Response to Request for Public Comment—Selection of a Remedy for Corrective Action at Material Disposal Area H, Solid Waste Management Unit 54-004 at Technical Area 54, Los Alamos National Laboratory, Los Alamos, New Mexico EPA ID NO. NM08990010515

1.0 INTRODUCTION AND REGULATORY BACKGROUND

Los Alamos National Laboratory (hereafter, the Permittees) submitted the corrective measures study (CMS) report for Material Disposal Area (MDA) H with a recommendation for an engineered evapotranspiration (ET) cover (Alternative 2) as the preferred corrective measure (LANL 2005, 089332, p. 49). This CMS was submitted pursuant to the schedule established in Section XII of the Consent Order, signed on March 1, 2005. In a Fact Sheet/Statement of Basis issued on November 5, 2007 (NMED 2007, 098991), the New Mexico Environment Department (NMED) raised the following primary concerns regarding Alternative 2 as the recommended alternative in the revised CMS report.

- NMED believes that the Alternative 2 ET cover proposed in the 2005 MDA H CMS report, including the 1.0-ft- (30-cm-) thick biointrusion barrier, is not adequate to prevent intrusion of deep-rooting plants and burrowing animals (NMED 2007, 098991, p. 11). The roots of local site-specific deep-rooting plants can extend as deep as 23 ft (7 m), and local burrowing animals can excavate as deep as 10 ft (3 m) (LANL 2005, 089332, pp. H7–H12). Thus, the proposed ET cover, with a 1.0-ft- (30-cm-) thick biointrusion barrier directly atop the current surface of the shafts, does not provide adequate protection from potential biointrusion to the shafts from the surrounding areas.
- NMED believes that the recommended Alternative 2 corrective measure does not address the continuous release of volatile organic compounds (VOCs), primarily trichloroethylene (TCE), and tritium to the subsurface from the shafts (NMED 2007, 098991, p. 11).

In the Fact Sheet/Statement of Basis referenced above, NMED selected the remedy described in Alternative 3b (Complete Shaft Encapsulation and Engineered ET Cover), along with a soil vapor extraction (SVE) system, as the remedy that should be implemented at MDA H. Justifications for this remedy selection included, but was not limited to, the desire to prevent biointrusion and to eliminate volatile organic compounds (VOCs) and tritium contaminants detected in soil pore gas so drinking-water resources can be conservatively protected (NMED 2007, 098991, pp. 12–14).

The information presented in subsequent sections of this public comment provides a basis for reexamining the remedy selection described above. The Permittees believe that the risk posed by both pathways were adequately evaluated in 2005 CMS report and concluded that it meets NMED goals. However, in light of NMED's concerns, the Permittees have reevaluated the potential for biointrusion and for migration of VOC vapors along with data collected as part of more recent investigations directed by NMED at comparable sites (e.g., MDA G). The Permittees have also evaluated recent data from ongoing vapor monitoring at MDA H as directed by NMED. In addition, the Permittees performed a robust technical review regarding the feasibility of implementing Alternative 3b in light of more recently collected technical data. Based upon these reviews, the Permittees respectfully request that NMED reconsider the remedy selection as presented in the above-referenced Fact Sheet/Statement of Basis in light of the new information presented herein and select a final remedy that relies primarily on a more complete description of the design and performance of the ET cap and site conditions to reduce the potential for biointrusion and VOC vapor migration.

2.0 ENHANCED ET COVER

To address NMED's concerns about the Alternative 2 ET cover, the Permittees propose a revised ET cover that would have the minimum characteristics to meet Resource Conservation and Recovery Act equivalent infiltration and erosion protection from 1000 yr precipitation events (40 Code of Federal Regulations [CFR] Part 264.310). Figure 2.0-1 shows the layers of this revised ET cover. From top to bottom, the layers are as follows.

- A minimum 1.5-ft- (45-cm-) thick surface treatment layer, consisting of a mixture of gravel and topsoil having a surface slope between 3% and 4% with vegetation or an armored top surface. The vegetation/soil layer would limit infiltration by promoting storage and ET. It also would provide erosion protection against 1000-yr precipitation events for the cover and physical protection of the underlying layers. The fact that the cover will be vegetated for most of its functional life makes this design very conservative.
- A minimum 3.5-ft- (105-cm-) thick cover soil layer consisting of crushed tuff amended with soil. The primary purposes of this layer would be to supply moisture to the surface vegetation and store infiltrating precipitation until it can be removed through ET.
- A minimum 2.5-ft- (75-cm-) thick composite capillary break/biointrusion barrier layer. This composite layer would consist of a 12-in.- (30-cm-) thick gravel- to cobble-size biointrusion barrier sandwiched between well-graded gravel and sand filter layers. The minimum thickness of gravel and sand filter layers for both the top and bottom of the biointrusion layer would be 5 in. (12.5 cm) and 4 in. (10 cm), respectively. The biointrusion layer is primarily designed to provide air space between cobbles to prevent root propagation. The grading of filter gravels helps prevent fines from moving into the cobble section during placement so the full thickness of the cobble zone will be effective in preventing plant intrusion. It is anticipated the gravel- to cobble-size layer would have a nominal particle size of 2 to 6 in. (5 to 15 cm) to prevent burrowing by the native animal population. The cobbled sizes are approximately 2 times the size of the largest burrowing animal head. In addition, the 22 in. (55 cm) combined thickness of gravel and cobbles would be adequate to prevent burrowing of ants and other insects, based on studies performed at Idaho National Laboratory (INEEL 2002, 099136, p. G-3). Furthermore, the 2.5 ft (75 cm) total thickness of the capillary break is adequate to prevent intrusion by native plant species. This composite layer would limit downward movement of moisture and serve as a lateral drainage layer, directing any infiltrating water away from the shafts. Biointrusion would be prevented by maintaining the cover in grasses to prevent intrusion of forbs, shrubs, and trees with deeper roots (Van Landingham 2005, 099135, p. 1).
- A minimum 0.5-ft- (15-cm-) thick contouring fill layer, constructed from naturally occurring soils. The purpose of this layer is to develop the design slope required for positive drainage of the overlying composite capillary break/biointrusion barrier layer. The contouring fill layer would be constructed over the existing interim cover/source material. Most of the ET cover would be a continuous south-facing slope constructed on top of the existing southerly sloping topography to promote ET.

This revised 8-ft- (2.4-m-) thick ET cover would combine with the existing 3 ft (90 cm) of soil cover and 3 ft (90 cm) of concrete cap to make 14 ft (4.3 m) of cover above the waste. Although the 2 ft of cobble alone is effective in preventing plant intrusion, the overall cover thickness also would prevent vertical biointrusion by burrowing animals. Local maximum animal burrow depths for pocket gophers, mice, and harvester ants are modeled to be 4.9 ft (1.5 m), 6.6 ft (2.0 m), and 8.2 ft (2.5 m), respectively, although field data indicate that the deepest observed burrow (from a pocket gopher) on Laboratory property was 1.5 m (Shuman 1999, 066804, pp. 2-37–2 38). The mesa-top climax vegetation is piñon-juniper woodland. (Climax vegetation is the last stage, mature, established community of plants for a given location.) For south-facing canyon slopes, the climax vegetation is grassland and juniper. Typically, the succession period is 100 yr to 200 yr or more. Maximum rooting depths of grasses, forbs, shrubs, and trees are 14 ft (4.4 m), 30 ft (9.1 m), 25 ft (7.6 m), and 20 ft (6.1 m), respectively (Shuman 1999, 066804, pp. 2–15). However, 70% to 90% of root depths are typically less than 13 ft (4 m) for the representative plant species expected in the succession at MDA H (Foxx et al. 1984, 006535, pp. 11–12 and Table III). Plants with high-uptake factors increase radionuclide concentrations at the surface. Plant uptake factors are 30 times higher from climax vegetation than from early succession plants because of root penetration into wastes. The cover will be maintained in native grasses so the maximum root depth cannot penetrate the 14 ft of cover materials above the waste. The addition of the biointrusion barrier provides additional defense against biointrusion.

