Idaho National Engineering Laboratory, HALS No. ID-1
Arco Naval Proving Ground
(Idaho National Laboratory)
Scoville Vicinity
Butte County
Idaho

BLACK & WHITE PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED & INTERPRETIVE DRAWINGS

FIELD RECORDS

Historic American Landscapes Survey
National Park Service
Pacific West Regional Office
U.S. Department of the Interior
Seattle, Washington

HISTORIC AMERICAN LANDSCAPES SURVEY

IDAHO NATIONAL ENGINEERING LABORATORY, ARCO NAVAL PROVING GROUND (Idaho National Laboratory)

HALS No. ID-1

Location: Within and adjacent to Idaho National Laboratory (INL), Scoville Vicinity, Butte County, Idaho.

NAD 1983 UTM Zone 12N	*northing*	*easting*
Northwest corner:	4865484 m	359125 m
Northeast corner:	4865286 m	368758 m
Southeast corner:	4816096 m	336881 m
Southwest corner:	4818941 m	348273 m

The 271 square mile Arco Naval Proving Ground (NPG) is located on the high desert of the northeastern Snake River Plain in southeastern Idaho. It lies approximately twenty miles east of Arco, fifty miles west of Idaho Falls, and sixty-five miles northwest of Pocatello. The Arco NPG is approximately nine miles wide by thirty miles long and trends from the southwest to the northeast. U.S. Highway 20/26 crosses the Arco NPG near its southwestern end and U.S. Highways 22, 28, and 33 intersect its northern half.

Present Owner: United States Department of Energy

Present Occupant: Idaho National Laboratory

Present Use: United States Department of Energy, United States Department of the Navy, United States Department of Defense, and United States Department of Homeland Security facilities and operations

Significance: *Primary*
World War II Naval Ordnance Testing (1943-1945)
Post-War Ordnance Testing (1945-1949)

Secondary
Army Air Force High Altitude Bomber Training (1943-1945)

The Arco NPG was one of five specialized ordnance facilities established in the United States during World War II to support ordnance testing and research and experiments related to safe storage and transportation of live ordnance. Victory in the Pacific theater relied partly on the performance of battleship guns and the Arco NPG was the only proving ground where the large caliber guns used by the Pacific Fleet were tested. The Arco NPG was the terminus of an elaborate logistical system that began with the guns on ships like *USS Missouri* and *USS Wisconsin*. After repeated combat firing wore down the rifling, the guns were taken to coastal ports, unloaded, and sent by rail overland to Pocatello, Idaho, where they were refurbished and relined. Finally, the guns were sent to the Arco NPG to be test-fired and scored for accuracy. The guns then returned to action the way they had come and entered battle once more.

In addition to naval ordnance testing, the U.S. Navy allowed the U.S. Army to use lands adjacent to the Arco NPG for two aerial bombing ranges. During World War II, over 40,000 pilots were trained at the Pocatello Army Air Base and many flew day and night training missions over the Arco High Altitude Bombing Range (AHABR) and the Twin Buttes Bombing Range (TBBR). Hundreds of men lost their lives while serving at the Pocatello

Army Airbase, including seven men whose B-24 Liberator went down in 1944 near TBBR while on a night mission. Later, the two military branches joined forces to conduct tests at the Arco NPG, which contributed greatly to determining safe storage and transport of conventional ordnance.

The Arco NPG provided the core setting for the establishment of the National Reactor Testing Station in the late 1940s and the evolution of present-day INL. Arco NPG buildings in the residential and proofing areas and other infrastructure such as roads and rail sidings influenced the location and footprints of the later facilities. Beyond the proofing and residential centers, the Arco NPG also altered the wider desert landscape. Explosives tests and gun firings required their own infrastructure such as roads, concrete and wood targets, and camera and instrument shelters. The tests and firings produced impact craters and left a variety of ruins on the desert floor – piles of shattered concrete and twisted metal, wood pieces and window glass shards, bomb shells and even unexploded projectiles. The latter, a hazardous legacy that remained unattended until many decades later.

The Arco NPG serves as a tribute to the logistical excellence of the U.S. military and its association with the great battleships of World War II and postwar military research and testing are nationally significant. The Arco NPG was the only proving ground of its kind west of the Mississippi River and is one of very few sites in Idaho that contributed to American victory during World War II. Post-war testing in the Arco NPG was also instrumental in revising national standards for the safe storage and transport of conventional ordnance.

Authors and Researchers:

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Project Information:

Based on evaluations conducted in 1993 and 1997, historians determined that the then-remaining Arco NPG structures were significant to the nation's history through their association with World War II (The Arrowrock Group, Inc. 1997, Braun 1995). Through ensuing discussions with the Idaho State Historic Preservation Office (SHPO), it was further determined that the related infrastructure and associated landscape were integral and significant components.

According to provisions of INL's *Cultural Resource Management Plan* (CRMP), which is legitimized through a 2004 Programmatic Agreement (PA) among the Department of Energy Idaho Operations Office (DOE-ID), the Idaho SHPO, and Advisory Council on Historic Preservation (ACHP), historians identified the Arco NPG World War II structures as DOE Signature Properties. As defined by DOE-Headquarters, Signature Properties "denote its [DOE's] most historically important properties across the complex… and/or those properties that are viewed as having tourism potential."

As original Arco NPG buildings and structures aged, INL programs sought more suitable working spaces and most of the buildings were unoccupied and idled. Although DOE-ID actively sought other uses for the vacant, unused Arco NPG buildings, none were identified. Heritage tourism was also ruled out for the properties due to their location in the core of INL property, where public access is strictly limited. A variety of health and safety concerns were also identified during subsequent condition assessments, including: lead-based paint, asbestos, rodent infestation/droppings, small animal carcasses, mold, and, in one building (CF-633), areas of radiological contamination.

In early 2013, DOE-ID notified the Idaho SHPO, ACHP, and, as required by the INL CRMP and PA, the DOE-Headquarters Federal Preservation Officer, of their intent to demolish the vacant Arco NPG buildings (CF-606, CF-607, CF-613, CF-632, and CF-633). At this time, the proposed end-state of the buildings was either grass and/or gravel pads.

Through the National Historic Preservation Act (NHPA) Section 106 consultation process, measures to mitigate the adverse impacts of demolition were determined and agreed upon through a Memorandum of Agreement (MOA) between DOE-ID, the Idaho SHPO, and ACHP. The measures included the development and installation of interpretive signs to be placed at a publically accessible location, retention of original components of CF-633, and completion of this Historic American Landscapes Survey (HALS) standard format. In order to fully document the entire Arco NPG landscape, a variety of buildings, infrastructure, features, and landscape elements that are not scheduled for removal are documented here as well as properties that are scheduled for demolition.

Scope: The scope of this HALS temporally spans from 1943 to 1949, and geographically covers approximately a 480 square mile area (772.50 sq. km) between Arco and Idaho Falls, Idaho. Included in this documentation is the development of the Arco NPG and Naval ordnance testing during World War II, as well as ordnance safety testing that took place during World War II and just after the war. In addition, the two bombing ranges, AHABR and TBBR, are also documented in this HALS. Establishment of the National Reactor Test Station (NRTS) in 1949 marks the end point of the study.

Methodology: An archival and literature search was conducted using: INL Electronic Document Management System (EDMS), which identified sources available both digitally and in hard copy on file at INL Records Management; INL CRMO project files, which include survey results, historic contexts, and SHPO consultation; Special Collections and University Archives housed at the Eli M. Oboler Library at Idaho State University; Pocatello Regional Airport archives; Bannock County Historical Museum archives; the Morrison-Knudsen corporate archives in Boise Idaho; and online resources available through the Naval History and Heritage Command and the National Archives and Records Administration.

Field work was conducted based on archival and literature results, using Trimble XH and XT global positioning system (GPS) units and digital photography. Landscape elements identified through historic maps and aerial photography (both historic and current) were field visited and documented using geographic location, photographs, and through written notes.

Three oral histories were conducted with individuals who either worked on the construction of the Arco NPG, or who had lived at the Arco NPG between 1943 and 1949. These oral histories are on file at the INL CRMO.

The Written Historical and Descriptive Data and the resulting maps were compiled using results from archival research, oral histories, and from information obtained during fieldwork.

ACRONYMS

ACHP	Advisory Council on Historic Preservation
AEC	Atomic Energy Commission
AHABR	Arco High Altitude Bombing Range
ANESB	Army-Navy Explosives Safety Board
ANL West	Argonne National Laboratory-West
ATD	American Table of Distances
ATR	Advanced Test Reactor
CEC	Civil Engineering Corps
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
CPP	Chemical Processing Plant
CRMO	Cultural Resource Management Office
CRMP	Cultural Resource Management Plan
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EBR-I	Experimental Breeder Reactor I
EDMS	Electronic Document Management System (INL)
GIS	Geographic Information System
GPS	Global Positioning System
HABS	Historic American Building Survey
HAER	Historic American Engineering Record

HALS	Historic American Landscapes Survey
HMS	His / Her Majesty's Ship
IHSI	Idaho Historic Site Inventory
INEEL	Idaho National Engineering and Environmental Laboratory
INEL	Idaho National Engineering Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MFC	Materials and Fuels Complex
MK	Morrison-Knudsen
MOA	Memorandum of Agreement
MWT	Megawatt Tons
NAIP	National Agriculture Imagery Program
NDRC	National Defense Research Committee
NEW	Net Explosives Weight
NOL	Naval Ordnance Laboratory
NOP	Naval Ordnance Plant
NOTF	Naval Ordnance Test Facility
NPG	Naval Proving Ground
NRF	Naval Reactor Facility
NRTS	National Reactor Test Station
OSRD	Office of Scientific Research and Development
PA	Programmatic Agreement
PAAB	Pocatello Army Air Base
PBR	Power Burst Facility

PSI	Pounds per Square Inch
PWP	Powdered White Phosphorus
RWMC	Radioactive Waste Management Complex
SHPO	State Historic Preservation Office
TAN	Test Area North
TBBR	Twin Buttes Bombing Range
TMB	Taylor Model Basin
TNT	Trinitrotoluene
TRA	Test Reactor Area
U.S.	United States
USAAF	United States Army Air Force
USN	United States Navy
USS	United States Ship
UTM	Universal Transverse Mercator (coordinate system)
WOW	Woman Ordnance Worker
WP	White Phosphorus

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1 HISTORICAL INFORMATION

1.1 Physical History

During World War II, the U.S. Navy set aside the core area of what was to become the Idaho National Laboratory (INL) through public land withdrawal and purchase, for use as the Arco Naval Proving Ground (NPG). In 1943, the Navy allowed the Army to use adjacent land for two aerial bombing practice ranges and, from 1944 to 1948, the Army and Navy conducted joint tests to determine safe storage and transport parameters for conventional ordnance. This Historic American Landscapes Survey (HALS) documents the Arco NPG landscape, including the residential and proof areas, proofing range, U.S. Army Air Force aerial bombing ranges, and post-war test areas.

1.1.1 Creator and Date of Establishment

The Arco NPG was established on November 23, 1942 under the authority of the Secretary of the Navy through the Sixth Supplemental National Defense Appropriation Act of 1942, as an outlying facility of the Pocatello Naval Ordnance Plant (NOP) that had been established on April 1, 1942 (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2; United States Department of the Navy 1947). The Navy Department issued a letter of intent on March 25, 1942 - through the Bureau of Yards and Docks and under the authority of the First War Powers Act of 1941 - authorizing the Morrison-Knudsen Construction Company out of Boise, Idaho to begin construction on the Pocatello NOP and the Arco NPG. Construction on the NOP began in April 1942, while construction on the Arco NPG didn’t begin until nearly eight months later and was completed in August of 1943 (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2; Morrison-Knudsen July 1943; Morrison-Knudsen April 1943).

Lands adjacent to the Arco NPG were identified for use by the U.S. Army Air Force (USAAF) for high altitude bombing training. A clearance request for a high altitude bombing range and an aerial gunnery range was submitted to Col. Robert W. Harper on November 6, 1942, and construction began the following December (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 95, 96). Flying from the Army airfield in Pocatello (now the site of the Pocatello Regional Airport), Second Air Force heavy bombers would run training missions over the Arco High Altitude Bombing Range (AHABR) and the Twin Buttes Bombing Range (TBBR), from September 1943 until the end of the war (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 98, 99).

1.1.2 Builders, Contractors, Laborers, and Suppliers

Morrison-Knudsen acted as the prime contractor on the original cost-plus-fixed-fee contract of $10,420,060.39, subcontracting portions of the construction (Table 1; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Labor was supplied locally from surrounding comunities including Arco, Blackfoot, and Idaho Falls. Among the hires were several high school-aged boys, who worked as assistants to painters, plumbers, and roofers during the summer of 1943, and either lived on the Arco NPG construction site or commuted weekly (Sherman 2014; Morris 2015).

Table 1: Subcontractors, fees and jobs.

Subcontractor	Fee	Job(s)
Brennan & Cahoon	$238,530.00	25 dwelling units and services
Dravco Corperation	$30,244.00	transfer car (crane contract)
J.A. Terteling & Sons, Inc.	$6,698,000.00	storage area – sewage plant
		explosion tests – permanent magazines
		rest room addition – storage buildings
		diesel plant
		heavy materials storehouses and wave barracks (Pocatello)
Northwest Construction Co.	$120,005.30	miscellaneous buildings
	$33,000.00	drainage emplacement area
Rosco Moss Company	$22,992.65	drilling deep well (water)
Wellman Engineering Co.	$158,619.53	two 250-ton gantry cranes

(Source: Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2)

1.1.3 Original and Subsequent Owners and Occupants

Extending as far back as 13,500 years ago, Native American hunter-gatherers found a multitude of useful resources on the high desert that would become the Arco NPG and eventually the INL. Archaeological remnants of their activities suggest that prehistoric groups visited the area regularly, but probably seasonally, for thousands of years. Members of the Shoshone and Bannock tribes continue to value the land and resources of the area today. Between the mid-nineteenth and the mid-twentieth century, explorers, Oregon Trail emigrants, ranchers, homesteaders, canal builders, and stagecoach and freighter companies used the area. Old trails, basalt foundations, trash dumps, and canal works are a testament to the tenacity of these early historic occupants (Idaho National Laboratory Cultural Resource Management Office 2013).

Before World War II, the land between Arco and Idaho Falls was used primarily for grazing. Earlier in the century, local irrigation companies and hopeful settlers had ambitions of bringing water from the Big Lost River to homestead claims located in the desert, but water never traveled through the dry canals. As a result, by the early 1900s these arid homestead claims were relinquished to county, state, and federal governments (The Arrowrock Group, Inc. 1997, 24; Braun 1995, 25-28).

When the Atomic Energy Commission (AEC) acquired the Arco NPG from the Navy in 1949 and established the National Reactor Test Station (NRTS) to conduct nuclear energy and safety testing (The Arrowrock Group, Inc. 1997, 32; Braun 1995, 37-40), the Arco NPG buildings and infrastructure were left in place and reused as office buildings, security headquarters, laboratories, utilities, and storage (Braun 1995, 37, 59). What is now the INL Central Facilities Area (CFA) was established in the area formerly occupied by the Arco NPG's civilian and military residential area and part of the proof area (where the gun emplacements are located). The proofing range was incorporated into the approximate 890 square miles that currently make up the INL site, which has served as a center for various AEC and subsequent Department of Energy (DOE) projects since 1949.

1.1.3.1 Original Owner, Occupant, and Use

Established under the jurisdiction of the U.S. Department of the Navy, the Arco NPG served as an ordnance testing facility as well as home to both military and civilian workers during and after World War II (Braun 1995, 30-37). Between 1943 and 1947, guns from the Pacific Fleet that had been relined at the Pocatello NOP were sent to the Arco NPG to be test fired before being shipped back for battle use. Projectiles of various designs were fired from the gun emplacements at the concussion wall (CFA-633, currently located in CFA) located within the Arco NPG proof area and were fired down the proofing range to the north/northeast at distances ranging from fifty feet to thirty-five miles. Many of these projectiles were then retrieved and examined for further Arco NPG research and development activities. In addition to projectiles, a range of different explosives, ammunition, and propellants were also tested during experiments that employed electrical timing devices and high-speed cameras to record data that would prove useful in the delineation of safe storage parameters for conventional ordnance (Braun 1995, 32).

Activity peaked at the Arco NPG in 1944 and then tapered off in 1946, with the last proofing activity recorded in 1947. In 1944, ordnance tests were conducted by the Safety and Security Division of the U.S. Army, and ammunition tests were carried out by the joint Army/Navy Ammunition Storage Board, authorized by the Secretary of the Navy and the Secretary of War (Braun 1995, 34). Toward the end of 1944 and into 1945, thrust tests for illuminating and white phosphorus projectiles were conducted; smokeless powder testing was conducted between 1944 and 1946; and mass detonation projectile tests began in 1945 (Braun 1995, 35). This experimental explosives testing continued at the Arco NPG after the end of World War II. In April 1947, the Arco NPG was designated as a depot for surplus manganese with the first shipment arriving in May the same year. By 1948, the Arco NPG was the designated site for a (still) highly classified experimental program that continued until the end of 1949, as well as the development of guided missile countermeasures (Braun 1995, 36). In 1968, ordnance testing activities resumed for a short time to support battleship needs associated with the Vietnam War.

The USAAF designated land to the southwest and southeast corners of the Arco NPG for two high-altitude bombing ranges between 1943 and 1945 (Braun 1995, 32; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 98, 99). The AHABR was located adjacent to the Arco NPG, just west of what is now CFA and north of Big Southern Butte. The TBBR was located approximately 12.5 miles (20 km) east of CFA and just north of East Butte (Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B).

1.1.3.2 Present Owner, Occupant, and Use

Currently, the landscape that was the Arco NPG is under the jurisdiction of the U.S. Department of Energy, Idaho Operations Office (DOE-ID) as part of the INL. The Arco NPG exists entirely within the 890 square miles that make up the INL. Today, the land and facilities of INL, including the Arco NPG, are the focus of various DOE, Department of Defense (DOD), and U.S. National and Homeland Security facilities and operations. INL lands and facilities are under the direction of DOE-ID, with the exception of the Naval Reactors Facility (NRF), which is under the direction of DOE's Office of Naval Reactors. Day-to-day operations are managed by contractors selected by DOE. Public access is strictly controlled and limited due to the sensitive nature of research conducted at the INL Site.

1.1.4 Periods of Development

The primary period of significance for the Arco NPG is 1943 to 1949, which includes both proofing activities and various explosives testing, as well as classified experimental programs. The secondary period of significance is defined by the high altitude bombing ranges and spans from 1942 to 1945 (Table 2; Stacy 2000, 17; Braun 1995, 32-36; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 88).

Table 2: Significant periods of development.

Activity / Land Use	Date	Significance
U.S. Navy: proofing of relined / refitted Pacific fleet battleship guns	1943 to 1947	primary
U.S. Army: Safety and Security Division explosives safety testing	1944 to 1945	primary
U.S. Army and Navy: Joint Ammunition Storage Board high-explosive storage magazine safety tests	1945-1946	primary
U.S. Navy: experimental explosives testing	1945 to 1947	primary
U.S. Navy: classified experimental programs	1948 to 1949	primary
U.S. Army Air Force: high altitude bombing ranges	1942 to 1945	secondary

(Source: Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 88)

Development associated with subsequent owners, occupants, and land use, which is non-significant to the Arco NPG, spans from 1949 to 2014; this includes the transfer of the Arco NPG from the U.S. Navy to the AEC for establishment of the NRTS and what would eventually become INL (Table 3; Stacy 2000, 217-217, 244; Braun 1995, 36-40).

Table 3: Other periods of development.

Activity / Land Use	**Date**
Atomic Energy Commission (AEC): National Reactor Test Station (NRTS)	1949 to 1974
U.S. Navy Naval Ordnance Test Facility (NOTF)	1968 to 1970
Energy Research and Development Administration (ERDA): Idaho National Engineering Laboratory (INEL)	1974 to 1997
Department of Energy (DOE): Idaho National Engineering and Environmental Laboratory (INEEL)	1997 to 2005
Department of Energy (DOE): Idaho National Laboratory (INL)	2005 to 2014

(Source: Stacy 2000, 217-217, 244; Braun 1995, 36-40)

1.1.4.1 Original Plans and Construction

The Arco NPG was divided into two main developments, the proof area and the residential area within a broader landscape that included the proofing range and other test localities (Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B). The proof area – which included gun emplacements, a concussion wall, and other associated facilities, structures and equipment, and the proofing range together served to test guns manufactured or relined at the Pocatello NOP and later to test explosives. The residential area included civilian and military quarters and other facilities that supported civilian workers who were employed at the site, as well as the Navy and Marine personnel stationed there. Toponyms bestowed by the Navy, including Lincoln Boulevard, Farragut Avenue, Portland Avenue, and Scoville, would remain even after the AEC took over and the area became CFA. Scoville referred to the railroad siding that serviced the Arco NPG, named in honor of the naval commander who had developed the site (The Arrowrock Group, Inc. 1997, 25-27; Braun 1995, 31).

A rail spur connected the Arco NPG to the Union Pacific Railroad main line at the Scoville siding approximately four miles north of Big Southern Butte, and provided access from the NOP in Pocatello to the proof area (Wyle Laboratories Scientific Services & Systems Group 1993, 3-11, Figure 2-1B). Access to the Arco NPG from Midway (now Atomic City) and Blackfoot was by means of old U.S. Highway 20 (Wyle Laboratories Scientific Services & Systems Group 1993, 3-2, Figure 2-1B).[1] At approximately five miles (8 km) south/southeast of the proof area, before continuing west into Arco, U.S. Highway 20 was shifted south of its original alignment between three quarters of a mile (1 km) and two and three-quarters miles (3 km) to allow for the construction of the Arco NPG proof and residential areas. Three monument roads, West Monument Line, Center Monument Line, and East Monument Line, were constructed, linking the proof (gun emplacement) area with the proofing range. West Monument Line Road followed a small segment of a previous historic stage road (now called INL T-20[2]) for about six and one-quarter miles (10 km), eighteen and one-half miles (30 km) northeast of the proof (gun emplacement) area, before aligning with present day Lincoln Boulevard for about three miles (5 km), approximately three miles (5 km) north of the proof (gun emplacement) area. Center Monument Line Road aligns with present day Lincoln Boulevard for approximately eighteen and one-half miles (30 km), eighteen and one-half miles (30 km) northeast of the proof (gun emplacement) area, and East Monument Line Road is now called INL T-17 (Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B; Idaho National Engineering Laboratory 1974; United States Department of the Navy ca. 1943, *Relocation of State Highway/US 20*; United States Department of the Navy 1942, *Layout, Roads, Railroad, Buildings*).

The approximately 80,000 acre proofing range, accessed by the various monument line roads, was located to the north/northeast of the proof (gun emplacement) area. It was four miles (6.5 km) wide at the proof (gun emplacement) area end, six miles (9.5 km) wide at the far end, and extended approximately thirty miles (48.25 km) north/northeast from the proof (gun emplacement) area (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B:

[1] The current alignment of U.S. Highway 20 between Idaho Falls and the NPG was not completed until the after the NPG was transferred to the AEC; previously, U.S. Highway 20 followed the alignment of the current U.S. Highway 26, which now joins U.S. Highway 20 at the shift point, approximately five miles (8 km) south/southeast of the proof area.

[2] T-roads denote unimproved roads in existence prior to the establishment of the NRTS in 1949; some T-roads are remnants of late nineteenth and early twentieth century stage and freight roads, while others were constructed as access corridors associated with the Arco NPG.

Reference 1, 2; United States Department of the Navy 1943). A geo-glyph target, approximately nine and one-quarter miles (15 km) in diameter, was constructed at the northeastern most end of the range (Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B). Concrete monuments, roughly one foot by one foot and two feet above grade (30 cm by 30 cm, 60 cm above grade) were placed at regular intervals along West and East Monument Line roads and used to calculate the range of proofed ordnance (Idaho National Laboratory Cultural Resource Management Office 2014; United States Department of the Navy ca. 1943, *Monument and Range Map*). Along Center Monument Line Road there were range observation towers located at seven and one-half miles (12 km), nine and one-half miles (15 km), and twelve and one-half miles (20 km) from the proof (gun emplacement) area (Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B).

The proof (gun emplacement) area was fenced and could be accessed only through a guardhouse (non-extant). In addition to the guardhouse, the area consisted of railroad tracks, gun emplacements, a storage area, at least one temporary building[3], a pump house, and several reinforced concrete buildings including: an oil storage area; a projectile storage area; a preservation building; a restroom; and two substations. The riggers shop (non-extant) was located across Main Street, just south of the guardhouse. A 315 foot long (96 m), eight foot thick (2.5 m), and fifteen and one-half feet high (4.75 m) reinforced concussion wall topped with a control/observation tower dominated the proof area and five magazines were also located nearby. Attached to the concussion wall were an office building, powder house, and tool room. Three of the magazines were concrete igloo-style structures, one of which was subsurface. One of the magazines was allowed to stow up to 500,000 pounds of smokeless powder, another held fuses and primers, and the other could stow a maximum of 50,000 pounds of ignition ends (Wyle Laboratories Scientific Services & Systems Group 1993, 2-6 to 2-7, Figure 2-2, Appendix B: Reference 4, 5; United States Department of the Navy 1949; 1946, 1945).

The military portion of the residential area was located to the northwest of the rail spur, approximately one-half mile southwest of the proof (gun emplacement) area, and included a Commanding (Battery) Officer’s quarters with a detached garage (CFA-607 and CFA-632, respectively), a caretaker’s quarters (CFA-613), five single-dwelling battery attendant quarters (non-extant), two double house battery attendant quarters (non-extant), and a Marine barracks (CFA-606), all of which were constructed between 1943 and 1944. The Commanding (Battery) Officer’s quarters and garage, the caretaker’s quarters, and the Marine barracks are all red brick

[3] Secondary written sources (The Arrowrock Group, Inc. 1997; Braun 1995) indicate that there were two temporary buildings located in the proof (gun emplacement) area; however, available historic drawings for the area indicate only one temporary building. As such, the accompanying maps compiled for this HALS indicate only one temporary building in the proof (gun emplacement) area.

masonry construction with poured asphalt and concrete basement foundations. The battery attendant quarters, both the single dwellings and the double houses, were wood frame construction with red cedar clapboard siding and poured asphalt and concrete basement foundations; the battery attendants quarters were painted white. The single-dwelling battery attendant quarters were single-story and designed with two different roof types: “Style 1” had a lateral gable roof that extended over a small side extension, with a smaller intersecting gable over the front entry area; “Style 2” had a hipped roof with smaller intersecting hipped roofs over the side extension and front entry area (Wyle Laboratories Scientific Services & Systems Group 1993, 2-7, Figure 2-2, Appendix B: Reference 2; United States Department of the Navy, architectural drawings, 1943, 1944). The battery attendant quarters and the caretaker’s quarters housed civilian workers and their families between 1943 and 1945 (Hamilton 2015).

During World War II there were approximately twenty Marines stationed at the Arco NPG, responsible for security around the proofing area. Trained security dogs were used to patrol the well-lit area around the gun emplacements. The dog kennels (non-extant) were located just north of the rail spur, approximately 300 feet west of the Marine barracks. A combined fire station, garage, and locomotive shed (CFA-640, non-extant) was initially constructed in the area in 1943, and extended with a maintenance shed addition in 1944 (Braun 1995, 31; The Arrowrock Group, Inc. 1997, 27; Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-2; United States Department of the Navy, architectural drawings, 1943, 1944).

Several service buildings were also located in the residential area, including a reservoir and pump house for fresh water, a second pump house, an elevated water tank, a warehouse for inert materials, two garages for civilian passenger cars, and a flagpole. The sanitary sewage pump house and septic tank were located just south of the proofing area (Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-2). In addition to residential and service buildings were other associated infrastructure elements including the deep well water system, sanitary sewers, electrical distributions lines, security fences, and paved roadways (Wyle Laboratories Scientific Services & Systems Group 1993, 2-7).[4]

After World War II, the Navy constructed a loop road to the southeast of the rail spur, around which seventeen single-dwelling houses (non-extant) and two dormitories (non-extant) were built for civilian housing to accommodate civilian NPG workers (Stacy 2000, 11). The houses and dormitories were wood frame construction with red cedar clapboard siding and poured asphalt and concrete basement foundations; these civilian dwellings were also painted white. The single dwelling houses were designed with three different roof types; Type A

[4] See map, “Residential Area, Scoville, 1943”.

consisted of a hipped roof with an intersection gable roof over the kitchen area; Type B consisted of a hipped roof with an intersecting hipped roof over the kitchen area; and Type C consisted of a lateral gable roof with an intersecting gable roof over the kitchen area. Aesthetically, the single-dwelling civilian houses and the apartment buildings were Minimal Traditional in their massing, floor plans, and architectural details (The Arrowrock Group, Inc. 1997, 26-27; Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-2; United States Department of the Navy, architectural drawings, 1945, 1946).[5]

AHABR was located toward the southwest corner of the Arco NPG, near the Scoville rail siding. While Naval records and newspaper accounts list the bombing range as three miles by four miles (4.80 by 6.60 km) in size, Army Air Force documents list the range as almost six miles north/south by seven miles east/west (9.65 by 11.25 km) in size. TBBR was located toward the southeast corner of the Arco NPG. The Twin Buttes range was approximately three and three-quarter miles north/south by three and one-tenth miles east/west (6 km by 5 km) in size (Wyle Laboratories Scientific Services & Systems Group 1993, 3-3 to 3-7, Figure 2-1B). Geo-glyph bull's eye targets were constructed on each range, measuring approximately 650 feet (198 m) in diameter (Aero Service Corporation 1949). TBBR may have had wood frame towers constructed in a triangular pattern around the geo-glyph target. Both bombing ranges are accessible from U.S. Highway 20 via connecting INL T-roads (Idaho National Laboratory Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B).

1.1.4.2 Changes and Additions

After World War II, nonnuclear military munitions testing continued until the AEC acquired the former ordnance test and parts of the training areas for development of a remote installation devoted to testing and developing nuclear reactor technologies. This transition began in 1949 when the AEC, a predecessor agency to DOE, increased the size of the Arco NPG, designated the new larger area as the National Reactor Test Station (NRTS), and began important nuclear energy research and engineering. Since its formation as the NRTS in 1949, basic research critical to design, safe operation, and licensing of nuclear power and propulsion reactors has taken place at INL. This includes prototypes of the nation's three commercial power reactor concepts - the pressurized water reactor, the boiling water reactor, and liquid-metal-cooled breeder reactor - which were first developed and tested at the NRTS (Idaho National Laboratory Cultural Resource Management Office 2013, 29).

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[5] See map, "Residential Area, Scoville, 1946".

Naval ordnance testing resumed at the former Arco NPG in 1968, during U.S. involvement in the Vietnam Conflict. Construction of nuclear research facilities and supporting infrastructure (power distribution lines and substations) associated with the NRTS in the original Arco NPG proofing range prevented the use of original Arco NPG proofing areas at this time. A new facility, designated as the Naval Ordnance Test Facility (NOTF) was developed to support the need for gun testing, and primarily to test fire guns from the battleship *USS New Jersey*. During test firing, the guns were aimed toward Big Southern Butte (Braun 1995, 37). NOTF is accessable from U.S. Highway 20 via INL T-roads and consists of a banked earth over re-inforced concrete concussion wall and re-inforced concrete gun emplacements that run in a southwest/northeast diagonal (Idaho National Laboratory Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B). A portion of the concussion wall was destroyed during DOD ordnance testing in the late 1990s (Idaho National Laboratory Cultural Resource Management Office 2013, 28; Idaho National Laboratory Cultural Resource Managment Office 1990-2010).

In 1974, changing missions led DOE to rename the NRTS reserve to the Idaho National Engineering Laboratory (INEL). In 1975, it was designated as a National Environmental Research Park, recognizing the ecological diversity and research potential of the large and relatively undisturbed land area included within its boundaries. In 1997, increasing emphasis on environmental restoration and stewardship was reflected in another name change to the Idaho National Engineering and Environmental Laboratory (INEEL). In 1999, the U.S. Secretary of Energy designated a large portion of INEEL as a “Sagebrush-Steppe Ecosystem Reserve,” recognizing the important and largely undisturbed natural resource inventories located there. In February 2005, with the separation of the national laboratory and environmental restoration missions into two separate DOE contracts, INEEL was renamed INL, its current designation. (Stacy 2000, 217-218).

Several geographically separated facility areas currently exist at the now-890 square mile INL; some remain active; others are undergoing extensive changes, and yet others have been remediated in accordance with federal requirements and are marked only by soil caps and monuments. One facility, the Experimental Breeder Reactor I (EBR-I), is designated as a National Historic Landmark and has been converted to an interpretive center for the public. Another important INL cultural resource, Aviators Cave, was listed on the National Register of Historic Places in 2010 (Idaho National Laboratory Cultural Resource Management Office 2013, 29-34). Public access to INL lands is restricted to the visitors center located at EBR-I and to public highways that pass through the INL site, including a public rest area located where U.S. Hwy 20/26 crosses the Big Lost River.

As originally and intentionally designed, INL facility areas stand in relative isolation to each other, separated by large expanses of undeveloped high-desert terrain dotted with auxiliary structures and infrastructure, roads, and trails. Excluding the Research and Education Campus in Idaho Falls, primary active INL Site areas currently are (Idaho National Laboratory Cultural Resource Management Office 2013, 29-34):

- Central Facilities Area (CFA)
- Critical Infrastructure Test Range Complex (CITRC), formerly Power Burst Facility (PBF)
- Idaho Nuclear Technology and Engineering Center (INTEC), formerly Chemical Processing Plant (CPP)
- Materials and Fuels Complex (MFC), formerly Argonne National Laboratory-West (ANL-West)
- Naval Reactors Facility (NRF)
- Radioactive Waste Management Complex (RWMC)
- Advanced Test Reactor Complex (ATRC), formerly Test Reactor Area (TRA)
- Test Area North (TAN)
- Experimental Breeder Reactor I (EBR-I)

1.2 Historic Context

Nearly 13,000 years of land use is recorded within the landscape of the Arco NPG, beginning in the Pleistocene. For much of this span, Native American hunter-gatherers utilized the natural resources of the region on a seasonal basis, leaving behind extensive archaeological evidence of their activities. Initial European exploration of the area was done by fur traders, and coincided roughly with the journey of Lewis and Clark, followed by miners and then ranchers. Attempts to irrigate the land and put it into agricultural production began in the 1870s and lasted until the 1920s. The land was acquired by the U.S. Navy in 1942 and has been under federal jurisdiction since.

1.2.1 Prehistoric Land Use

The prehistoric archaeological record preserved within the boundaries of INL is remarkable for outstanding preservation and time depth. This is undoubtedly due to the wide variety of useful resources and unique settings that prehistoric hunter-gatherers found on this portion of the high desert. Buttes, natural outcrops of volcanic glass, lava tube caves, meandering channels of the Big Lost and other desert rivers, and large natural wetlands that periodically coalesced into a large freshwater lake were probably the major attractions of the area throughout the long, 13,000+ year span of human occupation. Several basic prehistoric property types are currently recognized: isolated finds, lithic scatters, campsites, rock features (cairns, hunting blinds, rock walls, rock alignments, and hearths), rock art, and human burials.

Lands in southeastern Idaho that made up the Arco NPG and are part of INL today are part of a large aboriginal territory historically inhabited by two linguistically distinct, but highly interactive, American Indian groups—the Shoshone and the Bannock. Both groups (and a variety of subgroups within the Shoshone family) shared a common way of life in prehistoric times that allowed them to effectively utilize a wide variety of seasonally available local resources (Idaho National Laboratory 2013, 21; Liljeblad1957; Murphy and Murphy 1960; Murphy and Murphy 1986). The acquisition of the horse by some groups during the eighteenth century allowed some Shoshone and Bannock people to increase their exploitative ranges and interactions with other cultural groups. Changes in material culture and social organization followed, although the basic aspects of pre-horse economies remained fairly consistent with patterns rooted in prehistory (Idaho National Laboratory Cultural Resource Management Office 2013, 21; Walker 1978; Liljeblad 1957; Steward 1938).

Shoshone and Bannock people engaged in a highly nomadic lifestyle that was practiced for many thousands of years. The groups moved systematically throughout a large territory in order to utilize a variety of seasonally available resources, and, in contrast to their linguistically related kin in the Great Basin, probably enjoyed a relative abundance of food and other material resources in southern Idaho. A large proportion of this general abundance was found in and near rivers and streams (e.g., Snake River and Big Lost River) that flowed through even the driest and most desolate parts of the region. This led to an entire complex of subsistence and religious and social activities that centered on the riverine habitat (Clark 1986). Consequently, many of the larger Shoshone and Bannock villages were located near waterways. However, because the dispersed nature of the resource base required these groups to be highly nomadic, these villages were not occupied on a continuous, year-round basis. Instead, they were probably utilized cyclically during the winter months when weather and other factors forced less mobility. During the remainder of the year, native groups apparently dispersed to utilize resources that were often found far from these wintering grounds (Idaho National Laboratory Cultural Resource Management Office 2013, 22).

Nineteenth century observers have documented an extensive subsistence territory for the native groups that inhabited southeastern Idaho (Murphy and Murphy 1960; Murphy and Murphy 1986) and many different areas on and around the northeastern Snake River Plain, where the Arco NPG was located, were probably visited during these seasonal expeditions In the spring, some groups traveled from winter camps along the Snake River near Fort Hall to salmon fishing areas along the Snake River west of Twin Falls and to the camas prairies in central Idaho near Fairfield and Dubois. Several main routes were followed during these springtime expeditions: one followed the Snake River, and then north by a number of routes; and another proceeded from the Fort Hall and Idaho Falls area across to the Big Lost River and then west, skirting along the southern edge of the mountains. This latter route may have passed directly through the Arco NPG area.

Big game hunting became a primary focus in the autumn and a common route for these expeditions followed back along the southern edge of the mountains of central Idaho. Along this route, groups turned north to follow the valleys of the Big Lost River, Little Lost River, and Birch Creek to reach mountain passes that led to the Great Plains. Fall salmon runs in the Salmon River country were also accessed by these routes. Portions of the lands that made up the Arco NPG were likely traversed by these groups and archaeological evidence suggests that Big Southern Butte was also a destination for many because of the obsidian tool stone that outcrops near its crest. As winter approached, some migratory groups headed back to sheltered areas such as the bottomlands along the Snake River near present-day Fort Hall, probably traversing the northeastern Snake River Plain and Arco NPG lands along the way (Idaho National Laboratory Cultural Resource Management Office 2013, 22).

The Snake River Plain does form a natural east-west corridor for trade, travel, and subsistence activities. The basaltic terrain must also be traversed for north-south travel between the river valleys of central Idaho and the Great Basin to the south. As such, it was frequented by other groups as well as the Shoshone and Bannock Tribes. For example, the Nez Perce from northern Idaho frequently came into southeastern Idaho to trade and travel to the Great Plains. Historically, Euro-American explorers also traversed the area and although these more recent visitors did not report any large winter villages on lands that now make up the INL, some relatively large Indian camps were described. In the early 1830s, Warren A. Ferris encountered over 200 American Indians traveling near the three buttes and also reported a camp consisting of nearly 200 lodges on the Big Lost River (Ferris 1940). Nathaniel J. Wyeth also reported American Indians camped near the Big Lost River (Wyeth 1899). Although the Arco NPG area was probably not used as a wintering ground, it seems certain that it was frequently visited, either in transit to other areas, as a destination for groups interested in obtaining obsidian from the Big Southern Butte or Howe Point, or for those attracted by food resources such as bison, which are reported historically to have existed in great numbers in the area (Idaho National Laboratory 2013, 22-23; Russell 1969; Ross 1956; Work 1923).

Archaeological and ethnographic evidence indicates that the Shoshone and Bannock people utilized all of the animals that are native to the northeastern Snake River Plain, including now extinct species such as mammoth and others such as bison, which no longer live in the area. Many plants were also known and utilized for food and other practical purposes (Anderson 1996). It is likely that virtually every plant and animal species on the high desert was used in some way at some time of the year. Most, if not all, of these resources are still important to Shoshone and Bannock tribal members today. From approximately 1810 to 1850, the Native Americans in southeastern Idaho remained relatively undisturbed by the small groups of trappers, traders, miners, and emigrants who worked on or simply passed through Shoshone Bannock territory on their way to California, Washington, and Oregon. However, conflicts began to arise after gold discoveries and Euro-American settlement in the 1860s. In the late 1860s, treaties were signed between the tribes and the U.S. government in an attempt to reduce conflicts (Idaho National Laboratory Cultural Resource Management Office 2013, 23).

1.2.2 Historic Land Use Prior to World War II

From 1805, when Lewis and Clark explored what is now central Idaho, until gold was discovered in the early 1860s, exploration and development in southeastern Idaho was sparse. The socioeconomic development that was once dependent on trapping and fur trading became dependent on more abundant resources such as water, land, and minerals. Cattle and sheep were soon introduced, and while agriculture eventually became the leading economic force in southeastern Idaho as a whole, another resource—people—became instrumental in the Arco NPG landscape development (Idaho National Laboratory Cultural Resource Management Office 2013, 23-27).

The first Euro-Americans to explore the area were trappers, also known as mountain men. In 1816, Donald Mackenzie organized the Snake River Expeditions to explore territory that includes what was the Arco NPG. He was followed in 1823 by Antoine Goddin, who trapped beaver extensively in the Little Lost River region (Hammer 1967). Osborne Russell spent time on the eastern Snake River Plain in late 1835 and described in his journal large buffalo herds, the three buttes, and the Lost River sinks (Russell 1969). In 1834, a trading and supply post, Fort Hall, was established south of the Arco NPG's boundary by Nathaniel Wyeth (Trego n.d.). Fueled by promises of abundant land, and other natural resources, the Oregon Trail was established in 1836. In order to avoid Native American hostilities along the Snake River, Tim

Goodale established a northern extension of the Oregon Trail through the area along an established fur-trading route, and emigrant wagons used it as early as 1852. A portion of Goodale's or Jeffrey's Cutoff is still recognizable near the southwestern corner of the Arco NPG (Merrill 1990; Idaho State Historical Society n.d.; Dykes 1989). Later, the cutoff was used for cattle drives from Idaho, Washington, and Oregon to shipping points in Wyoming. After heavy herd stock losses occurred in the 1880s, cattle drives were curtailed and seasonal sheep drives traversed the route (Idaho National Laboratory Cultural Resource Management Office 2013, 23-24).

In the 1860s through the 1880s, discoveries of gold and other precious metals in central Idaho brought many miners, and in response, boomtowns sprang up in areas just north and west of present day INL boundaries. These mid- to late-1800s mining booms created a need for transportation systems between the newly established mining towns north of the Arco NPG, such as Mackay and Leadore, and their supply stations in older towns, such as Idaho Falls to the east and Blackfoot further to the south. Freighting and staging became a major business, and a number of companies were formed in order to meet the demand for mining equipment, passenger service, dry goods, and other supplies. Old wagon roads and trails became stage and freight lines virtually overnight and several new trails were forged across the desert (Idaho National Laboratory Cultural Resource Management Office 2013, 24).

In the 1890s, George Washington Powell established a stage station near the banks of the Big Lost River along a trail or route that ran parallel and several miles to the north of Goodale's Cutoff. Powell constructed a rock building that housed a store and post office and also maintained the only known bridge crossing of the Big Lost River in the area (Gilbert 2009). A second stage station known as the Birch Creek Stage Station existed at the north end of the Arco NPG along the banks of Birch Creek. Established as early as 1884, it was a stopover for travelers and freighters bound for the mining camps in the Birch Creek and Salmon River valleys. In 1901, completion of the Oregon Shortline railroad between Blackfoot and Arco signaled the end of stage and freight lines in the area (Sedgewick n.d.). As horse-drawn wagons became obsolete, many drivers increasingly relied on small farms and ranches in the area (Idaho National Laboratory Cultural Resource Management Office 2013, 26).

As transportation through the desert became more reliable, settlers began to make their way into the area. Many of these early occupants began cattle ranching in the northern reaches of the Arco NPG area. The disastrous winters of the 1880s killed so many stock animals that the local cattle industry never recovered and sheep were moved into the grazing areas once dominated by cattle. Major sheep drives across the area began in the 1860s and the growth of this new industry paralleled that of cattle (Wentworth 1948). As the demand for mutton and wool increased and sheep became a profitable commodity, many ranchers added flocks to their cattle herds or completely switched to sheep. By the early 1900s, sheep replaced cattle as the dominant livestock in the area (Idaho National Laboratory Cultural Resource Management Office 2013, 26).

While the northern portion of the Arco NPG was used primarily by ranchers, the western and northeastern areas were the focus of more homesteading and agricultural pursuits. After freight and wagon lines became firmly established in the 1880s, settlers came to the Arco NPG area in larger numbers and began to farm for commercial as well as subsistence purposes. Many settlers were prompted to move into the area by the Homestead Act of 1862 and the Desert Land Act of 1877. Most of the homesteaders who arrived in the late 1800s settled along the Big Lost River (Idaho National Laboratory Cultural Resource Management Office 2013, 26-27).

Water was a rare commodity in the desert areas of the eastern Snake River Plain and the success of farming efforts in the area hinged on the homesteaders' ability to obtain it. With passage of the Carey Land Act in 1894 and passage of the Desert Reclamation Act in 1902, the federal government stepped in to assist homesteaders in this endeavor (Scott 1983; Williams 1970). The 1894 act set aside one million acres of public land in Idaho for homesteading provided the settlers participated in state-sponsored irrigation projects and the 1902 act provided the funding necessary to reclaim these arid and semi-arid acres (Idaho National Laboratory Cultural Resource Management Office 2013, 27).

Southeastern Idaho was a major beneficiary of the federal aid and, as a result, the years from 1905 to 1920 saw a dramatic upswing in agricultural activity on land within and around the Arco NPG boundaries and in regional towns. The population of Idaho Falls quadrupled from approximately 1,262 in 1900 to 4,827 in 1910, and this growth is directly attributed to the promise of irrigable land. Irrigation companies formed, and with financial backing by the federal government, started construction on a number of dams, including the Mackay Dam on the Big Lost River upstream of Arco NPG, and canal projects that were intended to bring much needed water to homesteaders (Pettite 1983). Unfortunately, gross miscalculations of precipitation and water flow in the area coupled with ignorance of the fractured bedrock strata and porous gravels of the Big Lost River led to the failure and ultimate abandonment of all but a few of these projects in the 1920s (Pettite 1983; Staley 1978). Many of the small homesteads on and around the Arco NPG were forced to fold, although a few notable exceptions in the Mud Lake area to the east and far upstream in the Big Lost River valley continued to flourish (Idaho National Laboratory Cultural Resource Management Office 2013, 27).

Except for the few successful farms, by the 1930s most of the Arco NPG area had reverted back to federal ownership and was virtually abandoned. It would not remain so for long. When the United States' joined in World War II, the large isolated swath of land on

Idaho's high desert was acquired by the U.S. Navy (Idaho National Laboratory Cultural Resource Management Office 2013, 27-28).

1.2.3 U.S. Navy

Rhode Island commissioned the first American Navy in June of 1775 and armed ships were the first to actively fight back against the British during the Revolutionary War. On October 13, 1775 a national naval force was born when the Continental Congress established the Continental Navy. The nascent navy was comprised mostly of civilian sailors who were no match for the professional British sailors and powerful Royal Navy. It was only with the aid of French allies that the Revolutionaries began sinking British ships which helped the U.S. secure victory over Great Britain. In 1783, the Treaty of Paris ended the Revolutionary War and gave birth to a nation. Seeing no need for a standing navy, Congress disbanded the Continental Navy, an action that proved to be short lived (Naval History and Heritage Command 2014).

The Constitution of the United States ratified in 1789, empowered Congress "to provide and maintain a Navy" (Naval History and Heritage Command 2014). In response to aggression from other nations and the need for a stronger national defense, the Naval Act of 1794 called for the construction of six ships. In 1797, the launching of three frigates, the *USS United States*, *USS Constitution*, and *USS Constellation*, set the stage for the nation's New Navy (United States National Archives and Records Administration 2014).

Between 1798 and 1800 tensions between the U.S. and its former ally, France, began to mount. An undeclared war between the two countries, called the Quasi-War, broke out and was fought mainly on the high seas. In 1798, concerns over how the Department of War handled the Quasi-War led to the creation of the Department of the Navy and an executive position, the Secretary of the Navy, who was designated to oversee all aspects of the new Department including the production and testing of naval ordnance for battleships (Navy Recruiting Command 2014).

On February 7, 1815, an act of Congress [H.R. 254 (3 Stat. 202)] established the Board of Navy Commissioners to take over some of the Secretary of Navy's civil functions. The Board's duties included procuring naval stores, materials, equipment, and construction of armament and the repair and preservation of naval vessels. The Board also had responsibility for Navy agents and established regulations to assure uniformity in the classes of naval vessels; prepared expenditure estimates for naval service; and supervised navy stations and navy yards. The Secretary retained control of personnel and appointments, movement of ships, and other administrative duties not relegated to the Board (Naval History and Heritage Command 2014).

The Act of August 31, 1842 (5 Stat at Large, 579) dissolved the Board of Navy Commissioners and created five new bureaus, including the Bureau of Ordnance and Hydrography (Devereux 1856, 125-126). In 1862, the Hydrographic Office was transferred to the new Bureau of Navigation leaving the Bureau of Ordnance in charge of improving old and developing new materials and weapons during peacetime and, during wartime, the large-scale production and procurement of these materials and weapons (Hartwell 1911, 680). Prior to World War II, the Bureau supplied ordnance for four wars, the Crimean War (1853-1856), the Civil War (1861-1865), the Spanish American War (1898), and World War I (1914-1918) (Kinard 2007, 202-208, 222-225). During this time, advances in technology and war techniques influenced the evolution of ship designs and naval ordnance (Heimdahl 1976).

During World War II, the Bureau acquired an additional responsibility. It created new weapons and devices and vastly improved existing ordnance material, activities that would prove vital to U.S. and allied victory in the war (United States Department of the Navy 2014).

1.2.3.1 Naval Ordnance

Naval ordnance is defined as the "broad category of defensive and offensive weapons that make the difference between a mere seagoing vessel and a real man-of-war" (Rowland and Boyd 1953, 1). It includes "everything that is thrown at the enemy, the weapons for throwing them, the instruments for insuring their accuracy, and many of the protective devices that parry the enemy's blows" (Rowland and Boyd 1953, 1).

From the seventeenth to early twentieth century, naval guns consisted of large caliber tube-style weapons firing chemically propelled projectiles that dominated how wars were fought at sea. The guns were an essential feature of what would now be called a weapons system and, as they evolved so too did every other ship element (Chambers 2000).

Smooth bore cannons were the first guns mounted on early wooden sailing ships. The purpose of these cannons was to sink enemy ships; however, most battles ended by boarding rather than sinking. The cannons were so inaccurate that firing effectively had to be done at no more than a few hundred yards and sinking a ship with solid shot proved difficult. In addition to the inaccuracy of the guns, aiming the cannons required the slow and laborious task of maneuvering the ship into firing position. As battle tactics evolved, multiple sailing ships practiced "line ahead" allowing them to fire broadside on a single target. The success of cannons and line ahead strategy resulted in only slow changes to naval ordnance until the middle decades of the nineteenth century when rapid technological innovations changed naval weapons systems and war tactics forever (Chambers 2000).

The Industrial Revolution brought improved casting and precision machining that made possible production of larger guns that could withstand rifling, and breech loading and that allowed for much more tube pressures. Advances in chemistry and industrial design permitted exploding shells to replace solid shot which, in turn, led to a premium being placed on protective plated armor because of the increased accuracy of rifled shell guns (Chambers 2000).

The introduction of steam-powered warships in 1815 and their widespread acceptance by the mid-1850s further revolutionized naval ordnance. Steam power permitted increased maneuverability without concern for shifting winds (Fleming 1993, 5), and introduced the practice of mounting the main battery of much larger guns on the centerline rather than the sides making it possible for them to be fired in any direction. In the late nineteenth century, steam propulsion combined with the newly developed explosive shells, bigger guns, centerline swivel turret, and armor plating, gave rise to modern battleships called “capital ships” (Chambers 2000) (Fleming 1993, 6).

Typical capital ships of the 1890s had a main armament of four heavy guns of 12-inch caliber, a secondary armament of six to eighteen quick-firing guns of between 4.7-inch and 7.5-inch, and other small weapons. Some also had an intermediate battery of 8-inch guns; however, the smaller caliber illustrated the naval combat theory of the time. Battles were initially fought at a distance and final blows dealt at closer range using shorter-range, faster-firing guns. By the early twentieth century, continued improvements in armament, armor, and propulsion brought increases in capital ship sizes and the caliber and size of naval guns (Mackay 1973; Fleming 1993, 6).[6]

By 1903, naval combat theory had changed and several countries were proposing all-big-gun armament which provided double the firepower as earlier battleships (National Museum of the Royal Navy 2014). Between 1904 and 1906 three countries had commenced building capital ships. The Imperial Japanese Navy authorized construction of *Satsuma*, designed with twelve 12-inch guns, Great Britain began design of the *HMS Dreadnought* with ten 12-inch guns, and the U.S. Navy launched the *USS Michigan* carrying eight 12-inch guns in December 1906. Earlier in 1906, Great Britain’s *HMS Dreadnought* was the first of these capital ships to launch; within five years it and others like it were replaced by even more powerful ships (Mackay 1973).

[6]Until shortly after World War II ended, the USN gun designation system was based on gun classification. Each designation of USN gun was based on its inner bore diameter, barrel length (calibers), a mark number and a modification number. For example, 16"/50 Mark 7 Mod 0 meant a gun firing 16-inch (40.64 cm) projectiles with a barrel 16 x 50 = 800 inches (20.320 m) long, was the seventh gun in the 16-inch (40.64 cm) series and was built to the original design with no modifications (DiGiulian, Part 1 - Weapons and Monuntings 2015).

The years between 1906 and the start of World War I in 1914 saw a boom in capital ships as ship building and armament manufacturing technologies continued to increase ship speed and large gun accuracy. The British *Orion* class carried 13.5-inch guns and, in response, the U.S. Navy's *New York* class, launched in 1911, carried 14-inch guns. Japan followed suit and, between 1912 and 1914, laid down two ship classes that carried 14-inch guns. In 1917, Japan's *Nagato* class was the first ever to mount 16-inch guns, making their warships arguably the most powerful in the world (Sondahous 2001, 214-216). Other countries including France, Russia, Italy, Austria, and Germany joined Japan, Great Britain, and the United States in launching capital ships. Several secondary powers commissioned similar ships to be built at American and British yards (Breyer 1973, 84).

Technology continued to advance rapidly and capital ships came to include not only battleships but, also, lighter, faster but still heavily armed ships, called battle cruisers (Breyer 1973, 75-79). In addition, the introduction of aircrafts, first acting as scouts during battles, led to the development of carrier aircrafts and aircraft carriers (Fleming 1993, 9).

During the First World War, the role of capital ships was marginal as Germany, Great Britain, and secondary naval powers nearly halted the battle fleet building as funds and technical resources were diverted for more pressing wartime needs (Breyer 1973, 61). Less expensive weapons and delivery systems, such as torpedoes, mines, and submarines, illustrated the vulnerability of battleships and battle cruisers. The only major clash of battle fleets was between the British and Germans at the indecisive 1916 Battle of Jutland. Despite five coal-fired battleships the United States sent to aid the Royal Navy, Germany's use of U-boats, cruisers, destroyers, and the threat of torpedoes caused the British fleet to turn away. Following the Jutland conflict, the Germans needed submarines more for commerce raiding and their battleship fleet stayed mostly in port until Germany surrendered on November 11, 1918 (Keegan 1999, 289; Kennedy 1983, 245-248).

Between 1919 and 1922, a naval arms race threatened to erupt between Great Britain, Japan, and the United States (Breyer 1973, 62-63). In response, in 1921 the U.S. convened the Washington Naval Conference, a meeting of the world's five largest naval powers, the U.S., Great Britain, Japan, Italy, and France. Among other issues, the resulting Washington Naval Treaty called for the countries to scrap many of their original capital ships, virtually cease all capital ship construction, and limit the size of their mounting guns to 16-inch and vessels to under 35,000 tons (Mackay 1973; Fleming 1993, 10). Efforts to convene the Conference again in ten years to consider a renewal of the agreement failed (Fleming 1993, 10) when Japan withdrew from the Treaty and broke its conditions by continuing to build capital ships, some with secretly mounted 18-inch guns (Breyer 1973, 84).

As world tensions continued to mount, Japan and the United States prepared for a confrontation. U.S. plan, designated "War Plan Orange", relied on all twelve U.S. battleships and three aircraft carriers that comprised the Pacific Fleet to defend the Philippines against Japan but it did not take into account the transit time required to engage the Japanese Fleet. With prohibited 18-inch guns, Japan had a plan of their own that also relied on the engagement of capital ships to resolve any conflicts. The Japanese plan was to lure U.S. battleships to the Western Pacific, deliver a fatal blow to the main body of the U.S. Navy that would take years to recover from, and force Americans to sue for peace (Fleming 1993, 11).

The outbreak of war in Europe forced the U.S. to transfer three of its battleships from the Pacific Fleet to support the Atlantic war efforts and the flawed War Plan Orange was broken into a series of Rainbow Plans. The Rainbow Plans continued reliance on battleships and all but ignored the superior weapons system and increasing importance of U.S. aircraft carriers (Fleming 1993, 12). In the late 1930s, the Rainbow Five plan called for construction of U.S. military bases on the Atlantic and Pacific coasts as well as Hawaii, Guam, and five Pacific atolls. However, before the bases were finished, Japan attacked Midway, captured Guam and Wake Island, and on December 7, 1941, mounted a surprise attack on Pearl Harbor, Hawaii. This unexpected attack crippled the U.S. battleship fleet stationed there and prompted the U.S. Navy to expand existing west coast bases and look inland for secure places to build support facilities such as factories to supplement those on both coasts in the manufacture, repair, and relining of naval guns and land to test or proof them (Stacy 2000, 8; Fleming 1993, 12).

World War II altered naval strategy forever. Thanks in large part to aircraft carriers and the long reach of aircraft, battleships were no longer required to square off against each other to determine supremacy at sea. However, they did perform several vital tasks that aided in the Allied victory. Battleships escorted convoys and provided anti-air defense and gunfire support to troops ashore. Perhaps the most important task was shore-bombardment. In both the Atlantic and Pacific old battleships fired heavy guns at enemy shore facilities in advance of troop invasion or to destroy enemy war-making ability and new generations of faster American battleships escorted aircraft carriers and provided them with anti-aircraft cover when necessary. Both old and new battleships bombarded Japanese home islands in 1945 and, when the war in the Pacific ended on September 2, 1945, the Japanese surrendered in Tokyo Harbor aboard the battleship *USS Missouri*. Although replaced by the aircraft carrier as the principal capital ship, battleships played an important and vital role in allied victory (Global Security 2014, Global Security 2015).

1.2.3.2 Naval Ordnance Plants

The Washington Navy Yard opened in Washington D.C. in 1799 and was renamed the Naval Gun Factory after World War II. Its primary responsibility during its early history was shipbuilding and maintenance. During the War of 1812, the Yard was vital to the defense of Washington D.C. However, as the British marched through the capital city, it became clear that the Yard was in danger of falling under their control. To prevent seizure by the enemy, Commodore Thomas Tingey ordered the Yard burned and, in the years following, the Navy Yard failed to regain its prominence as a shipbuilding facility. Instead, the focus shifted to technology and ordnance (Comprint Military Publications 2014).

During the Civil War, under the direction of Commander John Dahlgren, the Washington Navy Yard again became an important part of Washington D.C.'s defense and, in 1869, was joined by the Naval Torpedo Station in Newport Rhode Island (Cowell and Whitman 2000). By 1886, the Yard had become the manufacturing center for the majority of Navy ordnance including armament for the Great White Fleet[7] and the U.S. Navy during World War I (Comprint Military Publications 2014).

To support the increased demand during World War I, the U.S. Navy commissioned three plants to join the Washington Navy Yard in the production of ordnance. The new plants and their specialties were (Rowland and Boyd 1953, 5):

- Dayton, Ohio - manufactured Vickers broadside director instruments;
- South Charleston, West Virginia - production of armor and projectiles, gun forging;
- Baldwin, New York - manufactured illuminating projectiles.

Ordnance expenditures during World War I were approximately $1 billion; however, the years immediately following the war saw a marked reduction in naval appropriations and personnel. By 1930, the Bureau of Ordnance's budget was a mere $31,092,020 and shore establishment, which involved proofing facilities in support of the operating forces and represented much of the Bureau's mission at the time, dropped to bare minimum levels. As a

[7] "The Great White Fleet" was the name given to the U.S. Navy battle fleet that circumnavigated the globe between December 16, 1907 and February 22, 1909 under the order of President Theodore Roosevelt. The fleet consisted of sixteen battleships divided into two squadrons and was launched on the global cruise as a demonstration of growing American military capability (McKinley 2015).

result of the decrease in shore establishment funding and activities, such as weapon research and development and ordnance production, the Bureau force shrank to twenty-two officers and sixty-four civilians (Rowland and Boyd 1953, 1-2).

By 1933, the Nazis were gearing up to take over power in Germany, America was well into the Great Depression, and naval fortification in the United States had all but stopped. In the mid-to-late 1930s, in recognition of the country's defense vulnerability, funding was made available through the National Industrial Recovery Act and the Public Works Administration to supplement the low Navy appropriations. The increased funding resulted in an expansion of naval activities, including the acquisition of additional personnel at the nation's four ordnance shore establishments including the Naval Gun Factory in Washington D.C., the Naval Power Factory in Indian Head, Maryland (formerly the Indian Head Naval Proving Ground), the Naval Torpedo Station in Newport, Rhode Island, and the Naval Ordnance Plant in Baldwin, New York. It also meant an increase in the manufacture and procurement of ordnance from three main sources – the Navy, overstocked Army arsenals, and the private sector. Prior to this time, procurement from private firms made up the smallest percentage of funding expended but, by 1939, this trend had reversed. Private firms acquired more government contracts than either the Navy or Army, dependency on eastern firms decreased, and naval ordnance production spread across the nation both within private industry and the four ordnance shore establishments. Two of the naval ordnance plants commissioned during World War I, South Charleston, West Virginia and Baldwin, New York, stayed in Navy ownership and made substantial contributions during World War II (Rowland and Boyd 1953, 2, 5; McDonald 2010).

When war broke out in Europe in September 1939, the U.S. declared a national emergency and the Bureau pressured Congress for additional ordnance production facilities. In July 1940, $50,000,000 was appropriated for that purpose and the search began for suitable facility locations that were inland, had good transportation connections, and an adequate supply of labor. The Bureau surveyed over 200 potential sites and by early 1942 had established ten new specialized Naval Ordnance Plants (NOPs) at a cost of $150,000,000 (United States Department of the Navy 1959; Rowland and Boyd 1953, 5). Their locations and type of specialized operations were (United States Department of the Navy 2014):

- Louisville, Kentucky - production of torpedo tubes and gun mounts;
- Macon, Georgia - manufacture of flares, small primers, detonators, and other triggering mechanisms;
- Milledgeville, Georgia - production of fuses;

- Indianapolis, Indiana - production of bombsights and fire control equipment;
- Canton, Ohio - supplemental work from the Naval Gun Factory in Washington D.C.;
- Center Line, Michigan - supplemental work from the Naval Gun Factory in Washington D.C. and parts for 20-millimeter guns;
- St. Louis, Missouri - production of torpedoes (Rowland and Boyd 1953, 127);
- Forest Park, Illinois - production of torpedoes, particularly for aircraft;
- York, Pennsylvania - manufacture of 40-millimeter guns;
- Pocatello, Idaho - manufacture, repair, and testing of various types of naval guns.

The final U.S. NOP was built in 1944 at Shumaker, Arkansas to become the principal rocket loading, assembly, and storage plant in the nation. With the Shumaker plant, two World War I plants, and the ten plants commissioned between mid-1940 and early 1942, there were thirteen NOPs operating in the U.S. during World War II. The federal government owned the plants and private enterprises operated all but one, the Pocatello NOP (Rowland and Boyd 1953, 5). Although primarily a rocket production facility, the Shumaker location also facilitated small rocket test ranges (United States Department of the Navy 1959, 326-327).

1.2.3.3 Naval Proving Grounds

Several supplementary and complimentary facilities supported the NOPs such as magazines, ammunition depots, and laboratories. Crucial to the mission of the NOPs were Naval Proving Grounds (NPG). As their name suggests, the NPGs provided places to test, or proof, ordnance of all types and sizes.[8]

The nation's first NPG was established in 1890 at Indian Head, Maryland for the testing of guns turned out by the Washington Navy Yard and gunpowder purchased by the Navy Department (Global Security 2015). By early 1918, the amount of proofing conducted at Indian Head was causing unsafe conditions to employees and residents of nearby communities in

[8]After a gun is manufactured or repaired it must pass visual and non-firing tests. Then, it is taken to a range for firing with charges well above the maximum service charge. Guns that pass the test are said to be "proofed" or "proof-tested" (DiGiulian, Part 3 - Miscellaneous 2014).

Virginia and Maryland. Following several near misses, Rear Admiral Ralph Earle, wartime Chief of the Bureau of Ordnance, pushed for the creation of a proving ground separate from the Indian Head NPG and distanced from nearby communities. He advocated for the new facility for two reasons. First was the need to test heavy guns fully without the limitation imposed by the range congestion at Indian Head and, second, was the need to test all ammunition ready for loading and shipment. To satisfy the requirements, Earle proposed building the new NPG on a peninsula in Virginia adjacent to Machodoc Creek, a small tributary of the Potomac (U.S. Department of the Navy 1977, 3).

Earle successfully argued his case before Congress and the Navy began acquiring land for the proving ground. The "Lower Station", as it was informally known, began its role as a proving ground on October 16, 1918 and, by year's end, had grown to include sewers, electrical power lines, several residential, administration, warehouse buildings, several gun emplacements, and the center of proofing activities, the Main Battery. In late 1918, the new station was named for Rear Admiral John Adolphus Dahlgren, a naval officer who had been prominent in the field of ordnance development and who was the first Chief of the Bureau of Ordnance (U.S. Department of the Navy 1977, 5).

Reductions in military funding across the board between the late 1920s and 1940 resulted in the construction of modest facilities at the Dahlgren NPG. The Main Battery expanded on a small-scale between 1926 and 1935 with the addition of two more major-caliber emplacements for multiple gun mounts, one additional minor (or intermediate)-caliber gun emplacement and two major-caliber gun parks. In spite of modest growth, the Main Battery was the center of the Dahlgren NPG's professional activities and it furnished trained personnel to other ordnance plants and proving grounds as they were developed across the nation (U.S. Department of the Navy 1977, 8).

From the beginning, transportation of personnel and ordnance to and from the Dahlgren NPG was a problem. Prior to World War II, heavy test ammunition could only be brought in by water. After being unloaded, it was then hauled to storage by old railroad cars in a cumbersome and slow process. With the improvement of area roads, trucks were increasingly used to transport small ammunition (U.S. Department of the Navy 1977, 14). Transportation again became a problem during World War II. Some ordnance, such as fuses, was assembled far from Dahlgren at places like Mare Island, California. Daily samples then had to be sent 3,000 miles to the Dahlgren Proving Ground for verification testing (Rowland and Boyd 1953, 283).

In addition to Dahlgren's many contributions to conventional ordnance development, a small amount of work was done to support the Manhattan Project's development of the atomic bomb. Later, Dahlgren served as the primary test and evaluation center for Elsie, a project tasked with performing additional work on atomic weapons. This type of work continued at Dahlgren NPG until 1956 (U.S. Department of the Navy 1977, 14).

1.2.4 U.S. Navy in Idaho

In the late 1930s, logistics problems, the nation's nascent and fast growing rocket program, and reorganization of the Bureau of Ordnance caused attention to shift from the east coast to existing naval facilities on the west coast such as the Navy Yard, Mare Island, California and Puget Sound Navy Yard, Bremerton, Washington. The logistics problems grew in importance following Japan's attack on Pearl Harbor on December 7, 1941. At the request of President Franklin D. Roosevelt, the following day the United States Congress declared war on the Empire of Japan and, between December 11 and December 13, Nazi Germany and its Axis partners, Japan and Italy, declared war on the United States (Stacy 2000, 8). Thus, by the middle of December 1941, the United States was entrenched in World War II.

As the war in the Pacific intensified, so did the U.S. demand for additional facilities and places to test ordnance. By this time, towns and cities on the west coast had largely exhausted their supplies of materials and labor and had become vulnerable to sea attack by the Japanese. In response, the Navy and other branches of the U.S. military began looking inland to places like Idaho to establish new support infrastructure (The Arrowrock Group, Inc. 1997, 24; United States Department of the Navy 1947).

The Sixth Supplemental National Defense Appropriation Act of 1942 designated two naval support facilities in Idaho. The first was Farragut Naval Base. Farragut was built in northern Idaho on the shore of Lake Pend Oreille as a training facility for sailors. From its inception until March 10, 1945, when the last class graduated, Farragut was the second largest U.S. naval training station in the world. Today, it is the site of Farragut State Park (Idaho Military Museum 2015). Idaho's second naval support facility was a naval ordnance plant and associated naval proving ground established in southeastern Idaho (The Arrowrock Group, Inc. 1997, 24; United States Department of the Navy 1947).

1.2.4.1 Pocatello Naval Ordnance Plant

Construction of a NOP in Idaho meant the long cross-country shipment of guns in need of relining or repair from naval shipyards on the west coast to the Dahlgren NPG could be avoided. The Navy chose 211 acres approximately three miles north of Pocatello in Bannock County, Idaho, as the location to build its only ordnance plant west of the Mississippi River. This location was chosen because it met several key criteria. Specifically, the land was: 1) far enough inland to be safe from a surprise sea attack; 2) marginal for farming and, therefore, inexpensive; and 3) located near the Pocatello railroad terminal, one of the largest Union Pacific railroad termini in the nation (The Arrowrock Group, Inc. 1997; 25 Braun 1995, 29-30; United States Navy Department 1947; Rowland and Boyd 1953, 253). Its proximity to the major rail system allowed the Pocatello NOP to easily receive steel, chemicals, personnel, and ordnance, including the guns transferred from capital ships, like the *USS Missouri and USS Wisconsin,* that ultimately helped the U.S. win the war (The Arrowrock Group, Inc. 1997, 34).

Road access was also an important consideration. U.S. Route 91 crossed the Pocatello NOPs northern border and U.S. Route 30 was located a short distance away, affording main highway connections east and west and north and south. County roads also bounded the plant site on all sides providing excellent access to the highways (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2).

Union Pacific Railroad officials with the Board of Survey and Public Assistance performed some preliminary work to determine the suitability of the Pocatello NOP site and during February and March 1942, they arranged for drillers to dig a test well at the proposed location of the Big Gun Shop. The well was necessary to determine the earth structure required for the design of the deep footings and placing of caissons for the gun pits. Bannock County officials completed land surveys and prepared damage maps as a means to determine adequate compensation for the land and improvements and began the necessary proceedings to establish the procurements necessary to ready the land for immediate Navy possession (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2).

Land was secured for the Pocatello NOP in two parcels. The original tract for the plant cost $58,785.00 and consisted of 145.94 acres and a second tract, acquired later, was $30,524.00 and 64.94 acres. The Navy Department began condemnation proceedings through the Justice Department on April 14, 1942, for the first tract and on October 12, 1942, a Declaration of Taking was filed for the second tract (Wyle Laboratories Scientific Services & Systems Group 1993, 3). On March 19, 1942, Representative Henry C. Dworshak (R-Idaho) officially announced the Navy's choice of Pocatello for the new plant with an estimated cost of $20,000,000 (The Associated Press 1942, 1).

On March 25, 1942, the Navy Department issued a letter of intent through the Bureau of Yards and Docks to the Morrison-Knudsen (MK) Company of Boise, Idaho. The letter authorized the company to proceed with construction of both the ordnance plant and associated proving ground and identified the structures to be built at both sites (The Associated Press 1942, 1). Contract number NO 5449 was cost-plus-a-fixed-fee and the estimated cost and contractor's fee was to be determined before construction began. Commander John A. Scoville, Civil

Engineering Corps (CEC) USN, was assigned to be the Officer in Charge of Construction, and MK broke ground at both facilities in early April 1942 (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Although there were two semi-autonomous construction organizations set up to perform the work, both were under the control of the MK project manager, J.V. Otter and Commander Scoville, whose headquarters office was at the Pocatello NOP site (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2; Morrison-Knudsen 1943, 1). The July 1943 Morrison-Knudsen employee magazine captured the sense of history embedded in the project:

> *"In the story that someday will be told of America's great military structural undertakings, the Naval Ordnance Plant and Proving Ground will be a chapter of fascinating importance. Nothing could be more eloquent of essential cooperation between land and sea than that the far-inland Idaho desert was chosen as the proving ground for guns of the Pacific Fleet." (Morrison-Knudsen 1943, 21).*

The MK contract called for the construction of the following buildings, with a total floor space of 618,355 square feet (31,482,697 cubic feet), at the Pocatello NOP and associated NPG (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2):

- Big Gun Shop;
- Small Gun Shop;
- Administration Building;
- Power Plant;
- Marine Barracks;
- Battery [Commanding] Officer's Quarters and garage;
- Caretaker's Quarters;
- Five, single-family Battery Attendant's Quarter with detached multiple car garage;
- Two, double house Battery Attendant Quarters and detached multiple car garage;
- Timber Storage;
- Fire Station;
- Locomotive Shed;

- Garage and Repair Shop;
- Cafeteria, Public Works Shop;
- Dispensary;
- Ordnance Storehouse;
- Inflammable Storehouse;
- Gate House;
- Miscellaneous small and temporary buildings.

Additional support infrastructure included (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2):

- two 1,000 GPM fresh water wells;
- water storage of 350,000 gallons;
- 130,000 gallon fuel oil storage;
- 3.243 miles of standard gauge railroad tracks;
- one 200-ton capacity railroad scales;
- one diesel-electric locomotive;
- two 30-ton locomotive cranes;
- 36,050 square yards of concrete paved streets;
- 13,067 square yards of gravel surfaced streets;
- 1,445 miles of concrete sidewalks;
- 12,446 square yards of bituminous surfaced parking areas;
- 10,487 feet of sanitary sewer trunk;
- 14,364 feet of water mains;
- 9,845 feet of storm sewer;
- 9,850 feet of chain link fence;
- an underground electric distribution telephone, fire alarm, and police call system

On or about April 1, 1942, Morrison-Knudsen established a small office in Pocatello at a local hotel and, as the construction project grew, moved to a county owned building adjacent to the work site. MK let and supervised several subcontracts, and excavation of the gun pits and construction of temporary buildings to house the contractor's activities began immediately (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2).

Delays resulted from many difficulties encountered during the construction process. Building materials were kept outside and efforts to protect them were of little avail (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Petty differences erupted between Morrison-Knudsen's personnel and the Naval Ordnance Plant's crew; and, as one naval officer put it, "the making of a gun machinist from a sheepherder is not an easy process" (Rowland and Boyd 1953, 253). By mid-February 1943, the contractor had only completed the Administration Building and three other buildings were only partially completed. A warehouse and the dispensary were approximately 90 percent complete and the power plant was at sixty percent completion. Interior streets were merely unpaved roads that were roughly laid out and no landscaping had been done. Despite the many setbacks and apparent lack of confidence in some personnel, after little more than one year, the Pocatello NOP was commissioned by July 1943 (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Once established, by early 1944 the Pocatello NOP had assumed responsibility for a considerable amount of relining and manufacturing work previously conducted by the Naval Gun Factory near Washington D.C. (Rowland and Boyd 1953, 253).

Unlike the nation's other NOPs, the Pocatello plant was owned and operated by the U.S. Navy and was originally designed as a relining plant. Relining was necessary because of the excessive pressure placed on battleship guns when fired. Firing caused erosion to the bore and worn rifling which resulted in decreased gun accuracy. By the end of World War II, nearly all of the naval ship guns used by the Pacific Fleet were sent to the Pocatello NOP for relining (Rowland and Boyd 1953, 5; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). The relining process of 12-inch to 16-inch diameter guns was described by former NOP employee, Cleve Stoddart, in a 1990 newspaper article:

> *"The gun was lowered butt down into deep pits so the barrel stuck straight up, and then the outside of the barrel was heated with electric rods. When it was very hot, cold water was poured down the inside of the barrel, causing the worn liner to contract so it could be lifted out by a crane and a new one installed." (Davidson 1990; Idaho State Journal 1990).*

Although the original and main function of the Pocatello NOP was to reline the large caliber guns, the plant also began manufacturing and assembling gun barrels from 3-inch diameter to those needed for the Pacific Fleet's big guns that weighed 100-tons and were 16-inch diameter. Later additions to the plant increased its capability to include the repair and assembly of 40-mm anti-aircraft guns (Pocatello Tribune 1944).

At its height, the Pocatello NOP employed 1,268 civilians and 130 Navy personnel (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2) and by war's end had grown to 1,400,211 square feet (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 1). Yet, despite its large size and variety of assets, the plant lacked one necessary component. Before the guns could be transported back to the west coast and remounted on battleships and newly manufactured and assembled guns could be shipped, they had to be test fired, or proofed, to ensure their accuracy. A suitable place was needed for the testing and, after a short search; a proof location was found on unoccupied desert lands nearby (Stacy 2000, 10).

