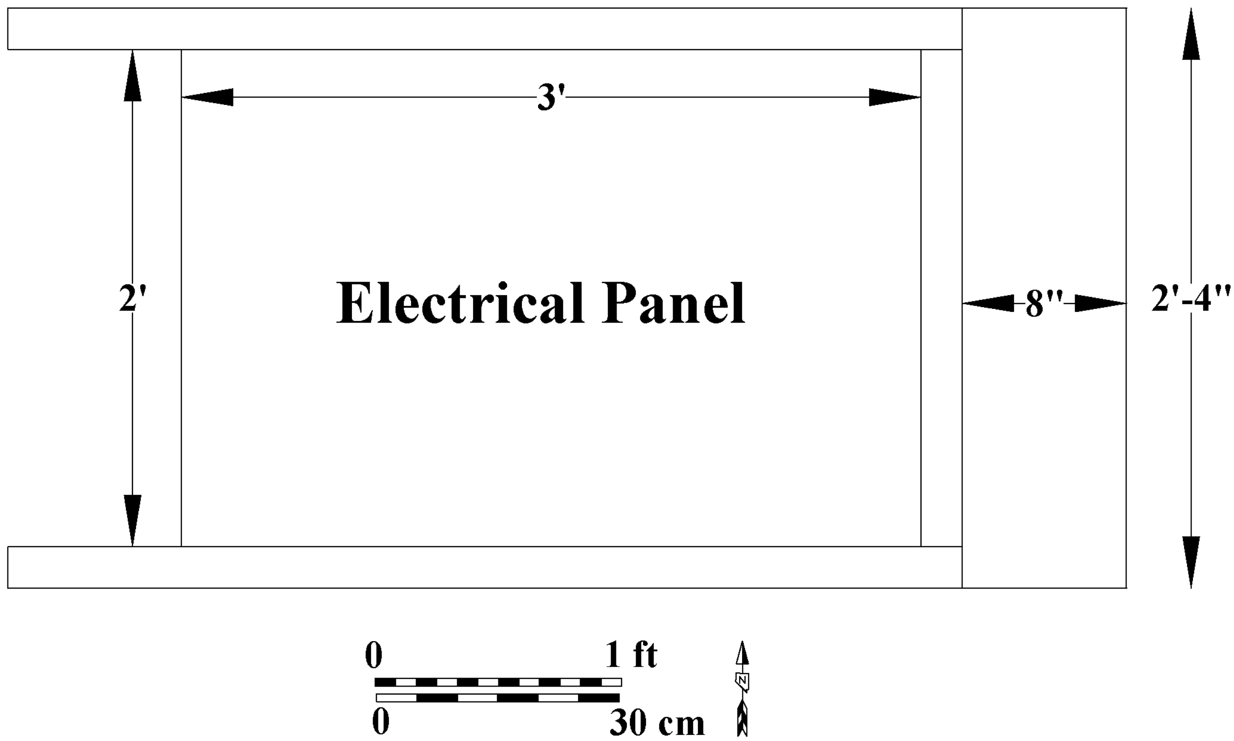

Figure 125. Plan map and photograph of Feature 66, U12t Tunnel, view west (2007).

Feature 67

Feature 67 is an open dirt trench (Figure 126). It is 48 ft 9 inches (14.8 m) in length and 6 ft 7 inches (2 m) in width and 2 ft deep. The trench is at the southwest corner of Feature 68. Use of the trench is undetermined at this time.

Feature 68

Feature 68 is a series of core holes (Figures 126 and 127). Four of the nine holes are marked with wooden stakes with identifying numbers. Near the stakes are rock core samples that are 2 1/2 inches in diameter and vary in length.

Feature 69

Feature 69 is a rough poured concrete block (Figure 128). It is approximately 36 x 36 inches with electrical conduit and insulated wire extending through the surface of the block. It is similar to Feature 64 and is probably the base support of a light pole. The concrete was poured without the use of forms, was not leveled, the surface was left unfinished, and the edges are now covered with soil and vegetation.

Feature 70

Feature 70 is a wood box (Figure 129). The box is constructed of 1/2 inch plywood and measures 24 x 22 x 12 inches. Inside the box is a battery and insulated wire and on the outside of the box is a 1/2 inch pipe assembly for air monitoring. A yellow plastic cup typical of air monitoring devices is near the box.

Feature 71

Feature 71 is a concrete foundation and cable holes U12tCH#1 and U12tCH#2 (Figure 130). The foundation surrounds the cable holes and measures 42 x 42 ft (12.8 x 12.8 m) and is covered around its perimeter with soil and vegetation. The foundation supported a building that covered the two cable holes (Wayne Griffin 2007, personal communication). Extending above the surface of the foundation and centered over each of the cable holes are 68 inch wide by 54 inch tall by 24 inches thick metal frames. The frames are constructed of pipe, I beam, and metal plate. Four vertical I beam posts support a horizontal I beam that is leveled with metal shims. Artifacts near the feature are metal plates and a galvanized post.

Feature 72

Feature 72 is exploratory drill hole UE12t #1 (Figure 131). The feature is near the center of the trailer park and consists of a metal pipe with the signage UE-12T-1.

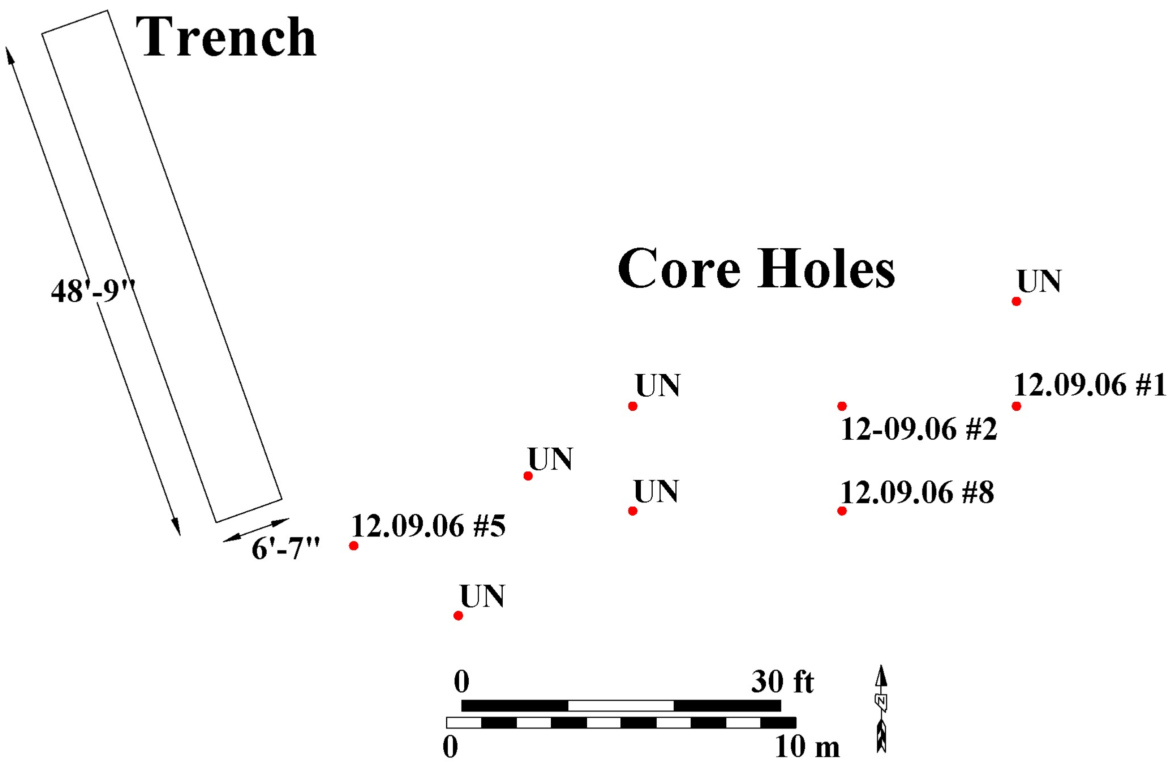

Figure 126. Plan map of Features 67 and 68 (UN = Unnumbered) and photograph of Feature 67, U12t Tunnel, view northwest (2007).

Figure 127. Photograph of Feature 68 (stakes mark core holes), U12t Tunnel, view north (2007).

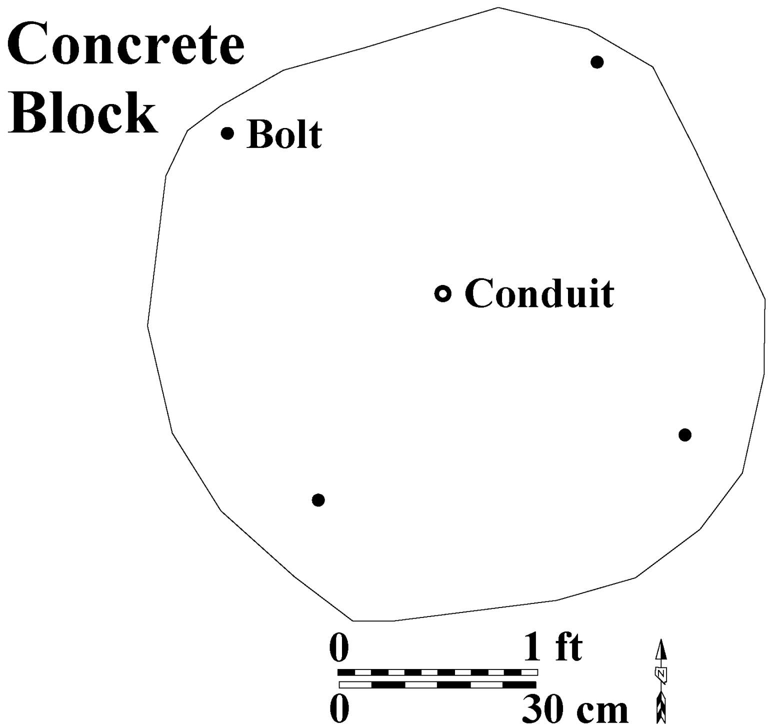

Figure 128. Plan map and photograph of Feature 69, U12t Tunnel, view east (2007).