A plan view of this revised ET cover shows that the cover would extend approximately 50 ft (15 m) to approximately 130 ft (40 m) laterally away from the shafts (Figure 2.0-2). A drainage swale would be constructed upslope of the cover to divert surface water runoff to inhibit focused recharge from ponded water in the vicinity of the shafts. The existing concrete caps over the shafts will be left undisturbed to provide additional protection against vertical biointrusion.

The cover, including side slopes and a vertical perimeter biointrusion barrier, would be sufficiently wide to inhibit horizontal migration of deep-rooted plants and burrowing animals. Generally, roots for local climax species extend a lateral distance up to 2 to 3 times the radius of the plant canopy (Van Landingham 2005, 099135, p. 1). For piñon pines and one-seed juniper, with an average mature canopy radius of approximately 15 ft (4.6 m), this translates into a horizontal root spread radius of 45 ft (Van Landingham 2005, 099135, p. 9). Trees at the perimeter of the cover are approximately 90 ft (27 m) from the shafts. Thus, horizontal roots of the local climax species will not penetrate any closer to the shafts than 45 ft (13.5 m). In addition, roots will not penetrate beneath the ET cover horizontally because the cover prevents moisture from accumulating beneath it, and roots do not grow in the direction of higher osmotic gradients.

Generally, the wider spreading horizontal roots (also called feeder roots) for climax species are confined to near the ground surface within the zone of recharge. Research at the Laboratory and elsewhere indicates that the bulk of a plant's root system is confined to the topmost 5.5 to 6 ft (1.5 to 2 m) of soil. Only a very small percentage of tree-root biomass is found at depths greater than about 5 to 6.5 ft (1.5 to 2 m) (Wheeler et al. 1977, 005577, p. 11-12). The deeper roots, also called structural roots or tap roots, penetrate much deeper into the ground to provide structural support for the aboveground portion of the plant or tree. These roots have a much more limited lateral extent than the horizontal feeder roots contained in the uppermost 5 to 6.5 ft (1.5 to 2 m) of soil (Wheeler et al. 1977, 005577, p. 11-12). Since the farther spreading horizontal feeder roots are contained within the upper 3 ft (1 m) of the ground surface, these roots can be effectively blocked with a shallow vertical biointrusion barrier. To inhibit propagation of feeder roots, a vertical trench filled with cobbles would be placed on the upslope and sideslopes of the ET cover at the limit of the biointrusion barrier. The depth of the trench would be variable, penetrating to a depth of 2 ft (.75 m) below the soil-tuff interface (see cross-sections in Figures 2.0-3 through 2.0-7).

The north, west, and east sideslopes will have the same soil-gravel admixture as the ET cover slope but will have an increased slope of 5 horizontal to 1 vertical (5H:1V) to meet the existing grade. On the downslope (south) side of the cover, the slope increases to 3H:1V. The south slope also has a rock buttress (1.5H:1V) because the site topography descends in a steep grade to a road on the south side of the cover. The 3H:1V slope maintains the same thickness as the ET cover but replaces the soil-gravel admixture with riprap. The rock buttress allows the ET cover to extend the maximum amount possible (35 ft beyond the shafts) before tying into steep grade. The biointrusion barrier connects to the bottom of the rock slopes/buttress, allowing any moisture to flow off the site. The lower portions of the rock slopes will consist of dark basaltic rock. The dark rock would evaporate any moisture that collects from precipitation or horizontal downslope interflow from the biointrusion barrier where it also acts as a capillary barrier. The rock slopes/buttress would inhibit plant growth and provide a biointrusion barrier to burrowing animals on the downslope side of the ET cover (see cross-sections in Figure 2.0-3, 2.0-4, and 2.0-5). Although some vegetation may establish on the rock slopes/buttress with time, maintenance would remove all plants.

An additional deterrent to burrowing animals will be provided by a fine mesh epoxy-coated fence erected around the site. This fence will prevent small burrowing animals from entering the property and mitigate lateral biointrusion from outside the fence. The fence would be placed 6 ft below and extend 3 ft above grade (see cross-sections in Figures 2.0-3, 2.0-4, 2.0-5, and 2.0-6). Except where there are rock slopes/buttresses, a vegetative cover of grass will be maintained over the entire site inside the fence. The lateral reach of tree roots outside of the site fence and the depths of penetration of burrowing animals and grass roots relative to the proposed cover are shown in Figure 2.0-6.

3.0 SVE

NMED proposed adding a SVE system to the final remedy to address concerns about vapor-phase contamination of VOCs and tritium below the shafts. Based upon recently collected data at MDA H, along with other recently proposed corrective actions, the Permittees present an analysis below as part of our public comment to support the request to reevaluate the SVE component of the final selected remedy.

3.1 Background Concerning Potential VOC Migration

The transport pathway through the unsaturated zone is of most concern because the MDA H site overlies a regional aquifer. Unsaturated zone monitoring will assess the effectiveness of the corrective measures and verify infiltration rates. In the Fact Sheet/Statement of Basis, NMED requires the Permittees to “evaluate the current wells located in the vicinity of TA-54 and to submit a plan to address all deficiencies in the groundwater monitoring network…” (p. 14). A monitoring well network with five additional regional monitoring wells and two additional intermediate-zone monitoring wells was proposed in the report titled “TA-54 Well Evaluation and Network Recommendations” (LANL 2007, 098548). In a letter from NMED dated December 7, 2007, NMED granted approval with direction for the Permittees to install regional and intermediate wells at Technical Area (TA) 54 (NMED 2007, 098991). Based on the volume of work conducted to date at MDA H, the Permittees do not expect to encounter contamination in the regional aquifer that originated from MDA H and therefore believe it is appropriate to move forward with the remedy selection process concurrent with the groundwater investigation. Groundwater data, when available, will be used to verify the basis for the remedy selection and, if necessary, identify modifications to the selected remedy. The monitoring wells will also provide additional information on possible perched groundwater, although to date none has been observed or is predicted to occur beneath MDA H.

Current site characterization data indicate that although the tuff is unsaturated, percent saturations increase in the tuff immediately above the Cerros del Rio basalt. Modeling has indicated that if infiltration were high enough to result in saturation at the top of the basalt, moisture could spread along the paleotopography of the Cerros del Rio basalt that slopes to the south towards Pajarito Canyon. Moisture content at this location could increase until moisture is sufficient to conduct water through fractures in the Cerros del Rio basalt. Simulated travel times for liquid-phase unsaturated-zone transport are approximately 10,000 yr for peak concentrations of nonadsorbing species to reach the water table.

