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5. NUCLEAR SAFETY PROGRAMS

5.1 ENVIRONMENTAL PROTECTION - RADIOLOGICAL

As a condition of certification, 10 CFR 76.60(d) requires that the United States Enrichment Corporation (USEC) comply with the applicable provisions of 10 CFR Part 20, Standards For Protection Against Radiation, not later than the date of the Director's decision on the initial application and/or as specified in an approved plan for achieving compliance. This section addresses the USEC management of radiological environmental protection.

5.1.1 Emission and Effluent Control Systems

The Portsmouth Gaseous Diffusion Plant (PORTS) observes the following policies:

- The dose to members of the public resulting from gaseous emissions and liquid effluents shall be maintained in accordance with the As Low As Reasonably Achievable (ALARA) principle and below legal limits.

- It is the responsibility of each employee to conduct their activities in such a manner so as to prevent or minimize the discharge of radioactive materials to the environment, and to report any unusual or excessive discharge of such material.

In addition to the above stated policy, the Production Support Manager serves on the Portsmouth Radiation Protection Committee, which is described in Section 5.3.1.2.

PORTS practices pollution prevention for business reasons and to demonstrate commitment to long-term environmental protection. USEC's commitment to environmental protection goes beyond ensuring operations meet just current environmental regulatory requirements. The goal is to minimize the impact to human health and the environment and to preserve resources for future generations. USEC will prevent pollution at the source by using innovative pollution prevention methods, education, training, and awareness.

To this end, USEC is developing and following five strategies for pollution prevention:

- Strategy I Reduce usage of toxic chemicals.

- Strategy II Implement a cost-effective pollution prevention and waste minimization program that reduces the generation of all wastes and minimizes discharges to air and water.

- Strategy III Incorporate pollution prevention into all phases of plant operations including process design, engineering, acquisition, procurement, and public outreach.

- Strategy IV Maintain full compliance with Emergency Planning and Community Right-to-Know Act (EPCRA) regulations dealing with reporting requirements and emergency planning and response.

- Strategy V Promote and instill a pollution prevention ethic through education, training, and awareness programs.

5.1.1.1 Airborne Emissions

Airborne Emission Standards

PORTS maintains and uses gaseous emission treatment systems, as appropriate, to maintain releases of radioactive material in gaseous emissions to unrestricted areas below the limits specified in 10 CFR 20.1301 and in accordance with the plant's ALARA policy described in Sections 5.1.1 and 5.3.1.1. Unrestricted areas are those areas beyond the DOE reservation boundary and to which any member of the public has unrestricted access. Compliance with 10 CFR 20.1301 is demonstrated as required by 10 CFR 20.1302. Section 5.1.3 discusses methods of evaluation and demonstration of compliance. Furthermore, controls are maintained in order to comply with 40 CFR 61, Subpart H, and 40 CFR 190.

Action Levels for Control of Airborne Emissions

Action levels for control of airborne radionuclide emissions are based on the ALARA philosophy. The action levels described in Table 5.1-1 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits. The Baseline Effluent Quantity (BEQ) used in Table 5.1-1 is the effluent expected under normal operating conditions. BEQs are established by Production Support and the facility manager responsible for the emission source. There is a BEQ at every continuously monitored radiological vent within the leased premises, and these BEQs are reviewed annually, at a minimum, by Production Support, the responsible facility manager and the Radiation Protection Committee to ensure the principles described in the plant's ALARA policy are followed. Table 5.1-2 provides a list of current BEQs for each of the continuously monitored radiological vents. The responsible facility manager and the Plant Shift Superintendent are jointly responsible for assuring that action levels are acted upon.

Airborne Emission Controls

PORTS uses a system of process and administrative controls to prevent the discharge of radionuclides above regulatory limits and to maintain airborne emissions ALARA.

Fifteen USEC emission sources have been identified at PORTS as potentially significant contributors to the total plant radionuclide emissions. Although none of these atmospheric radionuclide emission sources were identified to have the potential to exceed a 0.1 mrem/year dose to the most exposed member of the public during normal operation, continuous vent monitors have been installed to quantify plant radiological airborne emissions. The locations of these 15 continuous monitors are shown in Figure 5.1-1. The airborne emission controls associated with these emission sources are described

below.

The purge cascades are the primary airborne emission control. Figure 5.1-2 provides a flow diagram of the purge cascades. The purge cascades separate UF_6 continuously from lower molecular weight gases (lights) that have entered the process. The UF_6 is returned to the main cascade, and the "lights" are passed through chemical traps before continuous sampling and venting. Chemical trap efficiencies vary in relation to the concentration of UF_6, flow rate, and trap on-stream time. At very low concentrations (less than 1 ppm UF_6), operational data indicates that efficiencies approach zero (this is the normal concentration). When UF_6 concentrations approach 10 ppm, operational data indicates that efficiencies rise to the 95-99% range.

The cold recovery and wet air evacuation systems are maintenance support systems. Cold recovery systems are used to evacuate gases from cascade cells that must be opened for maintenance. Refrigerated "cold traps" are used to freeze out UF_6, and the noncondensable light gases are passed through chemical traps before continuous sampling and venting. The wet air evacuation systems' are used to evacuate cells that have been opened prior to returning the cell to service. The wet air evacuation systems' exhaust is passed through chemical traps before continuous sampling and venting.

The enrichment cascade is divided into control areas, each of which has a seal exhaust station. The seal exhaust stations collect and vent inleaked air from inside the shaft seals of the cascade compressors. This air passes through chemical traps, vacuum pumps, and mist eliminators before continuous sampling and venting.

The X-343 feed and sampling facility heats cylinders of UF_6 for sampling or for feeding of UF_6 from cylinders to the cascade. Residual UF_6 in the sampling manifold is evacuated back to the cascade, or it is sent to dump/surge volume cylinders, through cold traps, through chemical traps, then vented to atmosphere.

The X-344 sampling and transfer facility heats cylinders of UF_6 for sampling or for transfer of UF_6 between cylinders. There is a suction device that collects any small releases during cylinder disconnections. This exhaust is vented through a filter system before continuous sampling and venting. Residual UF_6 in the sampling manifold is evacuated back to the cascade, or it is sent to a dump cylinder, through cold traps, through chemical traps, then vented to atmosphere.

In addition, there are a number of maintenance and production activities using ventilation systems where the exhaust is vented through filter systems to control airborne emissions. A few of these systems are fixed High-Efficiency Particulate Air (HEPA) filter systems. These vents are not routinely monitored due to the small potential radionuclide emissions. A discussion of these unmonitored minor potential sources is provided in the United States Environmental Protection Agency (USEPA) approved Portsmouth Gaseous Diffusion Plant Compliance Plan For National Emission Standards For Hazardous Air Pollutants (August, 1992).

5.1.1.2 Waterborne Effluents

Waterborne Effluent Standards

PORTS maintains and uses liquid effluent treatment systems, as appropriate, to maintain releases of radioactive material in liquid effluents to unrestricted areas below the limits specified in 10 CFR 20.1301 and in accordance with the plant's ALARA policy described in Sections 5.1.1 and 5.3.1.1. Compliance with 10 CFR 20.1301 is demonstrated as required by 10 CFR 20.1302. Section 5.1.3 discusses methods of evaluation and demonstration of compliance.

Action Levels for Control of Waterborne Effluents

Action levels for control of liquid radionuclide effluents are based on the ALARA philosophy. The action levels described in Table 5.1-3 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits. The BEQ used in Table 5.1-3 is the maximum site water effluent expected under normal operating conditions. BEQs are established by Production Support, and the facility manager responsible for the outfall. There is a BEQ at every radiologically monitored USEC-leased outfall, and these BEQs are reviewed annually, at a minimum, by Production Support, the responsible facility manager and the Radiation Protection Committee to ensure the principles described in the plant's ALARA policy are followed. Table 5.1-4 provides a list of current BEQs for each USEC-leased site water outfall discharging to waters of the United States. The responsible facility manager and the Plant Shift Superintendent are jointly responsible for assuring that action levels are acted upon.

Waterborne Effluent Controls

PORTS uses a system of process and administrative controls to prevent the discharge of radionuclides above regulatory limits and to maintain waterborne effluents ALARA.

There are eight USEC-leased site water outfalls at PORTS discharging to waters of the United States. These eight outfalls are monitored to quantify plant radiological waterborne effluents. The locations of these eight outfalls are shown in Figure 5.1-3. Virtually all radiological waterborne discharges from the plant come from decontamination and cleaning activities. The waterborne effluent controls associated with these operations are described below.

Prior to discharge, decontamination and cleaning solutions are processed in the decontamination and recovery facility. Uranium from other sources (e.g., laboratory solutions) is also recovered in the same facility.

Dissolved uranyl nitrate hexahydrate is separated by liquid-liquid extraction followed by calcination to U_3O_8. The remaining wastewater is treated for residuals and other heavy metals by pH adjustment and precipitation, for dissolved technetium by ion exchange, and finally for residual nitrates by biodenitrification. The treated wastewater is discharged to the onsite sewage treatment plant.

Other radiologically contaminated process and cleaning wastewaters are collected, stored, and then treated using microfiltration and pressure filtration technology to remove radionuclides prior to discharge. Effluent discharge goes to the onsite sewage treatment plant. The facility and process description for the X-705 Decontamination Building provided in Chapter 3 furnishes additional information.

Waterborne Effluent Flow Paths

The eight USEC-leased site water outfalls at PORTS discharging to waters of the United States have the following designations:

- Outfall 001 (X-230J-7 East Holding Pond)

- Outfall 002 (X-230K South Holding Pond)
- Outfall 003 (X-6619 Sewage Treatment Facility)
- Outfall 004 (Headhouse #3)
- Outfall 005 (X-611B Lime Sludge Lagoon)
- Outfall 009 (X-230L North Holding Pond)
- Outfall 010 (X-230J-5 Northwest Holding Pond)
- Outfall 011 (X-230J-6 Northeast Holding Pond)

The X-230J-7 East Holding Pond (Outfall 001) provides a quiescent zone for settling of suspended solids, dissipation of chlorine, and oil diversion and containment. Influent to the East Holding Pond consists primarily of once-through cooling water and rainfall runoff. Figure 5.1-4 provides a flow diagram for the influent to the X-230J-7 East Holding Pond. The pond is approximately 100 ft wide by 375 ft long by 4 to 5 ft deep, and discharges to Little Beaver Creek.

The X-230K South Holding Pond (Outfall 002) provides a quiescent zone for settling of suspended solids, dissipation of chlorine, oil containment, and pH adjustment prior to discharge. Influent to this pond consists primarily of once-through cooling water, rainfall runoff, and treated coal pile runoff (Internal Outfall 602, X-621 Coal Pile Treatment Facility). Figure 5.1-5 provides a flow diagram for the influent to the X-230K South Holding Pond. As depicted in this diagram, Internal Outfall 602 (X-621 Coal Pile Treatment Facility) discharges into the pond. The pond is approximately 1,000 ft long, irregular in shape, averaging 250 ft in width and is approximately 12 to 15 ft deep, and discharges to Big Run Creek.

The X-6619 Sewage Treatment Plant (Outfall 003) uses screening and a grit chamber as preliminary treatment followed by an activated sludge treatment system. Mixed liquor from the aeration basins is clarified, filtered using multimedia sand filters, and then chlorinated/dechlorinated. Sludge is aerobically digested and dried on sludge drying beds. Influent to the Sewage Treatment Plant consists primarily of domestic sewage, biodenitrification effluent from Internal Outfall 604 (X-700 Biodenitrification Facility), microfiltration effluent from Internal Outfall 605 (X-705 Microfiltration Facility), treated groundwater and surface water from Internal Outfall 610 (X-623 North Groundwater Treatment Building), effluent from Internal Outfall 607 (X-700 Air Stripper, which is presently not in operation), treated groundwater from Internal Outfall 608 (X-622 Carbon Filtration Facility), effluent from X-622T (Carbon Filtration Facility), miscellaneous wastestreams (X-710 laboratory waste, cafeteria food wastes, hospital medicinal wastes, office chemicals, miscellaneous chemicals, laundry wastewater, and floor washwater), and infiltration/inflow of groundwater. Included in these wastestreams are contributions from both USEC and DOE facilities as well as from leased plantsite facilities (the Ohio National Guard). Figure 5.1-6 provides a flow diagram for the influent to the X-6619 Sewage Treatment Plant. Sludge produced by the facility is drummed and stored pending future disposal, and the effluent discharges to the Scioto River.

Figure 5.1-7 schematically shows the configuration of all PORTS recirculating cooling water systems and the cascading arrangement of the X-626 and X-6000 into the X-630, and the X-630 into the

X-633. It is only the blowdown from X-633 that is sent directly to the Scioto River.

The X-611B Lime Sludge Lagoon (Outfall 005) provides a quiescent zone for settling lime sludge used in the water softening process. X-611B also receives some water from rainfall runoff; supernatant is returned to the X-611 Water Treatment Plant. Figure 5.1-8 schematically shows the X-611B Lagoon and the three inactive X-611A Lagoons (DOE Outfalls 006, 007, and 008). Discharges are extremely rare and occur only during periods of excessive rainfall. Discharge is to Little Beaver Creek.

The X-230L North Holding Pond (Outfall 009) provides a quiescent zone for settling of suspended solids and dissipation of chlorine. The pond can also be closed for emergency containment of unpermitted discharges or spills. Influent to the North Holding Pond is depicted in Figure 5.1-9. The pond is approximately 200 ft long, averages 50 ft wide by 10 to 15 ft deep, and discharges to an unnamed tributary of Little Beaver Creek.

The X-230J-5 Northwest Holding Pond (Outfall 010) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. A unique feature of this drainage sector is the ability to manually control/contain all water upstream of the X-230J-5 at the X-230J-3 Impoundment Facility. Influent to the Northwest Holding Pond is described in Figure 5.1-10. The pond is approximately 100 ft long, averages 50 ft wide by 4 to 5 ft deep, and discharges to an unnamed tributary of the Scioto River.

The X-230J-6 Northeast Holding Pond (Outfall 011) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. Influent to the Northeast Holding Pond is described in Figure 5.1-11. The pond is approximately 75 ft long, averages 40 ft wide by 4 to 5 ft deep, and discharges to Little Beaver Creek.

5.1.2 Environmental Monitoring Description

PORTS conducts routine environmental surveillances in relation to the operation of the facility. Environmental monitoring locations are chosen to provide a comprehensive measurement of environmental dispersion of plant emissions and effluents, including upwind and downwind locations for airborne emissions and upstream and downstream locations for waterborne effluents.