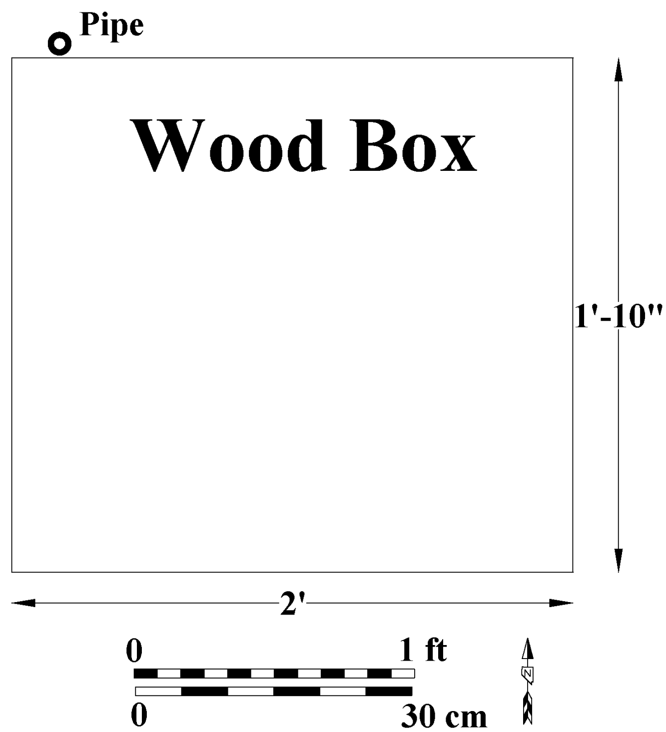

Figure 129. Plan map and photograph of Feature 70, U12t Tunnel, view south (2007).

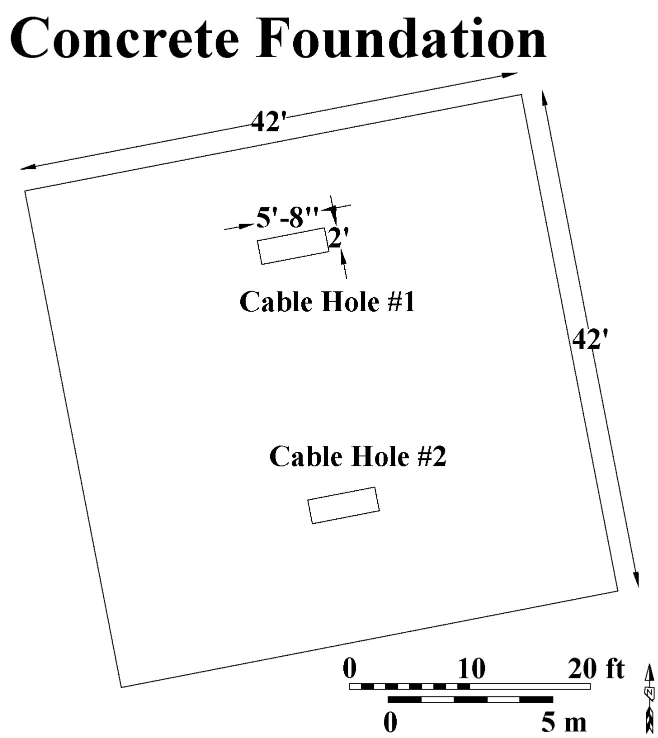

Figure 130. Plan map and photograph of Feature 71, concrete foundation and cable holes U12tCH#1 (left) and U12tCH#2 (right), U12t Tunnel, view northeast (2007).

Figure 131. Photograph of Feature 72, UE12t#1, view northwest (2007).

Feature 73

Feature 73 is a concrete pad and post-shot drill holes U12t.09PS#1A and U12t.09PS#1AA (Figure 132). The pad covers the drill holes and measures 13 x 13 ft and is 8 inches thick around the perimeter and 16 inches thick at the center (domed). Near the east edge is a metal plaque labeled 12t.09PS1APS1AA. The drill holes are not visible through the concrete pad.

Midas Myth/Milagro Trailer Park

The Midas Myth/Milagro Trailer Park is near the southwest edge of Aqueduct Mesa and northwest of the U12t Tunnel Mesa Trailer Park (Figure 56). Nine features were recorded and include miscellaneous equipment from construction and recording activities and cable hole U12t.04CH#1, post-shot drill holes U12t.04PS#1D and U12t.04PS#2D, and exploratory drill hole UE12t#3.

Feature 74

Feature 74 is stored equipment in a 21 x 8 ft area (Figure 133). Equipment is two rolls of 4 ft wood picket fencing, an aluminum antenna, a galvanized trash can, four pieces of 18 x 36 x 1/4 inch plywood (possible box), and four pieces of 6 x 6 inch milled lumber (two 96 inch and two 48 inch lengths). Most of the equipment was used for drilling and construction activities at this location.

Feature 75

Feature 75 is stored equipment in a 26 x 13 ft area (Figure 134). Equipment is 1 wheel barrow, 2 glass five gallon water bottles, 11 hex-cell aluminum pads (seven 24 x 24 inch and four 20 x 20 inch), 3 wood stands, 5 wood panels, and one 36 x 40 x 16 inch plywood box. Also found are two 5 x 5 ft pieces of 3/4 inch plywood and insulated cable. The hex-cell pads were used as shock absorbing devices that supported various types of equipment (e.g., trailers). The wood stands are constructed of a 4 ft x 4 ft x 3/4 inch plywood (platform) attached to a 2 x 4 frame. A 2 x 4 x 14 inch leg is attached at each corner of the frame. The wood panels are 2 ft x 4 ft x 3/4 inch plywood with a 2 x 4 frame. Most of the equipment was used for drilling and construction activities at this location.

Feature 76

Feature 76 is an electrical junction box (Figure 135). The box measures 36 x 30 x 13 inches, is horizontal to the surface, and is supported by 2 inch angle iron welded to each corner of the box and driven into the surface. A 1 1/4 inch insulated cable (near the box) was attached to the box. A portion of a wood picket fence supported by metal T posts is near the feature.

Feature 77

Feature 77 is a crater area containing equipment and Cable Hole U12t.04CH#1 (Figure 136). The area is 165 ft (50.3 m) east-west and 215 ft (65 m) north-south, has subsided and has signage (lying

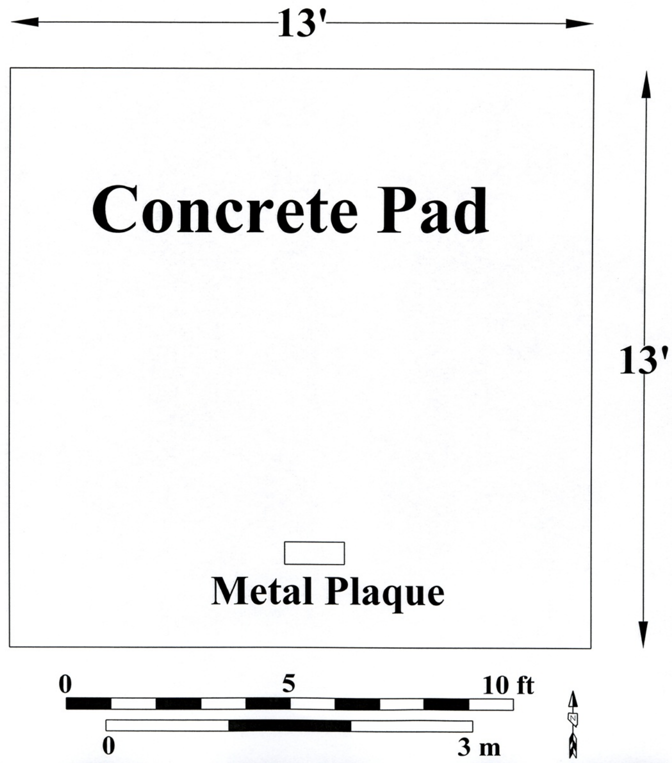

Figure 132. Plan map and photograph of Feature 73, concrete pad covering post-shot drill holes U12t.04PS#1A and U12t.04PS#1AA, U12t Tunnel, view northwest (2007).

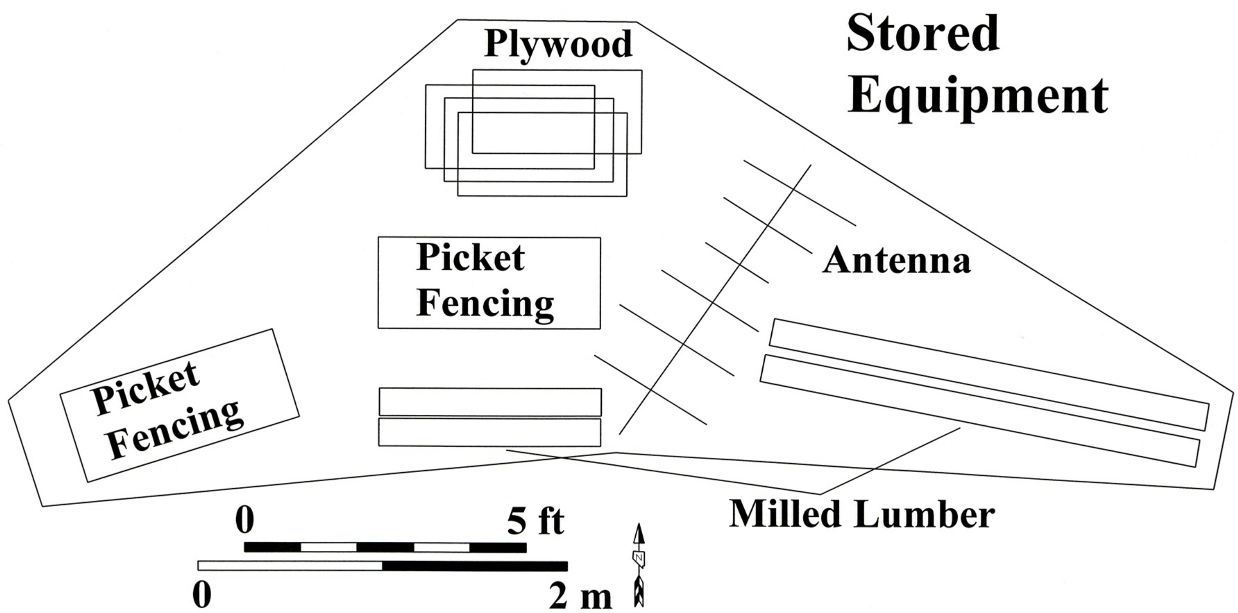

Figure 133. Plan map and photograph of Feature 74, U12t Tunnel, view west (2007).

