REVIEW OF CHARACTERIZATION SURVEY RESULTS
FOR THE ASH LAGOON
AND SAMPLING DESIGN FOR
THE KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA SITE
(RFTA NO. 98-08)

At the request of the U. S. Nuclear Regulatory Commission (NRC), ESSAP was tasked with the following:

Task 1: *Review the subsurface concentration data collected previously by ESSAP and determine if there is sufficient evidence to demonstrate that the radioactivities of U-238, U-234, and U-235 are essentially in a fixed ratio throughout the volume of sludge/ash in the KVWPCA lagoon. If it is possible, from this data, to define an imaginary contour line in the lagoon that differentiates the volume of sludge/ash that contains concentrations of greater than or equal to 30 pCi/g of enriched uranium (EU) from concentrations that are less than 30 pCi/g.*

A review of the subsurface data indicated that the U-238 and U-235 concentrations are generally in a fixed ratio indicating the presence of enriched uranium with a U-238 to U-235 ratio for the samples ranging from 2.1 to 9.1 (natural uranium ratio of U-238 to U-235 is 22:1). Note that on page 6 of the report that alpha spectrometry results for 5 ash samples indicated that the U-234 to U-235 ratios ranged from 21:1 to 26:1 which is also indicative of enriched uranium (ORISE 1995). To calculate total uranium concentrations, ORISE multiplied the U-235 concentrations by a factor of 23 (using the average U-234 to U-235 ratio of 22:1) and then added the U-238 concentration.

The U-238 to U-235 concentration ratios vary throughout the volume of ash with the surface samples (0 - 15 cm) ranging from 2.1 to 9.1; the one meter samples (100 - 115 cm) ranging from 4.3 to 7.1; the area between 115 and 180 cm ranging from 3.4 to 11.3; and, the samples at the bottom of the lagoon (180 - 215 cm) ranging from 3.8 to 5.9.

The known zone of contamination, as identified by the characterization report results, indicates that contaminated ash, at greater than 30 pCi/g, is present beginning at 1 meter below the surface and extends to the clay liner at the bottom of the lagoon (Figures 1 through 6). The area of contamination is presented on Figure 7.

Task 2: *Discuss the results of the review in Task 1 with the NRC staff in a teleconference.*

Tim Vitkus and Bob Neel discussed the results of the review on March 12 and March 16, 1998.

Task 3: *Prepare a letter report for the NRC that contains:*

- *An enhanced graphical representation of the data in Task 1.*

  Refer to Figures 1 through 6.

- *A comparison of sampling plans that ORISE might employ to characterize the distribution of uranium in the KVWPCA lagoon and the advantages and disadvantages of each plan. The discussion of each plan should identify:*

  1. *The number of surface and subsurface samples necessary to identify discrete volumes of sludge/ash in the KVWPCA lagoon that contain concentrations of EU less than 30 pCi/g.*

  2. *The number of surface and subsurface samples necessary to identify discrete volumes of sludge/ash in the KVWPCA lagoon that contain concentrations of EU greater than 30 pCi/g.*

  3. *The resources (costs of labor and equipment) required to implement each sampling plan and a recommendation to the NRC of the plan most suitable for subsurface sampling at the KVWPCA lagoon.*

SAMPLING PLAN RECOMMENDATIONS

Due to the lack of subsurface analytical data for grid blocks along the eastern and southern portions of the lagoon, ESSAP recommends additional sampling to fill these data gaps. The following sampling plan is recommended.

Based on the previous data, it is apparent that contamination above 30 pCi/g of EU exists from a depth of 1 meter (100 cm) to the clay liner of the lagoon within the shaded areas as indicated on Figure 7. However, there are insufficient data to make a determination on the radiological status of the volume of ash from the 15 to 100 cm depth interval. ESSAP recommends that additional subsurface soil samples be collected from five systematic locations within the known contaminated zone (Figure 7). ESSAP suggests that two subsurface soil samples be collected from each of these five locations—one sample from the 45 to 60 cm level and one sample from the 75 to 90 cm level.

In addition, ESSAP recommends that 11 boreholes be established and samples collected at the 100 to 115 cm interval and at the clay liner at the bottom of the lagoon from each of the 11 boreholes. Boreholes should be placed along the eastern and southern portions of the lagoon from areas that were not previously sampled at the subsurface (Figure 7). From three of these 11 locations, it is recommended that a sample also be collected at the 150 to 165 cm depth. This would lead to the collection of a minimum of 25 additional soil samples from areas not previously sampled.