PORTS radiological monitoring, as described in this document, is summarized in Table 5.1-5. This table provides a list of the radionuclides analyzed for each particular medium and the frequency of analysis. Effluent data are provided in the Portsmouth Environmental Compliance Status Report and the report's attachment. Production Support is responsible for the environmental monitoring program. Detail concerning analytical techiques at PORTS is provided in Section 5.7.

5.1.2.1 Air Monitoring

The primary monitoring system covers the enrichment cascade and the supporting systems that are potentially significant contributors to total plant emissions. Gaseous radionuclide emissions from the purge cascade vents, the cold recovery and wet air evacuation vents, the sampling and transfer evacuation vent, autoclave cold trap evacuation vents, and the seal exhaust vents are monitored by continuous vent samplers. The continuous vent samplers draw a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and sampler flow are continuously monitored by the continuous vent samplers. Major operational vents are monitored in real time by space recorders in the area control rooms which are equipped with both visible and audible alarms to indicate an elevated release. Normally, the primary sample traps are replaced weekly and the secondary traps are replaced quarterly. In the event of an unplanned or seriously elevated release, the applicable samplers are changed out (for immediate analysis) as soon as the situation has stabilized. Alternatively, the sampling period may be extended, provided the sampler is operating at all times the vent is operating. A summary of the continuously monitored stack and vent characteristics is provided in Table 5.1-6.

Continuous monitoring is provided on all process vents that have the potential to emit radionuclides that could result in a 0.1 mrem/year or greater dose to the most exposed member of the public.

5.1.2.2 Meteorological Monitoring

The site maintains a meteorological tower which, as shown in Figure 5.1-12, is located on the southern section of the site. The tower is equipped with instruments at the ground, 10-, 30-, and 60-meter levels. Among the parameters measured are air temperature, wind speed, wind direction, relative humidity, solar radiation, barometric pressure, precipitation, and soil temperature. Data from the National Weather Service or other local sources may be used in lieu of or to supplement onsite data.

Microprocessor-controlled dataloggers receive analog signals from the instruments and transmit digital summaries to the X-1020 Emergency Operations Center (EOC). The summaries include average and maximum wind speed, average wind direction, average air temperature, average relative humidity, average solar radiation, and total precipitation. Data may also be downloaded to a portable computer via communications ports on the dataloggers. Fifteen-minute summary data are displayed on video terminals at several locations on the site.

5.1.2.3 External Gamma Radiation Monitoring

The site conducts an external gamma radiation monitoring consisting of lithium fluoride thermoluminescence dosimeters positioned at various site locations and at locations remote to the site. There are nine dosimeters spaced around the perimeter of the limited area of the plant; eight dosimeters spaced around the reservation boundary; and two dosimeters located offsite. See Figure 5.1-14 for the locations of the onsite dosimeters and Figure 5.1-15 for the locations of the offsite dosimeters. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology (NIST).

The only significant sources of gamma radiation at the site are the uranium isotope ^{235}U and the short-lived ^{238}U daughters.

5.1.2.4 Water Monitoring

Radiological analyses are performed on samples from USEC-leased site water outfalls discharging to waters of the United States. The outfall locations are shown in Figure 5.1-3. Outfalls with routine continuous flow are monitored with composite samplers and analyzed weekly. Outfalls with intermittent flow are monitored with grab samplers during periods of flow. Aliquots from these samples are analyzed for total uranium concentrations, gross alpha, gross beta, and ^{99}Tc-beta radioactivity. The ratio of alpha activity to total uranium, along with process data, is used to calculate the proportions of the individual uranium isotopes.

In addition to the USEC-leased outfalls, radiological analyses are performed on grab samples from both upstream and downstream locations in Little Beaver Creek, Big Beaver Creek, Big Run Creek, and the Scioto River. See Figure 5.1-16 for the detailed locations of the sample points. Weekly grab samples are collected from the Scioto River and one downstream location in Little Beaver Creek. All other locations are sampled monthly. The analyzed parameters are the same as at the site outfalls: total uranium, gross alpha, gross beta, and ^{99}Tc beta.

5.1.2.5 Biological Monitoring

Biological monitoring is done to directly assess the impact of plant operations on vegetation and animals in the immediate vicinity of the plant site. This monitoring supplements indirect assessments consisting of emission monitoring, atmospheric dispersion modeling, and food chain modeling.

Vegetation samples are collected semiannually from the site boundary and at various locations between the boundary and background locations, located approximately 10 miles from the plant. Figure 5.1-17 identifies the locations of onsite vegetation sampling points; Figure 5.1-18 identifies the locations of offsite vegetation sampling points, and Figure 5.1-19 identifies the locations of remote vegetation sampling points. Samples of wide-blade grass, typical of local cattle forage, are analyzed for total uranium concentration and technetium beta activity.

The plant annually collects donated samples of food crops from local farmers and gardeners. Because of fluctuations in the types of crops available, selection of crops for analysis varies from year to year. Food crops are analyzed for total uranium concentration and technetium beta activity.

5.1.2.6 Soil and Sediment Monitoring

Soil samples are collected semiannually to determine whether airborne emissions from the site are influencing the soil surrounding the site. Sediment sampling at the site is conducted semiannually to assess potential radionuclide accumulation in the surrounding receiving streams. The locations of onsite soil sampling points, offsite soil sampling points, remote soil sampling points, and internal soil sampling points are provided in Figures 5.1-17, 5.1-18, 5.1-19, and 5.1-20, respectively. Figure 5.1-21 supplies the locations of stream sediment sampling points. Soil and sediment sample analyses include total uranium concentration, gross alpha activity, gross beta activity, and technetium beta activity.

5.1.2.7 Data Management

A Program Coordinator is designated for each surveillance and monitoring activity by the Environmental Compliance/Waste Management and Industrial Safety Manager. The responsibilities of the Program Coordinators are to acquire, store, validate, analyze trends, and report all field and analytical data collected in the performance of environmental monitoring

An Environmental Sampling Data Coordinator (ESDC), designated by the Environmental Compliance/Waste Management and Industrial Safety Manager, is responsible for the maintenance of the paper copies of all field information (field results, copies of field logbooks, and field notes). If electronic versions of this information are also required, the ESDC will work with the Program Coordinator to facilitate the electronic transfer of this data.

The laboratory is responsible for logging the results of all analyses and supporting QC documentation into the laboratory information system.

When a result exceeds an established limit, results of other parameters that may be related to the parameter in question are checked to confirm the result. If the result is still in question, the responsible lab is contacted to verify the reported results. This may require the lab to reanalyze the sample in question.

As discussed in Sections 5.1.1.1 and 5.1.1.2, plant action levels are established for both airborne radionuclide emissions and waterborne radionuclide effluents. It is the responsibility of the Program Coordinators in charge of these programs to ensure that the required actions described in Tables 5.1-1 and 5.1-3 take place.

5.1.2.8 Quality Control

QC for environmental samples and data addresses both sampling and data management. Sampling QC includes the use of field blanks, duplicate samples, and chain-of-custody procedures to identify

sampling and sample preparation protocol and to ensure sample integrity. Data review and verification, as described in Section 5.1.2.7, form the basis of data management QC. Analytical QC is described in Section 5.7.

5.1.3 Methods of Evaluation and Demonstration of Compliance

5.1.3.1 Airborne Radionuclides

Characterization of the radiological consequences of radionuclides released to the atmosphere from PORTS is accomplished by calculating the committed effective dose equivalents (CEDE) to the maximally exposed person and to the entire population residing within 80 km (50 miles) of the plant.

The dose calculations are made using the CAP-88 package of computer codes. This package contains an approved version of the AIRDOS-EPA and DARTAB computer codes and the ALLRAD88 radionuclide data file. The AIRDOS-EPA computer code implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate concentrations of radionuclides in the air and on the ground based on radionuclide releases to the atmosphere and annualized meteorological data. It then uses Regulatory Guide 1.109 (October 1988) food-chain models to calculate radionuclide concentrations in foodstuffs (e.g., vegetables, meat, milk) and subsequent intakes by individuals. The DARTAB computer code then uses these calculated uptakes and radionuclide data from the ALLRAD88 data file to calculate annual radiation doses to members of the public.

Annual radionuclide releases to air are measured by the continuous vent samplers described in Section 5.1.1.1 or estimated in accordance with guidance in 40 CFR 61 Appendices D and E. Atmospheric dispersion of the releases is modelled and the consequent public radiation dose is estimated using the U.S. EPA approved computer models in accordance with U.S. EPA guidance. An annual report summarizing the atmospheric releases and the dose assessment results is submitted in accordance with 40 CFR 61 Subpart H and U.S. EPA guidance.

The annualized meteorological data used in the calculations consist of joint frequency stability array (STAR) distributions of wind direction, wind speed, and atmospheric stability that is prepared from data collected from the site meteorological tower. Data from the National Weather Service may be used in lieu of or to supplement onsite meteorological data. PORTS has a consistent annual pattern of southwesterly winds predominating. This is largely attributable to the channelling effect of the hills and ridges on either side of the plant.

EPA published default values for offsite parameters (such as local crop productivity) are used in the AIRDOS-EPA model and, in accordance with EPA recommendations, rural patterns for food sources (i.e., home grown versus local production versus national supermarket chains) are assumed.

The AIRDOS-EPA computer code has an option of printing tables of annual average χ/Q values at specified distances in 16 directions (N, NNE, NE, ENE, E, and ESE, etc.,). The highest χ/Q value around the PORTS boundary line is consistently found to be the ENE sector. This is due to a combination of the dominant wind direction described above, and the geometry of the reservation. The computer generated plumes from all of the plant's release points reach ground level well within the reservation boundary. The NNW, N, NNE, and NE boundaries are between 3,600 and 4,500 m downwind of the main release point, while the ENE boundary is only 1,770 m downwind. Consequently, although the highest airborne concentrations historically occur in the NNE and NE sectors, the shorter distance results in higher boundary line doses in the adjacent ENE sector.

Specific emission and dose data is presented in the Environmental Compliance Status Report (ECSR).

5.1.3.2 Waterborne Radionuclides

Water is sampled at USEC-leased site water outfalls and at selected surface water locations. A hypothetical dose is calculated using measured radionuclide discharges from plant outfalls and the historical average annual flow of the Scioto River. Conservative public utilization estimates for the Scioto River are used in the calculations. Specific effluent and dose data is presented in the ECSR.

All waterborne radionuclide releases from USEC-leased outfalls flow to the Scioto River, and the majority of the released radionuclides flow directly to the river via a buried pipeline. Consequently, PORTS considers the Scioto River downstream of all plant discharges to be the point of maximum public exposure to radionuclides released from the plant.

Regulatory Guide 1.109 (October 1988) food chain models are used to calculate radionuclide intakes by individuals. The pathways considered by PORTS are the direct use of surface water for drinking water, the ingestion of fish from contaminated water, and the use of contaminated water for

irrigation. All radionuclides released to any receiving stream are presumed to be evenly dispersed throughout the river (i.e., no depletion by settling or absorption, etc.,).

Irrigation is not a widespread practice in the lower Scioto Valley, and when it is practiced, groundwater is the preferred source. Furthermore, analyses of local crops have never shown any detectable radionuclide contamination. Consequently, PORTS believes that contribution to the public radiation dose via the irrigation pathway is zero.

There are no public or known private drinking water intakes on the Scioto River or on Big Beaver or Little Beaver Creek. However, in view of the rural and loosely regulated character of the lower Scioto Valley PORTS does not wish to presume that there is not a small private drinking water intake somewhere along the lower Scioto River. Sport fishing is also common along the Scioto River, and while there is no data available on how much fish is consumed per person from this source, it could conceivably approach the 21 kg per year value cited for the ICRP's reference adult. Consequently, PORTS calculates an annual CEDE for a hypothetical person drinking 730 L/yr of untreated riverwater and eating 21 kg per year of fish caught in the Scioto River.

There is no routine comparison between measured waterborne concentrations in the Scioto River and those predicted by this model because there is no statistically significant difference between upstream and downstream measured concentrations.

5.1.3.3 Direct Radiation

Gamma radiation fields attributable to USEC operations at PORTS do not produce any measurable incremental radiation dose at the reservation boundary. Measurement of gross gamma levels by an environmental TLD network indicate no statistically significant difference between gamma levels at the reservation boundary and those at the offsite locations. Storage of cylinders containing USEC-generated depleted uranium and its daughters may produce a field of elevated gamma levels along the northern portion of the on-site Perimeter Road in the future, but is not anticipated as doing so in any area to which the public has unrestricted or uncontrolled access. Consequently the incremental dose contribution due to direct gamma exposure related to USEC operations at PORTS is zero.

5.1.3.4 Summary of Methods Of Evaluations

Radionuclide effluent data are summarized in the Portsmouth Environmental Compliance Status Report and the report's Attachment. It is unlikely that any one person could be exposed to maximum doses from both gaseous and liquid effluents because the point of maximum exposure to airborne radionuclides is on the east side of the reservation, and the point of maximum exposure to waterborne radionuclides is in the Scioto River approximately 1 mile west of the plant. See the preceding sections for details of how PORTS calculates the CEDE due to airborne and waterborne radionuclides.

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Table 5.1-1. Plant action levels for airborne radionuclide emissions.

Weekly Sample Results		
Uranium[a]	Technetium[a]	Required Actions[b]
Baseline Effluent Quantity (BEQ)	Baseline Effluent Quantity (BEQ)	Review emission data for previous 6 months for trends, and estimate probable impact over calendar year. Evaluate whether additional emission controls would significantly reduce public exposure.
10 x BEQ or 2 x BEQ averaged over 6 months	80 x BEQ or 16 x BEQ averaged over 6 months	Determine whether increased emissions are ongoing or a single spike. Initiate investigation into cause(s) of increased emissions. Evaluate whether mitigative and/or corrective measures are necessary to reduce public dose. Implement mitigative and/or corrective measures as needed.
EPA Reportable Quantity[c] (RQ) (0.1 Ci in 24 hours)	EPA Reportable Quantity[c] (RQ) (10 Ci in 24 hours)	Notify Plant Shift Superintendent. Trace source of abnormal emissions and establish control or shutdown as needed. If emissions cannot be mitigated within 24 hours, elevate to next level.
1 Ci[d]	8 Ci[d]	Close affected vents until control of emissions is re-established.

a. Uranium has an approximately 8-fold greater dose rate response than ^{99}Tc over all air dominated exposure pathways.

b. Required actions for any level include all required actions listed under lower emission levels.

c. Reportable Quantity (RQ) does not include permitted emissions. PORTS is regulated under 40 CFR Part 61, Subpart H for release of airborne radionuclides from the entire plant site up to the equivalent of 10 mrem/year EDE to the most exposed member of the public.

d. 1 Ci in one weekly sample analysis. Approximately equivalent to 2 mrem at most exposed residence.