However, the first arrival of extremely low concentrations by this method is simulated to occur in about 100 yr (LANL 2007, 098608, Appendix F).

Because of the long transport time for unsaturated flow, the existing depth of migration (to the base of the Bandelier Tuff) for VOCs is best explained by vapor-phase transport. Diffusive transport of VOC vapors has also been demonstrated through numerical modeling studies conducted at MDA L (Stauffer et al. 2000, 069794; Stauffer et al. 2005, 090537). Several activities and studies are proposed to address uncertainties associated with vapor-phase transport and its impact on the regional aquifer.

3.2 SVE Feasibility

Analytical calculations have already been performed for the approved MDA G CME plan demonstrating that groundwater screening criteria in the regional aquifer would not be exceeded for all VOCs and tritium with cover fluxes of 1 mm/yr at that site (LANL 2007, 098608, Appendix F). Because VOC concentrations are higher at MDA G than at MDA H and because the hydrogeology is similar, this interpretation of conditions at MDA H is conservative. Dilution by groundwater underflow is sufficient so potential future VOC concentrations in the saturated zone will not exceed screening criteria.

The SVE system is not designed to treat tritium vapor in the unsaturated zone. However, the long travel time of tritium to groundwater, the short-decay half-life (12.3 yr) and dilution by groundwater underflow ensure that tritium screening criteria will not be exceeded in groundwater. It has been 21 yr since waste disposal at MDA H ceased. Therefore, at least 69% of the original tritium inventory has decayed. Over 99% of the remaining will decay over the proposed 100-yr institutional control period. The highest concentration of tritium measured in a sample from a deep sampling port (247 to 249 ft below ground surface) during the last round of monitoring at MDA H was 21 times higher than the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) for drinking water. Approximately 4.4 half-lives (54 yr) are required to decay this concentration to the MCL. This time is less than the expected travel time to the regional aquifer described above. Therefore, controls beyond natural attenuation are not warranted.

3.3 Recently Collected Data from MDA H

The "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2007," submitted to NMED on November 29, 2007, reports on four quarters of pore gas analytical data collected at MDA H. These data indicate that no VOCs were detected at concentrations that would be high enough to partition into groundwater and therefore theoretically result in aqueous concentrations that would exceed the applicable New Mexico groundwater cleanup standards. In fact, the levels are so low that they actually meet the criteria for discontinuing SVE system operation if such an SVE system had been previously required and was in operation.

The Fact Sheet/Statement of Basis requires that the SVE system be operated until VOC concentrations are maintained below specified concentration limits for eight consecutive sampling events. The concentration limits specified in the Fact Sheet/Statement of Basis are one-half the concentration that would theoretically result in water concentrations above MCLs or the New Mexico Water Quality Control Commission (NMWQCC) standards based on equilibrium partitioning. These concentration limits have been met for the last six sampling events (third and fourth quarters of fiscal year 2006 and four quarters of fiscal year 2007) (Table 3.3-1). These new monitoring data, submitted to NMED in November 2007, show that subsurface VOC concentrations do not currently warrant installing an SVE system at MDA H.

Finally, the results of the monitoring are consistent with the operational history of the facility (e.g., incidental contamination of waste with solvents rather than bulk disposal of liquid solvents). Analytical results collected to date do not indicate the potential for continued or future releases of significant amounts of VOCs into the subsurface.

The potential for future releases of VOCs at MDA H depends on the inventory remaining in the disposal shafts. The MDA H waste inventory shows no record of disposal of VOCs at MDA H. MDA L was in operation at the same time as MDA H and was specifically intended for the disposal of liquid chemical wastes, such as VOCs. The source of VOCs, therefore, is likely incidental contamination of the classified solid-form wastes that were disposed of at MDA H. The concentration of VOCs detected in pore-gas samples from MDA H during recent monitoring events is consistent with a low source inventory. For example, the total mass of TCE present in a vapor plume 1 acre in area by 250 ft in thick with an average vapor concentrating of 100 $\mu g/m^3$ (which is higher than any TCE concentration detected during the fiscal year 2007 monitoring) is only 21 g, or equivalent to less than one-half ounce TCE as liquid. Such inventories are consistent with incidental contamination of disposed waste and do not indicate the potential for significant future releases.

3.4 Requirement for Implementation of an SVE System

Given our mutual interest in finalizing a remedy that is both conservative and protective, the Permittees support the concept of determining the potential for and, if necessary, preventing migrations of VOCs and tritium to the regional aquifer. At this time, concentrations in the unsaturated zone are not sufficiently high to affect regional groundwater quality, and an SVE system would remove negligible quantities of VOCs. Thus, installing an SVE system at this time is not warranted. The Permittees propose including a contingency action in the selected remedy that would specify installing an SVE system at a future date should vapor or groundwater monitoring indicate the need. In response to any future significant increases in subsurface VOC concentrations, such a system can be designed and installed quickly based on criteria determined from analyzing the 2006 pilot test data collected at MDA L and the planned 2008 pilot test at MDA G.

4.0 ISSUES WITH ALTERNATIVE 3B (COMPLETE SHAFT ENCAPSULATION WITH ET COVER)

Alternative 3B was selected to isolate the shafts from environmental media, offer the greatest protection against potential biointrusion (including human access), and prevent water from entering the shafts (NMED 2007, 098991, p. 12). The Permittees respectfully suggest that other methods such as the design and construction of a more robust ET cap will meet this objective more reliably (see section 1.0). Additional information collected since the revised CMS report was submitted on June 30, 2005, has raised concerns about the use of any corrective measure that includes grouting, based on the efficacy of grouting in a dry climate and potential risks to workers and the public. Such risks may include, but may not be limited to, ignition of the pyrophoric and or high-explosives materials and potential exposure to workers.

4.1 Pilot Test for Grouting of the Tuff Surrounding the Shafts

Although NMED has selected individual shaft encapsulation by grout combined with the ET cover and SVE to augment containment of waste and biointrusion as its preferred alternative, the feasibility of shaft encapsulation and the possible effects on waste in the shafts must be further investigated. The Permittees noted the need to examine the feasibility of this potential remedy when it included Appendix E, “In Situ Stabilization Alternatives Analysis Evaluated for the MDA H Corrective Measures Study,” in the revised CMS report. Grouting the individual shafts raises the following concerns.

- The data on in situ properties of tuff are not sufficient to approve the proposed grouting methods. To date, all geotechnical characterization has been on remolded tuff samples. The degree and variability of welding are critical to design and should be field tested in pilot tests.
- A laboratory trial batch study should be performed before the field pilot study to formulate grout mixes and optimize engineering properties to meet the stated objectives. These tests must be performed with representative samples of uncontaminated tuff obtained at or near the site. This laboratory study would address properties of the grout and grout-soil mixture. Some key aspects to be analyzed include control of bleed water, segregation of tuff particles, heat of hydration, curing times, permeability, strength, chemical/physical reaction of the grout with tuff, volumetric shrinkage, and long-term durability.
- Given the dry climate/soil conditions, the ability of the soil-grout mixture to maintain its structural integrity without significant shrinkage cracks must be clearly demonstrated in a pilot test. The pilot test must demonstrate the necessary methods for all soil mixing and jet grouting to optimize the mixing process (e.g., grout pressures, mixing speeds, injection rates, grout mixes, etc.) and quality-control procedures in the dry local environment. In addition, the ability to fragment and uniformly mix the tuff with grout must be demonstrated. In addition, lysimeter studies have shown when grout dries it actually creates pathways for roots. The pilot test will also provide better estimates of the volume of waste that would be generated during implementation at MDA H. Performance must be verified by implementation, exhumation, and testing in an uncontaminated area with similar subsurface conditions.

