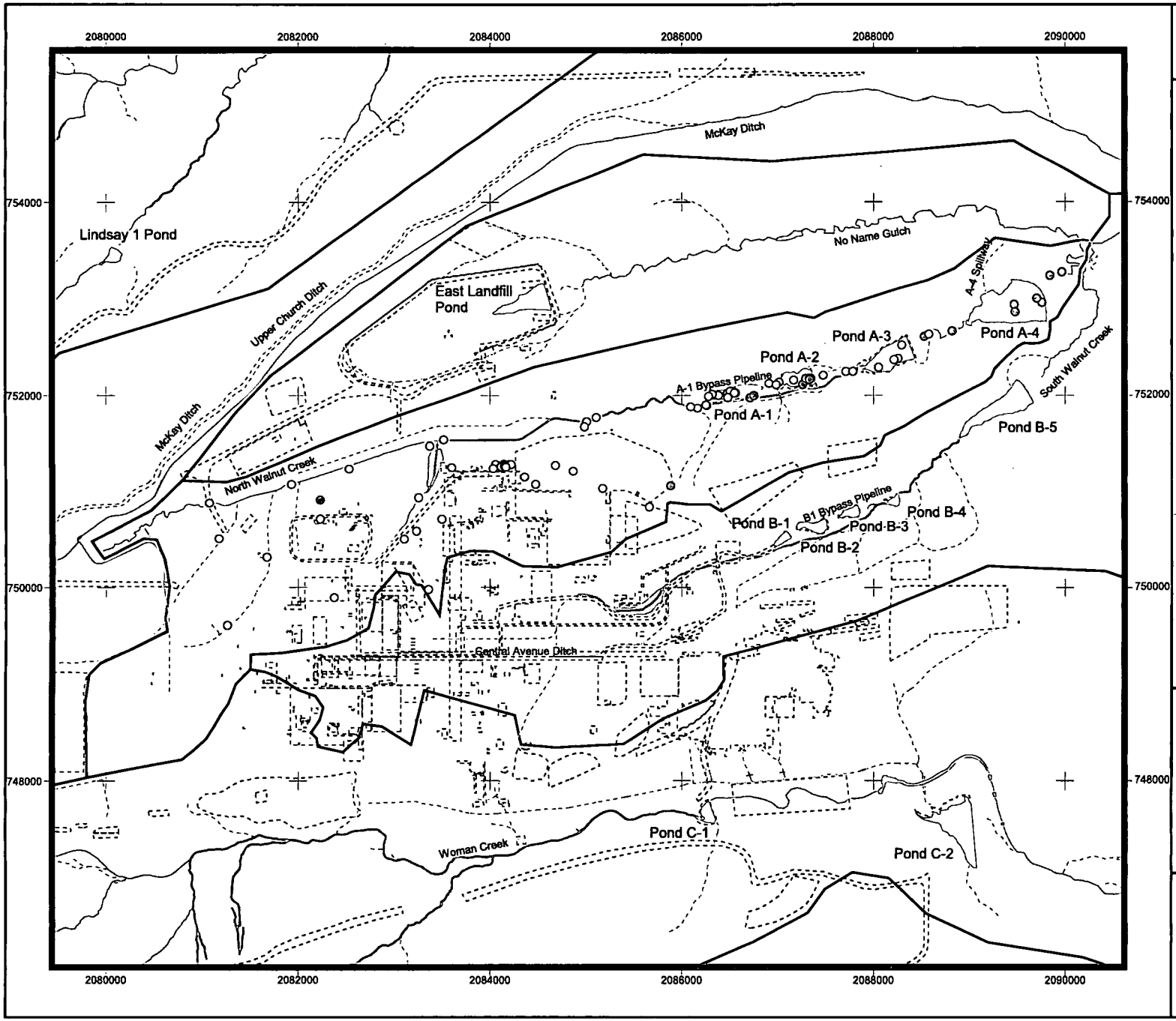

Figure 2.73
North Walnut Creek AEU
Sediment Sampling Locations
for Fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 423 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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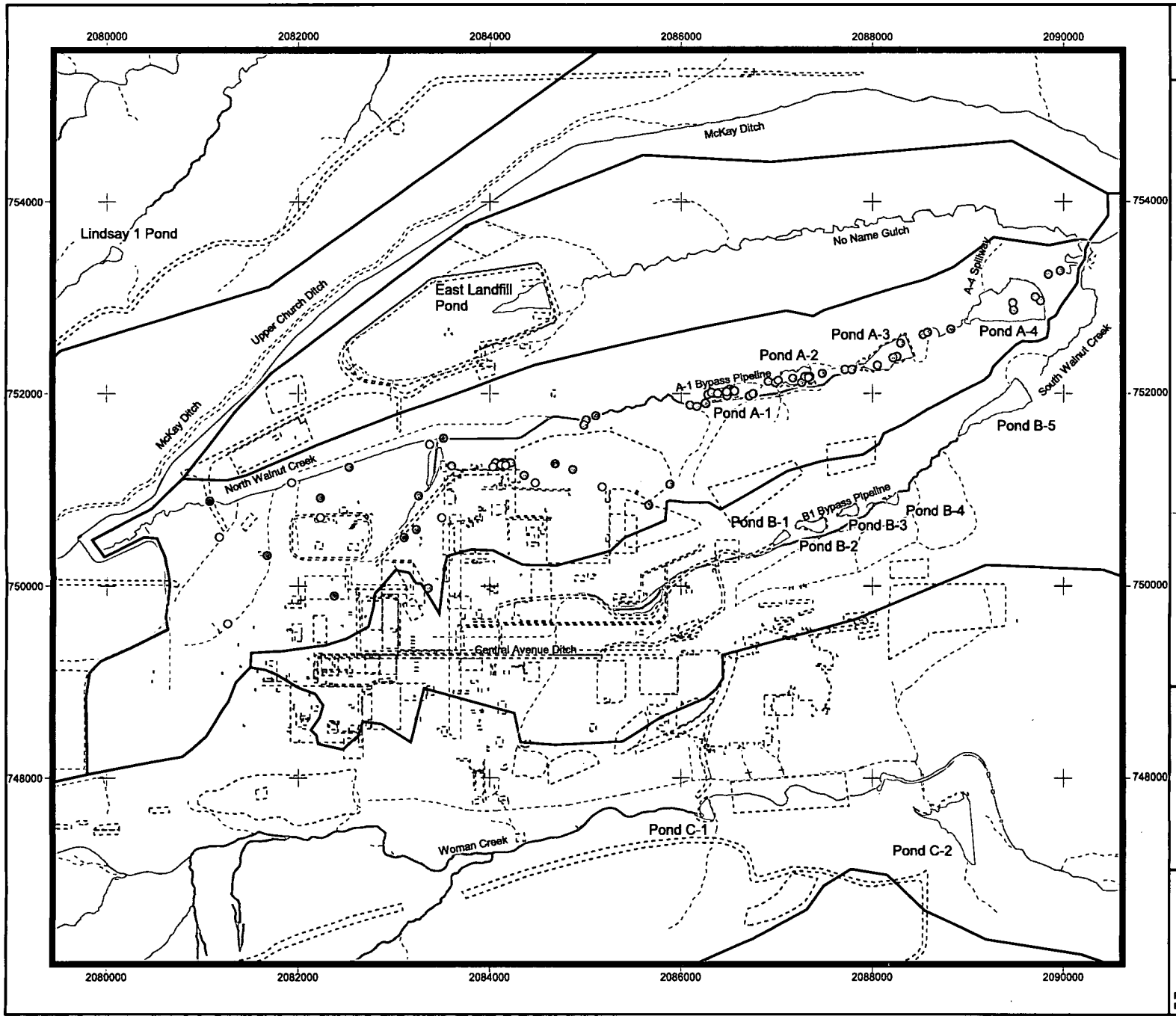

Figure 2.74
North Walnut Creek AEU
Sediment Sampling Locations
for Fluorene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 77.4 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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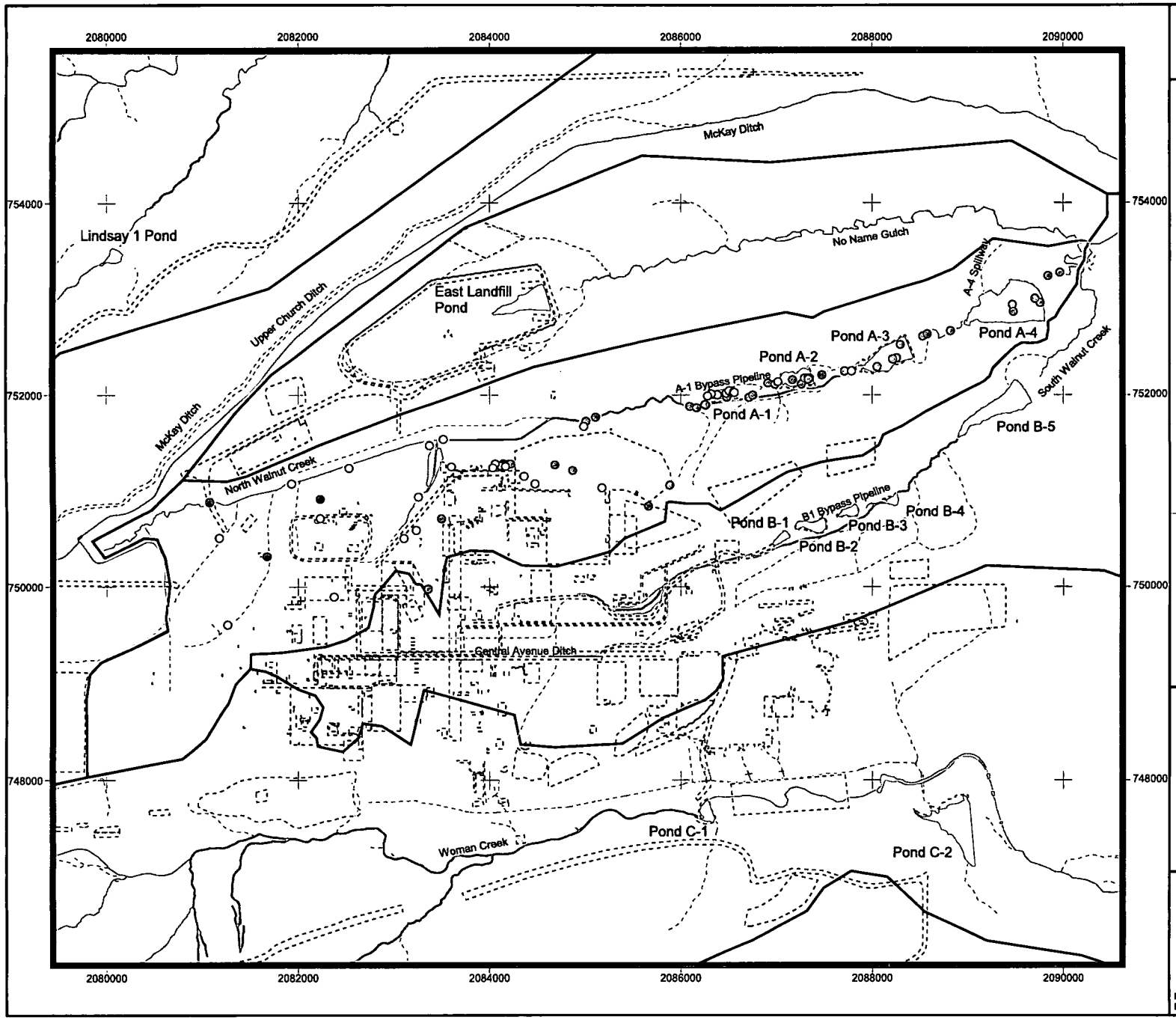

Figure 2.75
North Walnut Creek AEU
Sediment Sampling Locations
for Indeno(1,2,3-cd)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 17 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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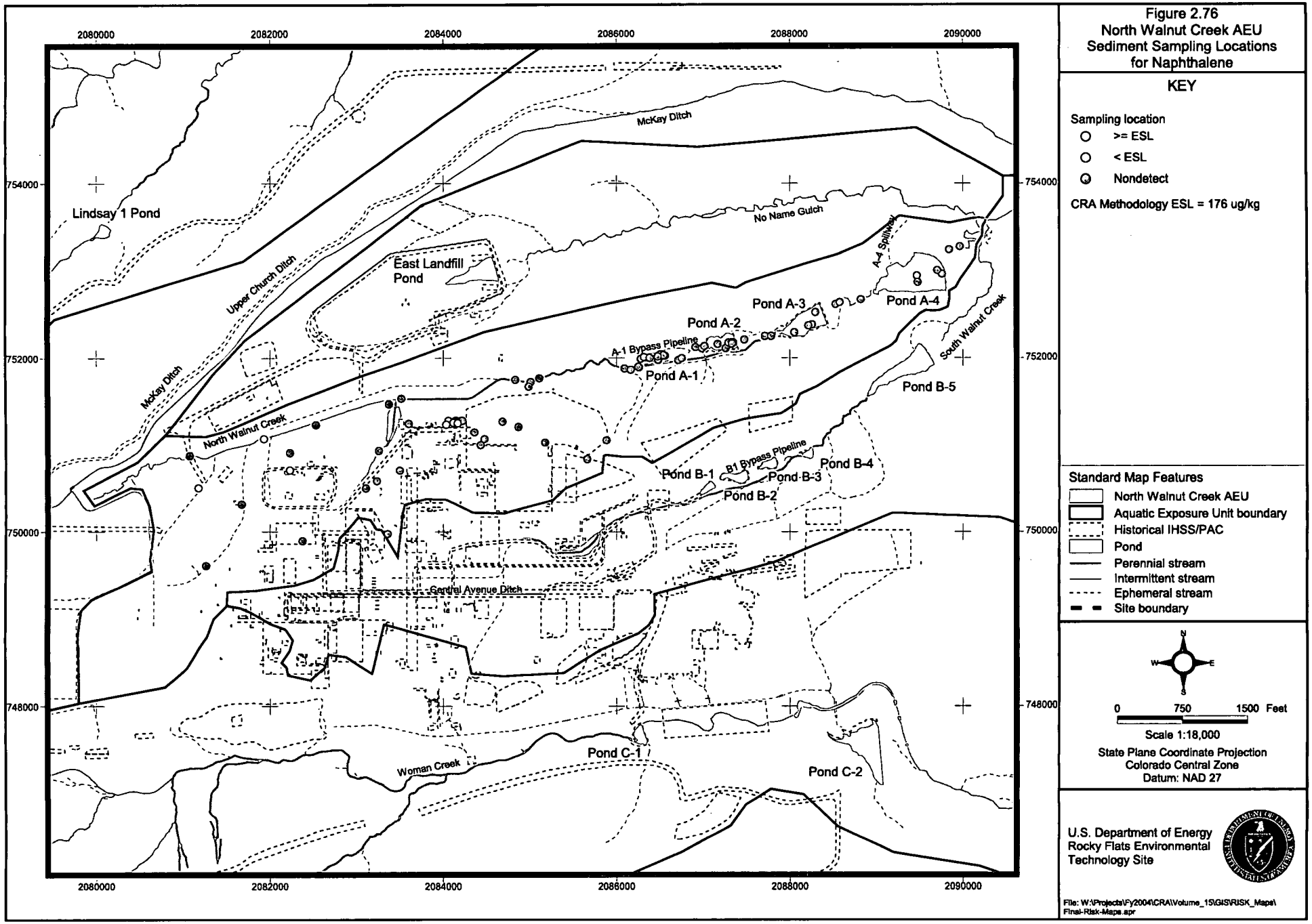
2080000
2082000
2084000
2086000
2088000
2090000
754000
752000
750000
748000
McKay Ditch
Lindsay 1 Pond
Upper Church Ditch
East Landfill Pond
No Name Gulch
A-4 Spillway
Pond A-3
Pond A-4
Pond A-2
A-1 Bypass Pipeline
Pond A-1
South Walnut Creek
Pond B-5
McKay Ditch
North Walnut Creek
B1 Bypass Pipeline
Pond B-1
Pond B-3
Pond B-4
Pond B-2
Central Avenue Ditch
Woman Creek
Pond C-1
Pond C-2
Figure 2.76
North Walnut Creek AEU
Sediment Sampling Locations
for Naphthalene
KEY
Sampling location
>= ESL
< ESL
Nondetect
CRA Methodology ESL = 176 ug/kg
Standard Map Features
North Walnut Creek AEU
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary
N
W
E
S
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750
1500 Feet
Scale 1:18,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
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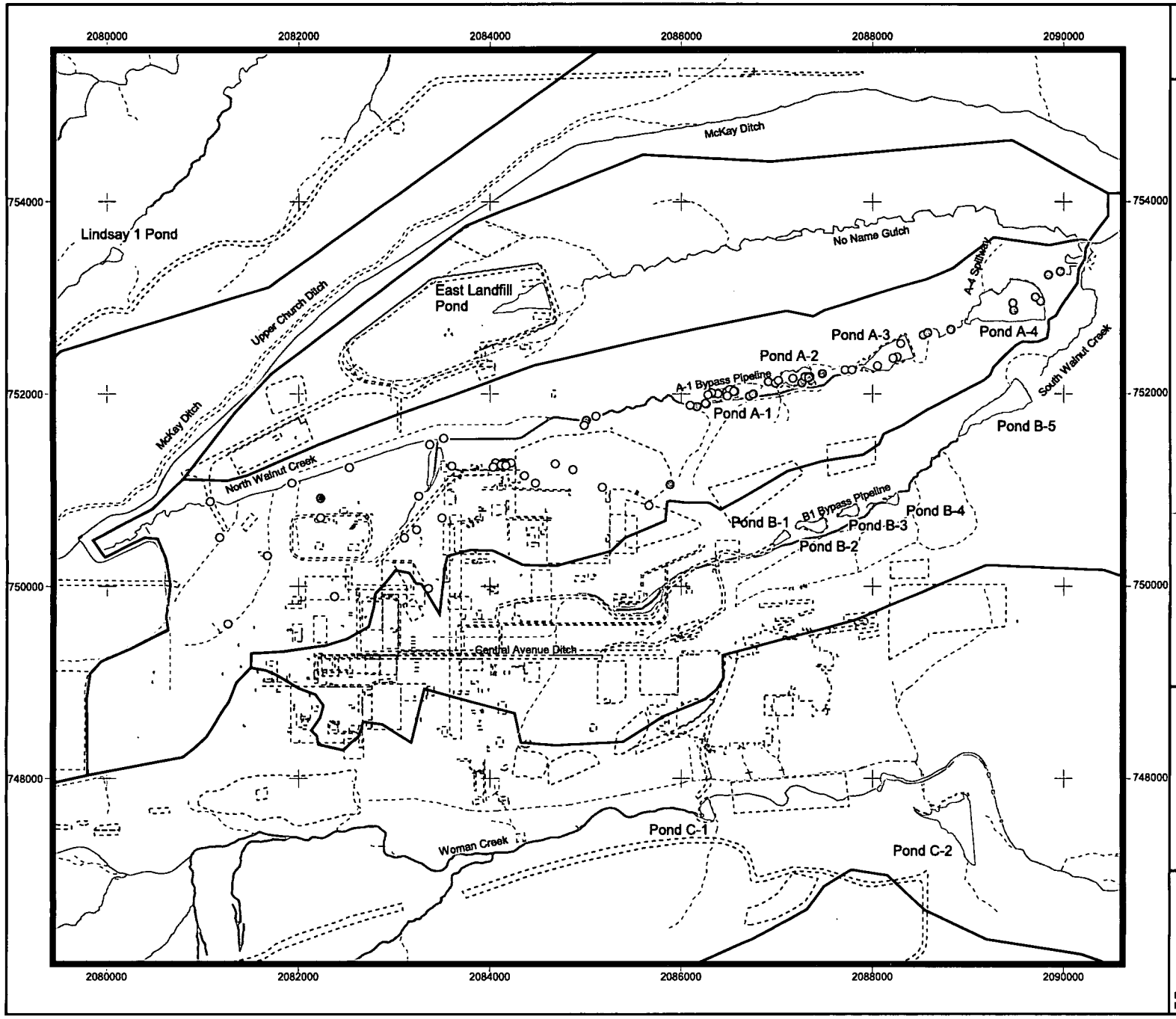

Figure 2.77
North Walnut Creek AEU
Sediment Sampling Locations
for Phenanthrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 204 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
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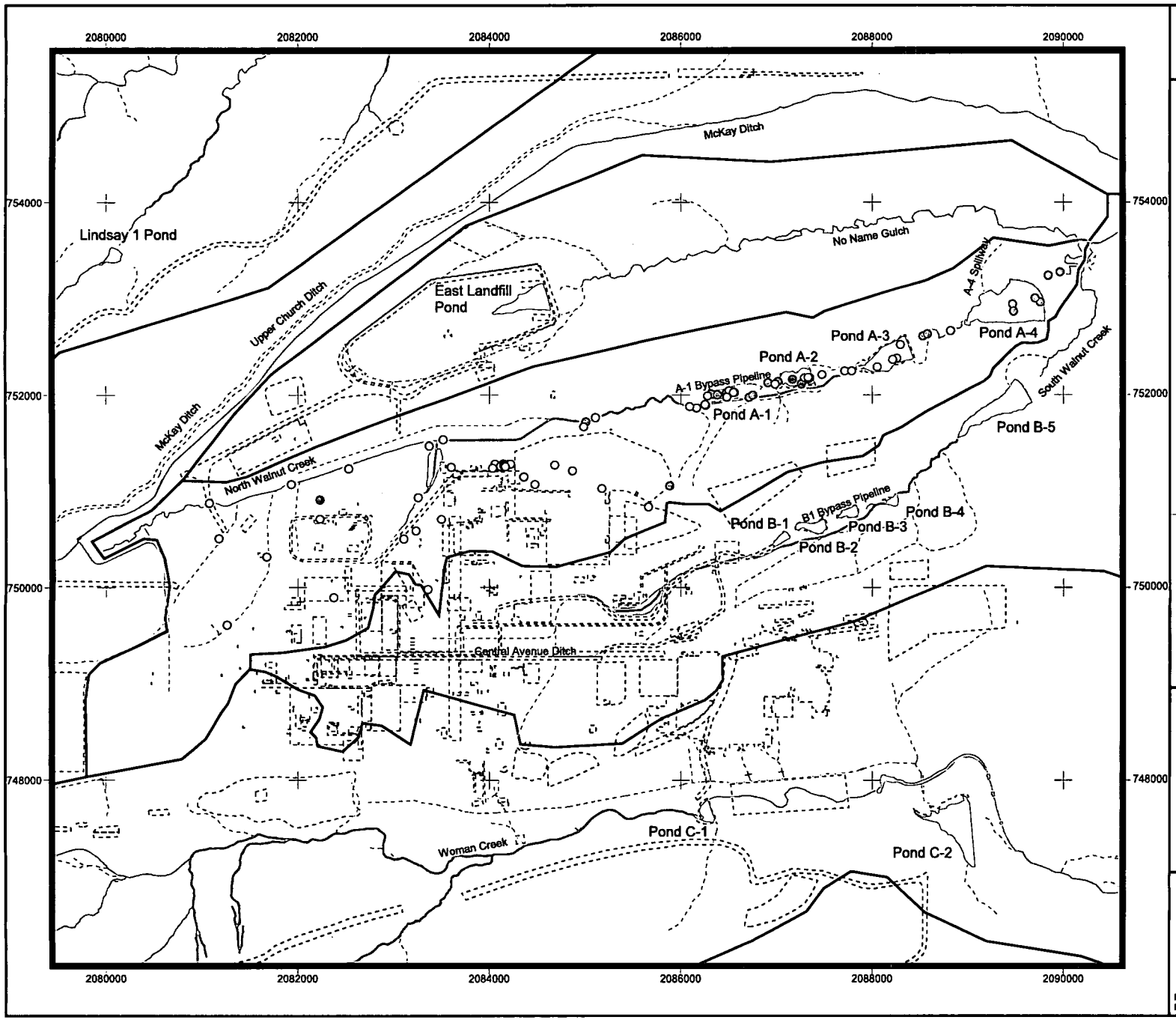

Figure 2.78
North Walnut Creek AEU
Sediment Sampling Locations
for Pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 195 ug/kg

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 750 1500 Feet

Scale 1:18,000

State Plane Coordinate Projection
Colorado Central Zone
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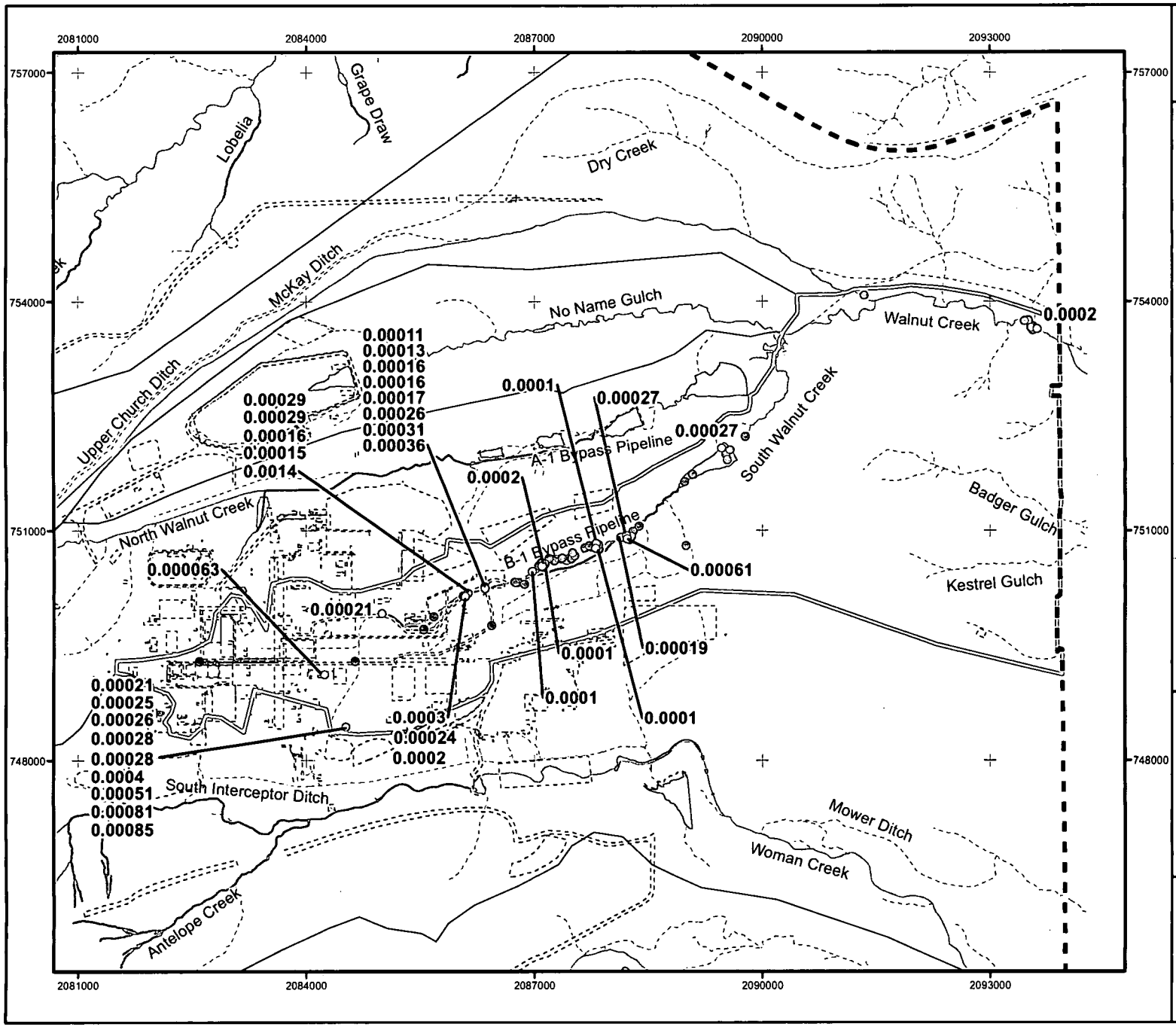

Figure 2.79
South Walnut Creek AEU
Surface Water Results for
Mercury (Dissolved)

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 0.00077 mg/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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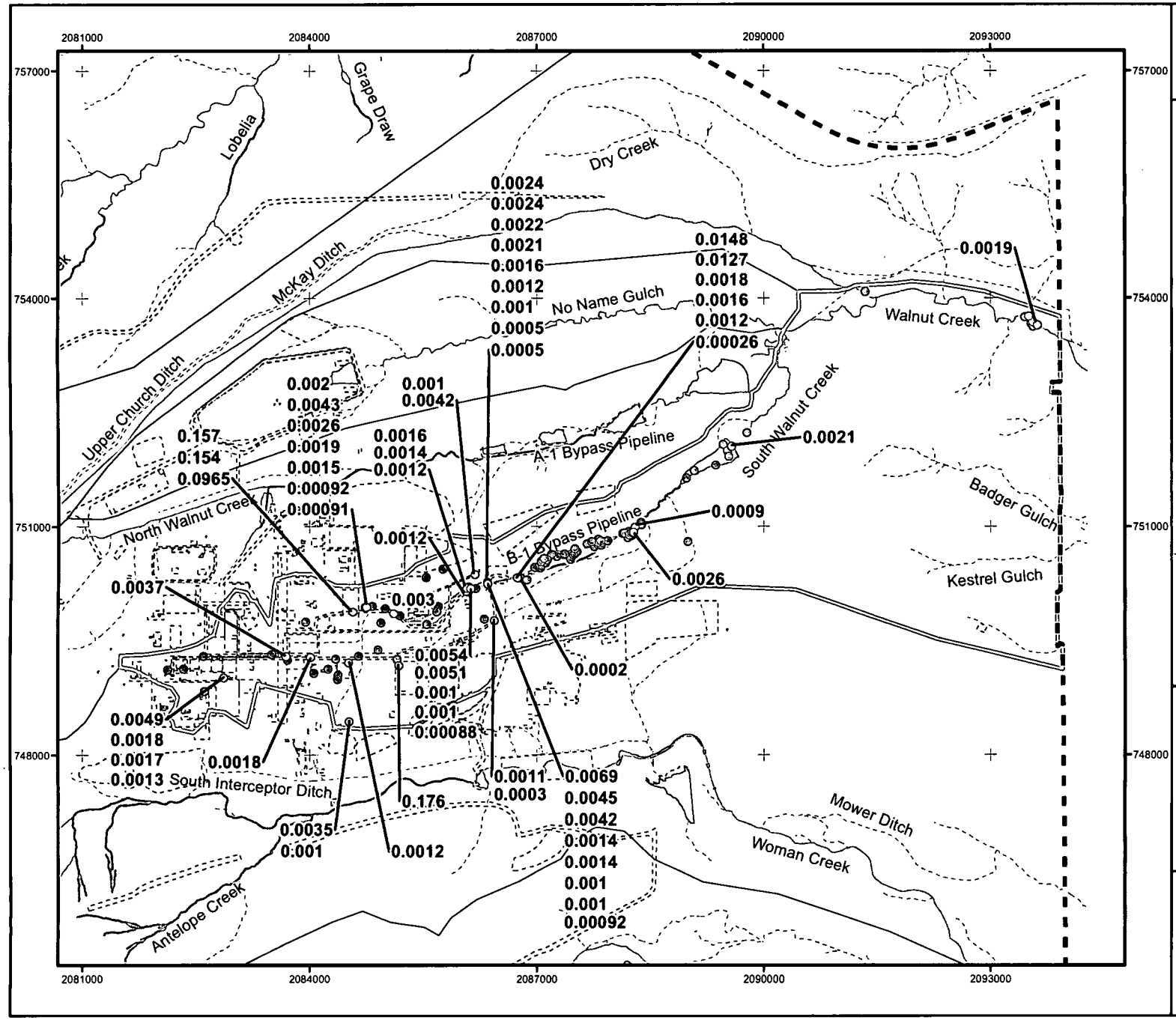

Figure 2.80
South Walnut Creek AEU
Surface Water Results for
Thallium (Total)

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 0.010 mg/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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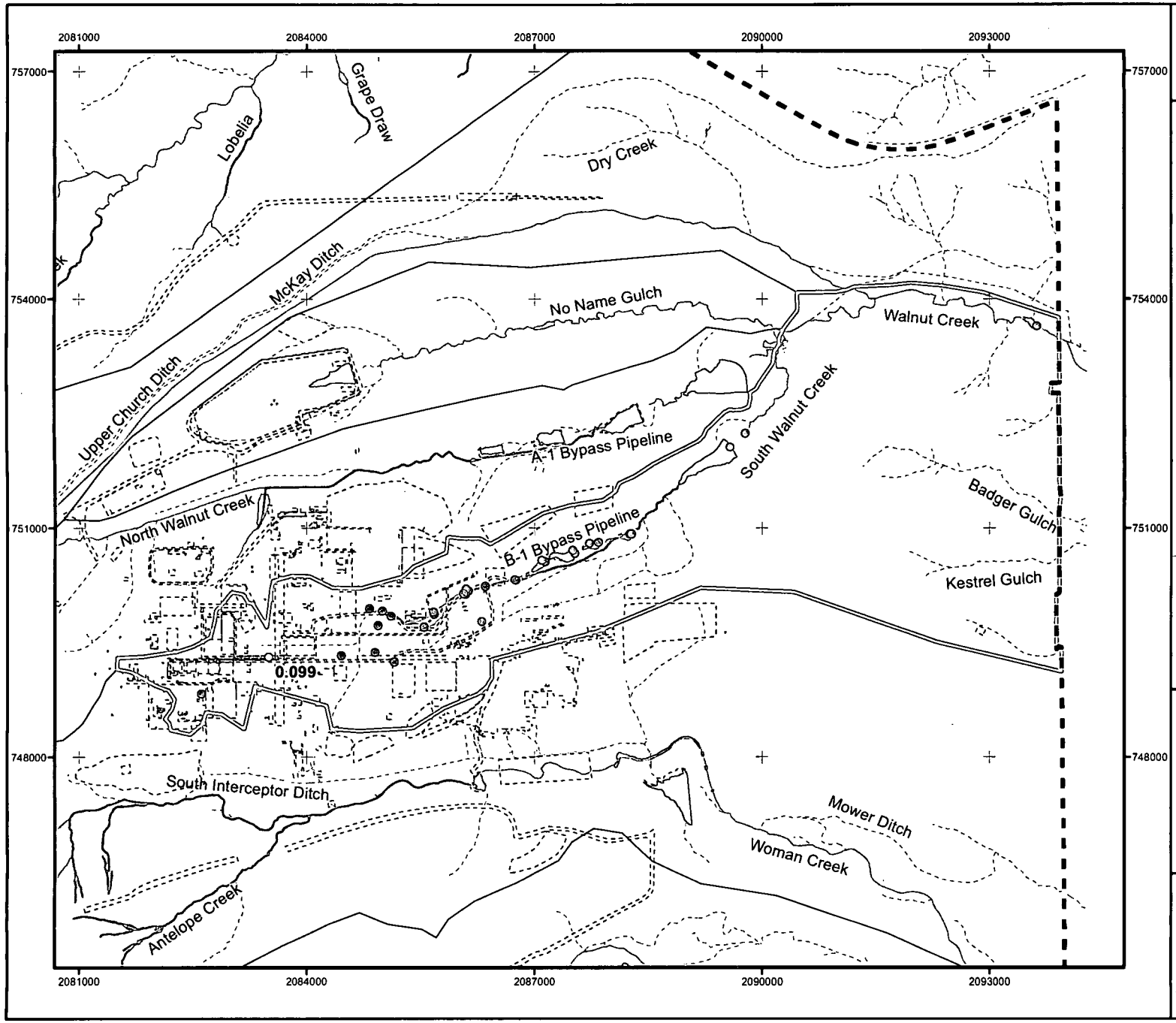

Figure 2.81
South Walnut Creek AEU
Surface Water Results for
4, 4-DDD

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 0.06 mg/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
Colorado Central Zone
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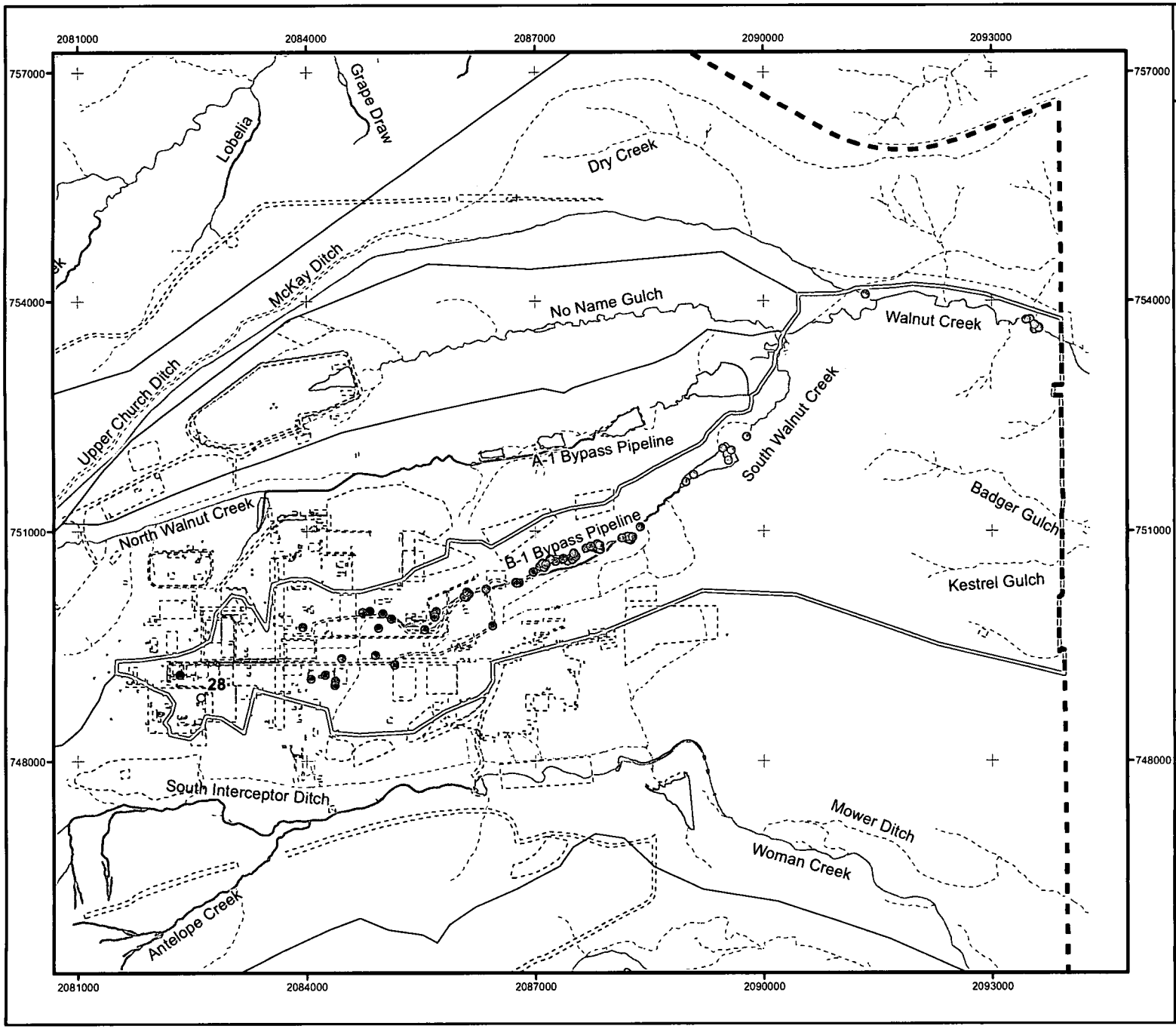

Figure 2.82
South Walnut Creek AEU
Surface Water Results for
4-methylphenol

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 25.0 mg/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
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Datum: NAD 27

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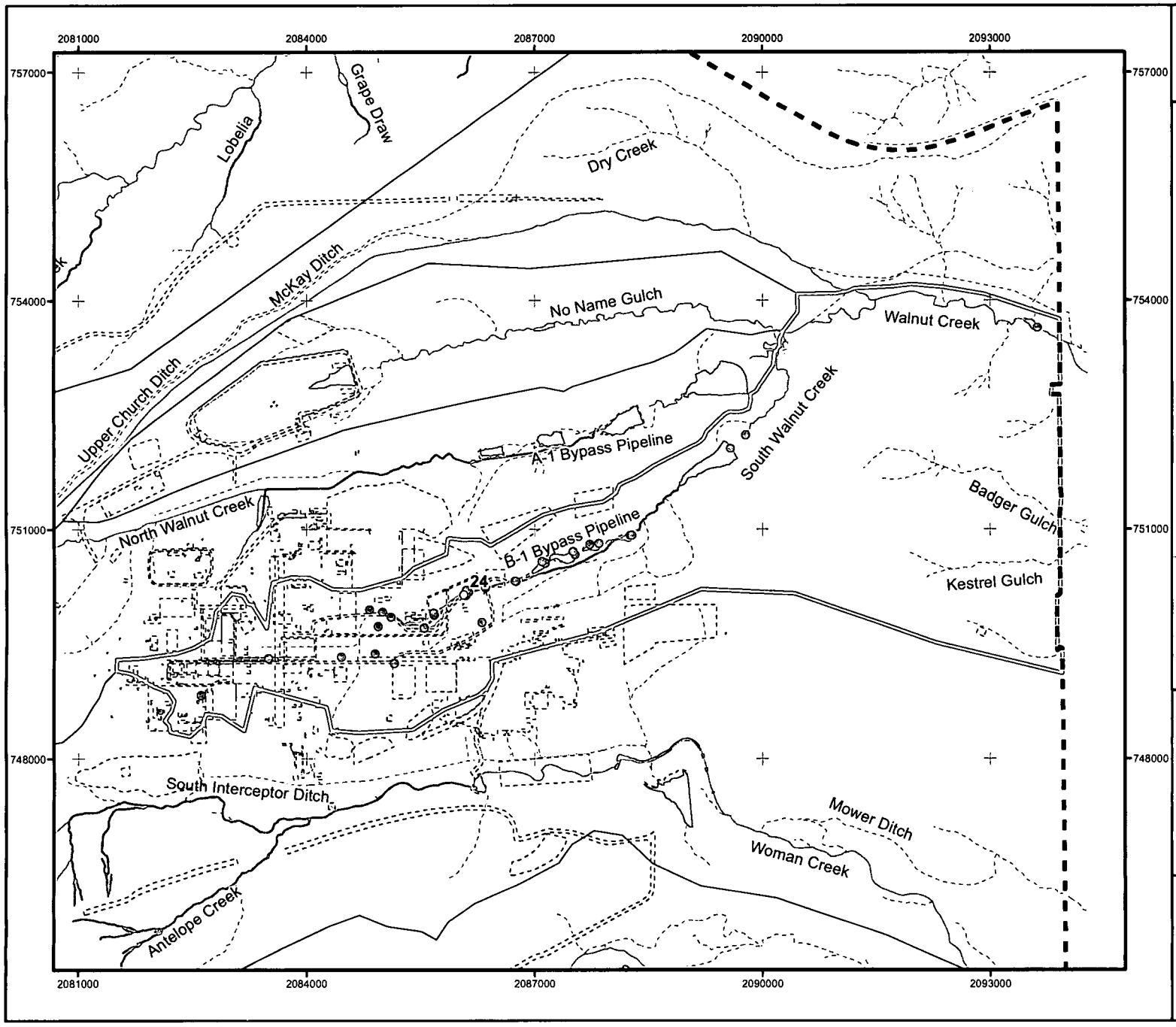

Figure 2.83
South Walnut Creek AEU
Surface Water Results for
Aroclor-1254

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 0.014 mg/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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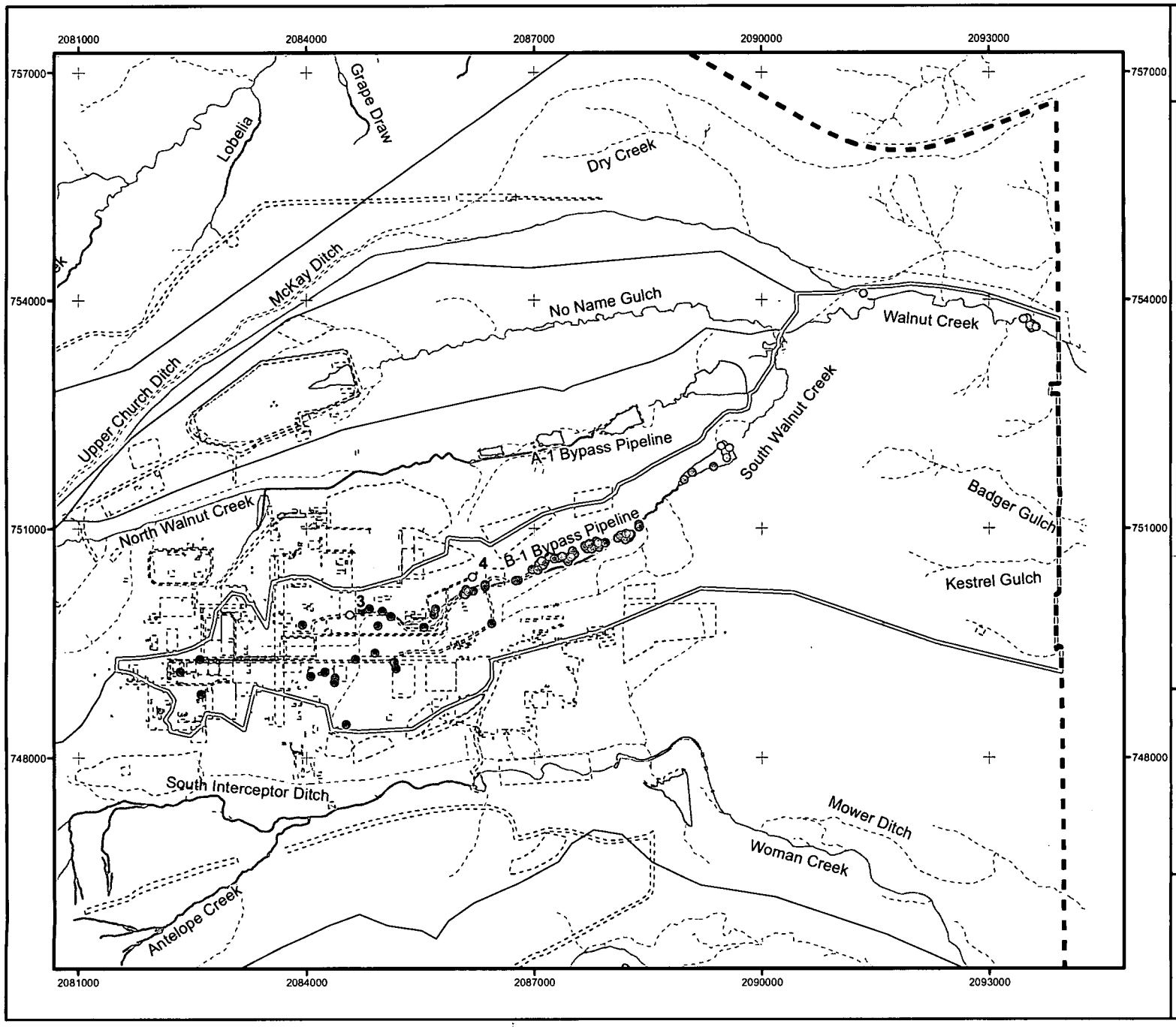

Figure 2.84
South Walnut Creek AEU
Surface Water Results for
Carbon disulfide

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 0.92 mg/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N W E S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
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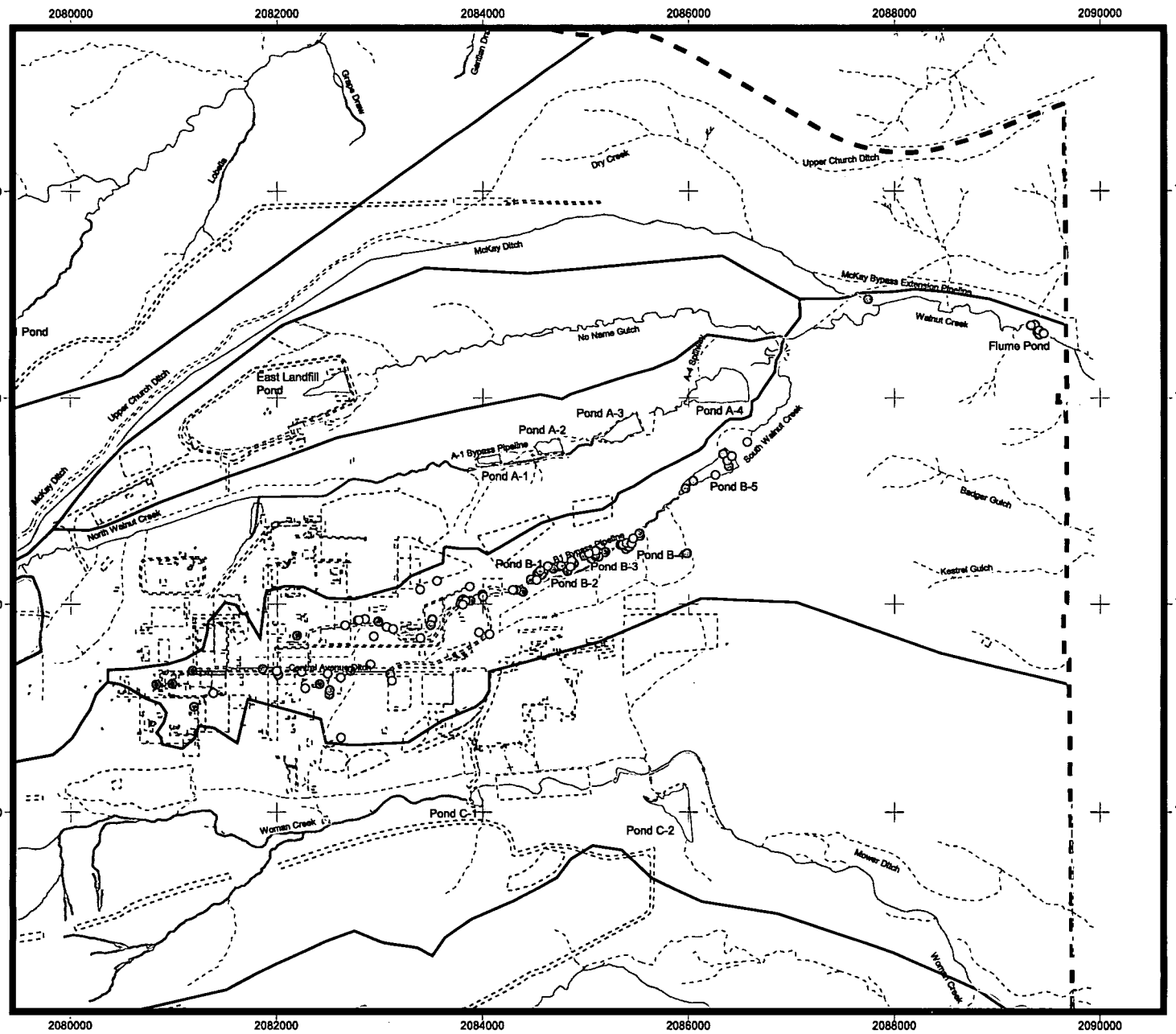

Figure 2.85
South Walnut Creek AEU Surface Water Sampling Locations for Antimony (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.24 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

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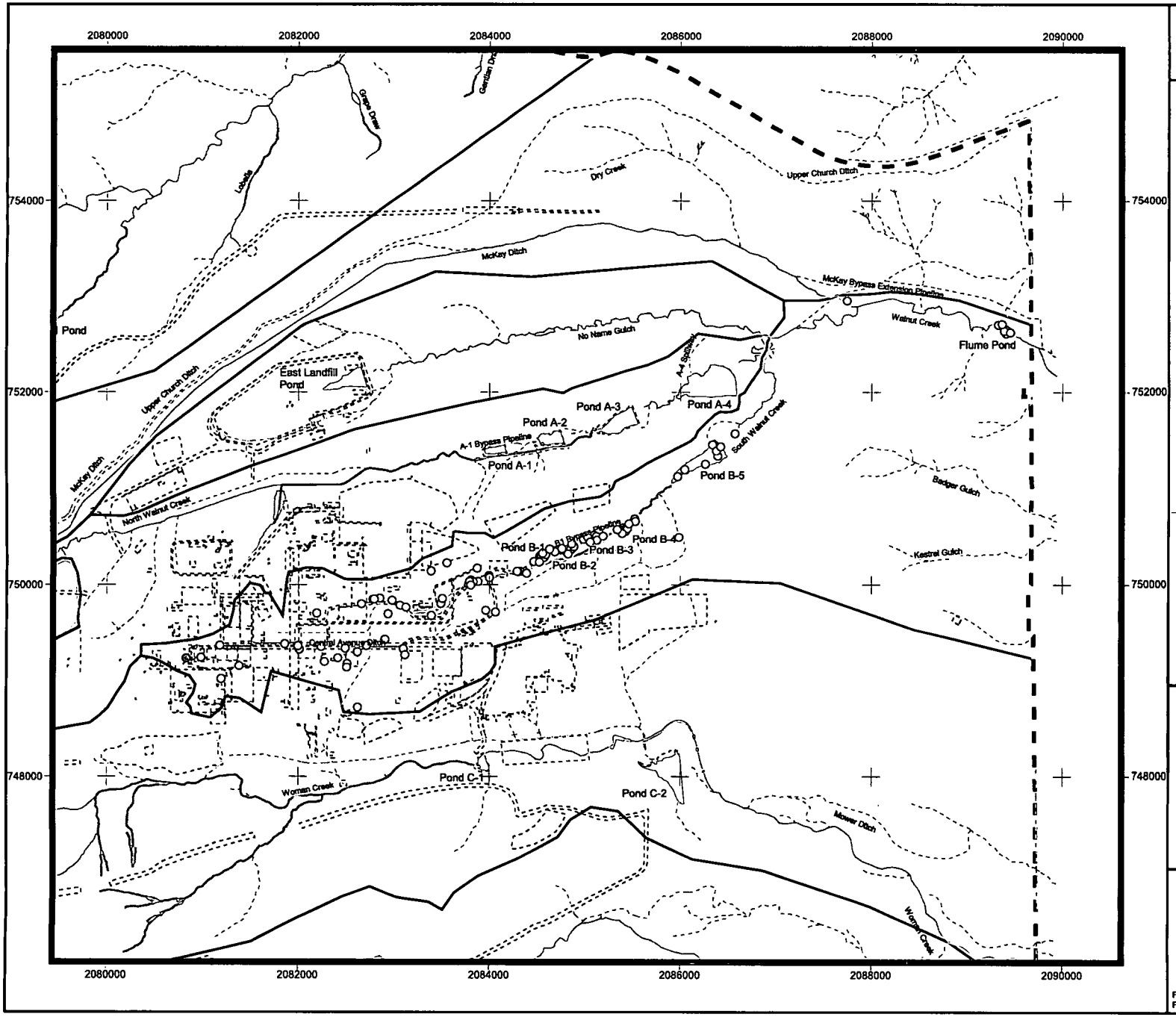

Figure 2.86
South Walnut Creek AEU Surface Water Sampling Locations for Barium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.438 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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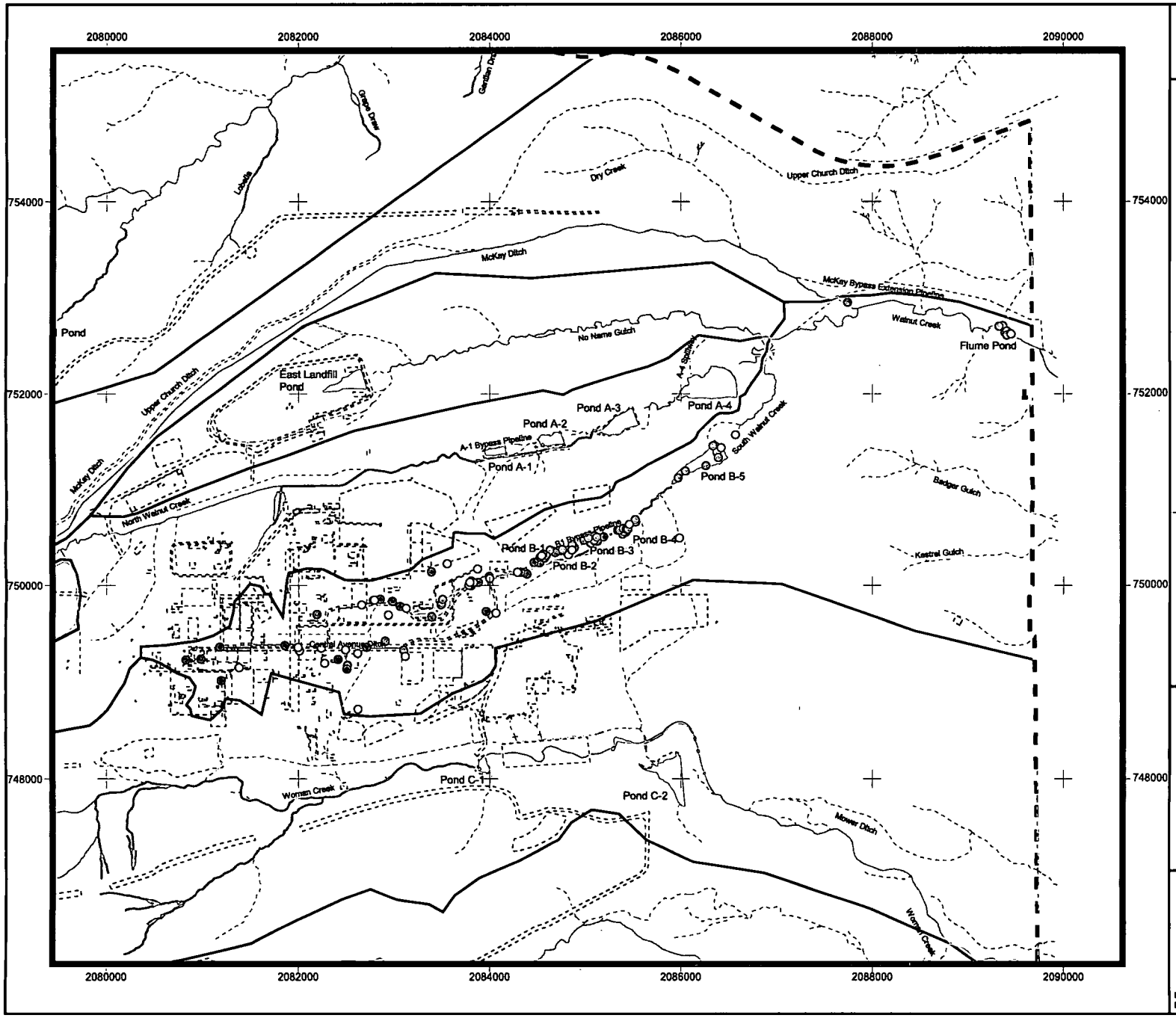

Figure 2.87
South Walnut Creek AEU Surface Water Sampling Locations for Beryllium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.0024 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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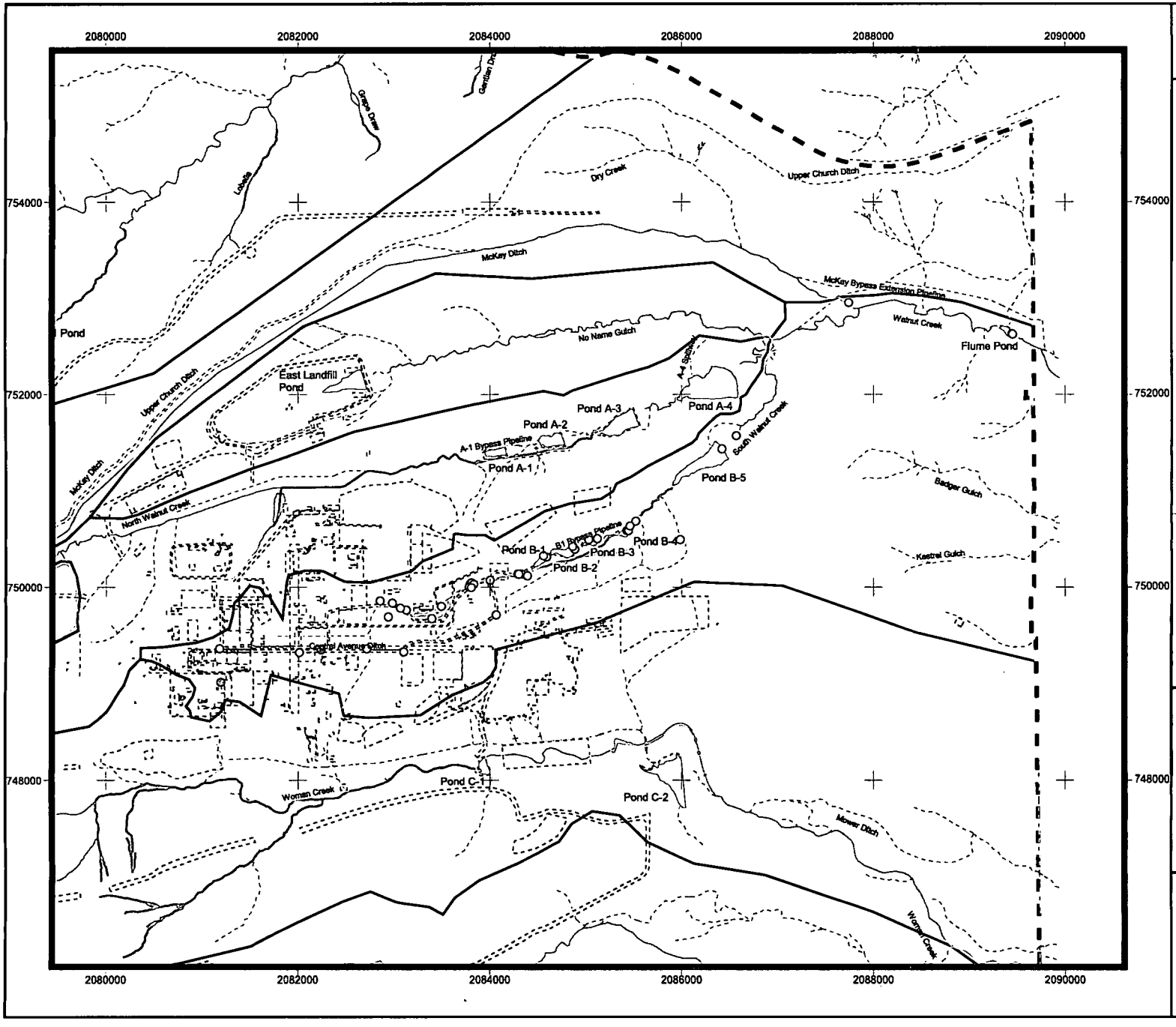

Figure 2.88
South Walnut Creek AEU Surface Water Sampling Locations for Fluoride (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 2.12 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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Datum: NAD 27

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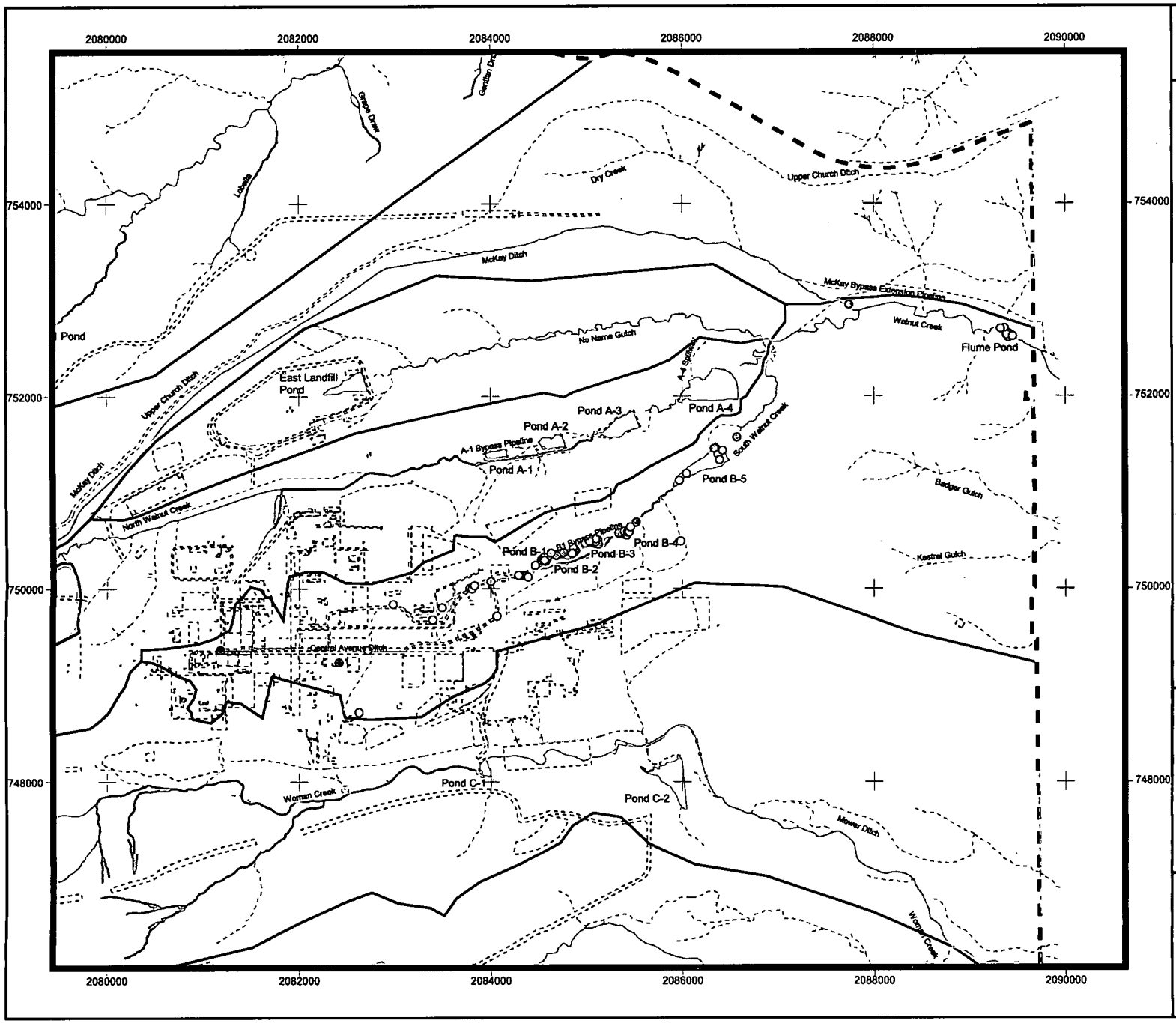

Figure 2.89
South Walnut Creek AEU Surface Water Sampling Locations for Lead (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.0025 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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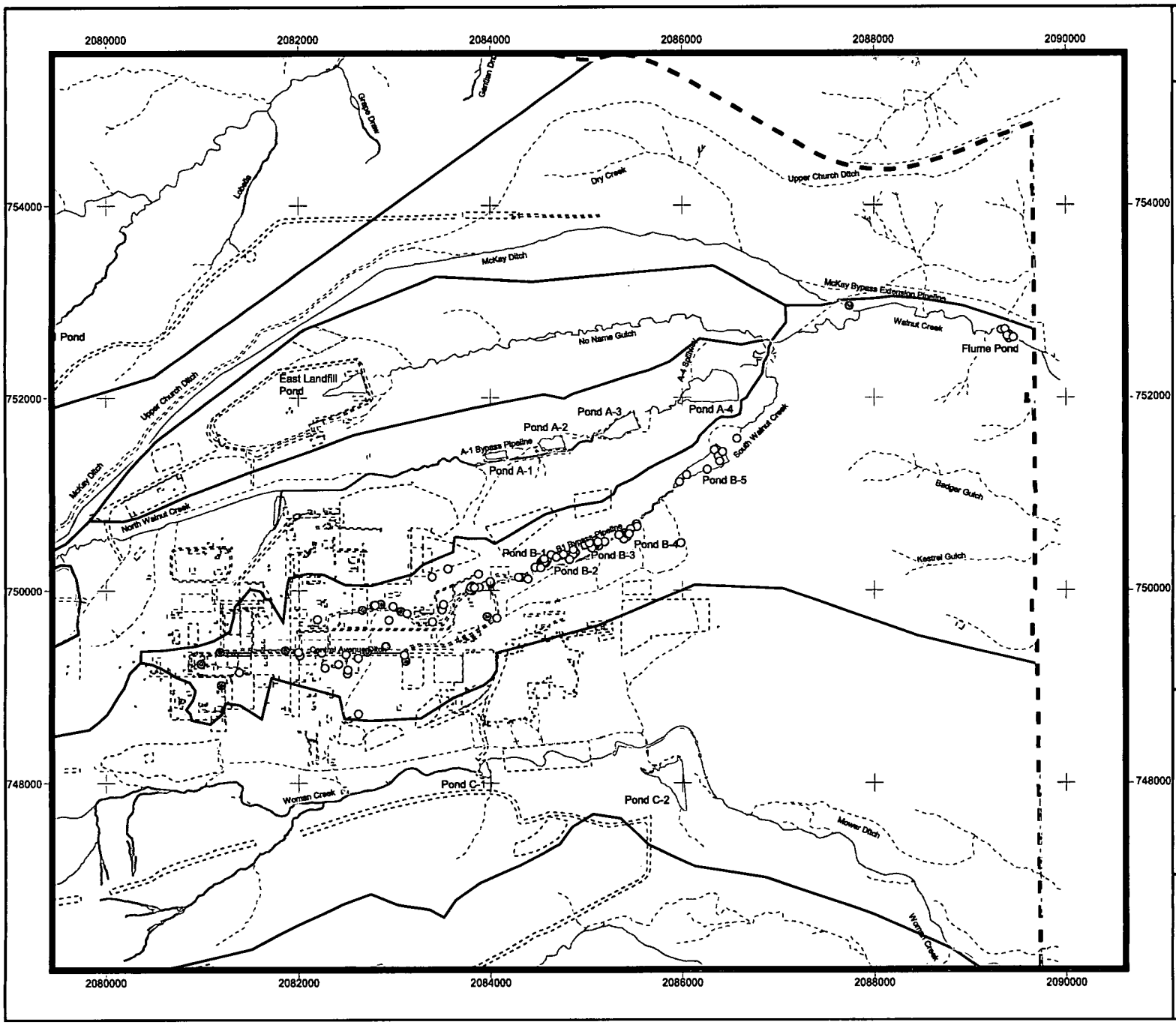

Figure 2.90
South Walnut Creek AEU
Surface Water Sampling Locations
for Lithium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.096 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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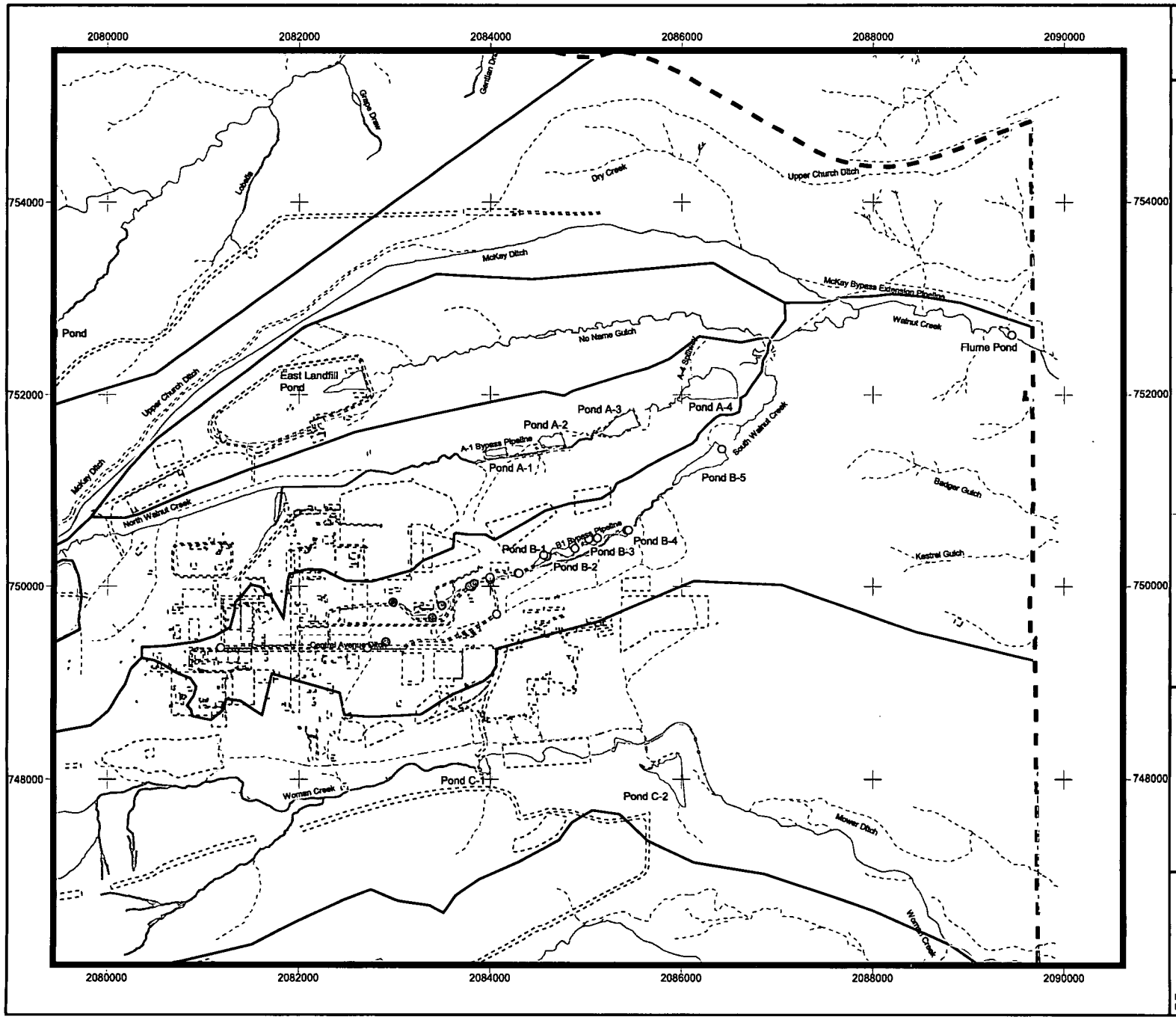

Figure 2.91
South Walnut Creek AEU Surface Water Sampling Locations for Nitrite

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 4.47 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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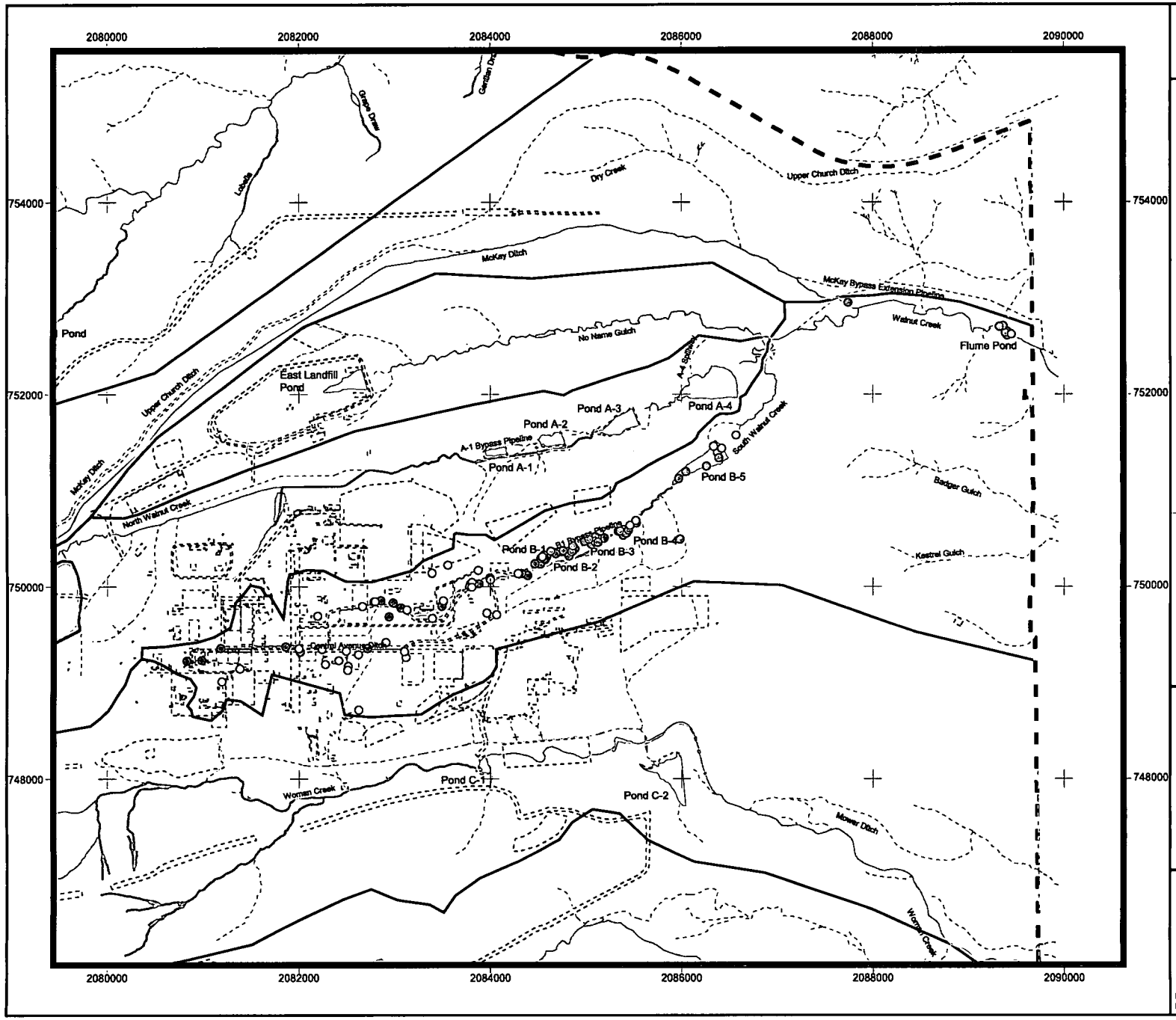

Figure 2.92
South Walnut Creek AEU Surface Water Sampling Locations for Selenium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.0046 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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Datum: NAD 27

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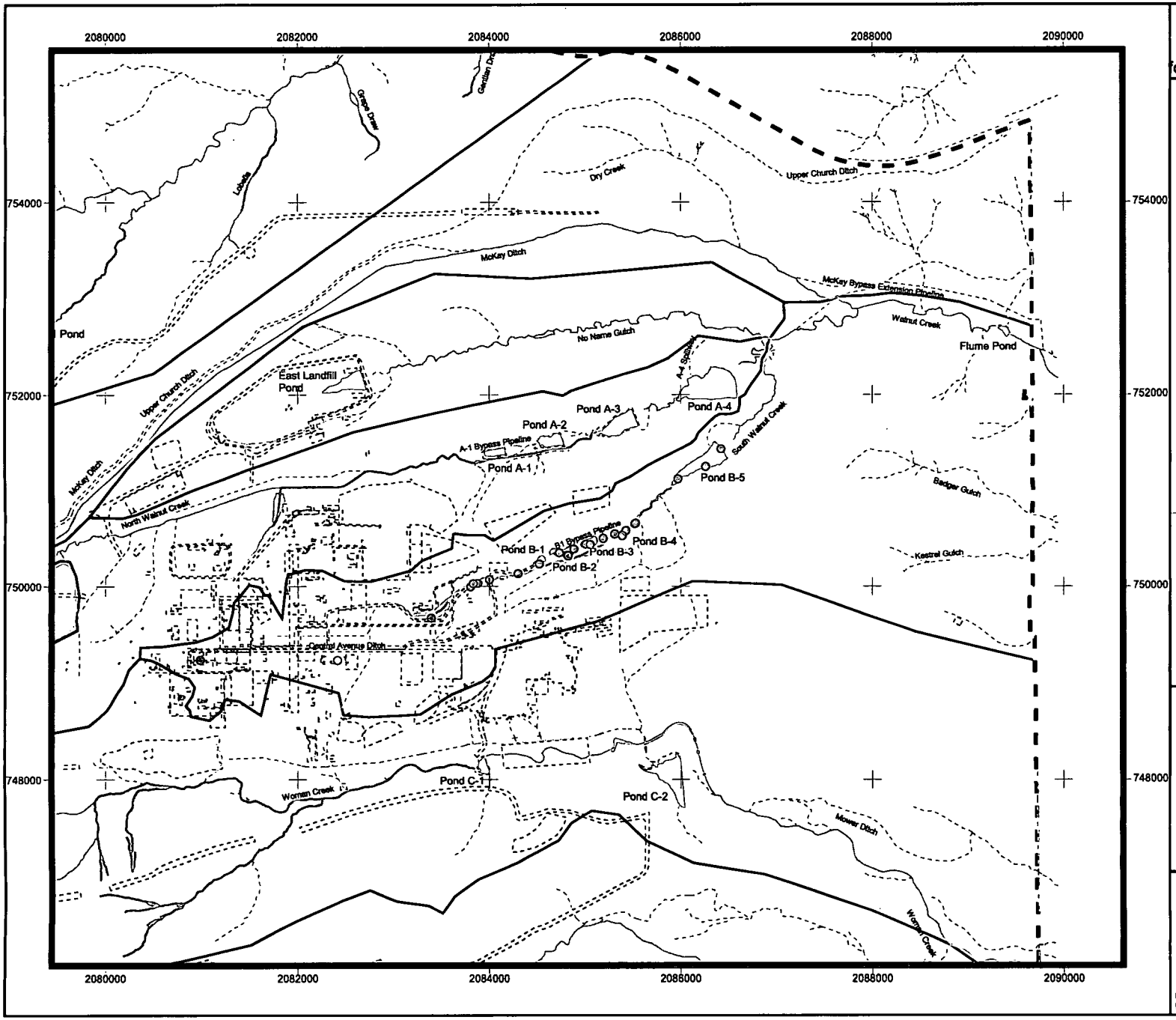

Figure 2.93
South Walnut Creek AEU
Surface Water Sampling Locations
for 1,1,2-Trichloro-1,2,2-trifluoroethane

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 32 ug/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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0 1000 2000 Feet

Scale 1:24000
State Plane Coordinate Projection
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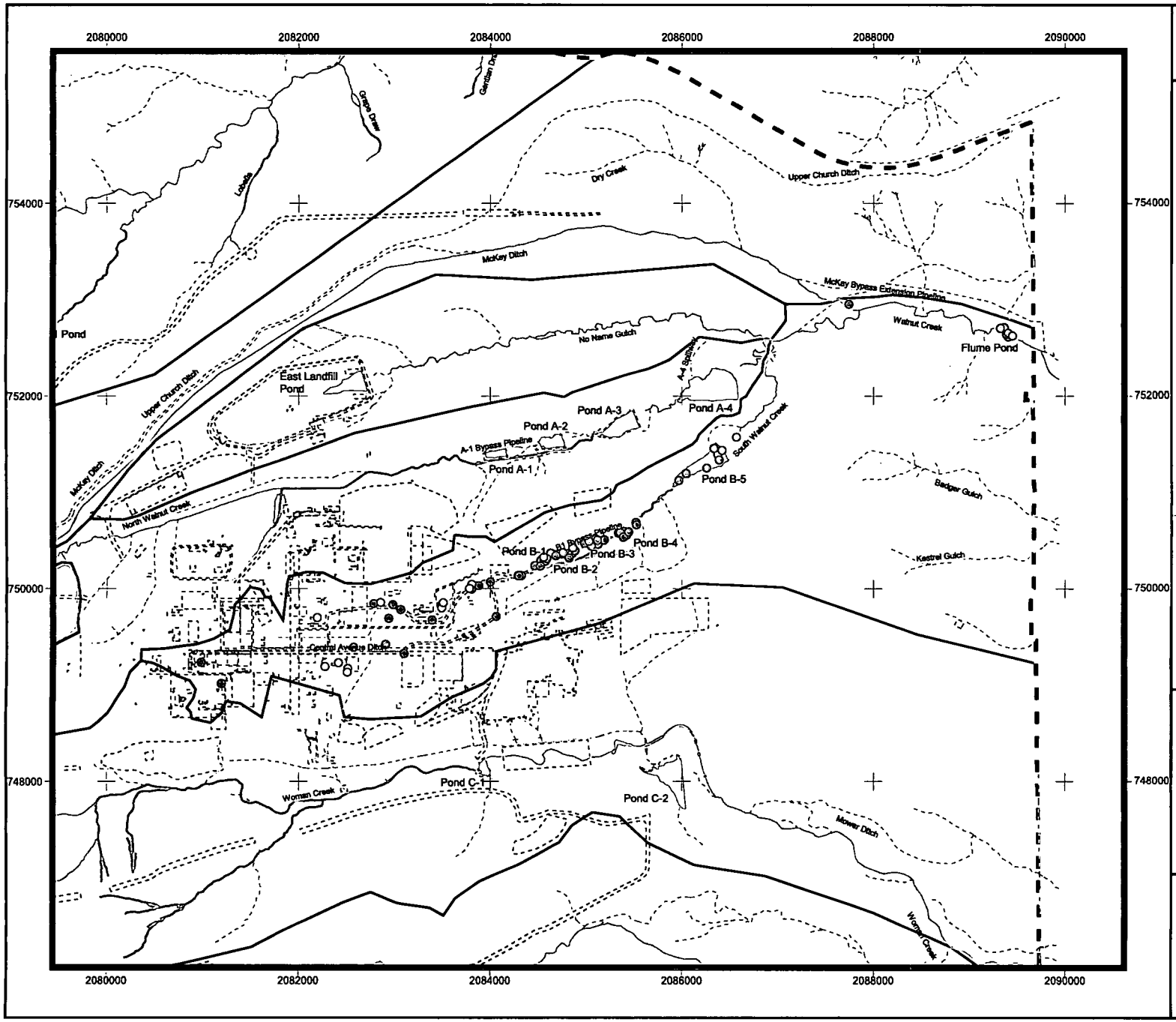

Figure 2.94
South Walnut Creek AEU
Surface Water Sampling Locations
for Bis(2-ethylhexyl)phthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 28.5 ug/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
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0 1000 2000 Feet

Scale 1:24000

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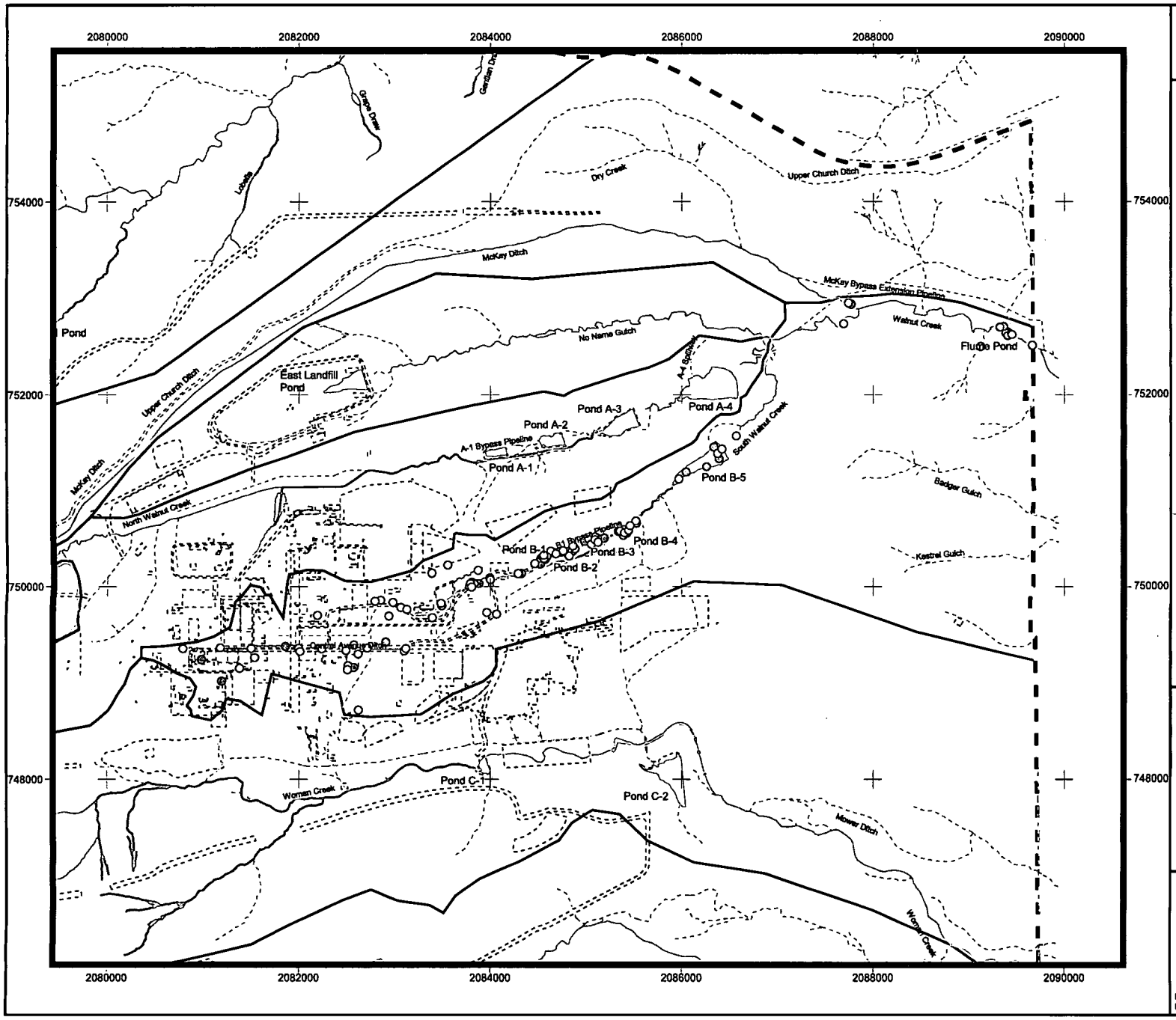

Figure 2.95
South Walnut Creek AEU
Surface Water Sampling Locations
for Plutonium-239/240

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 18.7 pCi/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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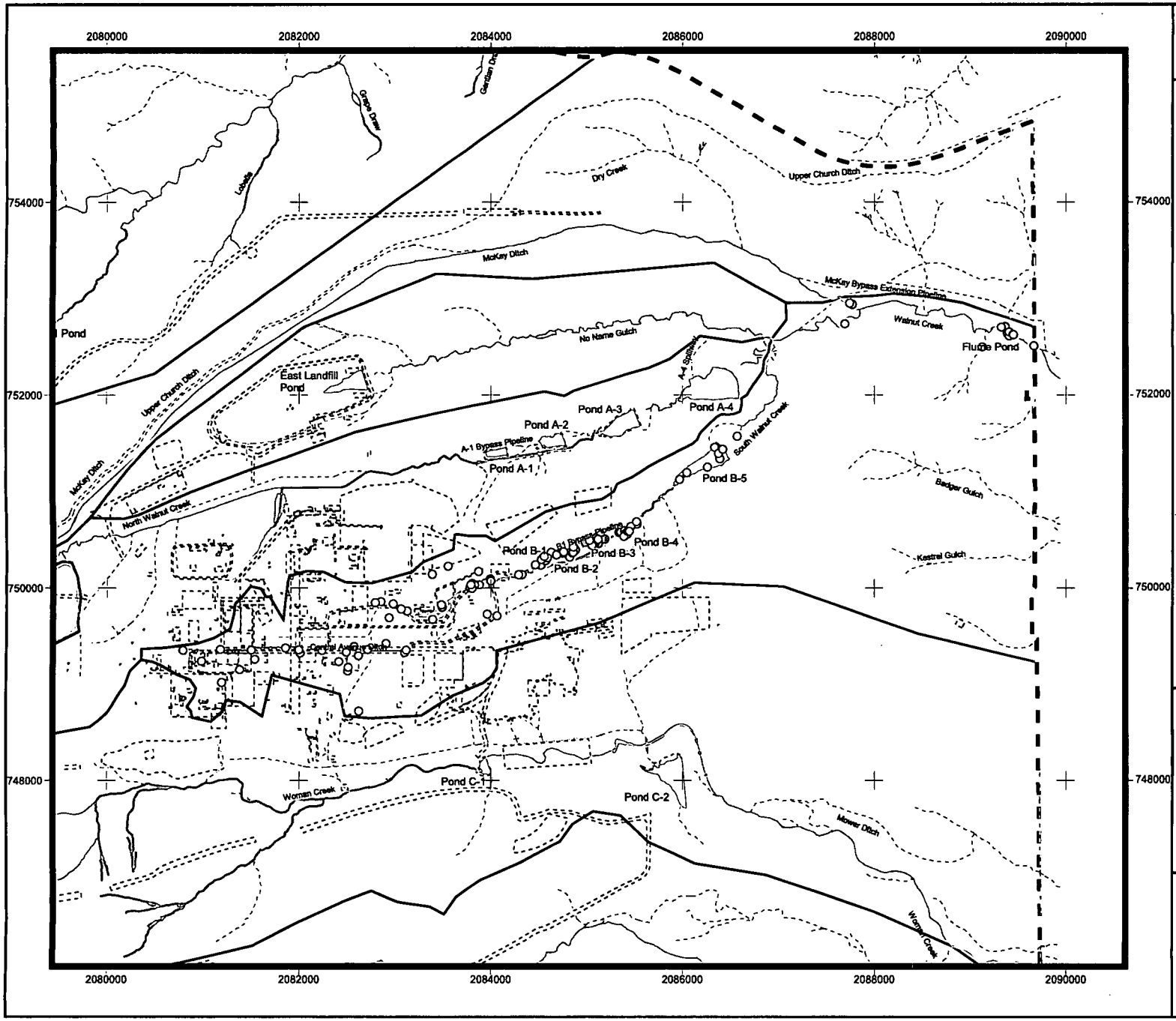

Figure 2.96
South Walnut Creek AEU
Surface Water Sampling Locations
for Uranium-233/234

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 20.1 pCi/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
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0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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Datum: NAD 27

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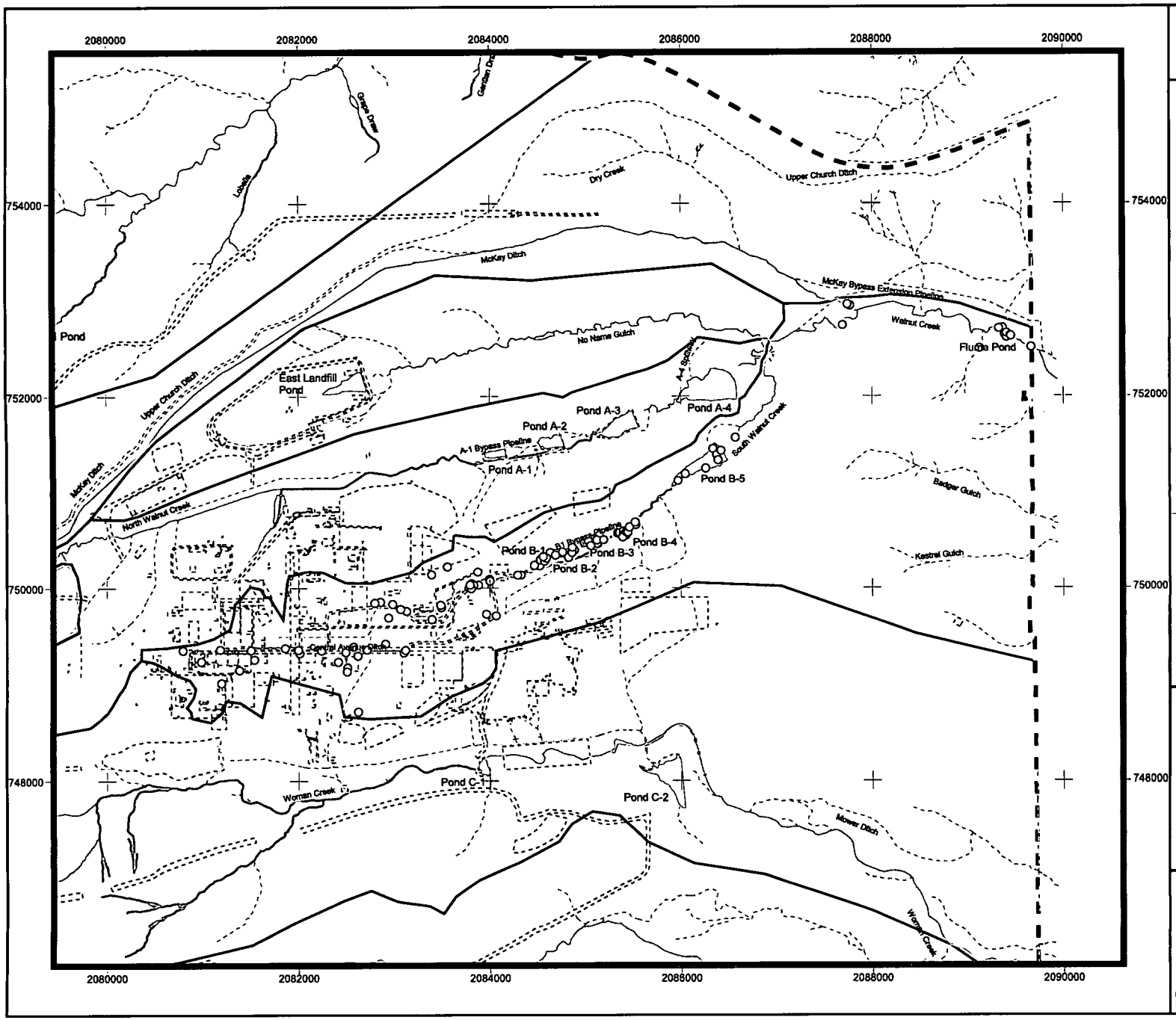

