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Phase III Letter Work Plan for DP Site Aggregate Area

Prepared by the Environmental Programs Directorate

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EXECUTIVE SUMMARY

This Phase III letter work plan addresses sampling to define extent and corrective actions for DP Site Aggregate Area sites at Technical Area 21 (TA-21) presented in the DP Site Aggregate Area Phase II investigation report as well as the diesel fuel spill from tank 21-57. These sites have been investigated previously and need additional sampling for extent and/or corrective actions to fully define contamination and/or reduce risk, hazard, or dose to acceptable levels under the human health and ecological risk scenarios.

The nature and extent of contamination were not defined for 10 of the 26 sites sampled as part of the Phase II investigation and at the diesel fuel spill site. The sampling locations and suites required to define extent are presented in this letter work plan for the sites listed below.

The following sites require additional sampling to define extent:

- Consolidated Unit 21-003-99 [includes Solid Waste Management Unit (SWMU) 21-003 and Area of Concern (AOC) 21-013(f)] and SWMU 21-024(c) (collocated sites)
- Consolidated Unit 21-006(c)-99 [consisting of SWMUs 21-006(a), 21-006(b), 21-006(c), and 21-006(d)]
- Consolidated Unit 21-022(h)-99 [consisting of SMWUs 21-022(h), 21-022(i), and 21-022(j)]
- Consolidated Unit 21-023(a)-99 [consisting of SWMUs 21-023(a), 21-023(b), and 21-023(d)]
- SWMU 21-024(d)
- SWMU 21-024(g)
- SWMU 21-024(k)
- SWMU 21-024(n)
- Consolidated Unit 21-026(a)-99 [consisting of SWMUs 21-013(a), 21-026(a), and 21-026(b) and AOCs 21-026(c) and 21-026(d)]
- AOC C-21-027
- Diesel fuel spill from aboveground storage tank 21-57

Sixteen of the 21 sites evaluated in the Phase II investigation report risk assessment were determined to pose no potential unacceptable risk, hazard, or dose to human health under the industrial, construction worker, and/or residential scenarios or to the environment. The remaining five sites listed below, in addition to the diesel fuel spill site, are addressed in this work plan as sites identified for corrective actions. Where possible, the sites identified for corrective actions will be remediated to residential cleanup levels. The diesel fuel spill site will be excavated to a depth of 10 ft below ground surface using the New Mexico Environment Department screening guideline of 520 mg/kg total petroleum hydrocarbon diesel #2 oil.

The following sites have been identified for corrective actions:

- Consolidated Unit 21-022(h)-99
- SWMU 21-024(b)
- Consolidated Unit 21-024(l)-99 [consisting of AOC 21-004(a) and SWMUs 21-022(a) and 21-024(l)]

- Consolidated Unit 21-026(a)-99
- SWMU 21-027(a)
- Diesel fuel spill from aboveground storage tank 21-57

Sites identified for corrective actions will be remediated to the extent practicable. TA-21 safety personnel have determined that portions of four sites have outfall areas that cannot be excavated safely with mechanical equipment because they are located on a steep slope, at the cliff edge, or on a bench below the cliff edge. After the work plan objectives have been met, a Phase III investigation report will be completed to summarize the site activities and present the calculated final site risk, hazard, or dose.

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1.0 INTRODUCTION

The Los Alamos National Laboratory (LANL or the Laboratory) Technical Area 21 (TA-21) Closure Project is investigating DP Site Aggregate Area sites potentially contaminated by past Laboratory operations. The sites addressed in this Phase III work plan are located on DP Mesa within TA-21 (Figure 1 and Tables 1 and 2). This Phase III work plan proposes additional sampling to define the extent of contamination and/or corrective actions to reduce potential site risk, hazard, or dose to human health and the environment. As outlined in the New Mexico Environment Department (NMED) direction to modify the Phase II investigation report for DP Site Aggregate (LANL 2010, 110772.33; NMED 2010, 110959), additional work to address the diesel contamination from tank 21-57 is included in this work plan. The sites addressed in this work plan are listed below. The sites under investigation are designated as solid waste management units (SWMUs), areas of concern (AOCs), and consolidated units. Individual SWMUs and AOCs may be grouped into consolidated units as a result of spatial proximity or function.

The SWMUs and AOCs addressed in this Phase III work plan are potentially contaminated with both hazardous and radioactive components. NMED, pursuant to the New Mexico Hazardous Waste Act, regulates cleanup of hazardous wastes and hazardous constituents. The U.S. Department of Energy (DOE) regulates cleanup of radioactive contamination, pursuant to DOE Order 5400.5, Radiation Protection of the Public and the Environment; DOE Order 435.1, Radioactive Waste Management; and DOE Order 458.1, Administrative Change 1, Radiation Protection of the Public and the Environment. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

Corrective actions at the Laboratory are subject to a Compliance Order on Consent (the Consent Order). This Phase II work plan describes work activities that will be executed and completed in accordance with the Consent Order.

Sixteen of the 21 sites evaluated in the Phase II investigation report risk assessment were determined to pose no potential unacceptable risk or dose to human health under the industrial, construction worker, and/or residential scenarios or to the environment. The remaining five sites are addressed in this work plan as sites identified for corrective actions. The nature and extent of contamination were not defined for 10 of the 26 sites sampled as part of the Phase II investigation. The remaining locations to be sampled for extent are presented in this letter work plan.

Section 2 proposes additional extent sampling as a result of the Phase II investigation report findings for the following sites:

- Consolidated Unit 21-003-99 [consisting of SWMU 21-003 and AOC 21-013(f)] and SWMU 21-024(c) (collocated sites)
- Consolidated Unit 21-006(c)-99 [consisting of SWMUs 21-006(a), 21-006(b), 21-006(c) and 21-006(d)]
- Consolidated Unit 21-022(h)-99 [consisting of SMWUs 21-022(h), 21-022(i), and 21-022(j)]
- Consolidated Unit 21-023(a)-99 [consisting of SWMUs 21-023(a), 21-023(b), and 21-023(d)]
- SWMU 21-024(d)
- SWMU 21-024(g)
- SWMU 21-024(k)
- SWMU 21-024(n)

- Consolidated Unit 21-026(a)-99 [consisting of SWMUs 21-013(a), 21-026(a), and 21-026(b) and AOCs 21-026(c) and 21-026(d)]
- AOC C-21-027
- Diesel fuel spill from tank 21-57

Section 3 proposes corrective actions and/or sampling to define areas with contamination detected above cleanup levels for the following sites:

- Consolidated Unit 21-022(h)-99
- SWMU 21-024(b)
- Consolidated Unit 21-024(l)-99 [consisting of SWMUs 21-022(a) and 21-024(l) and AOC 21-004(a)]
- Consolidated Unit 21-026(a)-99
- SWMU 21-027(a)
- Diesel fuel spill from aboveground storage tank 21-57

The work plan will be implemented following the processes and procedures described in the approved "Investigation Work Plan for Delta Prime Site Aggregate Area at Technical Area 21" (LANL 2004, 087461; NMED 2005, 089314).

Sites identified for corrective actions will be remediated to the extent practicable. TA-21 safety personnel have determined that portions of four sites have outfall areas that cannot be excavated safely with mechanical equipment because they are located on a steep slope, at the cliff edge, or on a bench below the cliff edge.

2.0 NATURE AND EXTENT DETERMINATION

Data collected during the Phase II investigation were evaluated in the Phase II investigation report (LANL 2008, 102760) to determine whether the vertical and lateral extent of contamination had been defined. Section 7.1 of the investigation report summarizes for each site the chemicals of potential concern (COPCs) for which extent of contamination is not defined. The sampling locations proposed to define the lateral and vertical extent of contamination that were not bounded during the Phase II investigation are presented in Figures 2 through 14, on Plate 1, and in Table 1.

Where lateral extent of a COPC is not defined, a sampling location will be placed 10 or 20 ft from the original location in the direction toward which lateral extent is not defined. Where vertical extent for a COPC is not defined, a sample may be collected immediately adjacent to the original sampling location to collect previously undisturbed material if a depth is being resampled and 4 to 5 ft deeper than the deepest depth previously sampled. The 4-ft-depth interval was selected to collect data within the risk profile for the construction worker and residential scenarios (i.e., 10 ft below ground surface [bgs]).

2.1 PROPOSED EXTENT SAMPLING

Sampling to define extent is proposed for the following sites listed in the Phase II investigation report.

- Consolidated Unit 21-003-99 and SWMU 21-024(c): lateral extent of cesium-137, nitrate, and tritium; vertical extent of chromium and copper (Figure 2, Table 1, locations 24c-1 through 24c-3). Copper was detected at location 21-25763 at 1.5 to 2 ft bgs at a concentration above background

(242 mg/kg; LANL 2008, 102760; Figure 6.3-13) but less than its corresponding soil screening level (SSL) (3130 mg/kg) without decreasing concentrations with depth. This location cannot be advanced deeper given the proximity of the sloped mesa edge. Therefore, a deeper sample will not be collected and analyzed for copper at this location.

- Consolidated Unit 21-006(c)-99: vertical extent of americium-241 and lateral extent of tritium (Figure 3, Table 1, locations 6c-1 and 6c-2).
- Consolidated Unit 21-022(h)-99: vertical extent of barium at SWMU 21-022(h). Reevaluation of the Phase II investigation report (LANL 2010, 110772.33, p. 25) supports the conclusion that vertical extent was previously defined for barium at location 21-605282 (total depth [TD] 10 ft); concentrations were not detected at the deepest depth sampled. However, lateral extent of barium is not defined west of this location from the 4- to 5-ft-depth interval and will be sampled for in this area (Figure 4, Table 1, location 22h-1). SWMU 21-022(i) is addressed in the building 21-002 footprint letter work plan (LANL 2011, 111603, Section 2.3). Extent is defined at SWMU 21-022(j) (LANL 2010, 110772.33, p. 25).
- Consolidated Unit 21-023(a)-99: vertical extent of several semivolatile organic compounds (SVOCs). Reevaluation of the Phase II investigation report (LANL 2010, 110772.33, p. 26) supports the conclusion that vertical extent was previously defined for SVOCs and plutonium-239 at location 21-601114 (TD 20 ft); these COPCs were not detected at the deepest depth sampled. However, as directed by NMED (2010, 110959), location 21-603010 will be resampled to confirm the presence of polyaromatic hydrocarbons (PAHs) from 3 to 4 ft and 5 to 6 ft bgs (Figure 5, Table 1, location 23a-1).
- SWMU 21-024(d): vertical extent of americium-241 and tritium (Figure 6, Table 1, location 24d-1). Reevaluation of the Phase II investigation report (LANL 2010, 110772.33, pp. 30–31) supports the conclusion that vertical extent was previously defined for SVOCs at location 19-601285 (TD 26 ft); SVOC concentrations were not detected at the deepest depth sampled.
- SWMU 21-024(g): vertical extent of isotopic uranium (Figure 7, Table 1, location 24g-1).
- SWMU 21-024(k): vertical extent of barium, calcium, and strontium. As stated in the Laboratory's response to comment 13 in NMED's notice of disapproval (LANL 2010, 110772.4), location 21-600859 could not be advanced deeper given the proximity of the sloped mesa edge; therefore, samples will not be analyzed for barium, calcium, or strontium at this location. Sample collection under the piping near DP East buildings will be completed per the DP East building footprints letter work plan (LANL 2010, 110082.4) (Figure 8, locations 52, 53, and 54). These locations are under piping running in the same trench as sampling locations A, B, 3, and 4, proposed in the original DP Site Aggregate Area investigation work plan (LANL 2005, 090225, Figure 5.14-3). Therefore, these locations will not be sampled during the Phase III investigation.
- SWMU 21-024(n): lateral extent of plutonium-239 and uranium-238 (Figure 9, Table 1, location 24n-1).
- Consolidated Unit 21-026(a)-99: lateral extent of calcium (Figure 10, Table 1, location 26a-1).
- AOC C-21-027: lateral extent of americium-241, calcium, chromium, dioxins/furans, isotopic plutonium, lead, nitrate, perchlorate, tritium, uranium-234, uranium-235, and zinc; vertical extent of americium-241, calcium, chromium, dioxins/furans, nitrate, perchlorate, and plutonium-239 (Figure 11, Table 1, locations C27-1 through C27-7).

3.0 CORRECTIVE ACTIONS AND/OR AREA EXTENT SAMPLING AT FIVE AGGREGATE AREA SITES AND THE DIESEL RELEASE SITE

Five sites were determined to pose potential unacceptable risk, hazard, or dose to human health under the industrial, residential, construction worker scenarios and/or the ecological scenario (LANL 2010, 110772.33, Appendix H). Three of these sites [SWMU 21-024(b), Consolidated Unit 21-024(l)-99, and SWMU 21-027(a)] will be remediated to levels that will reduce potential unacceptable risk, dose, or hazard to human health and ecological receptors (Tables 2 and 3, Figures 12, 13, and 14). Site remediation goals and acceptable risk, hazard, or dose levels are hazard index (HIs) equal to or less than 1 (NMED 2009, 108070), cancer risk equal to or less than 1E-05 (NMED 2009, 108070), and dose equal to or less than 15 mrem/yr (DOE 2000, 067489). At two of the five sites [Consolidated Units 21-022(h)-99 and 21-026(a)-99], a small amount of contaminated soil is interspersed with unstable, highly weathered, fractured bedrock on a steep slope or near the cliff edge. These areas are not accessible for soil removal and are discussed below.