Note: The Plant Shift Superintendent has the authority to allow a restart.

Table 5.1-2. BEQs for Portsmouth Vents.

Vent	Total Uranium	Technetium
Top Purge Cascade	1.3 mCi/week	3.4 mCi/week
Side Purge Cascade	0.50 mCi/week	1.1 mCi/week
E-Jet (Purge Cascades)	1.2 mCi/week	4.5 mCi/week
X-330 Cold Recovery/Wet Air Evacuation	0.089 mCi/week	0.15 mCi/week
X-333 Cold Recovery	0.27 mCi/week	0.1 mCi/week[a]
X-333 Wet Air Evacuation	1.0 mCi/week	0.1 mCi/week[a]
Area 6 Seal Exhaust	0.072 mCi/week	0.1 mCi/week[b]
Area 5 Seal Exhaust	0.0054 mCi/week	0.1 mCi/week[a]
Area 4 Seal Exhaust	0.022 mCi/week	0.1 mCi/week[b]
Area 3 Seal Exhaust	0.002 mCi/week[c]	0.1 mCi/week[a]
Area 2 Seal Exhaust	0.093 mCi/week	0.1 mCi/week[a]
Area 1 Seal Exhaust	0.054 mCi/week	0.1 mCi/week[a]
X-343 Cold Trap Operations	0.18 mCi/week	0.1 mCi/week
X-344A Cold Trap Operations	0.18 mCi/week	0.1 mCi/week
X-344A Sampling and Transfer Facility (Gulper)	0.0036 mCi/week	0.1 mCi/week

a. No ^{99}Tc emission detected from this vent in 1994. Listed BEQ is approximately equal to five times minimum detectable weekly emission.

b. Only occasional ^{99}Tc emissions were measured from this vent in 1994. The listed BEQ is approximately equal to five times the minimum detectable weekly emissions.

c. Only occasional uranium emissions were measured from this vent in 1994. The listed BEQ is approximately equal to five times the minimum detectable weekly emissions.

NOTE: If both uranium and ^{99}Tc were emitted continuously at their respective BEQs for one year, the total estimated EDE would be 0.3 mrem.

Table 5.1-3. Plant action levels for waterborne radionuclide effluents.

Sample Results		Required Actions[b]
Uranium[a]	Technetium[a]	
Baseline Effluent Quantity (BEQ)	Baseline Effluent Quantity (BEQ)	Review effluent data for previous 6 months for trends, and estimate probable impact over calendar year. Evaluate whether additional effluent controls would significantly reduce public exposure.
10 x BEQ or 2 x BEQ averaged over 6 months	80 x BEQ or 16 x BEQ averaged over 6 months	Determine whether increased releases are ongoing or a single spike. Initiate investigation into cause(s) of increased releases. Evaluate whether mitigative and/or corrective measures are necessary to reduce public dose. Implement mitigative and/or corrective measures as needed.
EPA Reportable Quantity[c] (RQ) (0.1 Ci in 24 hours)	EPA Reportable Quantity[c] (RQ) (10 Ci in 24 hours)	Notify Plant Shift Superintendent Trace source of abnormal releases and establish control or shutdown as needed. If releases cannot be mitigated within 24 hours, elevate to next level.
1 Ci	8 Ci	Close affected outfalls until control of effluent is re-established.

a. Uranium has an approximately 8-fold greater dose rate response than ^{99}Tc over all air dominated exposure pathways. This ratio is also used for water dominated exposure pathways.

b. Required actions for any level include all required actions listed under lower effluent levels.

c. Reportable Quantity (RQ) does not include permitted releases.

Note: The Plant Shift Superintendent has the authority to allow a restart.

Table 5.1-4. BEQs for PORTS Outfalls.

Outfall	Total Uranium	Technetium
001 East Holding Pond	8.2 mCi/week	1.9 mCi/week
002 South Holding Pond	0.13 mCi/week	4.8 mCi/week[a]
003 Sewage Treatment Plant	4.1 mCi/week	12 mCi/week
004 (Headhouse #3)	1.4 mCi/week	4.6 mCi/week[a]
005 X-611B Lime Sludge Lagoon	0.6 mCi/week[b]	3.0 mCi/week[a]
009 North Holding Pond	0.16 mCi/week	2.9 mCi/week[a]
010 Northwest Holding Pond	0.12 mCi/week	1.7 mCi/week[a]
011 Northeast Holding Pond	0.006 mCi/week	0.7 mCi/week[a]

a. No ^{99}Tc effluents detected from this outfall in 1994. Listed BEQ is approximately equal to five times the minimum detectable concentration times the maximum anticipated weekly flow.

b. No uranium effluents detected from this outfall in 1994. Listed BEQ is approximately equal to five times the minimum detectable concentration times the maximum anticipated weekly flow.

Table 5.1-5. Summary of Environmental Monitoring.

Media	Parameter	Frequency
Biota - Vegetation	^{99}Tc	Semiannual
	Uranium	Semiannual
Biota - Vegetables	^{99}Tc	Annual
	Uranium	Annual
Biota - Fish	Gross Alpha	Annual
	Gross Beta	Annual
	^{99}Tc	Annual
	Uranium	Annual
Airborne - Vents	Total U	Weekly
	^{234}U	Weekly
	^{235}U	Weekly
	^{99}Tc	Weekly

Table 5.1-5. (Continued)

Media	Parameter	Frequency
Waterborne - Outfalls	Gross Alpha	Weekly
	Gross Beta	Weekly
	Total U	Weekly
	^{99}Tc	Weekly
Waterborne - Surface	Gross Alpha	Monthly/Weekly
	Gross Beta	Monthly/Weekly
	Total U	Monthly/Weekly
	^{99}Tc	Monthly/Weekly
Soil and Sediment	Gross Alpha	Semiannual
	Gross Beta	Semiannual
	Total U	Semiannual
	^{99}Tc	Semiannual
Direct* Radiation	Gross Gamma	Quarterly

NOTE: See Table 5.7-3 for method and LLD information.

*** The method for direct radiation media is thermaluminescend dosimetry with a LLD of 5.0 mrem.**

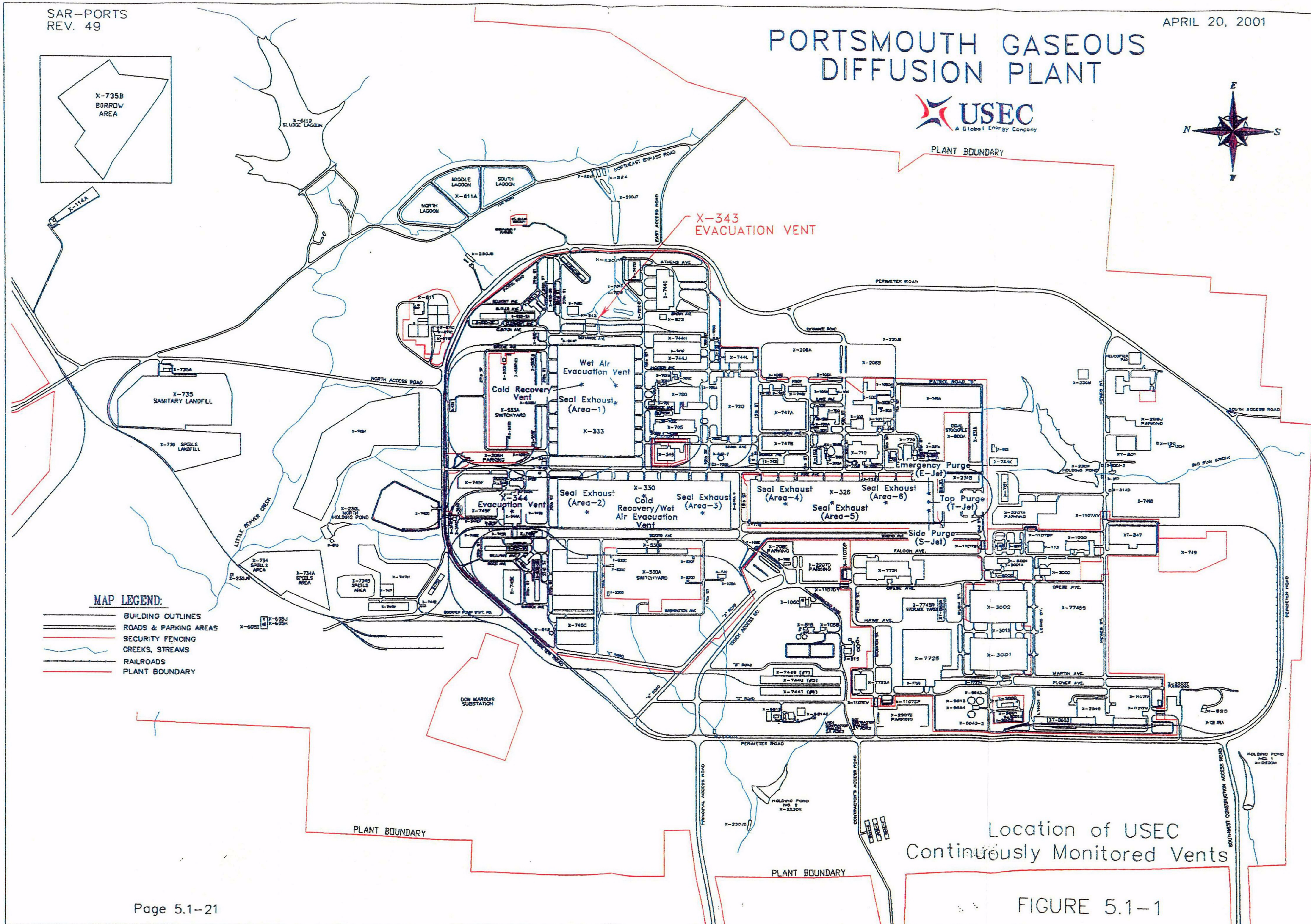
Table 5.1-6. Summary of Continuous Monitored Stack & Vent Characteristics.

Location	Dimensions			Flow Rates		
	Diameter (in.)	Height (ft)				
	Inside Dimension	Above Roof	Above Ground	Vol. (ACFM)	Velocity (ft/min)	Monthly[a] Vol.(SCF)
X-326 Top Purge Vent[b] (X-326-P-2799)	5	103	165	379	2779	1.47E+07
X-326 Side Purge[b] (X-326-P-2798)	5	103	165	626	4588	2.46E+07
X-326 E-Jet[b] (X-326-P-616)	5	103	165	869	6372	3.54E+07
X-330 Cold Recovery Vent (X-330-P-272)	4	12	78	415	4753	1.57E+07
X-333 Cold Recovery Vent (X-333-P-852)	3	15	97	429	8746	1.50E+07
X-333 Building Evacuation Vent (X-333-P-856)	4	15	97	917	10,508	2.27E+06
X-333 Seal Exhaust System Area 1 (X-333-A-851)	6	6	72	58	293	2.20E+06
X-330 Seal Exhaust System Area 2 (X-330-A-262)	4	6	72	37	424	1.71E+06
X-330 Seal Exhaust System Area 3 (X-330-A-279)	4	6	72	30	347	1.22E+06
X-326 Seal Exhaust System Area 4 (X-326-A-512)	8	6	72	30	87	1.22E+06
X-326 Seal Exhaust System Area 5 (X-326-A-528)	8	6	72	27	77	1.35E+06
X-326 Seal Exhaust System Area 6 (X-326-A-540)	8	6	72	29	83	1.20E+06
X-343 Cold Trap Operations Vent (X-343-P-964)	3	68	110	51	1033	2.19E+06
X-344 Cold Trap Operations Vent (X-344-P-3103)	3	12	58	51	1033	2.19E+06
X-344 Gulper (X-344-P-929)	16	8	58	450	322	2.81E+06

a. Monthly volumes are based on an average of data from 1992-1994, except for X-343 and X-344 Cold Trap Operations Vent, which were based on design information.

b. These three vents physically discharge through four interconnected pipes of the listed dimensions.

PORTSMOUTH GASEOUS DIFFUSION PLANT



Location of USEC
Continuously Monitored Vents

FIGURE 5.1-1

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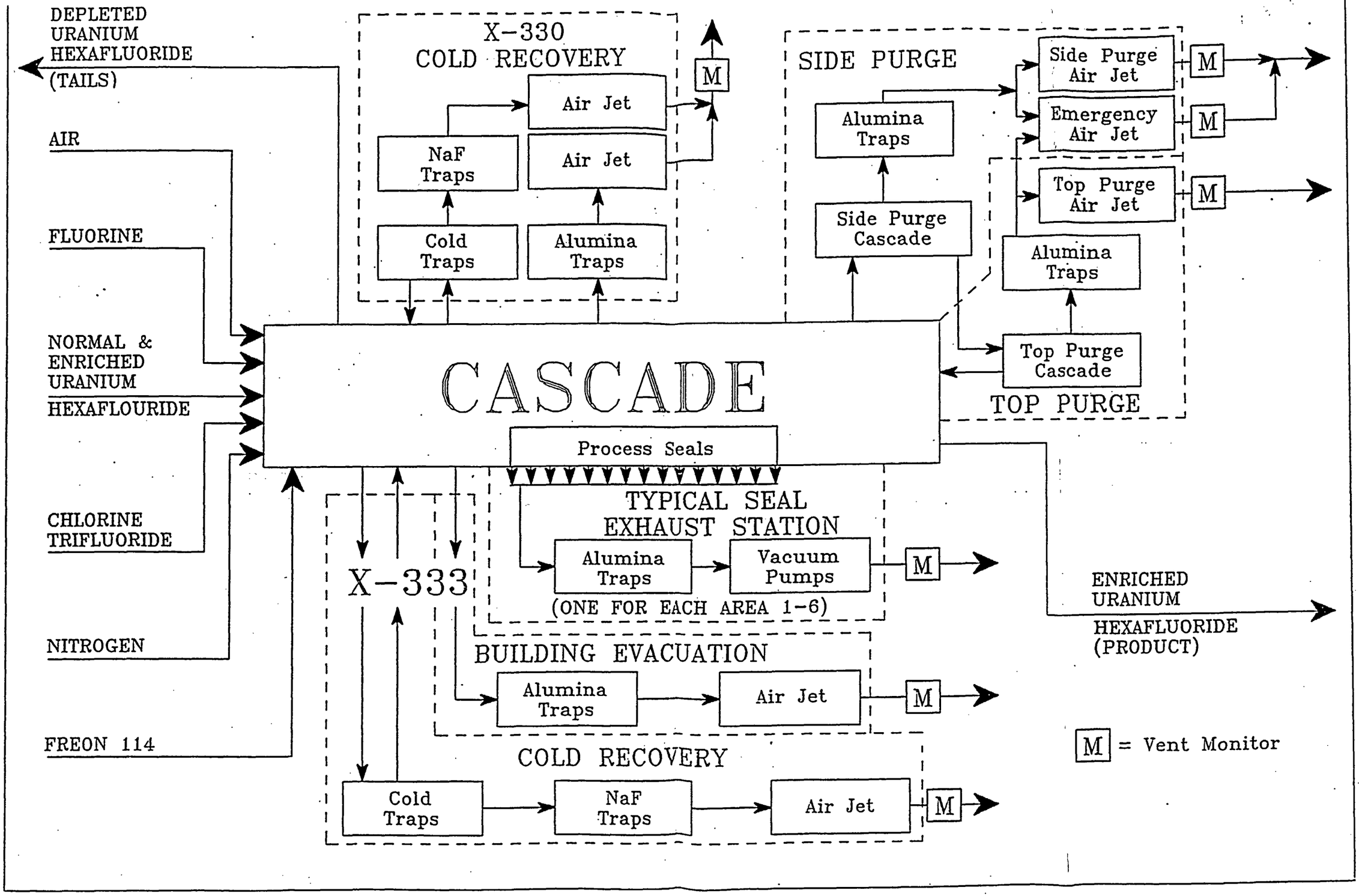

Figure 5.1-2. Portsmouth Gaseous Diffusion Cascade Flow Diagram.