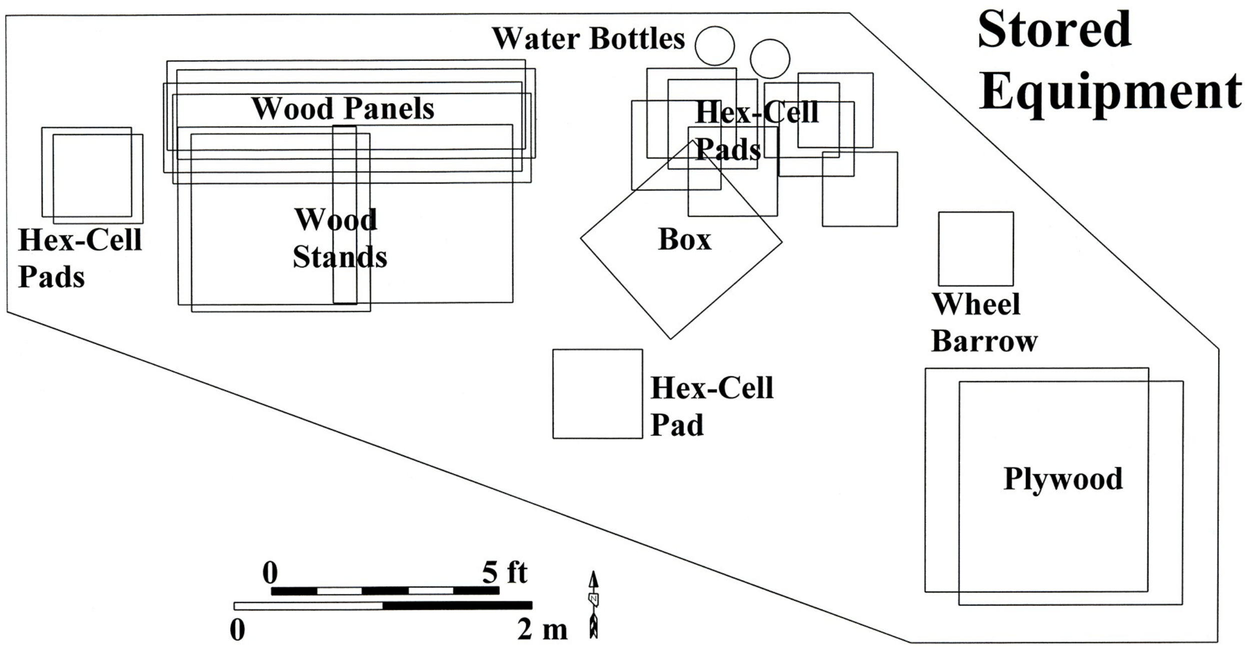

Figure 134. Plan map and photograph of Feature 75, U12t Tunnel, view north (2007).

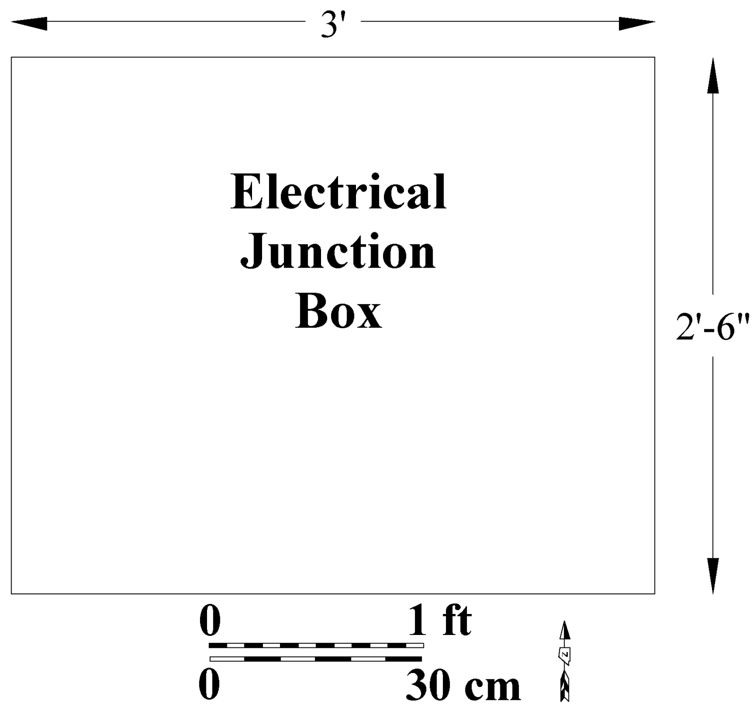


Figure 135. Plan map and photograph of Feature 76, U12t Tunnel, view west (2007).

Figure 136. Photograph of Feature 77, cratered area around U12t.04CH#1, U12t Tunnel, view southwest (2007)

on the surface) SECURITY AREA DO NOT ENTER. Because this area had cratered, no entry into the area for in-depth recording of the artifacts was attempted. Equipment visible in the crater area includes metal stands, metal racks, insulated cable, hex-cell pads, wood panels, five metal barrels, two galvanized trash cans, two plywood platforms, insulated cable, and channel iron. The platforms consist of a plywood deck, three stairs, and 2 x 4 railing. The panels are similar to those at Feature 75 and the metal stands are similar to those at Feature 79. Cable hole U12t.04CH #1 consists of a concrete pad and metal cover with a metal post and plate with signage U12T-04-1.

Feature 78

Feature 78 is stored equipment within a 25 x 13 ft area (Figure 137). Equipment is 11 sheets of 5 ft x 4 ft x 3/4 inch plywood, 6 black cable spools (32 inch diameter) with orange insulated cable, random lengths of black insulated cable, and more than30 hex-cell aluminum pads (partially covered with soil and vegetation). The equipment was used for drilling and construction activities at this location.

Feature 79

Feature 79 is stored equipment consisting of one circular metal plate, eight yellow painted metal stands, and a light stand within a 20 x 20 ft area (Figure 138). The metal plate is a probably a drill hole cover that is 96 inches in diameter and may not be associated with the U12t Tunnel. It is similar to other vertical test hole covers and was placed at this location for storage. Welded to the center of the cover (concentric) are one 16 inch and one 10 inch diameter metal rings 4 inches in height. Two pieces of 6 inch metal I beam are welded along the sides of the plate. The metal stands consist of a 48 x 48 x 5 inch metal base to which two 4 x 4 x 40 inch posts (one on each side) have been welded. The posts are braced with diagonal bracing. A 26 x 26 inch metal plate is centered between the posts. It appears that an object was placed and secured between the base and plate. The light stand is constructed of a 2 inch channel iron base (x shaped) and a 2 inch galvanized pole 8 ft in height. Two rectangular lights are attached to a brace on top of the pole. Black insulated cable was found near the feature.

Feature 80

Feature 80 is the U12t.04PS#1D postshot drill hole (Figure 139). The feature is near the center of the trailer park and consists of a metal post with the signage U-12T-04-PSS-1D.

Feature 81

Feature 81 is the U12t.04PS#2D postshot drill hole (Figure 140). The feature is near the center of the trailer park and northeast of Feature 80. It consists of a metal post with the signage U-12T-04-PSS-2D.

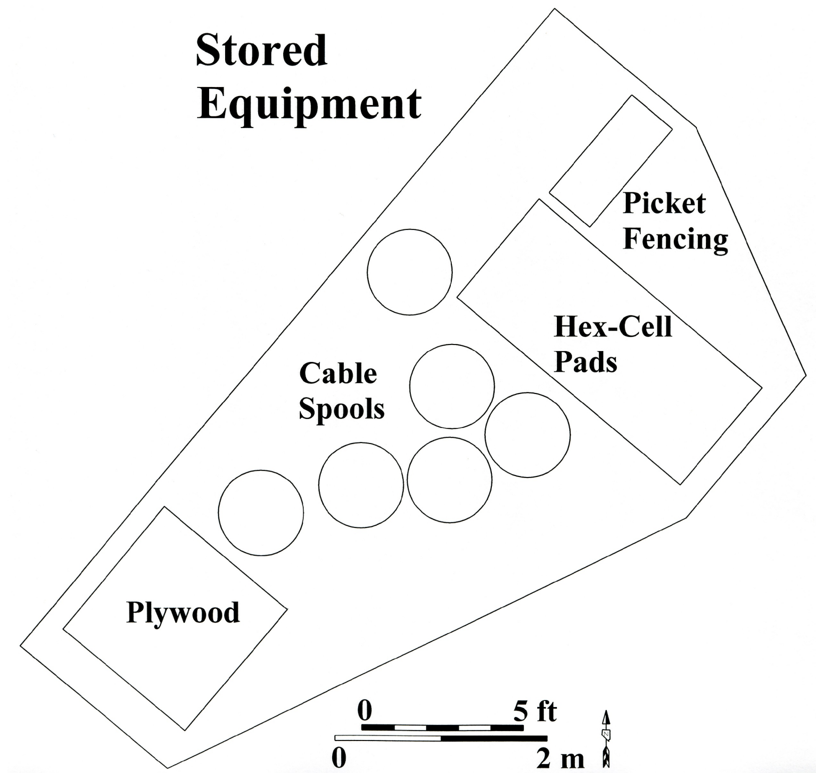

Figure 137. Plan map and photograph of Feature 78, U12t Tunnel, view southwest (2007).

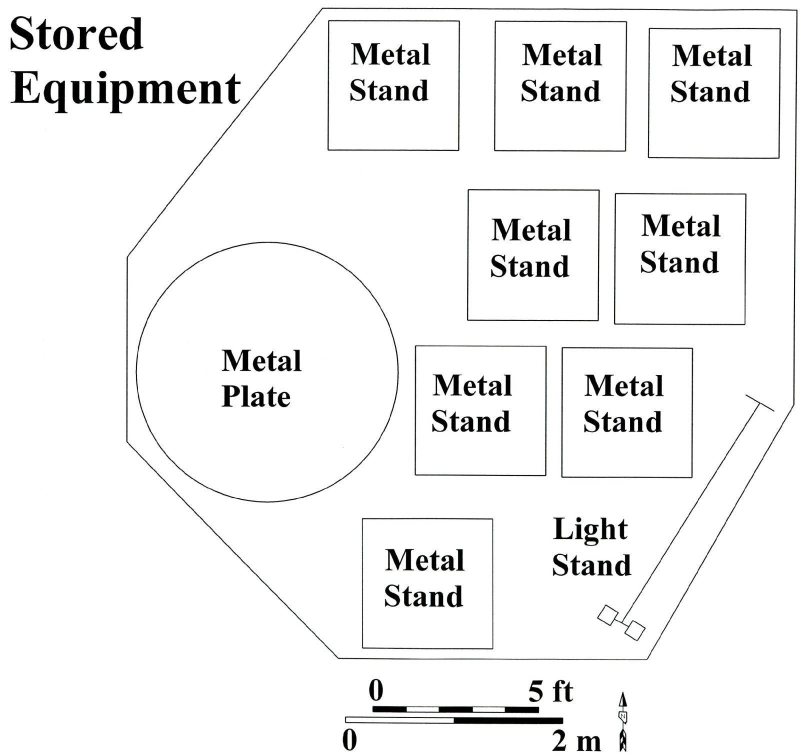

Figure 138. Plan map and photograph of Feature 79, U12t Tunnel, view south (2007).