Data presented in the Phase II investigation report were used to design the excavation areas. Previous sampling locations and depths used to determine the proposed excavation areas are presented in Table 4. Where necessary, new vertical and/or lateral sampling locations have been added to delineate areas above SSLs or screening action levels (SALs) (Table 1). For each corrective action site, the excavation areas and the total estimated volumes of soil to be removed at each location are provided in Table 2. The previous sampling locations to be removed from the sites are listed in Table 3.

Proposed corrective actions also take into consideration safety (personnel and equipment access and activity) and the likelihood of receptor exposure. At the four outfall areas of the sites [Consolidated Unit 21-022(h)-99, SWMU 21-024(b), Consolidated Unit 21-026(a)-99, and SWMU 21-027(a)] safety concerns for personnel and equipment preclude excavation activities. A photograph of each of these sites has been included in Appendix A. Sampling and/or excavation activities for each of the five sites are described below.

3.1 Consolidated Unit 21-022(h)-99

Appendix H of the Phase II investigation report (LANL 2010, 110772.33) concluded the following:

- Under the industrial scenario, potential unacceptable risk from benzo(a)pyrene and a potential unacceptable hazard from lead are present.
- Under the construction worker scenario, potential unacceptable hazard from lead and potential unacceptable dose from plutonium-239 are present.
- Under the residential scenario, potential unacceptable risk from benzo(a)pyrene, potential hazard from lead, and potential unacceptable dose from plutonium-239 are present.

One location will be sampled 10 ft east of the outfall area to delineate the area with detections of benzo(a)pyrene and plutonium-238 above the respective SSL/SAL (Figure 4, Table 1, location 22h-2). At this location, two depths will be sampled (0 to 0.5 ft and 1.5 to 2 ft) and analyzed for SVOCs and isotopic plutonium.

Risk, hazard, or dose levels are elevated because of the concentrations or activities of lead, benzo(a)pyrene, and plutonium-239 detected on the surface at the outfall area. The outfall contamination area is on a steep slope/cliff, with 45 to 90 degree slopes. This area consists of unstable, highly weathered, fractured bedrock with approximately 20% soil, filling fractures and voids between rocks (Appendix A, Photos 1 and 2). Fall-protection equipment was used when the Phase I and Phase II

samples were collected. The sampling method used during Phase I and Phase II biased sampling to collect only soil or sediment at locations 21-600239, 21-600241, 21-600242, and 21-600245 (Figure 4).

Extent has been defined for the outfall area, with decreasing trends laterally from the top of the outfall toward the bottom of the outfall and vertically with depth. Three analytes (benzo[a]pyrene, lead, and plutonium-239) detected within the outfall exceed industrial, construction worker, and/or residential SSLs and/or SALs. This area would likely not serve as an exposure area to residents, construction workers, or industrial workers for any length of time. Therefore, the exposure estimates used in the risk, hazard, or dose calculations (exposures ranging from 250 to 350 d/yr) are highly conservative for this site.

On May 9, 2011, TA-21 safety personnel conducted a site assessment to evaluate the use of mechanical excavation equipment, such as a small backhoe equipped with an 18-in. bucket, to remove the soil above SALs and/or SSLs at the outfall. Their assessment concluded that the use of mechanical excavation equipment to remove the small amount of soil/sediment interspersed with the bedrock at this location would not be an acceptable practice because of major concerns for personnel and equipment safety. First, workers would be working very near the edge of the canyon, and a fall-protection system would have to be designed, if possible, to sufficiently reduce the hazard risk to workers. Second, the mechanical equipment would also be located very near the edge of the mesa, and the stability of the rock/soil edge would be uncertain near the cliff edge where the contamination exists.

In conclusion, the outfall area cannot be excavated safely with mechanical equipment, and the likelihood of future receptor exposure to this area is low.

3.2 SWMU 21-024(b)

Appendix H of the Phase II investigation report (LANL 2010, 110772.33) concluded the following:

- Under the construction worker scenario, potential unacceptable dose from plutonium-239 and americium-241 is present.
- Under the residential scenario, potential unacceptable dose from plutonium-239 and americium-241 is present.

To reduce the potential dose to acceptable levels under the construction worker and residential exposure scenarios, soil will be excavated from under the septic tank inlet line north of DP Road from 5.5 to 7.5 ft bgs (excavation area A, 0 to 5.5 ft is fill, location 21-601088); 3.3 to 5.3 ft bgs (excavation area B, 0 to 3.3 ft bgs is fill, location 21-601089); at the inlet connection to the former septic tank from 5 to 8 ft bgs (excavation area C, 0 to 5 ft is fill, location 21-601091); and at the outlet connection to the former septic tank from 3.5 to 5.5 ft bgs (excavation area D, 0 to 1.5 ft bgs is fill, 1.5 to 2.5 ft bgs detections are below SALs, location 21-601090). One sample will be collected from 5.5 to 6 ft bgs under the excavation area D at location 21-601090 and analyzed for isotopic plutonium (Figure 12, Table 1, location 24b-1) to determine the excavation depth. To delineate the area with detections of americium-241 and isotopic plutonium above their respective SALs (Figure 12, Table 1, locations 24b-2 and 24b-3), locations will be sampled 20 ft west and 20 ft east of the outfall area at two depths (0 to 0.5 ft and 1.5 to 2 ft) and analyzed for americium-241 and isotopic plutonium.

Dose levels are elevated partially because of activities of americium-241 and plutonium-239 detected in the surface at the outfall area. The outfall contamination area is on a steep cliff, with 45 to 90 degree slopes. This area consists of unstable, highly weathered, fractured bedrock with approximately 20% soil, filling fractures and voids between rocks (Appendix A, Photo 3). Fall-protection equipment was used when samples were collected during Phase I and Phase II. The sampling method used during Phase I

and Phase II biased sampling for sediment or soil only at locations 21-600504, 21-600505, and 21-600512 (Figure 12).

Extent has been defined for the outfall area, with decreasing trends laterally from the top of the outfall toward the bottom of the outfall and vertically with depth. Two analytes (americium-241 and plutonium-239) detected within the outfall exceed construction worker and residential SALs. This area would likely not serve as an exposure area to residents or construction workers for any length of time. Therefore, the exposure estimates used in the dose calculations are highly conservative for this site (exposures ranging from 250 to 350 d/yr).

On May 9, 2011, TA-21 safety personnel conducted a site assessment to evaluate the use of mechanical excavation equipment, such as a small backhoe equipped with an 18-in. bucket, to remove the soil above SALs at the outfall. Their assessment concluded that the use of mechanical excavation equipment to remove the small amount of soil or sediment interspersed with the bedrock at this location would not be an acceptable practice because of major concerns for personnel and equipment safety. First, workers would be working very near the edge of the canyon, and a fall-protection system would have to be designed, if possible, to sufficiently reduce the hazard risk to workers. Second, the mechanical equipment would also be located very near the edge of the mesa, and the stability of the rock/soil edge would be uncertain near the cliff edge where the contamination exists.

In conclusion, the outfall area cannot be excavated safely with mechanical equipment, and the likelihood of future receptor exposure to this area is low.

3.3 Consolidated Unit 21-024(l)-99

Appendix H of the Phase II investigation report (LANL 2010, 110772.33) concluded the following:

- Under the residential scenario, potential unacceptable risk from benzo(a)pyrene is present.

To reduce the potential risk to acceptable levels under the residential scenario, two areas will be excavated from 2 to 4 ft and 2.5 to 4.5 ft at locations 21-27520 and 21-27521, respectively (Figure 13, Tables 2 and 3, excavation areas E and F, 0 to 2 ft and 0 to 2.5 ft are fill).

3.4 Consolidated Unit 21-026(a)-99

Appendix H of the Phase II investigation report (LANL 2010, 110772.33) concluded the following:

- Under the industrial scenario, potential unacceptable risk from benzo(a)pyrene is present.
- Under the residential scenario, potential unacceptable risk from dibenz(a,h)anthracene is present.

In the investigation report, residential SSLs instead of construction worker SSLs were inadvertently used at Consolidated Unit 21-026(a)-99. This error resulted in a higher risk to the construction worker since residential SSLs are more conservative than construction worker SSLs. Therefore, the construction worker risk is not carried forward in this work plan.

Risk levels are elevated because of SVOCs concentrations detected in the surface at the outfall area. The outfall contamination area is on a steep slope (approximately 30 degrees). This area consists of unstable, highly weathered, fractured bedrock with approximately 30% soil, filling fractures and voids between rocks (Appendix A, Photo 4). Fall-protection equipment was used when samples were collected during Phase I and Phase II. The sampling method used during Phase I and Phase II biased sampling for sediment only at locations 21-27576 and 21-27579 (Figure 10).

Extent has been defined for the outfall area, with decreasing trends laterally from the top of the outfall toward the bottom of the outfall and vertically with depth. Two analytes (benzo[a]pyrene and dibenz[a,h]anthracene) detected within the outfall exceed residential or industrial SSLs. This area would likely not serve as an exposure area to residents or industrial workers for any length of time. Therefore, the exposure estimates used in the risk calculations are highly conservative for this site (exposures ranging from 250 to 350 d/yr).

On May 9, 2011, TA-21 safety personnel conducted a site assessment to evaluate the use of mechanical excavation equipment, such as a small backhoe equipped with an 18-in. bucket, to remove the soil above SSLs at the outfall. Their assessment concluded that the use of mechanical excavation equipment to remove the small amount of soil/sediment interspersed with the bedrock at this location would not be an acceptable practice because of major concerns for personnel and equipment safety. First, workers would be working very near the edge of the canyon, and a fall-protection system would have to be designed, if possible, to sufficiently reduce the hazard risk to workers. Second, the mechanical equipment would also be located very near the edge of the mesa, and the stability of the rock/soil edge would be uncertain near the cliff edge where the contamination exists.

In conclusion, the outfall area cannot be excavated safely with mechanical equipment, and the likelihood of future receptor exposure to this area is low. Therefore, excavation will not be conducted in the outfall.

3.5 SWMU 21-027(a)

Appendix H of the Phase II investigation report (LANL 2010, 110772.33) concluded the following:

- Under the industrial scenario, potential unacceptable risk from dioxins/furans is present.
- Under the construction worker scenario, potential unacceptable hazard from dioxins/furans and potential unacceptable dose from isotopic plutonium are present.
- Under the residential scenario, potential unacceptable risk from dioxins/furans and potential unacceptable dose from isotopic plutonium are present.
- For ecological receptors, potential unacceptable ecological risks from dioxins/furans to the deer mouse and montane shrew are present.

To reduce the potential risk, hazard, or dose to acceptable levels under the industrial, construction worker, residential, and ecological exposure scenarios, soil will be excavated from 2.5 to 4.5 ft bgs from location 21-601226 (Figure 14, Tables 2 and 3, excavation area G, 0 to 2.5 ft is fill) and 1 to 4 ft bgs at the ponding area between locations 21-601225 and 21-601228 (Figure 14, Tables 2 and 3, excavation area H, 0 to 1 ft is fill). One sample will be collected from 4 to 5 ft bgs under the excavated area at location 21-601229 and analyzed for dioxins/furans and isotopic plutonium (Figure 14, Table 1, location 27a-1) to determine the excavation depth of 4 ft bgs. If these results are elevated above the respective SSL or SAL, the depth of the excavation area will be increased as appropriate. To delineate the area with detections of dioxins/furans and isotopic plutonium above their respective SSLs/SALs, locations will be sampled 10 ft west and 10 ft east of excavation area H (Figure 14, Table 1, locations 27a-2 and 27a-3) at two depths (1 to 2 ft and 4 to 5 ft) and analyzed for dioxins/furans and isotopic plutonium. If these results are elevated above the respective SSLs/SALs, the width of the excavation area will be increased as appropriate. Locations will be sampled 20 ft west and 20 ft east of the outfall area (Figure 14, Table 1, locations 27a-4 and 27a-5) at two depths (0 to 0.5 ft and 1.5 to 2 ft) and analyzed for dioxins/furans and isotopic plutonium to delineate the area with detections above SSLs/SALs.