ADVANTAGES

This sampling plan is intended to bound the horizontal extent of contamination and better define the vertical demarcation of the contaminated zones. This data can then be used by the NRC or a contractor to determine discrete volumes of sludge/ash in the KVWPCA lagoon that contain concentrations of EU that are less than 30 pCi/g from the volume of sludge/ash that is greater than or equal to 30 pCi/g. This information would then be used to determine remediation costs for removal and disposal of contaminated sludge/ash.

DISADVANTAGES

The disadvantage of this sampling plan is that there will be areas within the sampling areas that will not be sampled and therefore potential hot spots that would normally require remediation may be found that could substantially change the remediation process by increasing the scope and cost of the survey.

Task 4: *Discuss the letter report with the NRC staff in a teleconference and assist the NRC staff in selection of the most suitable sampling plan for KVWPCA.*

To Be Scheduled

SUMMARY

The central area of the lagoon is well characterized and the data clearly indicate the area of known contamination at greater than 30 pCi/g (Figure 7). There is no need to re-characterize the site—just the need to bound the areas of contamination both vertically and horizontally.

It is ESSAP's opinion that a systematic sampling approach will provide the necessary data. The total number of boreholes established, and hence the number of samples collected, will require further discussion. Obviously, the higher the sample density the less the uncertainty becomes in the contamination boundaries but at the price of higher investigative costs. Therefore, ESSAP recommends the use of a portable *in situ* gamma spectrometry system to assist with assuring that adequate data are collected during the additional survey activities. Attachment A provides the spending plan for the proposed sampling frequency.

REFERENCE

Oak Ridge Institute for Science and Education (ORISE 1995). Characterization Survey of the Ash Lagoon and Adjacent Property, Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania. Oak Ridge, Tennessee; May 1995.