1.2.4.2 Arco Naval Proving Ground

The Arco Naval Proving Ground (Arco NPG) was one of only five[9] specialized facilities that conducted ordnance testing in the United States during World War II. Each of these facilities specialized in testing different types of ordnance. The White Oak, Maryland, site tested underwater mines; Stump Neck, Maryland, facility tested powder; Montauk, New York, site specialized in torpedoes; rocket ordnance were tested in the Mojave Desert near Inyokern, California; and Arco NPG tested naval guns ranging in size from 3-inch to 16-inch diameter. It was one of only two proving grounds capable of test firing the Pacific Fleet's 16-inch battleship guns. During the war, the majority of big guns were tested at the Arco NPG as the other proving ground with such capability was Dahlgren located across the country in Maryland, where congestion and non-Navy development posed limitations on proofing activities (Stacy 2000; Braun 1996; Wyle Laboratories Scientific Services & Systems Group 1993; Rowland and Boyd 1953, 326-327).

The Navy's criteria for land on which to proof-test guns from the Pocatello NOP were simple. The new NPG had to it be flat, arid, and sparsely populated. A site near Tabor, Idaho, was initially chosen but later dismissed due to its uneven terrain and surface rock, which would have increased construction costs and limited usability (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Instead, the Navy chose a site further north,

[9] Some sources list six and include the facility at Shumaker, Arkansas. Shumaker was primarily a rocket production facility but also included small rocket ranges (Bureau of Ordnance, 326-327). The authors chose to include Shumaker in the NOP section of this document.

some sixty-five miles northwest of Pocatello and twenty-two miles east of its namesake, the small town of Arco.

Thanks in large part to failed homestead and irrigation attempts, by the 1930s most of the land needed for the Arco NPG was in the public domain. A few small parcels were privately held but no fund transfers were involved in placing them under the Navy Department's jurisdiction. On August 24, 1943, a petition was filed to condemn the privately held land and, at noon on the same day, a Declaration of Taking and court order were issued giving the land to the U.S. government (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Morrison-Knudsen, the same contractor hired to build the Pocatello NOP, also began construction of the proving ground in early April 1943 (Stacy 2000, 8; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2).

Morrison-Knudsen hired single and married men and boys, as young as sixteen, for construction crews. Some traveled daily from as far away as Blackfoot, Idaho, and others stayed in temporary quarters on the Arco NPG and played baseball in their spare time against local teams (Sherman 2014; Morris 2015).

The Arco NPG was subject to the authority of the Commanding Officer of the Pocatello NOP and the direct supervision of the Officer in Charge of the Naval Proving Ground (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, Reference 1, 2). The proving ground was dedicated and began operations on August 2, 1943 (Stacy 2000, 10) but its formal opening was held on Armistice Day, November 11, 1943. The Navy celebrated the opening by inviting curious local townspeople to a special program. The nearly 80,000-acre firing range was off-limits but dozens of visitors toured the southern portion of what residents called "the Base," including the residential and proofing areas (Stacy 2000, 11; Arco Advertiser 1943, 1).

From the beginning, Navy and Marine personnel and approximately fifty civilian employees and their families lived on the Base in the residential area (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 2). Water towers, a warehouse, a commissary locals called "the Store", paint house, several garages, single-family houses, duplexes, a military barracks, deep wells, sanitary sewers, fences, and electrical distribution lines made up the small mostly self-contained village (Stacy 2000, 11). A combination locomotive shed, garage, and fire station was extended in 1944 to include a maintenance shop (The Arrowrock Group, Inc. 1997, 26).

The Marines lived just west of the Base's flag pole in the barracks, which housed up to fourteen men (Stacy 2000, 11). The barracks had a workout room in the basement and the Arco NPG's only mess hall. Marines guarded the Arco NPG, patrolling the perimeter with dogs that were kenneled a short distance to the north and west of the garrison (The Arrowrock Group, Inc. 1997, 27; Wyle Laboratories Scientific Services & Systems Group 1993, 2-8, Figure 2-2).

The Officer in Charge lived and presumably dined in his own house which had a large kitchen and living room, a private bathroom and at least two bedrooms. The house also had a full basement and a matching single-car garage. An expansive lawn and several much needed shade trees[10] were planted between his house, the Marine barracks, and civilian housing and added to the Base's feeling of permanency (Stacy 2000, 11; The Arrowrock Group, Inc. 1997, 27).

Civilian employees averaged about fifty during the war and, initially, ten civilian families lived on the Base in eight dwellings while others lived in the small town of Arco about twenty-two miles to the west and had to travel to work on treacherous winter roads (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, Refernce 2). Later, the Navy had a loop road constructed with seventeen single-family white clapboard houses and two dormitories built around it to alleviate the dangerous travel and to "insure a higher type of employee who will be reasonably permanent" (Stacy 2000, 11; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, reference 2). The new housing was located south of the railroad tracks and the original officer and civilian residences in a semi-circle with the back of the houses facing each other and a large communal garden area. Sidewalks and lawns completed the new neighborhood and helped to create a village atmosphere in the small community (Idaho National Laboratory ca. 1945).

Children were an integral part of the Base and lived there with siblings and one or both parents. School age children traveled by bus to Arco and were sometimes accompanied by a marine guard when warranted by certain boys' behavior. Youngsters played in the sagebrush surrounding the Arco NPG and the bus stopped by the marine barracks once a year where each child received a shot to prevent Rocky Mountain spotted fever, an illness spread by infected ticks (Stacy 2000, 12).

Although the Base was isolated, entertainment was apparently quite easy to find for the Base's children. As a very young girl, one woman recalled mimicking Marines as they marched in formation down roads with names such as Farragut, Lincoln, and Portland (Hamilton 2015; The Arrowrock Group, Inc. 1997, 27). She also spoke fondly of a nice "service guy" called Crum and a playmate named Scotty who was with her when a sheep tethered to a tree managed to wrap its rope tightly around her and Scotty effectively tying them up. Another time, her older brother

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[10] No landscaping was indicated on available historic maps and plans; consequently this landscaping was left off of the ca. 1943 maps compiled for this HALS due to the uncertainty of location and species type; existing landscaping at CFA is included in the ca. 2014 maps compiled for this HALS.

almost drowned while swimming in what was described as a steep-sided concrete waterway and was "skinned" when his aunt pulled him from the water. After he was saved, the boy's frightened mother forbade her family from ever "going to the water" again (Hamilton 2015).[11] Other stories include two wayward young girls who climbed the tall checkered water tower one night and had to be "fetch[ed] down" by marine guards, and a lieutenant's oyster farm that children raided to open all the oysters just to see the "beautiful purple luster inside" (Stacy 2000, 12).

Not all was mischief at the military/civilian community, however. One family raised a small herd of dairy cows and the father and his sons pasteurized and delivered fresh milk to the Base's residents (Hamilton 2015; Stacy 2000, 12). Twice a week the locomotive was pulled from its shed and residents used the building as a recreation center and to watch first run movies (The Arrowrock Group, Inc. 1997, 26). Riding on the locomotive as it moved slowly from its housing provided additional entertainment for the Base's small children (Hamilton 2015).

As evidenced by photographs, now-grown children's memories, and items found in a nearby garbage dump, the people who lived at the Arco NPG had tried to make the isolated and barren desert seem more like a normal small town than a wartime Naval base. They raised and displayed flowers in once-bright red, yellow, and blue pots and vases, now strewn, broken and faded, throughout a nearby World War II era garbage dump.[12] The dump's bent pressure cookers, broken Mason jars, and fragile, floral-patterned crockery pieces enrich the interpretation of life on the Base, revealing that the residents planted, canned, and served fruits and vegetables from the backyard communal garden to supplement their families' diets. These items lay scattered randomly among thousands of cans that held food and other household items. Oil and gas cans, mop buckets, and paint cans provide evidence of routine domestic chores, but crown-top beer cans and whiskey bottles indicate that not all was work, and marbles, a doll buggy, bicycle parts, and other toys tell of children's play. A curry comb discovered among the trash, combined with a family photograph, together prove that at least one young woman kept a horse on the Base (Stacy 2000, 13). A birdcage shows the existence of smaller pets as does a story of searching garages and other buildings for a lost pet dog (Hamilton 2015).

Approximately one-third mile (0.60 km) from the residential area is the proofing area where the official business of the Arco NPG was focused. Along the railroad tracks here, newly manufactured or repaired guns and other material, such as damaged Navy floats and buoys, that originated at the Pocatello NOP were unloaded for testing. A 250-ton gantry crane offloaded the

[11] Judy Hamilton was born in Arco in 1945 while her family, the Andresen's, lived on the Arco NPG. They lived on the Base until 1950.

[12] The garbage dump is located in a dry c. 1910 canal approximately 2 miles (3.22 km) west of the NPG residential area (see map, "Scoville, Naval Proving Ground, 1946").

guns from shipping cars onto a flatcar. They were then either taken to a storage area or nearby bunker for later testing or secured to one of ten gun emplacements for immediate proofing/testing. These gun emplacements were situated north of an eight foot thick (2.5 m) thick concrete concussion wall that was topped with a secure observation tower. During testing/proofing, the guns were loaded with a charge likely prepared by a Woman Ordnance Worker, or WOW, and tested fired downrange to the northeast.[13] Dirt roads named Center Monument Line, East Monument Line, and West Monument Line ran north, northeast, and northwest respectively from the proof (gun emplacement) area and were marked at regular intervals with concrete monuments each etched with their location in longitude and latitude. In preparation for tests, spotters drove down the roads to observation posts and used the monuments to triangulate the shell impact locations and determine the guns' accuracy (Stacy 2000, 10-11, 15).

In spite of precautions and a culture of safety, as evidenced by a slogan, "Safety First," painted on the ends of concrete abutments associated with the gun emplacements, testing activities were not always safe. For example, anti-aircraft guns that had been tested at a much lower elevation at Dahlgren Proving Ground behaved differently when they were proofed at approximately 4,930 foot elevation above sea level at the Arco NPG. Rather than traveling to the north as planned, some of the shells landed south of the proofing area, creating a "highly dangerous" situation for those doing the firing and for civilians in the residential area (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, Reference 7).

In September 1943, the Arco NPG ordered a twelve-month supply of 15,300 projectiles of various types from the Bureau of Ordnance. The projectiles were to be used for target practice or for proofing guns relined at the Pocatello NOP. Weeks after the order was placed, the first gun tested at the Proofing Area on November 20, 1943 was a 3-inch 50-caliber anti-aircraft gun (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, Reference 2). Eleven additional tests were completed in December of that year and, in 1944, naval gun proofing activities at the Arco NPG reached their peak. Of the over 15,000 projectiles ordered, 7,471 shells of various calibers were proofed that year (Wyle Laboratories Scientific Services & Systems Group 1993, 2-9). In 1945, proofing continued with 900 3-inch 50-caliber and 5-inch 38-caliber proof shot and 1,000 5-inch 25-caliber projectiles being requested, and 2,733 shells of

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[13]During World War II some three million women worked in war plants across the United States. Working women were vital to the war effort, as the loss of men to military service left a workforce shortage in many areas. The U.S. government undertook a major public relations campaign to encourage women to work. The use of an invented character- "Rosie the Riveter" - on a brightly colored poster was a powerful propaganda piece (University of Massachusettes and National Park Service 2015). WOWs wore red bandanas with distinctive markings of a flaming bomb not only for safety reasons but from a sense of pride, accomplishment and achievement in their contributions to the war effort. (National Park Service 2015).

various calibers tested. In 1946, approximately 900 projectiles were fired. Proof test result sheets were prepared for these and all subsequent tests between 1943 and 1947 and sent from the Arco NPG Officer in Charge to the Chief of the U.S. Navy's Bureau of Ordnance. The sheets provided details of the tests such as the dates each gun was received and tested, gun maker, mark, model, and number tested. The sheets also noted if the case ejection and proof of gun and assembly were satisfactory (Wyle Laboratories Scientific Services & Systems Group 1993, 2-9 through 2-17). The total number of guns tested at the Arco NPG was estimated at 1,650 and ranged in size from 3-inch to 16-inch in diameter (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, Reference 2).

Gun tests continued at a much reduced rate after the war ended in 1945 but the military chose to continue use of the Arco NPG site. Beginning in spring 1944, proofing activities were joined by several other types of testing that also required an isolated location and that had relatively large available land masses. Tests included smoke screen tests, firing tests against projectile stowages, and the use of smokeless powder and illuminating projectiles. In 1948, a highly classified project which may have been "Project Marsh," was reported to have identified the Arco NPG as the place to test influence fuses and countermeasures for guided missiles. Later records from 1949 and interviews with former personnel include additional references to "Project Marsh" and also to a "Project Elsie" that may have involved the test firings of 16-inch shells containing depleted uranium at the Arco NPG in 1950. No formal records have been found to substantiate that these tests occurred (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 89, 2-9, 2-22 - 2-73). Nevertheless, a wide range of ordnance testing is documented at the Arco NPG during the Post-war period.

1.2.4.3 Arco High Altitude Bombing Range and Twin Buttes Bombing Range

At the beginning of World War II, naval strategy still focused on the importance of building and maintaining extensive fleets of battleships; however, by the end of the war, naval strategy had changed dramatically. Battleship construction was almost completely halted, and, within a few years, most battleships had either been scrapped or retired (Global Security 2014). As the dominance of battleships in the U.S. and world's navies waned, the importance of aircraft grew to include strategic aerial bombing.

Heavy bombers came into being during World War I but it was not until World War II that they gained prominence due to technologies developed in the years between the wars. Toward the end of World War I, German scientist Ludwig Prandl and his team developed the science of aerodynamics and the thick wing. In this critical development, a plane's structural reinforcement could be contained in the thick wing, thus doing away with the need for biplanes and giving planes the ability to climb at much steeper angles without losing lift and stalling.

Perhaps the most important new technology was radar, which used radio waves to detect the position of incoming aircraft. Although radar was developed nearly simultaneously by eight countries, Britain was the first to put it to use at the beginning of World War II. U.S. development of a highly secret, fully automatic bombsight, called the Norden Bombsight, which allowed for unprecedented accuracy in daytime bombing from high altitudes, was also significant (Thirteen/WNET New York 2006; LIFE 1943, 97-102). These and other advances in aircraft technology between the wars made the strategic bomber possible, forever changing the course of warfare across the world.

In 1934, the Boeing Aircraft Company of Seattle, Washington began construction of a four-engine heavy bomber. The first flight of what was initially called the Model-299 occurred on July 28, 1935, and between January and early August 1937, the U.S. government had taken possession of 13 of the bombers, by then designated B-17s. The B-17 came to be known as the "Flying Fortress" because of its defensive firepower capability; it was the first daylight strategic bomber and arguably the most famous bomber of World War II. Equipped with the Norden Bombsight and flying en masse, U.S. B-17 bombers devastated Germany's industrial areas and production ability. Of the 12,732 B-17s produced between early 1935 and May 1945, 4,735 were lost in combat (The Liberty Foundation 2014; Thirteen/WNET New York 2006).

In January 1939, the U.S. Army Air Forces (USAAF) invited the Consolidated Aircraft Company of San Diego, California, to submit a design study for a bomber with higher speed and longer range than a B-17 (Office of Air Force History 1983). Compared to the B-17, the proposed Model 32 had a shorter fuselage and twenty-five percent less wing area, but had a 6-feet greater wingspan and a substantially larger carrying capacity, as well as a distinctive twin tail. Whereas the B-17 used 9-cylinder Wright R-1820 Cyclone engines, the Consolidated design used twin-row, 14-cylinder Pratt & Whitney R-1830 "Twin Wasp" radials of 1,000 hp. The 70,547 pounds maximum takeoff weight was one of the highest of the period (Birdsall 1968, 40).

Later designated the B-24, the "Liberator" as it was commonly called, went through frequent design alterations as reflected in its series of designations beginning with the B-24A and ending with the B-24N. The B-24J was produced in greater numbers than any other series helping to make the B-24 the most heavily produced bomber in history[14] (Dwyer 1998).

The USAAF took delivery of its first B-24As in mid-1941. Over the next three years, B-24 squadrons deployed to all theaters of the war: African, European, China-Burma-India, the Anti-submarine Campaign, the Southwest Pacific Theater and the Pacific Theater. In the Pacific, to simplify logistics and to take advantage of its longer range, the B-24 (and its twin, the U.S.

[14]In "B-24 Liberator: in detail" author Bert Kinzey acknowledges the many faults of the B-24 but also states that it was the best long range maritime patrol aircraft during World War II.

Navy PB4Y) was the chosen standard heavy bomber. By mid-1943, the shorter-range B-17 was phased out (Lord 1967, 279).

During the war, U.S. B-17s dropped 640,036 tons of bombs on European enemy targets in daylight raids. This compares to the 452,508 tons dropped by B-24s and 464,544 tons dropped by all other U.S. aircraft. The B-17 also downed twenty-three enemy aircraft per 1,000 raids as compared with eleven by B-24s, eleven by fighters, and three by all U.S. medium and light bombers (Thirteen/WNET New York 2006).

The B-24 was one of the world's heaviest planes and had a reputation for being more difficult to fly than the B-17 earning nicknames from crew members that included the "Flying Coffin," "Flying Brick," "Flying Boxcar," and the "Constipated Lumberer" (Hillenbrand 2010, 62). In her book, "Unbroken: A World War II Story of Survival, Resilience, and Redemption," author Laura Hillenbrand recounts World War II B-24 crew member and prisoner-of-war, Louis Zamperini's hopes to be assigned to a B-17 because "it was the kind of plane that men wanted to be seen in" and that a B-24 had looks "only a myopic mother could love" (Hillenbrand 2010, 61). Zamperini went on to say that the B-24 had a cramped cockpit that allowed the pilot to see only the plane's nose when flying over mountains and a narrow nine inch-wide catwalk over the bomb bay. One slip and a crewman could fall into the fragile aluminum doors in the bay and tear them away. Another flaw was the lack of steering in a B-24's wheels, meaning the pilot had to feed power alternately from one side to the other, which made taxiing "an adventure" (Hillenbrand 2010, 62).

As had the U.S. Navy, in the early 1940s, the USAAF looked to the inland U.S. for remote locations to build airbases and aerial support ranges. Two such facilities were built in Idaho for training heavy bombardment crews: Gowen Field near Boise and the Pocatello Army Airbase (PAAB) (Kimbro 2012, 41). On May 2, 1942, the USAAF formally announced that a new base would be constructed near Pocatello at the existing airport, McDougal Field, in an undeveloped area called Michaud Flats. The project had an estimated cost of $6,000,000 to $8,000,000, would cover approximately 4,000 acres, and have a workforce of about 3,500 men and 400 officers (Idaho Examiner 1942, 1).

Although it later included fighter pilot and other training, the Second Air Force designated the base and associated ranges' primary mission to serve as training sites for heavy bombers; B-17 bombers, initially, and, within just a few months, B-24 bombers (Swanson 1987). During its period of use from December 1942 to May 1948, the 19th (B-17), 96th (B-17), 308th (B-24), 382nd (B-24) 453rd (B-24) and 464th (B-24) Bomb Groups were stationed at the PAAB, but not all at the same time. When fully complemented, each Bomb Group included over 5,600 people and PAAB was not equipped to handle two full Bomb Groups so groups moved in and out of the base with some regularity (Shaw Environmental, Inc. September 2009, 2-1; Nelson and Roberts-Wright 1993, 8, 105).

Each bomber had a seven to ten person crew and by the middle of July 1942, the first three enlisted men had arrived at the PAAB (Nelson and Roberts-Wright 1993, 8). By December, all aspects of heavy bomber aircrew training had begun including that for pilots, navigators, bombardiers, and gunners. Five ranges were eventually established to support the training, including the Taber Demolition and Incendiary Bombing Range, Taber High-Altitude Bombing Range, Pocatello Air-to-Ground Gunnery Range, Arco High Altitude Bombing Range (AHABR), and Twin Buttes Bombing Range (TBBR). The latter two ranges were located adjacent to the Arco NPG (Kimbro 2012, 41-43).

Historically, the land utilized for the AHABR and TBBR was undeveloped and used for livestock grazing. The AHABR was located approximately fifty miles northwest of the Pocatello Army Airbase. In December 1942, the Department of the Army began the process to lease 5,947 acres for the range from the State of Idaho and Bureau of Land Management and troops eventually made improvements to the range that included three towers, pyramids, lighting, lime targets, and other incidental construction. The military controlled the range until May 1948 (Shaw Environmental, Inc. September 2009, 2-1).

The 4,119 acre TBBR was located approximately forty-five miles north of the Pocatello Army Air Base on lands leased from the State of Idaho, Bureau of Land Management, and Bingham County, Idaho. Acquisition of the land commenced in November 1942, and the range was under military control from December 1944 to May 1948 (Kimbro 2012, 50).

During the years of operation, both ranges were open for business day and night. B-17 “Flying Fortresses” and B-24 “Liberators” flew from the PAAB to drop 100-pound sand-filled practice bombs with spotting charges and incendiary devices on targets from an altitude of up to 20,000 feet. The intended target was in the middle of three concentric circles, the outer being 1,000 feet wide and the inner a mere 250 feet wide. Hitting or coming close to the small target from such a high altitude proved to be difficult so bombardiers were known to doctor their scores. The reported success rate diminished substantially once military photographers joined the crews (Nelson and Roberts-Wright 1993, 39-41).

Heavy bombardment training was dangerous with the vast majority of accidents attributed to pilot error. Errors ranged from flying too low and inattention while landing to getting lost and failure to check for adverse flying weather prior to take off (Nelson and Roberts-Wright 1993, 90). Despite widespread campaigns to emphasize flying safety, PAAB had a substantial accident rate. For instance, between May 2 and November 9, 1944, there were sixty-six plane crashes that originated from the PAAB. Of those, half were “wash outs” meaning total losses and seventeen pilots were reportedly killed. The report does not mention the fate of the other six - nine crew members that would have also been involved in these crashes (Nelson and Roberts-Wright 1993, 88-90). In March 2014, INL archaeologists and a local historian relocated one example of such a crash on the former Arco Naval Proving Ground between the TBBR and AHABR. It likely typifies the makeup of PAAB bomber crews, their training experience, and the deadly challenges that they routinely faced.

On this fatal night, January 8, 1944, a Consolidated B-24J on a training mission to the AHABR took off at 8:05 pm and entered the bombing range at 8:40 pm. The night was frigid with temperatures near zero but, by all accounts, the sky was clear, the moon was nearly full, and the wind was minimal making for ideal flying conditions. At approximately 8:50 pm, the bombing range tower operator noted that the plane had made three bombing runs at approximately 20,000 feet. As they made a fourth run, something went wrong; later thought to be failure of one or more of the engines. According to sheep herders who witnessed the crash, the plane rapidly descended to 100 feet but managed to regain some altitude and climbed to about 500 feet. As the pilot tried to make a sharp turn around a butte, the bomber lost its rudder and left fin, spun out of control, crashed, and then exploded. All seven men on the crew died, the oldest was twenty-seven and the youngest twenty-one. Within the next several days, the USAAF recovered the crew's remains and large pieces of the aircraft. They completed a brusque and conflicting accident report, notified relatives, and sent the remains home for burial (U.S. Army Air Forces, Pocatello Army Air Base 1944).[15]

After the war, the Pocatello NOP was closed but it was reopened in the 1960s to serve the Vietnam War. After that war, it was closed permanently. Several area business men enlisted the help of their senators, Henry Dworshak and Frank Church, to force the Navy to keep it open. After several years and several attempts at finding work and new missions, the NOP was sold to area business men and today it is home to several private industries (Mitton 1993). Its sister facility, the Arco NPG, continued with testing until 1948. In 1949, the former Arco NPG became the nation's nuclear reactor testing ground under the authority of the Atomic Energy Commission and under the new designation as the National Reactor Testing Station. Proofing work also resumed during the Vietnam War, but a new proofing area had to be built because nuclear facilities had been established in the downrange area of the original Arco NPG.

[15] A woman's 1938 high school class ring was found at the crash site. Through the school insignia, names and hometowns of the crew members, and the initials "MAH", the ring's owner was identified as Madeline A. (Hopkins) Pearce, wife of Sgt. George A. Pearce, Jr., the tail gunner who had died in the crash. The ring was returned to their daughter just in time for Veterans Day 2014.

1.2.5 Post-World War II Ordnance Testing

A variety of accidents and circumstances related to the manufacture, transportation, storage, and handling of explosives during World War II pointed to the need for improved explosives safety (Moran Jr. 1992, 115). Up to this time, the primary source for determining safety parameters was the American Table of Distances (ATD), published in 1910. This standard outlined specified safe distances from stored explosives, based on recorded explosions. The ATD noted only the maximum distance of buildings affected by blasts. Damage was noted as either structural damage or broken glass and no further classification of damage by building type was included. In addition, it was noted whether the blast was shielded by a barrier of some type (Robinson 1945, 1). Prior to 1910, no accidental explosions would have involved modern military explosives, such as TNT, Amatol[16], and smokeless powder (Robinson 1945, 9). Changes in the type and size of explosive detonations in World War II made it necessary to address the inadequacies of the ATD and the outdated safety guidelines for explosive storage outlined therein, as well as the need of analysis of more recent explosive accidents (Lahoud and Zehrt Jr. 1992; Robinson 1945, 1).

Distances and siting of military structures was based on New Jersey explosive safety laws, which had been adapted from the ATD (Lahoud and Zehrt Jr. 1992, 417). When the Army-Navy Explosives Safety Board (ANESB) began experimental testing in the 1940s the ATD criteria were assessed. Revised criteria for the storage of military explosives and ammunition were published in 1948, which recommended a risk factor into the calculation of the distance of inhabited structures, public highways, and public railroads from stored munitions. This 1948 publication, combined with the results of experimental explosive testing conducted under the auspices of the ANESB, prompted a recommendation to the DOD leading to the adaptation by the U.S. military of revised explosive storage criteria in 1950 (Lahoud and Zehrt Jr. 1992, 418). In addition, the use of Torpex[17] was phased out by the Navy by the end of World War II due to its sensitivity to shock (Global Security 2015; Moran Jr. 1992, 116-117).

[16] Amatol is an explosive that was developed during World War I. Comprised of TNT and ammonium nitrate, Amatol has three times the explosive power of gunpowder. When the U.S. entered into World War II, Amatol was adapted for loading high explosive shells; due to the shortage of TNT and other types of explosives, many World War II mines were loaded with 50/50 Amatol (50% ammonium nitrate and 50% TNT) warheads. Amatol 80/20 (80% ammonium nitrate and 20% TNT) was used in Bangalore torpedoes and produces white smoke on detonation, while the 50/50 mixture produces more dark smoke but less so than pure TNT (Global Security 2015).

[17] Torpex is a secondary explosive that is 50% more powerful than TNT by mass and which was used by the U.S. Navy beginning in late 1942 until it was replaced by the less shock sensitive HBX composition. The name is short for Torpedo Explosive, as it was originally developed for use in torpedoes; the aluminum component in

Major accidental detonations of stored and in-transit explosives during World War II occurred across the country - including several that involved railcars and earth covered magazines (Tables 4 and 5) - reinforced the need for new testing, which lead directly to new programs at the Arco NPG.

Table 4: Ordnance related railcar explosions during World War II.

Date	**Description**
June 1942	At the Elwood Ordnance Plant in Illinois, an explosion involving three rail cars full of anti-tank mines with an explosive weight of 62,600 pounds of TNT, killed forty-nine people and injured sixty-seven.
April 1944	A cooling building (barricaded on two sides) detonated, setting off two railcars filled with 110,000 pounds of Torpex; massive concrete fragments littered the area for a distance of 3,200 feet (975 m), leaving eight dead and two injured.
July 1944	Ten railcars on the dock and aboard the *USS E.A. Bryan*, at Port Chicago in California, loaded with 3.75 million pounds of high explosive detonated, killing 325 and injuring 392.
September 1944	550 tons of Torpex-loaded mines stored in a cooling building, with ten loaded boxcars alongside, detonated killing ten and injuring 61; barricaded on both sides, the blast carved a crater 525 feet (160 m) long, 140 feet (42.7 m) wide, and 30 feet (9.15 m) deep; structural damage was recorded at 3,500 feet (1066.8 m) away and window breakage was recorded at 15 miles (24.15 km) away; concrete debris weighing 500 pounds (227 kg) was launched a mile (1.7 km) from the explosion site.

(Source: Moran Jr. 1992, 116, 118)

the composition creates a longer explosive pulse, making Torpex extremely useful underwater (Global Security 2015).

Table 5: Ordnance explosions involving earth covered magazines during World War II.

Date	**Description**
n.d.	Fragmentation bombs with a 40,759 Net Explosives Weight (NEW) of TNT detonated killing ten crew members; a man working in another magazine at a distance of 450 feet (137 m) was also killed (Moran Jr. 1992, 116).
December 1944	Loading Torpex bombs from a trailer into an igloo magazine, a detonation in the magazine propagated into the trailer and killed all eleven crew members (Moran Jr. 1992, 116-117).

(Source: Moran Jr. 1992, 116-117)

Prior to the ANESB experimental testing, much of the data upon which explosive safety criteria had been determined was based on after-the-fact assessments of accidental explosions. The culmination of World War II resulted in the accumulation of excess munitions, which lead to increased explosive storage at military facilities. To make efficient use of facility space the explosives safety testing aimed to determine if the space between the storage structures, and other inhabited buildings, could be decreased while at the same time increasing the amount of explosives stored, without increasing the risk of sympathetic detonation or injuries to personnel. The Arco NPG was chosen as a test site for conventional explosives storage and transportation due to its isolated location, possession as a government owned facility, and the availability of personnel and construction supplies (Thompson 1948, 1). Testing began toward the end of World War II and continued through the end of the war into 1947.

At the Arco NPG, structures were built and then loaded with explosives that were intentionally discharged to assess the effects to the structures and to the surrounding area of such explosions, and to determine safe storage and transport of military ordnance. One such test occurred on August 29, 1945 (just before the end of the war), when 250,000 pounds of high explosive (113,398.10 kg) were detonated within an igloo type storage magazine. The explosion created a smoke and dust cloud nearly a mile high and a crater fifteen feet deep. The blast was heard well into neighboring states (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: References 63, 65). Another test on October 31, 1946, detonated 500,000 pounds of excess high explosives to determine the safe distance for explosive ordnance storage in the open. At the time, this was believed to be the world's largest conventional ordnance explosion (Wyle Laboratories Scientific Services & Systems Group 1993, 2-38, 2-52, Appendix

B: Reference 47). Craters and debris from these and other ordnance tests still remain on the INL landscape.[18]

Explosive testing during 1945 included Mass Detonation tests, Army Safety and Security Division tests, a Canadian Joint Staff test, and ANESB igloo tests (Wyle Laboratories Scientific Services & Systems Group 1993, 2-29). Mass Detonation testing first appears in the historical record in January of 1945, proposed as a means to characterize mass detonation of contemporary projectiles and update standard operating procedures that were based on large scale explosives tests that had occurred in 1926 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-30). Detonators, plastic explosive, wire, and other necessities required to create an explosion, along with 1,000 5-inch 38-caliber projectiles, were shipped from Hawthorne, Nevada to the Arco NPG for testing (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 26). Tests were planned and conducted throughout 1945 using a variety of projectiles types and numbers, with successful mass detonation tests using explosive D appearing in the historical record in February 1945, and additional tests occurring in March 1945 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-30, AppendixB: References 27-37). A number of craters associated with mass detonation testing are still present within the proofing range of the Arco NPG [19] (Wyle Laboratories Scientific Services & Systems Group 1993, 2-34).

Army Safety and Security Division tests, which began a few months prior to the end of the war, continued throughout 1945. In March and April of 1945, the following tests were proposed and carried out (Wyle Laboratories Scientific Services & Systems Group 1993, 2-34):

- Barrier Wall Tests

  The initial proposal for this test outlined the construction of two barrier walls, one Army and one Navy, for the analysis of various properties of different munitions storage barrier wall types. The primary charge would consist of 7,980 pounds (3,619.70 kg) of high explosive. The secondary charge, placed on the opposite side of the wall form the primary charge, would consist of 7,548 pounds (3,423.75 kg) of high explosive bombs. The proposal mandated that at least two of these type tests were to be conducted; in all, at least three tests were conducted (Wyle Laboratories Scientific Services & Systems Group 1993, 2-34 to 2-35, Appendix B: Reference 40).

  The first test occurred on June 30, 1945, in which approximately 16,000 pounds (7,257.50 kg) of explosive in the form of Amatol loaded DP and Dutch bombs were

[18] See maps, “Mass Detonation Area, 1946” and “Scale Model, Barrier Wall and Railcar Detonation Sites, 1945-46”.
[19] See maps, “Mass Detonation Area, 1945” and “Mass Detonation Area, 1946”.

used (Wyle Laboratories Scientific Services & Systems Group 1993, 2-35, Appendix B: Reference 41).

The second test, referred to as the "Three Wall Test", was conducted August 15, 1945. For this test, three one-foot (0.30 m) thick concrete walls were constructed twenty feet (6.10 m) apart with a cement floor between, representing two cooling bays of a munitions loading plant. Each bay was loaded with 20,000 pounds (9,071.75 kg) of high explosive in the form of Amatol loaded Dutch bombs, which were detonated simultaneously (Wyle Laboratories Scientific Services & Systems Group 1993, 2.35, Appendix B: Reference 42). The detonation annihilated the walls and created a crater approximately six feet (1.82 m) deep under the floor of each bay, throwing debris as far as 5,000 feet (1,524 m) away proving conclusively that the current cooling bays at Army loading plants were unsafe (Wyle Laboratories Scientific Services & Systems Group 1993, 2-35, Appendix B: Reference 43).

The third test, which analyzed "Sandwich Wall" type Army wall construction, was also conducted in August 1945. The purpose of the test was to determine if adjacent bays in loading plants could be modified to make it safe for loading up to 50,000 pounds (22,679.60 kg) of explosive. Army sandwich wall construction consisted of a one-foot (0.30 m) concrete wall with 3/8 inch (0.95 cm) plates fastened three feet (0.92 m) from either side; the area between the wall and the plates was then filled with loose sand and dirt. A standard Navy sand-filled barrier wall, fifty feet (15.25 m) long and consisting of two courses of 8-inch (20.32 cm) cinder block separated by four feet (1.22 m) of dirt infill, was built twenty feet (6.10 m) from the Army wall. 50,000 pounds (22,679.62 kg) of high explosive contained in 250 Amatol-Dutch bombs were loaded on either side of the Army wall, and 10,000 pounds (4535.92 kg) of high explosive contained in twenty-nine Amatol-Dutch bombs was placed on the other side (away from the Army wall) of the Navy wall. The 50,000 pound (22,679.62 kg) charge loaded at the Army wall detonated simultaneously with the primary charge, while eighteen of the twenty-nine bombs loaded at the Navy wall were found undetonated but severely damaged at distances up to 3,000 feet (914.40 m) from the detonation site. This test provided evidence that it would not feasible to modify Army cooling plants for the storage of high explosive in the amount of 50,000 pounds (22,679.62 kg) or more (Wyle Laboratories Scientific Services & Systems Group 1993, 2.35, Appendix B: Reference 43).

- Railroad Box Car Tests

  On August 31, 1945, five railroad box cars were loaded with 150,000 pounds (68,038.85 kg) of explosive in the form of Amatol bombs and TNT-loaded Navy mines. This test was conducted to determine the "missile distance and hazard" potential of a train loaded with high explosive, were it to detonate in a classification yard (Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B: Reference 45). A short track, sufficient to accommodate five condemned box cars obtained for the test, was constructed. Each car was loaded with 30,000 pounds (13,607.77 kg) of explosive, with the center load in the center car set as the primary charge. In addition, piles of mines were set at various distances from the box cars in both longitudinal and broadside directions. With the detonation of the primary charge, the entire train load detonated, sending fragments of box car and rail up to 2,500 feet (762 m) away and leaving a crater of eight feet (2.44 m). Effects of the explosion were most notable on the mine piles stacked broadside and the nearest mine pile caught fire and burned. Test results indicated that ammunitions trains in classification yards located on the same track at a distance of one-half mile (0.80 km) from one another would be relatively safe; however, trains on parallel tracks, even at distances of one-half mile (0.80 km) would be unsafe (Wyle Laboratories Scientific Services & Systems Group 1993, 2-35 to 2-37, Appendix B: Reference 45).

- Sympathetic Detonation Tests

  The first four sets of sympathetic detonation tests involved relatively small amounts of explosive and were used primarily to determine explosion mechanics. The first set of these tests was designed to determine the effects of a primary detonation on elongated charges. Five tests were conducted using 960 pounds (435.45 kg) of Tetrytel explosive, with an additional five tests conducted using 1,920 pounds (870.90 kg) of Tetrytel explosive (Wyle Laboratories Scientific Services & Systems Group 1993, 2-38 to 2-39, Appendix B: Reference 44).

  Analysis of lateral air gap propagation on Bangalore torpedoes comprised the second set of sympathetic detonations tests. Five tests were conducted using the explosives charges and configurations outlined in Table 6. These tests were designed to determine the critical values for air space between various amounts of Bangalore torpedoes to limit propagation by an initial detonation (Wyle Laboratories Scientific Services & Systems Group 1993, 2-38, 2-40 to 2-41, Appendix B: Reference 44).

Table 6: Primary charge and pile layout for lateral air gap propagation tests on Bangalore torpedoes, 1945.

Test Number	Number of Torpedo Piles	Torpedo Piles – NEW	Primary Charge – NEW
1	4	80 pounds (36.29 kg)	40 pounds (18.14 kg)
2	4	160 pounds (72.57 kg)	800 pounds (362.87 kg)
3	6	750 pounds (340.19 kg)	2,000 pounds (907.18 kg)
4	6	650 pounds (294.84 kg)	5,000 pounds (2,267.96 kg)
5	6	700 pounds (317.52 kg)	10,000 pounds (4,535.92 kg)

(Source: Wyle Laboratories Scientific Services & Systems Group 1993, 2-41)

Air gap bomb propagation was the basis for the third and fourth set of sympathetic detonation tests. Air gap tests measure the distance required between the edges of explosive piles to deter propagation of detonation by either shock or missiles. The tests were designed to measure propagation between both similar and dissimilar bomb types. Bombs used in these tests are identified in Table 7 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-38, 2-42 to 2-48, Appendix B: Reference 44).

Table 7: Bomb types used in air gap propagation tests, 1945.

Bomb Type	Number of Bombs	NEW
Demolition Bomb, MK 1 M4	44	66 pounds (29.94 kg)
GP Bomb, AN-M57	265	125 pounds (56.70 kg)
Demolition Bomb, MK 1 M2	157	148 pounds (67.13 kg)
GP Bomb, AN-M43	44	266 pounds (120.65 kg)
GP Bomb, AN-M44	44	538 pounds (244.03 kg)

(Source: Wyle Laboratories Scientific Services & Systems Group 1993, 2-42, 2-46)

The fifth set of sympathetic detonation tests involved barricades and the effectiveness of screening in deterring propagation. Two 12-inch (30.48 cm) thick reinforced concrete walls, fifteen feet (4.57 m) long by ten feet (3.05 m) high, and separated by 100 yards (91.44 m) were constructed. A primary charge of demolition blocks was set on one side and blast meters were installed on the other. The results of these tests were used to determine wall size and distance required to deter propagation of detonation in stored explosive (Wyle Laboratories Scientific Services & Systems Group 1993, 2-38, 2-49). The final set of tests related to sympathetic detonation was used to determine barrier wall constants for standard dividing walls in explosive storage facilities. Construction and setup for the wall constant tests was similar to that of the screening tests (Wyle Laboratories Scientific Services & Systems Group 1993, 2-38, 2-50 to 2-51, Appendix B: References 40, 44).

A final auxiliary cooling shed test was conducted in June 1945, designed to assess propagation issues related to explosive storage buildings (Wyle Laboratories Scientific Services & Systems Group 1993, 2-52 to 2-56, Appendix B: References 49-50). Smokeless powder experiments were conducted in July 1945 to characterize charges, pressures, and velocities of the powder (Wyle Laboratories Scientific Services & Systems Group 1993, 2-52, Appendix B: Reference 48). Fragmentation tests of major caliber projectiles were conducted in August 1945 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-52, Appendix B: References 52-53). The Canadian Joint Staff Tests conducted were conducted in September or October 1945, and required elevation and firing range capabilities available at the Arco NPG; however, few details are known about the tests (Wyle Laboratories Scientific Services & Systems Group 1993, 2-57, Appendix B: Reference 62).

The ANESB igloo type storage magazine tests, initially discussed in 1944, were first executed in 1945 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-26, 2-57, Appendix B: References 3, 63). Seven different government and scientific agencies were invited to participate in the explosive testing (Thompson 1948, 1):

- the Underwater Explosives Research Laboratory of the Woods Hole Oceanographic Institution;
- the Office of Scientific Research and Development (OSRD), Division 2 of the National Defense Research Committee (NDRC);
- the David Taylor Model Basin of the Navy Department;

- the U.S. Coast and Geodetic Survey, Commerce Department;
- the U.S. Weather Bureau of the Commerce Department;
- the U.S. Geological Survey of the Interior Department;
- and the U.S. Bureau of Reclamation of the Interior Department.

Earth-covered, arch-type, standard magazines - called igloos - two Army and two Navy type, approximately twenty-six and one-half feet by eighty-one feet (8.10 m by 24.69 m) were constructed along with one two-story, wood frame Navy barracks building, approximately thirty feet by sixty feet (9.14 m by 18.29 m), and three open storage sites called revetments (Thompson 1948, 3). In addition, three camera stations, and instrument and observation stations were constructed to record as much information as possible about the full scale detonations and their impacts (Thompson 1948, 4). Observations included the recording of blast pressures at detonation, seismic effects, the distribution of blast debris, shock wave measurements, recording crater size and shape, structural damage to the wood frame barracks, and meteorological effects (Thompson 1948, 3). The data collected and instrumentation used reflected the cooperative nature of the tests and the desire to collect as much data as possible, a contrast to the limited information that had been gathered from reports following an accidental detonation. The U.S. Coast and Geodetic Survey, U.S. Geologic Survey, David Taylor Model Basin of the Navy Department and the U.S. Bureau of Reclamation brought seismometers, the U.S. Bureau of Reclamation also contributed strain gauges, and the U.S. Weather Bureau recorded meteorological effects (Thompson 1948, 5).

Air-blast pressures were measured by six different types of gauge for test 1: paper-blast meters, foil-blast meters, ball crusher gauges, David Taylor Model Basin (TMB) diaphragm gauges, and piezoelectric gauges, while only paper blast meters were used in the subsequent tests (Thompson 1948, 5, 92). The ground movement, crater recording, barracks damage, and missile data from the blasts were all assessed by ground survey, and the assessment of damage to the adjacent target igloos by the blast was recorded by slide rule gauges and stop-point indicators within the structures (Thompson 1948, 10-11). A total of eight igloo tests were conducted in 1945, the general purpose of which was to assess propagation of detonation from the primary charge to nearby loads of high explosive, as well as to measure damage to structures within the testing vicinity. These eight tests are individually summarized below:

- Igloo Test No. 1 - August 29, 1945

  The purpose of Test No. 1 was to determine if the mass detonation of 250,000 pounds (11,3398.10 kg) of high explosive in Igloo A would propagate to three other igloos

(B, C, and D), as well as to measure damage to nearby structures. Igloo A was of Army construction with a Navy door barricade. Igloo B was also Army construction, located 185 feet (56.39 m) from, and parallel to, Igloo A. Igloos C and D were both Navy construction; C was in line 210 feet (64.00 m) in front of A, and D was located 500 feet (152.40 m) diagonally from the left rear of A. Test Barracks E, a wooden frame structure, was located 1,155 feet (656.85 m) to the right rear of A. The high explosive loaded in igloos A and B consisted of 425, 1,100-pound (4998.95 kg) 50/50 Amatol bombs similar to Army MK-33 bombs. Igloos C and D were loaded with 541, 650-pound (294.84 kg) MK-49 aircraft depth charge bombs containing 462 pounds (291.21 kg) of Torpex (Thompson 1948, 12).

Results of detonation of the primary charge included “a bush-like cloud of smoke that engulfed the flames within”, which “merged with the dust near the ground and developed into a billowing black mass of smoke rising to a height of 2,380 feet [1,079.55 m] in two minutes” (Thompson 1948, 12). No propagation from the primary detonation in Igloo A was recorded in igloos B, C, or D, all of which sustained only minor damage. Barracks E suffered structural damage and extensive glass breakage (Thompson 1948, 12). The blast from the detonation was heard as far away as Colville, Washington, Vernal, Utah, and Idaho Springs, Colorado (Thompson 1948, 43-51). The resulting crater was oval in shape with a long diameter of 200 feet (60.96 m), a short diameter of 150 feet (45.72 m), and an actual depth of thirteen feet (3.96 m) below grade (Thompson 1948, 16).

- Igloo Test No. 2 – October 18, 1945

After the completion of Test No. 1, two revetments (earth barricaded open storage sites) were constructed, one 185 feet (56.39 m) east of Igloo C (Revetment 1) and the other 185 feet (56.39 m) west of Igloo C (Revetment 2). The 50/50 Amatol bombs that had been loaded in Igloo B during Test No. 1 were removed and divided equally between the two revetments, placing 125,000 pounds (56,699.05 kg) of high explosive in each. The Torpex depth charges loaded in Igloo D were moved to Igloo B. A temporary timber and earth door barricade was then constructed in front of Igloo B. The doors on Igloo C, damaged during Test No. 1, were repaired and a sandbag barricade was constructed inside of the igloo to prevent the doors from flying into the stored ammunition during the test detonation. The purpose of Test No. 2 was to determine if the mass detonation of high explosive loaded in Revetment 1 would propagate to Igloo C or to Revetment 2, as well as to assess damage to nearby structures (Thompson 1948, 53).

The detonation of the explosive loaded in Revetment 1 measured 1,440 megawatt tons (MWT). Although the resulting explosion in Revetment 1 created a mushroom cloud of dense, black smoke crested with red flames; no propagation was recorded in Igloo C, B or D, or in Revetment 2 (Thompson 1948, 54). The resulting crater measured eighty-two feet (24.99 m) long, seventy-nine feet (24.08 m) wide, and ten feet (3.05 m) actual depth below grade (Thompson 1948, 55).

- Igloo Test No. 3 – October 19, 1945

  Test No. 3 was conducted to determine if the detonation of 250,000 pounds (11,3398.10 kg) of high explosive loaded in Igloo C would propagate to Revetment 2 or to Igloo B., located 280 feet (85.35 m) diagonally to the right rear of Igloo C. Damage to nearby structures was also measured (Thompson 1948, 60-62).

  The detonation of the explosive loaded in Igloo C measured 1,215 MWT, creating a cloud of smoke similar to that resulting from Test No. 1. No propagation to Revetment 2 or to Igloo B was recorded, although both were damaged in the explosion. Igloo D was undamaged, but the Barracks E was more severely damaged than in previous tests (Thompson 1948, 62). The resulting crater was oval in shape and measured 156 feet (47.55 m) long, 128 feet (39.01 m) wide, and 17.8 feet (5.43 m) apparent depth (Thompson 1948, 62).

- Igloo Test No. 4 – October 30, 1945

  After the completion of Test No. 3, another revetment (Revetment 3) was constructed next to the site of Igloo A, which had been destroyed in Test No. 1. The crater left from the detonation of explosive loaded in Igloo A was filled in and compacted to level it with the surrounding grade. The damage to Revetment 2, sustained during Test No. 3, was repaired and the explosive load restored. The purpose of this test was to determine if the primary detonation of Revetment 3 would propagate to Igloo B, which was located 185 feet (56.39 m) parallel from Revetment 3; or to Revetment 2, located 293 feet (89.31 m) diagonally from the right front of Revetment 3. In addition, damage to nearby structures was also measured (Thompson 1948, 68).

  Revetment 3 was loaded with 783, 600-pound (355.16 kg) bombs with an explosive weight of 320 pounds (145.15 kg) of 50/50 Amatol, creating a 250,000 pound (113,398.10 kg) stack of high explosive (Thompson 1948, 68). The primary detonation, located in Revetment 3, created a black cloud of smoke similar to that of Test No. 2. No propagation of detonation was recorded, but Igloo B and the test barracks were further damaged. No measurements were taken of the crater left by the explosion as Revetment 3 had been constructed on back-filled ground (Thompson 1948, 70).

- Igloo Test No. 5 – October 30, 1945

  The purpose of Test No. 3 was to determine if a primary detonation in Igloo B would propagate to Revetment 2, located 230 feet (70.10 m) north of Igloo B, and to assess damage to nearby structures. Igloo B was detonated at a force of 1,250 MWT, creating a cloud of smoke similar to that resulting from tests No. 1 and No. 3. No propagation was recorded and Igloo D and Revetment 2 were undamaged; however, Barracks E sustained further damage. The explosion created an oval crater measuring 158 feet (48.16 m) long, 134 feet (40.84 m) wide, and an apparent depth of 10.7 feet (3.26 m) (Thompson 1948, 75).

- Igloo Test No. 6 – October 30, 1945

  Test No. 6 was designed to obtain additional crater data by detonating the 125,000 pounds of high explosive in Revetment 2. The explosion created a cloud of smoke similar to that produced in tests No. 2 and No. 4. The resulting crater measured eighty-nine feet long (27.13 m) long, eighty-seven feet (26.52 m) wide, with an apparent depth of 10.9 feet (3.32 m) (Thompson 1948, 79).

- Igloo test No. 7 – October 31, 1945

  Test No. 7 was designed to determine if 250,000 pounds (11,3398.10 kg) of high explosive loaded in an un-barricaded stack would propagate to another 250,000-pound (11,3398.10 kg) un-barricaded stack of high explosive located 800 feet (243.84 m) parallel from the primary charge. The primary charge contained 600-pound (272.16 kg) bombs, MK 9 depth charges, scrap TNT, Tetryl boosters, and Bangalore[20] torpedoes. The secondary stack of explosive was comprised entirely of M1-A1 antitank mines (Thompson 1948, 80).

  The initial detonation produced a cloud of smoke similar to that produced in tests No. 2 and No. 4, but no propagation occurred in the secondary stack of explosive. High humidity on the test day made it possible to observe a rarefaction wave, which moved just ahead of the shockwave caused by the explosion. The rarefaction wave was caused by the compression of the air by the shockwave, which then cooled and

[20] Bangalore torpedoes are used to clear antipersonnel mines and other combat obstacles. Deployment consists of several sections of tubing used to push the torpedo into the target area. The modern Bangalore torpedo was developed during World War II for use by dismounted infantry and combat engineer troops (Global Security 2015).

condensed. The resulting crater measured 134 feet (40.84 m) long, eighty-six feet (26.21 m) wide, with a depth of nearly four feet (1.19 m) at the lowest point (Thompson 1948, 80).

- Igloo Test No. 8 – October 31, 1945

  Test No. 8 was conducted in order to obtain additional crater data. The secondary stack of high explosive from Test No. 7 was detonated, creating a crater 134 feet (40.84 m), ninety-four feet (28.65 m) wide, with an apparent depth of nearly fifteen feet (4.54 m). The smoke cloud produced was typical to that produced in Test No. 7 (Thompson 1948, 82-83).

Collectively, the conclusions drawn from the igloo tests in 1945 established that the distance between the standard earth-covered magazines could be reduced from 400 feet (Army) and 500 feet (Navy) to 185 feet, the shortest distance tested, for the storage of 250,000 net pounds (113,398.10 kg) of high explosives without risk of propagation. In reference to the inhabited building distance tested, defined by the ATD, the tests established that despite the fact that the igloo structures were considered barricaded structures, they were insufficient for the type, amount and storage methods used in these experiments (Thompson 1948, 109). The barracks were found to sustain serious damage from the detonation of 250,000 pounds (113,398.10 kg) of explosives in an earth-covered igloo and, while the test barracks were not structurally unsound following the tests serious injury to personnel or even fatalities could not be ruled out at a distance of 2,155 feet (656.85 m) (Thompson 1948, 101-102). In addition, earth-barricaded open storage sites were determined to be 'reasonably safe' for the temporary storage of 250,000 net pounds (113,398.10 kg) of explosives located between army igloos, as were un-barricaded storage at a distance of 800 feet from earth-covered igloos containing this amount of net explosives (Thompson 1948, 101-102).

Although proofing activities at the Arco NPG were drastically reduced by 1946 due to the end of World War II, five proof tests were conducted that year. Along with proof tests, firing tests against projectile stowage, smoke screen tests, and additional ANESB smokeless powder and igloo tests were conducted throughout 1946 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-58). As a result of the 1945 mass detonation testing, the Navy determined that more tests were needed to simulate ship stowage conditions; testing involved firing approximately 900, 5-inch projectiles at stowage piles. Testing was completed by the end of June 1946 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-60, Appendix B: References 68-70). A second round of mass detonation testing occurred in December 1946 (Wyle Laboratories Scientific Services & Systems Group 1993, 2-60, Appendix B: References

71-72). Smoke screen testing was conducted in February and March of 1946, in which approximately 100 White Phosphorus (WP) and Powdered White Phosphorus (PWP) projectiles that produced smoke screen and acted as antipersonnel weapons, were detonated (Wyle Laboratories Scientific Services & Systems Group 1993, 2-60 to 2-64).

Igloo and revetment testing by the ANESB continued in the summer of 1946, beginning with scale model igloo tests, designed to further investigate propagation of detonation without the expense of construction full scale magazines. One-tenth linear scale models of Army and Navy twenty-seven foot by eighty foot (8.23 m by 24.38 m) standard igloo magazines were constructed (Mann 1947, 1). Due to the scale of the model igloos, some modifications were required in their construction, mainly the mounting of the arch barrel to the slab that served as both foundation and floor, rather than having deeper footing walls with a separate slab floor poured directly on earth fill as the full scale magazines had been. The mortar concrete used to form the igloo was reinforced with 4-inch by 4-inch (10.16 cm by 10.16 cm) No. 13 steel wire mesh (Mann 1947 1, 10). The explosive weight of the scaled charges for these tests equated to 250 pounds (113.40 kg) for 250,000 pounds (113,398.10 kg) and 500 pounds (226.80 kg) for 500,000 pounds (226,796.19 kg), with individual test sites separated from one another by 1,500 feet (457.20 m) (Mann 1947, 1,5). Before each igloo was set in place, the site was cleared of vegetation and loose soil was removed to a depth of two inches (5.08 cm) (Mann 1947, 10).

A total of seven scale model tests were executed in 1946, beginning in July (Table 8). The first five tests involved only scale igloos, while the last two tests involved scale earth revetments in which model-sized Bangalore torpedoes were detonated (Mann 1947, 5, 12, 19, 64, 73). Earth cover and shape on the primary igloos varied in the first five tests, while the earth cover on the target igloos remained the same, scaled to ANESB standards (Mann 1947, 10).

Table 8: Scale model igloo and revetment tests, 1946.

Test	**Date**	**Description**	**Explosive Type and Weight**
1	July 30, 1946	Detonation in primary igloo with target igloo set parallel at 21 feet (6.41 m); barricade in front of primary igloo	Amatol, 250 pounds (113.40 kg)
2	August 1, 1946	Detonation in primary igloo with target igloo set parallel at 21 feet (6.41 m); barricade in front of primary igloo	Amatol, 250 pounds (113.40 kg)

Test	Date	Description	Explosive Type and Weight
3	August 2, 1946	Detonation in primary igloo with target igloo set parallel at 21 feet (6.41 m); barricade in front of primary igloo	Amatol, 250 pounds (113.40 kg)
4	August 5, 1946	Detonation in primary igloo with target igloo set parallel at 21 feet 4 inches (6.41 m, 10.16 cm)	Amatol, 500 pounds (226.80 kg)
5	August 5, 1946	Detonation in primary igloo with target igloo set parallel at 21 feet 4 inches (6.41 m, 10.16 cm)	Amatol, 500 pounds (226.80 kg)
6	August 8, 1946	Detonation in revetment with target igloo set parallel at 21 feet 4 inches (6.41 m, 10.16 cm)	Amatol loaded Bangalore torpedoes, 250 pounds (113.40 kg)
7	August 8, 1946	Detonation in revetment with target igloo set parallel at 21 feet 4 inches (6.41 m, 10.16 cm)	Amatol loaded Bangalore torpedoes, 250 pounds (113.40 kg)
1-A	August 10, 1946	Detonation in primary igloo with target igloo set parallel at 21 feet (6.41 m); barricade in front of primary igloo; reduction in number of air pressure gauges from that in Test 1; no window glass test	Amatol, 250 pounds (113.40 kg)

(Source: Mann 1947, 6-9, 19-83)

Window glass tests were also conducted, with three glass test panel assemblies set at different distances for each test; equivalent to one-tenth of the ATD inhabited building safety distances (Table 9). Air blast measurements were made using Naval Ordnance Laboratory (NOL) ball crusher gauges, (and a modification of such), foil diaphragm gauges such as those used by the Explosives Research Laboratory of Woods Hole, Massachusetts, and Aberdeen Proving Ground paper blast meters were used to measure air blast pressures (Mann 1947, 14).

Table 9: Window glass distances for scale model tests, 1946.

Test	ATD type distance from primary charge		
	Panel 1	**Panel 2**	**Panel 3**
1	Barricaded distance, 215 feet (65.53 m)	2/3 un-barricaded distance, 287 feet (87.48 m)	Full un-barricaded distance, 431 feet (131.37 m)
2	Barricaded distance, 215 feet (65.53 m)	2/3 un-barricaded distance, 287 feet (87.48 m)	Full un-barricaded distance, 431 feet (131.37 m)
3	Barricaded distance, 215 feet (65.53 m)	2/3 un-barricaded distance, 287 feet (87.48 m)	Full un-barricaded distance, 431 feet (131.37 m)
4	Barricaded distance, 270 feet (82.28 m)	2/3 un-barricaded distance, 360 feet (109.73 m)	Full un-barricaded distance, 541 feet (164.90 m)
5	Barricaded distance, 270 feet (82.28 m)	2/3 un-barricaded distance, 360 feet (109.73 m)	Full un-barricaded distance, 541 feet (164.90 m)
6	1/3 un-barricaded distance, 144 feet (43.89 m)	Barricaded distance, 215 feet (65.53 m)	2/3 un-barricaded distance, 287 feet (87.48 m)
7	1/3 un-barricaded distance, 144 feet (43.89 m)	Barricaded distance, 215 feet (65.53 m)	2/3 un-barricaded distance, 287 feet (87.48 m)

(Source: Mann 1947, 14)

Results from the scale model tests indicated that while the diameters of craters created from test explosions tended to follow scale, the apparent depth of the craters did not. In addition, the damage to scale models from ground shock tended to be greater than in full scale tests; although damage was somewhat greater in the scale model tests, damage type was very similar to that of the full scale tests. The increased earth cover on the model igloos did decrease peak air blast pressures, although not adequately enough to reduce the standard ATD spacing (Mann 1947, 109-110). The final report for the scale model tests concluded that the models were useful in determining (Mann 1947, 109):

- Peak air blast pressure;
- Apparent crater diameters;

- Horizontal and permanent ground displacement;
- General qualitative behavior of flying debris;
- Approximate missile range;
- Transient arch deflection of target igloos;
- And damage to target igloos from air blast pressure.

However, the final report also concluded that the scale models were not valid in determining (Mann 1947, 109):

- Crater depths and volumes;
- Vertical permanent ground displacement;
- Ground shock, or damage to target igloos from ground shock;
- Or disturbance of contents in target igloos.

The ANESB experiments sought to determine if the capacity of storage structures could safely be increased to 500,000 net pounds (226,796.19 kg) of explosives, doubling the amount detonated in the largest of the full scale tests performed in 1945 (Mann 1948, 4). Even though this higher weight is the maximum provided for on the ATD the military storage had not exceeded 250,000 pounds (113,398.10 kg) in a single storage structure as this had been the maximum considered economical to lose in the event of detonation. However, the same motivation that brought about the need to begin testing in 1945 in the form of excess ammunition now made increasing the maximum allowed capacity of storage structures a viable, and even necessary, economic decision (Mann 1948, 2). As such, the tests conducted at the Arco NPG once again required the construction of earth-covered igloo magazines and revetments, which would be spaced at the reduced 185 feet (56.39 m) established in the 1945 tests. As such, increased earth cover was used in the full-scale explosive tests in 1946, along with approval for the effect of overburden on blast impacts and inhabited building distances using scale model tests. In addition, three more test barracks were built at increasing distances from the two igloo and two revetment structures constructed for the 1946 tests, with the furthest barracks building at the un-barricaded distance of 5,000 feet (1524 m), given by the ATD (Mann 1948, 3).

Three types of monitoring devices were used in the 1946 tests; NOL ball crusher gauges (and a modification of such), foil diaphragm gauges developed by the Bureau of Ordnance during the testing on the Bikini atoll, and Aberdeen Proving Ground paper blast meters (Mann

1948, 18). A total of five full scale igloo and revetment tests were conducted using both Army and Navy type munitions (Tables 10 and 11). Remnants of these tests, in the form of craters, camera and instrument shelters, and personnel bunkers, are still present today within the area that was the Arco NPG proofing range.[21]

Table 10: Full scale igloo and revetment tests, 1946.

Test	Date	Description	Explosive Weight
1	October 1, 1946	Detonation of explosives in Igloo D	500,000 pounds (226,796.19 kg)
2	October 8, 1946	Detonation of explosives in Igloo E	500,000 pounds (226,796.19 kg)
3	October 16, 1946	Detonation of explosives in Igloo F	250,000 pounds (113,398.09 kg)
4	October 26, 1946	Detonation of explosives in Revetment 1	500,000 pounds (226,796.19 kg)
5	October 25, 1946	Detonation of explosives in Revetment 2	250,000 pounds (113,398.09 kg)

(Source: Mann 1948, 14)

Table 11: Munition types and explosive weights used in full scale igloo and revetment tests, 1946.

Igloo/Revetment	Munition Type	Number of Munitions	NEW
Igloos D and E	Navy Mark 36, 1,000 pound aircraft demolition bombs	930	538 pounds (244 03 kg) per bomb; 500,340 pounds (226,950.41 kg) total/per magazine

[21] See maps, “Mass Detonation Area, 1945” and “Mass Detonation Area, 1946”.

Igloo/Revetment	**Munition Type**	**Number of Munitions**	**NEW**
Igloo F	Navy Mark 36, 1,000 pound aircraft demolition bombs	465	538 pounds (244 03 kg) per bomb; 250,170 pounds (113,475.20 kg) total
Revetment 1	M6-R7ARA, Army anti-tank mines	40,323	12.4 pounds per mine (5.62 kg); 500,005 pounds (226,798.45 kg) total
Revetment 2	M6-R7ARA, Army anti-tank mines	20,162	12.4 pounds per mine (5.62 kg); 250,008 pounds (113,401.72 kg) total

(Source: Mann 1948, 14)

The results from the full scale 1946 igloo and revetment tests were similar to those of the 1945 tests. The doubled earth cover over the primary igloo did not reveal an additional decrease in blast pressure; although the scale model igloo tests had shown no decrease in blast pressure until the earth cover had been quadrupled (Mann 1948, 142-143). Resulting craters from the igloo explosions were either circular or elliptical, with the maximum apparent depth being no more than one-tenth of the average apparent diameter, with the actual depth below grade being two to three feet (0.61 to 0.91 m) deeper. Much of the earth displaced by the primary explosions “fell back into the crater at random, forming haphazardly located hollows and mounds, so that the general effect was one of great irregularity and unevenness”; stones in the backfill were blackened and shattered, and aggregate in the bottom of the crater was cracked (Mann 1948, 143). In addition, the craters were littered with structural debris including small pieces of concrete and re-bar and large sections of foundation wall (Mann 1948, 143).

The 1945 damage to target structures had been negligible, consistent with blown-off ventilators, slumping of earth fill, and cracked concrete. Damage sustained by target igloos in the 1946 tests was similar in character but much more severe, in keeping with blast pressures thirty percent greater in magnitude (Mann 1948, 147). Structural damage to revetments was minor; however, the scattering of mines and the impact of debris indicated that had the explosive contained within the revetments been highly sensitive to shock, an explosion would have been absolute. Damage to the barracks was consistent with that of the 1945 tests with regard to the ATD standards for un-barricaded, inhabited buildings. Although structural damage was more severe, the extent of damage decreased significantly with increased distance from the primary explosion (Mann 1948, 148-149).

Results from the 1946 full scale igloo and revetment tests were very similar to those of the 1945 tests, concluding that (Mann 1948, 153-155):

- Based on the extremely low probability of propagation from one standard igloo magazine to another at the standard spacing of 400 feet (121.92 m) with a NEW of 500,000 pounds (226,796.16 kg), the limit of high explosive, with equal or less shock sensitivity as that of TNT, could be could be increased in standard 80-foot [24.38 m] reinforced concrete arch, earth covered, igloo type magazines (Mann 1948, 153);
- Spacing between parallel igloos could be reduced from 400 feet (121.92 m) to 185 feet (56.39 m);
- The distance at which to "avoid serious risk" to inhabitants of nearby buildings, as well as at which to avoid "substantial structural damage" (that would translate into serious risk to inhabitants) should be maintained at a minimum of 4,350 feet (1,325.88 m) as identified in the ATD (Mann 1948, 154);
- Increased earth cover over standard igloo magazines did not significantly decrease damage or risk to nearby inhabited buildings;
- Tempered and laminated safety glass, when properly and securely mounted into window openings, did significantly reduce potential damage and risk of injury from flying debris (glass shard missiles);
- However, even at a distance of 4,350 feet (1,325.88 m), the danger of flying glass debris would still be present within a 6,000-foot (1,828.80 m) radius of inhabited buildings;
- And at "214 feet [65.23 m] from the center detonation of a [standard] 500,000 pound [226,796.16 kg] charge, hydrostatic peak blast pressures were of the order of 35 p.s.i. [pounds per square inch]… and at 2,700 feet [822.96 m] they were of the order of 1 p.s.i. Velocities of propagation were of the order of 2,250 feet per second [685.80 m] at 214 feet [65.23 m] and close to the velocity of sound at 2,700 feet [822.96 m]" (Mann 1948, 155).

Records indicate that a total of five proof tests were conducted at the Arco NPG in 1947; however, details of these activities are sparse. February 1947 references indicate that the Bureau of Ordnance inspected the Arco NPG for potential classified work (Wyle Laboratories Scientific Services & Systems Group 1993, 2-72, Appendix B: Reference 83). In April, the Arco NPG was designated as a manganese storage site for the U.S. Treasury Department; in May, 24,393 dry tons (22,128,957 kg) of manganese were shipped to the site for storage (Wyle Laboratories Scientific Services & Systems Group 1993, 2-72, Appendix B: Reference 84). A series of firing tests against projectile stowages was also conducted in May (Wyle Laboratories Scientific Services & Systems Group 1993, 2-72, Appendix B" refernce 85).

In June of 1948, reference was made again to a highly classified experimental program that continued until the end of 1949 and may have been associated with “Project Marsh” (Wyle Laboratories Scientific Services & Systems Group 1993, 2-72, Appendix B: References 87-88). Between August 1948 and June 1950 the Arco NPG was a test site for influence fuses and the development of countermeasures for guided missiles and testing of experimental illuminating projectiles using smokeless powder (Wyle Laboratories Scientific Services & Systems Group 1993, 2-72 to 2-73, Appendix B: References 89-90). Activity at the Arco NPG in 1949 included projectile salvage, along with the manufacture of materials for missiles and test firing of 16-inch (40.64 cm) shells containing depleted uranium, which may have been associated with the highly classified Project Elsie (Wyle Laboratories Scientific Services & Systems Group 1993, 2-73, Appendix B: References 39, 91-93).

Between 1968 and 1970, during the Vietnam War, massive 16-inch naval guns were again heard on the Idaho desert. A naval firing site, located southwest of CFA, was established and used for test firing the battleship *USS New Jersey’s* armament. Since AEC research facilities were then scattered throughout the original downrange area of the Arco NPG, the guns tested at that time were aimed in the opposite direction. From the firing site located a few miles south of CFA, the guns were aimed southward across uninhabited territory toward the Big Southern Butte. Craters can still be found on the northern flank of the butte (Idaho National Laboratory Cultural Resource Management Office 2013, 28; Idaho National Laboratory Cultural Resource Managment Office 1990-2010).

Arco NPG land and infrastructure were acquired from the Navy by the AEC in 1949 and formed the nucleus of the future INL. The buildings and infrastructure acquired by the AEC became known as the Central Facilities Area. As its name suggests, CFA served as a centralized support services facility for the reactor testing operations, containing such jointly used services as a fire department, medical dispensary, cafeteria, crafts shops, and motor vehicle repair and maintenance facilities. Most of the buildings were vacated in the mid-1990s. CFA-633, the core structure in the Arco NPG proofing area, closed in 2005 (Idaho National Laboratory Cultural Resource Management Office 2013, 29-34; Idaho National Laboratory Cultural Resource Managment Office 1990-2010).

1.2.6 Nuclear Science and Engineering

After World War II, nonnuclear military munitions testing continued until the Atomic Energy Commission (AEC) acquired the former ordnance test and parts of the training areas for development of a remote installation devoted to testing and developing nuclear reactor technologies. Beginning in 1949, the AEC, a predecessor agency to DOE, increased the size of the Arco NPG, designated the new larger area as the National Reactor Test Station (NRTS), and began important nuclear energy research and engineering. Prototypes of the nation's three commercial power reactor concepts—the pressurized water reactor, the boiling water reactor, and liquid-metal-cooled breeder reactor—were first developed and tested at this NRTS, now INL. Since its formation as the NRTS in 1949, basic research critical to design, safe operation, and licensing of nuclear power and propulsion reactors has taken place at INL.

In 1974, changing missions led DOE to rename the NRTS as the Idaho National Engineering Laboratory (INEL). In 1975, INEL was designated as a National Environmental Research Park, recognizing the ecological diversity and research potential of the large and relatively undisturbed land area included within its boundaries. In 1997, increasing emphasis on environmental restoration and stewardship was reflected in another name change to the Idaho National Engineering and Environmental Laboratory (INEEL). In 1999, the U.S. Secretary of Energy designated a large portion of INEEL as the Sagebrush-Steppe Ecosystem Reserve, recognizing the important and largely undisturbed natural resource inventories located there. In February 2005, with the separation of the national laboratory and environmental restoration missions into two separate DOE contracts, INEEL was renamed INL, its current designation.

Several geographically separated facility areas exist at the now-890 square mile INL. Some remain active; others are undergoing extensive changes; yet others have been remediated in accordance with federal requirements and are marked only by soil caps and monuments. One facility, the Experimental Breeder Reactor I (EBR-I), is designated as a National Historic Landmark and has been converted to an interpretive center for the public. Another important INL cultural resource, Aviators Cave, was listed on the National Register of Historic Places in 2010.

2 PHYSICAL INFORMATION

2.1 Natural Landscape Summary

The land that made up the Arco NPG, along with the two high altitude bombing ranges, was acquired through public land withdrawal. In 1949, the Atomic Energy Commission (AEC) increased the area encompassed by the Arco NPG, designating the site as the National Reactor Testing Station (NRTS). The area was designated as a National Environmental Research Park in 1975, in recognition of the relatively undisturbed and sizable amount of land included within the boundaries originally set by the AEC. In 1999, the U.S. Secretary of Energy designated a large portion of INEEL as a "Sagebrush-Steppe Ecosystem Reserve," recognizing the important and largely undisturbed natural resource inventories located there. Then, in February 2005, with the separation of the national laboratory and environmental restoration missions into two separate contracts, the site was renamed INL, its current designation (Idaho National Laboratory Cultural Resource Management Office 2013, 9). With the exception of the Naval Reactor Facility (NRF), INL lands are under the direction of the Department of Energy Idaho Operations Office (DOE-ID) (Idaho National Laboratory Cultural Resource Management Office 2013, 11).

The natural setting and landscape of the Arco desert have been important in different ways to the people who have travelled through, lived, and worked in the region. American Indian prehistoric and historic land use was and is intimately tied to the resources offered by this landscape. Efforts of Euro-American immigrants to utilize this landscape during the eighteenth and early nineteenth centuries may have failed in part due to a general lack of understanding of the high desert. More recent historic activities associated with what is now the INL include those activities associated with World War II ordnance testing and high altitude bombing training as well as nuclear science and engineering, all of which have left an impression on the landscape (Idaho National Laboratory Cultural Resource Management Office 2013, 11). As the Arco NPG, the Arco High Altitude Bombing Range, and the Twin Buttes Bombing Range are all encompassed by the current INL boundaries, the landscape is referred to as INL in the following sections (2.1.1 Topography, 2.1.2 Flora and Fauna, and 2.1.3 Water), which discuss the natural landscape elements of the area.

2.1.1 Topography

INL is located in the northeastern portion of the Snake River Plain near the foothills of the Lost River, Lemhi, and Bitterroot mountains in southeastern Idaho. The general region is a high altitude "cold desert" or, more accurately, a sagebrush-grassland steppe, with minimal precipitation of nine inches (23 cm) annually, mostly falling as winter snow and early spring and late fall rains. Seasonal and daily temperature extremes vary widely (Idaho National Laboratory Cultural Resource Management Office 2013, 11).

The Snake River Plain is a large topographic depression approximately thirty-one to sixty-two miles (50 to 100 km) wide that extends in a curved swath across the length of southern Idaho from the communities of Payette in the west, to Twin Falls in the south, and up to Ashton 186 miles (300 km) northeast. The Plain is divided into two distinct parts: the western Snake River Plain (Payette to Twin Falls) and the eastern Snake River Plain (Twin Falls to Ashton), which are defined by geologic and geophysical features unique to each. The eastern Snake River Plain, where INL is situated, is a broad, flat Cenozoic[22] volcanic feature that is filled by thick sequences of rhyolitic tuffs overlain by approximately one-half to one and two-quarter miles (1 to 2 km) of basaltic lava flows and interbedded aeolian, alluvial, and lacustrine sediments (Idaho National Laboratory Cultural Resource Management Office 2013, 11-12).

The northern border of the eastern Snake River Plain near INL is formed by the northernmost extent of the fault-block mountains of the Basin and Range Province (Lost River, Lemhi, and Bitterroot). To the west, the rolling terrain of the Plain itself continues uninterrupted. The Yellowstone Plateau lies to the east-northeast and is an extension of the Snake River Plain and the geologic events that created it. Mountain ranges to the east of the INL region are part of the northern Rocky Mountain Province (Idaho National Laboratory Cultural Resource Management Office 2013, 12).

At INL, the Snake River Plain is composed of many superimposed flows of basaltic lava extruded from low-shield volcanoes, fissures, and tubes over the past two million years during the Quaternary period. Over time, these original lava flows have weathered, alluvial and lacustrine deposits that have accumulated on top of them in low-lying areas, and a widespread but variable veneer of aeolian sediment has been deposited across the entire region. The result is a subdued modern topography and landscape typified by low, rolling hills punctuated by occasional volcanic features. Elevations range from 4,769 to 5,387 feet (1,454 to 1,652 m) above sea level with isolated rhyolitic domes, or buttes, which reach a maximum height of 7,557 feet (2,304 m) (Idaho National Laboratory Cultural Resource Management Office 2013, 12).

The topographic results of Quaternary volcanic activity on INL are quite uniform across the area. Common features include low-relief pressure ridges, pressure plateaus, collapse

[22] The Cenozoic is the most recent era of geologic time on Earth, from about 65 million years ago to the present. The Cenozoic era is divided into two periods: the Tertiary and Quaternary. The Quaternary period covers the past 1.8 million years and is comprised of two epochs: the Pleistocene and Holocene. Characterized by numerous major ice sheet advances in the northern hemisphere, the Pleistocene is also known informally as the Ice Age. Modern climatic conditions characterize the Holocene, which began approximately 11,000 years ago (Allaby 2008).

depressions, and fissures. Though pronounced changes in topographic relief are generally rare, several striking volcanic features are present. The most prominent of these are three buttes (Big Southern Butte, Middle Butte, and East Butte) that dominate the horizon from any vantage point on INL. These buttes served as important prehistoric and historic landmarks and appear on the earliest maps of this area (Idaho National Laboratory Cultural Resource Management Office 2013, 12).

The Big Southern Butte, just south of the southwestern INL boundary, is a 300,000-year-old rhyolite dome complex and largest of the three buttes. It rises 2,493 feet (760 m) above the Snake River Plain and has a diameter of four miles (6.5 km) at its base. It consists of two coalesced domes that grew by internal expansion and an uplifted section of older basalt flows approximately 1,148 feet (350 m) thick on its northern flank. A freshwater spring also bubbles from the northern slopes of Big Southern Butte and the volcanic glass that outcrops near its crest was an important commodity for prehistoric hunter-gatherers.

The Middle Butte and East Butte are within INL boundaries. The Middle Butte is an uplifted block of basalt lava flows with a rhyolite core. Its exact age has not been determined. The lava flows capping the Middle Butte are approximately 246 feet (75 m) thick and the presence of a rhyolite core is inferred from magnetic and gravity data. The East Butte is a 600,000-year-old rhyolite dome. It rises approximately 1,148 feet (350 m) above the surrounding terrain and was formed by the same geologic processes that created the Big Southern Butte—subsurface expansion of highly viscous lava (Idaho National Laboratory Cultural Resource Management Office 2013, 12).

Other unique volcanic features in the area include rifts, lava tubes, cinder pits, volcanic glass outcrops, craters, and locally prominent pressure ridges. All of these features exhibit a high density of prehistoric archaeological sites, reflecting their use as vistas, shelters, and hunting and ambush sites; and as areas where water, plant and animal foods, and other raw materials of economic and cultural importance might be found (Idaho National Laboratory Cultural Resource Management Office 2013, 12).