Risk, hazard, or dose levels are elevated partially because of concentrations or activities of dioxins/furans and isotopic plutonium detected in the surface at the outfall area. The outfall contamination area is on a

steep cliff, with 45 to 90 degree slopes. This area consists of unstable, highly weathered, fractured bedrock with approximately 15% soil, filling fractures and voids between rocks (Appendix A, Photo 5). Fall-protection equipment was used when samples were collected during Phase I and Phase II. The sampling method used during Phase I and Phase II biased sampling to collect only soil/sediment at all locations at the outfall (Figure 14).

Extent has been defined for the outfall area, with decreasing trends from the top of the outfall toward the bottom of the outfall and with depth. Two analytes (dioxins/furans and plutonium-239) detected within the outfall exceed industrial, construction worker, and/or residential SSLs/SALs. Dioxins/furans pose a potential ecological risk at the outfall. The area is not open for use and is not suitable as a future building site. In addition, the area would likely not serve as an exposure area to residents, construction workers, or industrial workers for any length of time. Therefore, the exposure estimates used in the risk, hazard, or dose calculations are highly conservative for this site (exposures ranging from 250 to 350 d/yr).

On May 9, 2011, TA-21 safety personnel conducted a site assessment to evaluate the use of mechanical excavation equipment, such as a small backhoe equipped with an 18-in. bucket, to remove the soil above SALs and/or SSLs at the outfall. Their assessment concluded that the use of mechanical excavation equipment to remove the small amount of soil/sediment interspersed with the bedrock at this location would not be an acceptable practice because of major concerns for personnel and equipment safety. First, workers would be working very near the edge of the canyon, and a fall-protection system would have to be designed, if possible, to sufficiently reduce the hazard risk to workers. Second, the mechanical equipment would also be located very near the edge of the mesa, and the stability of the rock/soil edge would be uncertain near the cliff edge where the contamination exists.

In conclusion, the outfall area cannot be excavated safely with mechanical equipment, and the likelihood of future receptor exposure to this area is low.

3.6 Diesel Fuel Spill from Aboveground Storage Tank 21-57

The diesel spill from the aboveground storage tank (structure 21-57), located at the former steam plant (building 21-357), will be remediated (Plate 1). This tank was installed in early 1945 to store fuel oil to supply the old central steam plant, building 21-9. In 1986, the new steam plant, building 21-357, replaced building 21-9. The fuel tank, steam plant 21-357, and fuel lines have been removed. In January 2002, it was discovered that only 3-in. of fuel remained in the tank rather than the previous inventory readings that indicated the tank contained 128-in. of fuel. After investigation, it was found that small leaks had occurred in the supply fuel-oil pipeline between the tank and the plant, resulting in soil contamination (Plate 1, locations S/R-1 through S/R-13, supply line trench samples). Excavation area I (Plate 1) was excavated previously in 2002. Four composite samples were collected (Plate 1, locations JPA-1 through JPA-4) in a 2-ft radius on four sides of the excavated region. The lateral extent of total petroleum hydrocarbons–diesel range organics (TPH-DRO) was defined; however, soil excavated from the area was placed back into the ground until remediation activities could be planned (Baumgartner et al. 2003, 201613, p. A2-2).

Plate 1 shows the TPH-DRO concentrations detected above the NMED TPH-screening guideline of 520 mg/kg (NMED 2006, 094614) for diesel fuel #2 within 10 ft bgs (validated and screening-level data, Shaw 2003, 110706, Appendix A). As recommended by NMED (2010, 110959), TPH-DRO contamination detected within 10 ft of the surface at concentrations above the TPH-screening guideline will be removed (Plate 1, Tables 2 and 3, excavation areas I and J). Vertical extent is not defined at excavation areas I and J; therefore, samples will be collected at locations D-1 and D-2 from 9 to 10 ft bgs to define extent (Table 1, Plate 1). Analytical data associated with angled boreholes 1 and 2 drilled in 2002–2003 indicate contamination also exists under the building footprint (Figure 15 [from Stanton 2005, 201612]). Therefore,

samples will be collected in these areas to determine extent under the slab from 0 to 1 ft, 5 to 6 ft, 9 to 10 ft, and 14 to 15 ft bgs (Plate 1, Table1, locations D-3 through D-6). If the extent of TPH-DRO, SVOCs, or volatile organic compounds (VOCs) is not defined by decreasing concentrations with depth or laterally, additional samples will be collected at 5-ft intervals laterally and vertically until extent is defined. Excavation area K depth and width will be determined by the sampling results obtained from locations D-3 through D-6. SVOCs and VOCs will be analyzed from samples within 10 ft bgs to determine which organic chemicals coincide with the diesel spill excavation areas.

4.0 SCHEDULE

The Laboratory intends to start Phase III work after completion of field work at the delayed sites Consolidated Unit 21-004(b)-99, SWMU 21-011(b), and DP East building footprints and complete it by the end of fiscal year 2011, September 30, 2011. Validated data will be received approximately 60 days after completion of field work. The Laboratory will perform risk-screening assessments on the sites remediated in this plan and submit the Phase III investigation report 5 mo after the validated data are received, in April 2012. The Phase III investigation report will present all Phase I, Phase II, and Phase III data in the figures and in table format for the sites investigated in this work plan, except for the diesel fuel spill site. The Phase III investigation report will discuss only the results of the Phase III sampling effort and will include a risk-screening assessment that includes all Phase I, II, and III data.

The field activities prescribed for the diesel fuel spill site will be implemented during the DP West field activities and reported in the investigation report for Consolidated Unit 21-022(b)-99, Material Disposal Area T, and DP West building footprints, to be completed in 2014.

5.0 REFERENCES

The following list includes all documents cited in this work plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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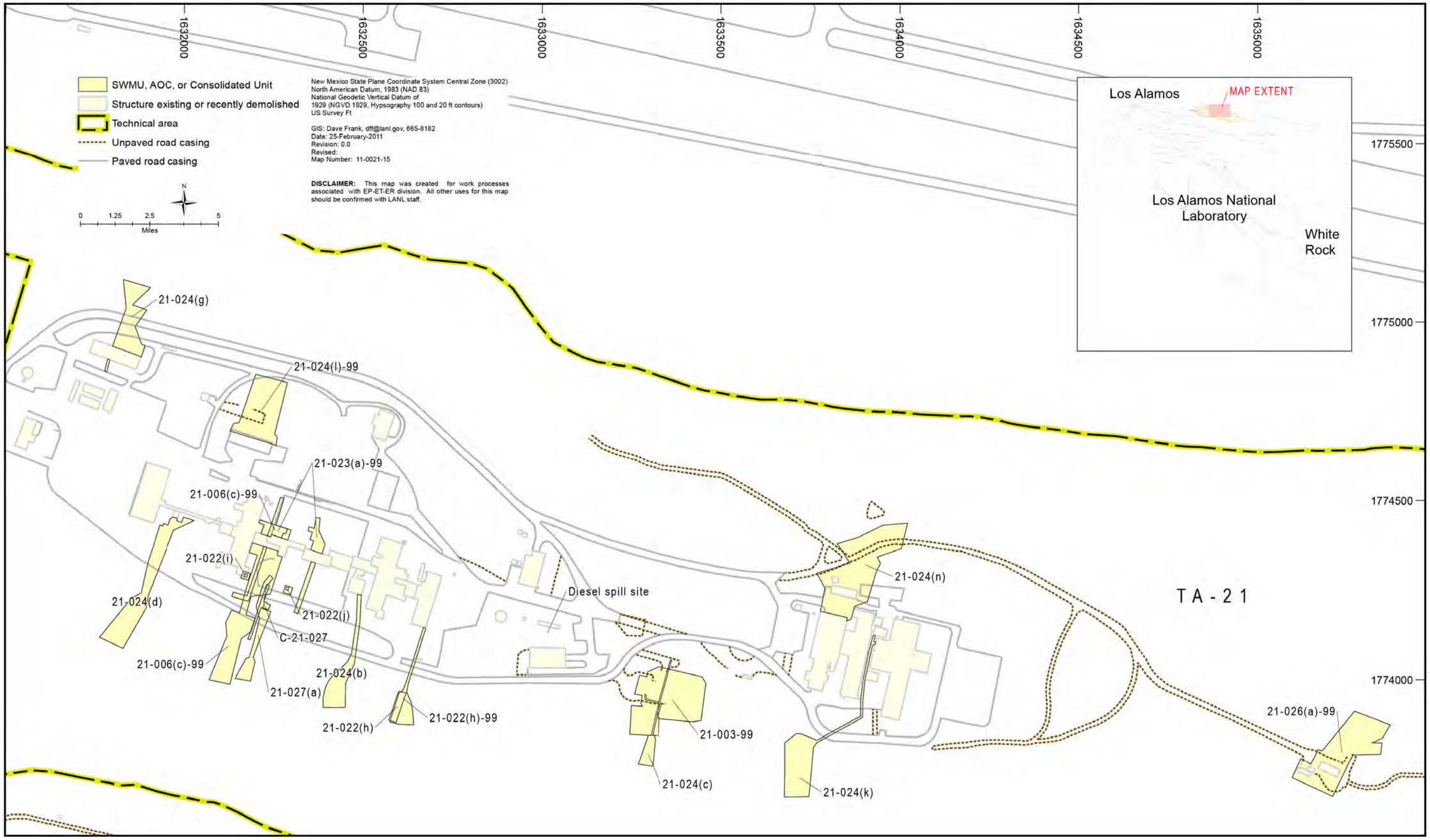

Figure 1 Sites addressed in this work plan

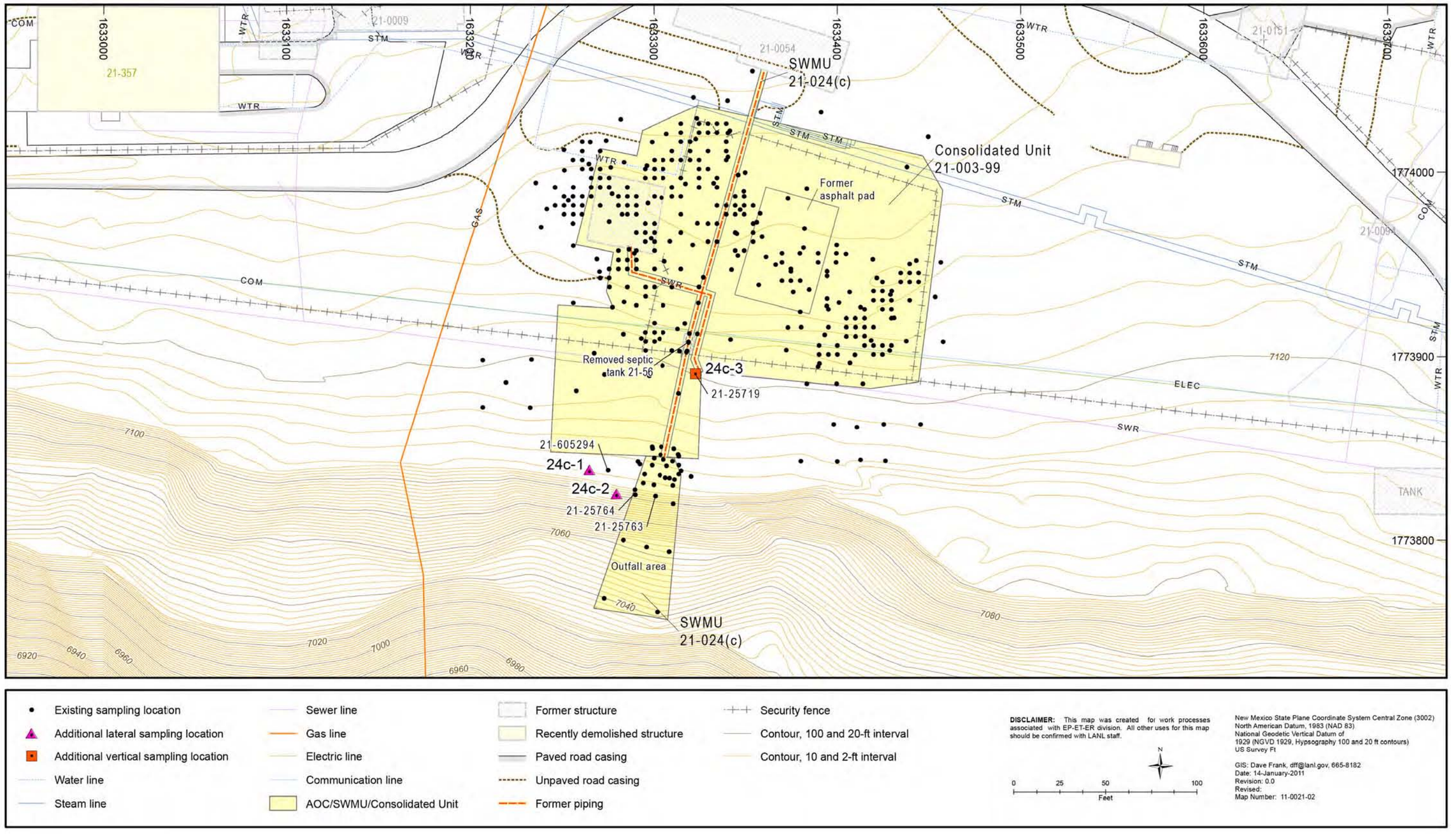

Figure 2 Proposed sampling locations at Consolidated Unit 21-003-99 and SWMU 21-024(c)