Figure 2.97
South Walnut Creek AEU
Surface Water Sampling Locations
for Uranium-238

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 22.3 pCi/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
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0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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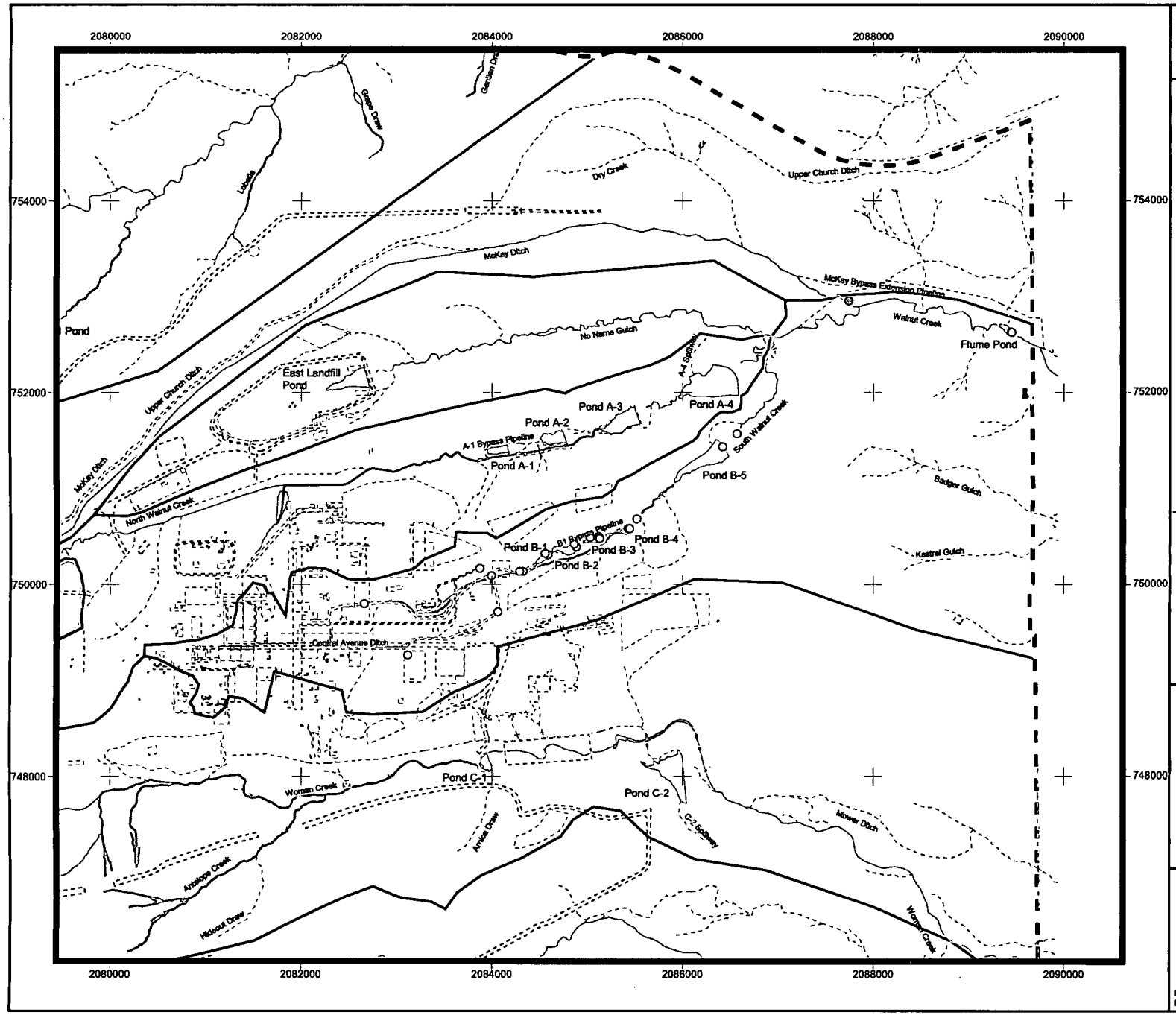

Figure 2.98
South Walnut Creek AEU
Surface Water Sampling Locations
for non-ionized Ammonia

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.02 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
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0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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Datum: NAD 27

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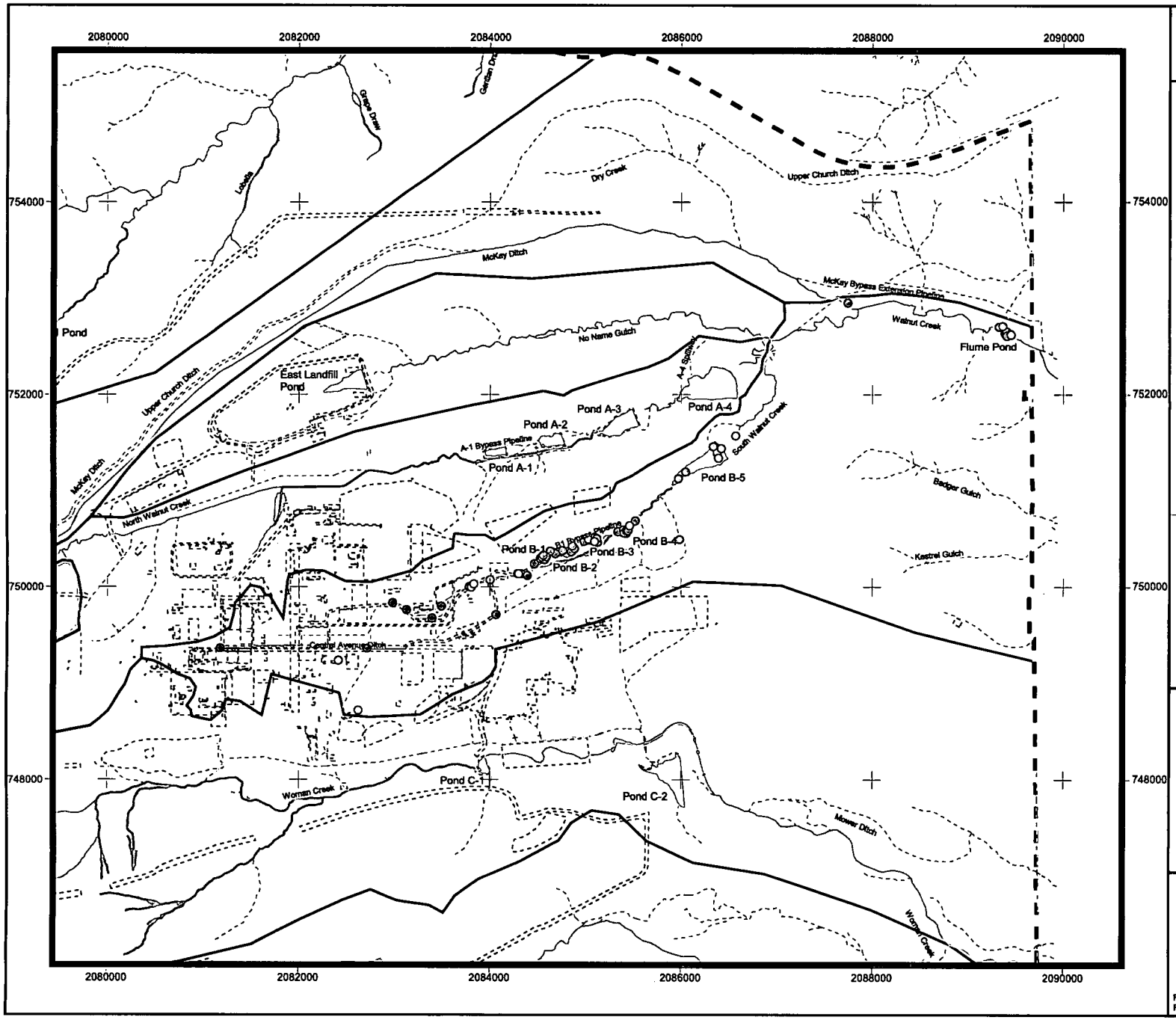

Figure 2.99
South Walnut Creek AEU
Surface Water Sampling Locations
for Cadmium (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.0038 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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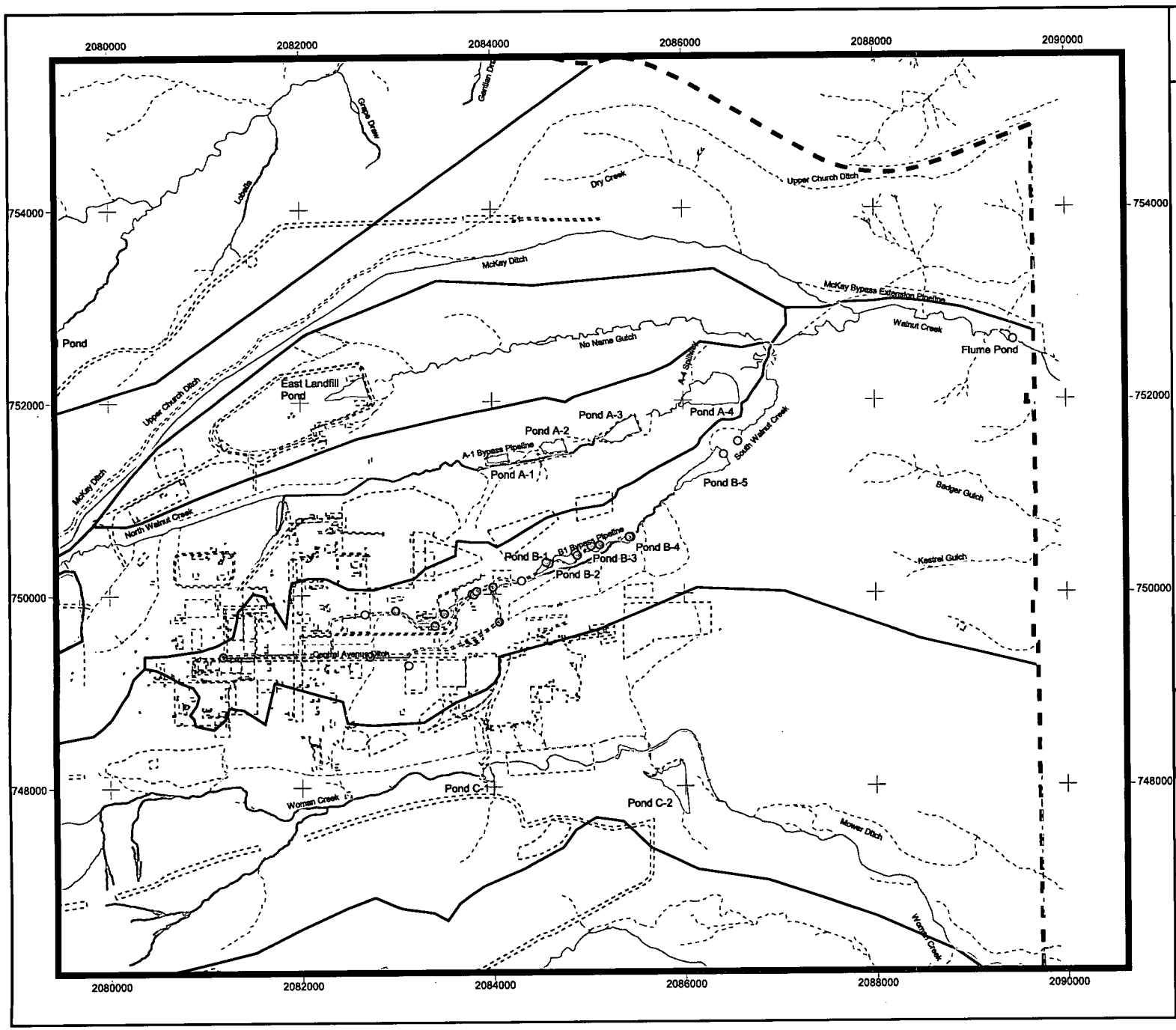

Figure 2.100
South Walnut Creek AEU Surface Water Sampling Locations for Cyanide

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-wide ESL = 0.0005 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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Datum: NAD 27

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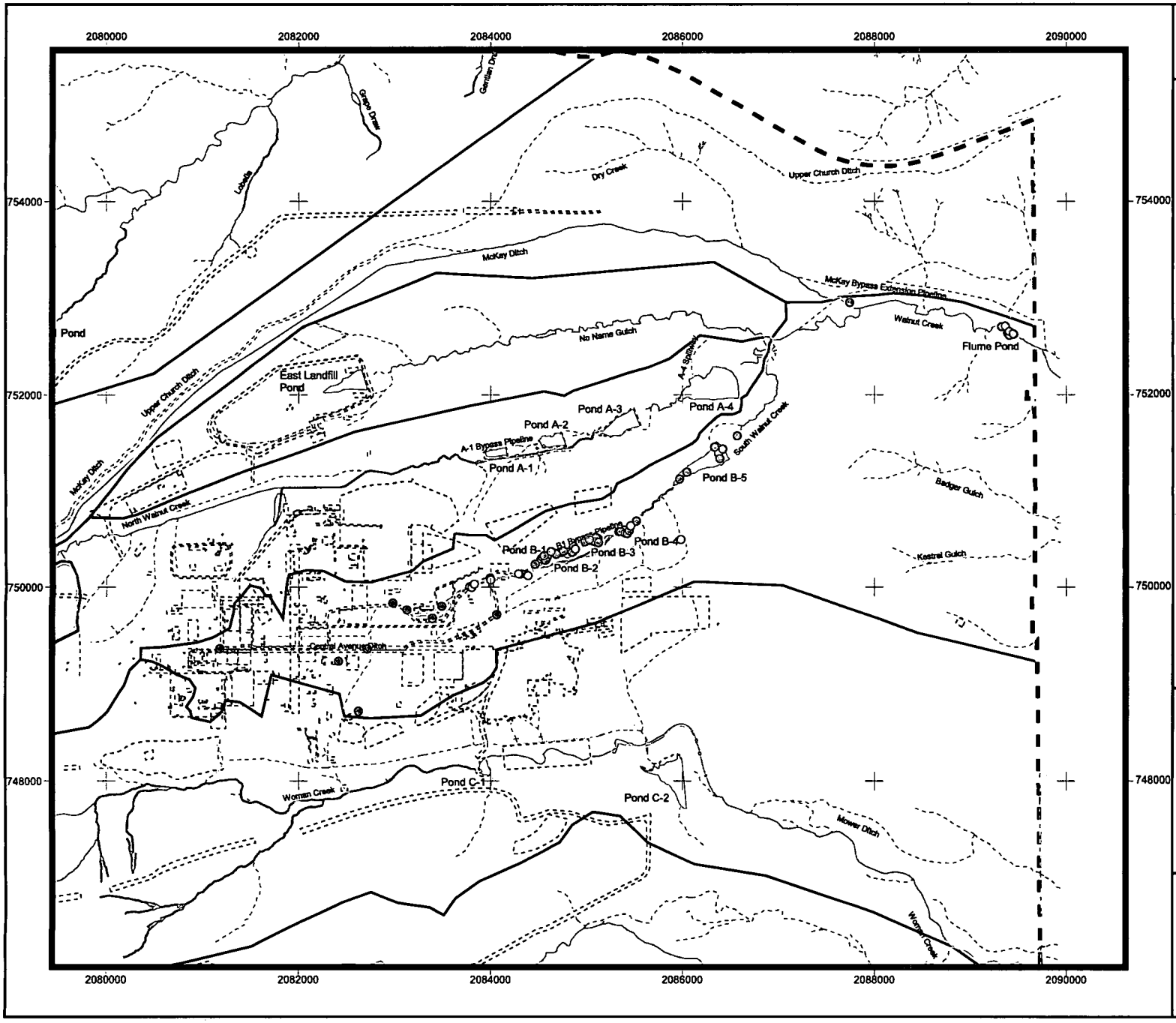

Figure 2.101
South Walnut Creek AEU
Surface Water Sampling Locations
for Silver (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.0011 mg/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
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0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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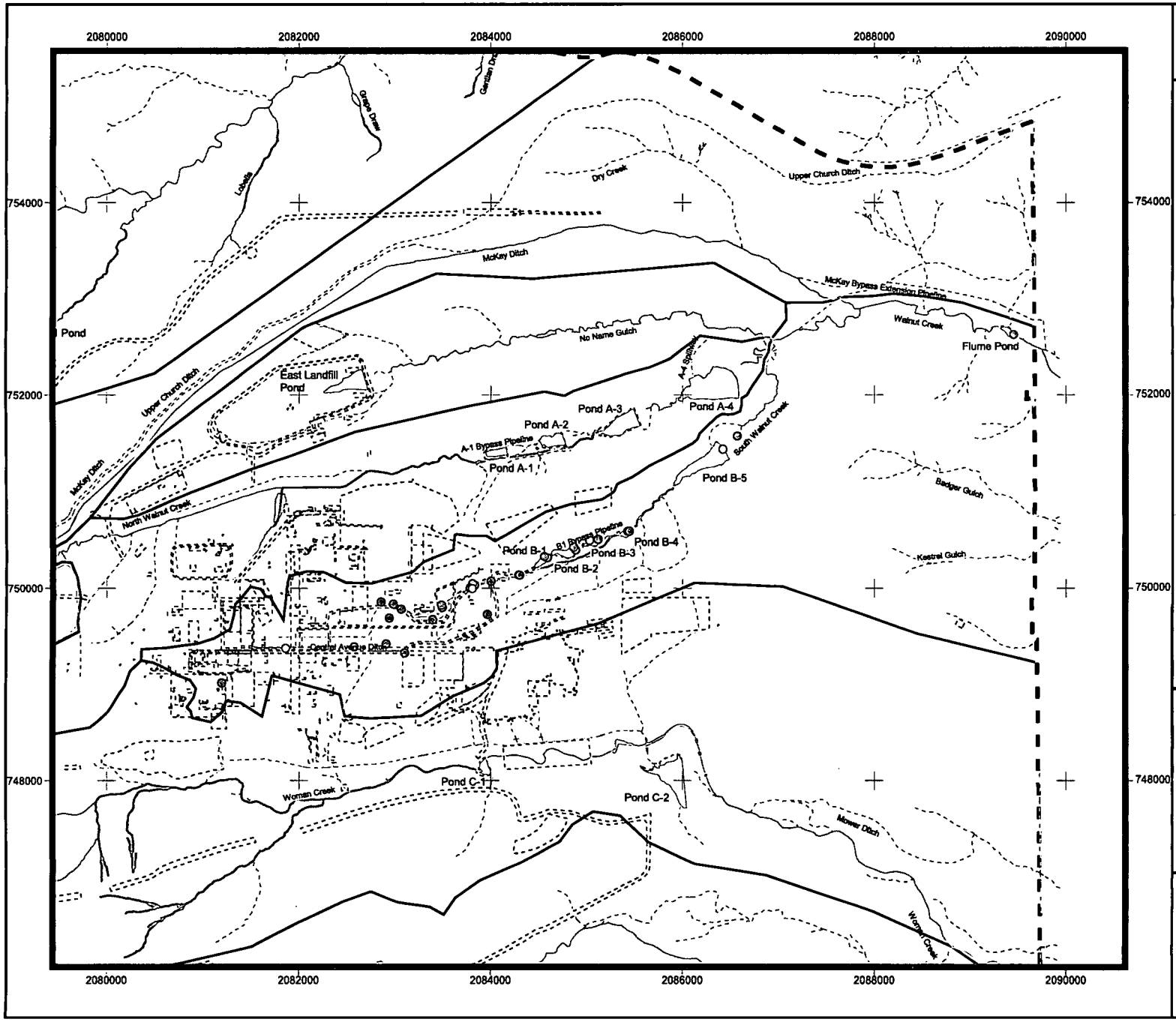

Figure 2.102
South Walnut Creek AEU Surface Water Sampling Locations for 4,4'-DDT

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-wide ESL = 0.001 ug/L

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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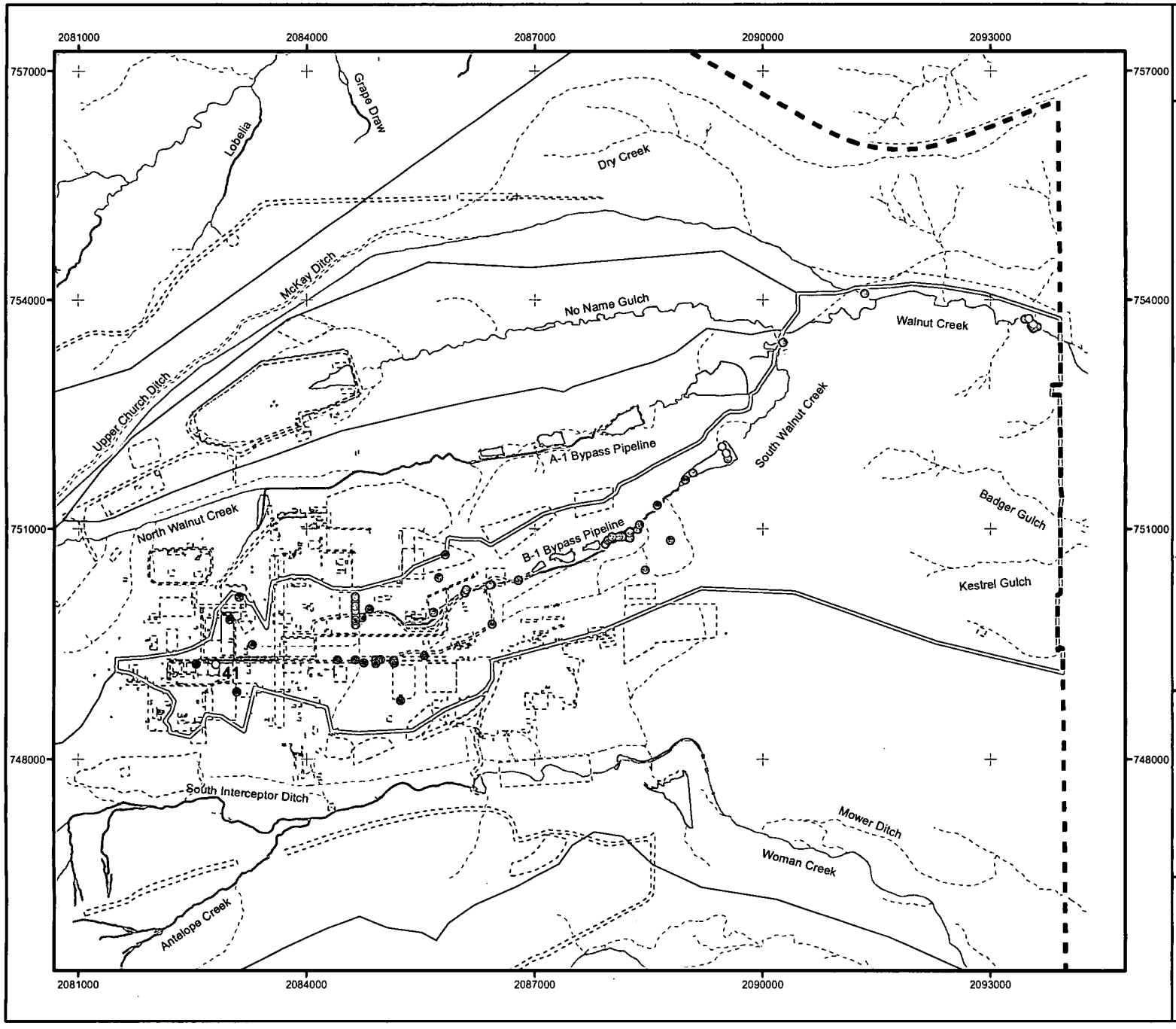

Figure 2.103
South Walnut Creek AEU
Sediment Sampling Results for
2-methylnaphthalene

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 20.2 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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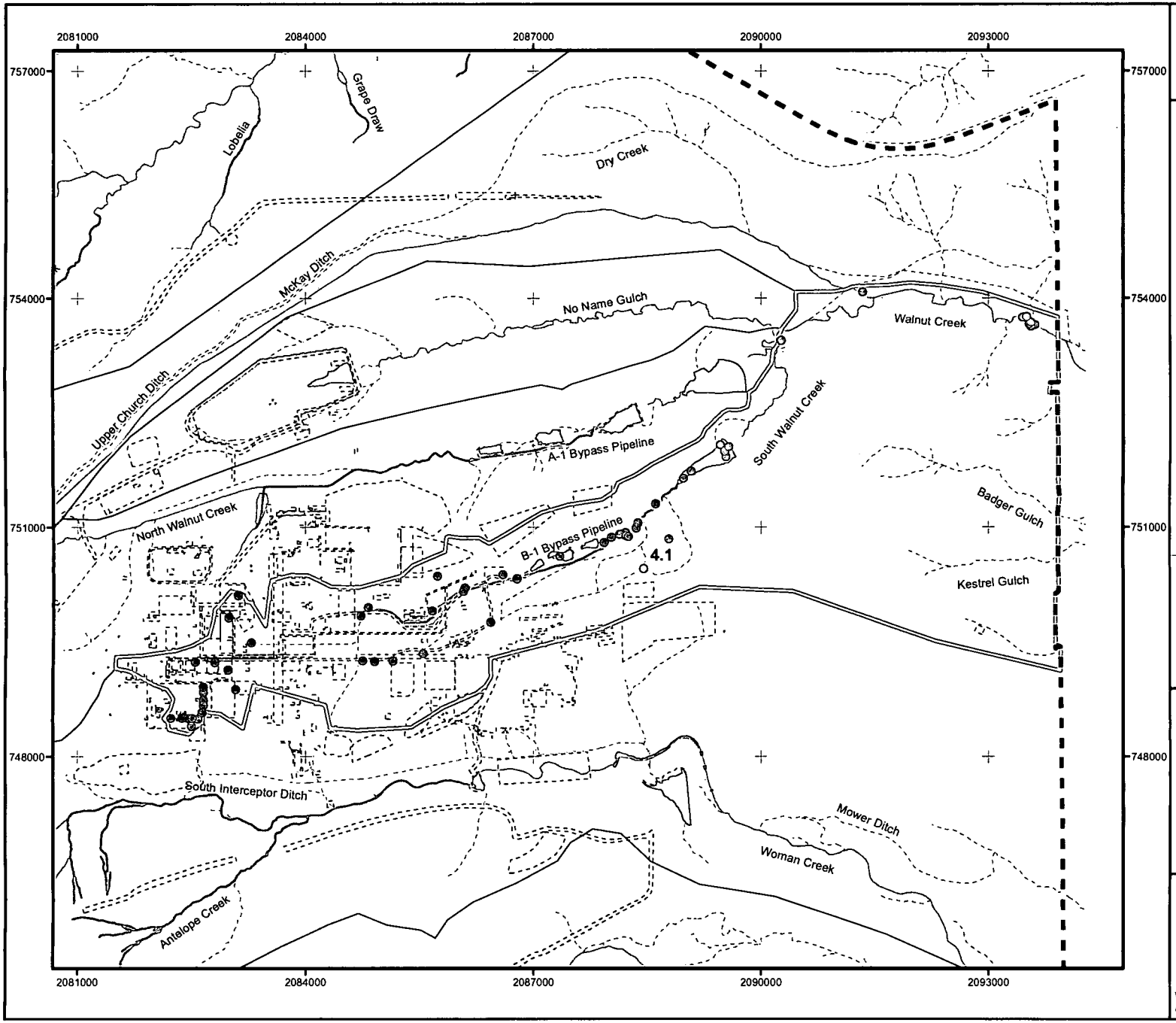

Figure 2.104
South Walnut Creek AEU
Sediment Sampling Results for
4,4-DDE

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 3.16 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

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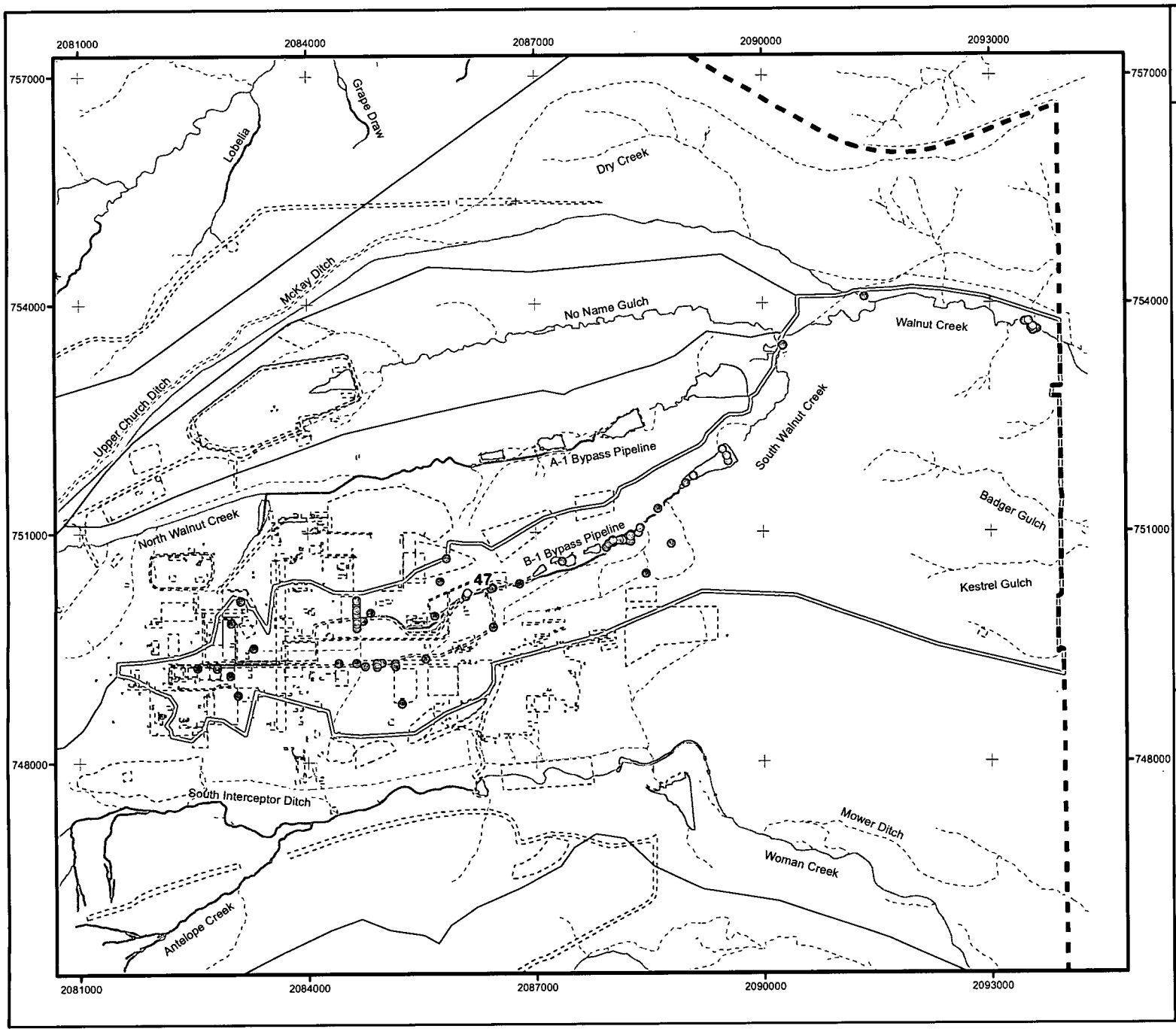

Figure 2.105
South Walnut Creek AEU
Sediment Sampling Results for
4-methylphenol

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 12.3 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
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S

0 950 1,900 Feet

Scale 1:22,800

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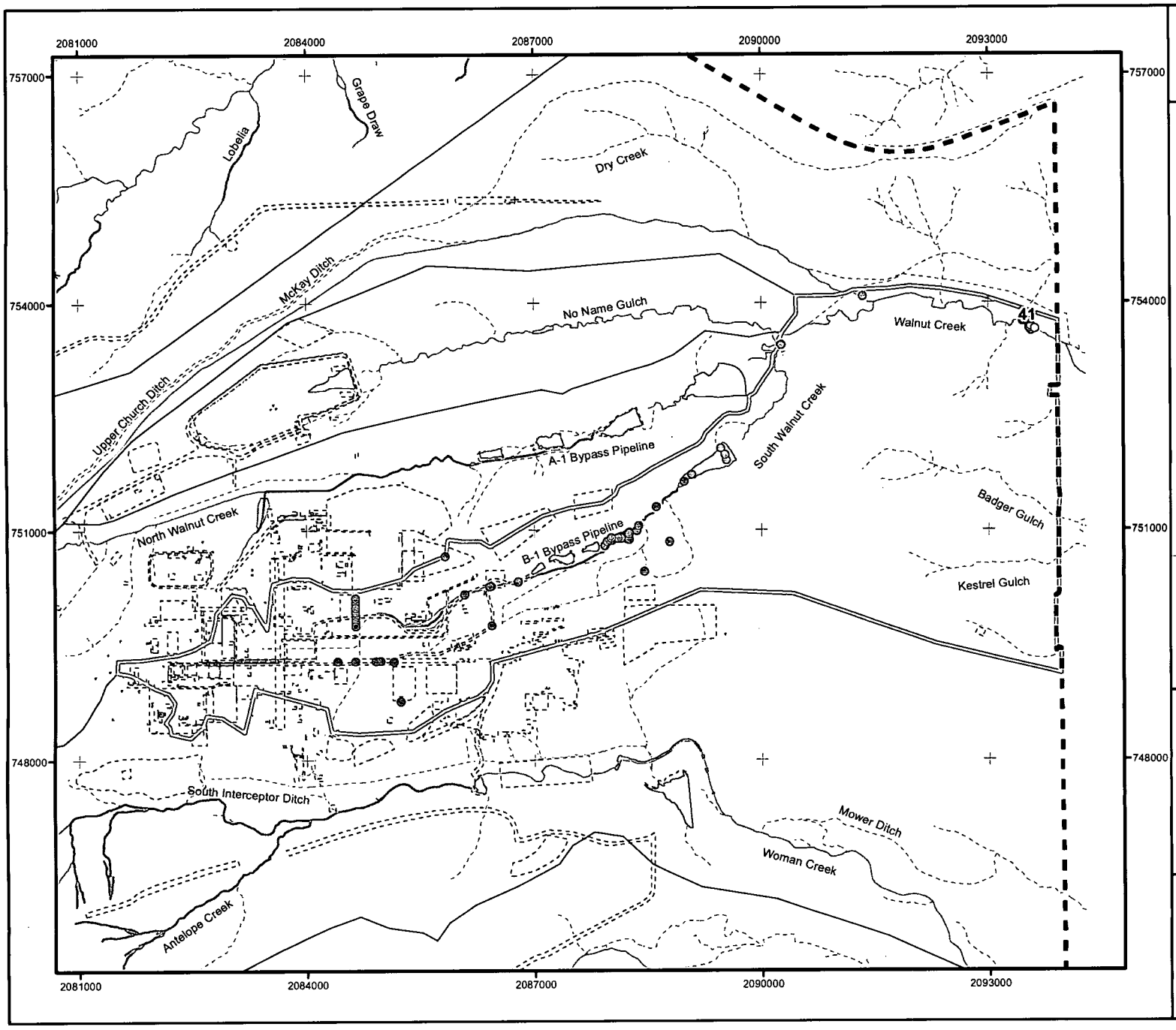

Figure 2.106
South Walnut Creek AEU
Sediment Sampling Results for
Benzyl alcohol

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 1.34 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

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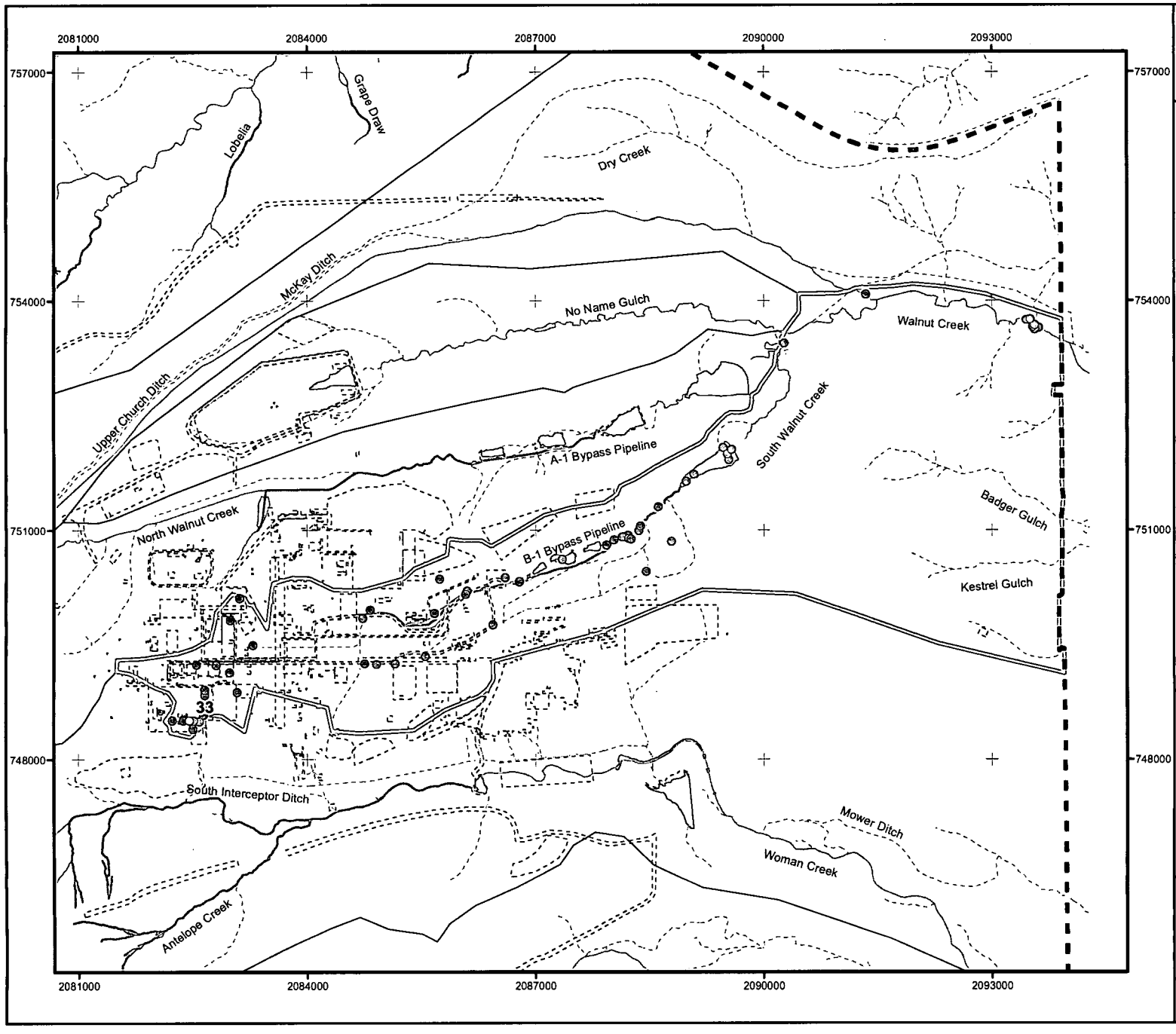

Figure 2.107
South Walnut Creek AEU
Sediment Sampling Results for
Heptachlor epoxide

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 2.47 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

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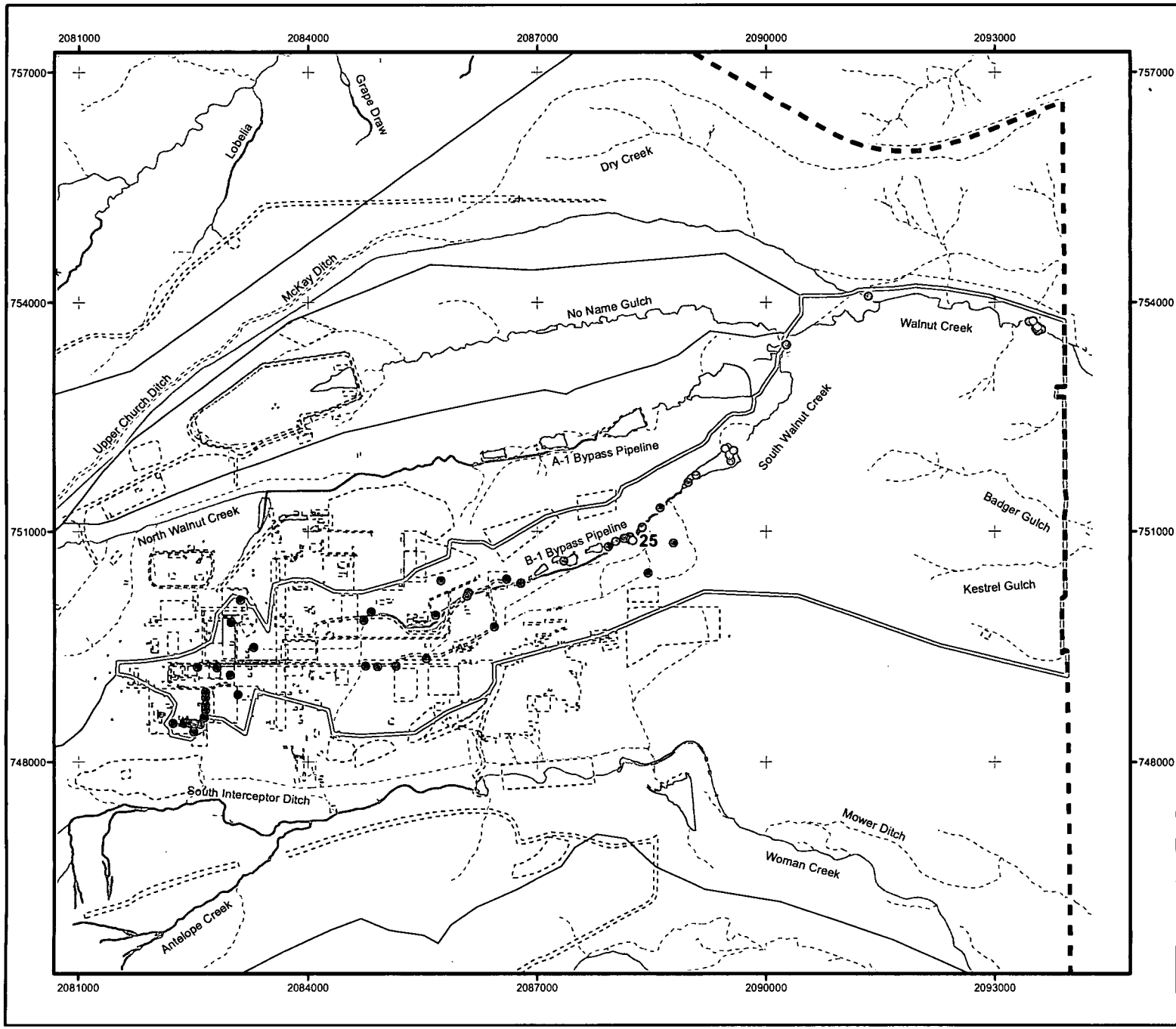

Figure 2.108
South Walnut Creek AEU
Sediment Sampling Results for
Gamma-BHC (Lindane)

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 2.37 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 950 1,900 Feet

Scale 1:22,800

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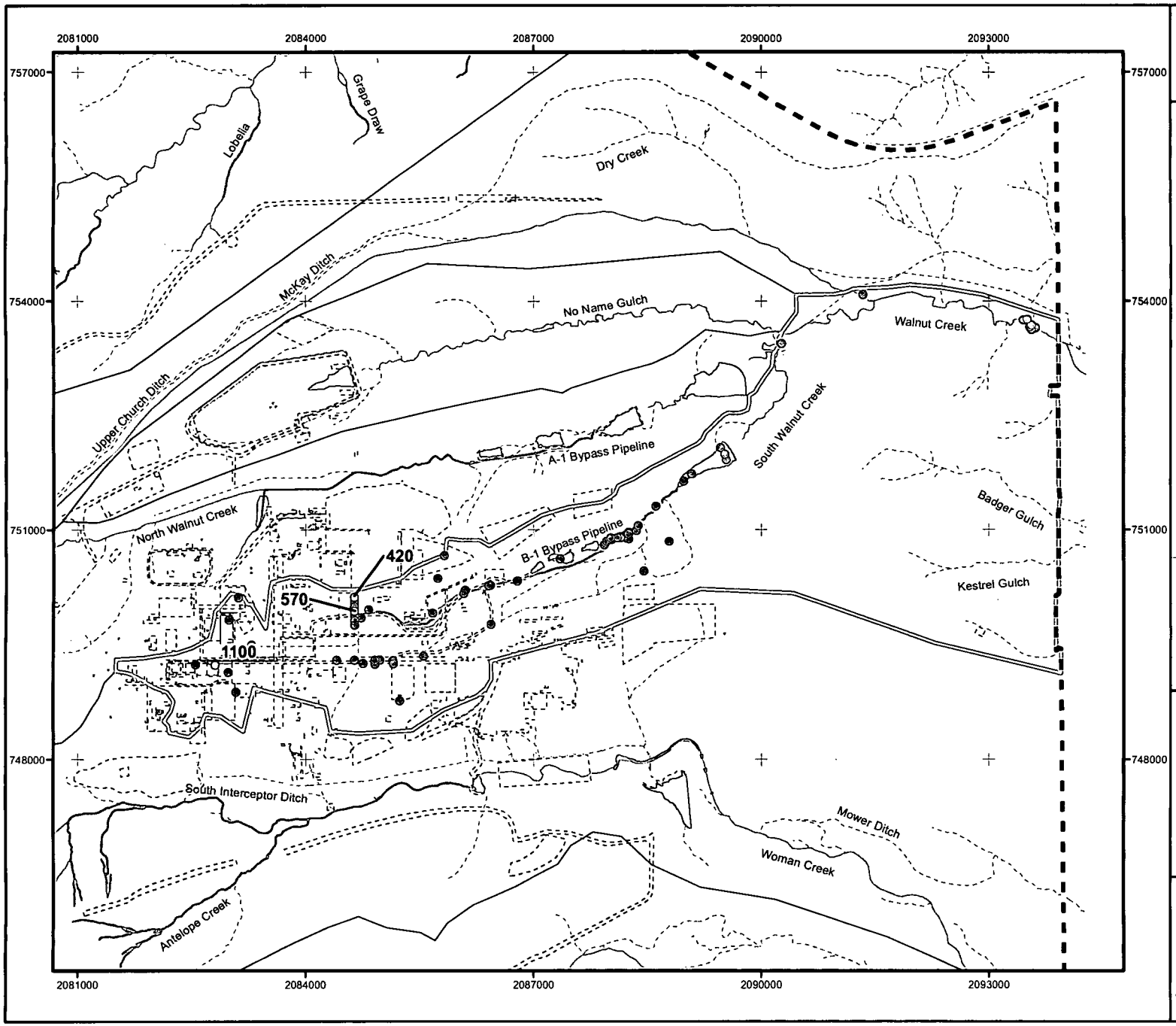

Figure 2.109
South Walnut Creek AEU
Sediment Sampling Results for
Pentachlorophenol

Key

Sample location
- Detect
- Nondetect
- South Walnut Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 255 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
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0 950 1,900 Feet

Scale 1:22,800

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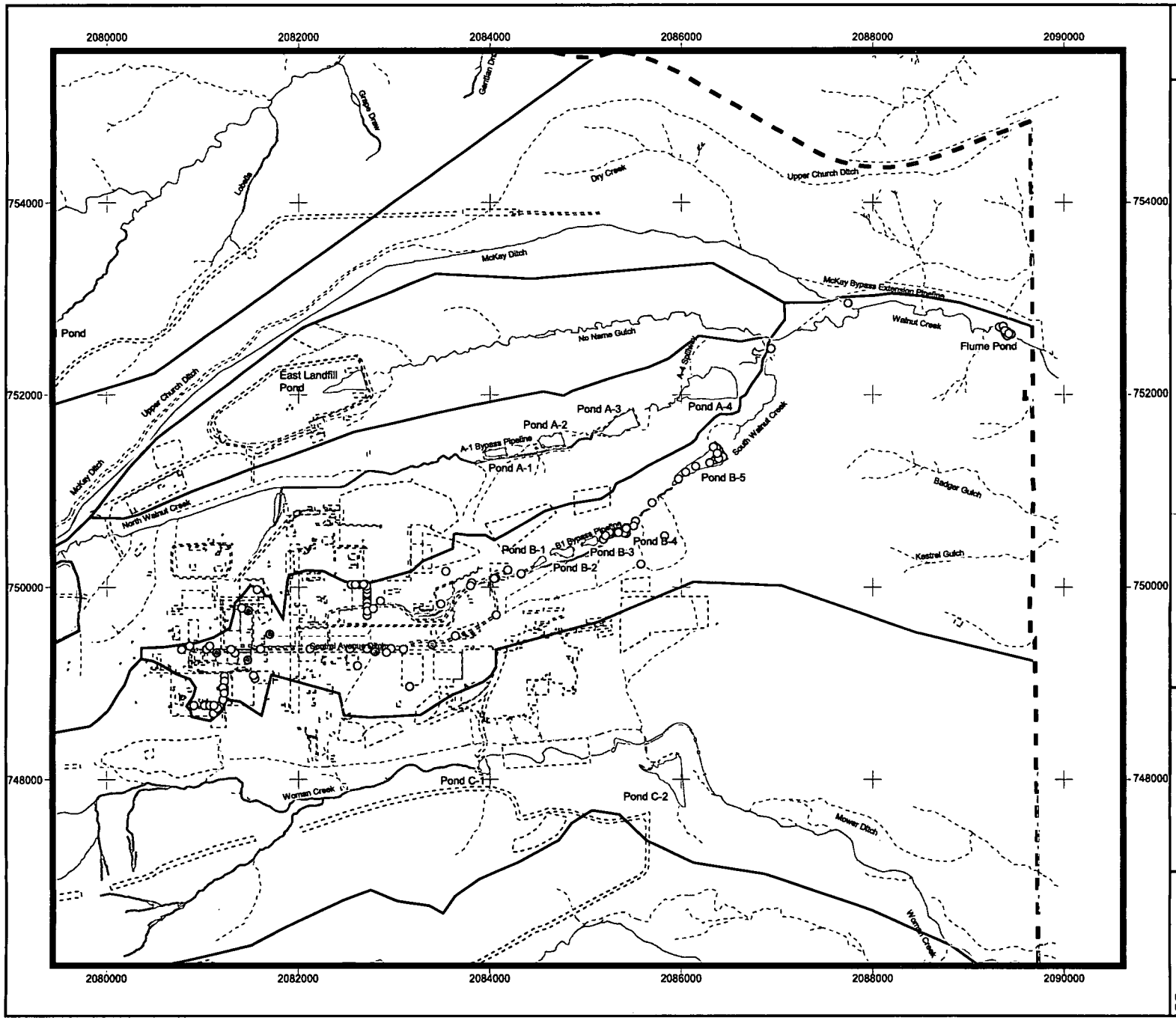

Figure 2.110
South Walnut Creek AEU Sediment Sampling Locations for Arsenic

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 9.79 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

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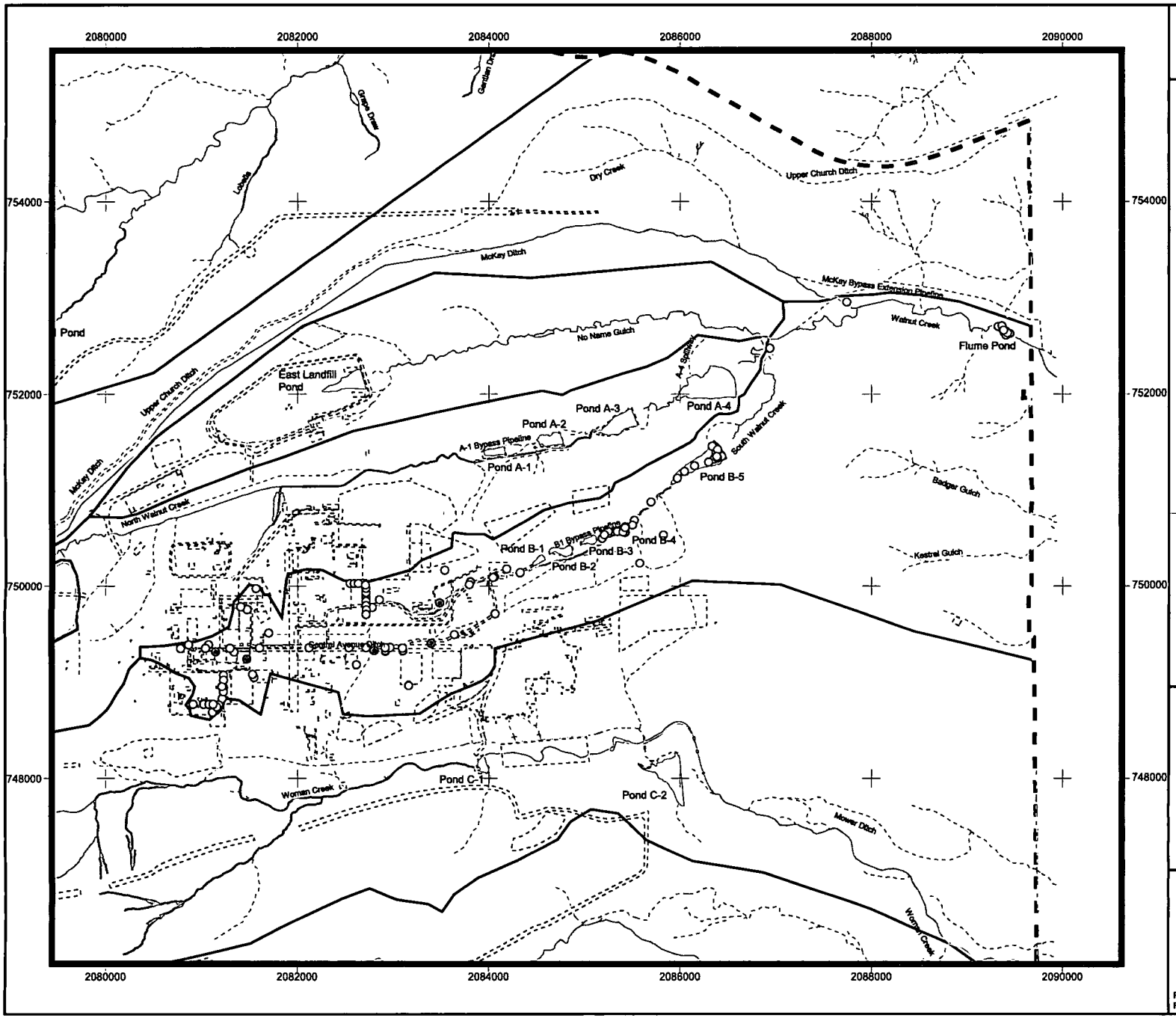

Figure 2.111
South Walnut Creek AEU
Sediment Sampling Locations
for Chromium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 43.4 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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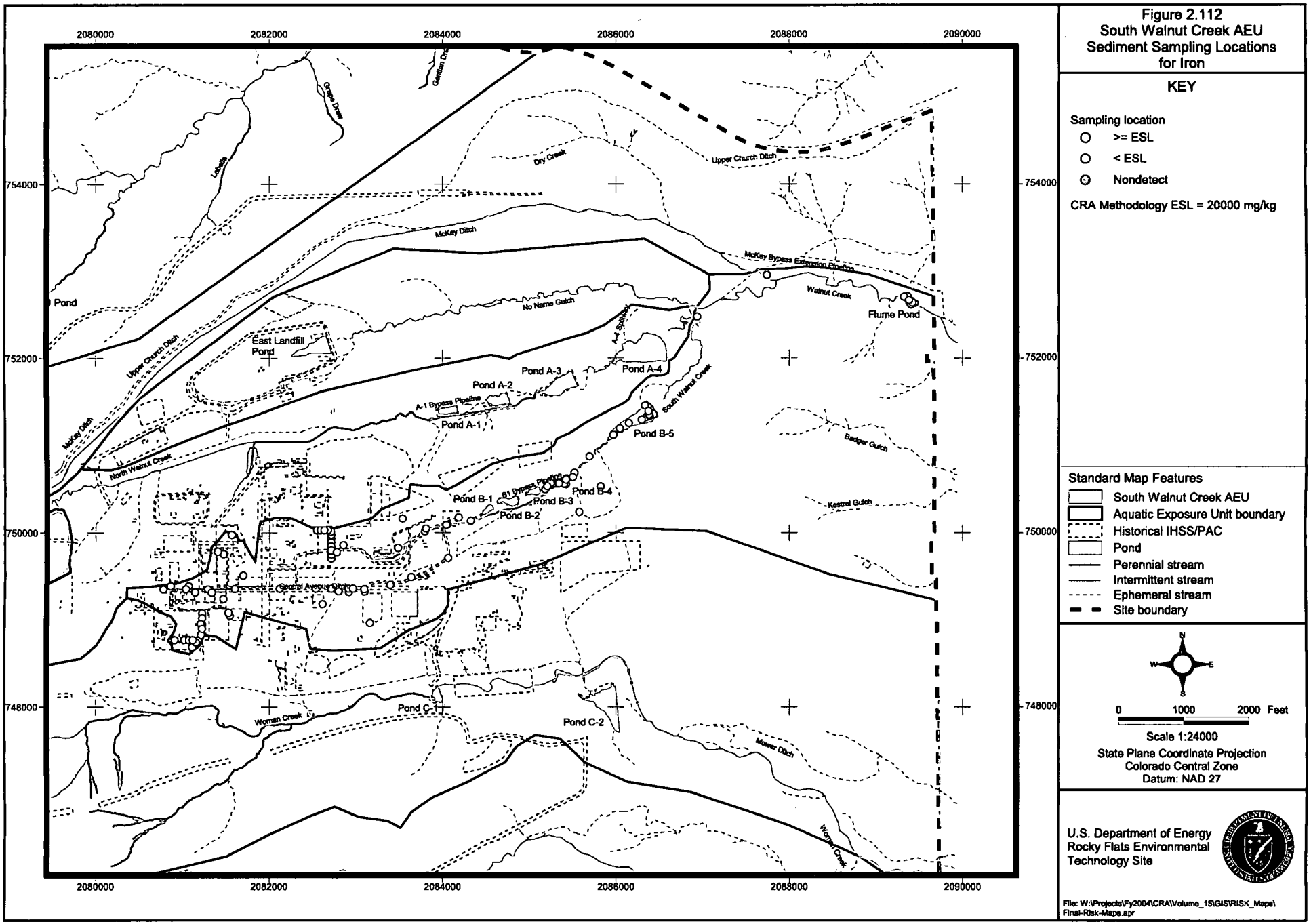

Figure 2.112
South Walnut Creek AEU Sediment Sampling Locations for Iron

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 20000 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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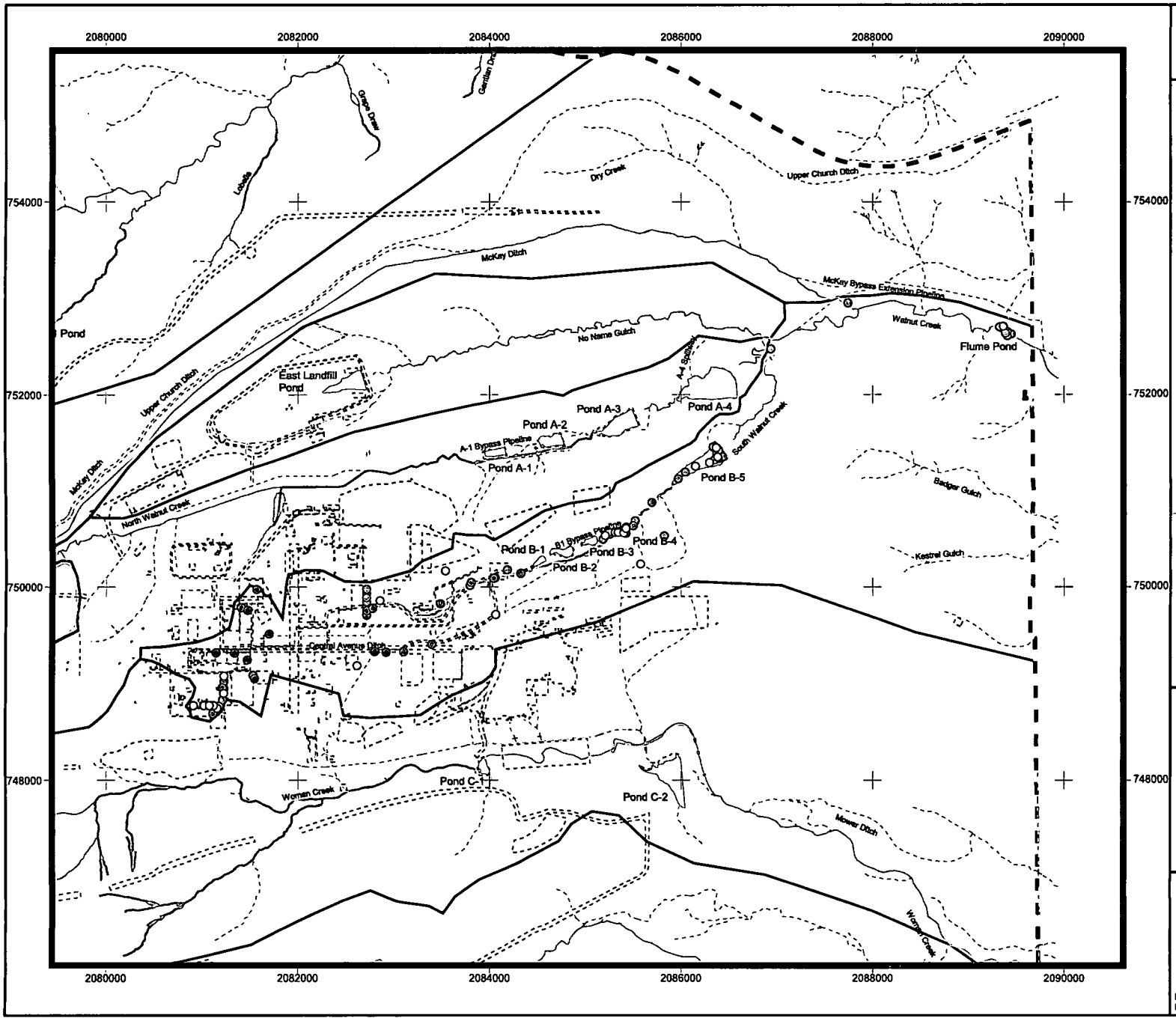

Figure 2.113
South Walnut Creek AEU
Sediment Sampling Locations
for Mercury

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.18 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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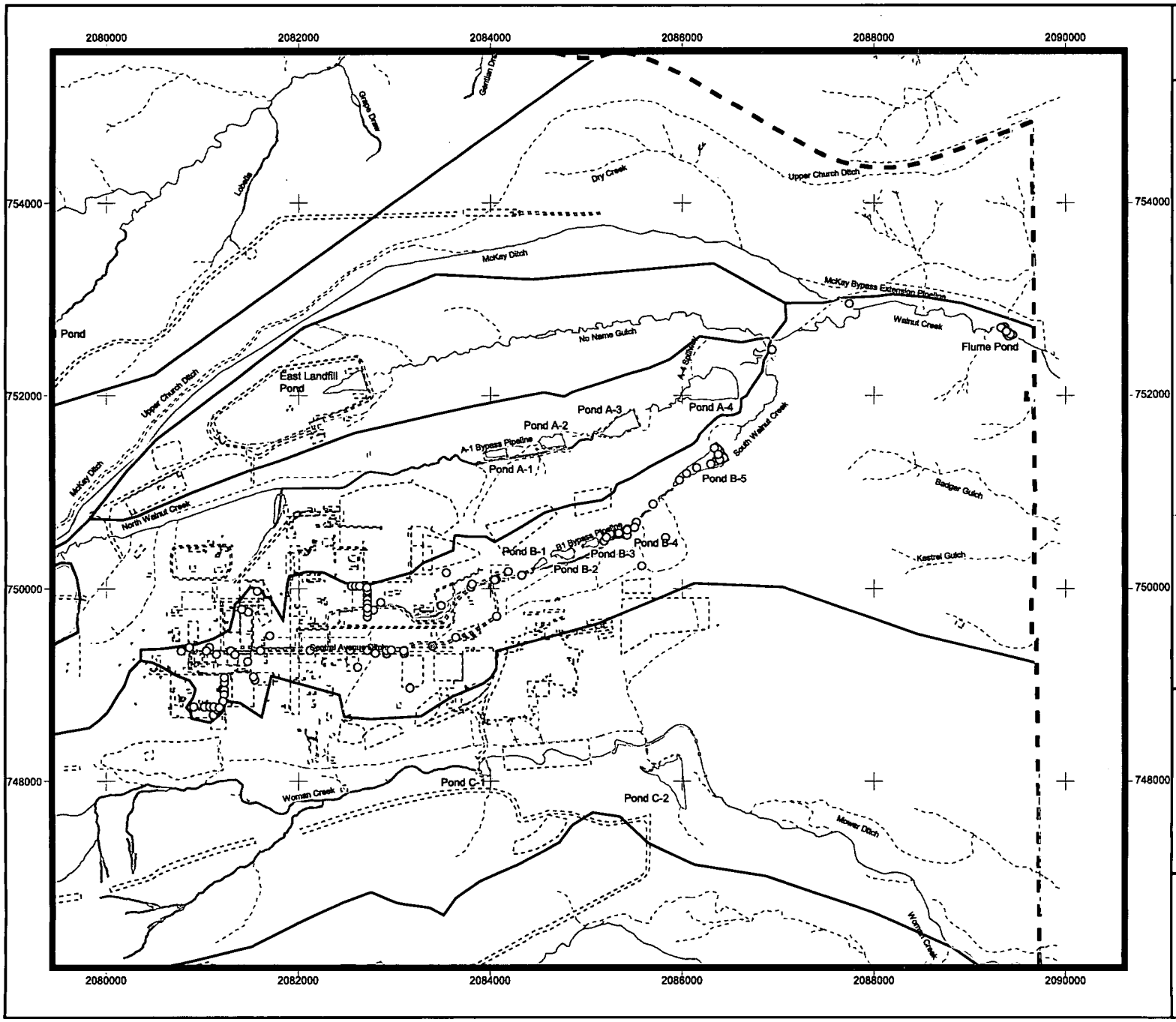

Figure 2.114
South Walnut Creek AEU
Sediment Sampling Locations
for Nickel

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 22.7 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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State Plane Coordinate Projection
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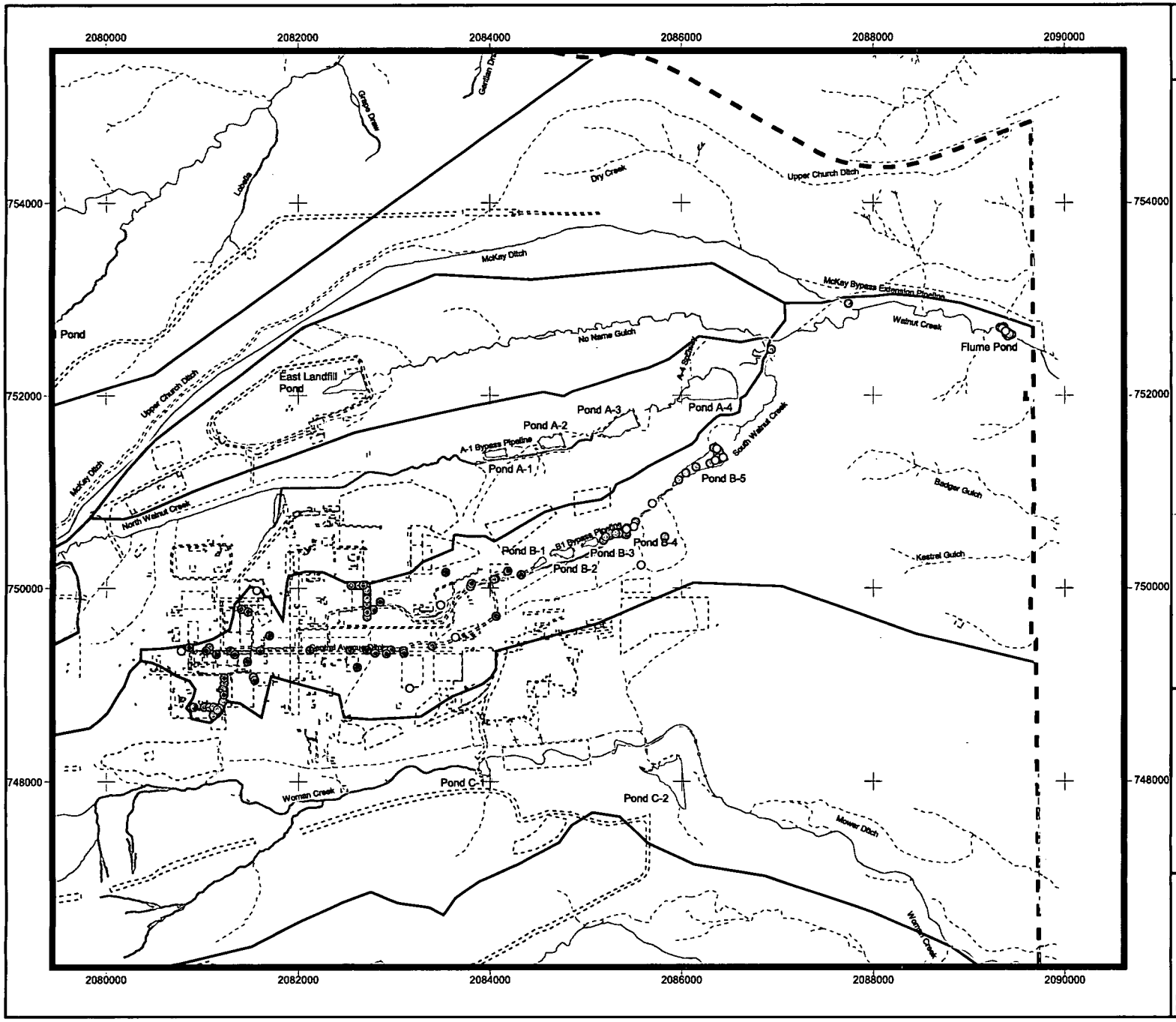

Figure 2.115
South Walnut Creek AEU Sediment Sampling Locations for Selenium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.95 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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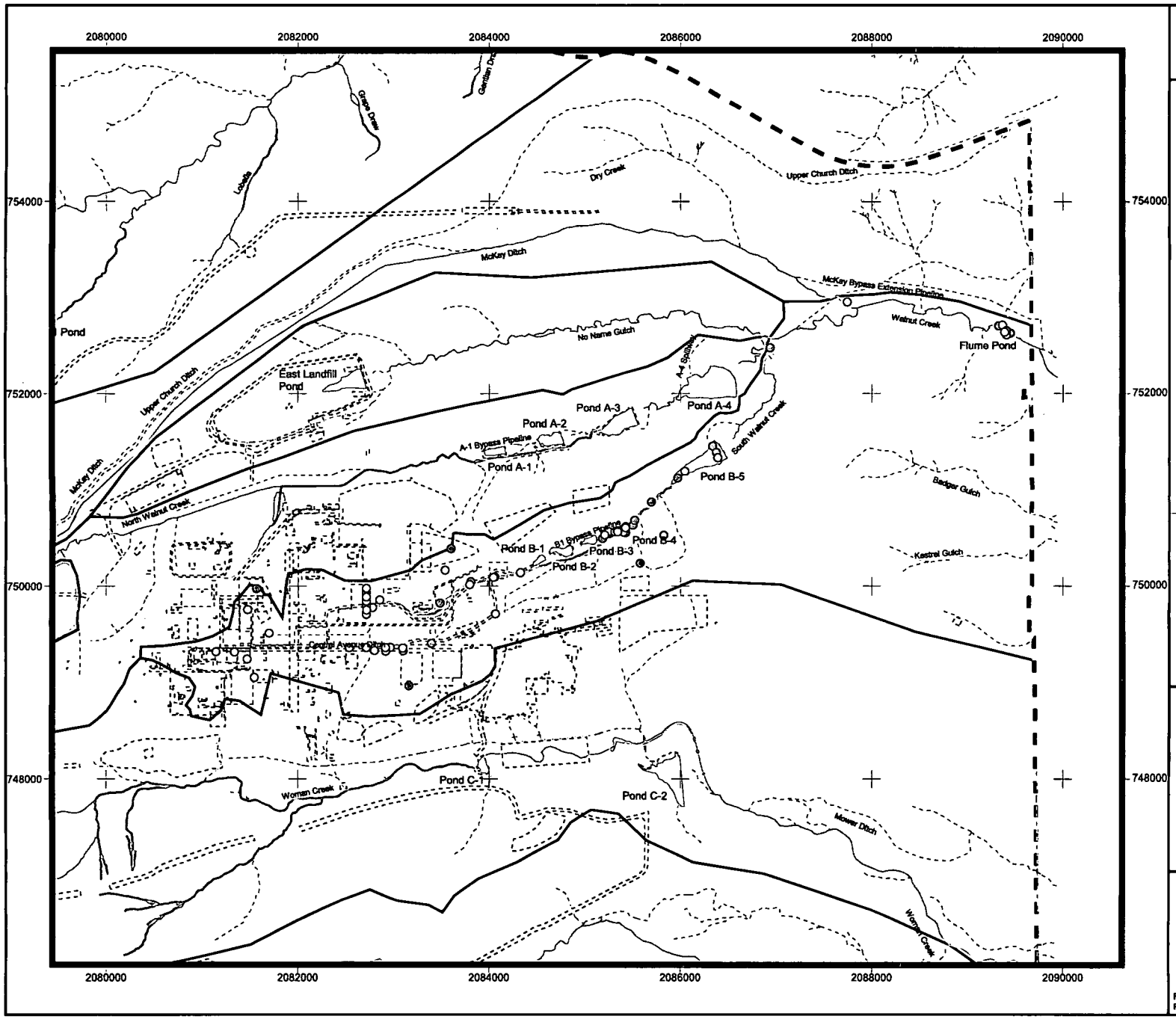

Figure 2.116
South Walnut Creek AEU
Sediment Sampling Locations
for Bis(2-ethylhexyl)phthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 24900 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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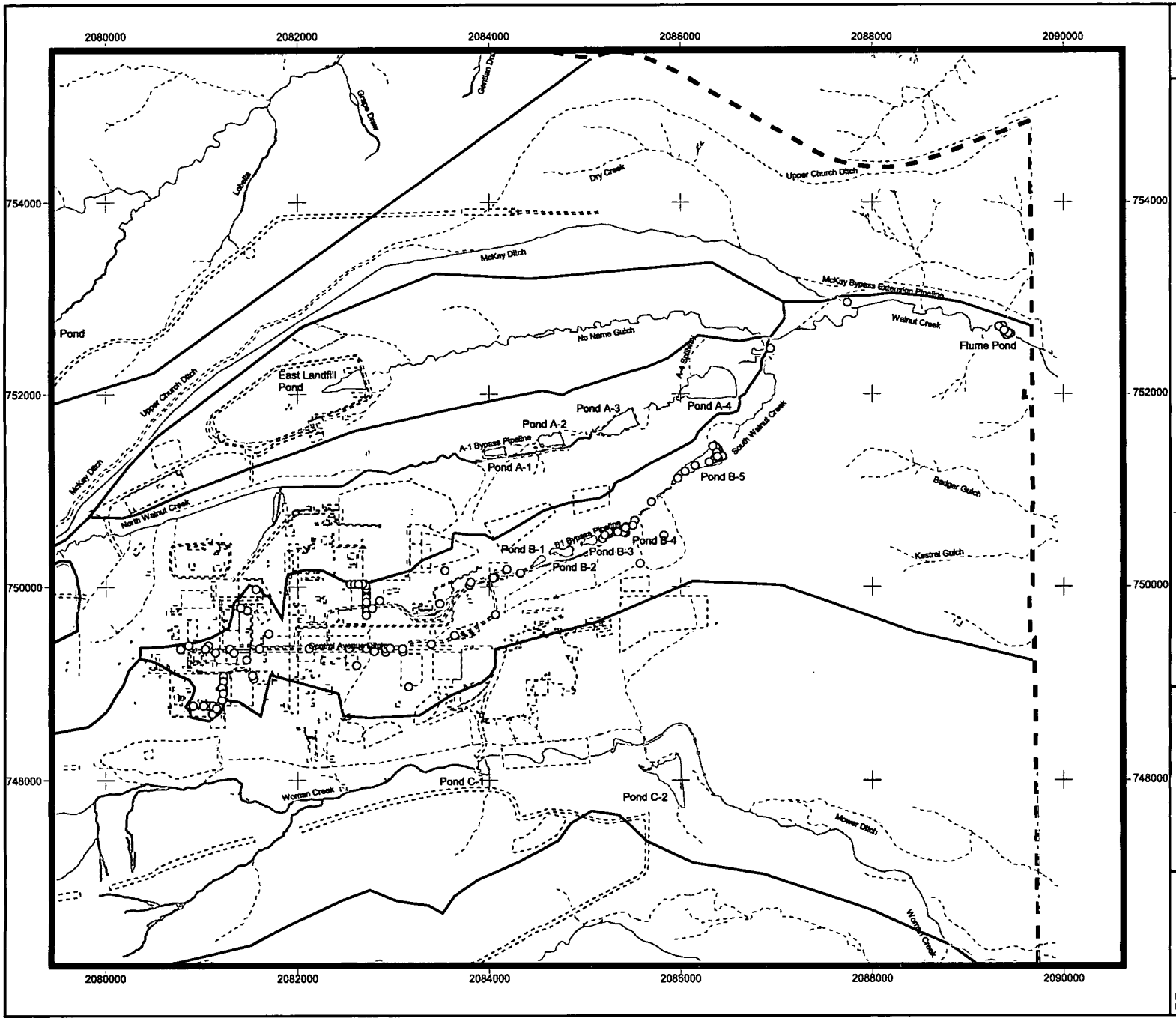

Figure 2.117
South Walnut Creek AEU
Sediment Sampling Locations
for Aluminum

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 15900 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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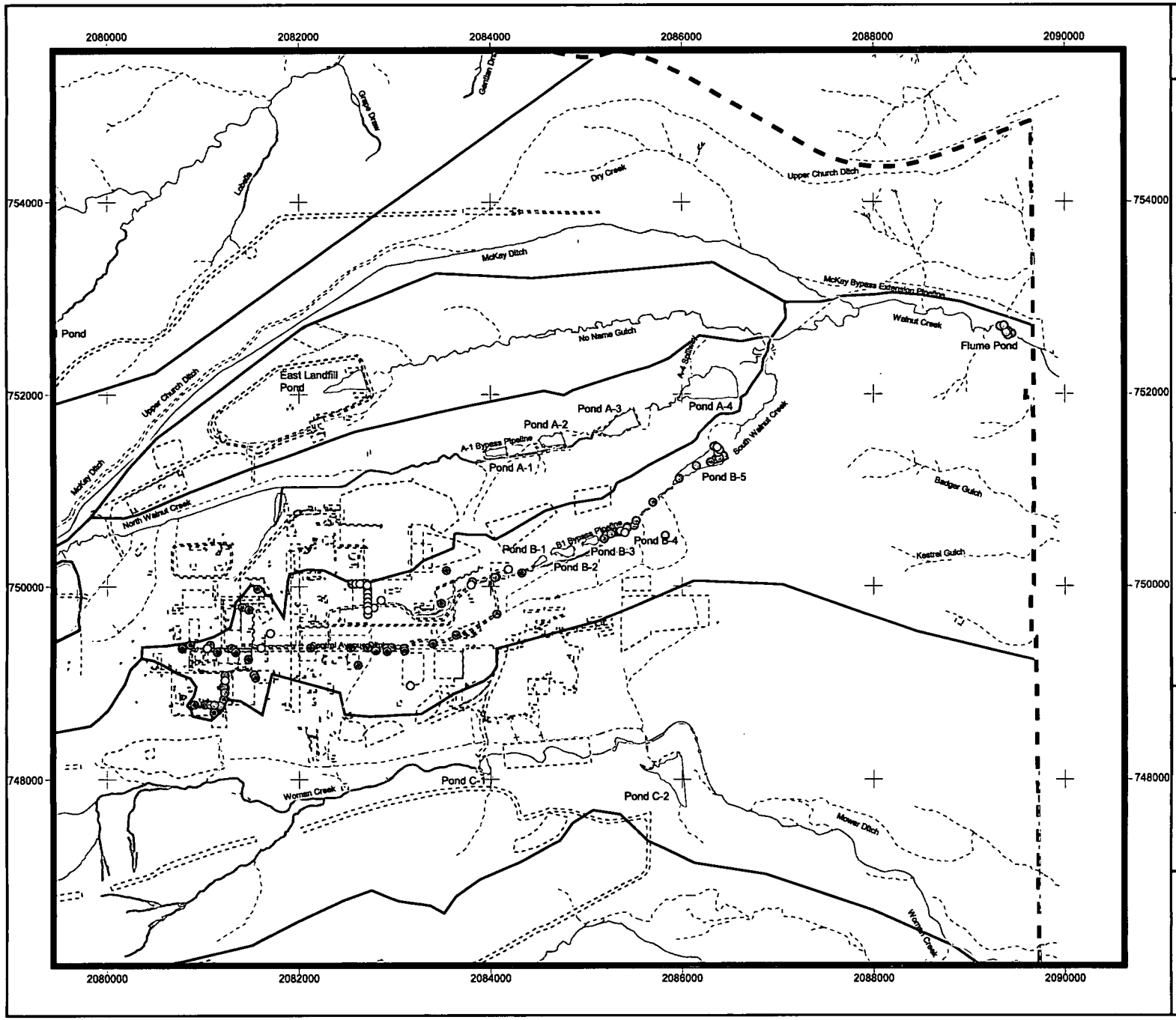

Figure 2.118
South Walnut Creek AEU
Sediment Sampling Locations
for Antimony

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 2 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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State Plane Coordinate Projection
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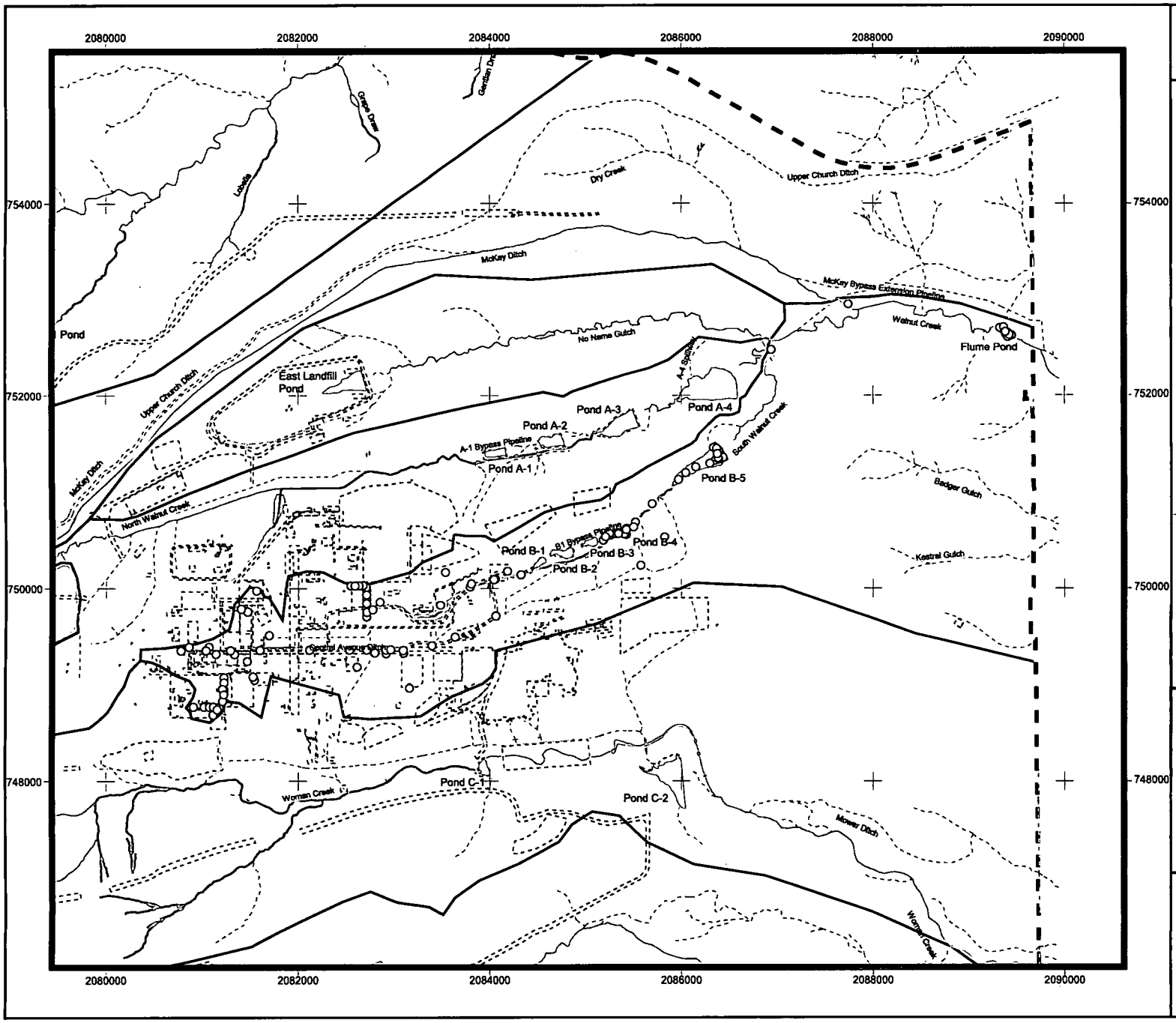

Figure 2.119
South Walnut Creek AEU
Sediment Sampling Locations for Barium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 189 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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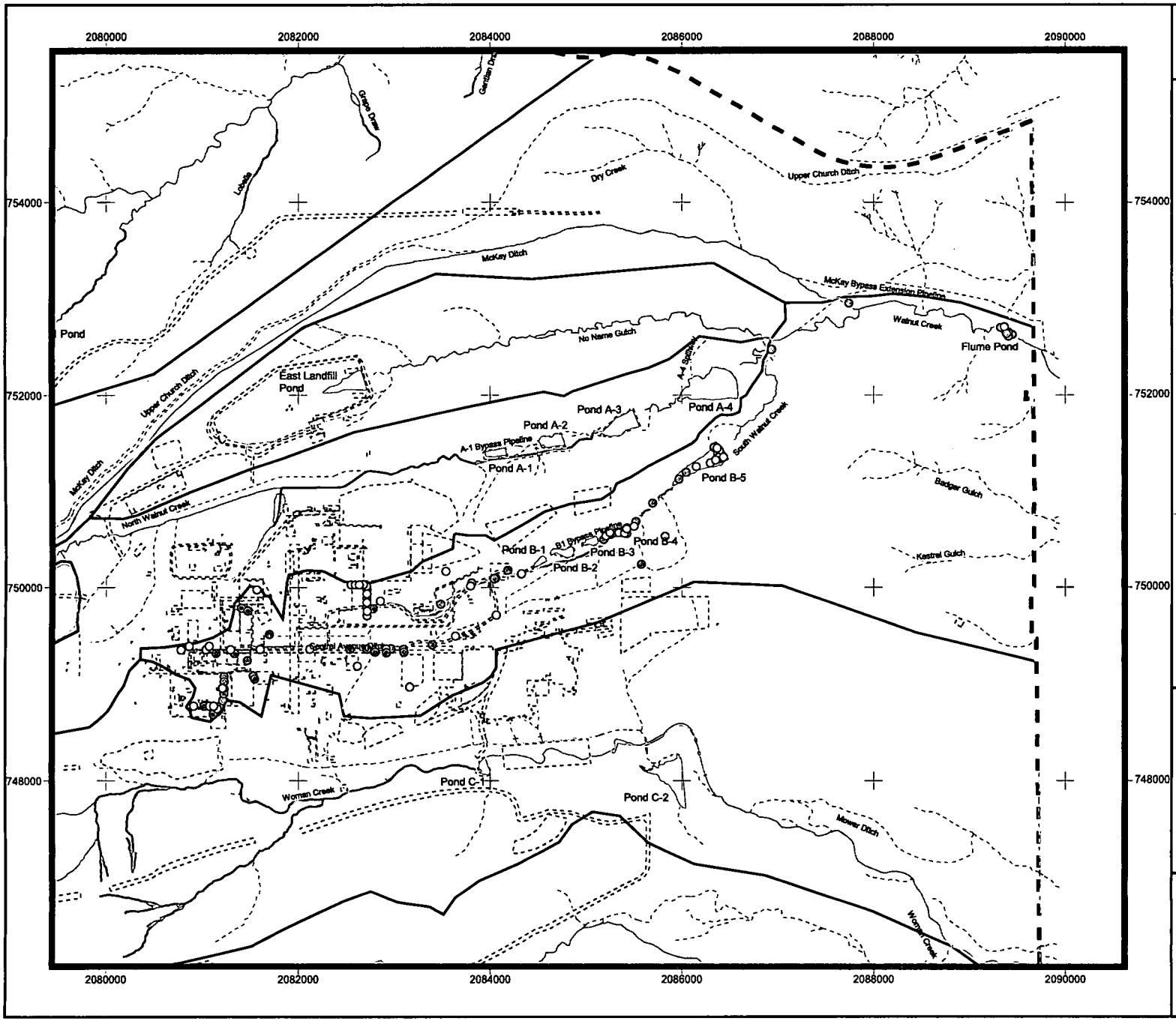

Figure 2.120
South Walnut Creek AEU Sediment Sampling Locations for Cadmium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.99 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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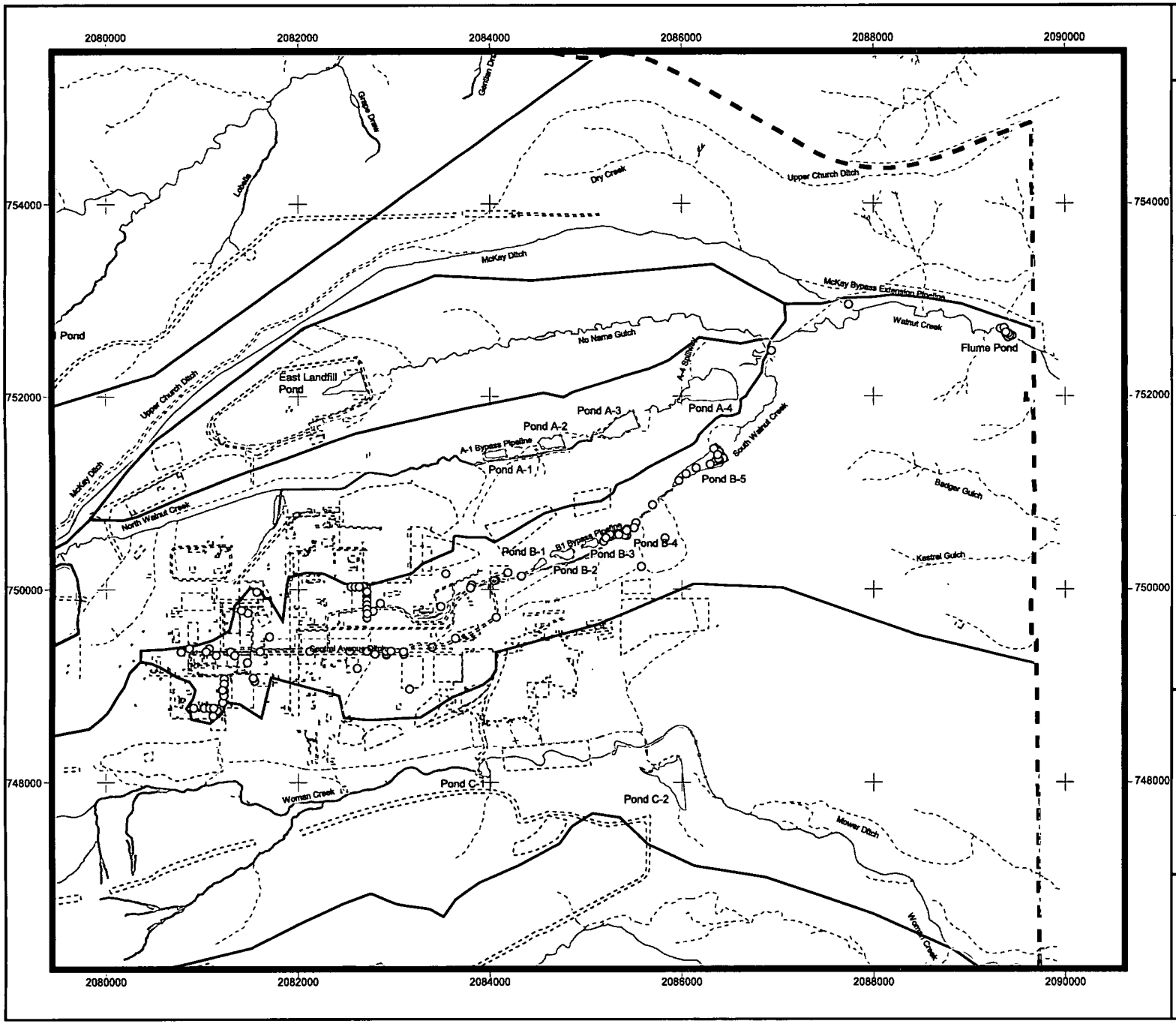

Figure 2.121
South Walnut Creek AEU
Sediment Sampling Locations
for Copper

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 31.6 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24000