A discontinuous layer of windblown Holocene sands and silts covers many of the topographic features of the northeastern Snake River Plain. These aeolian deposits are derived from distant upwind sources and from the eroded rocks of nearby mountain ranges and then re-deposited by mountain streams at the northern margin of the Snake River Plain. The thickness of these deposits is variable, ranging from a thin dusting on top of the more recent lava flows to accumulations of more than ten feet (3 m) in low-lying areas and at flow margins. Wind action has also produced and continues to influence a series of dune fields in the north-central portion of INL downwind from the sinks and the Lake Terreton basin. The abundance of prehistoric sites in this area indicates that human populations apparently took advantage of the relative comfort provided by these accumulations of soil and sand and, at times, the nearby aquatic resources (Idaho National Laboratory Cultural Resource Management Office 2013, 13).

2.1.2 Flora and Fauna

Plant life at INL is strongly influenced by climate and topography and is generally similar to other cool desert environments of the Great Basin and the Columbia Plateau. Communities range from shad scale steppe at lower altitudes, to several sagebrush- and grass-dominated communities, to juniper woodland along the foothills of the nearby mountains and buttes. Although the relative dominance and boundaries of these general communities have expanded and contracted in response to variation in available moisture and temperature regimes, palynological data indicate their continued presence since the late Pleistocene glacial periods (Idaho National Laboratory Cultural Resource Management Office 2013, 14).

A total of twenty to twenty-two distinct vegetation cover types have been identified on present-day INL. Although the specific makeup of each cover type varies according to differences in soil composition and available moisture, big sagebrush (*Artemesia spp*.) is a component of almost every identified community and occurs on approximately eighty percent of INL. A variety of grasses, cacti, forbs, and low shrubs dominate the understory in nearly every cover type (Idaho National Laboratory Cultural Resource Management Office 2013, 14).

Differences in vegetation cover are significant in the archaeological study of INL because many of the vegetation communities and their corresponding topographic situations provide microenvironments within the basaltic terrain. Pressure ridges, in particular, offered shelter throughout much of the area. These protected areas were probably attractive mainly as shelter from prevailing winds, but they also tend to trap moisture in deep aeolian deposits and, thus, support a variety of useful plants in the spring and early summer. The Big Lost River channels sink areas, and playas would have also provided a variety of useful vegetable materials and water for people and livestock in prehistoric and early historic times. The variety of native plant species on the eastern Snake River Plain and INL can be surprising to the casual modern observer, but a great number of these were known and used in a variety of sophisticated ways by indigenous people (Idaho National Laboratory Cultural Resource Management Office 2013, 14)

A total of 219 resident and seasonal vertebrate species live on or frequent INL today. Birds constitute the largest single class of wildlife in this census, although many of these are migratory. Small mammals are the most common year-round residents. Of particular cultural interest are species that are known or expected to have been utilized by people. Many of these, including mammoth and camel, are now extinct in North America. However, archaeological sites near INL provide evidence of these animals' past presence and indications of their importance to prehistoric people. It is certain that many species also provided welcome meals and useful products for early historic explorers, Oregon Trail emigrants on their way through the area, and early homesteaders who tried to make a living there (Idaho National Laboratory Cultural Resource Management Office 2013, 15).

The most abundant big game animal currently in residence at INL is the pronghorn (*Antilocapra americana*). It is estimated that up to forty percent of the pronghorn population of Idaho (as well as many from Montana) may utilize the area during the winter months. Deer, elk, and mountain sheep are also occasionally observed at INL. Other big game animals, such as bison, no longer inhabit the area, but were once hunted by prehistoric and early historic populations (Idaho National Laboratory Cultural Resource Management Office 2013, 15).

2.1.3 Water

While volcanic features dominate much of the contemporary landscape of INL, a large portion of the facility is contained within what is known as the Pioneer Basin. This basin incorporates three important features: the alluvial deposits of the Lost Rivers (Big Lost River, Little Lost River, and Birch Creek), the sink areas of these same watercourses, and the lake bed of Pleistocene Lake Terreton (Idaho National Laboratory Cultural Resource Management Office 2013, 12-13).

The Big Lost River enters INL at its southwestern border and flows northeast approximately thirty miles (48.25 km) through the Laboratory. This river channel is presently dry throughout most of the year, but probably flowed year-round before upstream irrigation and increased aridity depleted local water flows. The river also flooded, occasionally severely, in the recent and distant geologic past. Evidence of these events is seen in the extensive deposits of alluvial material that have accumulated near the watercourse and in some expanses that extend up to five miles (8 km) away. The myriad of abandoned stream channels and meander scars that cross the Big Lost River floodplain also testify to higher water levels in the past. These alluvial features probably gained much of their present character during the Pleistocene epoch when higher moisture levels increased stream flow and provided the energy necessary for their creation (Idaho National Laboratory Cultural Resource Management Office 2013, 13).

The Big Lost River, the Little Lost River, and Birch Creek all terminate in sink areas near the northern INL boundary. It is here that the watercourses cease all overland flow and enter the Snake River Plain aquifer by seeping through fine sediments and porous basalt bedrock. If unimpeded by modern water control projects, most surface water on INL would eventually drain to one of these areas (Idaho National Laboratory Cultural Resource Management Office 2013, 13).

During the Pleistocene epoch, when high discharge from the Big Lost River combined with increased flows from the Little Lost River and Birch, Beaver, and Camas creeks, the sink areas were completely submerged by the waters of Lake Terreton. This shallow freshwater lake once covered approximately thirty-five square miles (233 km/sq.) of INL land—now occupied by sagebrush grassland, playas, and low dunes—and extended far to the east. While the lake probably reached maximum extent at the close of the last glacial period, paleontological and archaeological studies suggest that the basin may have partially filled as recently as 700 years ago. Decreases in the amount of available moisture during the Holocene epoch and modern water diversion practices have transformed the lake into a dry and relatively barren expanse of silts, clays, and sand dunes. Usually, the only standing water held by the basin today occurs intermittently in early spring in years when runoff is high and the sinks become marshy (Idaho National Laboratory Cultural Resource Management Office 2013, 13).

The basaltic plains of INL also contain a number of scaled down and isolated versions of Pleistocene Lake Terreton. The area commonly known as Rye Grass Flats near the main INL entrance is one example. Playas such as this generally occur in low-lying areas atop the older lava flows. However, unlike Lake Terreton, which depended on the discharge of local rivers and streams, the moisture levels in these features are maintained exclusively through the seasonal flow of intermittent drainages or high precipitation rates. Today, the small playas rarely hold water; but in the past, when effective moisture levels were higher, each of the basins probably offered a shallow, semi-reliable, seasonal water source. The grasses and forbs that would have thrived in the moisture-laden soil would have attracted game animals, and a rich aquatic community would have been supported as well (Idaho National Laboratory Cultural Resource Management Office 2013, 13).

The relatively permanent water sources at the Big Southern Butte, the Lost Rivers, Birch Creek, the sinks, and during prehistoric times, Lake Terreton, were essential and well known to the inhabitants occupying or crossing the Snake River Plain. High concentrations of prehistoric sites exist in those areas, and well-used prehistoric and early historic trails and wagon and stage roads connect them (often replaced by modern railroads and highways). Many of these areas contain evidence of historic attempts to store water and divert streams for agriculture (Idaho National Laboratory Cultural Resource Management Office 2013, 14).

2.2 Character Defining Landscape Features

The area that originally encompassed the Arco NPG is essentially flat, although the proofing range loses elevation, sloping gradually downward from southwest to northeast at a rate of five feet/mile over the thirty-three mile length of the range, with the gun emplacements and concussion wall located at the southwest end at an elevation of approximately 4,935 feet (1,504 m). Most of the proofing range consists of high desert sagebrush steppe with wind-deposited soils interspersed with volcanic basalt at the surface and at depth. The Big Lost River enters the proofing range on the southwest and flows through the center approximately three miles north/northwest of the proofing (gun emplacement) area located at what is now CFA, before exiting the proofing range on the west in another nine miles. Alluvial gravels are prominent in the surface soils, carried and deposited by the Big Lost River throughout the Pleistocene and Holocene epochs. Currently, the area receives only about nine inches of precipitation per year from late winter snow and early spring rain. The proofing range encompasses not only the impact scars of World War II naval ordnance tested at the site, but also the craters and small scale structures and associated debris left by post-war munitions testing (Wyle Laboratories Scientific Services & Systems Group 1993, 3-1).

Although the proofing range and the concussion wall with its associated features are still extant, they have undergone many changes since first being constructed. In addition, the residential area of the Arco NPG (also currently part of CFA) has also undergone significant change since it was constructed. Of the original buildings associated with the residential area, only the Commanding (Battery) Officer's quarters and garage, the officers' quarters, the marine barracks, and two pump houses are still extant (Idaho National Laboratory, Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B).

The Arco and Twin Buttes Bombing ranges are located on the edges of volcanic ridges located approximately to the six and three-quarter miles (11 km) west and 12.5 miles (20 km) east (respectively) of CFA and the original Arco NPG residential and proofing (gun emplacement) areas. Both bombing ranges are located on higher ground than the proofing area; the Arco range sits at approximately 5,235 feet (1,804 m), while the Twin Buttes range sits at approximately 5,135 feet (1,704 m) (Wyle Laboratories Scientific Services & Systems Group 1993, 3-1). Additional ordnance testing was conducted at the Naval Ordnance Test Facility (NOTF), located between the southeast corner of the Arco bombing range and the Scoville railroad siding, during the United States' involvement in the Vietnam Conflict. Although the majority of the NOTF concussion wall remains as part of the landscape, along with its associated gun emplacements, it was partially blown apart during Department of Defense ordnance testing in the late 1990s (Idaho National Laboratory Cultural Resource Management Office 2014, 28; Idaho National Laboratory Cultural Resource Managment Office 1990-2010).

2.2.1 Circulation

U.S. Highway 20, which presently links the communities of Arco and Idaho Falls with the INL site, was not yet constructed at the time that the Arco NPG was in operation. Originally, access to the Arco NPG was provided by U.S. Highway 26, which connects the town of Blackfoot with Arco. There have been no significant alterations to the path of U.S. Highway 26 since the Arco NPG was in operation (Wyle Laboratories Scientific Services & Systems Group 1993, 3-2). CFA currently encompasses what was the civilian and military residential area of the Arco NPG, as well as the munitions storage bunkers, concussion wall, gun emplacements (both proofing and storage emplacements areas), and the gantry crane and a portion of the rail that connected the Arco NPG to the NOP in Pocatello. Access to CFA is provided by: Lincoln Boulevard, which connects the area to Highway 33 to the north; East Portland Avenue, which connects the area to U.S. Highways 20 and 26 to the south/southeast; and Van Buren Boulevard, which connects the western end of East Portland Avenue to U.S. Highway 20 to the west of CFA. Within CFA, several local roads provide access to various facilities; many of these roads part of the originally constructed layout of the Arco NPG (Idaho National Laboratory, Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, Appendix B, references 1 and 2; Idaho National Engineering Laboratory 1974).

Railroad service for the Arco NPG was provided by a spur-line constructed by the U.S. Navy from CFA to the Scoville Siding located on the Union Pacific Railroad four miles north of Big Southern Butte. Since the Arco NPG became part of the NRTS in 1949, the rail line has been expanded to expedite transportation needs for various facilities located on what is now INL; however, the portion of the line originally associaed with the Arco NPG is still extant (Idaho National Laboratory, Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, 3-11, Figure 2-1B)

Three main service roads provided access to the proofing range – West Monument Line Road, Center Monument Line Road, and East Monument Line Road. Center Monument Line Road runs down the length of the centerline of the proofing range at twenty-eight degrees east of true north, while West Monument and East Monument Line Roads are offset from Center Monument Line Road approximately two and one-half miles (four km) west and east of the proof (gun emplacement) area, and run the length of the proofing range. West and East Monument Line Roads expand west and east (respectively) from two and one-half miles (four km) on either side of Center Monument Line Road to approximately three and one-half miles (5.75 km) in either direction at the roads' termination points.

Lincoln Boulevard is currently the main north/south travel corridor on the INL, and follows portions of Center Monument Line and West Monument Line Roads (Wyle Laboratories Scientific Services & Systems Group 1993, 3-2; Idaho National Engineering Laboratory 1974). East Monument Line Road is now INL T-17, a historic trail that predates the Arco NPG (Idaho National Engineering Laboratory 1974). Along West and East Monument Line Roads, concrete monuments marking distance and elevation were placed at regular intervals, with each monument being one mile apart for the first six miles, then two miles apart after that. Several monuments are still extant along East Monument Line Road; however, very few were relocated during field study along West Monument Line Road (Idaho National Laboratory Cultural Resource Management Office 2014). Observation towers were located along Center Monument Line Road at nine, eleven, and fourteen miles from the proof (gun emplacement) area (Wyle Laboratories Scientific Services & Systems Group 1993, 3-2). In addition, the geo-glyph target, part of the proofing range, is located at a heading of six degrees to the north of the proof (gun emplacement) area. The target measures approximately ten miles in diameter and is only discernible with high resolution aerial photography (Idaho National Laboratory, Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B).

The Mass Detonation Area, located at a twenty degree heading north/northeast of the concussion wall and gun emplacements, encompasses what remains of World War II and post-war naval munitions testing, including concrete blast wall testing, scale model igloo testing, and full scale igloo testing. The area is fully within the proofing range. Remnants of these tests include some extant concrete blast walls and scale model igloos, craters of various sizes, and wood, concrete, and re-bar debris. The concrete blast wall test area is approximately four and one-half miles (7.25 km), the scale model igloo test area is approximately five miles (eight km) miles, and the full scale igloo test area is approximately seven and one-quarter miles (11.5 km) from the proof (gun emplacement) area (Idaho National Laboratory Cultural Resource Management Office 2014). The Mass Detonation Area is accessible by a combination of INL T-roads (historic trails that predate the Arco NPG) that connect with Lincoln Boulevard as well as Center Monument Line and East Monument Line Roads (Idaho National Laboratory Cultural Resource Management Office 2014; Idaho National Engineering Laboratory 1974).

The Arco bombing range is located toward the southwest corner and the Twin Buttes bombing range is located toward the southeast corner of the INL. Both bombing ranges are accessible from U.S. Highway 20 via connecting INL T-roads (Idaho National Laboratory, Cultural Resource Management Office 2014; Wyle Laboratories Scientific Services & Systems Group 1993, Figure 2-1B).

2.2.2 Extant Buildings, Structures, and Features

2.2.2.1 Proof (Gun Emplacement) and Residential Areas (now CFA)

Construction on the Arco NPG began in the fall of 1942 in what is now called the INL Central Facility Area (CFA); it was commissioned on August 2, 1943 (Braun 1995 p. 31). CFA was established in the area formerly occupied by the Arco NPG's proof (gun emplacement) and residential areas. When the AEC acquired the Arco NPG from the Navy in 1949, the buildings and infrastructure were left in place and reused as office buildings, security headquarters, laboratories, utilities, and storage. Most of the Arco NPG buildings within CFA were removed by the mid-2000s (Idaho National Laboratory Cultural Resource Managment Office 1990-2010). The structures that remain and that are still in use include:

- Pump houses (CF-642 and CFA-651);
- Explosive Magazines (CFA-637 and CFA-638).

Also extant is associated infrastructure including a gantry crane, flagpole, railroad tracks, gun emplacements, storage yard, the proofing range geo-glyph target, camera and instrument shelters associated with ANESB testing, roads, landscaping, unexploded ordnance (UXO), proofing range monuments, proof (gun emplacement) area perimeter lights, and a myriad of craters and debris left from explosives tests. The buildings that remain, which are vacant, include the:

- Marine Barracks (CFA-606);
- Battery [Commanding] Officer's Quarters (CFA-607);
- Battery [Commanding] Officer's Garage (CFA-632);
- Caretaker's Quarters (CFA-613);
- Concussion Wall (CFA-633, including additions - observation tower, office and bombproof storage building; and CFA-648 - shop and oil storage building.

Other features associated with the concussion wall include gun emplacements for the proofing range (on the northeast side of the concussion wall), gun emplacements used for storage (located to the northwest of the concussion wall), railroad tracks, gun rail truck, and gantry crane. In addition to the associated features within the proofing area is a concrete basin located a little over one-half mile (1 km) west of the proof (gun emplacement) area at a 282 degree heading, and a World War II era trash dump located in a canal approximately two and one-quarter mile (3.5 km) west of the proof (gun emplacement) area at a 275 degree heading (Idaho National Laboratory Cultural Resource Management Office 2014). Extant and non-extant buildings, features, and structures original to the Arco NPG, located within the proof (gun emplacement) and residential areas (now CFA), are identified in Table 12; the map, "Central Facilities Area, Idaho National Laboratory, 2014", included in Part III of this HALS depicts the locations of these properties (Idaho National Laboratory Cultural Resource Management Office 2014).

Table 12: Buildings, structures, and features within the proof (gun emplacement) and residential areas (now CFA).

***** *P= proof (gun emplacement) area, R = residential area*

Building/Structure/Feature	**INL (CFA) Number**	**IHSI Number**	**Extant**	**Area***
Battery attendant quarters (5)	Unknown	None	No	R
Battery attendant quarters, garage	Unknown	None	No	R
Battery attendant quarters, double house (2)	Unknown	None	No	R
Battery attendant quarters, double house, garage	Unknown	None	No	R
Battery [Commanding] officer's quarters	CFA-607	23-9956	Yes	R
Battery [Commanding] officer's quarters, garage	CFA-632	23-9957	Yes	R
Caretaker's quarters	CFA-613	23-9911	Yes	R
Civilian houses (17)	Unknown	None	No	R
Civilian housing, apartment buildings (2)	Unknown	None	No	R
Commisary	Unknown	None	No	R

Building/Structure/Feature	**INL (CFA) Number**	**IHSI Number**	**Extant**	**Area***
Concussion wall	CFA-633	23-9958	Yes	P
Diesel generator plant	CFA-656	None	No	P
Dog kennel	CFA-600	None	No	R
Elevated water tank	Unknown	None	No	R
Emplacement area, fence	Unknown	None	No	P
Emplacement area, perimeter lighting	Unknown	None	Partial	P
Flagpole	Unknown	None	Yes	R
Fuse and primer storage	CFA-636	None	No	P
Gantry crane	Unknown	None	Yes	P
Gatehouse	Unknown	None	No	P
Gun emplacements (10)	Unknown	None	Partial	P
Heating plant	CFA-650	None	No	P
Inflamable storehouse	Unknown	None	No	P
Locomotive shed, garage, and fire house	CFA-640	None	No	R
Maintenance shop and equipment storage shelter (addition to CFA-640)	CFA-640	None	No	R
Marine barracks	CFA-606	23-9955	Yes	R
Observation tower (addition to CFA-633, northeastern elevation)	CFA-633	23-9958	Yes	P
Office and bombproof storage (addition to CFA-633, southwest elevation)	CFA-633	23-9958	Yes	P
Personnel shelter	Unknown	None	No	P

Building/Structure/Feature	INL (CFA) Number	IHSI Number	Extant	Area*
Powder bag storage	CFA-635	None	No	P
Projectile storage	CFA-634	None	No	P
Pump house and reservoir	CFA-641	None	No	R
Pump house (2)	CFA-642, CFA-651	23-9961, 23-9966	Yes	R
Rail spur	Unknown	None	Yes	P
Rail tresstle	Unknown	None	Partial	P
Rest room	CFA-649	None	No	P
Riggers shop	Unknown	None	No	P
Septic tank	Unknown	None	No	P
Sewage pump house	Unknown	None	No	P
Shop and oil storage (addition to CFA-633, southwest elevation)	CFA-647, CFA-648	None	Yes	P
Smokeless powder magazine	CFA-637	23-9960	No	P
Standard high explosive magazine (igloo; 2)	CFA-638, CFA-639	23-9938	Yes	P
Storage yard	Unknown	None	Partial	P
Storage yard service building	Unknown	None	No	P
Temporary storage building	Unknown	None	No	P
Transfer car	Unknown	None	Yes	P
Transfer track	Unknown	None	Partial	P
Warehouse	CFA-654	None	No	R

(Source: Wyle Laboratories Scientific Services & Systems Group 1993, 2-8, Figure 2-2; Idaho National Laboratory Cultural Resource Management Office 2014;Drawings and plans on file at INL Records Storage, Idaho Falls.)

Marine Barracks (CFA-606):

The Marine Barracks is masonry construction of brick laid in a common bond pattern, set on a poured asphalt and concrete basement foundation, and roofed with cedar shingle. The original roof is hipped with an intersecting gable over the addition on the northeastern elevation, which was added sometime after 1950. The front entry consists of a poured concrete stoop covered by a gabled roof extension that has been partially enclosed with a corrugated fiberglass weather break. A secondary entrance is located in the northwestern elevation consists of a poured concrete stoop covered by a shed extension; this entrance has also been partially enclosed with a corrugated fiberglass wind stop. The windows are wooden, six-over-six and nine-over-nine, double-hung sash that have been covered with aluminum storms. The basement window wells are poured concrete and have been covered with shed-type corrugated fiberglass well covers. Aesthetically, the original massing, floor plan, and architectural details of the Marine Barracks are mid-century military vernacular with a Georgian influence.

Commanding (Battery) Officer's Quarters (CFA-607) and Garage (CFA-632):

The Commanding (Battery) Officer's quarters is masonry construction of brick laid in a common bond pattern, set on a poured asphalt and concrete basement foundation, and roofed with cedar shingle. The roof is hipped with smaller intersecting gables over dining and living room areas toward the front of the house; the gables are clad in vertical ship-lap, wooden siding with a scalloped bottom edge. The front entry consists of a poured concrete stoop set under a gabled roof extension; a corrugated fiberglass weather break addition has been added to the front entry. A secondary entrance is located in the southwestern elevation and consists of a single-step poured concrete stoop covered with a gabled-shed extension. Above the side door there is a cylindrical electric light that appears to be original to the building. The original windows are wooden, six-over-six and eight-over-eight, double-hung sash, all of which have been covered with aluminum storms. The basement window wells are poured concrete. Aesthetically, the massing, floor plan, and architectural details of the Commanding (Battery) Officer's quarters are Minimal Traditional.

The single-car garage is also masonry construction, with the brick laid in a running bond pattern rather than a common bond. The building is set on a poured concrete foundation and roofed with cedar shingle. The roof is a front-gable and the front and rear gables are clad in vertical ship-lap, wooden siding with scalloped bottom edges; a large ca. 1965 metal driveway lamp is mounted in the front gable. The overhead door, located in the front (northwestern) elevation is wooden, as is the pedestrian door located in the southwestern elevation and is covered by a gabled roof extension. A single, sash, wooden window with six lights was likely located in the center of the southwestern and the northeastern elevations at the time of construction; however, both openings have been covered with plywood. Like the nearby Commanding (Battery) Officer's quarters, the overall aesthetic of the garage is also Minimal Traditional.

Caretaker's Quarters (CFA-613):

The Caretaker's Quarters is masonry construction of brick laid in a common bond pattern, set on a poured asphalt and concrete basement foundation, and roofed with cedar shingle. The roof is a lateral gable with smaller intersecting gables over the front bedroom and rear kitchen areas. The front and side entrances are accessed by poured concrete stoops. The side entrance, located in the northeastern elevation, has been partially enclosed with a corrugated fiberglass weather break. An exterior basement entrance is located on the rear (northwestern) elevation and has been partially enclosed with a composite clapboard weather break. The windows are wooden, six-over-six and eight-over-eight, double-hung sash windows; all of which have been covered with aluminum storms. The basement window wells are poured concrete and have been covered with aluminum shed-type awnings. The overall aesthetic of the building in massing, floor plan, and architectural details is that of an English Cottage style.

Pump Houses (CFA-642 and CFA-651):

The Pump Houses are masonry construction of brick laid in a common bond pattern, set on a poured asphalt and concrete basement foundation, and roofed with cedar shingle. The gable roofs are clad in cedar shingle. The windows are wooden eight-over-eight, double-hung sash windows, one located in the center of each side elevation. Each building also has a corrugated metal addition on the rear elevation. The overall aesthetics of the buildings is mid-century utilitarian vernacular.

Concussion Wall (CFA-633) and Associated Features:

The concussion wall is constructed from solid reinforced concrete, eight feet (2.44 m) thick and 315 feet (96 m) long from the northwest end to the southeast end. Additions to the wall are also constructed from reinforced concrete. The northeast elevation of the wall faces the gun emplacements. While there are several original additions to the wall on the southwest elevation - including the observation tower, the office area and bombproof storage, and the shop and oil storage building - the addition on the northeast elevation was constructed sometime after 1950. Entrances into the original additions consist of various types of wooden doors and wooden and metal casement type windows with varying numbers of lights. The roofs of these additions are clad in asphalt. The aesthetic of these buildings and structures is military utilitarian vernacular.

The rail spur runs from the Scoville rail siding southwest of CFA northwest through the residential area to the gun emplacements next to the concussion wall in the proof area. The gantry crane, the transfer car, and the main transfer tracks are located on the southeast end of the concussion wall. The portion of track running northwest between the transfer track, gun emplacements, and storage yard has been mostly removed. The ten gun emplacement alleys, constructed from reinforced poured concrete are still partially extant with a remnant safety slogan, “Safety First,” painted on end portions facing the concussion wall; however the gun mounts have been removed. The storage yard is located to the west of the concussion wall. Nine alleys constructed from reinforced concrete and timber planking remain today in various stages of decay. Although the original perimeter fence is no longer extant, remnants of the perimeter lighting are still present along the emplacement area fence line.

High Explosive Magazines (CFA-637 and CFA-638)

The extant High Explosive Magazines, located to the south of the concussion wall, are standard military construction, earth covered, igloo type magazines. Constructed from reinforced concrete and earth fill, the igloos are arched vaults set on reinforced concrete foundations. Each magazine stands approximately fifteen feet (4.57 m) high, sixty-four feet (19.50 m) wide, and 106 feet (32.31 m) long. Both were modified after 1950 to house and facilitate projects associated with nuclear energy research.

Other Associated Features:

The flag pole, which is located toward the western end of the military residential area, and many of the original street signs distinguished by World War II era toponyms, are still present at CFA. The loop road which marked the civilian residential area constructed post-war is still extant, although all of the civilian housing structures have been removed.

Approximately one-half mile west of the concussion wall, just off of East Portland Avenue, is a concrete basin associated with the construction of the Arco NPG. The basin measures about fifty feet (15.25 m) square and ten feet (3.50 m) deep. The use or purpose of the basin is unknown; however, in the concrete on one edge of the basin is inscribed, “CDG Supt., EWA, AAM, CEB Eng. 1943. “CDG Supt.” may refer to Dugan Graham, who was the general superintendent for construction under MK, while “CEB Eng.” may refer to Charles Burton who was an engineer working on the project under MK (Morrison-Knudsen 1943, 20). The other initials may be of other MK employees who worked on the project.

Another one and one-half miles west, off of Van Buren Boulevard, is a ca. 1945 dump contained within a ca. 1910 irrigation canal. The dump contains mostly household items and was likely associated with the Arco NPG residential area.

2.2.2.2 Proofing Range

Range Monuments and Roads

Of the monument roads that provided access to the proofing range, West Monument Line and Center Monument Line roads are only partially extant, while East Monument Line Road is still completely extant. Field survey in 2015 identified twenty-seven of the original thirty-eight concrete monuments; ten of the relocated monuments were on West Monument Line Road, while the remaining seventeen were along East Monument Line Road. Of the relocated monuments, eight were in excellent condition, ten were in good condition, seven were in fair condition, and three were in poor condition. Criteria for monument condition assessment are outlined in Table 13 and relocated monuments are identified in Table 14; the map, "Arco Naval Proving Ground and Bombing Ranges, 1943," in Part III of this HALS depicts the original location of all thirty-eight range monuments.

Table 13: Criteria for monument condition assessment.

Condition	Attributes
Excellent	Monument exhibits virtually no damage and/or degradation. Structure is intact with identification plate in place and clearly legible. Metal cap cover present and in good condition with monument number still visible.
Good	Monument exhibits only minimal damage and/or degradation. Structure is almost completely intact and identification plate is in place and legible. Metal cap is present but exhibits some damage.
Fair	Monument is damaged and/or suffered some form of degradation. Structure does not exhibit the original dimensions/exhibits cracking. Identification plate is legible. Metal cap is missing.
Poor	Monument has sustained significant damage and/or degradation. Structure no longer standing/none of the original dimensions can be determined. Identification plate present but may be damaged. Metal cap is missing.

(Source: Idaho National Laboratory Cultural Resource Management Office 2014)

Table 14: Monuments relocated during field survey.

Monument Number	Condition	Location
USN 01	Excellent	East Monument Line Road
USN 02	Poor	East Monument Line Road
USN 03	Poor	East Monument Line Road
USN 05	Excellent	East Monument Line Road
USN 06	Fair	East Monument Line Road
USN 07	Good	East Monument Line Road
USN 08	Good	East Monument Line Road
USN 09	Excellent	East Monument Line Road
USN 10	Excellent	East Monument Line Road
USN 11	Excellent	East Monument Line Road
USN 12	Good	East Monument Line Road
USN 13	Good	East Monument Line Road
USN 14	Good	East Monument Line Road
USN 15	Fair	East Monument Line Road
USN 16	Fair	East Monument Line Road
USN 17	Good	East Monument Line Road
USN 18	Fair	East Monument Line Road
USN 19	Good	East Monument Line Road
USN 23	Excellent	West Monument Line Road
USN 24	Fair	West Monument Line Road
USN 25	Excellent	West Monument Line Road

Monument Number	**Condition**	**Location**
USN 26	Fair	West Monument Line Road
USN 29	Poor	West Monument Line Road
USN 30	Fair	West Monument Line Road
USN 31	Good	West Monument Line Road
USN 32	Good	West Monument Line Road
USN 33	Good	West Monument Line Road
USN 38	Excellent	West Monument Line Road

(Source: Idaho National Laboratory Cultural Resource Management Office 2014)

Mass Detonation Area

Various features and structures associated with the ANESB testing between 1945 and 1946 were identified during field survey, including debris, craters, poured concrete walls, scale model igloos, personnel bunkers, camera shelters, and instrument shelters. Personnel bunkers were timber and earth construction, measuring approximately eight feet by eight feet square (2.44 m by 2.44 m) and half as high. Camera shelters were constructed of reinforced concrete and measured approximately four feet by four feet square (1.22 m by 1.22 m) and six feet high (1.83 m). The instrument shelter was also constructed of timber and earth; however, the remnants were too badly decayed to discern construction size. Extant features and structures located during field survey and in current high resolution aerial photography are identified in Table 15; the maps, “Mass Detonation Area, 1945”, “Mass Detonation Area, 1946”, and “Scale Model, Barrier Wall and Railcar Detonation Sites, 1945-46”, in Part III of this HALS depict the locations of these features and structures.

Table15: Artifacts, features and structures associated with ANESB testing identified during field survey.

Feature/Structure	Associated Testing	Date of Test	Number Identified
Debris	All ANESB testing	1945/1946	various
Craters	All ANESB testing	1945/1946	various
Concrete walls	Barrier Walls tests	1945	6
Scale model igloos	Scale Model Igloo tests	1946	6
Firing Station	Full Scale Igloo tests	1946	1
Personnel bunkers	Full Scale Igloo tests	1946	3
Camera shelters	Full Scale Igloo tests	1946	3
Instrument shelters	Full Scale Igloo tests	1946	2

(Source: Idaho National Laboratory Cultural Resource Management Office 2014)

2.2.2.3 High Altitude Bombing Ranges

While no discernible landscape features were identified on the TBBR, smashed practice sand bombs still litter the AHABR. In addition, the geoglyph target of the AHABR can still be faintly discerned in high resolution aerial photography.

3 REFERENCES

3.1 Works Cited

Aero Service Corporation. "Controlled Aerial Mosaic of Reactor Testing Sation." Idaho Falls, Idaho: U.S. Atomic Energy Commission, Idaho Operations Office, 1949.

Allaby, Michael (editor). *Oxford Dictionary of Earth Sciences.* Oxford, England: Oxford University Press, 2008.

Anderson, J.E, K.T. Ruppel, J.M. Glennon, K.E. Holte, and R.C. Rope. *Plant Communities Ethnoecology, and Flora of the Idaho National Engineering Laboratory*. Environmental Science and Research Foundation Report Series, Number 005, Idaho Falls, Idaho: Environmental Science and Research Foundation, 1996.

Arco Advertiser. "Armistice Day At Gun Range." *Arco Adverstiser*, November 5, 1943: 1.

Birdsall, Steve. *The B-24 Liberator.* New York : Arco Publishing Company, Inc, 1968.

Braun, Julie B. *LITCO Internal Report: Idaho National Engineering Laboratory, Historic Building Inventory Survey, Phase I.* INEL-95/0498, Idaho Falls, Idaho: Idaho National Engineering Laboratory, 1995.

Breyer, Seigfried. *Battleships and Battlecruisers of the World, 1905-1970.* London, England: Macdonald and Jane's, 1973.

Chambers, John Whiteclay. "Naval Guns: A Historical Perspective." *Encyclopedia.com.* 2000. http://www.encyclopedia.com/doc/1O126-NavalGuns.html (accessed March 11, 2015).

Clark, S.F. *Ninteenth Century Shoshone-Banock Riparian Adaptation.* Unpublished Master's Thesis, Pocatello, Idaho: Idaho State University, 1986.

Comprint Military Publications. "Naval Support Activity Washington: Washington Navy Yard." *dcmilitary.com.* January 20, 2014. http://www.dcmilitary.com/article/20140620/NEWS12/140629959/washington-navy-yard&template=baseguide (accessed January 30, 2015).

Cowell, Mary Anne, and Edward C. Whitman. "Newport and Navy Torpedoes - An Enduring Legacy." *navy.mil.* Spring 2000. http://www.navy.mil/navydata/cno/n87/usw/issue_7/newport.htm (accessed May 28, 2015).

Davidson, Phyllis. "Naval Gun Plant Came to Pocatello." *Idaho State Journal*, 1990.

Devereux, John C. *Court of Claims, Reports and Diget of Opinions Delivered Since the Organization of the Court.* New York, New york: Edward Jenkins, 1856.

DiGiulian, Tony. " Part 1 - Weapons and Monuntings ." *Definitions and Information about Naval Guns.* May 16, 2015. http://www.navweaps.com/Weapons/Gun_Data.htm (accessed May 18, 2015).

—. "Part 3 - Miscellaneous." *Definitions and Information about Naval Guns.* July 28, 2014. http://www.navweaps.com/Weapons/Gun_Data_p3.htm (accessed February 17, 2015).

Dwyer, Larry. "The Aviation History Online Museum." *Consolidated B-24 Liberator.* October 6, 1998. http://www.aviation-history.com/consolidated/b24.html (accessed April 14, 2015).

Dykes, F.W. *Jeffery's Cutoff: Idaho's Forgotten Oregon Trail Route.* Pocatello, Idaho: F.W. Dykes, 1989.

Ferris, W.A. "Life in the Rocky Mountains." By P.C. Phillips (editor) . Denver, Colorado: O.H. West Publishing Co., 1940.

Fleming, John L. "Capital Ships: A Historical Perspective." (Naval War College) March 1993.

Gilbert, H.K. *The Powell Stage Station.* INL/EXT-09-15268, Idaho Falls, Idaho: Idaho National Laboratory, 2009.

Global Security. "Military: Battleships and World War II." *GlobalSecurity.org.* 2014. http://www.globalsecurity.org/military/systems/ship/battleship-ww2.html (accessed May 18, 2015).

—. "Military: Explosives-Compositions." *GlobalSecurity.org.* 2015. http://www.globalsecurity.org/military/systems/munitions/explosives-compositions.htm (accessed March 10, 2015).

—. "Military: Indian Head History." *GlobalSecurity.org.* 2015. http://www.globalsecurity.org/military/facility/indian-head-history.htm (accessed January 30, 2015).

—. "Military: M1A1 Bangalore Torpedo." *GlobalSecurity.org.* 2015. http://www.globalsecurity.org/military/systems/munitions/bangalore.htm (accessed April 22, 2015).

Hamilton, Judy (Andresen), interview by Christina Olson and Julie Williams. *Historic American Landscapes Survey: Arco Naval Proving Ground* (January 8, 2015). On file at INL Cultural Resource Management Office, Idaho Falls, Idaho.

Hammer, C.G. "The Lost Gold of the Lavas." *True West*, 1967.

Hartwell, Mary Ann. *Checklist of United States Public Documents 1789-1909: Congressional: to Close of Sixtieth Congress; Departmental: to End of Calendar Year 1909.* Washington D.C.: U.S. Government Printing Office, 1911.

Heimdahl, William C. and Edward J. Marolda. "Guide to United States Naval Administrative Histories of World War II." *Naval History and Heritage Command.* 1976. http://www.history.navy.mil/research/library/research-guides/guide-us-naval-administrative-histories-wwii.html#shore (accessed January 22, 2015).

Hillenbrand, Laura. *Unbroken: A World War II Story of Survival, Resilience, and Redemption.* New York: Random House LLC, 2010.

Idaho Examiner. "Construction Work Begins on New Air Base." *Idaho Examiner*, May 23, 1942: 1.

—. "Immense Air Base, 2nd War Project, Comes to Pocatello." *Idaho Examiner*, May 2, 1942: 1.

Idaho Military Museum. "Farragut, Idaho: Wherer Fightin' Blue Jackets Were Made!" *Idaho Military Museum.* 2015. http://museum.mil.idaho.gov/farragut.html (accessed February 10, 2015).

Idaho National Engineering Laboratory. "Map of the INEL and Vicinity Roads and Trails; drawing number 109507 (B50-500-IDO-28), revision 02." Idaho Falls, Idaho: microfilm on file at INL Records Storage, September 26, 1974.

Idaho National Laboratory Cultural Resource Management Office. "Field Notes." *Arco Naval Proving Ground (Idaho National Laboratory) Historic American Landscapes Survey.* Idaho Falls, Idaho: unpublished, 2014.

Idaho National Laboratory Cultural Resource Management Office. *Idaho National Laboratory Cultural Resource Managment Plan.* DOE/ID-10997, revision 5, Idaho Falls, Idaho: U.S. Department of Energy, Idaho Operations Office, 2013.

Idaho National Laboratory Cultural Resource Managment Office. "Project Files." unpublished, 1990-2010.

Idaho National Laboratory. "Photograph, negative number 02974." Idaho Falls, Idaho: on file at INL Records Storage, ca.1945.

Idaho State Historical Society. *Goodales's Cutoff.* Reference Series, No. 51, Boise, Idaho: Idaho State Historical Society, n.d.

Idaho State Journal. *Idaho State Journal, Centenial Edition*, 1990.

Keegan, Jophn. *The First World War.* London, England: Pimlico, 1999.

Kennedy, Paul M. *The Rise and Fall of British Naval Mastery.* London, England: Macmillan, 1983.

Kimbro, Valerie M. *OU 10-04 Conceptual Site Models: Munitions and Explosivess of Concern on the INL Site.* Technical, Idaho Falls: United States Department of Energy, 2012.

Kinard, Jeff. *Artillery: An Illustrated History of Its Impact (Weapons and Warfare).* Santa Barbara, California: ABC-CLIO, Inc., 2007.

Lahoud, Paul M., and William H. Zehrt Jr. *Inhabited Building Distance Criteria and Modern Construction.* Huntsville, AL: Corps of Engineers, 1992.

LIFE. "Precision Bombing: Sample Mission Shows Details That Make It Work." *LIFE Magazine*, August 30, 1943: 97-102.

Liljeblad, S. *Indian Peoples in Idaho.* Unpublished Master's Thesis, Pocatello, Idaho: Idaho State University, 1957.

Lord, Walter. *Incredible Victory.* New York: Harper & Row, 1967.

Mackay, Ruddock F. *Fisher of Kilverstone.* Oxford, England: Oxford University Press, 1973.

Mann, R.L. *Igloo and Revetment Tests, Naval Proving Ground, Arco, Idaho, October 1946.* Tecchnical Paper No. 5, Washington, D.C.: Army-Navy Explosives Safety Board, 1948.

Mann, R.L. *Scale Model Igloo Magazine Explotion Tests, Naval Proving Ground, Arco, Idaho, August 1946.* Technical Paper No. 4, Washington D.C.: Army-Navy Explosives Safety Board, 1947.

McDonald, Jonathan. "Indian Head Navy Base Celebrates 120 Years." *navy.mil.* September 23, 2010. http://www.navy.mil/submit/display.asp?story_id=56162 (accessed May 28, 2015).

McKinley, Mike. "Cruise of the Great White Fleet." *Naval History and Heritage Command.* April 01, 2015. http://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/c/cruise-great-white-fleet-mckinley.html (accessed May 12, 2015).

Merrill, I.R. "Tim Goodale and His Cutoff: A Major Trail Segment During and After the Fouth Emigration Wave." *Overland Journal*, 1990: 9-16.

Mitton, Derk. "The Disestablishment of the NOP: Conspiracy or Necessity?" *Idaho State University Senior Project.* Pocatello: Unpublished, December 2, 1993.

Moran Jr., Edward P. *Expolsive Accident Summary: World War II.* Alexandria, VA: Department of Defense Explosives Safety Board, 1992.

Morris, Dr. Charles, interview by Christina Olson. *Historic American Landscapes Survey: Arco Naval Proving Ground* (February 15, 2015). On file at INL Cultural Resource Management Office, Idaho Falls, Idaho.

Morrison-Knudsen. "Proving Ground for Guns and Men." *The Em Kayan*, July 1943: 20-21.

—. "To Help the Big Guns Speak, Naval Ordnance on the Plains of Idaho." *The Em Kayan*, April 1943: 1.

Murphy, R.F. and Y. Murphy. "Shoshone-Banock Subsistence and Society." *University of California Anthropological Records*, Vol. 16, No. 7: 293-338, 1960.

Murphy, R.F. and Y. Murphy. "Northern Shoshone and Bannock." In *Handbook of North American Indians, Great Basin*, by W.L. D'Azevedo (editor), 284-307. Washington D.C.: Smithsonian Institution, 1986.

National Museum of the Royal Navy. "Dreadnoughts: The ships and men who built lived and fought in them." *National Museum of the Royal Navy (Portsmouth).* 2014. http://royalnavalmuseum.org/visit_see_20th_dreadnought.htm (accessed February 18, 2015).

National Park Service. "WOWs (Women Ordnanace Workers) to the Rescue!" *Springfeild Armory National Historic Site, Masssachusetts.* 2015. http://www.nps.gov/spar/learn/news/wows-to-the-rescue.htm (accessed May 18, 2015).

Naval History and Heritage Command. "The Establishment of the Department of the Navy." *Naval History and Heritage Command.* May 19, 2014. http://www.history.navy.mil/browse-by-topic/commemorations-toolkits/navy-birthday/the-establishment-of-the-department-of-the-navy.html (accessed January 30, 2015).

Navy Recruiting Command. "About the Navy: History." *America's Navy.* 2014. https://www.navy.com/about/history.html;%20http://www.linking.to/Navy/ (accessed January 30, 2015).

Nelson, Leonard J., and Bessie M. Shrontz Roberts-Wright. *The First Fifty Years: Michaud Flats U.S. Army Base Pocatello Reginal Airport.* Pocatello, 1993.

Office of Air Force History. *The Army Air Forces in World War II: Plans and Early Operation, January 1939 to August 1942.* Edited by Wesley Craven and James Lea Cate. Vol. One. Seven vols. Washington, District of Columbia: Government Printing Office, 1983.

Pettite, W.S. *Memories of Market Lake.* William Stibal Pettite, 1983.

Pocatello Tribune. *Pocatello Tribune,* December 14, 1944: 2.

Robinson, Clark S. *The Present Status of the American Table of Distance.* Technical Paper, Washington, D. C.: Army-Navy Explosives Safety Board, 1945.

Ross, A. "The Fur Hunters of the Far West." By K.A. Spaulding (editor). Norman, Oklahoma: University of Oklahoma Press, 1956.

Rowland, Buford, and William B. Boyd. *U.S. Navy Bureau of Ordnance in World War II.* Washington D.C.: U.S. Government Printing Office, 1953.

Russell, Osborne. "Journal of a Trapper." By A.L. Haines (editor). Lincoln, Nebraska: University of Nebraska Press, 1969.

Scott, P.L. *Idaho and the Carey Act, 1894-1930.* unpublished Master's Thesis, Salt Lake City, Utah: University of Utah, 1983.

Sedgewick, M. "Manuscript." Pocatello, Idaho: on file at Idaho State University Archives, Eli M. Oboler Library, n.d.

Shaw Environmental, Inc. *Final Site Inspection Report: Idaho National Engineering Laboratory, Butte and Jefferson Counties, Idaho, FUDS Property Number F10ID0701.* Contract No. W912DY-04-D-0010, Delivery Order No. 003, Omaha, Nebraska: US Army Corps of Engineers, September 2009.

Sherman, Scott, interview by Chrsitina Olson and Julie Williams. *Historic American Landscapes Survey: Arco Naval Proving Ground* (November 4, 2014). On file at INL Cultural Resource Management Office, Idaho Falls, Idaho.

Sondahous, Lawrence. *Naval Warefare 1815-1914.* London, England: Routledge, 2001.

Stacy, Susan M. *Proving the Principle: A History of the Idaho Engineering and Environmental Laboratory 1949-1999.* DOE/ID-10799, Idaho Falls, Idaho: Idaho Operations Office of the Department of Energy, 2000.

Staley, M. "Water - A History of the Mud Lake Area." *Snake River Echos*, 1978: 11-12.

Steward, J.H. *Basin Plateau Aboriginal Sociopolitical Groups.* Bureau of American Ethnology Bulletin No. 102, Washington DC: U.S. Government Printing Office, 1938.

Swanson, Merwin R. "A Community At War: Pocatello, Idaho and WWII." *Rendezvous*, 1987.

The Arrowrock Group, Inc. *Toward a Programmatic Agreement: Big Government / Big Science in the West, A Historic Context, Idaho National Engineering and Environmental Laboratory*. INEEL/EXT-97-01021, Contract K97-557098, Idaho Falls, Idaho: U.S. Department of Energy Idaho Operations Office, 1997.

The Associated Press. "Bureau Chief Announces Site Location." *Pocatello Tribune*, March 19, 1942: 1.

—. "Otter Arrives To Handle Local Project." *Pocatello Tribune*, March 31, 1942: 1.

The Liberty Foundation. "B-17 Flying Fortress." *Boeing B-17 History.* 2014. http://www.libertyfoundation.org/b17history.html (accessed May 20, 2015).

Thirteen/WNET New York. "Military Aviation: Key Innovations." *Warplane.* October 2006. http://www.pbs.org/wnet/warplane/topicfeature2.html (accessed May 12, 2015).

Thompson, Stanley W. *Igloo Tests, Naval Proving Ground, Arco, Idaho, 1945.* Technical Paper No. 3, Washington D.C.: Army-Navy Explosives Safety Board, 1948.

Trego, B. "Manuscript No. 142." Pocatello, Idaho: on file at Idaho State University Archives, Eli M. Oboler Library, n.d.

U.S. Army Air Forces, Pocatello Army Air Base. *Report of Aircraft Accident.* A.A.F. Form No. 14 (Revisd May 15, 1942), Pocatello: U.S. War Department, 1944.

U. S. Army Corps of Engineers. *Defense Environmental Restoration Program for Formerly Used Defense Sites, Ordnance and Explosive Archives Search Report, Findings for the Former Naval Proving Ground, Arco, Idaho.* Project Number F10ID70101, Rock Island, Illinois: U.S. Army Corps of Engineers, October 1996.

U.S. Department of the Navy. "Dahlgren." *archive.org.* Edited by Kenneth G. McCollum. June 1977. www.archive.org/stream/dahlgren00mcco/dahlgren00mcco.djva.text (accessed February 2, 2014).

United States Department of the Navy. "Annotated Guide, Shore Establishment." *Guide to United States Naval Administrative Histories of World War II.* 2014. http://www.ibiblio.org/hyperwar/USN/Admin-Hist/USN-Admin-Guide/USN-Admin-Guide-3B.html#128 (accessed April 16, 2014).

—. "Battery Attendant Quarters, Details; drawing number 112169 (CF-609-610-USN-5)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Managment, 1943.

—. "Battery Attendant Quarters, Double House, Elevations & Roof Plan; drawing number 112142 (CF-603-614-USN-3)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, February 29, 1944.

—. "Battery Attendant Quarters, Double House, Plans, Section, Details (basement); drawing number 112140 (CF-603-614-USN-1)." *Naval Proving Ground, Arco , Idaho.* Idaho Falls, Idaho: on file at INL Records, February 29, 1944.

—. "Battery Attendant Quarters, Double House, Plans, Section, Details (ground floor); drawing number 112141 (CF-603-614-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, February 29, 1944.

—. "Battery Attendant Quarters, Double House, Window & Door Details; drawing number 112143 (CF603-614-USN-4)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, February 29 , 1944.

—. "Battery Attendant Quarters, Elevations & Roof Plan; drawing number 112167 (CF-60-610-USN-3)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, April 12, 1943.

—. "Battery Attendant Quarters, Plans & Sections; drawing number 112166 (CF-609-610-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, April 12, 1943.

—. "Battery [Commanding] Officer Quarters, Elevations & Details; drawing number 112163 (CF-607-USN-5)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Managment, 1943.

—. "Battery [Commanding] Officer Quarters, Floor Plans; drawing number 112160 (CF-607-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, 1943.

—. "Battery [Commanding] Officer Quarters, Garage; drawing number 112181 (CF-632-USN-1)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, 1943.

—. "Battery [Commanding] Officers Quarters, Details; drawing number 112162 (CF-607-USN-4)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, 1943.

—. "Battery [Commanding] Officers Quarters, Sections; drawing number 112161 (CF-607-USN-3)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, 1943.

—. "Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corps, 1940-1946, Vol. I." *The Navy Department Library.* 1947. http://www.history.navy.mil/library/online/buildbaseswwii/bbwwiicontents.htm (accessed January 2014).

—. "Caretakers Quarters, Elevations & Details; drawing number 112173 (CF-613-USN-4)." *Naval Proving Ground, Arco, Idaho."* Idaho Falls, Idaho: on file at INL Records Storage, March 22, 1943.

—. "Caretakers Quarters, Floor Plans, Section, & Details; drawing number 112172 (CF-613-USN-3)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, March 22, 1943.

—. "Chapter VIII: Bureau of Ordnance." *Administration of the Navy Department in World War II.* 1959. http://www.ibiblio.org/hyperwar/USN/Admin-Hist/USN-Admin/USN-Admin-8.html (accessed April 16, 2014).

—. "Civilian Houses, Detail Location Plan; drawing number 112101 (CF-101-USN-7)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, November 1, 1946.

—. "Civilian Houses, Details; drawing number 112178 (CF-615-THRU-631-USN-4)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, June 13, 1945.

—. "Civilian Houses, Elevations, Types "A", "B", &"C"; drawing number 112176 (CF-615-THRU-631-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, June 13, 1945.

—. "Civilian Houses, Plans and Schedules; drawing number 112175 (CF-615-THRU-631-USN-1)." *Naval Poving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, June 13, 1945.

—. "Civilian Houses, Sections and Details; drawing number 112177 (CF-615-THRU-631-USN-3)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, June 13, 1945.

—. "Locomotive Shed, Fire House, and Garage, Plans Elevations, and Details; drawing number 112201 (CF-640-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, March 1943.

—. "Locomotive Shed, Fire House, and Garage; drawing number 112200 (CF-640-USN-1)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, March 1943.

—. "Lost River Proving Ground, Area Map; drawing number 112089 (B50-101-USN-1)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, May 10, 1943.

—. "Lost River Proving Ground, Layout, Roads, Railroad, Buildings; drawing number 112097 (CF-101-USN-3)." *Naval Ordnance Plant, Pocatello, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, December 31, 1942.

—. "Lost River Proving Ground, Relocation of State Highway/US 20, Typical Section; drawing number 112091 (B60-501-USN-1)." *Naval Ordnance Plant, Pocatello, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, ca. 1943.

—. "Maintenance Shop and Equipment Storage Shelter, Plan, Elevation, and Details; drawing number 112202 (CF-640-USN-3)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, January 1944.

—. "Maintenance Shop and Equipment Storage Shelter, Plans and Elevations; drawing number 112203 (CF-640-USN-4)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, January 1944.

—. "Map of US Naval Proving Ground; drawing number 112095 (CF-101-USN-1)." *Naval Proving Gorund, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, June 30, 1949.

—. "Marine Barracks, Plan - Elevation Section; drawing number 112152 (CF-606-USN-4)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, September 09, 1942.

—. "Marine Barracks, Plans, Elevations, & Section Notes; drawing number 112150 (CF-603-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Managment, March 11, 1942.

—. "Marine Barracks, Structural Details; drawing number 112153 (CF-606-USN-5)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, September 15, 1942.

—. "Monument Line & Range Map, frame 1 of 2; drawing number 112090 (B50-101-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, ca. 1943.

—. "Monument Line & Range Map, frame 2 of 2; drawing number 11209002 (B50-101-USN-2)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, ca. 1943.

—. "Permanenet Standard Magazines; drawing number 112100 (CF-101-USN-6)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, June 8, 1945.

—. "Three Dog Kennel, Details; drawing number 112139(CF-600-USN-1)." *Naval Proving Ground, Arco, Idaho.* Idaho Falls, Idaho: on file at INL Records Storage, September 4, 1943.

United States National Archives and Records Administration. "Launching the New U.S. Navy." *National Archives.* 2014. http://www.archives.gov/education/lessons/new-us-navy/ (accessed January 30, 2015).

University of Massachusettes and National Park Service. "Women in World War II: Introduction." *The Springfeild Armory: Forge of Innovation.* 2015. http://www.forgeofinnovation.org/springfield_armory_1892-1945/Themes/People/Women/World_War_II/introduction/?index.html (accessed May 18, 2015).

Walker, Deward E. *Indians of Idaho*. University Press of Idaho: Moscow, 1978.

Wentworth, E.C. *America's Sheep Trails.* Ames, Iowa: Iowa State College Press, 1948.

Williams, M.H. *Special Report: The History of the Developemnt and Current Status of the Carey Act in Idaho.* Boise, Idaho: Idaho Department of Reclamation, Idaho Department of Water Resources, 1970.

Work, J. "The Journal of John Work, A Cheif Trader of the Hudson's Bay Company During His Expedition Form Vancouver to the Flatheads and the Blackfeet of the Pacific Northwest." By W.S. Lewis and P.C. Phillips (editors). Cleveland, Ohio: Arthur H. Clark Co., 1923.

Wyeth, N.J. *The Correspondence and Journals of Captain Nathaniel J. Wyeth.* Eugene, Oregon: University Press, 1899.

Wyle Laboratories Scientific Services & Systems Group. *Interim Ordnance Cleanup Program, Record Search Report.* 21-ICP-02, revision 2, Idaho Falls, Idaho: Idaho National Engineering Laboratory, 1993.

3.2 Map References

Geospatial data used in the development of maps for this HALS were created by INL Geospatial Science and Engineering analysts using ArcGIS software. The method of data acquisition of base information used to develop each geographic information system (GIS) layer varies including digitization from paper maps, GPS ground data collection, and aerial and satellite image processing.

Imagery used during development of maps for this HALS includes Esri World Imagery, National Agriculture Imagery Program (NAIP), and Pictometry Aerial Photography, for which individual references are listed below:

- Esri World Imagery. World Imagery provides one meter or better satellite and aerial imagery in many parts of the world and lower resolution satellite imagery worldwide. The map includes 15m TerraColor imagery at small and mid-scales (591M down to 72k) and 2.5m SPOT Imagery (288k to 72k) for the world, and U.S. Geological Survey 15m Landsat imagery for Antarctica. The map features 0.3m resolution imagery in the continental United States and 0.6m resolution imagery in parts of Western Europe from Digital Globe. In other parts of the world, one meter resolution imagery is available from GeoEye IKONOS, Getmapping, AeroGRID, IGN Spain, and IGP Portugal. Additionally, imagery at different resolutions has been contributed by the GIS User Community (Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, U.S. Geological Survey, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).
- NAIP. This data set contains imagery from the National Agriculture Imagery Program (NAIP). The NAIP acquires 4-band digital ortho imagery from airbourne and/or space based platforms during the agricultural growing seasons in the U.S. A primary goal of the NAIP program is to enable availability of ortho imagery within sixty days of acquisition. The NAIP provides one meter GSD ortho imagery rectified within +/- six meters to true ground at a 95% confidence level. The tiling format of NAIP imagery is based on a 3.75' x 3.75' quarter quadrangle with a 300 (plus or minus 30) pixel buffer on all four sides. The NAIP imagery is formatted to the UTM coordinate system using the North American Datum of 1983 (NAD83). The NAIP imagery may contain as much as 10% cloud cover per tile. This file was generated by compressing NAIP imagery that cover the county extent. Two types of compression may be used for NAIP imagery: MrSID and JPEG 2000. Target value for the compression ratio for one meter GSD is (15:1) (Source: National Agriculture Imagery Program, Digital

Georectified Image, USDA-FSA-APFO Aerial Photography Field Office, Salt Lake City, UT, 11/21/2013).

- Pictometry. Pictometry International Corp. 100 Town Centre Dr. Suite A, Rochester, NY 24623

Imagery used from the National Map Viewer includes:

USGS NED 1/3 arc-second Contours for Idaho Falls W, Idaho 20141204 1 x 1 degree FileGDB 10.1 [downloaded file]. Renton, Virginia: U.S. Geological Survey – National Geospatial Program. Available FTP: http://viewer.nationalmap.gov/viewer/ [1/12/2015].

USGS NED 1/3 arc-second Contours for Idaho Falls E, Idaho 20141204 1 x 1 degree FileGDB 10.1 [downloaded file]. Renton, Virginia: U.S. Geological Survey – National Geospatial Program. Available FTP: http://viewer.nationalmap.gov/viewer/ [1/12/2015].

USGS NED 1/3 arc-second Contours for Dubois W, Idaho 20141215 1 x 1 degree FileGDB 10.1 [downloaded file]. Renton, Virginia: U.S. Geological Survey – National Geospatial Program. Available FTP: http://viewer.nationalmap.gov/viewer/ [1/12/2015].

USGS NED 1/3 arc-second Contours for Dubois E, Idaho 20141215 1 x 1 degree FileGDB 10.1 [downloaded file]. Renton, Virginia: U.S. Geological Survey – National Geospatial Program. Available FTP: http://viewer.nationalmap.gov/viewer/ [1/12/2015].

Additional data and maps referenced include:

ICP, 2015, *Arco High Altitude Bombing Range History*, \gis_projects\Data_Requests\NPG_GIS_Data_2015\Naval_Proving_Ground_Request_FGDB.gdb\Arco_High_Altitude_Bombing_Range_History, Idaho Cleanup Project, Data file created April 2015. (Note: This is an internal Idaho Cleanup Project data file and Official Use Only and may not be publicly available.)

U.S. Geological Survey [Scanned map in geoPDF]. 1:250000-scale Quadrangle for Idaho Falls, ID. (1958) U.S. Geological Survey, Denver, CO. Available: http://viewer.nationalmap.gov/viewer/ [1/12/2015].

3.3 Other Sources of Information

3.3.1 Primary and Unpublished

Department of Energy, Idaho (DOE-ID) Operations Office, "AEC Meeting From 1948-1957 (Historical)." Atomic Energy Commission (AEC) meeting reports pertaining to acquisition of land at National Reactor Test Station, reactor development program, chemical and metallurgical processing at the reactor testing station, and excerpts from AEC meeting minutes. Electronic document on file, Idaho National Laboratory Electronic Document Management System, identification number 1849684. Unpublished manuscript, November 24, 1948.

Department of Energy, Idaho (DOE-ID) Operations Office, "Real Property-1624-E NRTS Land Condemnation (W.H. Poe)." Weise-Poe Land Tract Condemnation, AEC. Electronic document on file, Idaho National Laboratory Electronic Document Management System, identification number 1778075. Unpublished correspondence, April 07, 1953.

3.3.2 Secondary and Published

The following technical papers are available electronically through the U.S. Department of Defense, Defense Technical Information Center online collections (http://www.dtic.mil/dtic/).

Army-Navy Explosives Safety Board. *Igloo Tests, Naval Proving Ground, Arco, Idaho.* Technical Paper No. 3, Washington D.C., 1945 (Revised November 6, 1947).

—. *Scale Model Igloo Magazine Explosion Tests, Naval Proving Ground, Arco, Idaho*. Technical Paper No. 4, Washington D.C., August 1946.

—. *Igloo and Revetment Test, Naval Proving Ground, Arco, Idaho*. Technical Paper No. 5, Washington D.C., October 1946.

The following documents are on file electronically within the INL Electronic Document Management System (EDMS).

Department of Energy, Idaho (DOE-ID) Operations Office. "Historical Documents Regarding Idaho Operations Office, INEL, Atomic Energy Act of 1946." Various documents. Electronic document on file, Idaho National Laboratory Electronic Document Management System, identification number 2111576. Administrative record, October 28, 1986.

U.S. Army Corps of Engineers. Defense Environmental Restoration Program for Formerly Used Defense Sites, Ordnance and Explosive Archives Search Report, Findings for the Former Naval Proving Ground, Arco, Idaho. Project Number F10ID70101, Rock Island, Illinois: U.S. Army Corps of Engineers, October 1996.

3.4 Supplemental Materials

Eight Historic American Engineering Record (HAER) reports documenting INL historic properties associated with nuclear energy research have been written; these HAER reports are available through the Library of Congress' website (http://www.loc.gov/pictures/item/2009632512/).

Pace, Brenda, Julie Braun, and Hollie Gilbert. *Fuel Reprocessing Complex* . HAER No. ID-33-H, INL/EXT-06-11969, Idaho Falls, Idaho: Idaho National Laboratory, 2006.

Stacy, Susan M. *Advanced Re-entry Vehicle Fuzing System (ARVFS).* HAER No. ID-33-B, INEL-97-00066, Idaho Falls, Idaho: Idaho National Laboratory, 1997.

—. *Army Reactors Experimental Area.* HAER No. ID-33-D, INL/EXT-97-01369, Idaho Falls, Idaho: Idaho National Laboratory, 1997.

—. *Old Waste Calcining Facility (CPP 633).* HAER No. ID-33-C, INEEL-97-01370, Idaho Falls, Idaho: Idaho National Laboratory, 1997.

—. *Power Burst Facility and SPERT I*. HAER No. ID-33-F, ICP/EXT-05-00768, Idaho Falls, Idaho: Idaho National Laboratory, 2005.

—. *Test Area North (TAN)*. HAER No. ID-33-E, INEEL/EXT-04-02536, Idaho Falls, Idaho: Idaho National Laboratory, 2004.

—. *Test Area North Hanger (TAN 629)*. HAER No. ID. 33-A, INEL-94-0228, Idaho Falls, Idaho: Idaho National Laboratory, 1994.

—. *Test Reactor Area, Materials Testing & Engineering Test Reactors*. HAER No. ID-33-G, INL/EXT-06-01185, Idaho Falls, Idaho: Idaho National Laboratory, 2006.

4 COPIES OF HISTORIC VIEWS AND PHOTOGRAPHS

The following historic views and photographs for the Arco NPG are digitally scanned copies of original photographs on file at INL the Records Storage facility located in Idaho Falls, Idaho.

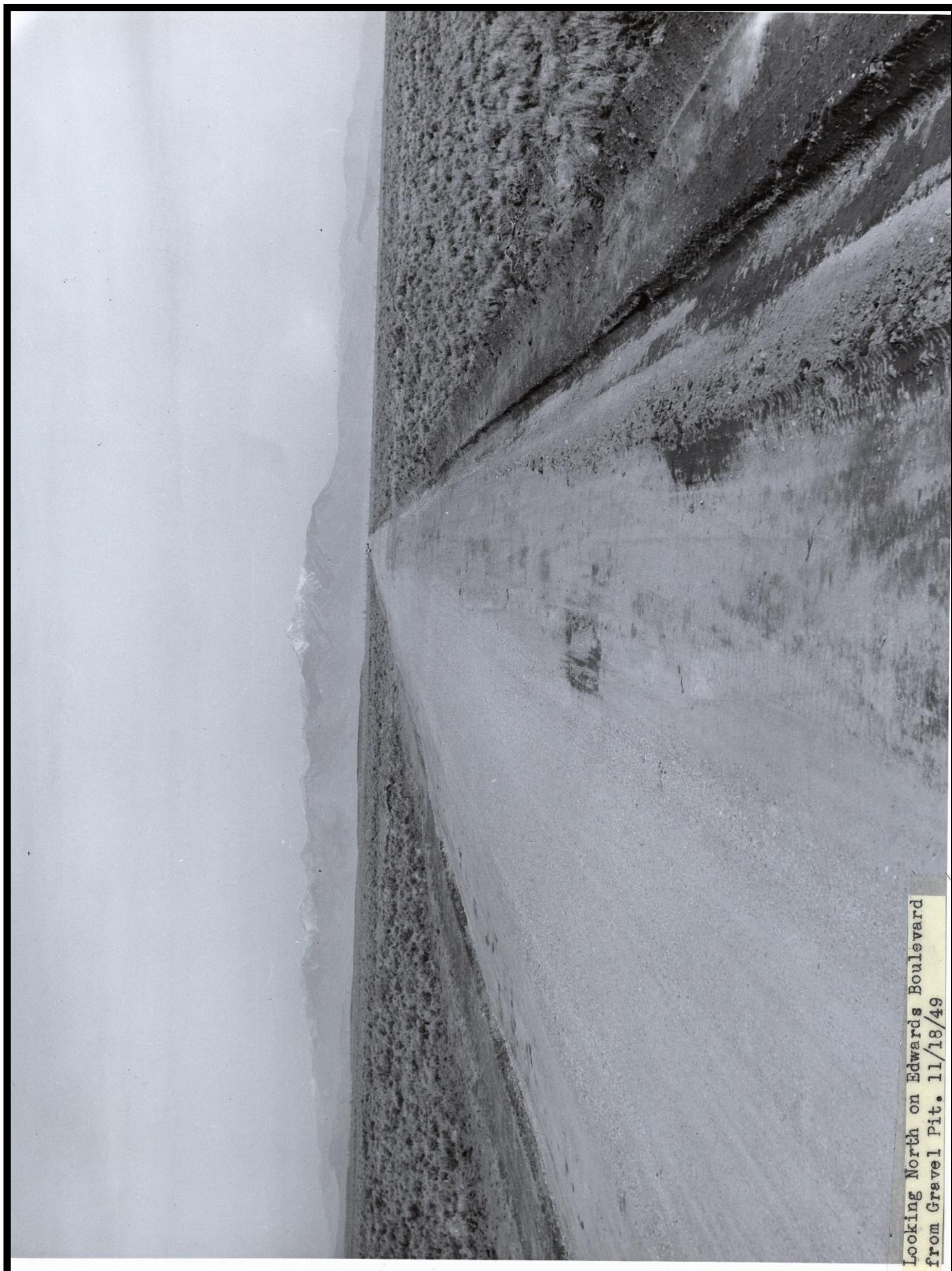


Figure 4.1: INL photo number 49-00116; construction of Lincoln Boulevard, Saddle Mountain in center background; view looking north toward Lemhi Mountains; November 1949.

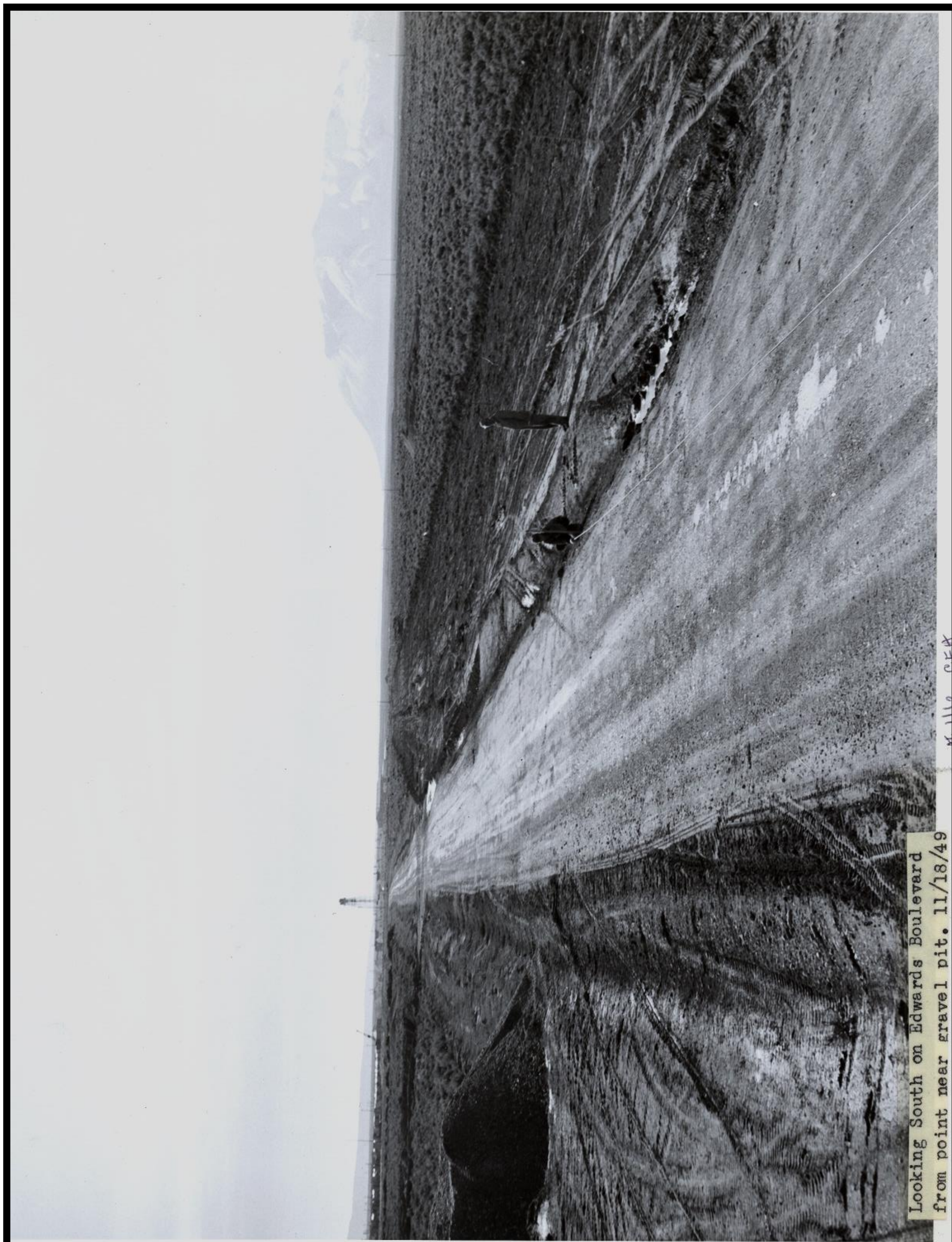


Figure 4.2: INL photo number 49-00116; construction of Lincoln Boulevard, Big Southern Butte in background; view looking south toward CFA; November 1949.

Figure 4.3: Unknown INL photo number; aerial of proofing (emplacement) area, gun emplacements in foreground; view looking northwest; ca. 1949.

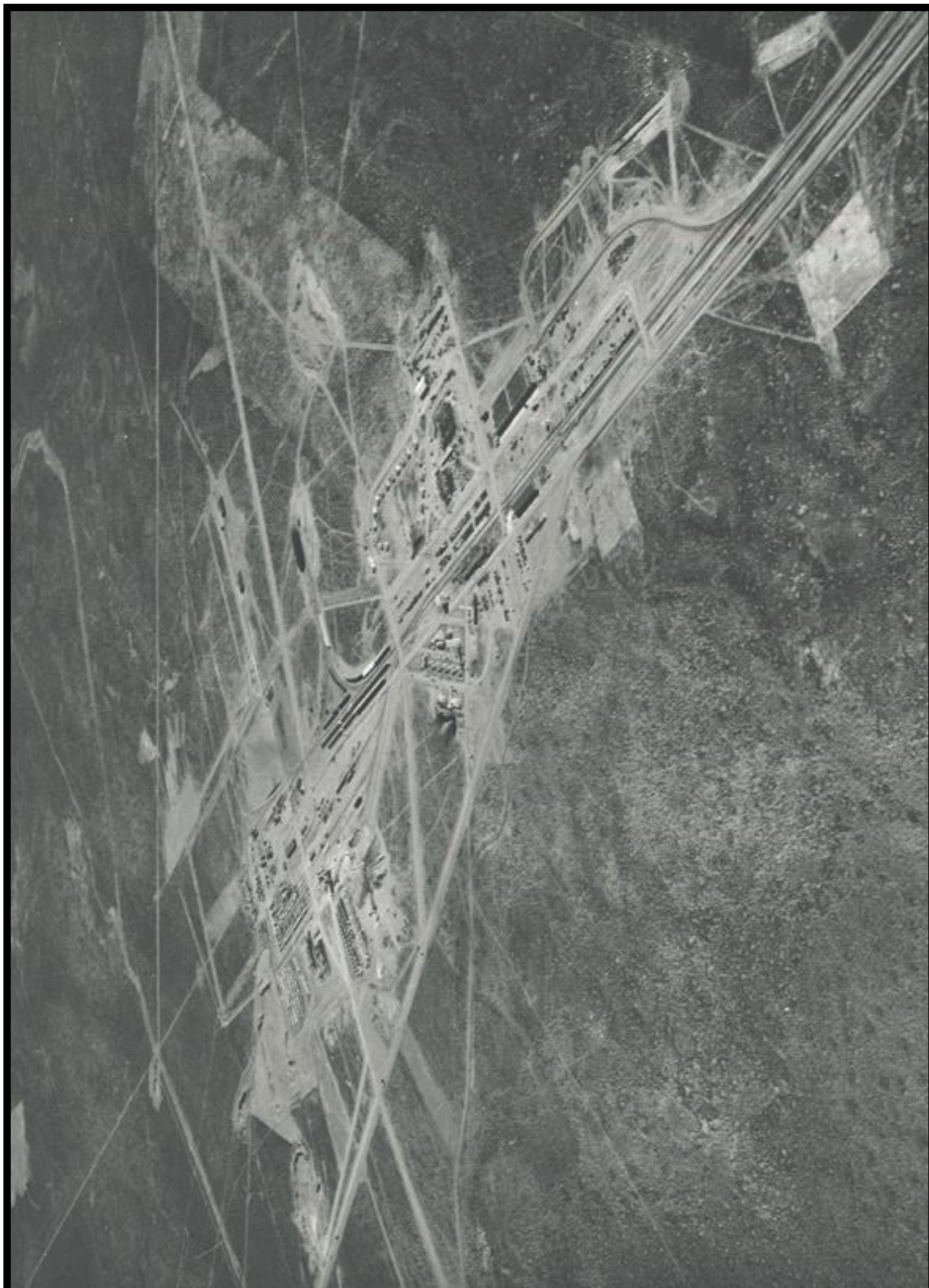


Figure 4.4: INL photo number 51-1758; aerial view of CFA looking northeast; March 1951.

Figure 4.5: INL photo number 51-2663; aerial of CFA showing detail of NPG residential area; view looking northwest; ca. 1951.

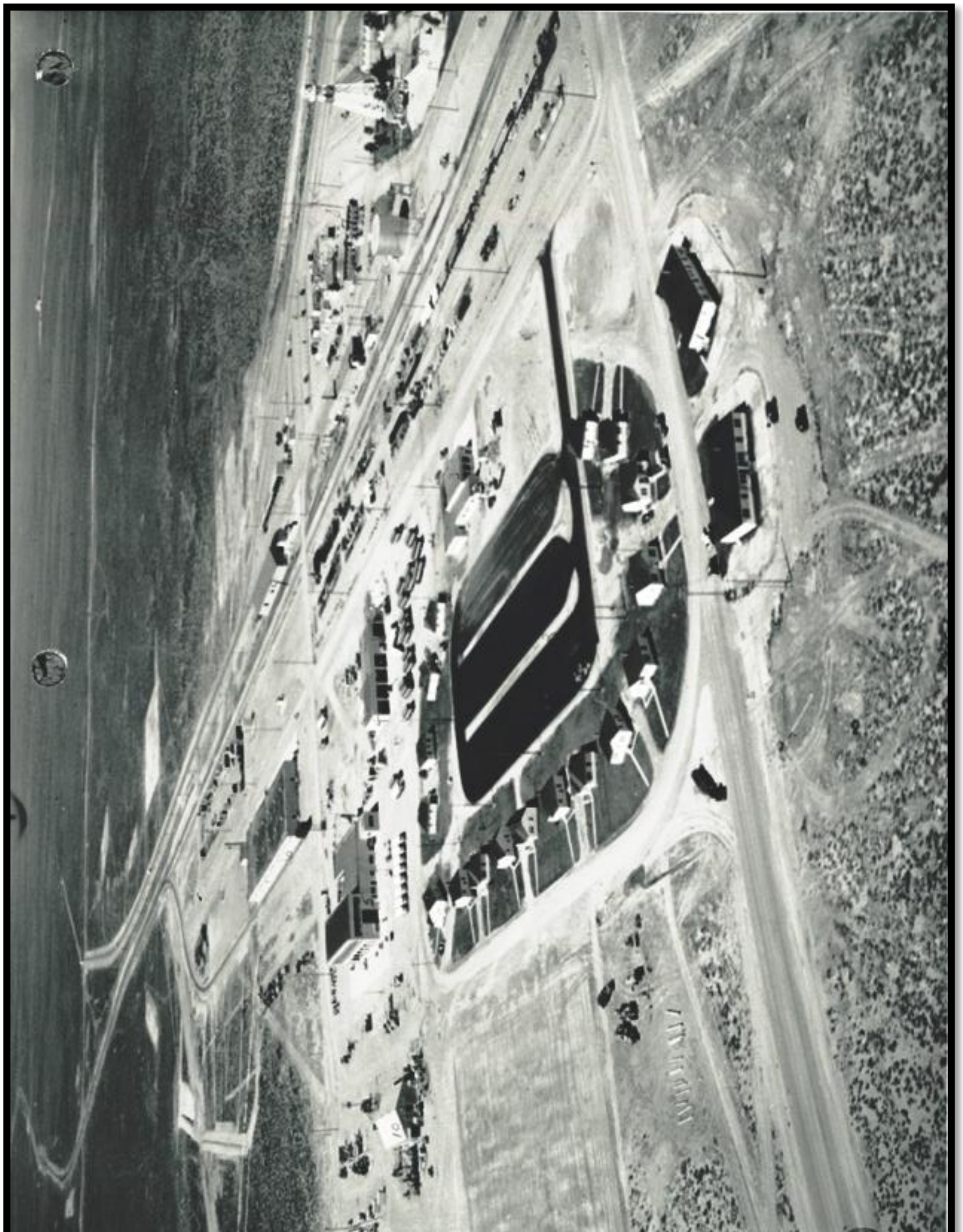


Figure 4.6: INL photo number 51-2974; Aerial of CFA showing detail of NPG residential area; EBR-I in far, upper- right background; view looking southwest; ca. 1951.