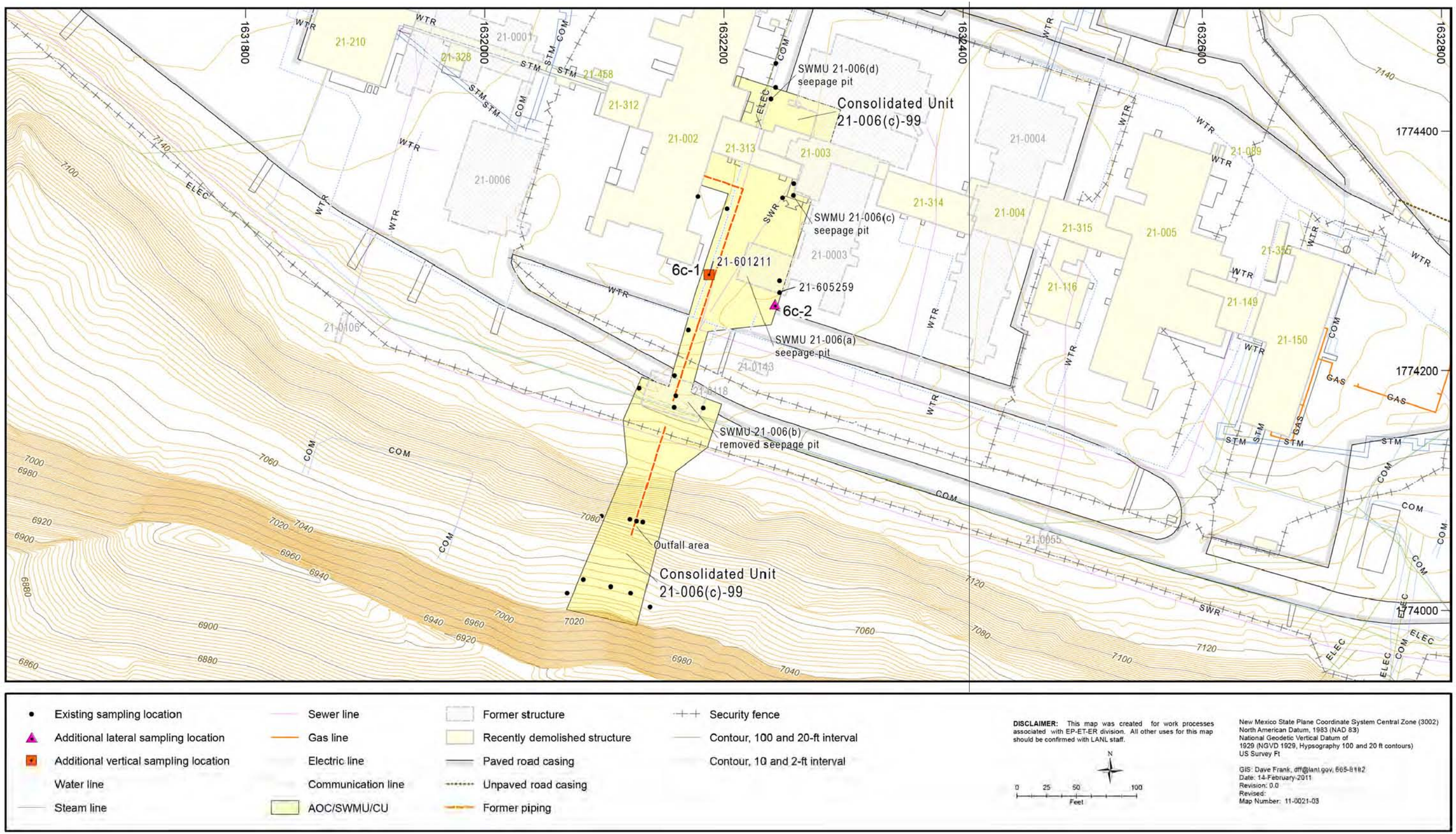

Figure 3 **Proposed sampling locations at Consolidated Unit 21-006(c)-99**

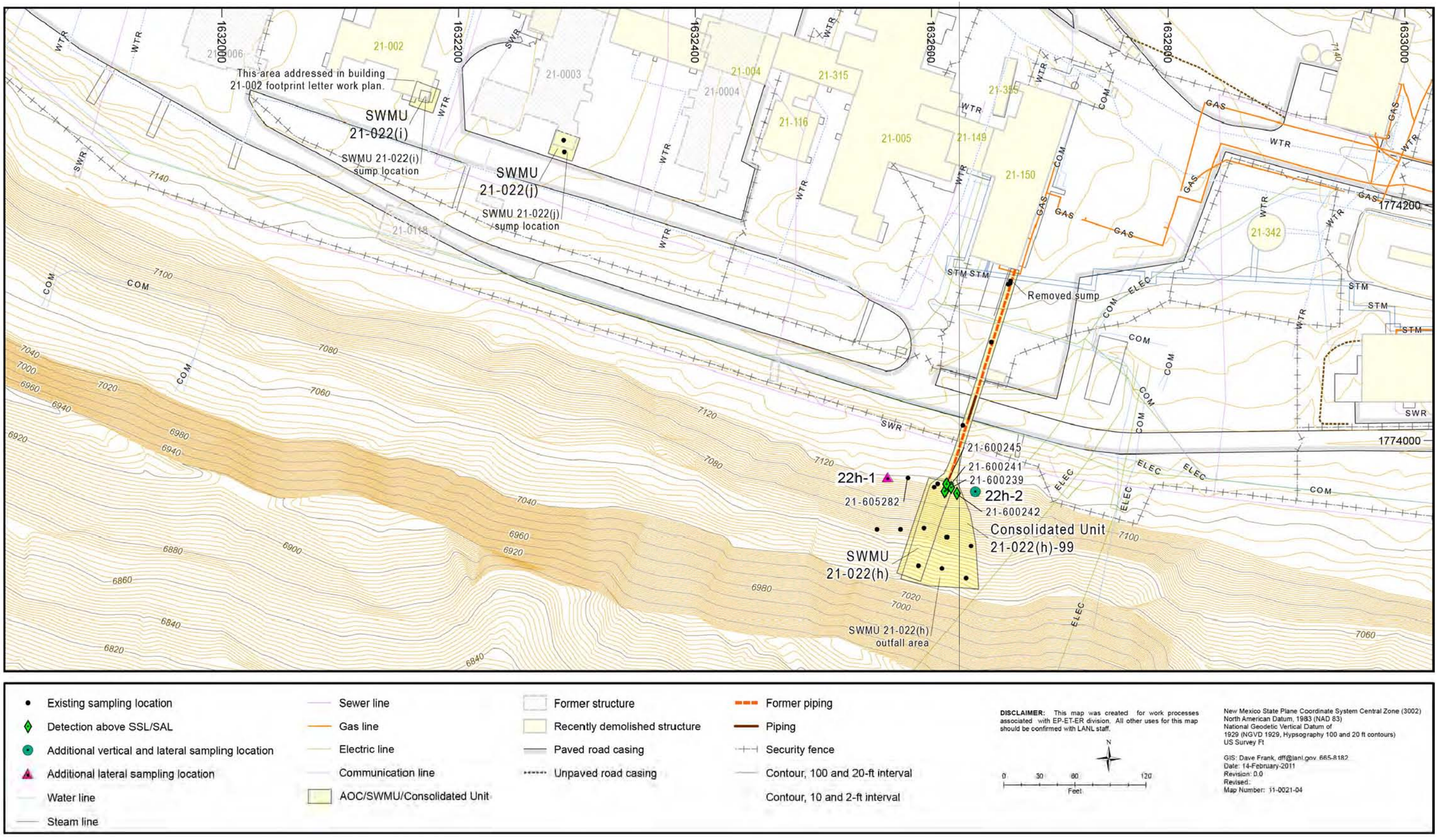

Figure 4 Proposed sampling locations and excavation area at Consolidated Unit 21-022(h)-99