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PORTSMOUTH GASEOUS DIFFUSION PLANT

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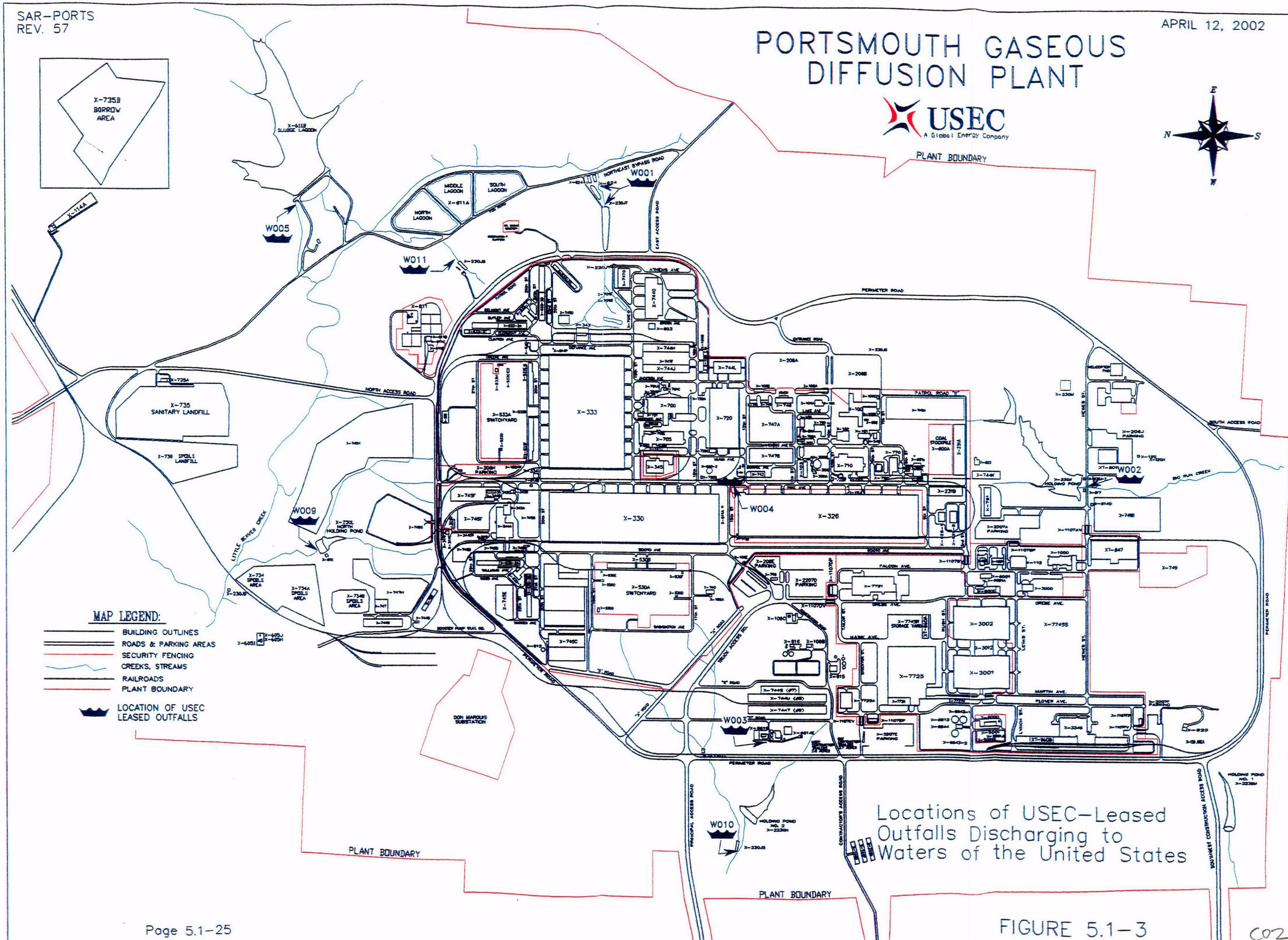

Locations of USEC-Leased Outfalls Discharging to Waters of the United States

FIGURE 5.1-3

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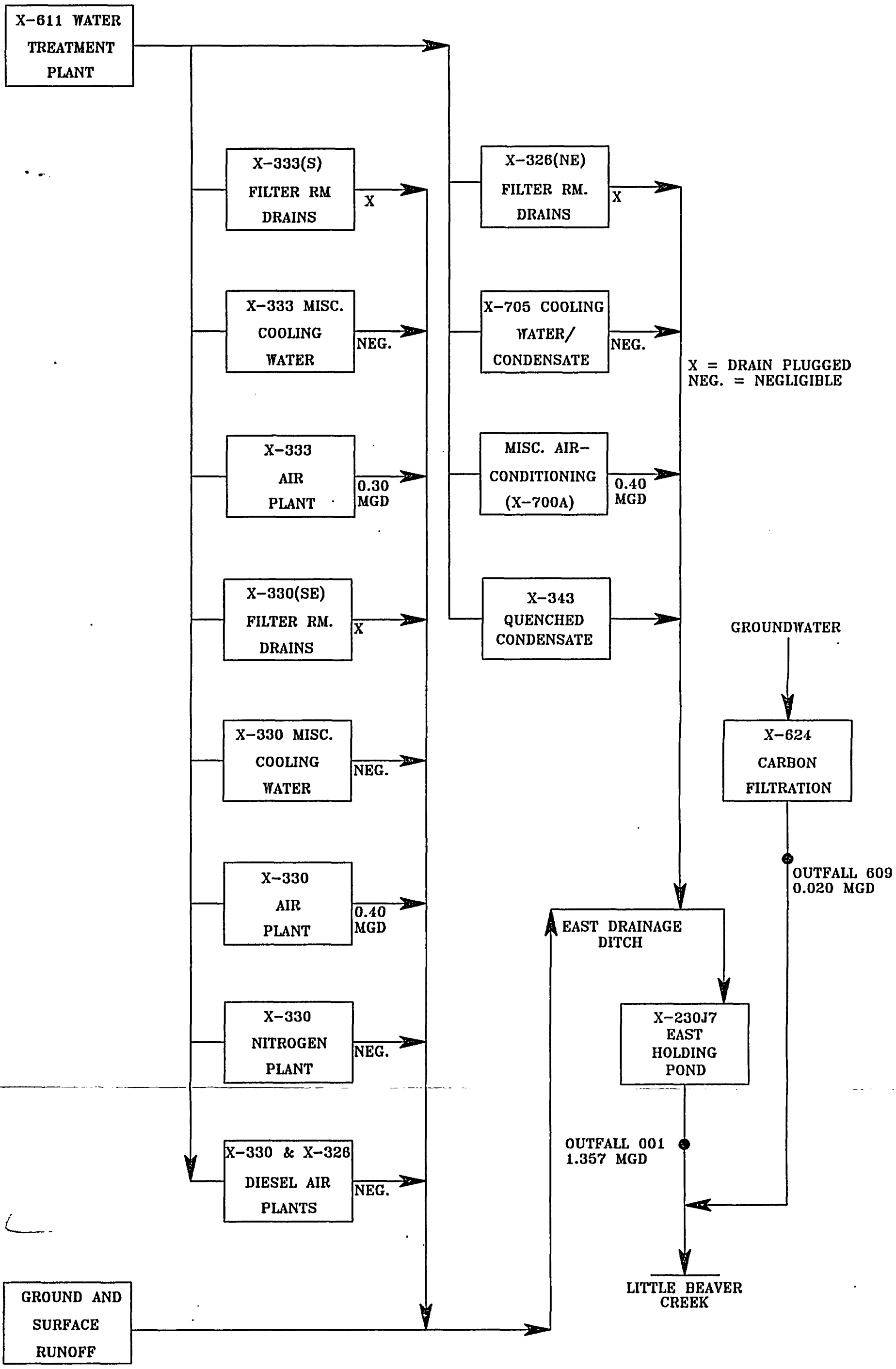

Figure 5.1-4. Influent flow diagram for USEC-leased Outfall 001.

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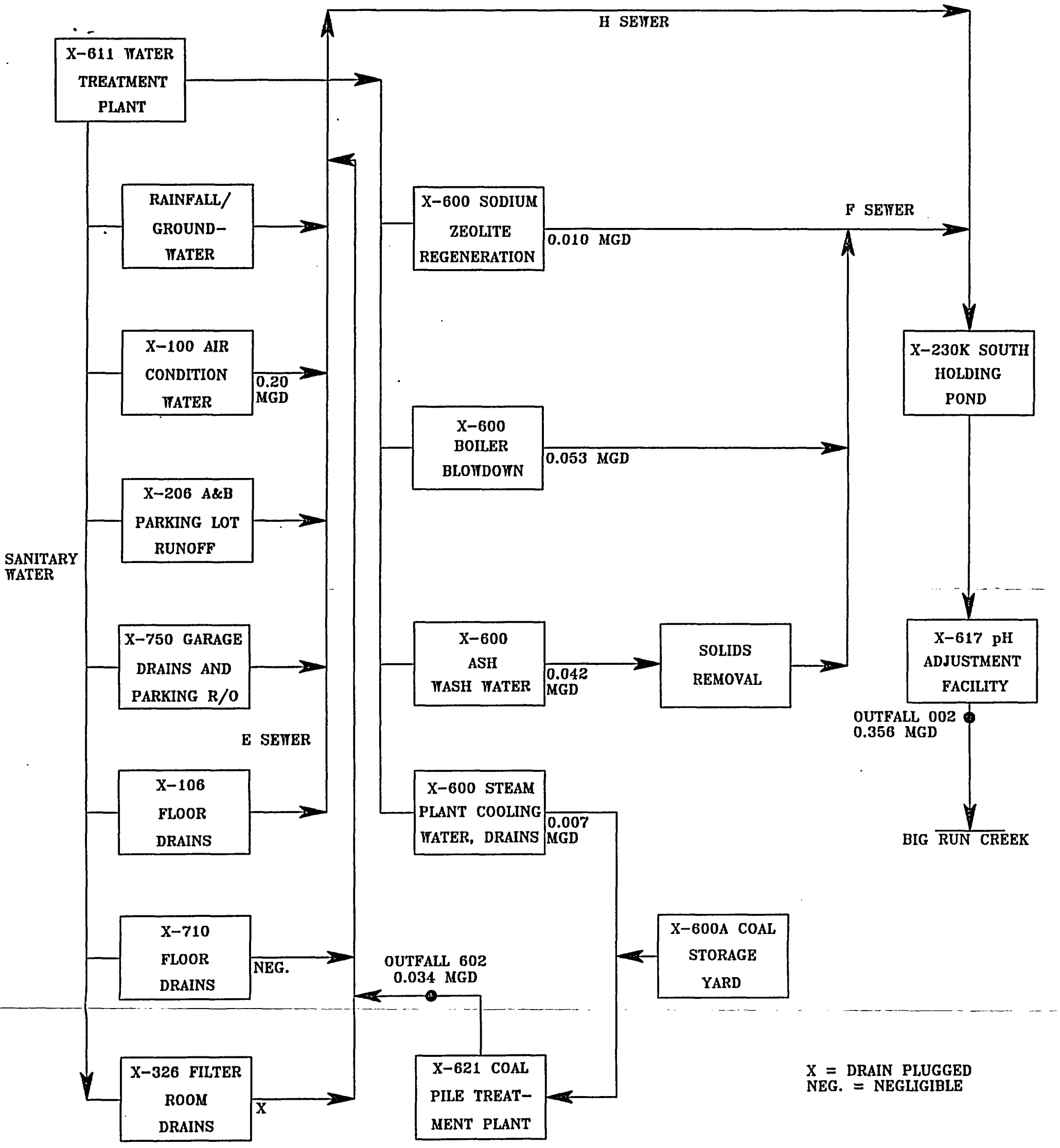

Figure 5.1–5. Influent flow diagram for USEC–leased Outfall 002.