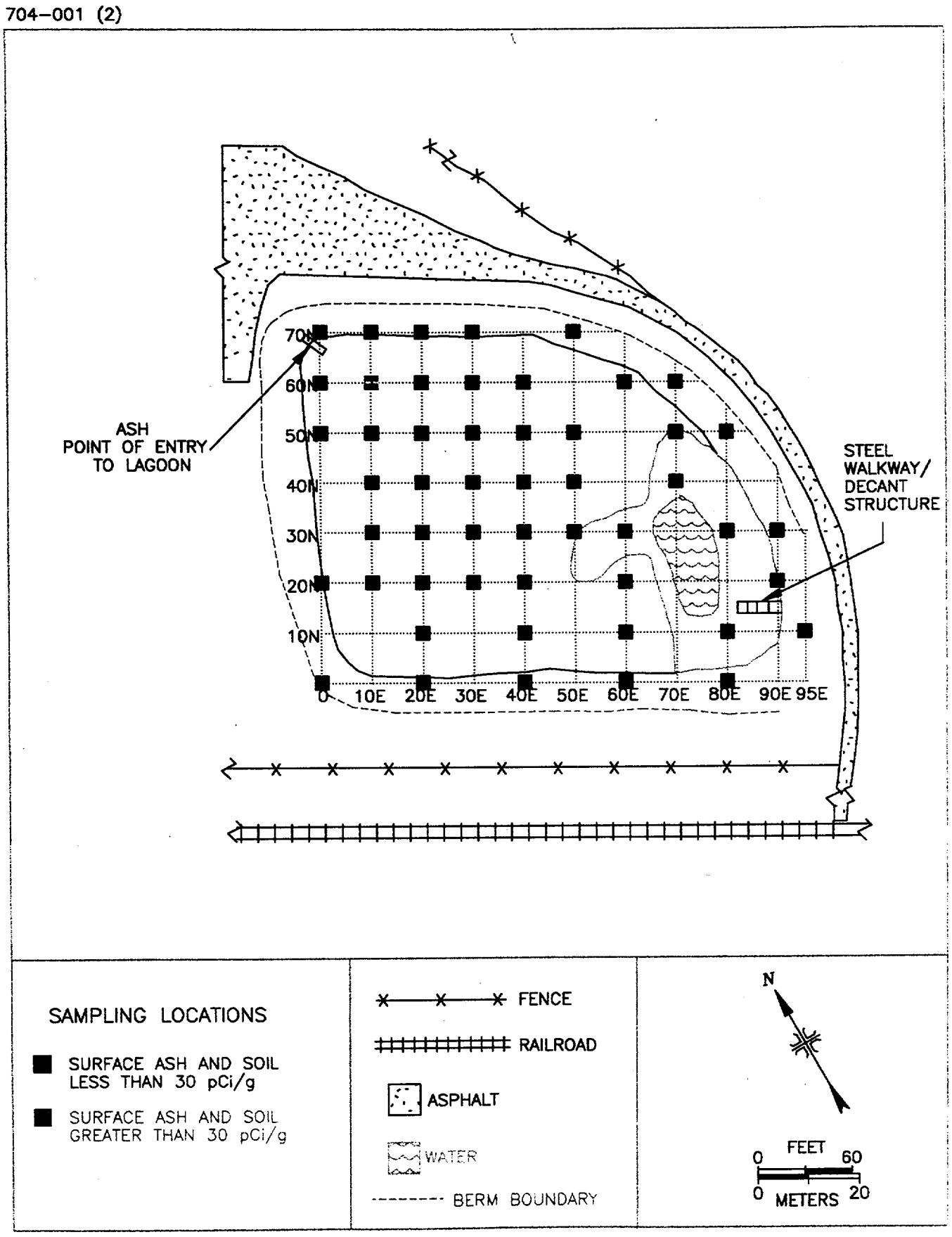

FIGURE 1: Kiski Valley Water Pollution Control Authority – Surface Ash and Soil Sampling Locations