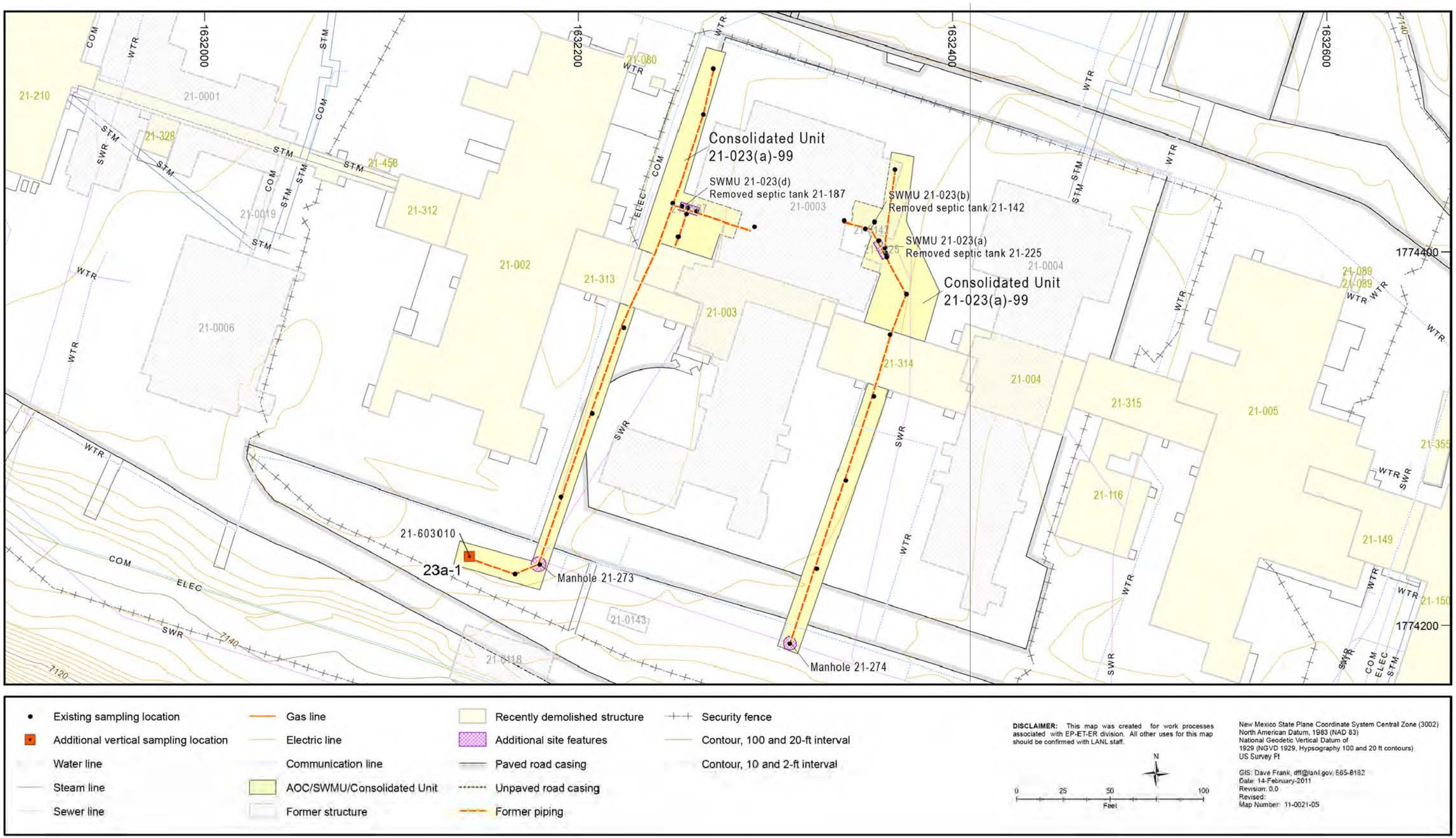

Figure 5 Proposed sampling locations at Consolidated Unit 21-023(a)-99

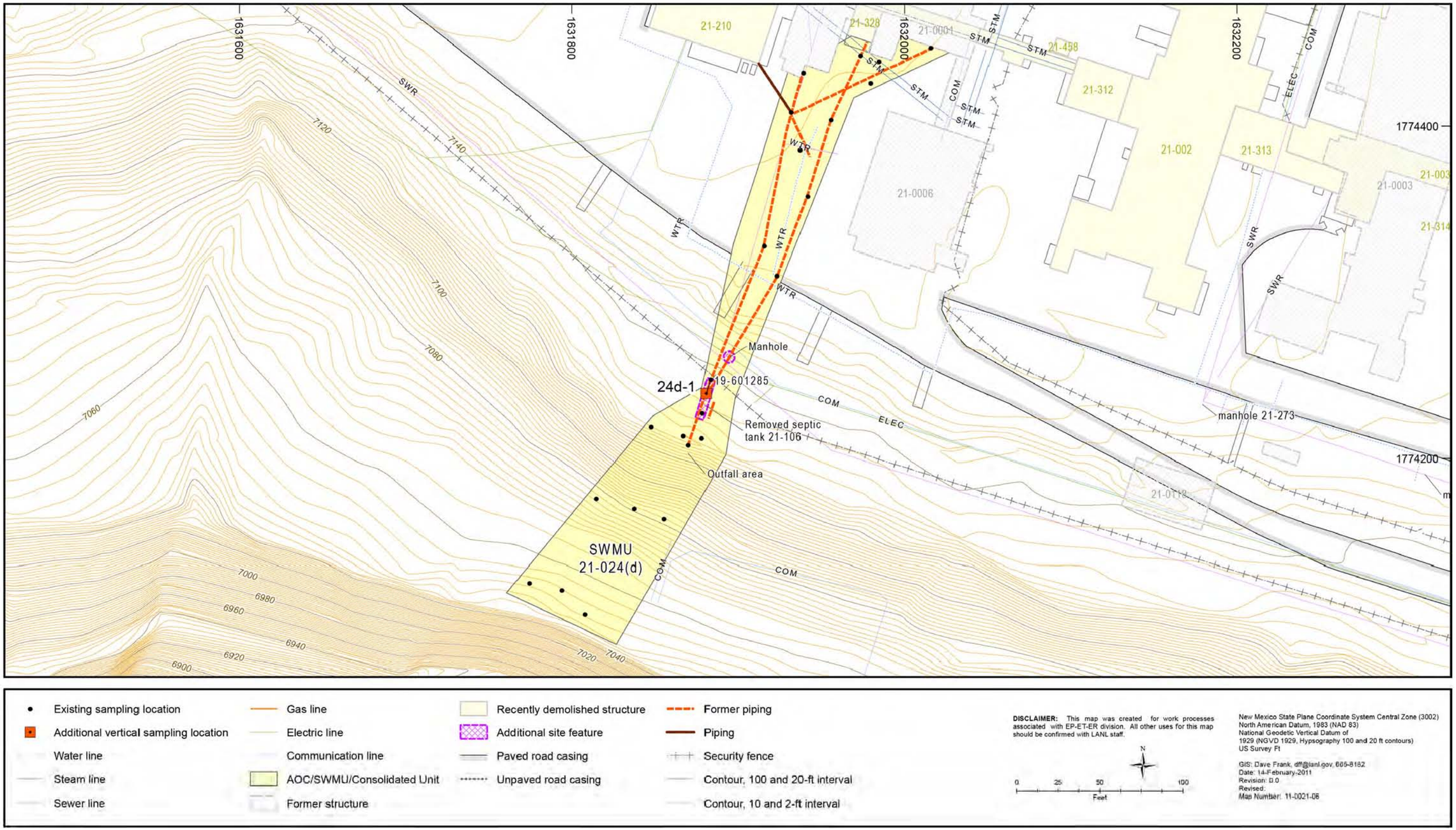

Figure 6 Proposed sampling locations at SWMU 21-024(d)

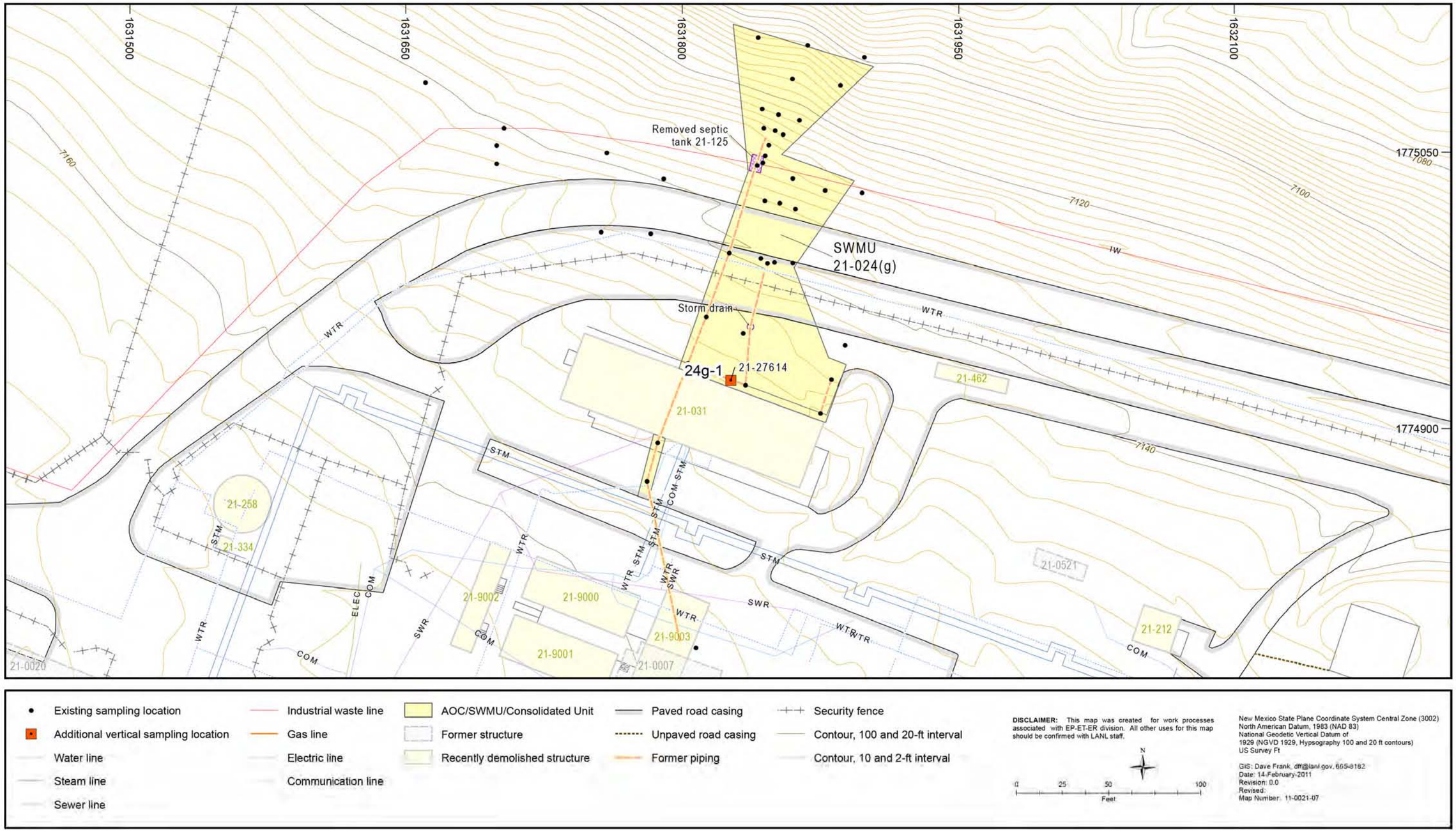

Figure 7 Proposed sampling locations at SWMU 21-024(g)

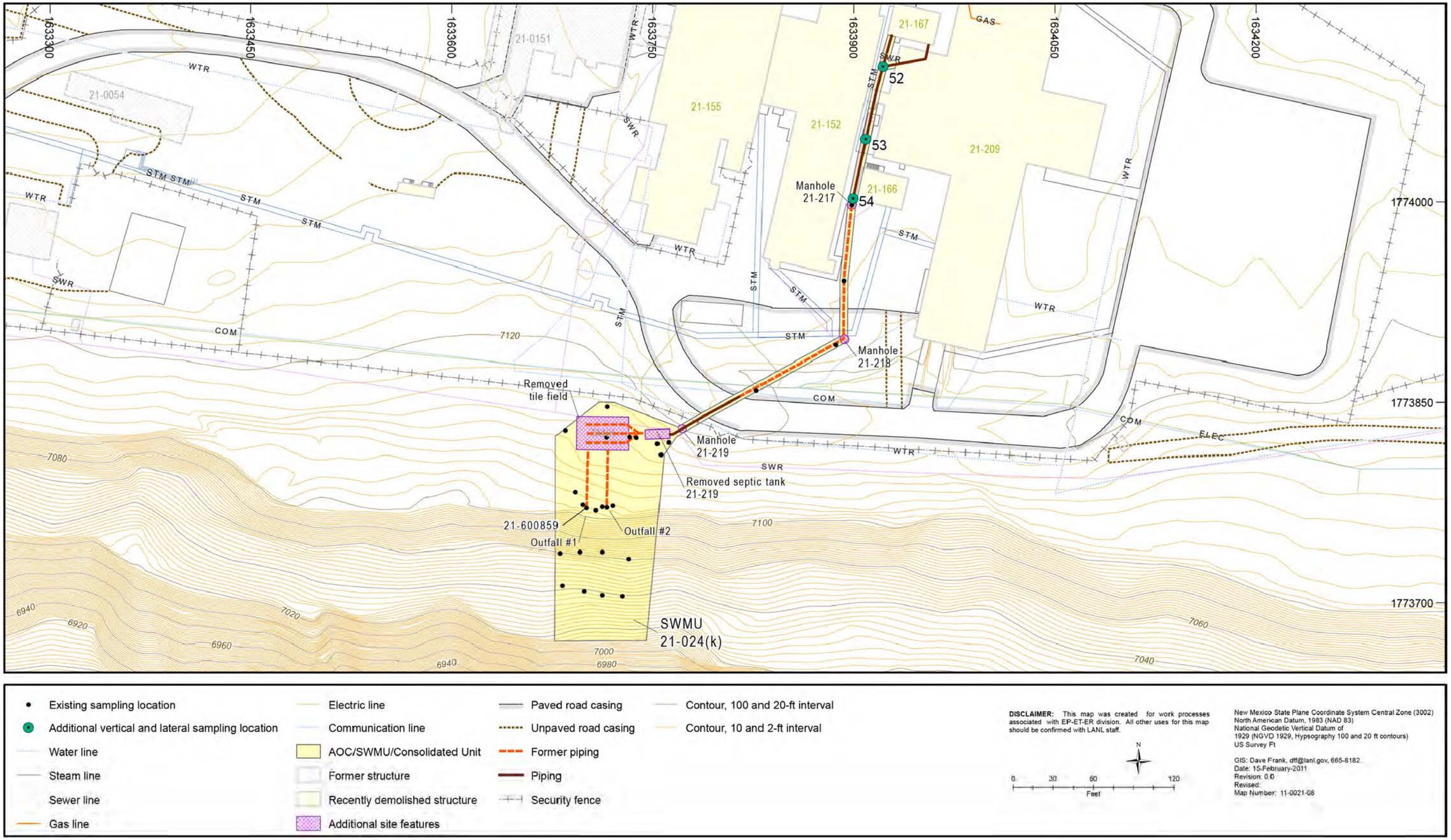

Figure 8 Proposed sampling locations at SWMU 21-024(k)