State Plane Coordinate Projection
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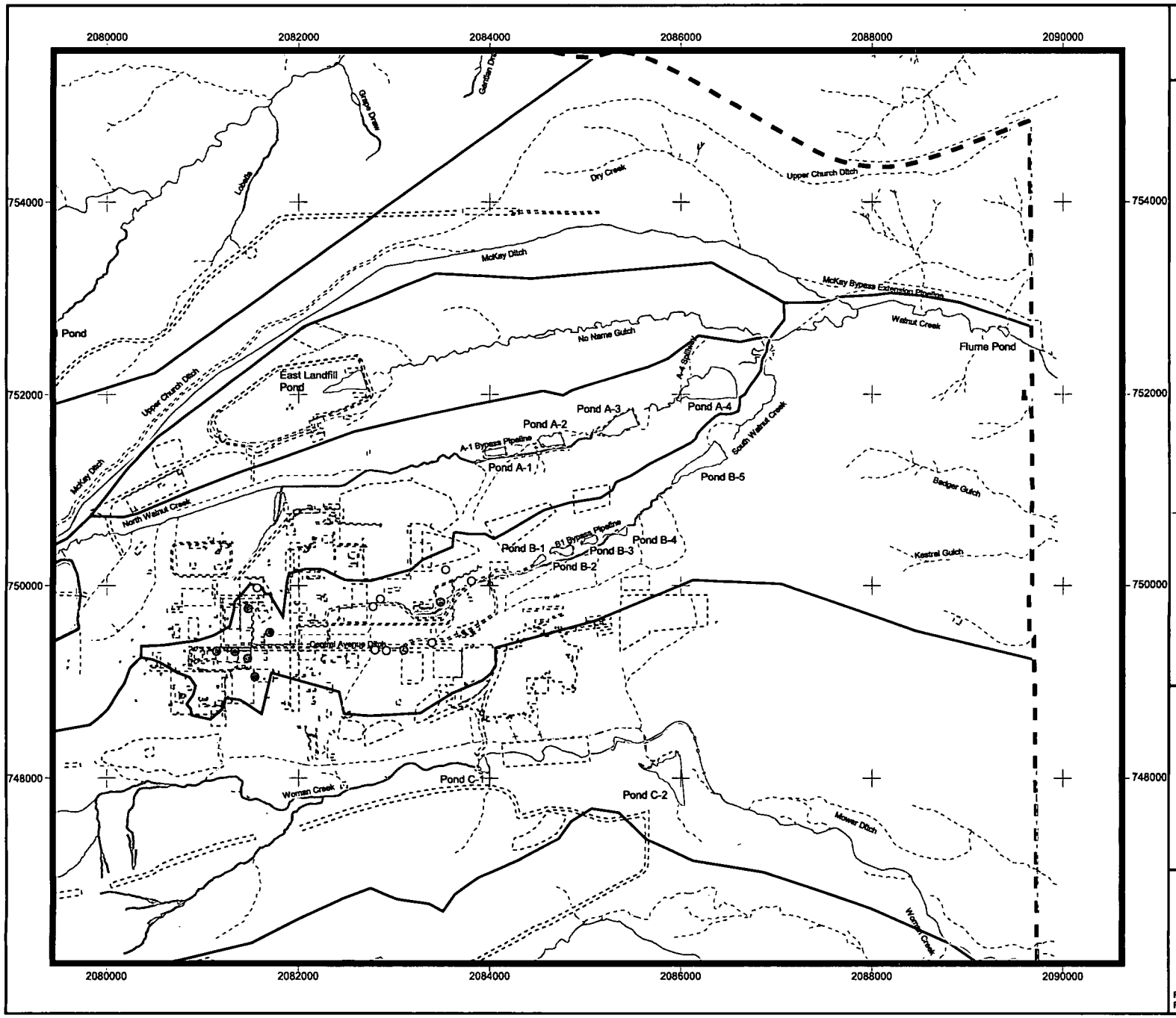

Figure 2.122
South Walnut Creek AEU
Sediment Sampling Locations
for Fluoride

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.01 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24000

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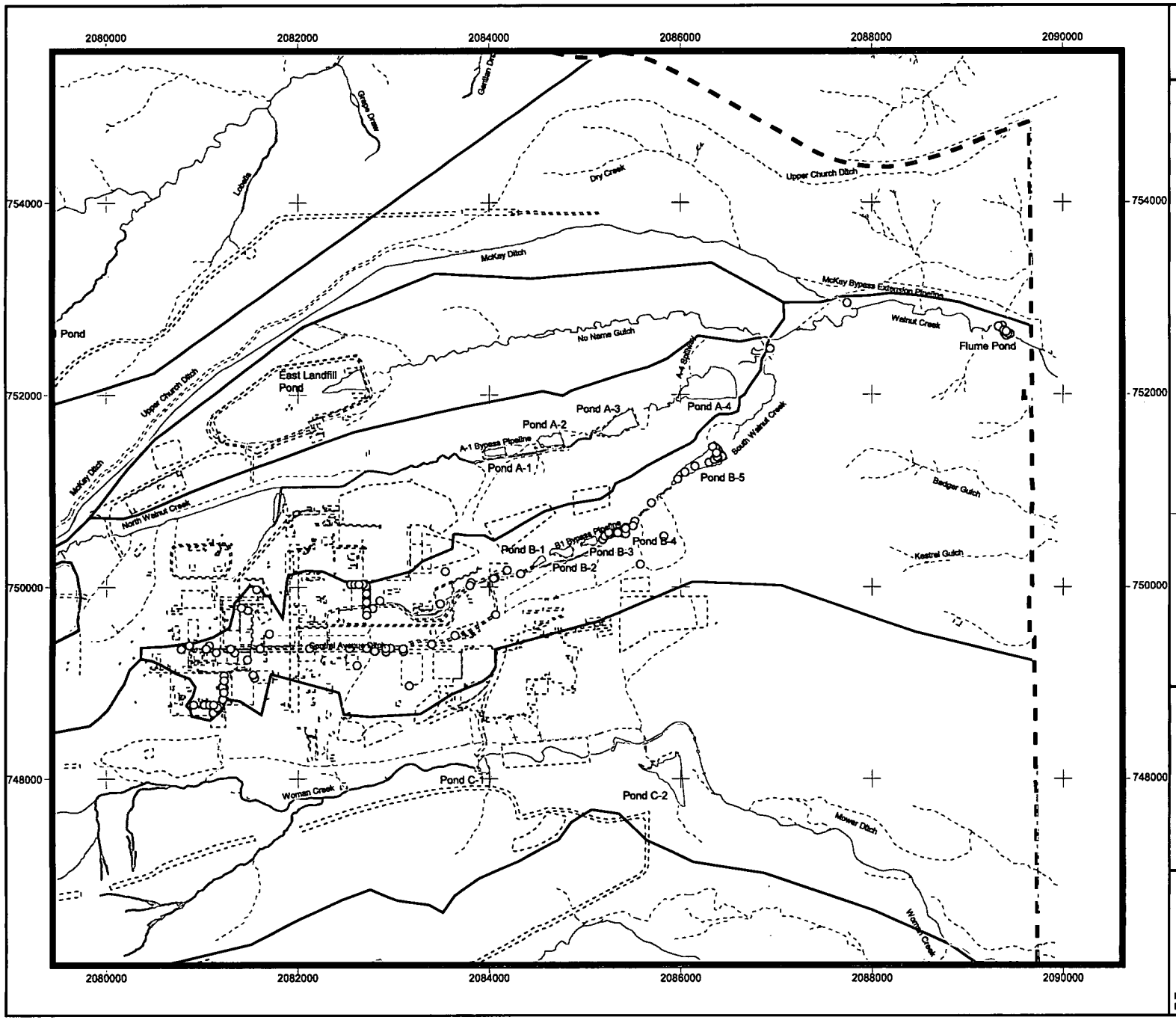

Figure 2.123
South Walnut Creek AEU Sediment Sampling Locations for Lead

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 35.8 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
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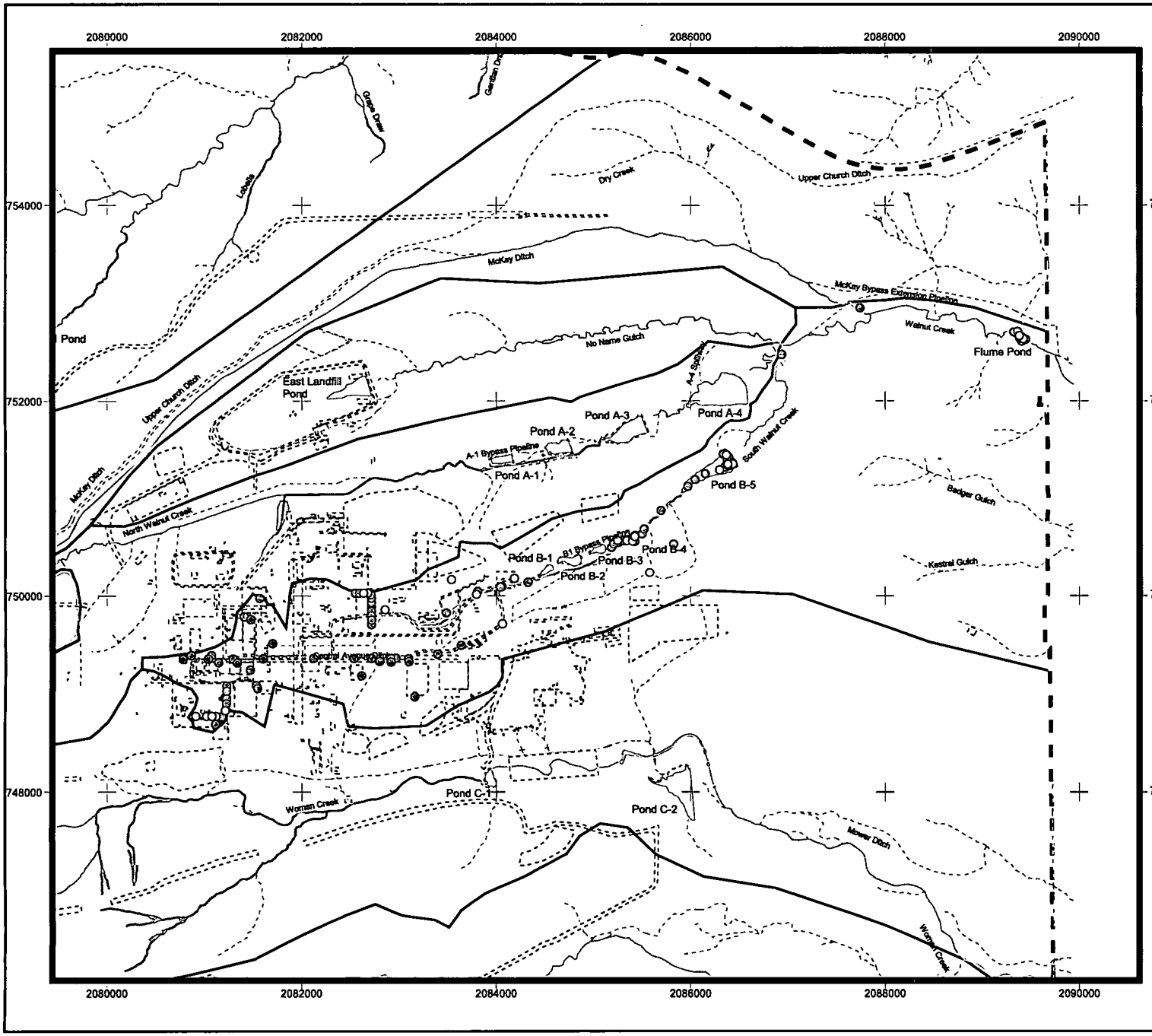

Figure 2.124
South Walnut Creek AEU
Sediment Sampling Locations
for Silver

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 1 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24000

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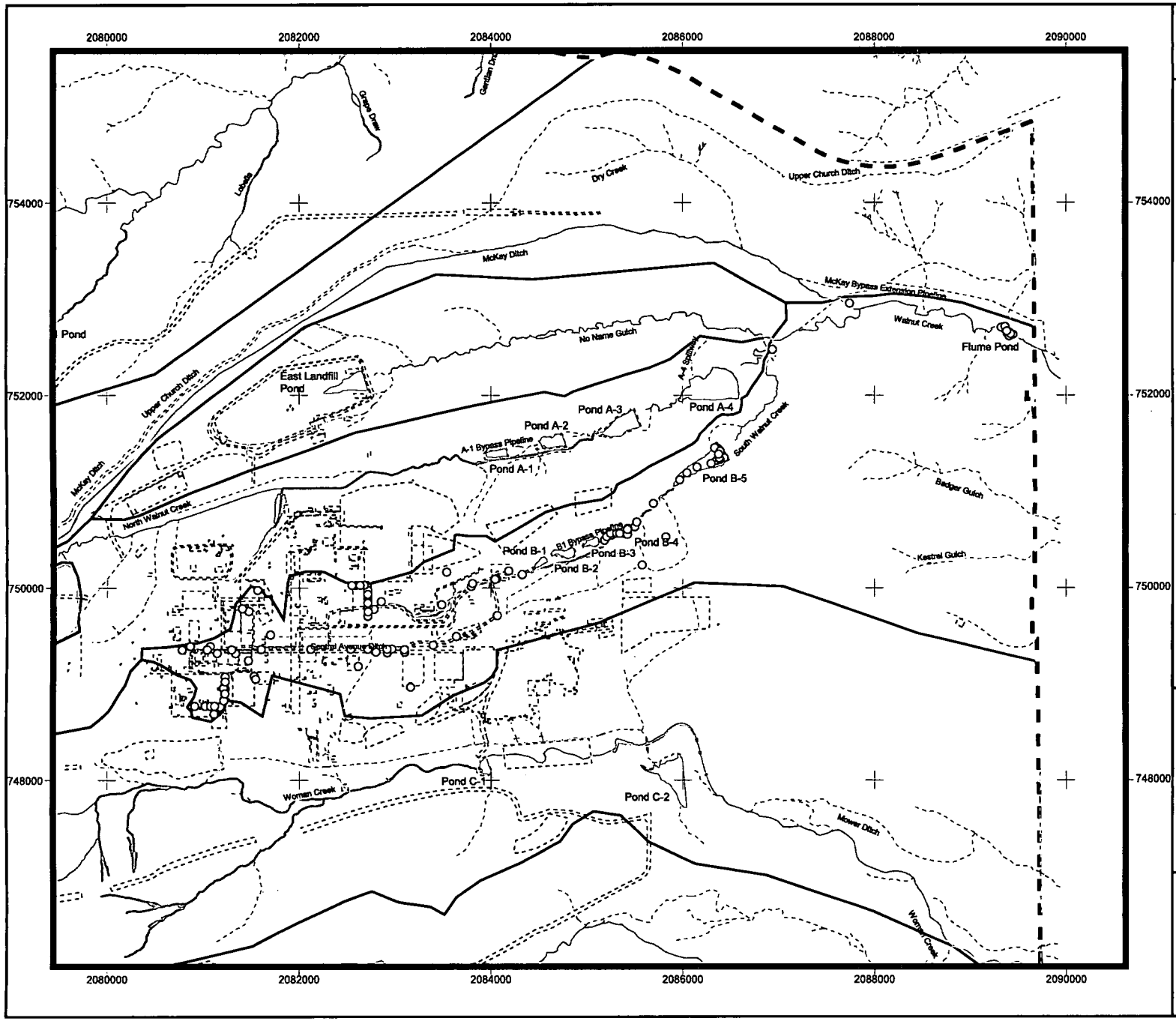

Figure 2.125
South Walnut Creek AEU
Sediment Sampling Locations
for Zinc

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 121 mg/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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Datum: NAD 27

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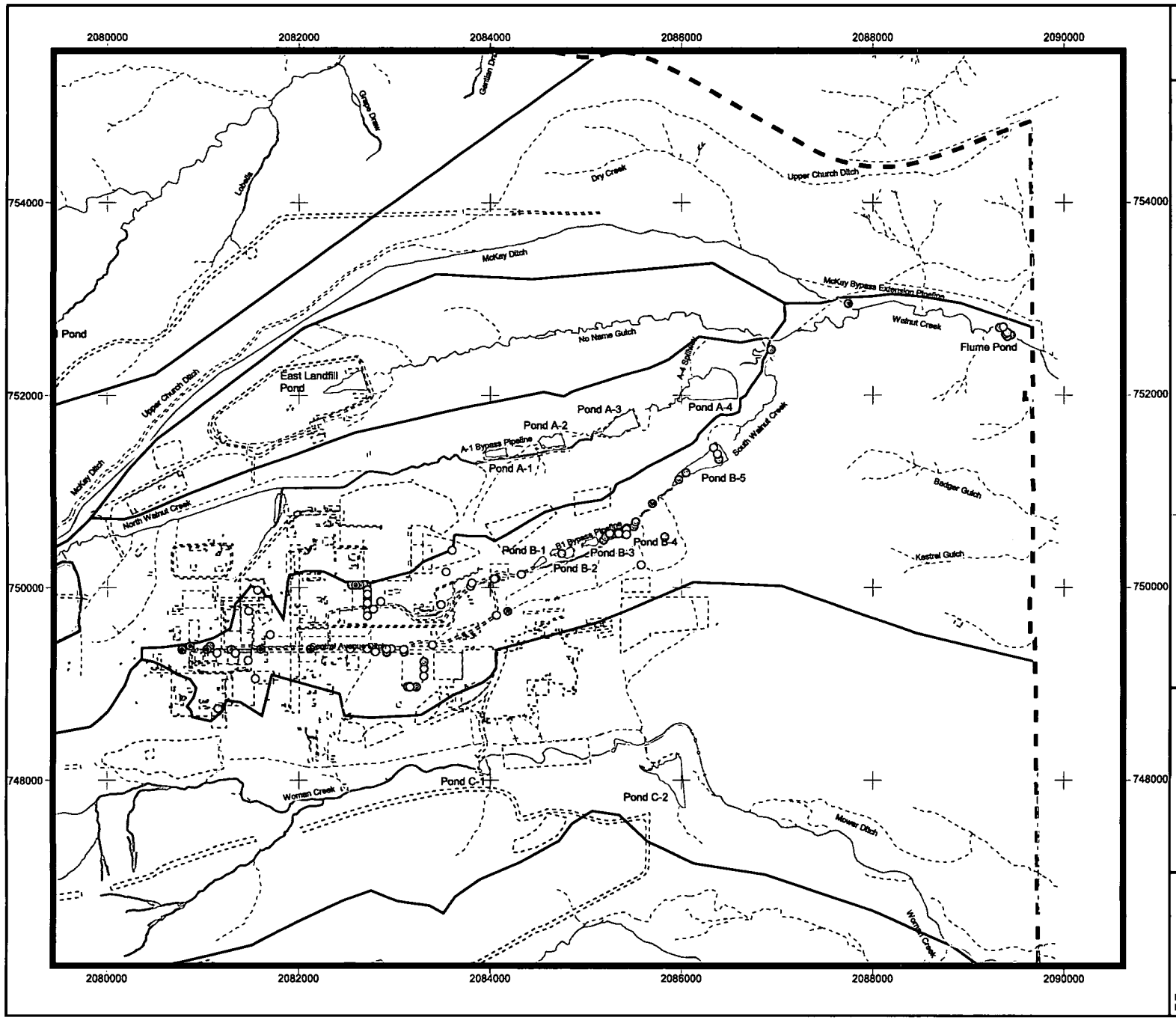

Figure 2.126
South Walnut Creek AEU
Sediment Sampling Locations
for Total PAHs

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 1610 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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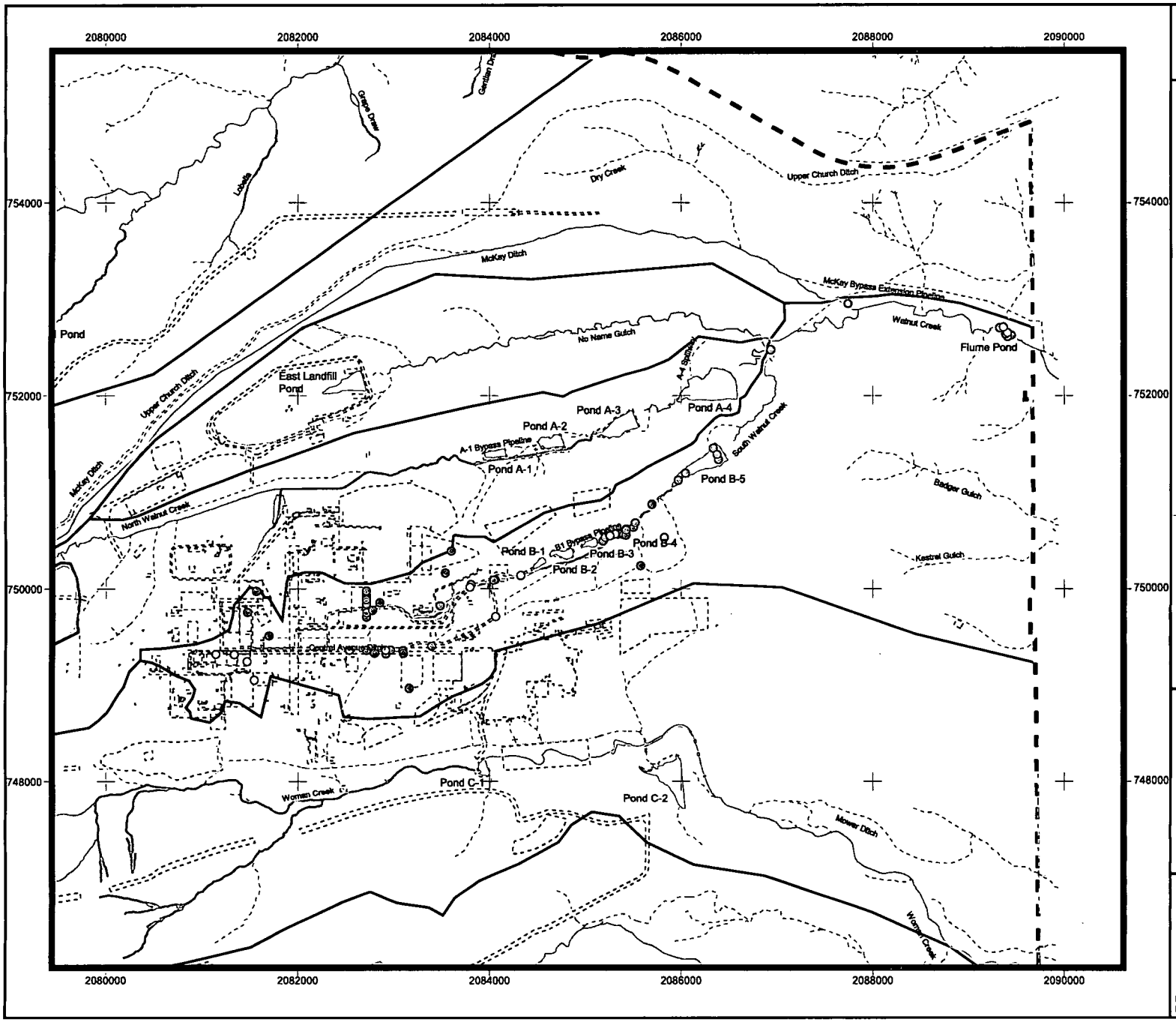

Figure 2.127
South Walnut Creek AEU Sediment Sampling Locations for Acenaphthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 6.71 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

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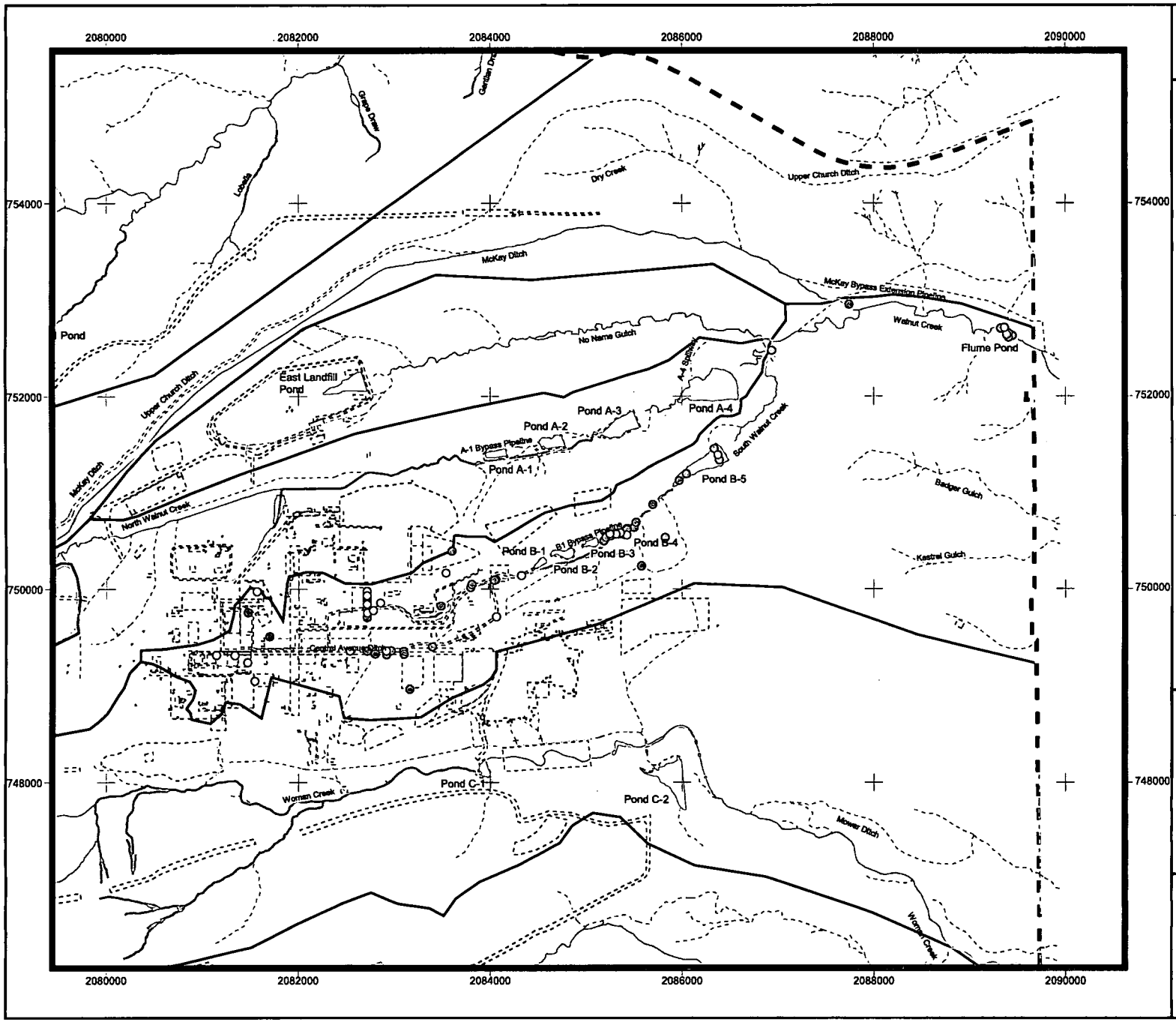

Figure 2.128
South Walnut Creek AEU Sediment Sampling Locations for Anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 57.2 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

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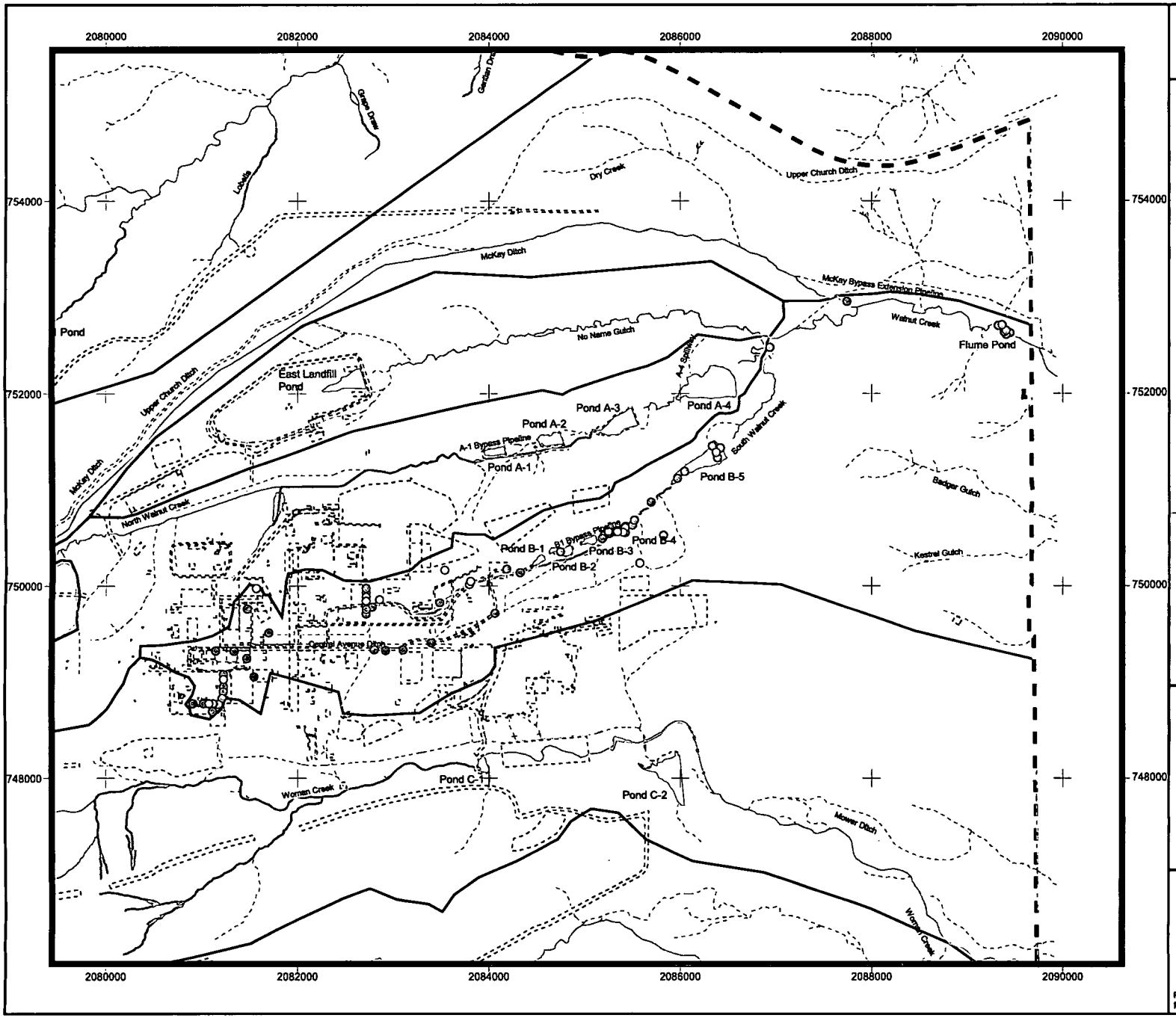

Figure 2.129
South Walnut Creek AEU
Sediment Sampling Locations
for Total PCBs

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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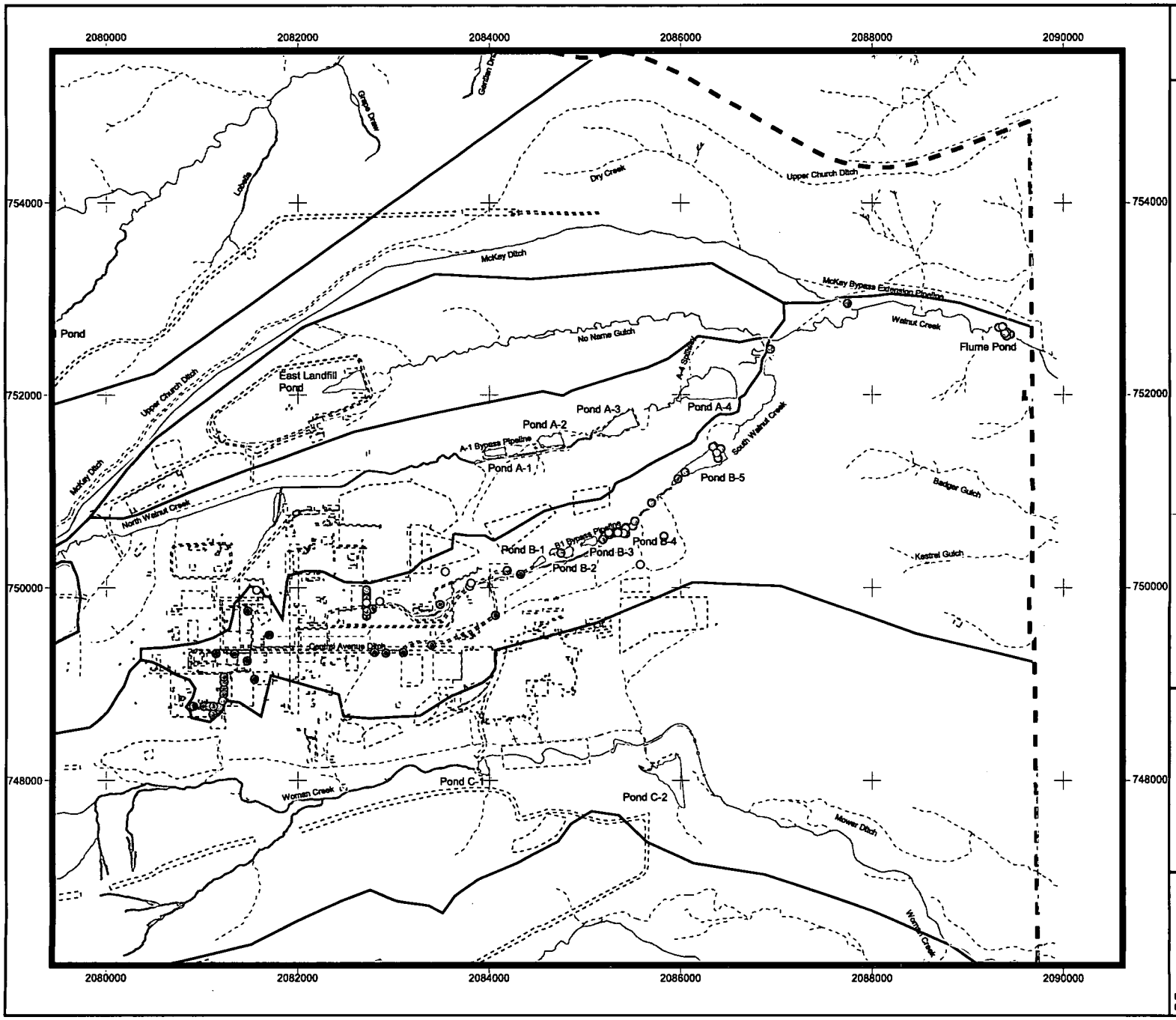

Figure 2.130
South Walnut Creek AEU Sediment Sampling Locations for Aroclor-1254

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24000

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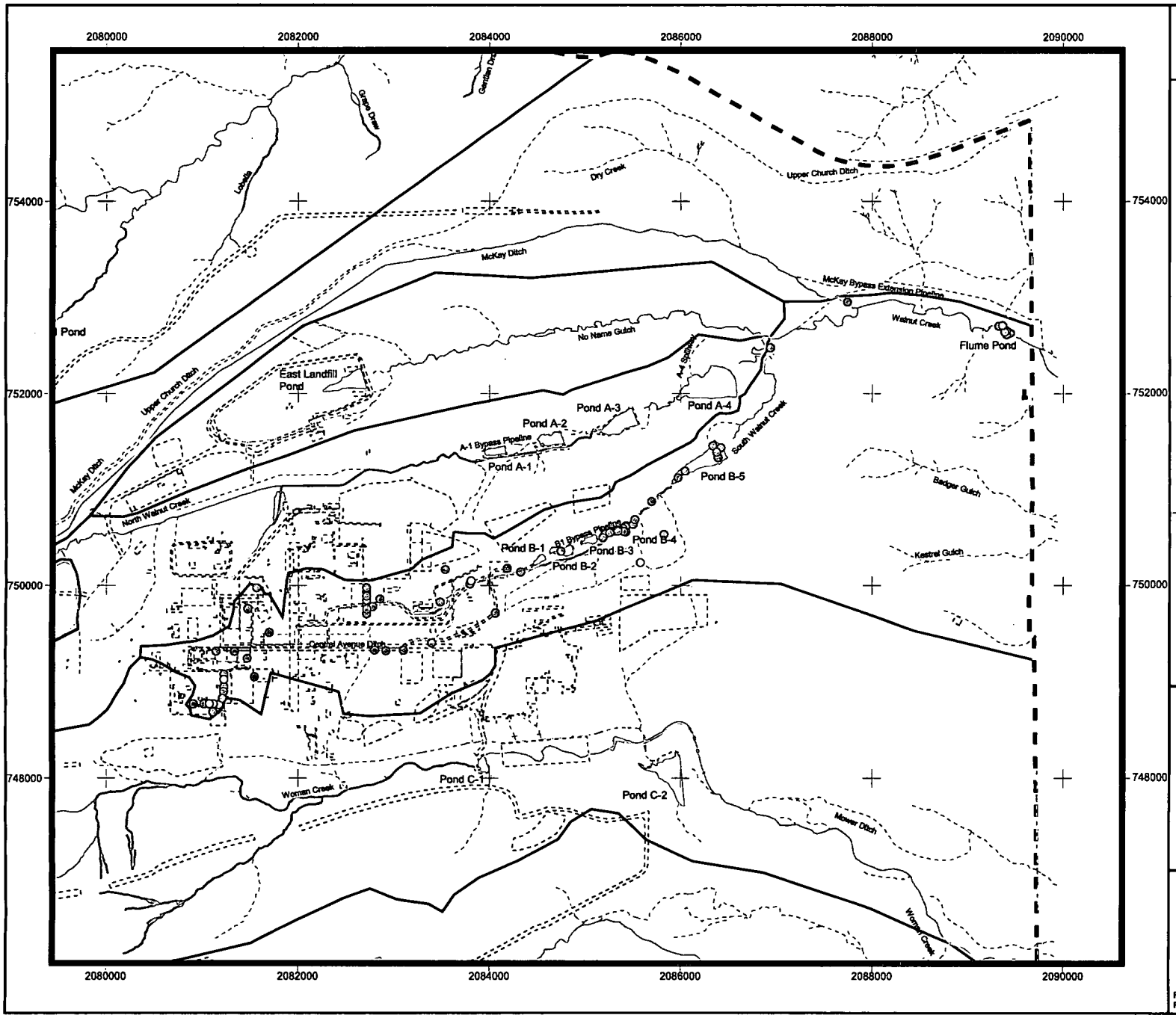

Figure 2.131
South Walnut Creek AEU Sediment Sampling Locations for Aroclor-1260

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

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Scale 1:24000

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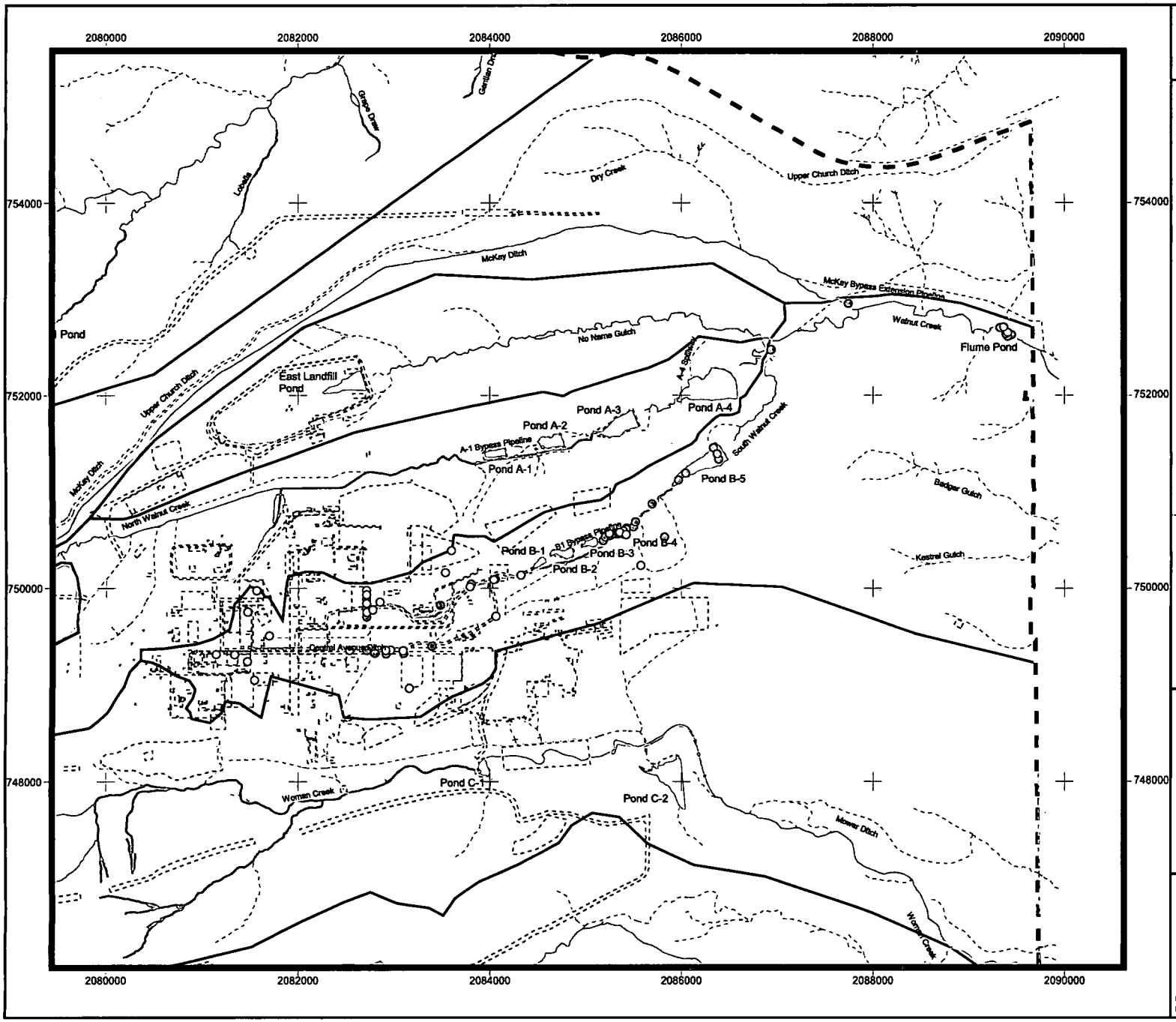

Figure 2.132
South Walnut Creek AEU
Sediment Sampling Locations
for Benzo(a)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 108 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

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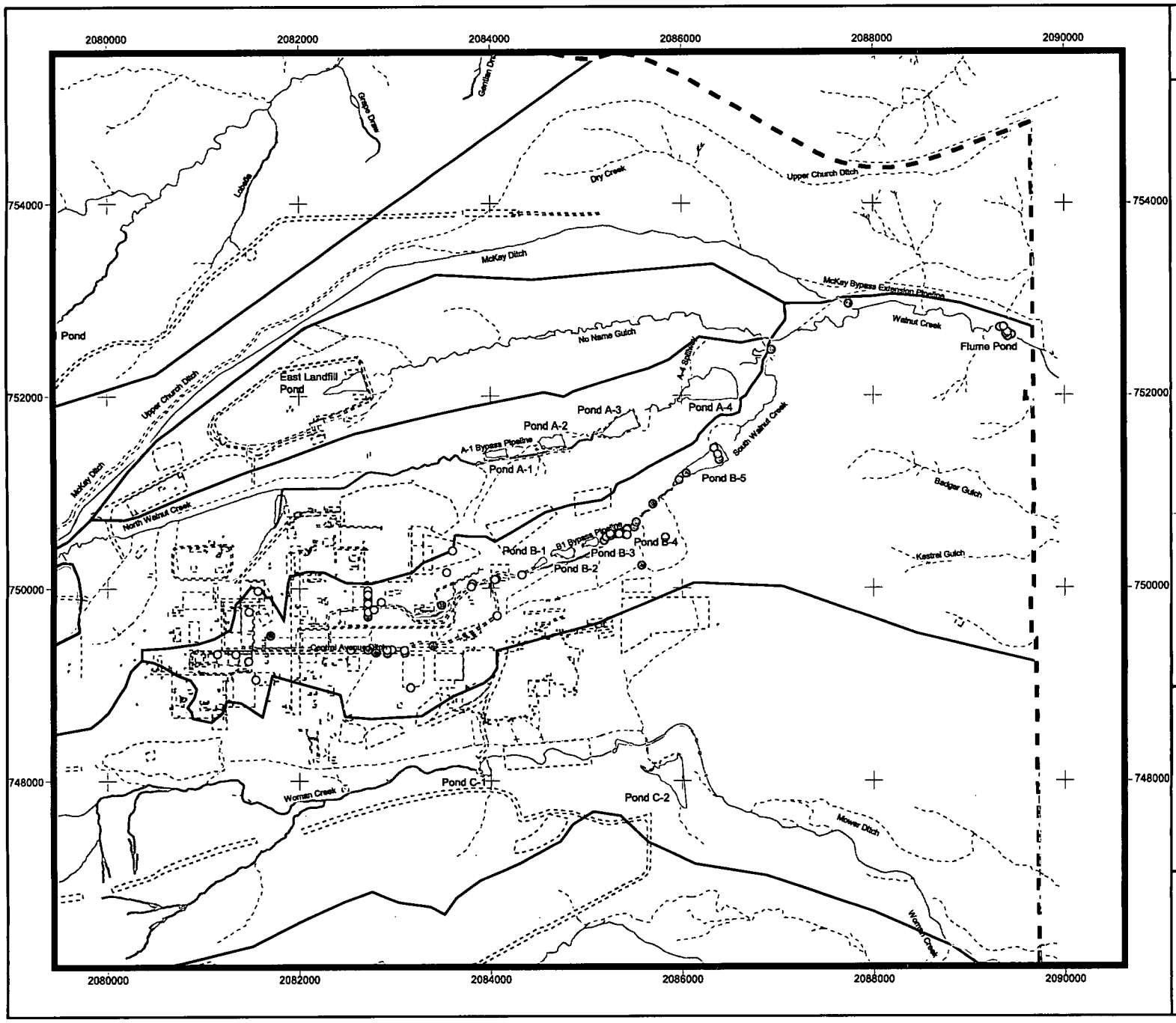

Figure 2.133
South Walnut Creek AEU
Sediment Sampling Locations
for Benzo(a)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 150 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

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330

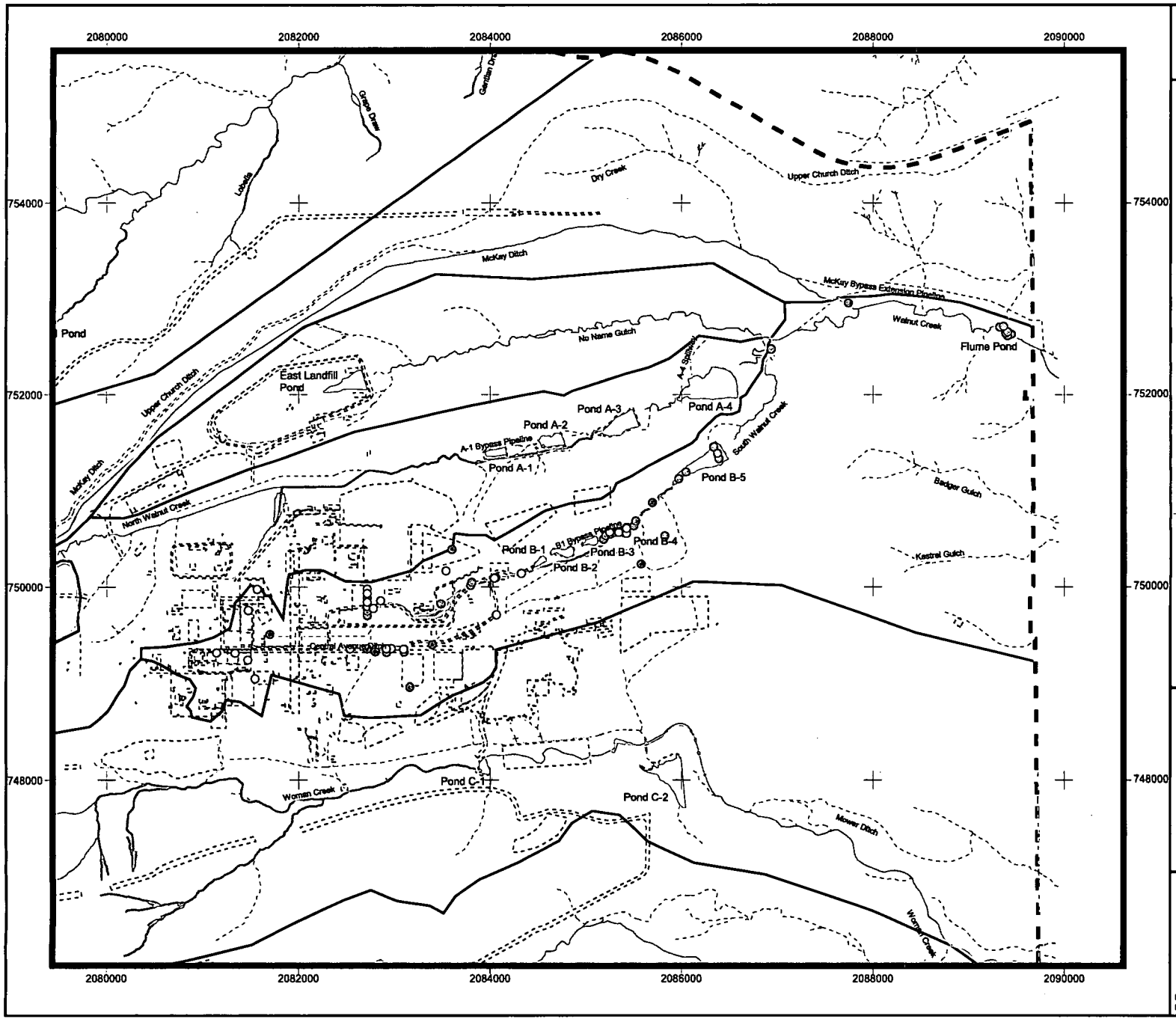

Figure 2.134
South Walnut Creek AEU
Sediment Sampling Locations
for Benzo(g,h,i)perylene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 13 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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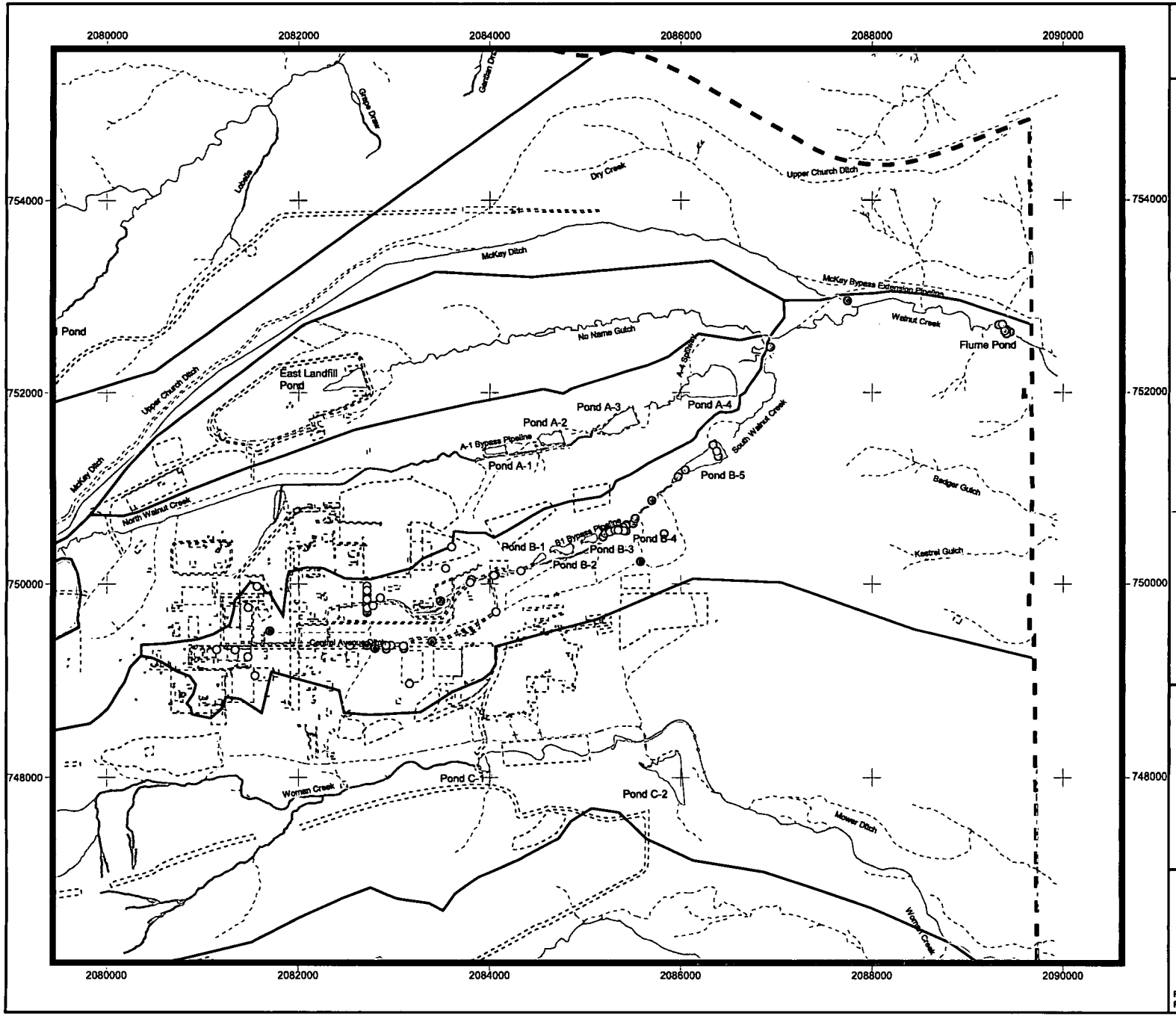

Figure 2.135
South Walnut Creek AEU
Sediment Sampling Locations
for Benzo(k)fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 240 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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332

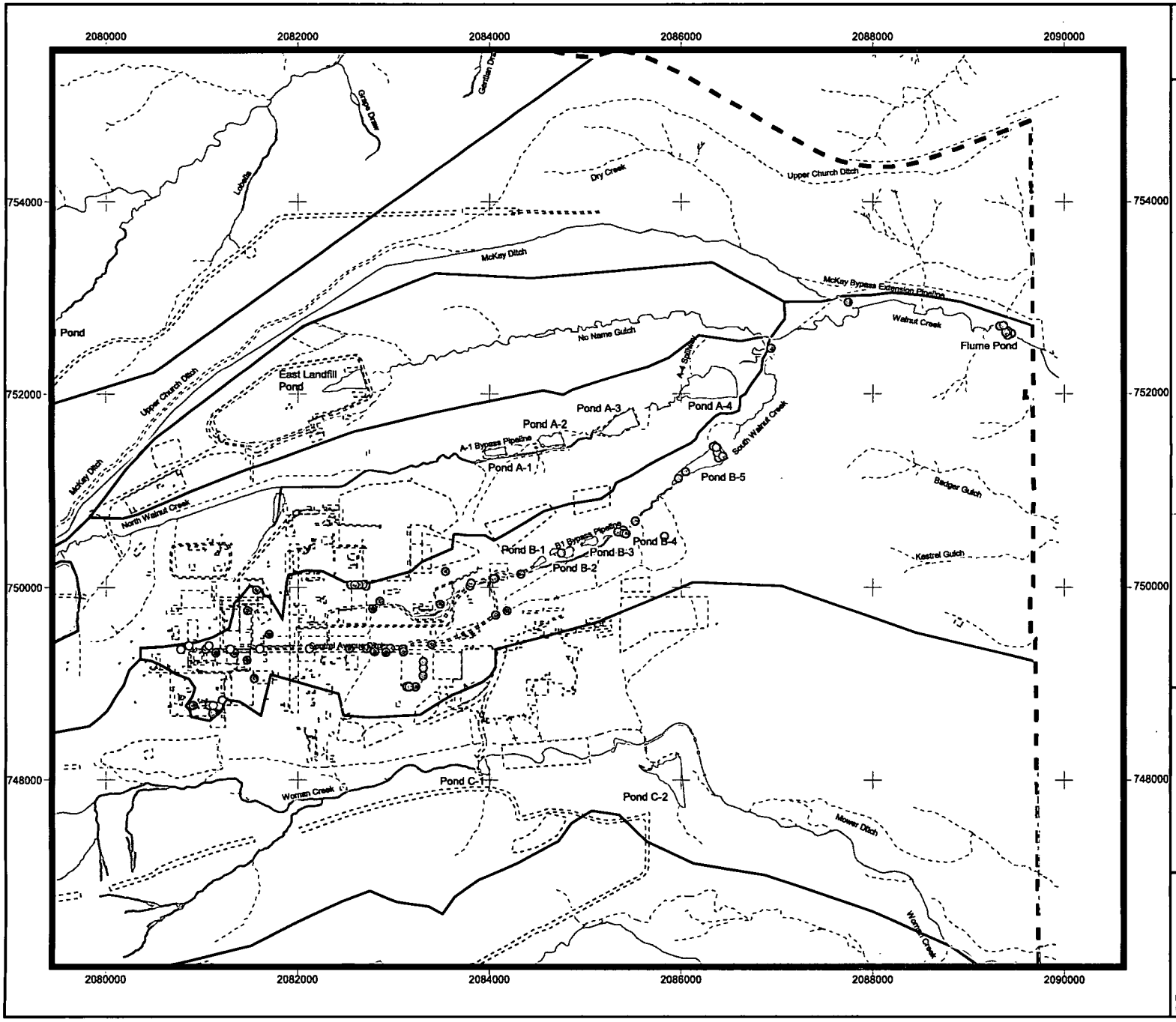

Figure 2.136
South Walnut Creek AEU
Sediment Sampling Locations
for Bromomethane

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 3.43 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
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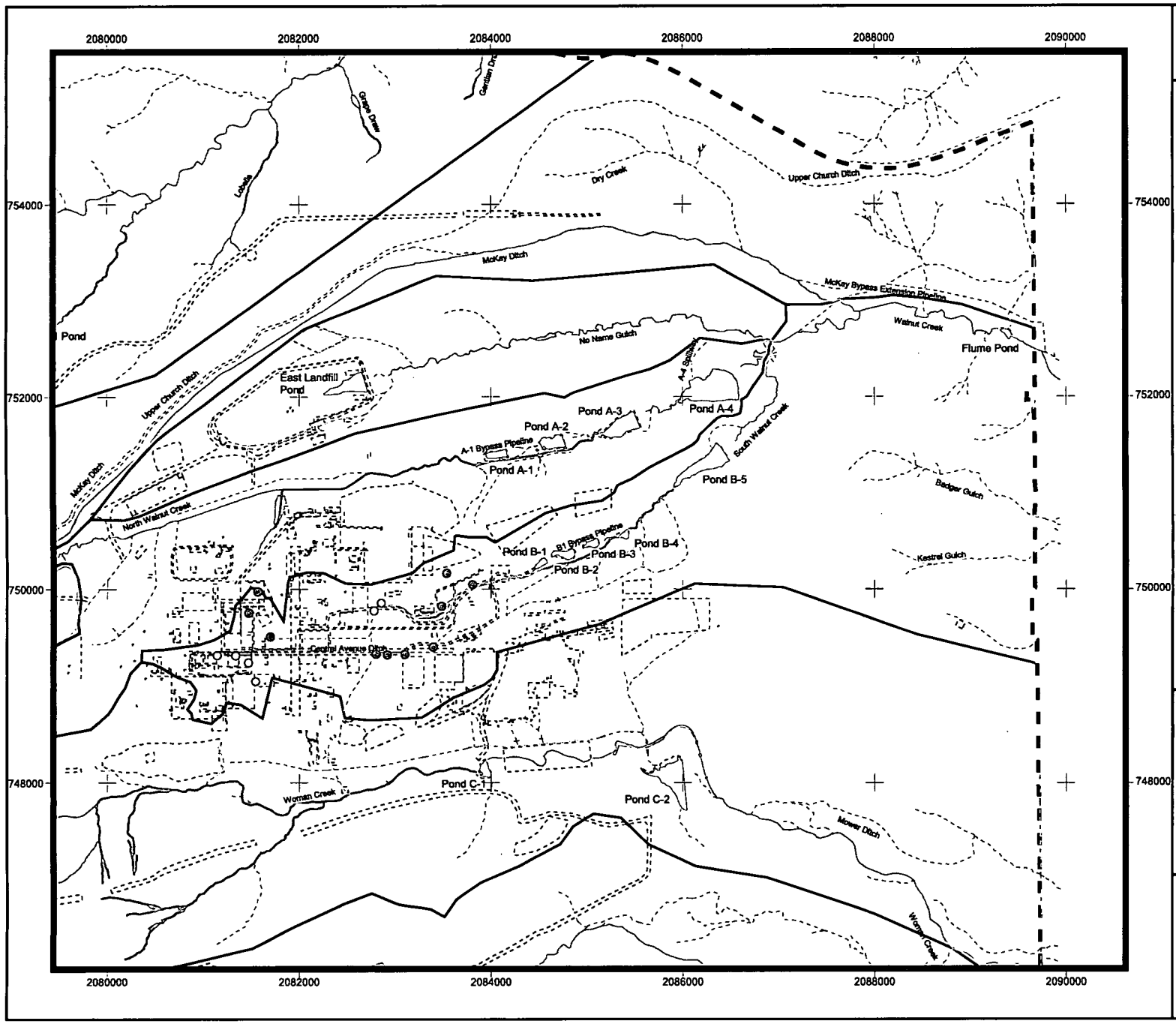

Figure 2.137
South Walnut Creek AEU Sediment Sampling Locations for Carbazole

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 25.2 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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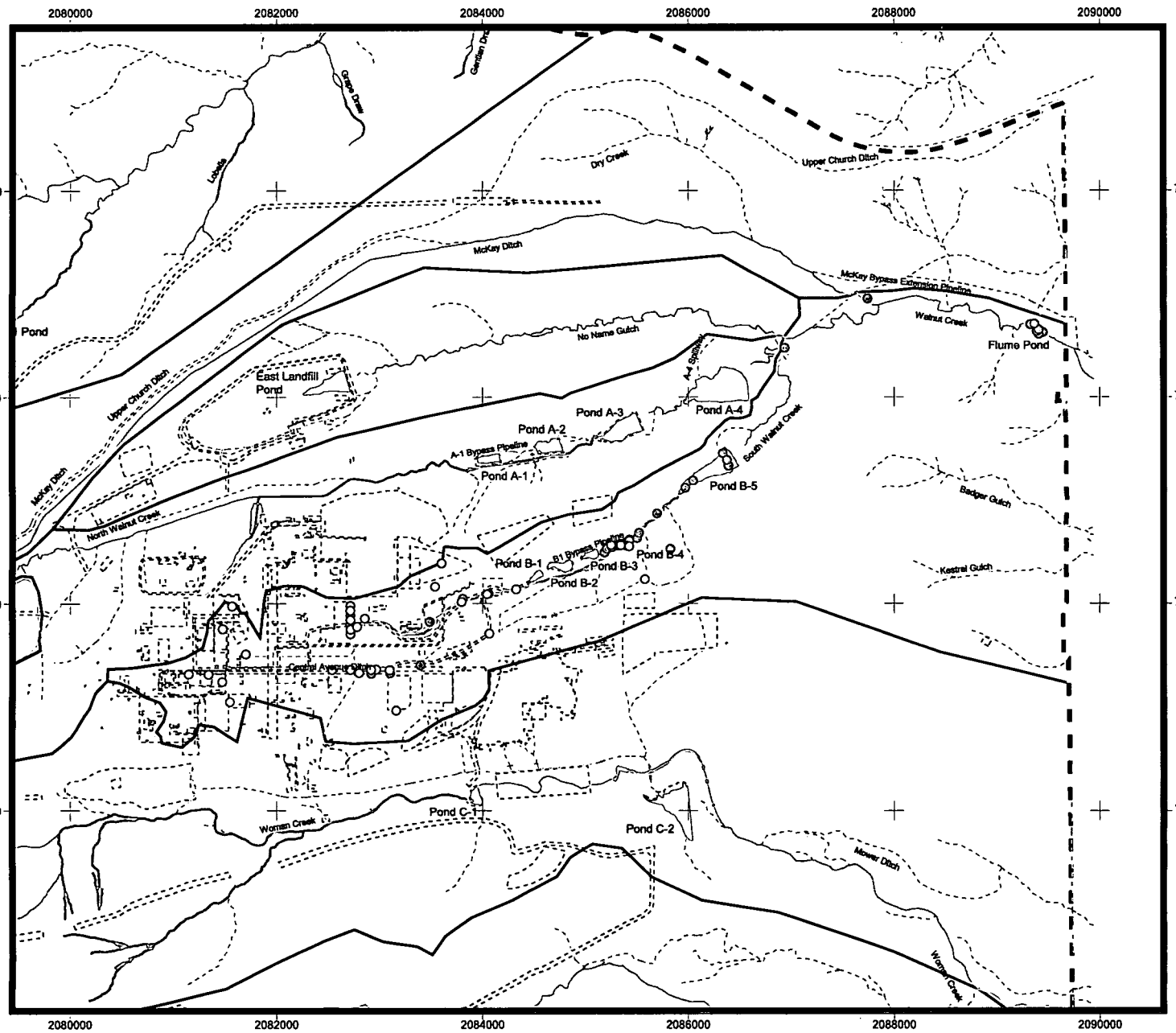

Figure 2.138
South Walnut Creek AEU
Sediment Sampling Locations
for Chrysene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 166 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
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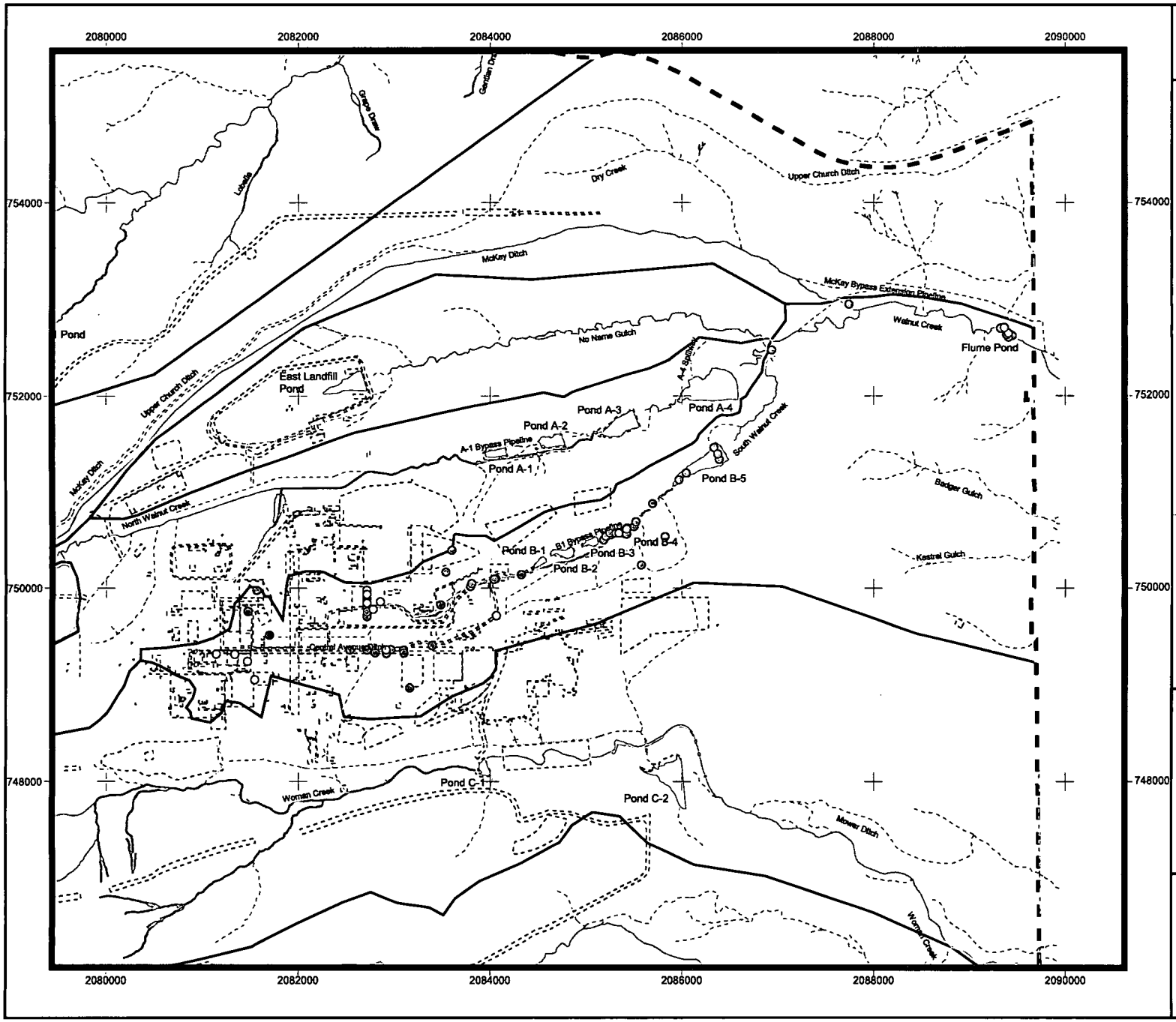

Figure 2.139
South Walnut Creek AEU Sediment Sampling Locations for Dibenz(a,h)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 33 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

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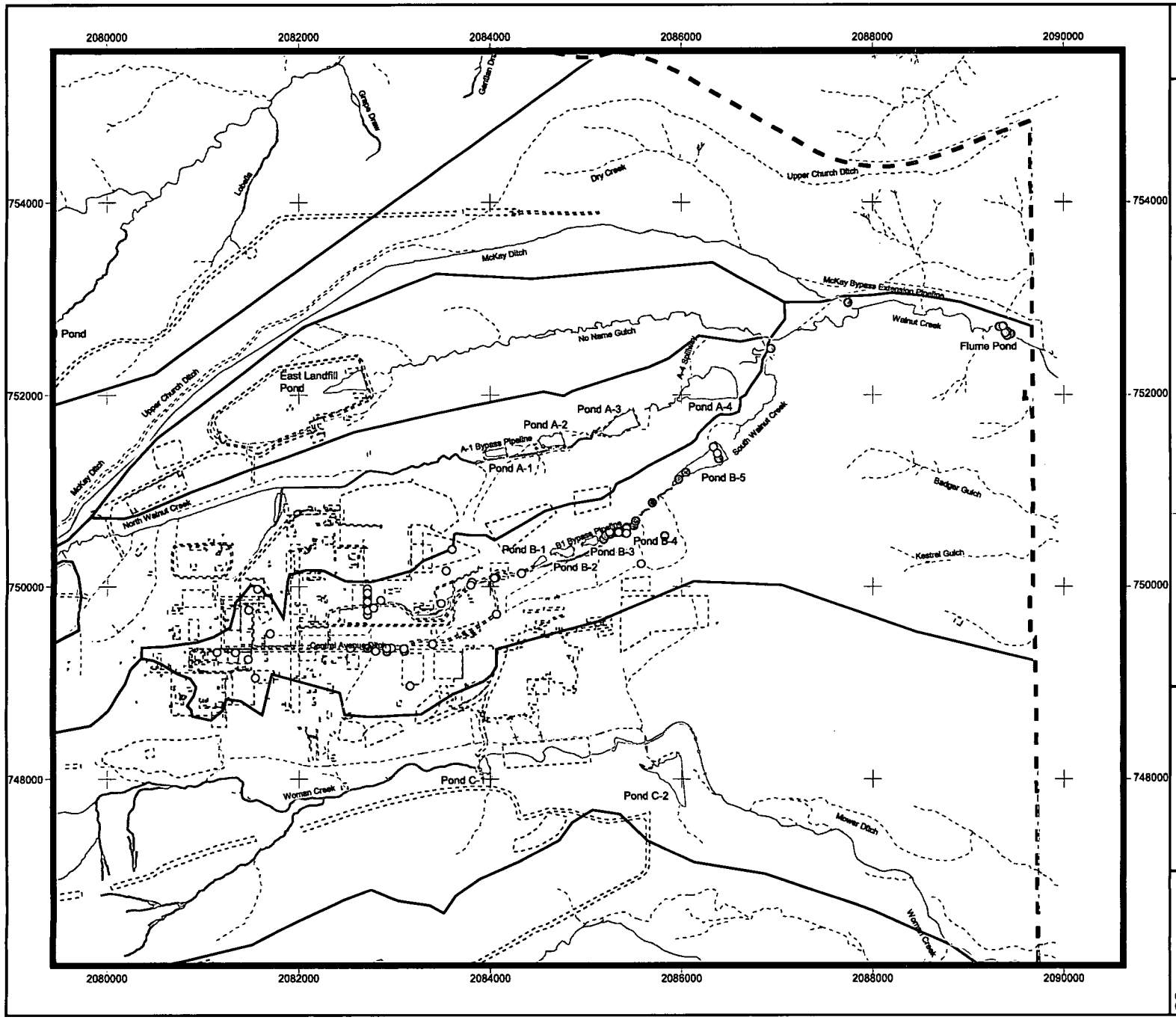

Figure 2.140
South Walnut Creek AEU Sediment Sampling Locations for Fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 423 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
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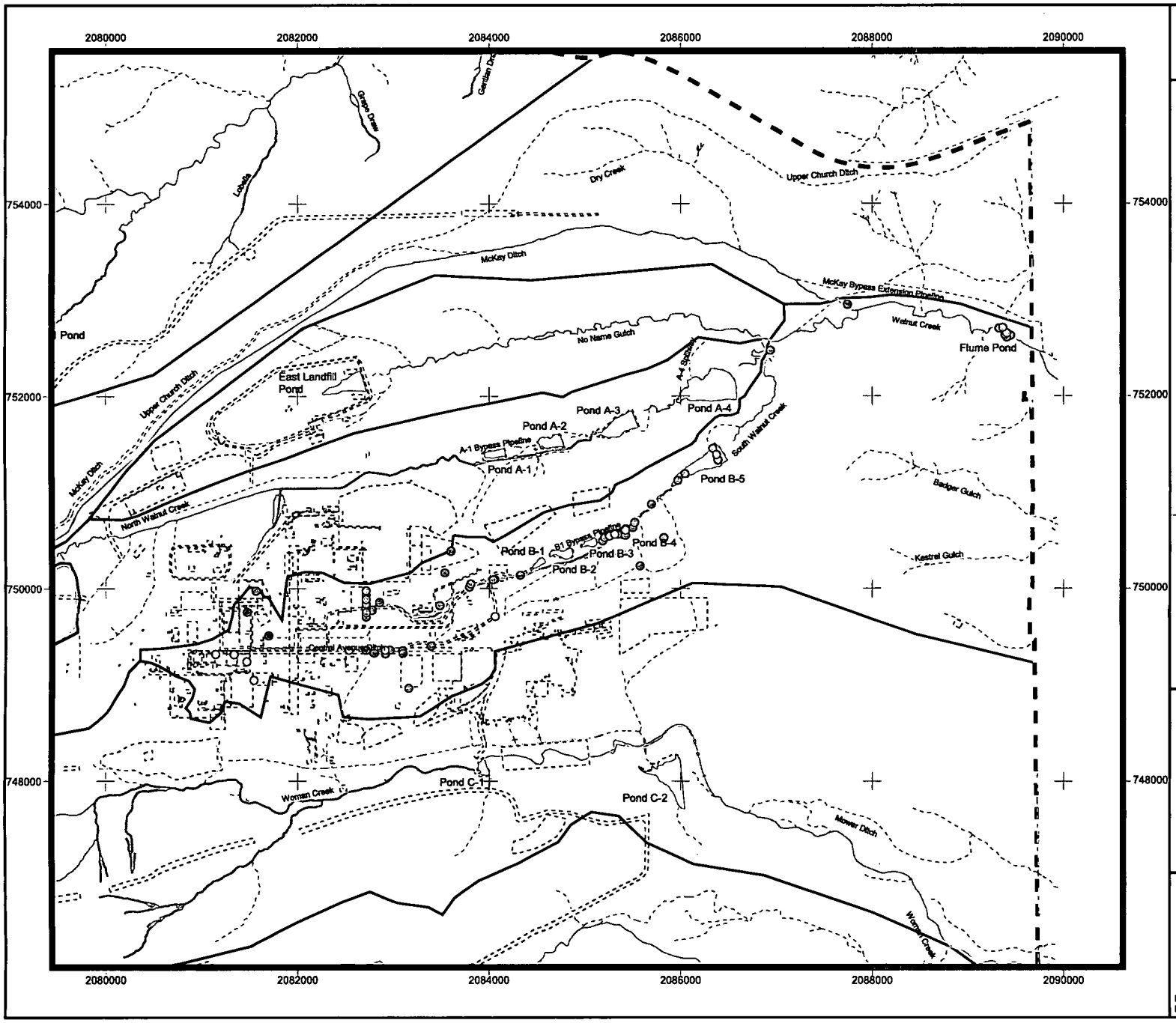

Figure 2.141
South Walnut Creek AEU
Sediment Sampling Locations
for Fluorene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 77.4 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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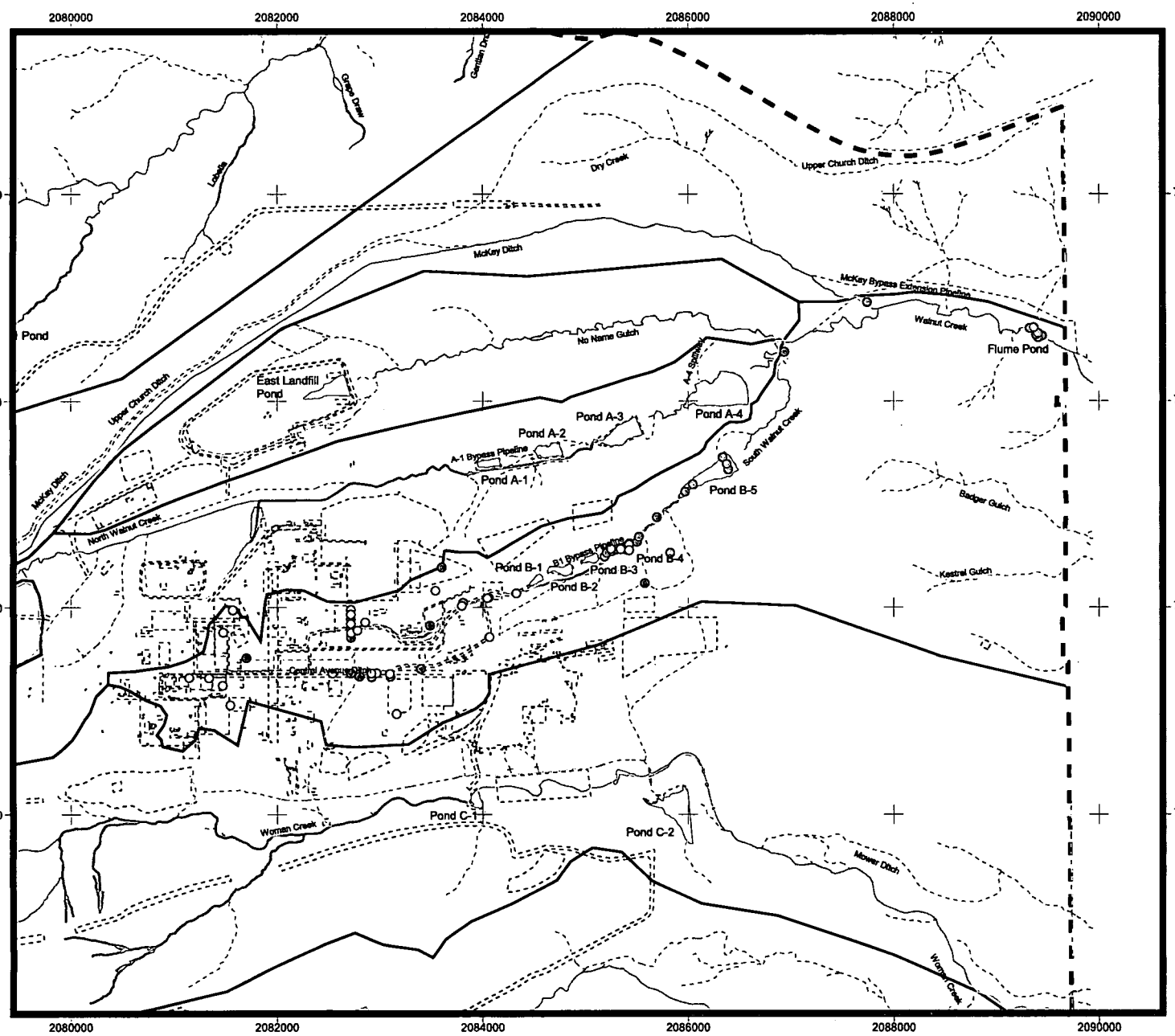

Figure 2.142
South Walnut Creek AEU
Sediment Sampling Locations
for Indeno(1,2,3-cd)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 17 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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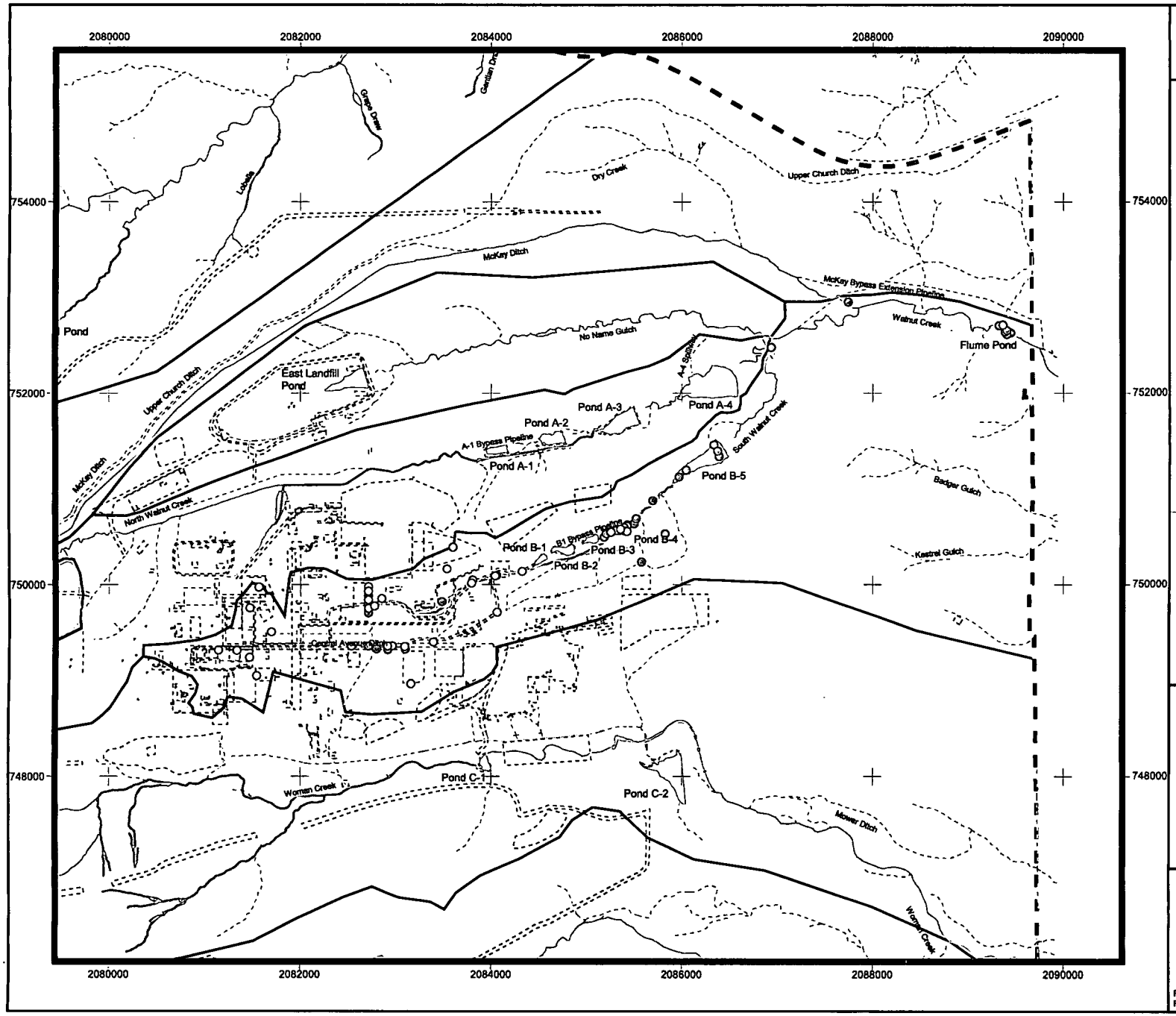

Figure 2.143
South Walnut Creek AEU
Sediment Sampling Locations
for Phenanthrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 204 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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340

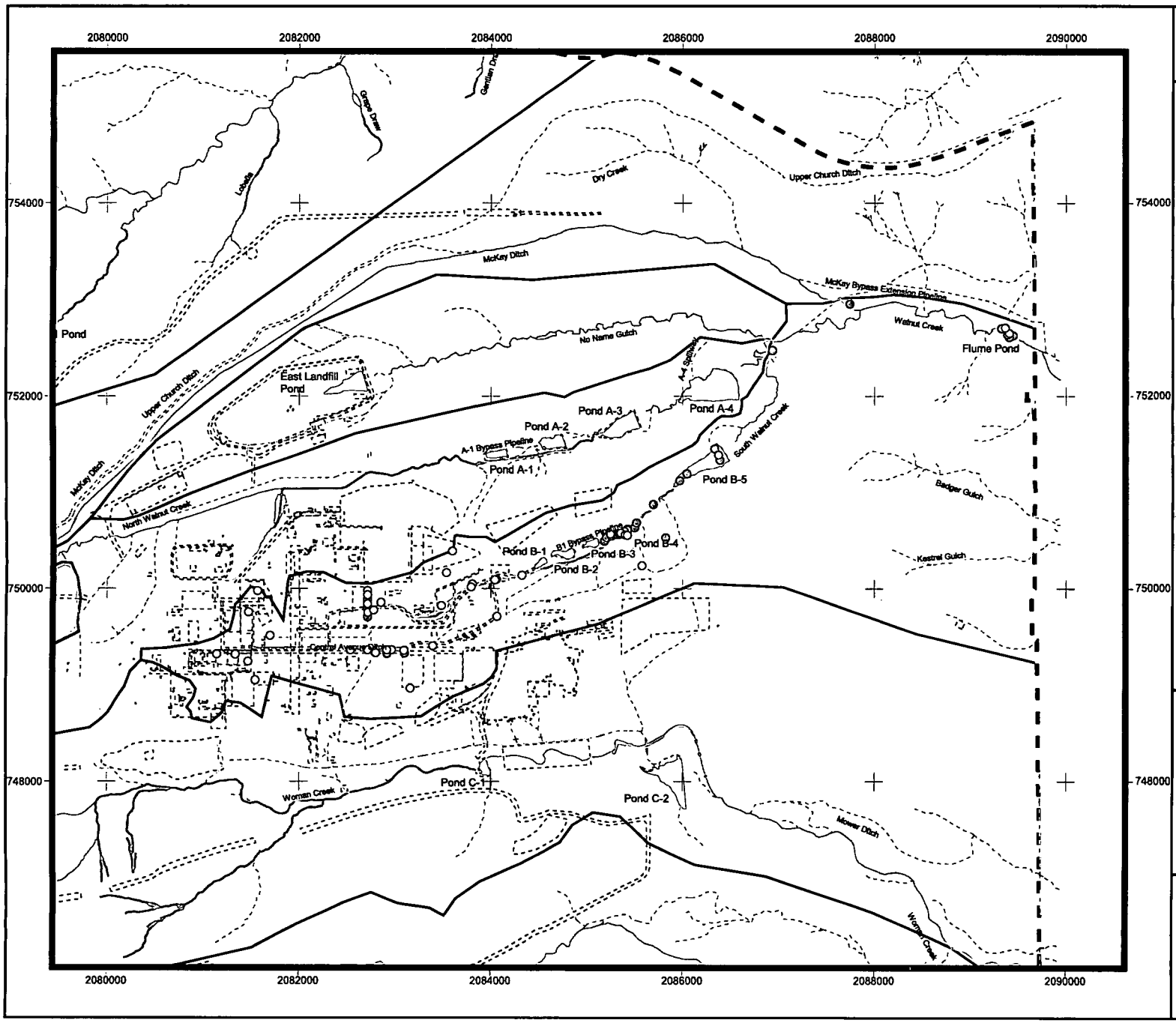

Figure 2.144
South Walnut Creek AEU Sediment Sampling Locations for Pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 195 ug/kg

Standard Map Features
- South Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1000 2000 Feet

Scale 1:24000

State Plane Coordinate Projection
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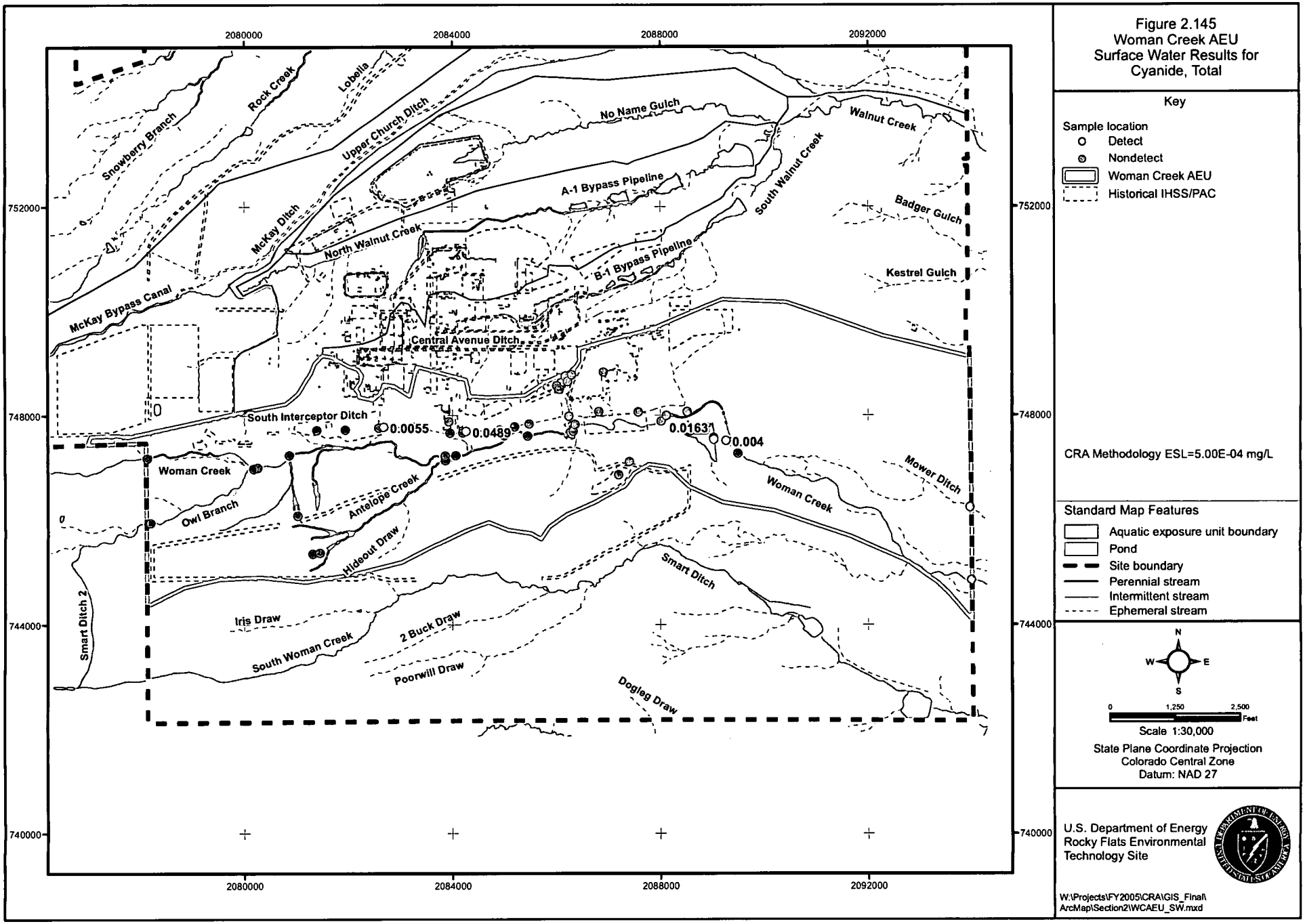

Figure 2.145
Woman Creek AEU
Surface Water Results for
Cyanide, Total

342

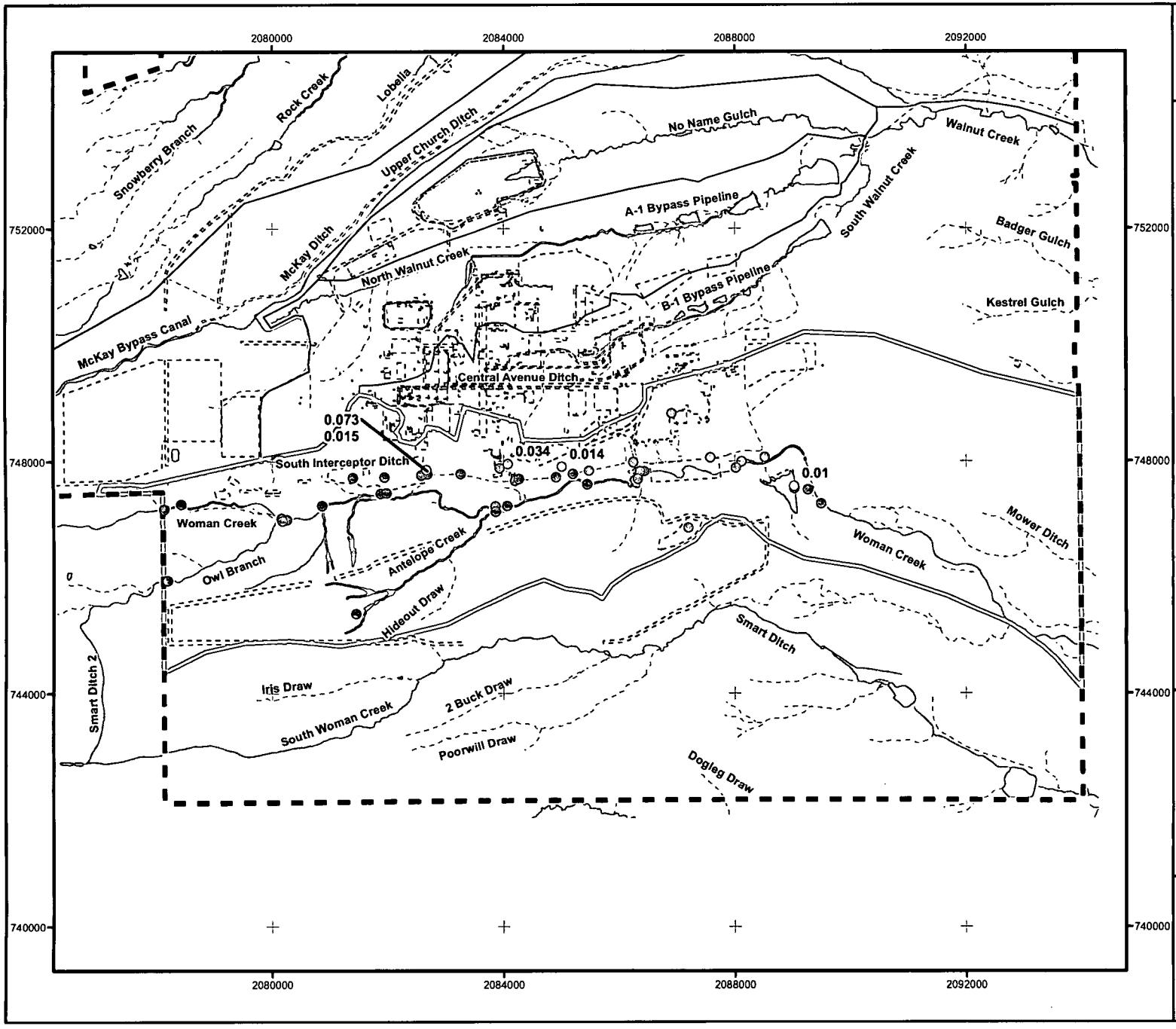

Figure 2.146
Woman Creek AEU
Surface Water Results for
4,4-DDT

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=1.00E-03 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,250 2,500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
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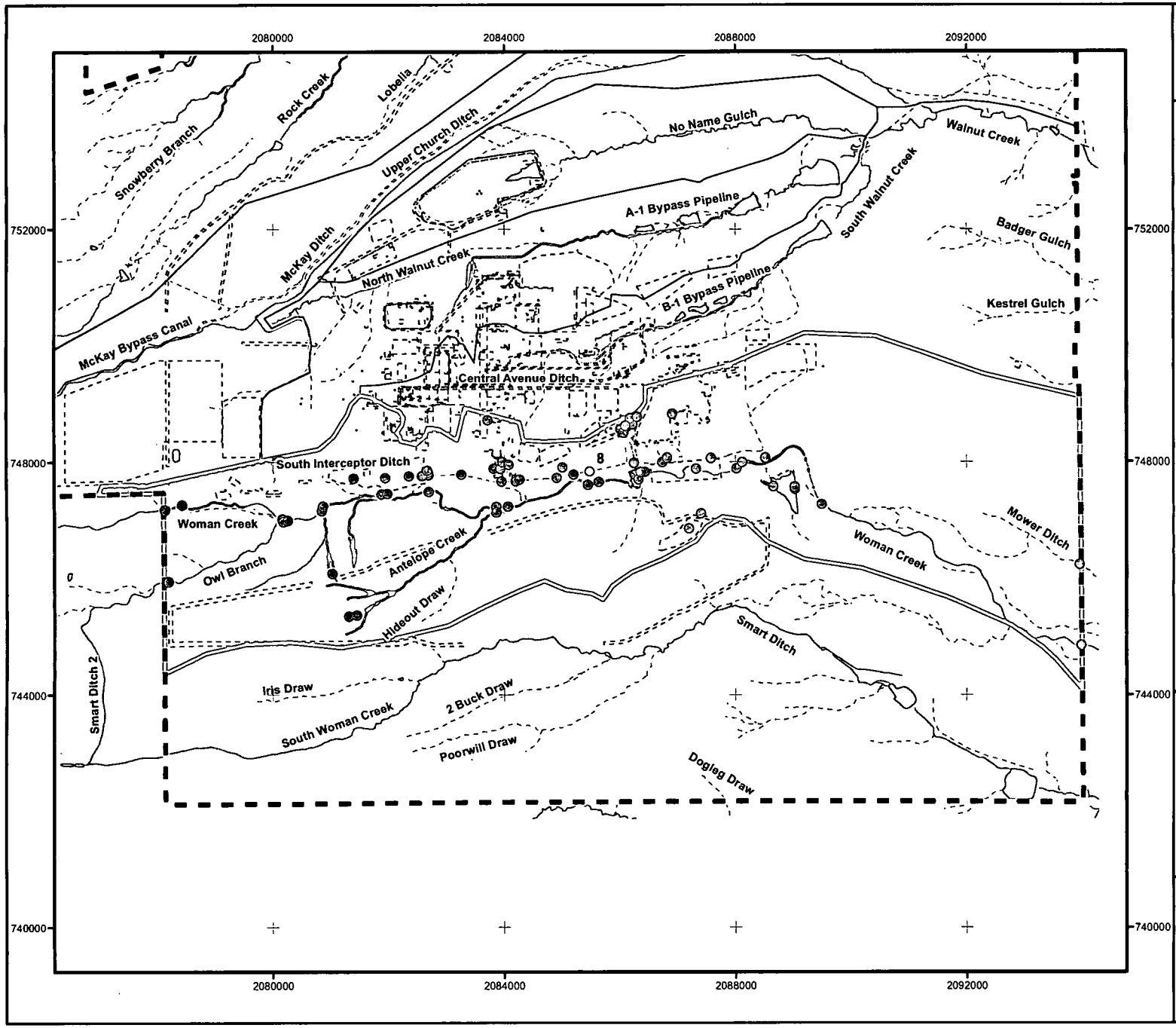