Figure 4.7: INL photo number 51-2991; aerial of CFA showing detail of CFA residential area; view looking south/southeast; ca. 1951.

Figure 4.8: INL photo number 52-4797; aerial of aerial of proofing (emplacement) area, NRTS electrical sub-station in foreground; view looking southwest; April 1952.

Figure 4.9: INL photo number 52-4798; aerial of CFA; view looking southwest; April 1952.

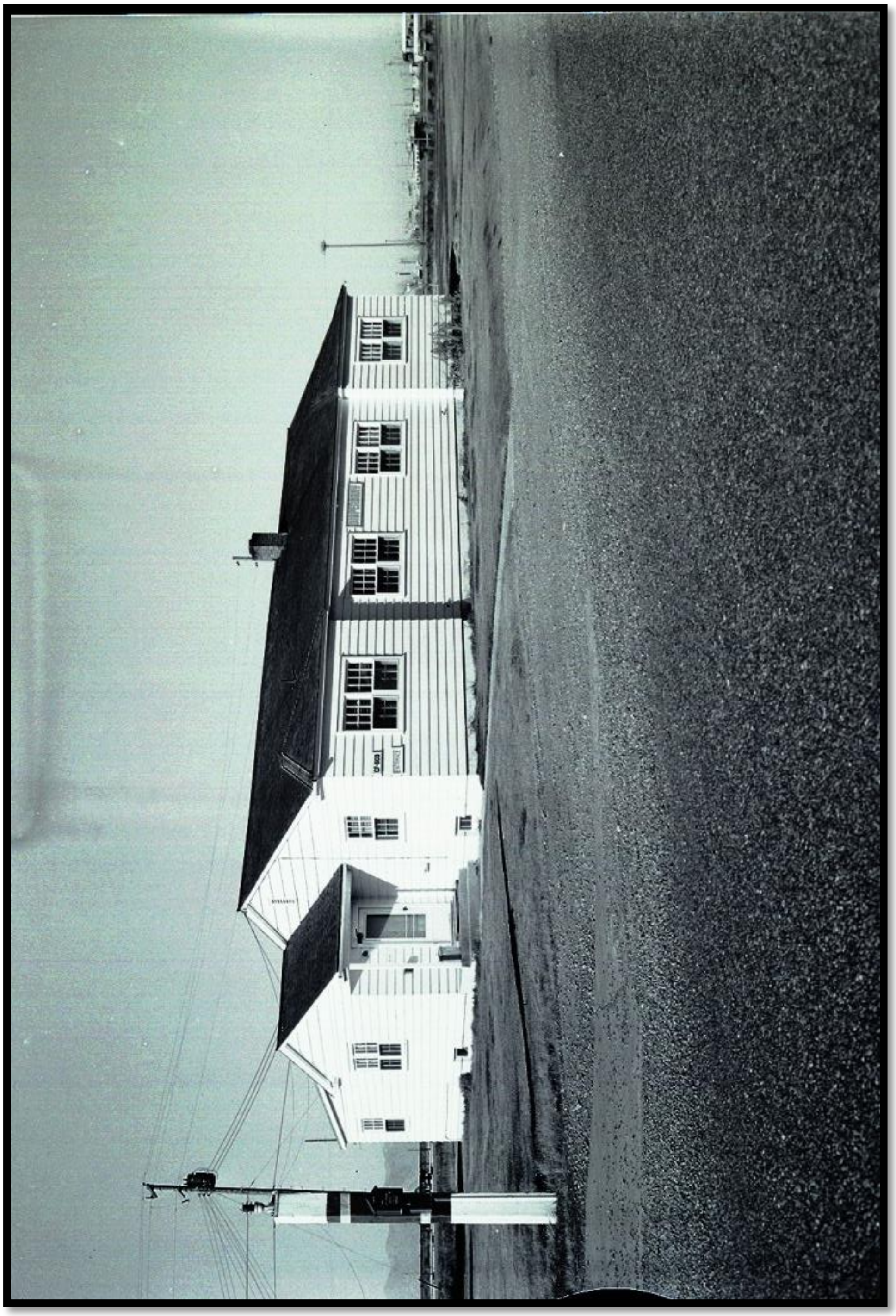


Figure 4.10: INL photo number 51-2728; Battery Attendant's Quarters Double House after being converted into the Dispensary at CFA under AEC; view looking north/northeast; ca. 1951.

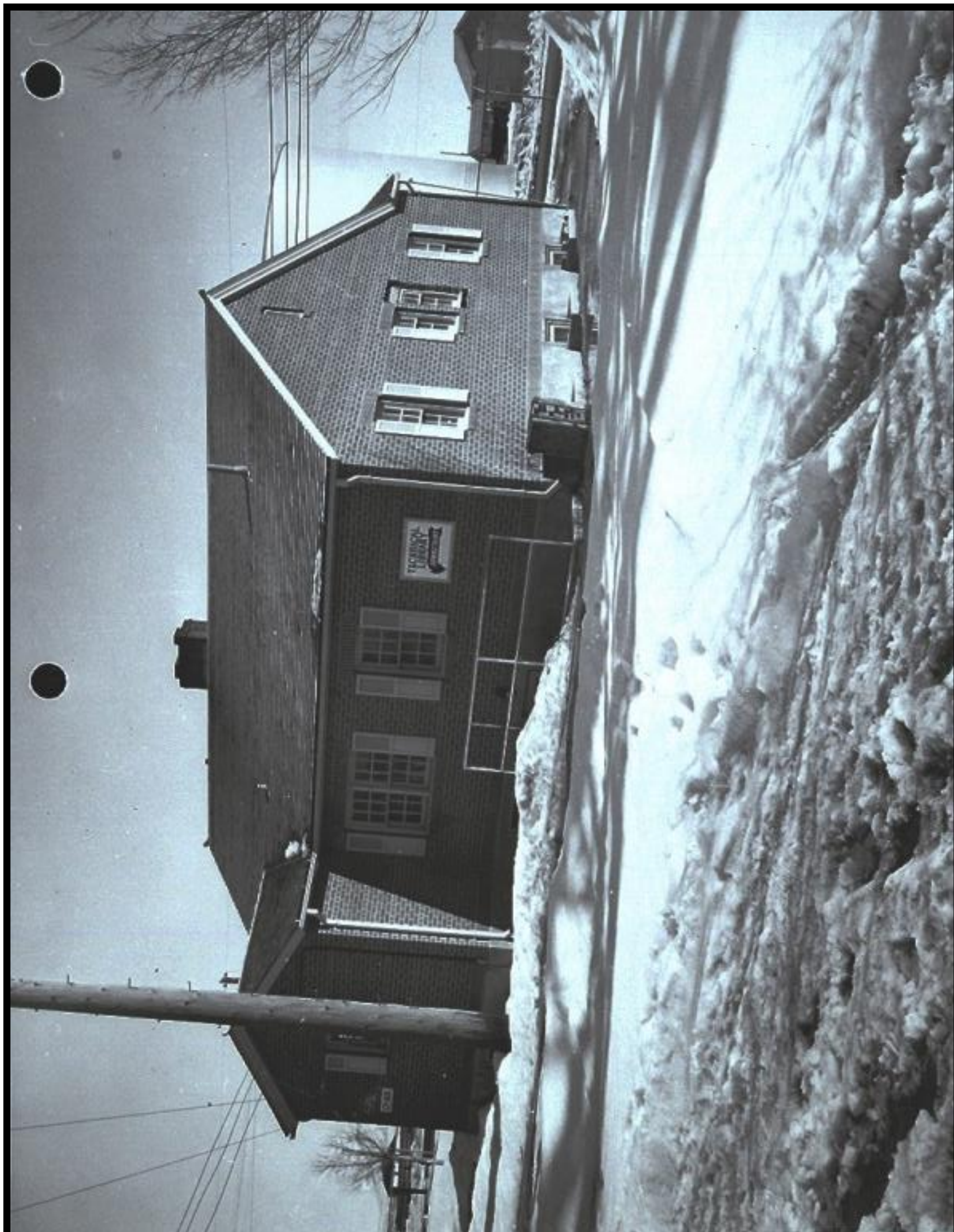


Figure 4.11: INL photo number 52-4447; rear elevation of Caretaker's Quarters after being converted into the Technical Library under AEC; view looking southeast; March 1952.

Figure 4.12: INL photo number 52-6306; dismantling of water tower; view looking northwest; July 1952.

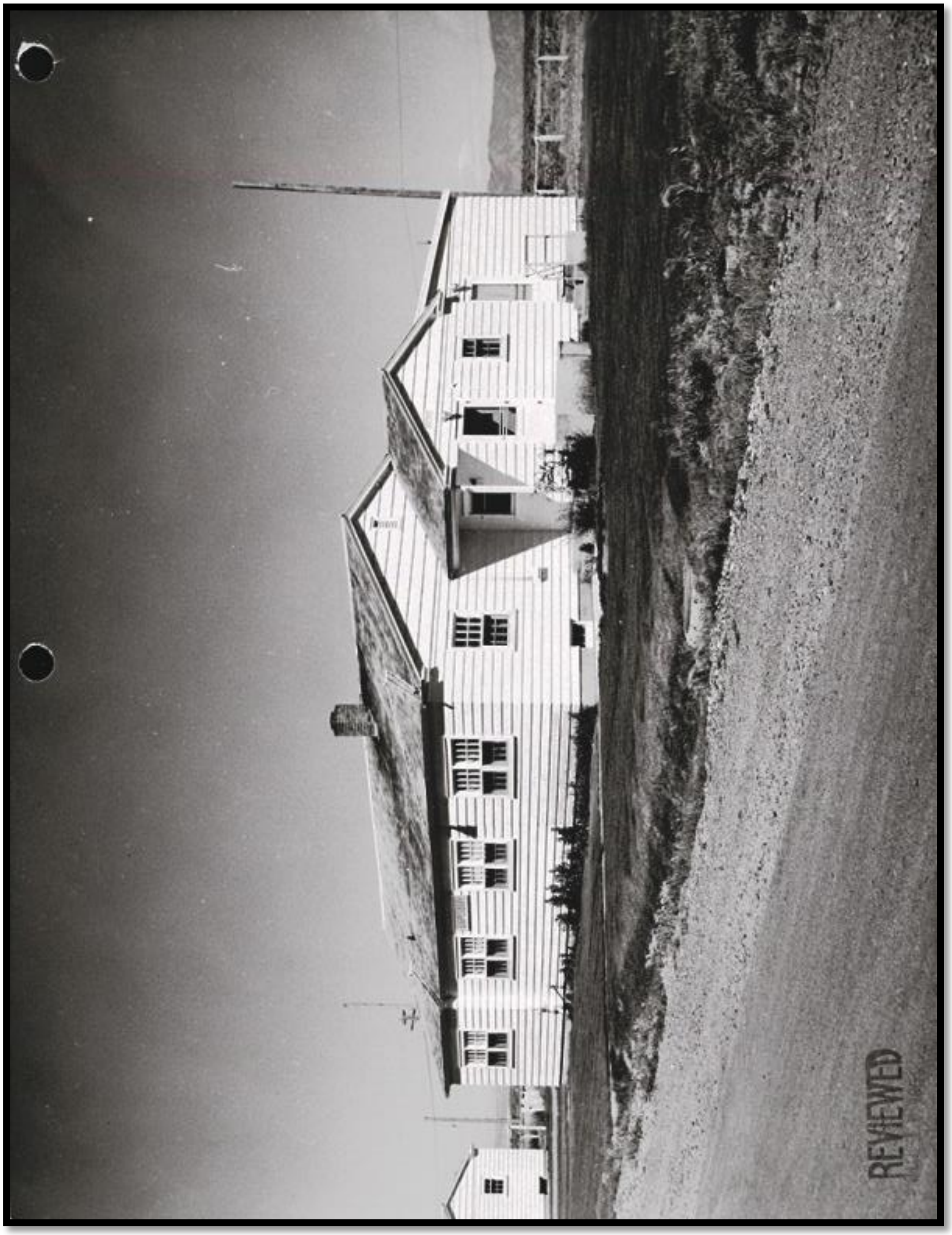


Figure 4.13: INL photo number 54-12664; Battery Attendant's Quarters Double House after construction of addition on rear elevation; view looking west/northwest; ca. 1954.

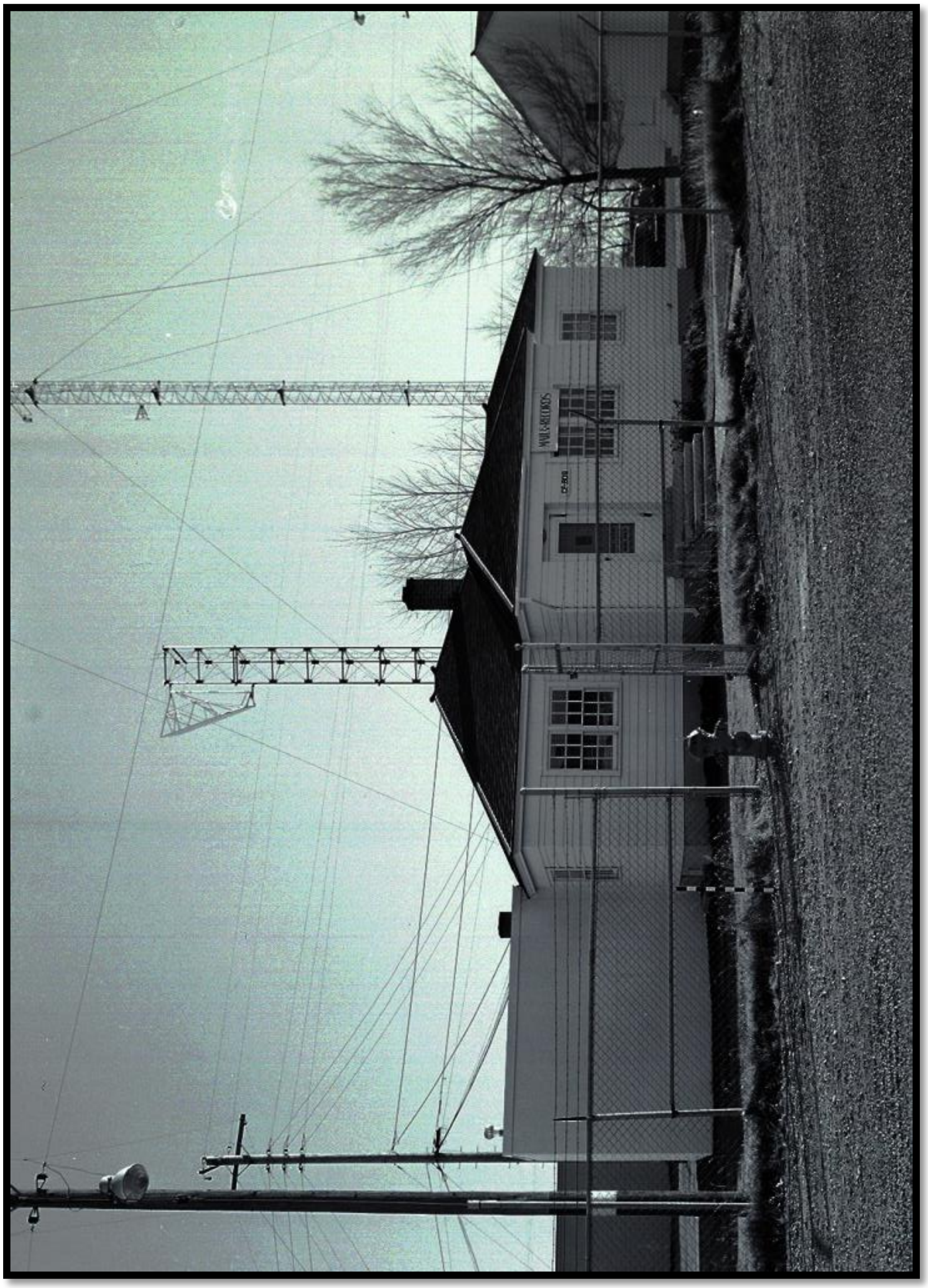


Figure 4.14: INL photo number 54-12665; Battery Attendant's Quarters after being converted into the Mail and Records Office at CFA under the AEC; view looking southeast; ca. 1954.

Figure 4.15: INL photo number 54-12663; Civilian Housing Apartment Building after being converted into office space under AEC; view looking northeast; ca. 1954.

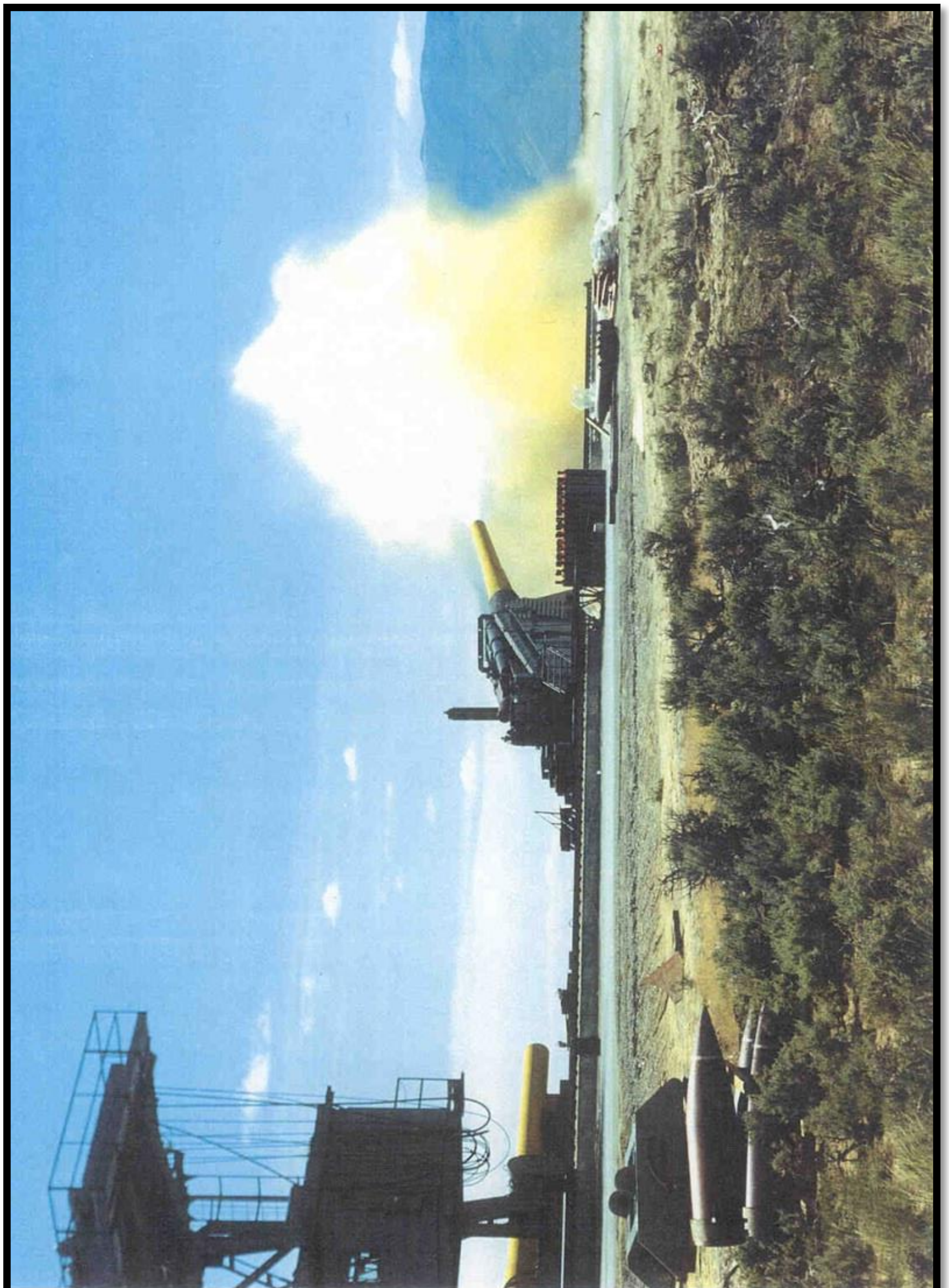


Figure 4.16: Unknown INL photo number; test firing of 16-inch guns from the Battleship USS New Jersey at NOTF; Big Southern Butte in background; view looking south/southeast; ca. 1969.

5 REDUCED COPIES OF MEASURED AND INTERPRETIVE DRAWINGS

The following historic measured drawing and plans for the Arco NPG are only available in microfiche format; as such, the best available, digitally scanned and reduced copies have been included in this documentation. Where INL (CFA) numbers are known for buildings, features, or structures, they have been included in associated captions; in addition, frame or sheet number information has been included in captions where available. Measured drawings and plans for the Arco NPG referenced in this HALS are on file at INL the Records Storage facility located in Idaho Falls, Idaho.

Historic interpretive drawings associated with the ANESB tests conducted from 1945 to 1946 were taken from digital copies of ANESB reports and technical papers published between 1945 and 1947; these reports are available through the U.S. Department of Defense, Defense Technical Information Center online collections (http://www.dtic.mil/dtic/).

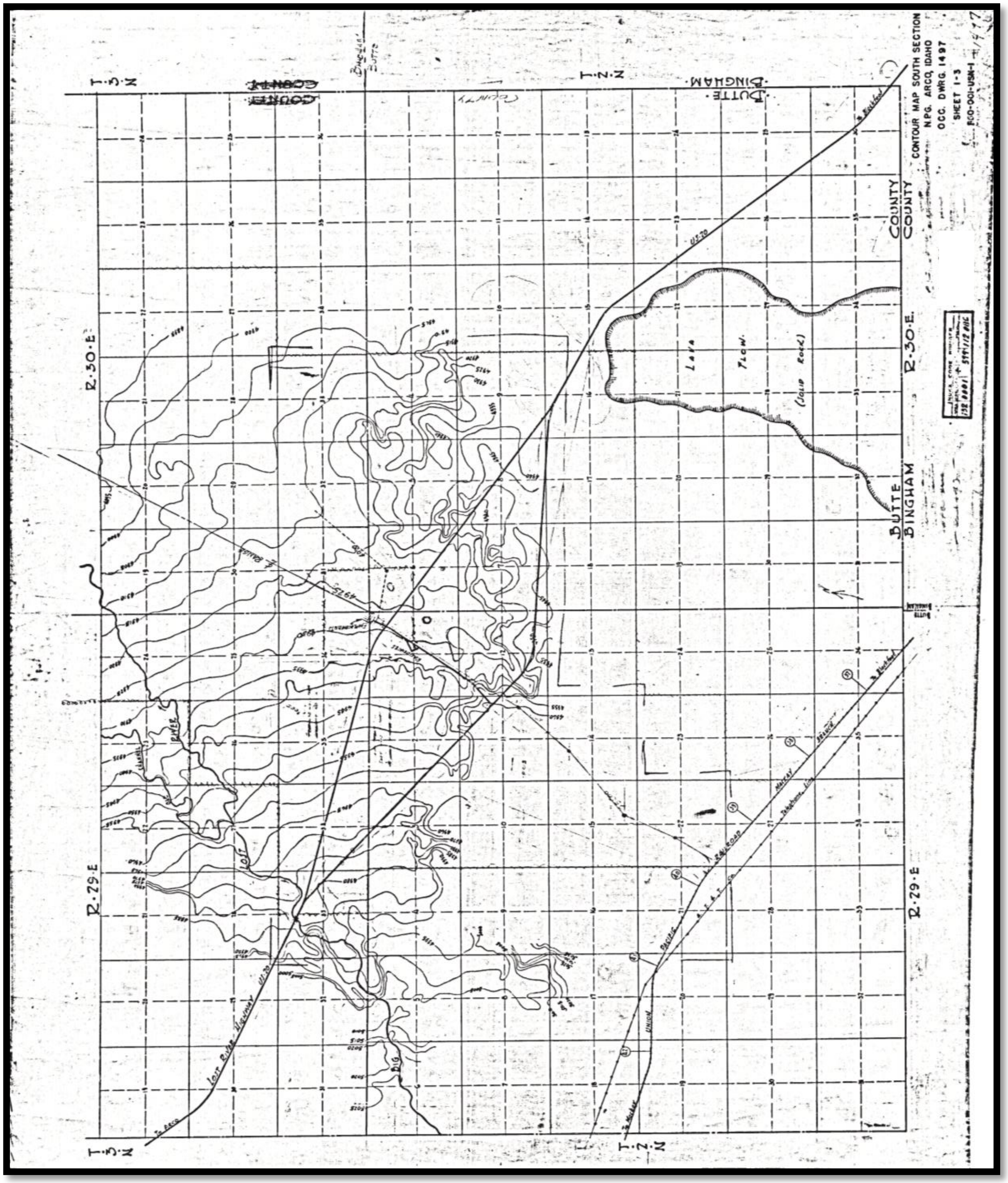


Figure 5.1: INL drawing number 112086 (B50-001-USN-1); contour map, south section; sheet 1 of 3; ca. 1942.

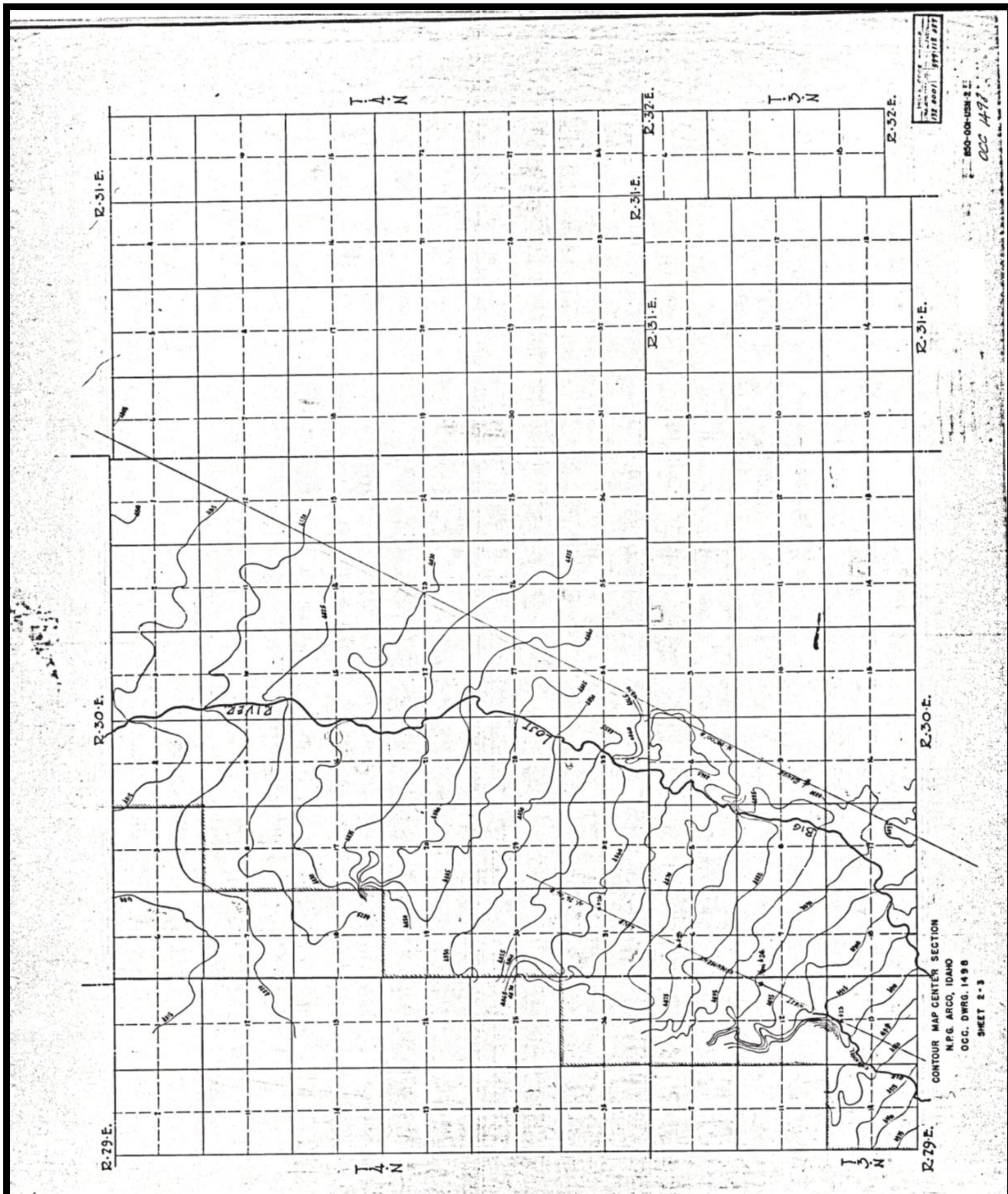


Figure 5.2: INL drawing number 112087 (B50-001-USN-2); contour map, center section; sheet 2 of 3; ca. 1942.

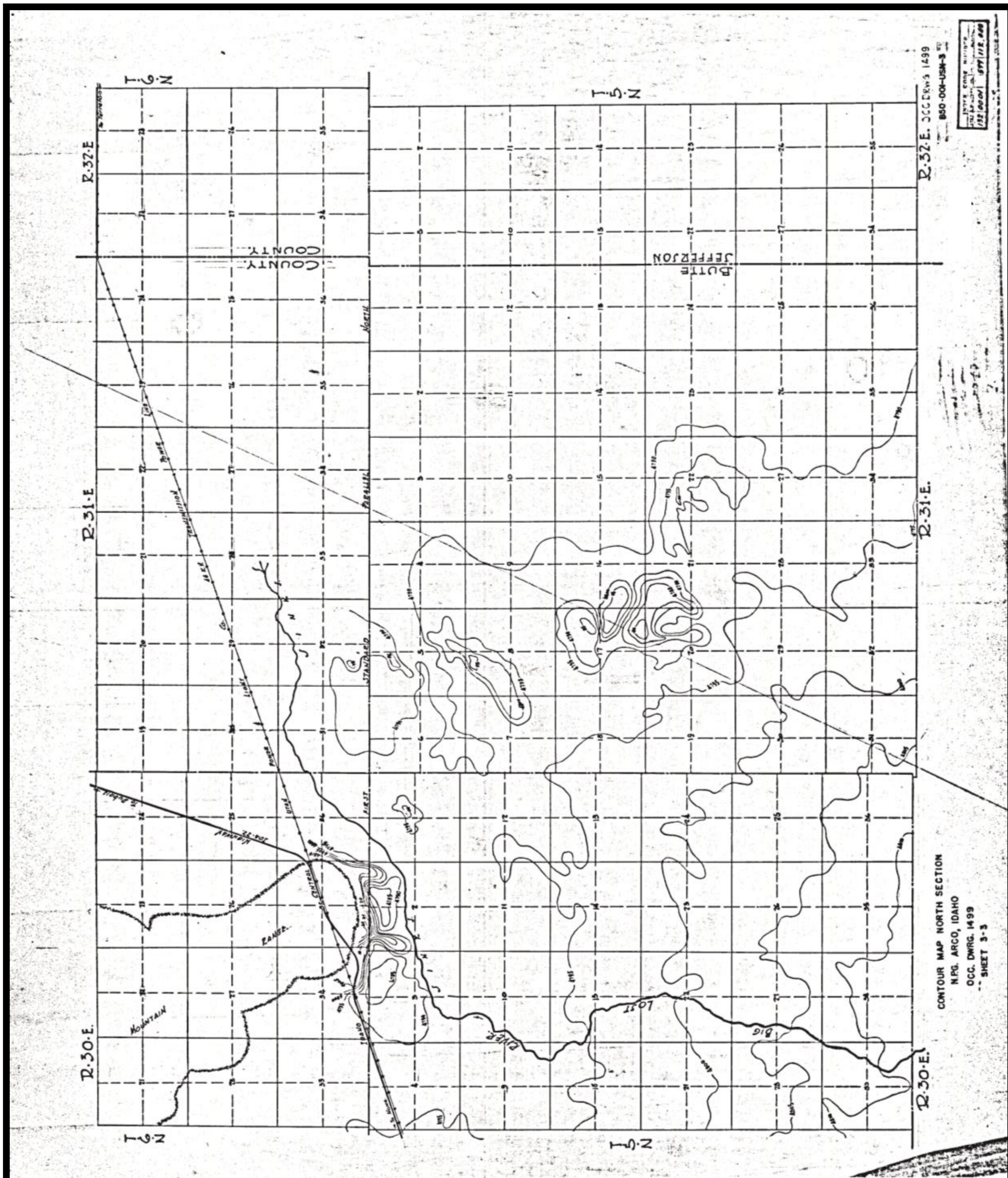


Figure 5.3: INL drawing number 112088 (B50-001-USN-3); contour map, north section; sheet 3 of 3; ca. 1942.

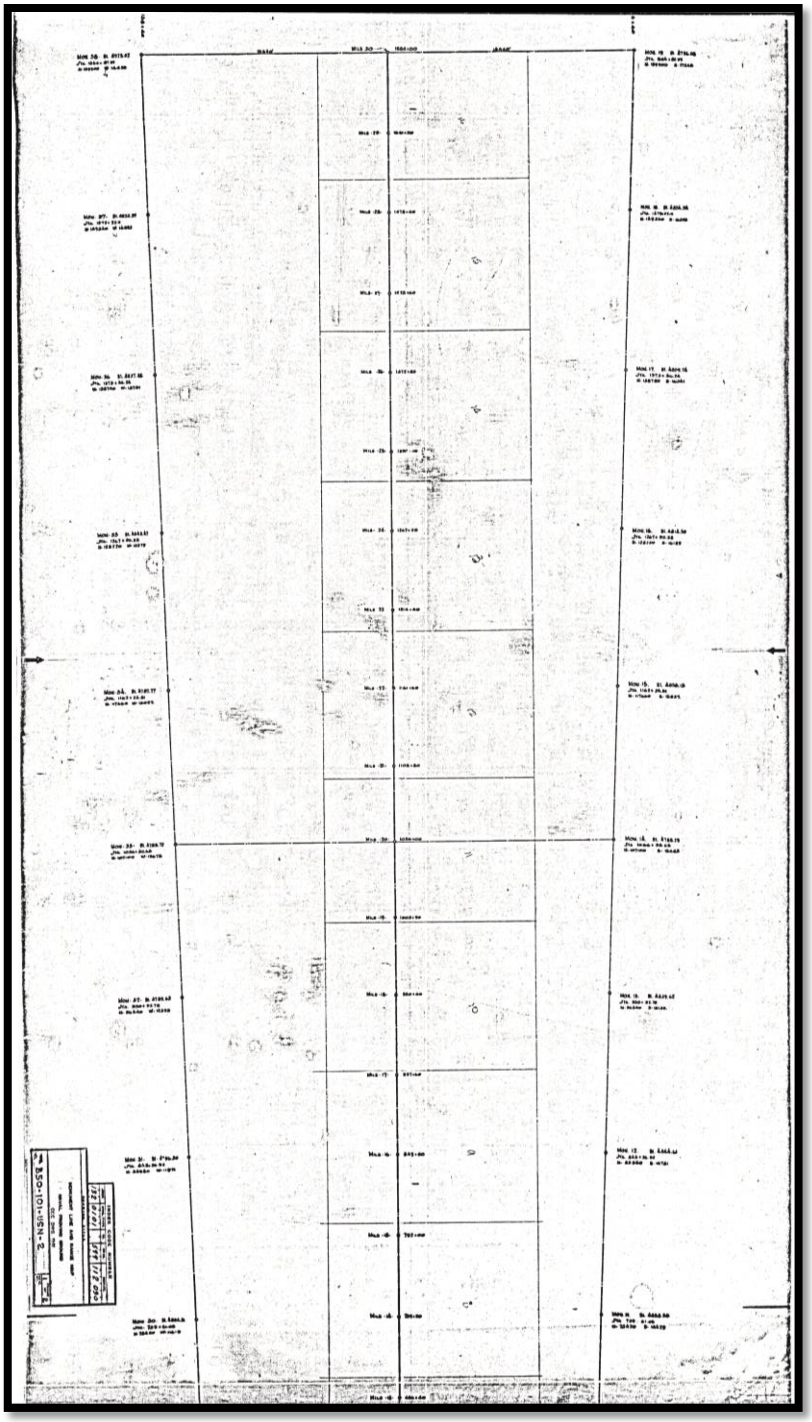


Figure 5.4: INL drawing number 112090 (B50-101-USN-2); monument line and range map, frame 1 of 2; ca. 1943.

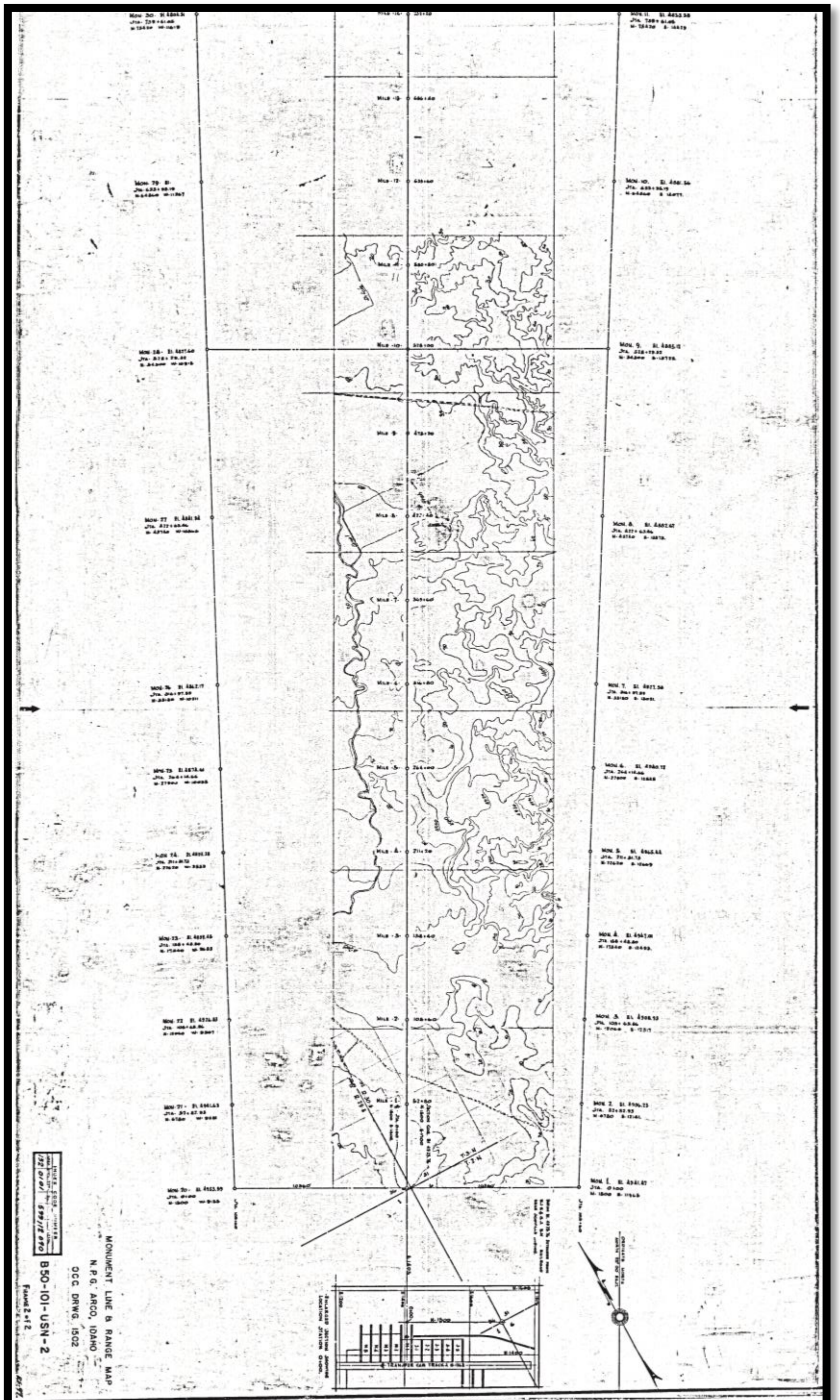


Figure 5.5: INL drawing number 11209002 (B50-101-USN-2); monument line and range map, frame 2 of 2; ca. 1943.

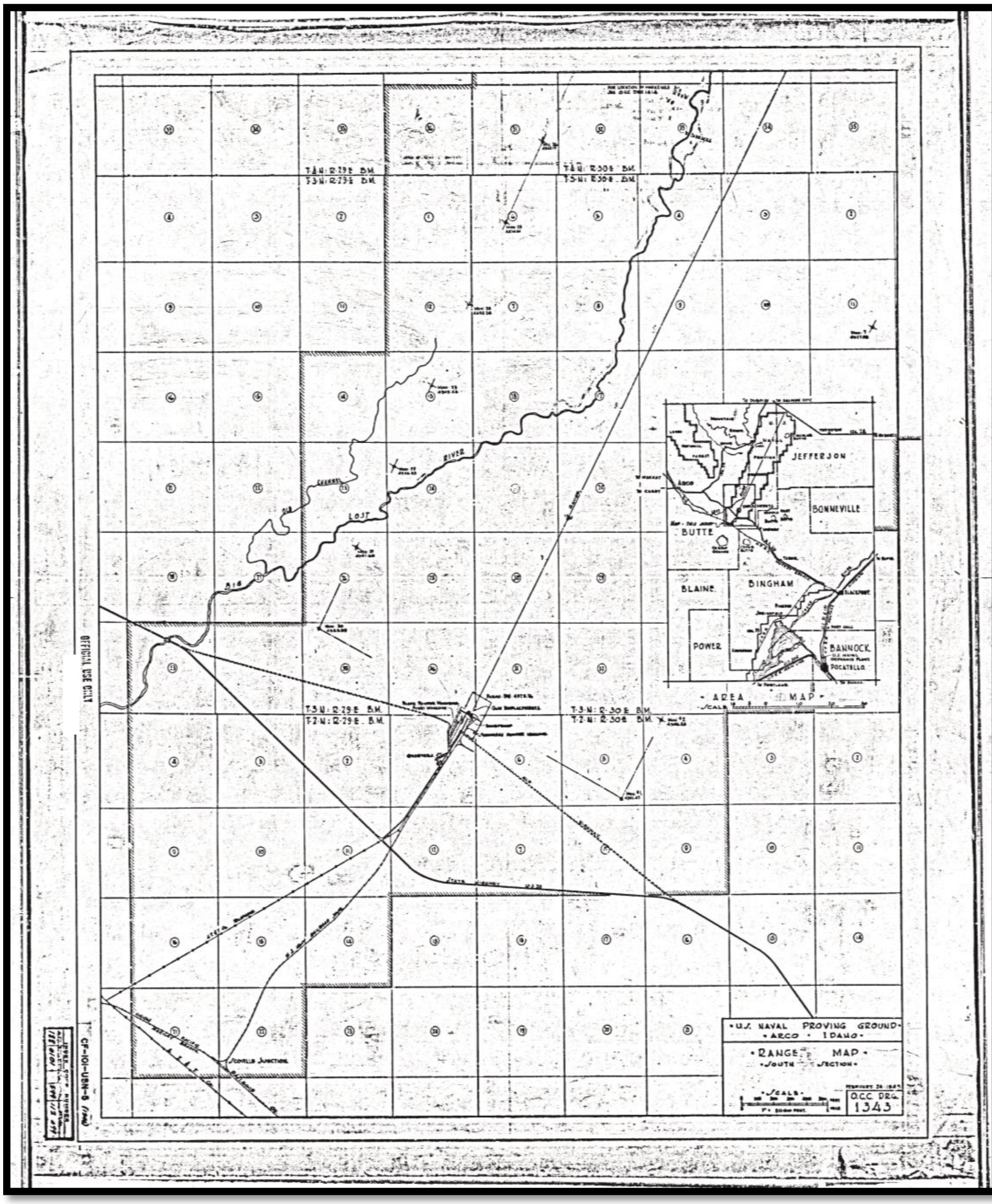


Figure 5.6: INL drawing number 112099 (CF-101-USN-5); "Range Map, South Section", Arco NPG; layout of U.S. highway 20 (original and relocated alignments), railroads, and Big Lost River relative to the proofing (emplacement) and residential areas (CFA), and the Scoville railroad siting, with regionsl inset map; February 1942.

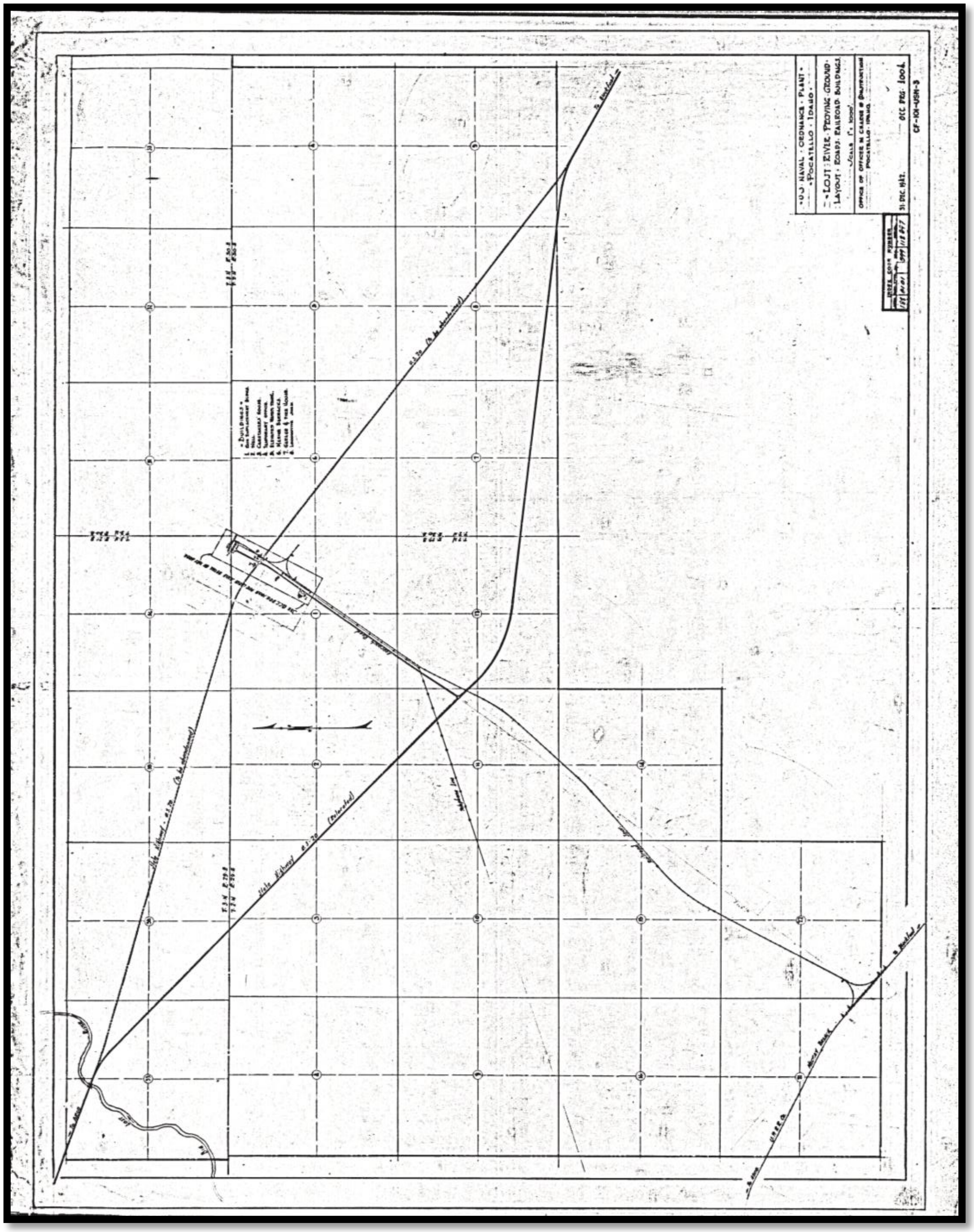


Figure 5.7: INL drawing number 112097 (CF-101-USN-3); Arco NPG, layout of U.S. Highway 20 (original and relocated alignments)and railroads relative to the proofing (emplacement) and residential areas (CFA), and the Scoville railroad siting, with regionsl inset map; December 1942.

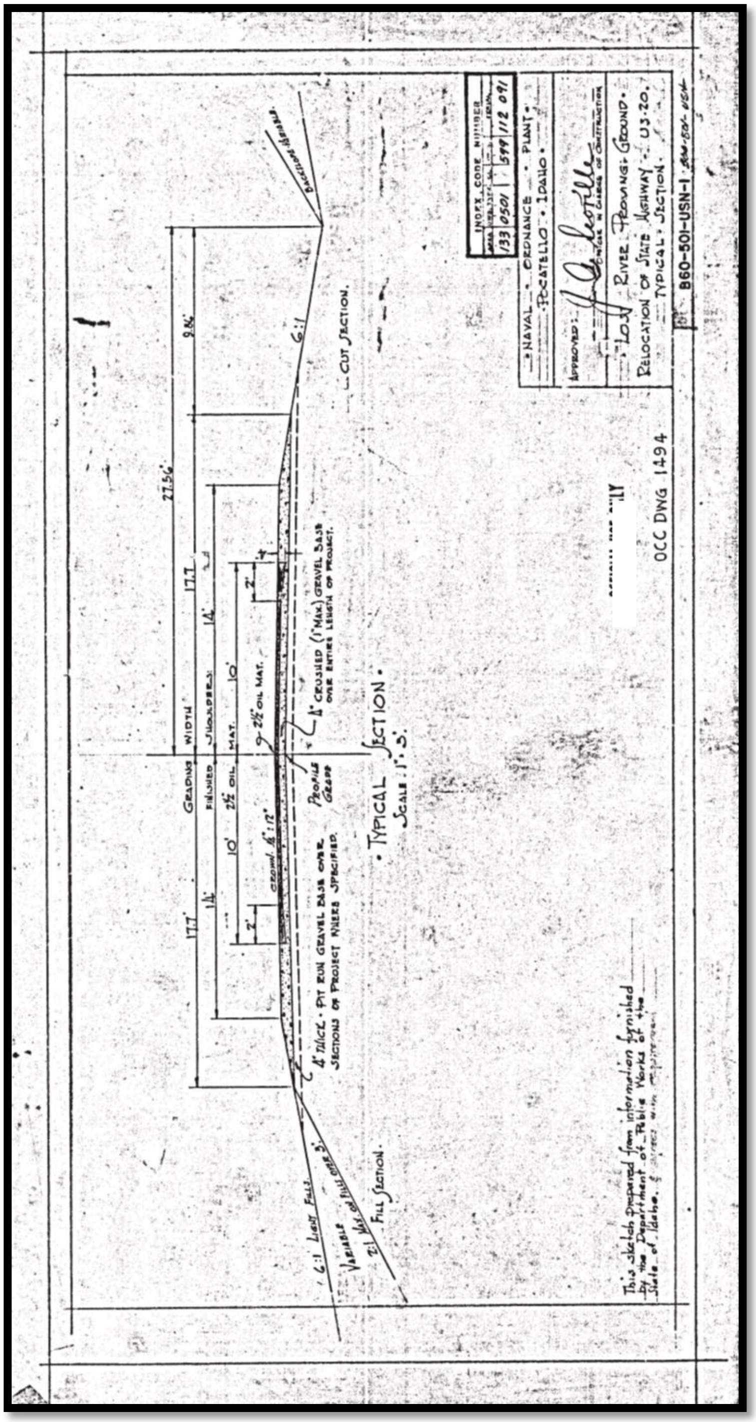


Figure 5.8: INL drawing number 112091 (B60-501-USN-1); relocation of State Highway / U.S. 20, typical section; ca. 1943.

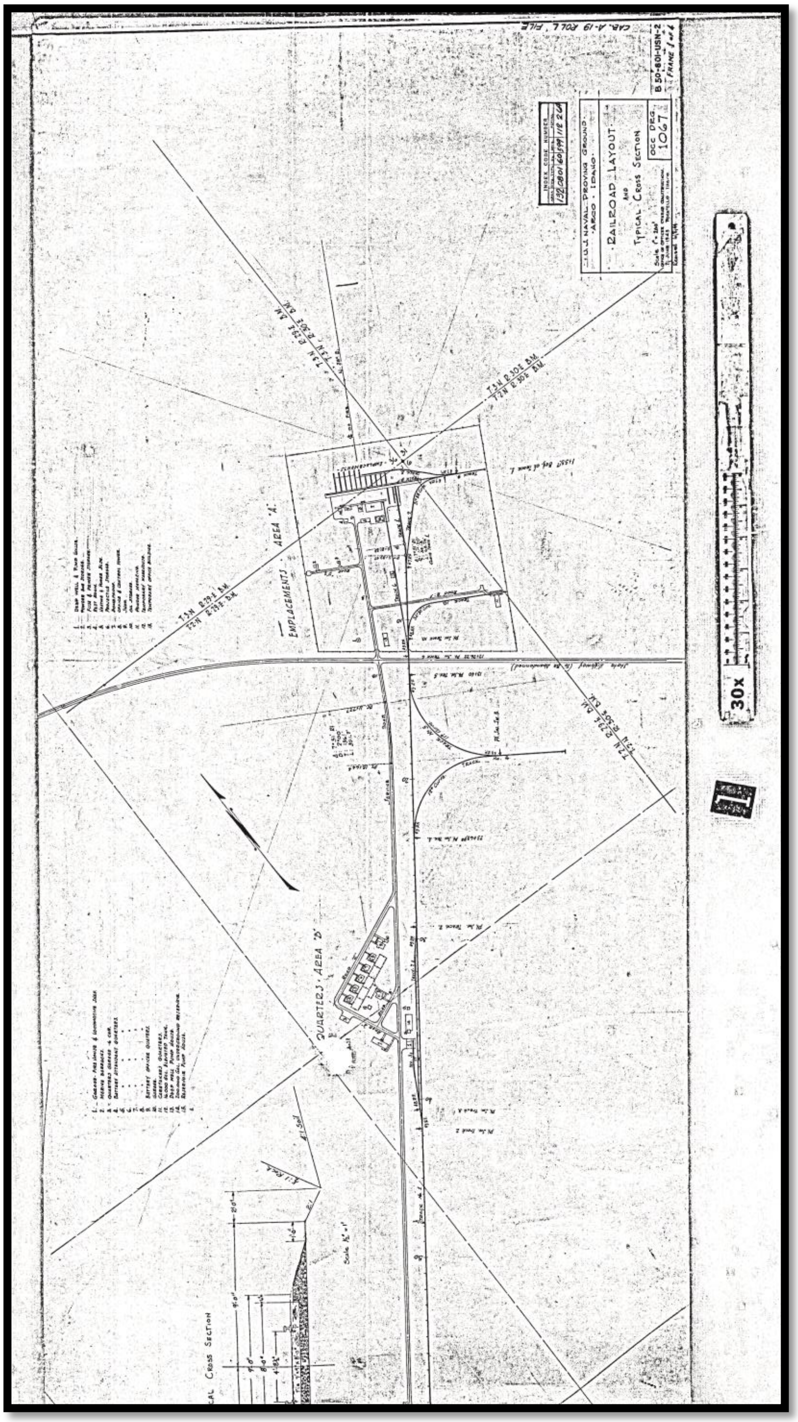


Figure 5.9: INL drawing number 11264 (B50-801-USN-2); railroad, layout and typical cross section, frame 1 of 4; June 1944.

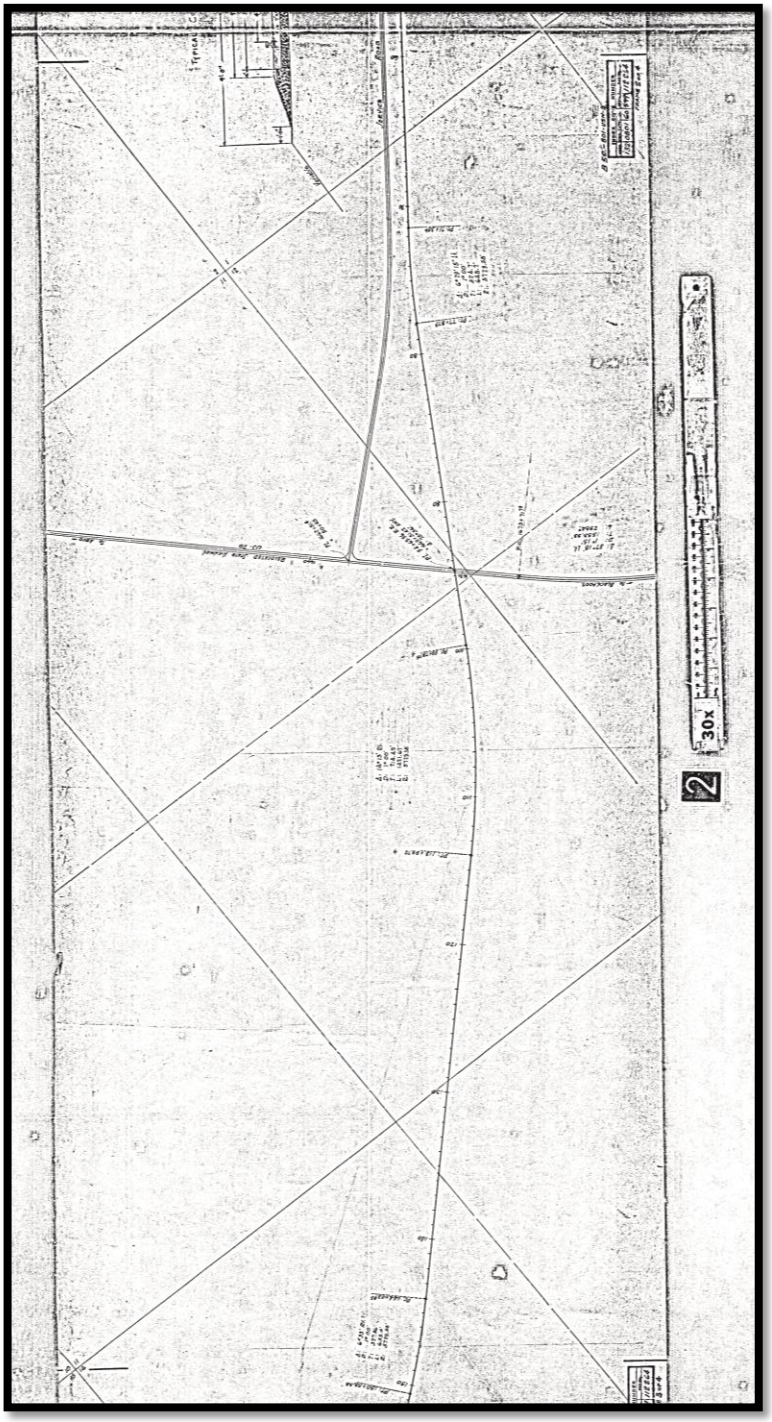


Figure 5.10: INL drawing number 112264; (B50-801-USN-2); railroad, layout and typical cross section, frame 2 of 4; June 1944.

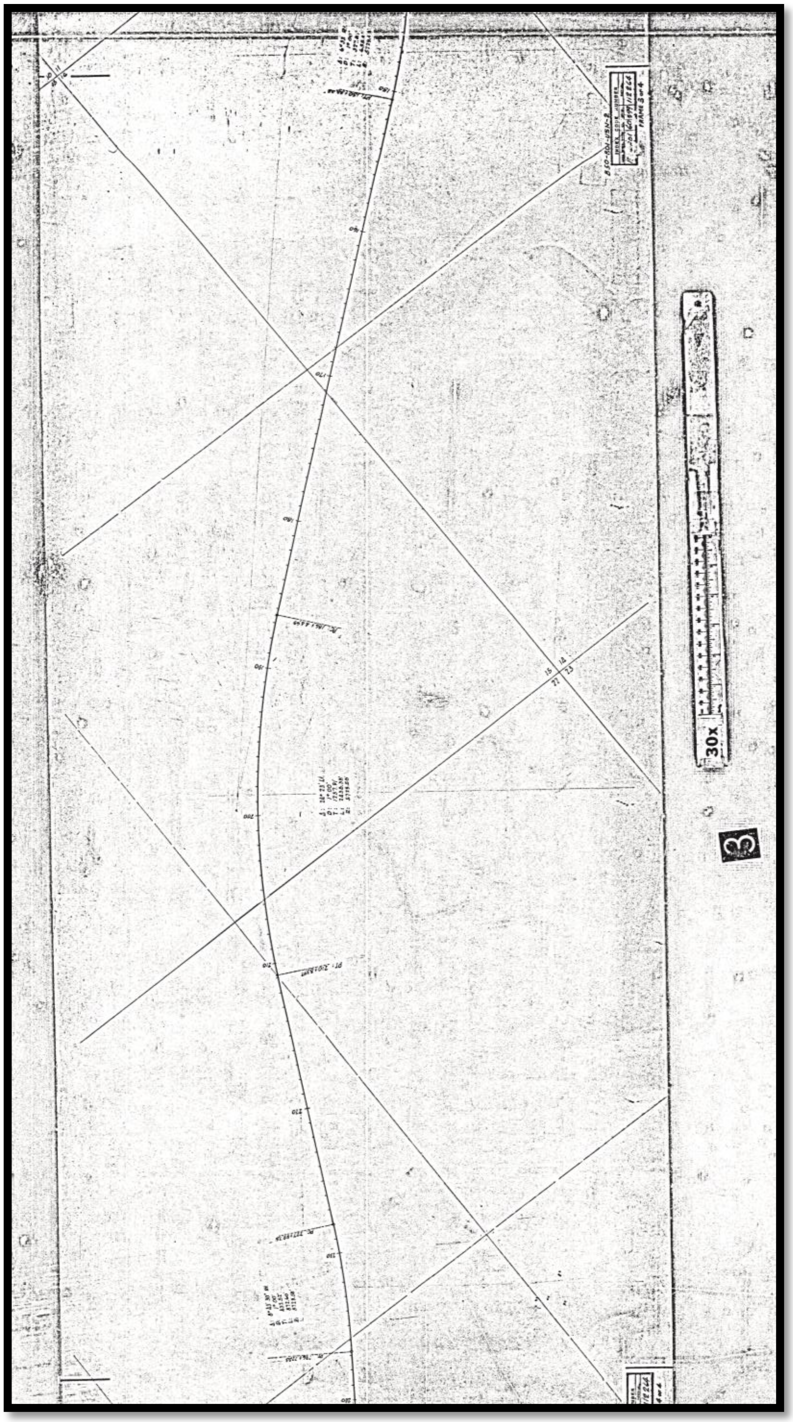


Figure 5.11: INL drawing number 112264; (B50-801-USN-2); railroad, layout and typical cross section, frame 3 of 4; June 1944.

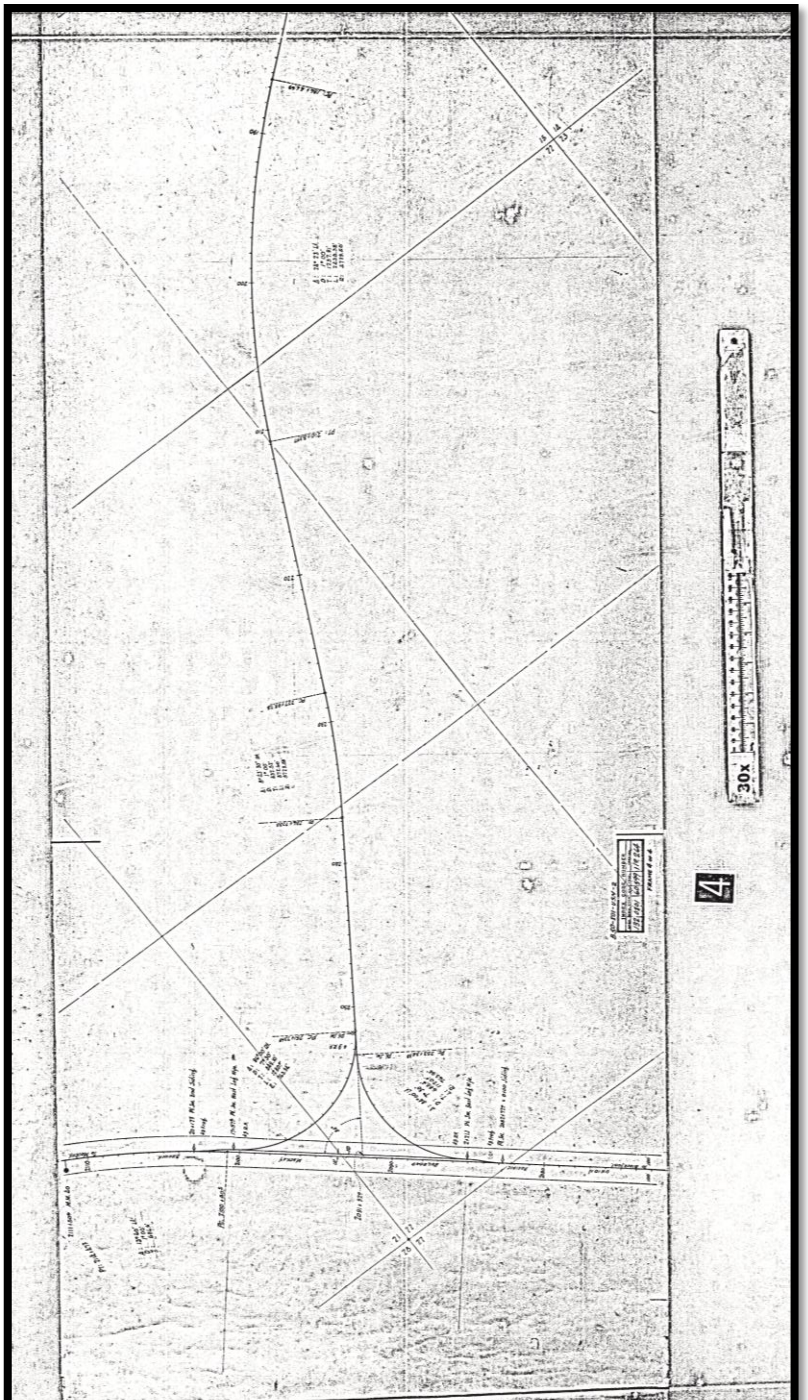


Figure 5.12: INL drawing number 112264; (B50-801-USN-2); railroad, layout and typical cross section, frame 4 of 4; June 1944.

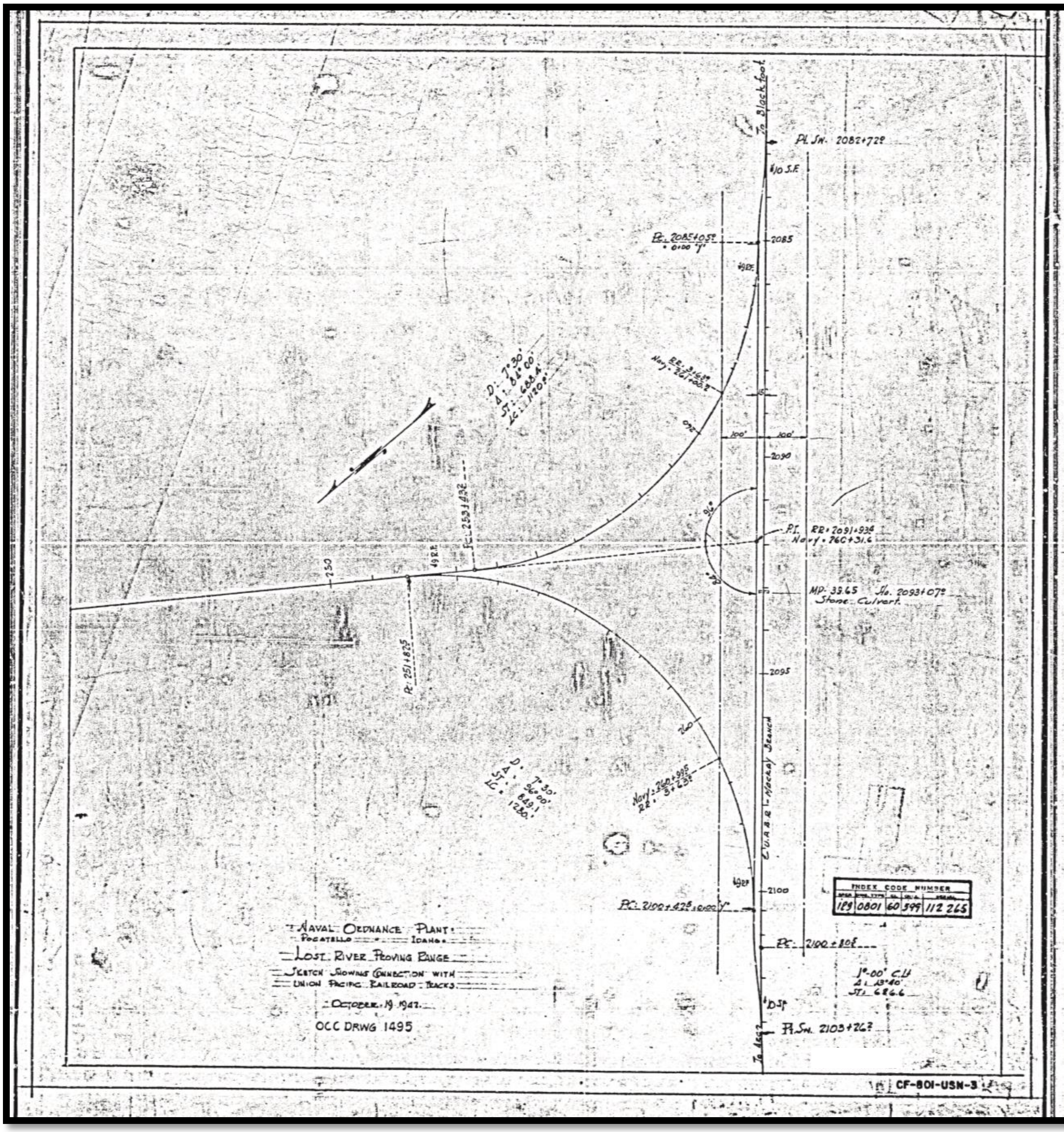


Figure 5.13: INL drawing number 112265 (CF-801-USN-3); sketch of rail spur connection with Union Pacific Railroad; October 1942.

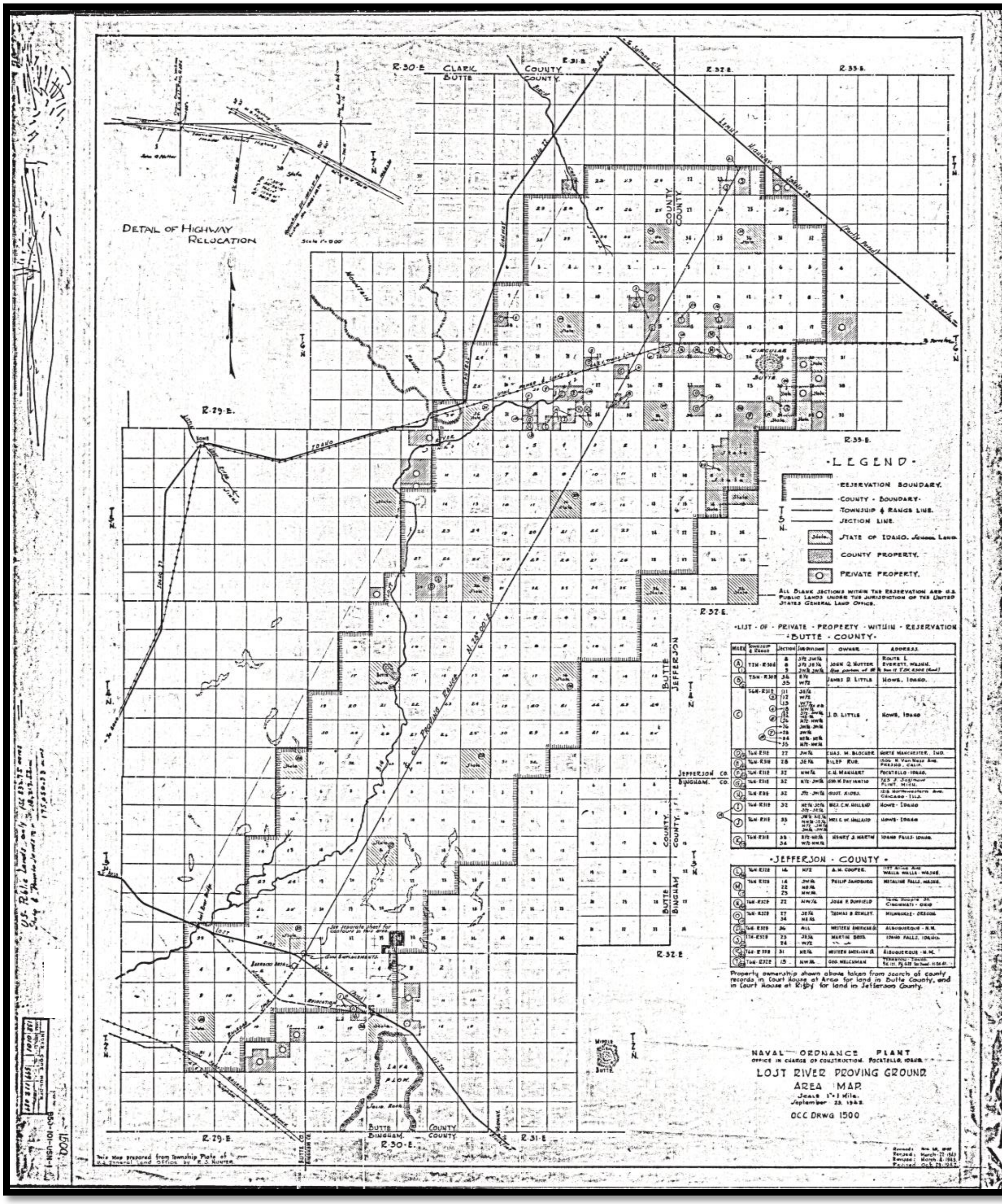


Figure 5.14: INL drawing number 112089 (B50-101-USN-1); Arco NPG, area map depicting entire NPG; March 1944.

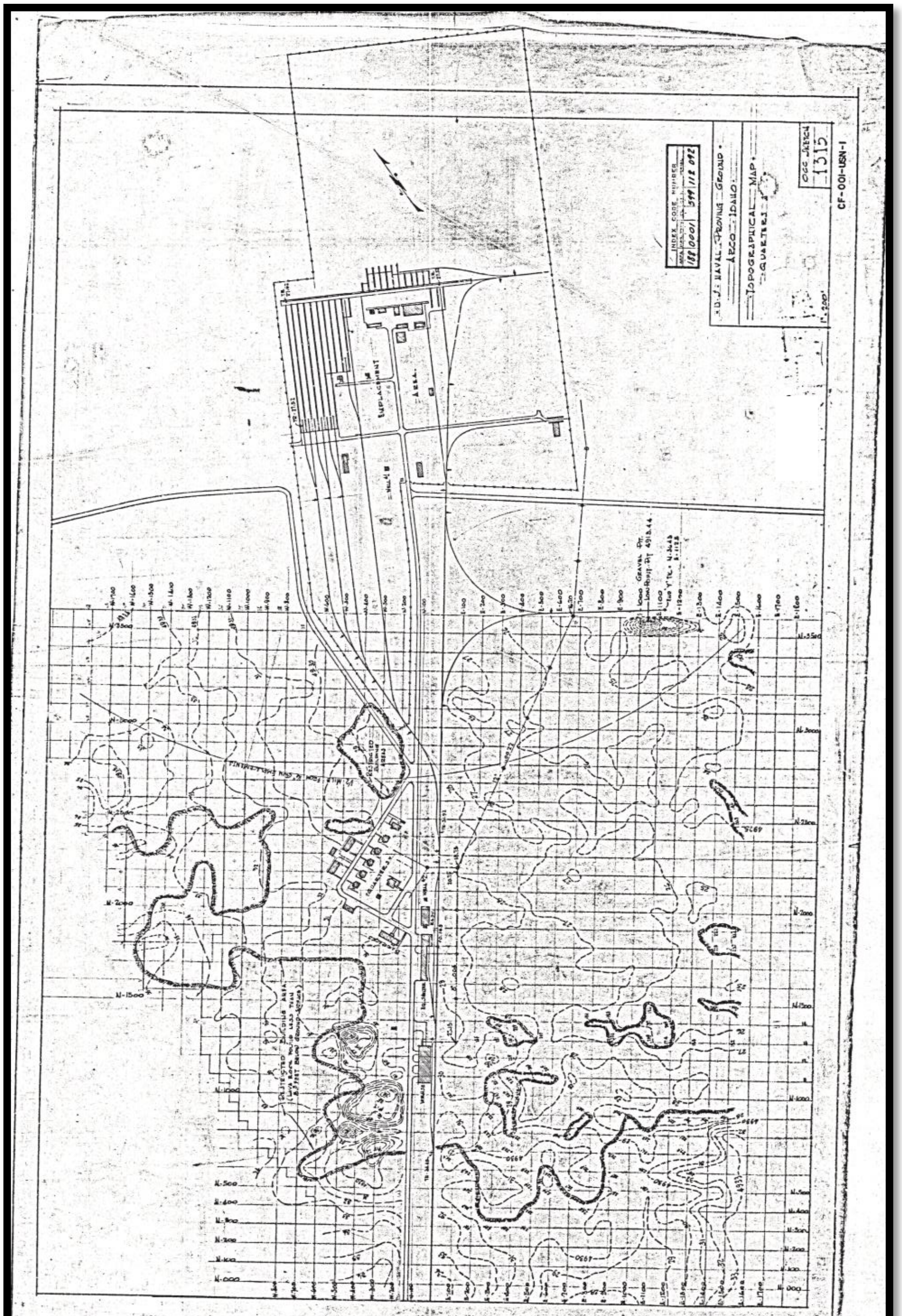


Figure 5.15: INL drawing number 112092 (CF-001-USN-1); topographical map depicting gun emplacements, storage yard, and residential area; ca. 1942.