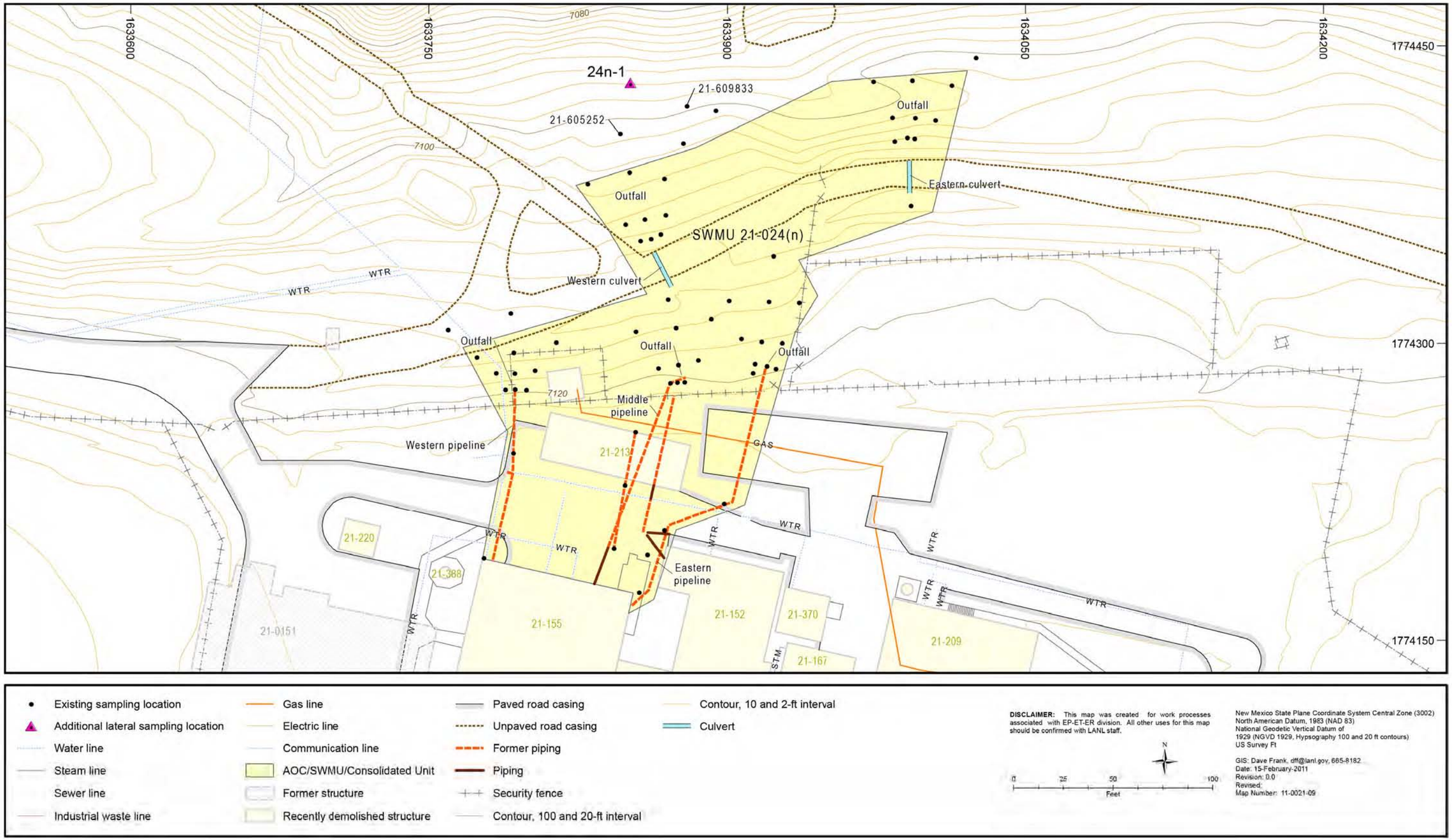

Figure 9 Proposed sampling locations at SWMU 21-024(n)

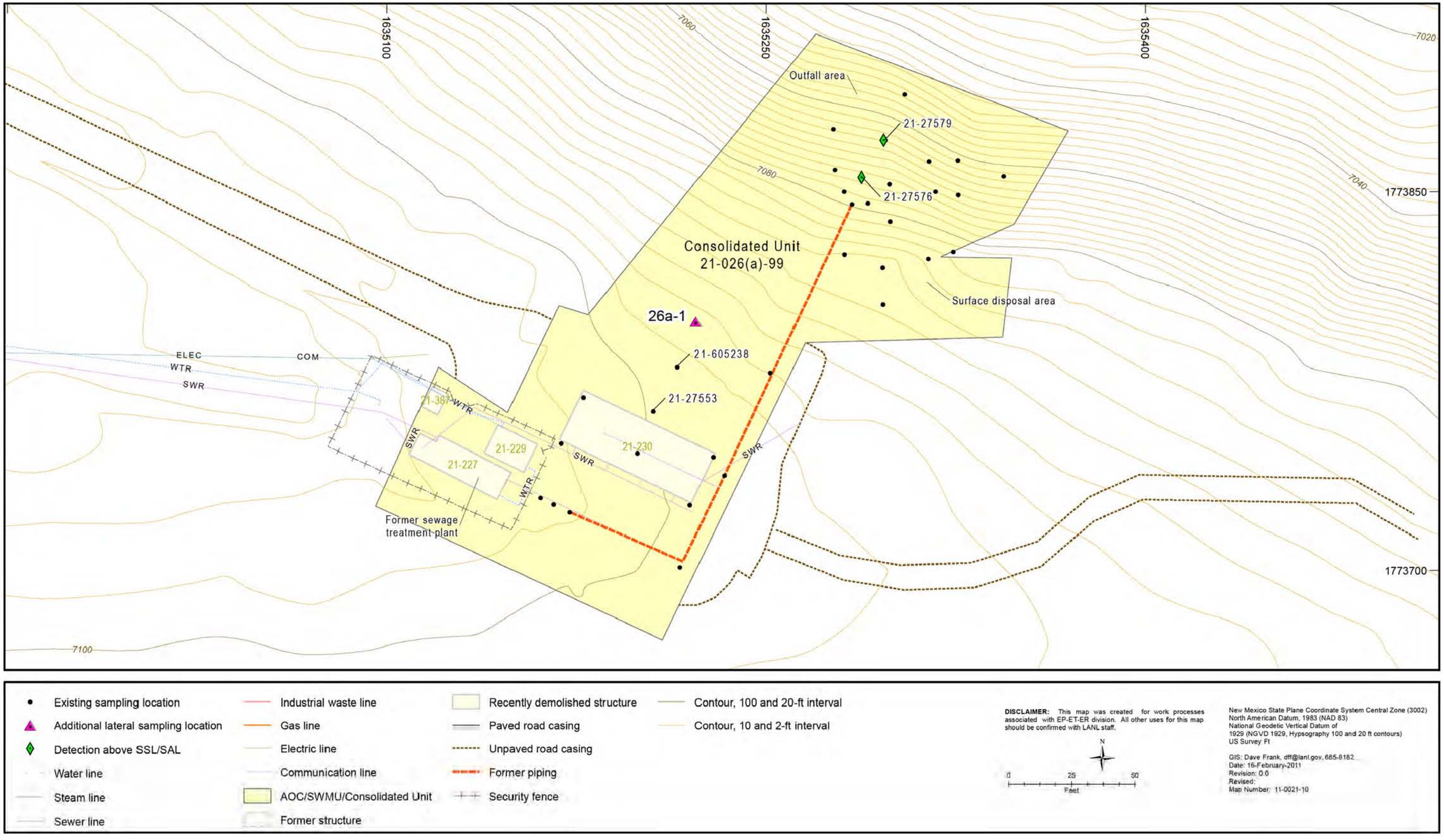

Figure 10 Proposed sampling locations at Consolidated Unit 21-026(a)-99

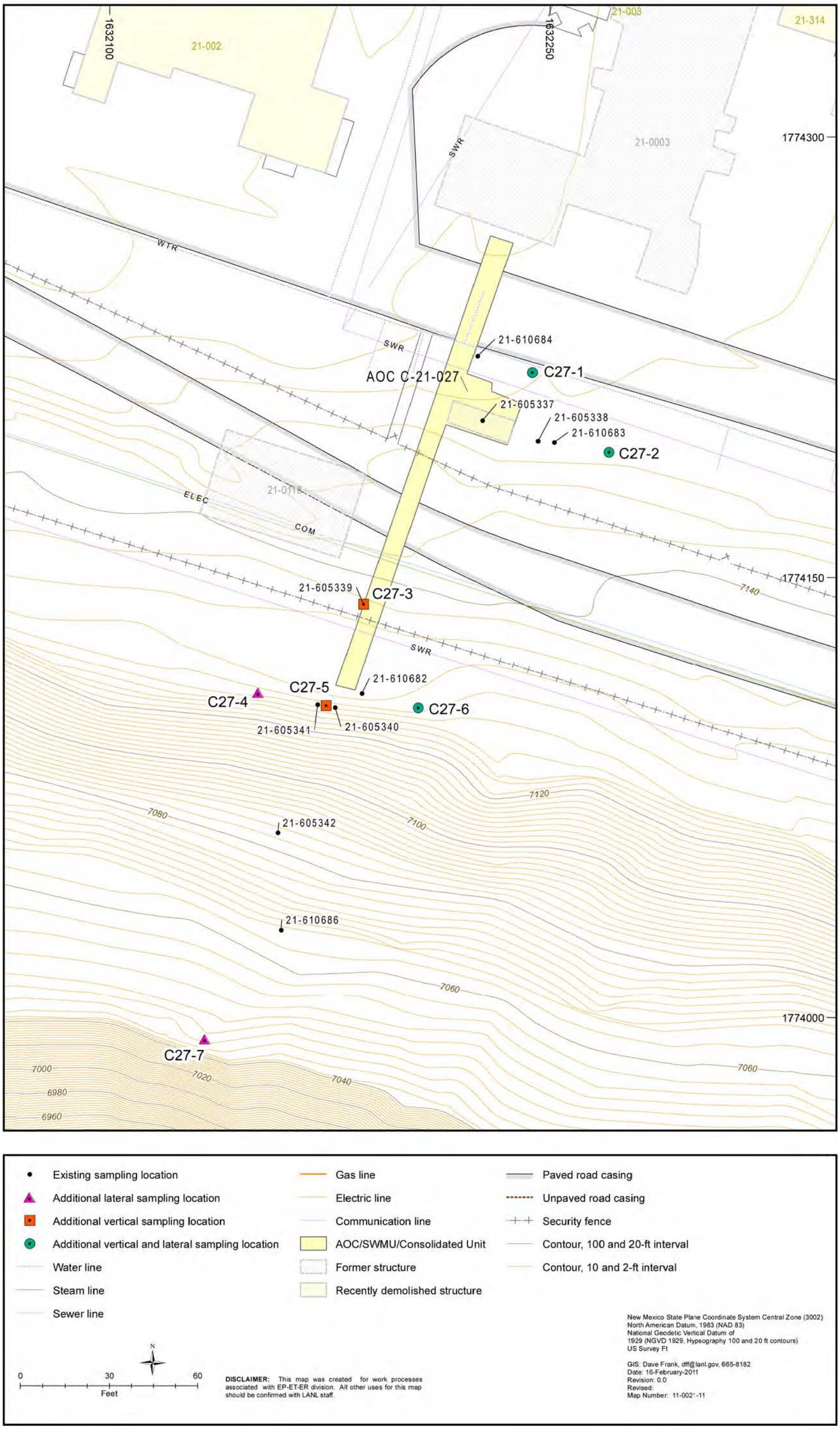

Figure 11 Proposed sampling locations at AOC C-21-027

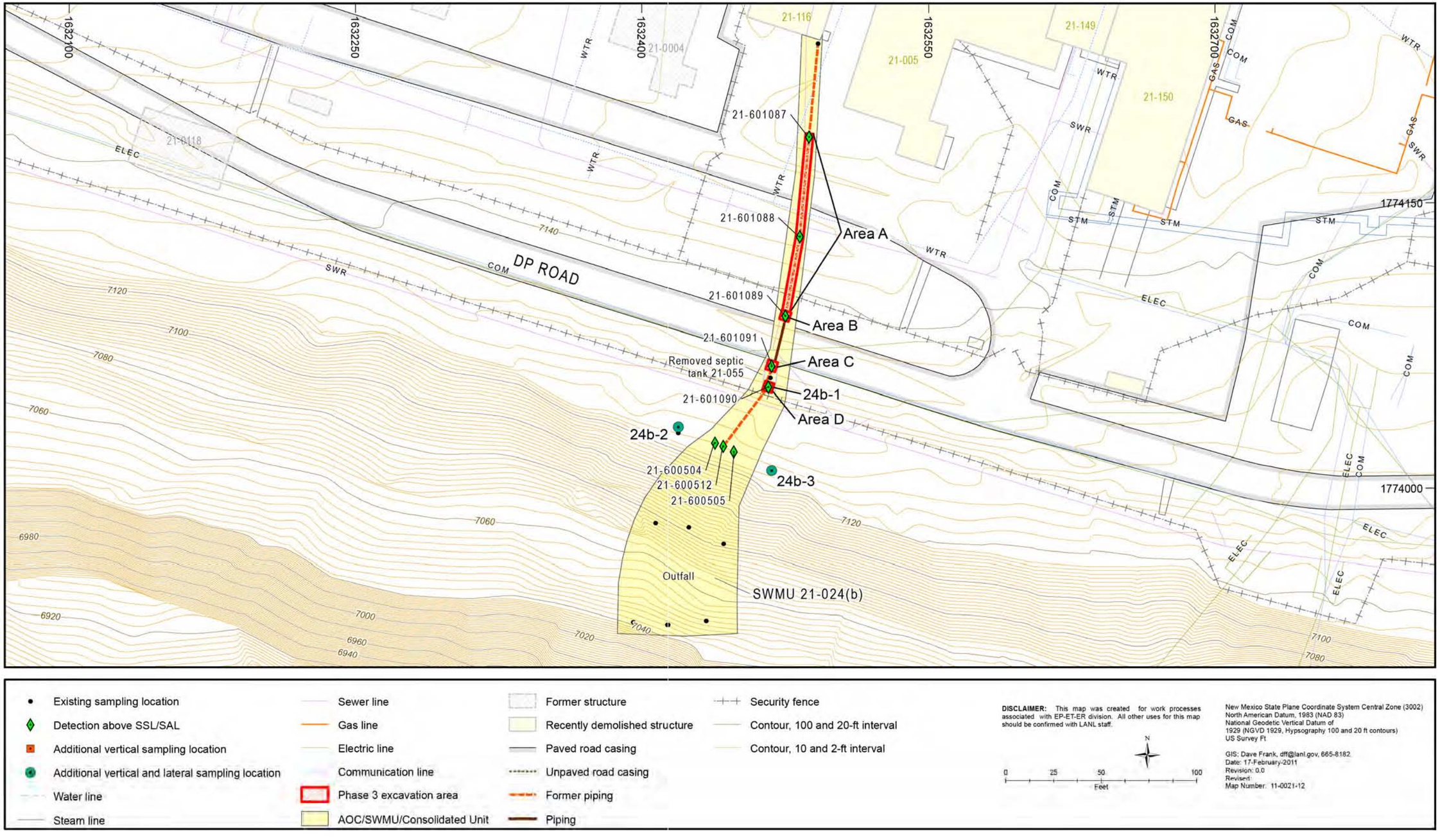

Figure 12 Proposed excavation areas at SWMU 21-024(b)