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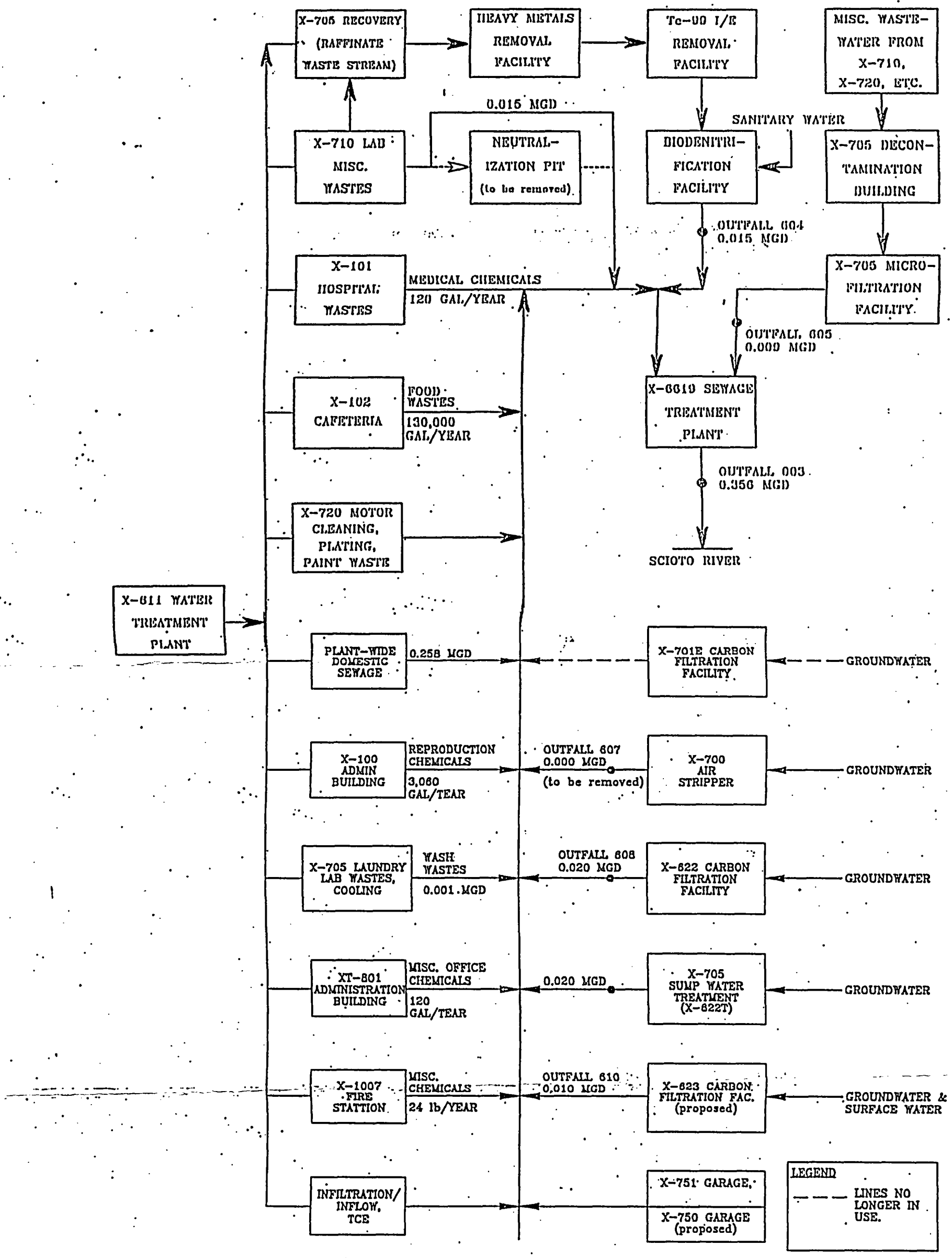

FIGURE 5.1-6 Influent flow diagram for USEC-leased Outfall 003

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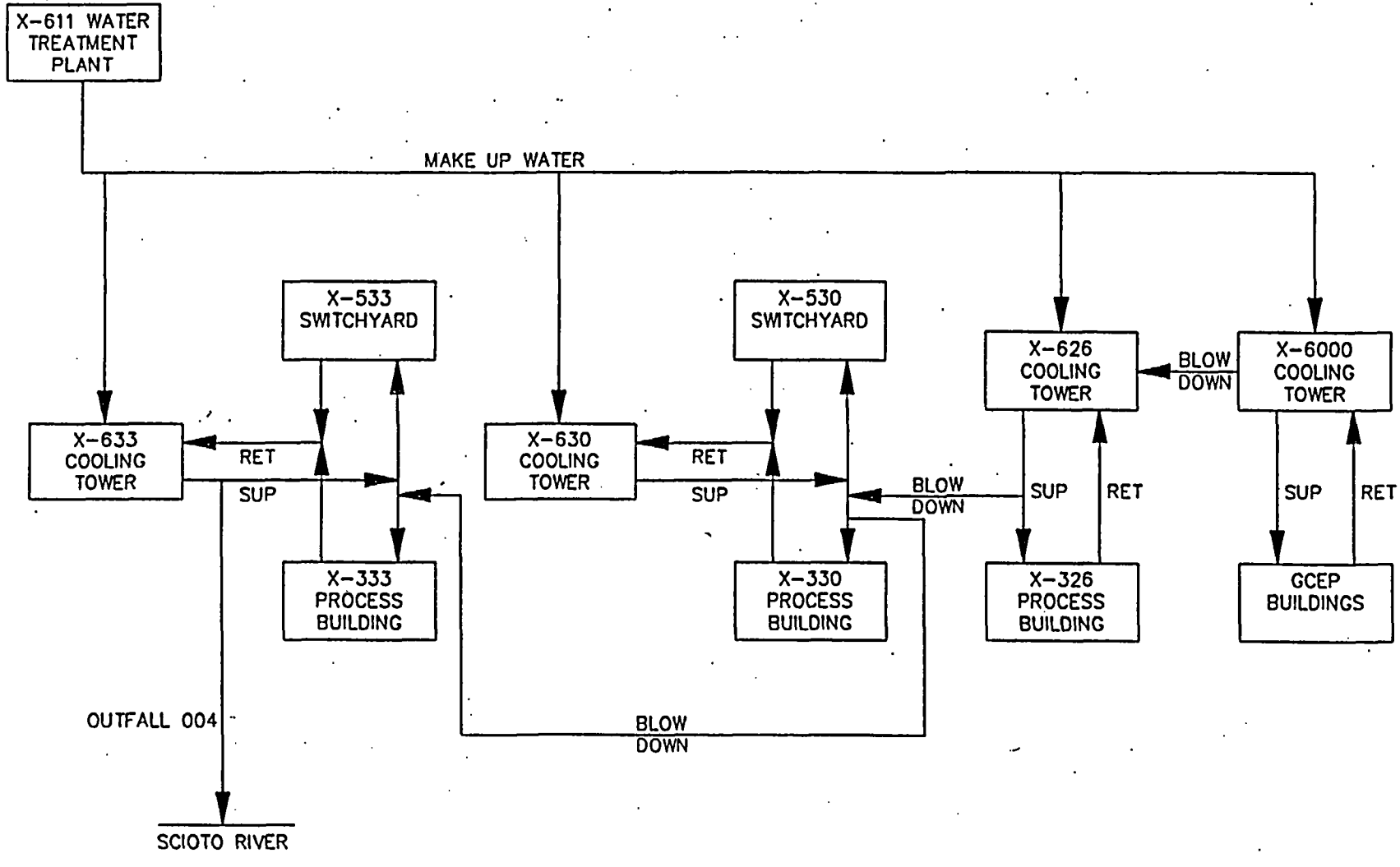

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FIGURE 5.1-7 Influent flow diagram for USEC-leased Outfall 004

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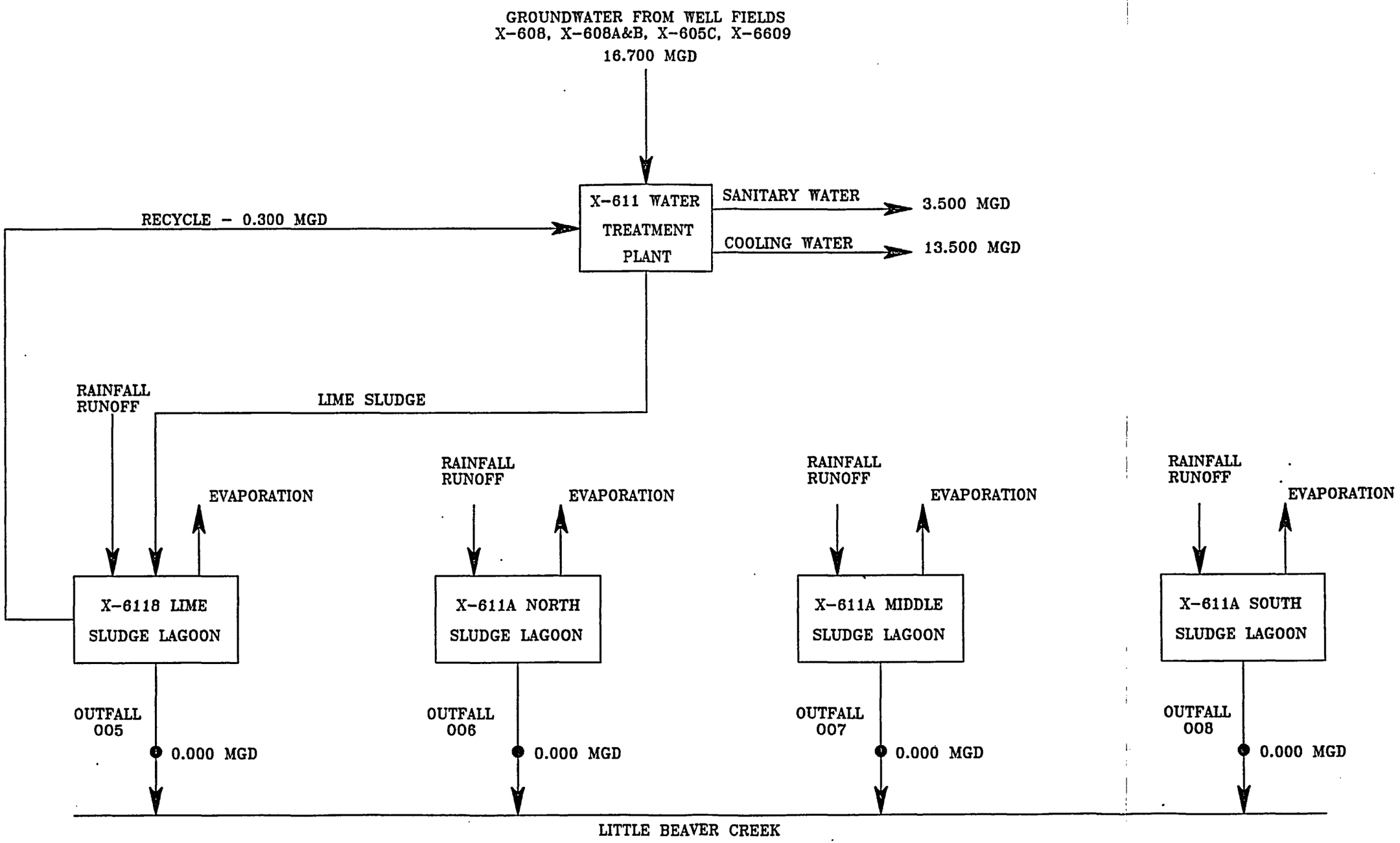

Figure 5.1-8. Influent flow diagram for USEC-leased Outfall 005.

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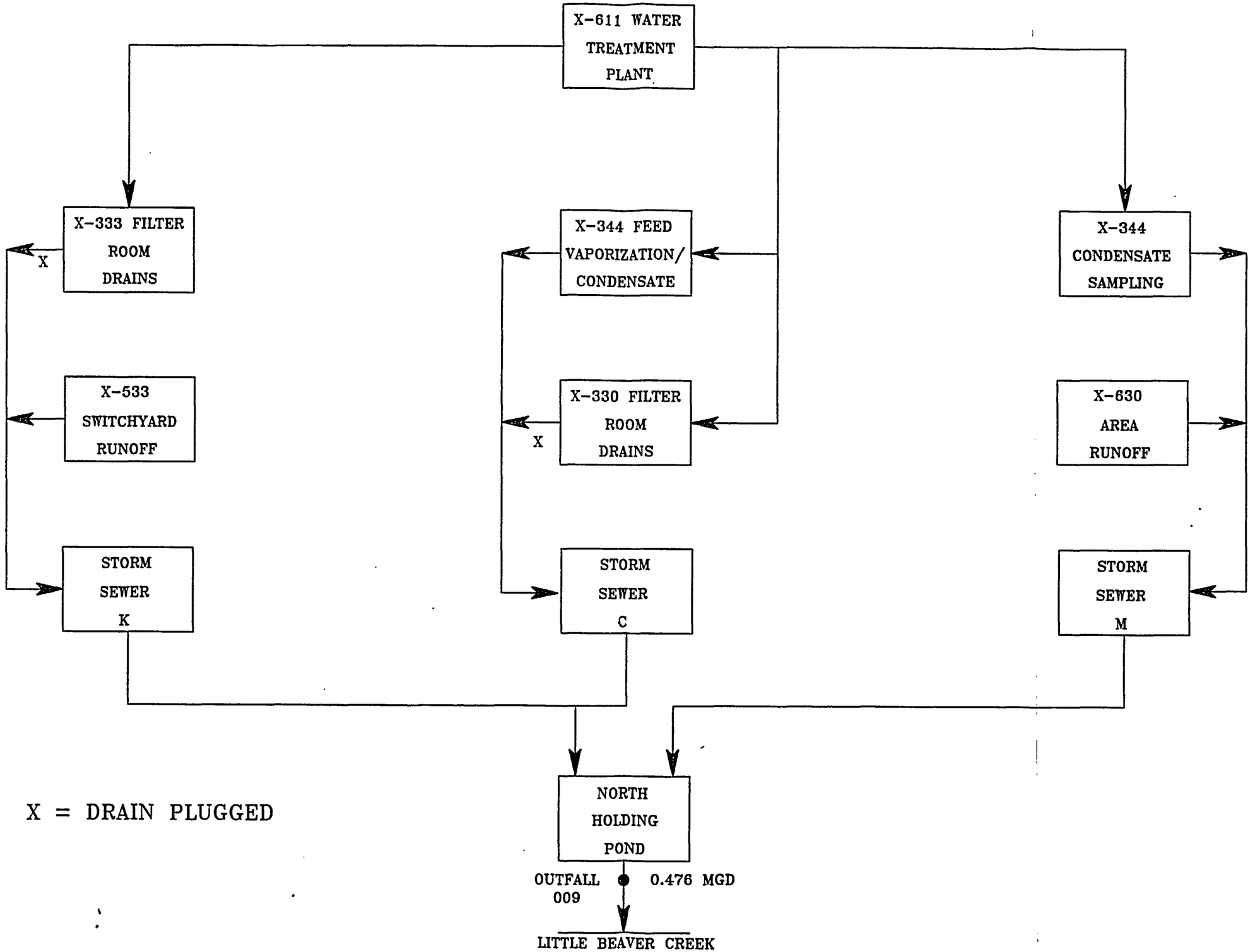

Figure 5.1–9. Influent flow diagram for USEC–leased Outfall 009.