Possible deleterious effects of shaft encapsulation by grouting include the following.

- Any form of grouting involving drilling near the shafts and mixing of materials may create unacceptable risk to workers of exposure to contamination. To construct a bottom barrier beneath the shafts using existing commercial technologies, the vertical barriers must be constructed close to the shafts, increasing the chance of interception with potential stringers of high contamination that have migrated outside the sides and bottoms of the shafts.
- Any hydraulic connection or failure of the sidewall and/or bottom of the shaft under the hydraulic head of the fresh grout resulting in contact of the waste with fresh grout may result in pyrophoric reactions with the depleted uranium and/or the high-explosives material disposed of in the shafts. This event would be of particular concern if high-pressure jet grouting were used to construct the bottom barrier, as described in the revised CMS report. Grout under high pressure could readily access the buried waste through discontinuities in the tuff formation. Both of these strong possibilities raise safety issues associated with the materials in the MDA H inventory.
- A recently performed technical analysis focusing on the temperature increase in the waste that might be expected to result from grout emplacement identified the following variables, which must be better understood:
    - ❖ grout heat-generation rate
    - ❖ thermal conductivity of the grout
    - ❖ thermal conductivity of the tuff material
    - ❖ distance between the edge of the waste and the edge of the grout hole
    - ❖ average temperature of surrounding tuff material

The concern is that even in a condition where the shaft is not breached, enough heat may be generated from the grout to cause a temperature increase in the buried waste. The extent and effect of that temperature increase require more study.

- If contaminated tuff is encountered during installation of the soil-grout mixed barriers, large volumes of contaminated waste could be brought to the surface and would require containment and disposal. Typical soil-mixing operations in friable/erodable soil produce about 20% to 30% spoils (on a volume basis) (Nicholson et al. 1997, 099139; Hayward Baker Geotechnical Construction 2007, 099138). This volume could easily reach 50% if there is difficulty fragmenting these materials and mixing them (or if the cohesive forces within the in situ materials are sufficient to retard the erosive forces of jet grouting).
- Optimal hydraulic conductivities achieved with grouting are comparable to the revised ET cover flux in reducing potential flow that could enter the waste. Thus, the revised ET cover proposed in section 2.0 will perform as well as or better than encapsulation as a means of preventing water from entering the waste shafts.
- A major obstacle to overcome with the grouting proposed in Alternative 3b is desiccation and cracking of the grouted media itself. The grout must cure slowly to reduce the potential for thermal shrinkage. Generally, the grout needs to remain hydrated as it cures. The relatively dry tuff beneath the cap may not provide sufficient moisture to keep the grout hydrated, causing it to shrink and crack. Portland cement is hydraulic cement and must have a source of water present to facilitate the chemical reaction. However, it is undesirable to inject any water adjacent to the waste shafts. Admixtures such as bentonite used to achieve low hydraulic conductivity are subject to significant volumetric shrinkage with drying. Vapors, plant roots, and insects can easily penetrate shrinkage cracks in the grouted medium. Thus, contrary to the idea that encapsulation offers the greatest protection against biointrusion and accidental human access, grouting may actually increase avenues for potential biointrusion.
- Long-term diffusion of oxygen through the tuff into the shafts allows oxidation of uranium to a more stable oxide form. Complete encapsulation of each individual shaft would prevent this.
- Pressure considerations and determination of borehole spacing layout exist with regard to any proposed grout emplacement adjacent to the waste shaft. In addition, the determination of the borehole spacing layout will be critical to predicting pressure impacts upon the waste as well as grout travel distance into the tuff fractures. Specifically, 3-ft-diameter boreholes may make it difficult to produce a high enough pressure to enable the grout to properly penetrate the tuff fractures and to produce the required complete waste encapsulation.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the public comment presented herein, the Permittees respectfully provide the following conclusions and recommendations.

- Information collected and analyzed since the submittal of the revised MDA H CMS on June 30, 2005, indicate to the Permittees that SVE should not be required as part of the final selected remedy.
- The design and construction of the specified, more robust ET cover will achieve the same or better performance than grouting with respect to reducing potential biointrusion and therefore should form the basis for the final selected remedy.

6.0 REQUEST FOR APPROVAL OF PROPOSED SCHEDULE

Pursuant to Section VII.E.2 of the Consent Order, the Permittees propose a schedule for delivery of the corrective measures implementation plan of 120 d after the date of final remedy selection for MDA H, provided that the final remedy selected does not contain a grouting component.

7.0 REFERENCES

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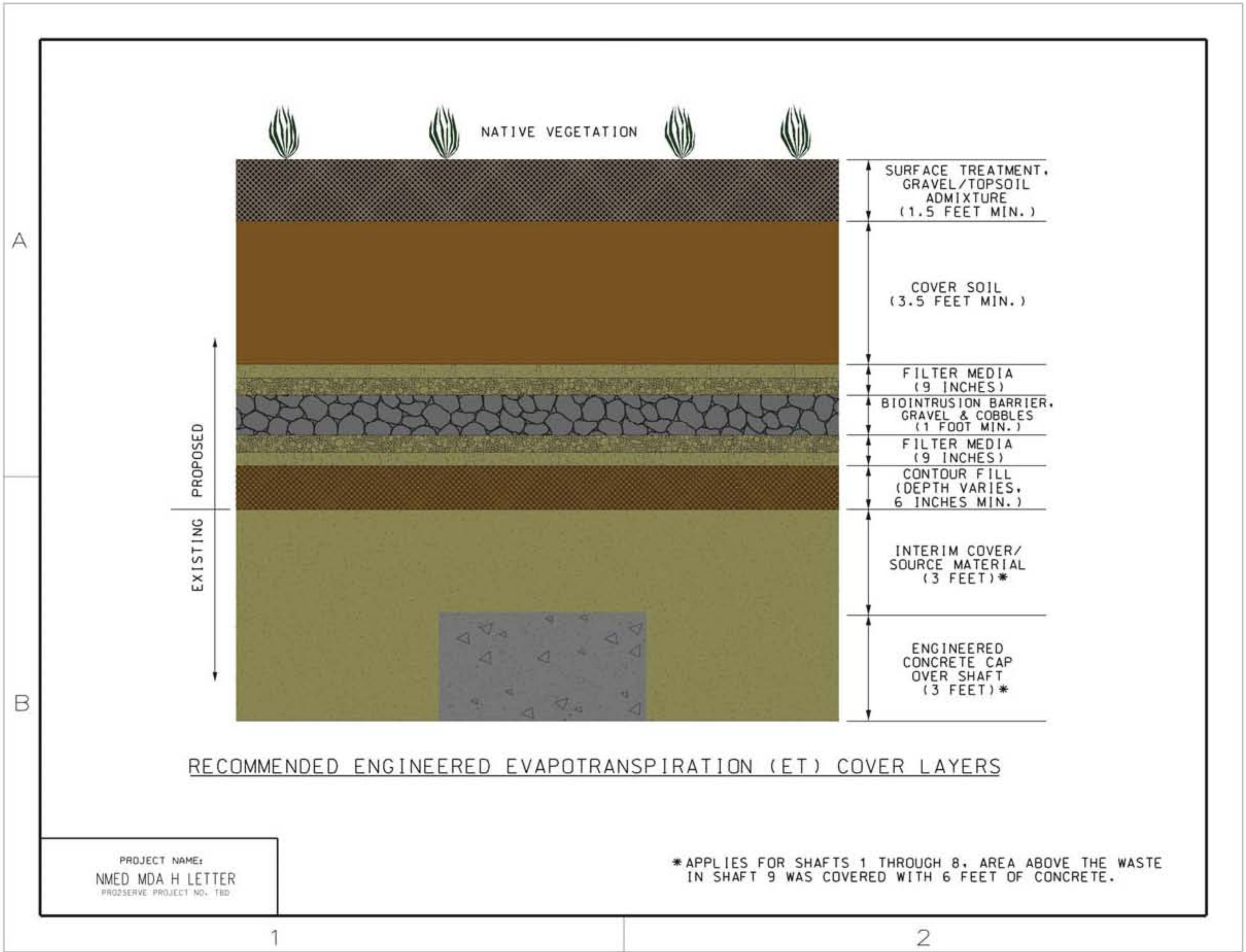