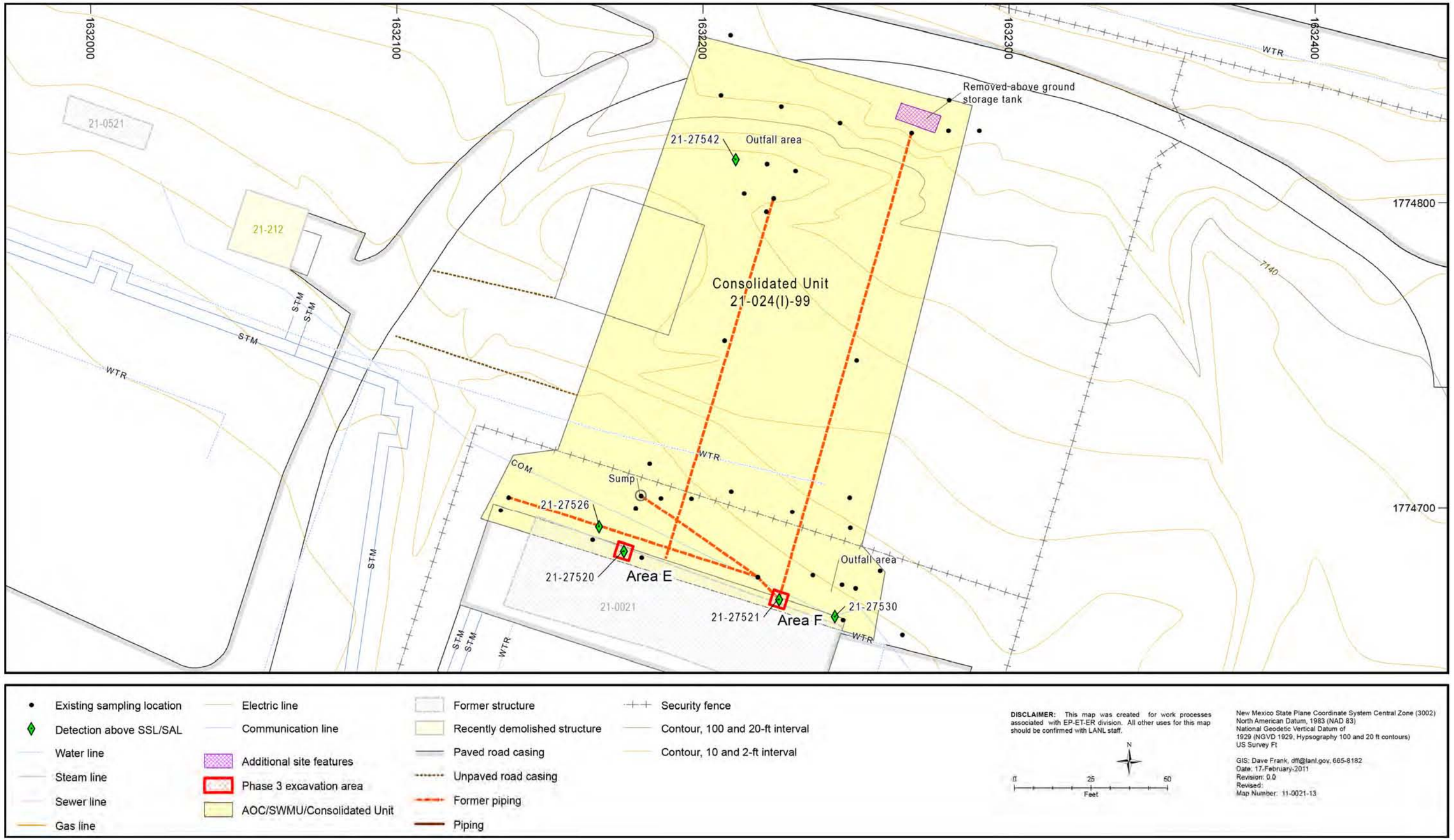

Figure 13 Proposed excavation areas at Consolidated Unit 21-024(I)-99

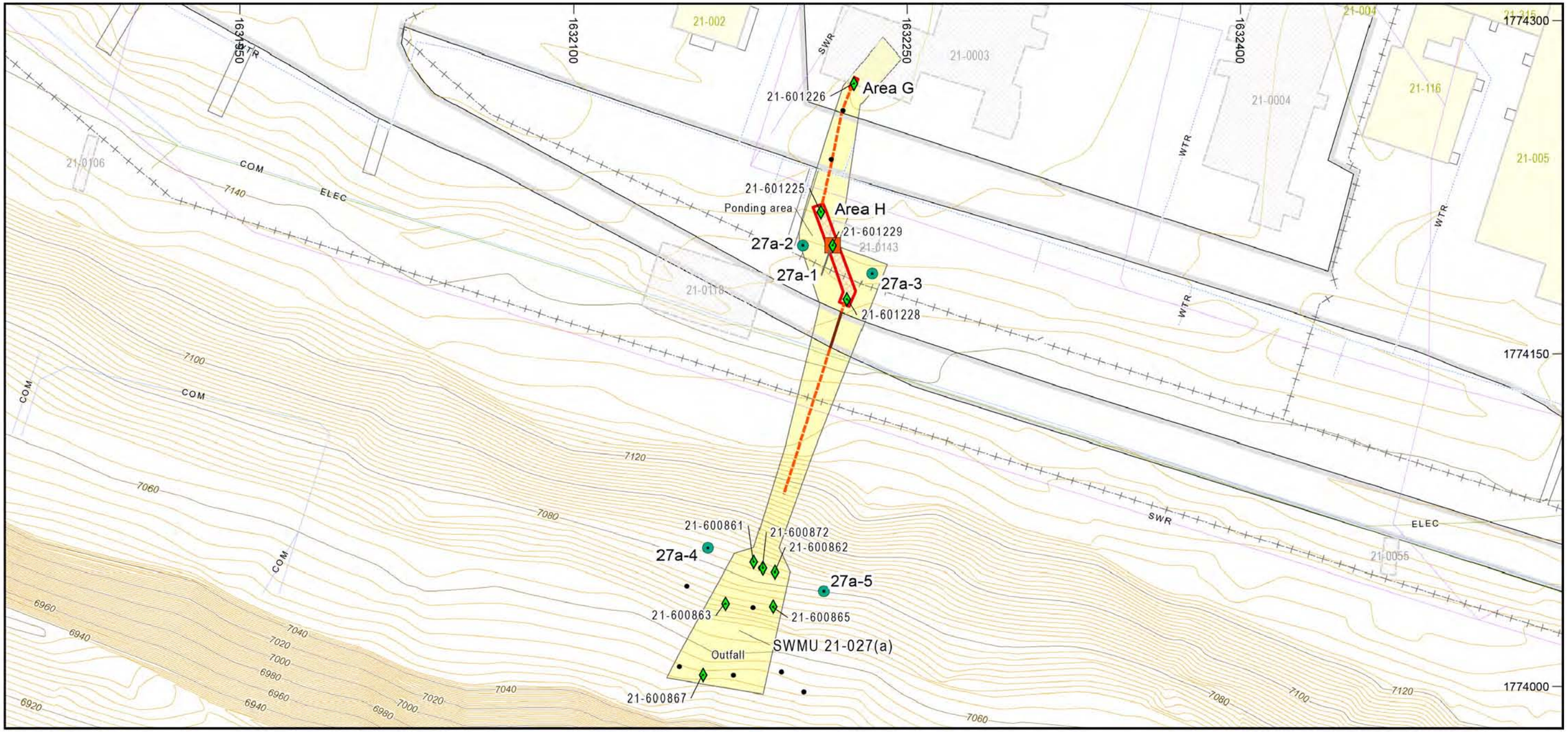

Figure 14 Proposed sampling locations and excavation areas at SWMU 21-027(a)

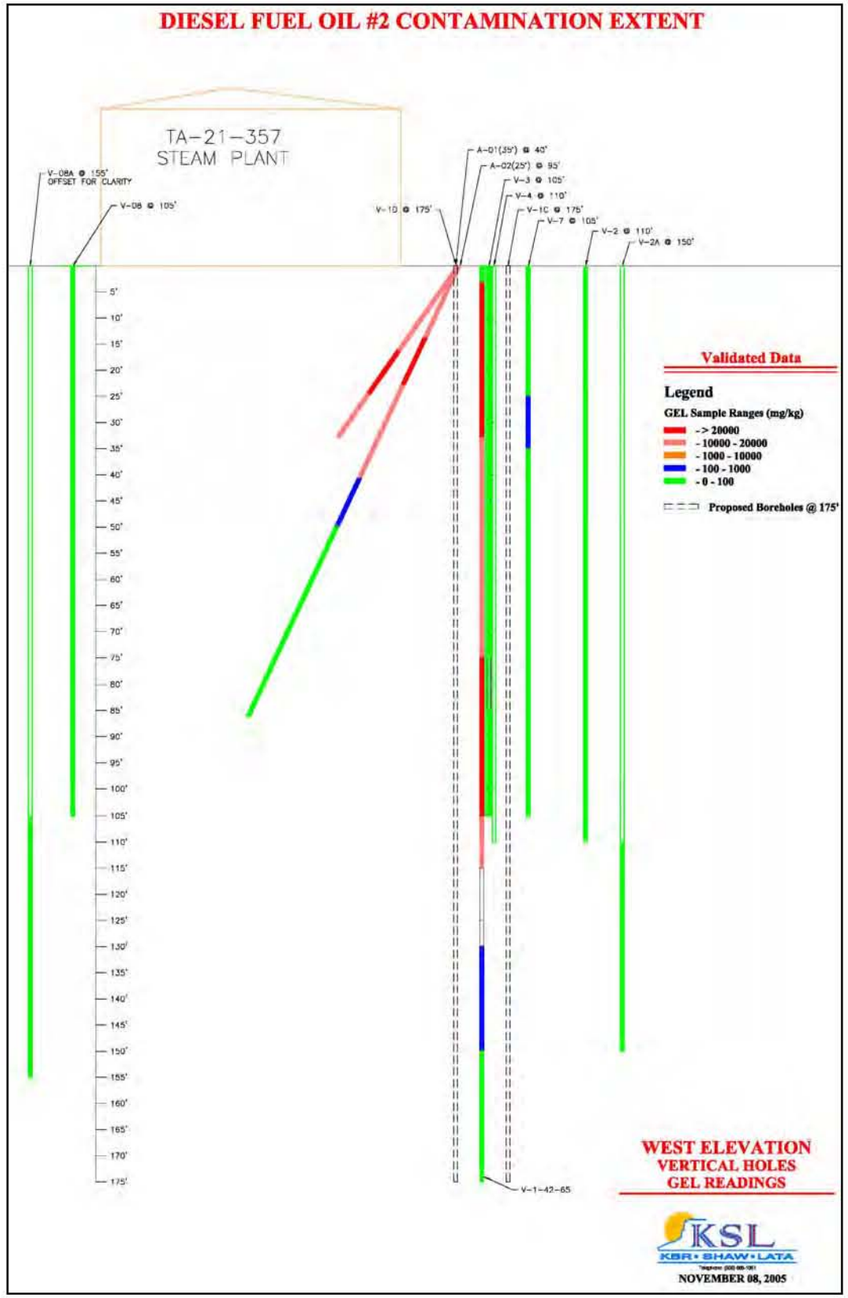

Figure 15 Diesel contamination under building 21-357

Table 1
Proposed Extent Sampling

SWMU/AOC/ Consolidated Unit	Sampling Location and Figure	Proposed Sampling Location	Sample Depth (ft bgs)	Analyses	Sampling Objective	
21-003-99 and 21-024(c)	Location 24c-1, Figure 2	New, 20 ft west of location 21-605294	0–0.5	Nitrate	Lateral extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
	Location 24c-2, Figure 2	New, 20 ft west of location 21-25764	0–0.5 and 1.5–2	Cesium-137 and tritium	Lateral extent	
	Location 24c-3, Figure 2	Location 21-25719	14–15	Chromium	Vertical extent	
21-006(c)-99	Location 6c-1, Figure 3	Location 21-601211	13–14	Americium-241	Vertical extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
	Location 6c-2, Figure 3	New, 10 ft south of location 21-605259	3–4, 8–9, and 18–19	Tritium	Lateral extent	
21-022(h)-99	Location 22h-1, Figure 4	New, 10 ft west of location 21-605282	4–5	Barium	Lateral extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
	Location 22h-2, Figure 4	New, 10 ft east of outfall area	0–0.5 and 1.5–2	SVOCs and isotopic plutonium	Delineate area above SSLs/SALs	Necessary for contamination extent
21-023(a)-99	Location 23a-1, Figure 5	Immediately adjacent and downslope of location 21-603010	3–4 and 5–6	SVOCs	Vertical extent	Requested in NMED modification letter (NMED 2010, 110959)
21-024(b)	Location 24b-1, Figure 12	Location 21-601090	5.5–6	Isotopic plutonium	Determine excavation depth	Necessary for contamination extent
	Location 24b-2, Figure 12	20 ft west of outfall	0–0.5 and 1.5–2	Americium-241 and isotopic plutonium	Lateral and vertical extent	
	Location 24b-3, Figure 12	20 ft east of outfall	0–0.5 and 1.5–2	Americium-241 and isotopic plutonium	Lateral and vertical extent	
21-024(d)	Location 24d-1, Figure 6	Immediately adjacent and downslope of location 19-601285	25–26	Americium-241 and tritium	Vertical extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)