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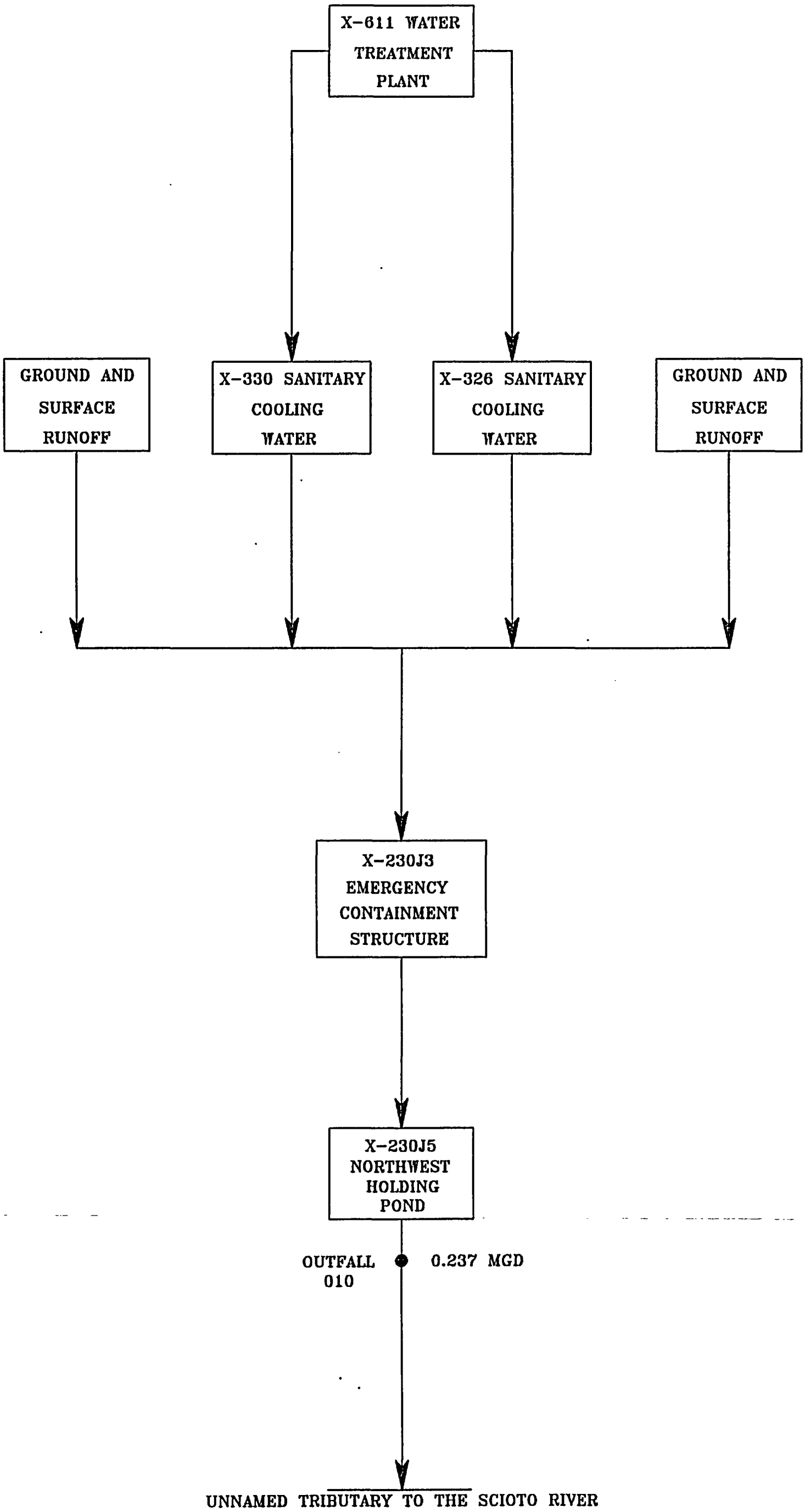

Figure 5.1-10. Influent flow diagram for USEC-leased Outfall 010.

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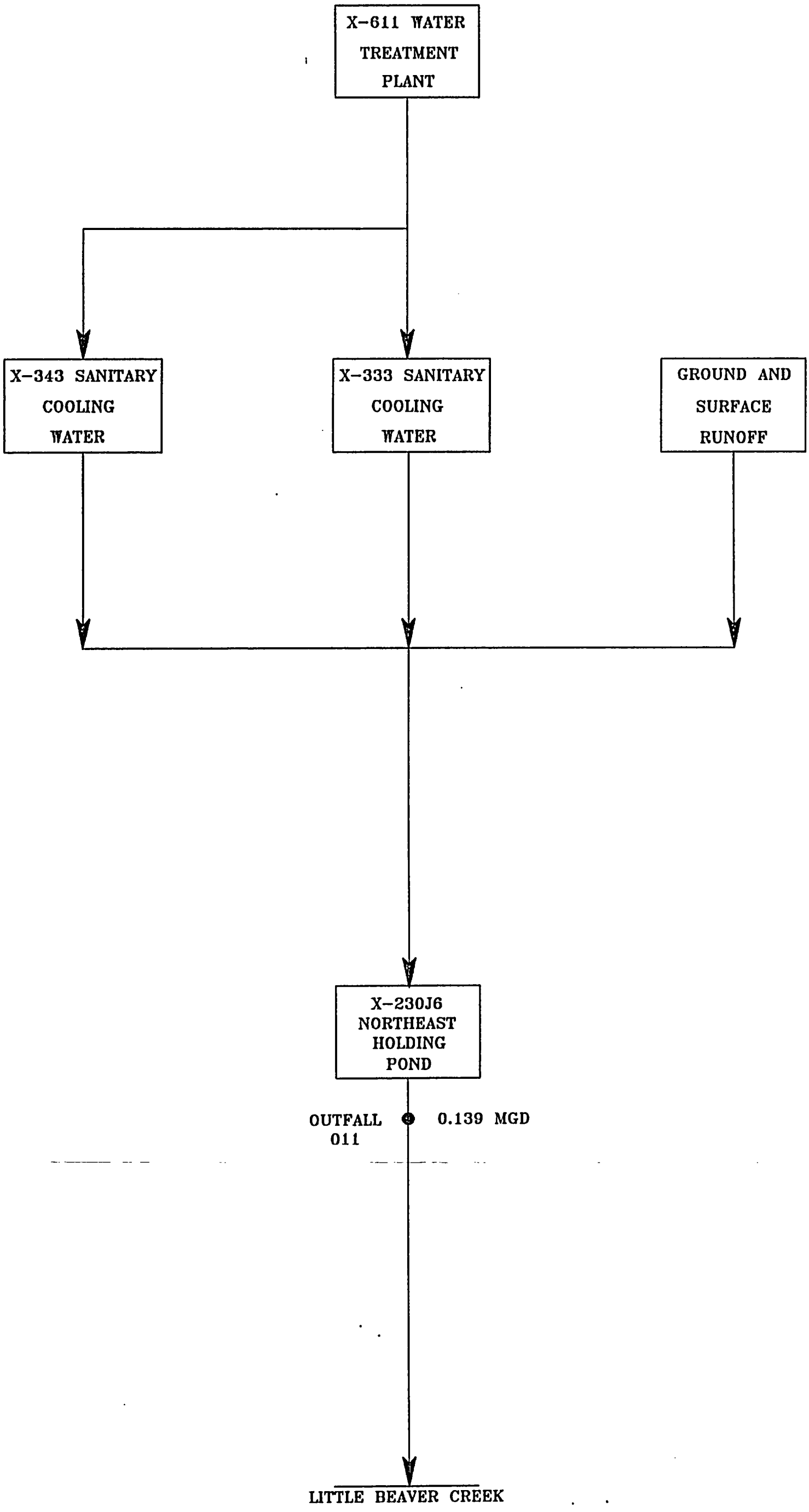

Figure 5.1-11. Influent flow diagram for USEC-leased Outfall 011.

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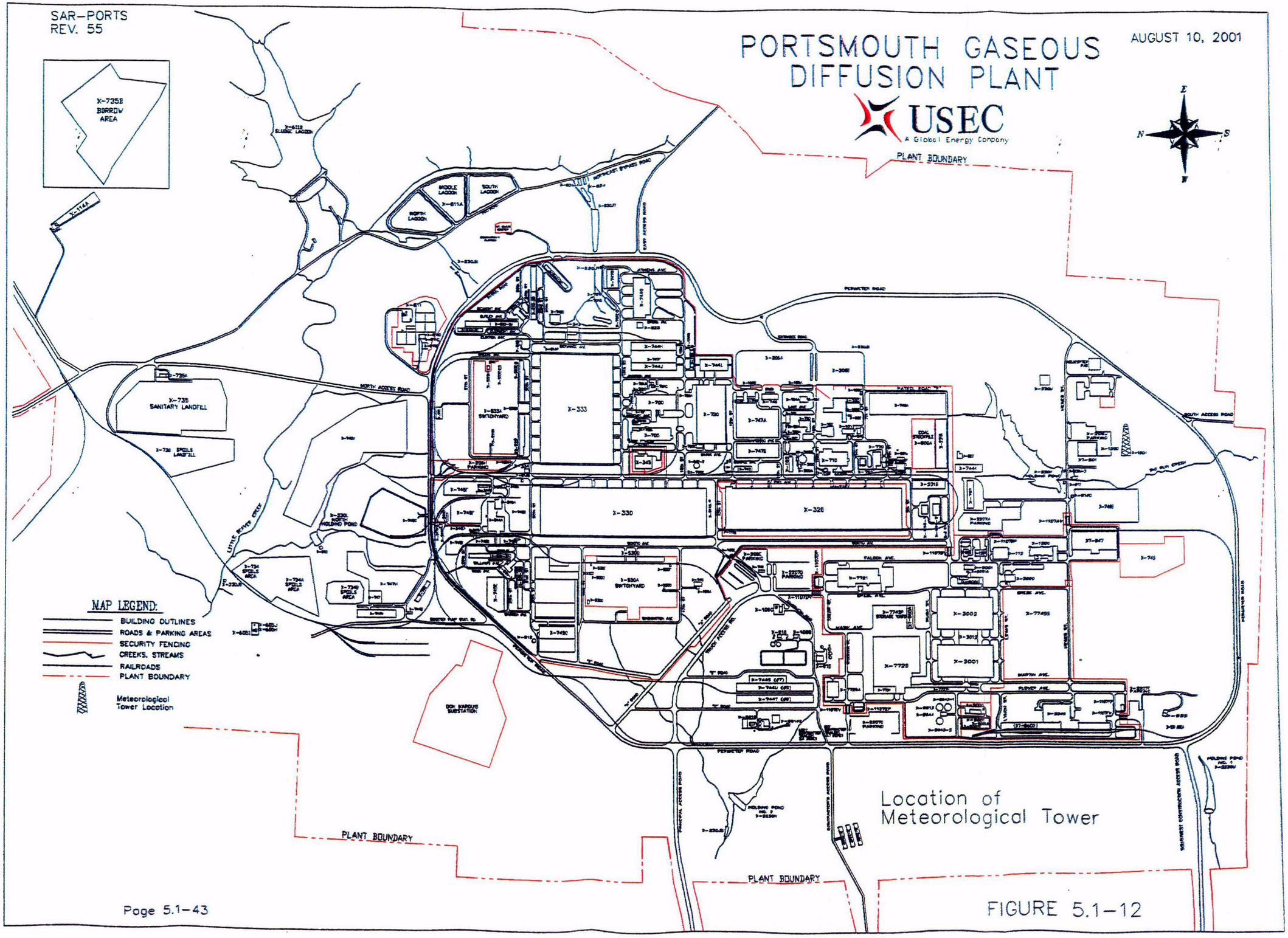
SAR–PORTS
REV. 55

PORTSMOUTH GASEOUS DIFFUSION PLANT

AUGUST 10, 2001

USEC
A Global Energy Company



MAP LEGEND:

- BUILDING OUTLINES
- ROADS & PARKING AREAS
- SECURITY FENCING
- CREEKS, STREAMS
- RAILROADS
- PLANT BOUNDARY

Meteorological Tower Location

Location of Meteorological Tower

FIGURE 5.1–12

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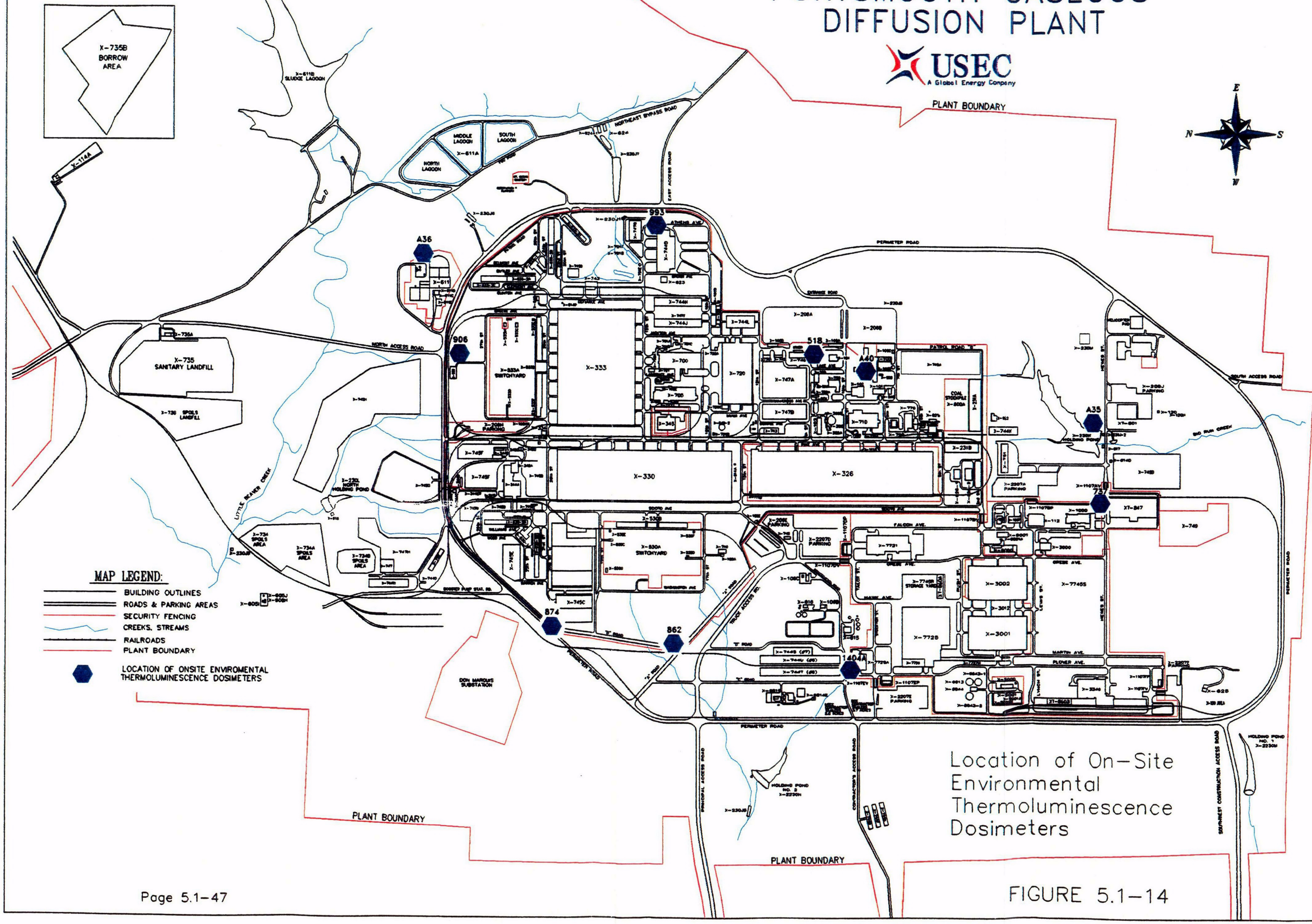
April 14, 2000