Figure 2.0-1 MDA H ET cover layers

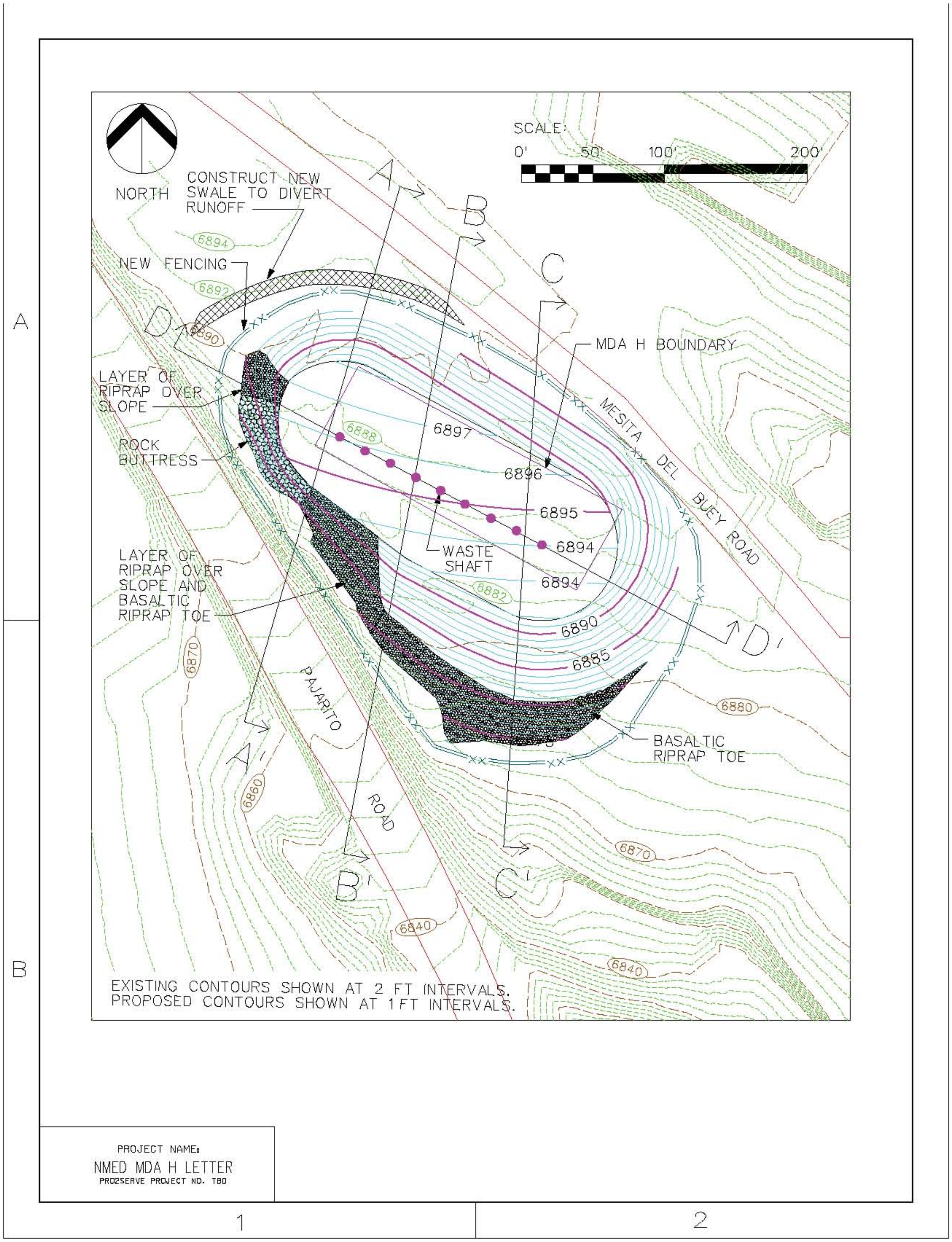

Figure 2.0-2 MDA H plan view of revised ET cover

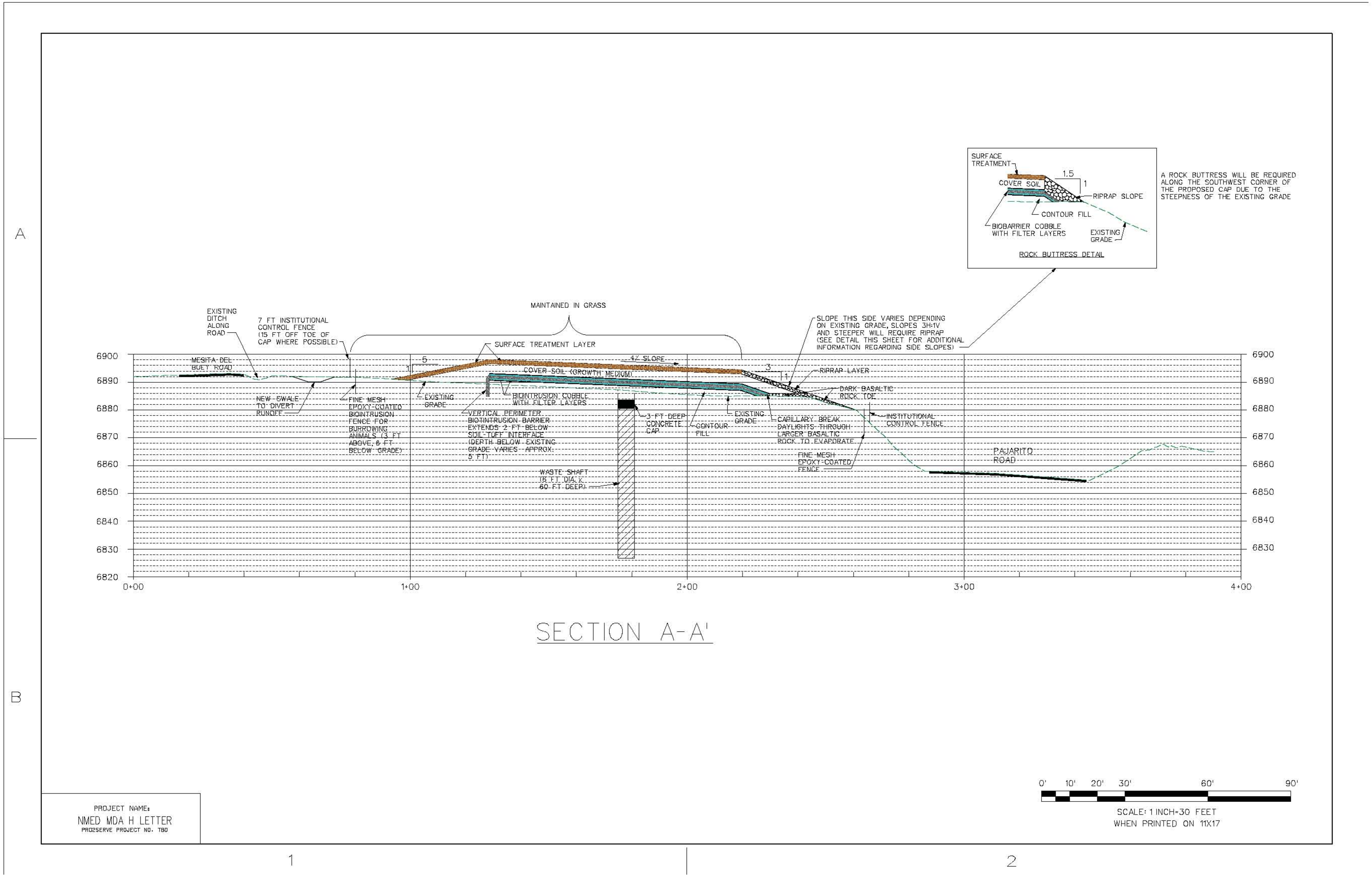

Figure 2.0-3 MDA H Section A

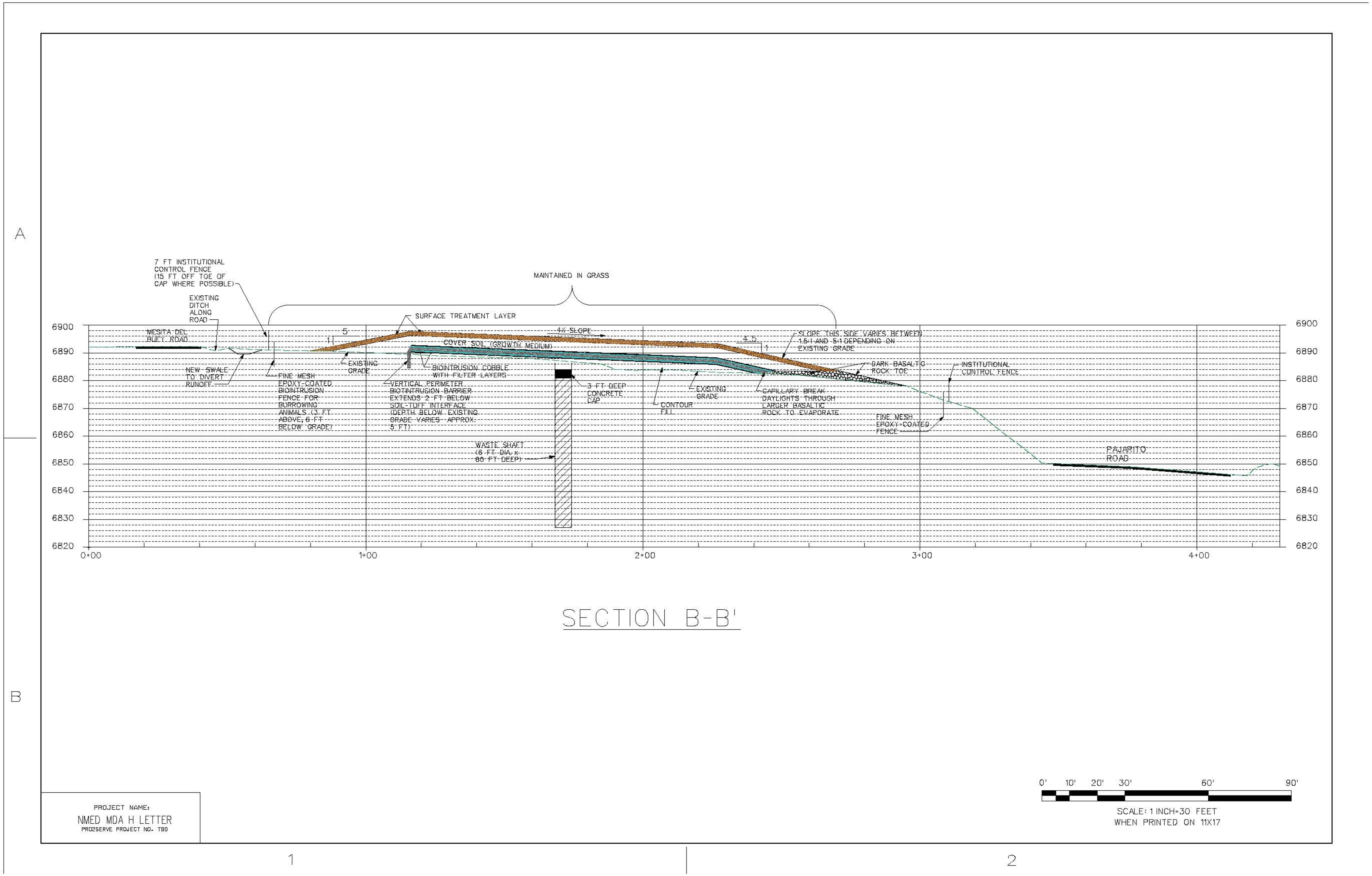

Figure 2.0-4 MDA H Section B

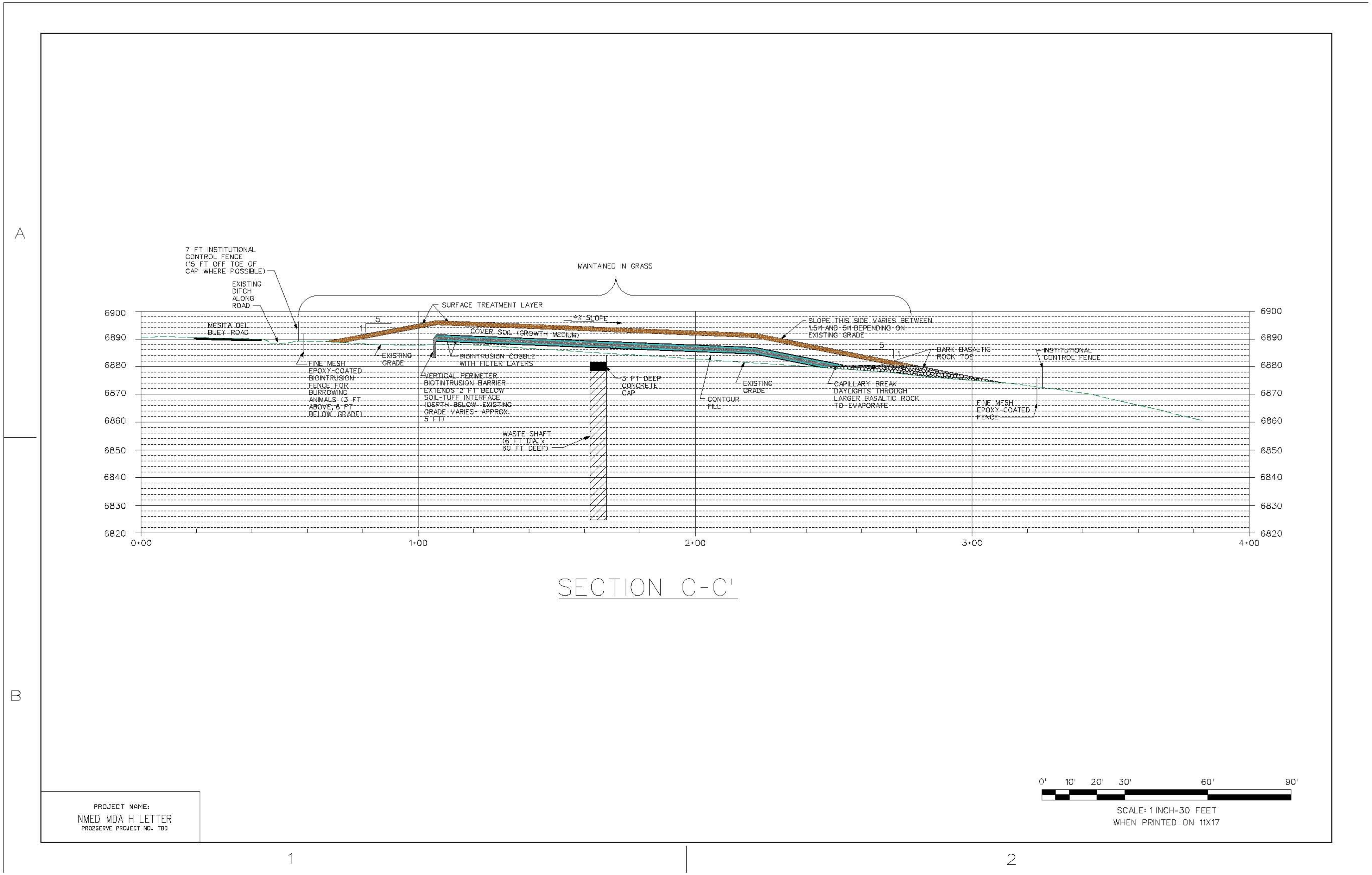

Figure 2.0-5 MDA H Section C

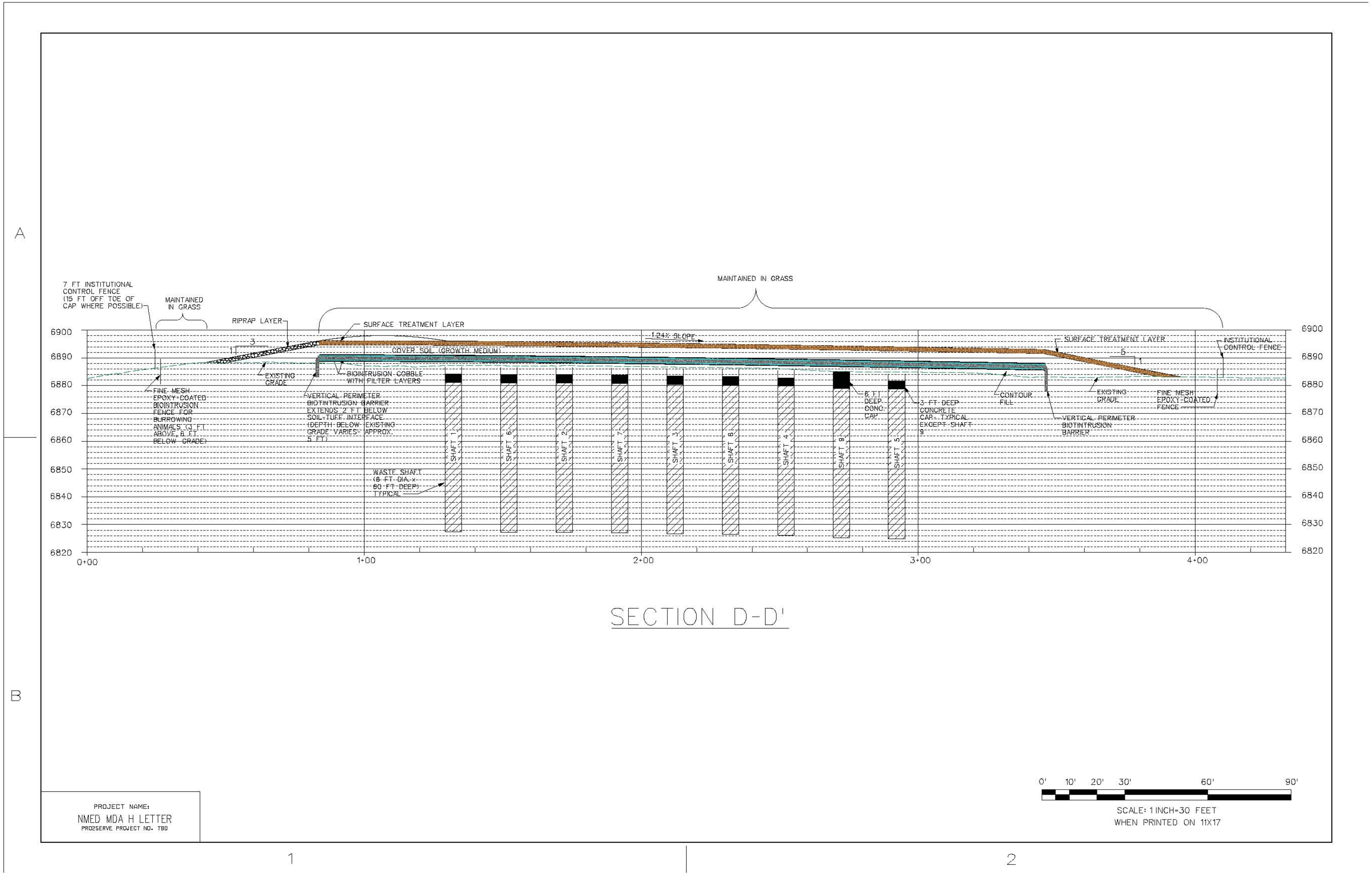

Figure 2.0-6 MDA H Section D

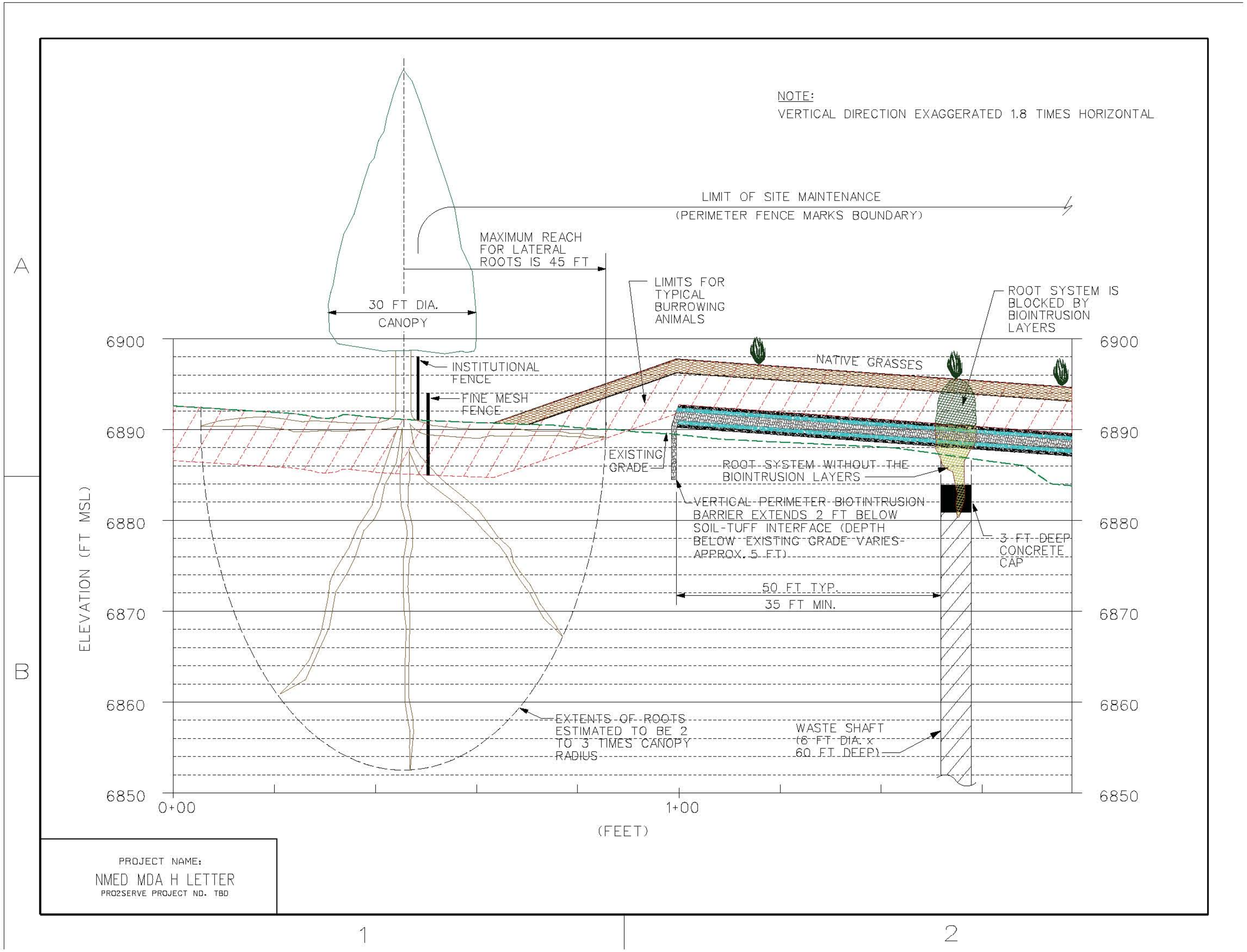

Figure 2.0-7 Cross-section of the trench below the soil-tuff interface

Table 3.3-1
Comparison of Maximum VOC Concentrations to SVE Cleanup Levels

Chemical	SVE Cleanup Level (µg/m³)	Maximum Detected Concentration During Quarter (µg/m³)					
		3rd Qtr FY06	4th Qtr FY06	1st QTR FY07	2nd Qtr FY07	3rd Qtr FY07	4th Qtr FY07