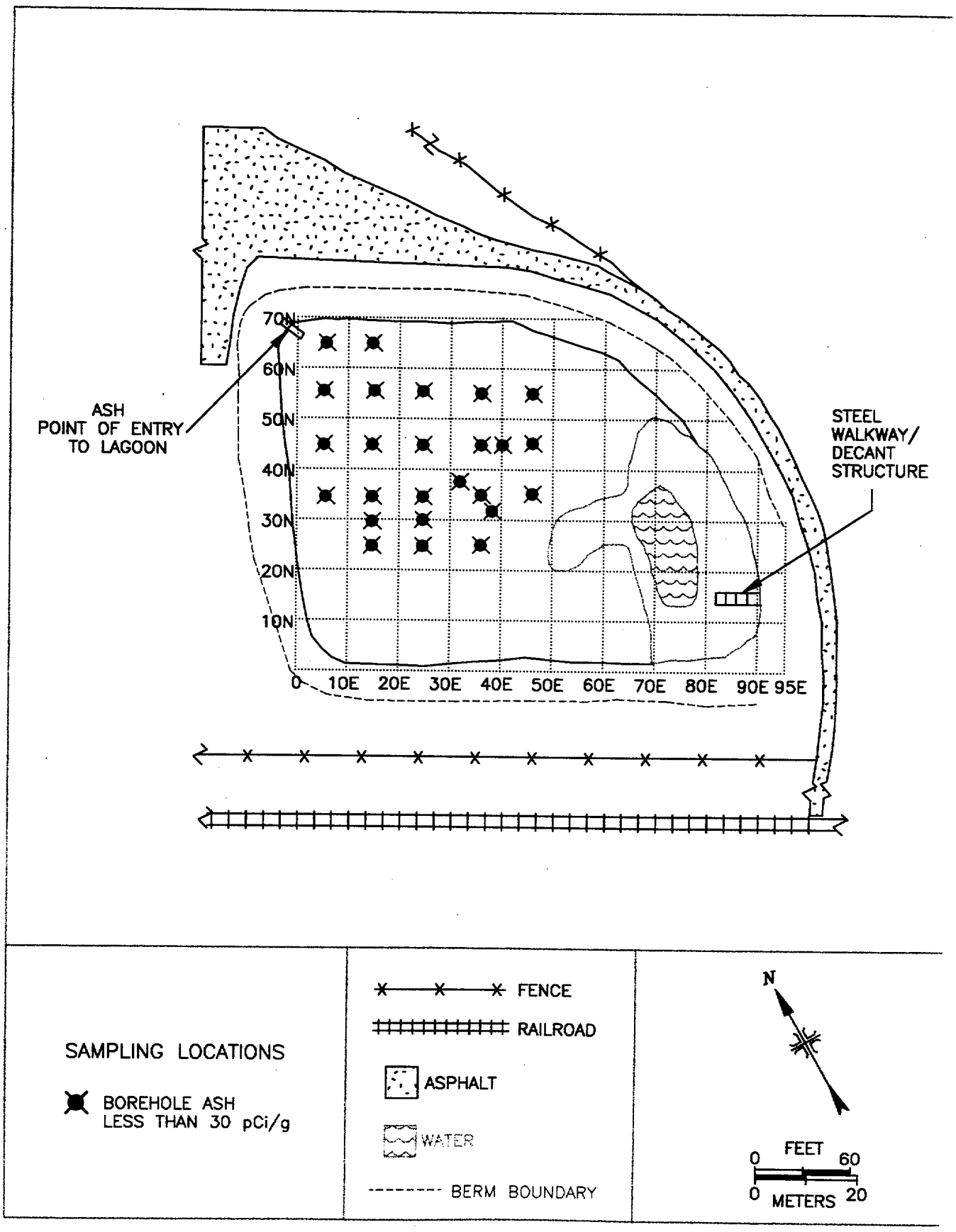

FIGURE 2: Kiski Valley Water Pollution Control Authority – Borehole Ash Sampling Locations (0–15 cm)