Table 1 (continued)

SWMU/AOC/ Consolidated Unit	Sampling Location and Figure	Proposed Sampling Location	Sample Depth (ft bgs)	Analyses	Sampling Objective	
21-024(g)	Location 24g-1, Figure 7	Immediately adjacent and downslope of location 21-27614	9–10	Isotopic uranium	Vertical extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
21-024(n)	Location 24n-1, Figure 9	New, 20 ft downslope of western outfall (locations 21-609833 and 21-605252)	0–0.5	Isotopic uranium and isotopic plutonium	Lateral extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
21-026(a)-99	Location 26a-1, Figure 10	New, 20 ft north of location 21-605238	9–10	Calcium	Lateral extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
21-027(a)	Location 27a-1, Figure 14	Immediately adjacent and downslope of location 21-601229	4–5	Dioxins/furans and isotopic plutonium	Determine excavation depth	Necessary for contamination extent
	Location 27a-2, Figure 14	New, 10 ft west of excavation area H	1–2 and 4–5	Dioxins/furans and isotopic plutonium	Delineate area above SSLs/SALs	
	Location 27a-3, Figure 14	New, 10 ft east of excavation area H	1–2 and 4–5	Dioxins/furans and isotopic plutonium	Delineate area above SSLs/SALs	
	Location 27a-4, Figure 14	New, 20 ft west of outfall	0–0.5 and 1.5–2	Dioxins/furans and isotopic plutonium	Delineate area above SSLs/SALs	
	Location 27a-5, Figure 14	New, 20 ft east of outfall	0–0.5 and 1.5–2	Dioxins/furans and isotopic plutonium	Delineate area above SSLs/SALs	
C-21-027	Location C27-1, Figure 11	New, 20 ft east of location 21-610684	0–0.5, 5–6, and 9–10	Americium-241, isotopic plutonium, isotopic uranium, tritium, calcium, chromium, lead, and zinc	Lateral and vertical extent	Prescribed in Phase II investigation report (LANL 2010, 110772.33)
	Location C27-2, Figure 11	New, 20 ft east of location 21-610683	0–0.5 and 5–6	Isotopic plutonium	Lateral and vertical extent	
	Location C27-3, Figure 11	Location 21-605339	7–8	Calcium	Vertical extent	

Table 1 (continued)

SWMU/AOC/ Consolidated Unit	Sampling Location and Figure	Proposed Sampling Location	Sample Depth (ft bgs)	Analyses	Sampling Objective	
C-21-027 (continued)	Location C27-4, Figure 11	New, 20 ft west of location 21-605341	0–0.5	Nitrate, perchlorate, americium-241, isotopic plutonium, isotopic uranium	Lateral extent	
	Location C27-5, Figure 11	New, between locations 21-605340 and 21-605341	6–7	Chromium, americium-241, isotopic plutonium, dioxins/furan, nitrate, perchlorate	Vertical extent	
	Location C27-6, Figure 11	New, 20 ft east of location 21-610682	0–0.5 and 5–6	Isotopic plutonium	Lateral and vertical extent	
	Location C27-7, Figure 11	New, downslope of location 21-610686 at edge of bench	0–0.5	Dioxins/furans	Lateral extent	
Diesel spill site from tank 21-57	Location D-1, Plate 1	TA-21 Hole J	9–10	TPH-DRO, VOCs, and SVOCs	Vertical extent	Requested in NMED modification letter (NMED 2010, 110959)
	Location D-1, Plate 1	TA-21 Hole J	14–15	TPH-DRO	Vertical extent	
	Location D-2, Plate 1	S/R-09	9–10	TPH-DRO, VOCs, and SVOCs	Vertical extent	
	Location D-2, Plate 1	S/R-09	14–15	TPH-DRO	Vertical extent	
	Location D-3, Plate 1	Under slab	0–1, 5–6, and 9–10	TPH-DRO, VOCs, and SVOCs	Lateral and vertical extent	
	Location D-3, Plate 1	Under slab	14–15	TPH-DRO	Lateral and vertical extent	
	Location D-4, Plate 1	Under slab	0–1, 5–6, and 9–10	TPH-DRO, VOCs, and SVOCs	Lateral and vertical extent	
	Location D-4, Plate 1	Under slab	14–15	TPH-DRO	Lateral and vertical extent	
	Location D-5, Plate 1	Under slab	0–1, 5–6, and 9–10	TPH-DRO, VOCs, and SVOCs	Lateral and vertical extent	

Table 1 (continued)

SWMU/AOC/ Consolidated Unit	Sampling Location and Figure	Proposed Sampling Location	Sample Depth (ft bgs)	Analyses	Sampling Objective	
Diesel spill site from tank 21-57 (continued)	Location D-5, Plate 1	Under slab	14–15	TPH-DRO	Lateral and vertical extent	
	Location D-6, Plate 1	Under slab	0–0.5, 5–6, and 9–10	TPH-DRO, VOCs, and SVOCs	Lateral and vertical extent	
	Location D-6, Plate 1	Under slab	14–15	TPH-DRO	Lateral and vertical extent	

Table 2
Estimated Excavation Areas and Volumes

SWMU/Consolidated Unit/Site	Excavation Area Location	Corresponding Figure	Excavation Area ID	Excavation Area Depth (ft bgs)	Excavation Area Dimensions (ft)	Excavation Volume (yd^3)*
21-024(b)	Inlet line, locations 21-601087 and 21-601088	12	Area A	5.5–7.5	95 × 2 × 2	
	Inlet line, location 21-601089		Area B	3.3–5.3	5 × 2 × 2	20
	Inlet line at former septic tank connection, location 21-601091		Area C	5–8	5 × 5 × 3	
	Outlet line at former septic tank connection, location 21-601090		Area D	3.5–5.5	5 × 5 × 2	
21-024(l)-99	North side of former building 21-21, location 21-27520	13	Area E	2–4	5 × 5 × 2	
	North side of former building 21-21, location 21-27521		Area F	2.5–4.5	5 × 5 × 2	4
21-027(a)	Inlet line, location 21-601226	14	Area G	2.5–4.5	2 × 5 × 2	28
	Inlet line to ponding area, location 21-601225; ponding area, location 21-601229; inlet line to outfall, location 21-601228		Area H	1–4	241 ft^2 × 3	
Diesel fuel spill from tank 21-57	Northwest of diesel tank 21-57	Plate 1	Area I	0–10	5 × 5 × 10	
	North of diesel tank 21-57		Area J	0–10	5 × 5 × 10	
	North of building 21-357		Area K	0–10	5550 ft^3 (irregular)	
	Under building 21-357 slab		Area K (under slab)	0–10 (will be based on new data)	2500 ft^3 (estimated)	317
					Total*	**369**

*Does not account for soil volume expansion after excavations. Concrete is not included in these estimates.

Table 3
Sampling Locations To Be Excavated

SWMU/Consolidated Unit	Corresponding Figure	Location ID	Sample ID Excavated	Sampled Depth (ft bgs)
21-024(b)	Figure 12	21-601087	RE21-07-5149	5.5–6.5
		21-601088	RE21-07-5151	5.5–6.5
		21-601089	RE21-07-5153	3.3–4.3
		21-601090	RE21-07-5156	3.5-4.5
		21-601091	RE21-07-5157	5–6
		21-601091	RE21-07-5158	7–8
21-024(l)-99	Figure 13	21-27520	RE21-07-75631	2–3
		21-27521	RE21-07-75633	2.5–3.5
21-027(a)	Figure 14	21-601225	RE21-07-5862	1–2
		21-601226	RE-21-075864	2.5–3.5
		21-601228	RE21-07-5868	2–3
		21-601229	RE21-07-5870	1–2
Diesel fuel spill from tank 21-57	Plate 1	TA-21 Hole C	n/a[a]	2–4.25
		TA-21 Hole D	n/a[a]	6–8 and 8–12
		TA-21 Hole J	n/a[a]	0–2 and 2–5
		TA-21 Hole U	n/a[a]	2–4, 4–6, 6–8, and 8–10
		TA-21 Hole V	n/a[a]	0–4
		TA-21 Vertical Hole 1	n/a[a]	3–3 and 8–8
		TA-21 Vertical Hole 5	n/a[a]	n/a[b]
		TA-21 Vertical Hole 7	n/a[a]	n/a[b]
		TA-21 Building 21-357 Restroom	n/a[a,c]	0–3.75
		S/R-03	n/a[a]	4.5–5
		S/R-04	n/a[a]	4.5–5
		S/R-05	n/a[a]	4.5–5
		S/R-09	n/a[a]	4.5–5

[a] n/a = Not applicable. No sample IDs available.

[b] n/a = Not applicable. No samples were collected from less than 10 ft bgs.

[c] Possible contamination surrounding this sample. This location is included in the excavation area below the slab.

Table 4
Existing Samples that Provide Excavation Area Extent

SWMU/ Consolidated Unit	Excavation Area	Location ID Providing Extent	Extent Provided	Total Depth Sampled (ft bgs)	Corresponding Data Source
21-024(b)	A	21-601087	Vertical	8.5	Radionuclide data map [Figure 6.11-3 in the Phase II investigation report (LANL 2010, 110772.33)]
	A	21-601088	Vertical	8.5	
	B	21-601089	Vertical	6.3	
	C	21-601091	Vertical	8	
	C	21-601093	Vertical/Lateral	19	
21-024(l)-99	E	21-27520	Vertical	5	Organic data map [Plate 10 in the Phase II investigation report (LANL 2010, 110772.33)]
	E	21-27522	Lateral	8	
	E	21-27545	Lateral	6	
	F	21-27521	Vertical	5.5	
	F	21-27535	Lateral	3	
	F	21-27523	Lateral	6	
21-027(a)	G	21-601226	Vertical	10.5	Organic and radionuclide data maps [Figures 6.23-2 and 6.23-3 in the Phase II investigation report (LANL 2010, 110772.33)]
	H	21-601225	Vertical	4 (rads); 8 (dioxins/furans)	
	H	21-601228	Vertical	5	
	H	21-601229	Vertical	22 (rads); 12 (dioxins/furans)	
Diesel fuel spill from tank 21-57	I	JPA-1	Lateral	5	Appendix A data from the Tier 1 Evaluation TA-21-57 Aboveground Storage Tank Diesel Fuel Oil Release Report (Shaw 2003, 110706); Concentrations detected greater than 520 mg/kg TPH-DRO within 10 ft bgs posted on Plate 1 in this work plan
	I	JPA-2	Lateral	5	
	I	JPA-3	Lateral	5	
	I	JPA-4	Lateral	5	
	J	S/R-08	Lateral	5	
	J	TVP #1	Lateral	5	
	J	S/R-10	Lateral	5	
	K	TA-21 Hole E	Lateral	6.17	
	K	TA-21 Hole F	Lateral	2.17	
	K	TA-21 Vertical Hole 2	Lateral	110	
	K	TA-21 Hole B	Lateral	6	
	K	TA-21 Hole A	Lateral	4	
	K	S/R-06	Lateral	5	
	K	S/R-07	Lateral	5	

Appendix A

Photographs of DP Site Aggregate Area Outfalls

Photo 1 Consolidated Unit 21-022(h)-99 outfall looking west

Photo 2 Consolidated Unit 21-022(h)-99 outfall looking south

Photo 3 Solid Waste Management Unit 21-024(b) outfall, looking south

Photo 4 Consolidated Unit 21-026(a)-99 outfall looking west

Photo 5 Solid Waste Management Unit 21-027(a) outfall, looking south