Acetone	4400[a]	35	22	51	24	41	20
Benzene	570[b]	23	13	120	27	12	5.4
Butanol[-1]	640[a]	—[c]	—	NA[d]	—	14	10
Butanone[2-]	3900[a]	81	26	66	13	13	4.8
Carbon disulfide	620,000[a]	6.0	15	10	16	40	12
Carbon tetrachloride	3100[b]	6.5	15	11	10	9.5	9.9
Chloroform	7500[e]	2.1	2.7	2.6	—	—	—
Chloromethane	10,000[a]	—	1.7	—	—	—	—
Cyclohexane	47,000,000[a]	—	—	NA	11	804	4.4
Dichlorodifluoromethane	800,000[a]	31	48	57	64	44	56
Dichloroethane[1,1-]	2900[e]	—	6.8	5	4.1	3.7	3.8
Dichloroethane[1,2-]	100[b]	16	—	—	—	—	—
Dichloroethene[1,1-]	2800[e]	17	2.0	2.5	7.6	6	—
Dichloroethene[cis-1,2-]	5800[b]	—	—	5.4	—	—	—
Dichloropropane[1,2-]	280[b]	4.7	8.2	7.0	4.9	5.2	5.1
Ethanol	na[f]	—	—	NA	7.9	—	—
Ethylbenzene	110,000[b]	0.77	7.3	3.1	9.3	—	—