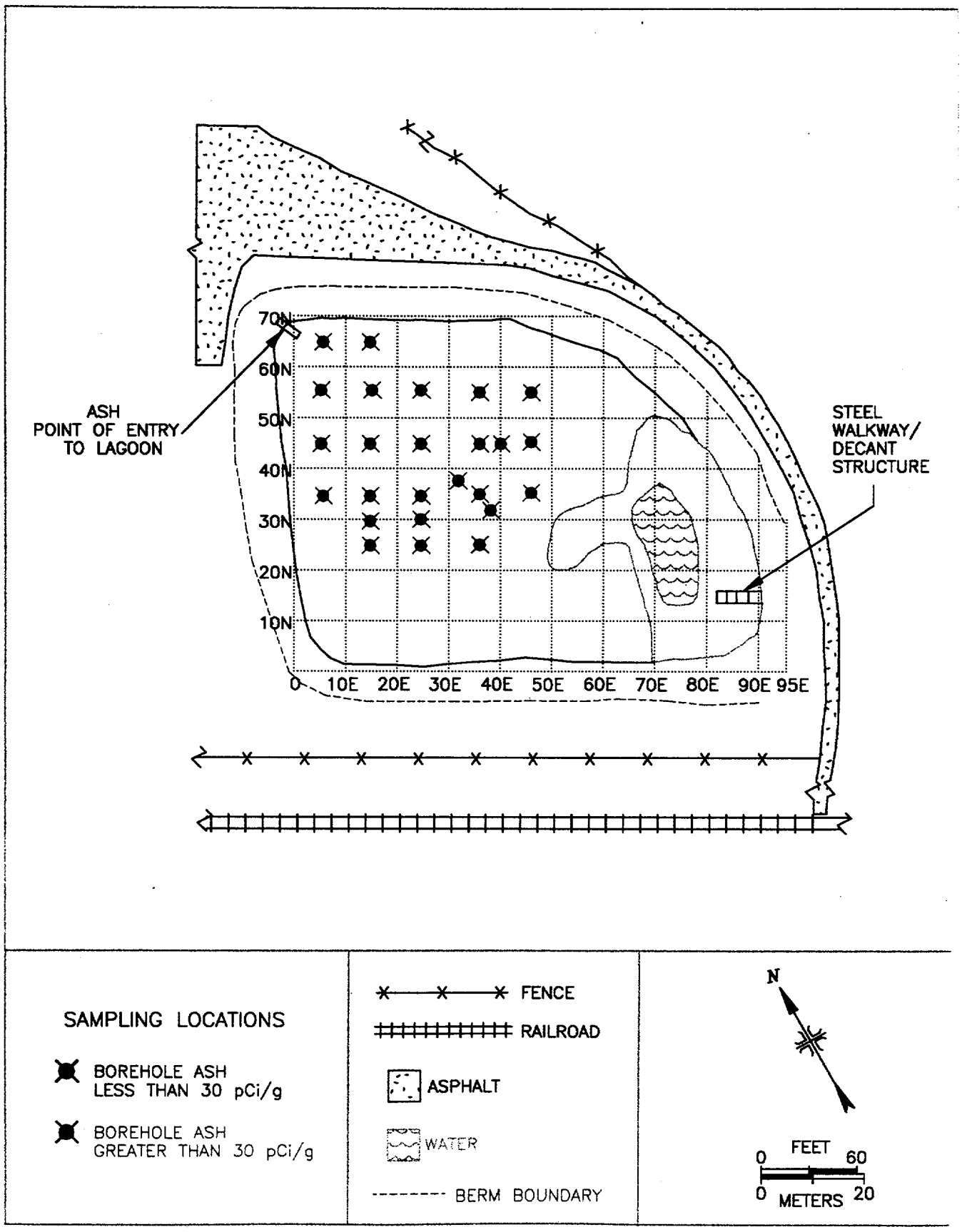

FIGURE 3: Kiski Valley Water Pollution Control Authority – Borehole Ash Sampling Locations, Subsurface Samples (100–115cm)