Figure 2.147
Woman Creek AEU
Surface Water Results for
Carbon Disulfide

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=9.20E-01 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,250 2,500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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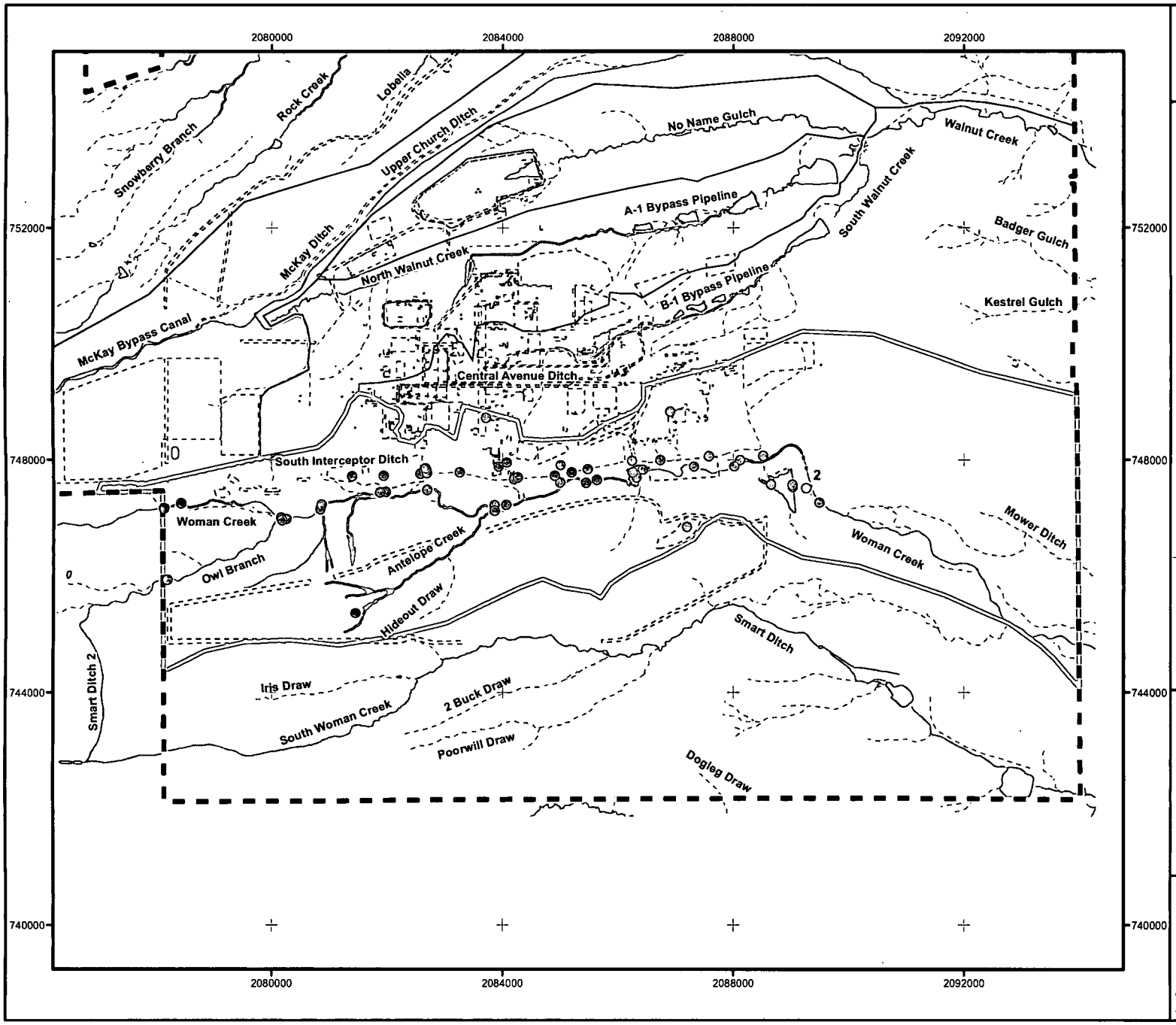

Figure 2.148
Woman Creek AEU
Surface Water Results for
Pyrene

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL=2.50E-02 ug/L

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,250 2,500 Feet

Scale 1:30,000

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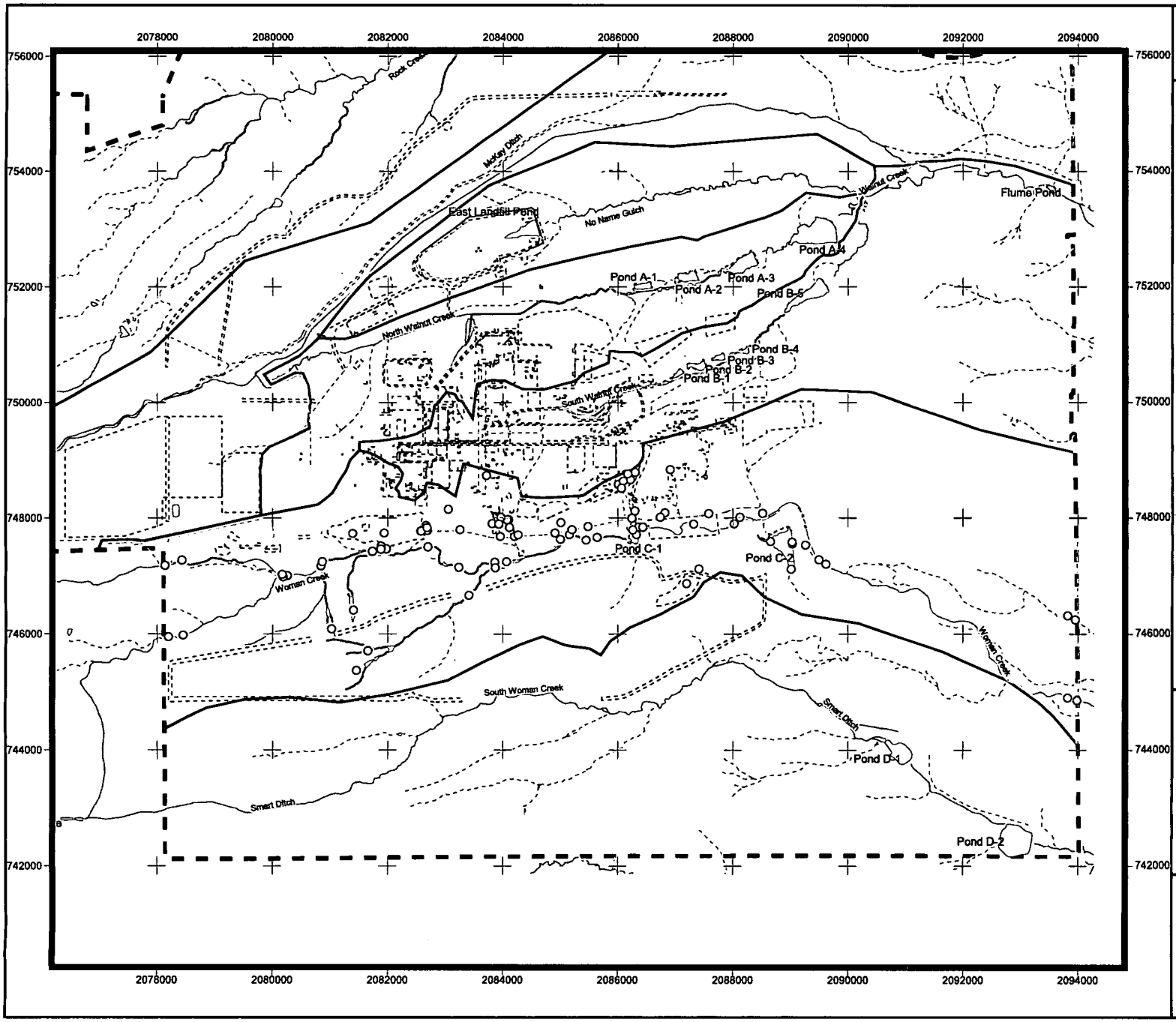

Figure 2.149
Woman Creek AEU
Surface Water Sampling Locations for Barium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.438 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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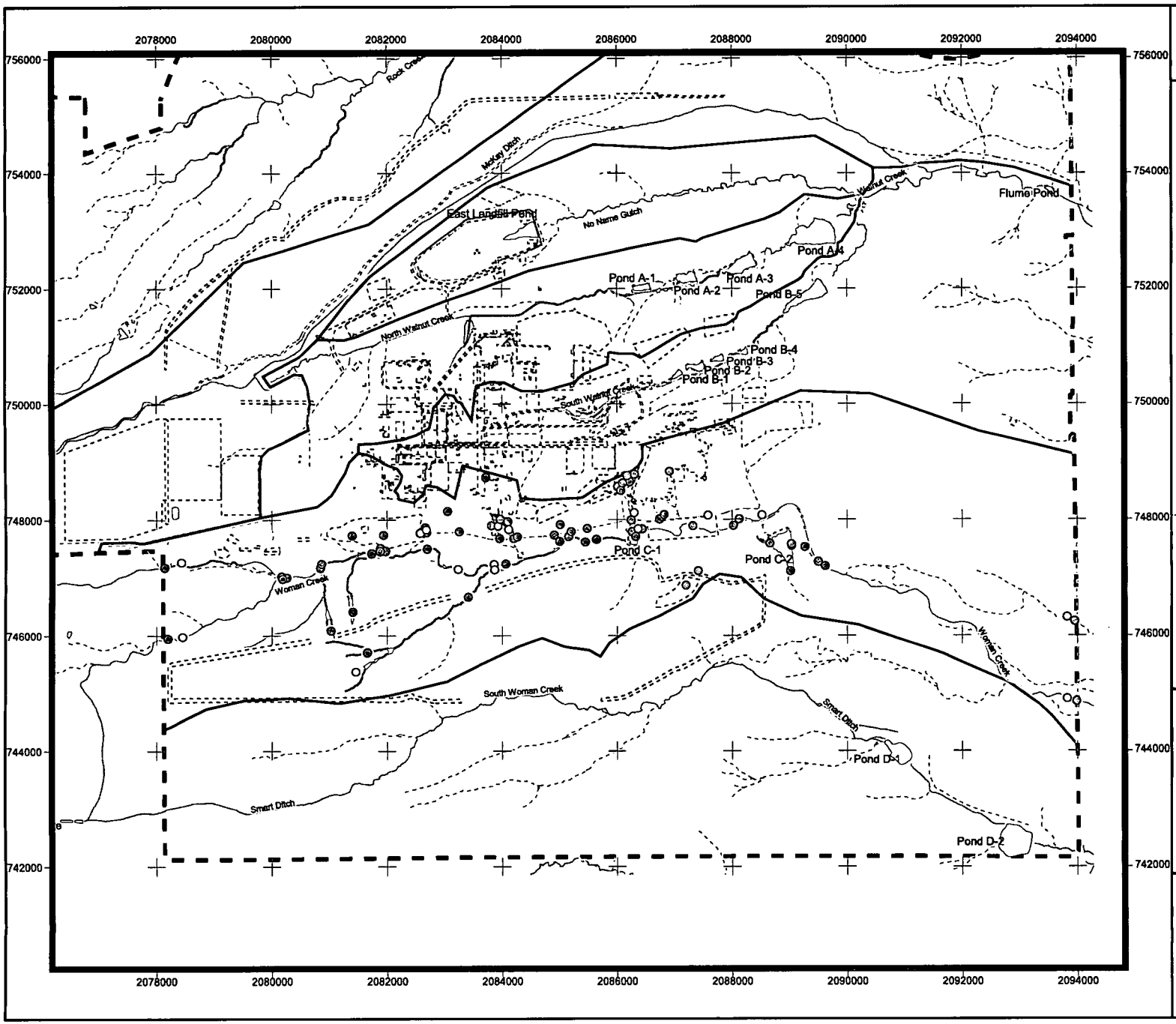

Figure 2.150
Woman Creek AEU
Surface Water Sampling Locations
for Beryllium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.0024 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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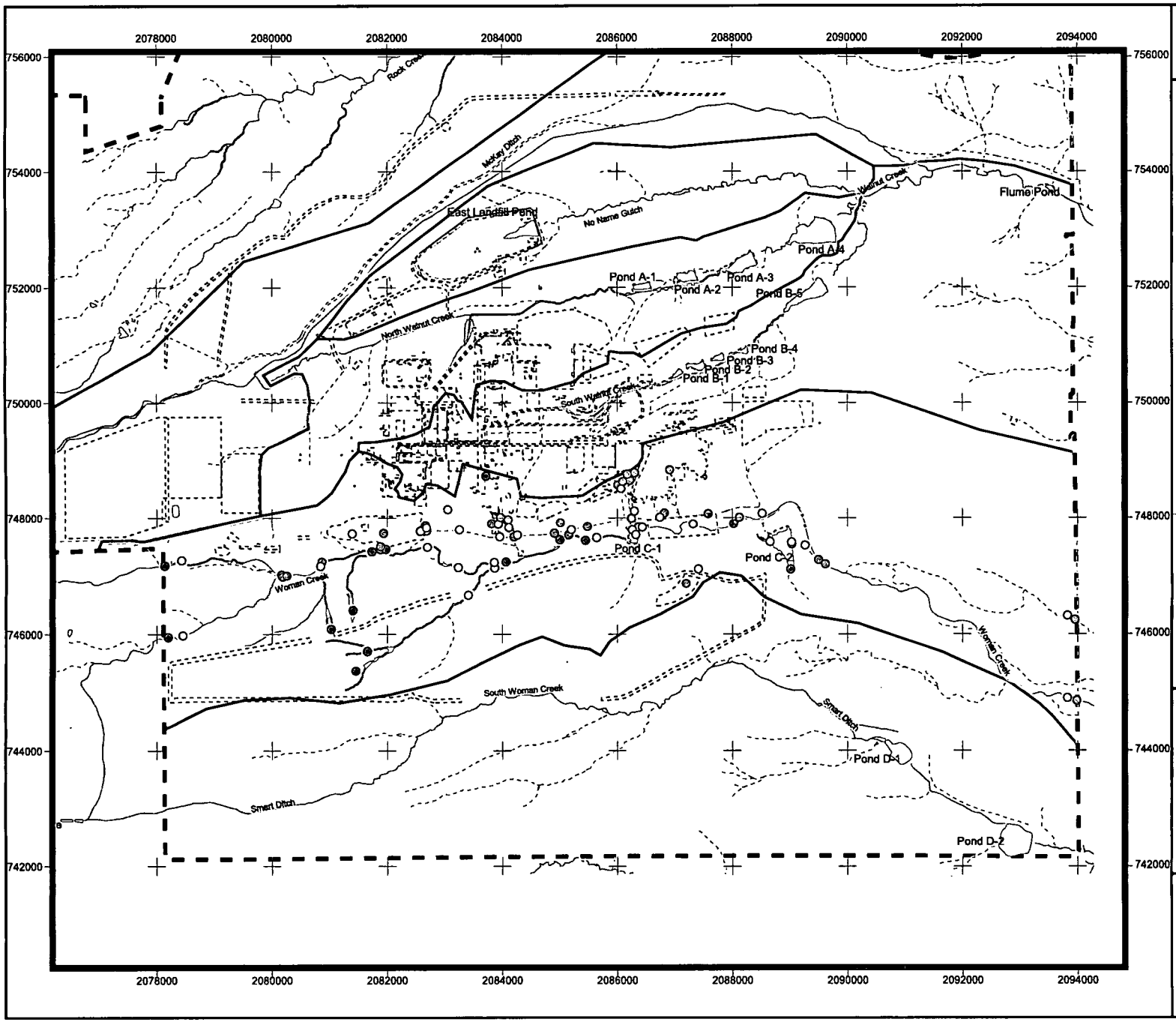

Figure 2.151
Woman Creek AEU
Surface Water Sampling Locations
for Cobalt (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.1 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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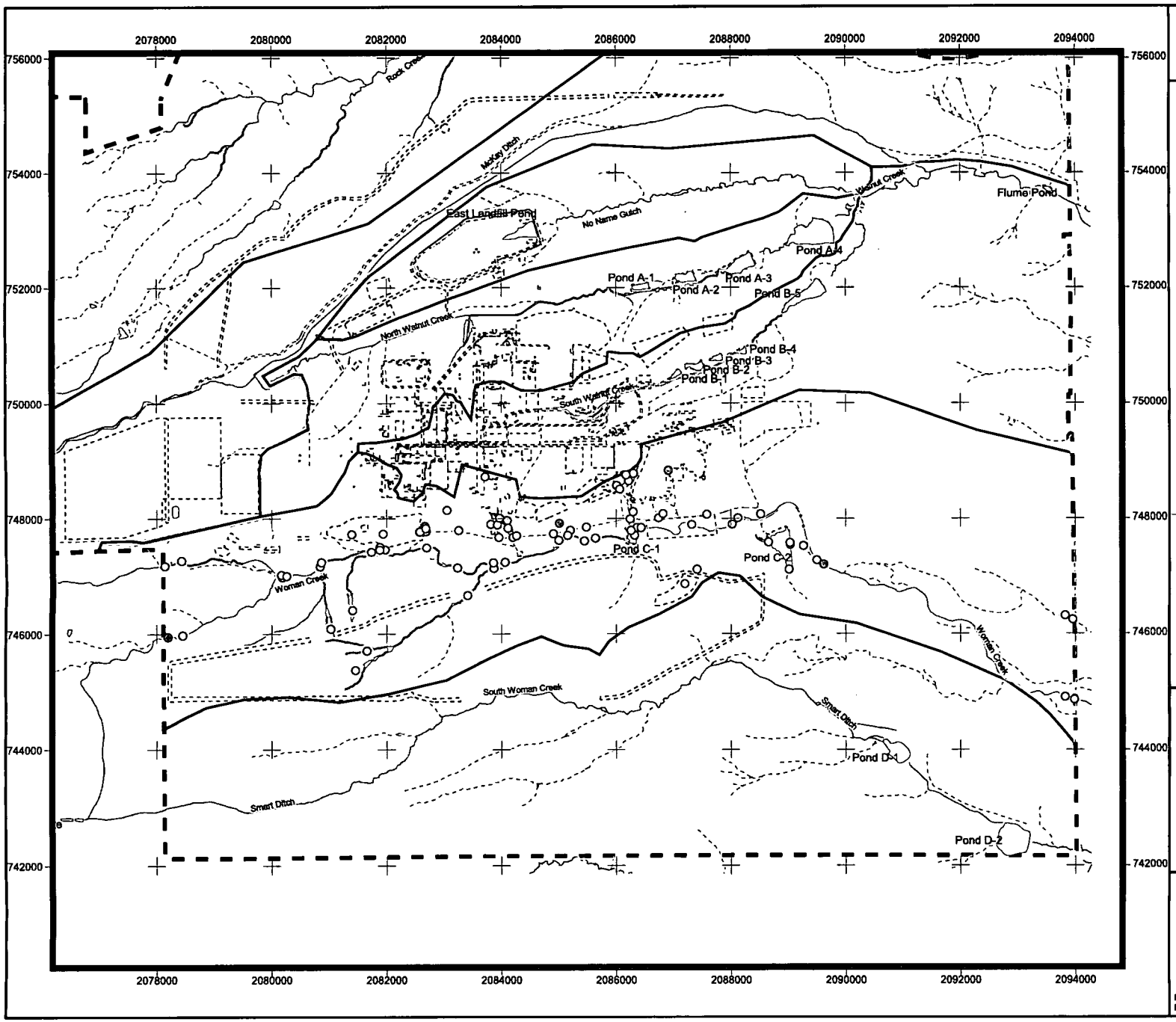

Figure 2.152
Woman Creek AEU
Surface Water Sampling Locations
for Lithium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.096 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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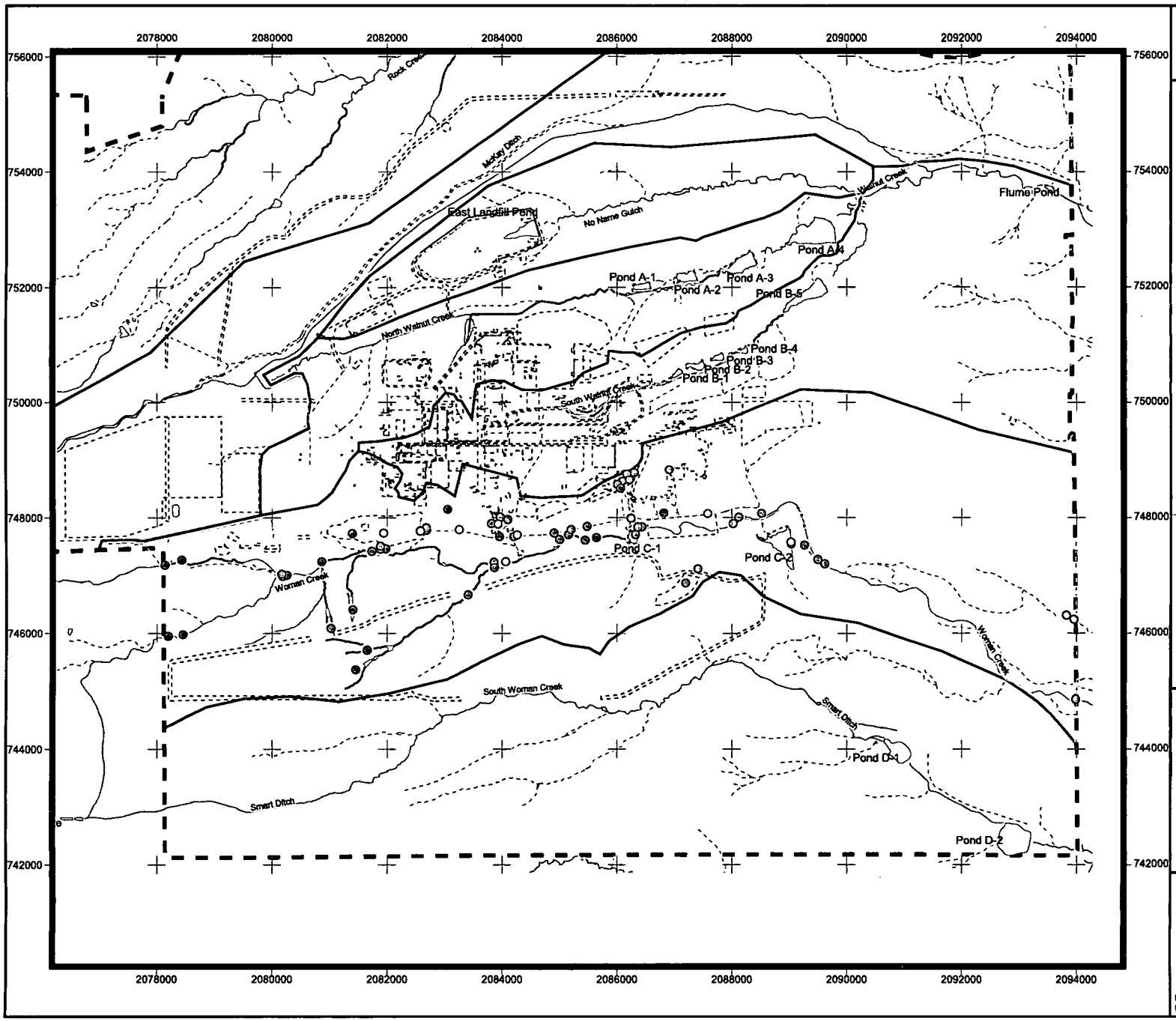

Figure 2.153
Woman Creek AEU
Surface Water Sampling Locations for Mercury (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.00077 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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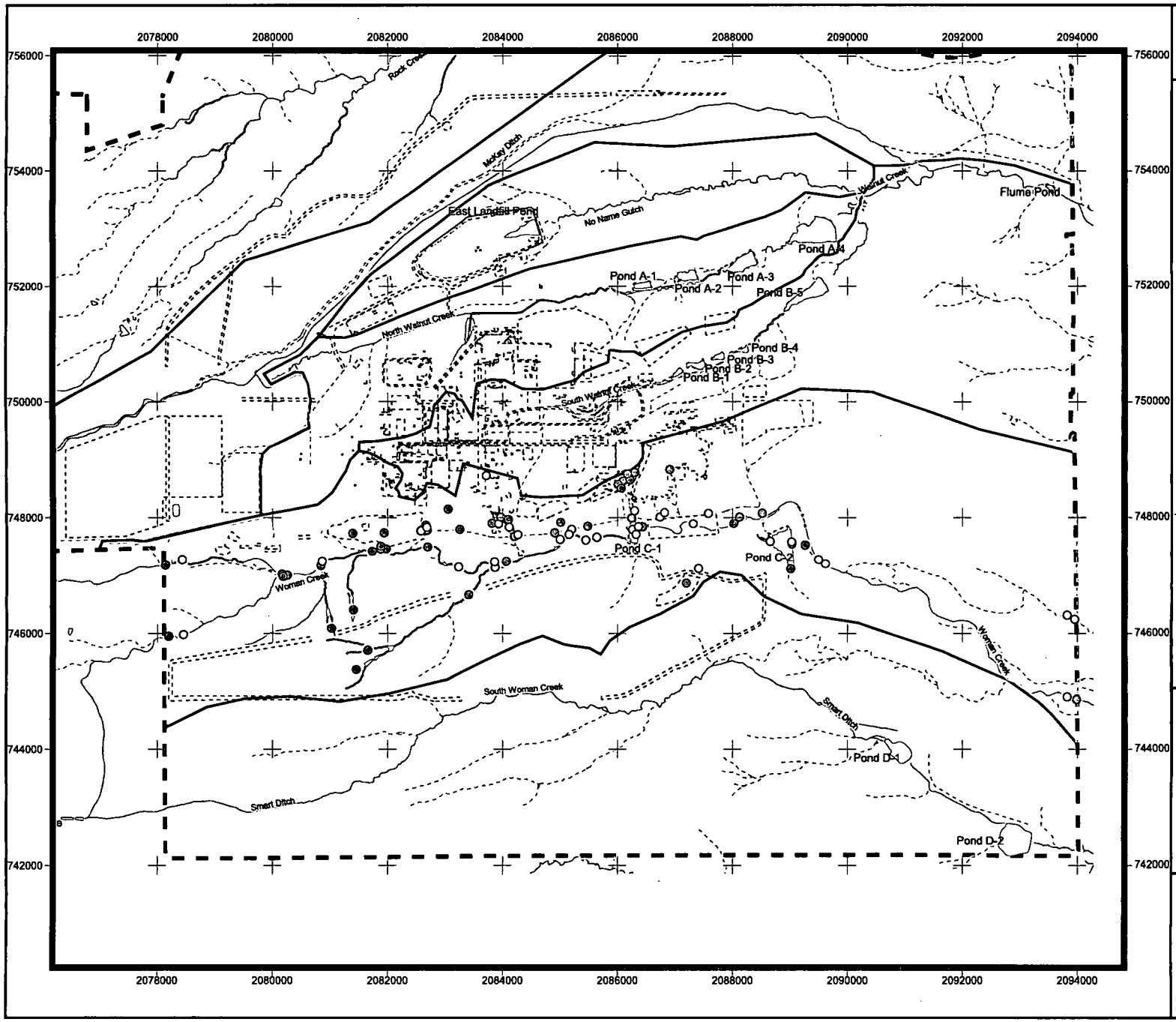

Figure 2.154
Woman Creek AEU
Surface Water Sampling Locations for Selenium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.0046 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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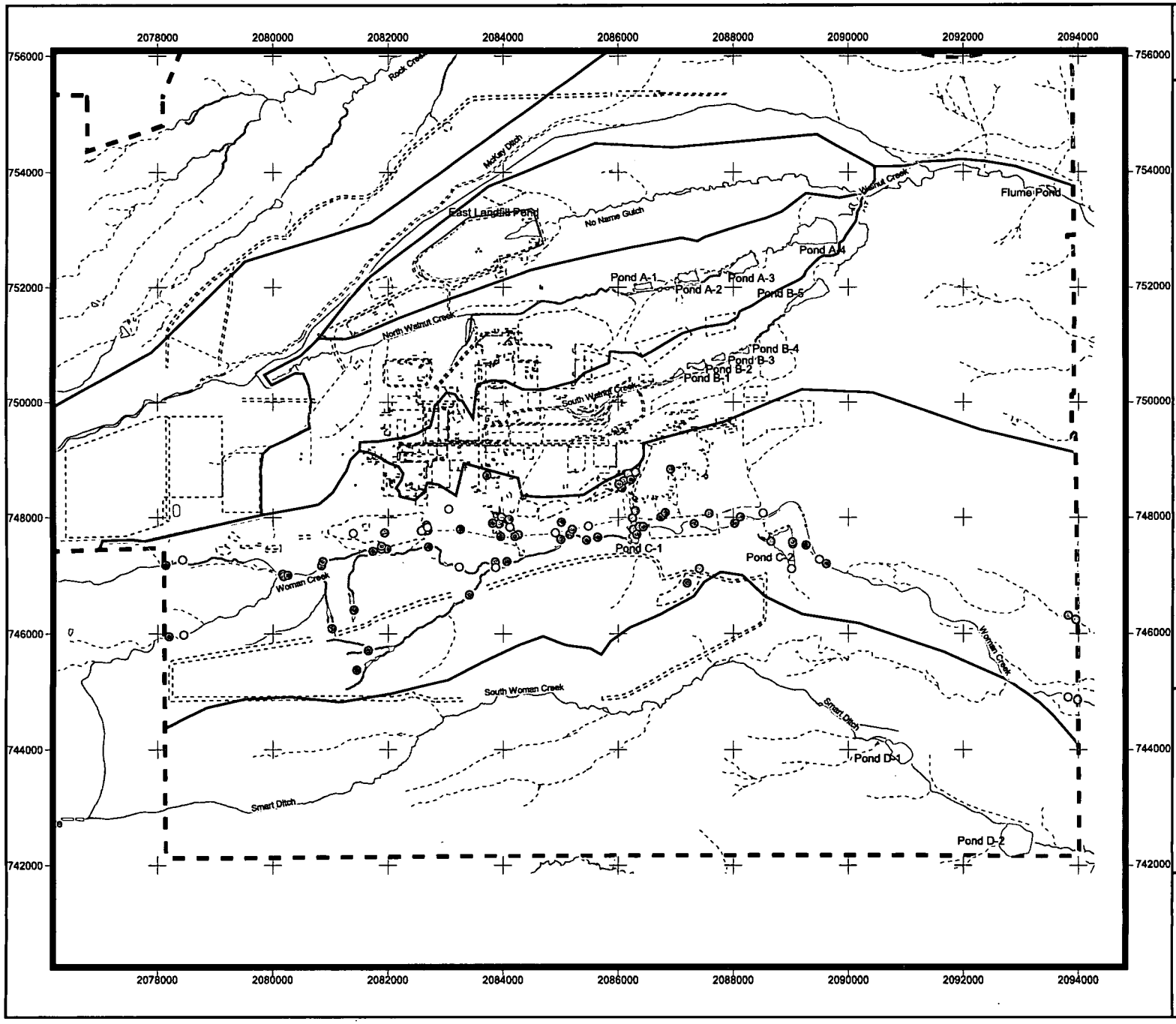

Figure 2.155
Woman Creek AEU
Surface Water Sampling Locations for Thallium (Total)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.01 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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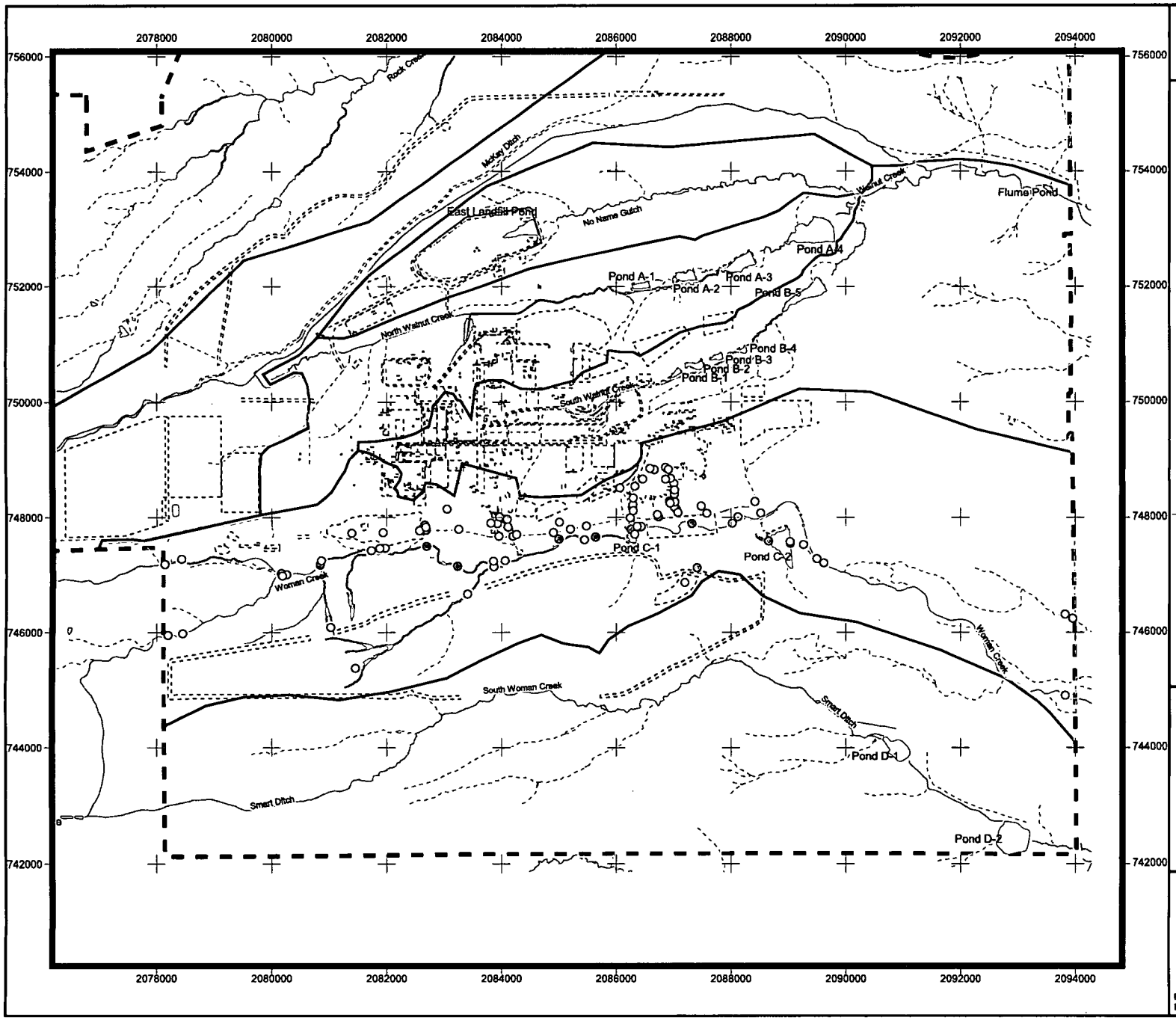

Figure 2.156
Woman Creek AEU
Surface Water Sampling Locations
for Americium-241

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 43.8 pCi/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
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S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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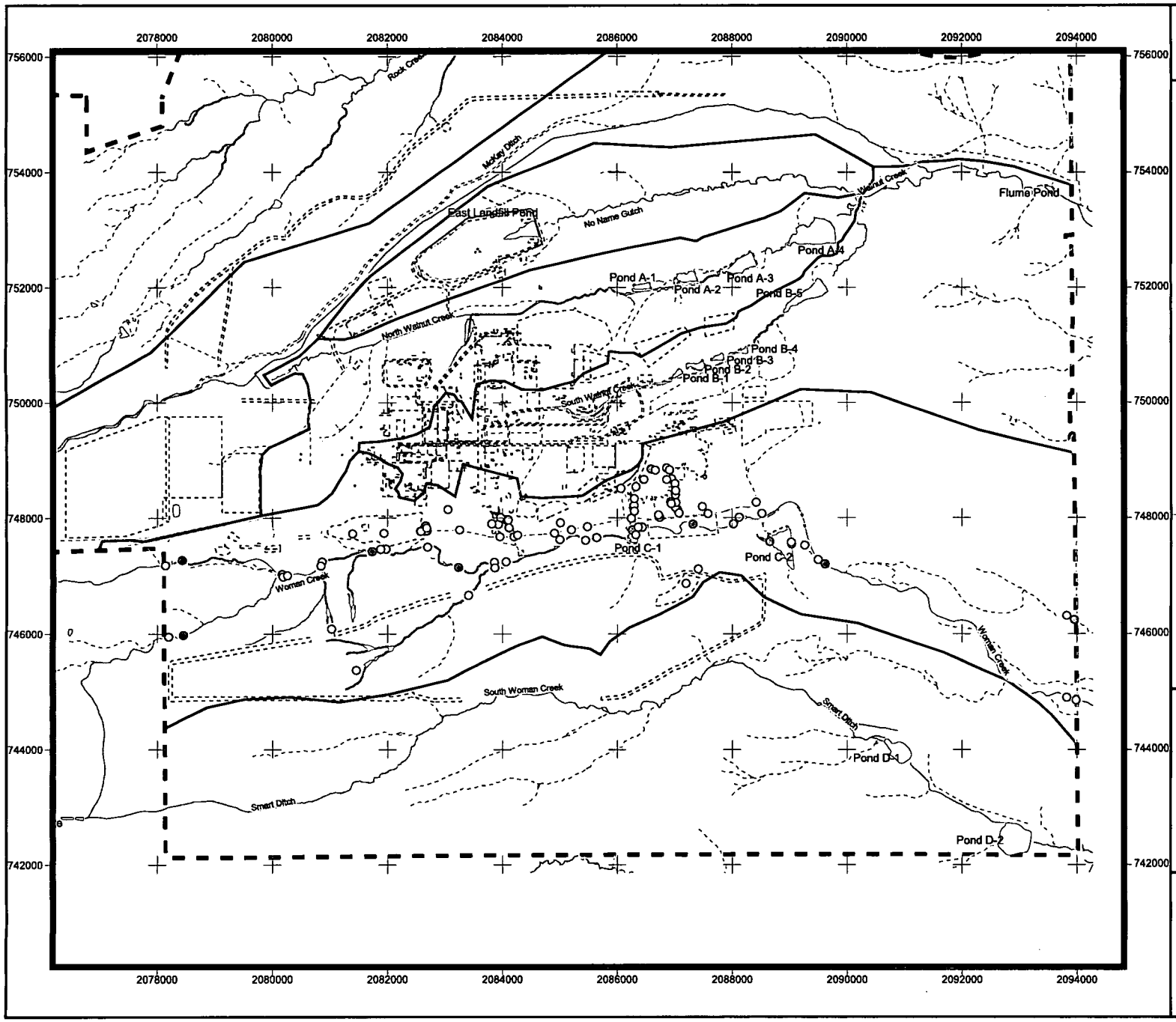

Figure 2.157
Woman Creek AEU
Surface Water Sampling Locations for Plutonium-239/240

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 18.7 pCi/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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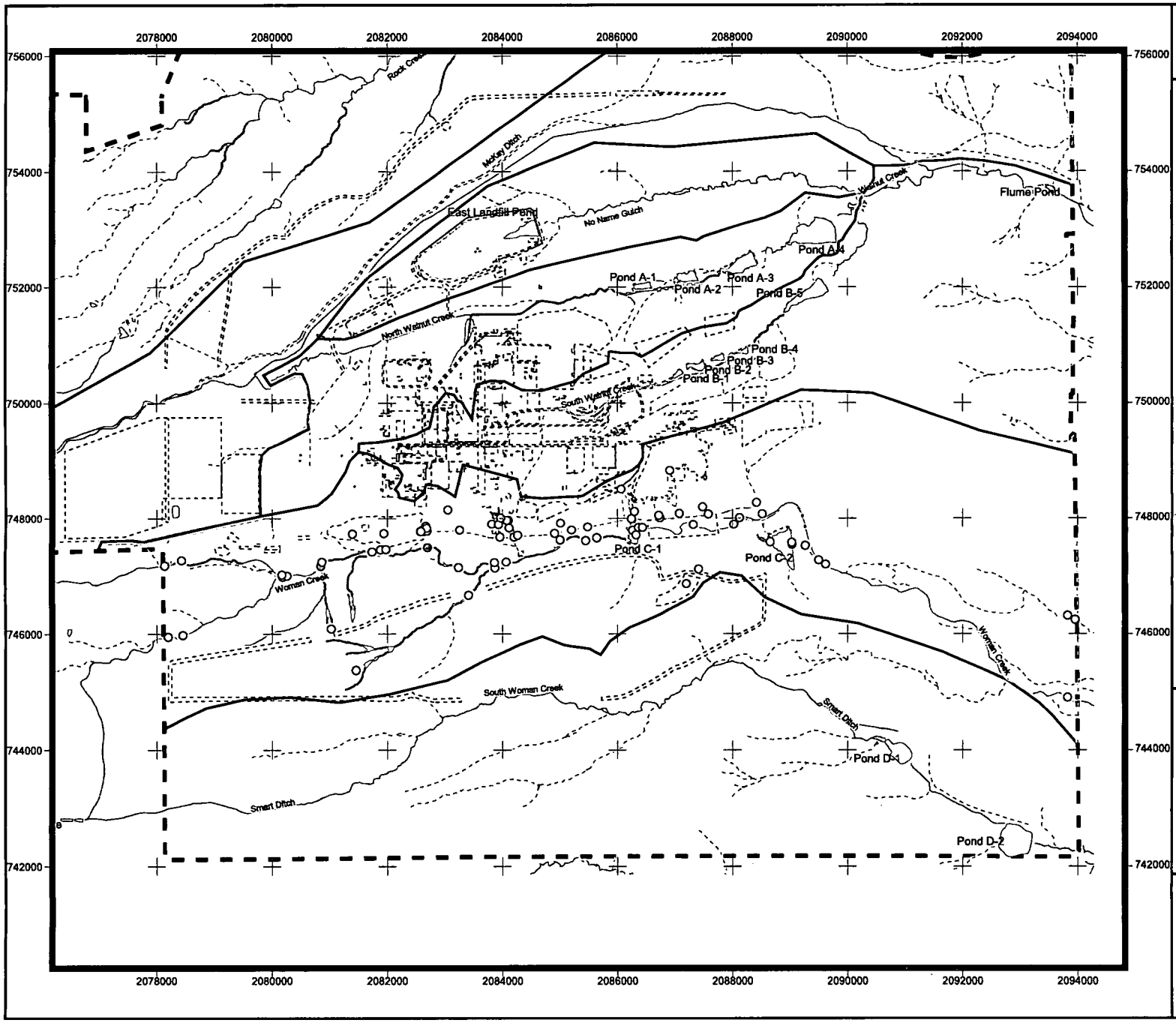

Figure 2.158
Woman Creek AEU
Surface Water Sampling Locations
for Uranium-233/234

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 20.1 pCi/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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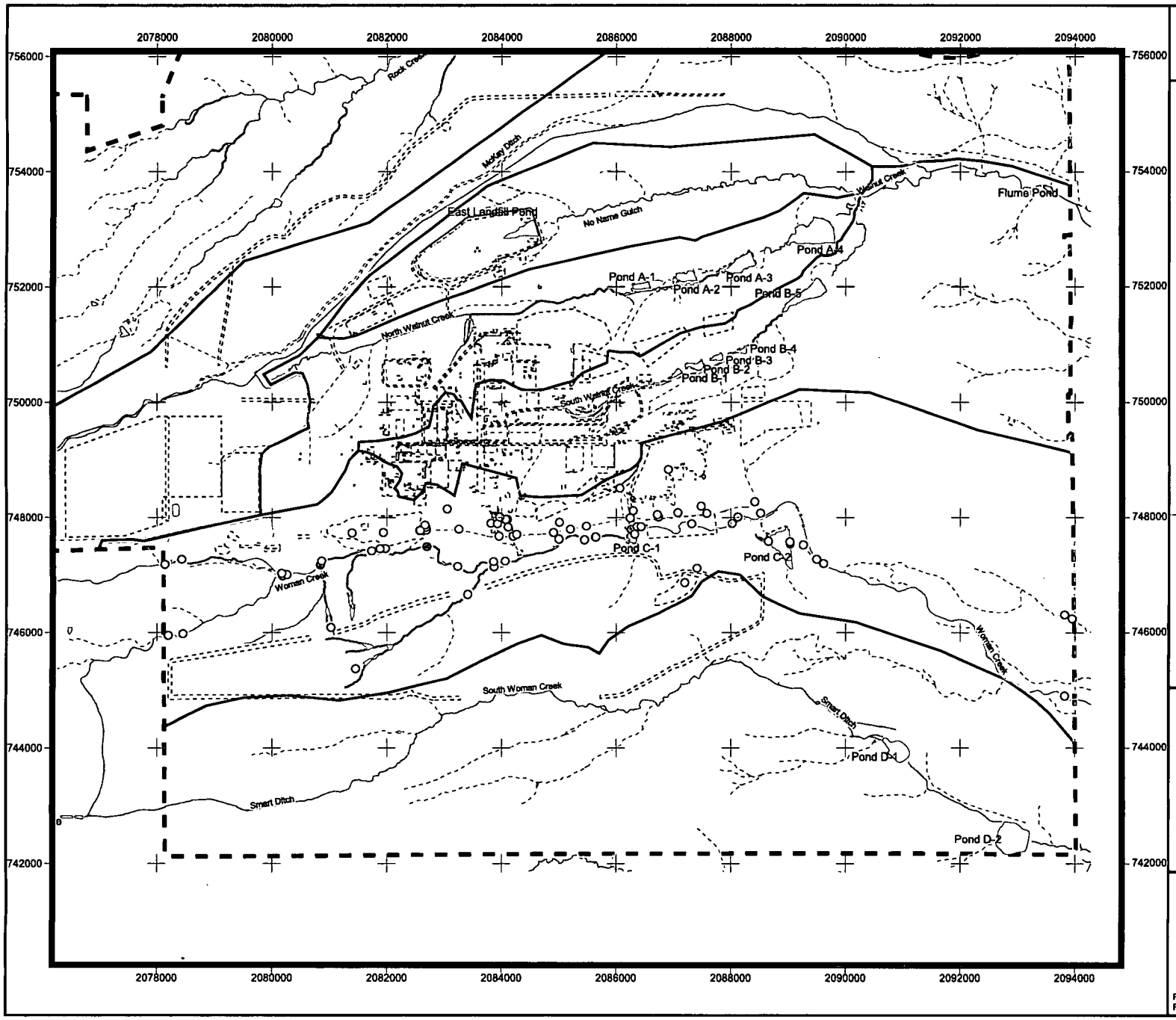

Figure 2.159
Woman Creek AEU
Surface Water Sampling Locations for Uranium-238

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 22.3 pCi/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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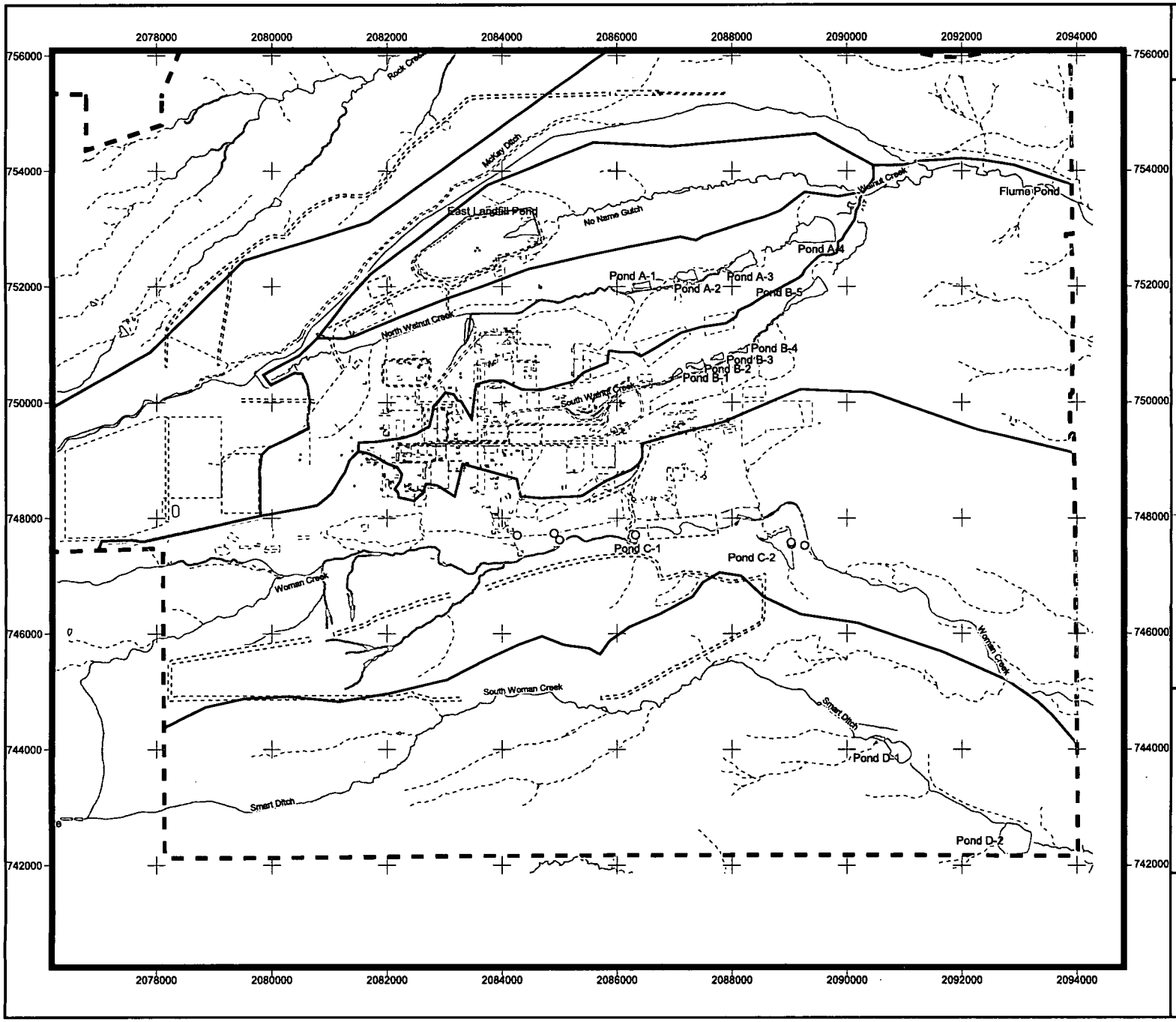

Figure 2.160
Woman Creek AEU
Surface Water Sampling Locations
for non-ionized Ammonia

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.02 mg/L

Standard Map Features
- North Walnut Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
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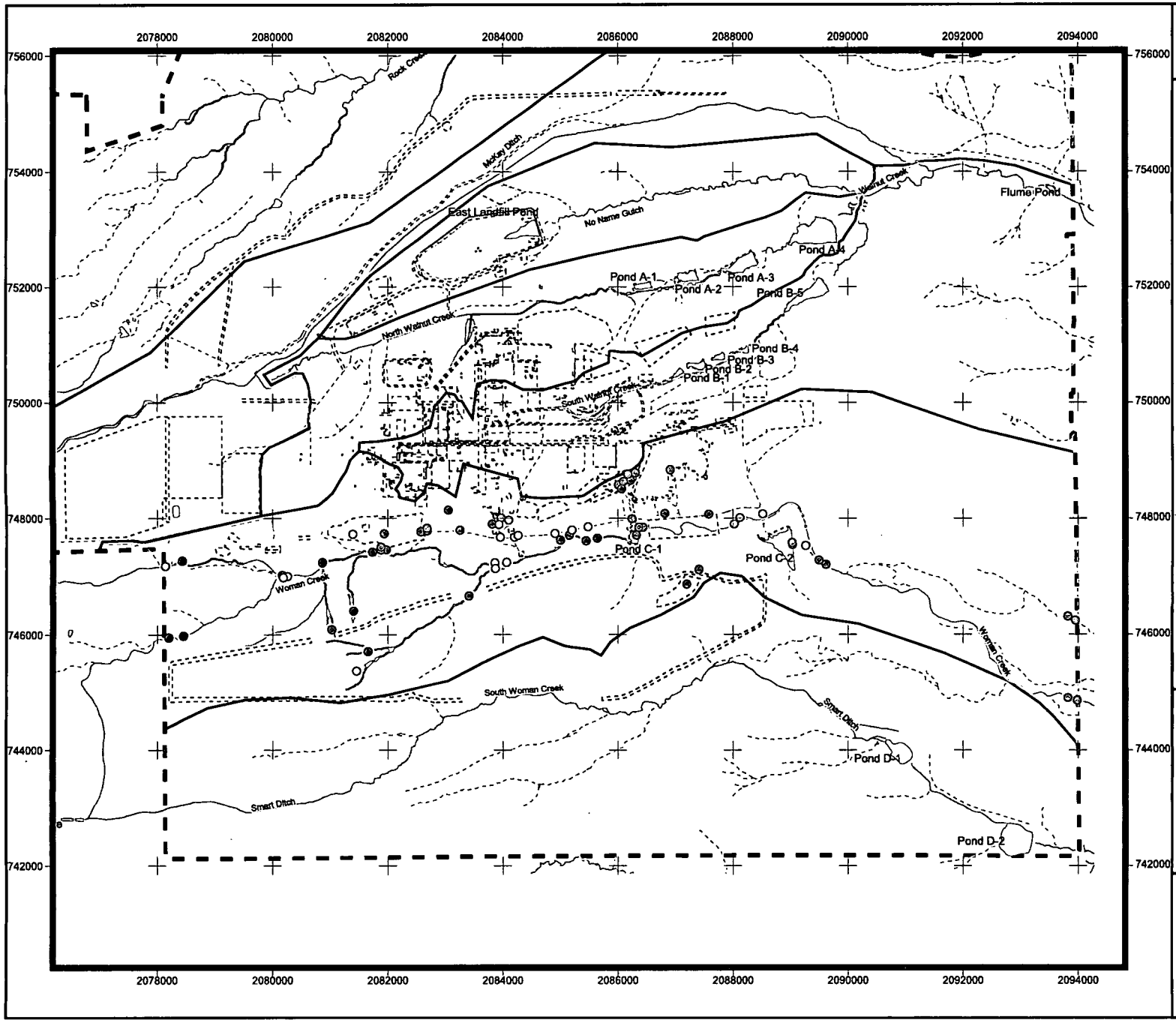

Figure 2.161
Woman Creek AEU
Surface Water Sampling Locations for Cadmium (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.0032 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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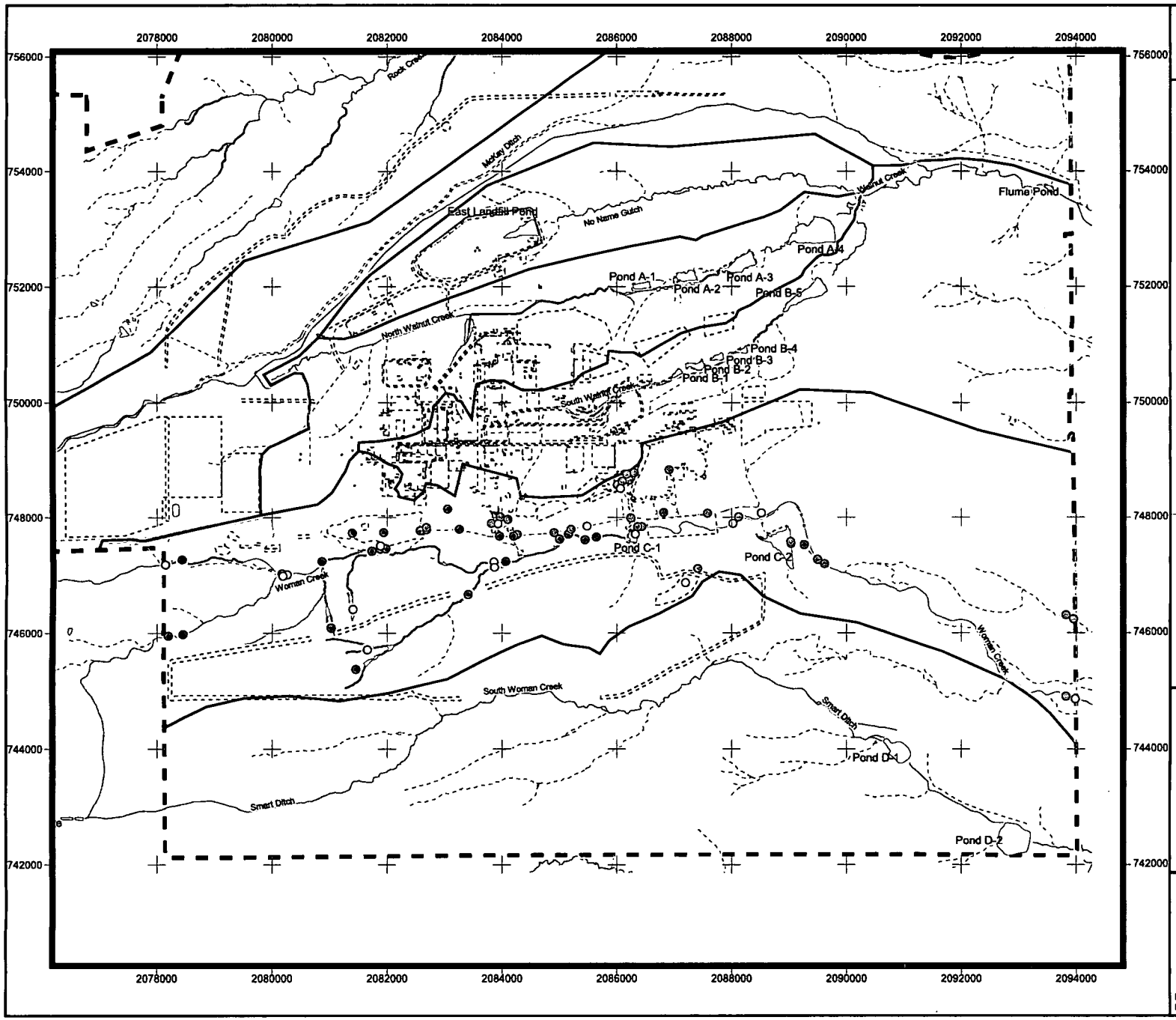

Figure 2.162
Woman Creek AEU
Surface Water Sampling Locations for Silver (Dissolved)

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

Site-specific ESL = 0.0007 mg/L

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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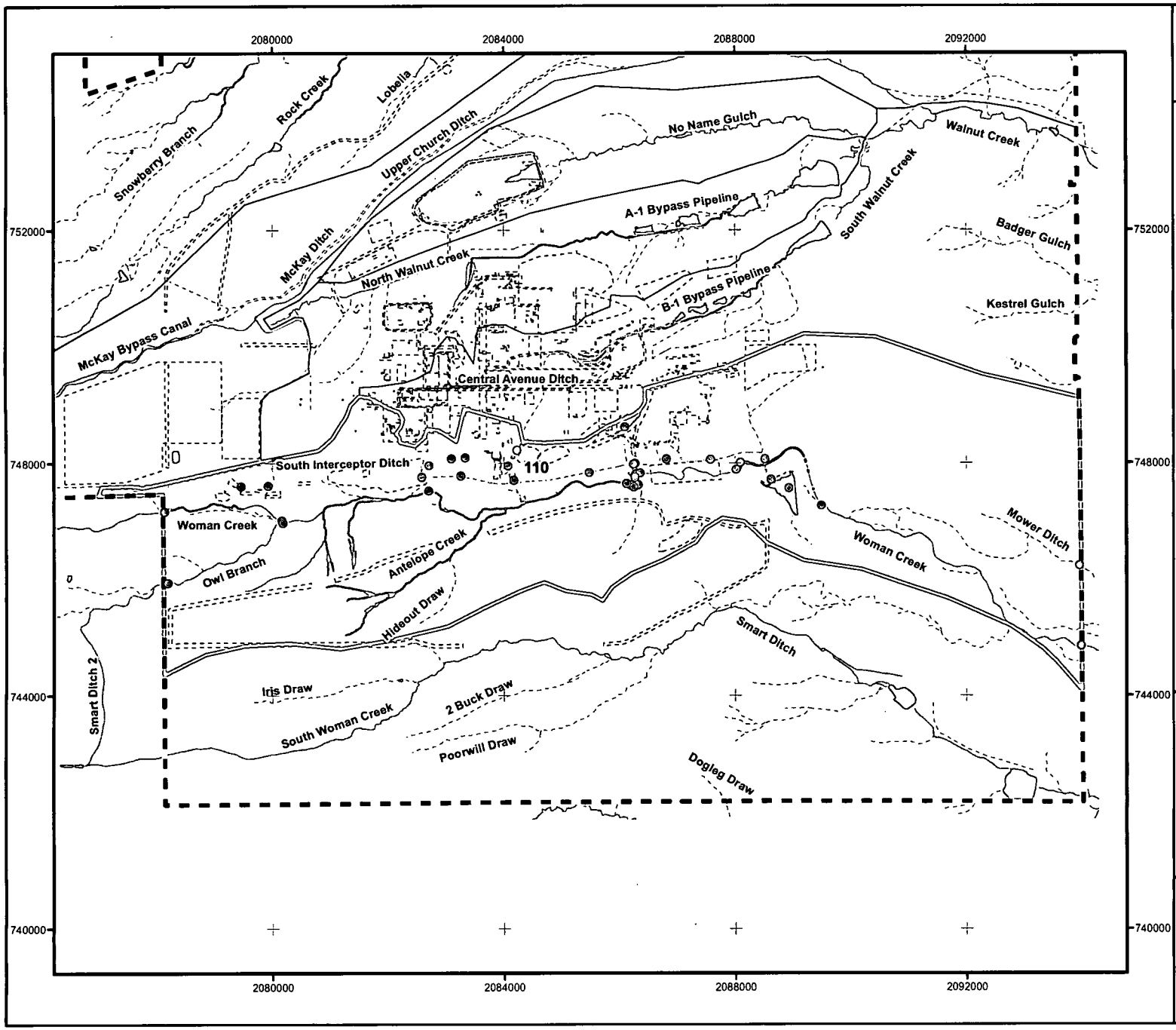

Figure 2.163
Woman Creek AEU
Sediment Results for
2-methylnaphthalene

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 20.2 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

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0 1,250 2,500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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Datum: NAD 27

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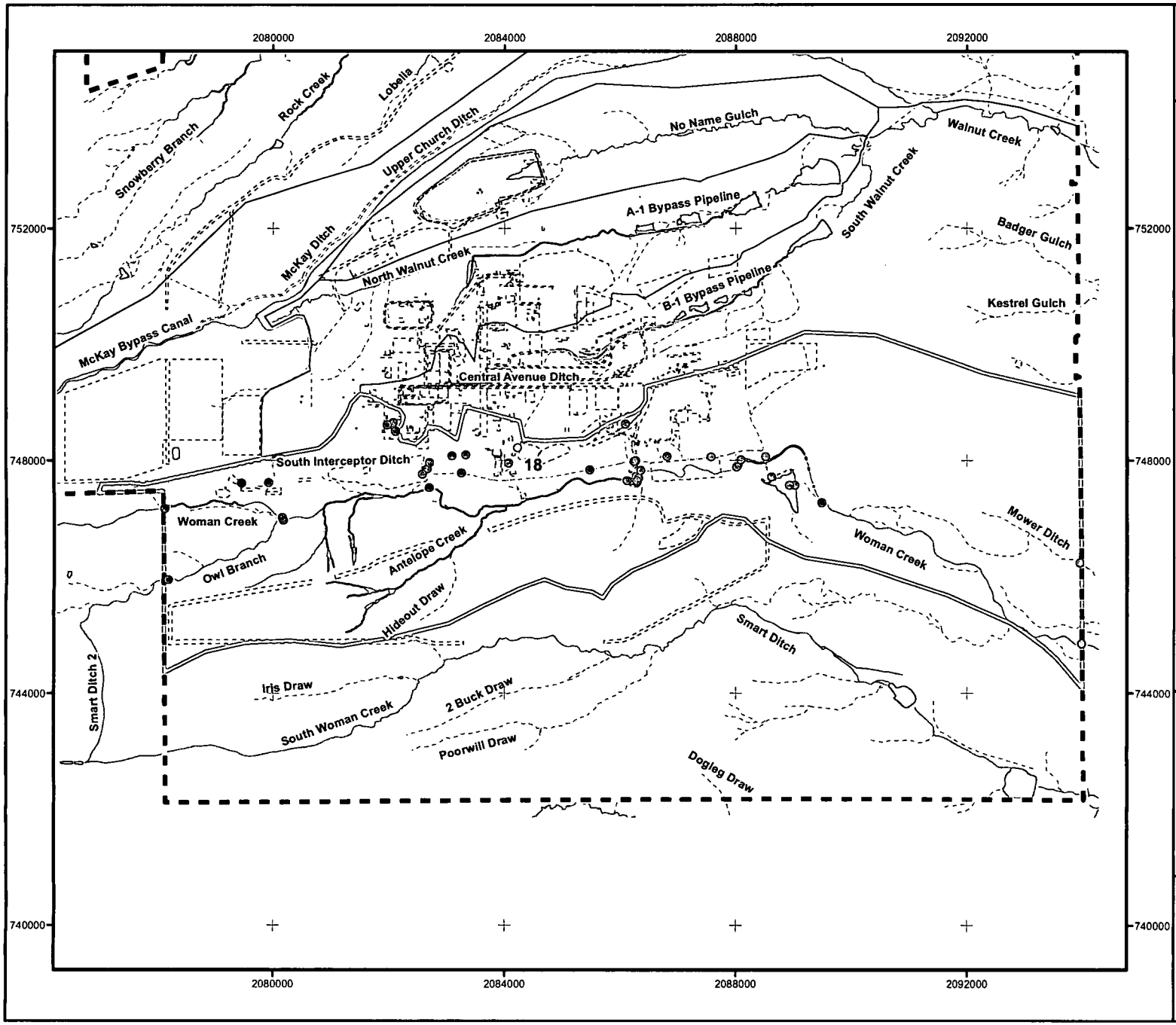

Figure 2.164
Woman Creek AEU
Sediment Results for
44-DDT

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 4.16 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
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0 1,250 2,500 Feet

Scale 1:30,000

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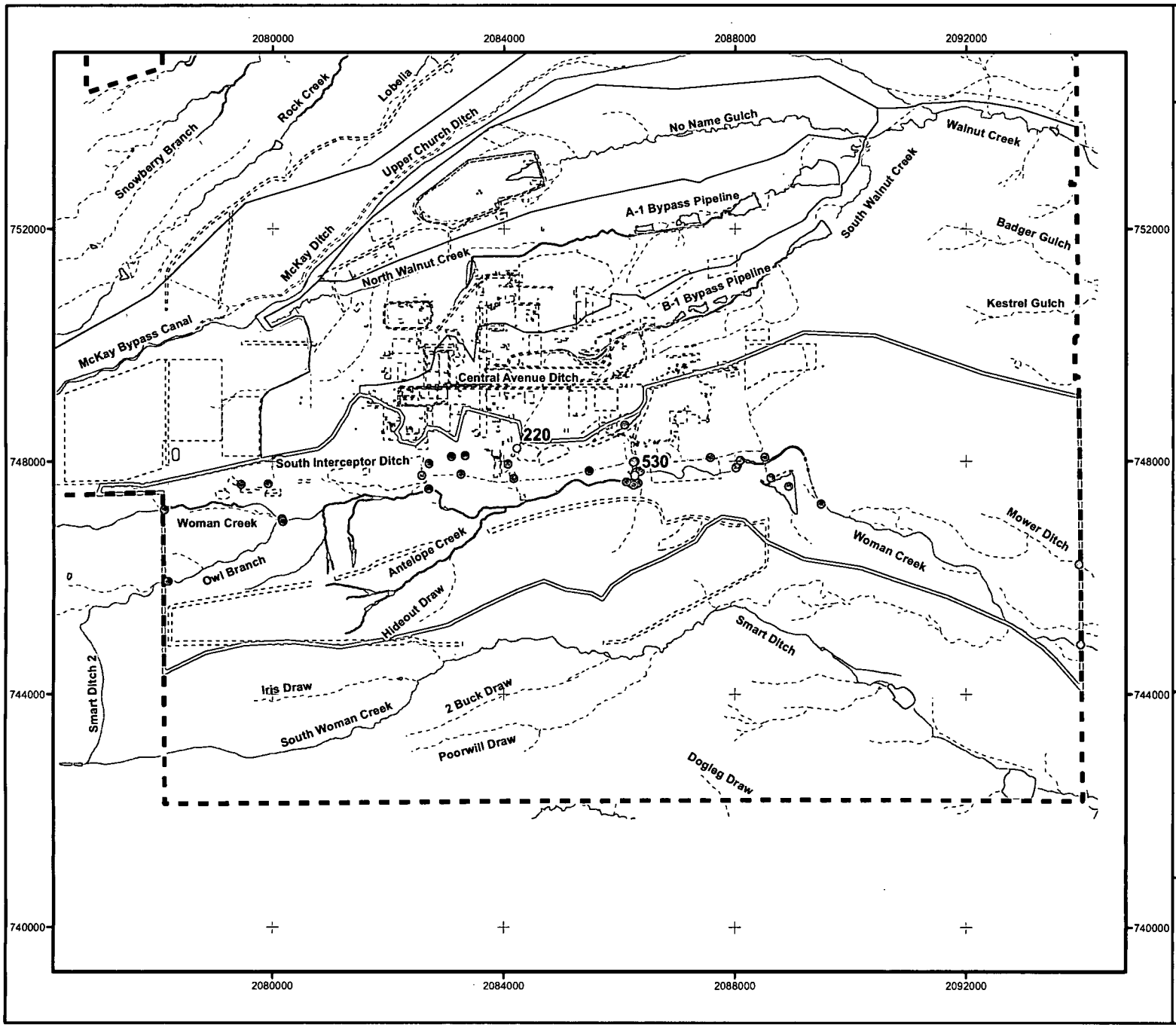

Figure 2.165
Woman Creek AEU
Sediment Results for
Dibenz (a,h) anthracene

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 33 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

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0 1,250 2,500 Feet

Scale 1:30,000

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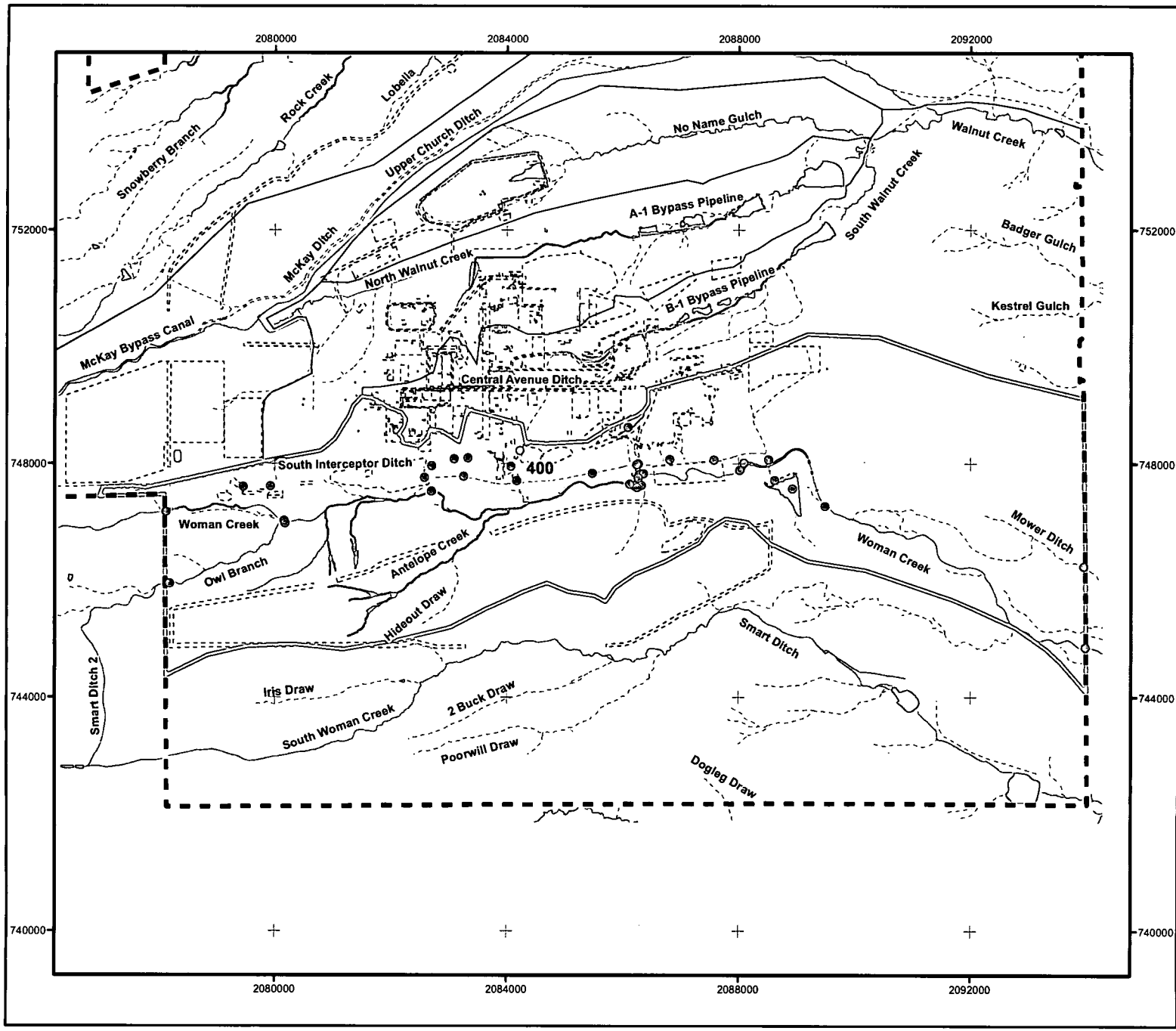

Figure 2.166
Woman Creek AEU
Sediment Results for
Fluorene

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 77.4 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
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0 1,250 2,500 Feet

Scale 1:30,000

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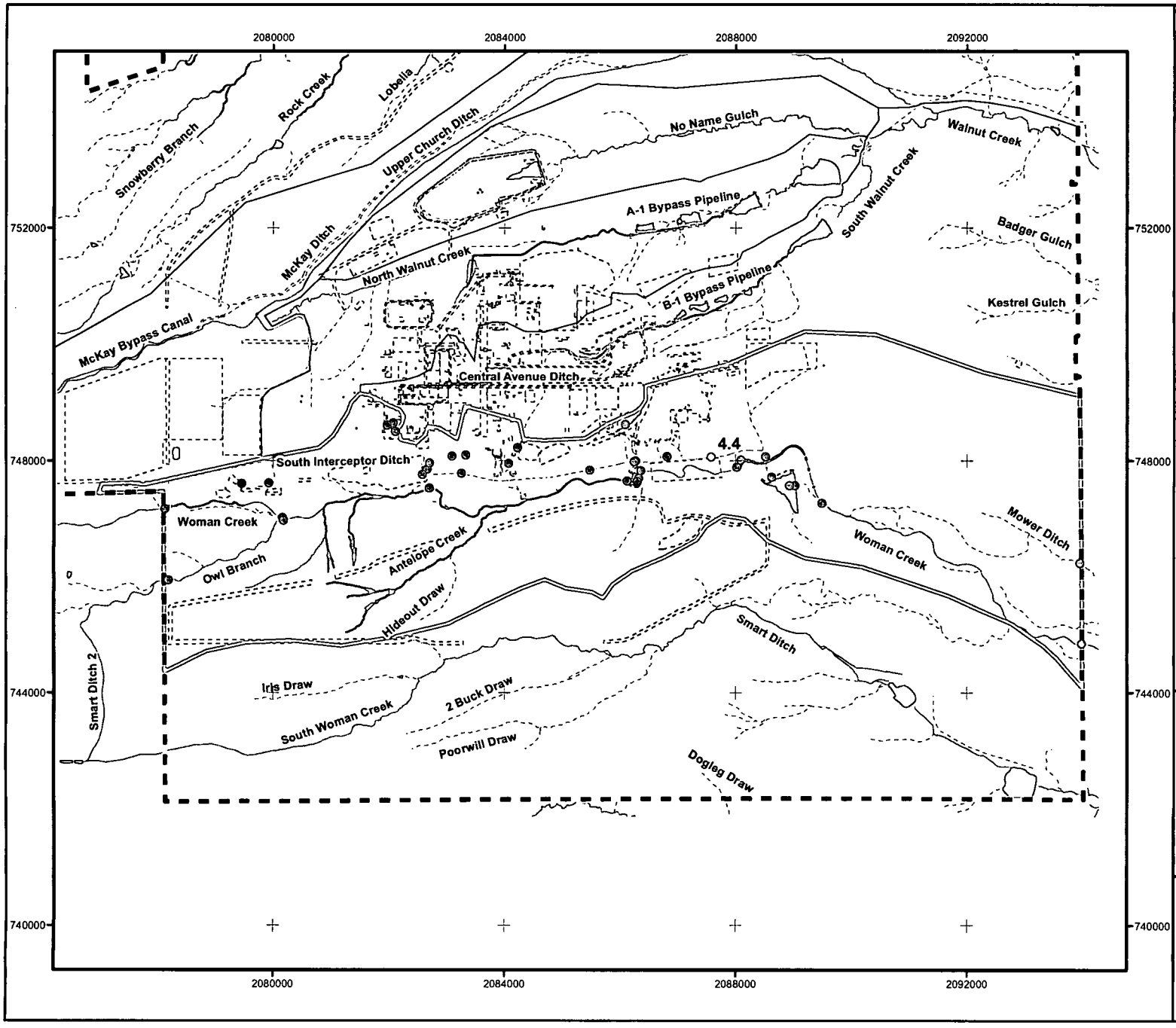

Figure 2.167
Woman Creek AEU
Sediment Results for
Gamma-BHC

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 2.37 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

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0 1,250 2,500 Feet

Scale 1:30,000

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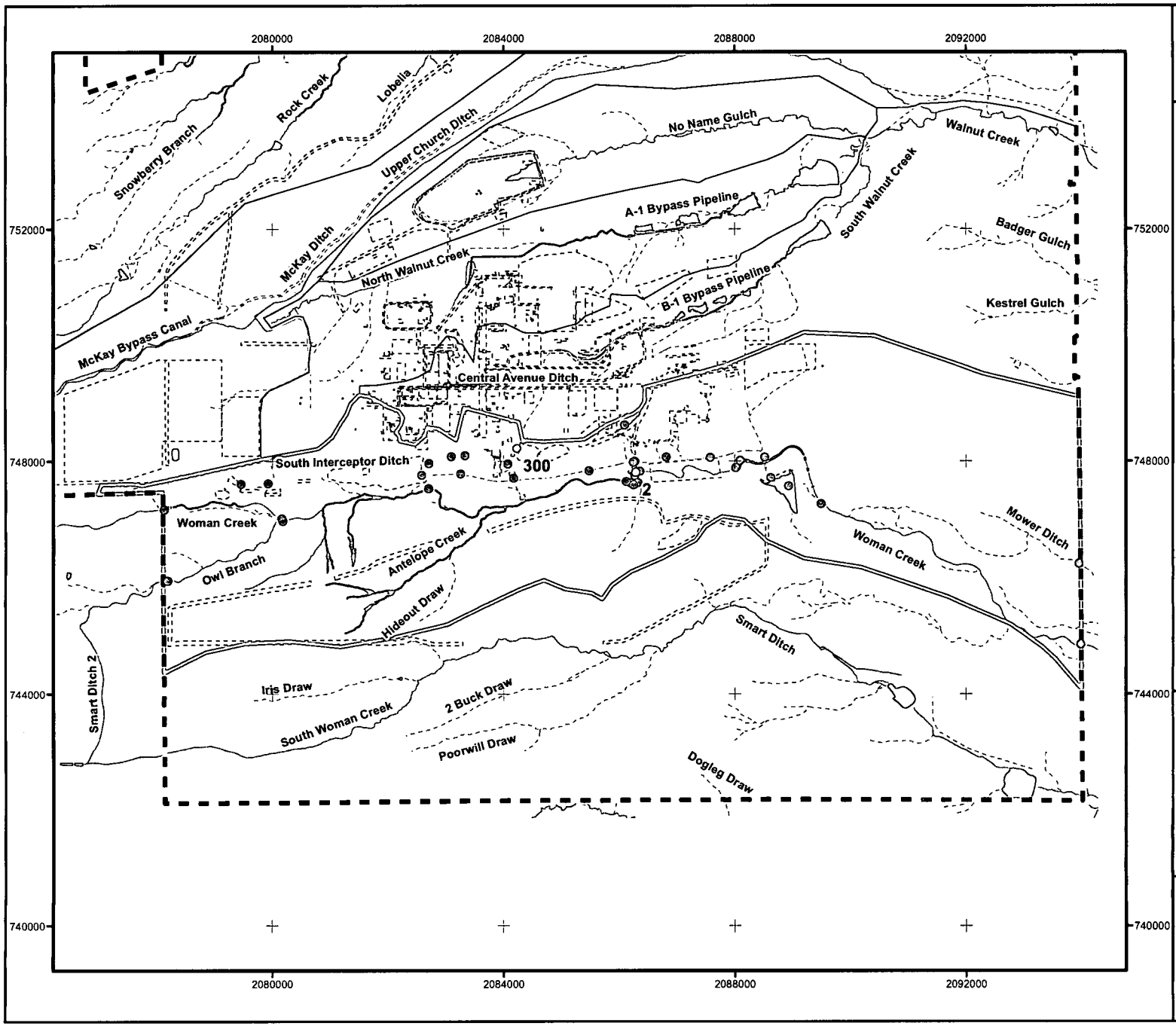

Figure 2.168
Woman Creek AEU
Sediment Results for
Naphthalene

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 176 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
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0 1,250 2,500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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365

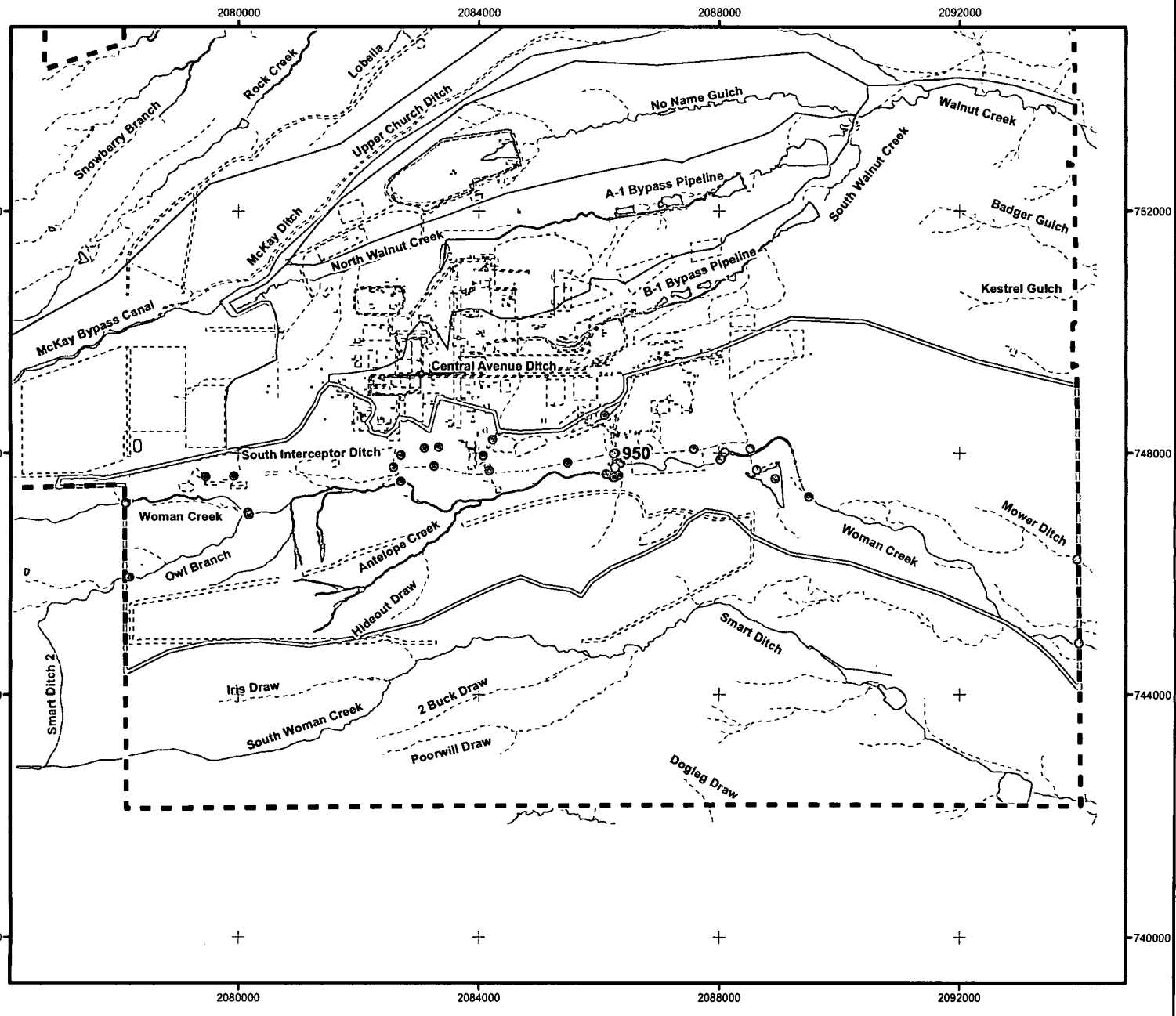

Figure 2.169
Woman Creek AEU
Sediment Results for
Pentachlorophenol

Key

Sample location
- Detect
- Nondetect
- Woman Creek AEU
- Historical IHSS/PAC

CRA Methodology ESL = 255 ug/kg

Standard Map Features
- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
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0 1,250 2,500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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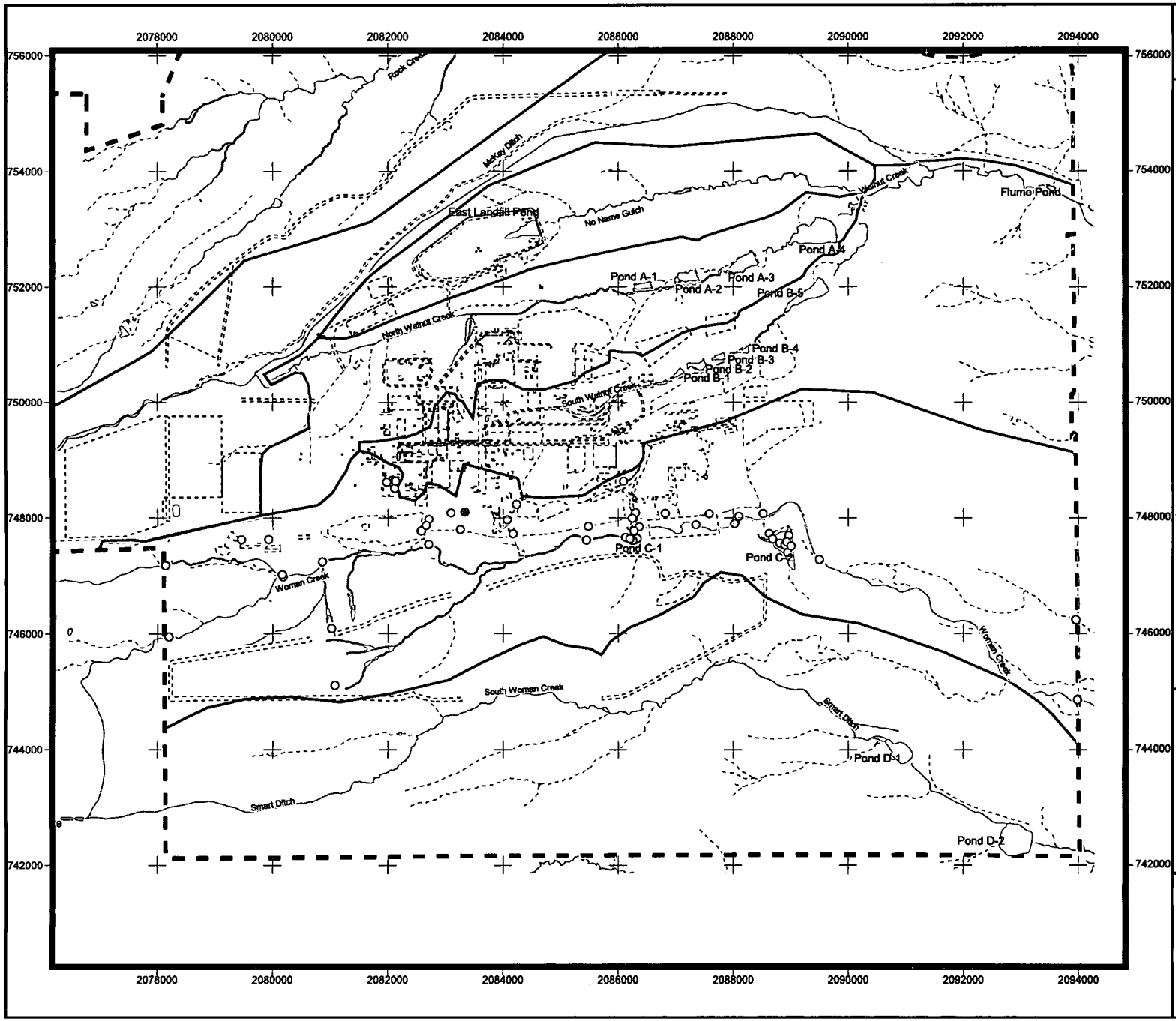

Figure 2.170
Woman Creek AEU
Sediment Sampling Locations
for Arsenic

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 9.79 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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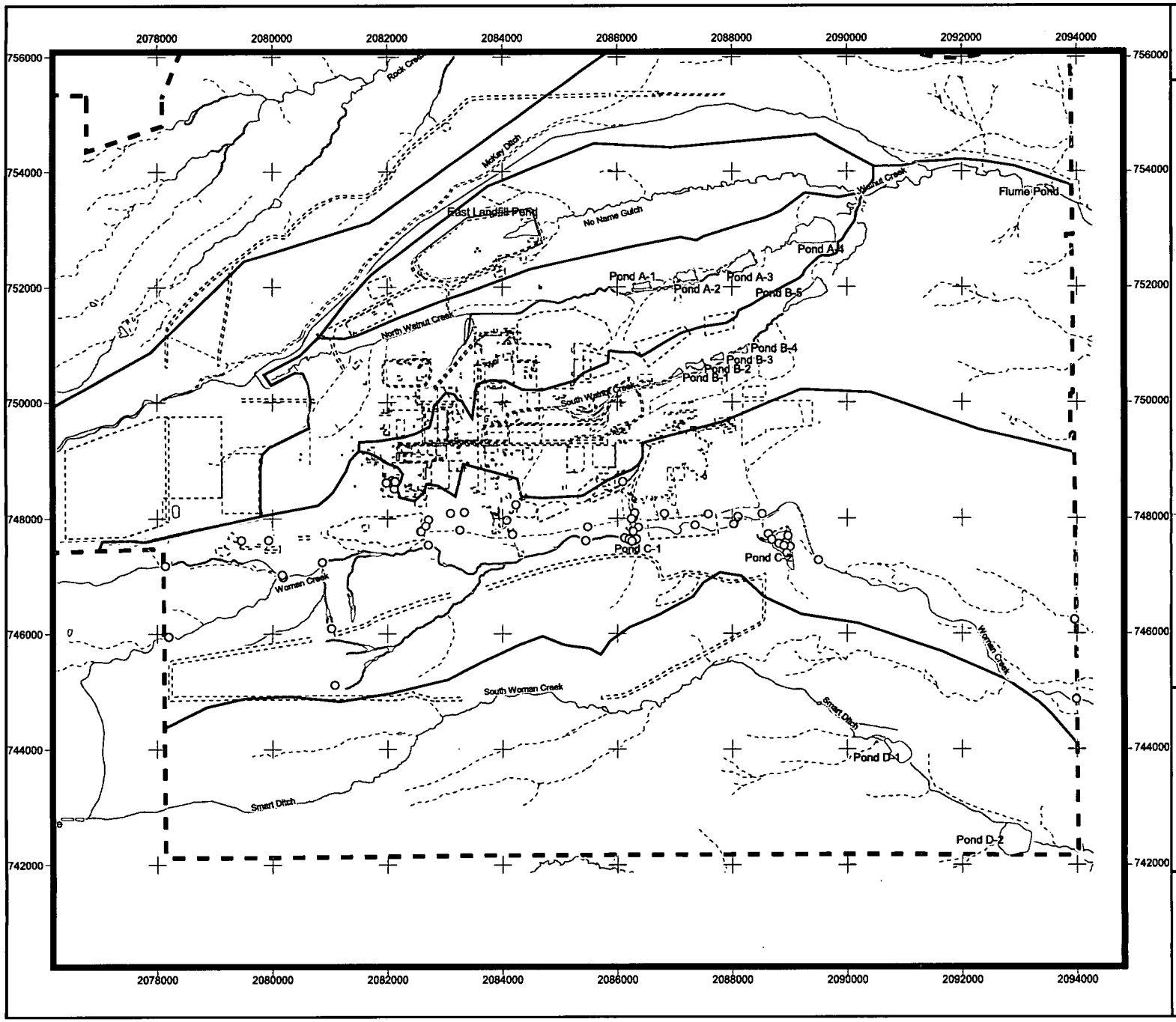