Ethyltoluene[4-]	na	—	5.6	3.1	7.3	—	—
Heptane[n-]	na	—	—	NA	7.2	9.8	—
Hexane	1,000,000[a]	—	—	NA	20	4.6	—
Hexanone[2-]	na	—	—	3.8	—	—	—
Methylene chloride	220[b]	1.4	6.4	0.83	—	5.6	—
Methyl-2-pentanone[4-]	5700[a]	6.6	—	—	—	—	—
Propanol[2-]	na	—	—	NA	150	230	130
Propylene	na	—	—	NA	—	—	11

Table 3.3-1 (continued)

Chemical	SVE Cleanup Level (μg/m^3)	Maximum Detected Concentration During Quarter (μg/m^3)					
		3rd Qtr FY06	4th Qtr FY06	1st QTR FY07	2nd Qtr FY07	3rd Qtr FY07	4th Qtr FY07
Tetrachloroethene	1900[b]	7.5	17	19	—	12	8.7
Tetrahydrofuran	130[a]	—	—	NA	5.0	7.2	11
Toluene	100,000[e]	1100	87	91	62	18	5.4
Trichloro-1,2,2-trifluoroethane[1,1,2-]	630,000,000[a]	24	34	43	42	32	31
Trichloroethane[1,1,1-]	21,000[e]	72	380	190	170	140	140
Trichloroethene	1100[b]	6.9	78	9.2	9.7	8.3	9.1
Trichlorofluoromethane	2,600,000[a]	73	100	62	58	77	48
Trimethylbenzene[1,2,4-]	1400[a]	—	7	16	9.0	—	—
Trimethylbenzene[1,3,5-]	1900[a]	—	—	2.9	—	—	—
Xylene[1,2-]	150,000[a]	0.96	7.7	1.6	9.4	—	—
Xylene[1,3-]+xylene[1,4-]	30,000[a]	NA	NA	NA	39	5.2	—
Xylene (total)	93,000[e]	1.3	31	NA	NA	NA	NA

[a] MCL or NMWQCC standard not available, cleanup level based on EPA Region 6 human health media-specific screening level for tap water.

[b] Cleanup level based on EPA MCL (40 CFR 141.61).

[c] — = Chemical not detected.

[d] NA = Not analyzed.

[e] Cleanup level based on NMWQCC groundwater standard (20.6.2.3103 NMAC).

[f] na = Not available. No MCL, NMWQCC groundwater standard, or EPA Region 6 human health media-specific screening level available.