PORTSMOUTH GASEOUS DIFFUSION PLANT



Location of On-Site Environmental Thermoluminescence Dosimeters

FIGURE 5.1-14

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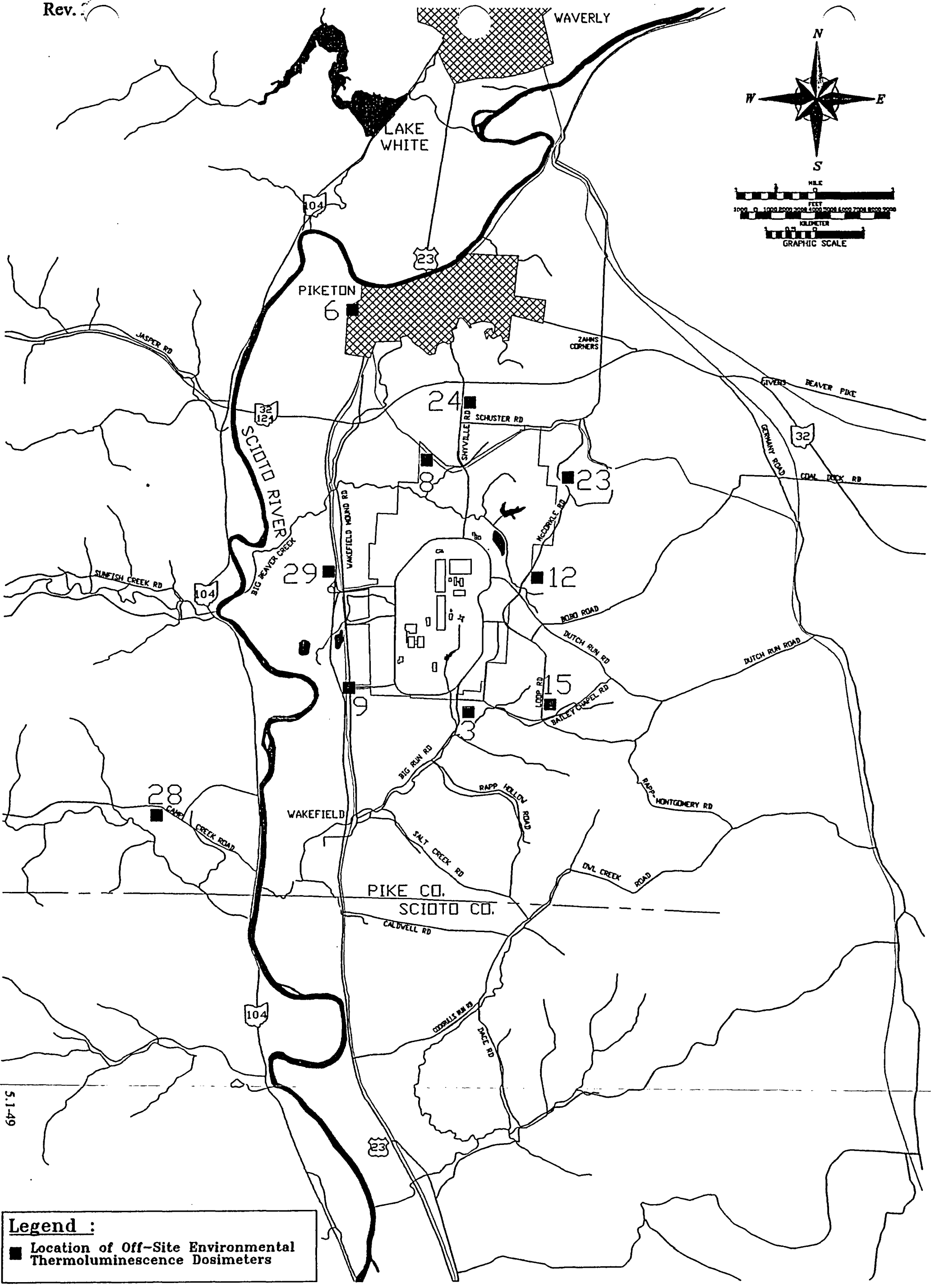

Figure 5.1-15. Locations of offsite environmental thermoluminescence dosimeter.

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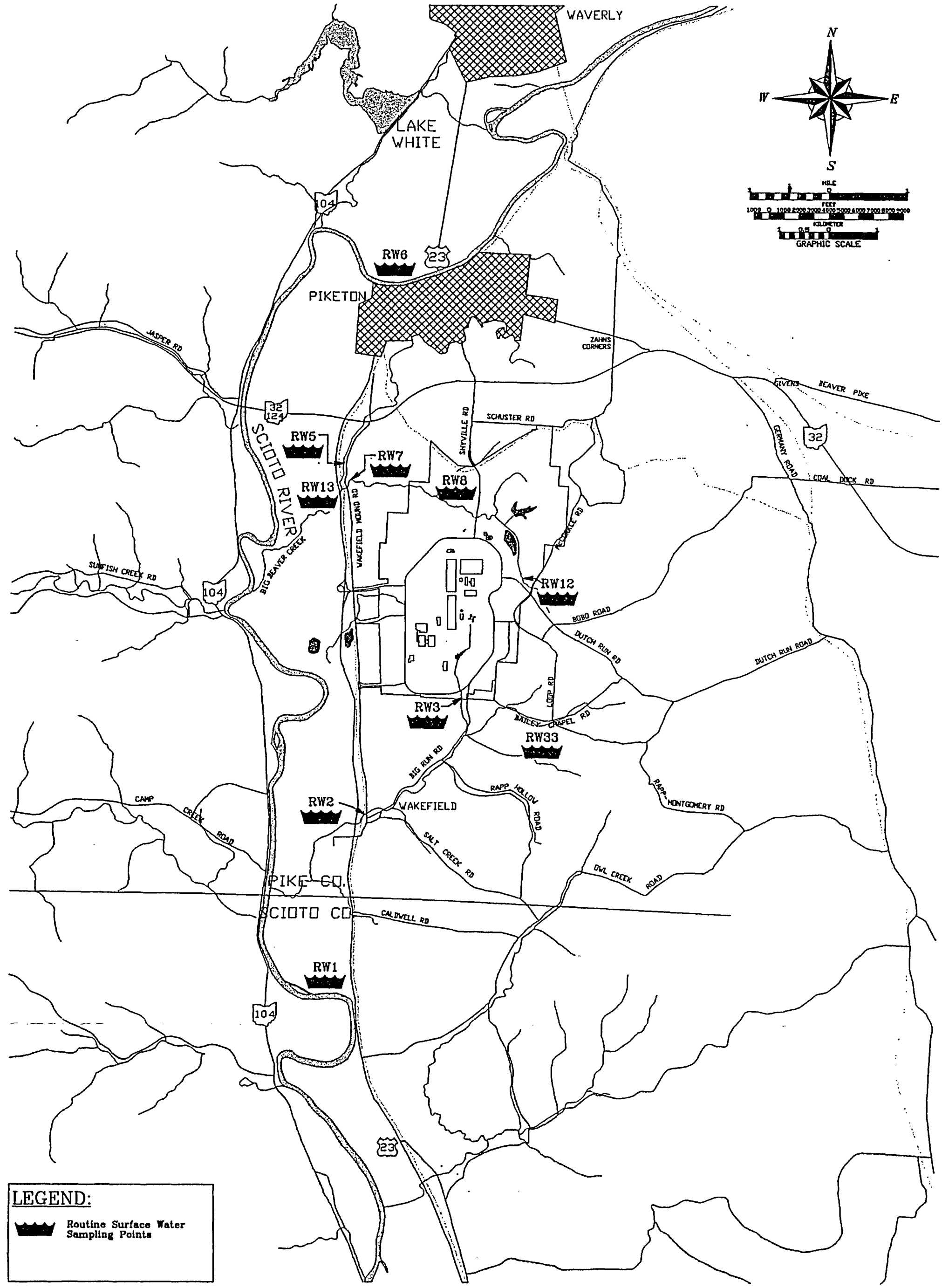

Figure 5.1-16. Locations of routine surface water sampling points

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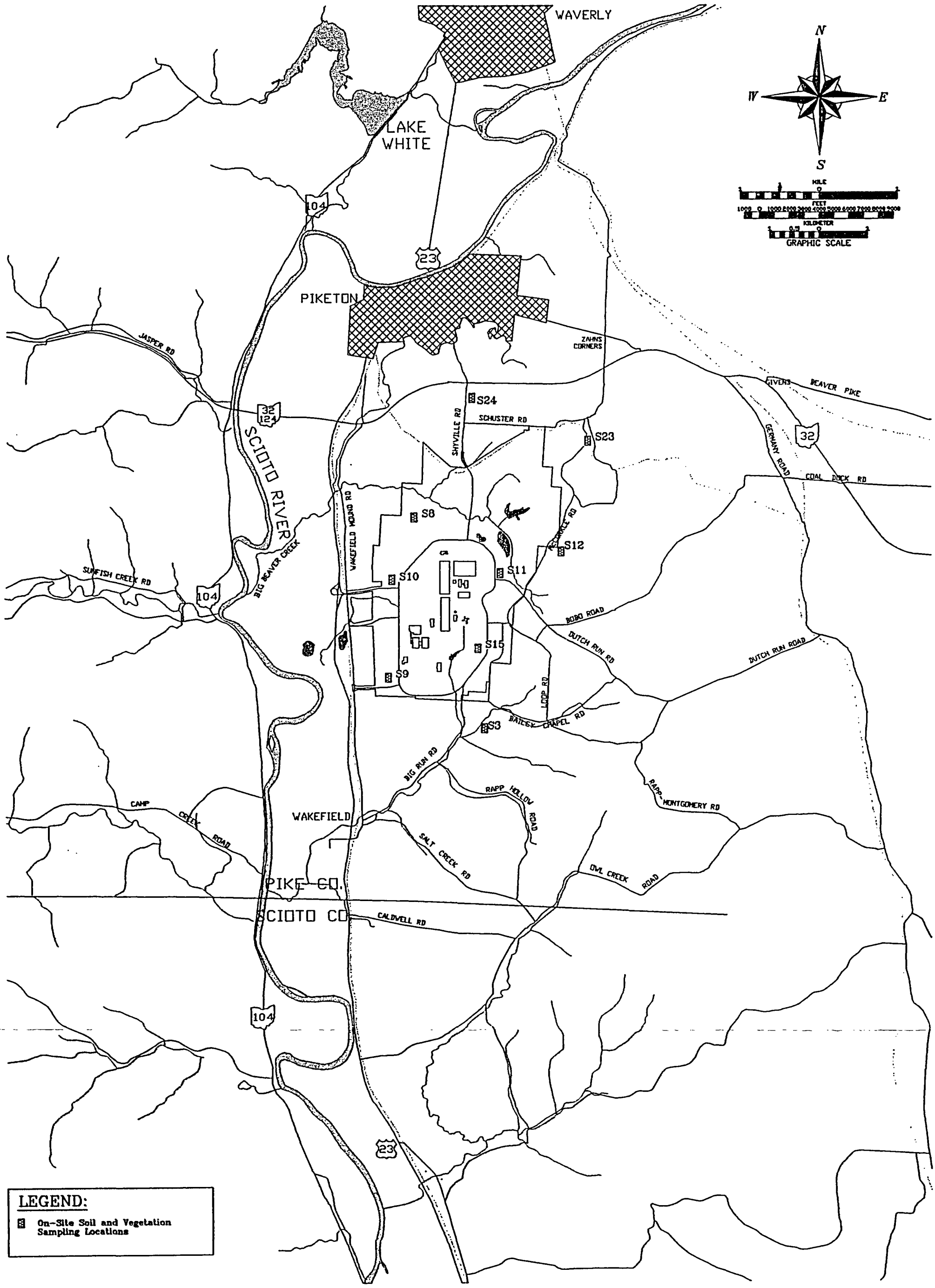

Figure 5.1-17. Locations of onsite soil and vegetation sampling points.