Figure 139. Photograph of Feature 80, U12t.04PS#1D, view northwest (2007).

Figure 140. Photograph of Feature 81, U12t.04PS#2D, view northwest (2007).

Feature 82

Feature 82 is the UE12t #3 exploratory drill hole (Figure 141). The feature is near the east end of the trailer park and consist of a metal pipe extending approximately 40 inches above the surface and a metal post and plate with the signage UE-12T-3.

Drill Holes

Nine drill holes have been previously described at the U12t Tunnel Mesa Trailer Park and Midas Myth/Milagro Trailer Park. The remaining seven drill holes are at various locations on Aqueduct Mesa (Figure 53, Table 3). The most noticeable feature on the pad is a vertical pipe, usually 6 or 8 inches in diameter, near the center of the pad.

Feature 83

Feature 83 is the U12t.02PS#1A postshot drill hole (Figure 142). The feature is on a dirt pad along the north edge of North Mesa Road. It consists of a metal pipe extending above the surface, metal T posts, and a metal post and plate with the signage U-12T-02-PS-1.

Feature 84

Feature 84 is the UE12t #2 exploratory drill hole (Figure 143). The feature is on a dirt pad along the north edge of North Mesa Road. It consists of a metal pipe extending above the surface and a metal post and plate with the signage UE-12T-2.

Feature 85

Feature 85 is the UE12t #5 exploratory drill hole (Figure 144). The feature is along the west side of an access road near its intersection with the North Mesa Road. It consists of a metal pipe extending above the surface and a metal post and plate with the signage UE-12T-5.

Feature 86

Feature 86 is the UE12t #4 exploratory drill hole (Figure 145). The feature is near the center of a dirt pad along an unnamed dirt road. It consists of a metal pipe extending above the surface and a metal post and plate with the signage UE-12T-5. The post and sign are lying on the surface.

Feature 87

Feature 87 is the UE12t #6 exploratory drill hole (Figure 146). The feature is near the center of a dirt pad that is south of the road that accesses Aqueduct Mesa through Gold Meadows. It consists of a metal pipe extending a few inches above the surface that is capped with a metal plate with the signage UE-12T-5. Two metal T posts are near the pipe.

Figure 141. Photograph of Feature 82, UE12t#3, view northwest (2007).

Figure 142. Photograph of Feature 83, U12t.02PS#1A, view northwest, (2007).

Figure 143. Photograph of Feature 84, UE12t#2, view northwest (2007).

Figure 144. Photograph of Feature 85, UE12t#5, view northwest (2007).

Figure 145. Photograph of Feature 86, UE12t#4, view west (2007).

Figure 146. Photograph of Feature 87, UE12t#6, view northeast (2007).

Feature 88

Feature 88 is the UE12t #7 exploratory drill hole (Figure 147). The feature is near the center of a dirt pad along the north side of the road that accesses Aqueduct Mesa through Gold Meadows. It consists of a metal pipe extending above the surface and a metal post and plate with the signage UE-12T-7.

Feature 89

Feature 89 is the UE12t #8 exploratory drill hole (Figure 148). The feature is near the center of a dirt pad along the north side of the road that accesses Aqueduct Mesa through Gold Meadows. It consists of a metal pipe extending above the surface and a metal post and plate with the signage UE-12T-8. Three T posts are near the pipe.

Cultural Features Summary

A total of 89 features were recorded, mapped, and photographed. At the Portal Terrace, lagging around the gates securing the portal has been replaced. On the Ventilation Terrace, the Vent Raise has been modified and used to pour a concrete plug to seal the U12t Tunnel directly below. These modifications indicate that the portal area was not static but changed through time to accommodate various requirements for testing within the tunnel. The Water Supply Terrace remains unchanged and most of the Pond area is not accessible. Only concrete foundations and pads remain at the U12t Tunnel Mesa Trailer Park, various equipment remains at the Midas Myth/Milagro Trailer Park, and generally only pipe and signage remain at the drill hole locations.

U12t Tunnel Tests

Six nuclear weapons effects tests were conducted within the U12t Tunnel complex (Table 5). The first test was conducted in May 1970 and the last one in June 1987. In addition to the nuclear tests, one nitromethane high explosive test, designated SPLAT for Stemming Plan Test, was carried out within the tunnel in 1973 (Muma et al. 1974). The Dipole Knight 2 and 3 and the Divine Eagle conventional weapons tests took place in the tunnel portal area in 1997 and 1998 (Oxtoby 1998; Thompson 2008, personal communication; Thompson and Goodfellow 1997).

The six nuclear weapons effects tests were sponsored by DTRA. LLNL provided four of the nuclear devices and LANL provided two. The yield of each nuclear device was less than 20 kilotons (DOE/NV 2000). The Mint Leaf test was conducted in the Tunnel Bed 3a geological stratum, the Diamond Sculls test in the Tunnel Bed 2 stratum, and the remaining four in the Tunnel Bed 4 stratum (Ristvet et al. 2007; Townsend 2007). The overall goal of the first five nuclear weapons effects tests was to determine the vulnerability or survivability of various military hardware, structures, and electronic equipment when exposed to the radiation field generated by a nuclear explosion (Brady et al. 1989; Horton et al. 1987:2-3; McDowell et al. 1987:20-21; Schoengold 1999:3; Stinson et al. 1993:2). For example, two of the nuclear tests were for the U.S. Army to test the Spartan missile system, one of the tests was for the Trident missile used by the U.S. Navy, and

Figure 147. Photograph of Feature 88, UE12t #7, view east (2007).

Figure 148. Photograph of Feature 89, UE12t#8, view northwest (2007).

two were for the Peacekeeper missile also for the U.S. Navy (Ristvet et al. 2007). The tests were designed to measure the effects of radiation on specific components, known as experiments, and required a direct line-of-sight between the experiments and the nuclear explosion. The tests also required high altitude simulation that was produced within the line-of-sight pipe by large vacuum pumps that created the desired atmospheric or exoatmospheric condition. The sixth nuclear test in the U12t Tunnel, located in a hemispherical cavity, was designed to study the shock-induced effects of a near surface nuclear detonation.

Table 5. Nuclear Weapons Effects Tests in the U12t Tunnel (DOE/NV 2000).

TEST	OPERATION*	DATE	LOCATION
Mint Leaf	Mandrel/Minute Gun	05/05/1970	U12t.01
Diamond Sculls	Toggle/Minute Gun	07/20/1972	U12t.02
Husky Pup	Anvil/Hussar Sword	10/24/1975	U12t.03
Midas Myth/Milagro	Fusileer/Hussar Sword	02/15/1984	U12t.04
Mighty Oak	Charioteer/Hussar Sword	04/10/1986	U12t.08
Mission Ghost	Musketeer/Hussar Sword	06/20/1987	U12t.09

* Consists of the DOE/DoD operation designations.

Mint Leaf

Mint Leaf was the first nuclear weapons effects test in U12t Tunnel (Figures 149-150). It was detonated on the morning of May 5, 1970 (DOE/NV 2000:59; Horton et al. 1987:127). Vertical depth of the test below the surface was 1,330 ft (405 m). LLNL supplied the nuclear device, placing it in the U12t.01 drift, and was in charge of device operations.

Prior to mining the U12t.01 drift, four holes were drilled to explore and characterize the geology (Lee 1971:5). One vertical hole was drilled from the surface above the tunnel and three horizontal holes were drilled underground. Mining of the U12t.01 drift began October 1968 and was completed August 27, 1969 (Bennett 1991). The drift was started by turning left off the U12t main drift 3,400 ft (1,036 m) from the portal (Lee 1971:1). The U12t.01 drift was mined 2,085 ft (636 m) long. It was 19 ft (5.8 m) wide and 19.5 ft (5.9 m) high where it began at the main drift. The dimensions were incrementally reduced in size over the span of the drift until it was 10 ft (3 m) wide and 9 ft (2.7 m) high at the entrance to the zero room. The zero room was 15 ft (4.6 m) wide and high. The Mint Leaf test did not have a bypass drift to facilitate device insertion in the zero room. Instead, the device was transported down a walkway alongside the line-of-sight pipe. The walkway was stemmed with grout just prior to test execution. The line-of-sight pipe for the test was 1,800 ft (549 m) long, had a maximum outside diameter of 16.7 ft (5.1 m), and a volume of 150,000 cu ft (Flangas 1971). The majority of the Mint Leaf data were recorded at the mesa trailer park where 33 diagnostic trailers