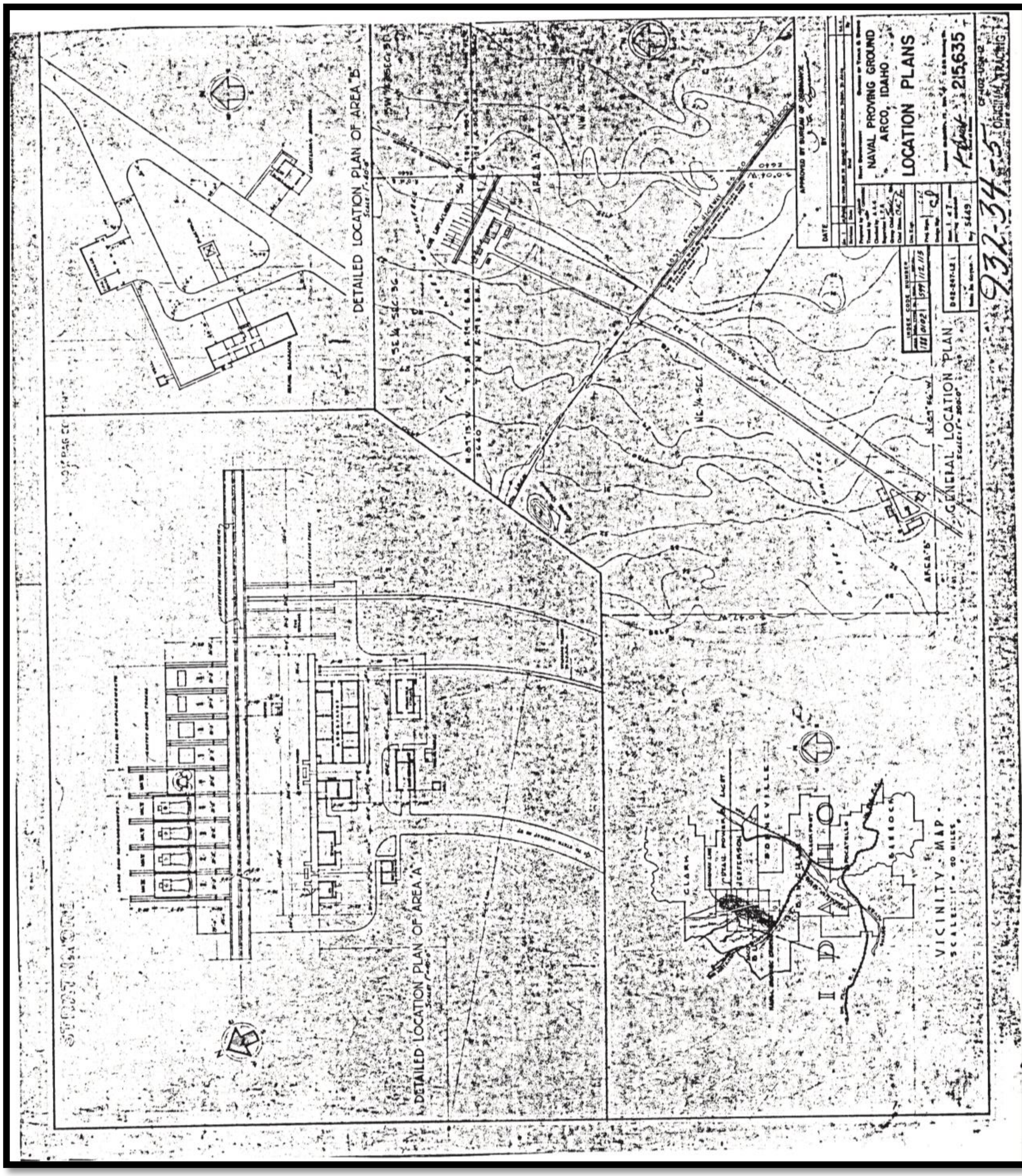


Figure 5.16: INL drawing number 112115 (CF-102-USN-12); location plans for proof (emplacement) and residential areas (CFA), with regional inset map; ca. 1943.

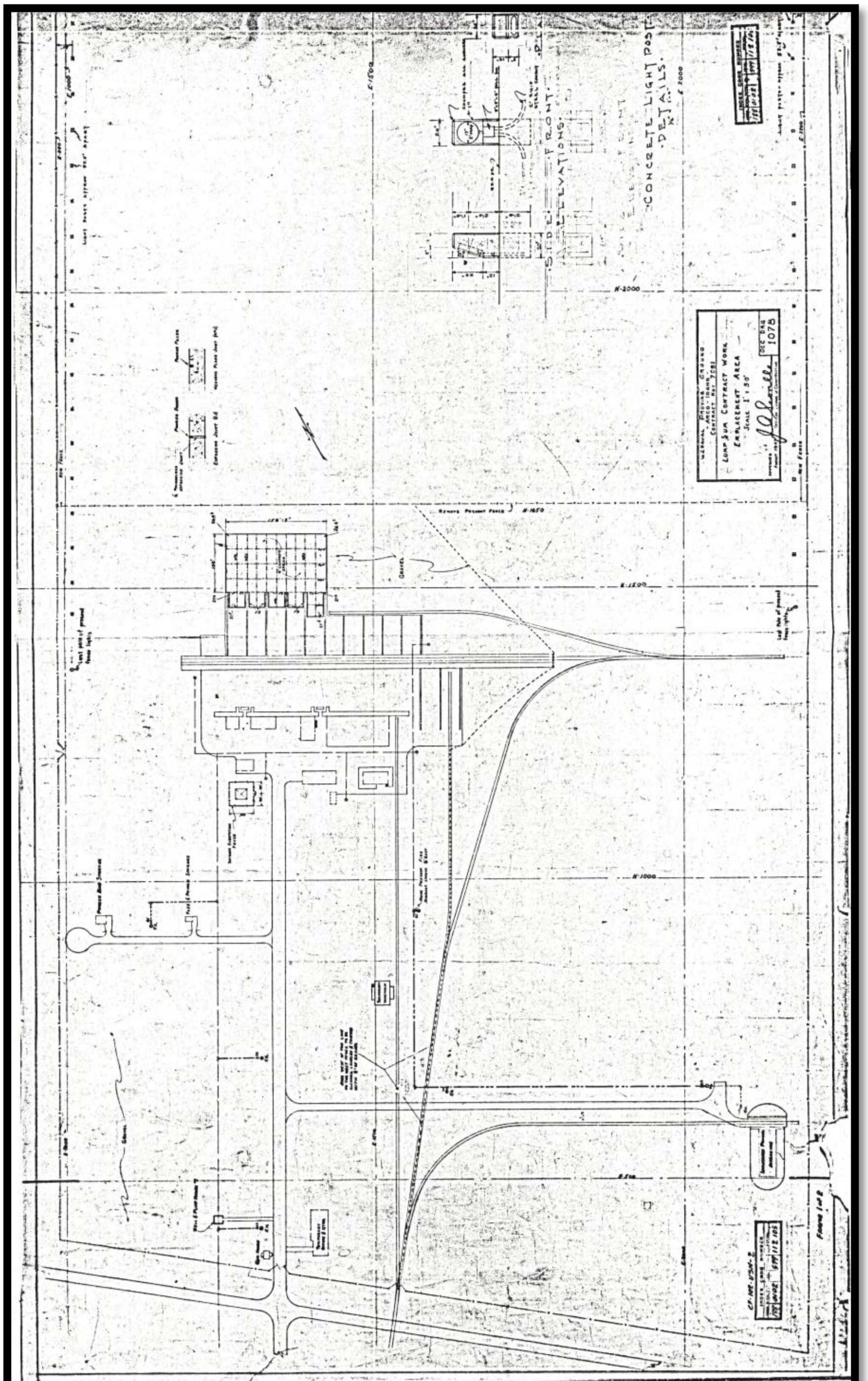


Figure 5.17:INL drawing number 112105 (CF-102-USN-2); proof / gun emplacement area, contract number 7081 lump sum contract work, frame 1 of 2; August 1943.

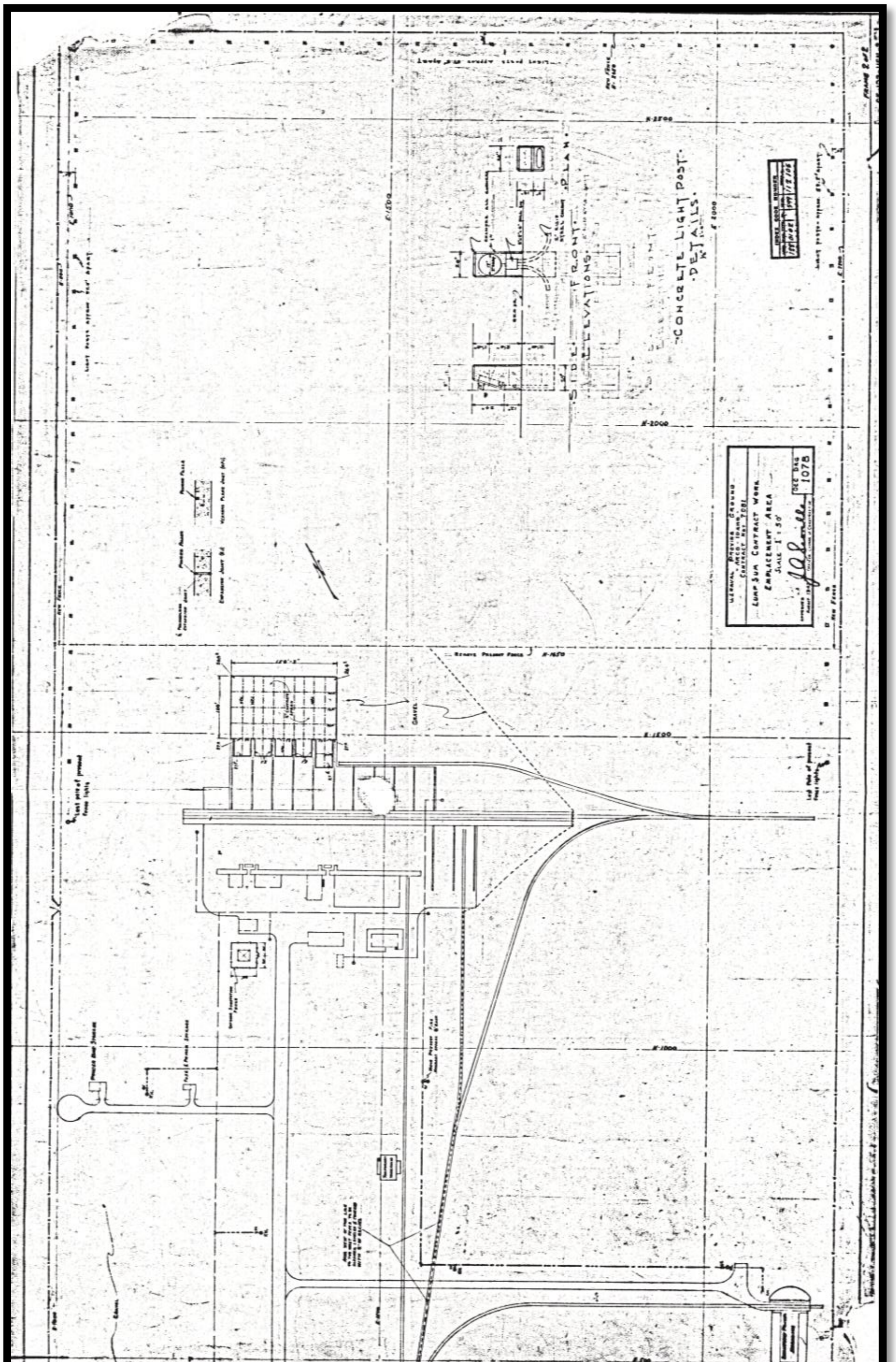


Figure 5.18: INL drawing number 11210502 (CF-102-USN-2); proof / gun emplacement area, contract number 7081 lump sum contract work, frame 1 of 2; August 1943.

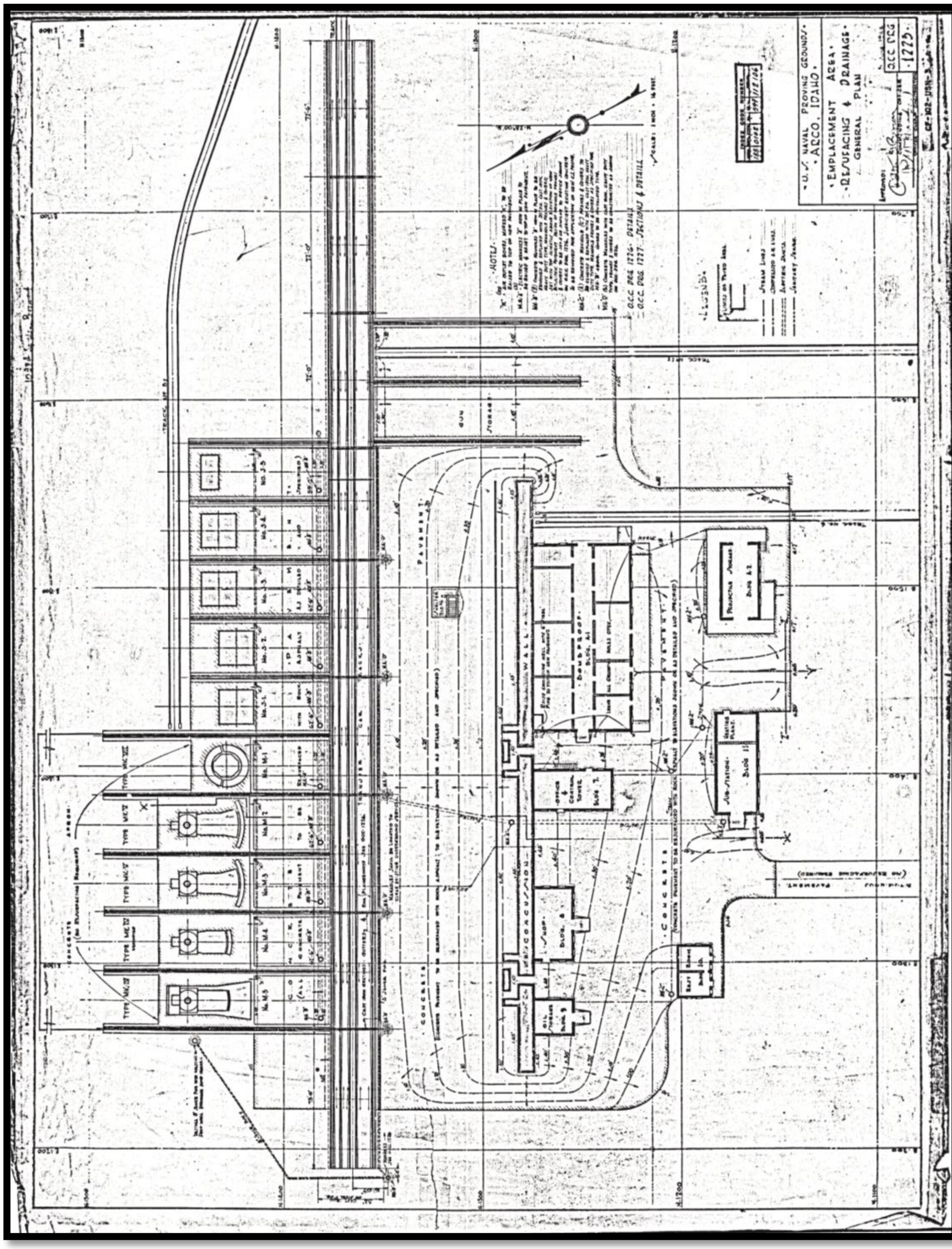


Figure 5.19: INL drawing number 112106 (CF-102-USN-3); proof / gun emplacement area, general plan, resurfacing and drainage; June 1944.

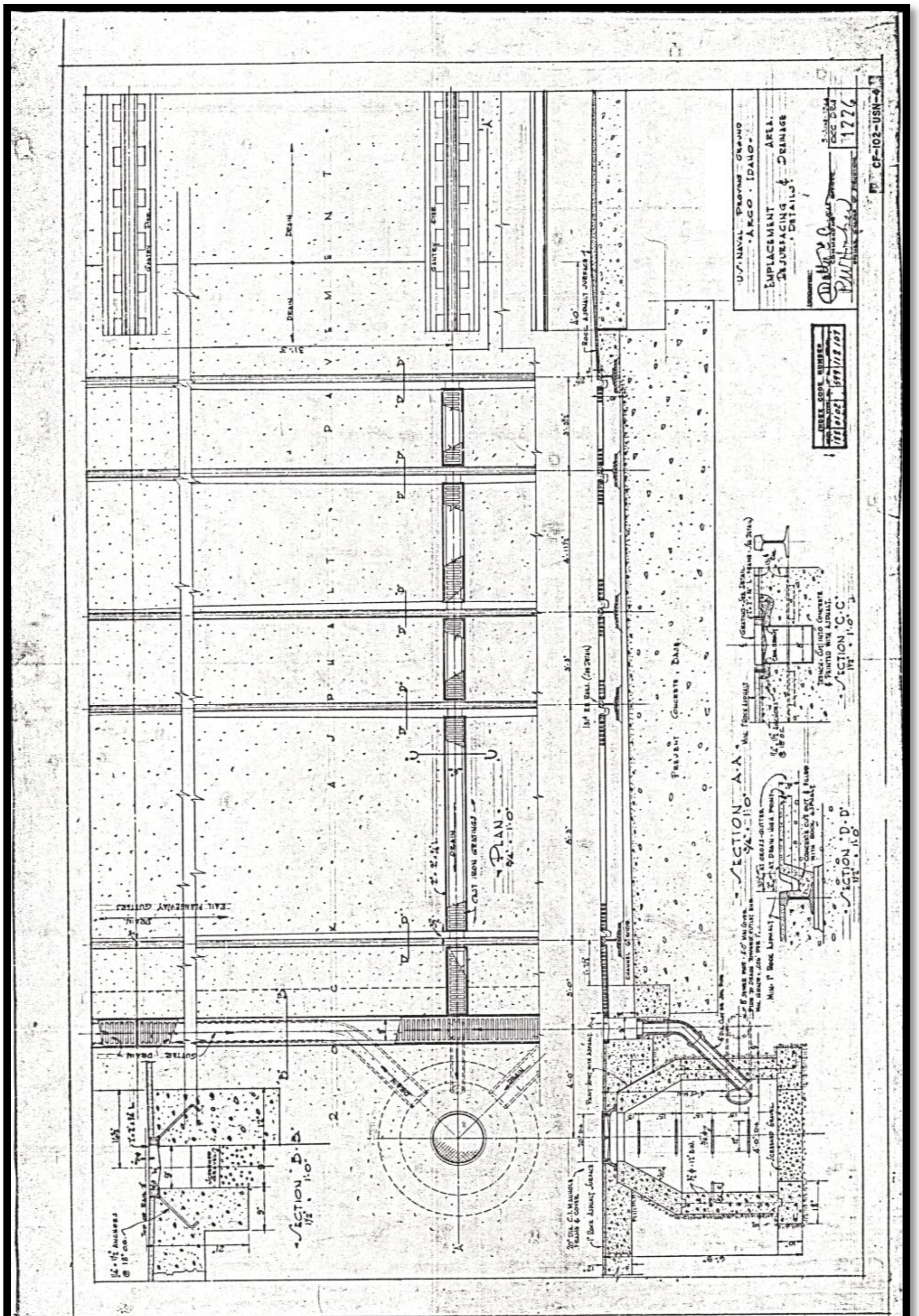


Figure 5.20: INL drawing number 112107 (CF-102-USN-4); proof / gun emplacement area, details, resurfacing and drainage; June 1944.

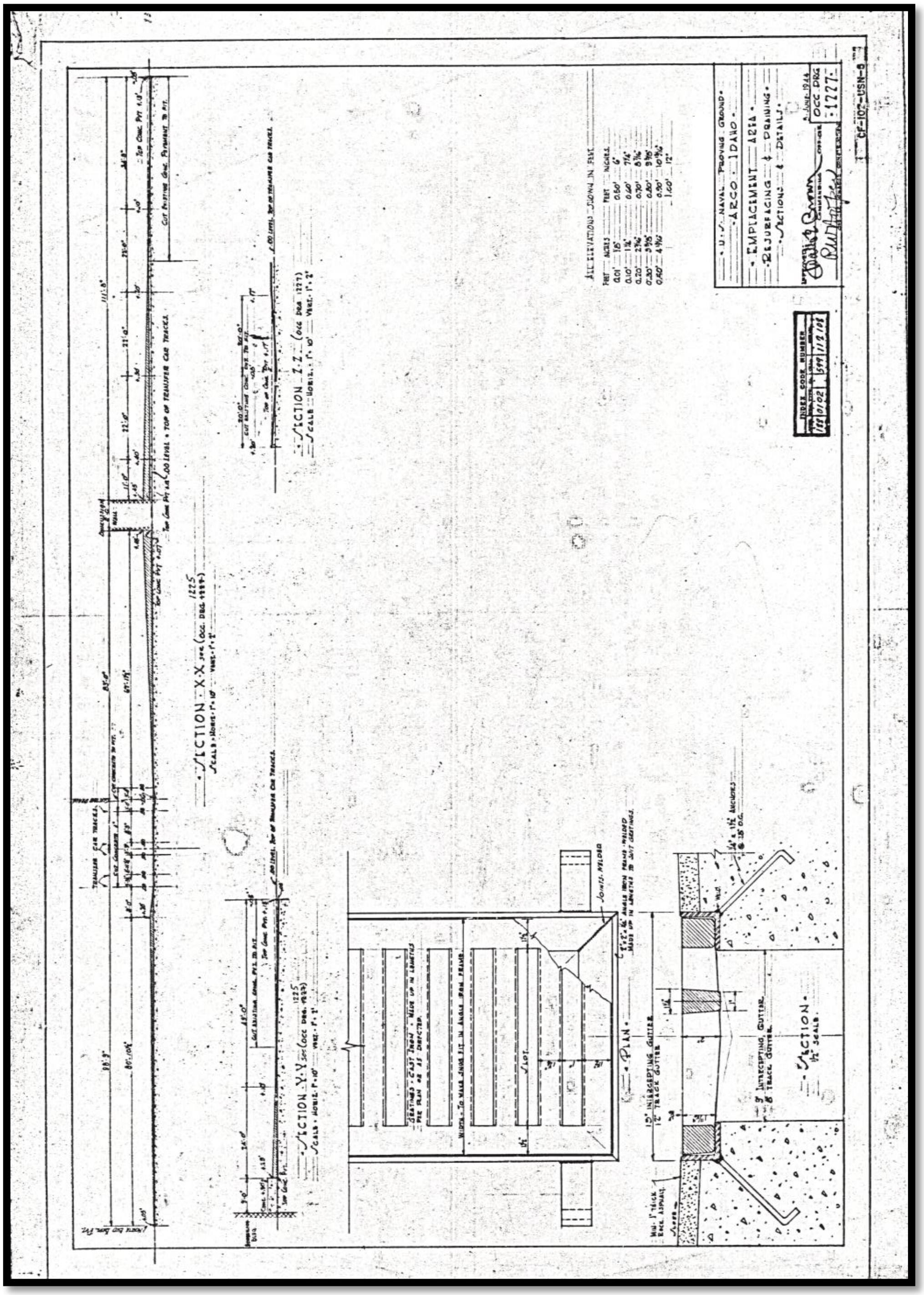


Figure 5.21: INL drawing number 112108 (CF-102-USN-5); proof / emplacement area, sections and details, resurfacing and drainage; June 1944.

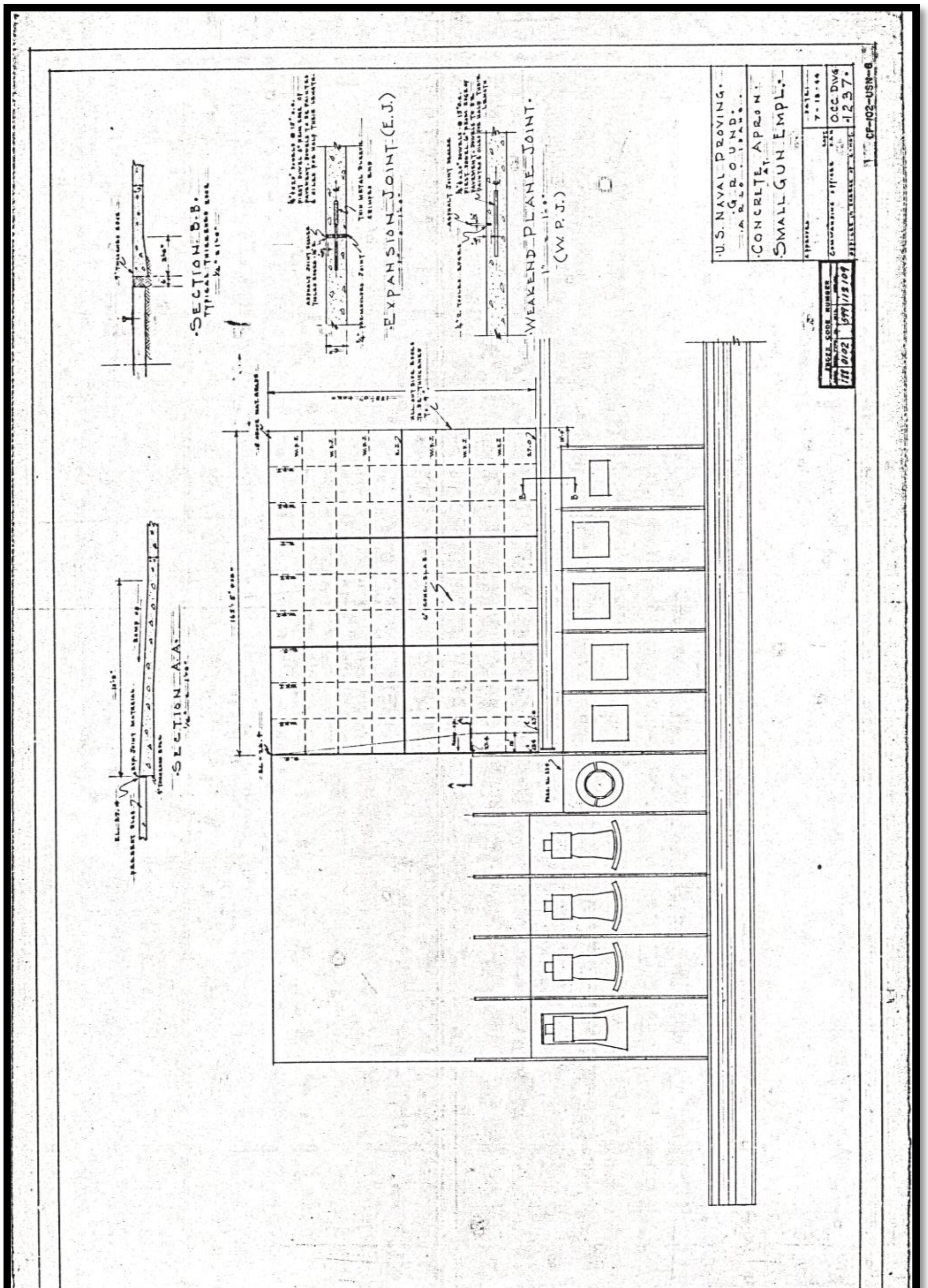


Figure 5.22: INL drawing number 112109 (CF-102-USN-6); proof / gun emplacement area, concrete apron at small gun emplacement; July 1944.

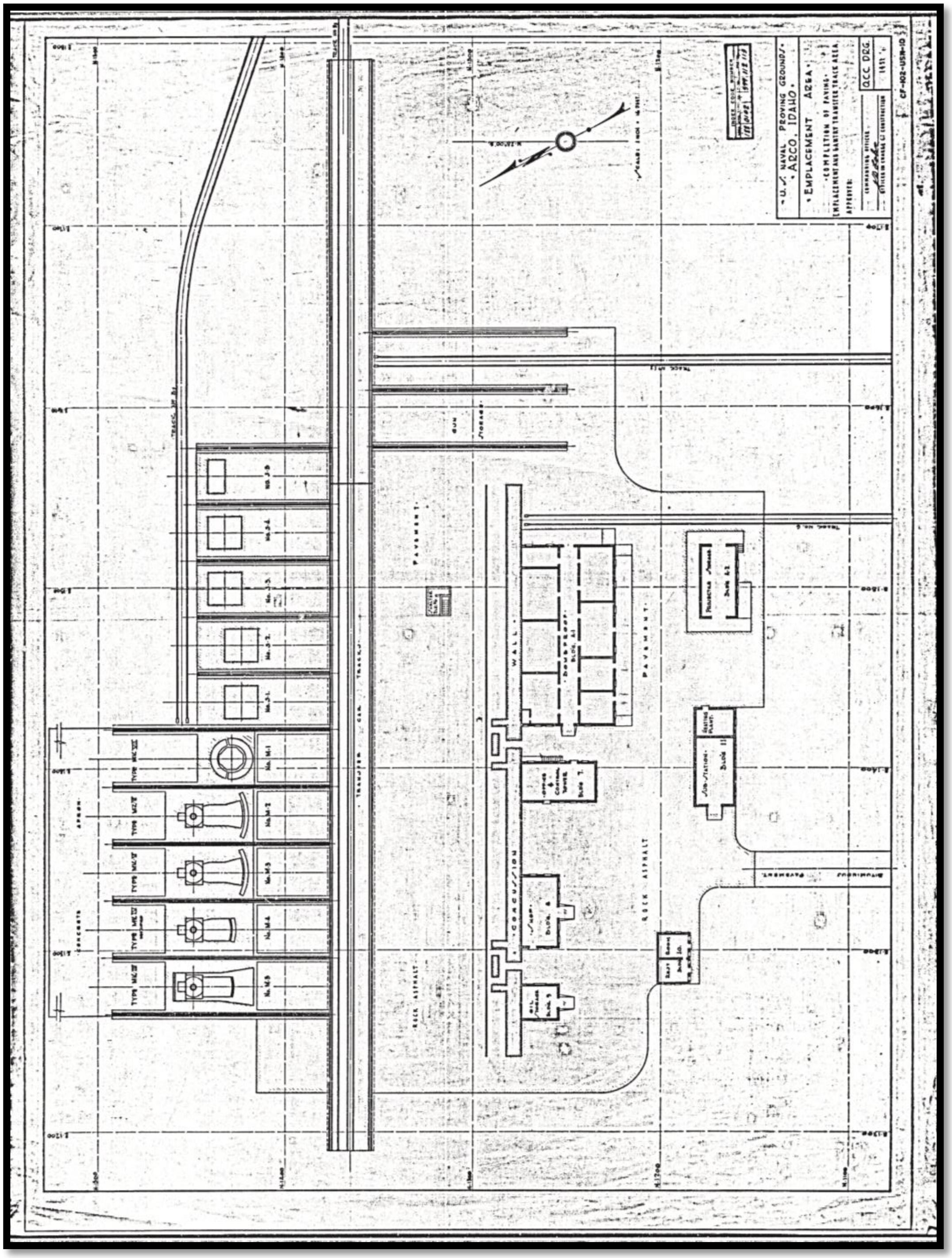


Figure 5.23: INL drawing number 112113 (CF-102-USN-10); proof / emplacement area, completion of paving, emplacement and gantry transfer track area; ca. 1944.

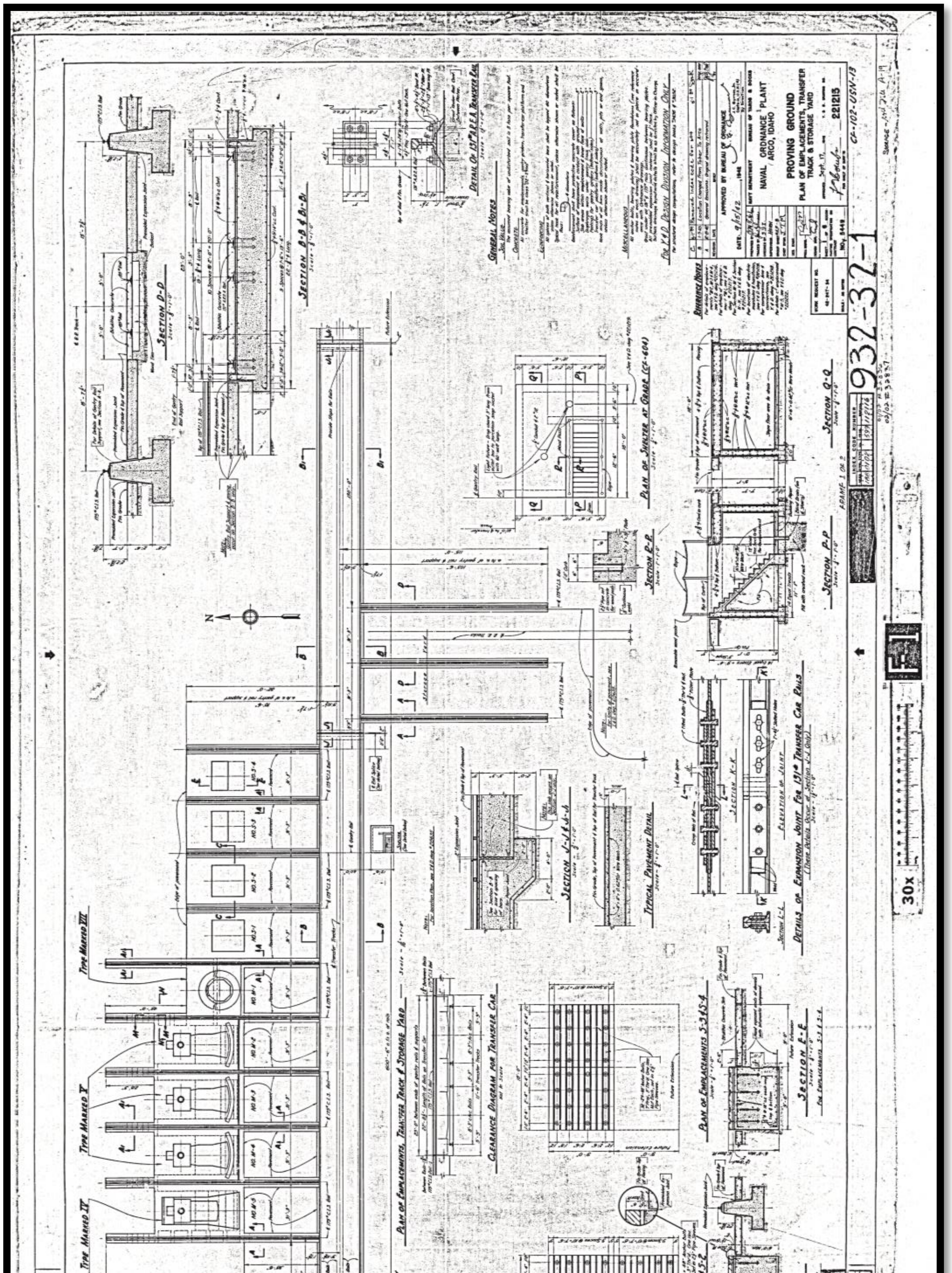


Figure 5.24: INL drawing number 112116 (CF-102-USN-13); proof / gun emplacement area, transfer track and storage yard, frame 1 of 2; September 1942.

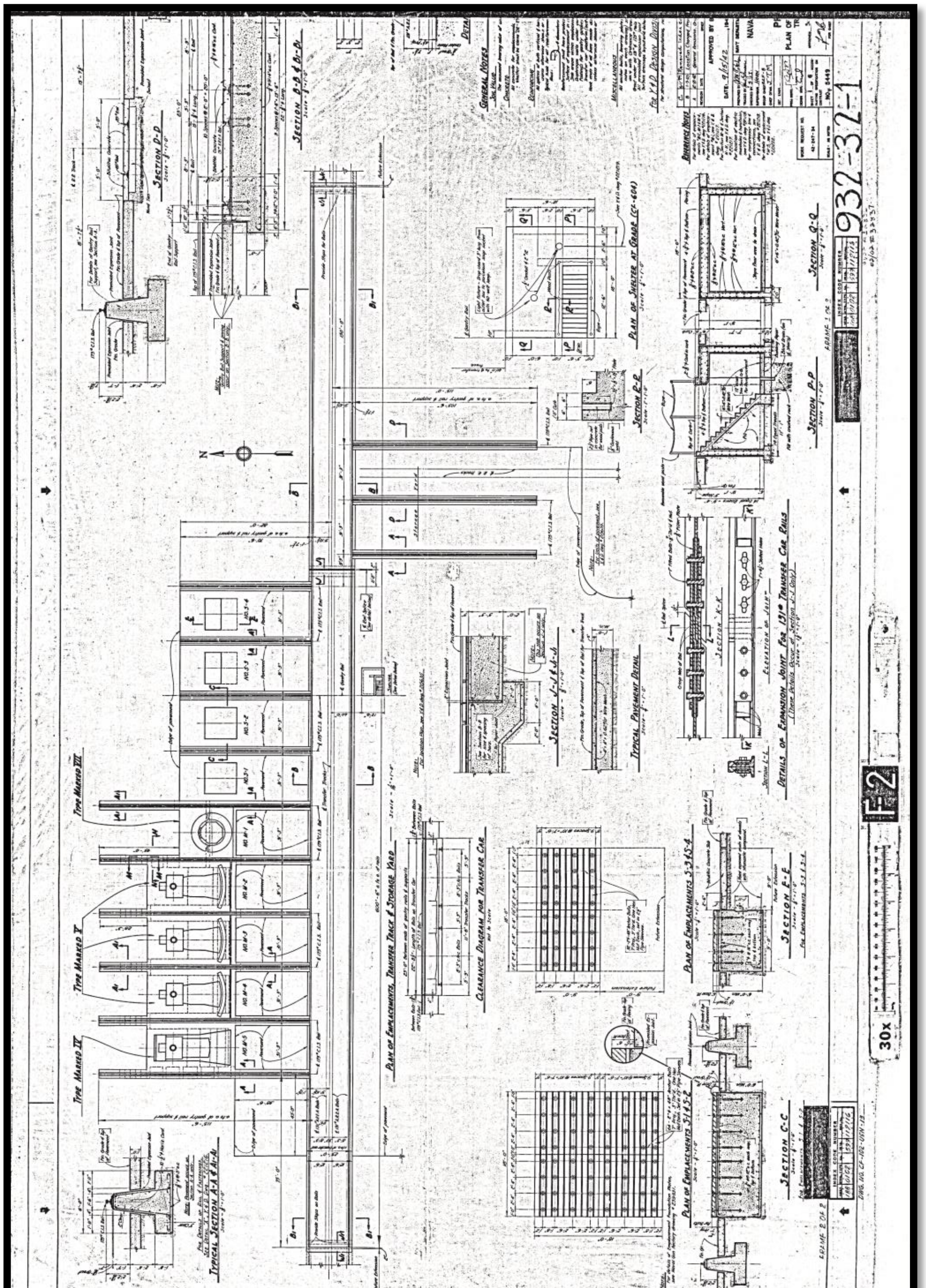


Figure 5.25: INL drawing number 112116 (CF-102-USN-13); proof / gun emplacement area, transfer track and storage yard, frame 2 of 2; September 1942.

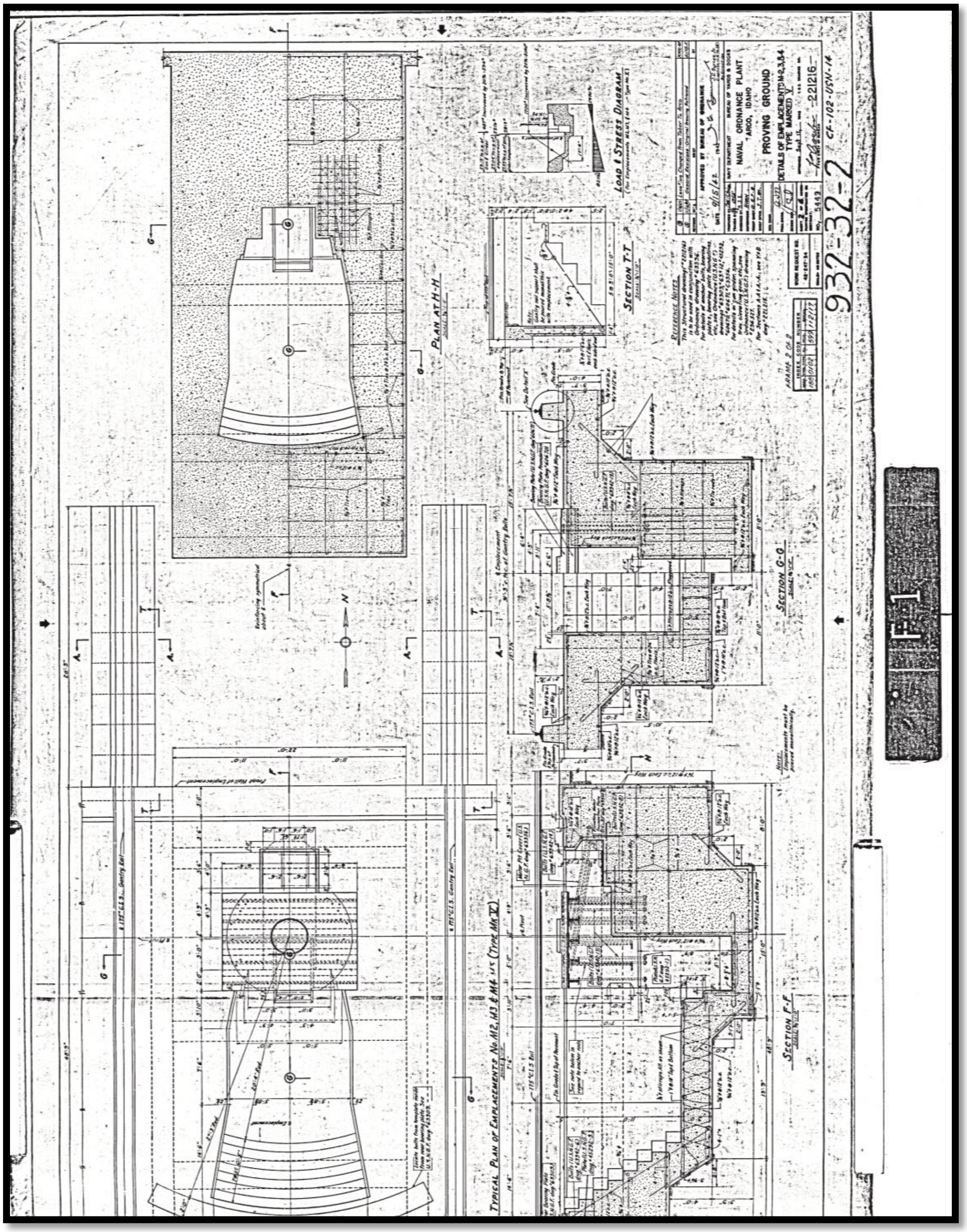


Figure 5.26: INL drawing number 112117 (CF-102-USN-14); proof / gun emplacement area, details of emplacements M-2, -3, and -4, typed marked V, frame 1 of 2; September 1942.

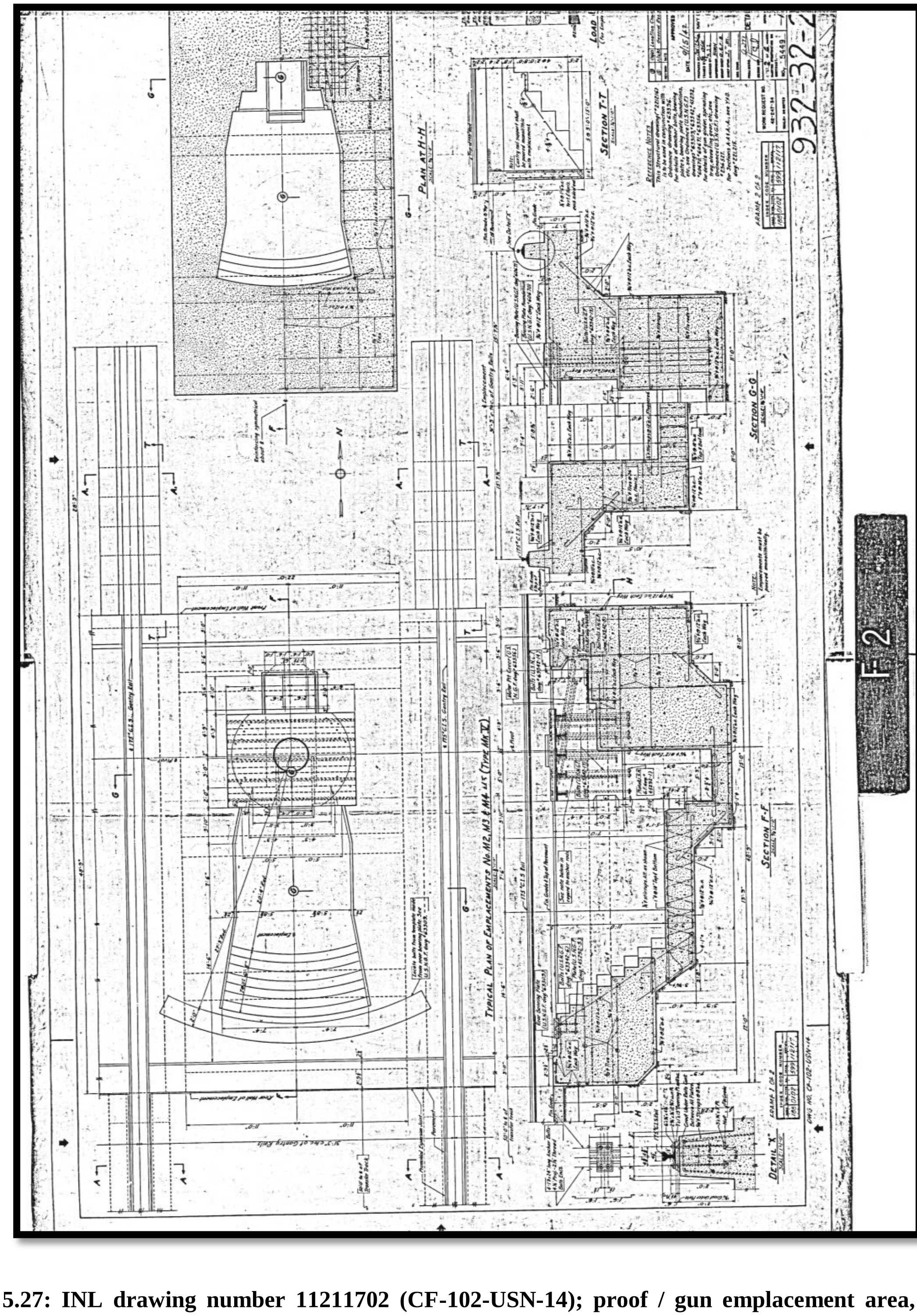


Figure 5.27: INL drawing number 11211702 (CF-102-USN-14); proof / gun emplacement area, details of emplacements M-2, -3, and -4, typed marked V, frame 2 of 2; September 1942.

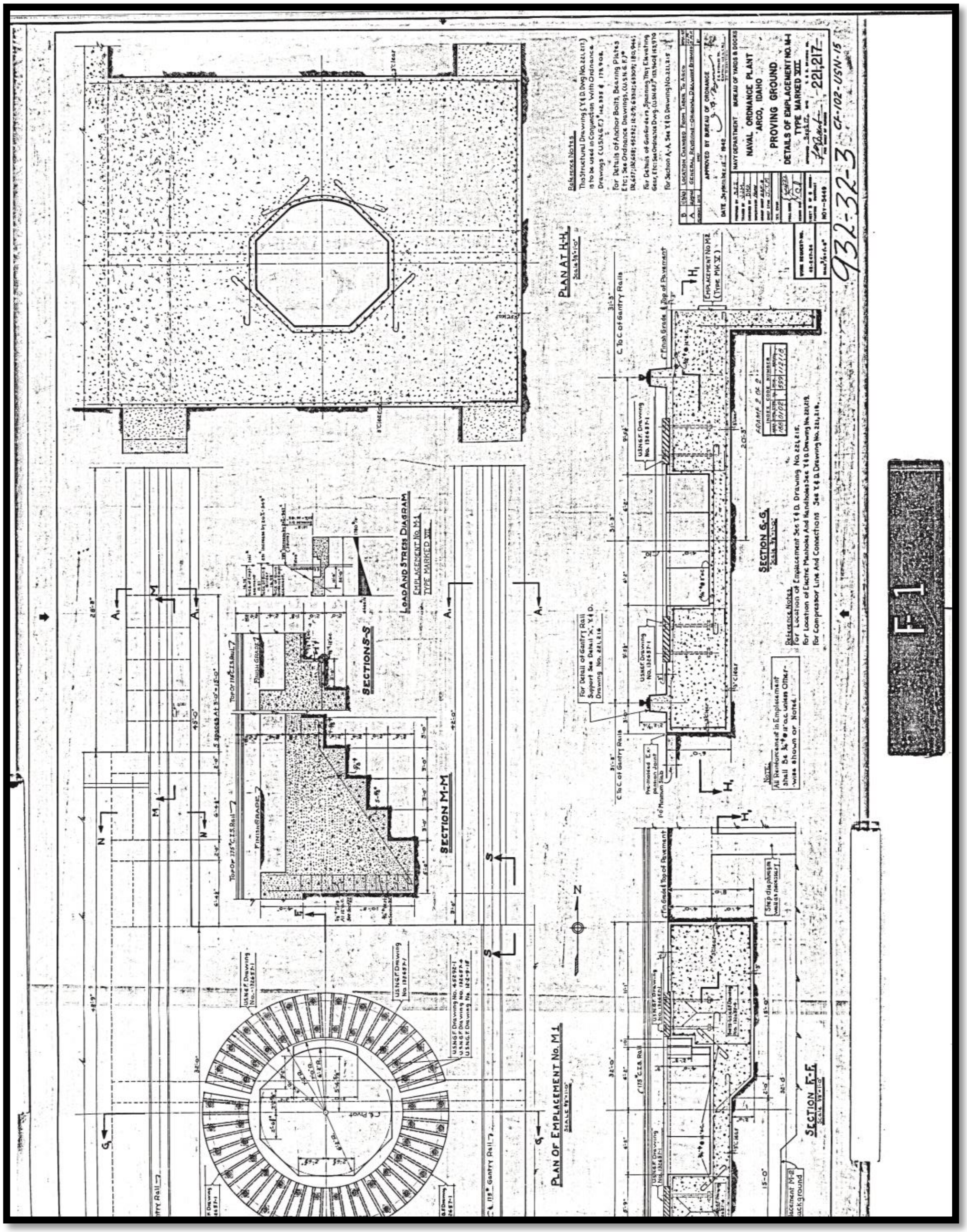


Figure 5.28: INL drawing number 112118 (CF-102-USN-15); proof / gun emplacement area, details of emplacement no. M-1, type marked VII; frame 1 of 2; September 1942.

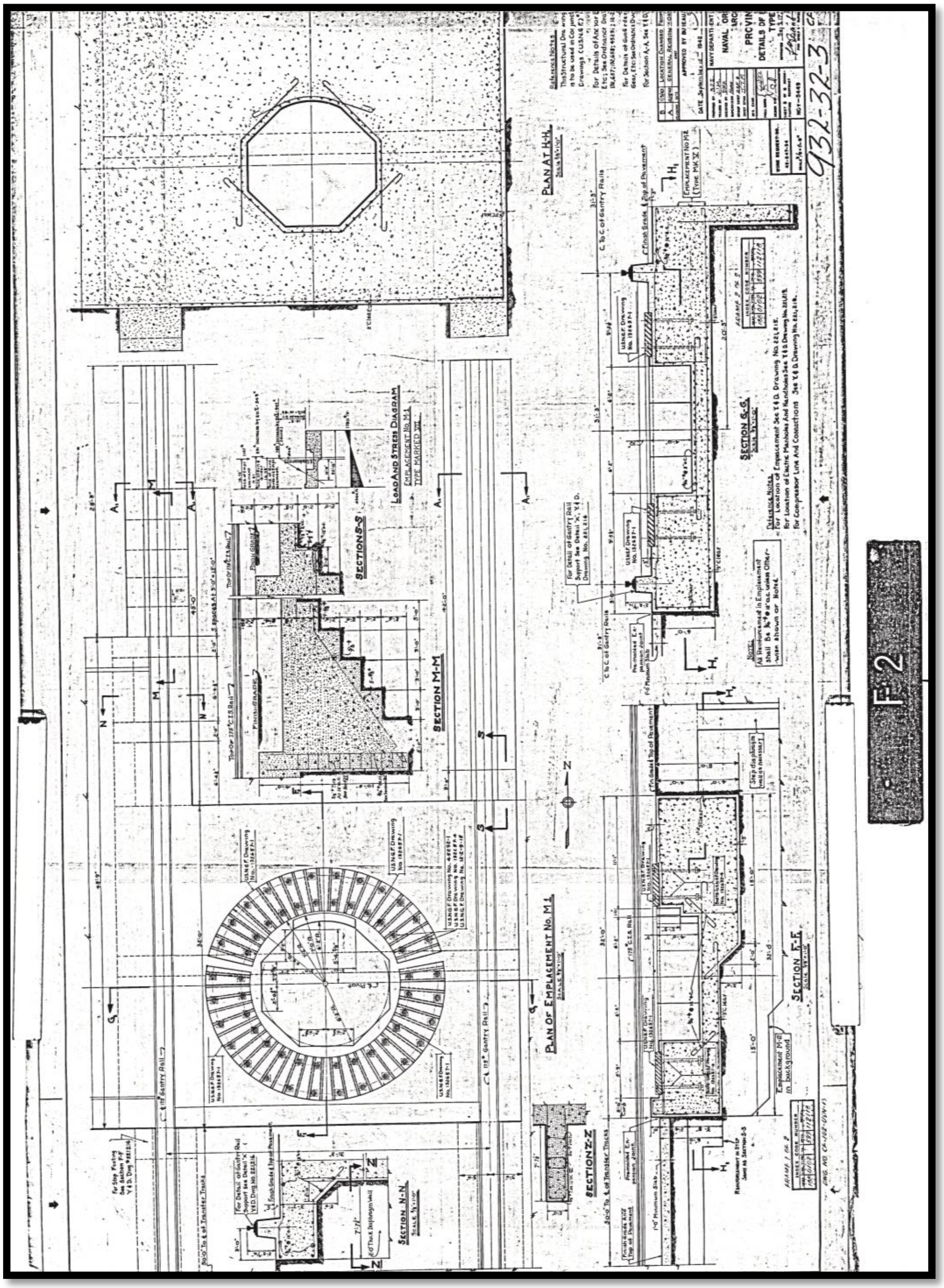


Figure 5.29: INL drawing number 11211802 (CF-102-USN-15); proof / gun emplacement area, details of emplacement no. M-1, type marked VII; frame 2 of 2; September 1942.

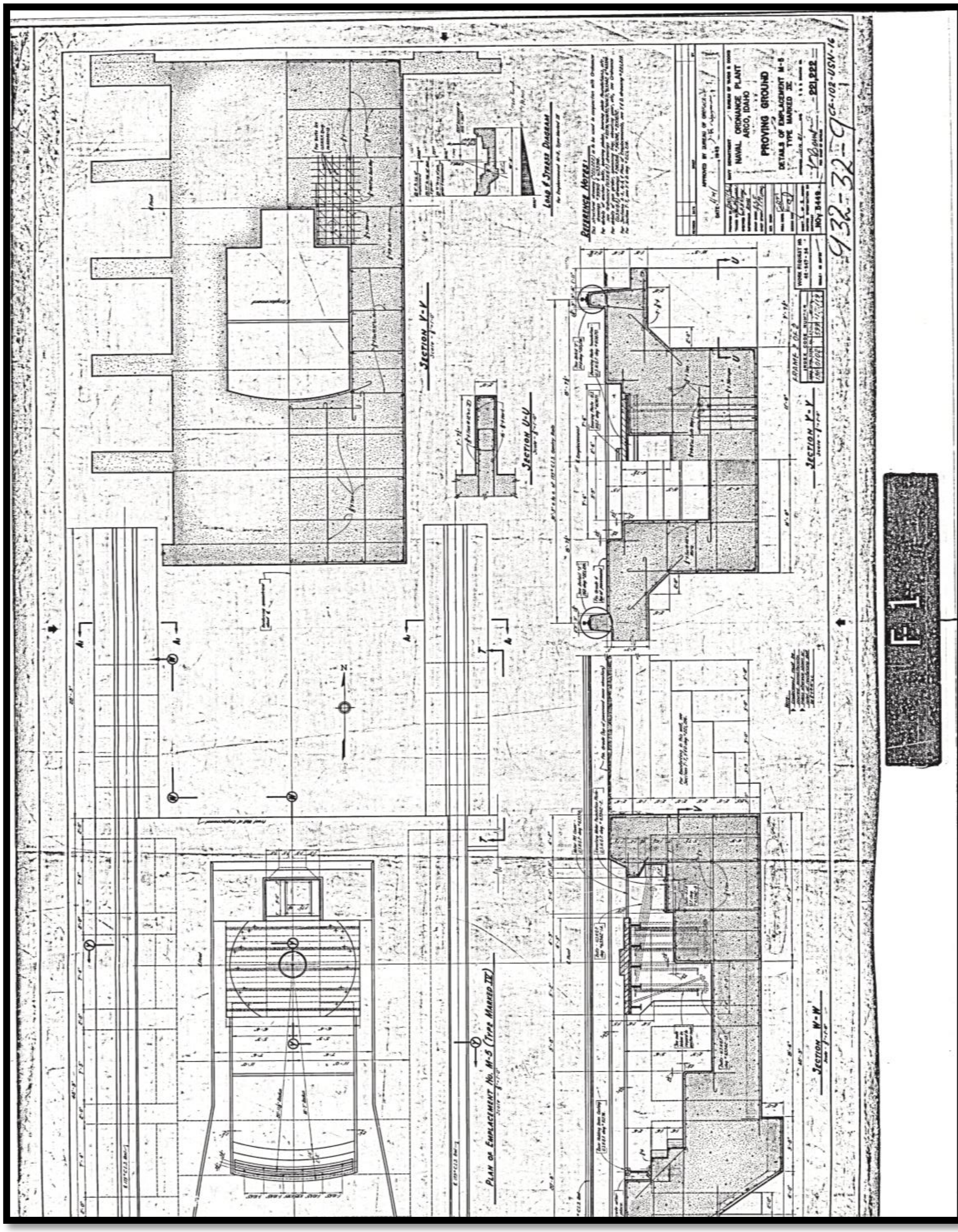


Figure 5.30: INL drawing number 112119 (CF-102-USN-16); proof / gun emplacement area, details of emplacement M-5, type marked IV, frame 1 of 2; January 1943.

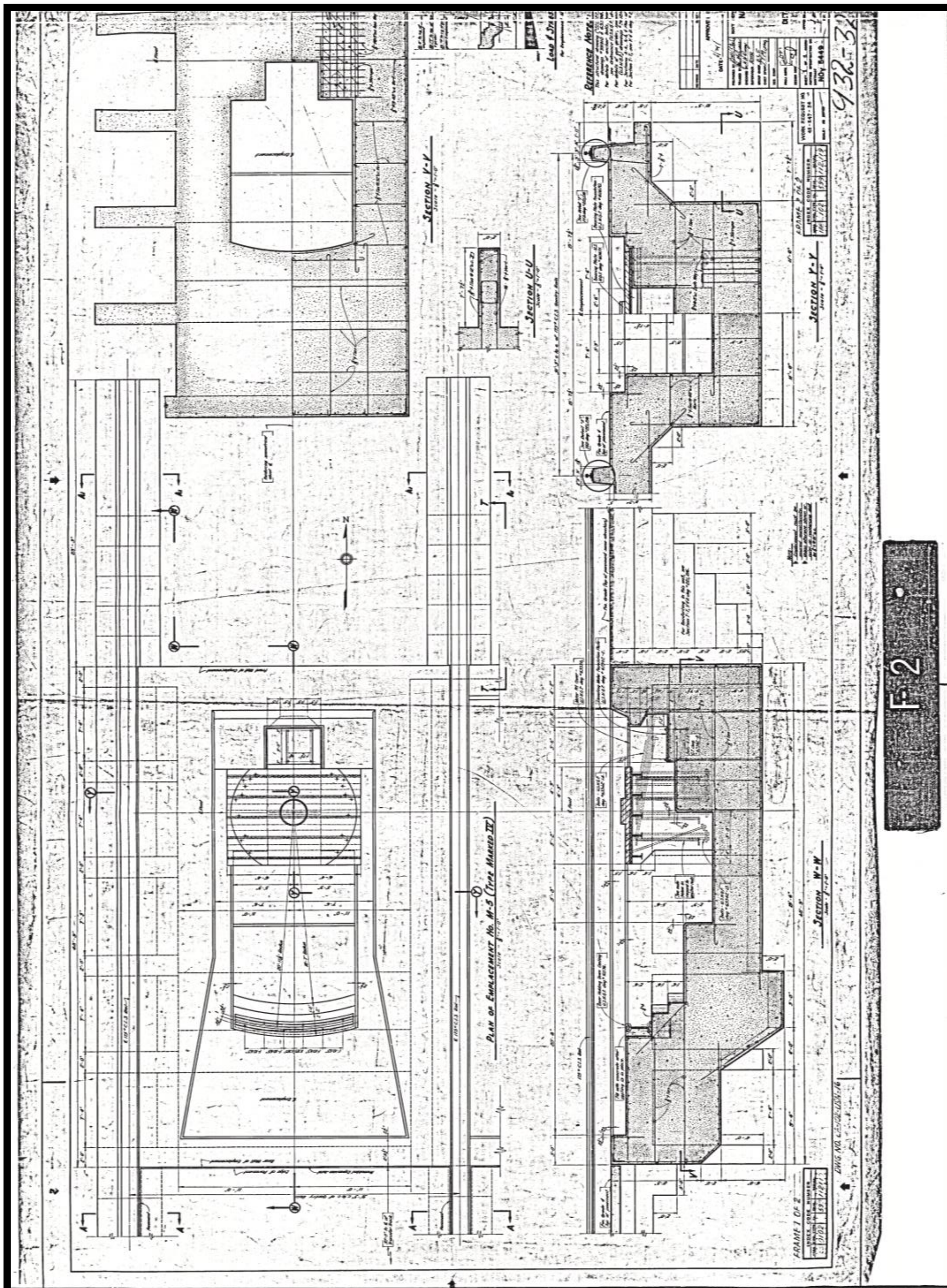


Figure 5.31: INL drawing number 11211902 (CF-102-USN-16); proof / gun emplacement area, details of emplacement M-5, type marked IV, frame 2 of 2; January 1943.

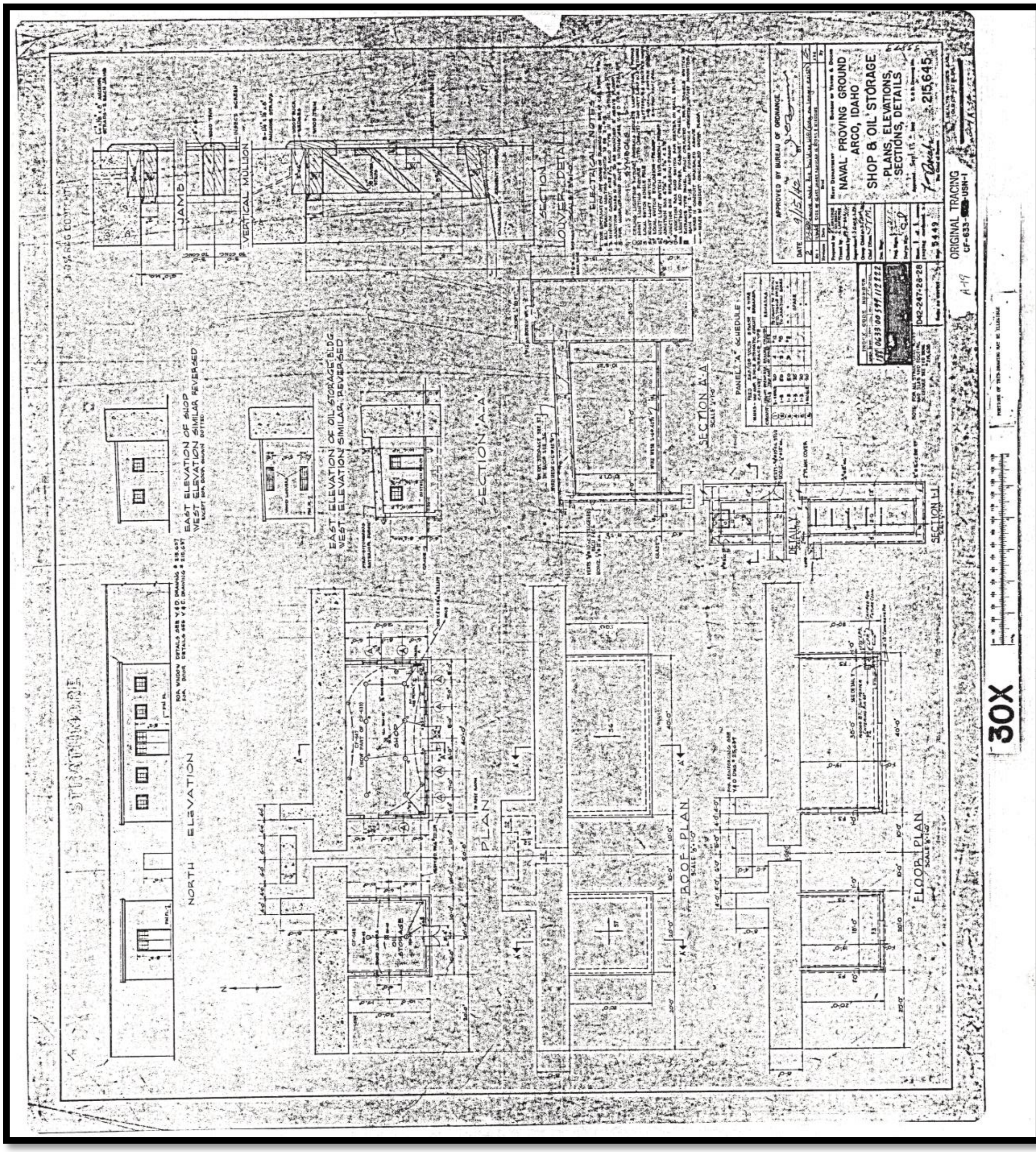


Figure 5.32: INL drawing number 112222 (CF-633-648-USN-1); shop and oil storage (CFA-647 and CFA-648, additions on southwest elevation of concussion wall / CFA-633 - extant), plans, elevations, sections, and details; September 1942.

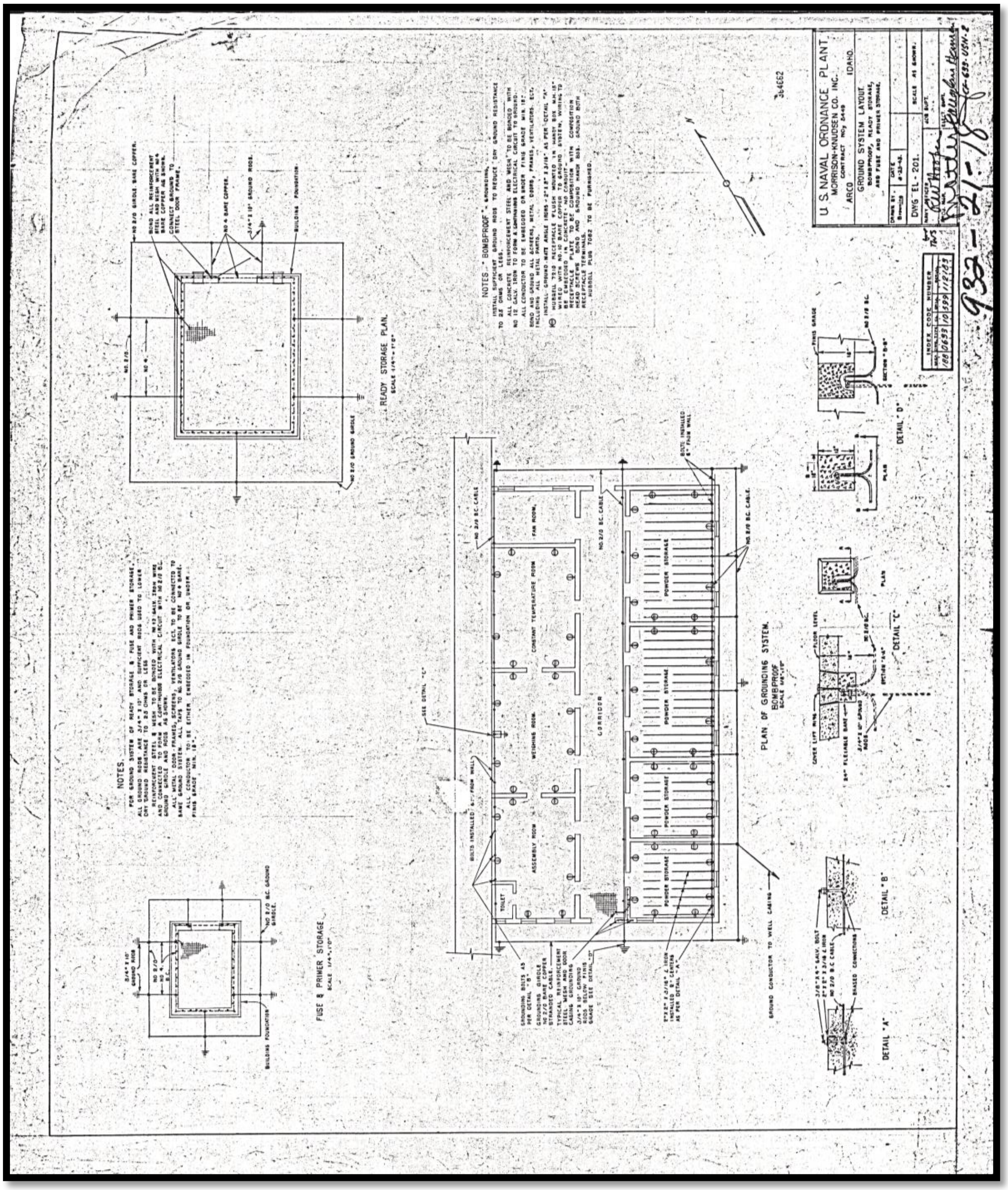


Figure 5.33: INL drawing number 112183 (CF-633-USN-2); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), ground system layout, bombproof ready storage, and fuse and primer storage; 1943.

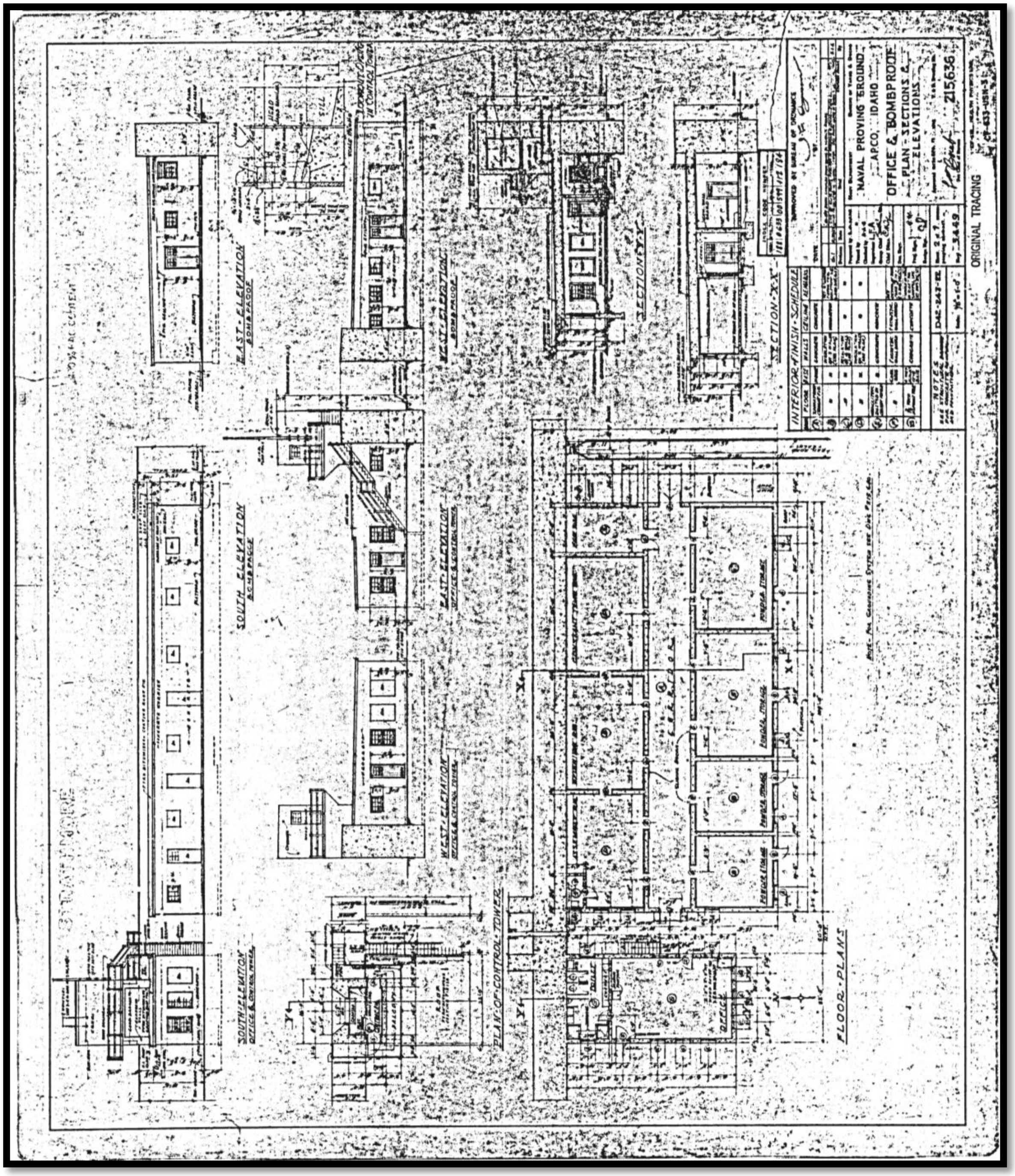


Figure 5.34: INL drawing number 112184 (CF-633-USN-3); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), plan, sections, and elevations; sheet 2 of 7; ca. 1943.