Figure 2.171
Woman Creek AEU
Sediment Sampling Locations
for Chromium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 43.4 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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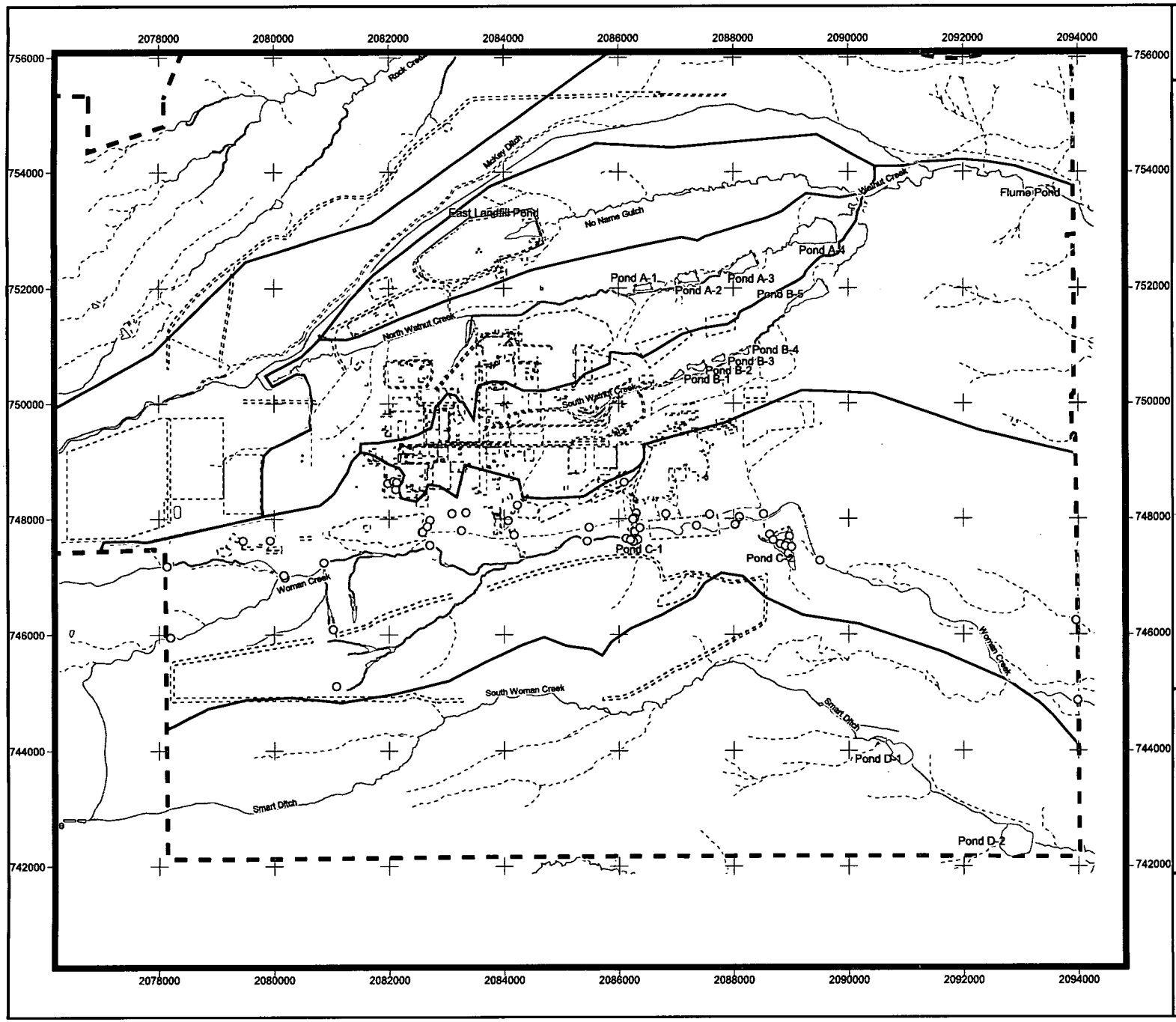

Figure 2.172
Woman Creek AEU
Sediment Sampling Locations
for Manganese

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 630 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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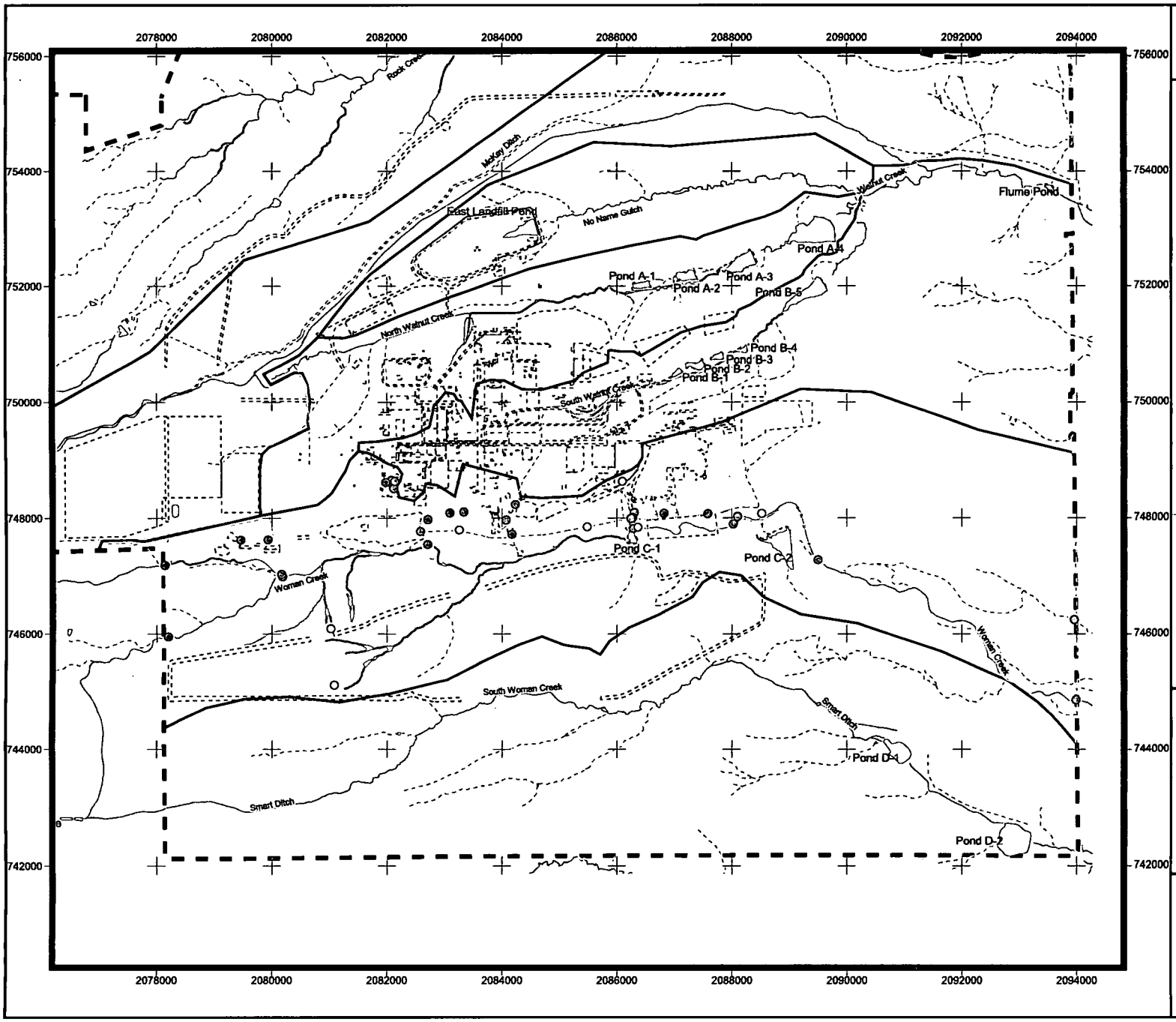

Figure 2.173
Woman Creek AEU
Sediment Sampling Locations
for 2-Butanone

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 84.194 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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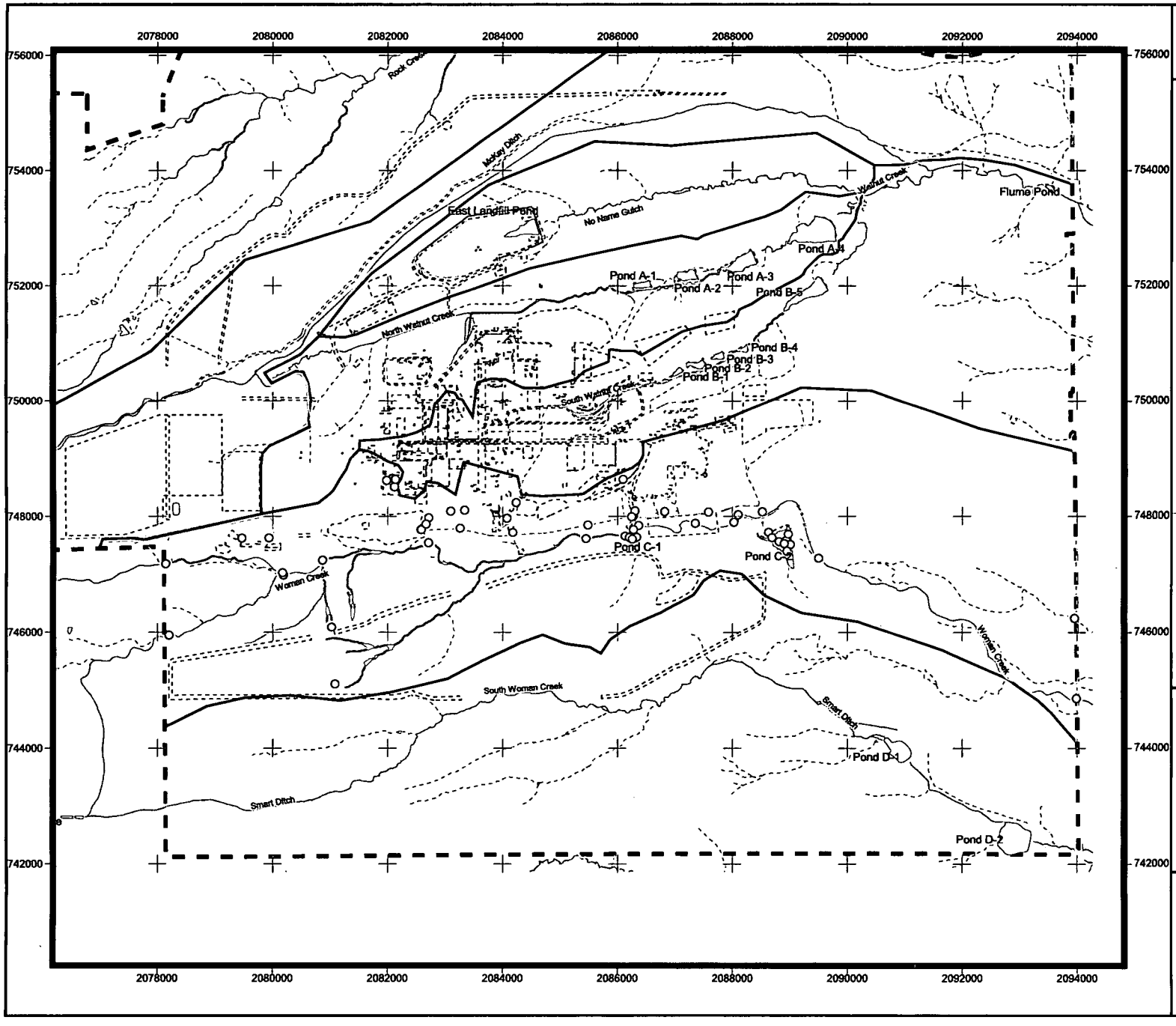

Figure 2.174
Woman Creek AEU
Sediment Sampling Locations
for Aluminum

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 15900 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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0 1250 2500 Feet

Scale 1:30,000

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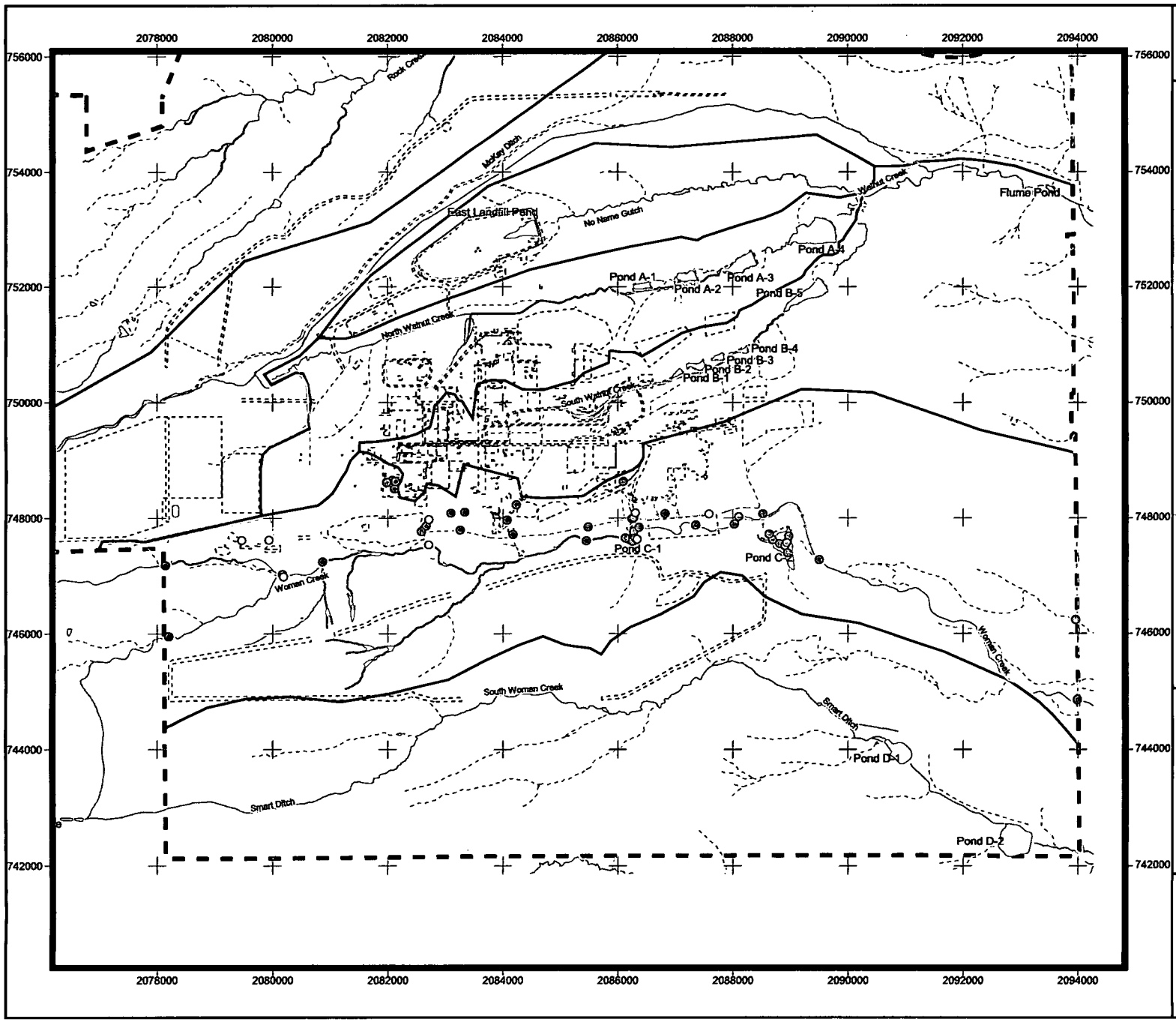

Figure 2.175
Woman Creek AEU
Sediment Sampling Locations
for Antimony

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 2 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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Datum: NAD 27

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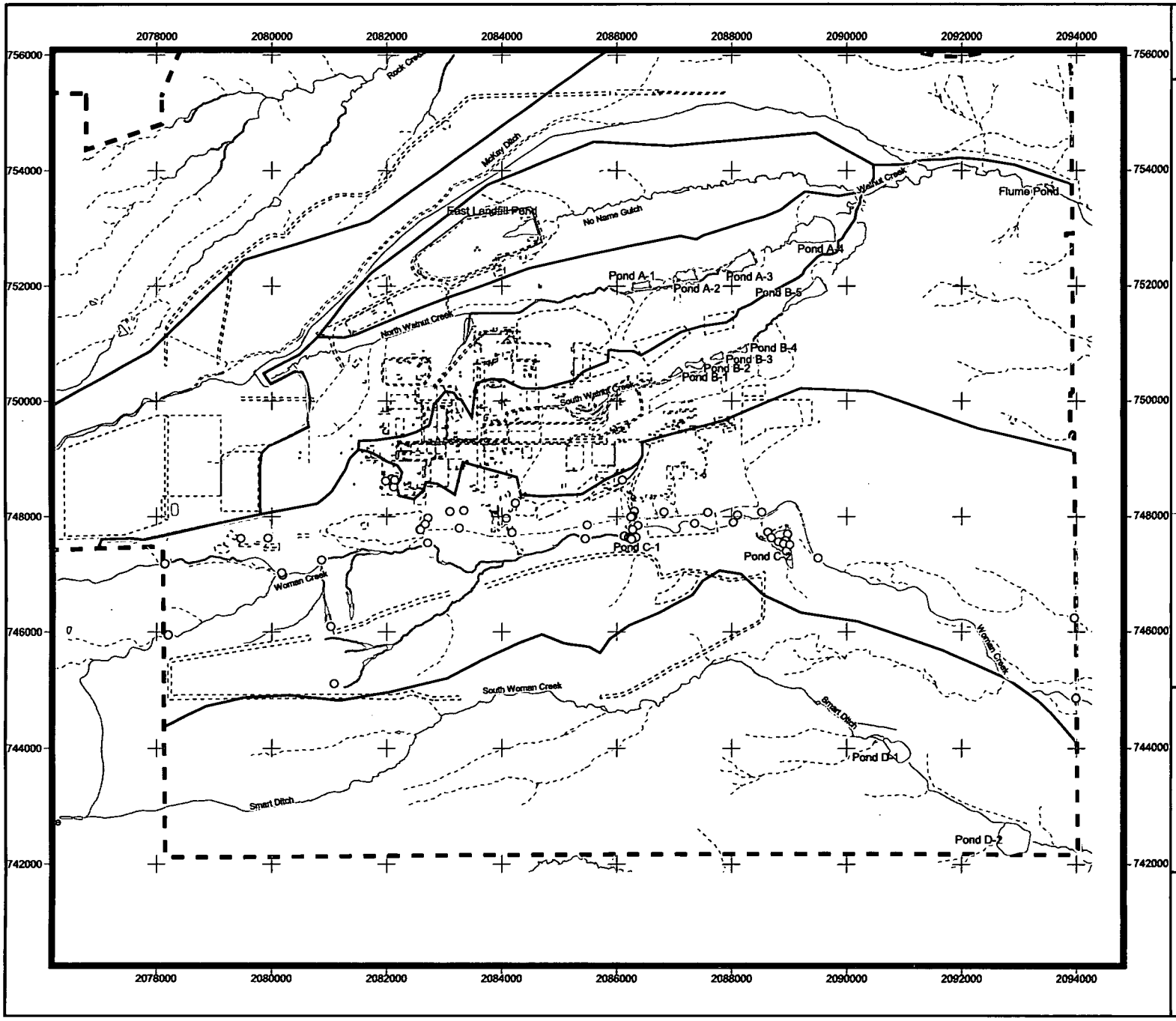

Figure 2.176
Woman Creek AEU
Sediment Sampling Locations
for Barium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 189 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
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0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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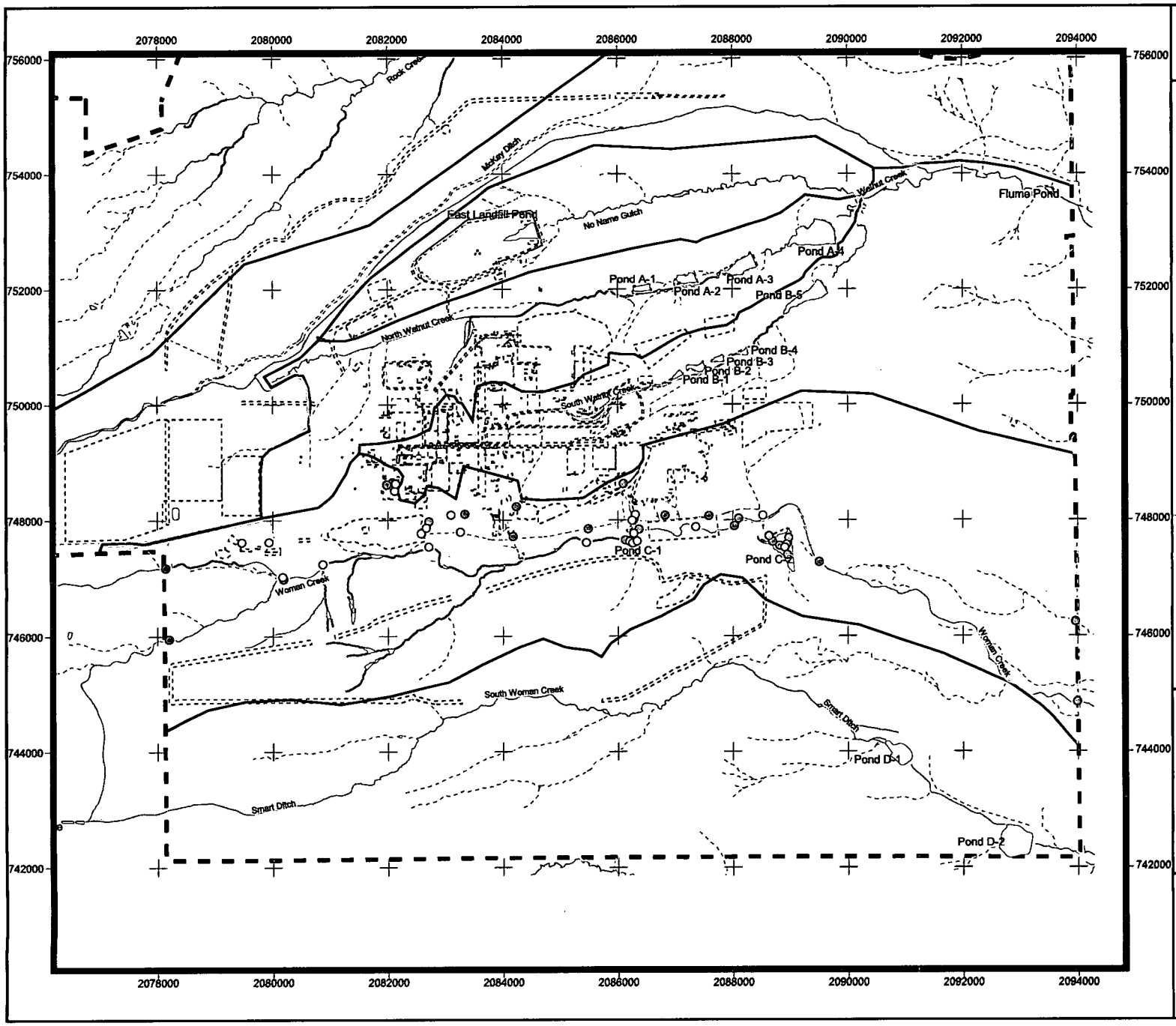

Figure 2.177
Woman Creek AEU
Sediment Sampling Locations
for Cadmium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.99 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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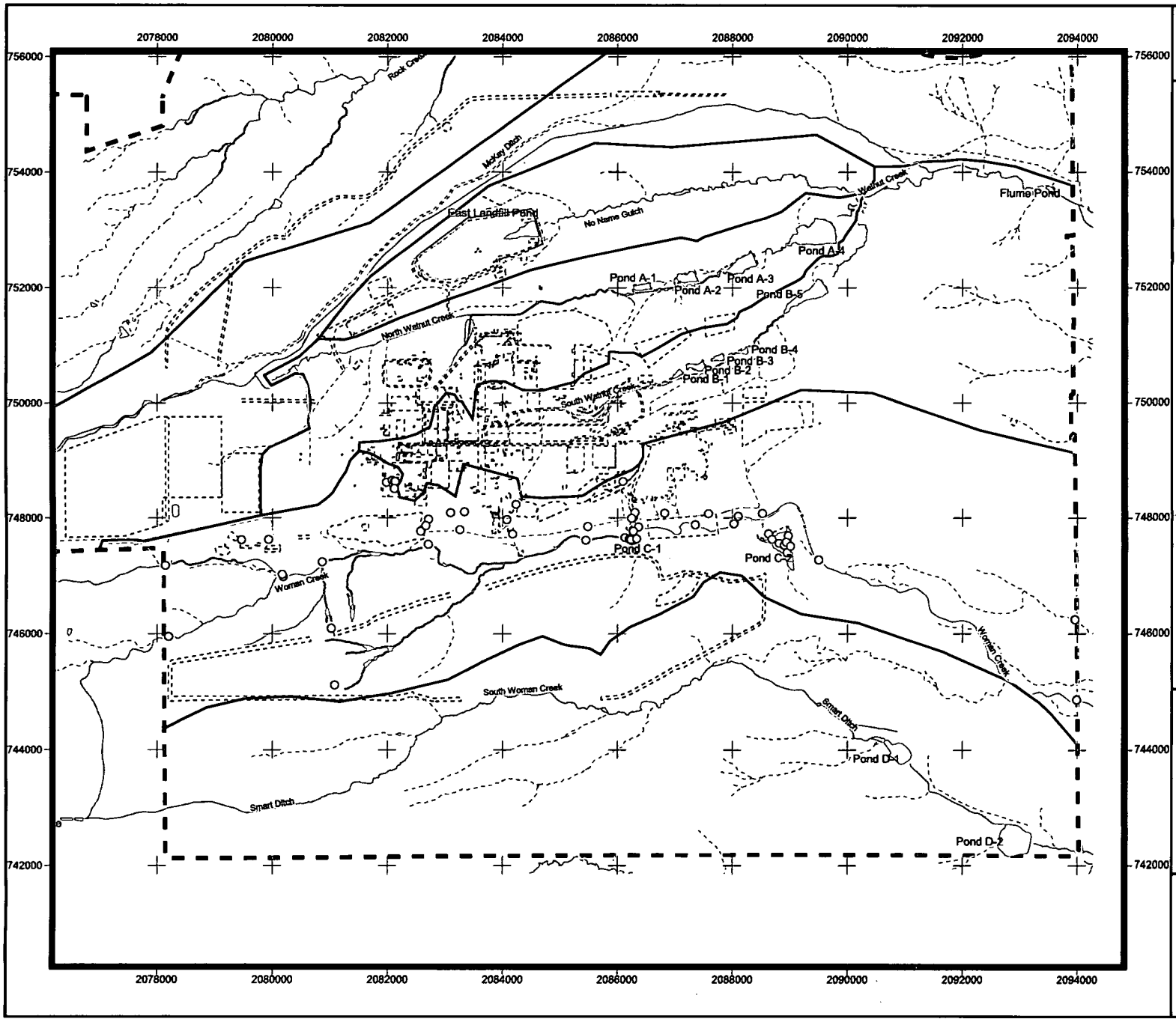

Figure 2.178
Woman Creek AEU
Sediment Sampling Locations
for Copper

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 31.6 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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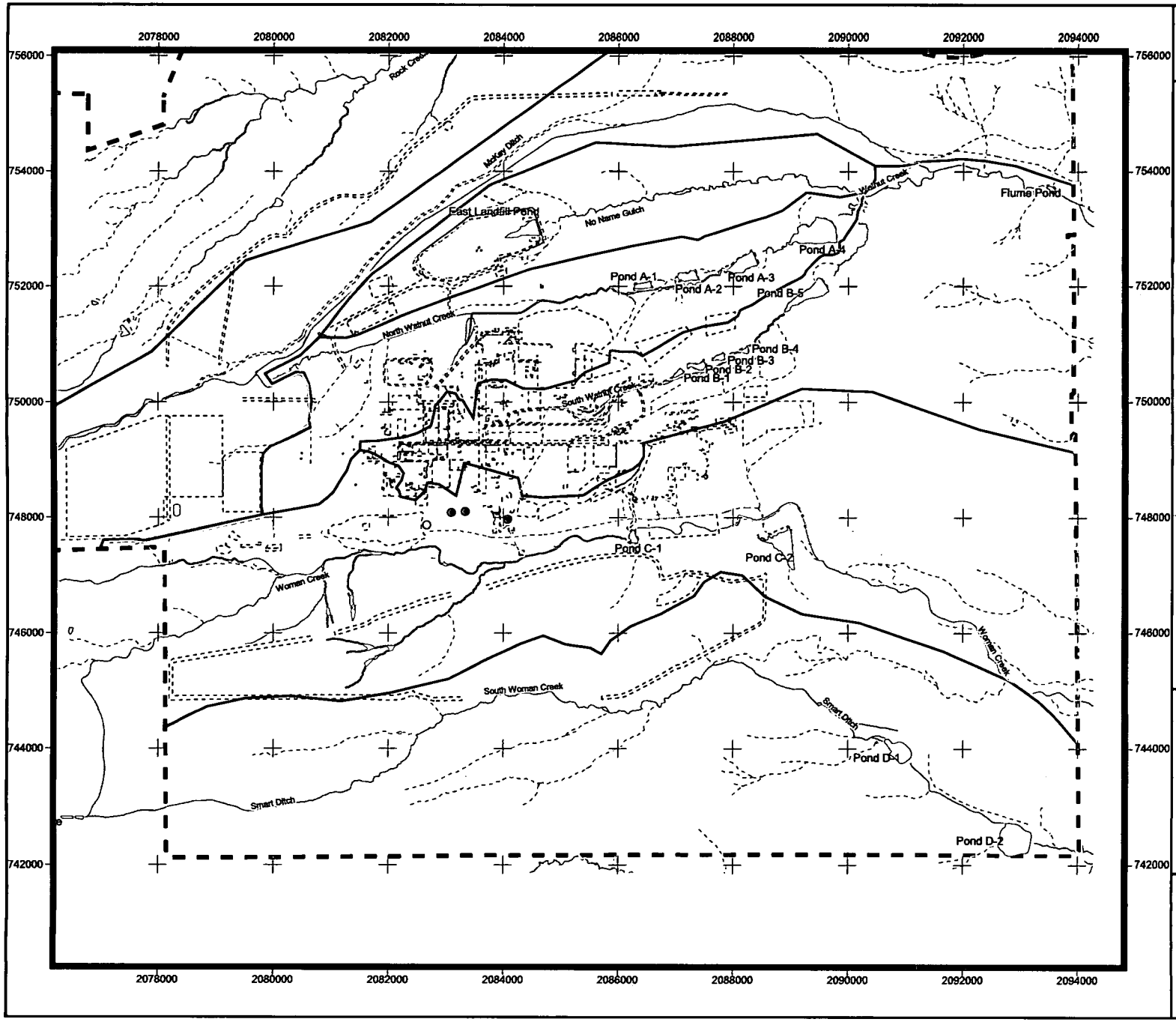

Figure 2.179
Woman Creek AEU
Sediment Sampling Locations
for Fluoride

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.01 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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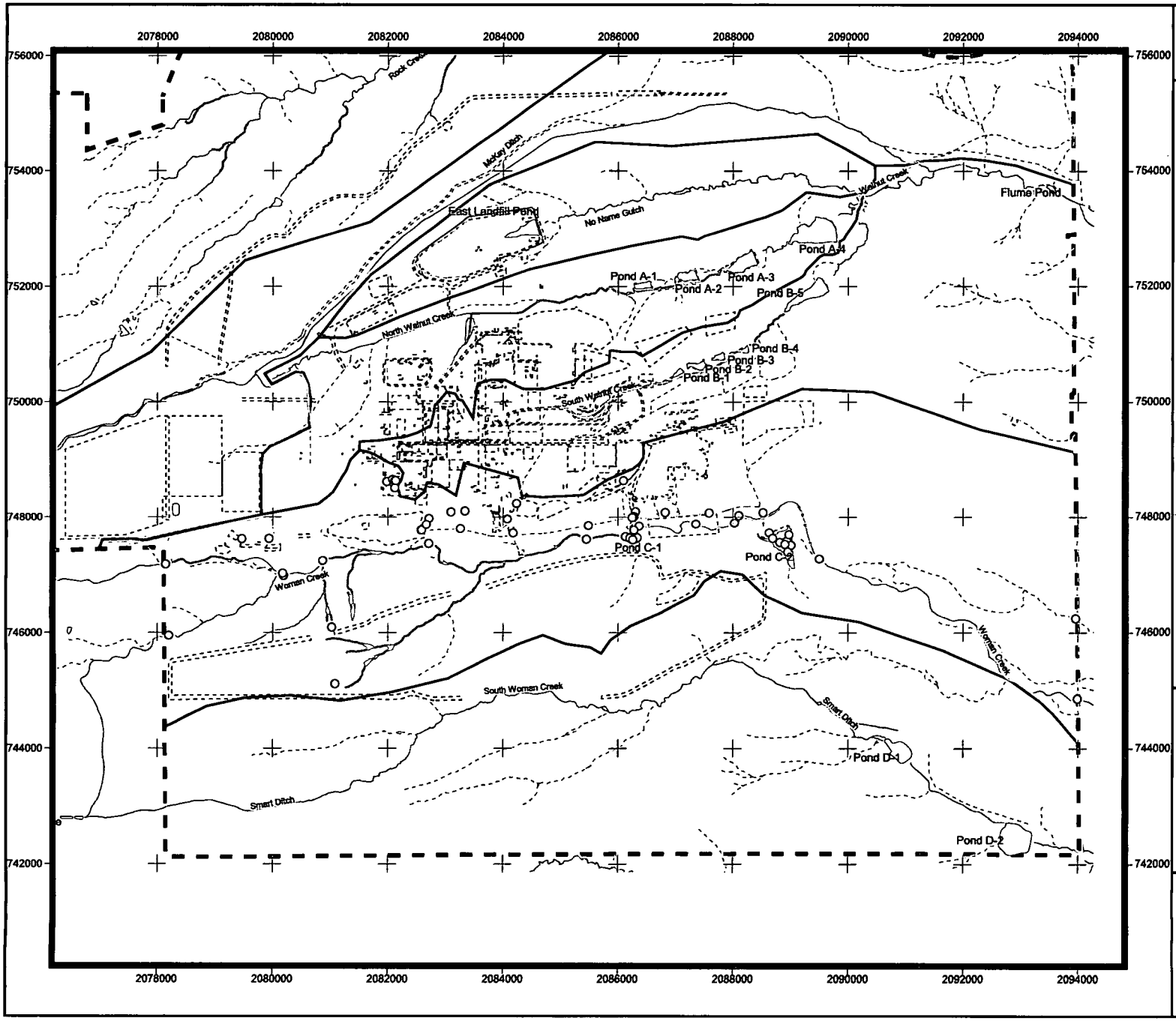

Figure 2.180
Woman Creek AEU
Sediment Sampling Locations
for Iron

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 20000 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
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0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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377

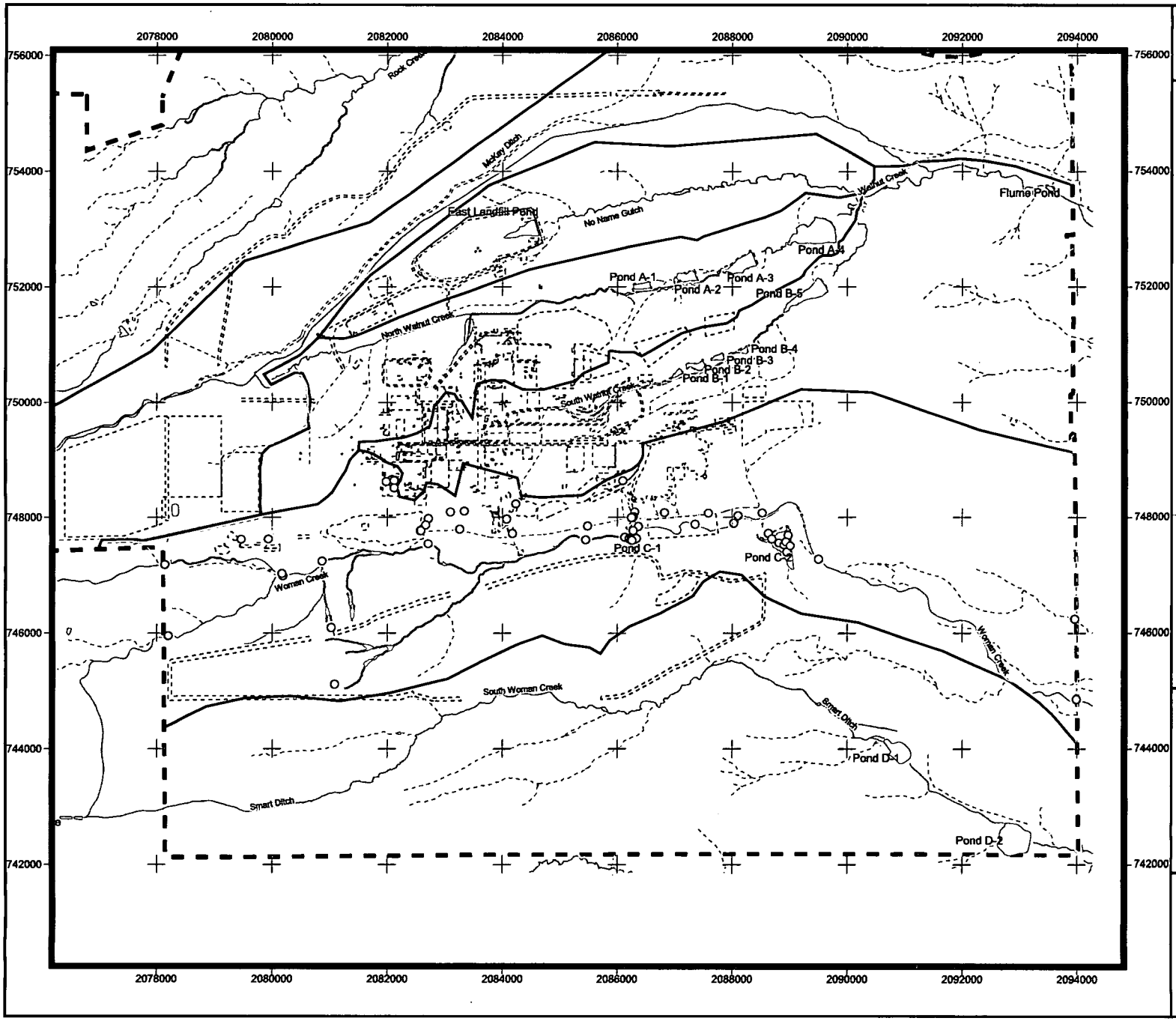

Figure 2.181
Woman Creek AEU
Sediment Sampling Locations
for Lead

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 35.8 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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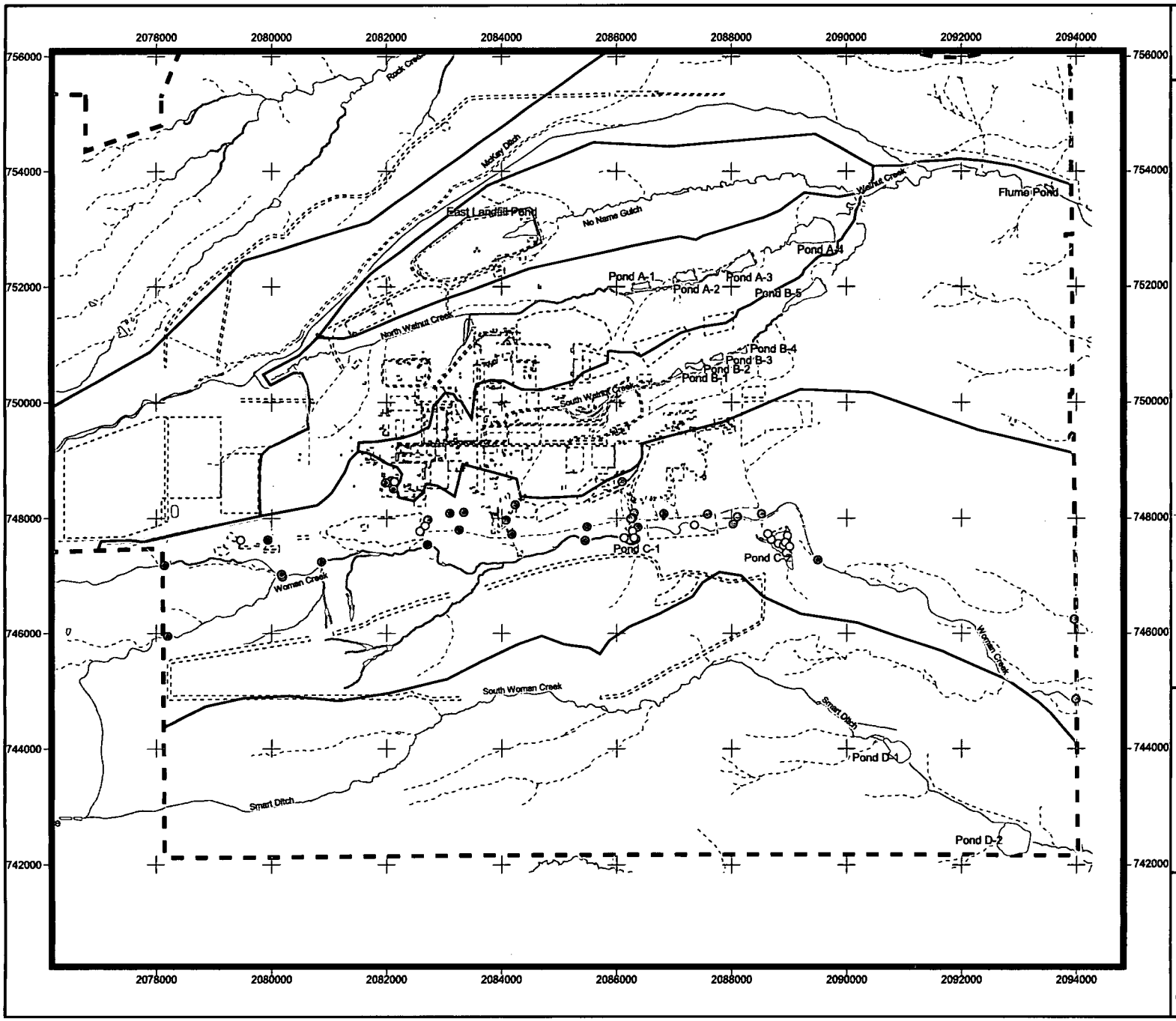

Figure 2.182
Woman Creek AEU
Sediment Sampling Locations
for Mercury

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.18 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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Datum: NAD 27

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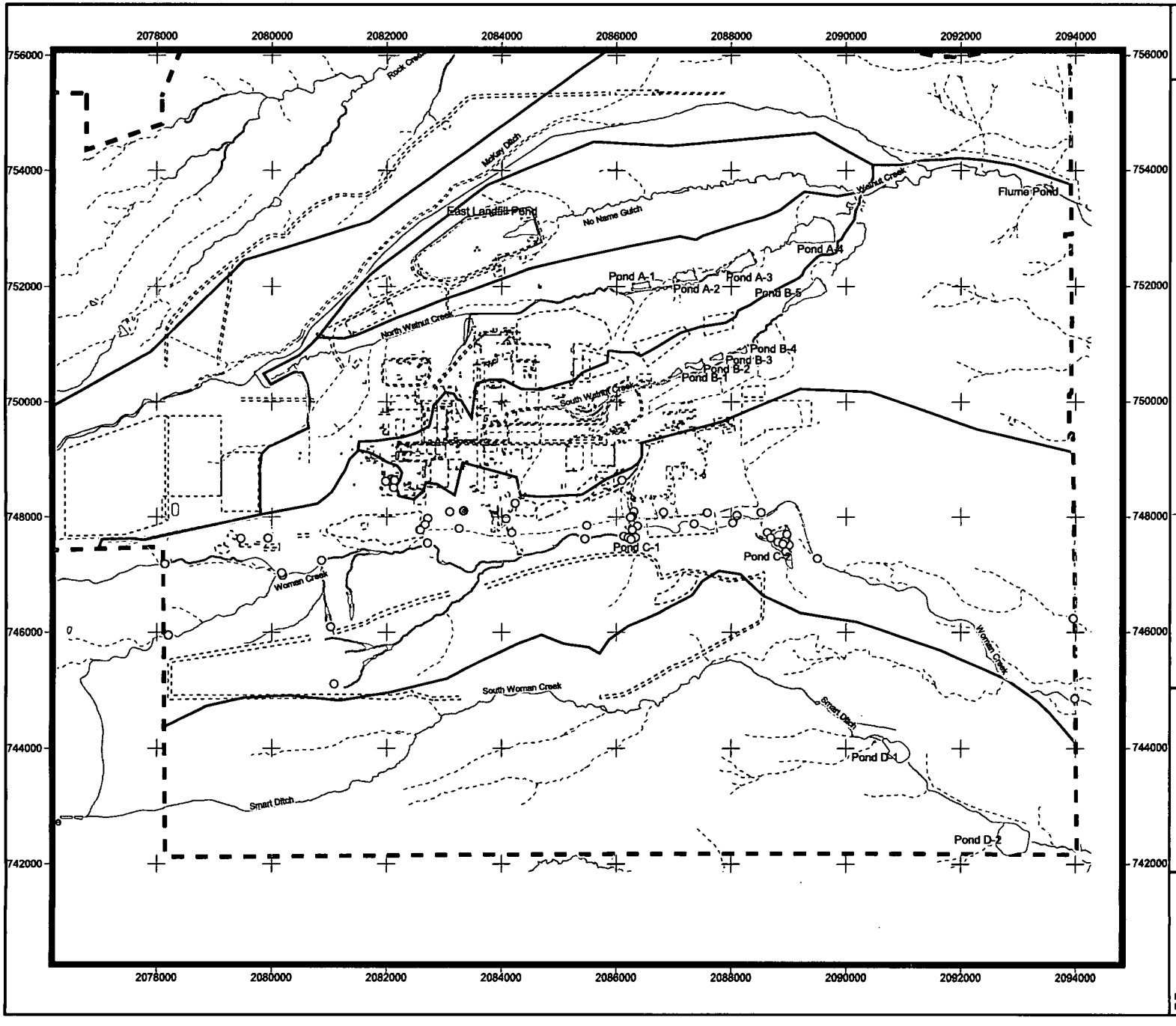

Figure 2.183
Woman Creek AEU
Sediment Sampling Locations
for Nickel

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 22.7 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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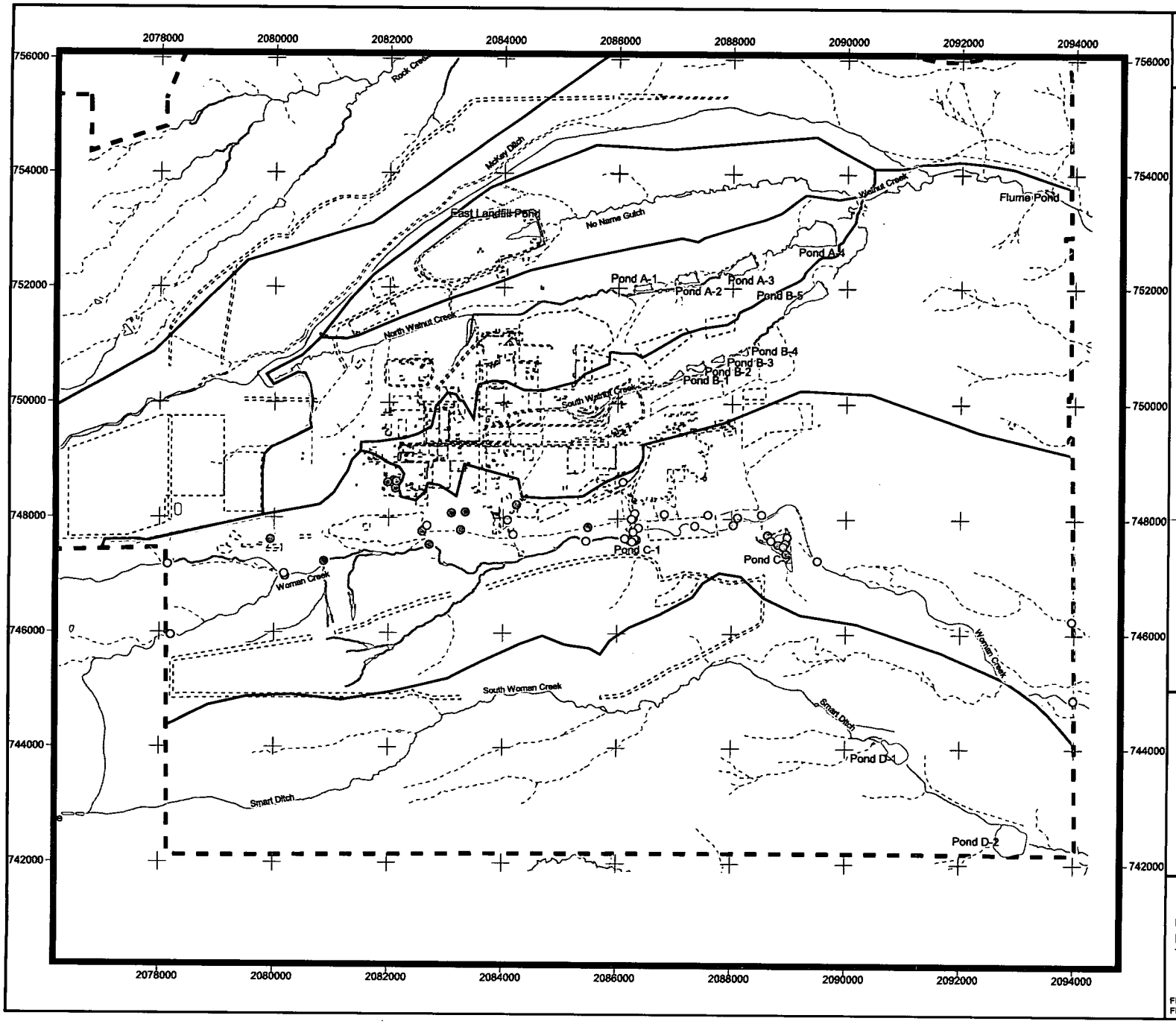

Figure 2.184
Woman Creek AEU
Sediment Sampling Locations
for Selenium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.95 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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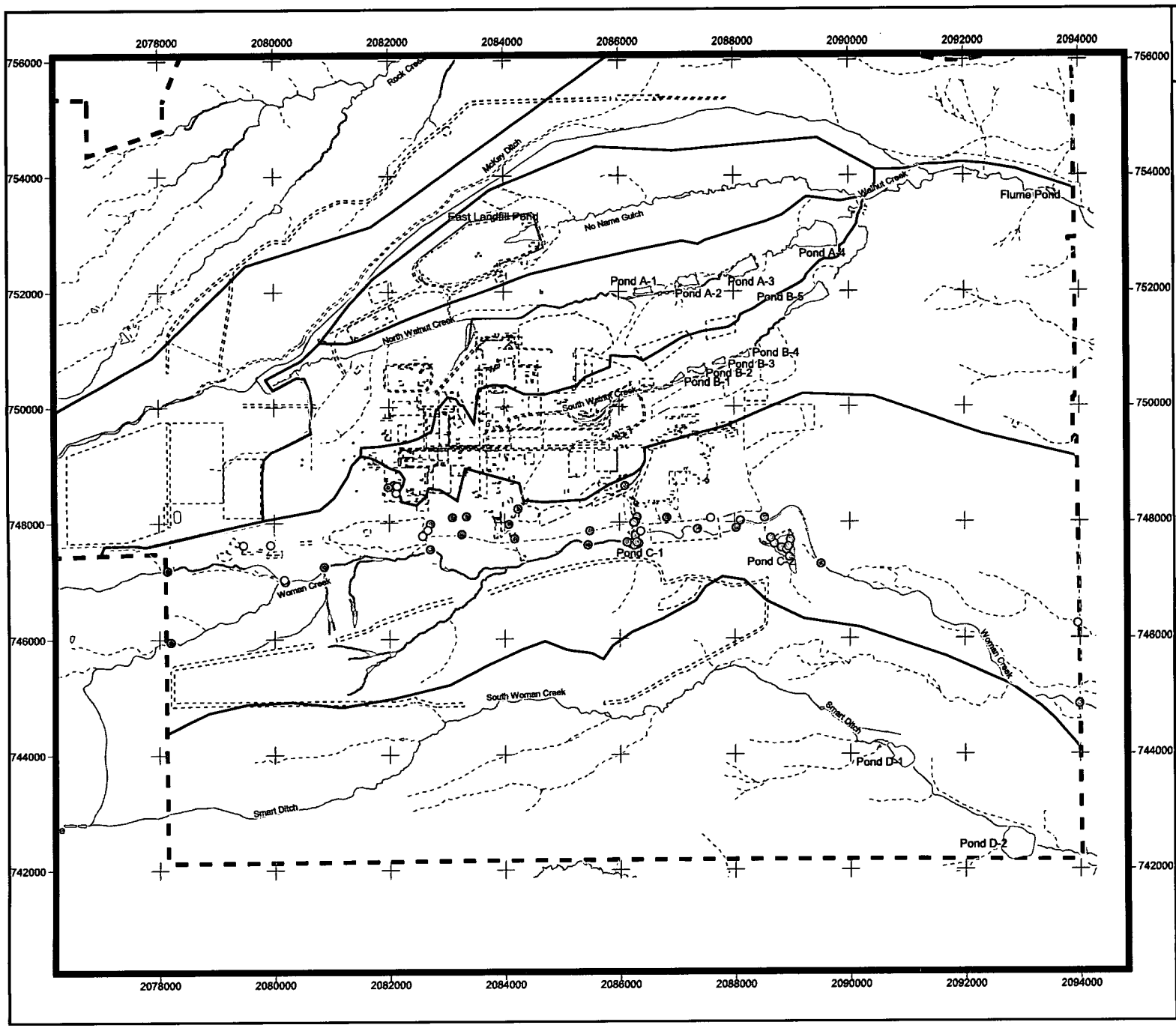

Figure 2.185
Woman Creek AEU
Sediment Sampling Locations
for Silver

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 1 mg/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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Datum: NAD 27

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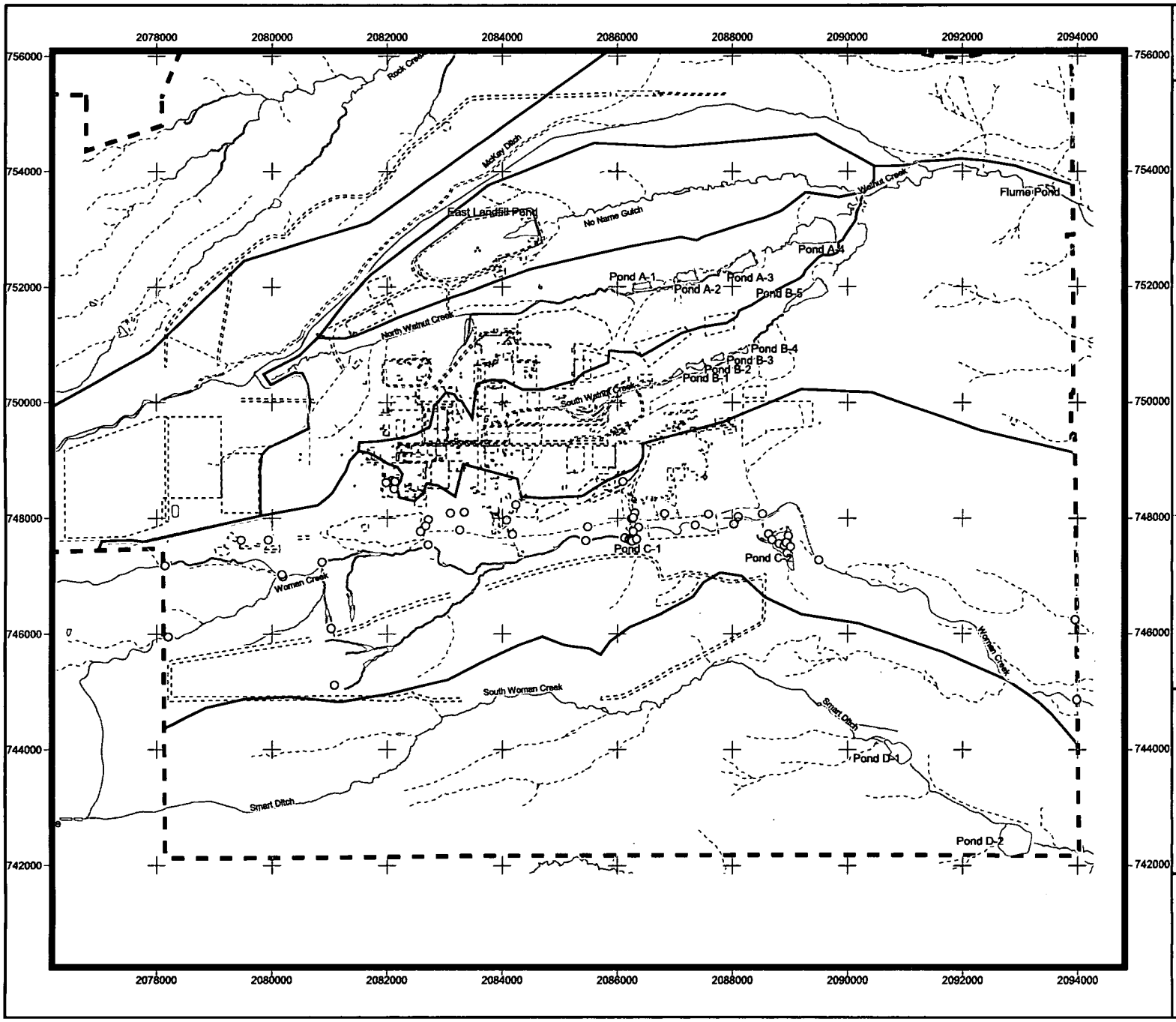

Figure 2.186
Woman Creek AEU
Sediment Sampling Locations for Zinc

KEY

Sampling location

- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 121 mg/kg

Standard Map Features

- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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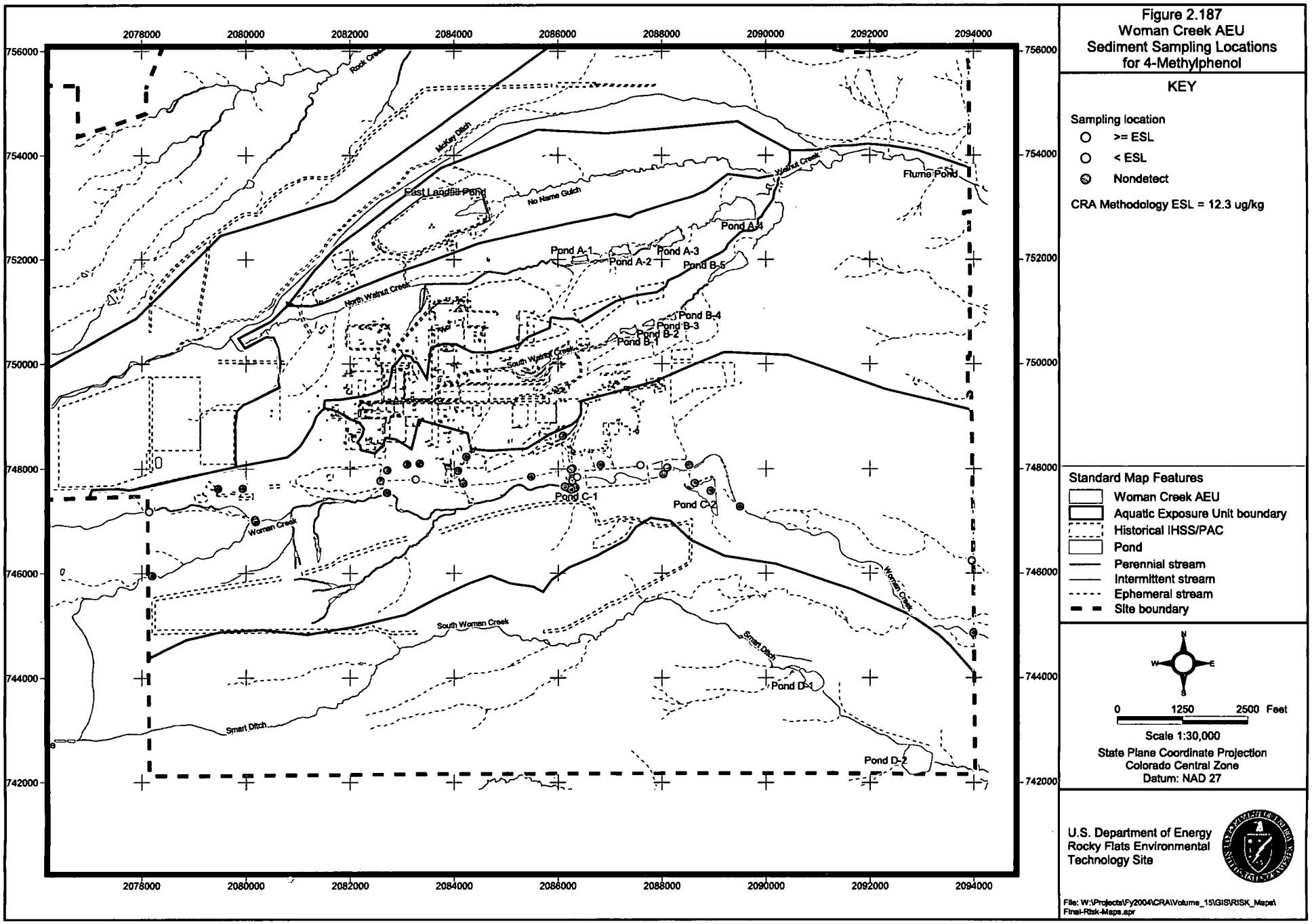
2078000
2080000
2082000
2084000
2086000
2088000
2090000
2092000
2094000
756000
754000
752000
750000
748000
746000
744000
742000
Rock Creek
Mckay Ditch
East Landfill Pond
No Name Gulch
Walnut Creek
Flume Pond
Pond A-4
Pond A-1
Pond A-2
Pond A-3
Pond B-5
North Walnut Creek
Pond B-4
Pond B-3
Pond B-2
Pond B-1
South Walnut Creek
Pond C-1
Pond C-2
Woman Creek
South Woman Creek
Smart Ditch
Pond D-1
Pond D-2
Figure 2.187
Woman Creek AEU
Sediment Sampling Locations
for 4-Methylphenol
KEY
Sampling location
>= ESL
< ESL
Nondetect
CRA Methodology ESL = 12.3 ug/kg
Standard Map Features
Woman Creek AEU
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary
N
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1250
2500 Feet
Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
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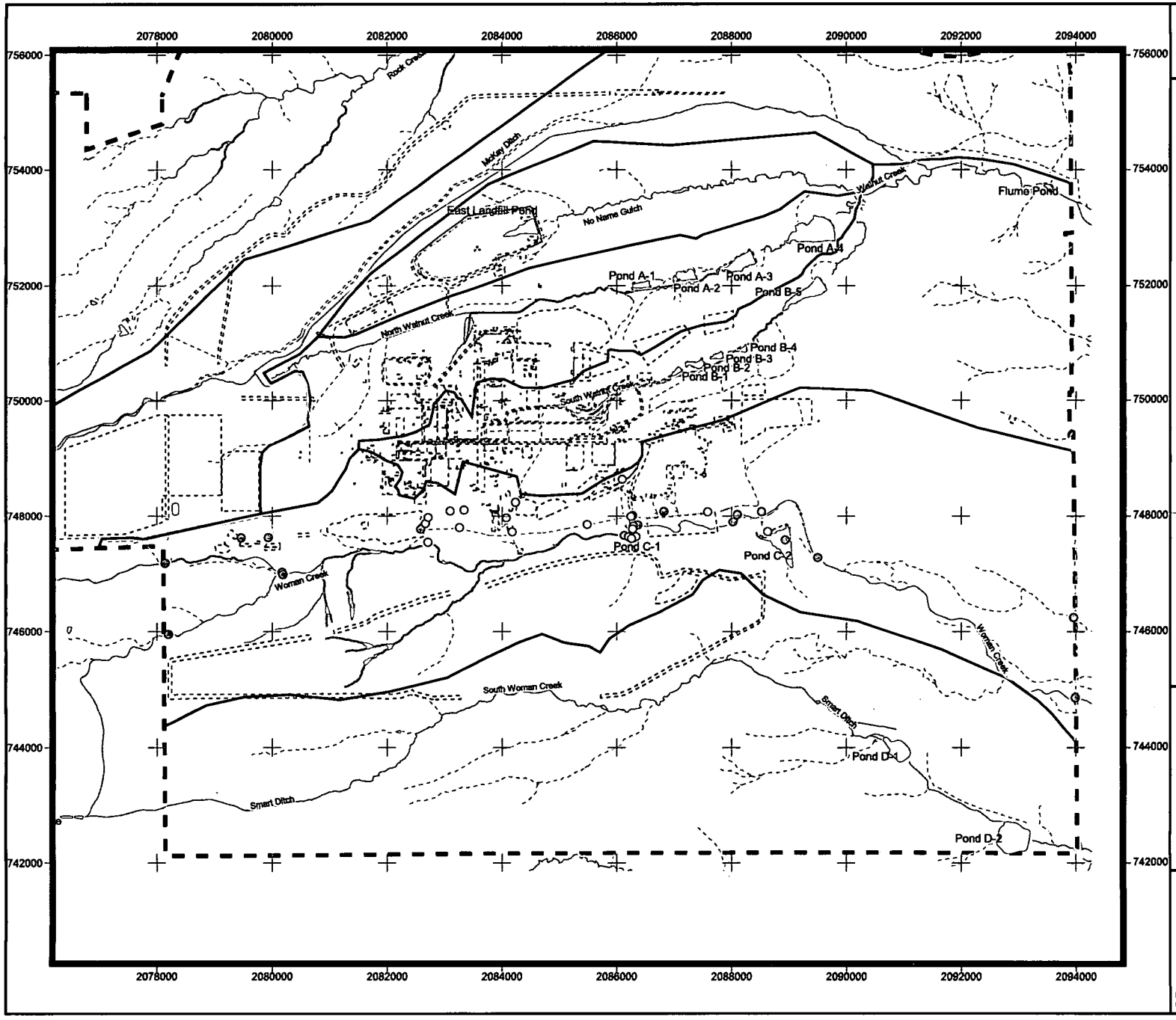

Figure 2.188
Woman Creek AEU
Sediment Sampling Locations
for Total PAHs

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 1610 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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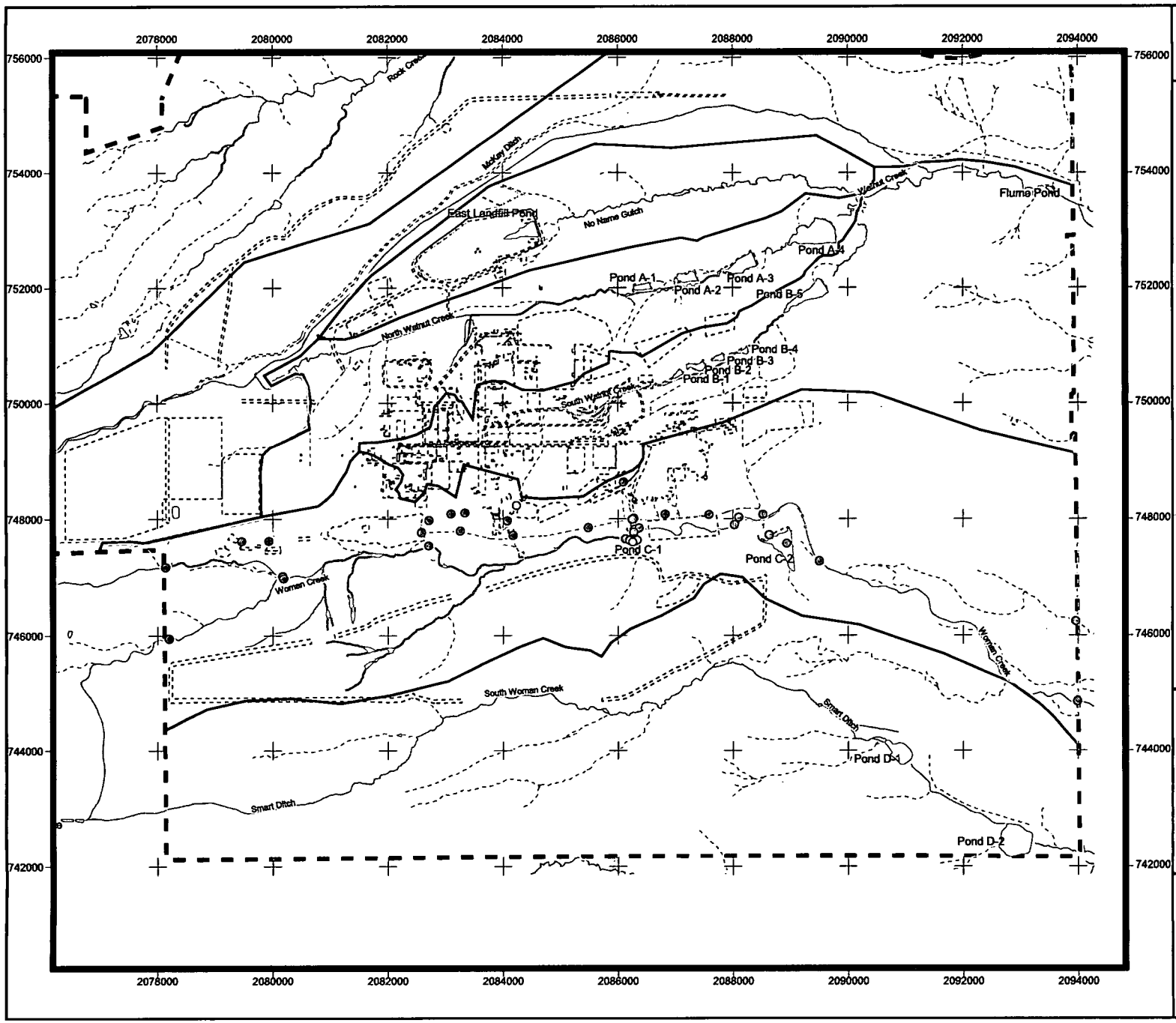

Figure 2.189
Woman Creek AEU
Sediment Sampling Locations
for Acenaphthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 6.71 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
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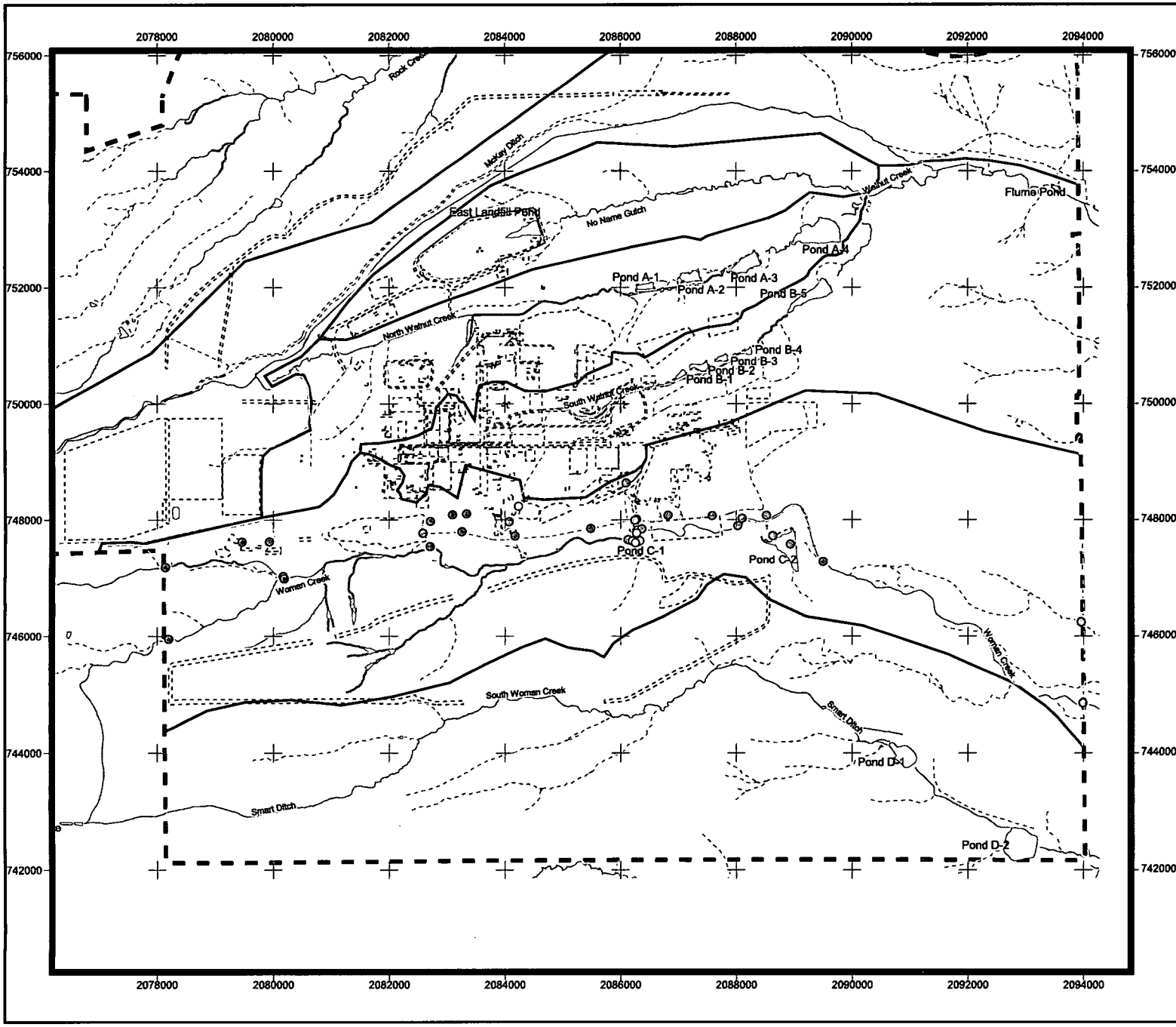

Figure 2.190
Woman Creek AEU
Sediment Sampling Locations
for Anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 57.2 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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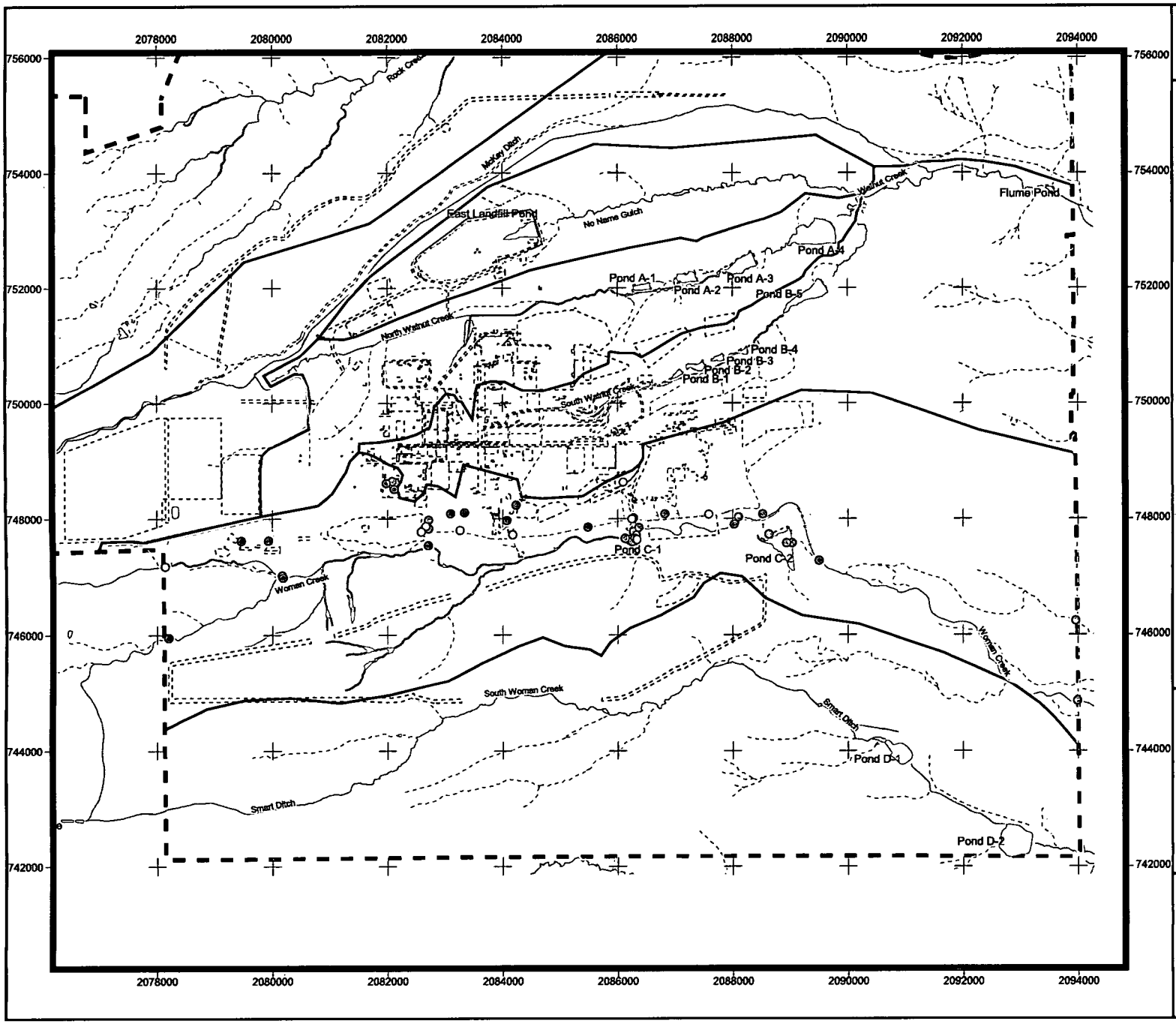

Figure 2.191
Woman Creek AEU
Sediment Sampling Locations
for Total PCBs

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
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0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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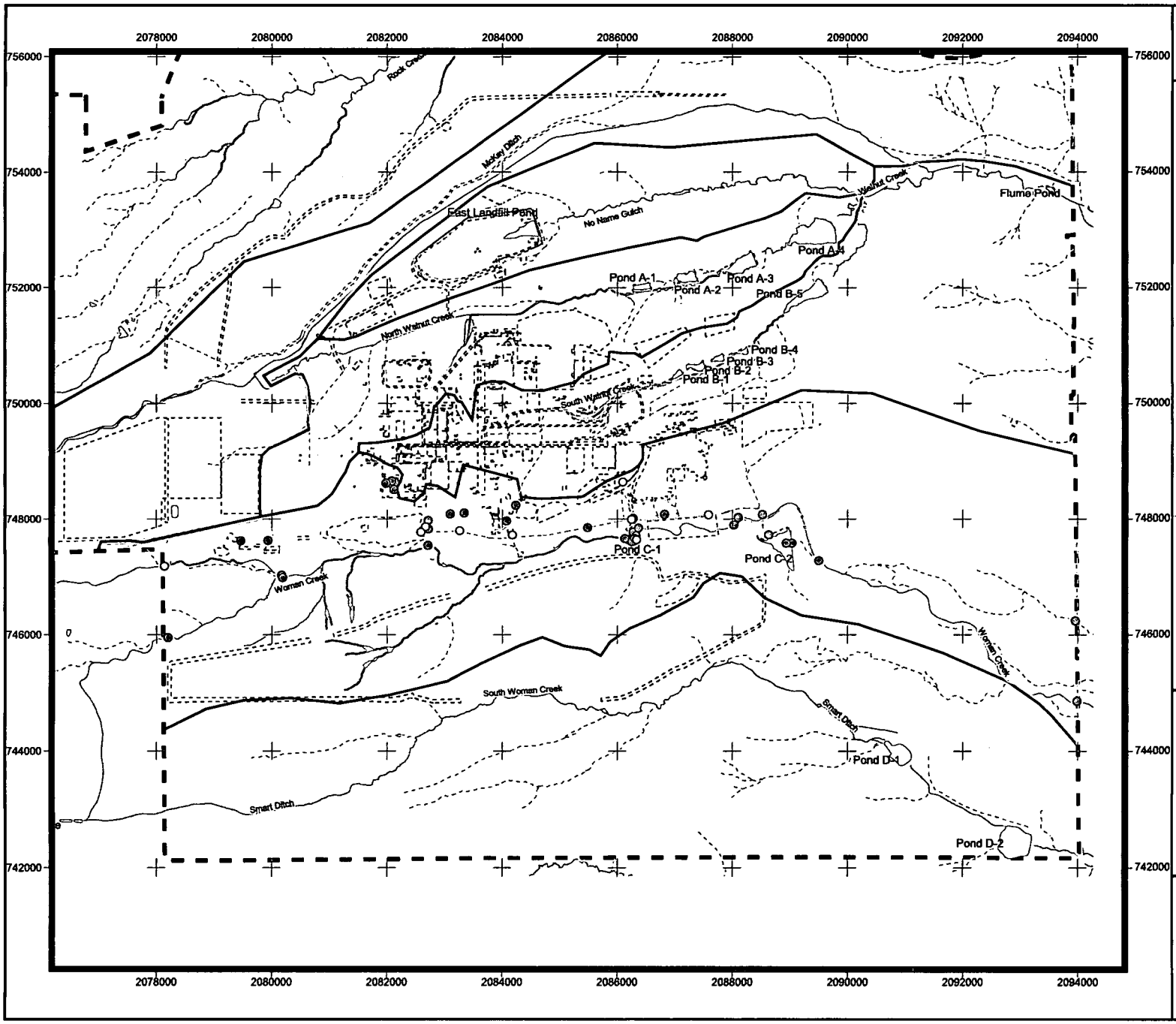

Figure 2.192
Woman Creek AEU
Sediment Sampling Locations
for Aroclor-1254

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 40 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
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S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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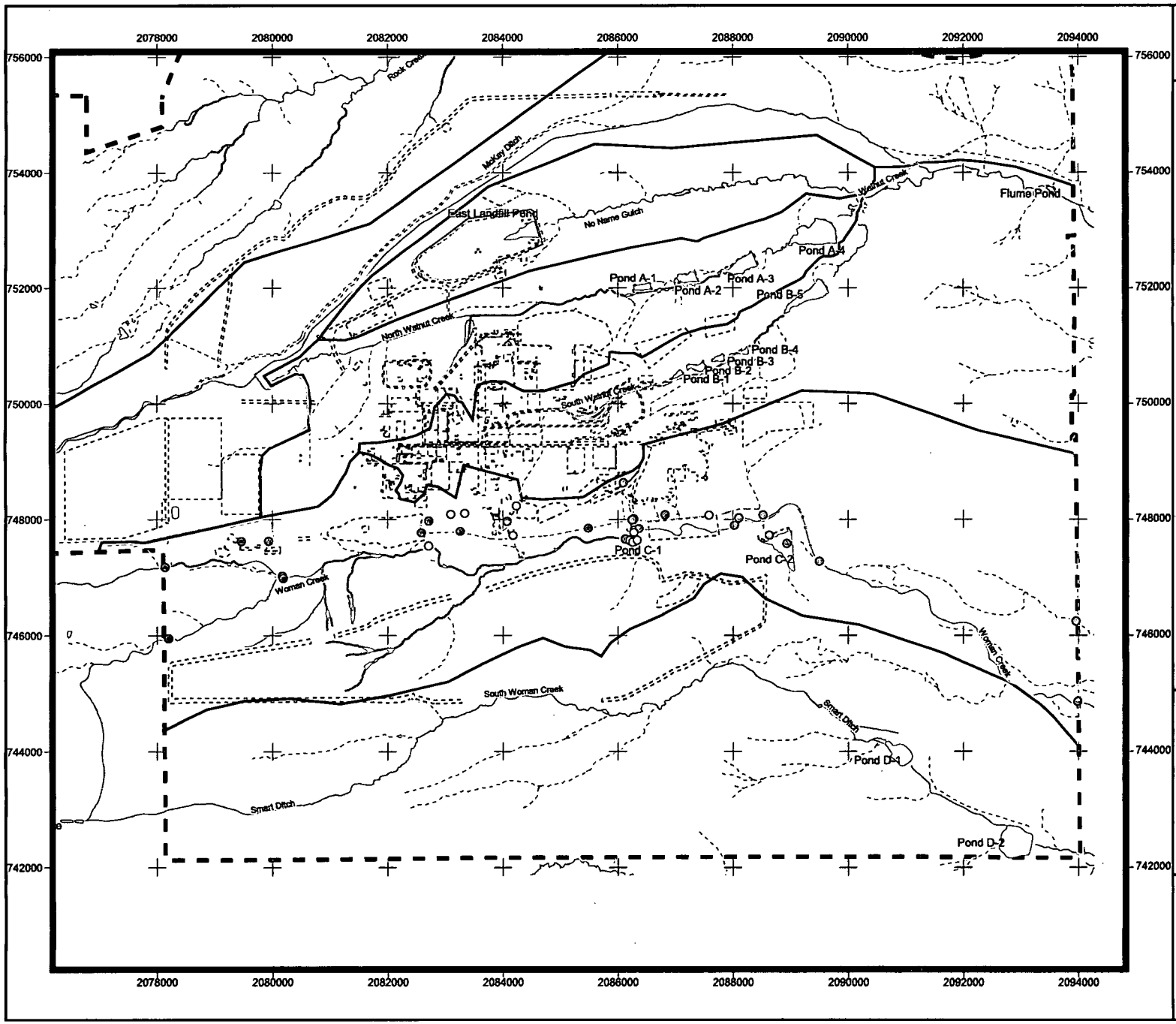

Figure 2.193
Woman Creek AEU
Sediment Sampling Locations
for Benzo(a)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 108 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
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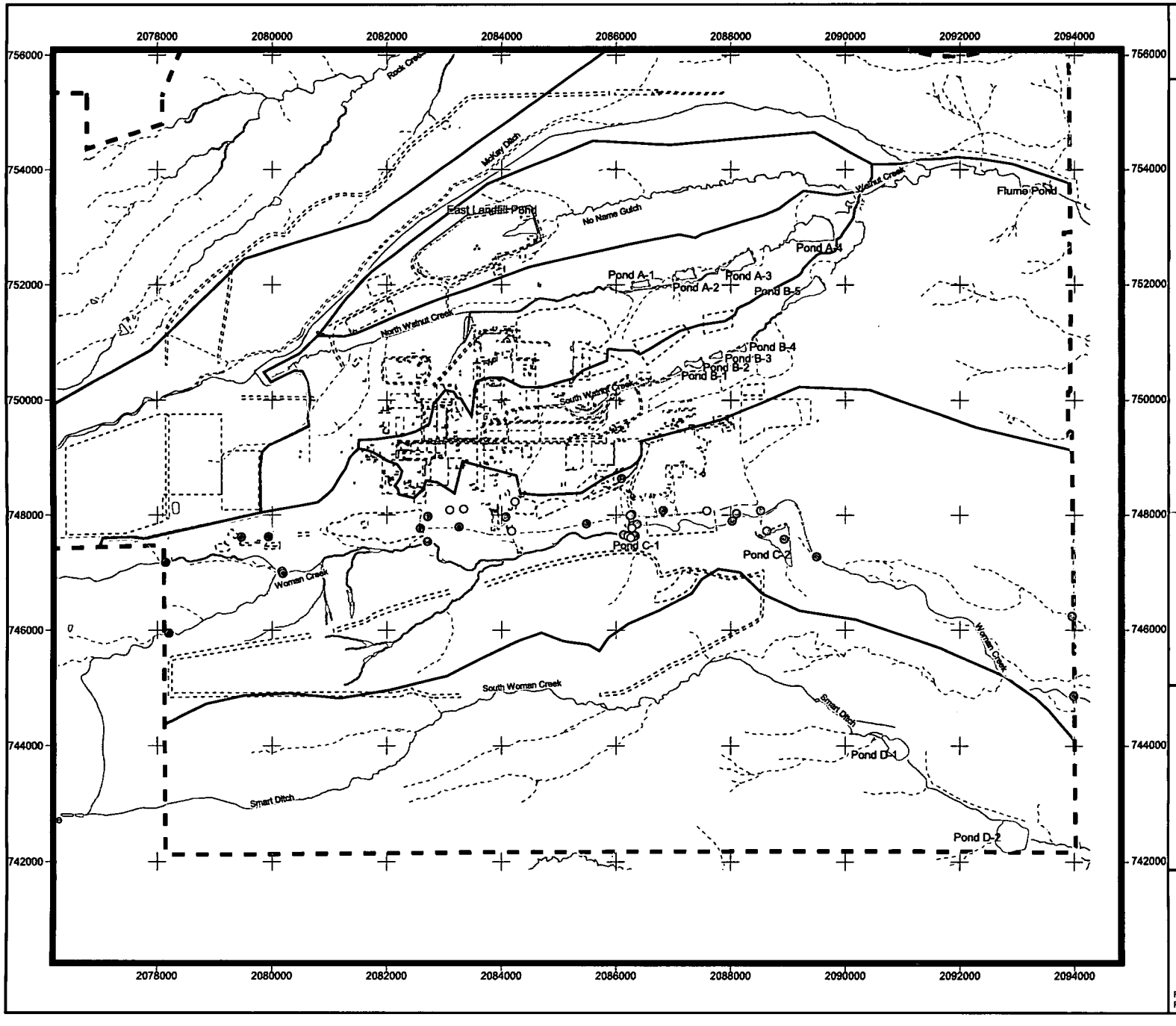

Figure 2.194
Woman Creek AEU
Sediment Sampling Locations
for Benzo(a)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 150 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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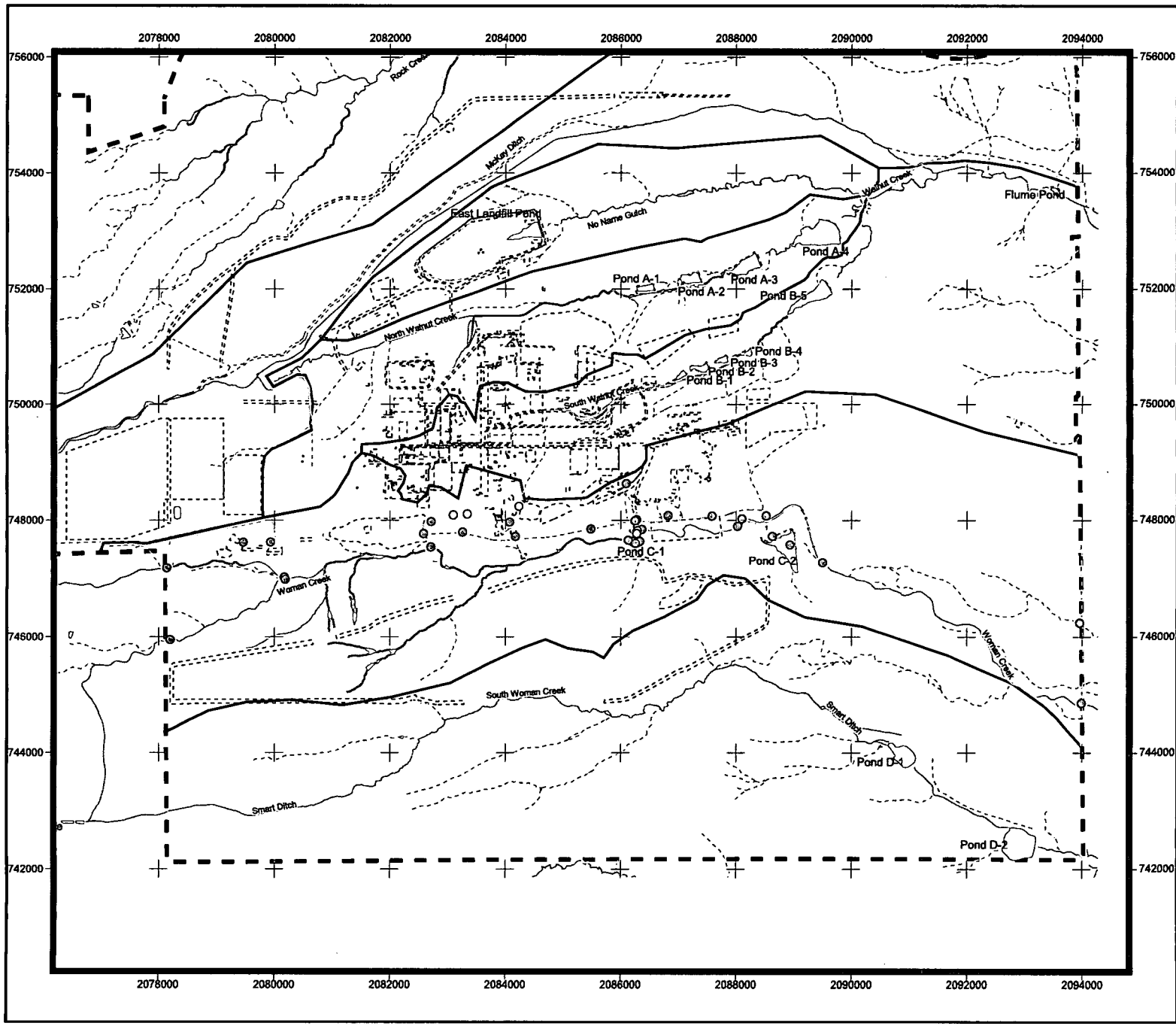

Figure 2.195
Woman Creek AEU
Sediment Sampling Locations
for Benzo(g,h,i)perylene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 13 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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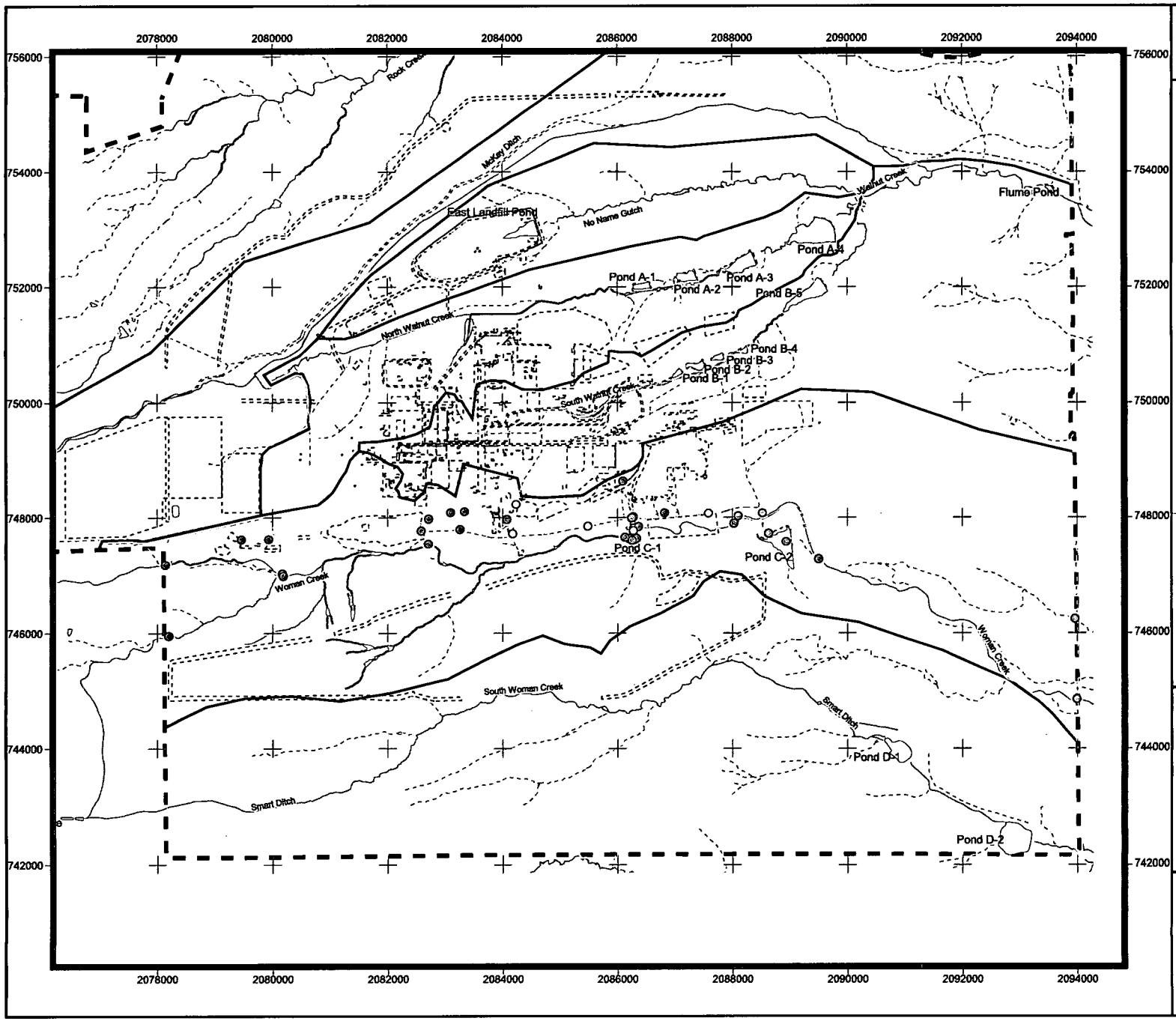