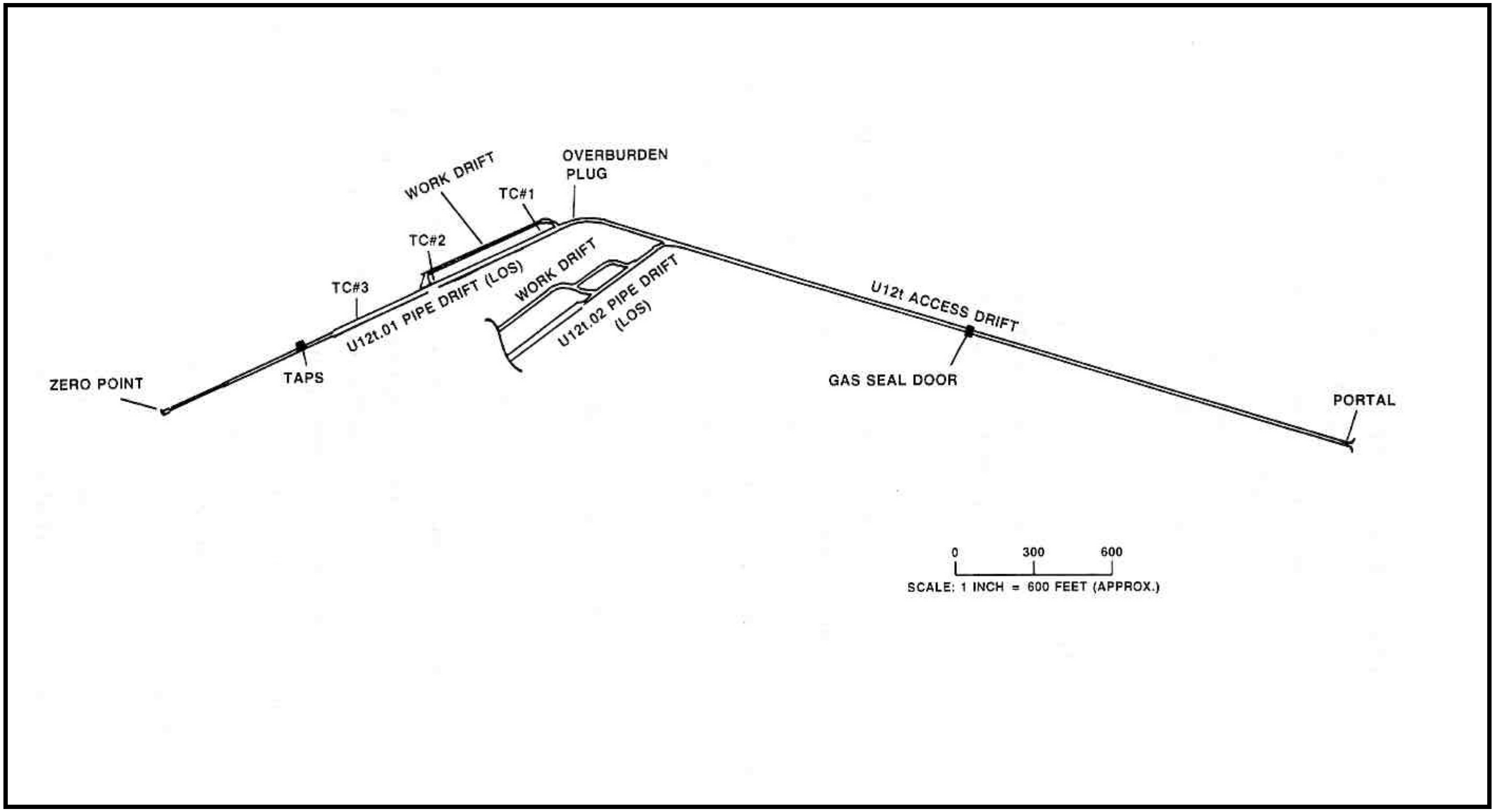

Figure 149. Plan of the U12t.01 drift for the Mint Leaf nuclear weapons effects test (Horton et al. 1987:128).

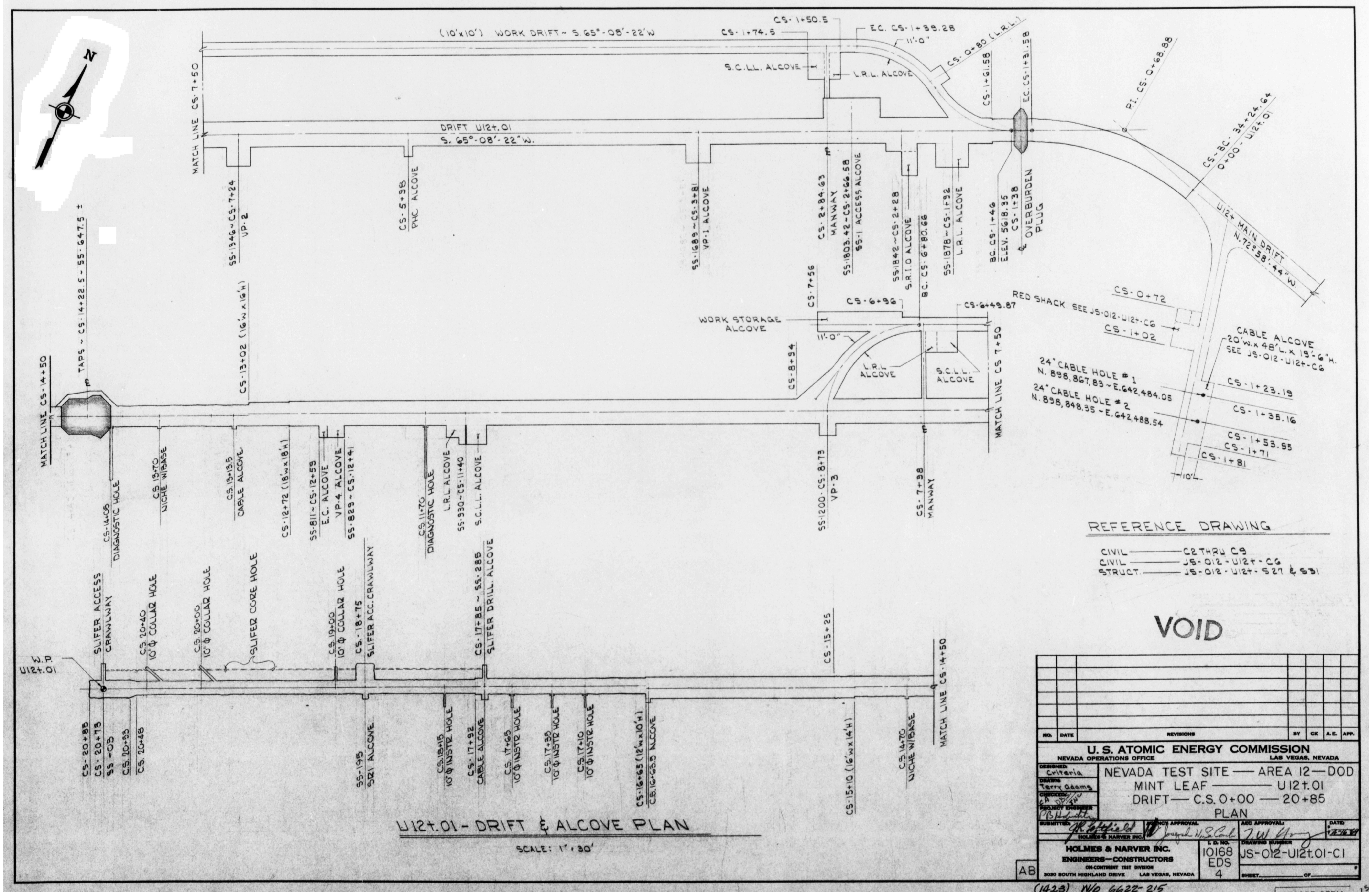

Figure 150. Construction plan of the U12t.01 drift, 1969 (drawing JS-012-U12t.01-C1, on file at the Archives and Records Center, Mercury).

were positioned (Flangas 1970). At the portal were three diagnostic trailers. Support trailers were at both locations. Two cable holes were used to route the signal cables from the experiments in the tunnel to the mesa trailer park. Standard Remote Area Monitoring System units were located at the portal, on the mesa in the recording trailer park, and throughout the tunnel (Horton et al. 1987:131-132).

Detonation of the Mint Leaf device was initially planned for April 28, 1970, but because of unfavorable weather conditions, the test was postponed until weather conditions became favorable (Horton et al. 1987:136). Mint Leaf was finally detonated at 8:30 on the morning of May 5. All instrumentation and data acquisition systems, stemming, and closures worked as designed (Vincent 1971:339). At 34 minutes after detonation a small amount of radioactive gas began to seep into the tunnel from the end of stemming in the line-of-sight drift (Horton et al. 1987:127). The seepage did not breach the containment plugs or doors. It continued for 62 hours and 14 minutes at which time the cavity, created by the nuclear explosion, collapsed and released the pressure causing the seep.

Initial reentries to the mesa and the portal began about one hour after detonation and were completed before noon (Horton et al. 1987:127). No elevated readings above background levels were detected (Horton et al. 1987:139). Shortly after noon, remote gas sampling began within the tunnel. Elevated radiation and toxic and explosive gas levels were detected in Containment Vessel II on the working point side of the Overburden Plug. In addition, elevated toxic and explosive gas levels were detected at Test Chamber No. 3.

Radioactive effluents were ventilated to the atmosphere through three controlled releases by way of the filter system (Schoengold et al. 1996:151). The first controlled release was during remote gas sampling about 4.5 hours after detonation and the last two during ventilation of the tunnel on the day after or D+1 and then again on D+7. On the third release the radiation levels in the ventilation lines finally reached background level (Horton et al. 1987:138). Radioactive effluents from the controlled releases were detected beyond the boundaries of the NTS (DOE/NV 2000:58; Schoengold et al. 1996:151). Cloud tracking procedures began shortly after detonation and again on D+1 (Horton et al. 1987:138).

Tunnel reentry began on May 13 by opening the Gas Seal Door and reinstalling the train rails (Horton et al. 1987:140). Reentry continued for the next two days, installing sump pumps at the Overburden Plug to drain water and opening the crawl tube to the plug (Horton et al. 1987:141). On May 18, reentry teams inspected the three test chambers, finding them in good condition. Some water was on the floor in Test Chamber No. 2 and sand, rock, and sandbags were found on the floor of Test Chamber No. 3. Elevated radiation levels were encountered beyond the test chambers and near the Tunnel and Pipe Seal.

Experiments were recovered from the test chambers between May 19 and June 17, 1970 (Horton et al. 1987:142). A small amount of radiation was still present in the test chambers, which required all recovery crews to wear anti-contamination clothing and to wrap all experiments before they were removed to the decontamination facility for cleaning. Limited reentry work was performed after June

1970 due to a labor dispute at the NTS that lasted until October, and from December 1970 through January 1971 the area was closed because of radioactive material venting at the Baneberry nuclear test site in Yucca Flat just east of the tunnels area. Recovery of hardware from the U12t.01 drift was conducted in February and April 1971. The U12t.01 drift was closed on May 7, 1971. No post test drilling was performed.

Diamond Sculls

Diamond Sculls was the second nuclear test in U12t Tunnel (Figures 151-160). It was conducted on July 20, 1972 in the U12t.02 drift at a vertical depth of 1,391 ft (424 m) below the surface (McDowell et al. 1987:91). LLNL supplied the device and was in charge of device operations. Yield of the explosion was less than 20 kilotons (DOE/NV 2000). The Diamond Sculls test, from inception to execution, took almost four years to complete because of its size and complexity.

Mining of the U12t.02 drift began in October 1968 and was completed by November 1971 (Bennett 1991). In addition to a line-of-sight drift, the Diamond Sculls test had a bypass drift and eight crosscuts between the two drifts (Figures 151-152). The bypass and crosscuts provided access to test chambers for installation and recovery of experiments, for front-end experiment and auxiliary closure installation, space for electronic equipment, and for the late-time insertion of the nuclear device into the zero room. Permanent U12t Tunnel features, such as the Gas Seal Door and the Cable Plant were reused from the Mint Leaf test (McDowell et al. 1987:96). The Cable Plant consisted of the Cable Alcove, two cable holes to the mesa, and a power distribution system. Geological data from three additional exploratory drill holes were added to the U12t.01 drill hole data to help develop containment requirements for the Diamond Sculls test.