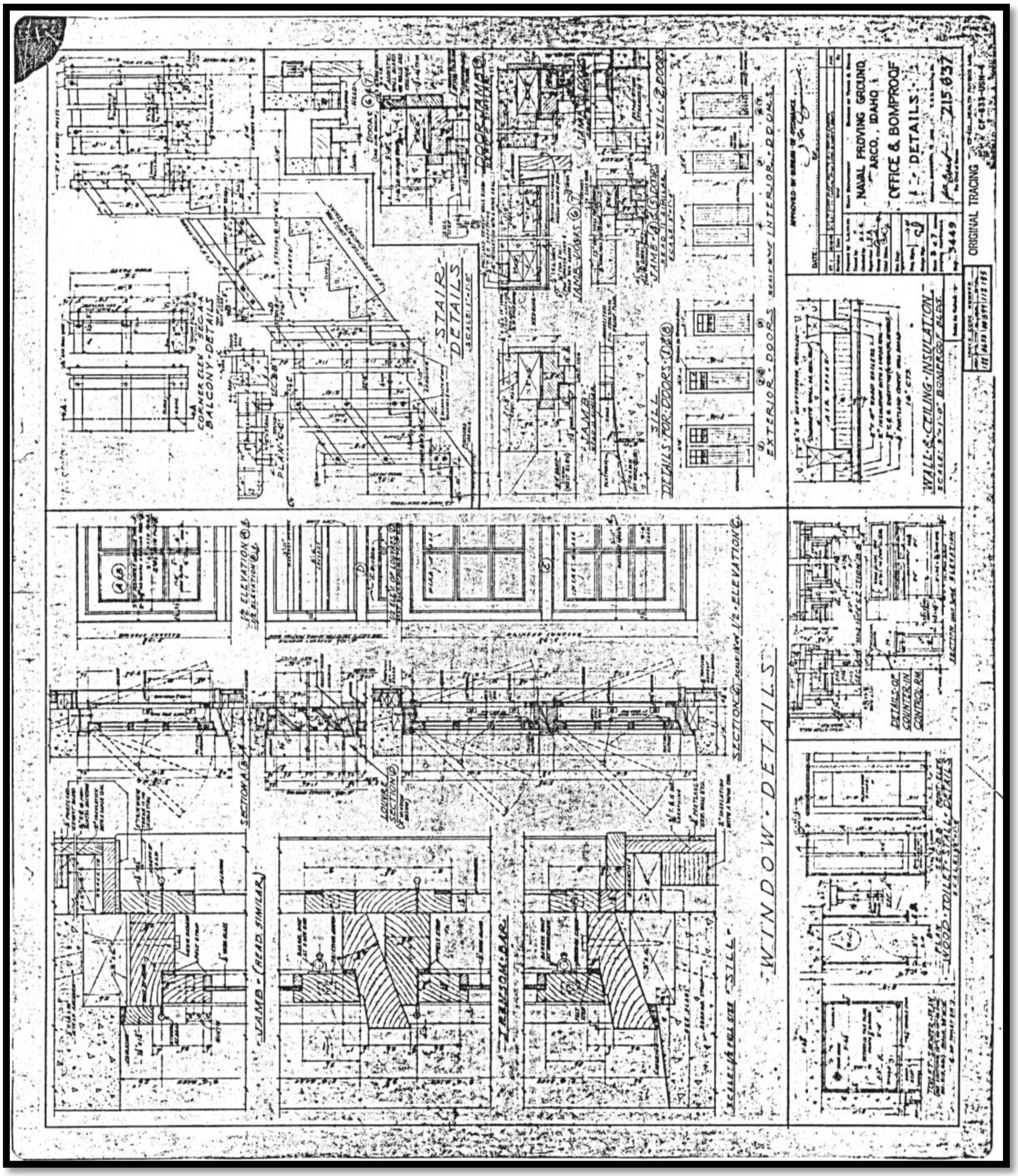


Figure 5.35: INL drawing number 112185 (CF-633-USN-4); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), details; sheet 3 of 7; ca. 1943.

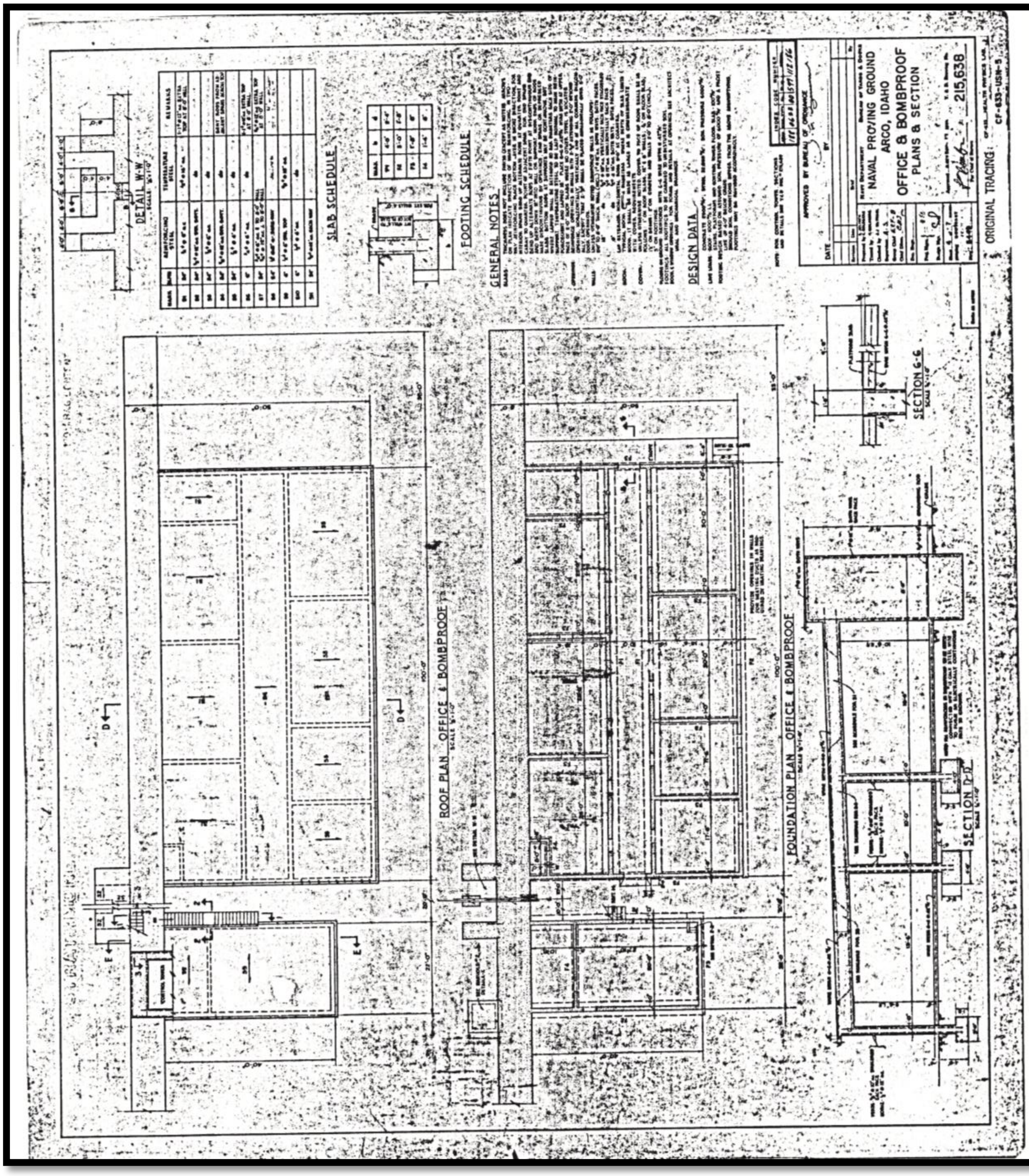


Figure 5.36: INL drawing number 112186 (CF-633-USN-5); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), plans and section; sheet 4 of 7; ca. 1943.

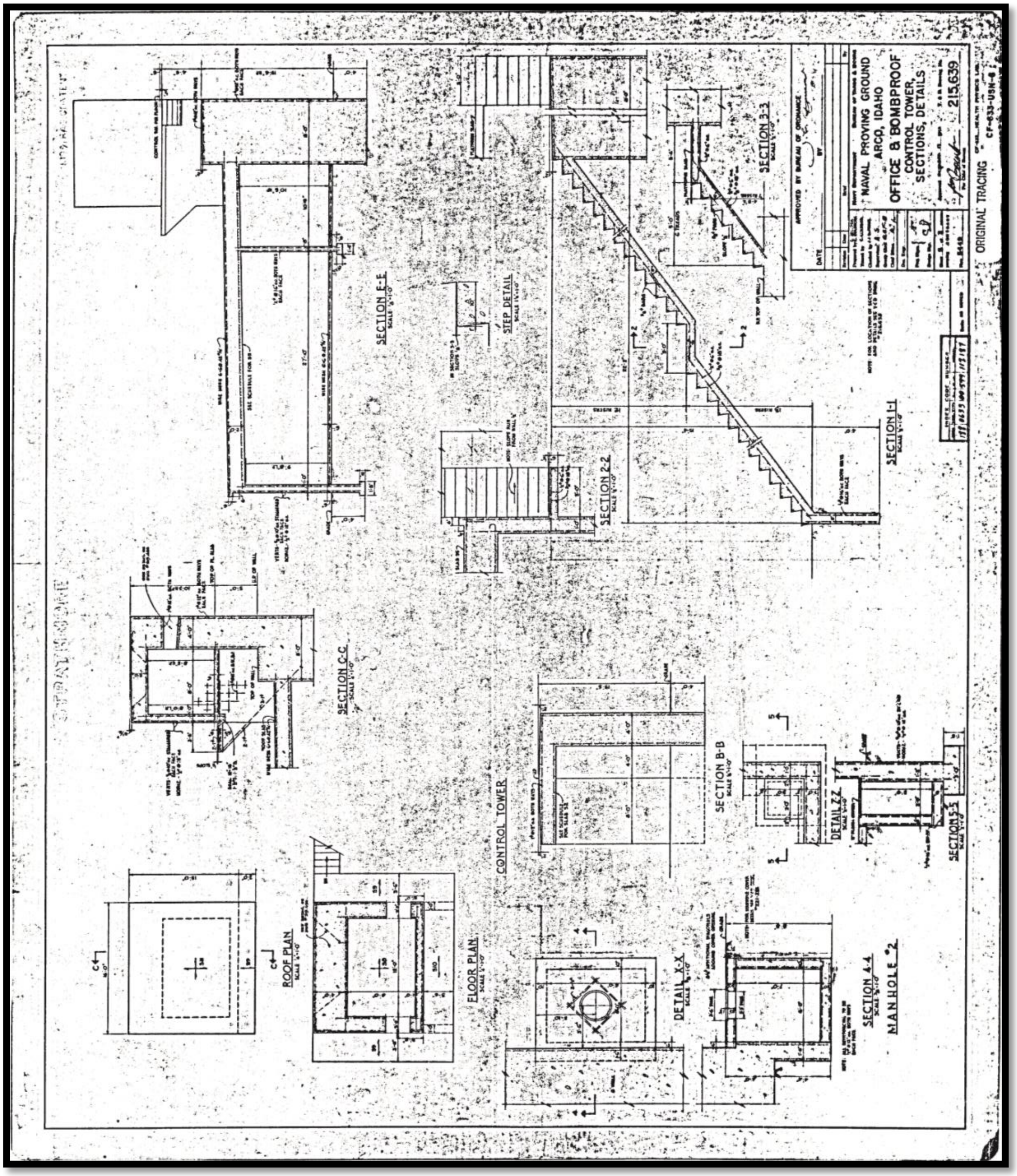


Figure 5.37: INL Drawing number 112187 (CF-633-USN-6); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), control tower, sections and details; sheet 5 of 7; ca. 1943.

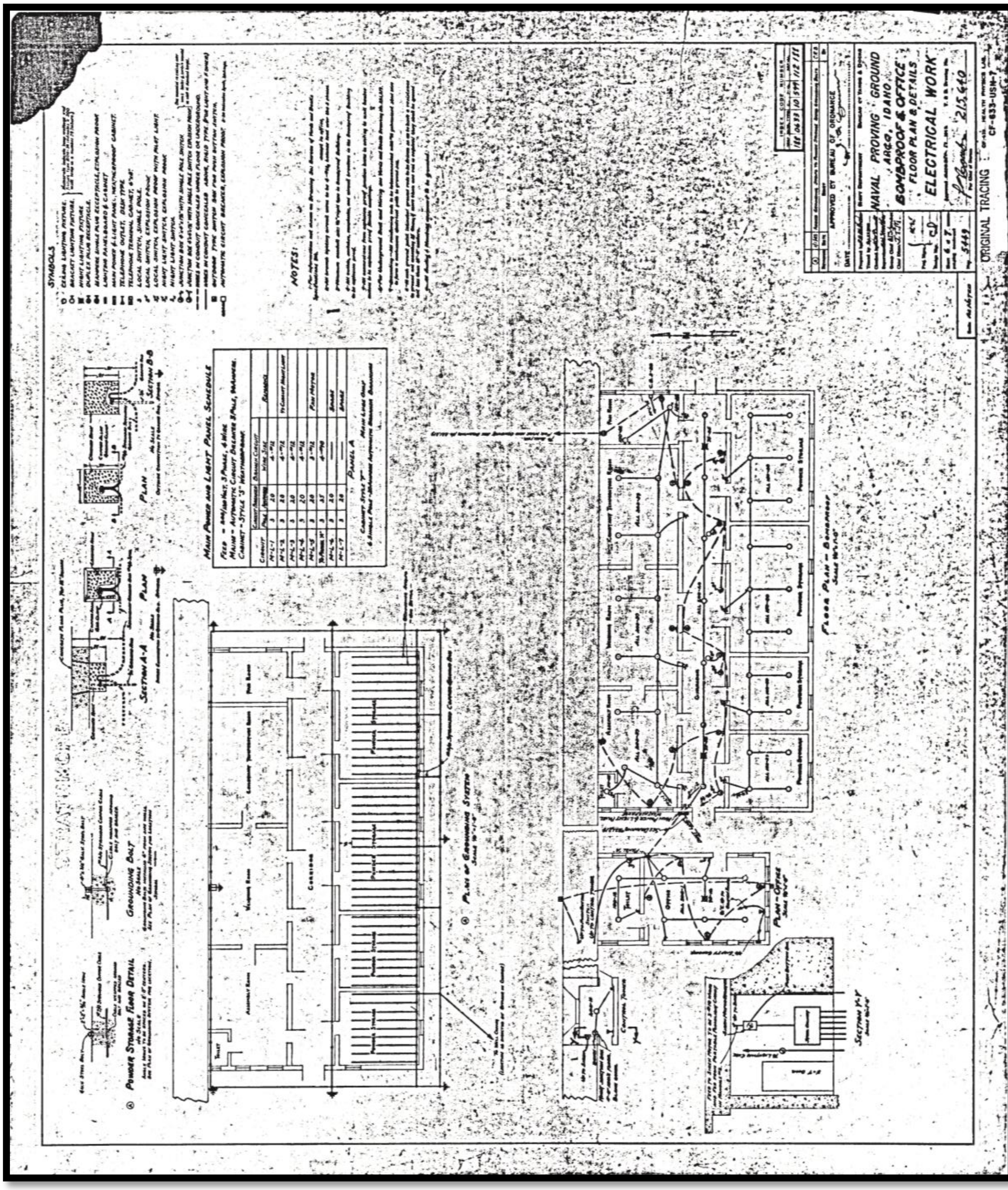


Figure 5.38: INL drawing number 112188 (CF-633-USN-7); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), floor plan and details, electrical work; sheet 6 of 7; ca. 1943.

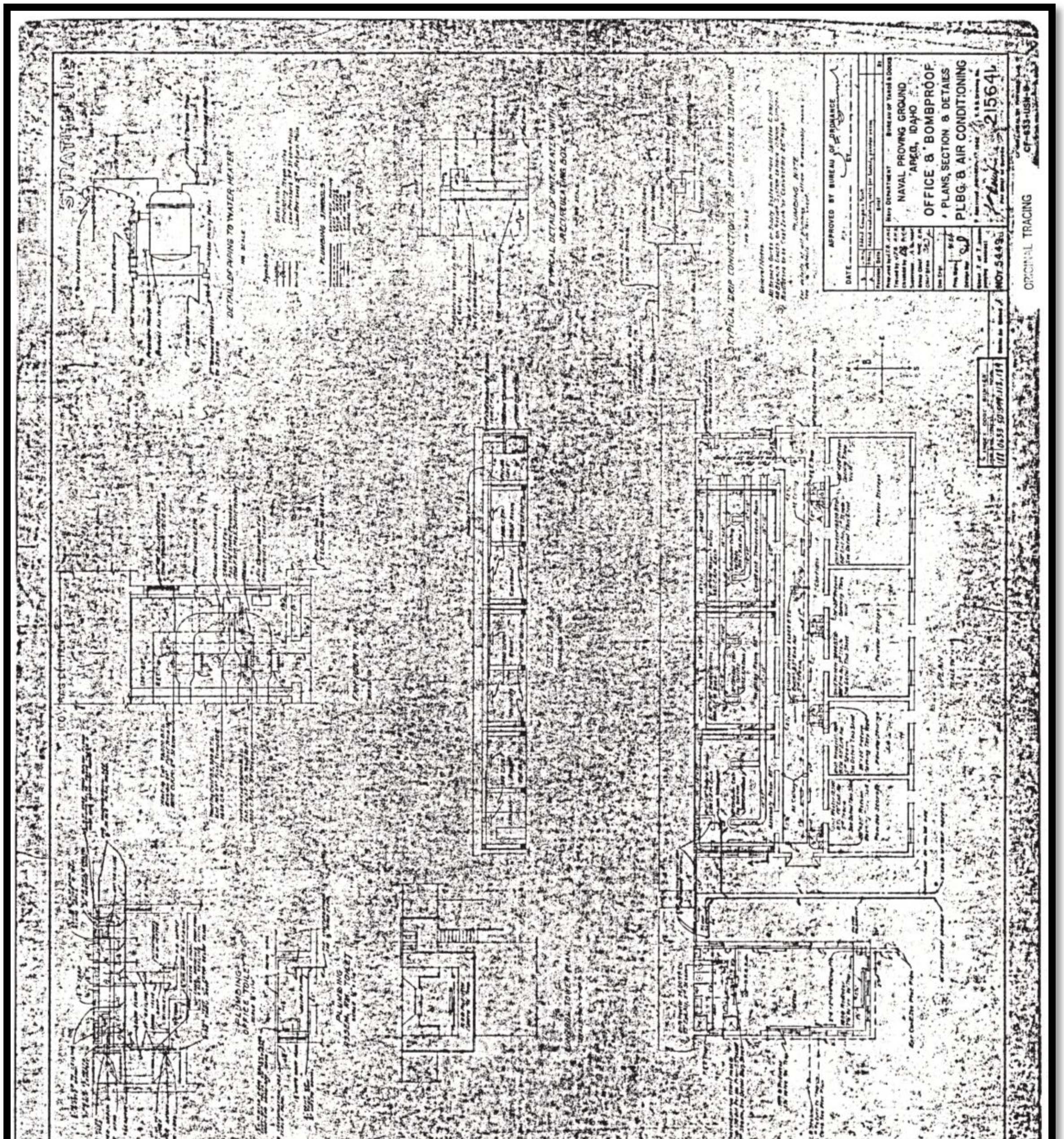


Figure 5.39: INL drawing number 112189 (CF-633-USN-8); office and bombproof storage (addition on southwest elevation of concussion wall / CFA-633 – extant), plans, section, and details, plumbing and air conditioning; sheet 7 of 7; ca. 1943.

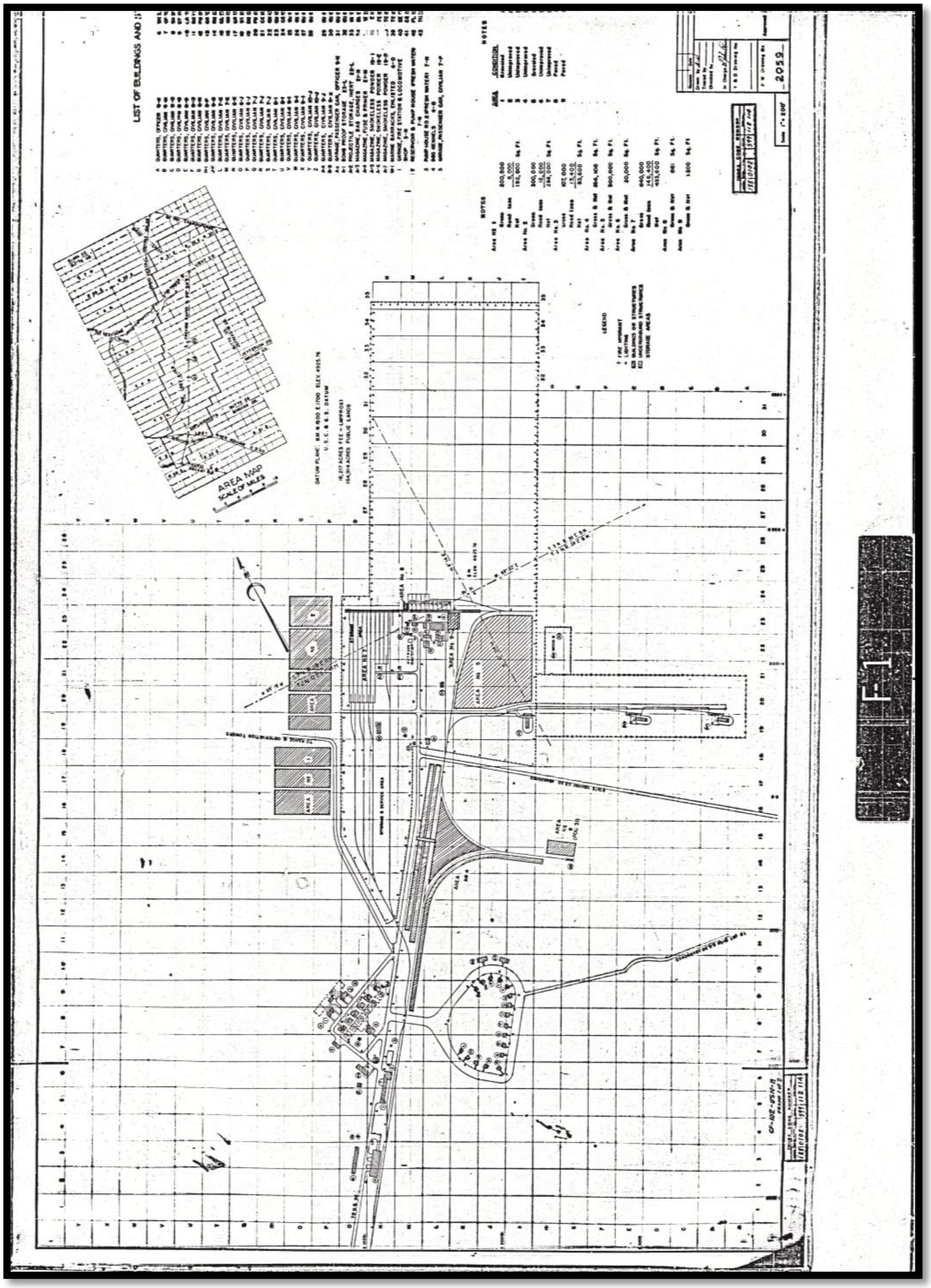


Figure 5.40: INL drawing number 112114 (CF-102-USN-11); storage yard, frame 1 of 2; June 1943.

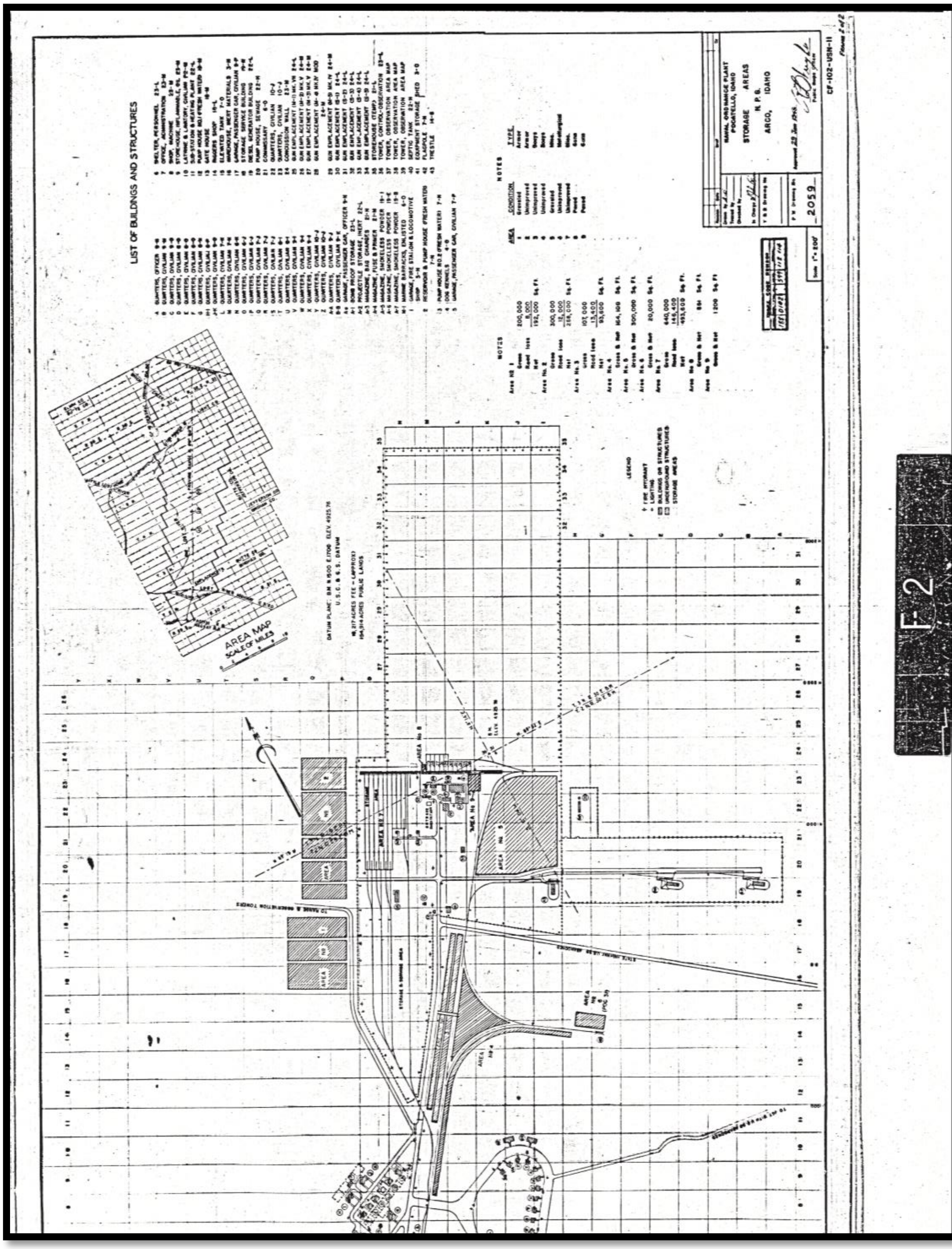


Figure 5.41: INL drawing number 112114 (CF-102-USN-11); storage yard, frame 2 of 2; June 1943.

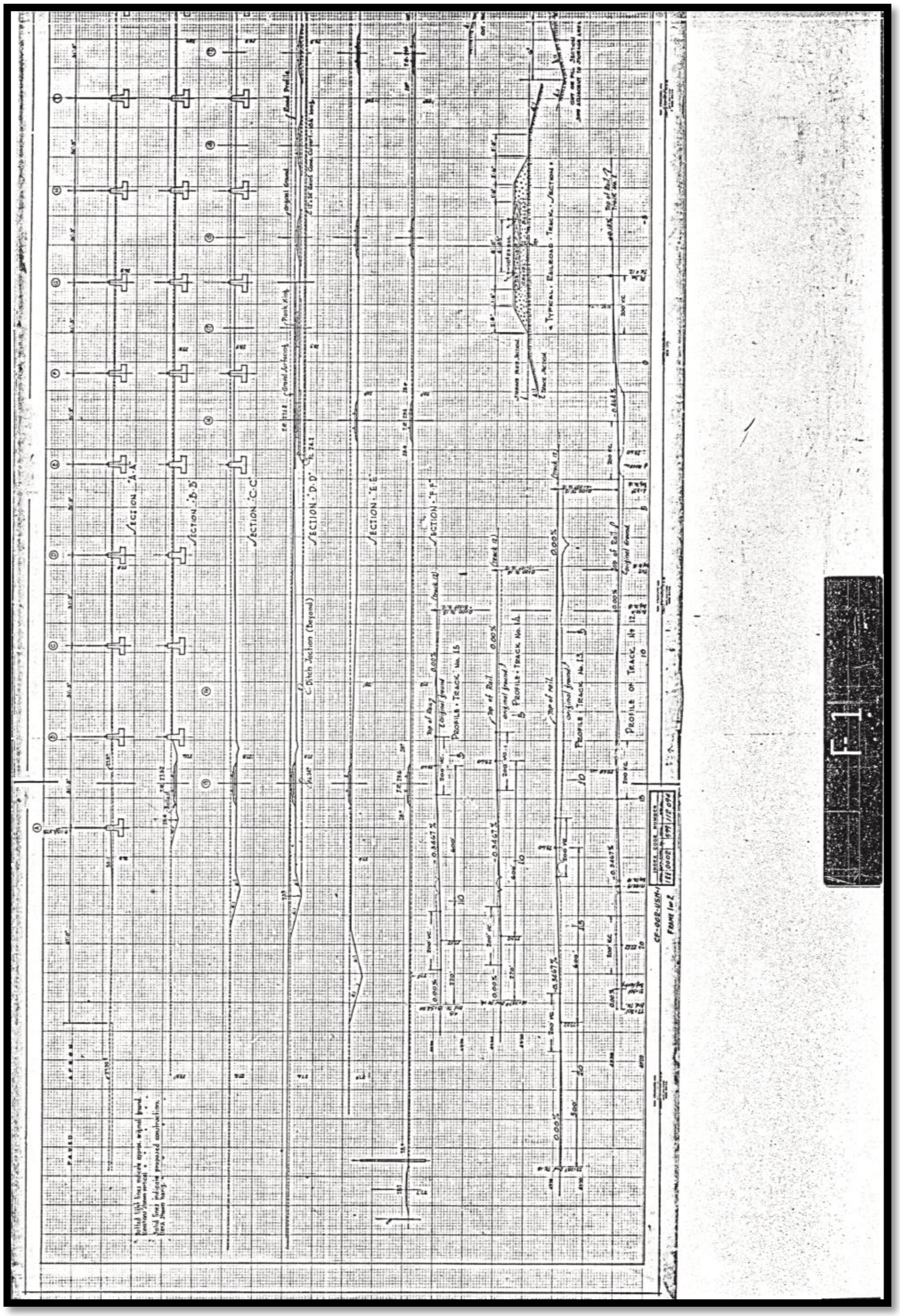


Figure 5.42: INL drawing number 112094 (CF-002-USN-1); storage yard, cross sections and profiles, frame 1 of 2; ca. 1943.

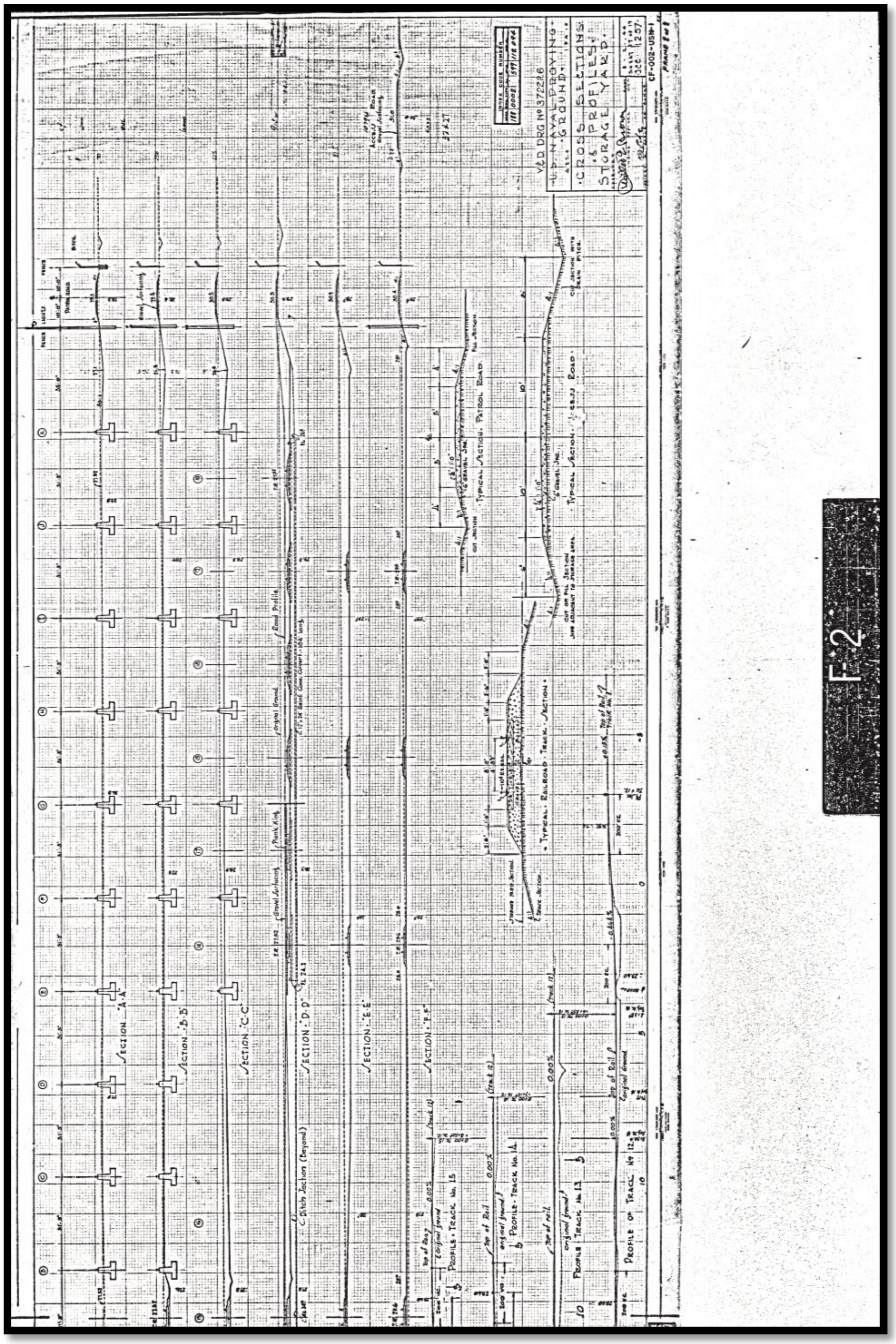


Figure 5.43: INL drawing number 112094 (CF-0020USN-1); storage yard, cross sections and profiles, frame 2 of 2; ca. 1943.

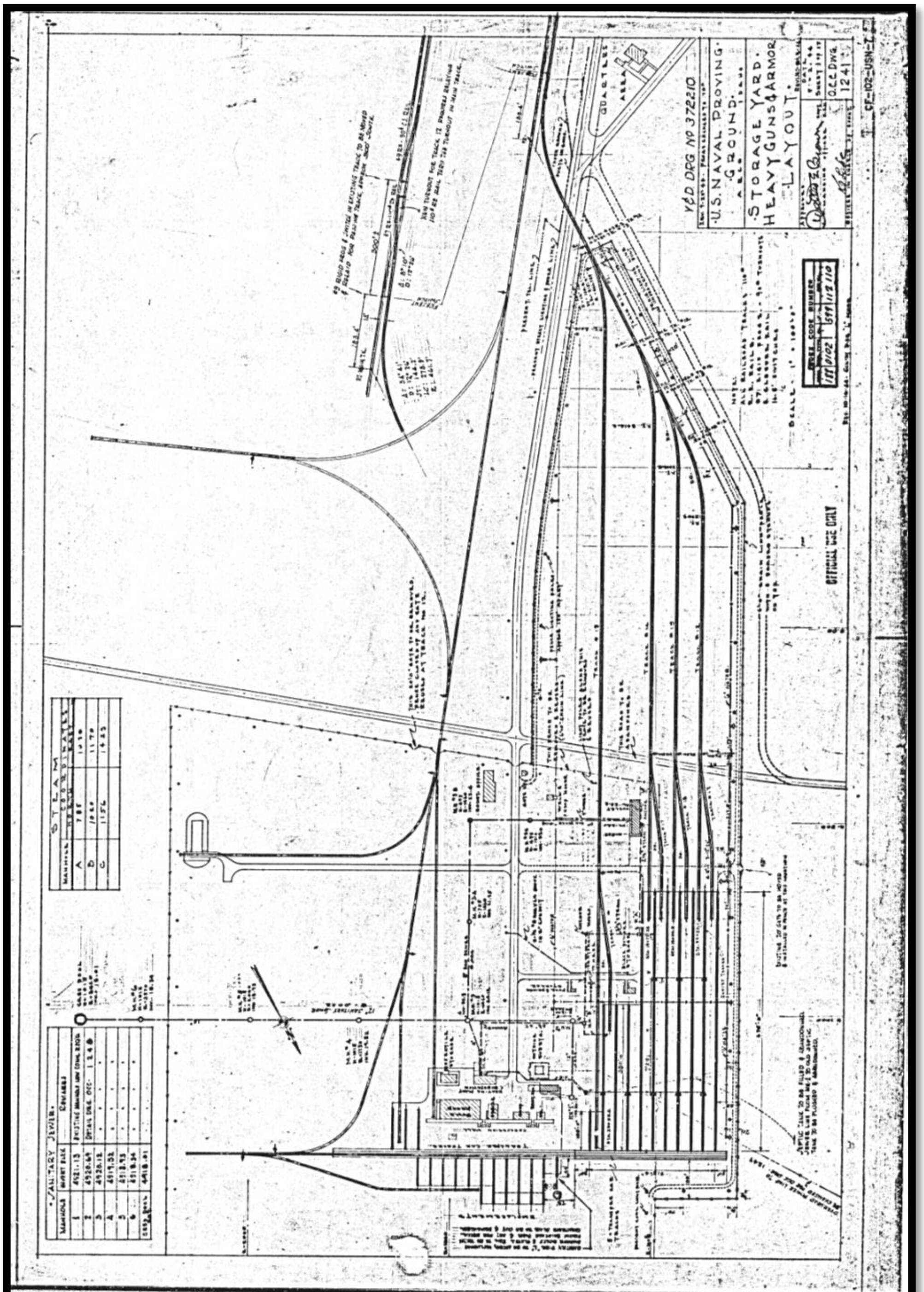


Figure 5.44: INL drawing number 112110 (CF-102-USN-7); storage yard, heavy guns and armor layout; sheet 1 of 17; July 1944.

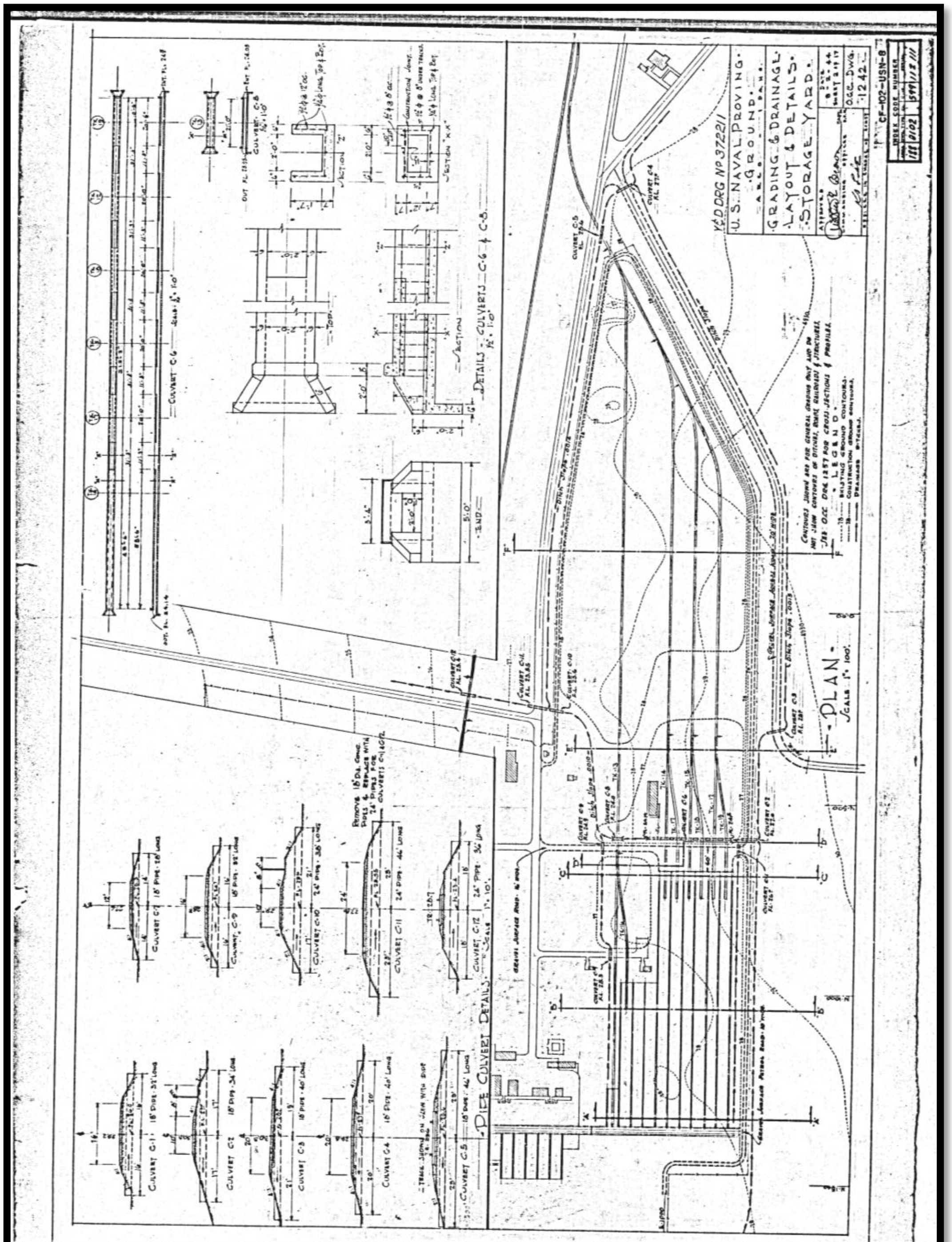


Figure 5.45: INL drawing number 112111 (CF-102-USN-8); storage yard, layout and details, grading and drainage; sheet 2 of 17; August 1944.

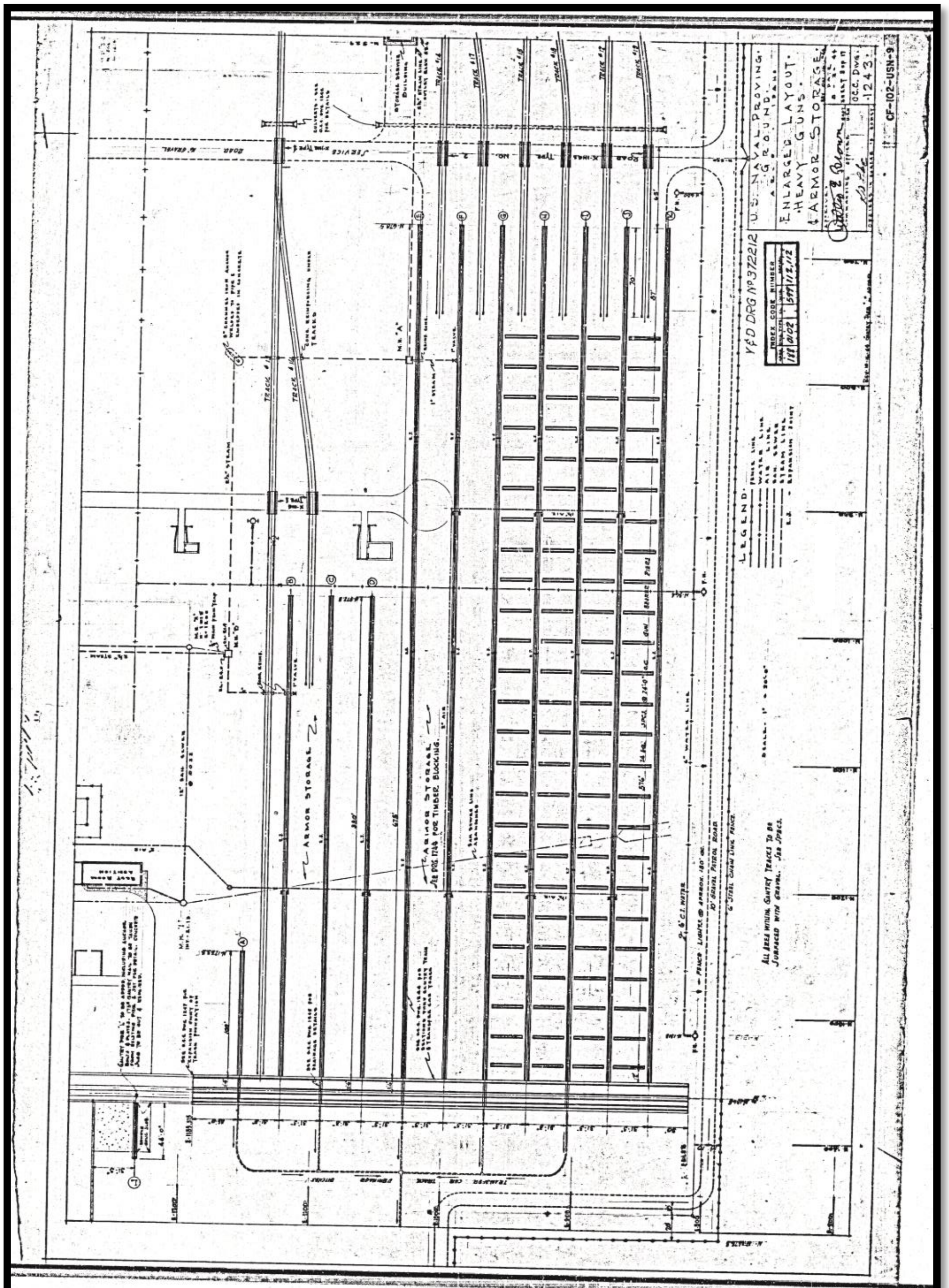


Figure 5.46: INL drawing number 112112 (CF-102-USN-9); storage yard, enlarged layout, heavy guns and armor storage; sheet 3 of 17; August 1944.

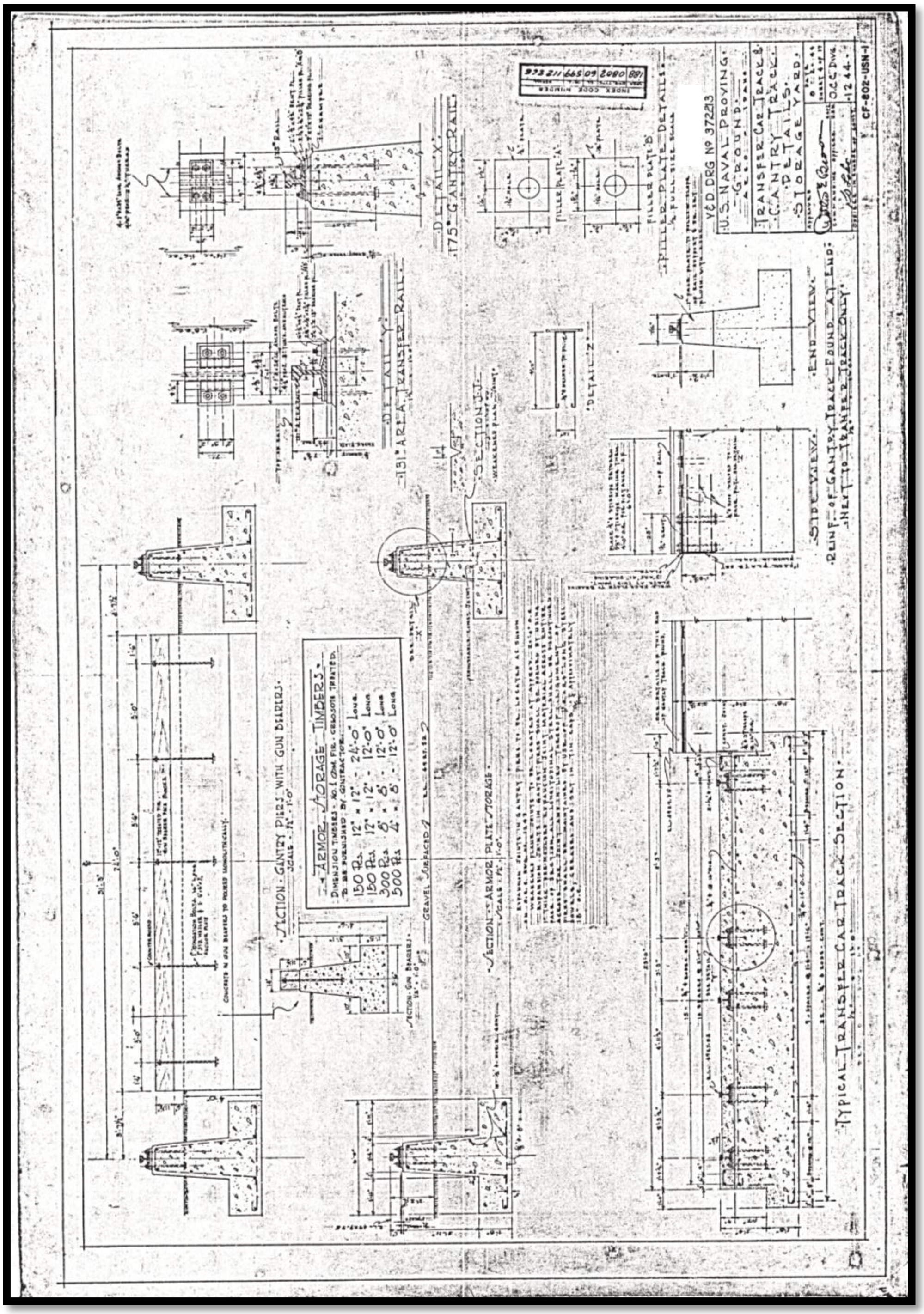


Figure 5.47: INL drawing number 112266 (CF-802-USN-1); storage yard - transfer car track and gantry crane track (CFA-802, extant), details; sheet 4 of 17; August 1944.

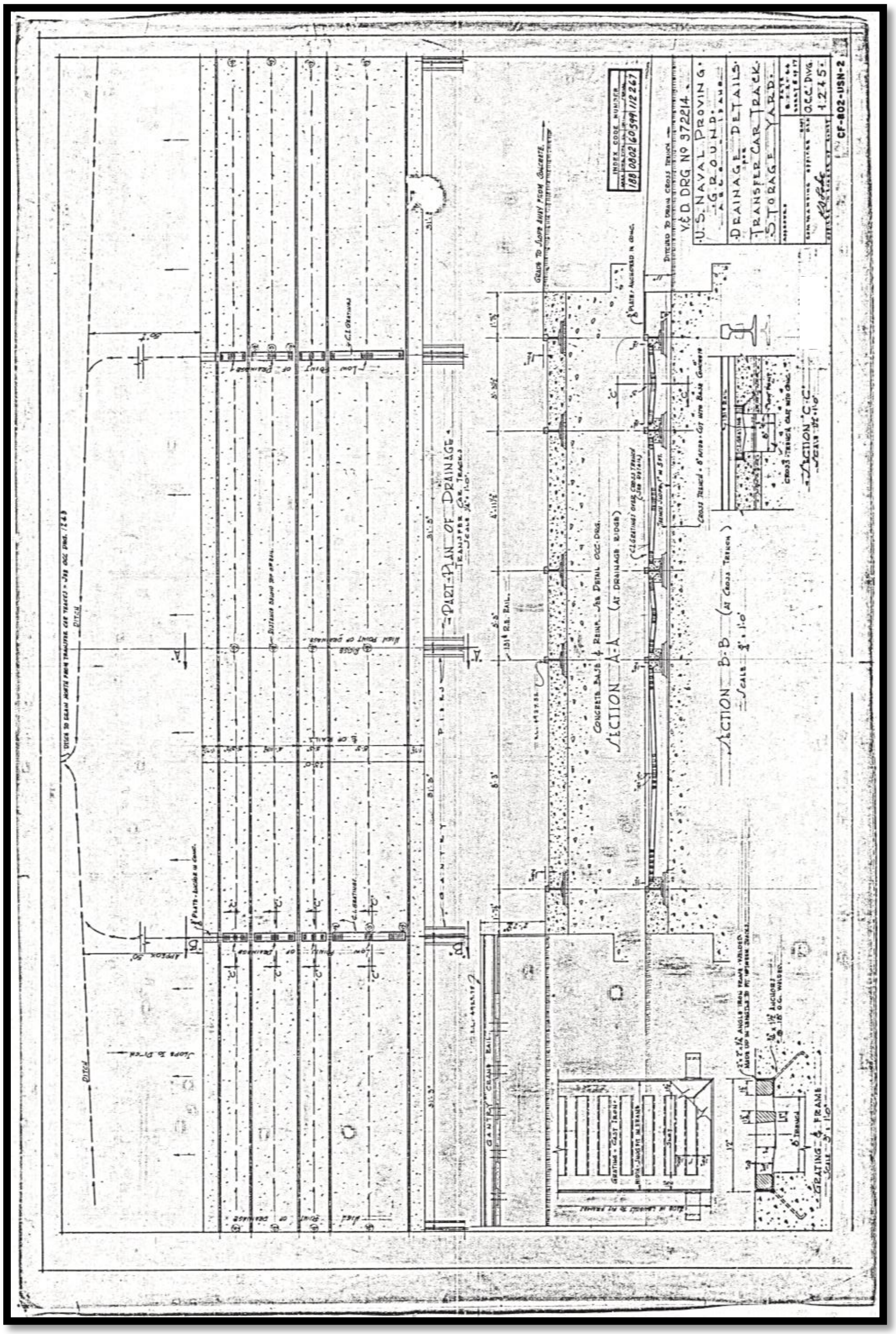


Figure 5.48: INL drawing number 112267 (CF-802-USN-2); storage yard, transfer car track (extant), drainage details; sheet 5 of 17; August 1944.

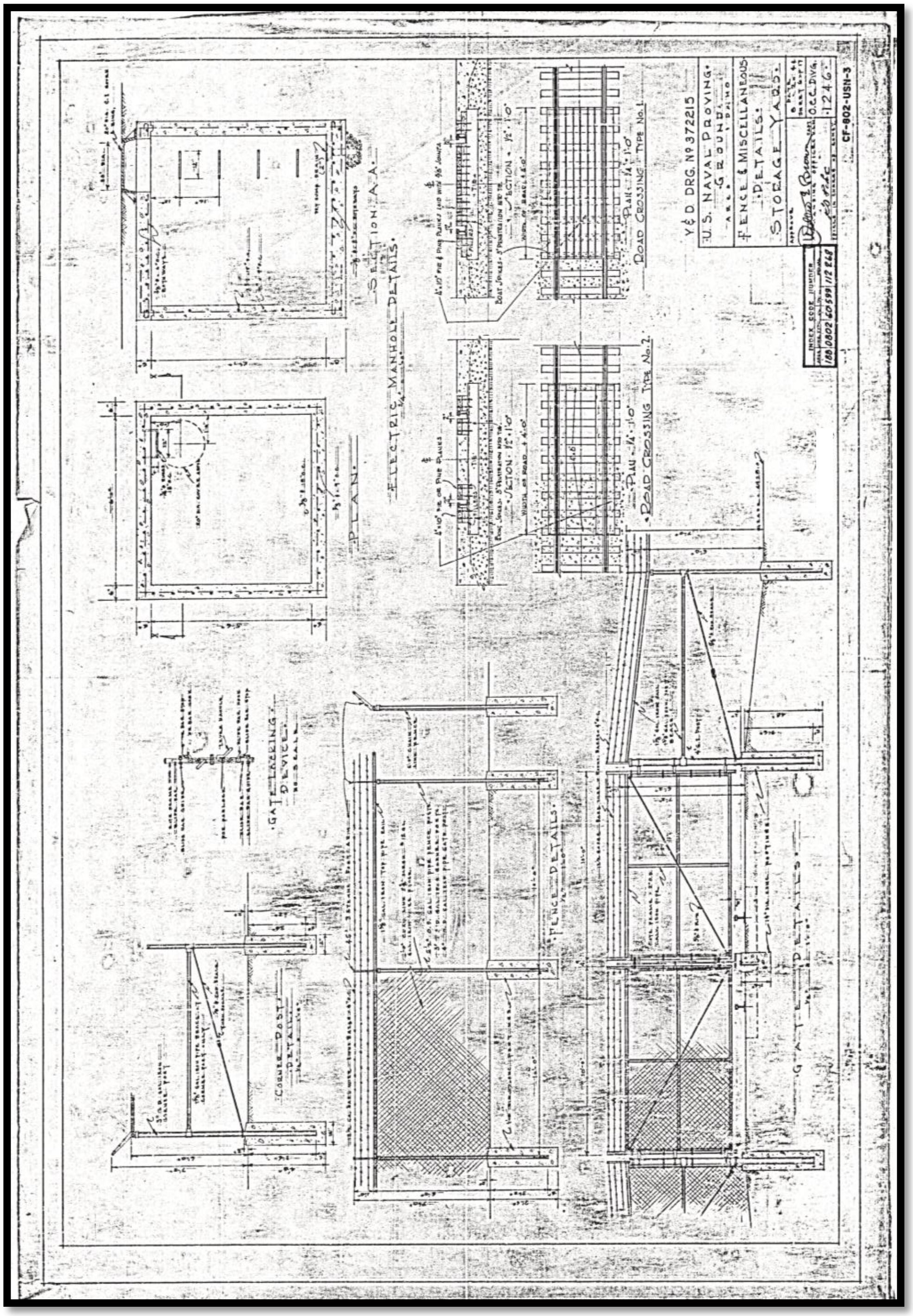


Figure 5.49: INL drawing number 112268 (CF-802-USN-3); storage yard, fence and miscellaneous details (non-extant); sheet 6 of 17; August 1944.

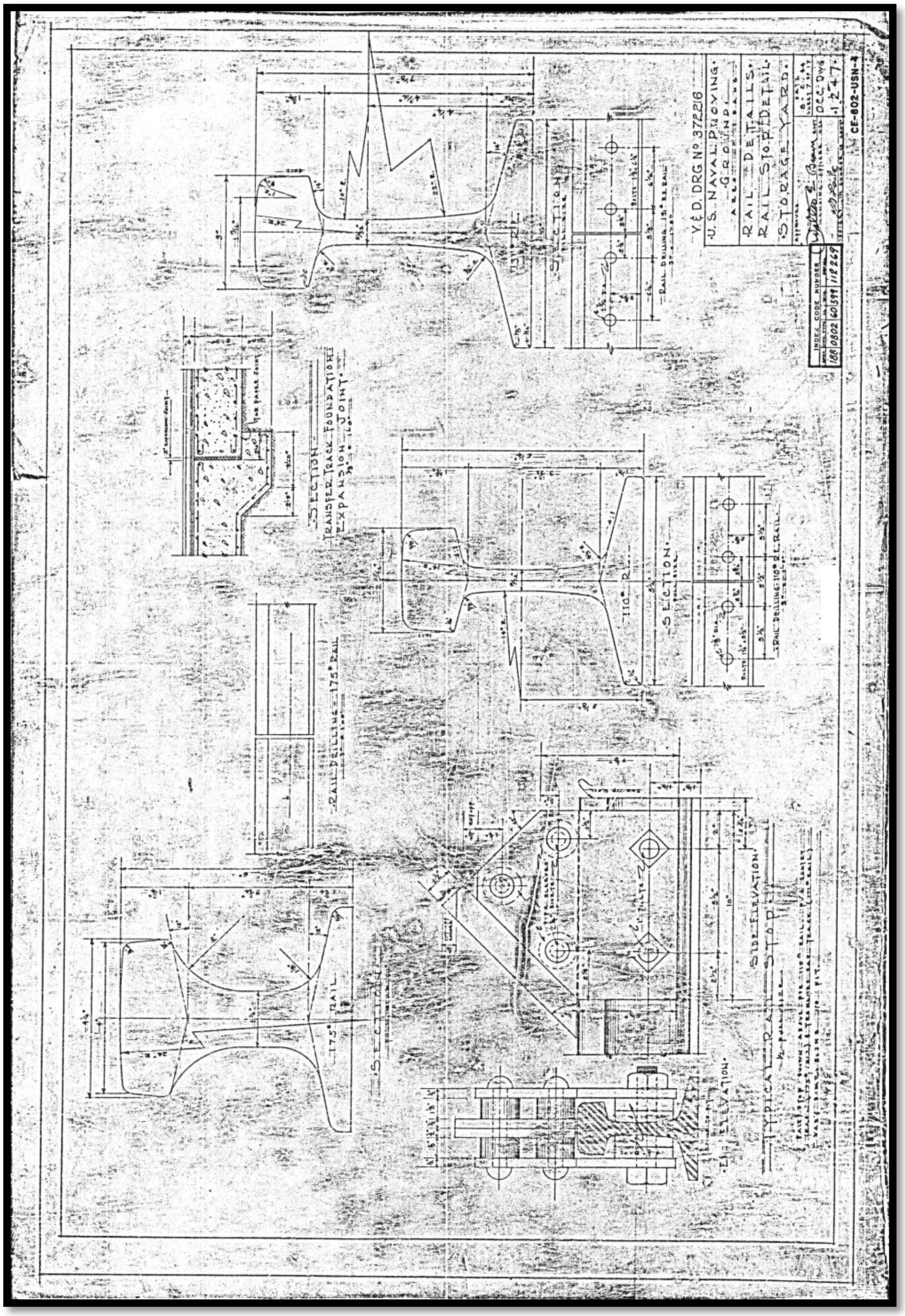


Figure 5.50: INL drawing number 112269 (CF-802-USN-4); storage yard, rail and rail stop (extant), details; sheet 7 of 17; August 1944.

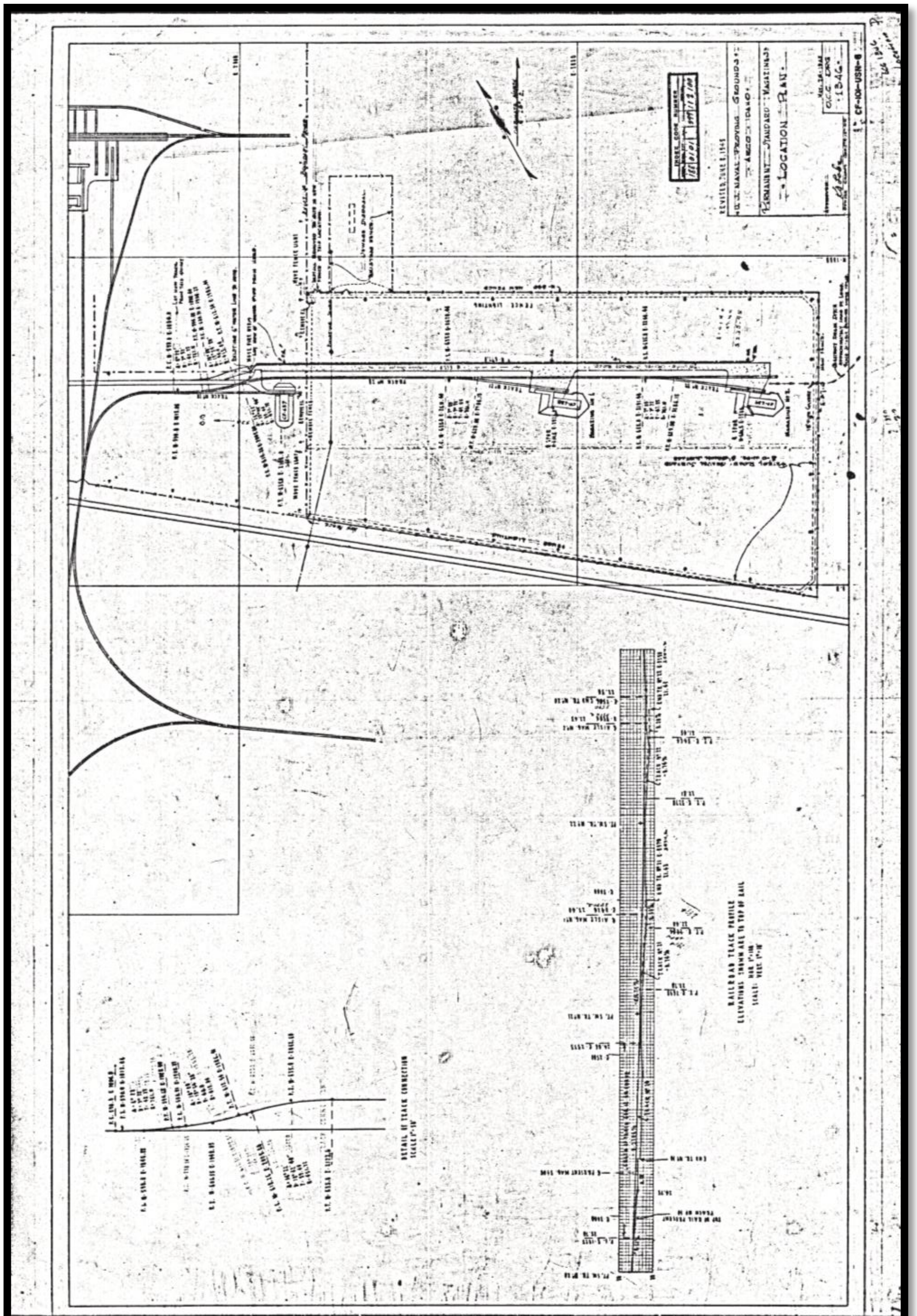


Figure 5.51: INL drawing number 112100 (CF-101-USN-6); permanent standard magazines, location plan; June 1945.

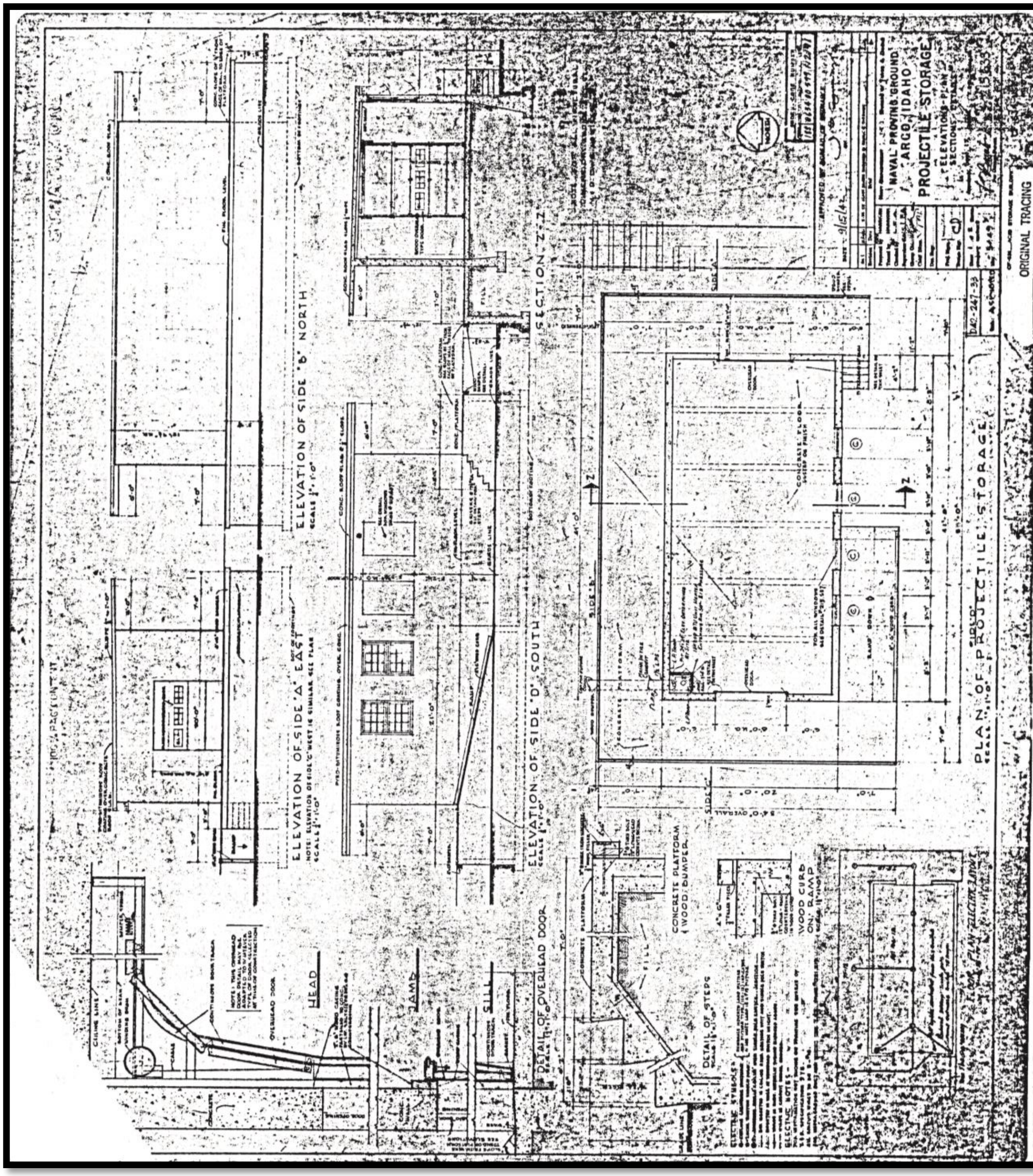


Figure 5.52: INL drawing number 112191 (CF-634-USN-1); projectile storage (CFA-634, non-extant), elevations, plan, sections, and details; September 1942.

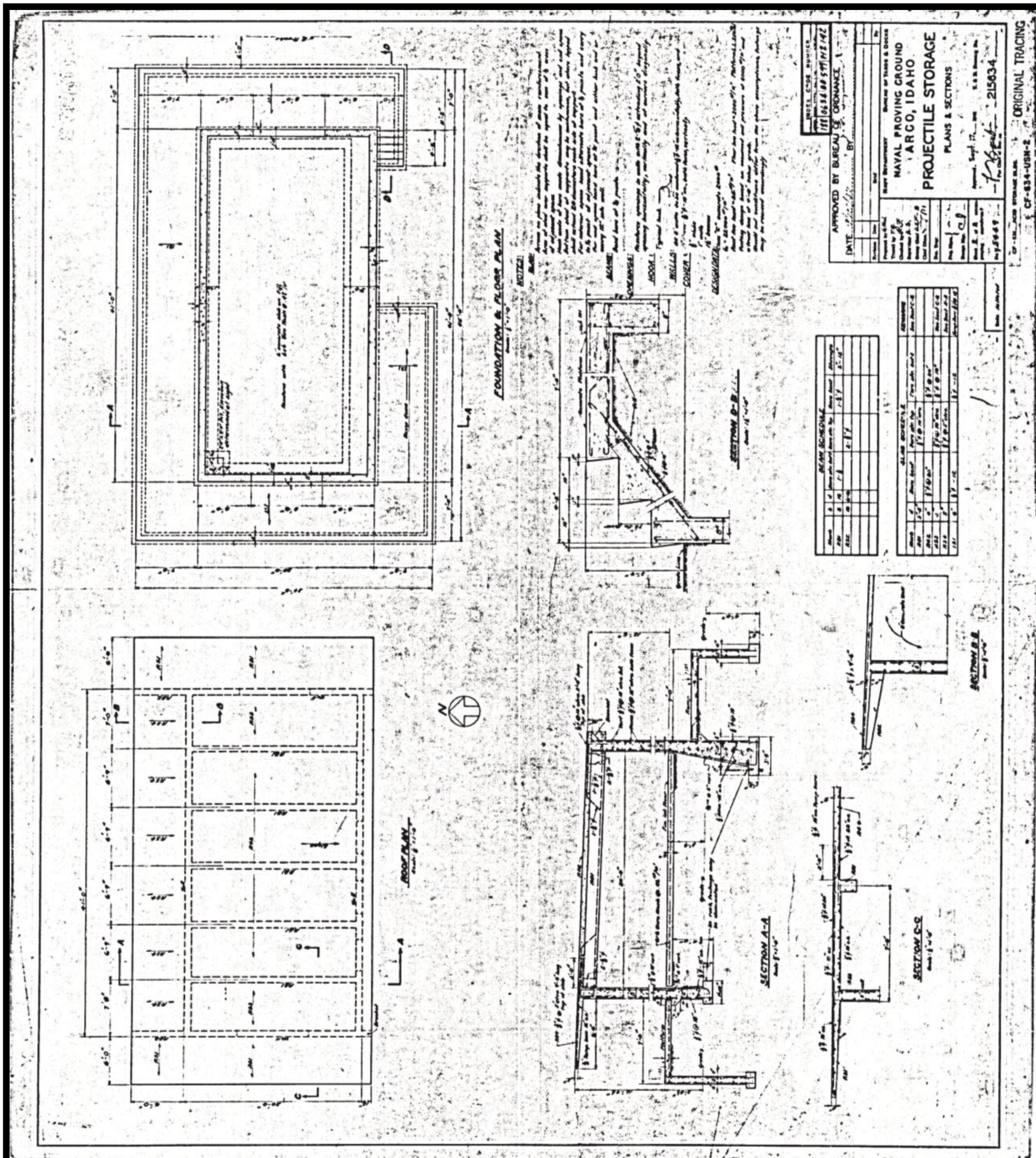


Figure 5.53: INL drawing number 112192 (CF-634-USN-2); projectile storage (CFA-634), non-extant), plans and sections; September 1942.

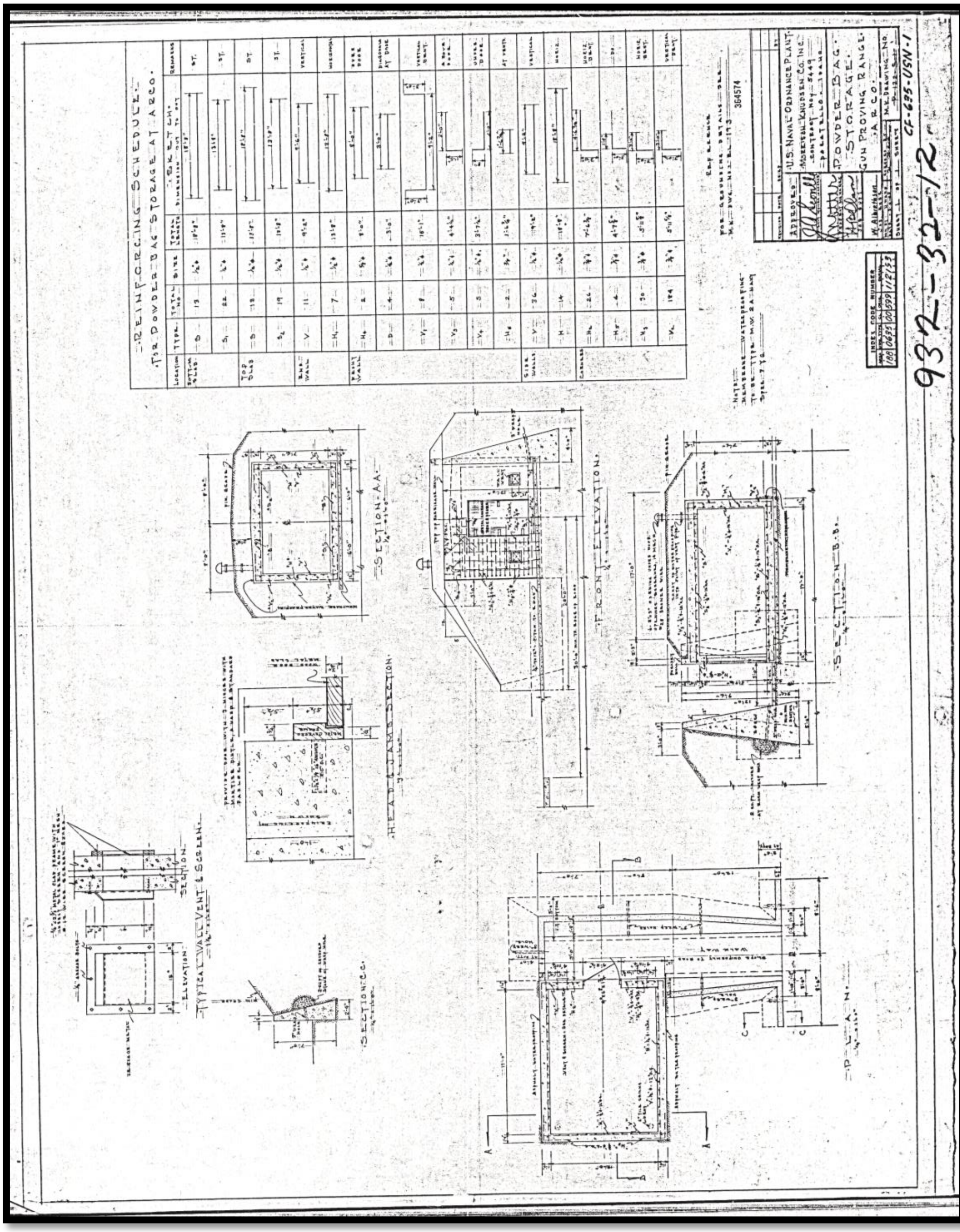


Figure 5.54: INL drawing number 112193 (CF-635-USN-1); powder bag storage (CFA-635, non-extant); sheet 1 of 1; ca. 1943.