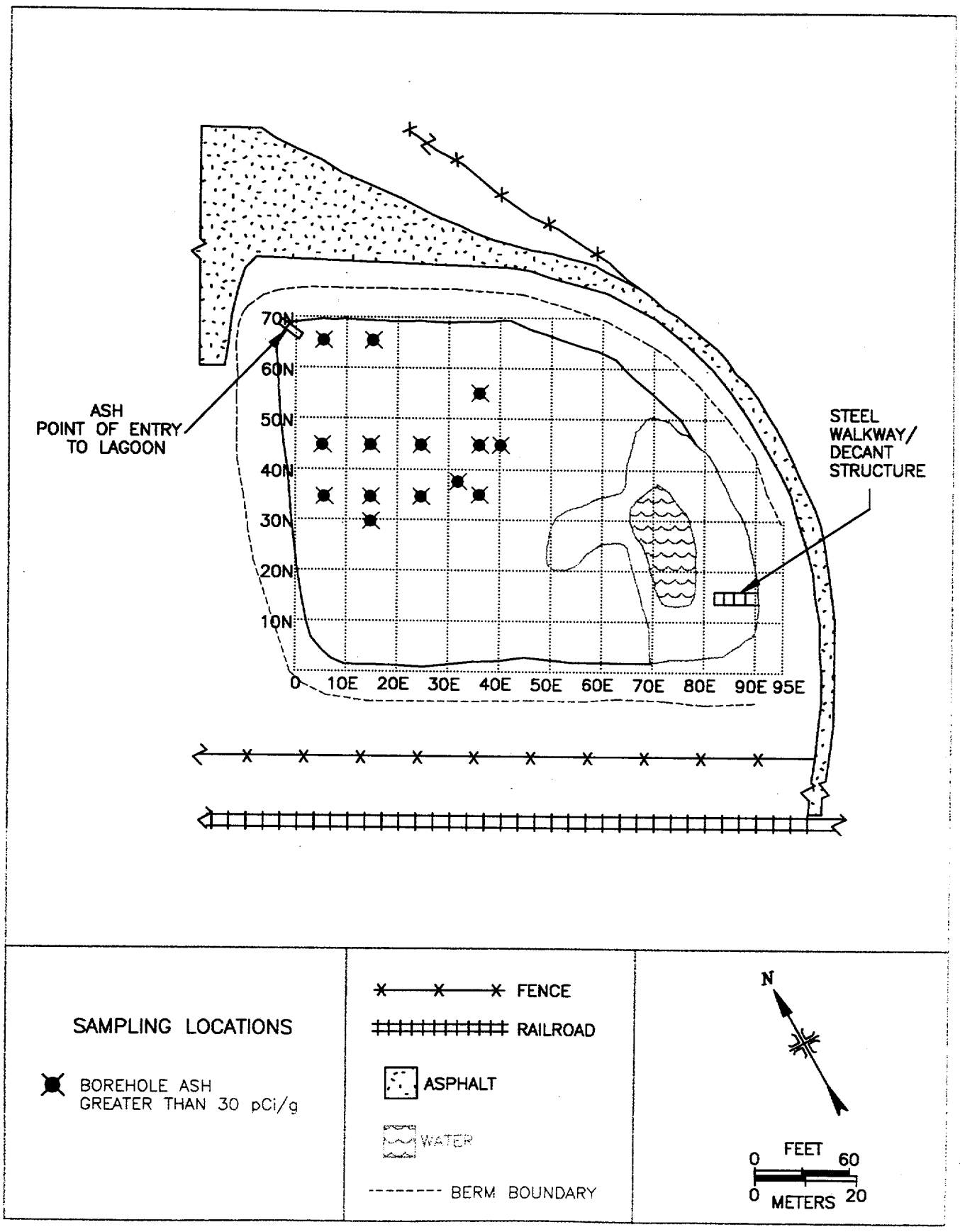

FIGURE 4: Kiski Valley Water Pollution Control Authority – Borehole Ash Sampling Locations, Subsurface Samples (>115–175cm)

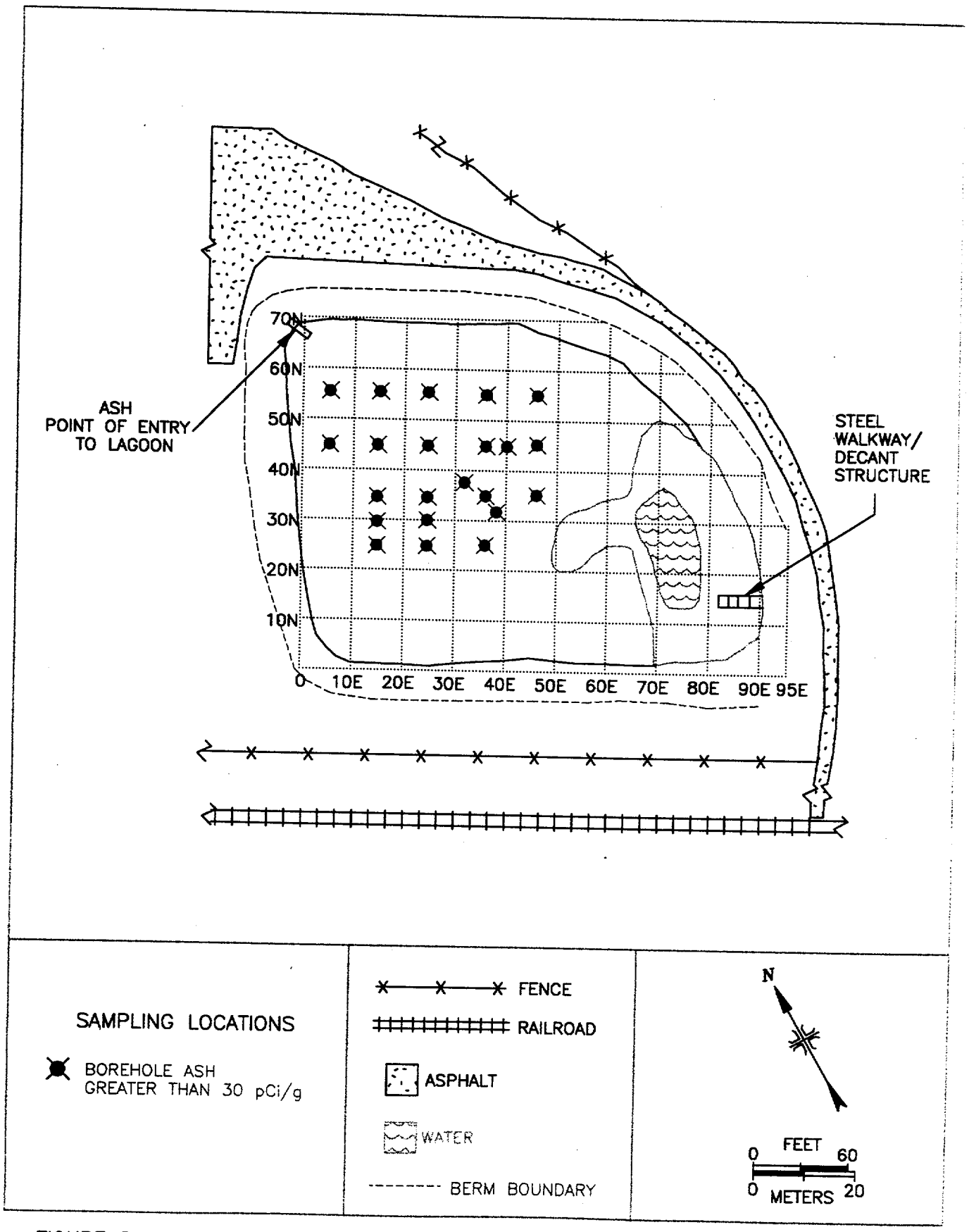

FIGURE 5: Kiski Valley Water Pollution Control Authority – Borehole Ash Sampling Locations, Subsurface Samples (>175 cm)