Diamond Sculls has the distinction of being the largest diameter and longest line-of-sight pipe ever used at the NTS (DTRA 2002:382; McDowell et al. 1987:91). The pipe was 1,940 ft (591 m) long and tapered from a 1 ft (30 cm) diameter at the A-box in the zero room to a 26.67 ft (8.1 m) diameter at the last test chamber, Test Chamber No. 1. This test chamber also has the distinction of being the largest. The total length of the line-of-sight pipe, including the stub pipes mounted to the end of Test Chamber No. 1 was 2,540 ft (774 m) long. Volume of the pipe was 300,000 cubic feet (Flangas and Harvey 2007). To accommodate the size of the pipe, an Assembly Area was constructed underground in the line-of-sight drift. This area was 176 ft (54 m) long, 38 ft (11.6 m) high, and 33 ft (10 m) wide (Figures 152, 157). It had four bays where different tasks were performed to complete the assembly of the larger pipe segments (Carpenter 1971). A bridge crane was installed in the Assembly Area to lift and move the pipe sections. Half-round sections of pipe, each 12 ft (3.7 m) long, were moved into the tunnel on specially designed rail transporters (Figure 156). When the pipe sections reached the Assembly Area, they were lifted, rotated, fitted, welded together, moved forward, precisely aligned, and welded in place (Figure 158). The smaller segments of pipe not requiring assembly underground were moved into position by way of the bypass drift and crosscuts (Carpenter 1971).

An assembled large pipe segment consisted of six sections, with three on the bottom and three on the top, and measured 36 ft (11 m) long (Flangas and Harvey 2007). The largest segment assembled

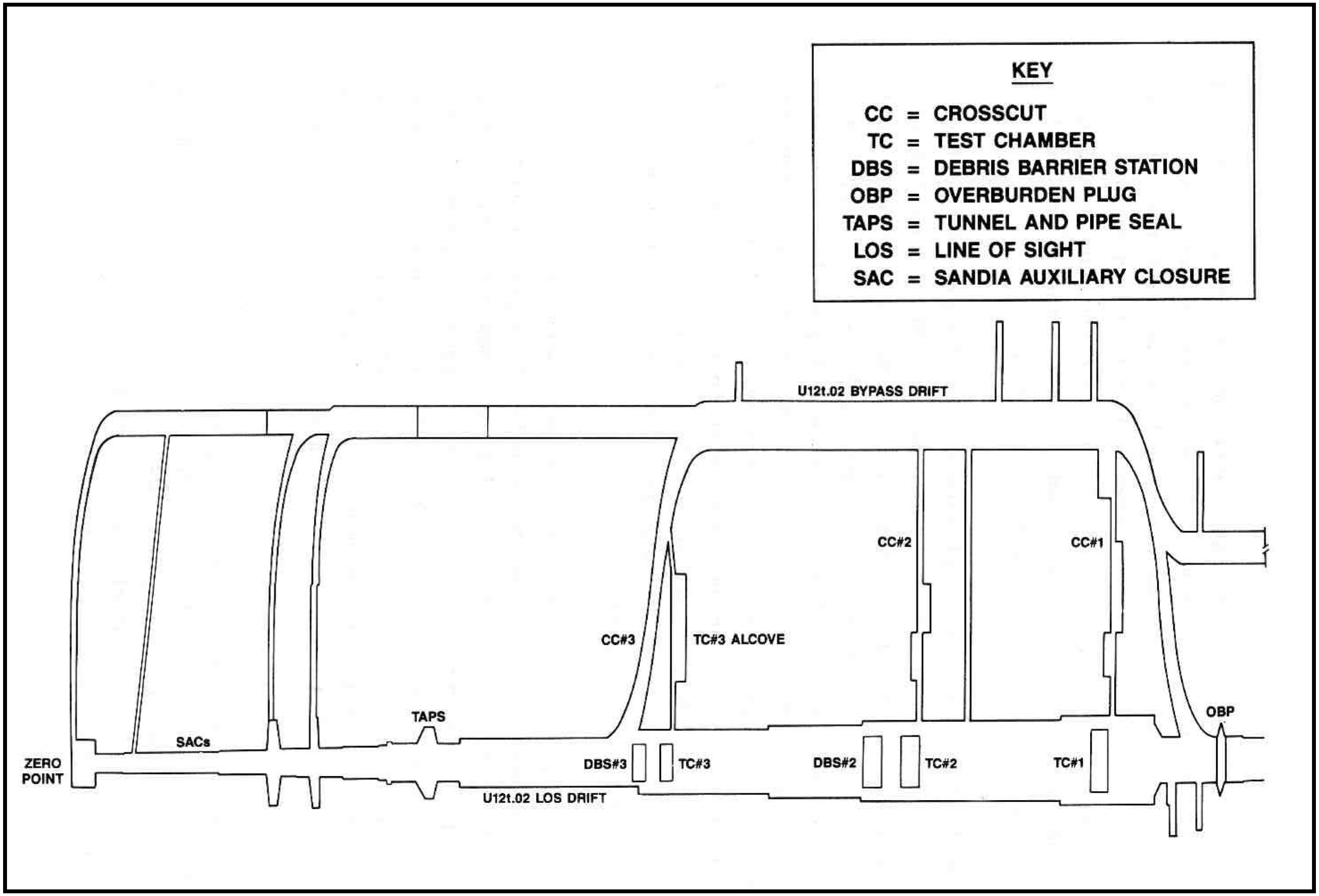

Figure 151. Plan of the U12t.02 drift for the Diamond Sculls test (McDowell et al. 1987:109).

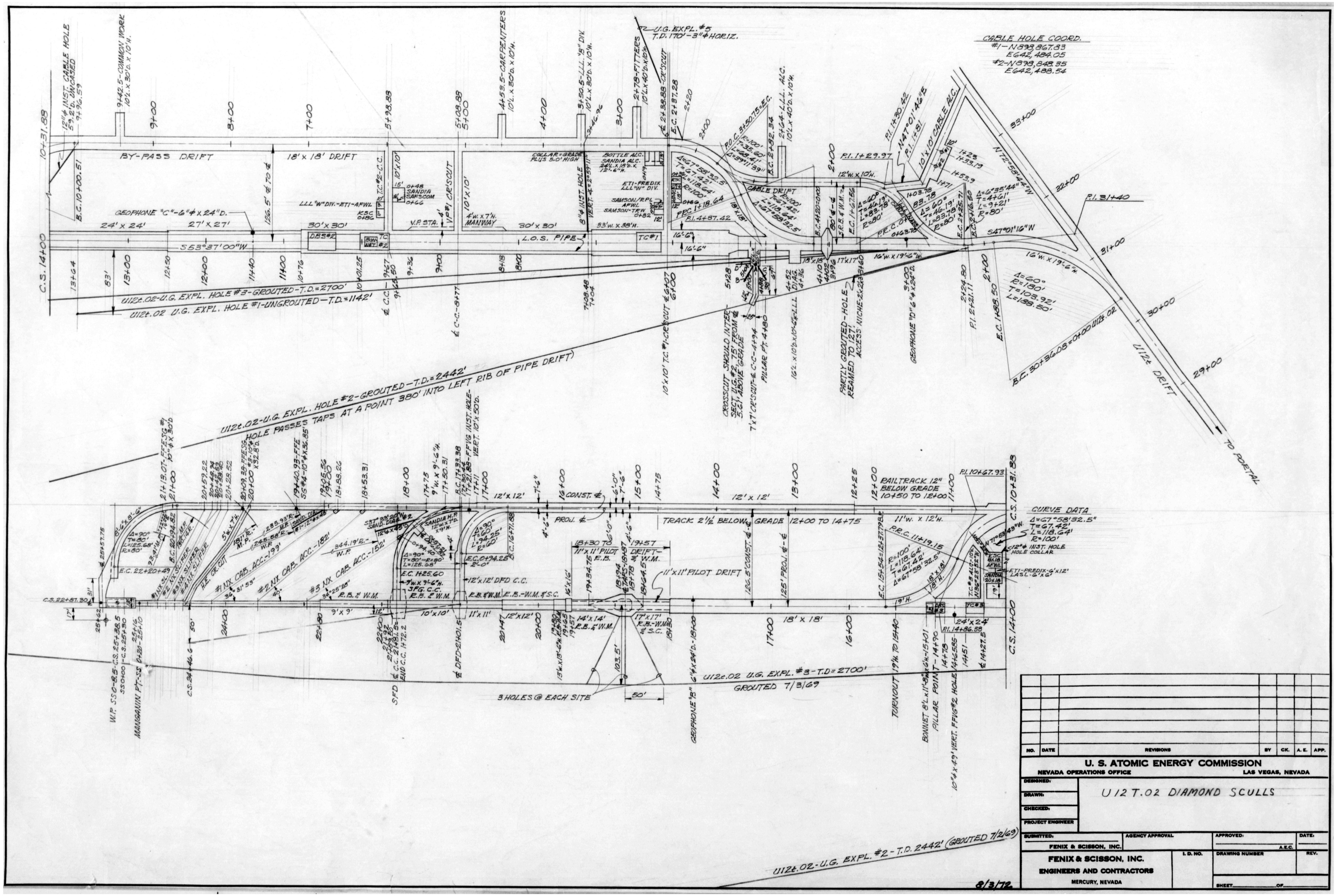

Figure 152. Construction plan of the U12t.02 drift for the Diamond Sculls test, 1972 (No Number - 170533, on file at the Archives and Records Center, Mercury).

Figure 153. U12t Tunnel Portal Area, with storage of the half sections of the line-of-sight pipe for the Diamond Sculls test, view southeast, 1970 (photograph on file, Nuclear Testing Archive, Las Vegas).

Figure 154. Half sections of the line-of-sight pipe for the Diamond Sculls test, U12t Tunnel Portal Area, view south, 1970 (photograph on file, Nuclear Testing Archive, Las Vegas).