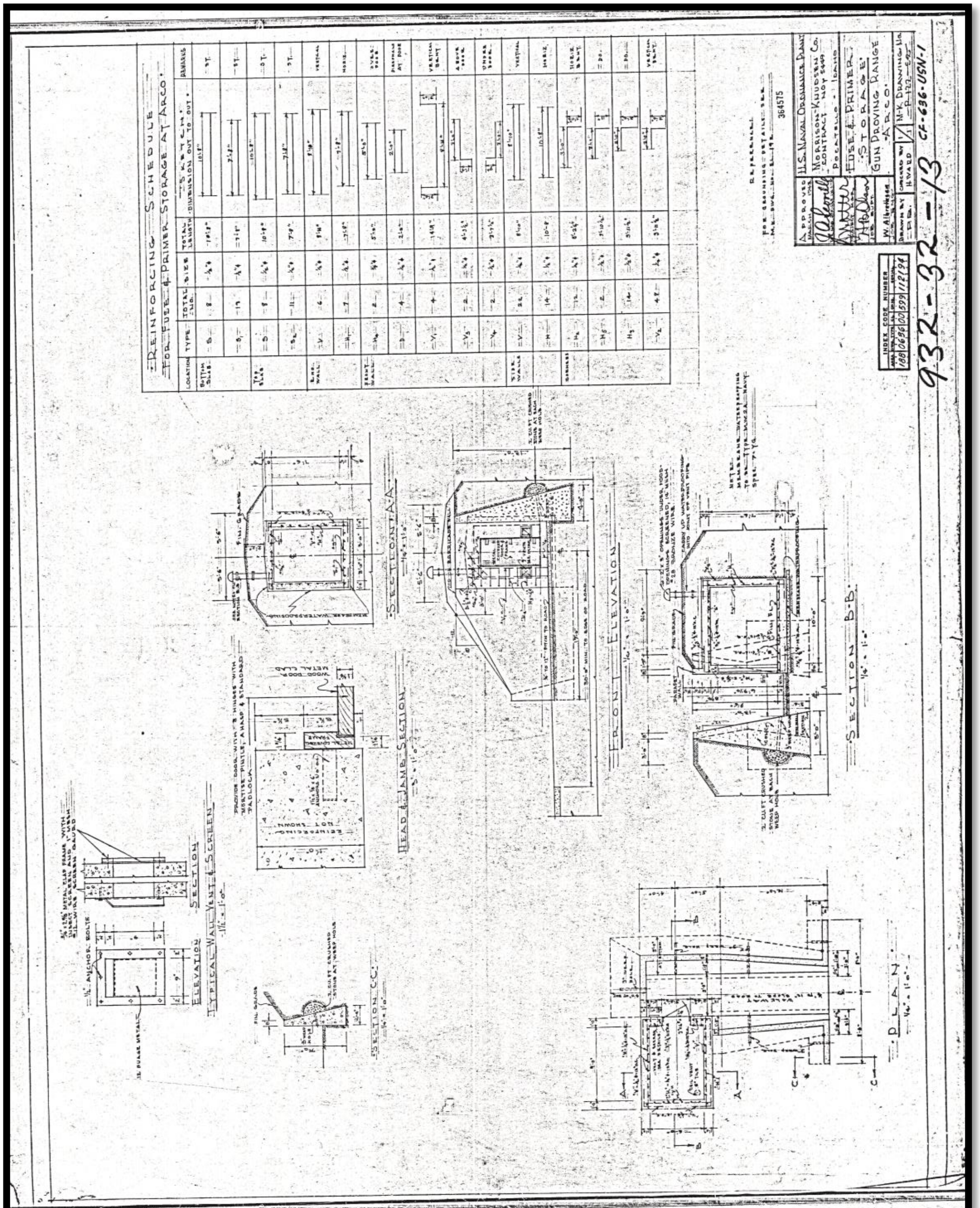


Figure 5.55: INL drawing number 112194 (CF-636-USN-1); fuse and primer storage (CFA-636, non-extant); ca. 1943.

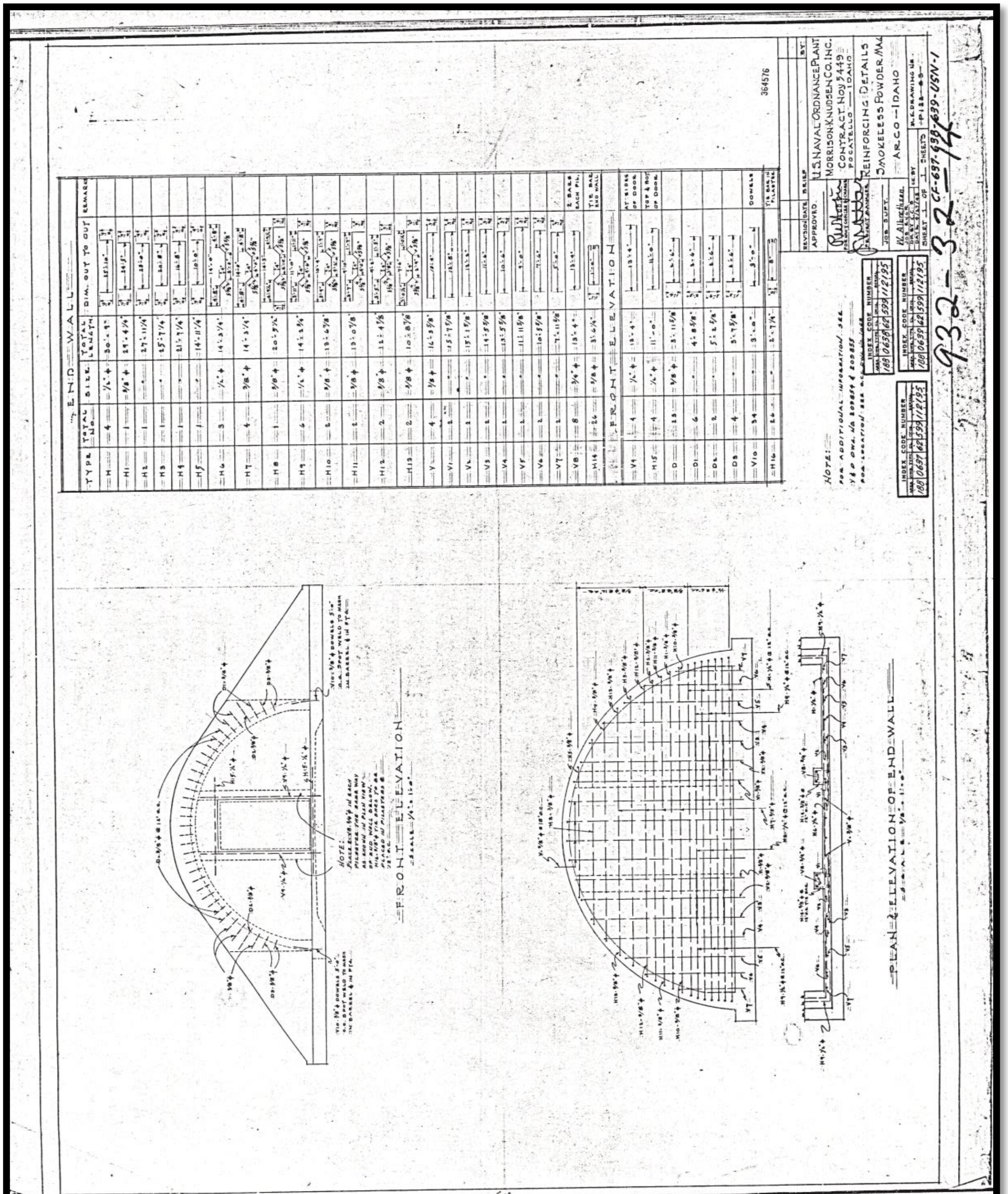


Figure 5.56: INL drawing number 112195 (CF-637-638-639-USN-1); smokeless powder magazine (CFA-637, non-extant), reinforcing details; sheet 1 of 1; ca. 1943.

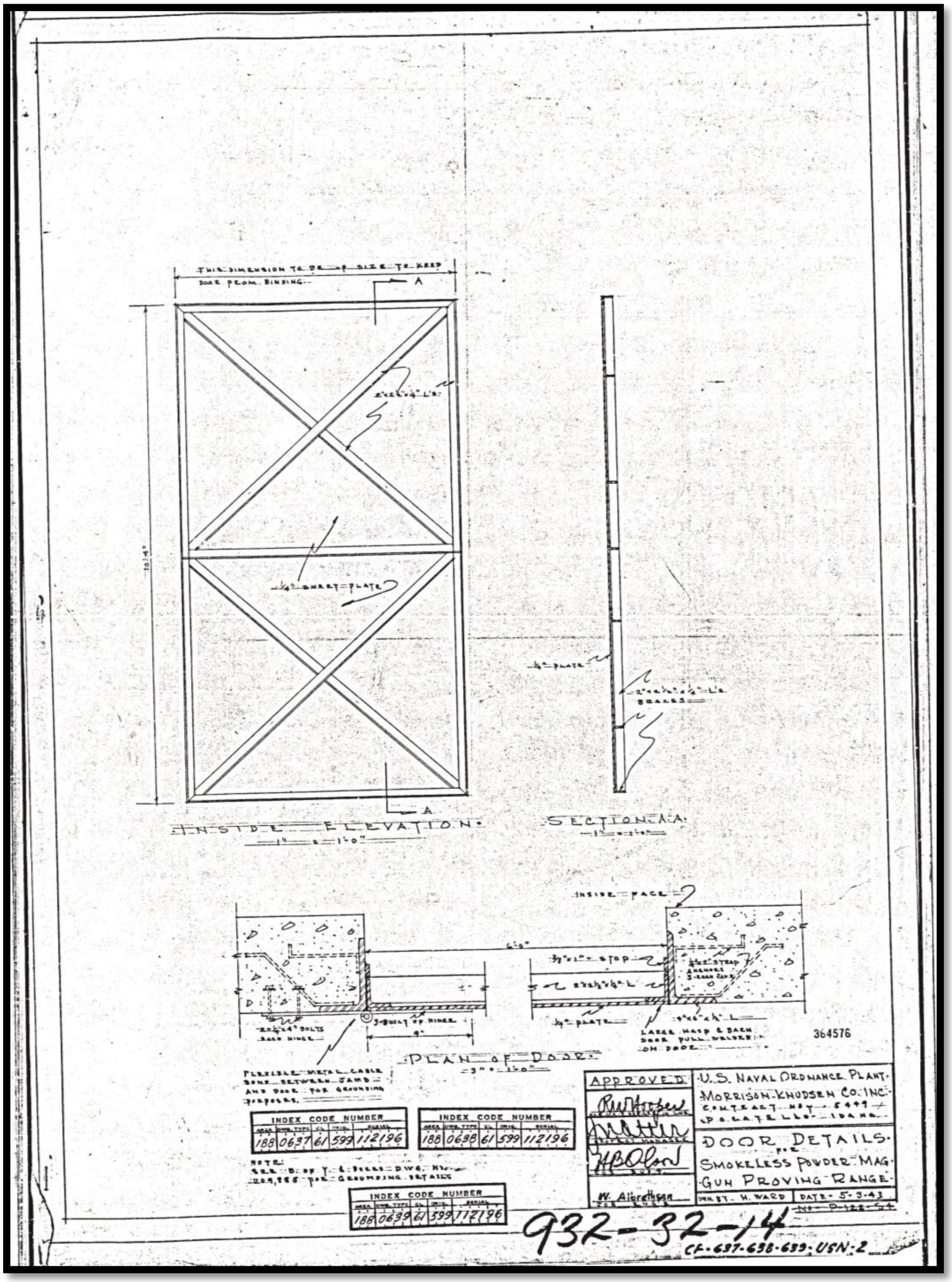


Figure 5.57: INL drawing number 112196 (CF-637-638-639-USN-2); smokeless powder magazine (CFA-637, non-extant), door details; ca. 1943.

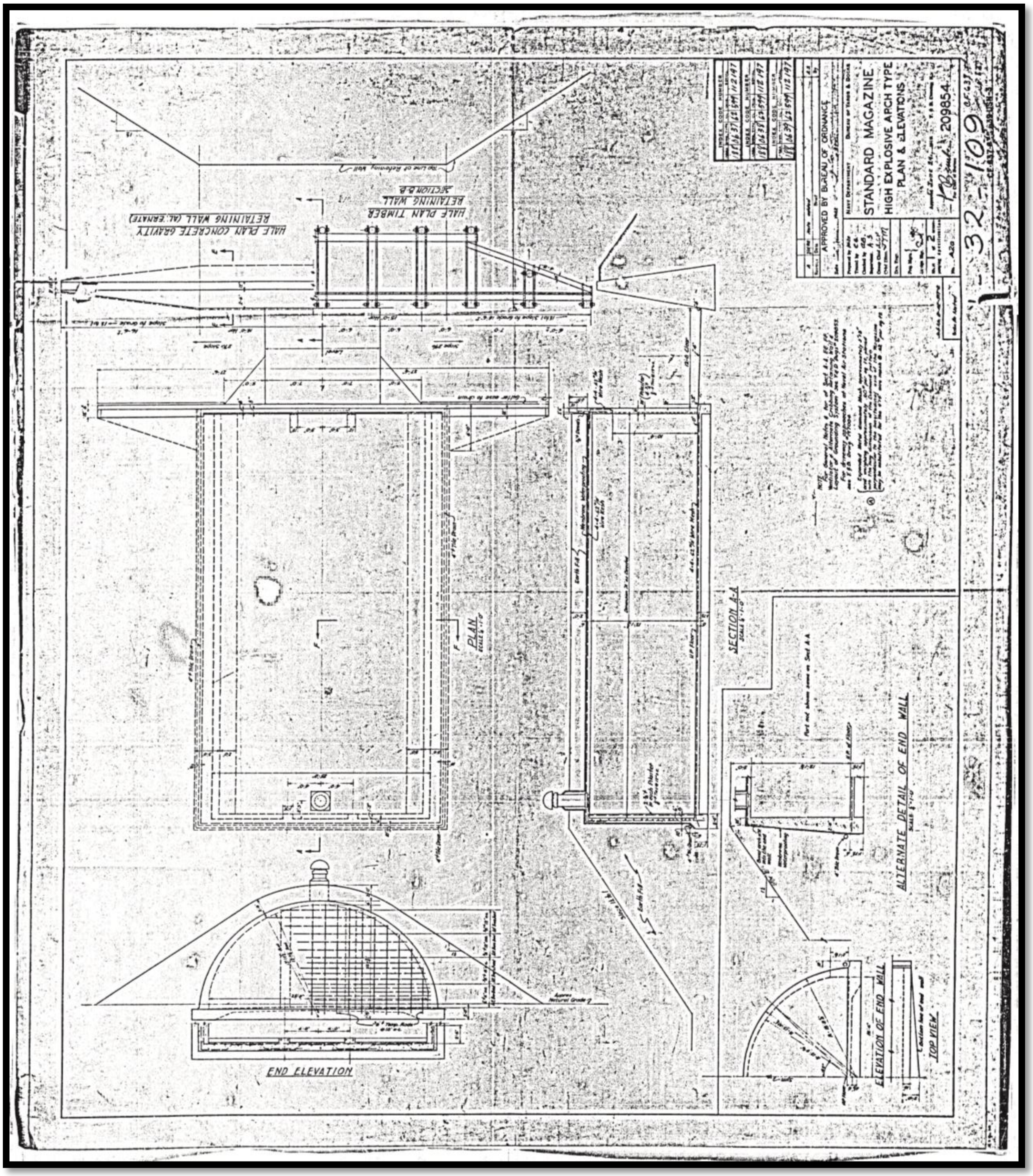


Figure 5.58: INL drawing number 112197 (CF-637-638-639-USN-3); standard magazine, high explosive arch type / igloo (CFA-638 and CFA-639, both extant), plans and elevations; ca. 1943.

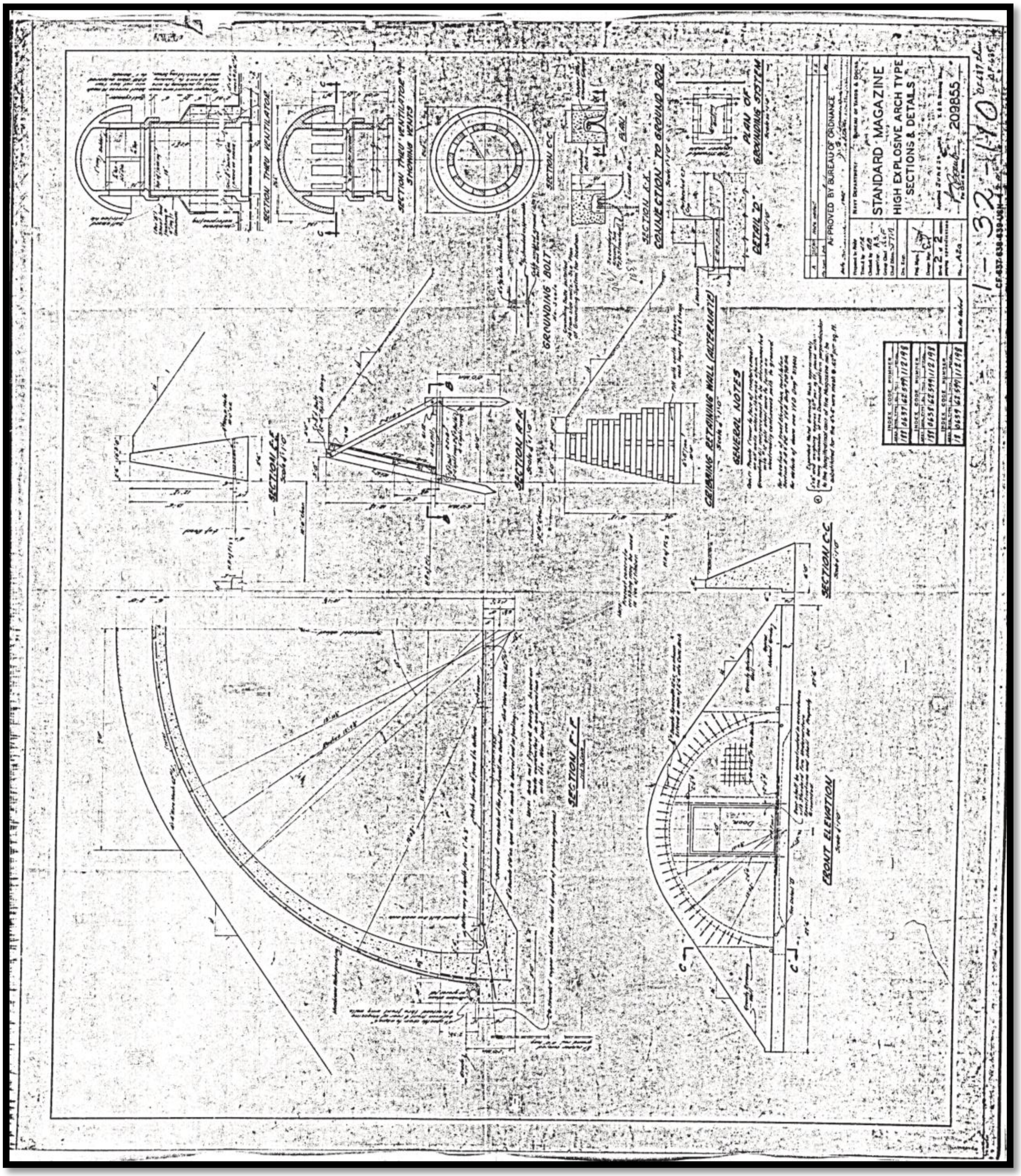


Figure 5.59: INL drawing number 112198 (CF-637-638-639-USN-4); standard magazine, high explosive arch type / igloo (CFA-638 and CFA-639, both extant), sections and details; ca. 1943.

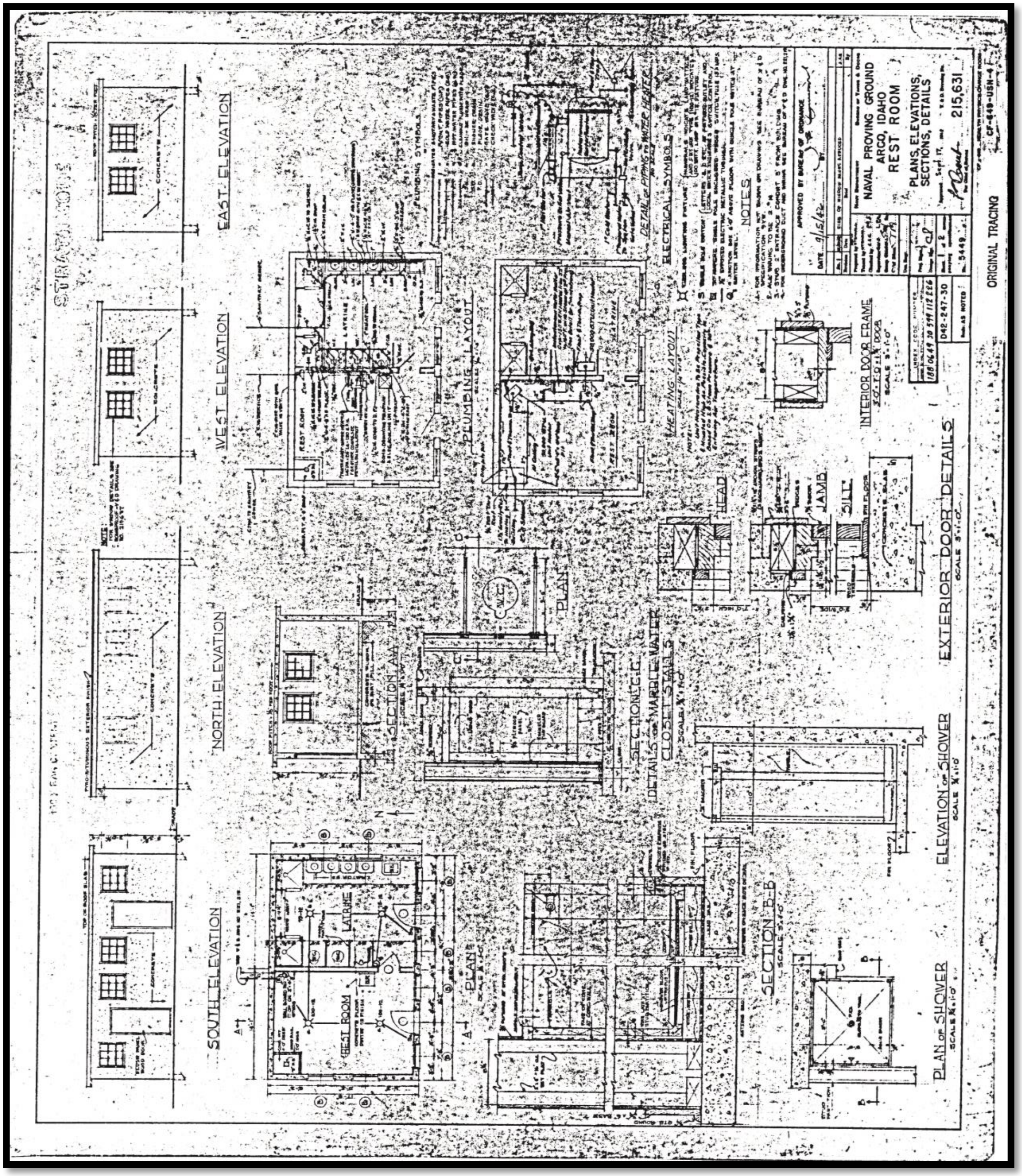


Figure 5.60: INL drawing number 112226 (CF-649-USN-4); rest room (CFA-649, non-extant), plans, elevations, sections, and details; September 1942.

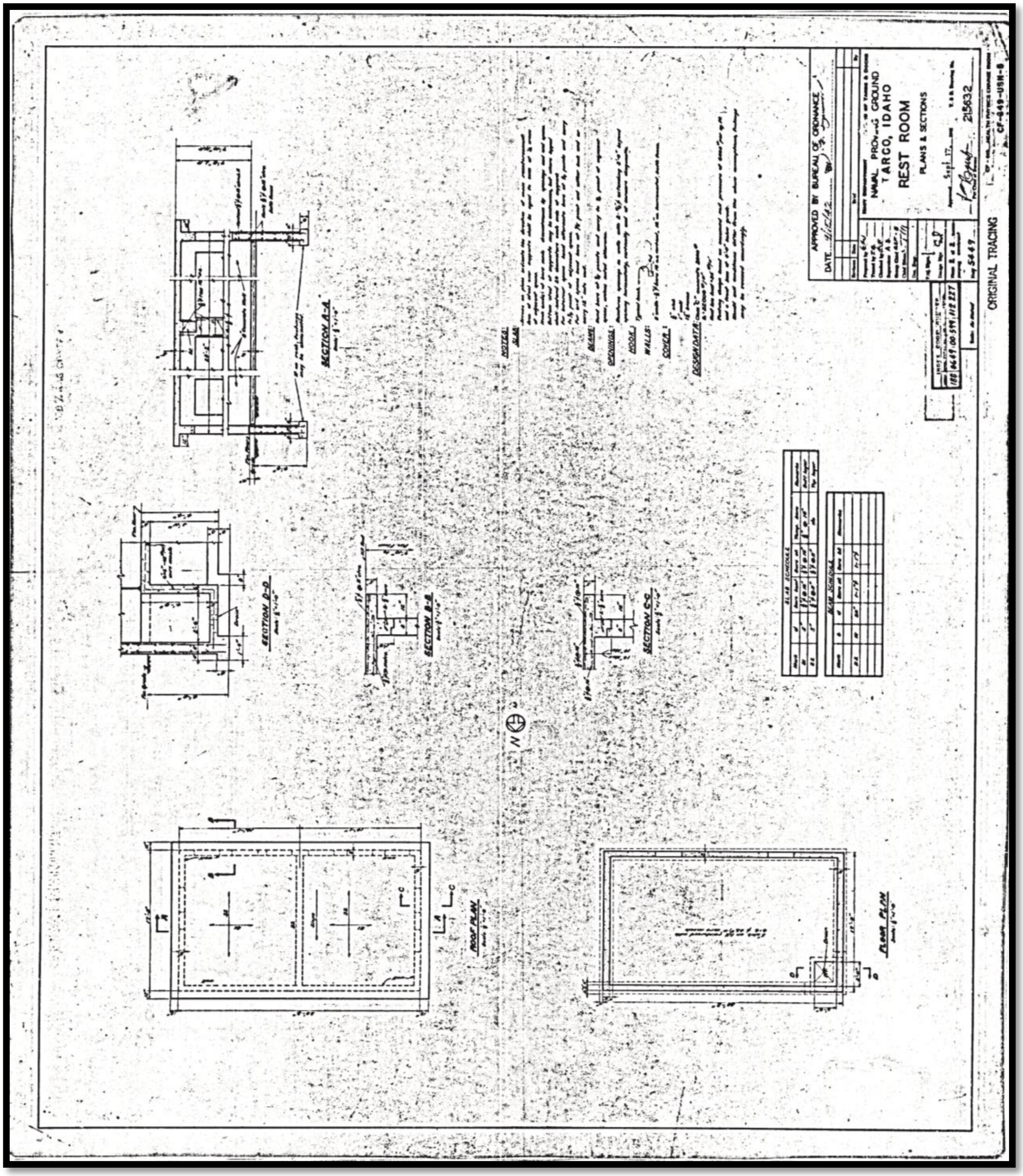


Figure 5.61: INL drawing number 112227 (CF-649-USN-5); rest room (CFA-649, non-extant), plans and sections; September 1942.

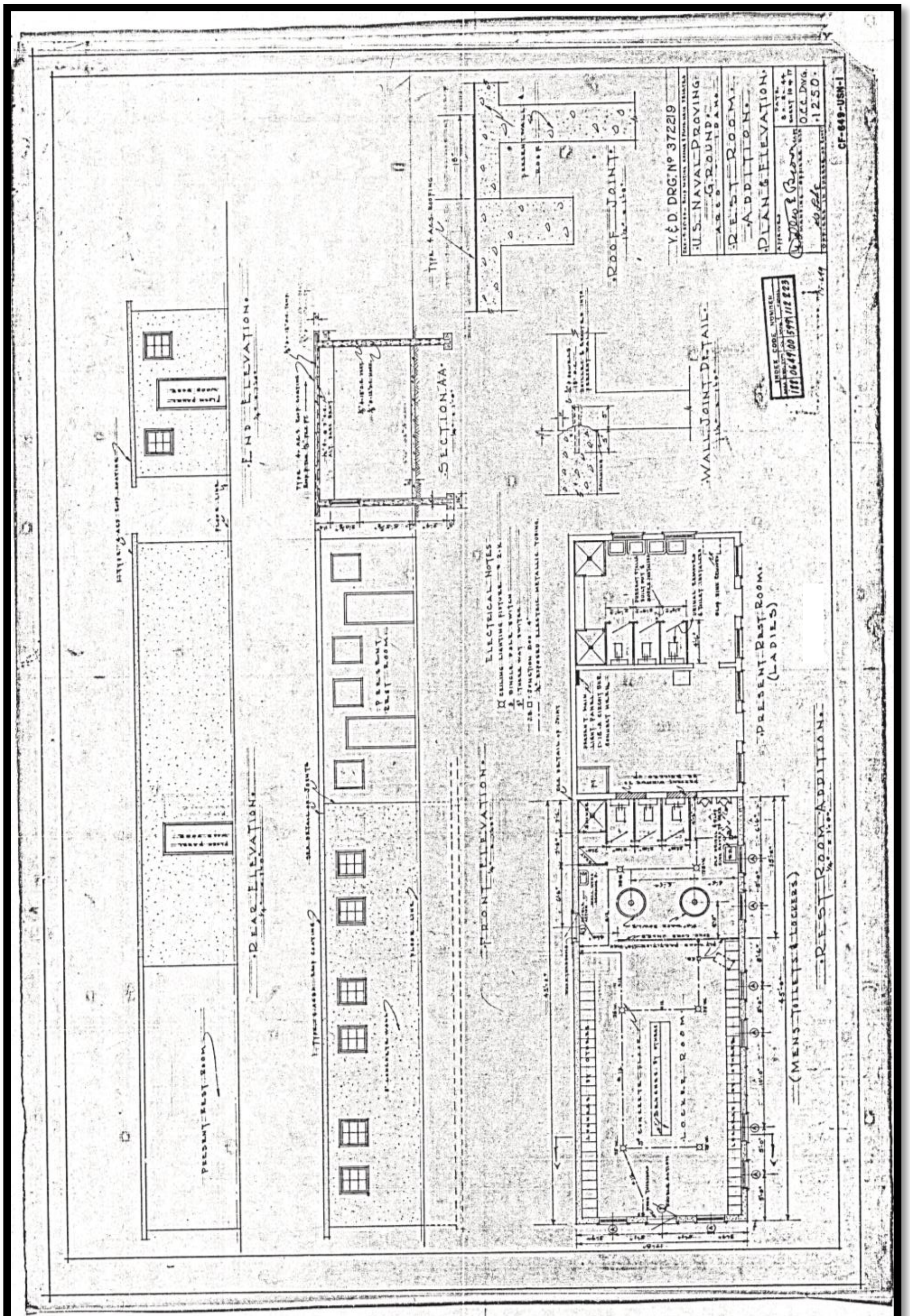


Figure 5.62: INL drawing number 112223 (CF-649-USN-1); rest room addition (CFA-649, non-extant), plan and elevation; sheet 10 of 17; August 1944.

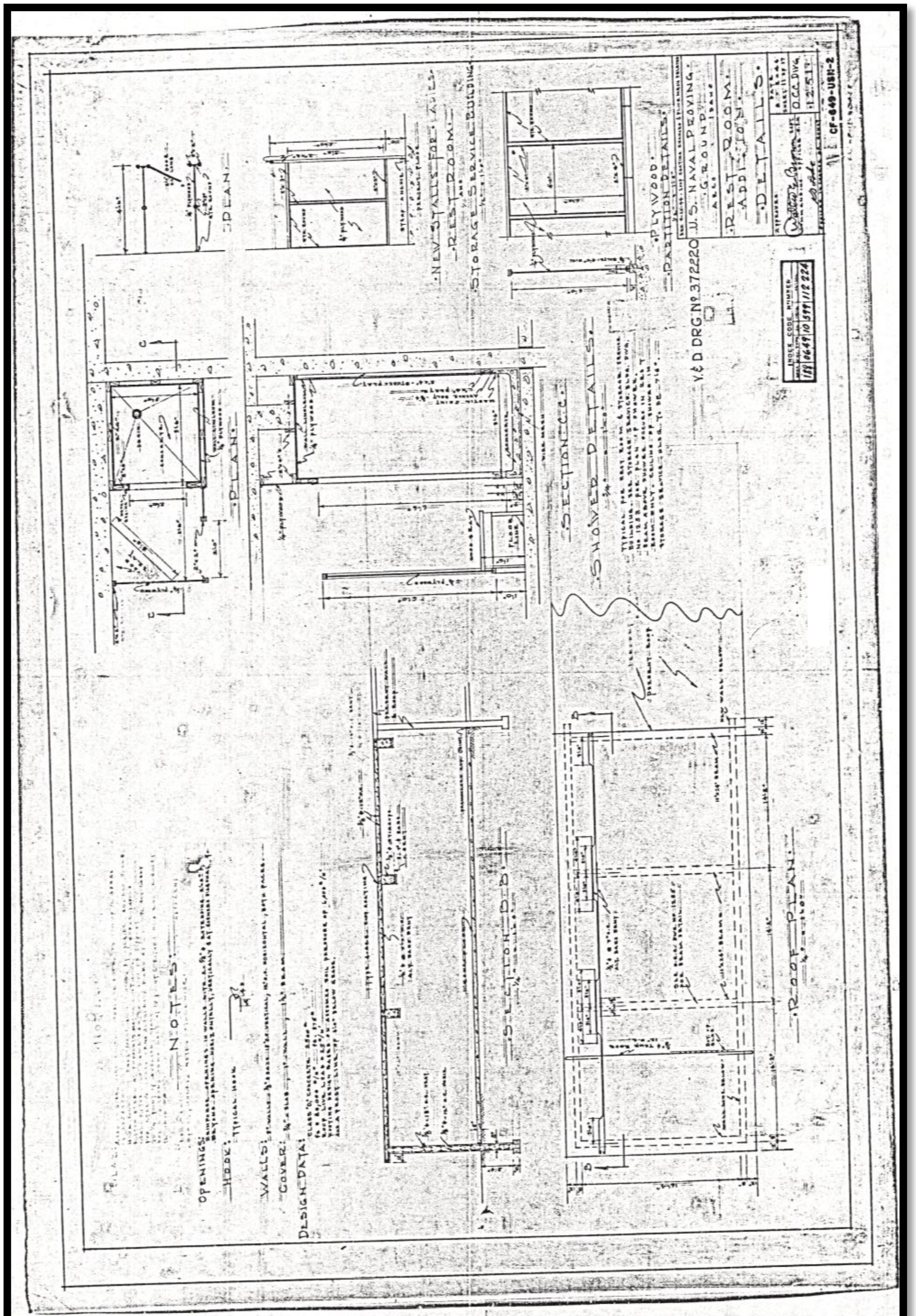


Figure 5.63: INL drawing number 112224 (CF-649-USN-2); rest room addition (CFA-649, non-extant), details; sheet 11 of 17; August 1944.

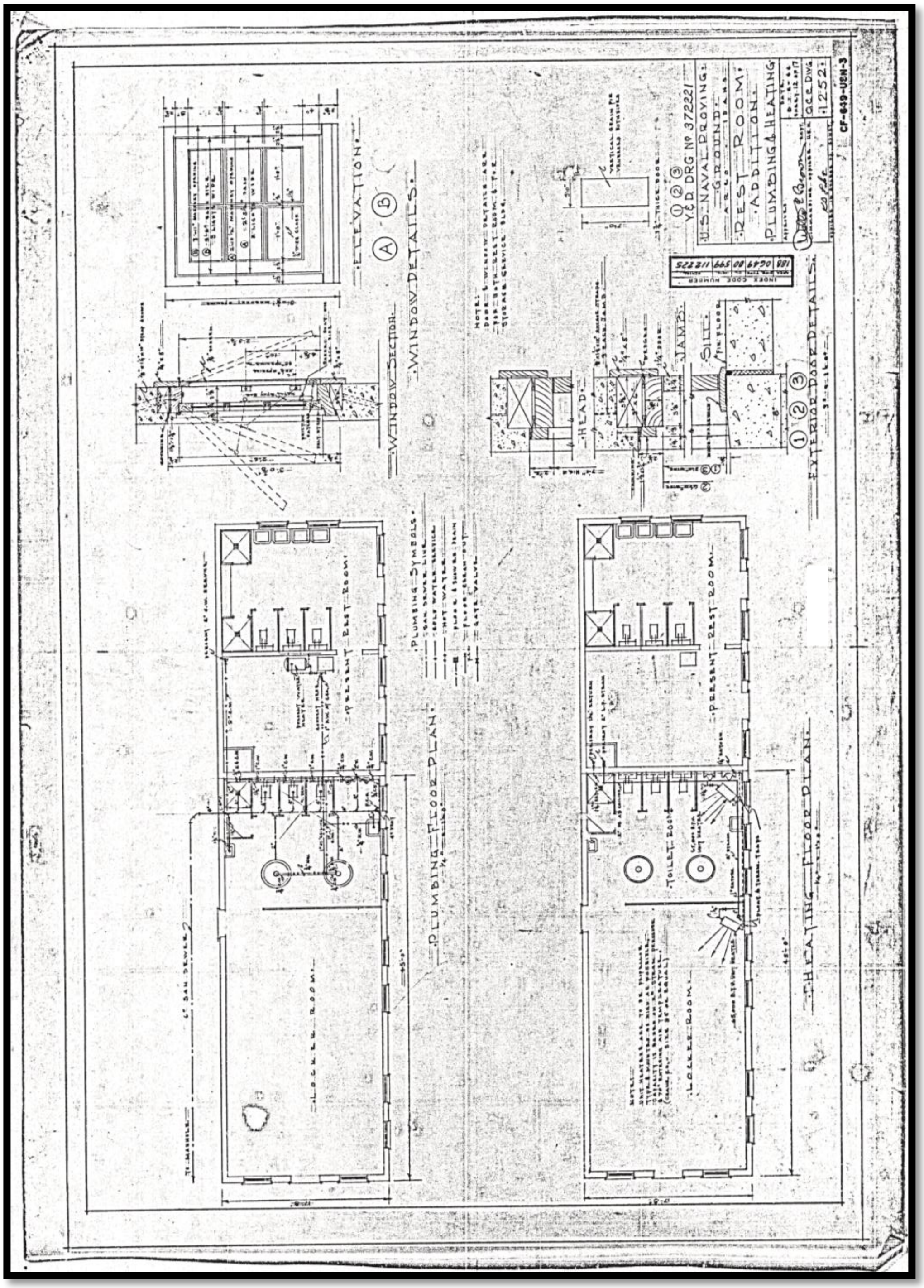


Figure 5.64: INL drawing number 112225 (CF-649-USN-3); rest room addition (CFA-649, non-extant), plumbing and heating; sheet 12 of 17; August 1944.

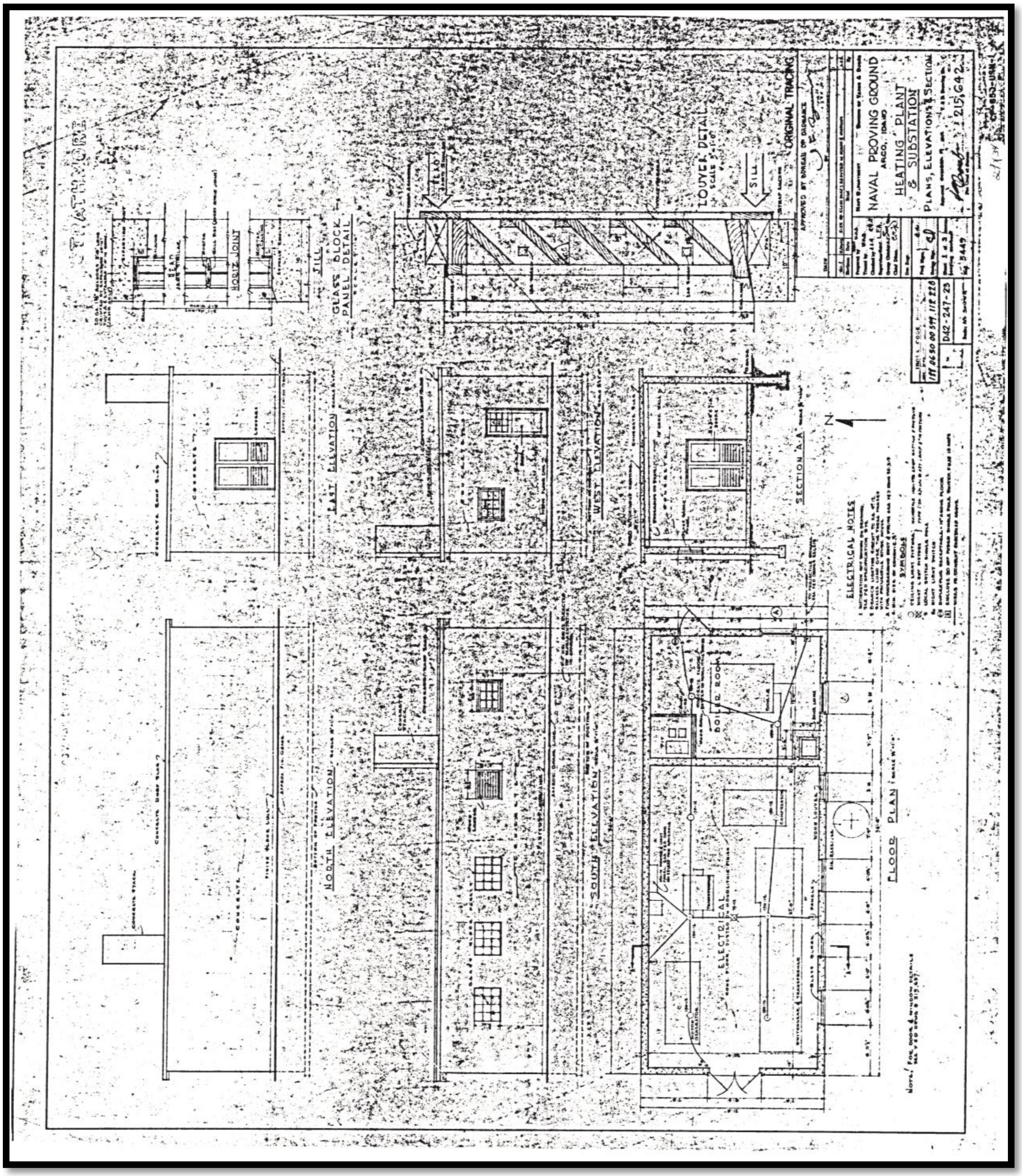


Figure 5.65: INL drawing number 112228 (CF-650-USN-1); heating plant substation (CFA-650, non-extant), plans, elevations, and sections; sheet 1 of 3; 1942.

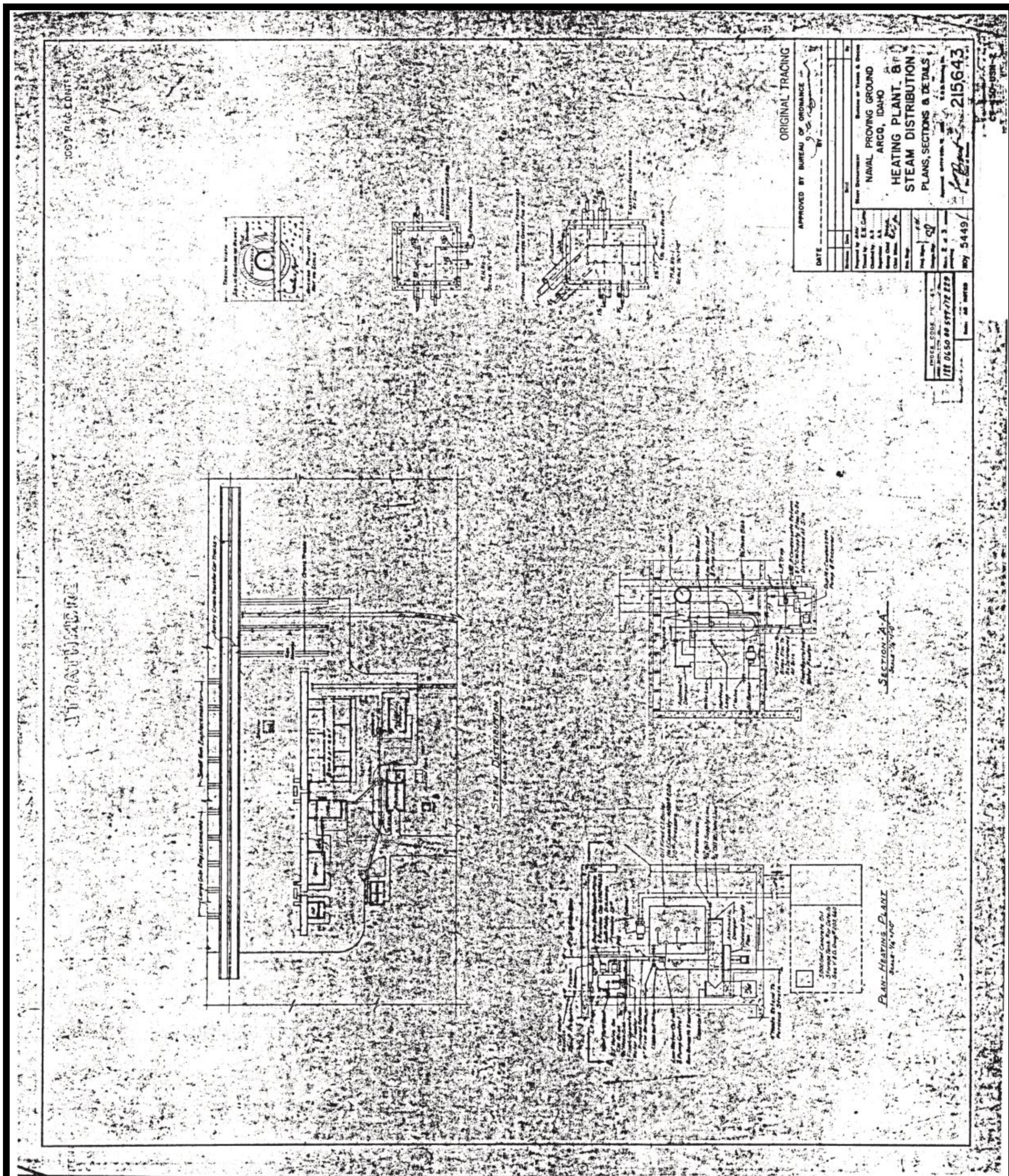


Figure 5.66: INL number 112229 (CF-650-USN-2); heating plant (CFA-650, non-extant), steam distribution, plans and details; sheet 2 of 3; 1942.

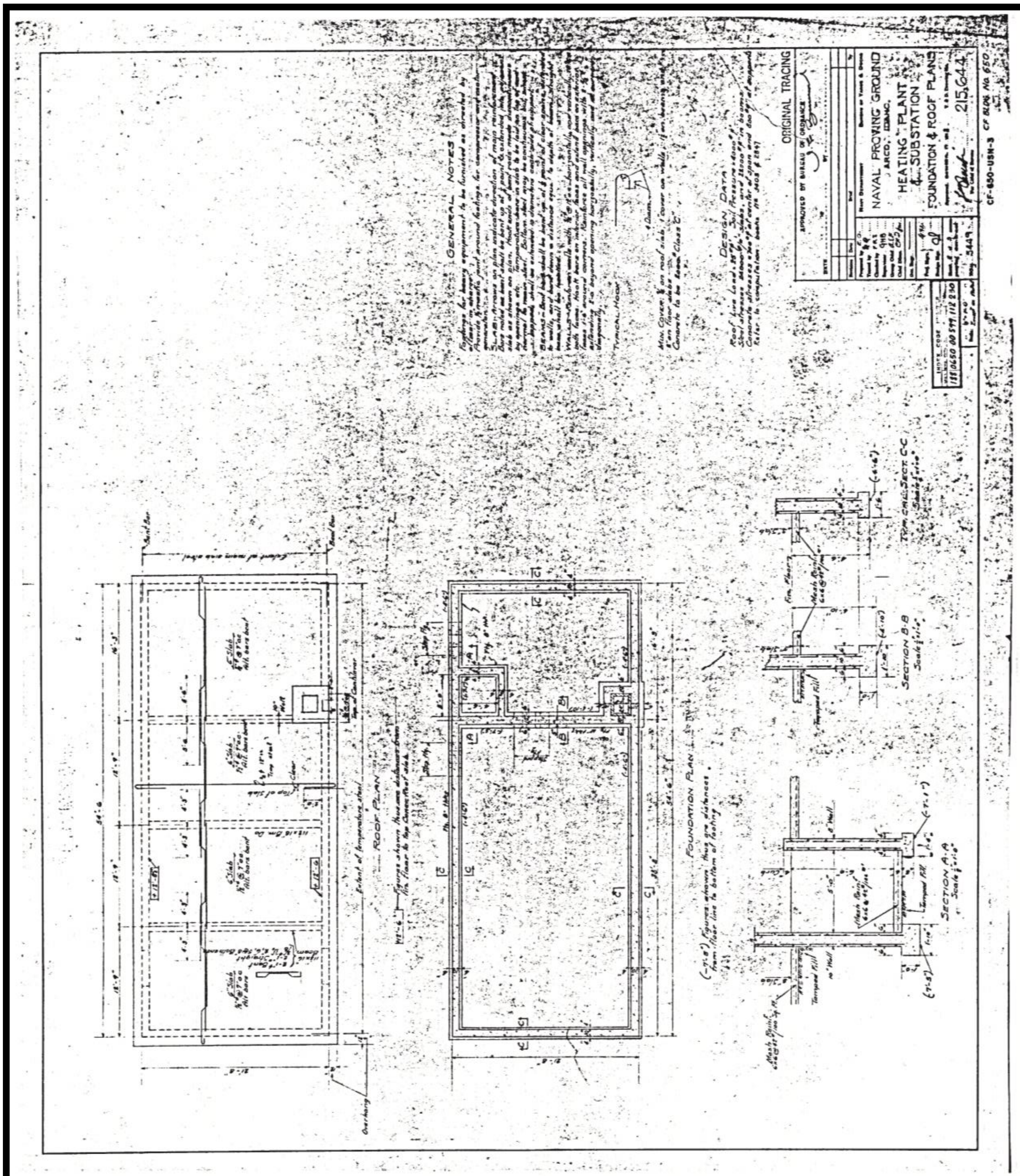


Figure 5.67: INL drawing number 112231 (CF-650-UN-4); heating plant substation (CFA-650, non-extant), foundation and roof plans; sheet 3 of 3; 1942.

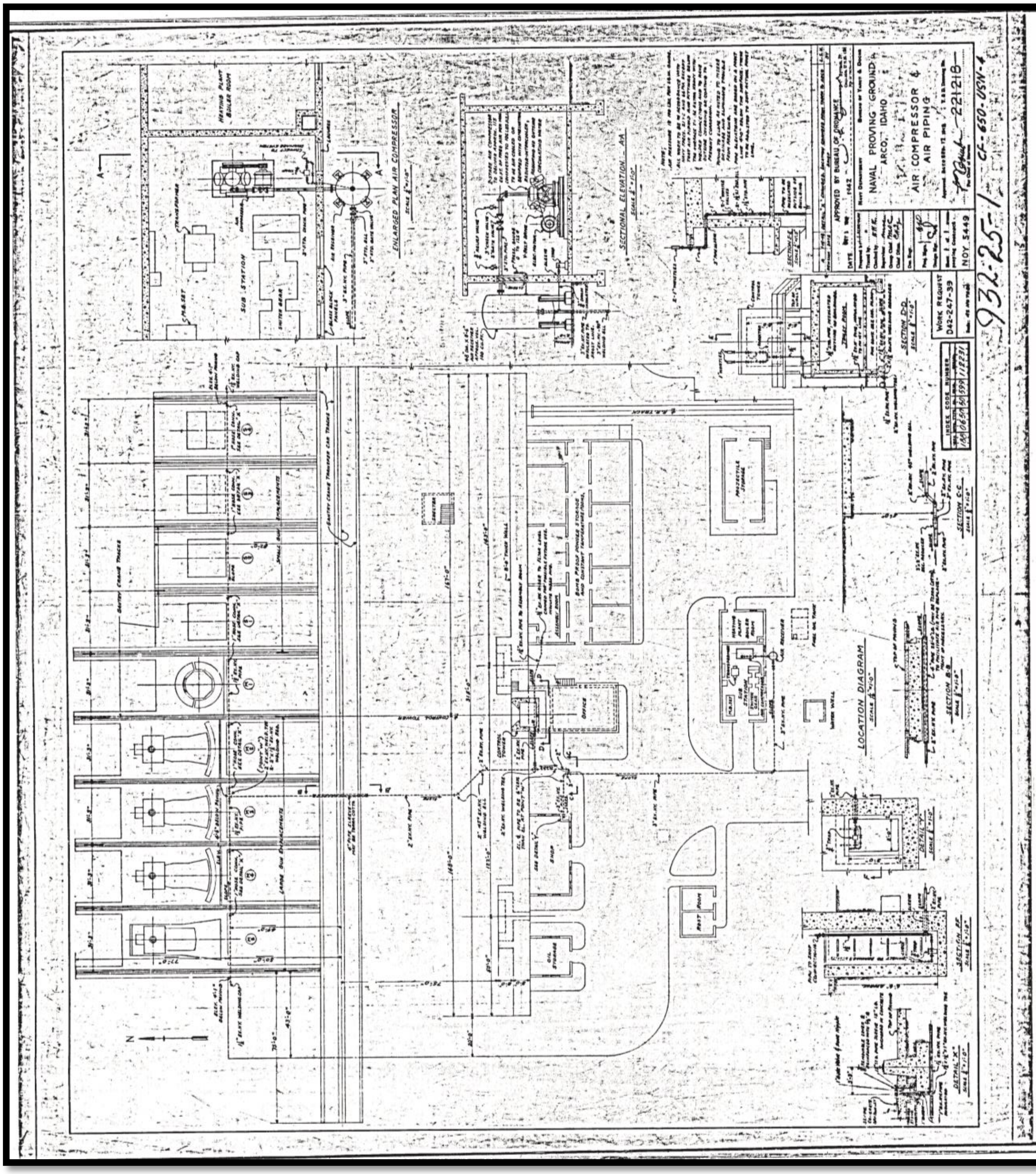


Figure 5.68: INL drawing number 112231 (CF-650-USN-4); air compressor and air piping (CFA-650, non-extant); sheet 1 of 1; October 1942.

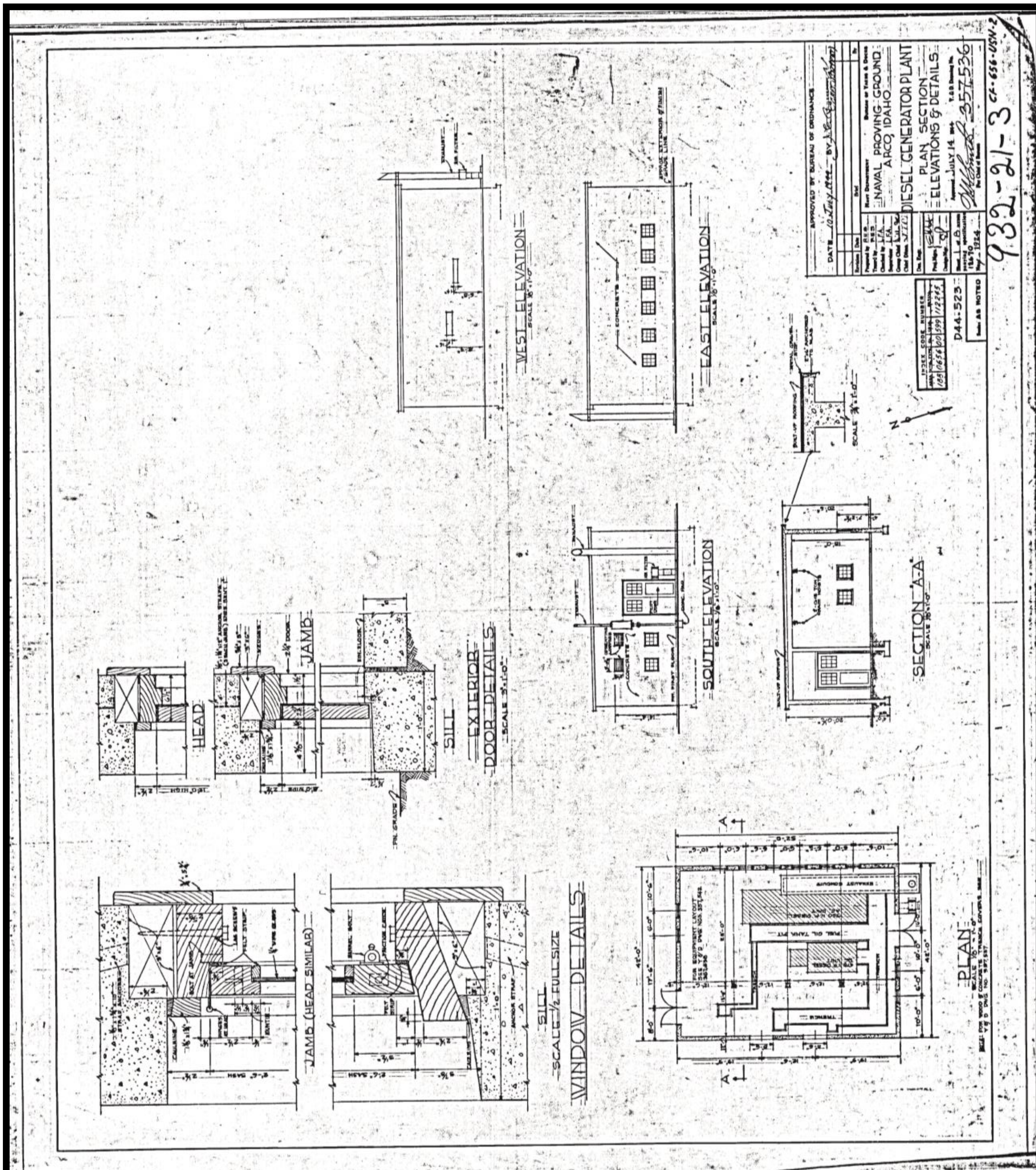


Figure 5.69: INL drawing number 112245 (CF-656-USN-2); diesel generator plant (CFA-656, non-extant), plan, section, elevations, and details; sheet 1 of 8; July 1944.

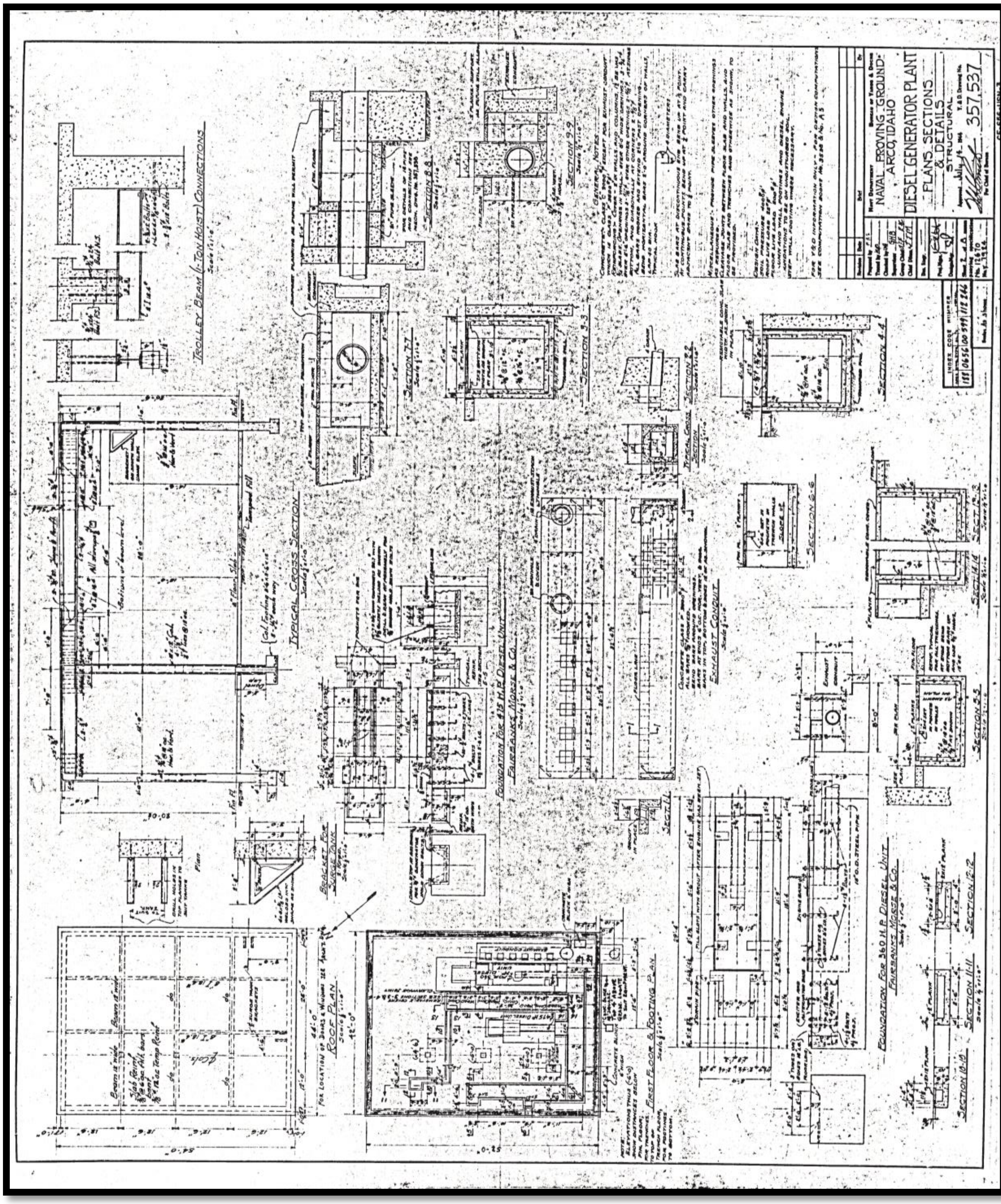


Figure 5.70: INL drawing number 112246 (CFA-656-USN-3), diesel generator plant (CFA-656, non-extant), structural plans, sections, and details; sheet 2 of 8; July 1944.

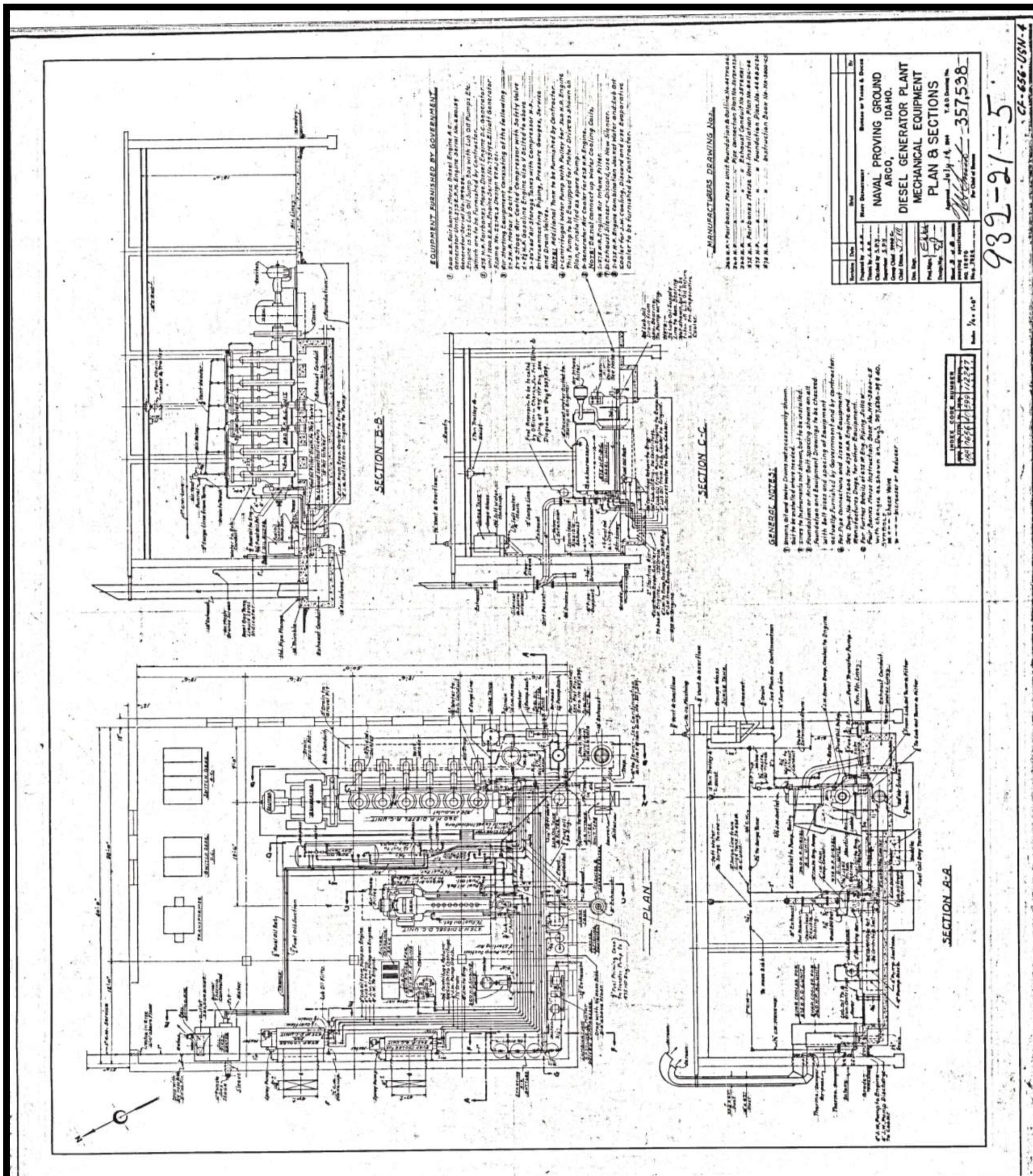


Figure 5.71: INL drawing number 112247 (CF-656-USN-4); diesel generator plant (CFA-656, non-extant), mechanical equipment, plan, and sections; sheet 3 of 8; July 1944.

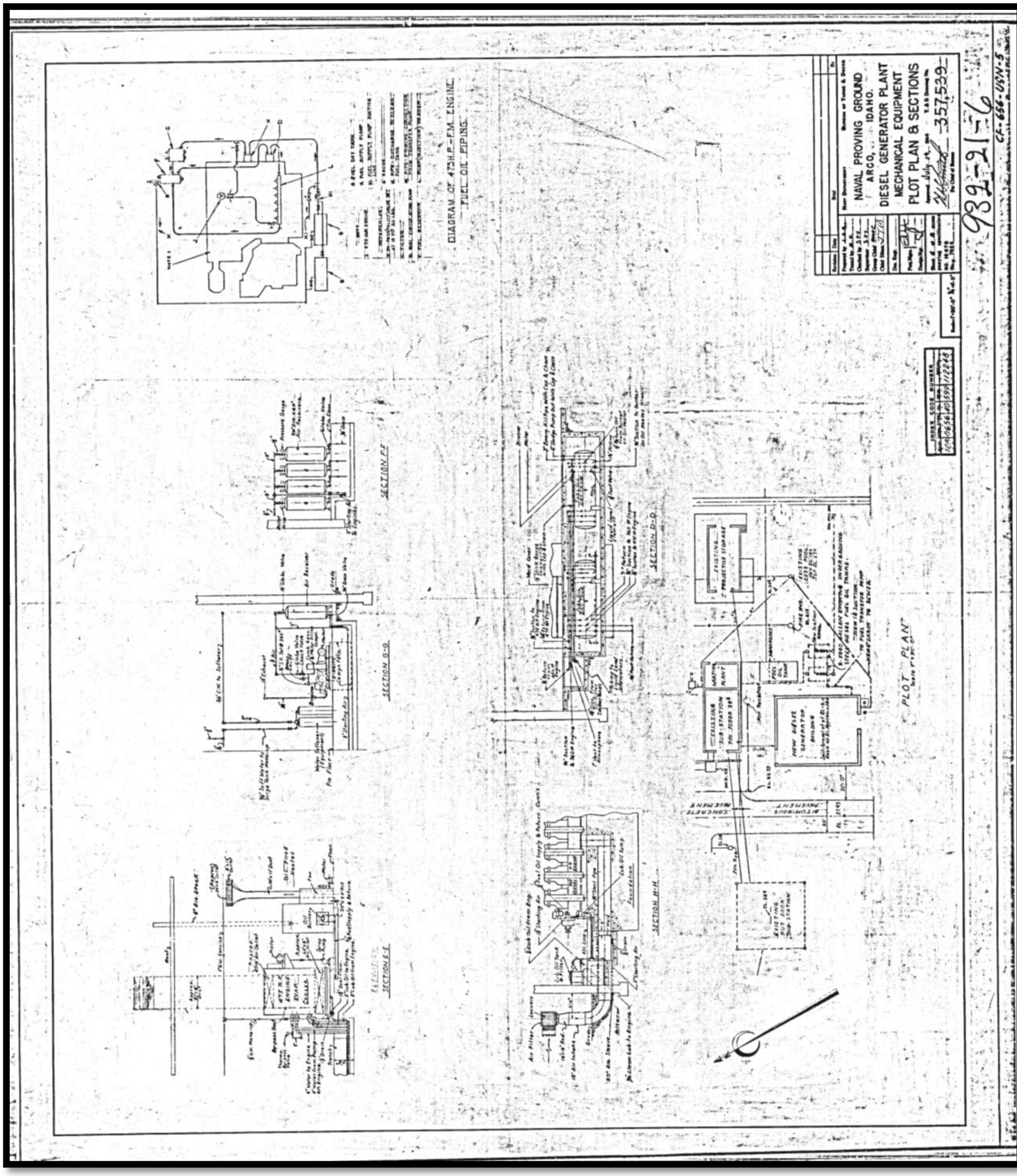


Figure 5.72: INL drawing number 112248 (CF-656-USN-5); diesel generator plant (CFA-656, non-extant), mechanical equipment, plot plan and sections; sheet 4 of 8; July 1944.

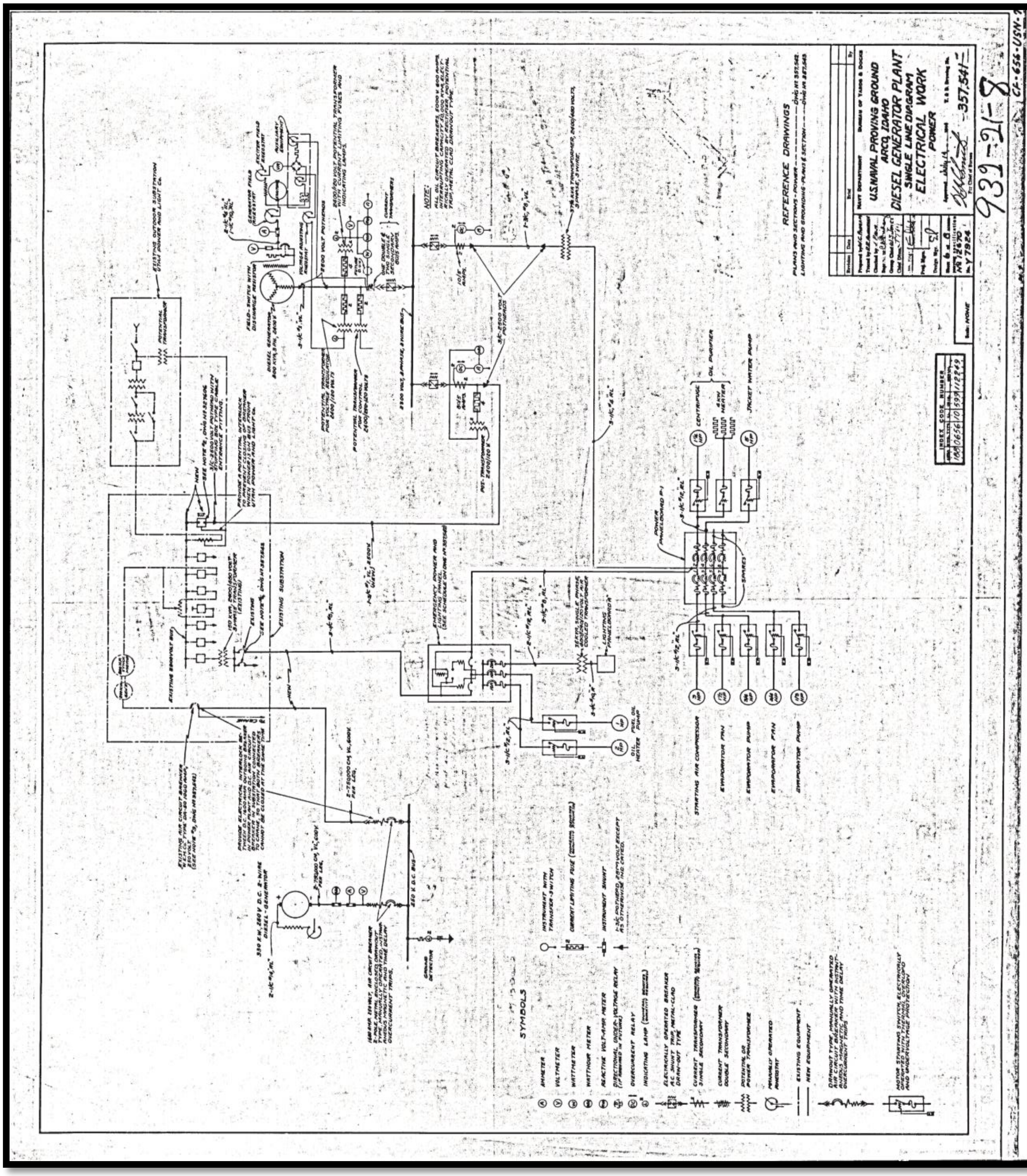


Figure 5.73: INL drawing number 112249 (CF-656-USN-7); diesel generator plant (CFA-656, non-extant), electrical work, single line diagram; sheet 6 of 8; July 1944.

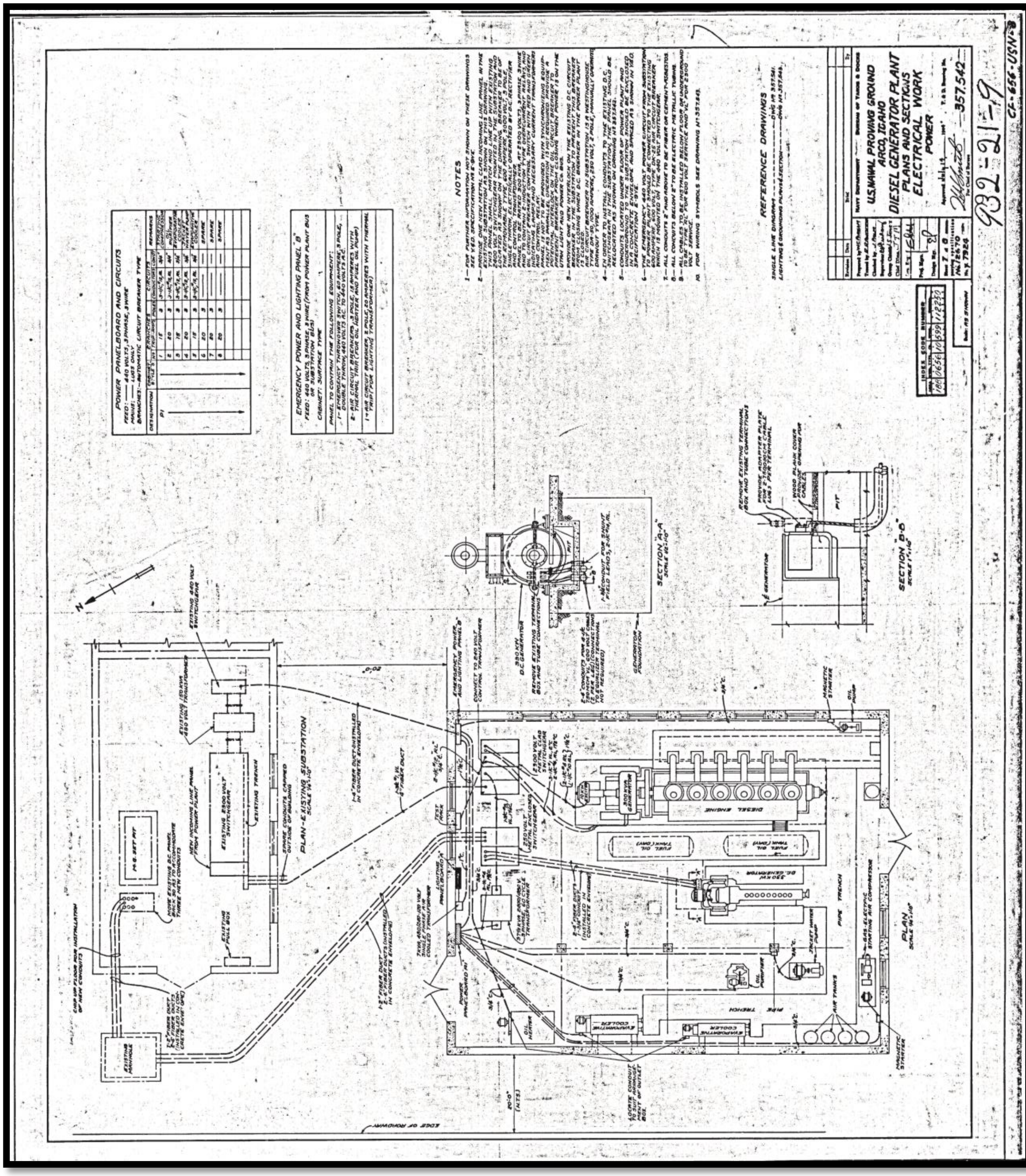


Figure 5.74: INL drawing number 112250 (CFA-656-USN-8); diesel generator plant (CFA-656, non-extant), electrical work, plans and sections; sheet 7 of 8; July 1944.