Figure 2.196
Woman Creek AEU
Sediment Sampling Locations
for Benzo(k)fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 240 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000
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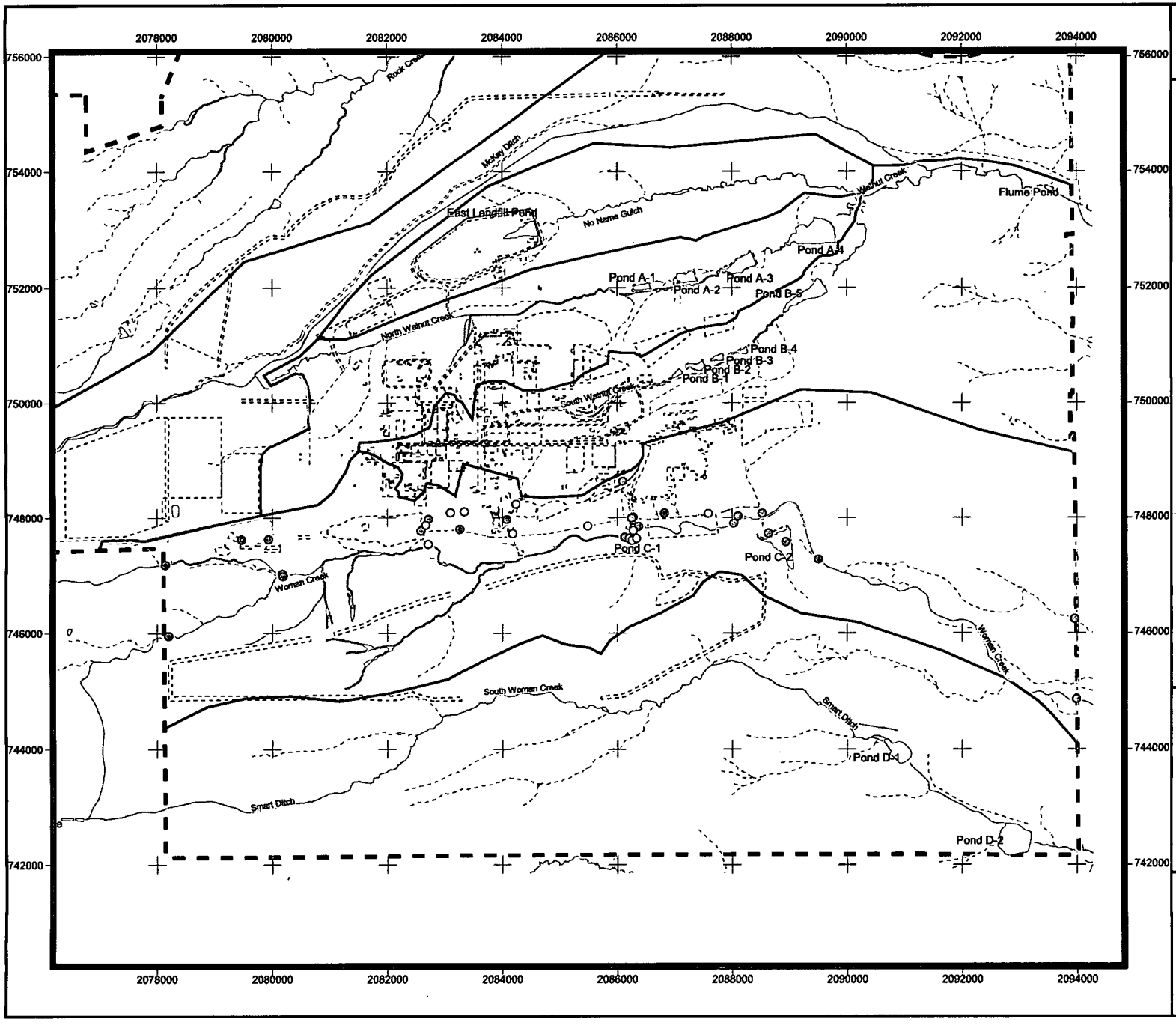

Figure 2.197
Woman Creek AEU
Sediment Sampling Locations
for Chrysene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 166 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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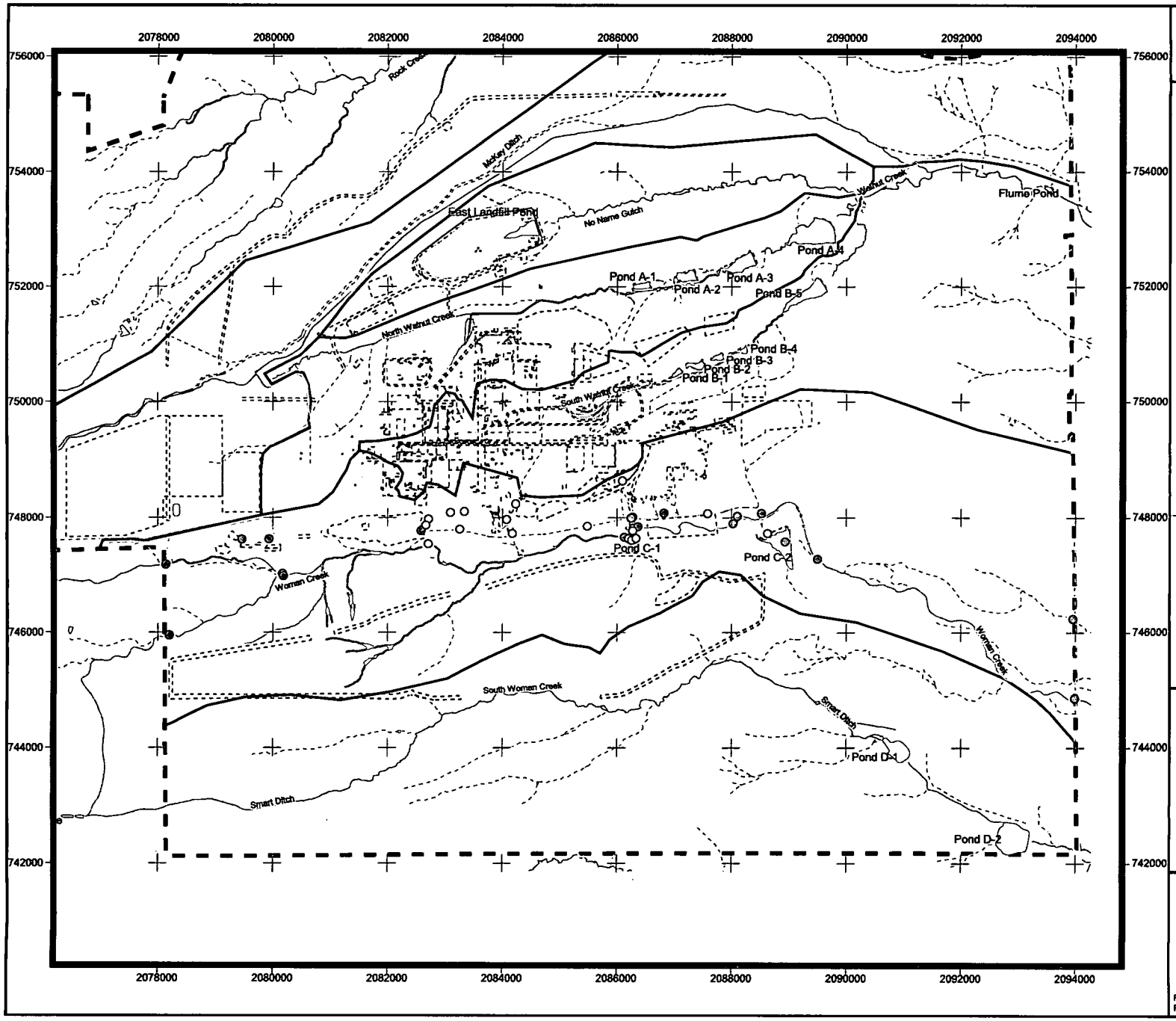

Figure 2.198
Woman Creek AEU
Sediment Sampling Locations
for Fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 423 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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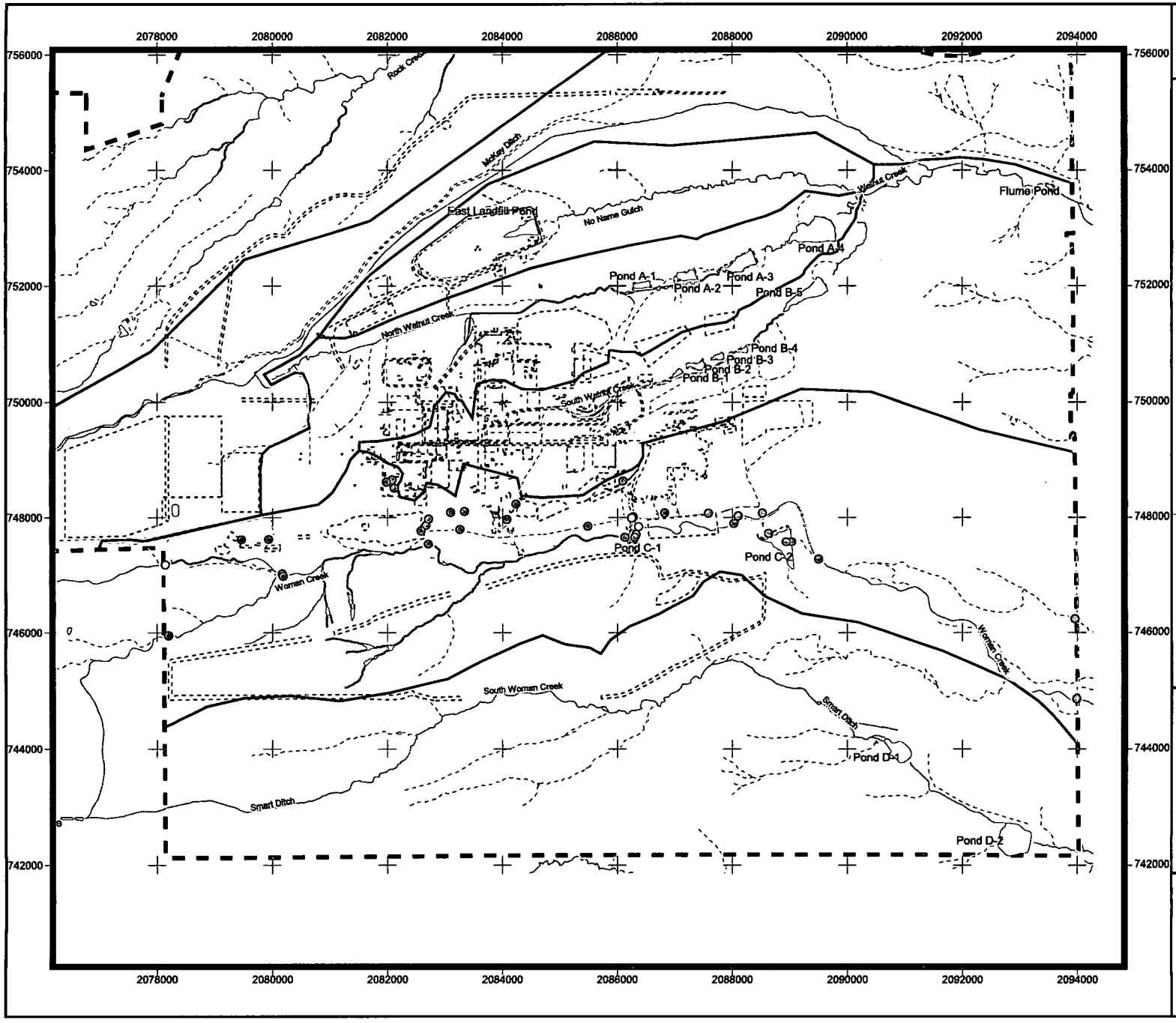

Figure 2.199
Woman Creek AEU
Sediment Sampling Locations
for Heptachlor

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 0.132 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

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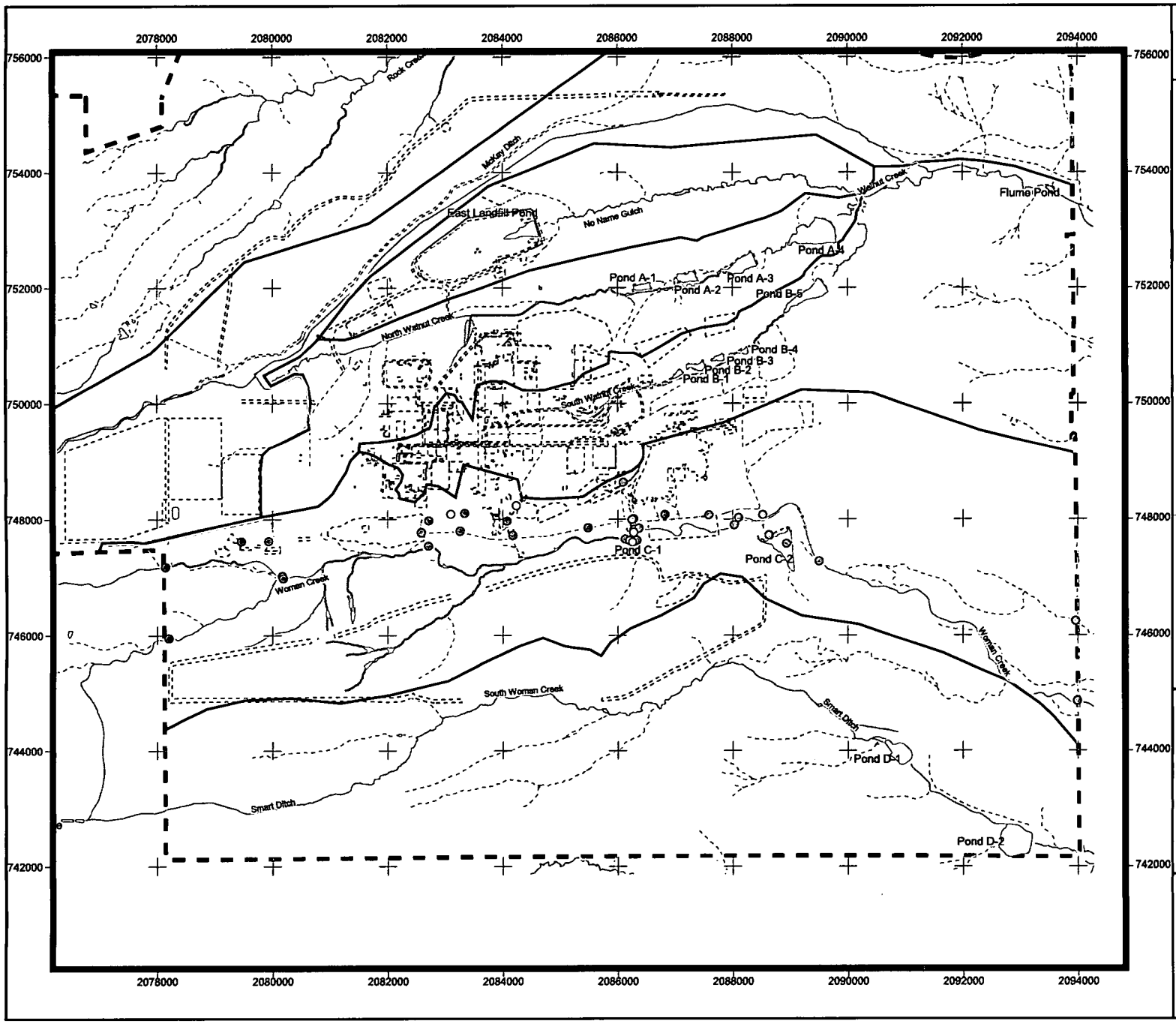

Figure 2.200
Woman Creek AEU
Sediment Sampling Locations
for Indeno(1,2,3-cd)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 17 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\RISK_Maps\
Final-Risk-Maps.apr

397

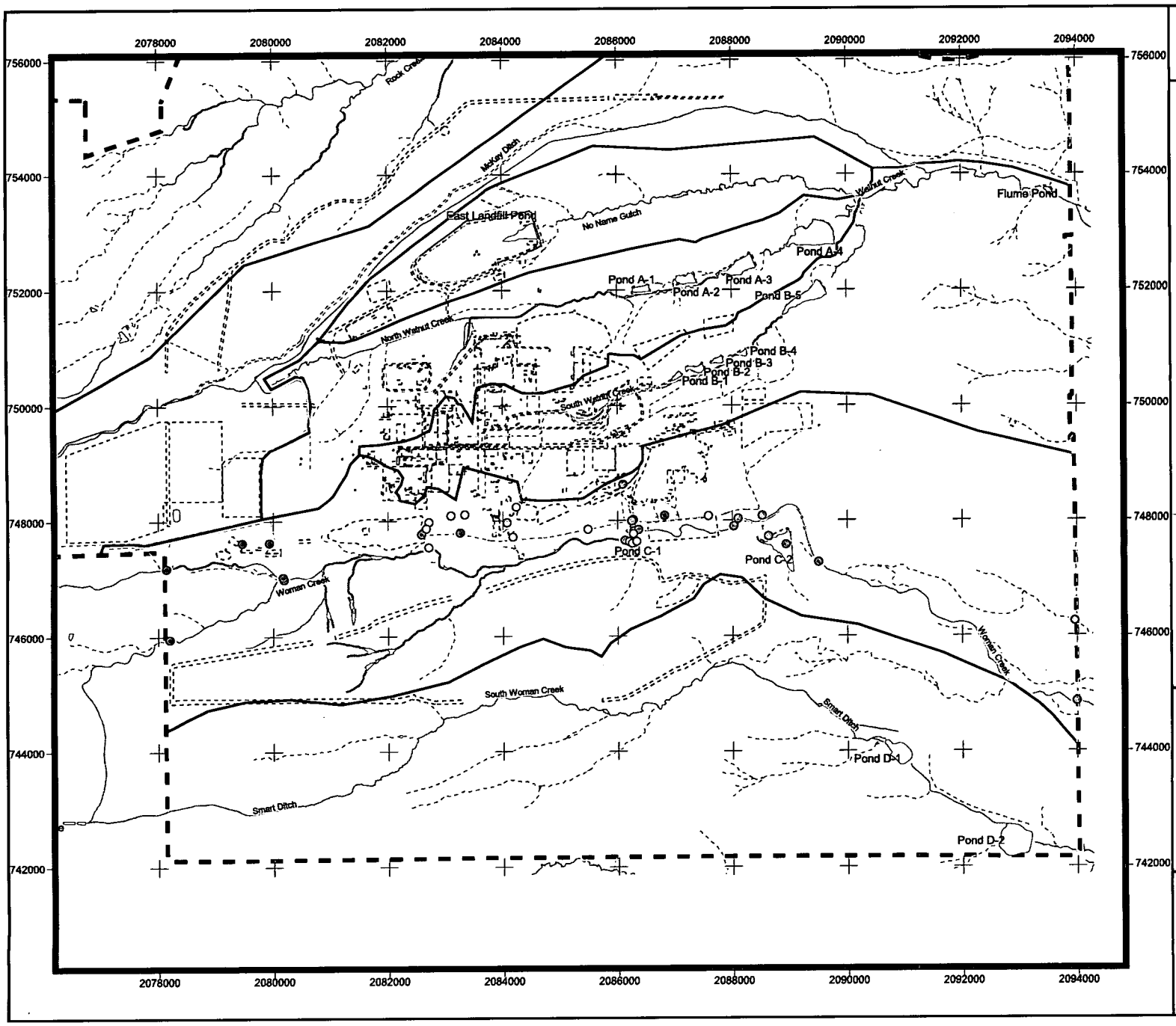

Figure 2.201
Woman Creek AEU
Sediment Sampling Locations
for Phenanthrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 204 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N W E S

0 1250 2500 Feet

Scale 1:30,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\RISK_Maps\
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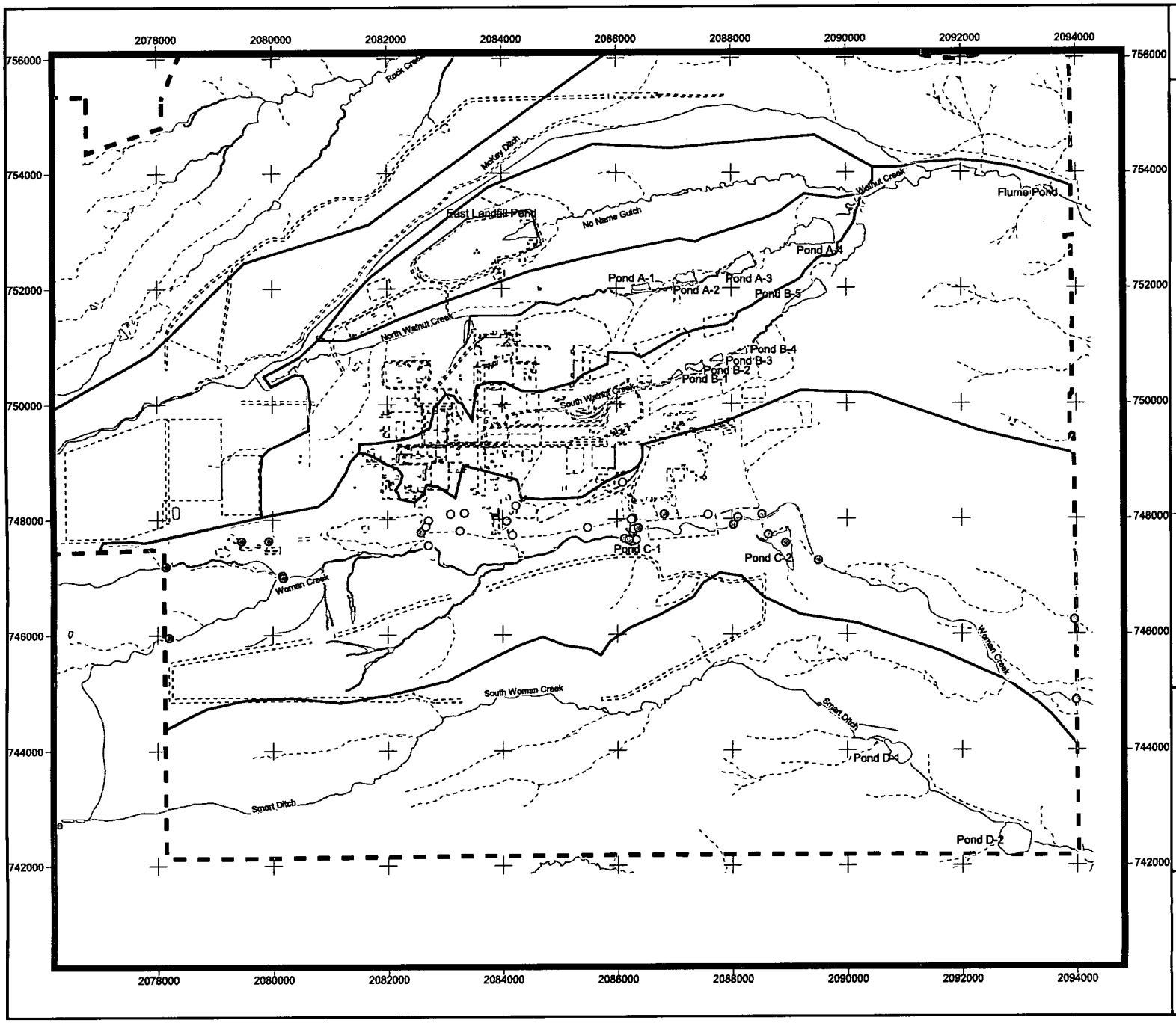

Figure 2.202
Woman Creek AEU
Sediment Sampling Locations
for Pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

CRA Methodology ESL = 195 ug/kg

Standard Map Features
- Woman Creek AEU
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1250 2500 Feet

Scale 1:30,000
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\RISK_Maps\
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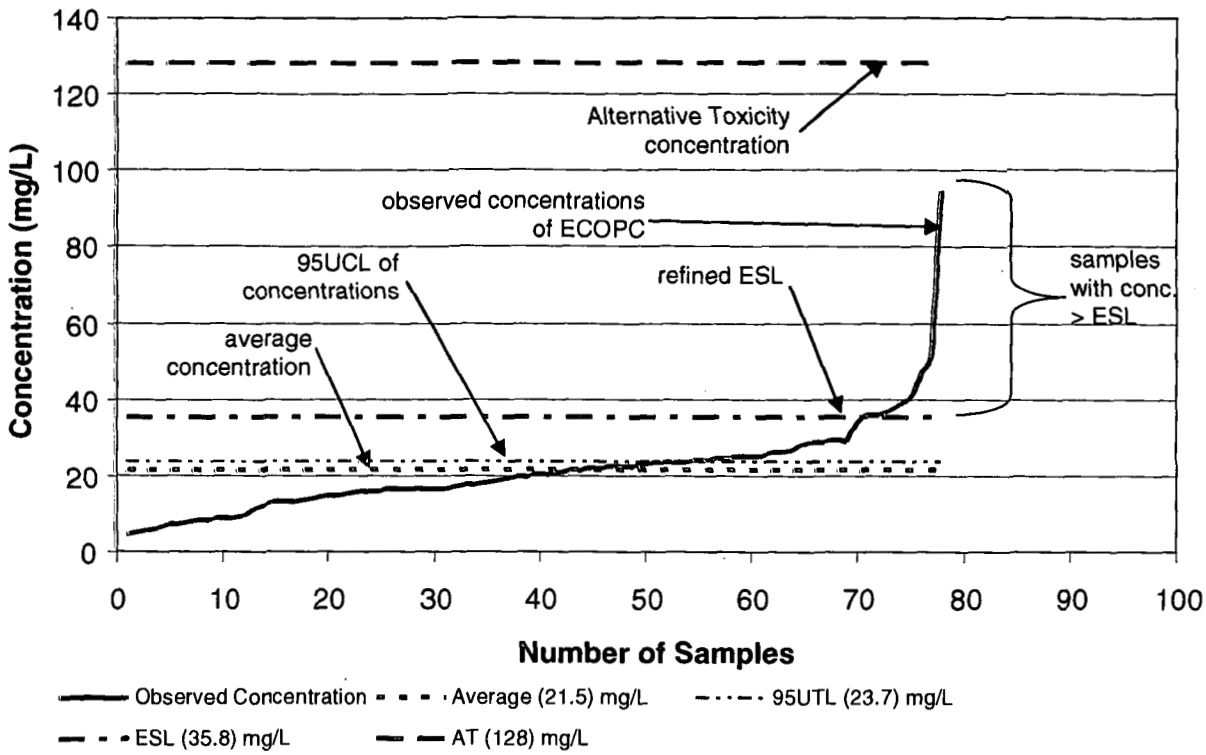

Figure 5.1 Example Data Distribution Curve (Lead in Surface Water)