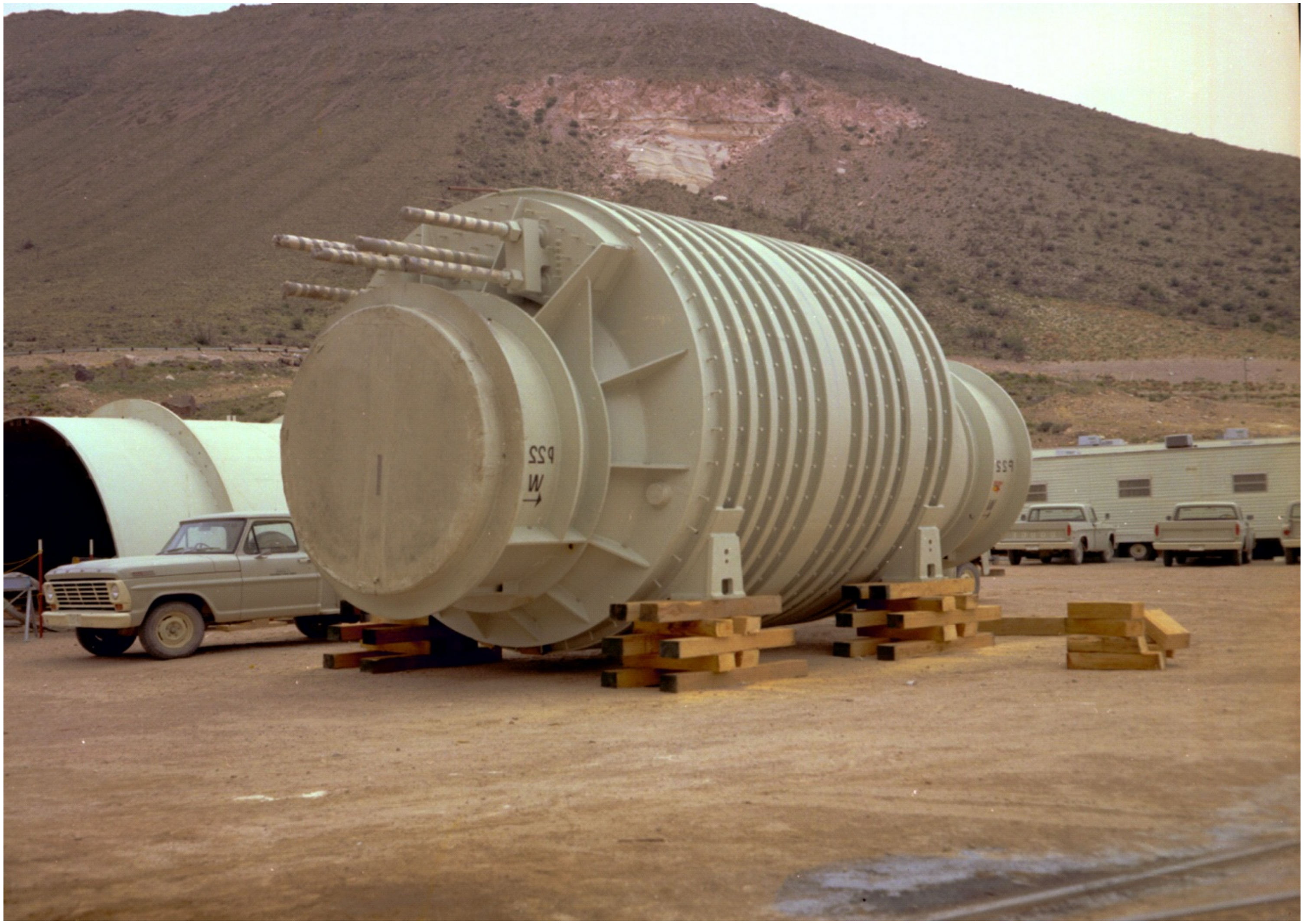

Figure 155. Tunnel and Pipe Seal for the Diamond Sculls test, U12t Tunnel Portal Area, 1971 (photograph on file, Defense Threat Reduction Information Analysis Center, Albuquerque).

Figure 156. Half section of the line-of-sight pipe being moved into the portal entrance, U12t Tunnel, 1970 (photograph on file, Defense Threat Reduction Information Analysis Center, Albuquerque).

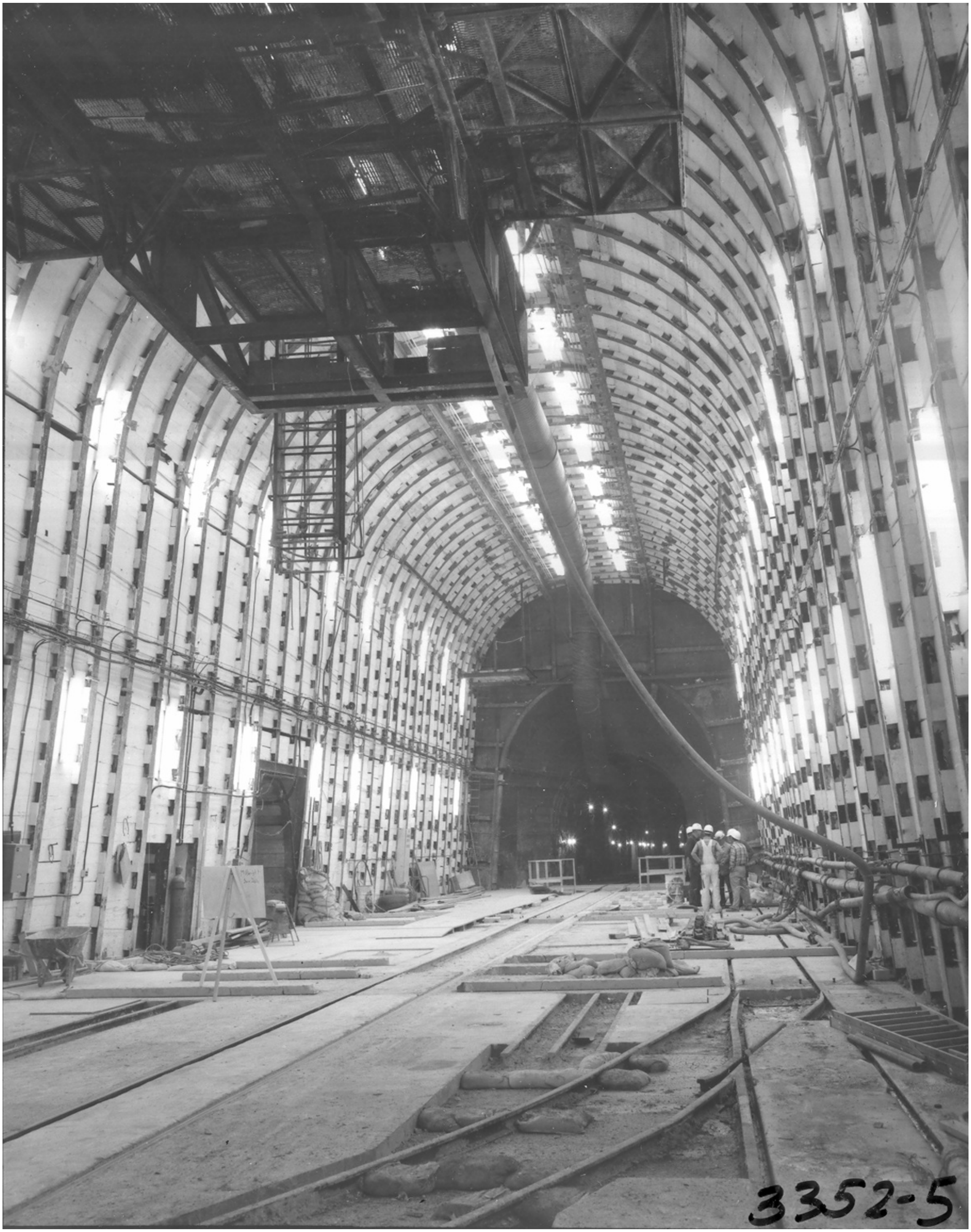

Figure 157. Assembly room, U12t.02 drift, 1971 (photograph on file, Nuclear Testing Archive, Las Vegas).

Figure 158. Construction of the line-of-sight pipe, U12t.02 drift, 1971 (photograph on file, Nuclear Testing Archive, Las Vegas).

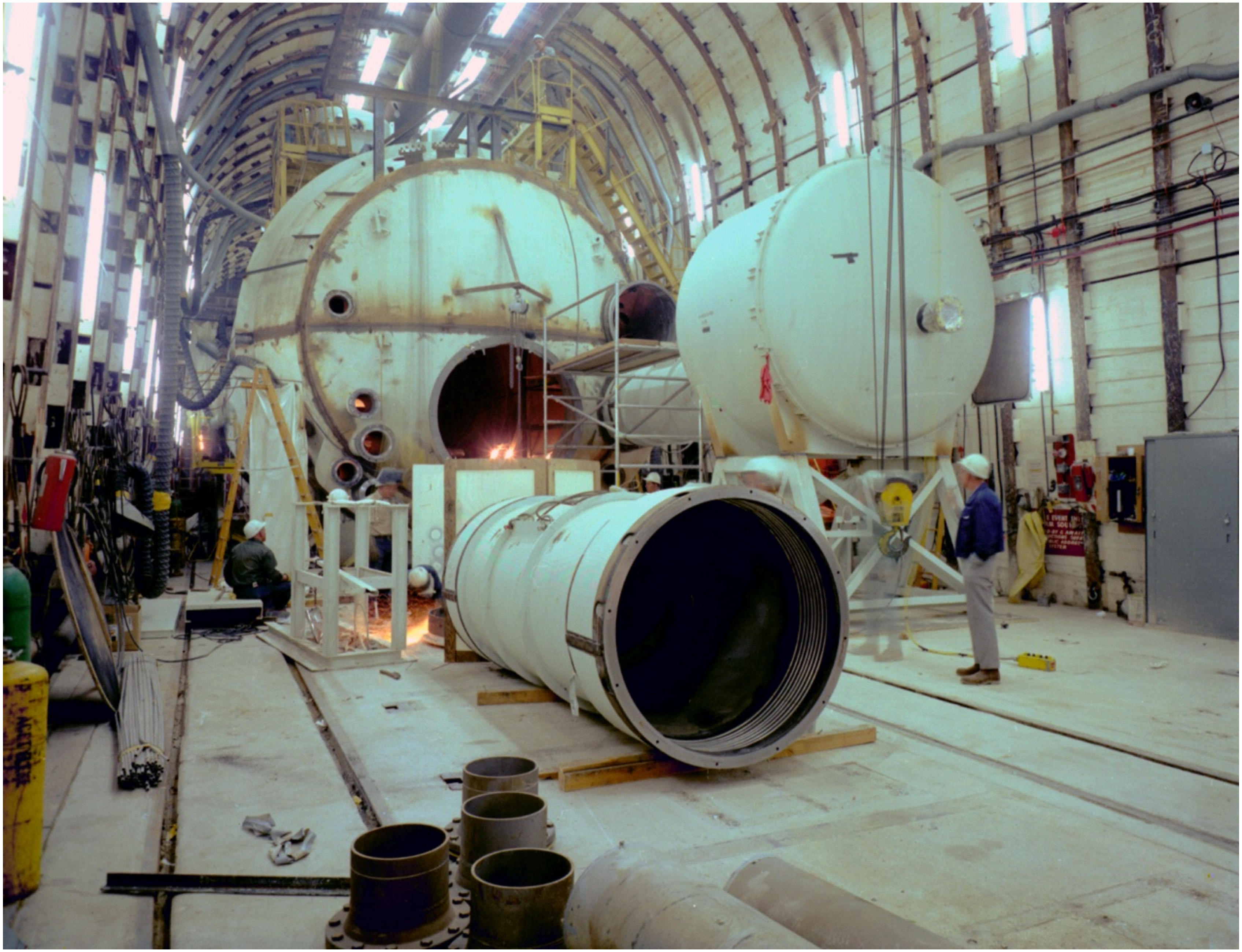

Figure 159. Test Chamber No. 1 in Assembly Room, U12t.02 drift, 1972 (photograph on file, Defense Threat Reduction Information Analysis Center, Albuquerque).