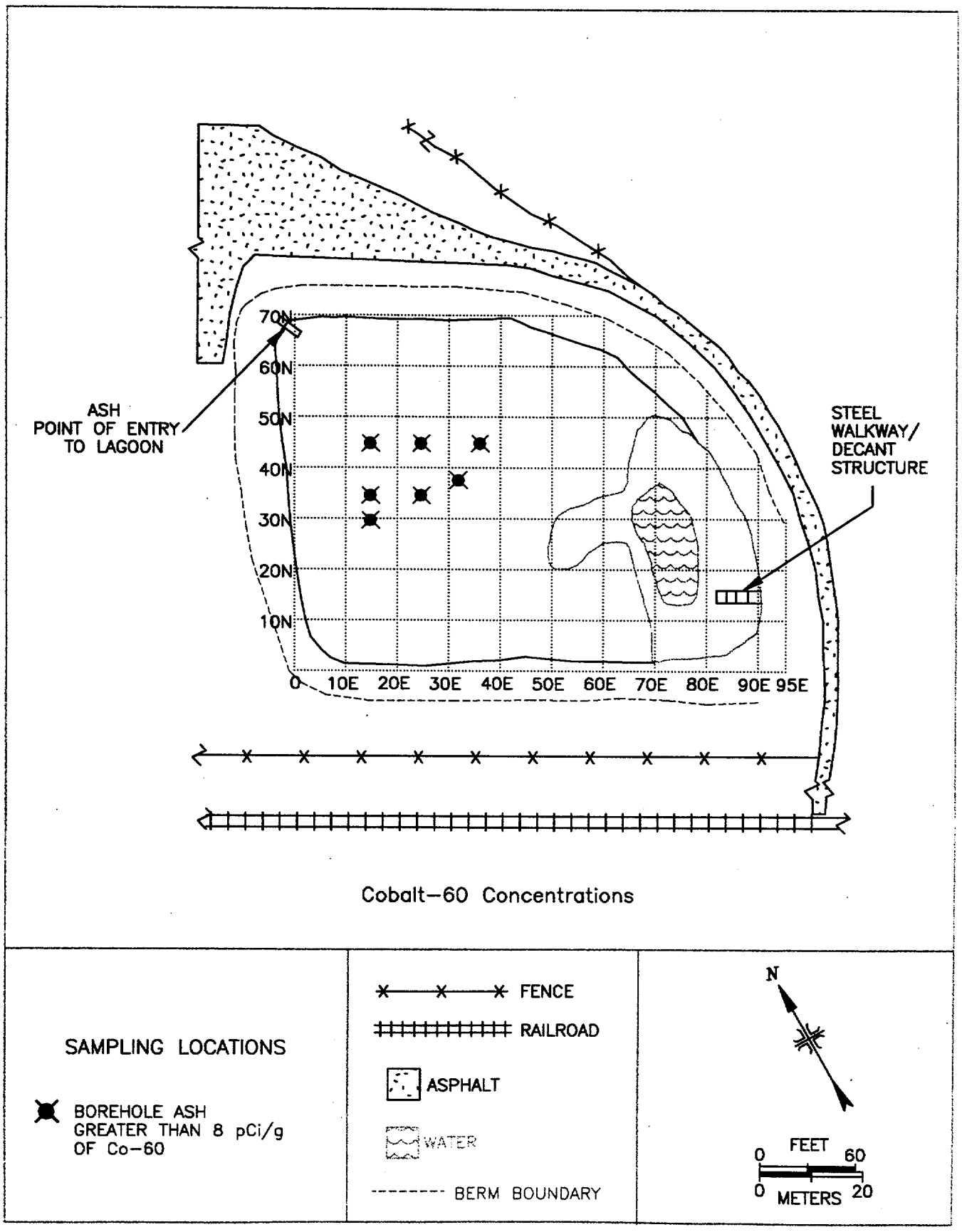

FIGURE 6: Kiski Valley Water Pollution Control Authority – Borehole Ash Sampling Locations, Subsurface Samples (150–200cm)