399

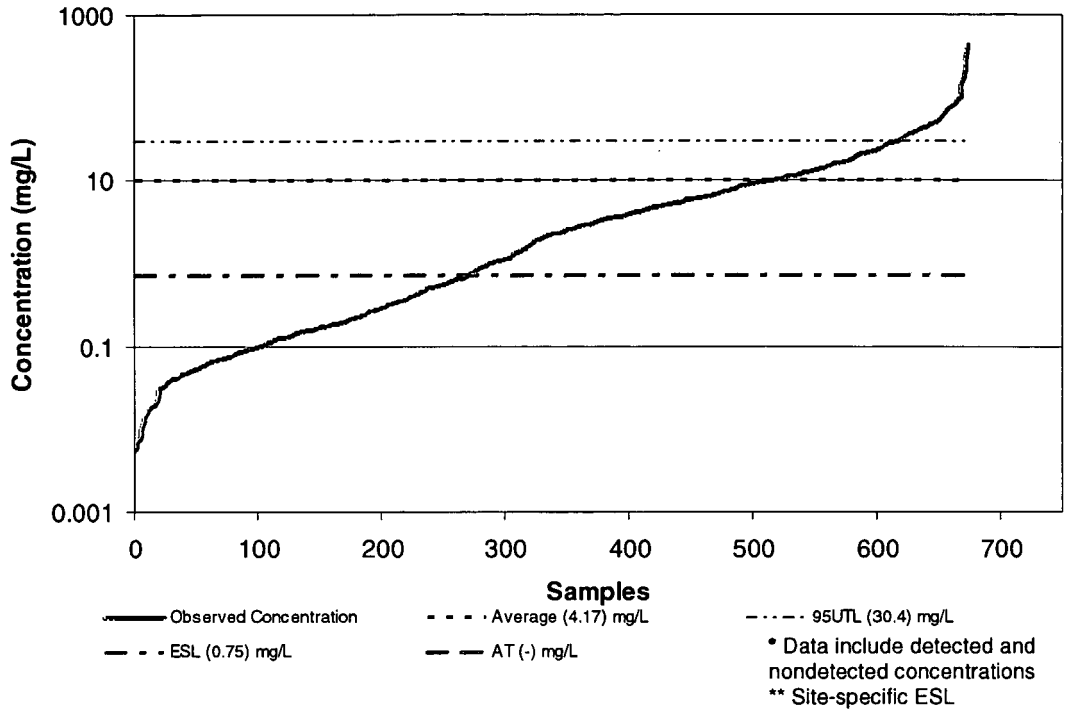

Figure 5.2 Data Distribution for Aluminum (total) in NW AEU Surface Water

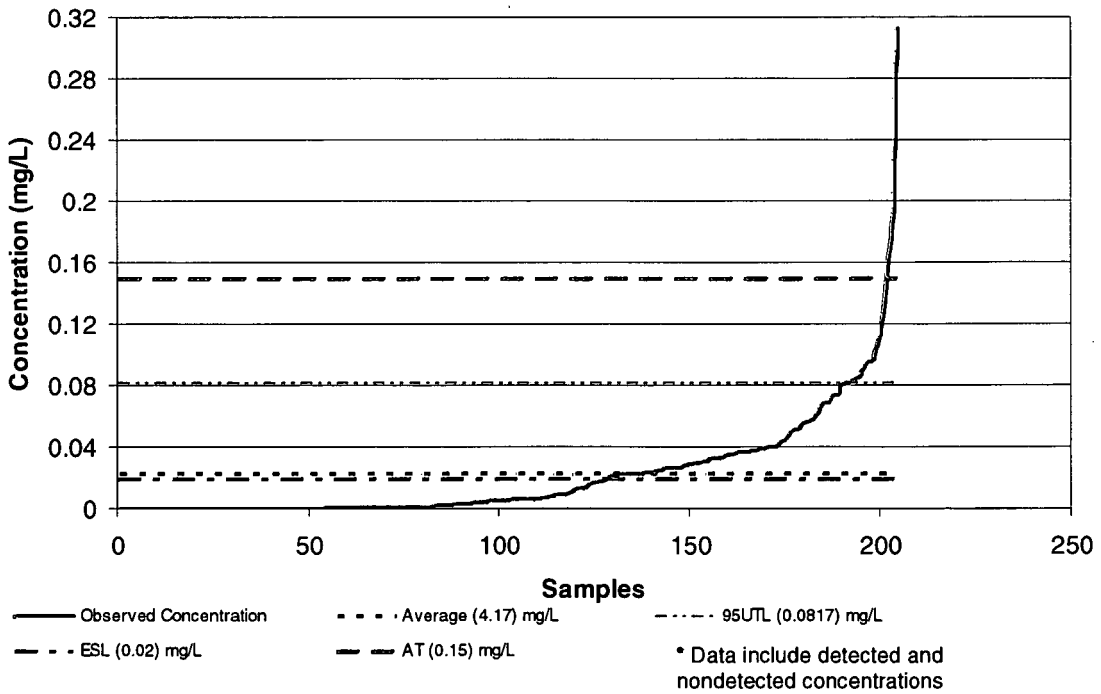

Figure 5.3 Data Distribution for Ammonia (un-ionized) in NW AEU Surface Water

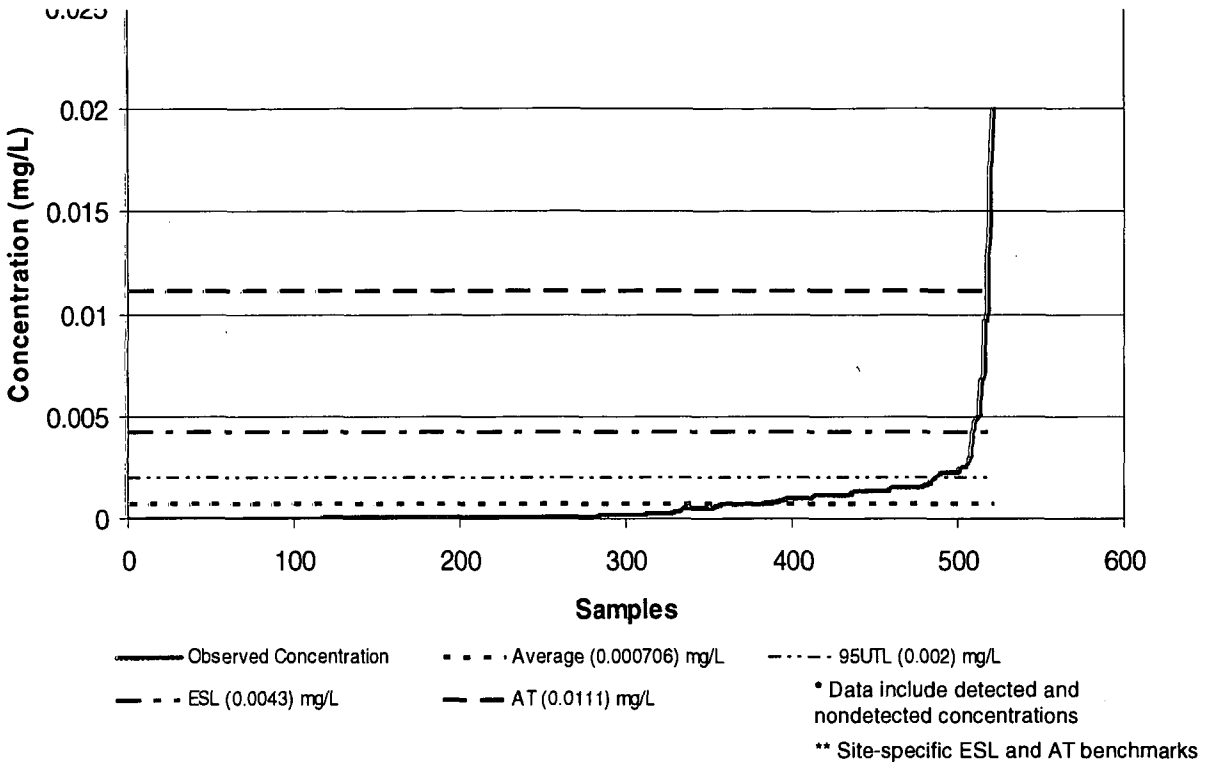

Figure 5.4 Data Distribution for Cadmium (dissolved) in NW AEU Surface Water

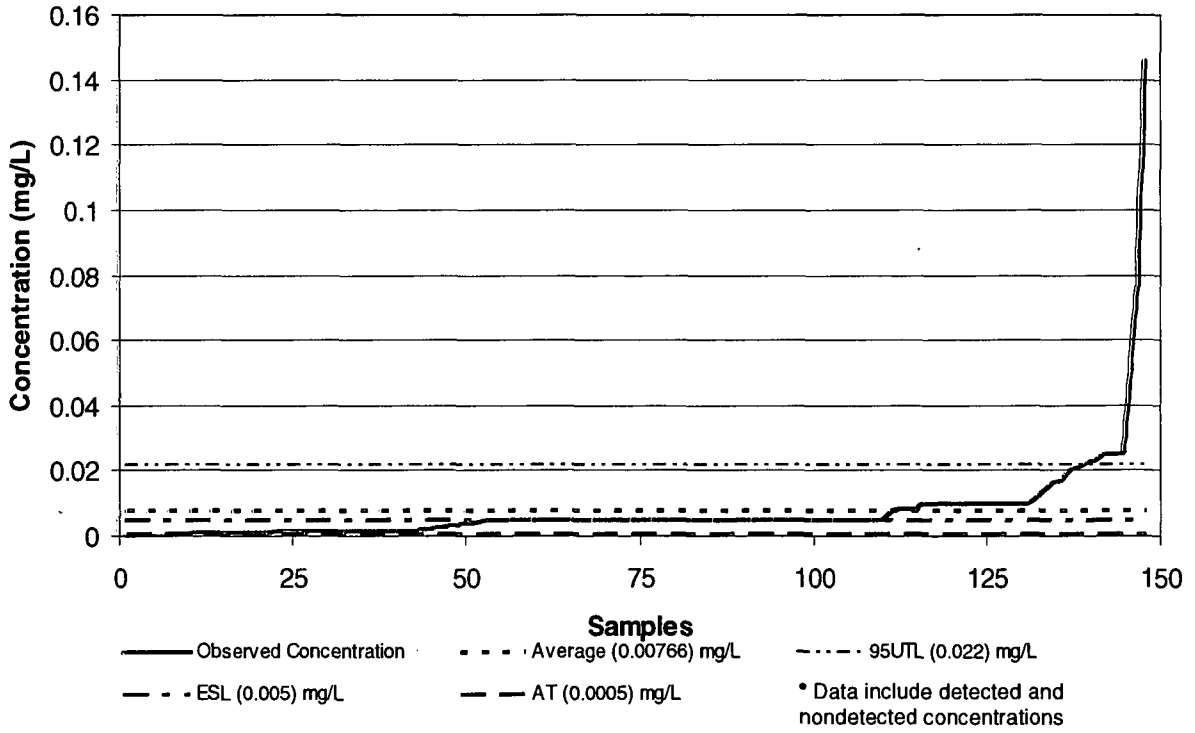

Figure 5.5 Data Distribution for Cyanide (total) in NW AEU Surface Water

401

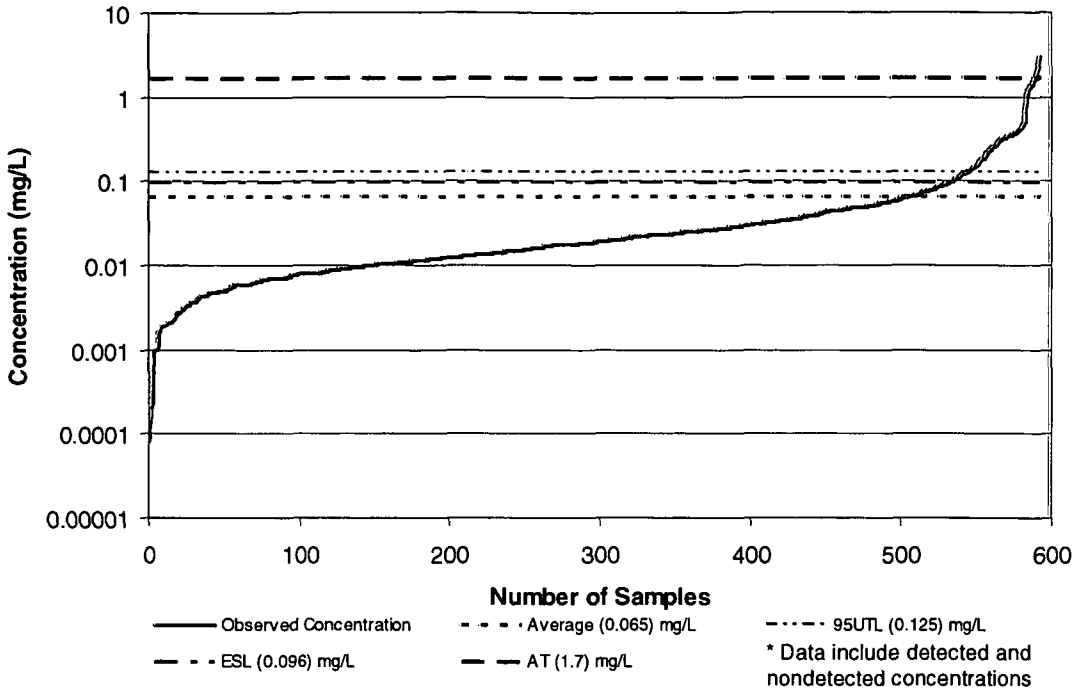

Figure 5.6 Data Distribution for Lithium (total) in NW AEU Surface Water

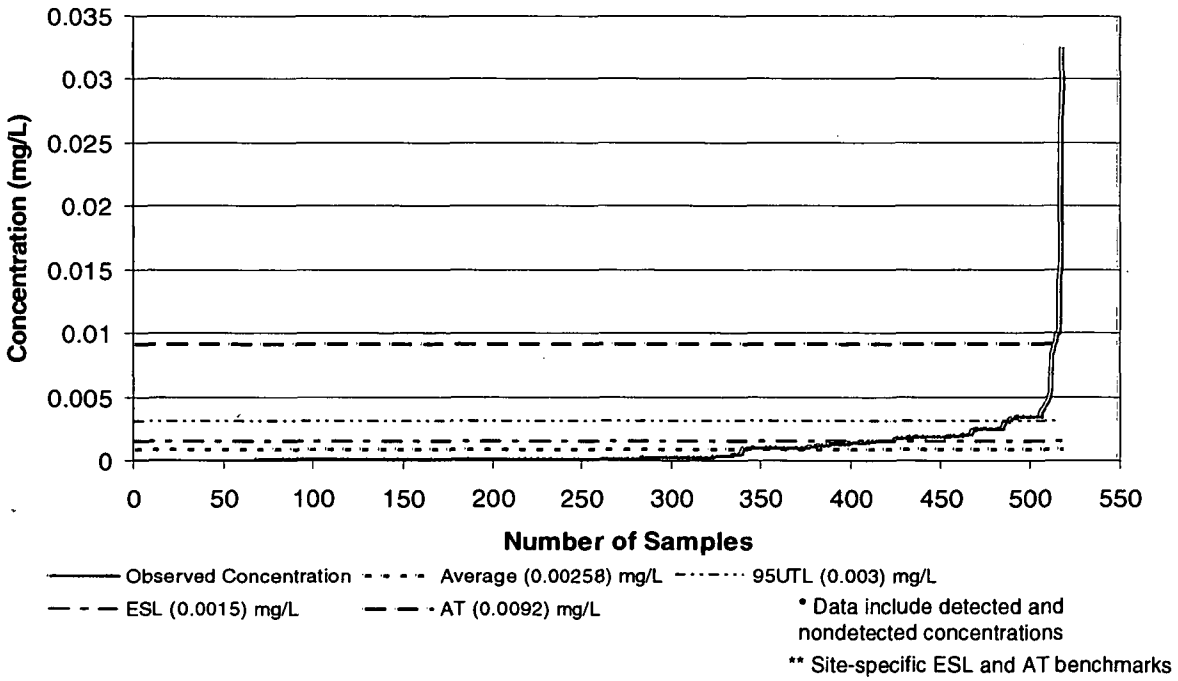

Figure 5.7 Data Distribution for Silver (dissolved) in NW AEU Surface Water

402

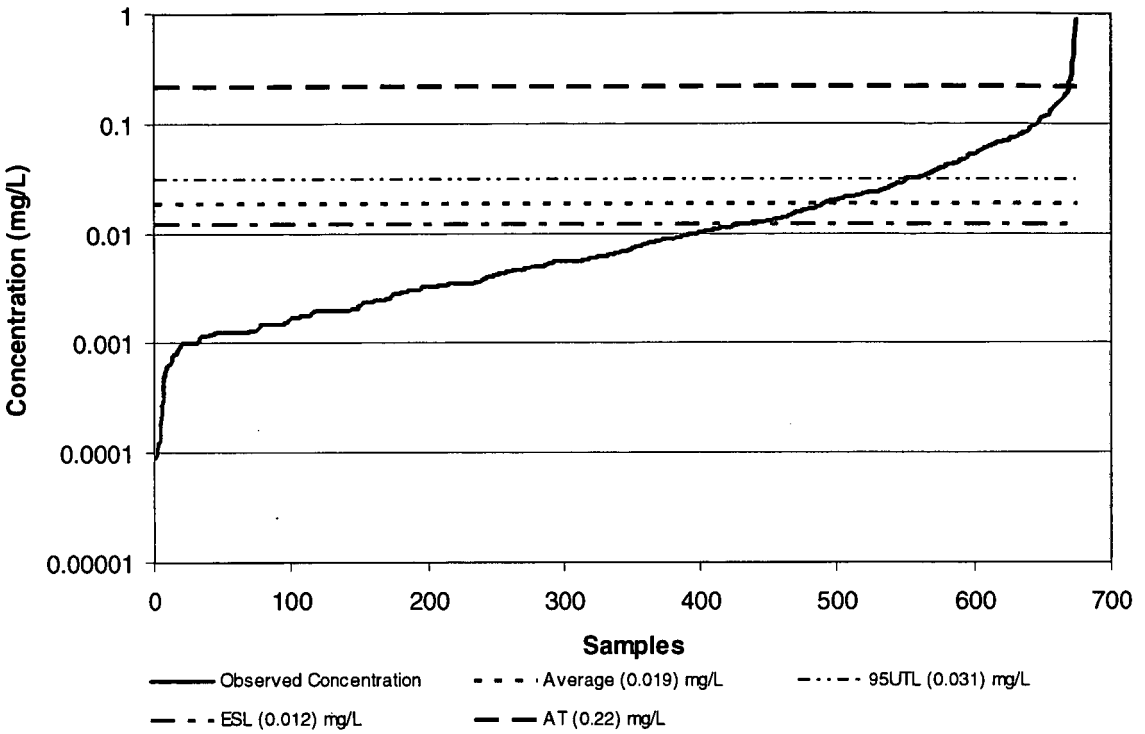

Figure 5.8 Data Distribution for Vanadium (total) in NW AEU Surface Water

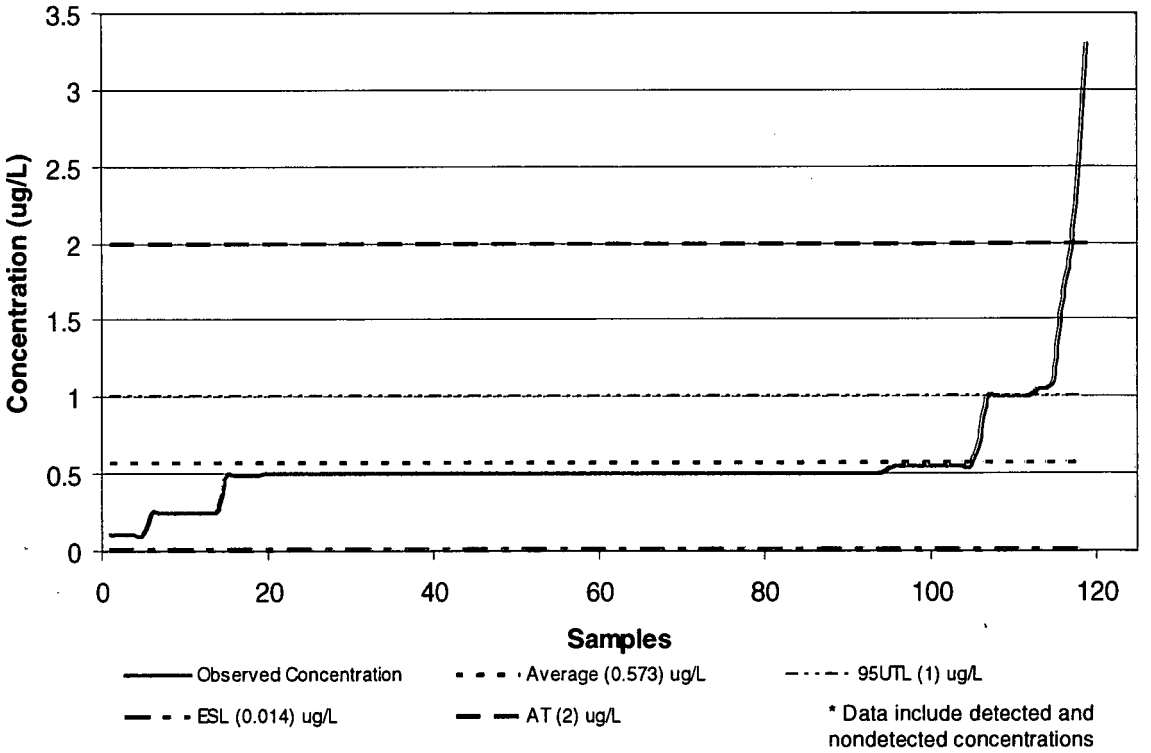

Figure 5.9 Data Distribution for Aroclor-1254 in NW AEU Surface Water

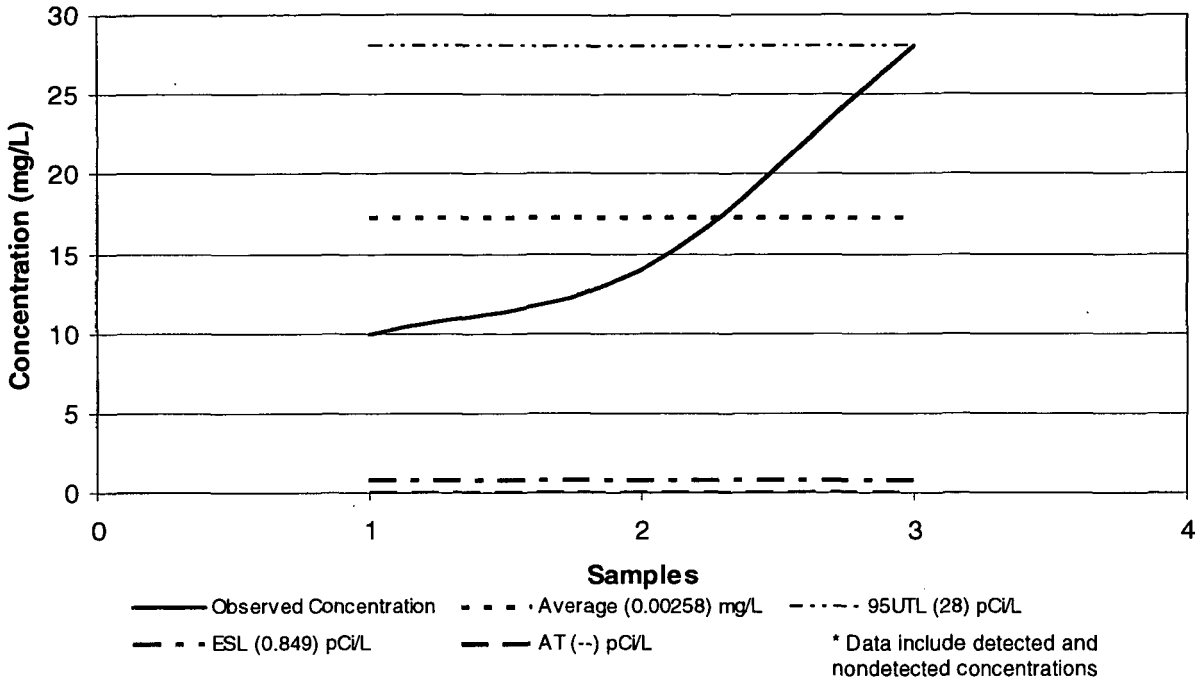

Figure 5.10 Data Distribution for Radium-228 in NW AEU Surface Water

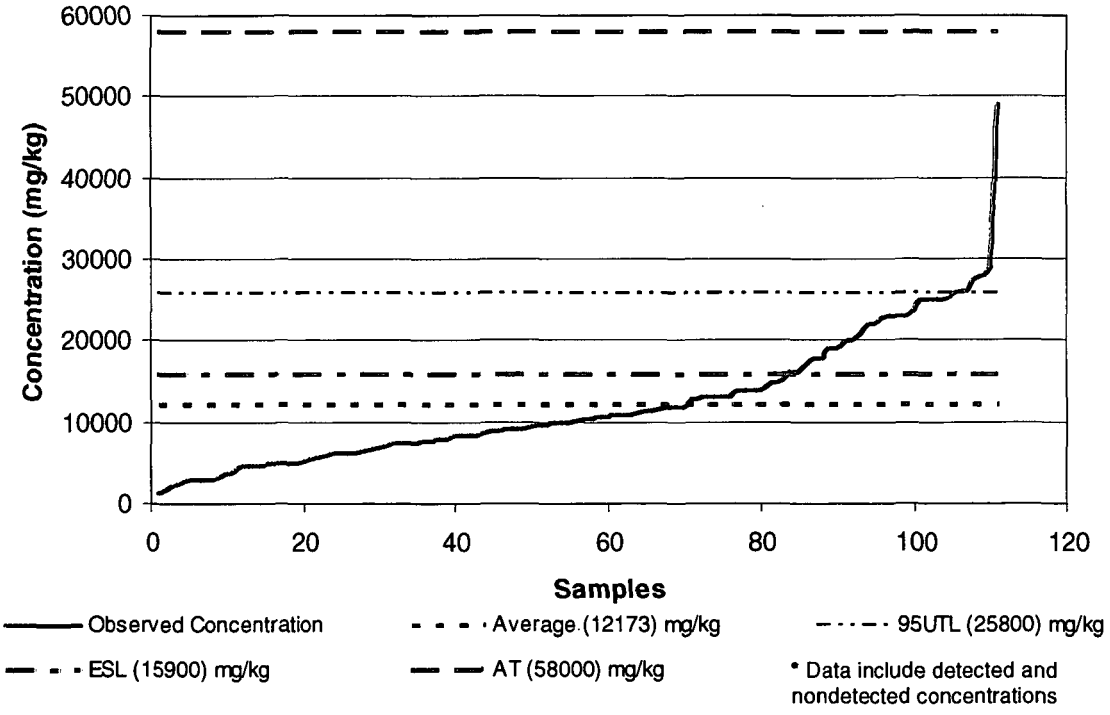

Figure 5.11 Data Distribution for Aluminum in NW AEU Sediment

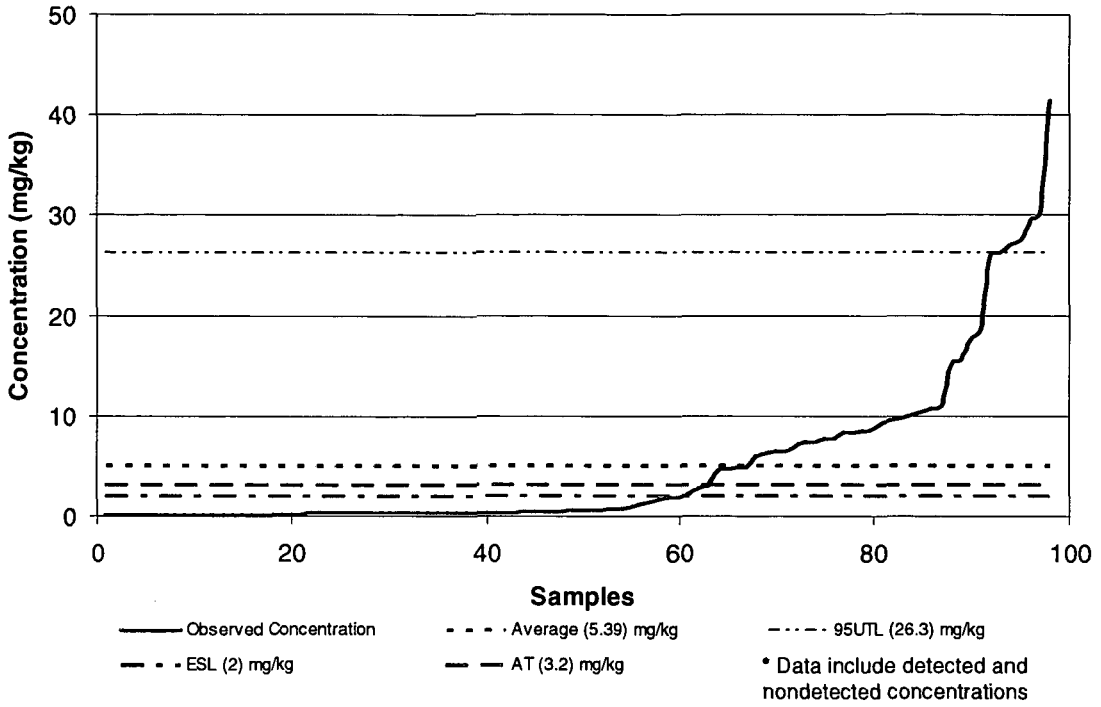

Figure 5.12 Data Distribution for Antimony in NW AEU Sediment

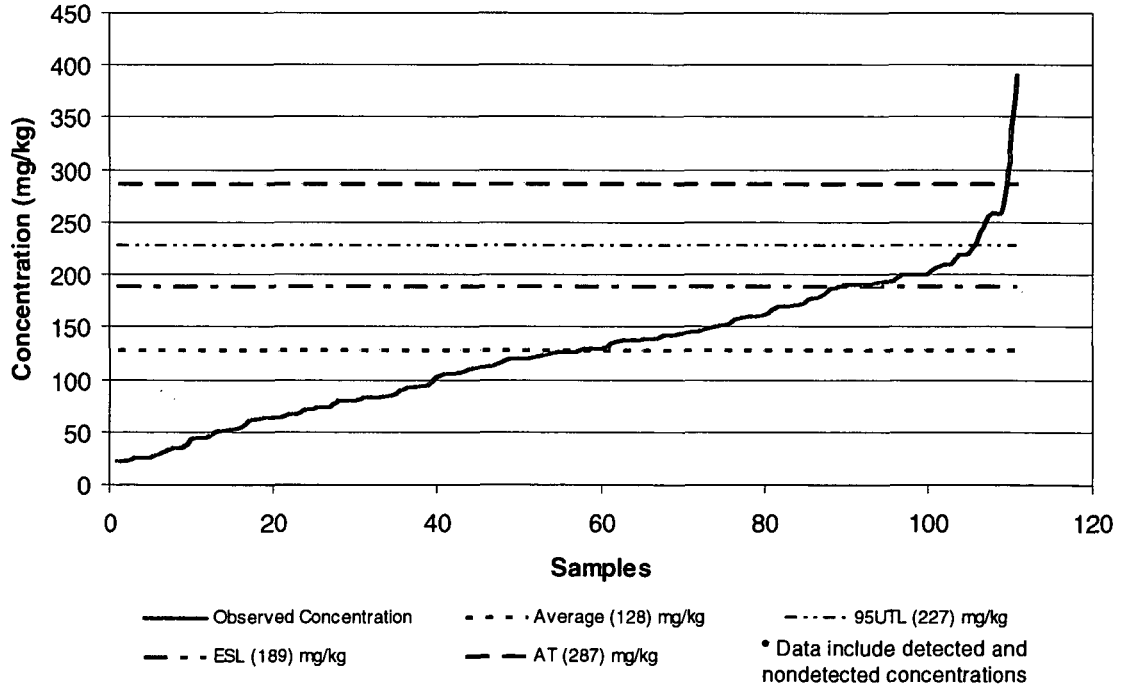

Figure 5.13 Data Distribution for Barium in NW AEU Sediment

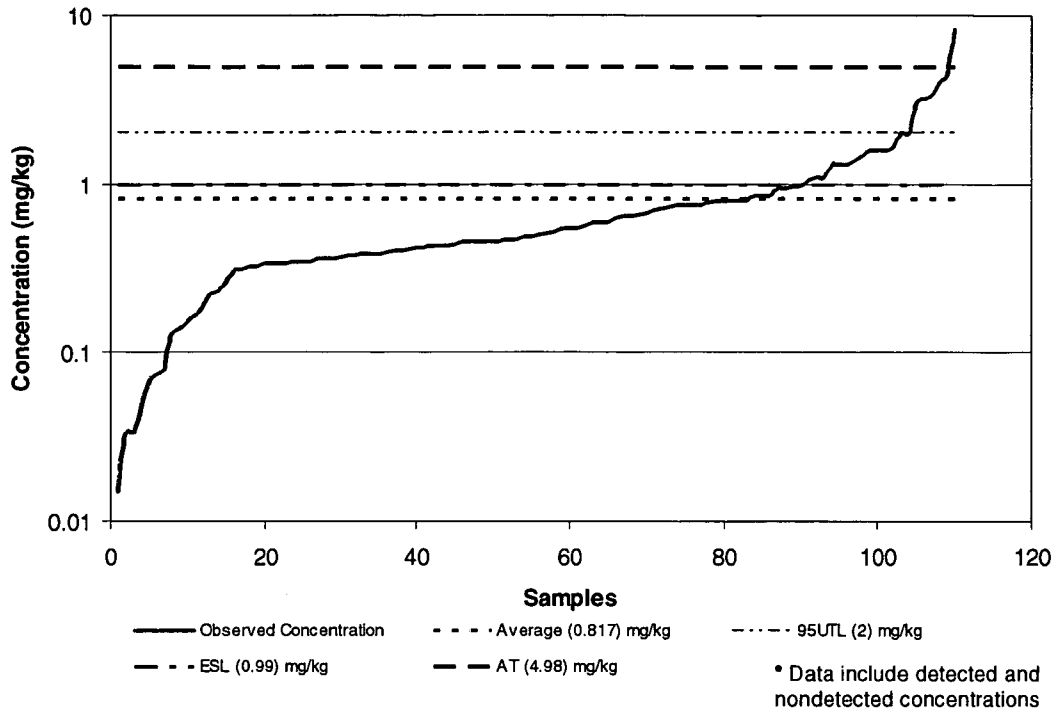

Figure 5.14 Data Distribution for Cadmium in NW AEU Sediment

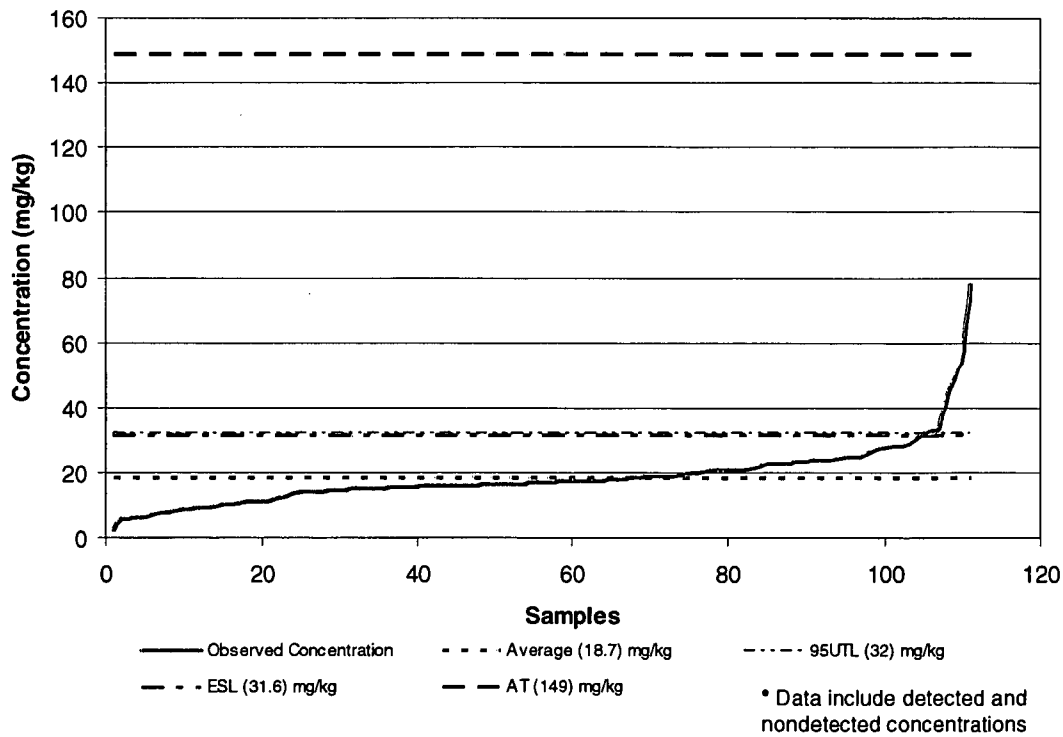

Figure 5.15 Data Distribution for Copper in NW AEU Sediment

406

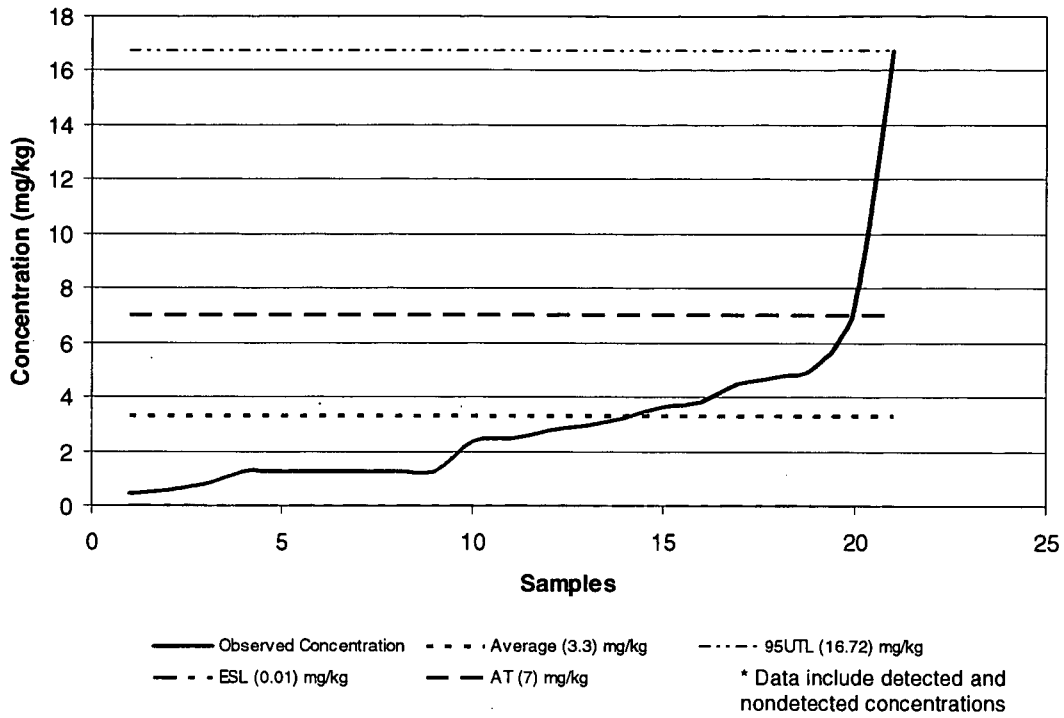

Figure 5.16 Data Distribution for Fluoride in NW AEU Sediment

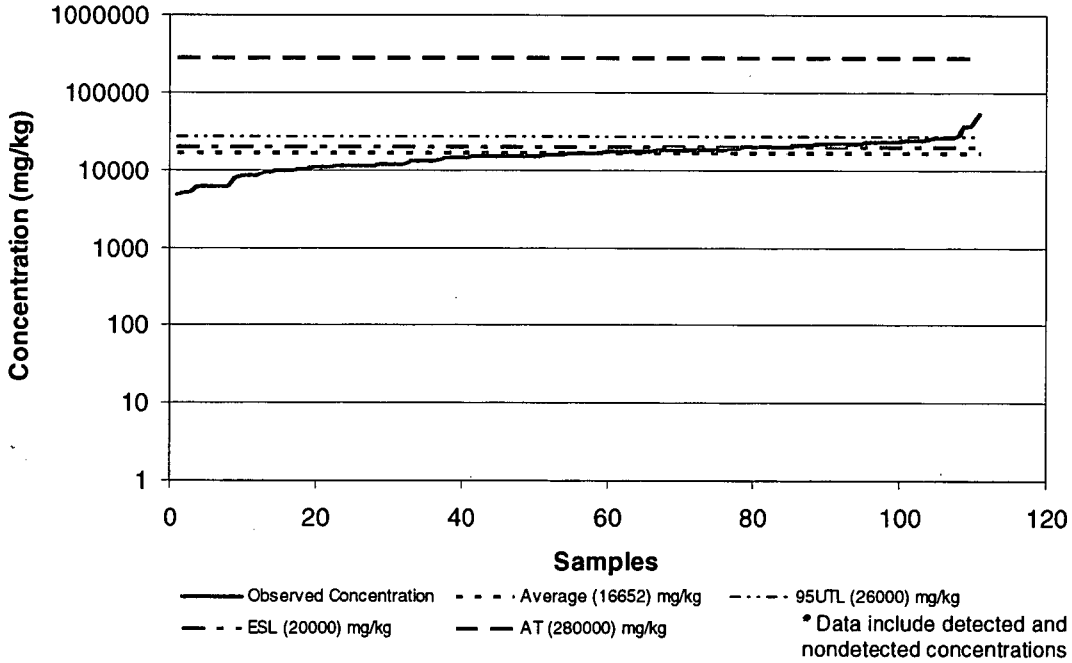

Figure 5.17 Data Distribution for Iron in NW AEU Sediment

407

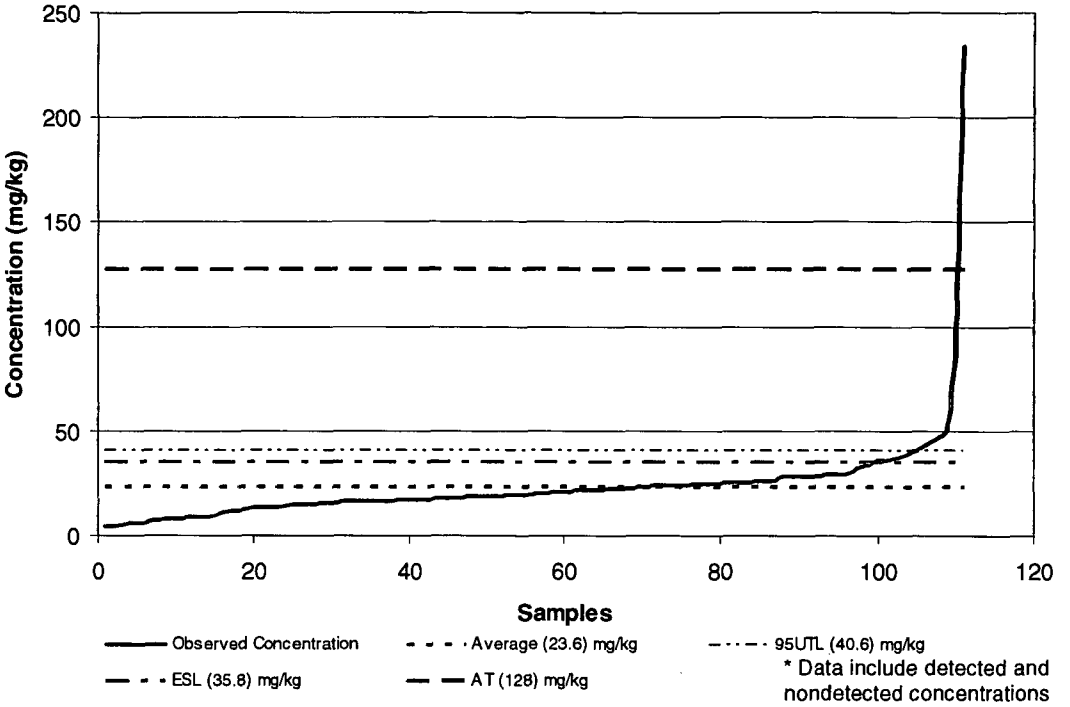

Figure 5.18 Data Distribution for Lead in NW AEU Sediment

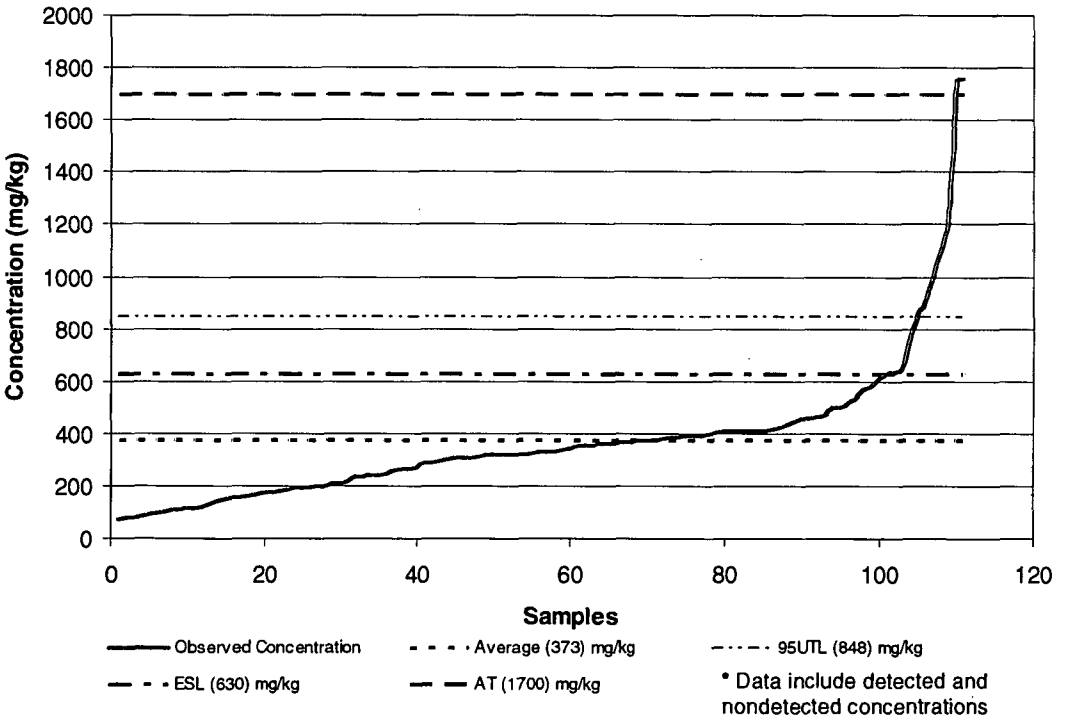

Figure 5.19 Data Distribution for Manganese in NW AEU Sediment

408

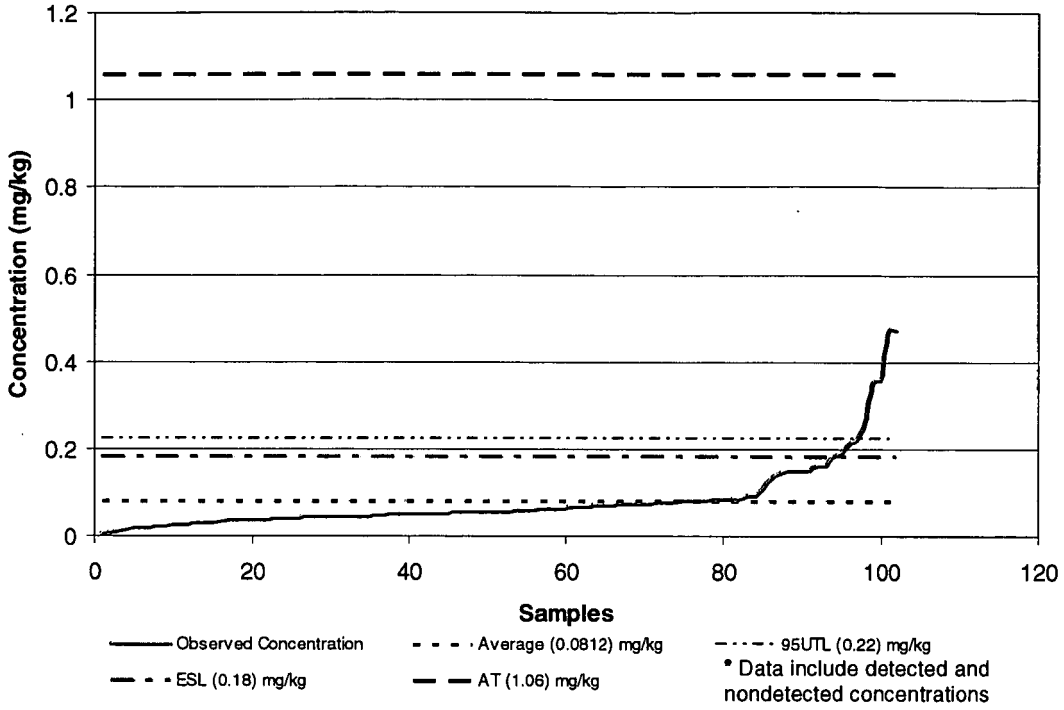

Figure 5.20 Data Distribution for Mercury in NW AEU Sediment

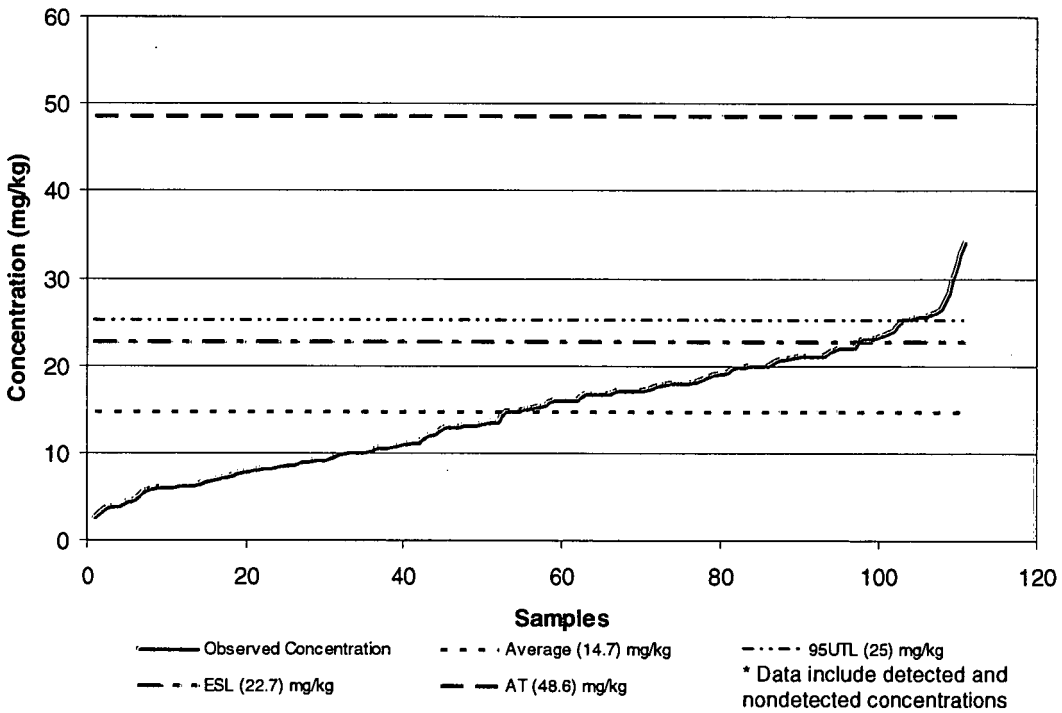

Figure 5.21 Data Distribution for Nickel in NW AEU Sediment

409

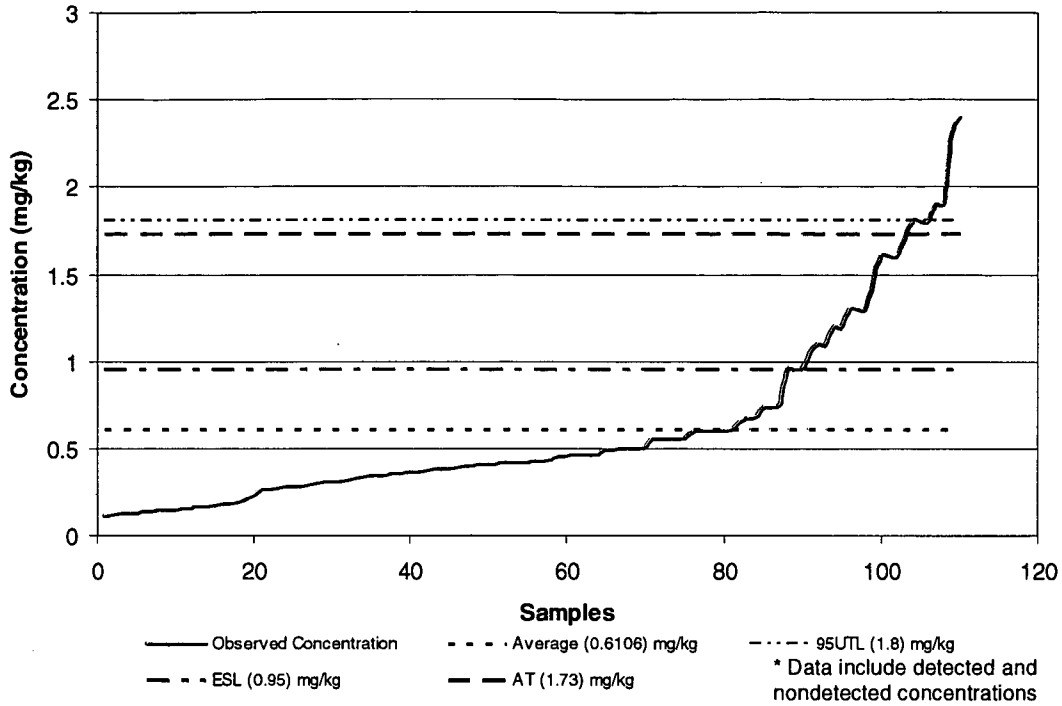

Figure 5.22 Data Distribution for Selenium in NW AEU Sediment

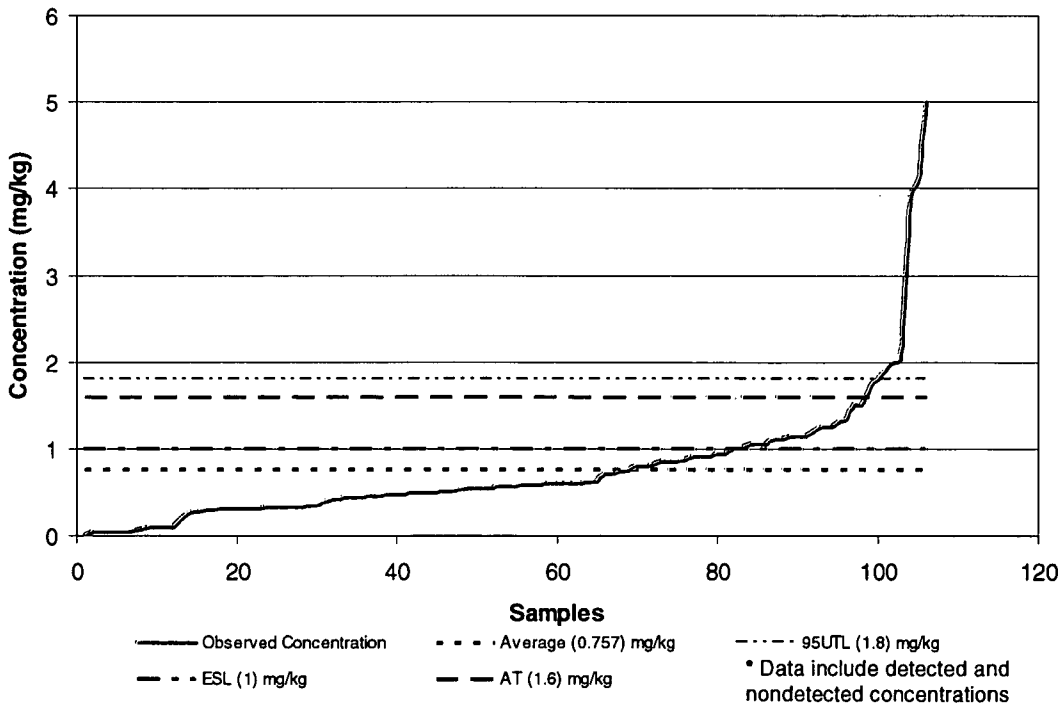

Figure 5.23 Data Distribution for Silver in NW AEU Sediment

410

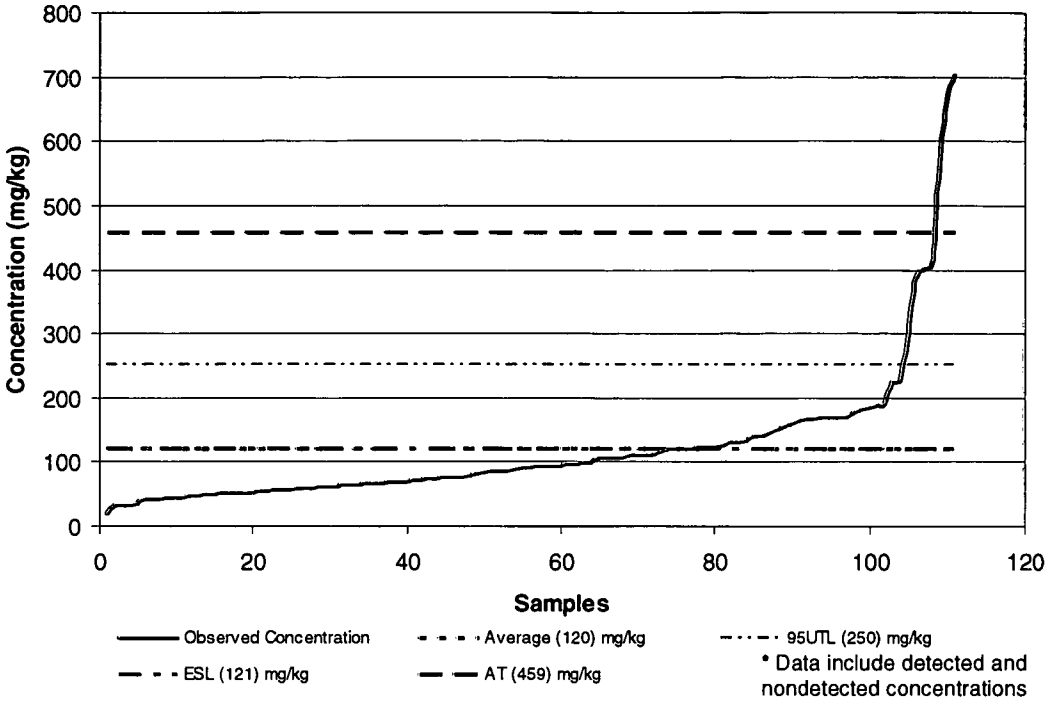

Figure 5.24 Data Distribution for Zinc in NW AEU Sediment

411

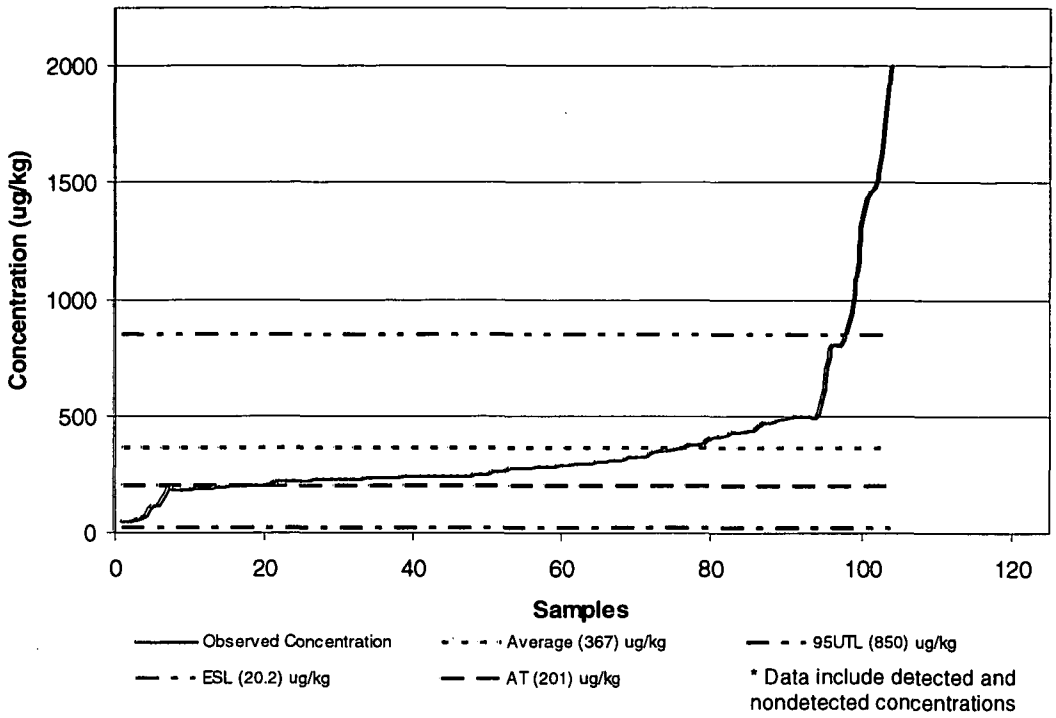

Figure 5.25 Data Distribution for 2-Methylnaphthalene in NW AEU Sediment

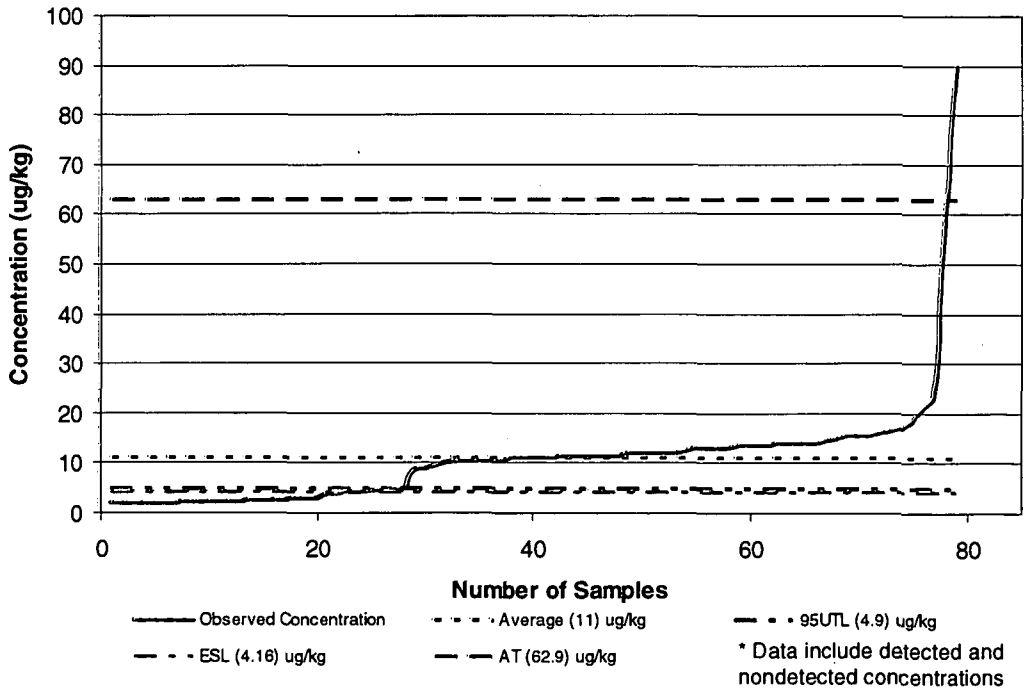

Figure 5.26 Data Distribution for 4,4'-DDT in NW AEU Sediment

412

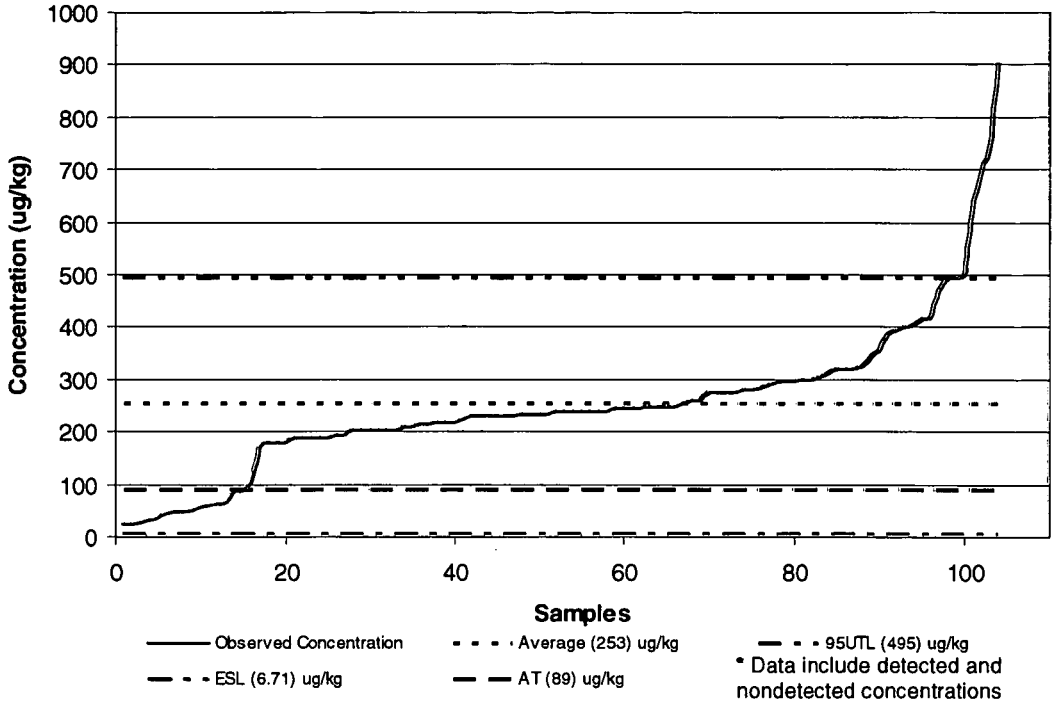

Figure 5.27 Data Distribution for Acenaphthene in NW AEU Sediment

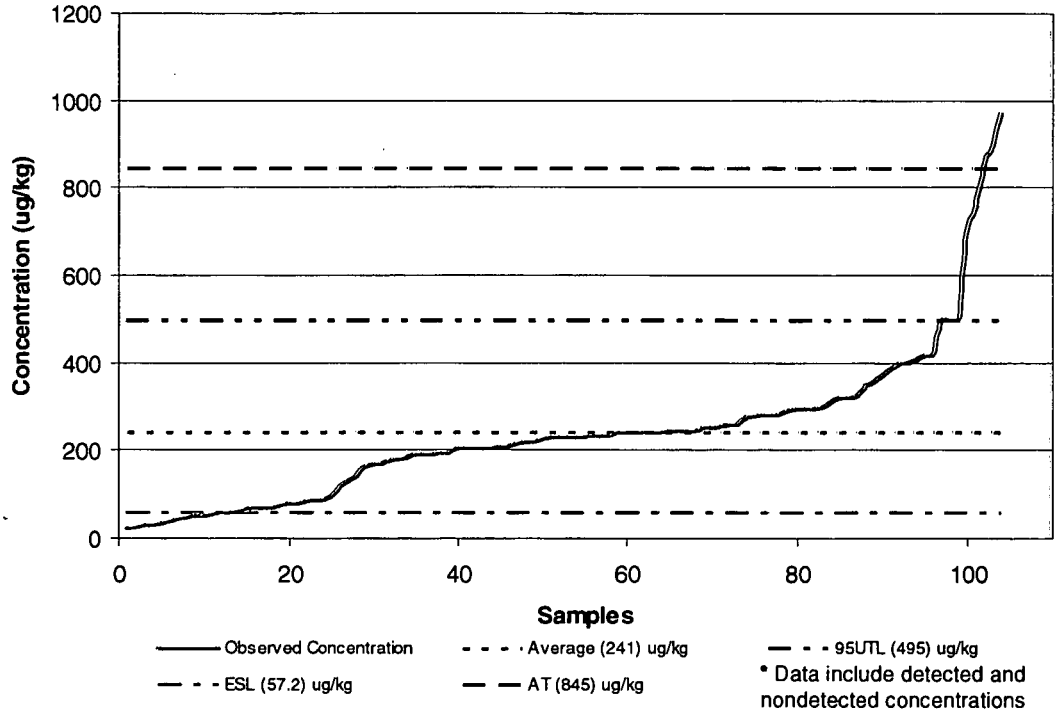

Figure 5.28 Data Distribution for Anthracene in NW AEU Sediment

413

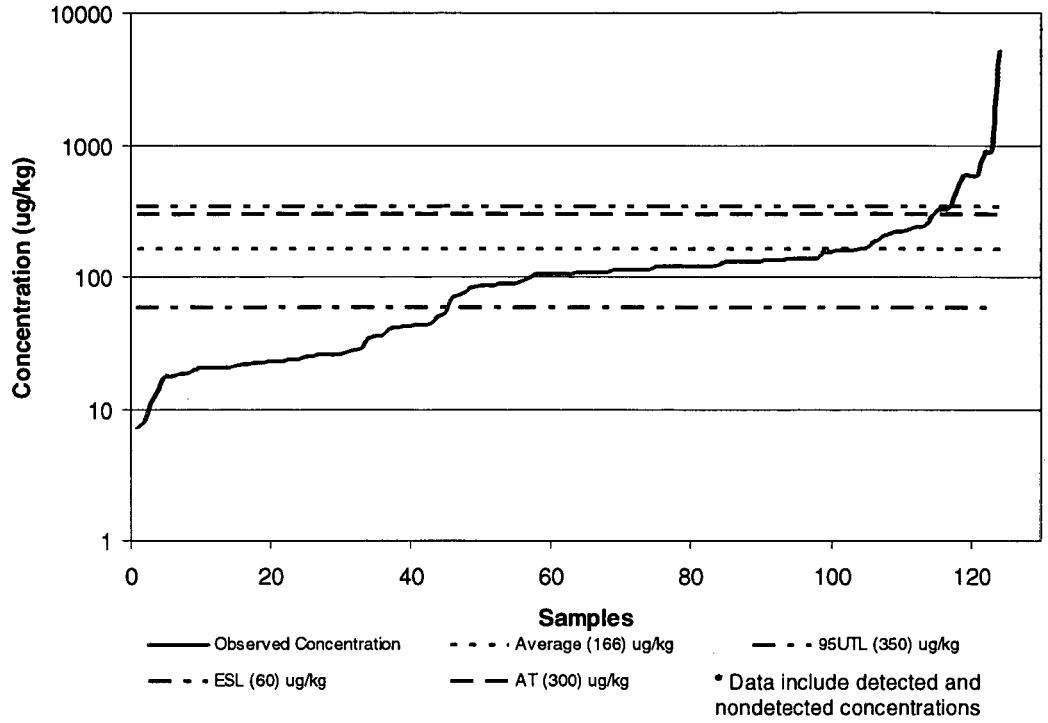

Figure 5.29 Data Distribution for Aroclor-1254 in NW AEU Sediment

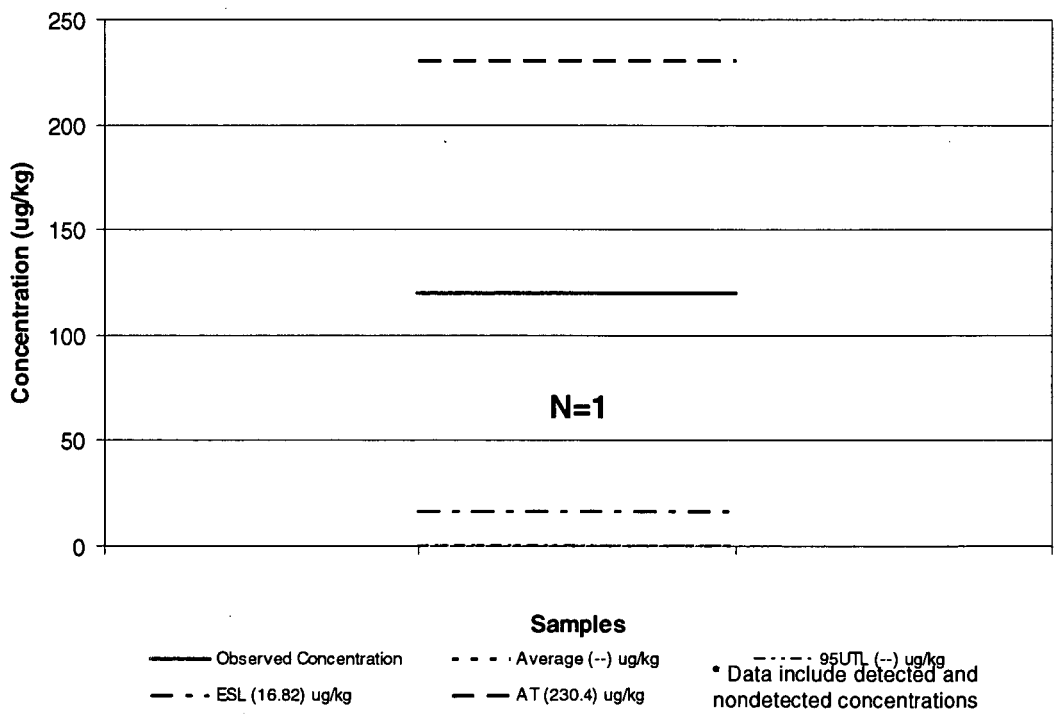

Figure 5.30 Data Distribution for Atrazine in NW AEU Sediment

414

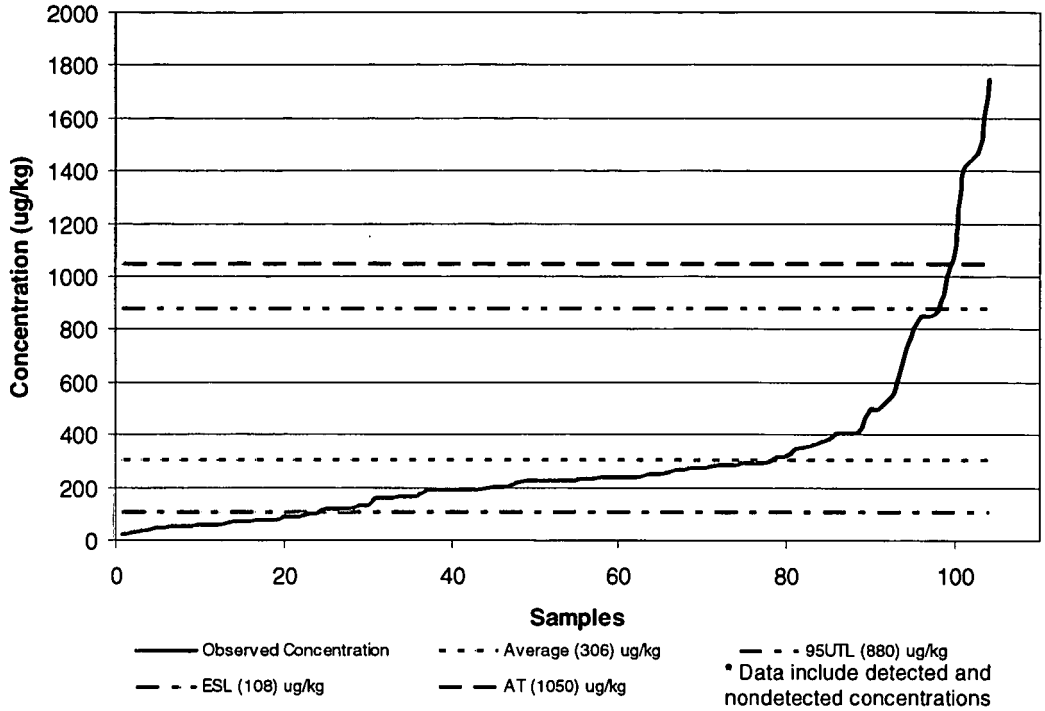

Figure 5.31 Data Distribution for Benzo(a)anthracene in NW AEU Sediment

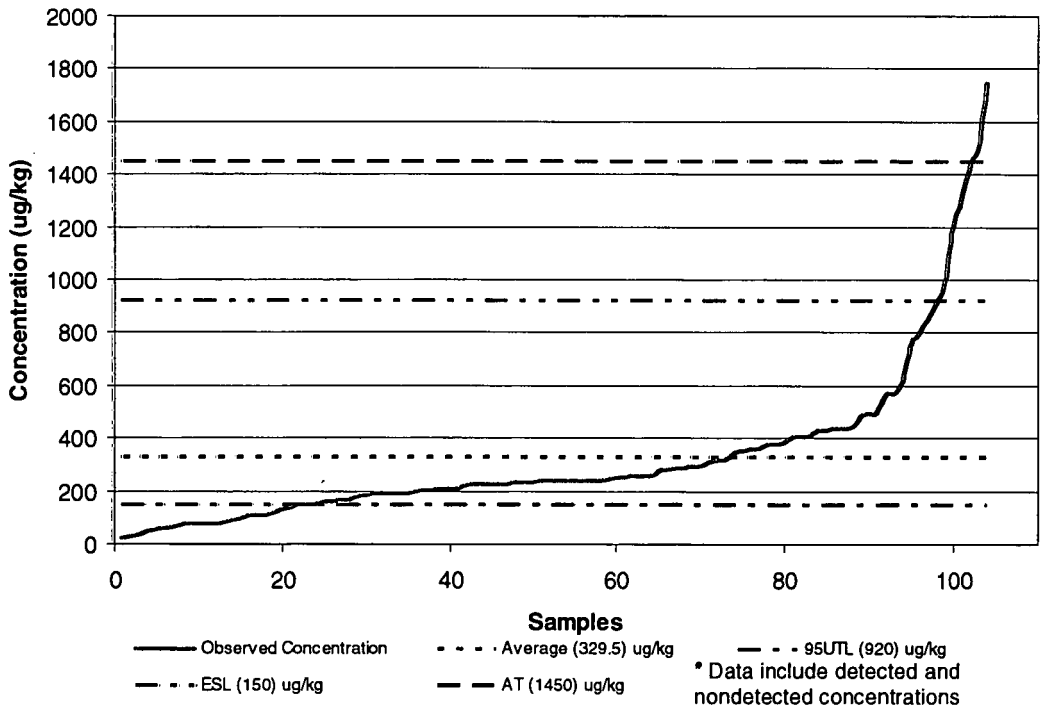

Figure 5.32 Data Distribution for Benzo(a)pyrene in NW AEU Sediment

415

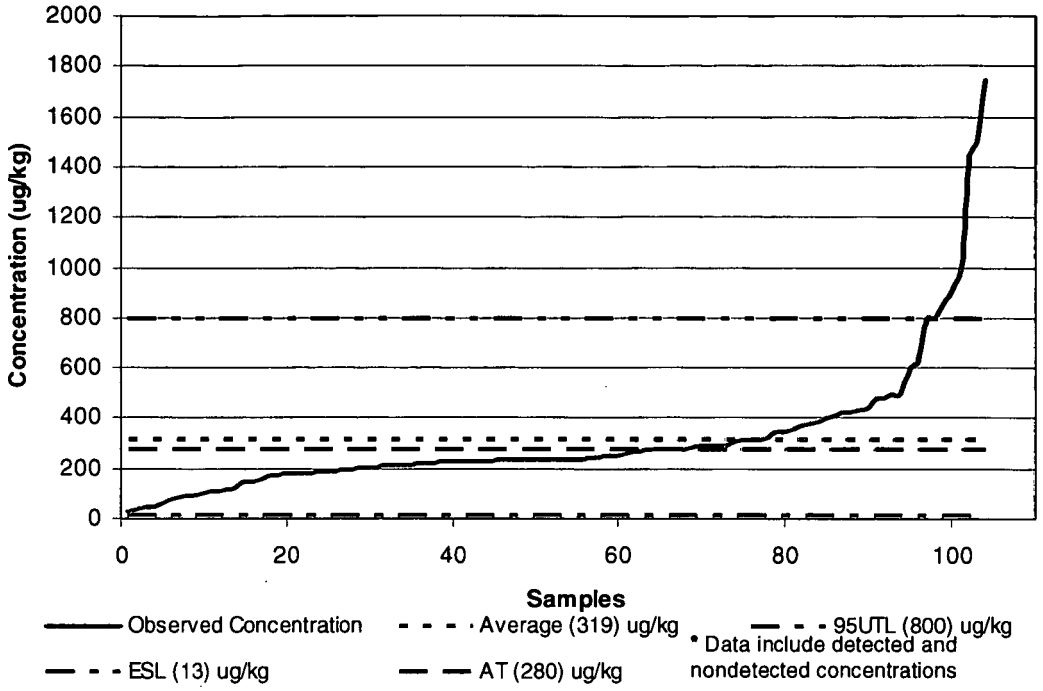

Figure 5.33 Data Distribution for Benzo(g,h,i)perylene in NW AEU Sediment

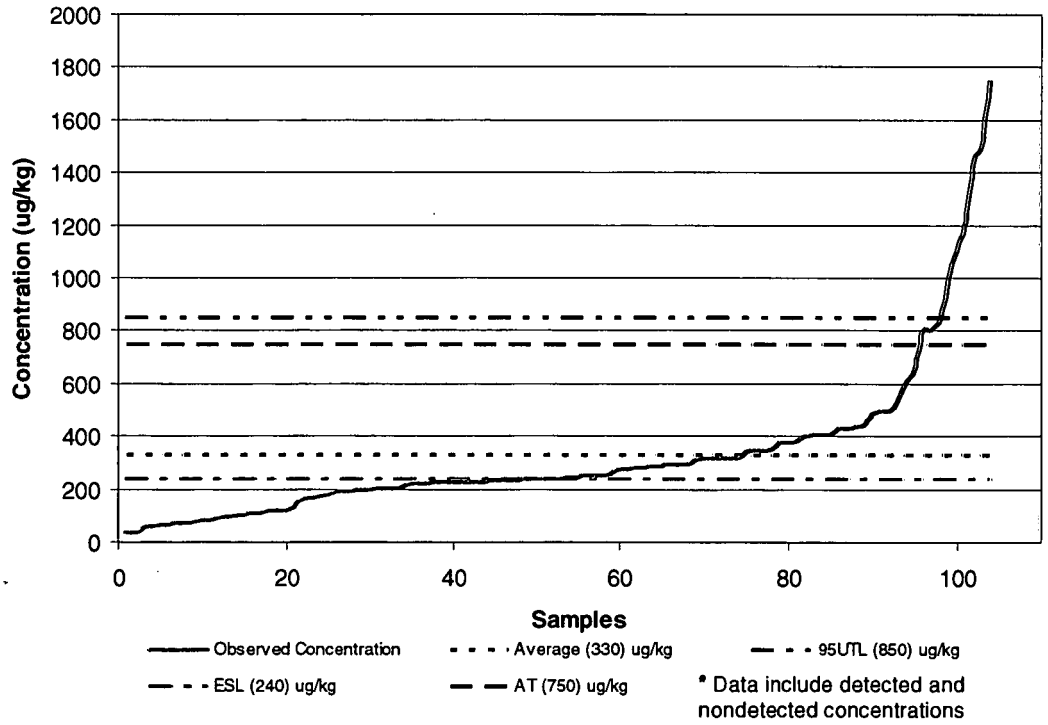

Figure 5.34 Data Distribution for Benzo(k)fluoranthene in NW AEU Sediment

416

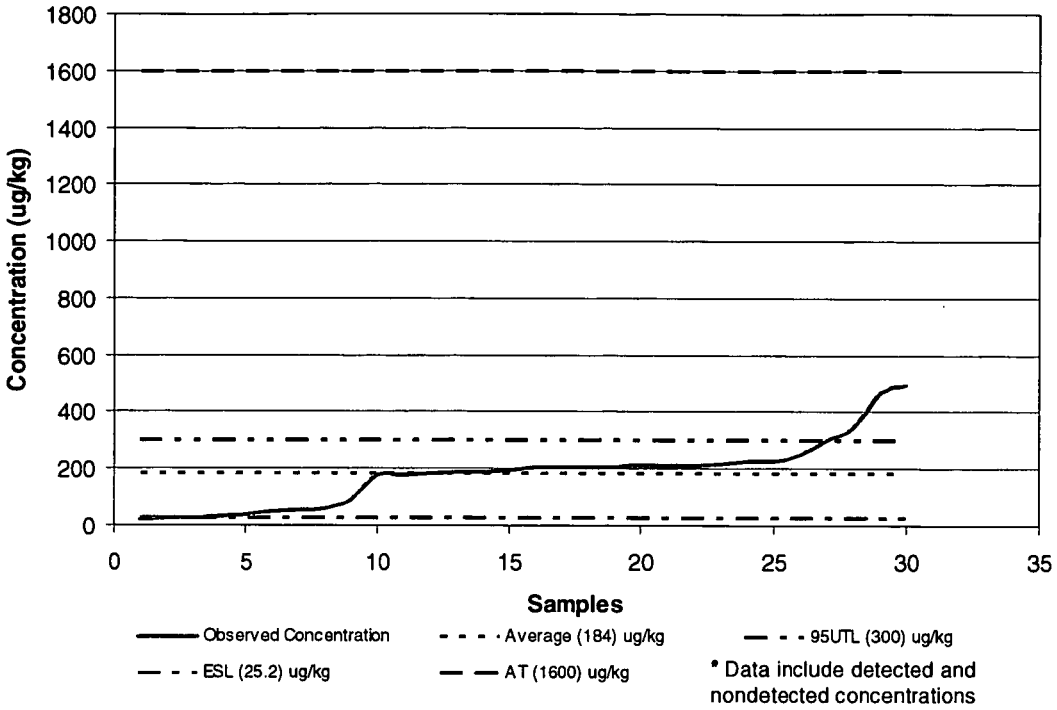

Figure 5.35 Data Distribution for Carbazole in NW AEU Sediment

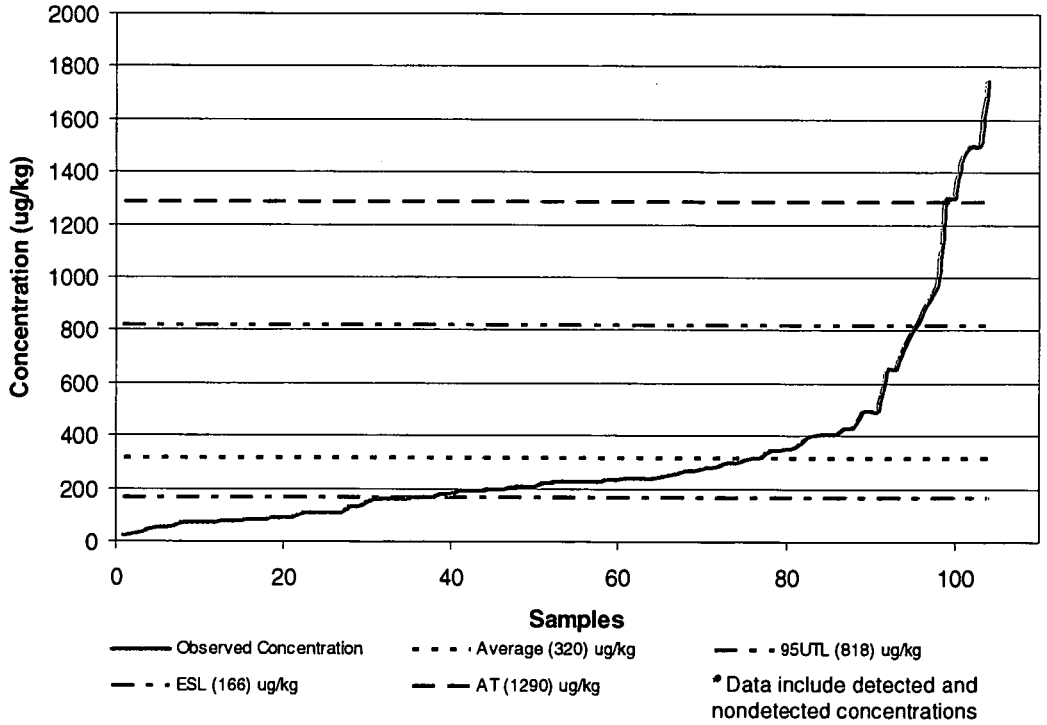

Figure 5.36 Data Distribution for Chrysene in NW AEU Sediment

417

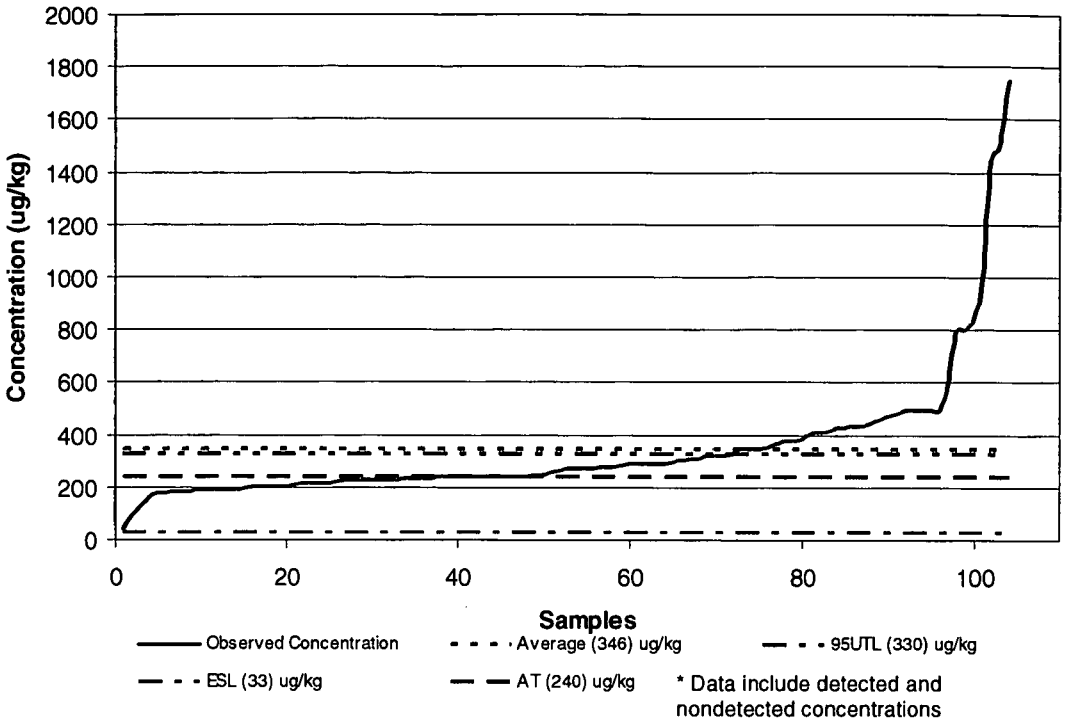

Figure 5.37 Data Distribution for Dibenz(a,h)anthracene in NW AEU Sediment

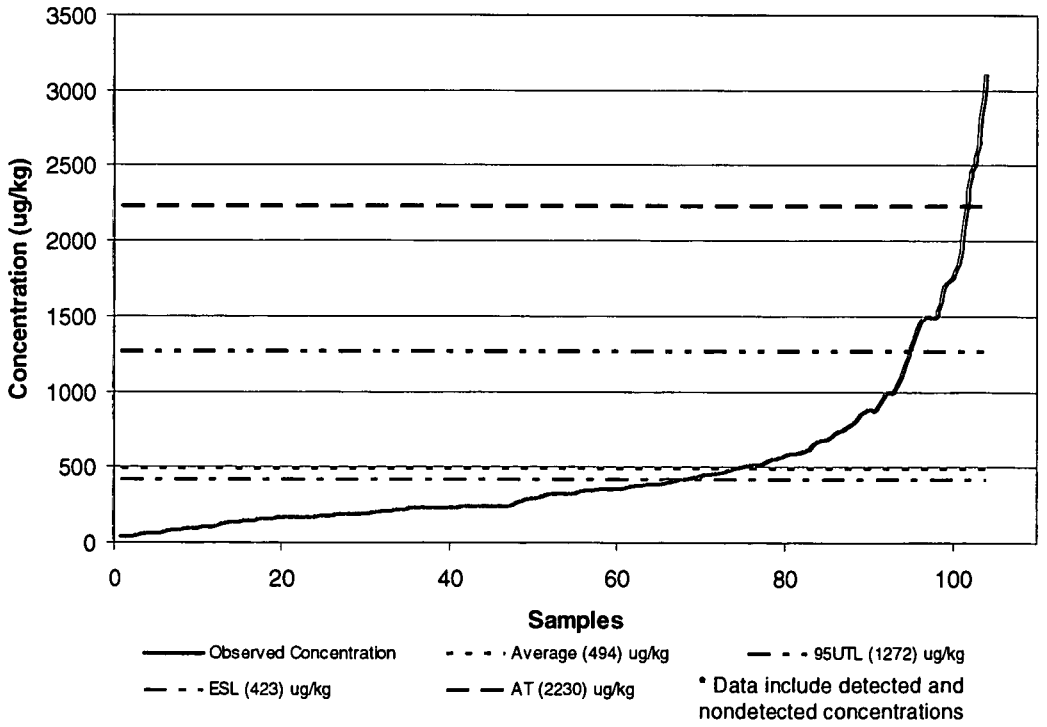

Figure 5.38 Data Distribution for Fluoranthene in NW AEU Sediment

418

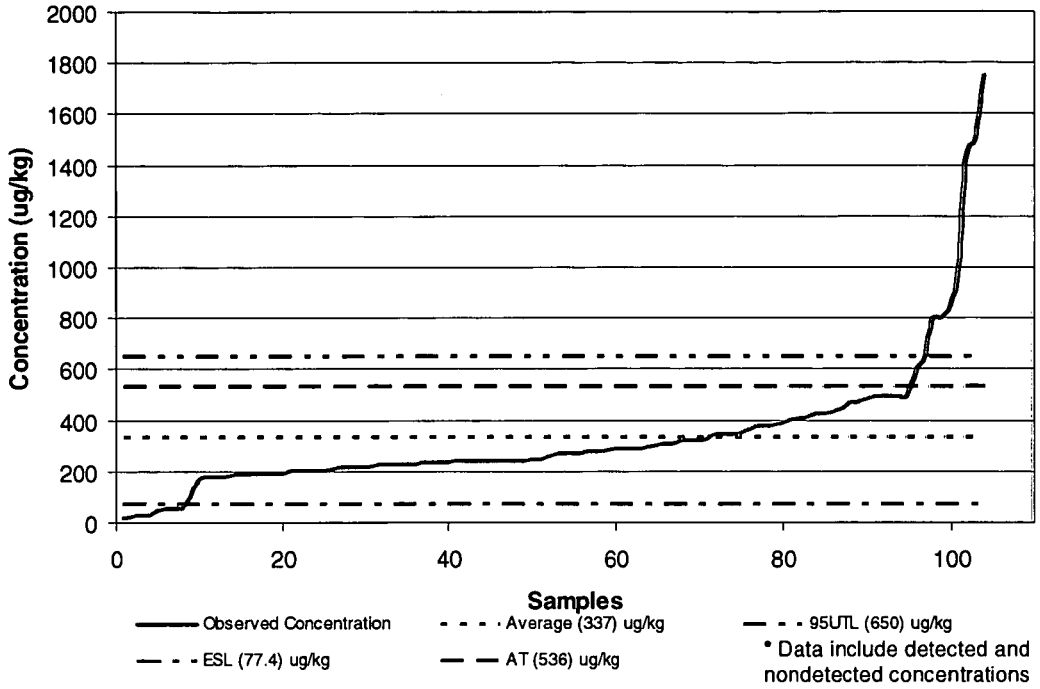

Figure 5.39 Data Distribution for Fluorene in NW AEU Sediment

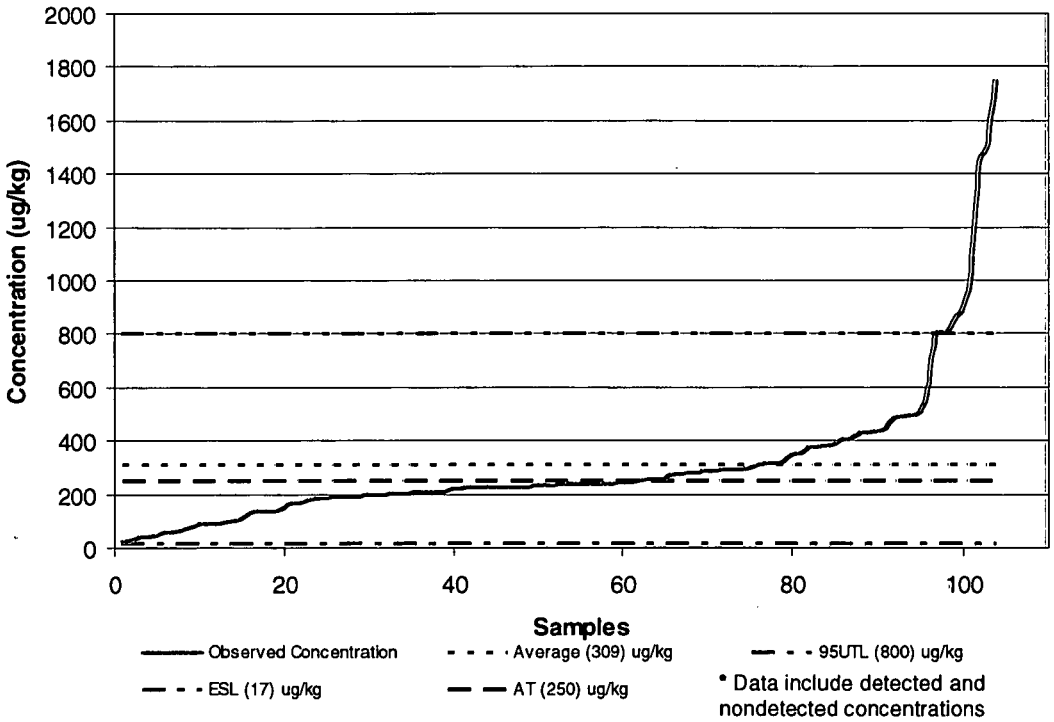

Figure 5.40 Data Distribution for Indeno(1,2,3-cd)pyrene in NW AEU Sediment

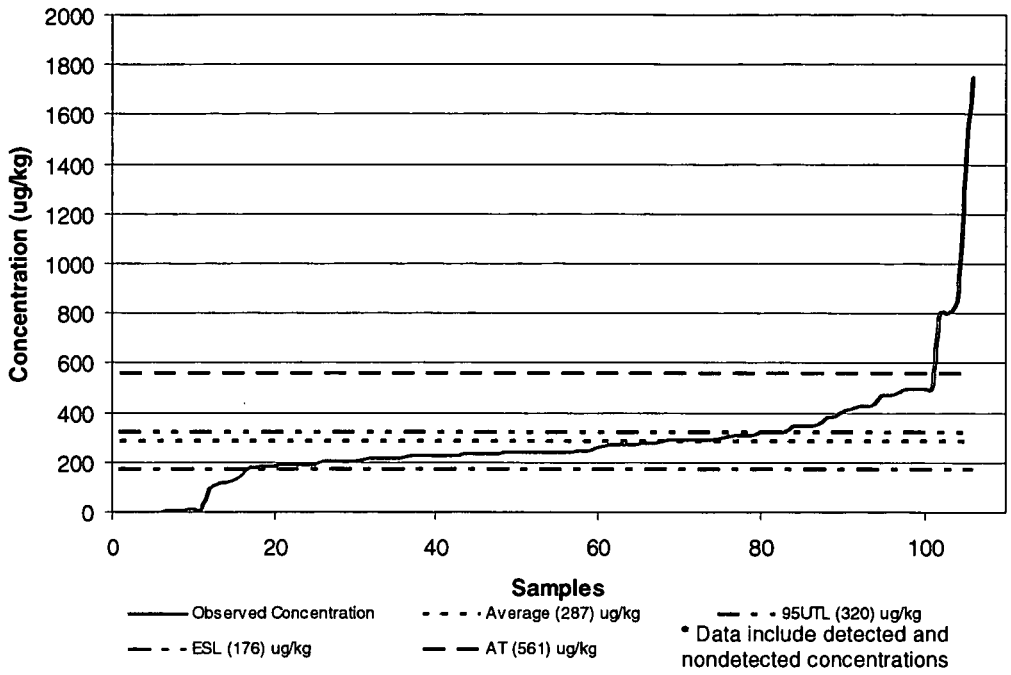

Figure 5.41 Data Distribution for Naphthalene in NW AEU Sediment

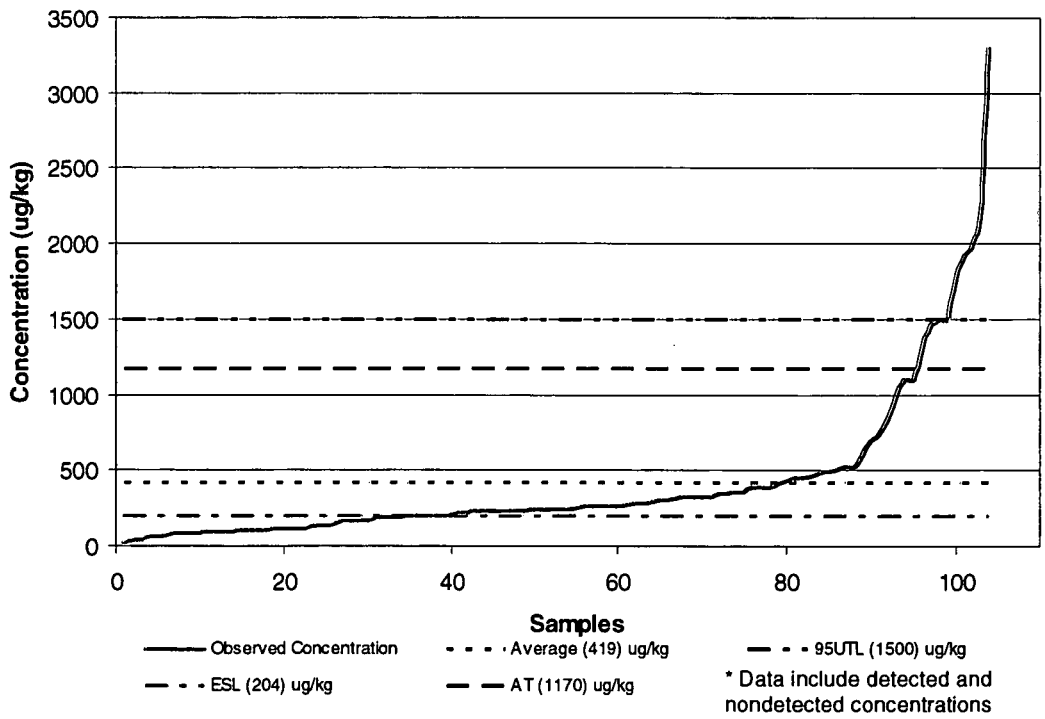

Figure 5.42 Data Distribution for Phenanthrene in NW AEU Sediment

420

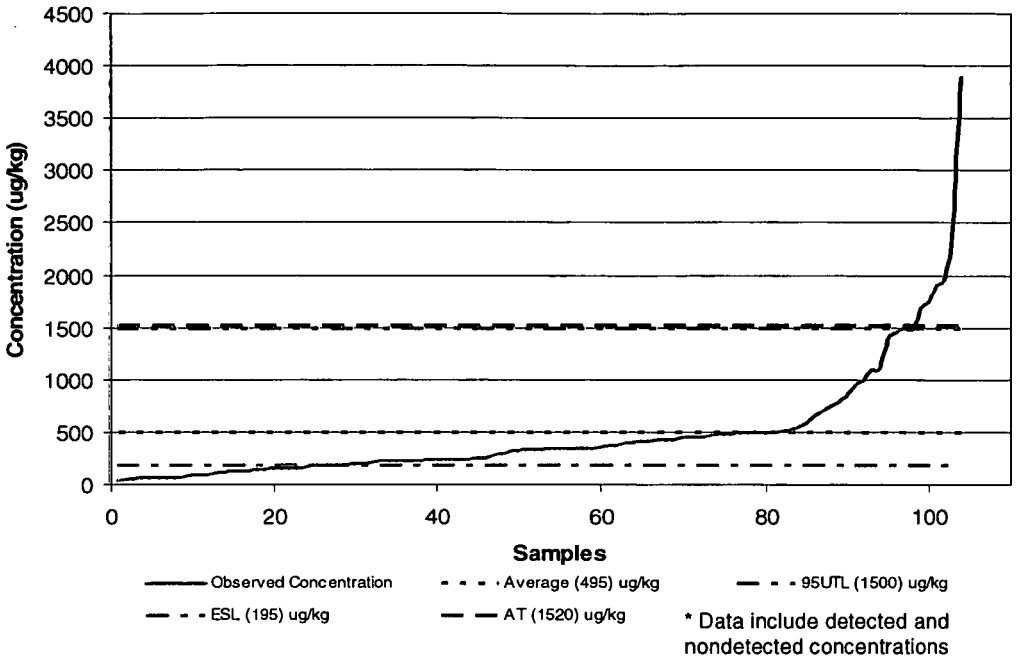

Figure 5.43 Data Distribution for Pyrene in NW AEU Sediment

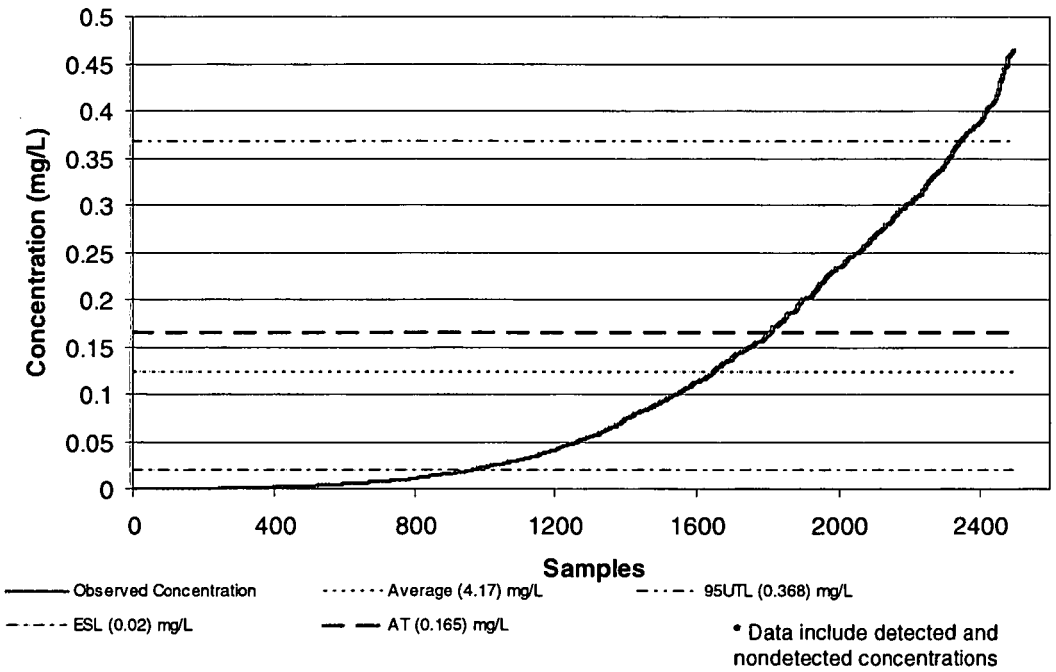

Figure 5.44 Data Distribution for Ammonia (un-ionized) in SW AEU Surface Water

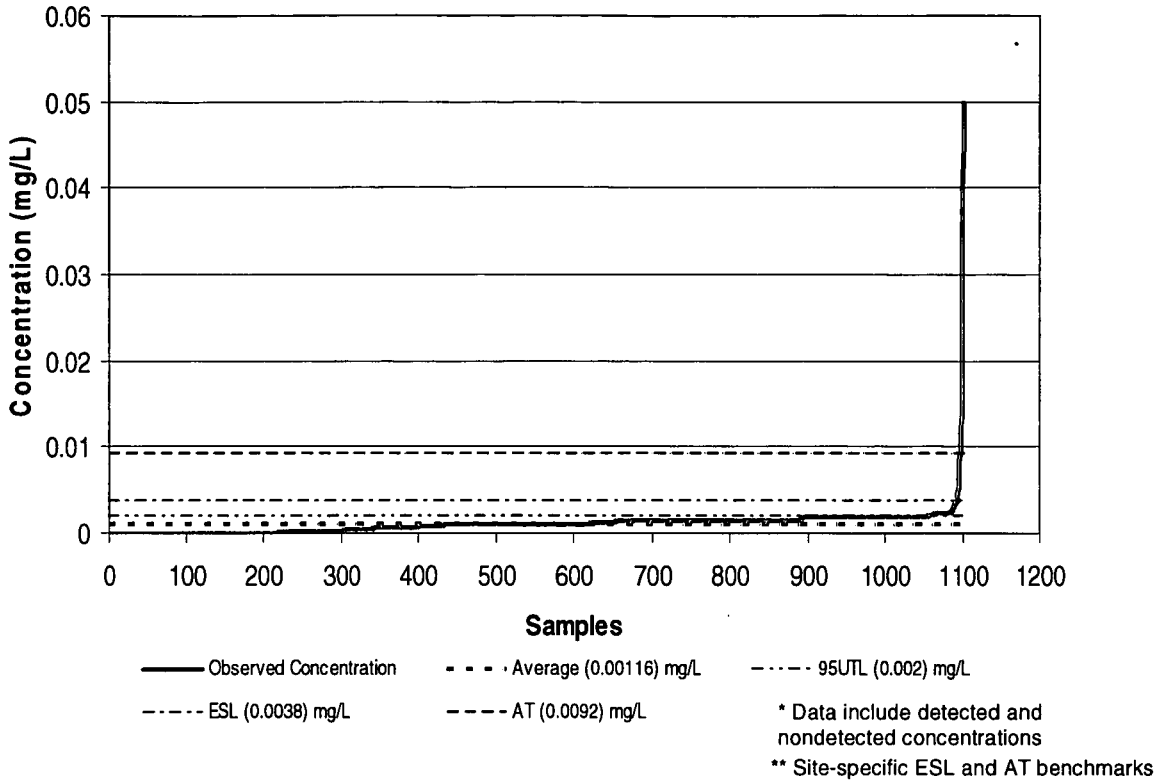

Figure 5.45 Data Distribution for Cadmium (dissolved) in SW AEU Surface Water

422

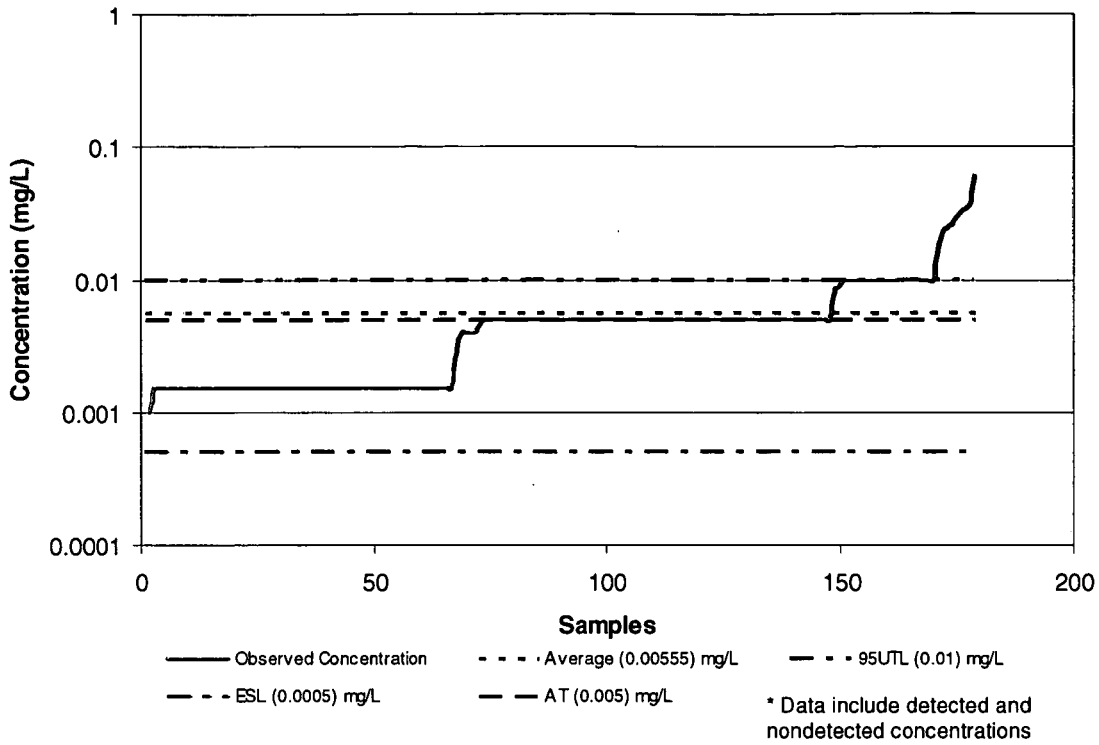

Figure 5.46 Data Distribution for Cyanide (total) in SW AEU Surface Water

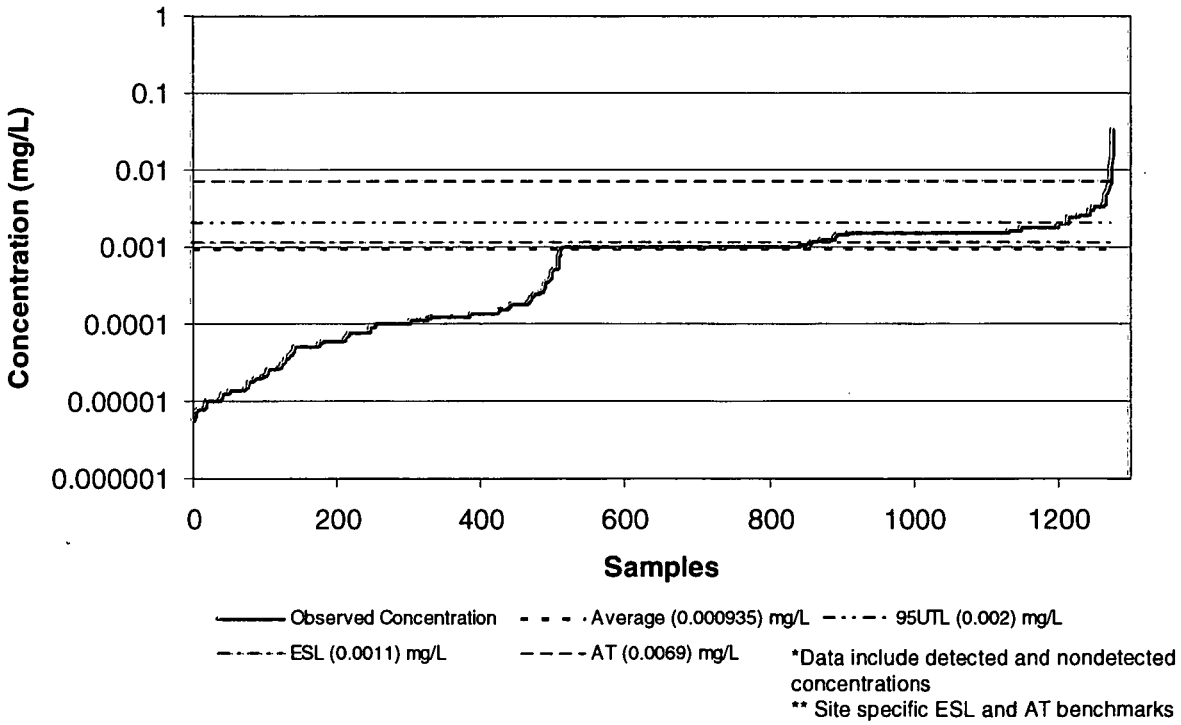

Figure 5.47 Data Distribution for Silver (dissolved) in SW AEU Surface Water

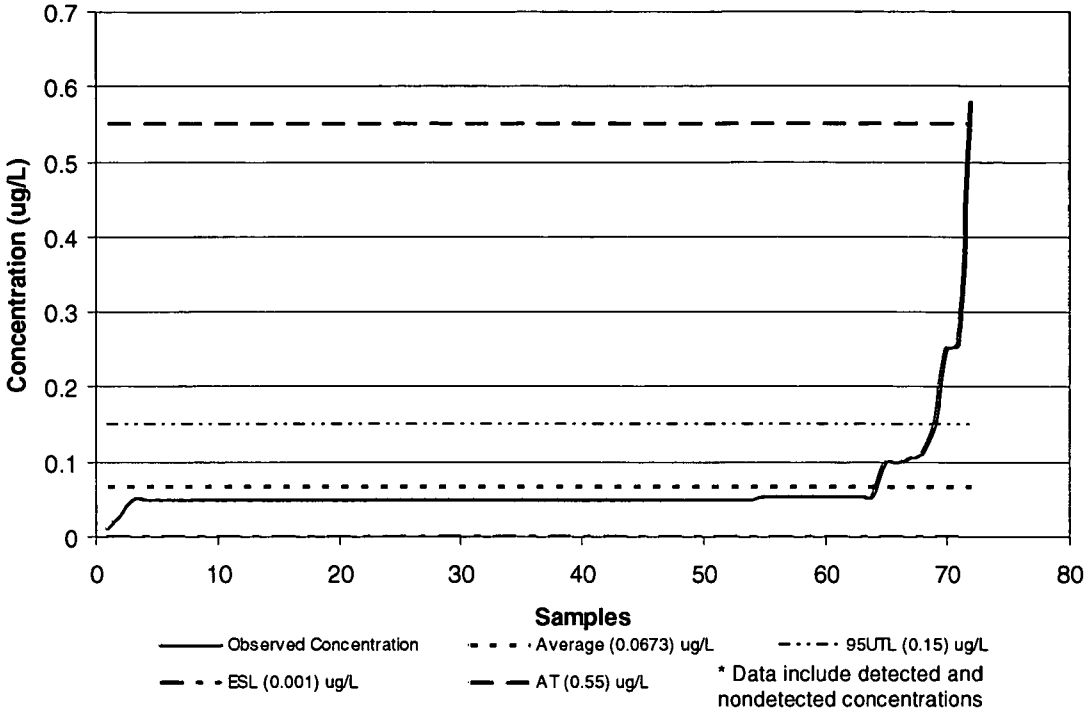

Figure 5.48 Data Distribution for 4,4-DDT in SW AEU Surface Water

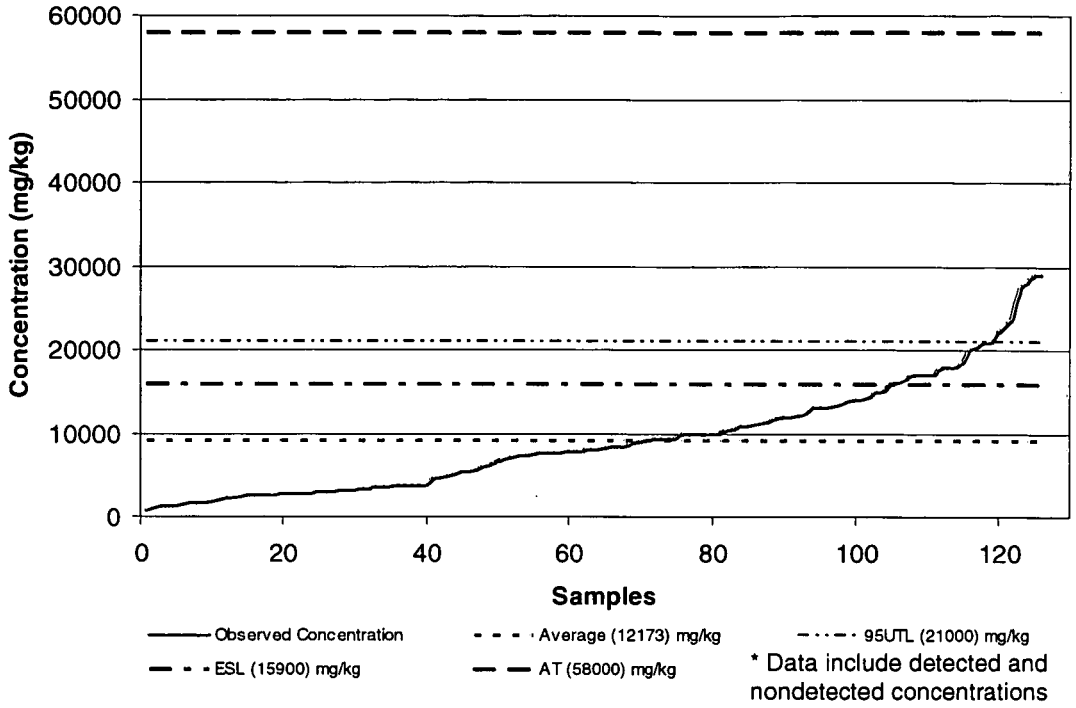

Figure 5.49 Data Distribution for Aluminum in SW AEU Sediment

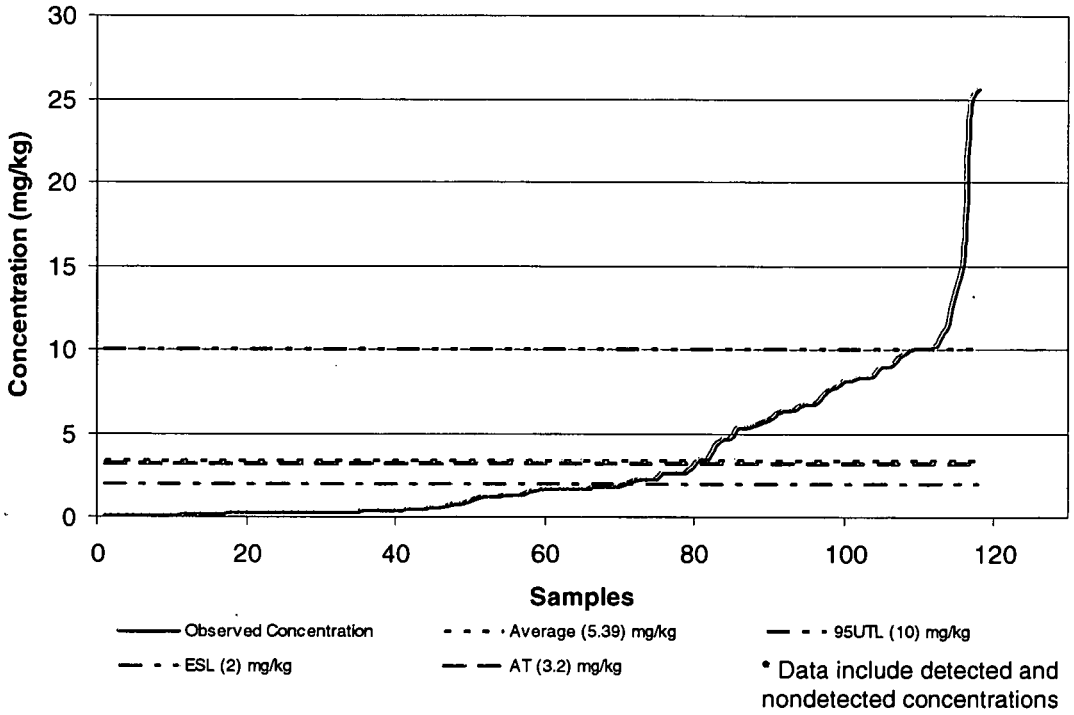

Figure 5.50 Data Distribution for Antimony in SW AEU Sediment

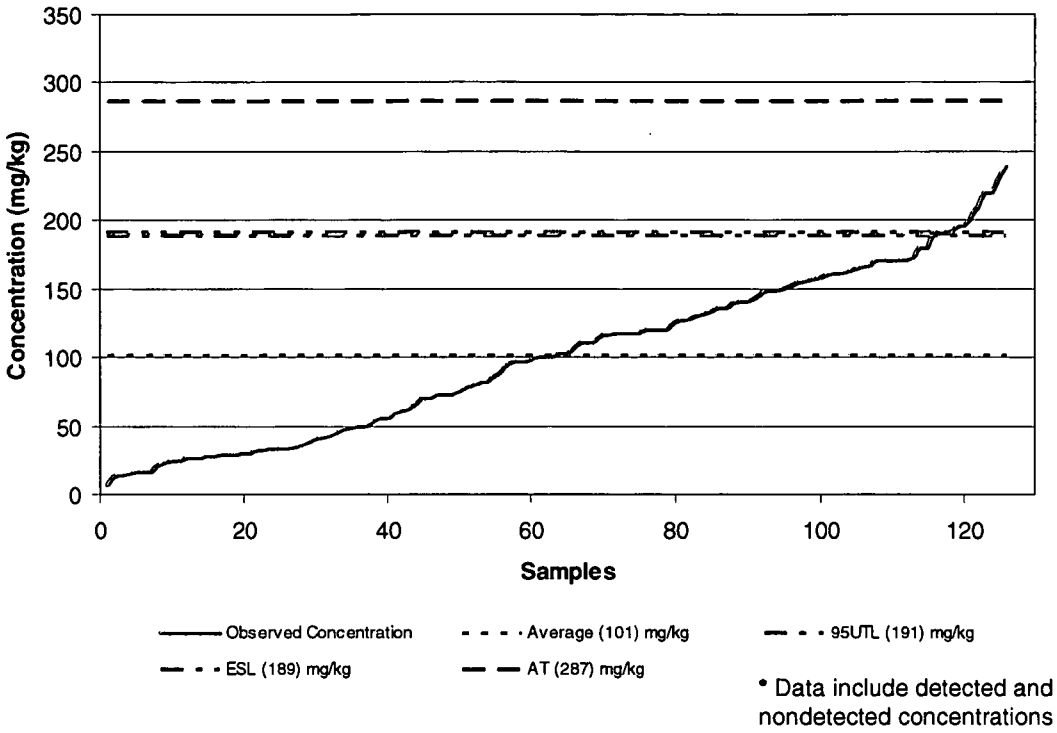

Figure 5.51 Data Distribution for Barium in SW AEU Sediment

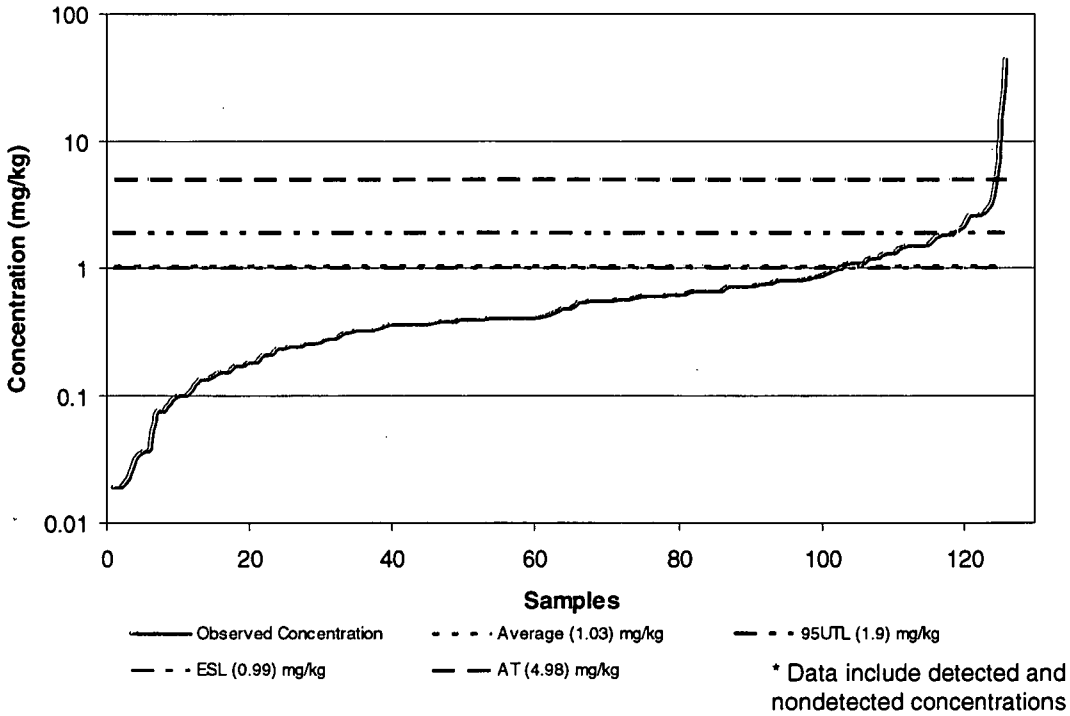

Figure 5.52 Data Distribution for Cadmium in SW AEU Sediment

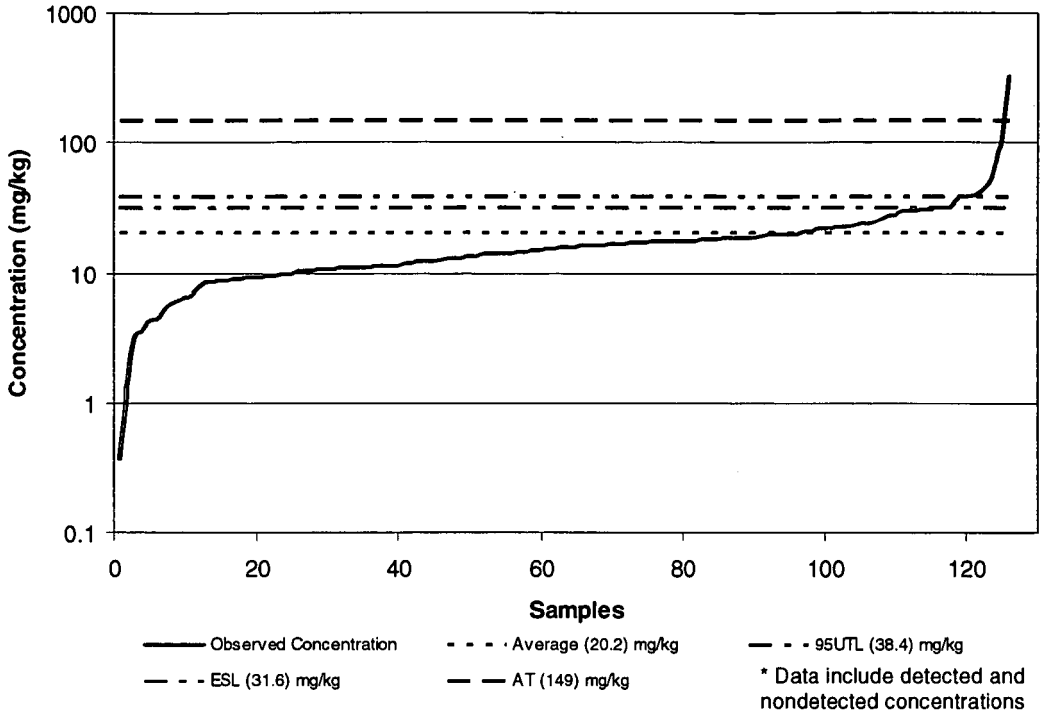

Figure 5.53 Data Distribution for Copper in SW AEU Sediment

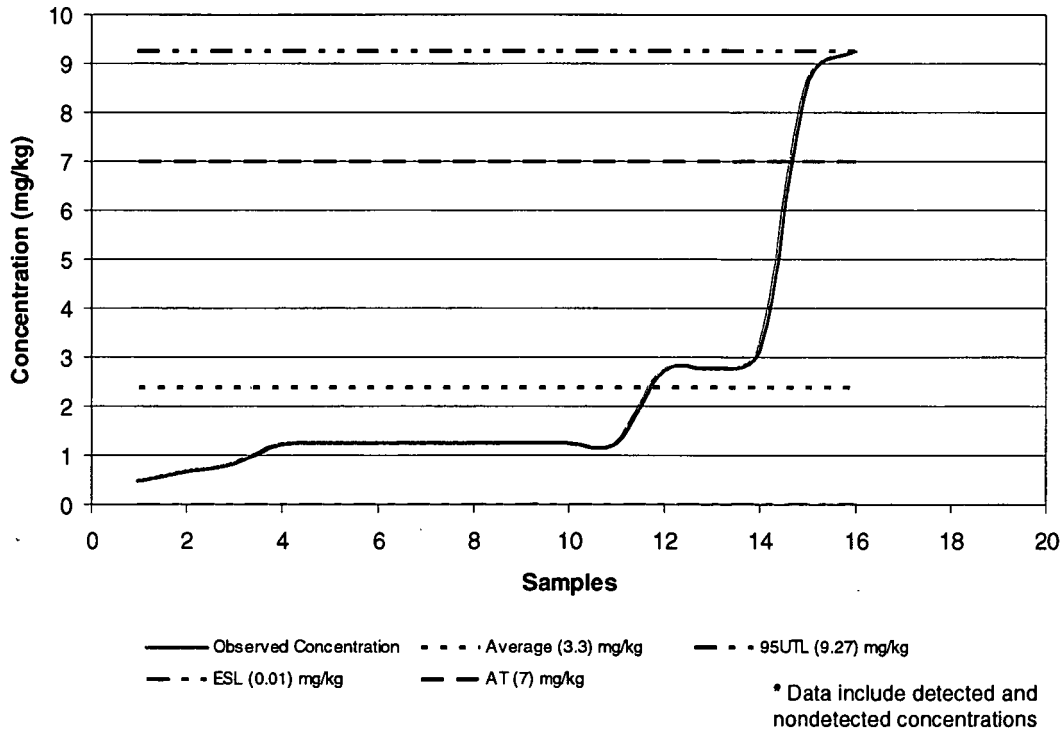

Figure 5.54 Data Distribution for Fluoride in SW AEU Sediment

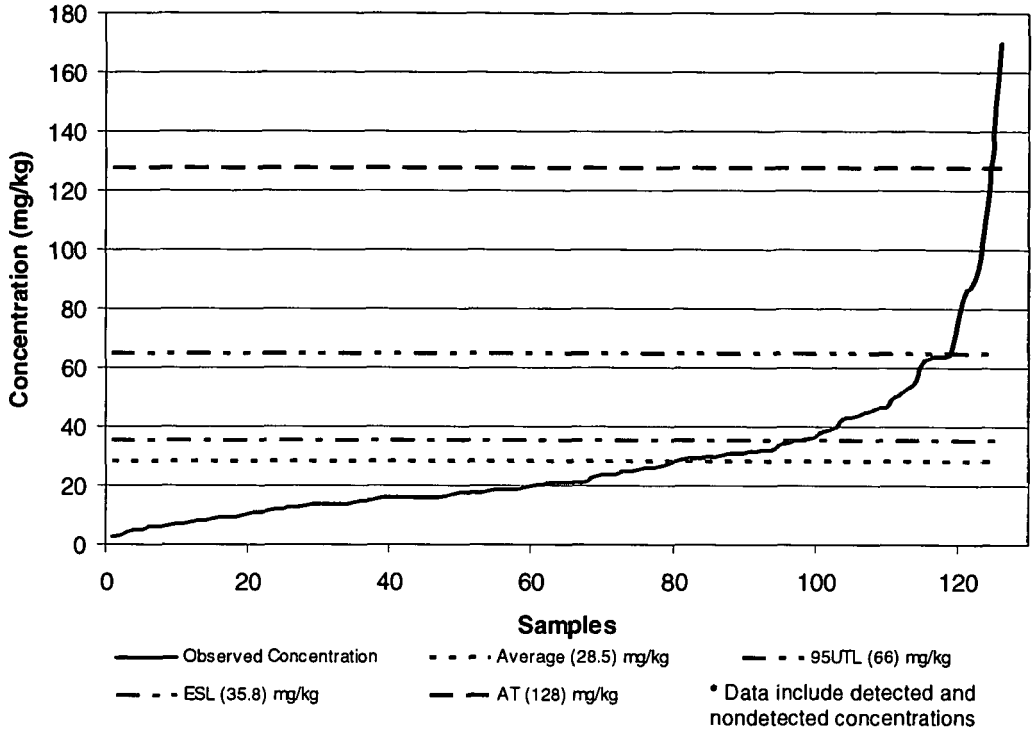

Figure 5.55 Data Distribution for Lead in SW AEU Sediment

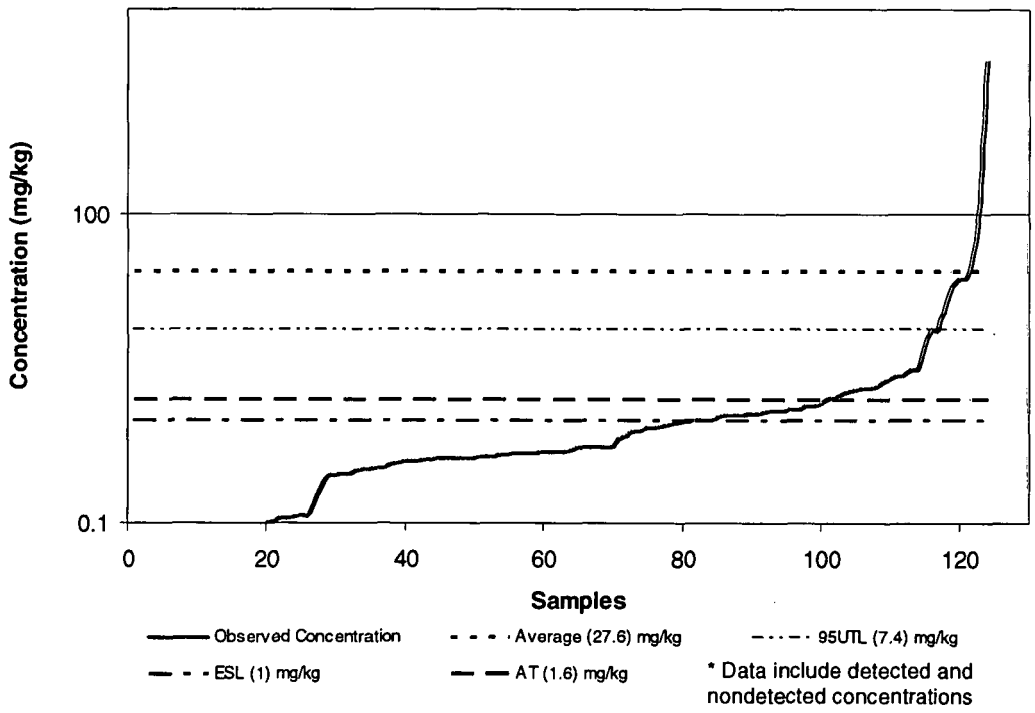

Figure 5.56 Data Distribution for Silver in SW AEU Sediment

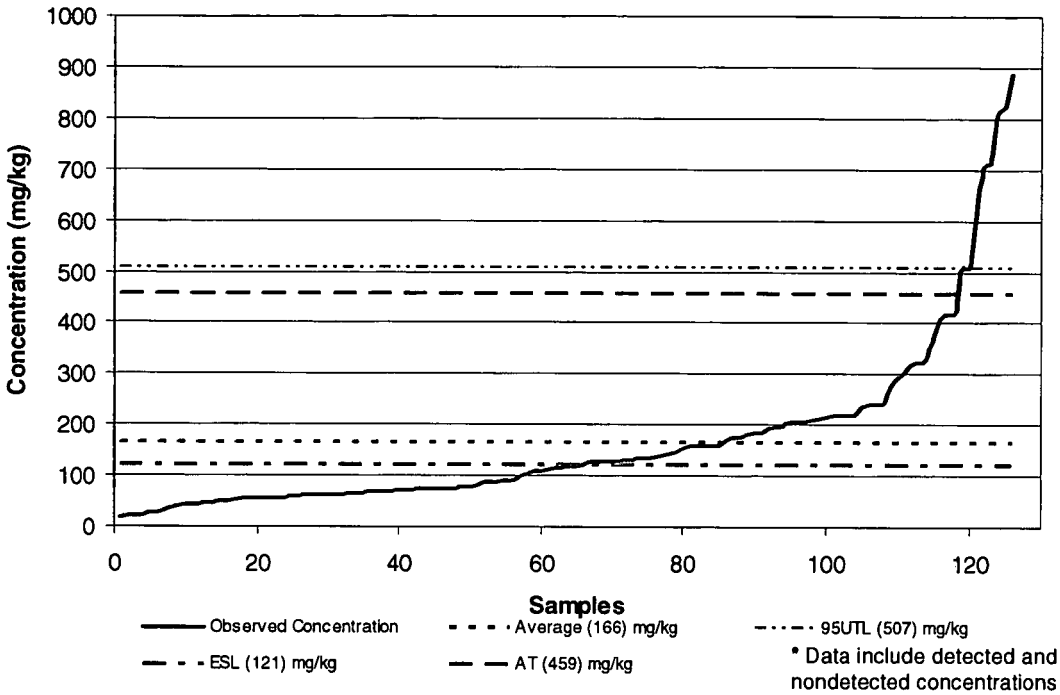

Figure 5.57 Data Distribution for Zinc in SW AEU Sediment

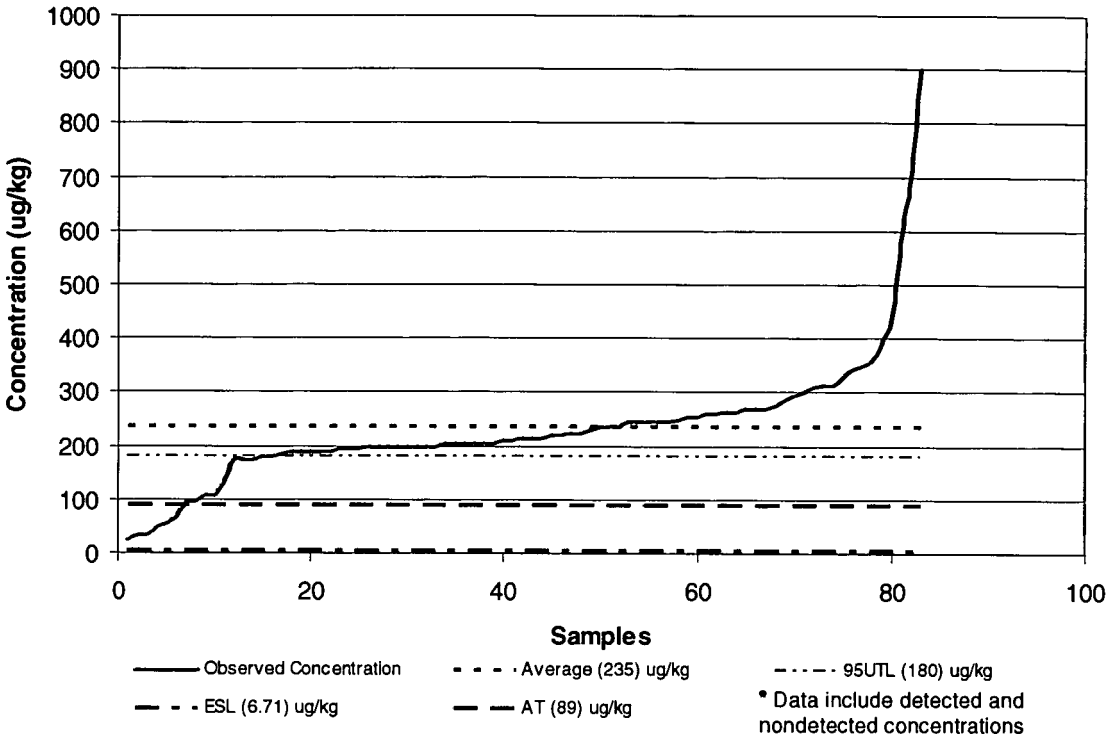

Figure 5.58 Data Distribution for Acenaphthene in SW AEU Sediment

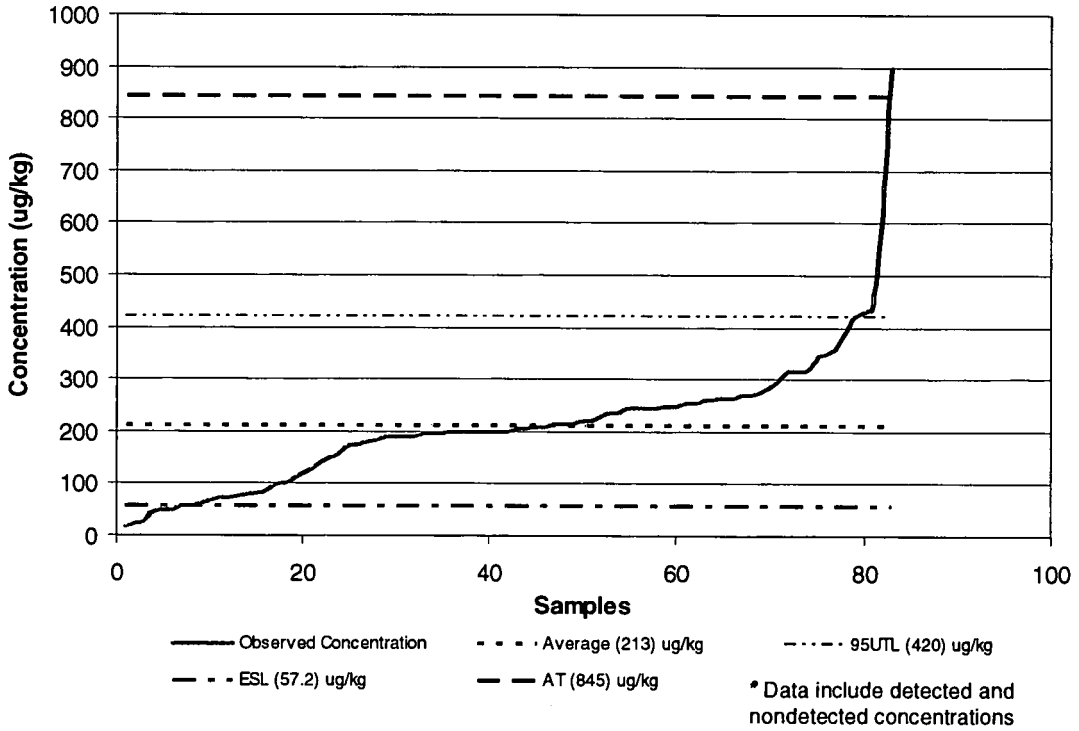

Figure 5. 59 Data Distribution for Anthracene in SW AEU Sediment

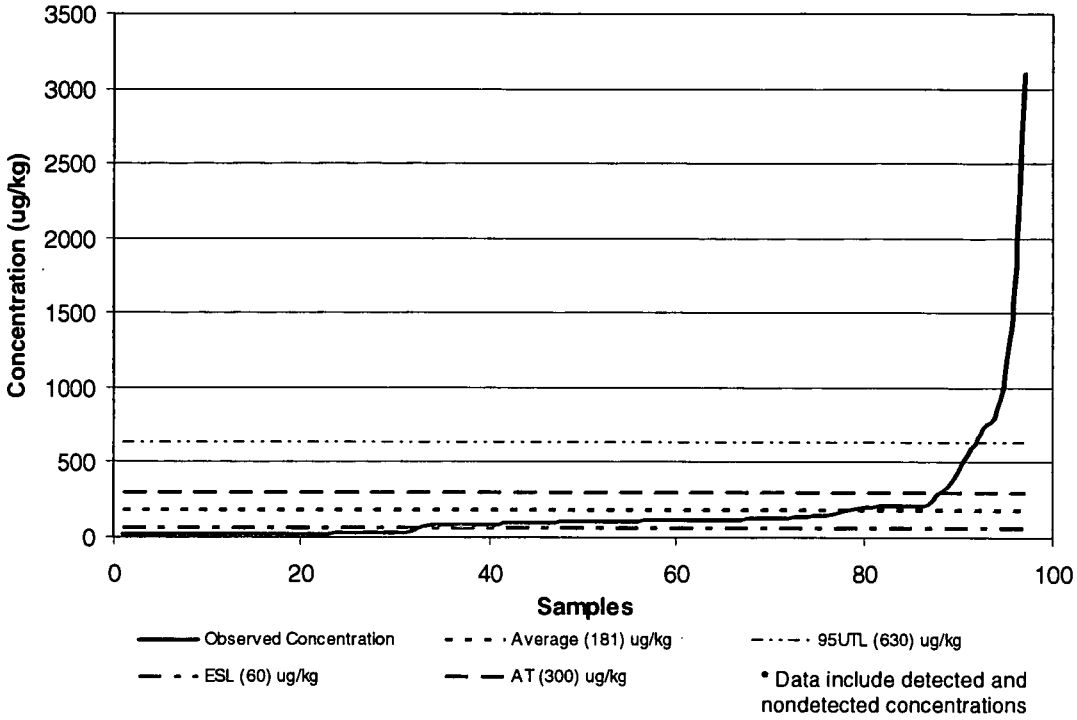

Figure 5.60 Data Distribution for Aroclor-1254 in SW AEU Sediment

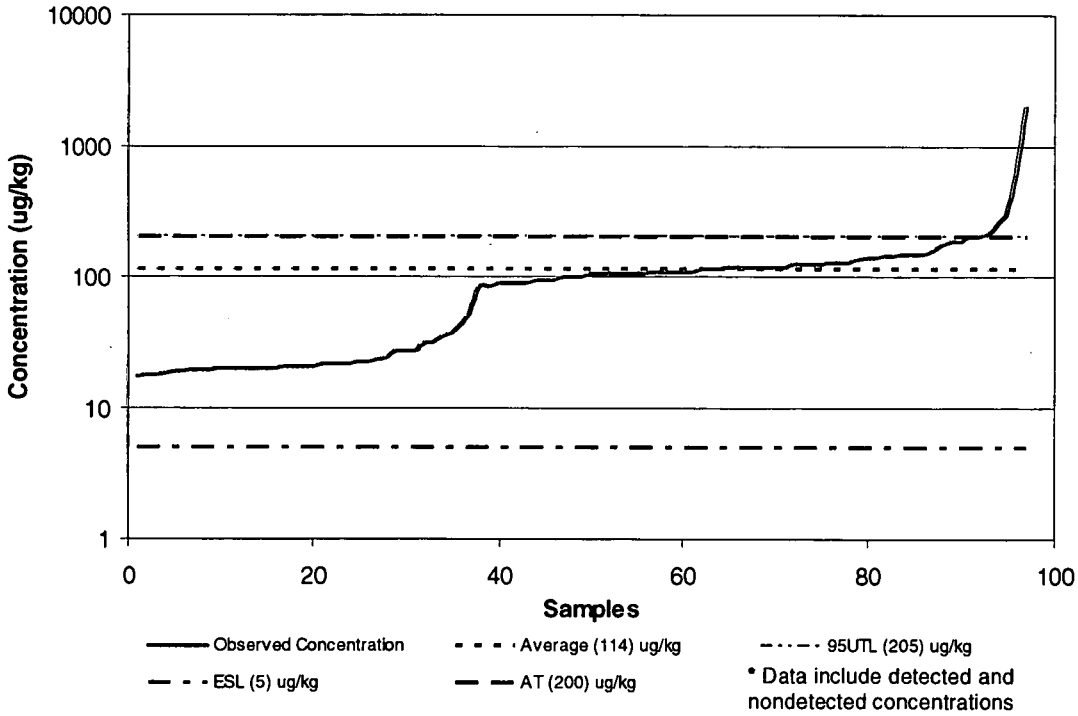

Figure 5.61 Data Distribution for Aroclor-1260 in SW AEU Sediment

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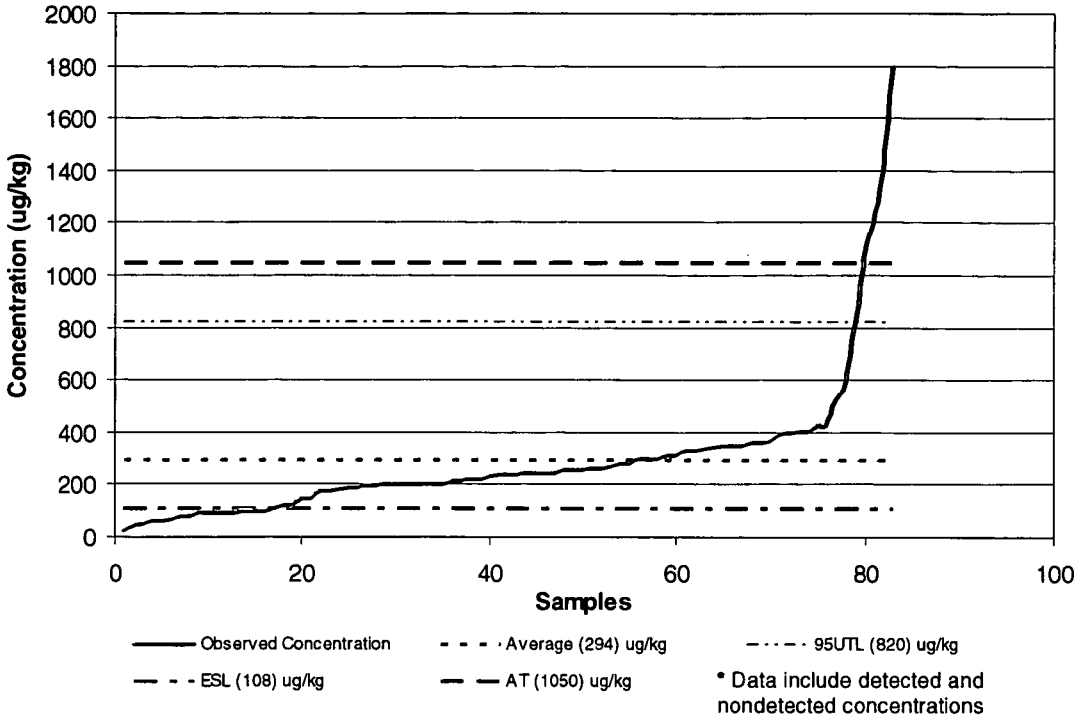

Figure 5.62 Data Distribution for Benzo(a)anthracene in SW AEU Sediment

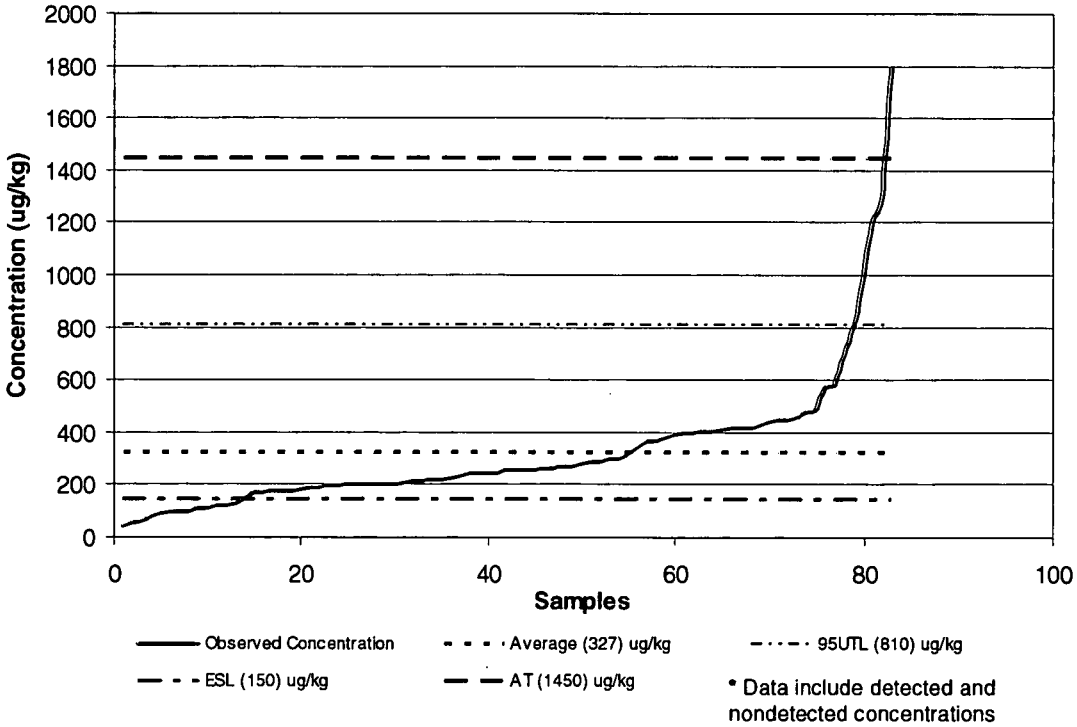

Figure 5.63 Data Distribution for Benzo(a)pyrene in SW AEU Sediment

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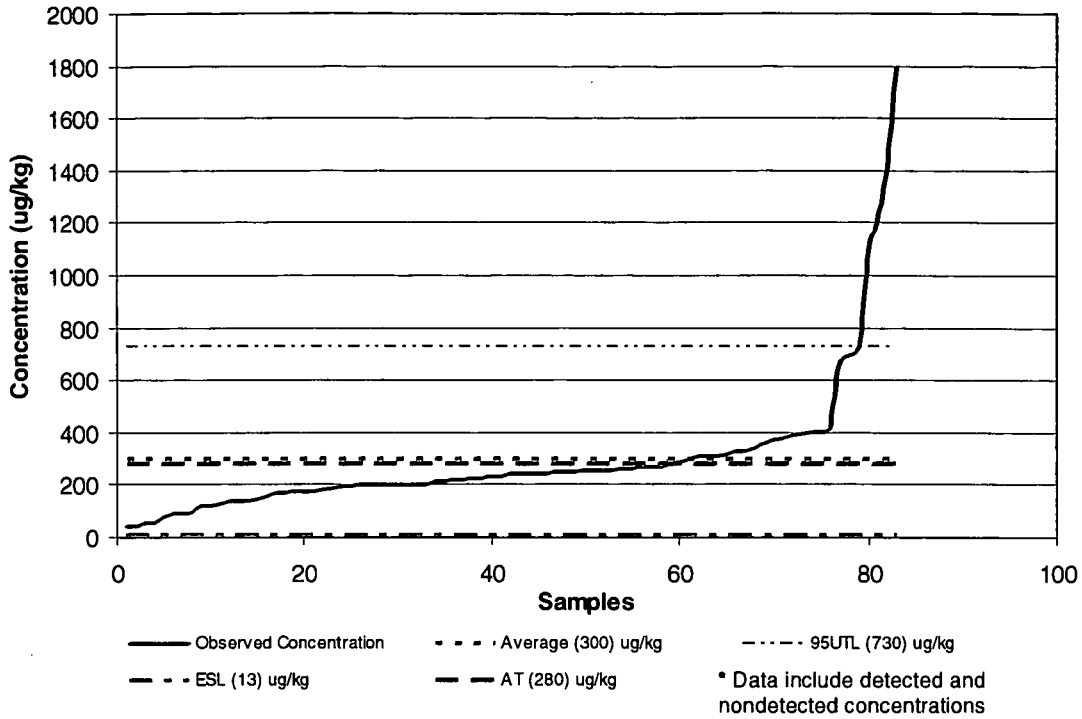