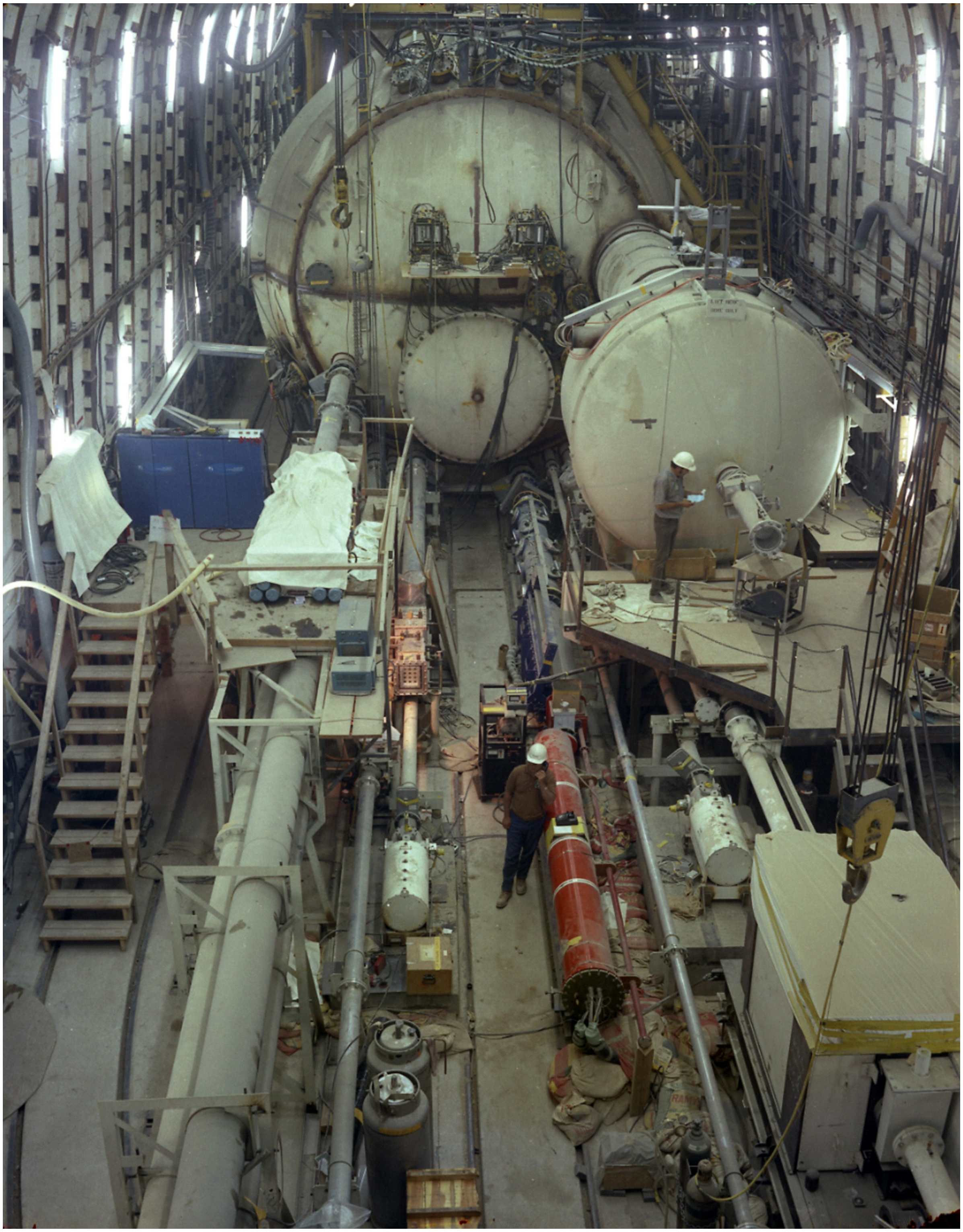

Figure 160. View of Test Chamber No. 1 and attached pipe stubs in the Assembly Room for the Diamond Sculls test (photograph on file, Archives and Records Center, Lawrence Livermore National Laboratory, California).

weighed 84 tons. To produce a uniform weld, and with no tolerances, the welding tool was held stationary and the pipe rotated during the welding process. Situated above the pipe was a hopper that provided a continuous flow of flux to the weld. Two passes of welding were conducted for each pipe segment and the process was continuous until the welding operation was completed. Test Chamber No. 1 was the last segment assembled and was attached to the line-of-sight pipe in Bay No. 3 of the Assembly Area (Carpenter 1971). The equipment used to assemble the pipe was unique to all the tunnel operations, created just for this test, and is still there today inside the tunnel (Flangas and Harvey 2007).

The final dry run for the test was conducted on July 17, 1972 (McDowell et al. 1987:104). Some problems arose, one being an air leakage at the Overburden Plug. Fixing these problems delayed the test two days. Another delay of one day was added because approval to conduct the test had not yet been given by DOE Headquarters. On the day of the test, July 20, some minor delays occurred, involving security and a problem with an experiment. The device was finally detonated around 10:00 in the morning. All instrumentation and containment systems functioned as designed. No radioactive effluents were released to the atmosphere (McDowell et al. 1987:91; Schoengold et al. 1996).

Remote Area Monitoring System units were deployed at the portal, on the mesa, and in the tunnel. Elevated radiation levels along the line-of-sight pipe just after detonation were detected by the units (McDowell et al. 1987:105). This occurrence was expected and the radiation decayed quickly. Initial reentry to the mesa trailer park and the portal area began about two hours after detonation and no radiation levels above background were found at either place. The tunnel was checked next. Valves through the Gas Seal Door were electrically operated, while the ventilation valves through the Gas Seal Plug and Overburden Plug had to be manually operated in order to remotely sample gas from the working point side of the plugs. In this way, gases were drawn through the valves into plastic bags, analyzed for radioactivity and toxic gases, and returned to their origin. Remote gas sampling from the Overburden Plug found no evidence of elevated radiation levels or of toxic and explosive gases (McDowell et al. 1987:105). Ventilation was established on the portal side of the Gas Seal Door and a valve opened in the Overburden Plug to drain water from the working point side of the plug towards the portal side.

The next day or D+1, tunnel reentry was made to the Gas Seal Door where water about 18 inches (46 cm) deep was found on the working point side (McDowell et al. 1987:106). The presence of water was normal for U12t Tunnel and sump pumps were installed to drain the water. Next, the reentry team moved through the Gas Seal Door to the Gas Seal Plug, installed a vent line through the plug, opened the Gas Seal Door, and installed train rails through the door. The following day or D+2, reentry was to the Overburden Plug and a vent line was installed. It was not until the third day or D+3 that reentries into the line-of-sight and bypass drifts were attempted (McDowell et al. 1987:108). Test Chambers 1 to 3 in the line-of-sight drift were reached and high radiation levels were detected. On the next two days, D+4 and D+5, an experiment in the pipe was secured and photographs were taken of the various stations within the pipe (McDowell et al. 1987:110). The final initial reentry was to the Tunnel and Pipe Seal on July 26 or D+6. Recovery of experiments began on July 31, 1972 and most of the smaller experiments were removed by August 2 (McDowell et al.

1987:111). Recovery of the remaining and larger experiments began on August 7 and were finished by August 10.

An extensive reentry drift was mined between the line-of-sight and bypass drifts to obtain gas samples from the working point side of the auxiliary closures. Monitoring for radioactive and toxic gases continued during the mining of the reentry drift and on several occasions elevated toxic gas levels and a noxious odor were detected (McDowell et al. 1987:111-114). Mining of the reentry drift continued until November 2 when the first of two probe holes were started in the face of the drift toward the test cavity to determine its size (McDowell et al. 1987:115). A postshot hole was also drilled from the top of the mesa into the test cavity the latter part of August (McDowell et al. 1987:116). Samples were taken and the drill hole was grouted. All work in the U12t.02 drift was completed November 16, 1972. The information collected and lessons learned during the Diamond Sculls reentry efforts were incorporated in the design of containment features for future tunnel nuclear tests.

SPLAT

A stemming plan high explosive test was conducted in the U12t.02 bypass drift on the morning of August 9, 1973 (Muma et al. 1974:27). The Stemming Plan Test, or SPLAT, was designed as a scaled model of the line-of-sight pipe configuration that had been used for the Misty North nuclear test conducted in May 1972 in the U12n Tunnel. Preparation for the SPLAT test began mid July 1973 (REECo 1975). The test included a galvanized steel pipe 25 ft (7.6 m) long, with a diameter of 2.18 inches (5.54 cm) at one end and 6.09 inches (15.47 cm) at the other, forming a cylindrical cone similar to a typical line-of-sight pipe (Muma et al. 1974:33). It was inserted into a straight 10 inch (25.4 cm) diameter steel pipe that served as an exterior envelope. Superlean grout of different colors and sand were placed between the two pipes. The pipe assembly was then placed into a 1 ft (30.5 cm) diameter horizontal drill hole 28 ft (8.5 m) long. Rock-matching grout was placed between the exterior pipe and the walls of the drill hole (Muma et al. 1974:37). To form an explosive container, 950 pounds of nitromethane explosive was placed between two 10 ft (3 m) diameter steel disks separated by a 2 inch (5 cm) thick ring at the outer edge. The explosive container was then placed against the wall where the pipe was inserted and on center with the pipe. Voids between the wall and the inner steel disk were filled with rock-matching grout. Eighty-five detonators and booster assemblies were placed uniformly on the face of the outer steel disk. Active and passive gages were used to measure pressures, stress waves, and arrival time of material at the end of the pipe away from the explosive (Muma et al. 1974:39). Timing and firing was controlled from the DoD trailer in the portal area (Muma et al. 1974:45). Much of the expected results for the test were not realized because no vacuum was created inside the pipe and the second exterior pipe was not characteristic of a typical tunnel line-of-sight pipe test and should not have been included in the experiment (Muma et al. 1974:59, 62).