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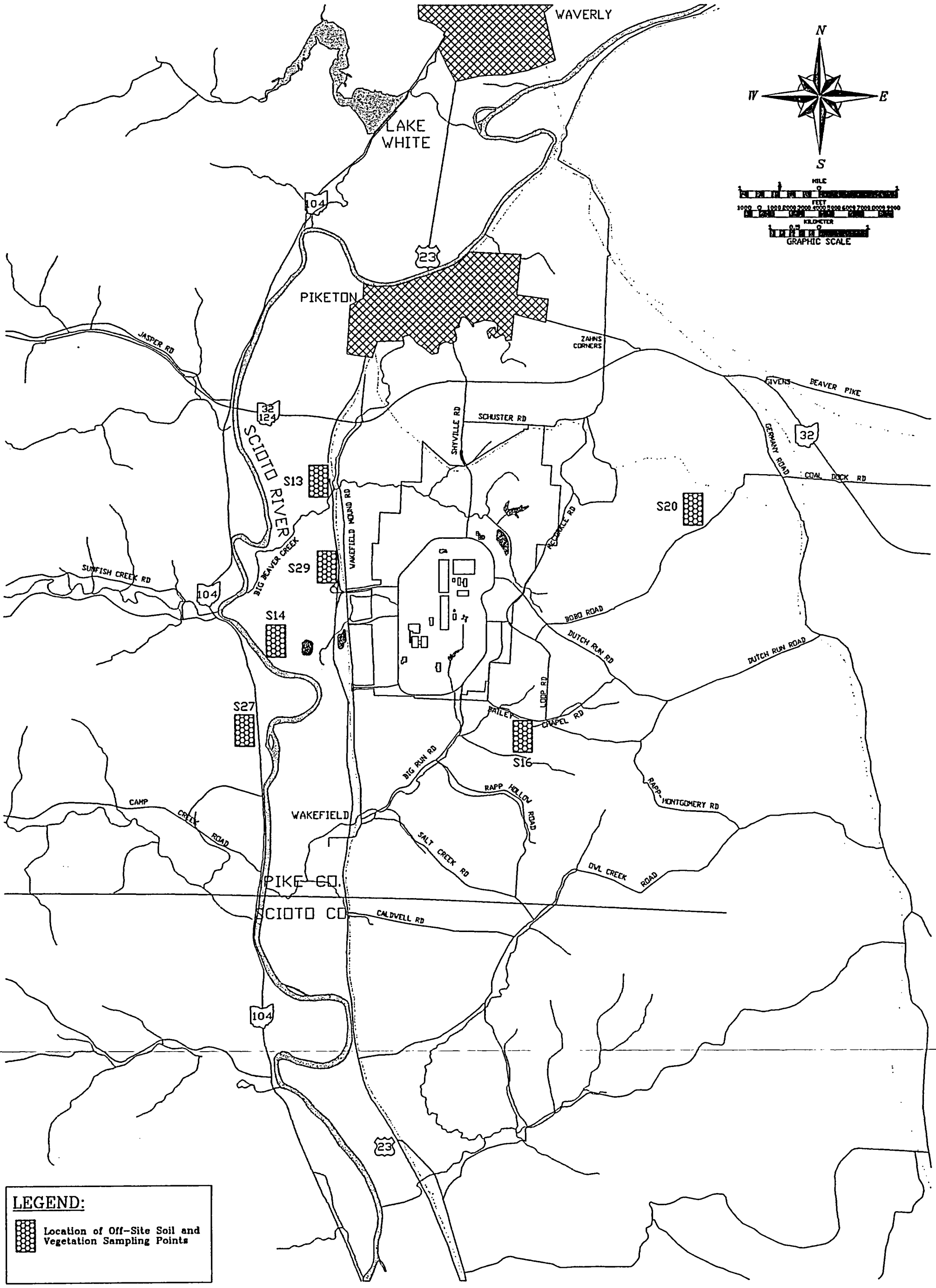

Figure 5.1-18. Location of offsite soil and vegetation sampling points.

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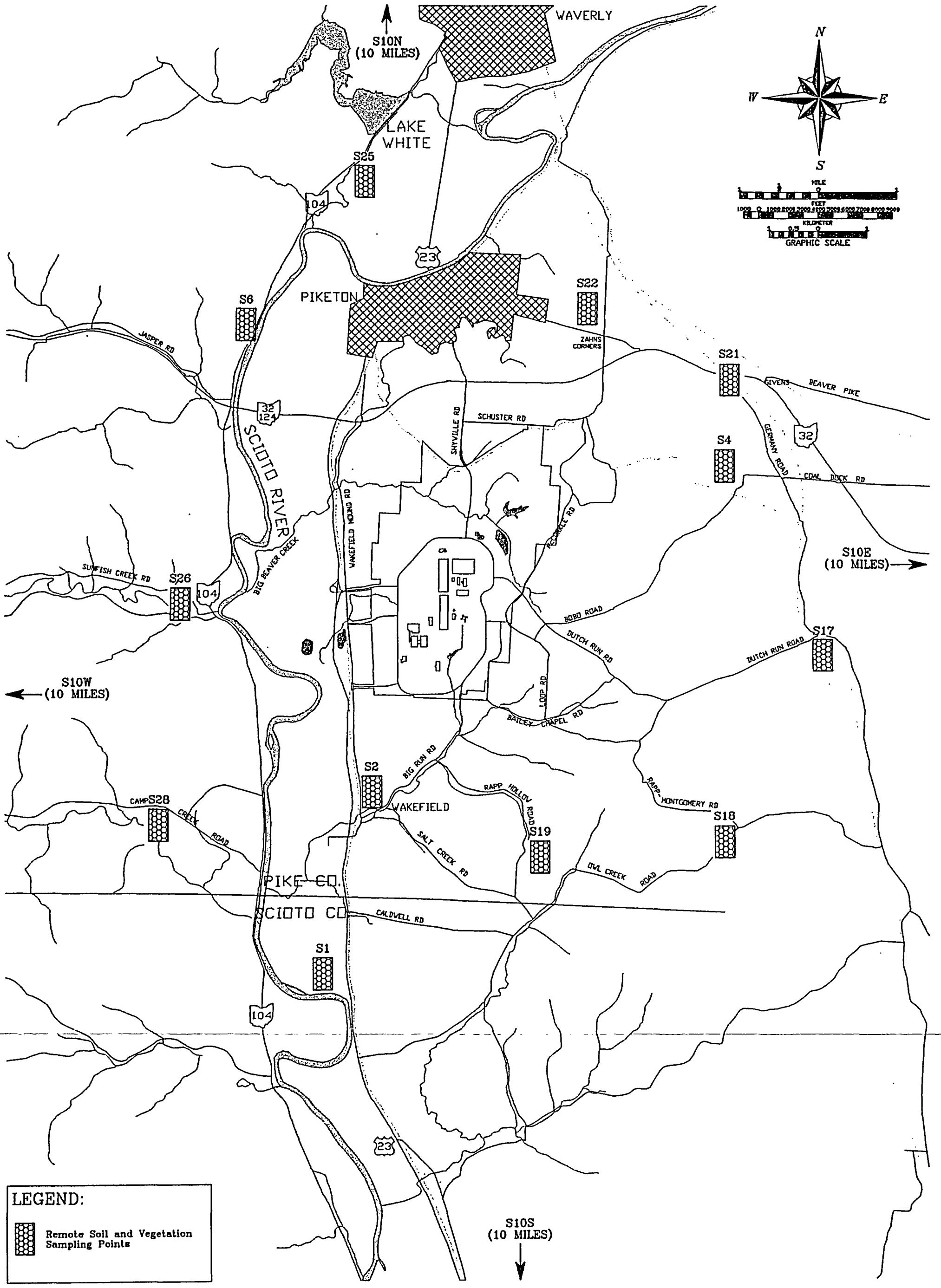

Figure 5.1–19. Locations of remote soil and vegetation sampling points.

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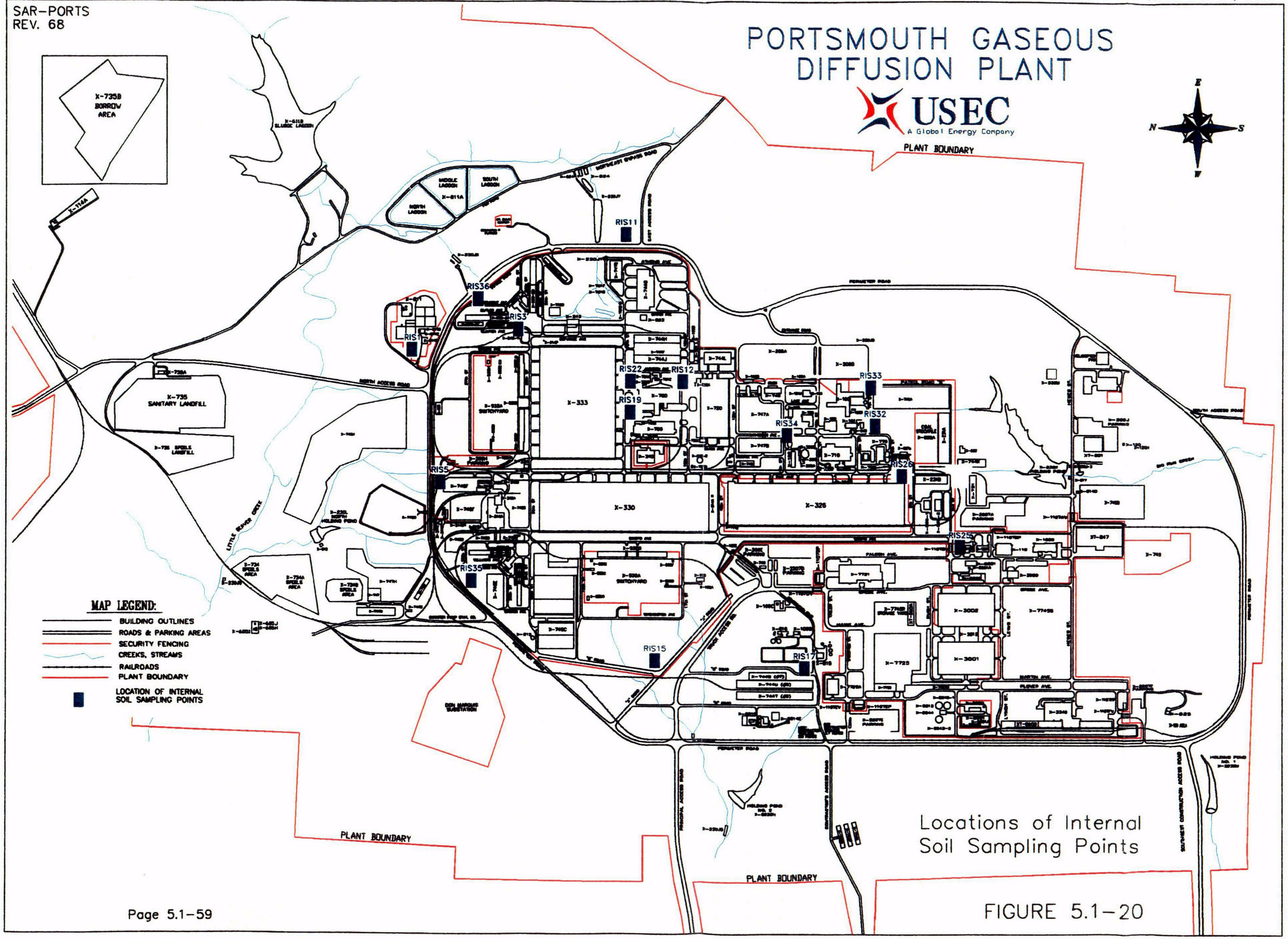

FIGURE 5.1-20

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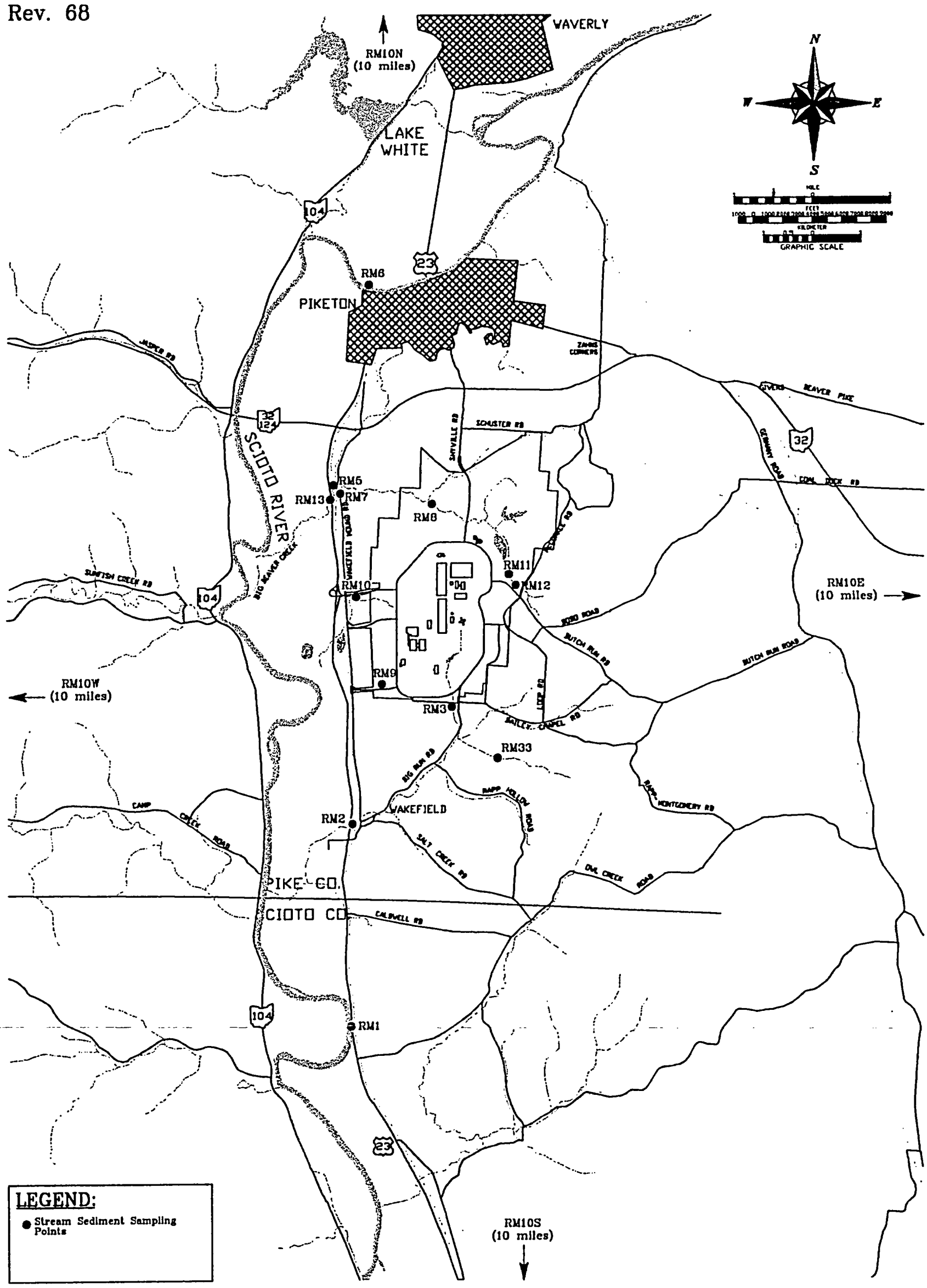

Figure 5.1–21. Locations of Stream Sediment Sampling Points.

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