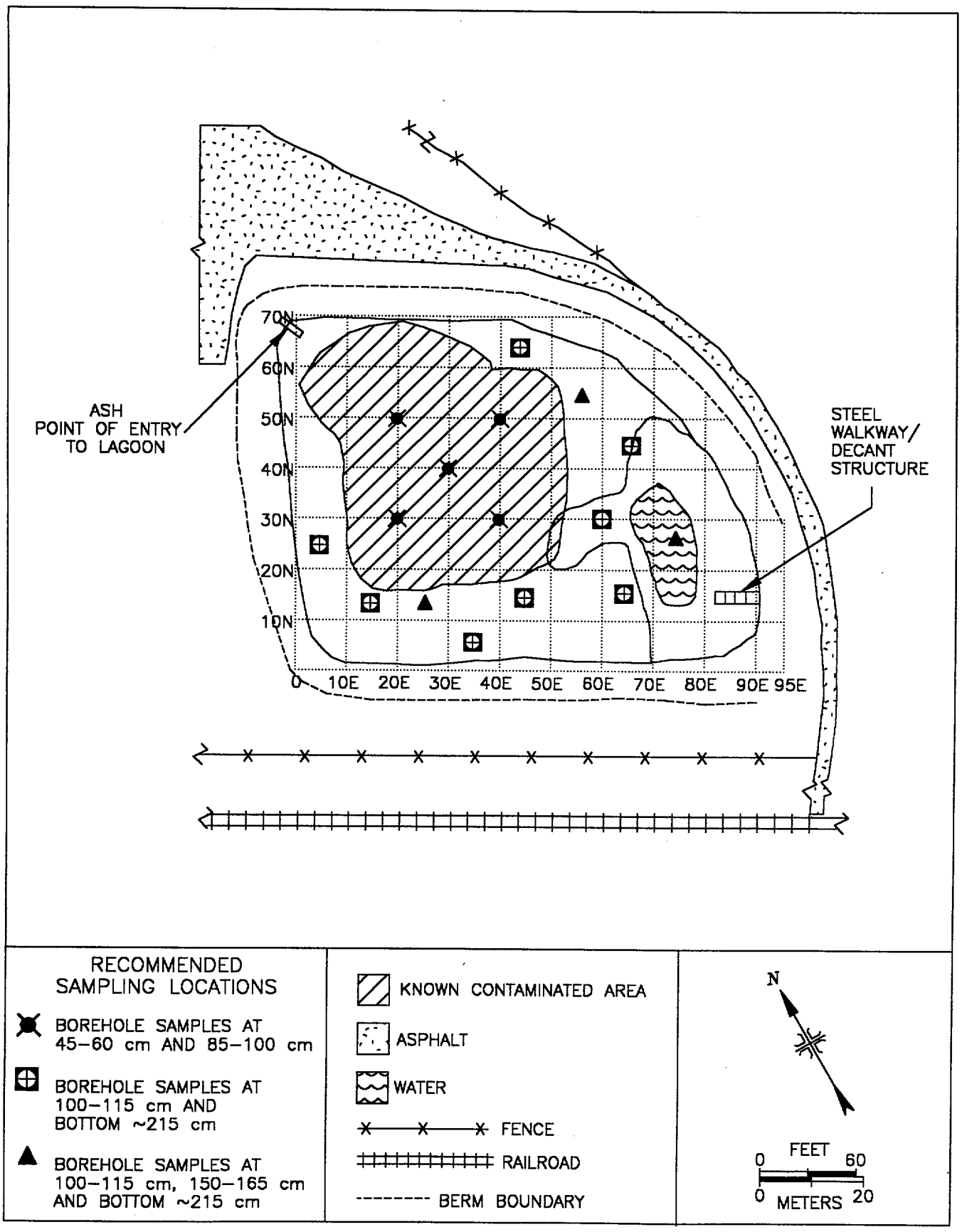

FIGURE 7: Kiski Valley Water Pollution Control Authority – Recommended Borehole Ash Sampling Locations