Figure 5.64 Data Distribution for Benzo(g,h,i)perylene in SW AEU Sediment

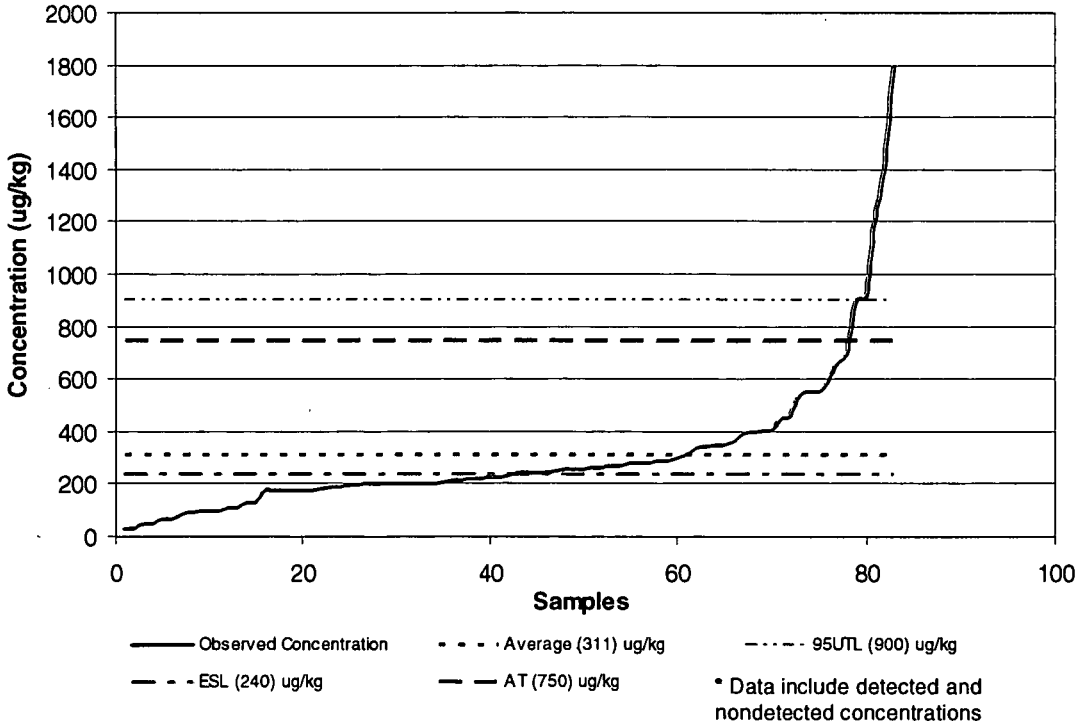

Figure 5.65 Data Distribution for Benzo(k)fluoranthene in SW AEU Sediment

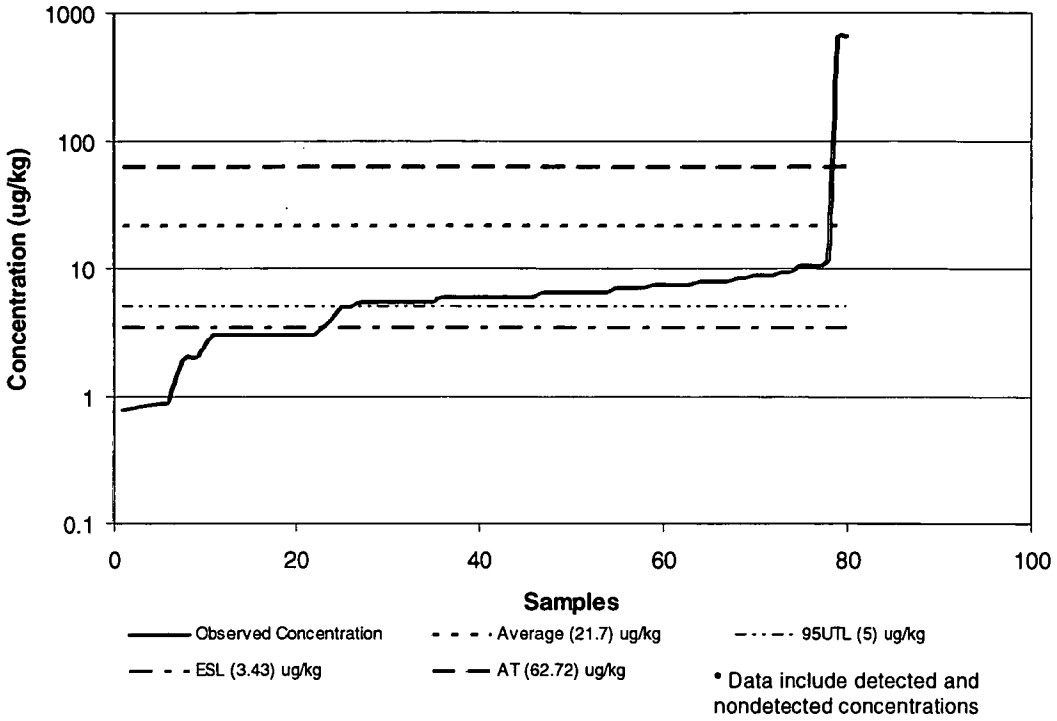

Figure 5.66 Data Distribution for Bromomethane in SW AEU Sediment

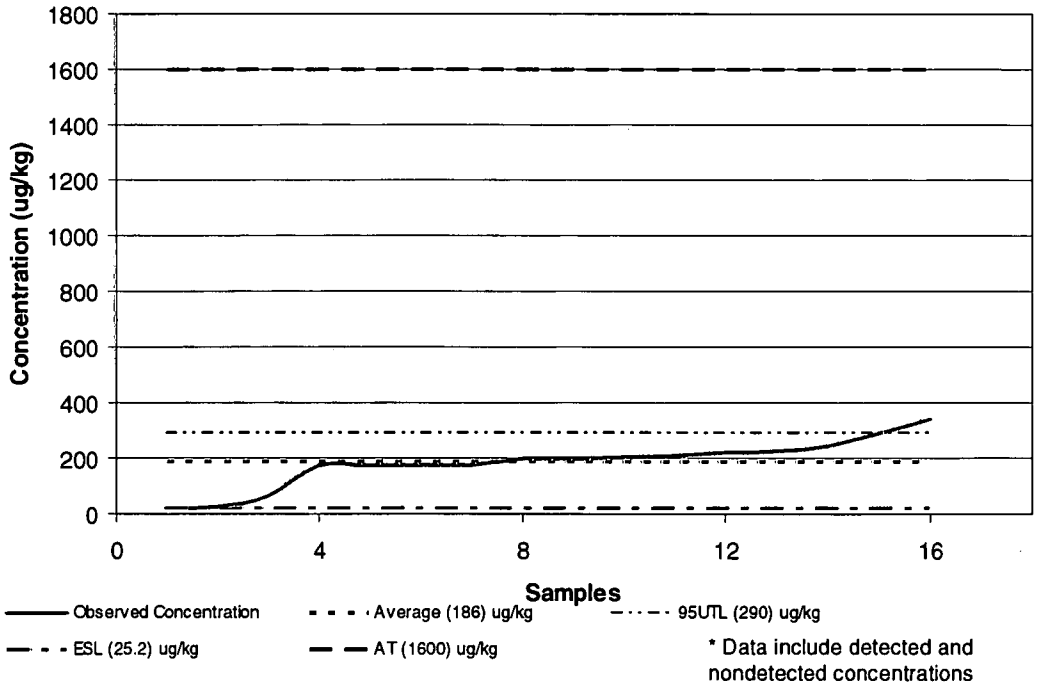

Figure 5.67 Data Distribution for Carbazole in SW AEU Sediment

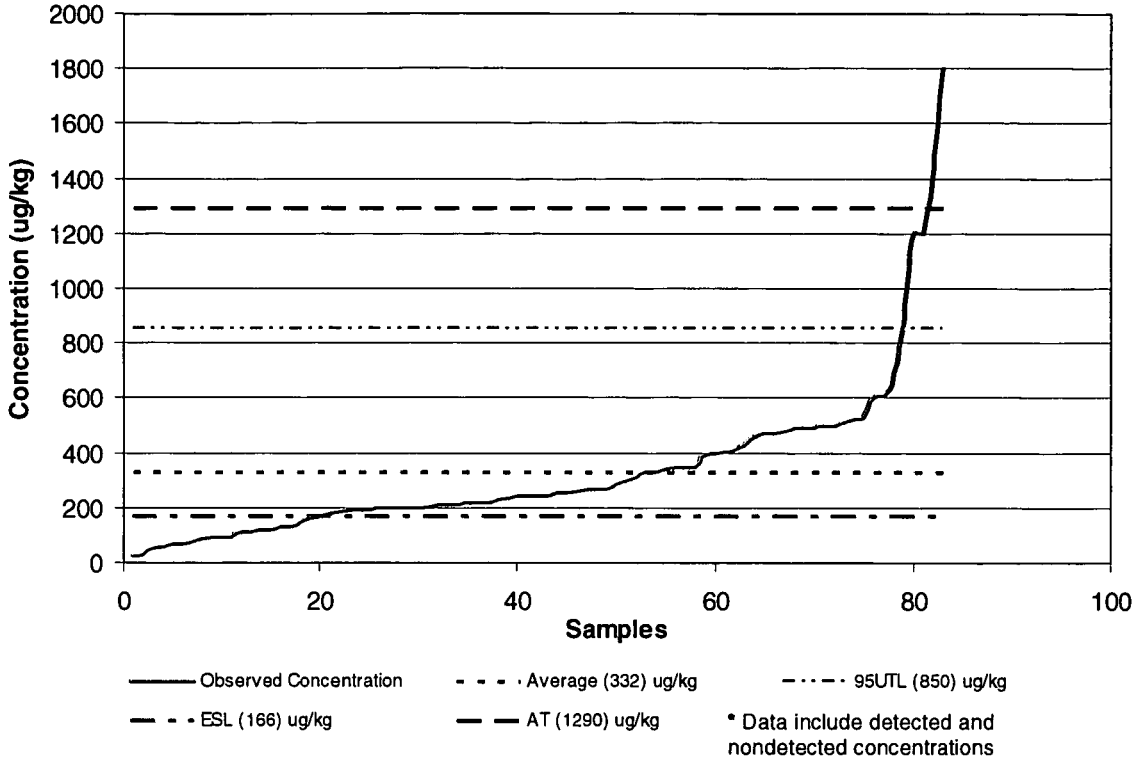

Figure 5.68 Data Distribution for Chrysene in SW AEU Sediment

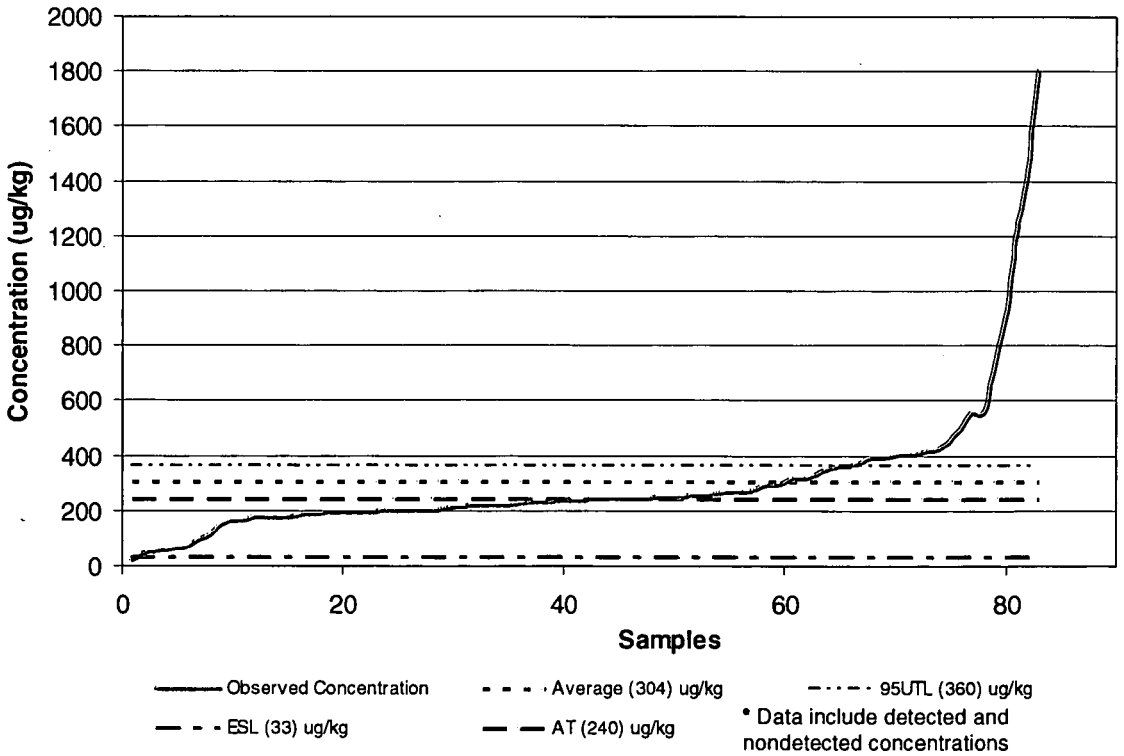

Figure 5.69 Data Distribution for Dibenz(a,h)anthracene in SW AEU Sediment

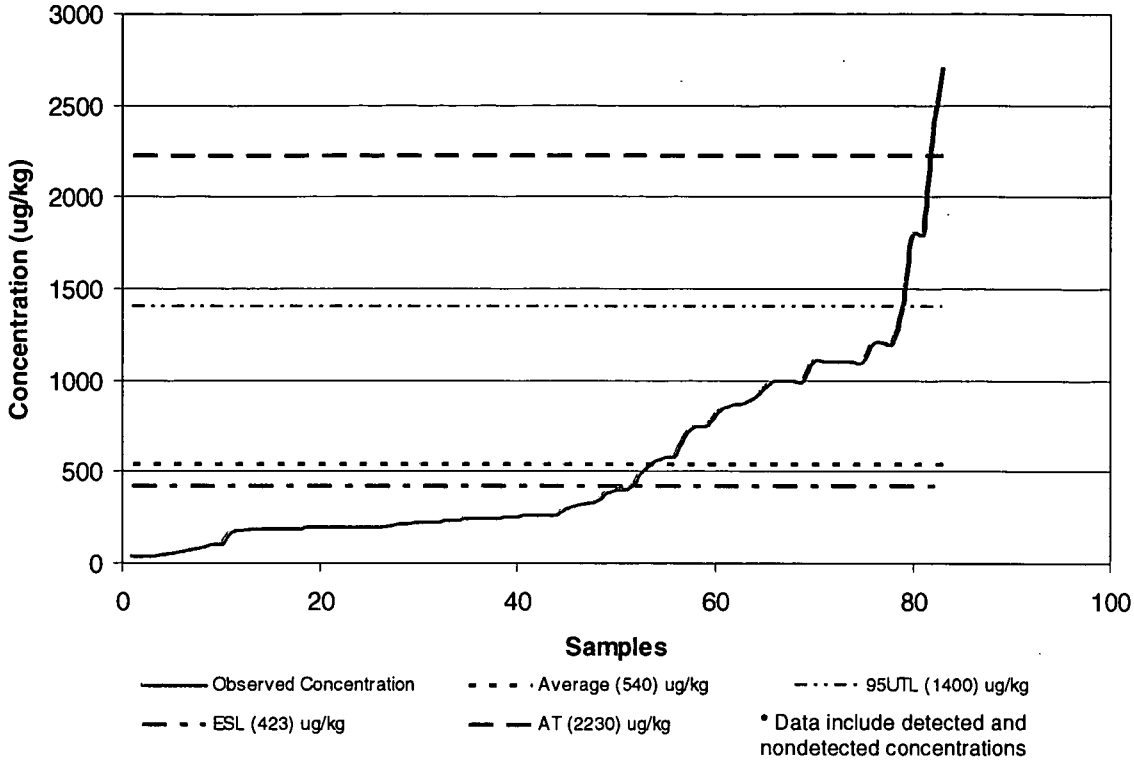

Figure 5.70 Data Distribution for Fluoranthene in SW AEU Sediment

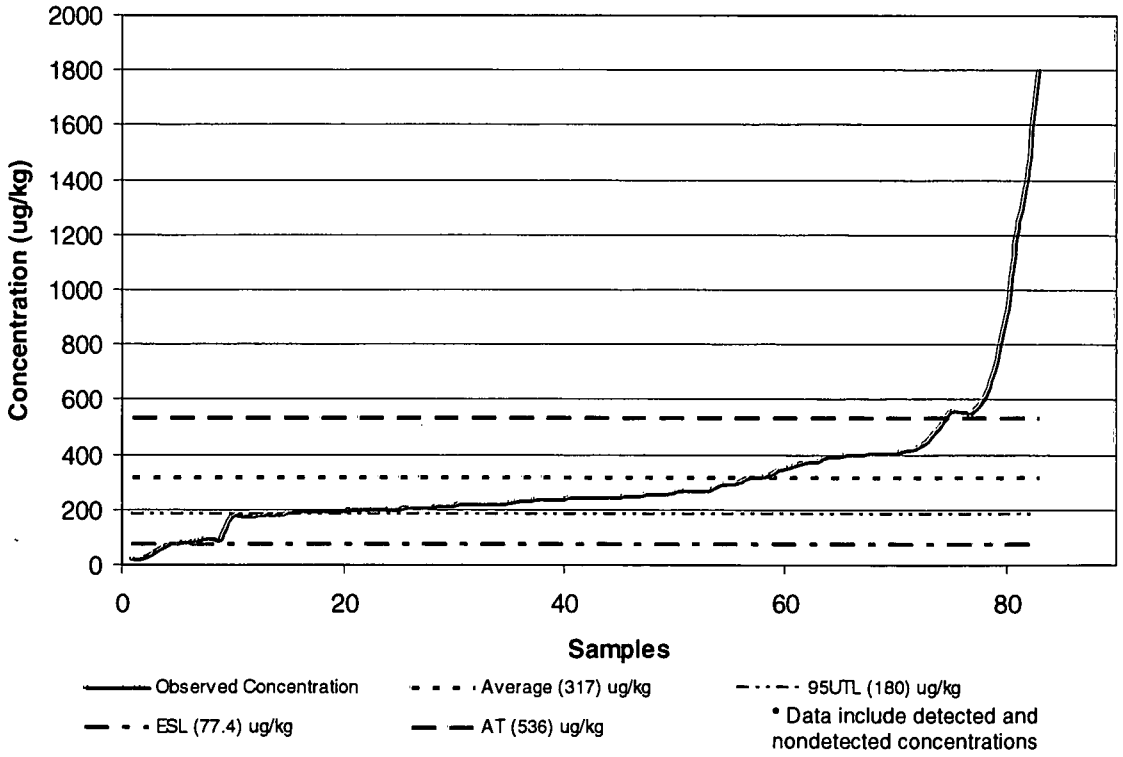

Figure 5.71 Data Distribution for Fluorene in SW AEU Sediment

436

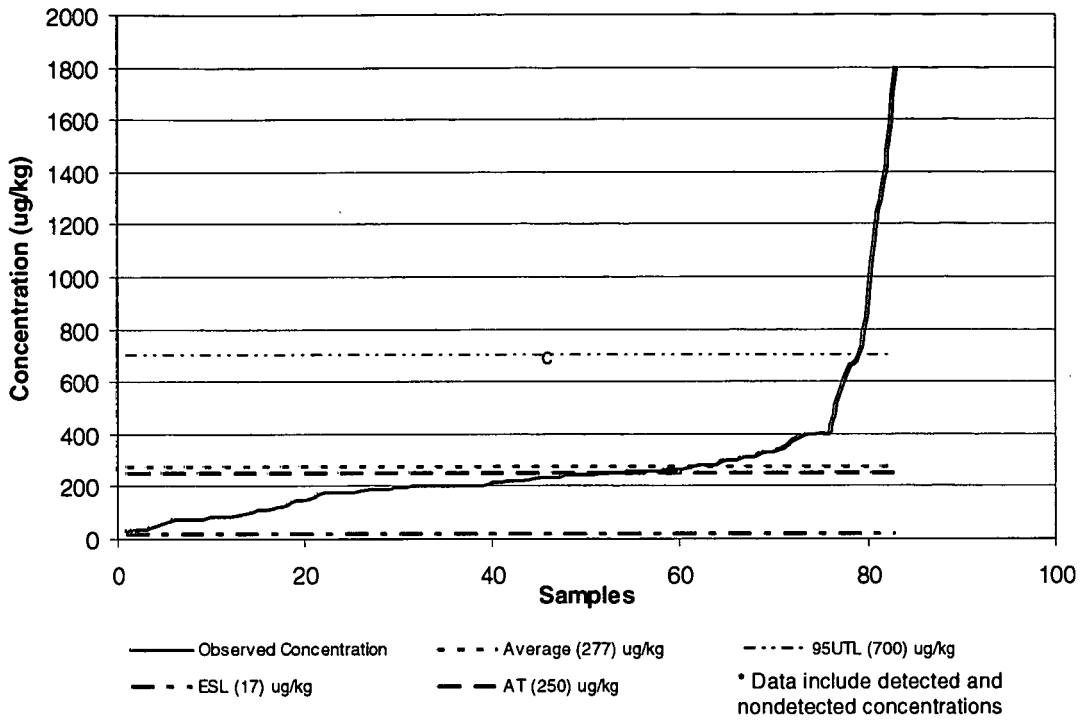

Figure 5.72 Data Distribution for Indeno(1,2,3-cd)pyrene in SW AEU Sediment

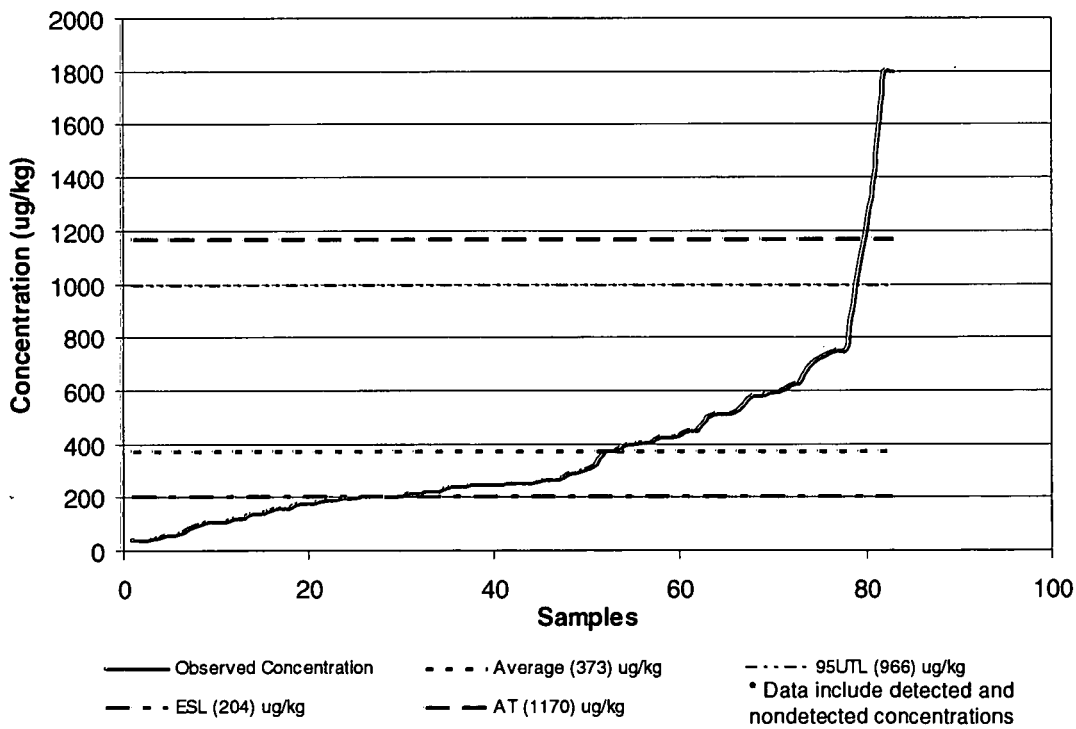

Figure 5.73 Data Distribution for Phenanthrene in SW AEU Sediment

437

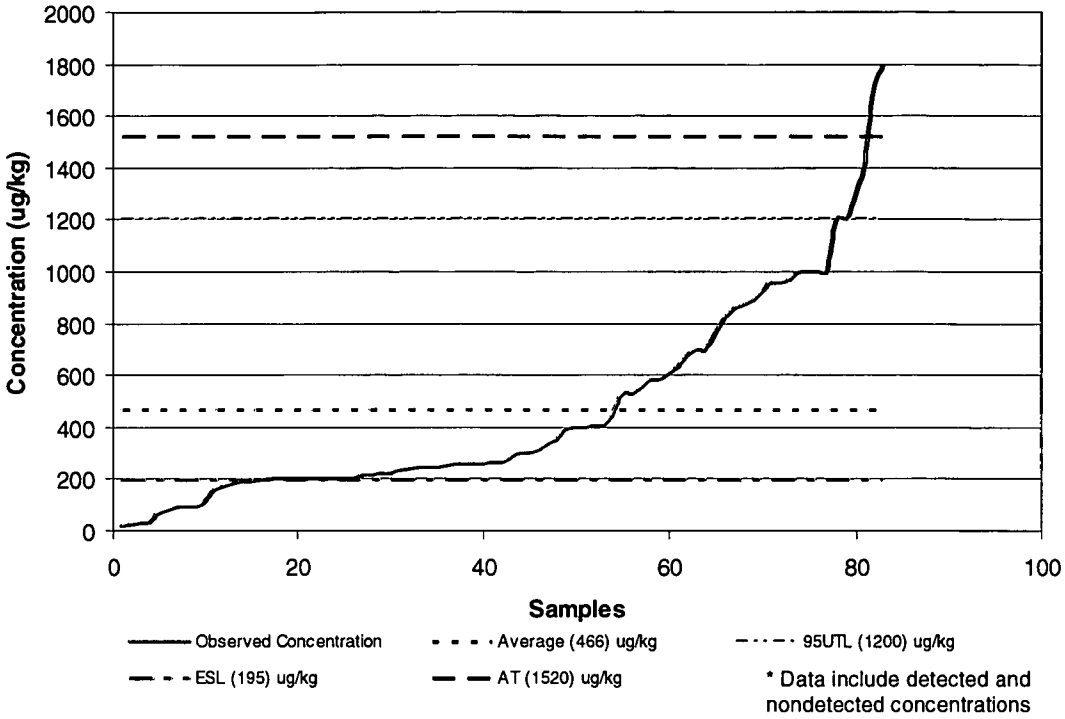

Figure 5.74 Data Distribution for Pyrene in SW AEU Sediment

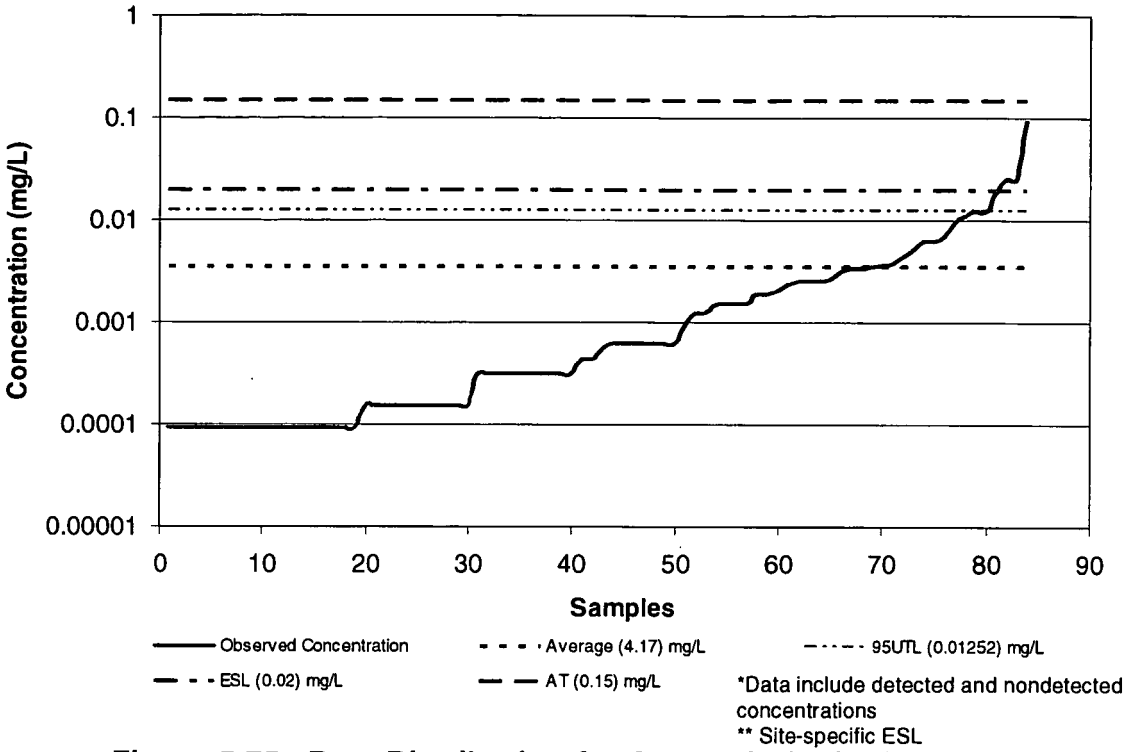

Figure 5.75 Data Distribution for Ammonia (unionized) in WC AEU Surface Water

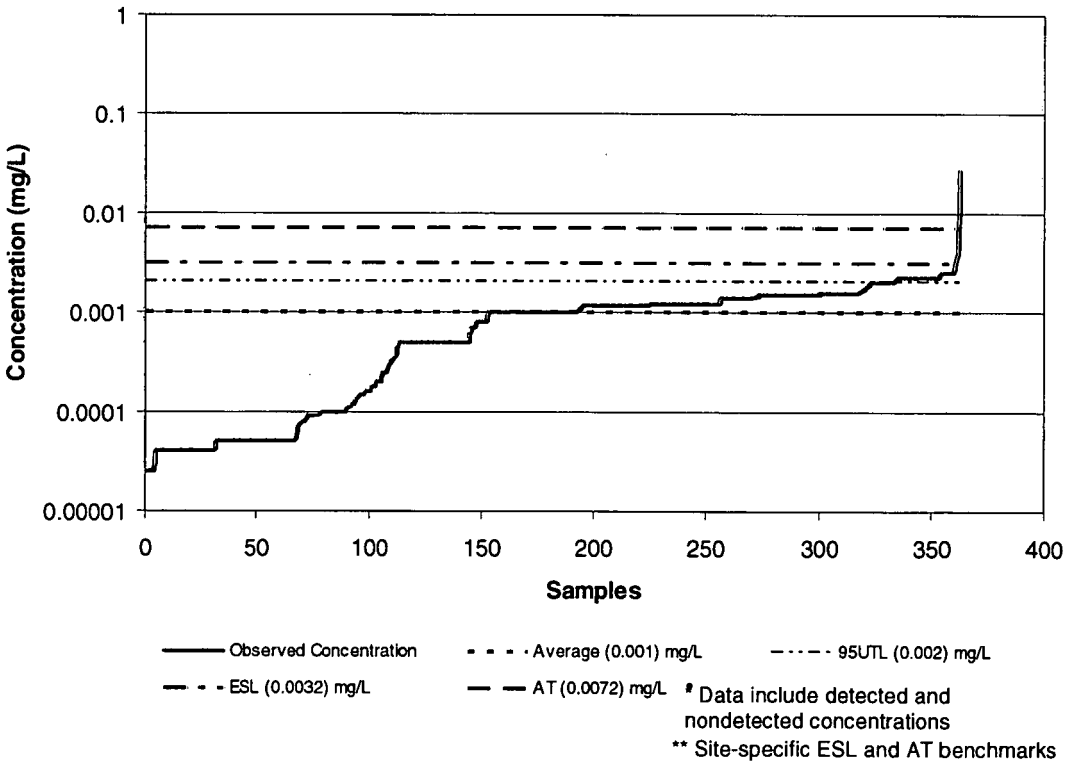

Figure 5.76 Data Distribution for Cadmium (dissolved) in WC AEU Surface Water

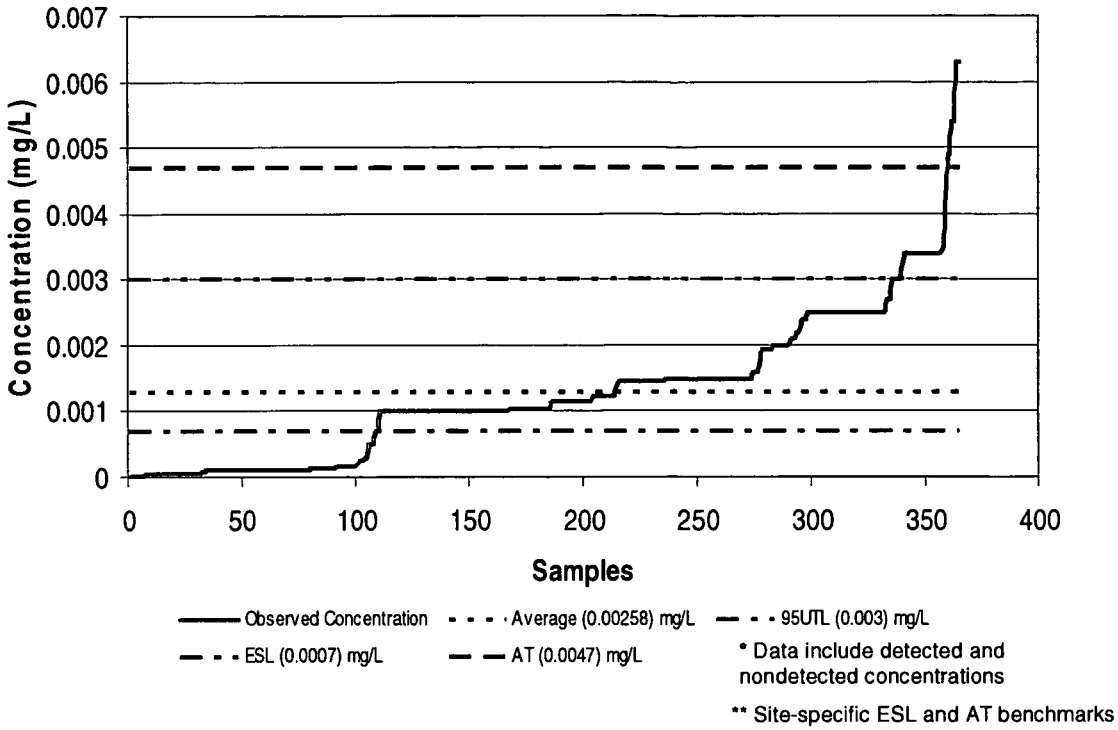

Figure 5.77 Data Distribution for Silver (dissolved) in WC AEU Surface Water

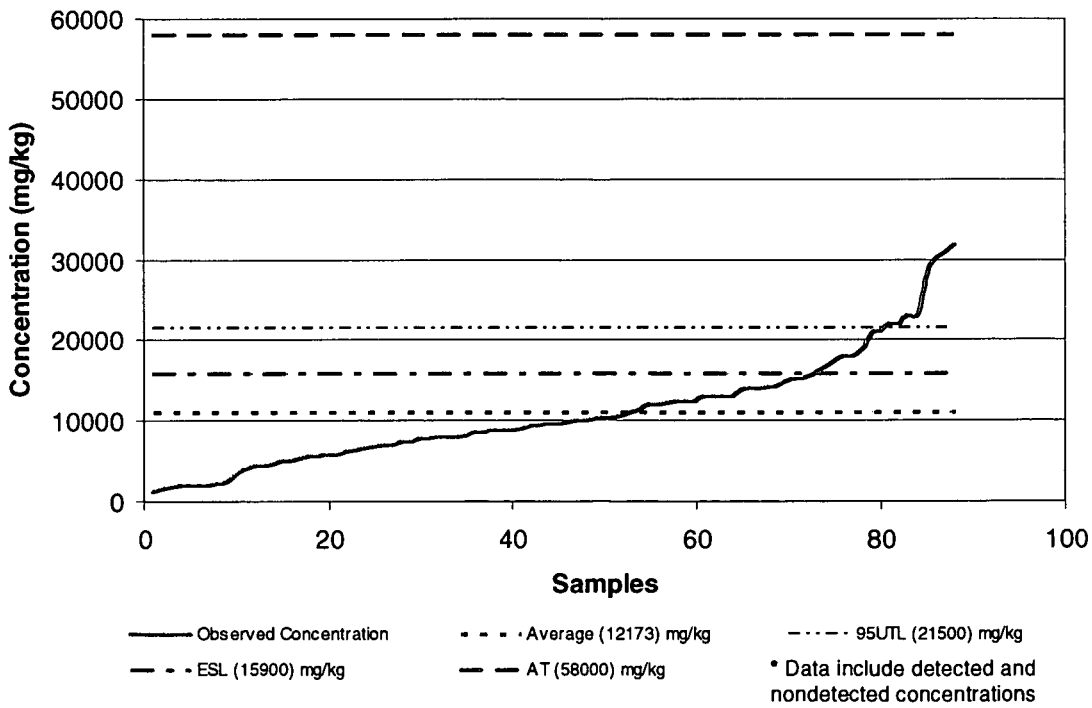

Figure 5.78 Data Distribution for Aluminum in WC AEU Sediment

440

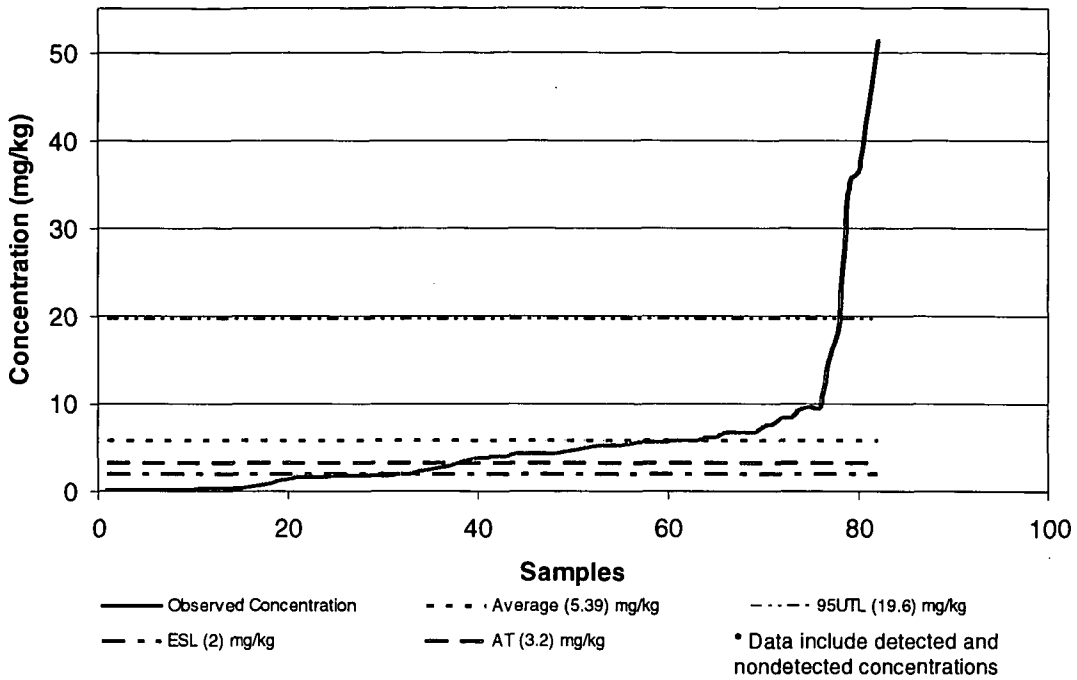

Figure 5.79 Data Distribution for Antimony in WC AEU Sediment

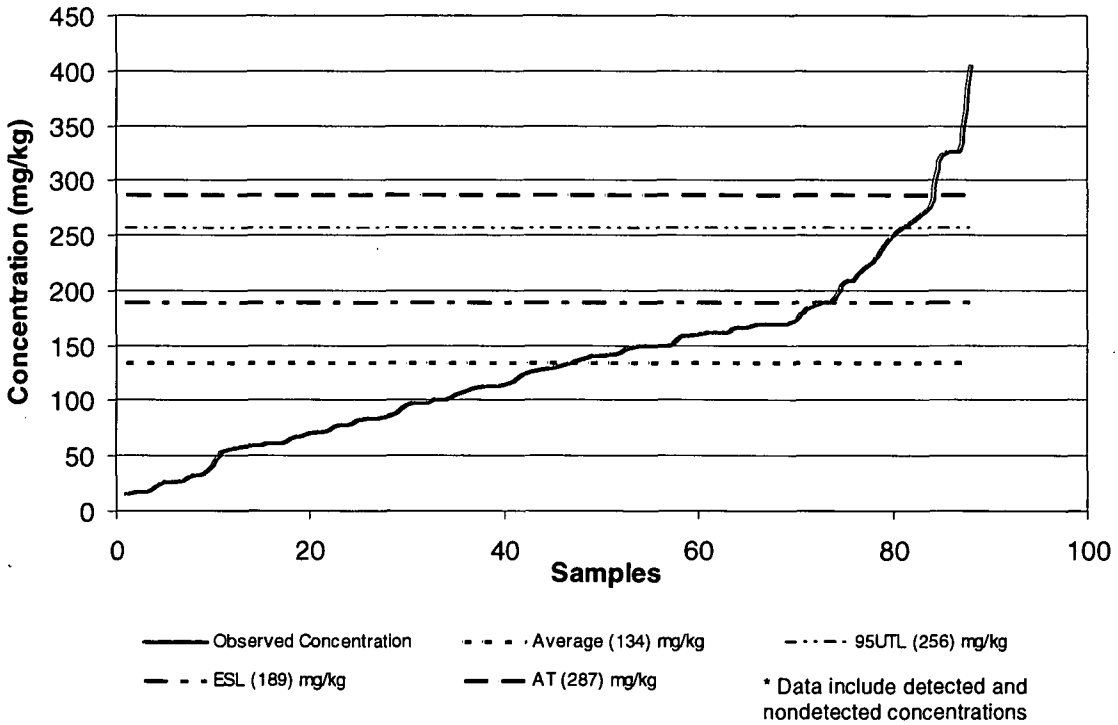

Figure 5.80 Data Distribution for Barium in WC AEU Sediment

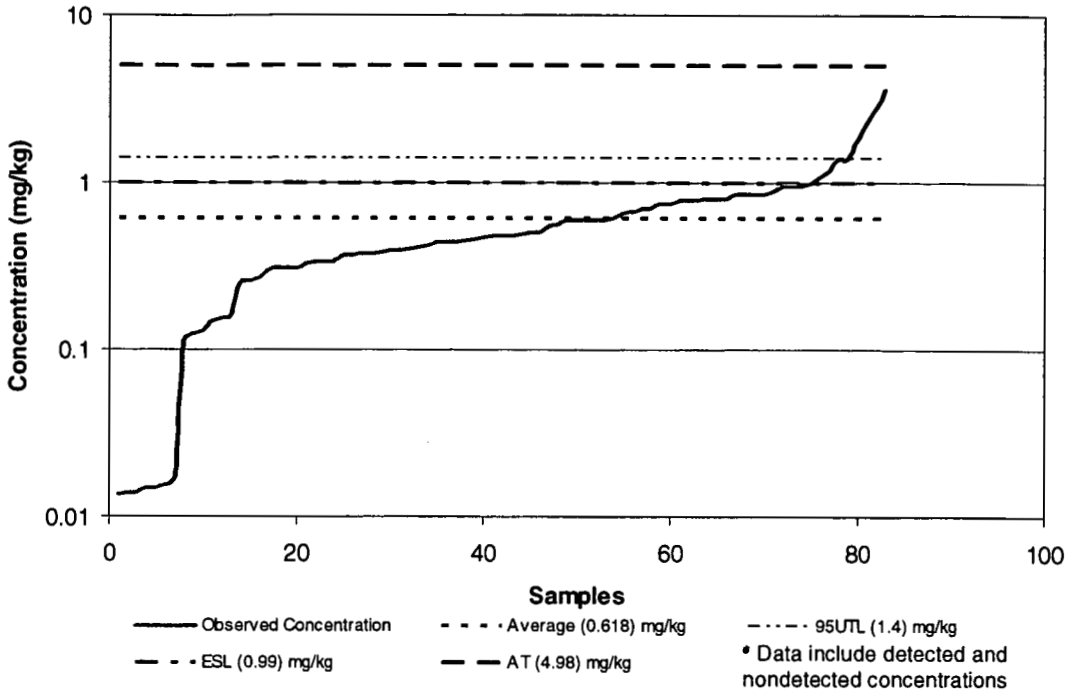

Figure 5.81 Data Distribution for Cadmium in WC AEU Sediment

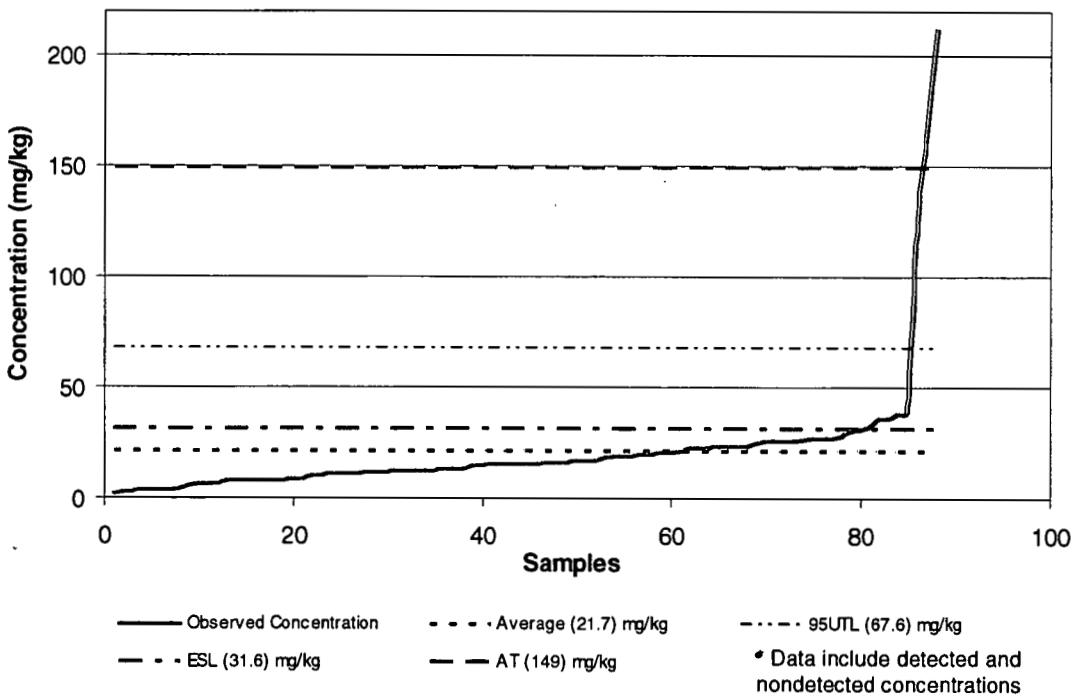

Figure 5.82 Data Distribution for Copper in WC AEU Sediment

442

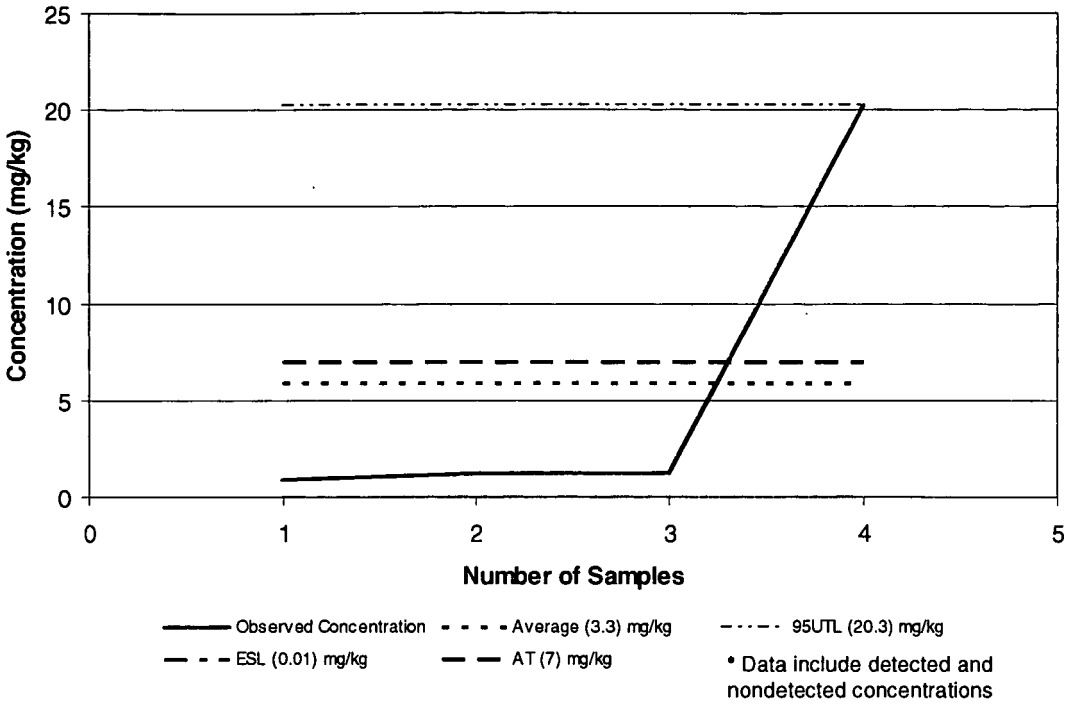

Figure 5.83 Data Distribution for Fluoride in WC AEU Sediment

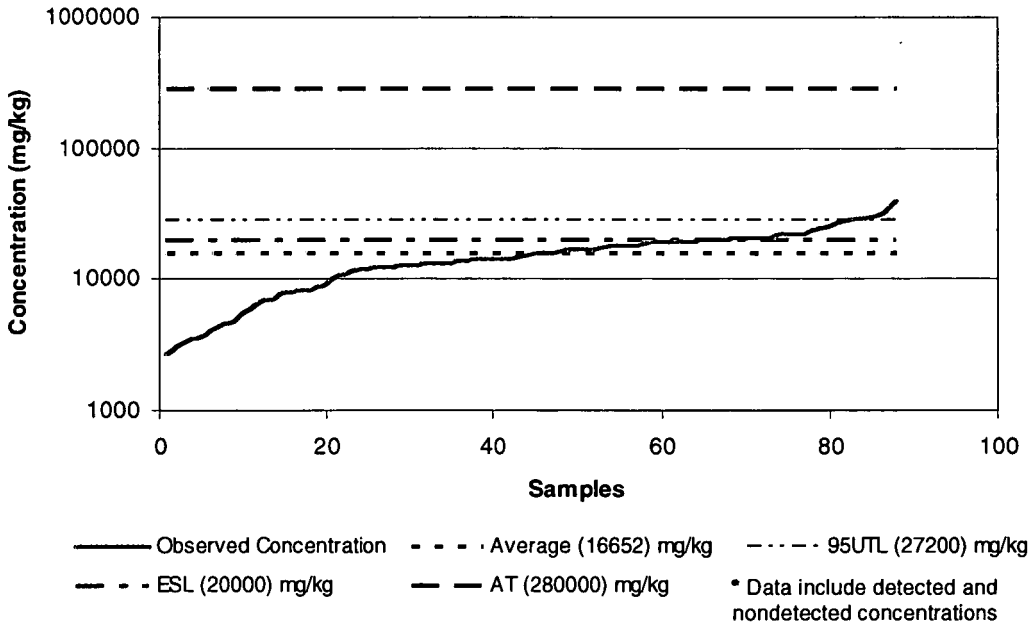

Figure 5.84 Data Distribution for Iron in WC AEU Sediment

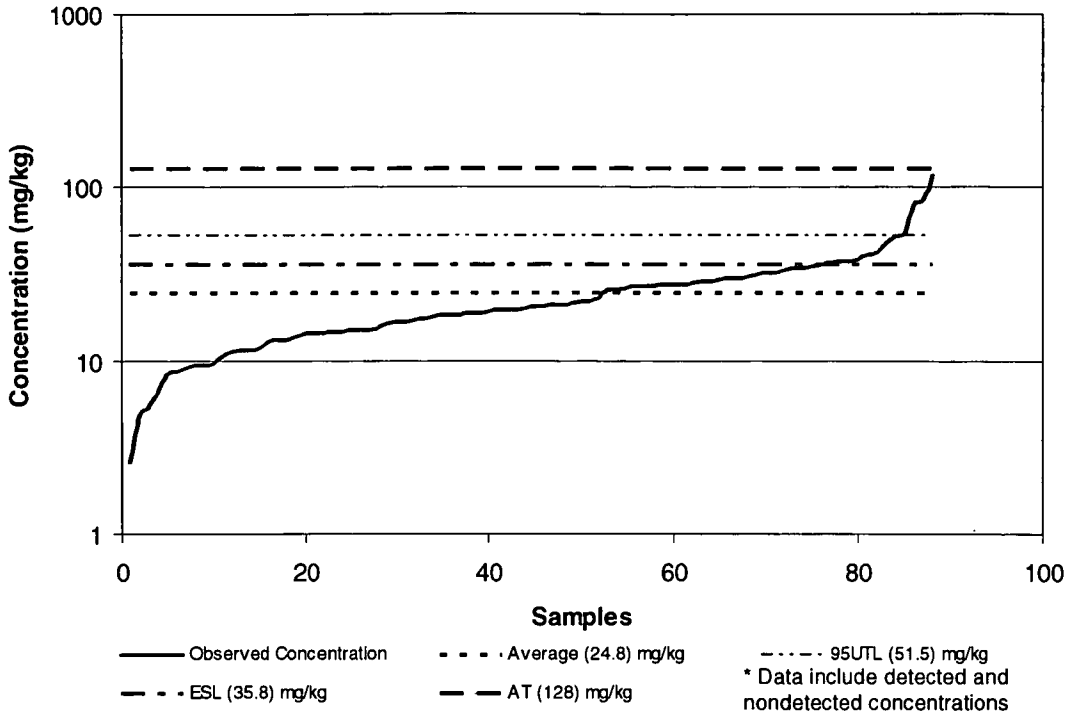

Figure 5.85 Data Distribution for Lead in WC AEU Sediment

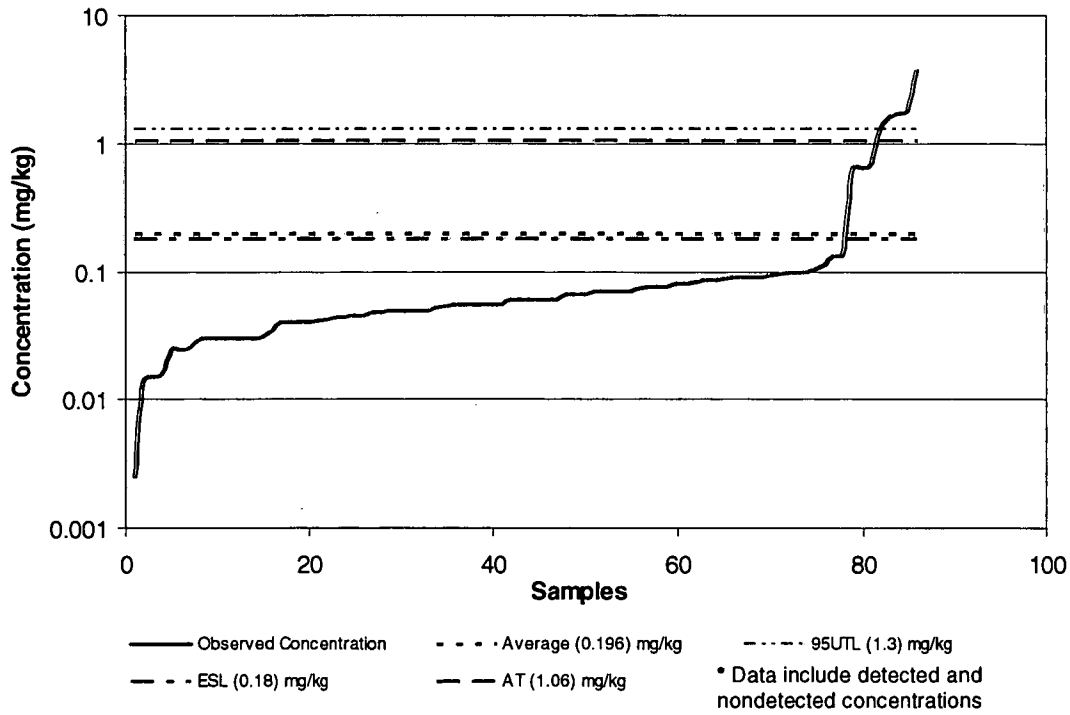

Figure 5.86 Data Distribution for Mercury in WC AEU Sediment

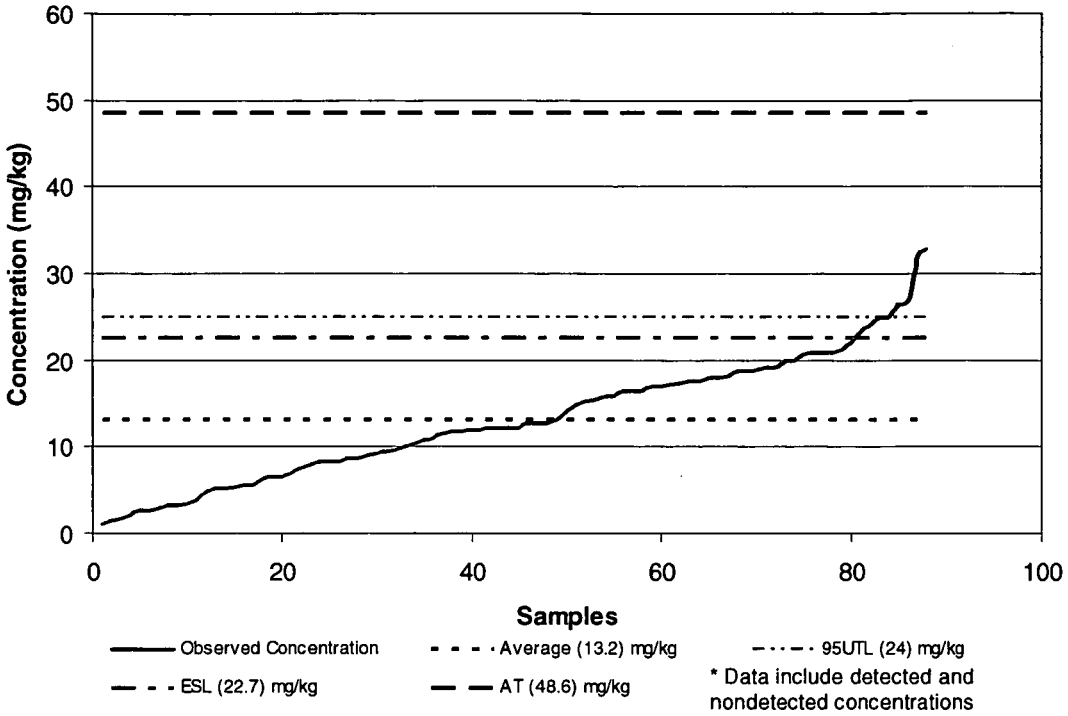

Figure 5.87 Data Distribution for Nickel in WC AEU Sediment

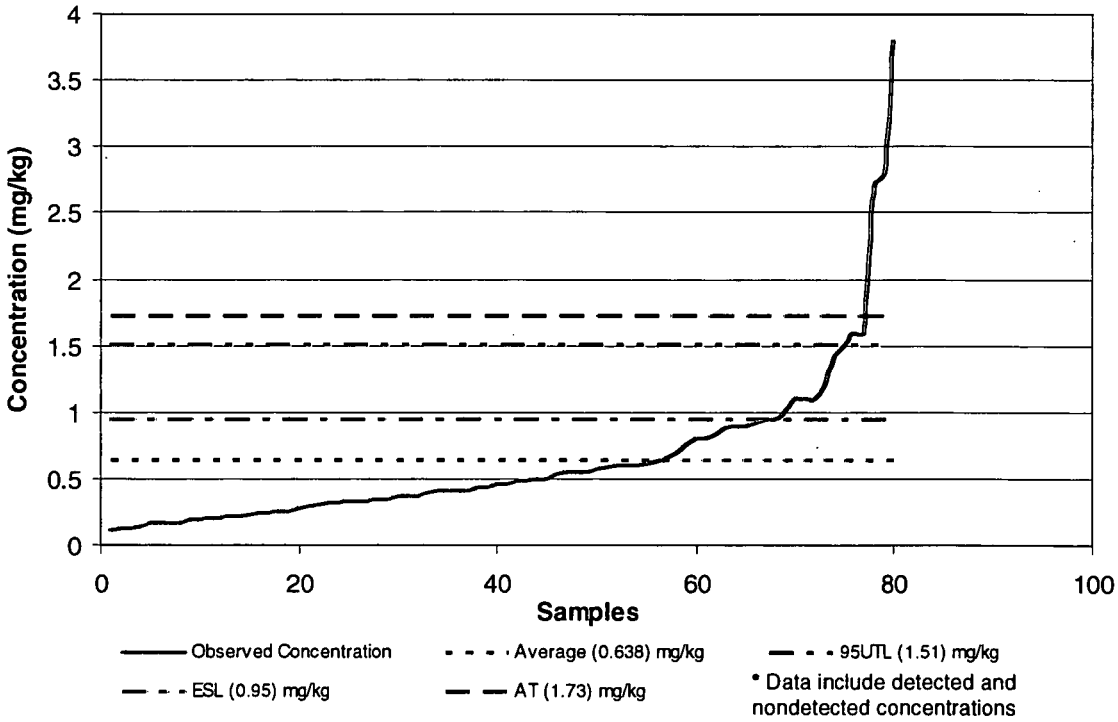

Figure 5.88 Data Distribution for Selenium in WC AEU Sediment

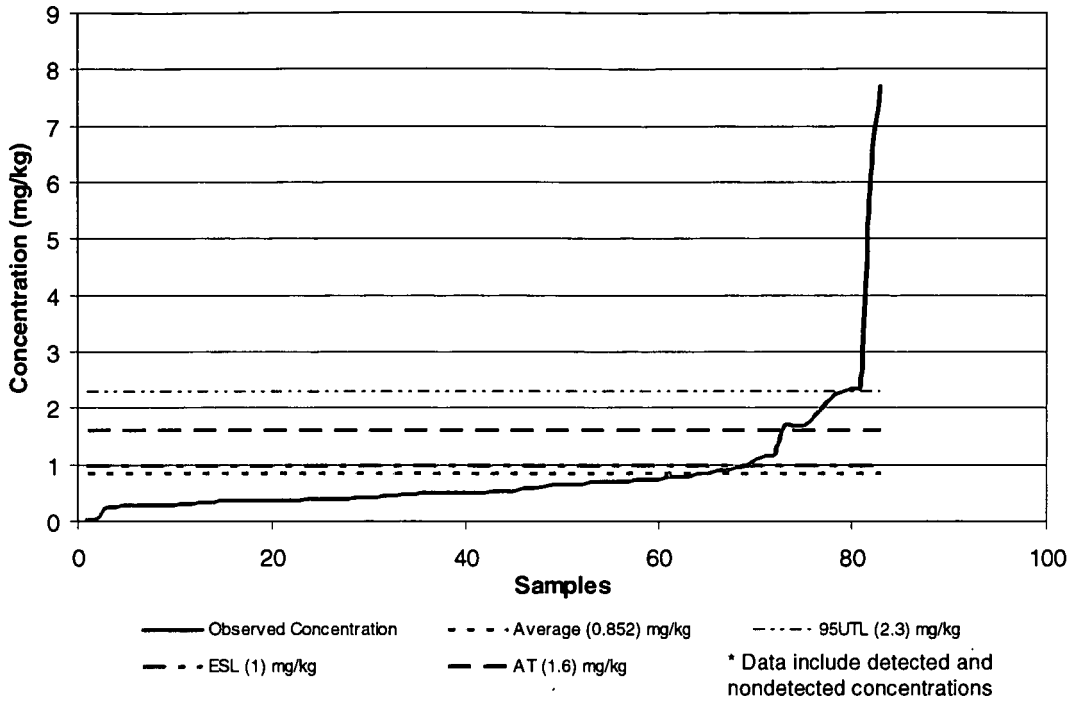

Figure 5.89 Data Distribution for Silver in WC AEU Sediment

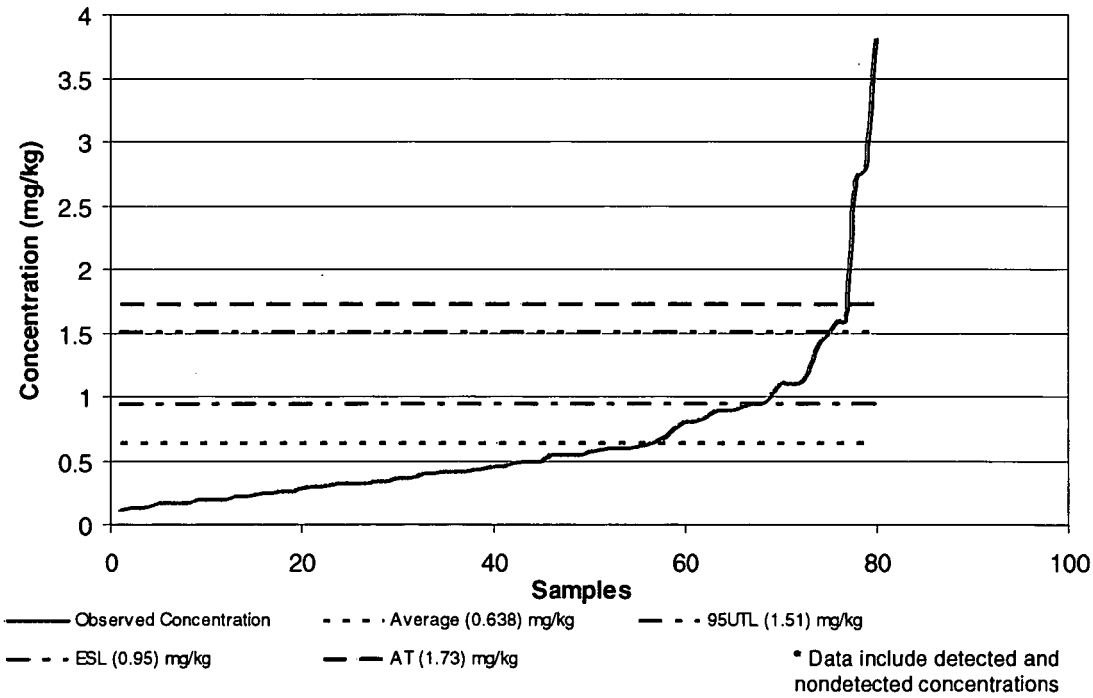

Figure 5.90 Data Distribution for Zinc in WC AEU Sediment

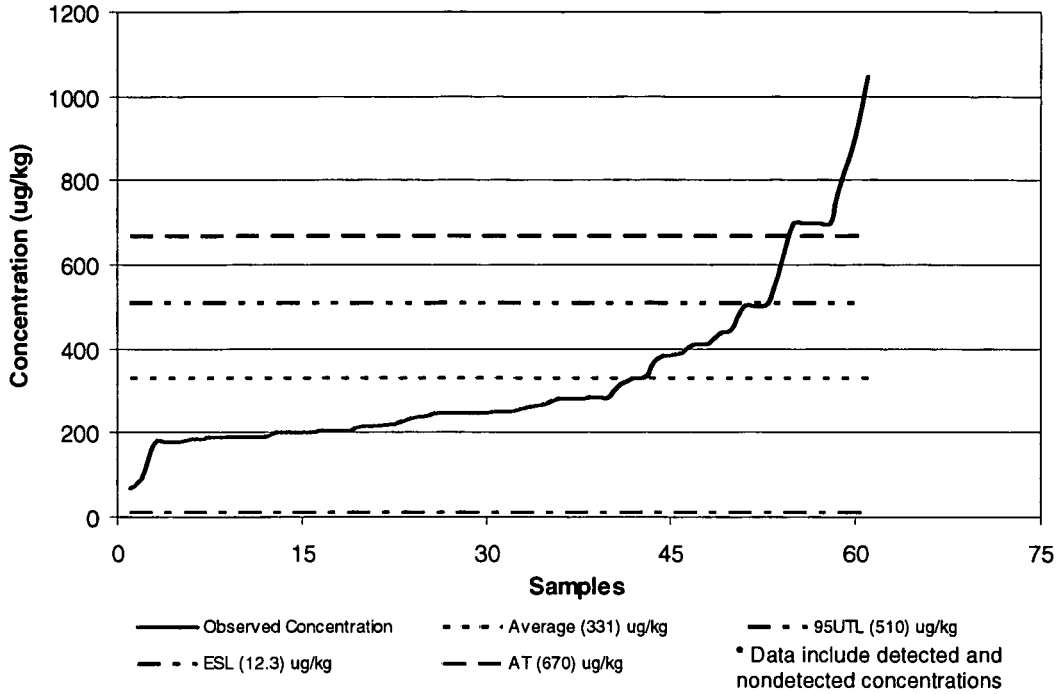

Figure 5.91 Data Distribution for 4-Methylphenol in WC AEU Sediment

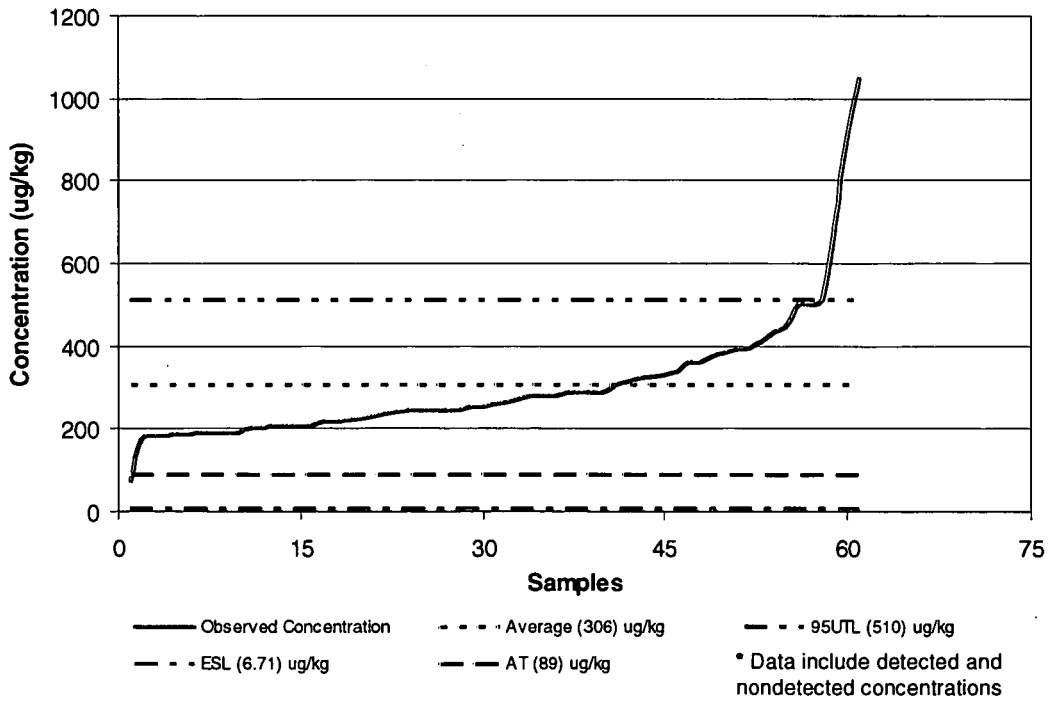

Figure 5.92 Data Distribution for Acenaphthene in WC AEU Sediment

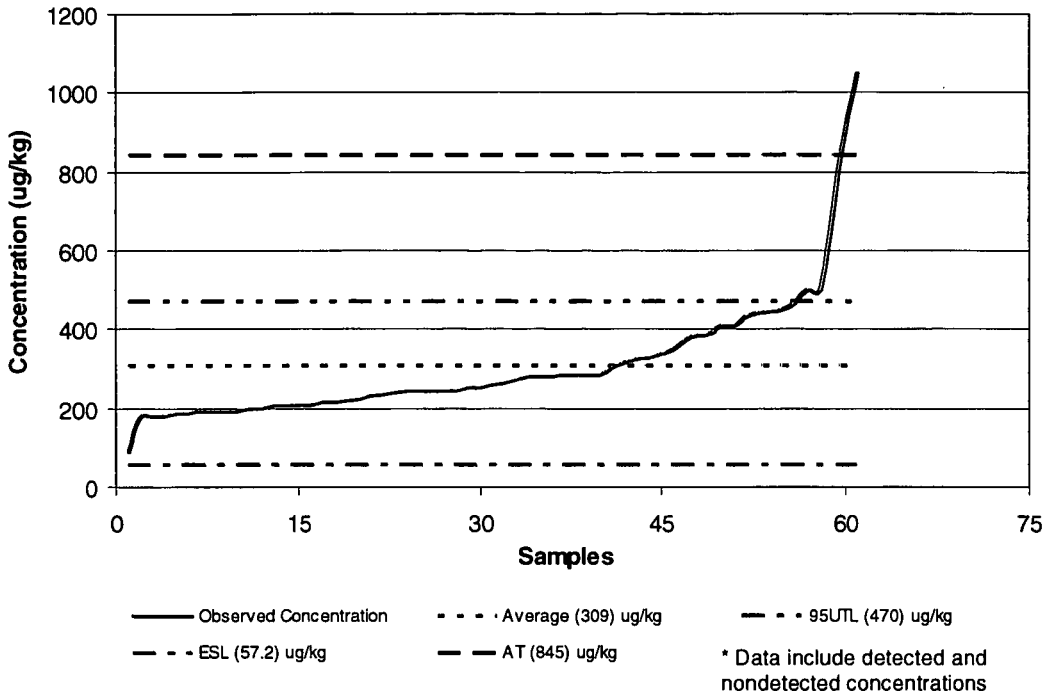

Figure 5.93 Data Distribution for Anthracene in WC AEU Sediment

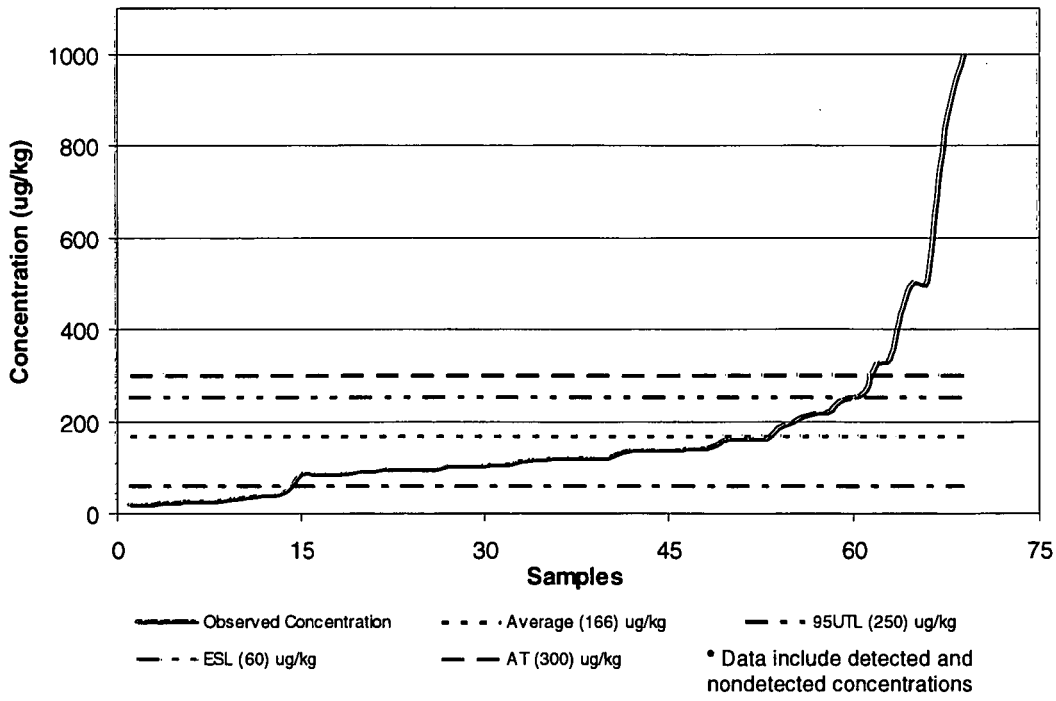

Figure 5.94 Data Distribution for Aroclor-1254 in WC AEU Sediment

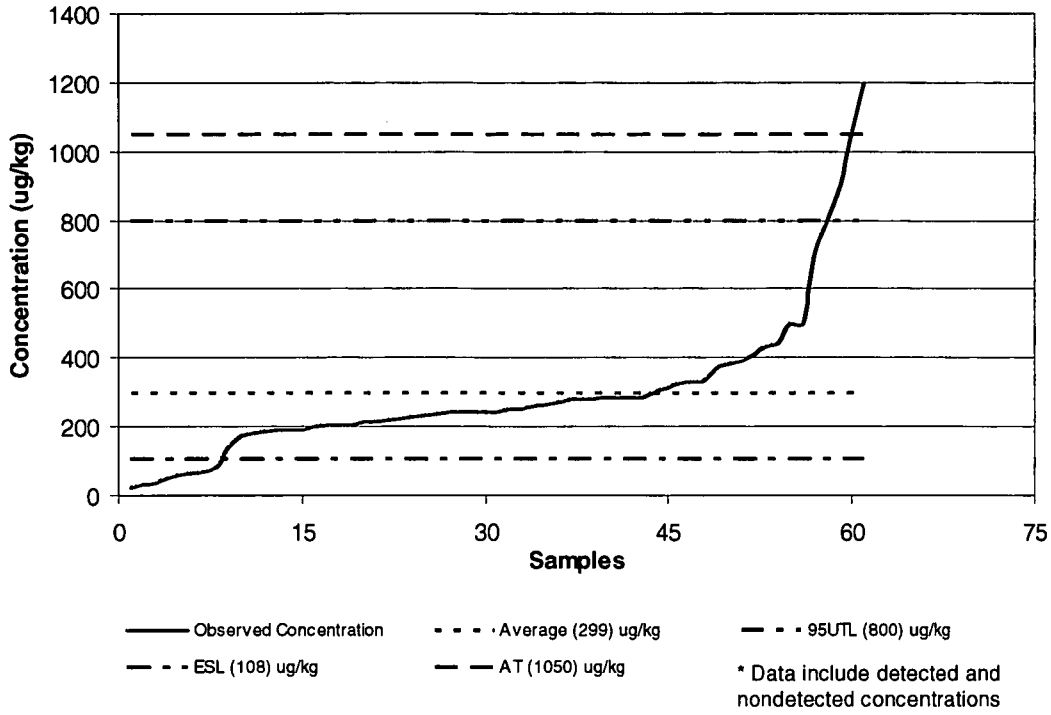

Figure 5.95 Data Distribution for Benzo(a)anthracene in WC AEU Sediment

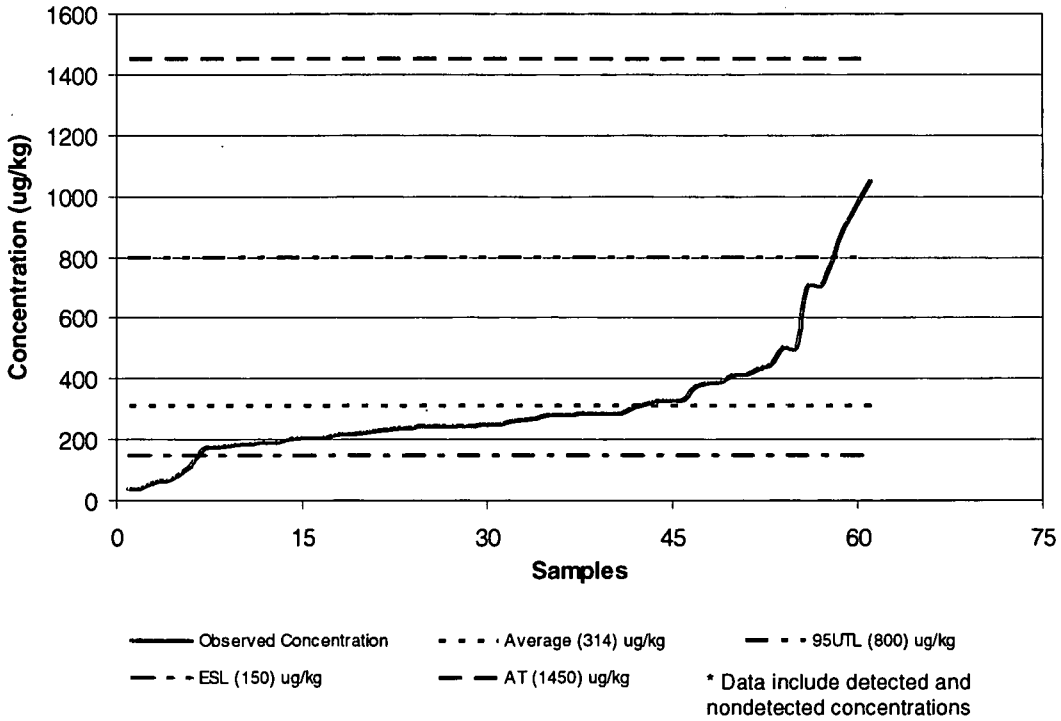

Figure 5.96 Data Distribution for Benzo(a)pyrene in WC AEU Sediment

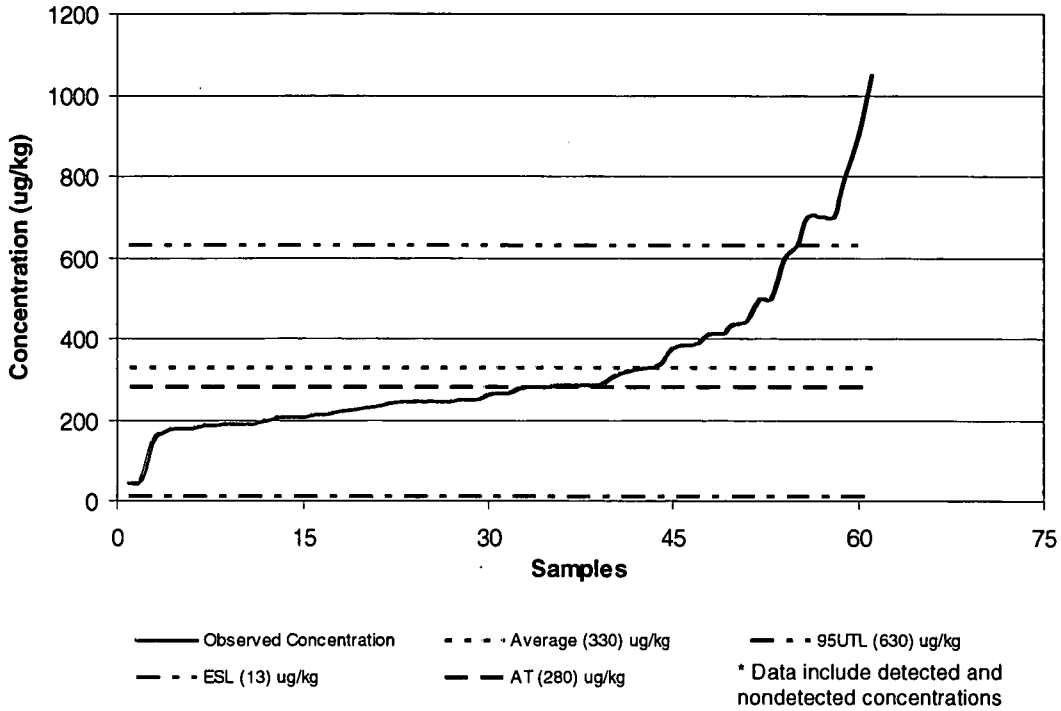

Figure 5.97 Data Distribution for Benzo(g,h,i)perylene in WC AEU Sediment

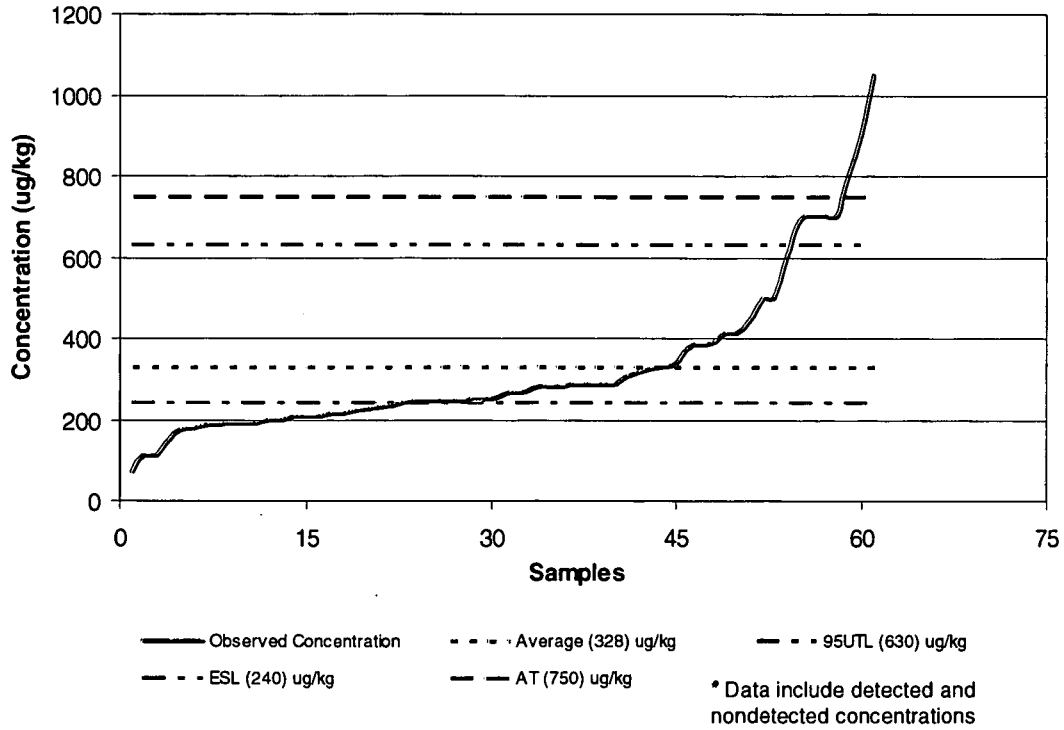

Figure 5.98 Data Distribution for Benzo(k)fluoranthene in WC AEU Sediment

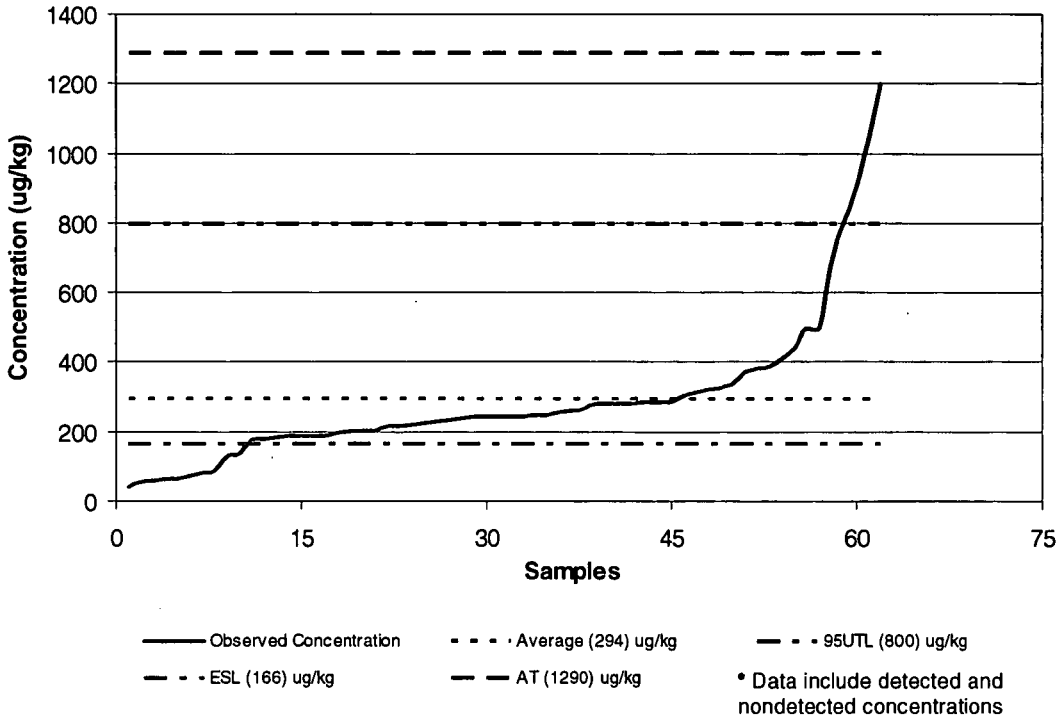

Figure 5.99 Data Distribution for Chrysene in WC AEU Sediment

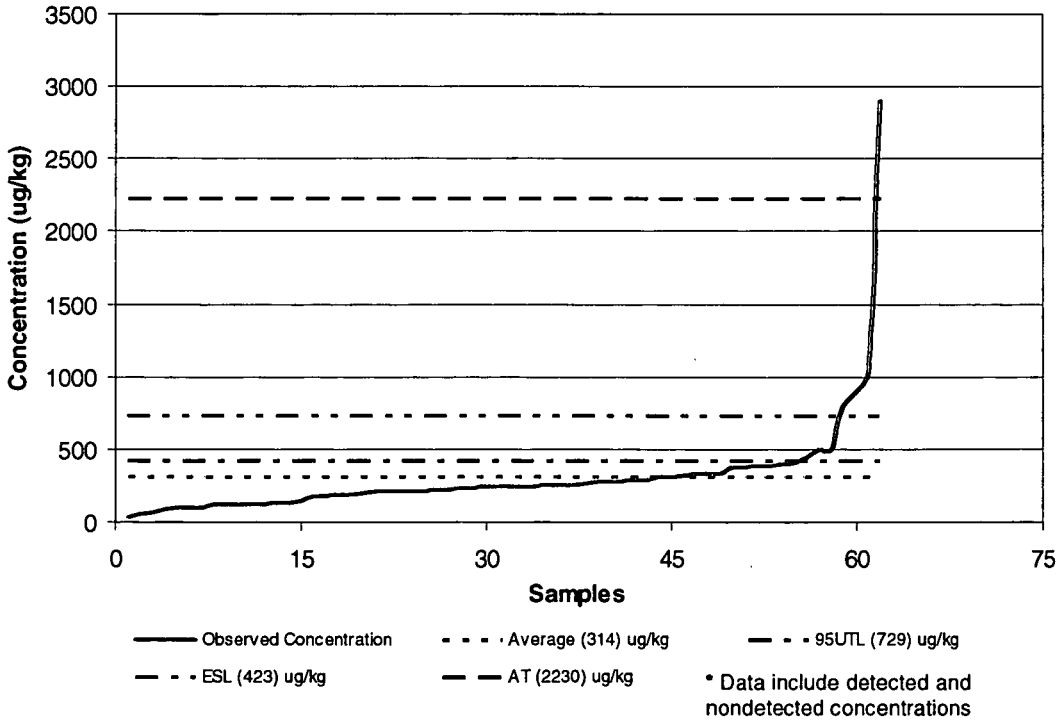

Figure 5.100 Data Distribution for Fluoranthene in WC AEU Sediment

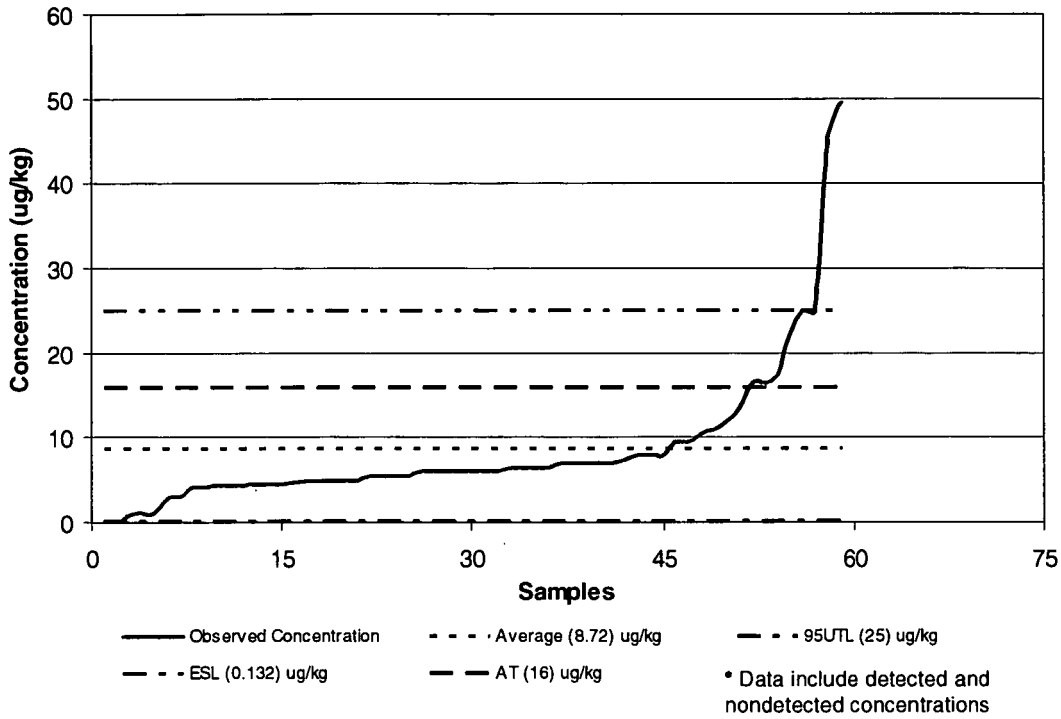

Figure 5.101 Data Distribution for Heptachlor in WC AEU Sediment

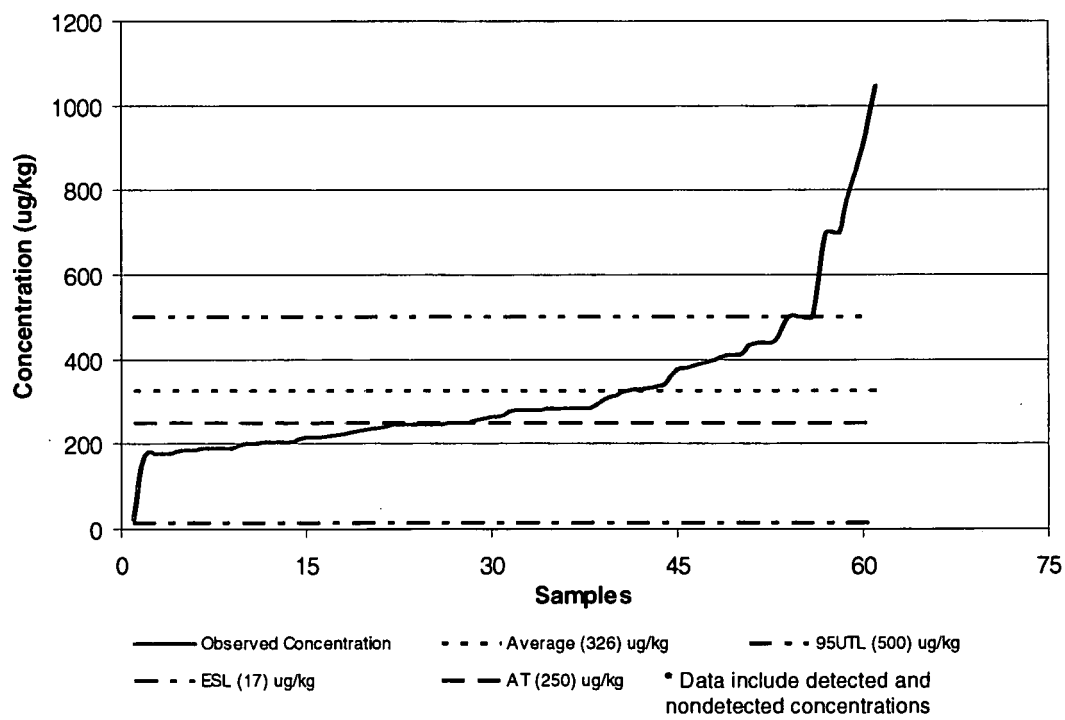

Figure 5.102 Data Distribution for Indeno(1,2,3-cd)pyrene in WC AEU Sediment

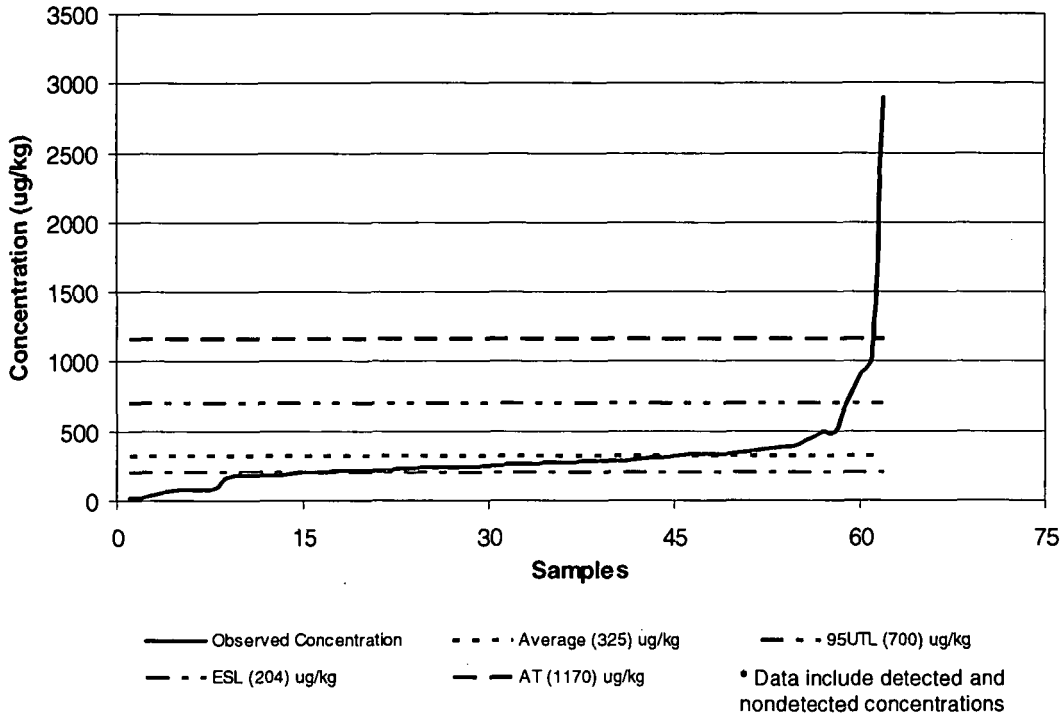

Figure 5.103 Data Distribution for Phenanthrene in WC AEU Sediment

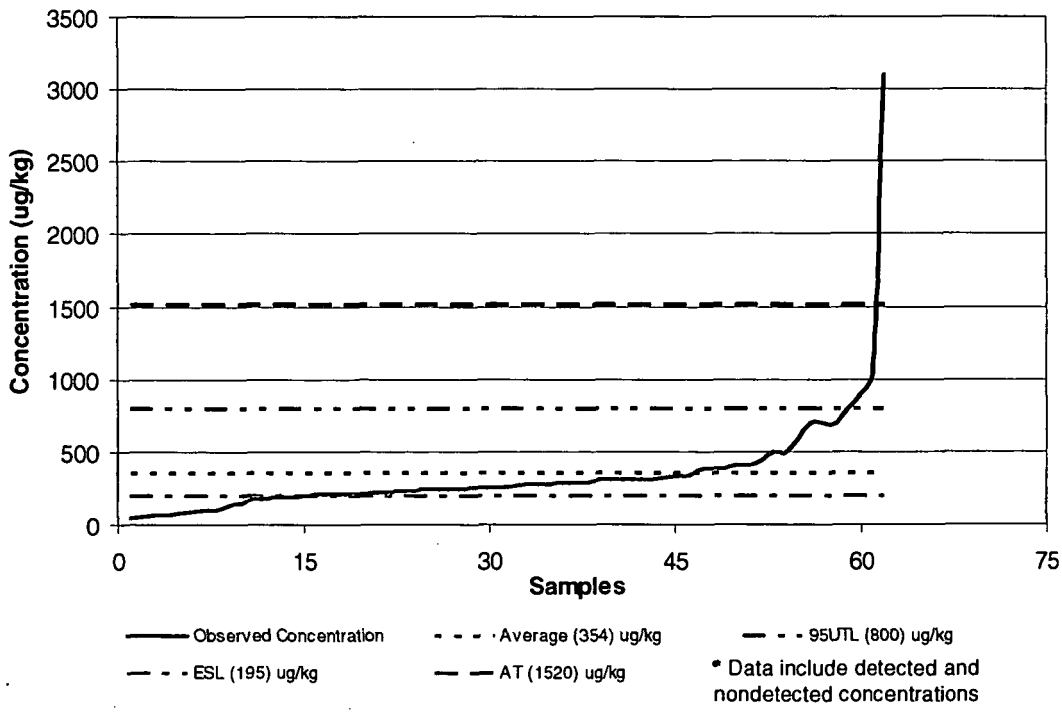

Figure 5.104 Data Distribution for Pyrene in WC AEU Sediment