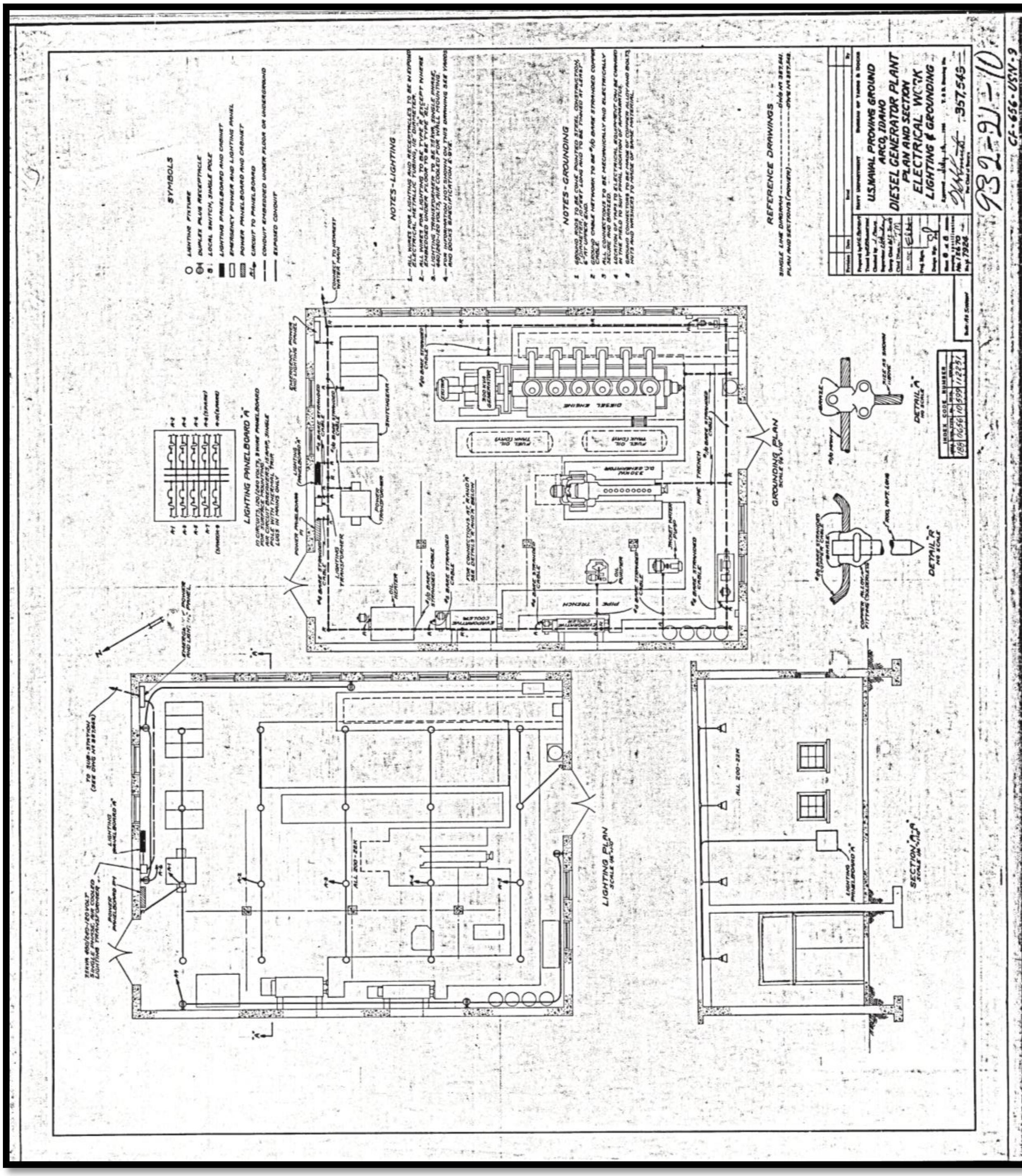


Figure 5.75: INL drawing number 112251 (CF-656-USN-9); diesel generator plant (CFA-656, non-extant), electrical work, lighting and grounding plan and section; sheet 8 of 8; July 1944.

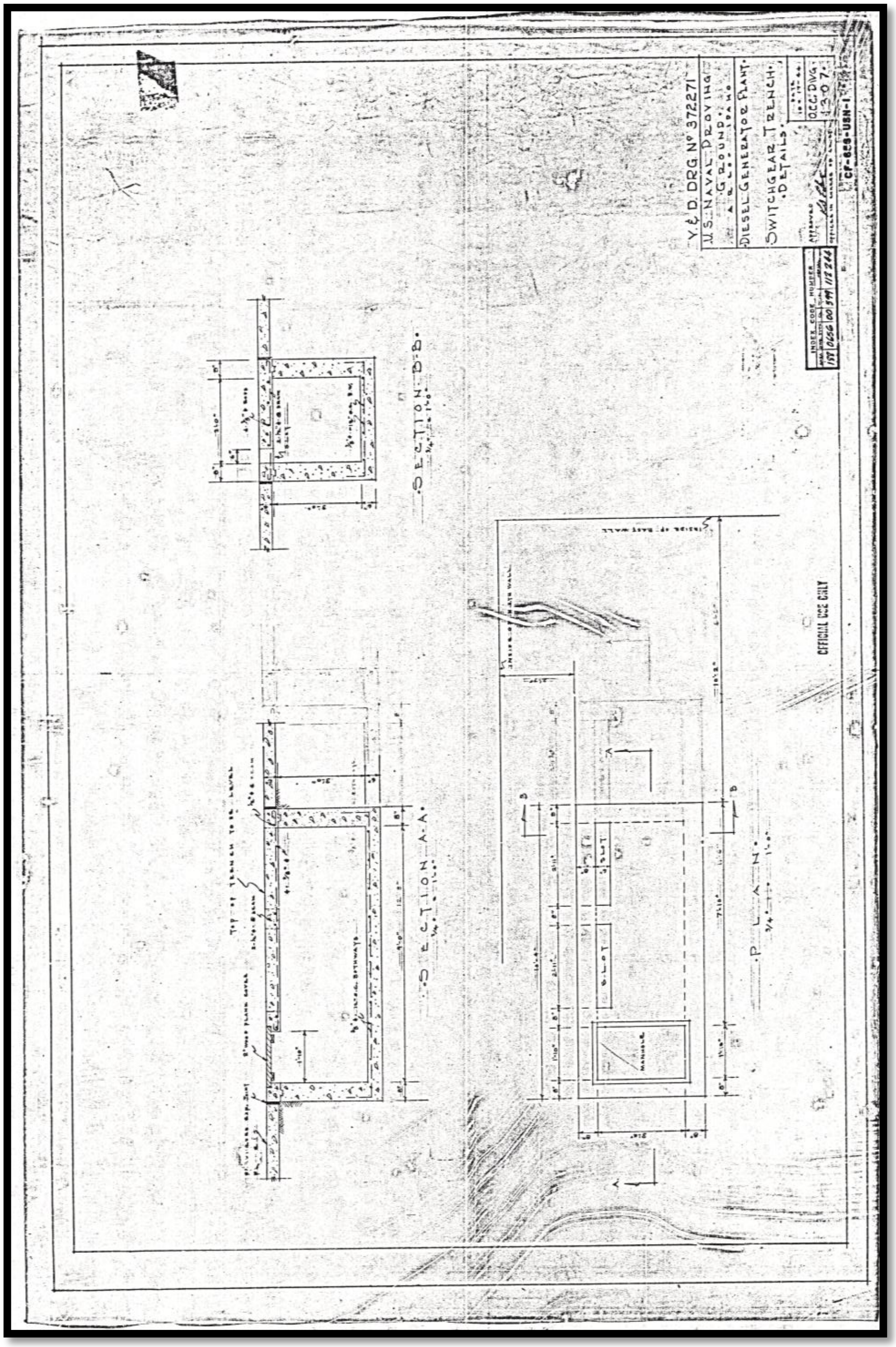


Figure 5.76: INL drawing number 112244 (CF-656-USN-1); diesel generator plant (CFA-656, non-extant), switchgear trench details; October 1944.

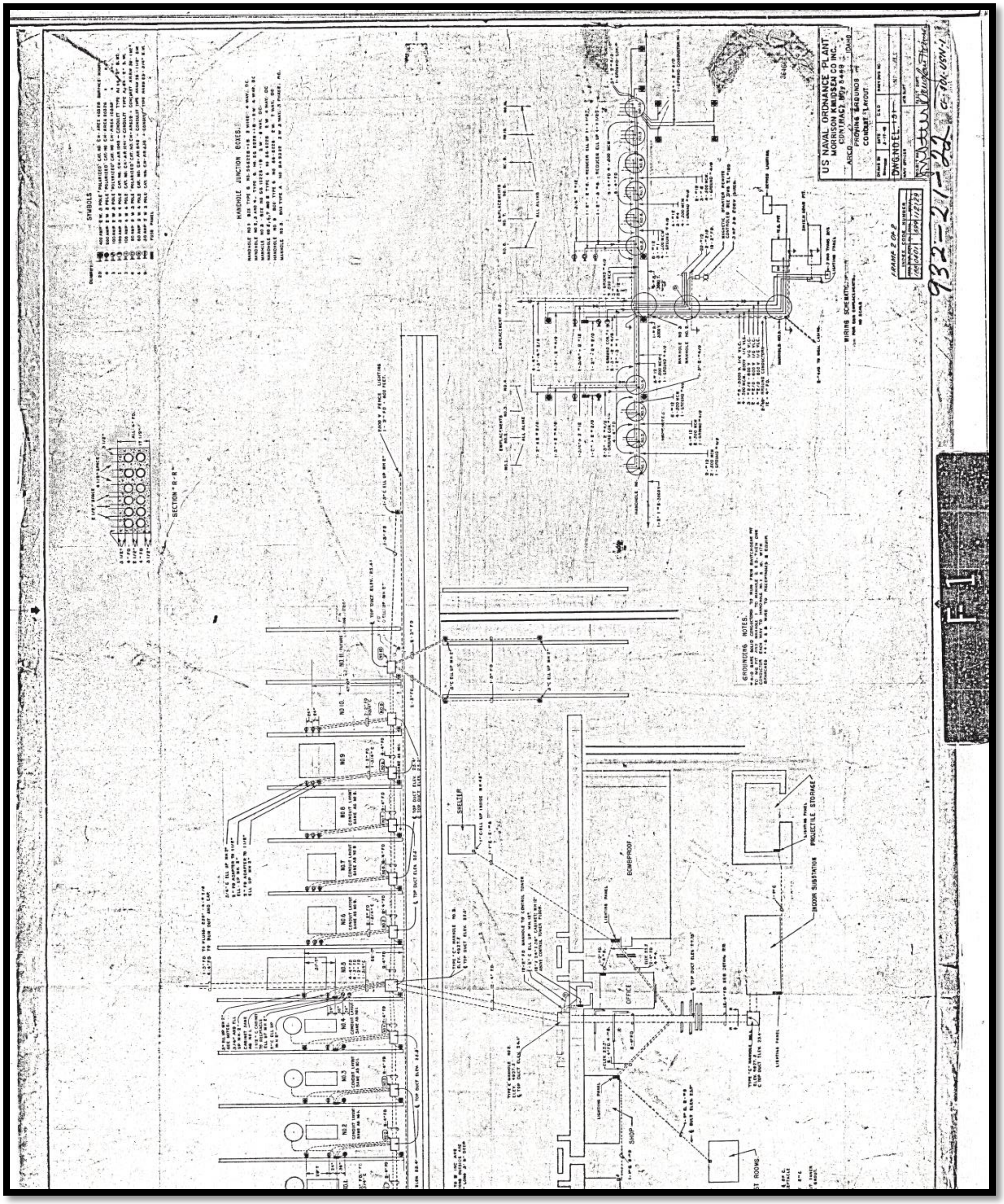


Figure 5.77: INL drawing number 112129 (CF-401-USN-1); emplacement area (CFA), conduit layout; frame 1 of 2; ca. 1943.

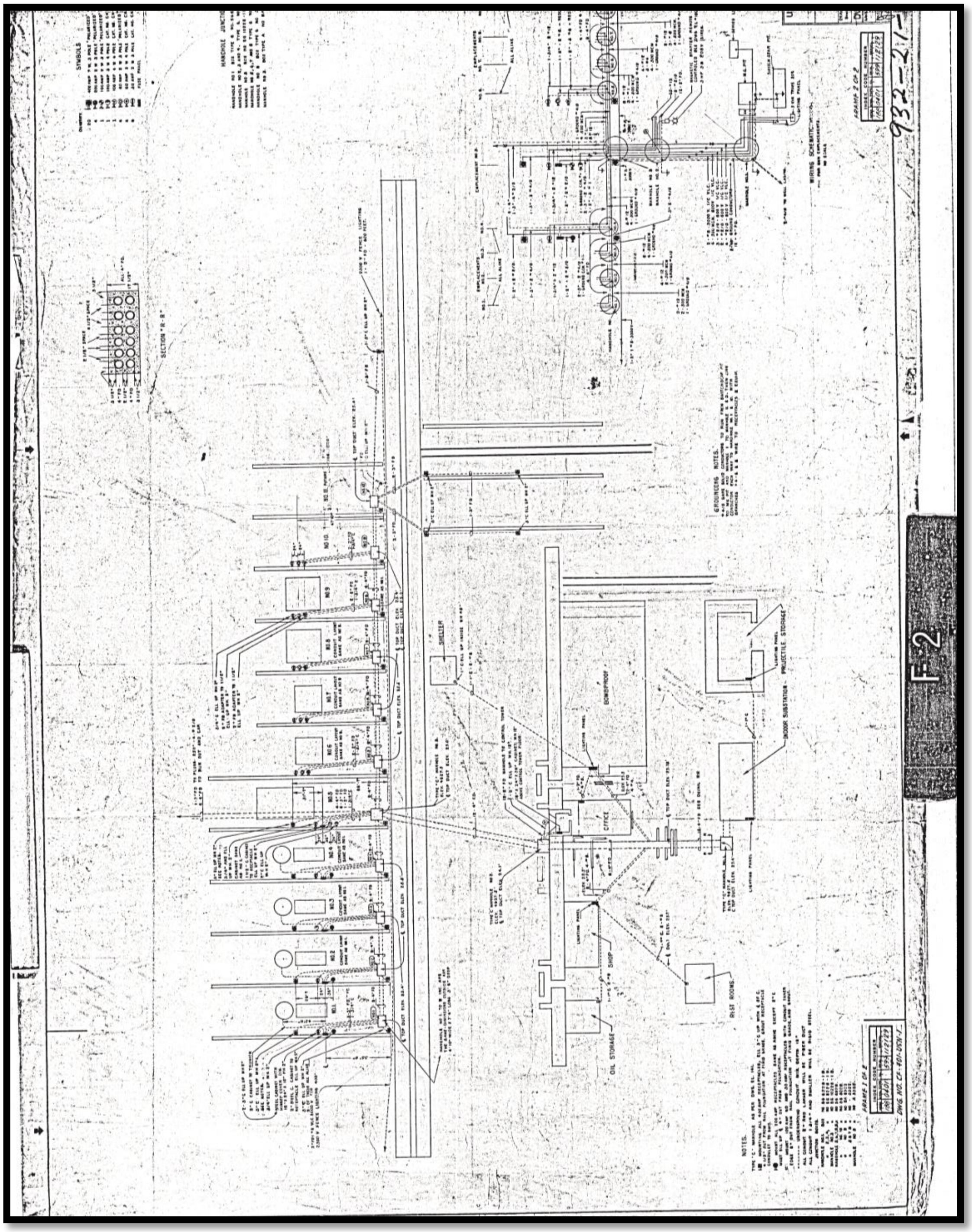


Figure 5.78: INL drawing number 11212902 (CF-401-USN-1); emplacement area (CFA), layout; frame 2 of 2; ca. 1943.

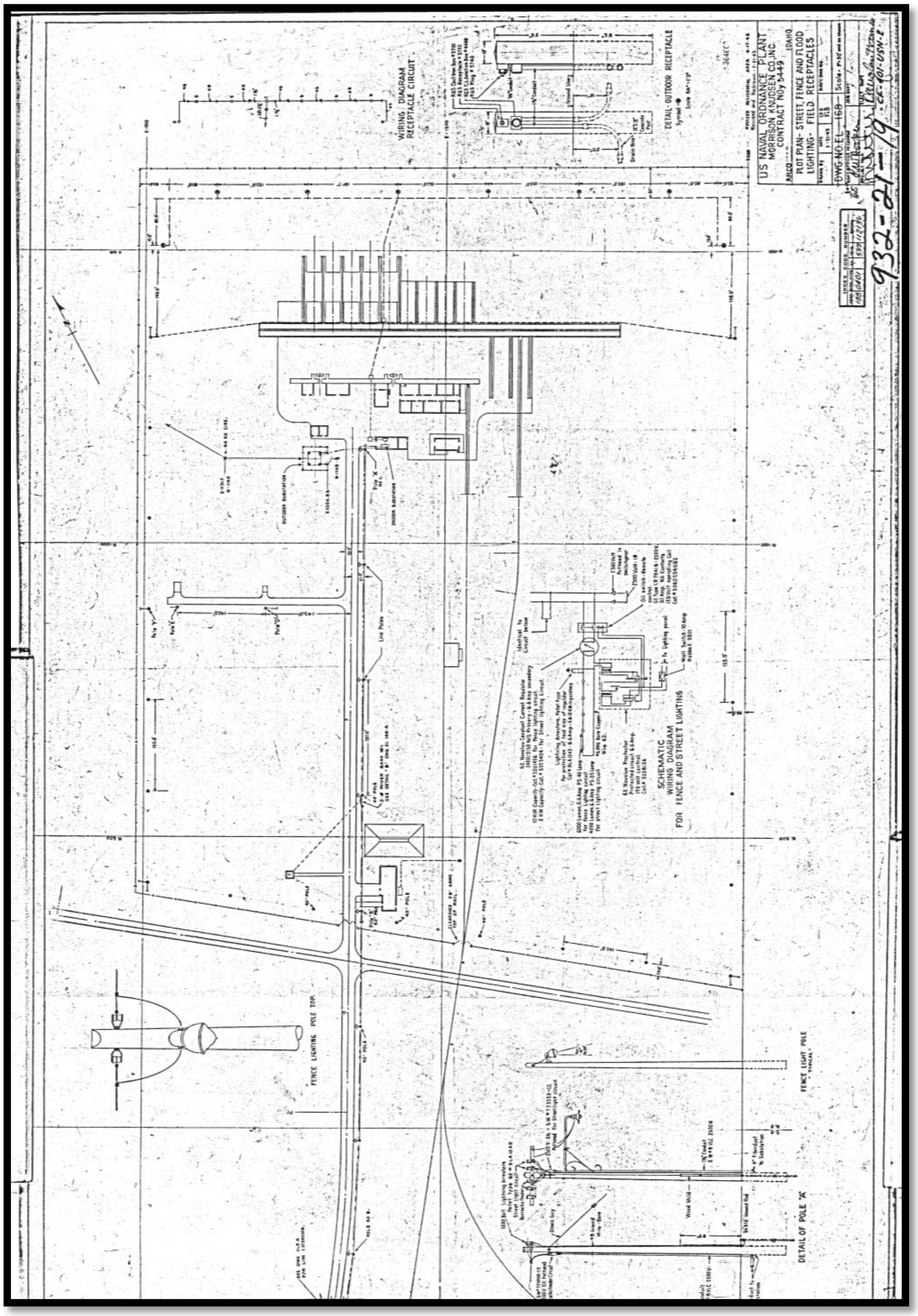


Figure 5.79: INL drawing number 112130 (CF-401-USN-2); emplacement area (CFA), plot plan, street, fence and flood lighting, field receptoicles; February 1943.

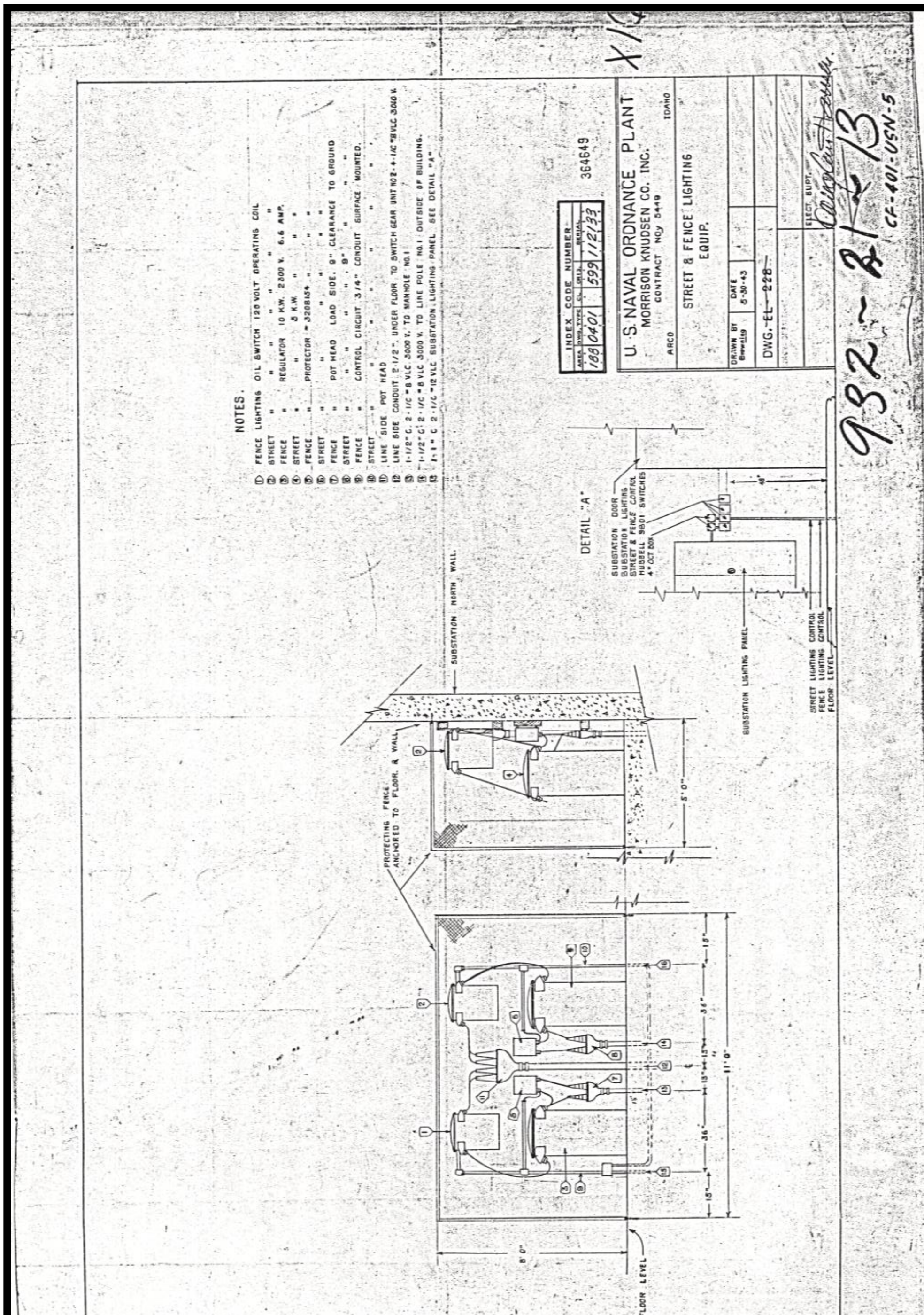


Figure 5.80: INL drawing number 112133 (CF-401-USN-5); emplacement area (CFA), street and fence lighting equipment; May 1943.

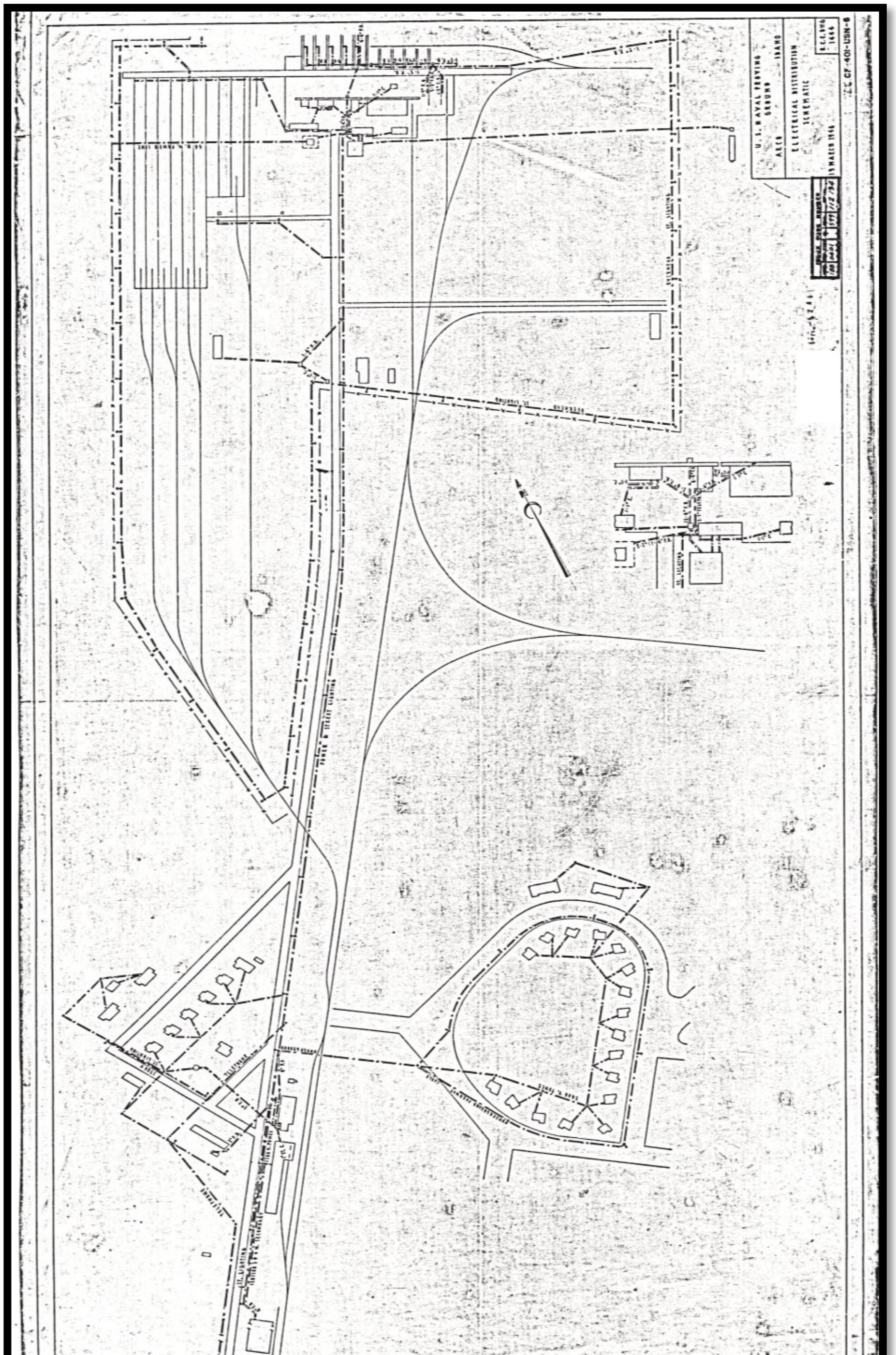


Figure 5.81: INL drawing number 112134 (CF-401-USN-6); emplacement area (CFA), electrical distribution schematic; March 1946.

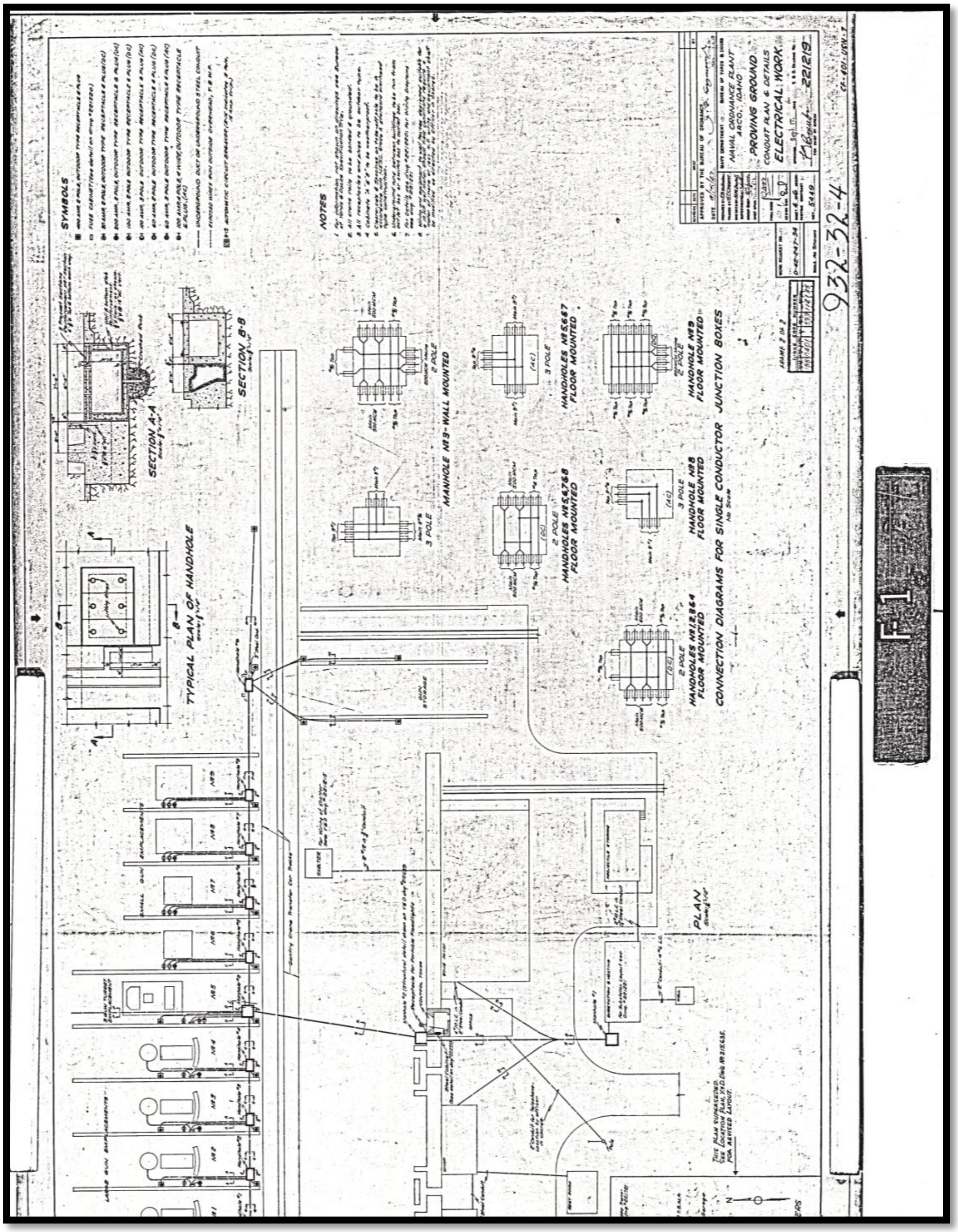


Figure 5.82: INL drawing number 112135 (CF-401-USN-7); emplacement area (CFA), conduit plan and details, electrical work; frame 1 of 2; September 1942.

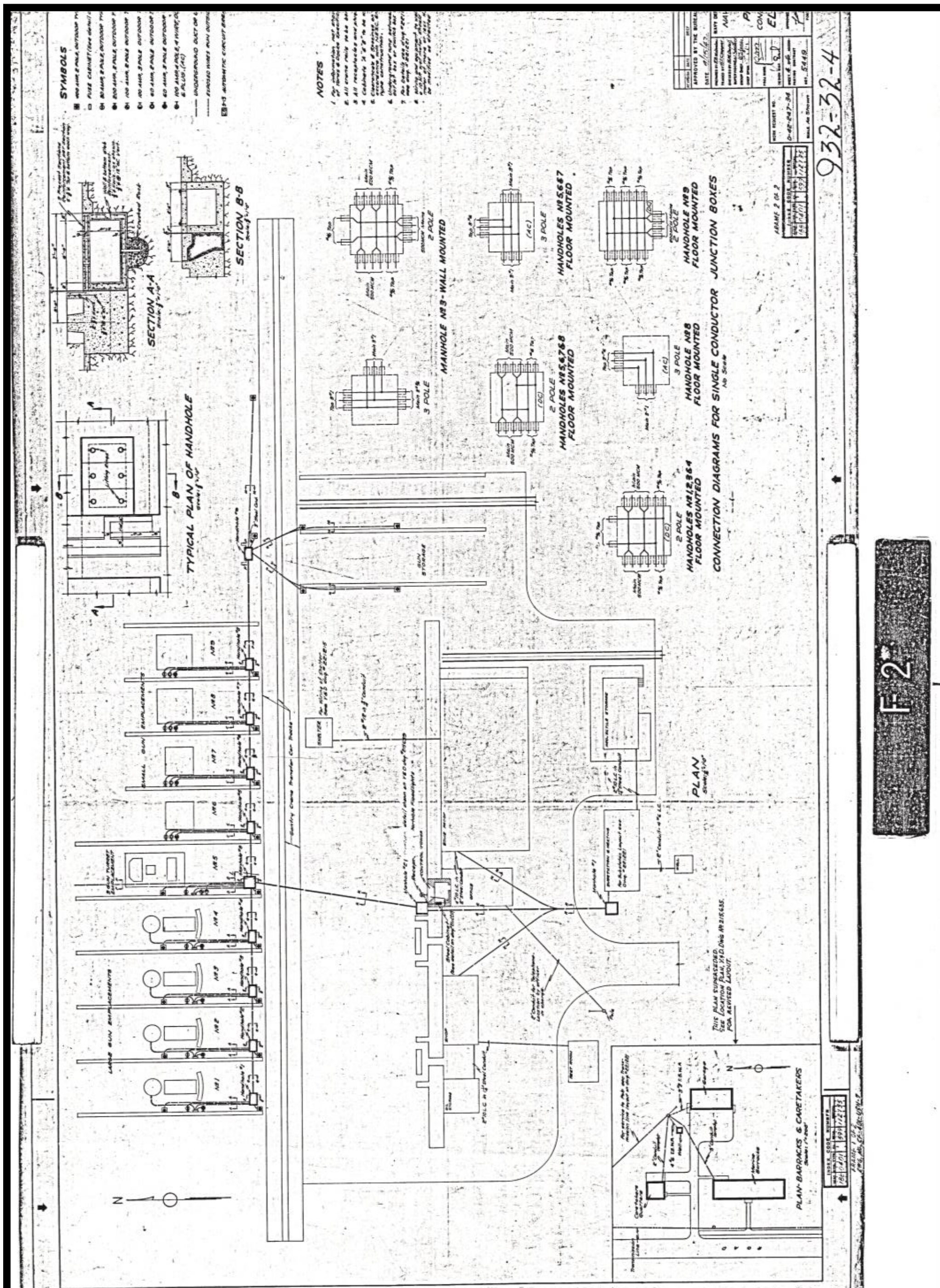


Figure 5.83: INL drawing number 11213502 (CF-401-USN-7); emplacement area (CFA), conduit plan and details, electrical work; frame 2 of 2; September 1942.

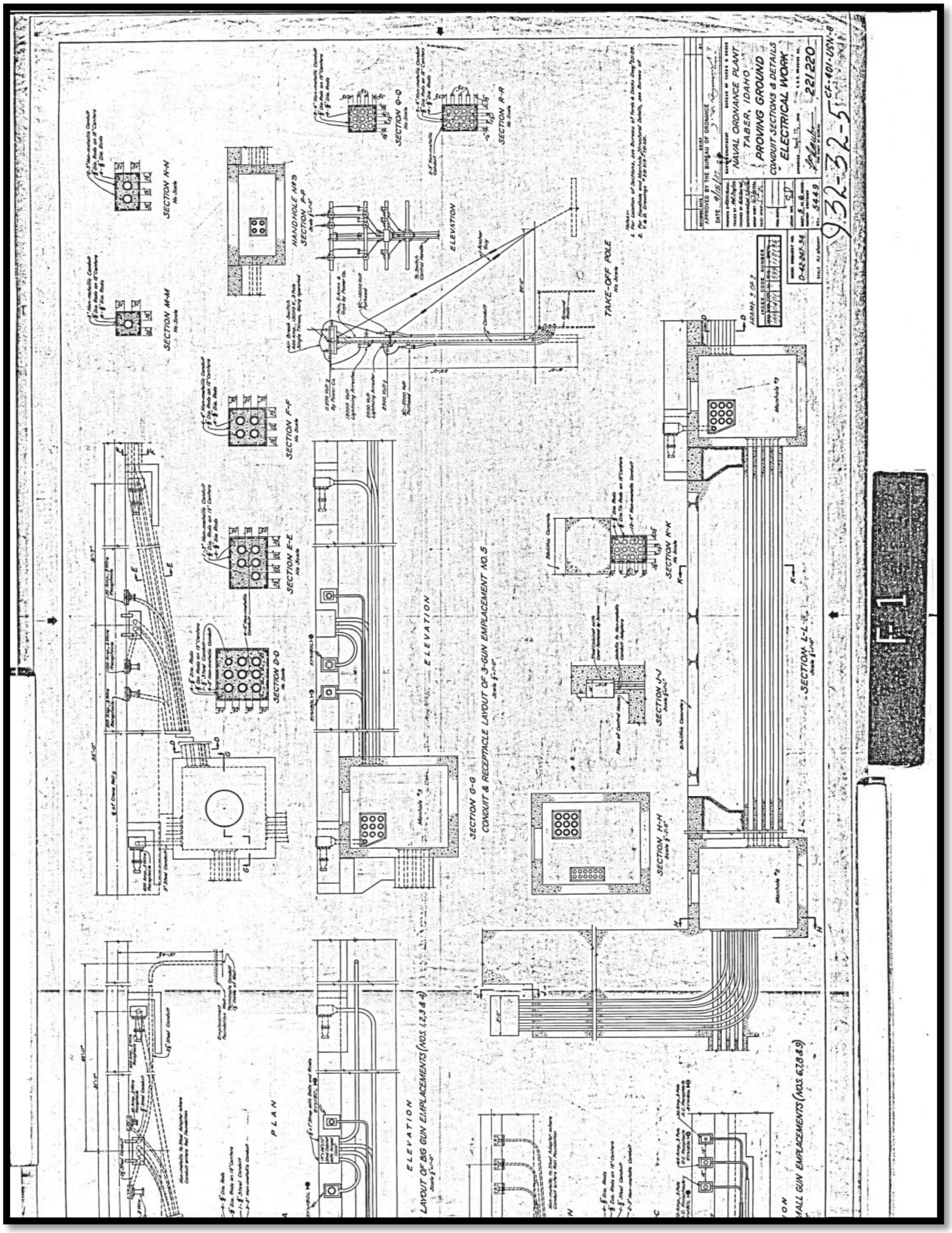


Figure 5.84: INL drawing number 112136 (CF-401-USN-8); emplacement area (CFA), conduit sections and details, electrical work; frame 1 of 2; September 1942.

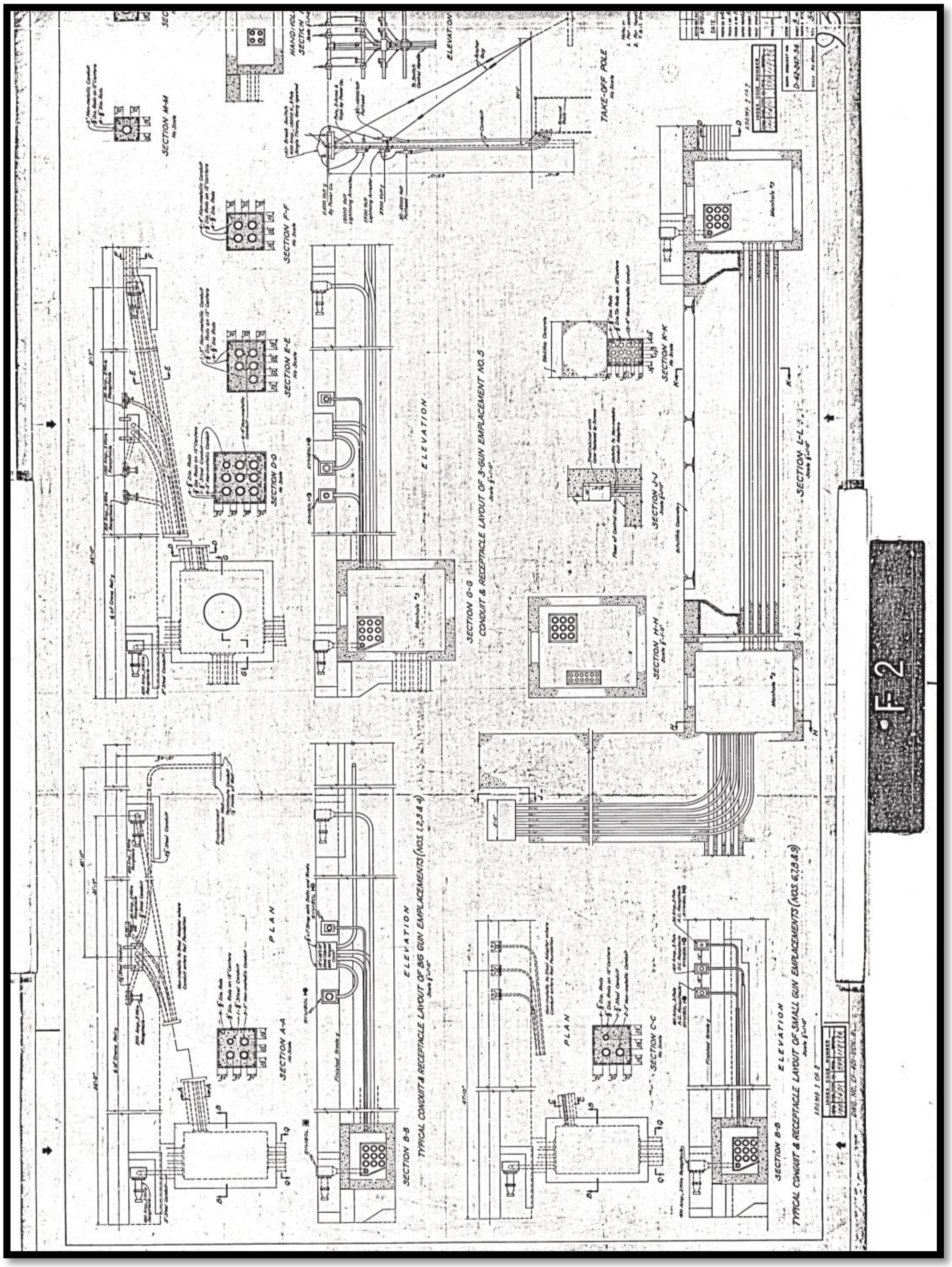


Figure 5.85: INL drawing number 11213602 (CF-401-USN-8); emplacement area (CFA), conduit sections and details, electrical work; frame 2 of 2; September 1942.

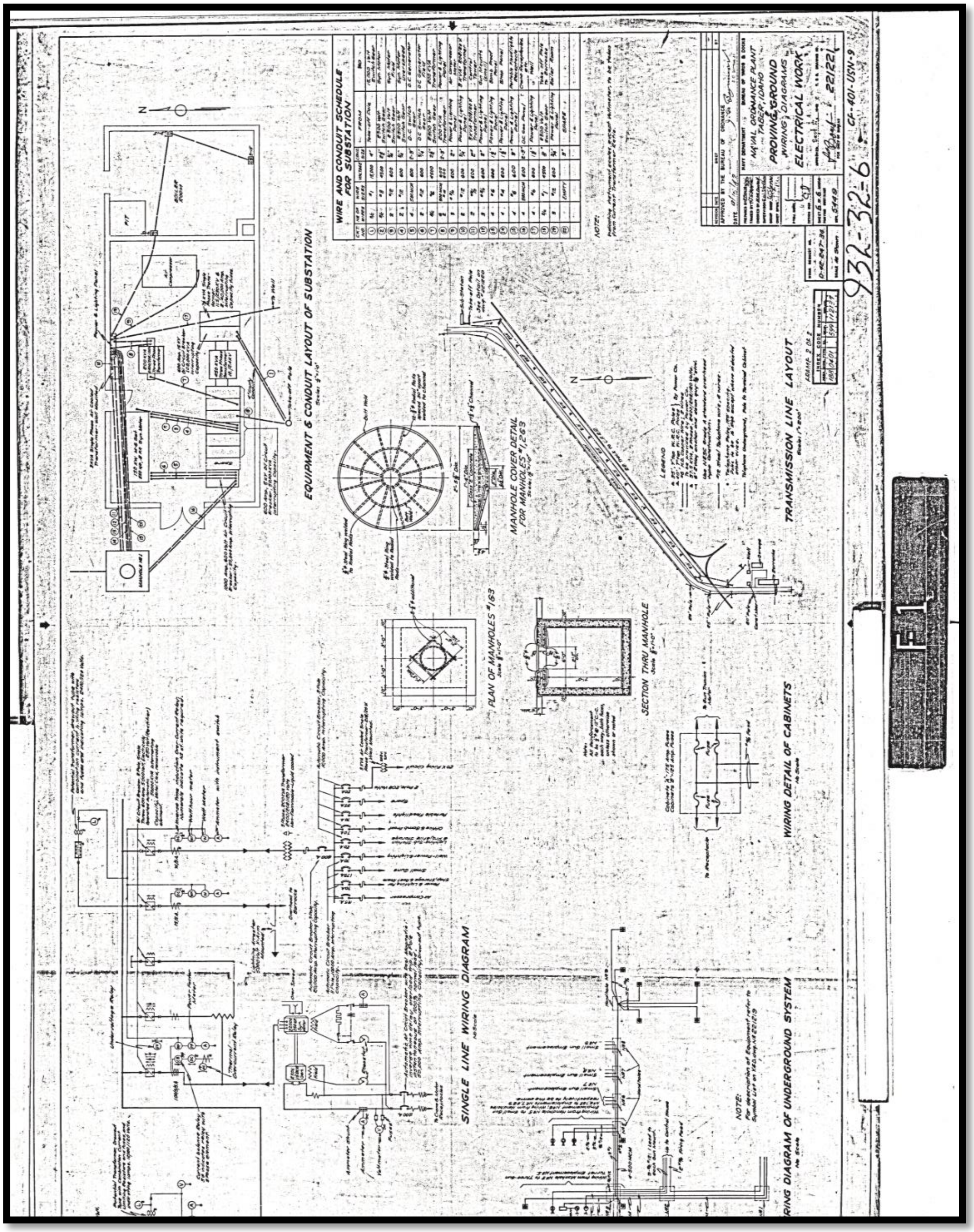


Figure 5.86: INL drawing number 112137 (CF-401-USN-9); emplacement area (CFA), wiring diagrams, electrical work; frame 1 of 2; September 1942.

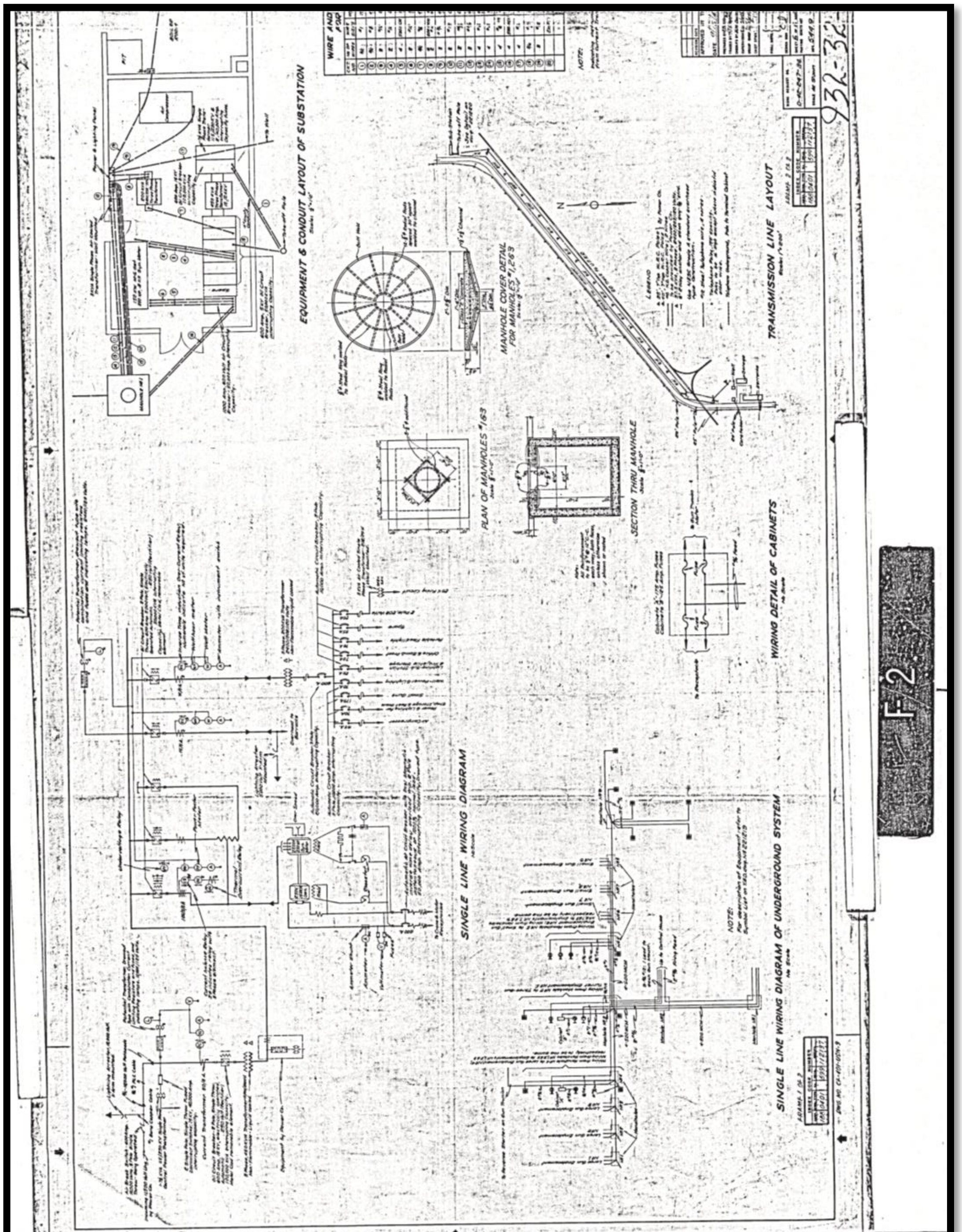


Figure 5.87: INL drawing number 11213702 (CF-401-USN-9); emplacement area (CFA), wiring diagrams, electrical work; frame 2 of 2; September 1942.

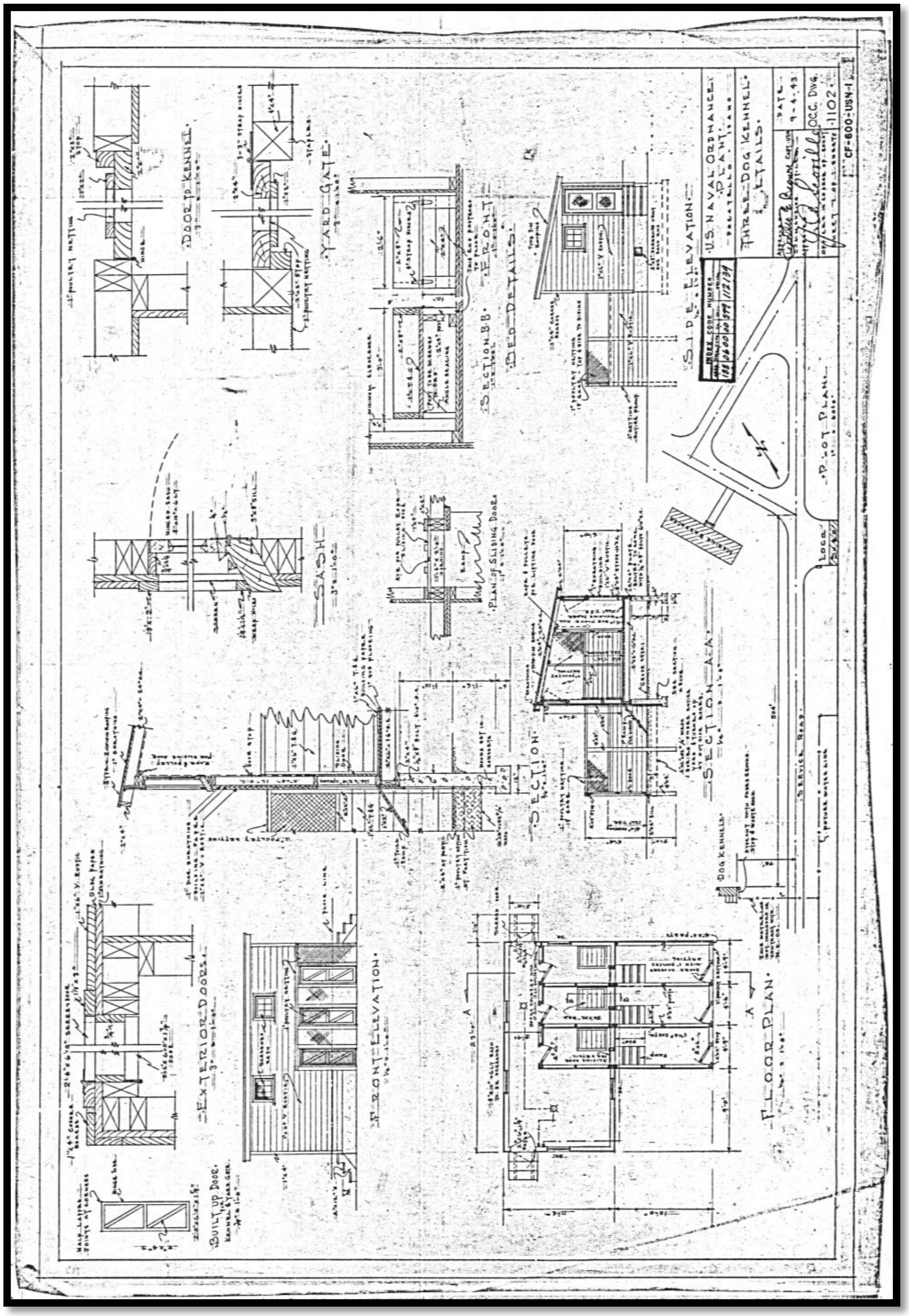


Figure 5.88: INL drawing number 112139 (CF-600-USN-1); three dog kennel (CFA-600, non-extant), details; September 1943.

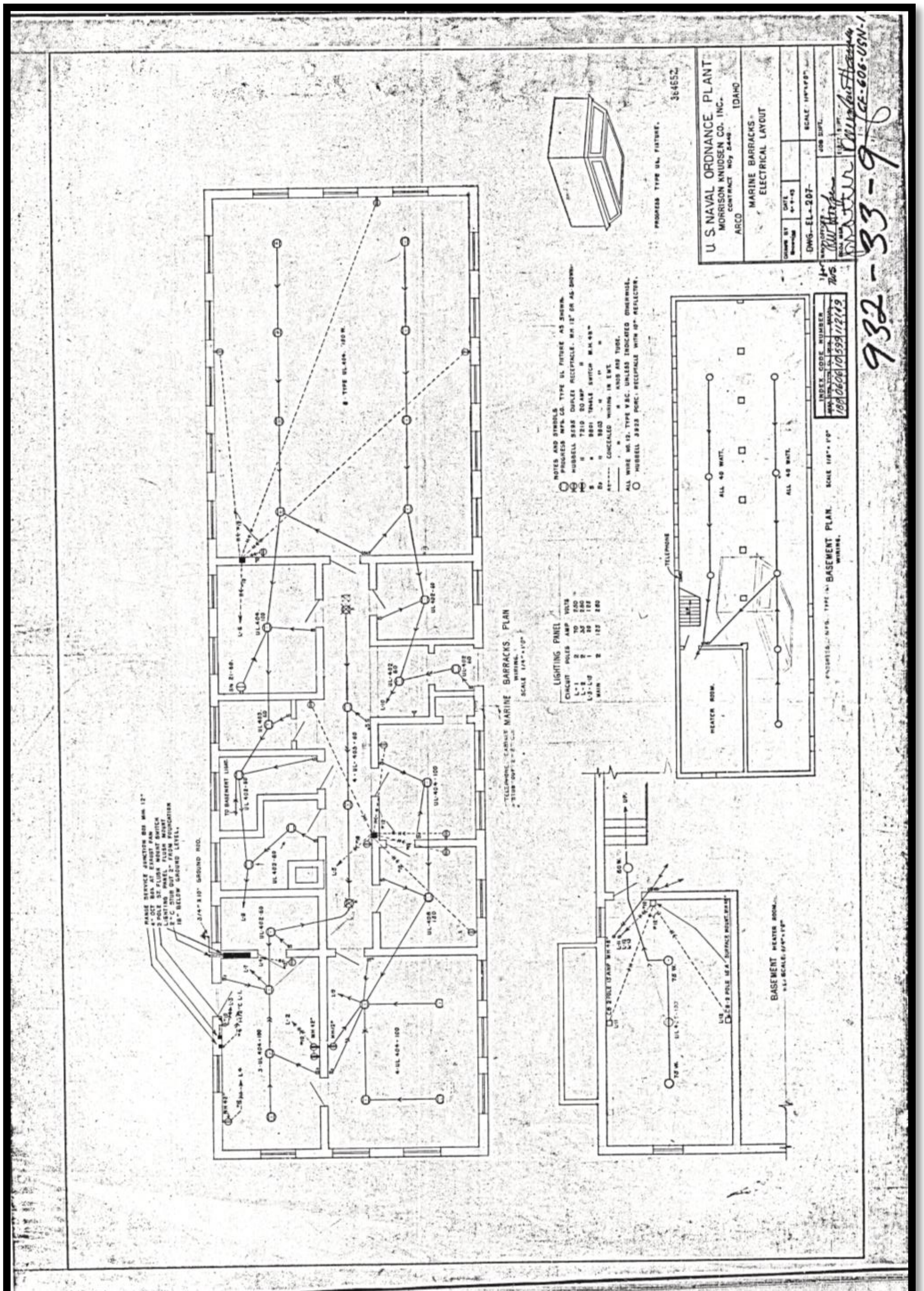


Figure 5.89: INL drawing number 12149 (CF-606-USN-1); marine barracks (CFA-606, extant), electrical layout; April 1943.

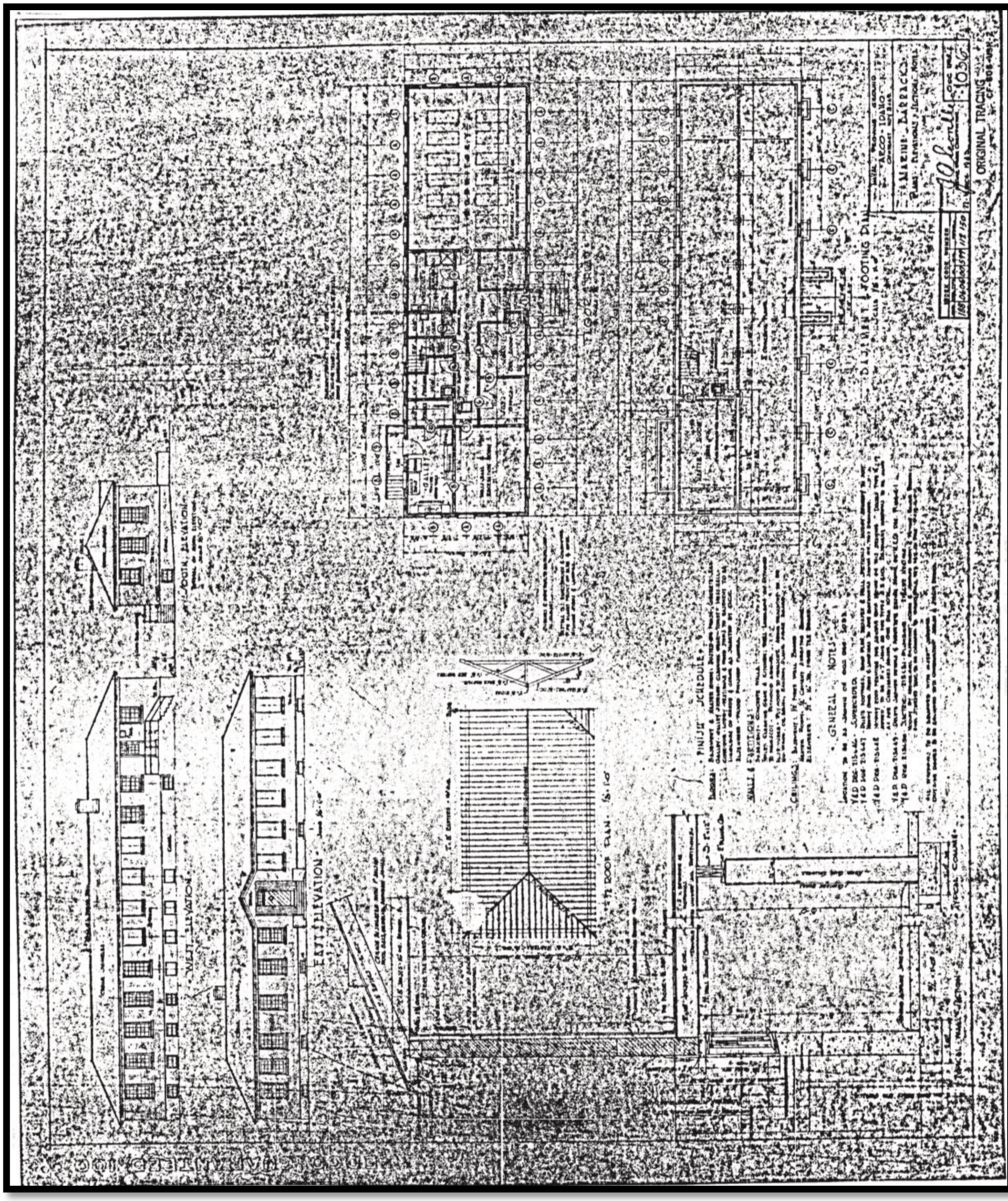


Figure 5.90: INL drawing number 112150 (CF-606-USN-2); marine barracks (CFA-606, extant), plans, elevations, sections, and notes; March 1943.

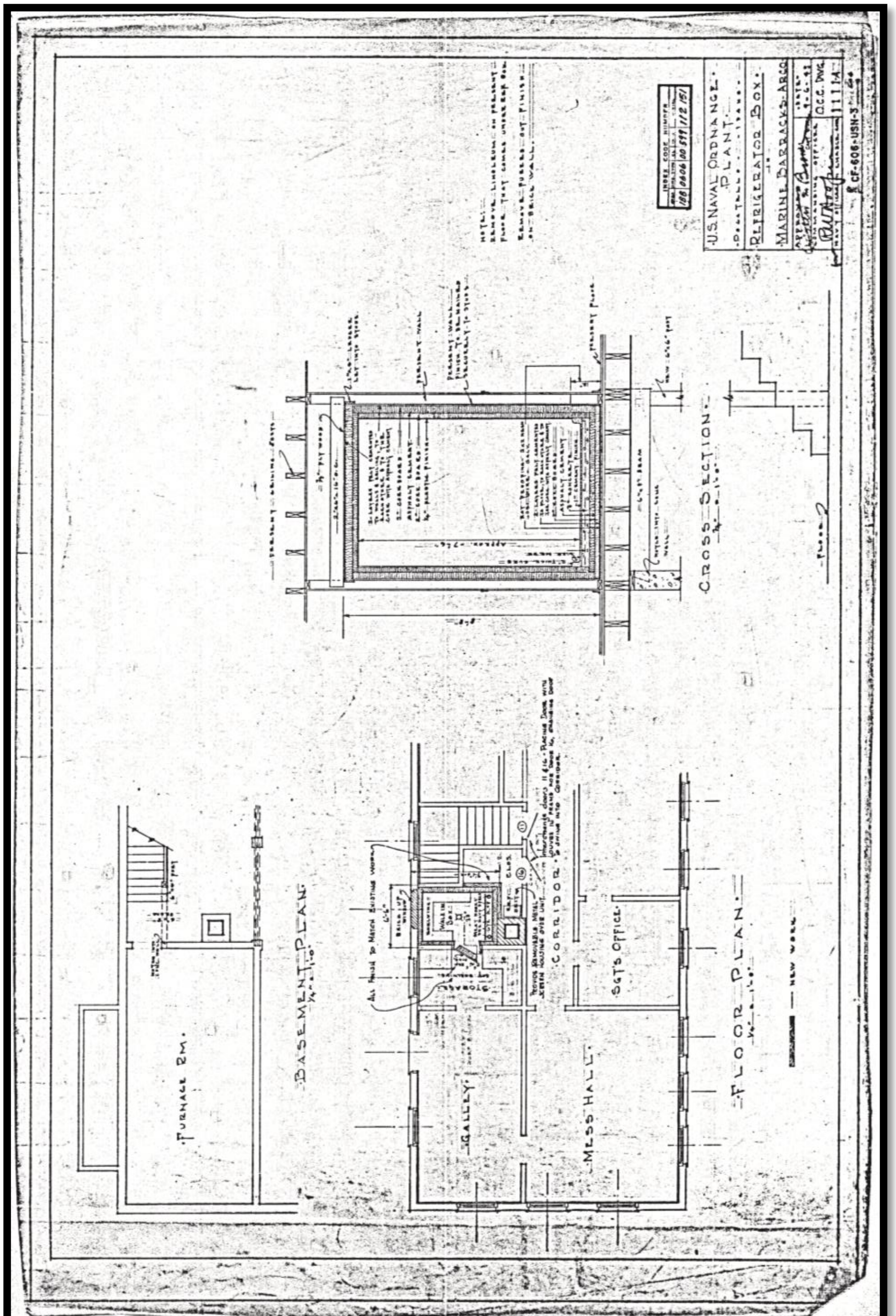


Figure 5.91: INL drawing number 112151 (CF-606-USN-3); marine barracks (CFA-606, extant), refrigerator box; September 1943.

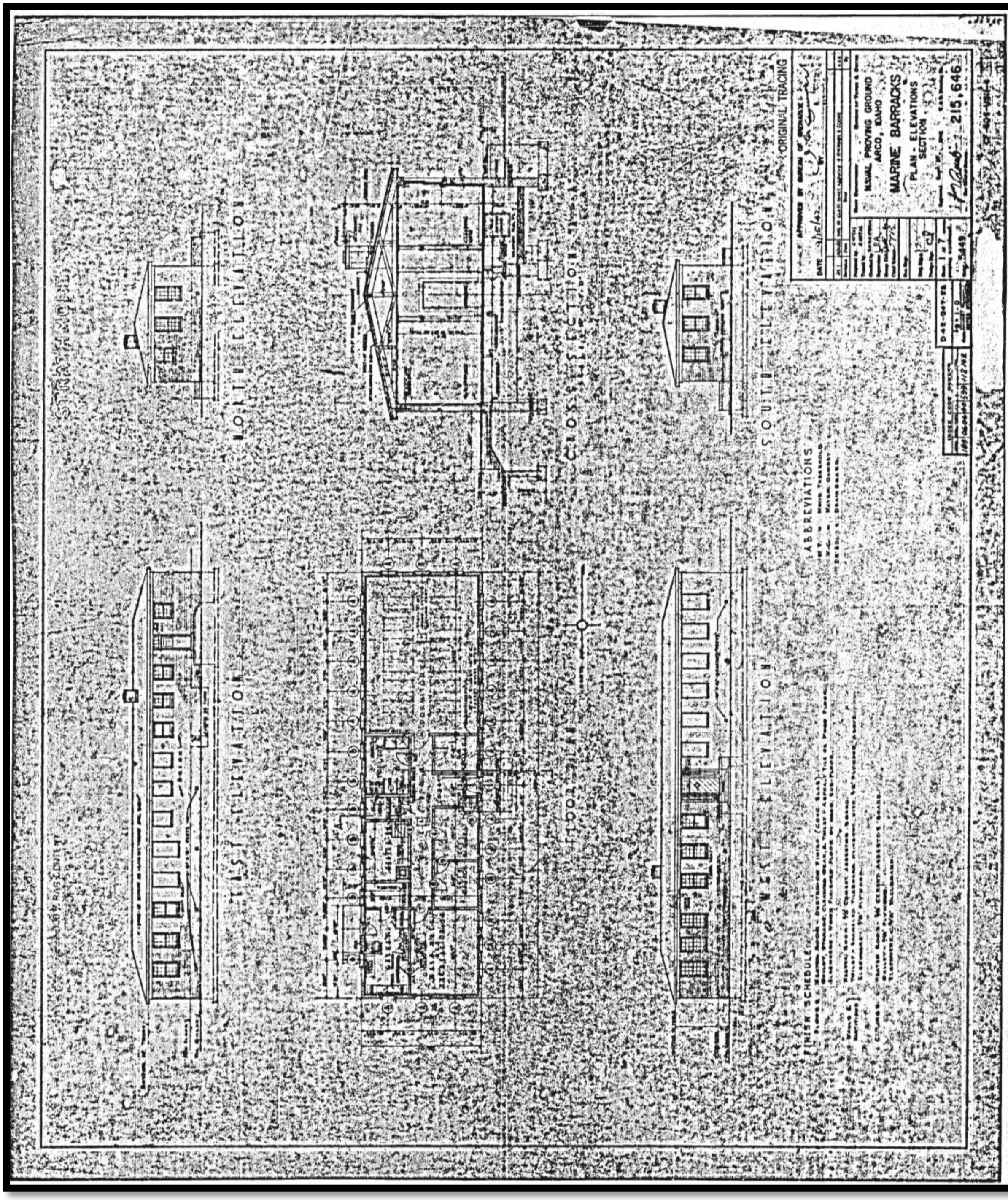


Figure 5.92: INL drawing number 112152 (CF-606-USN-4); marine barracks (CFA-606, extant), plans, elevations, and section; September 1942.

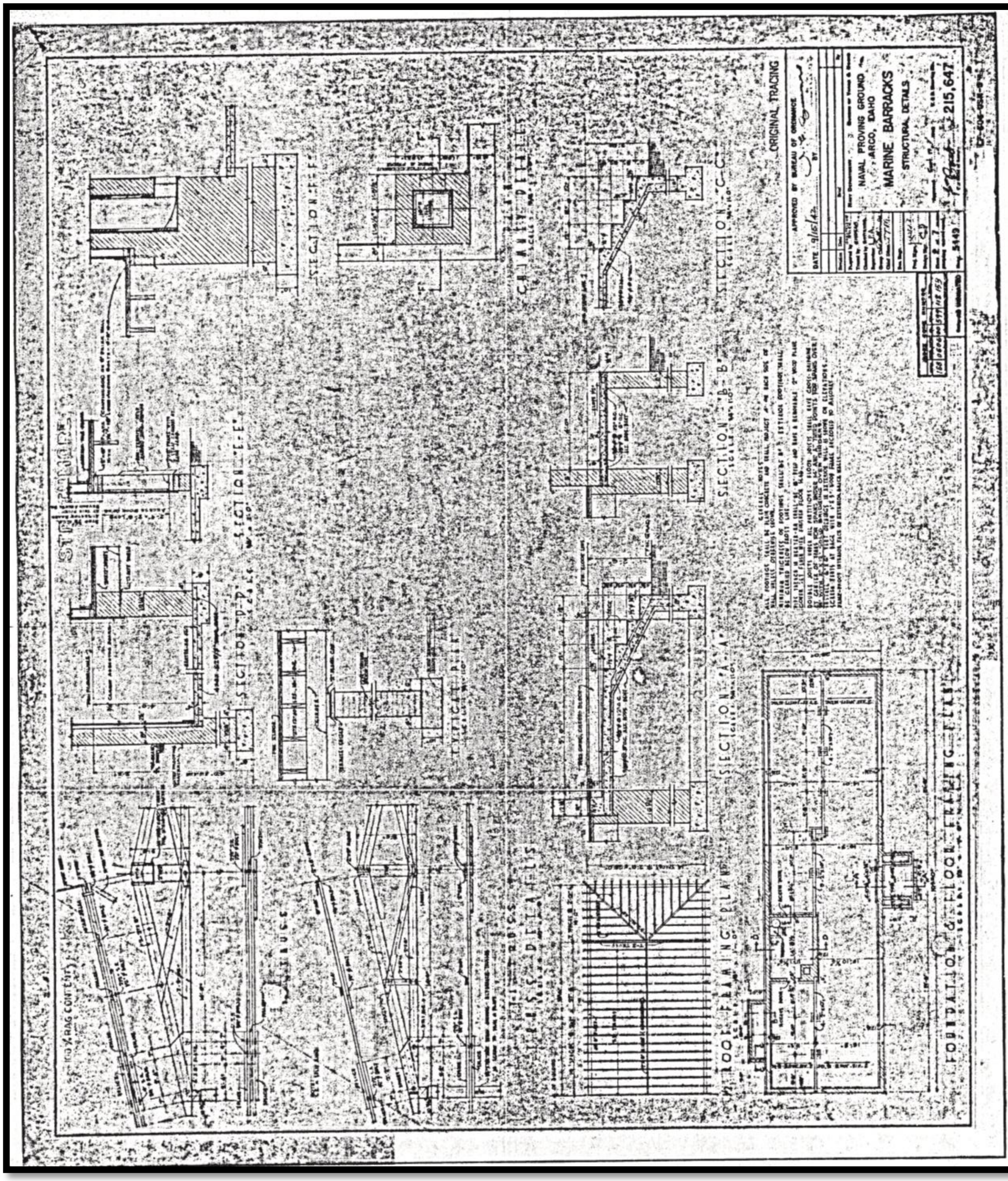


Figure 5.93: INL drawing number 112153 (CF-606-USN-5); marine barracks (CFA-606, extant), structural details; September 1942.

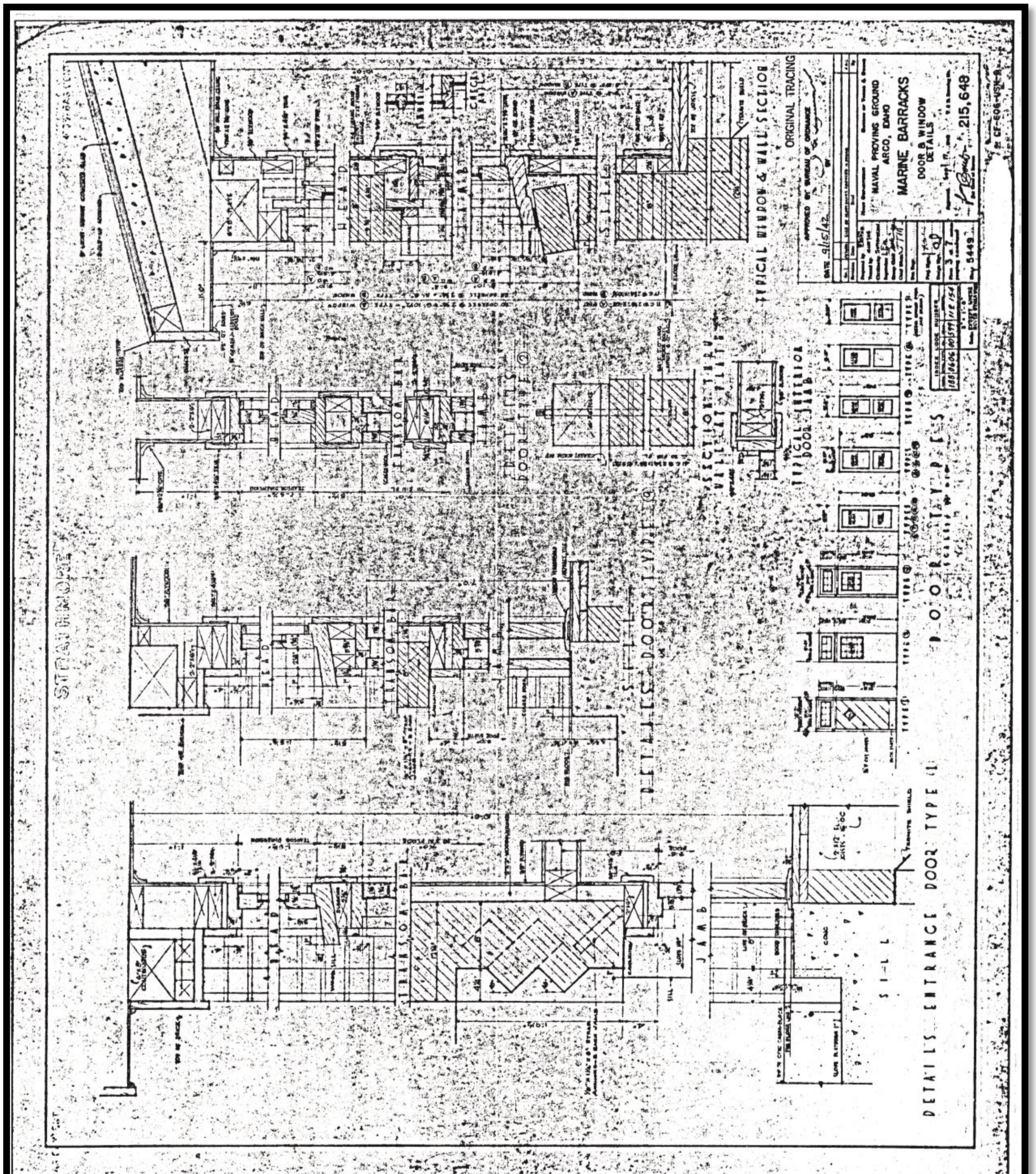


Figure 5.94: INL drawing number 112154 (CF-606-USN-6); marine barracks (CFA-606, extant), door and window details; September 1942.

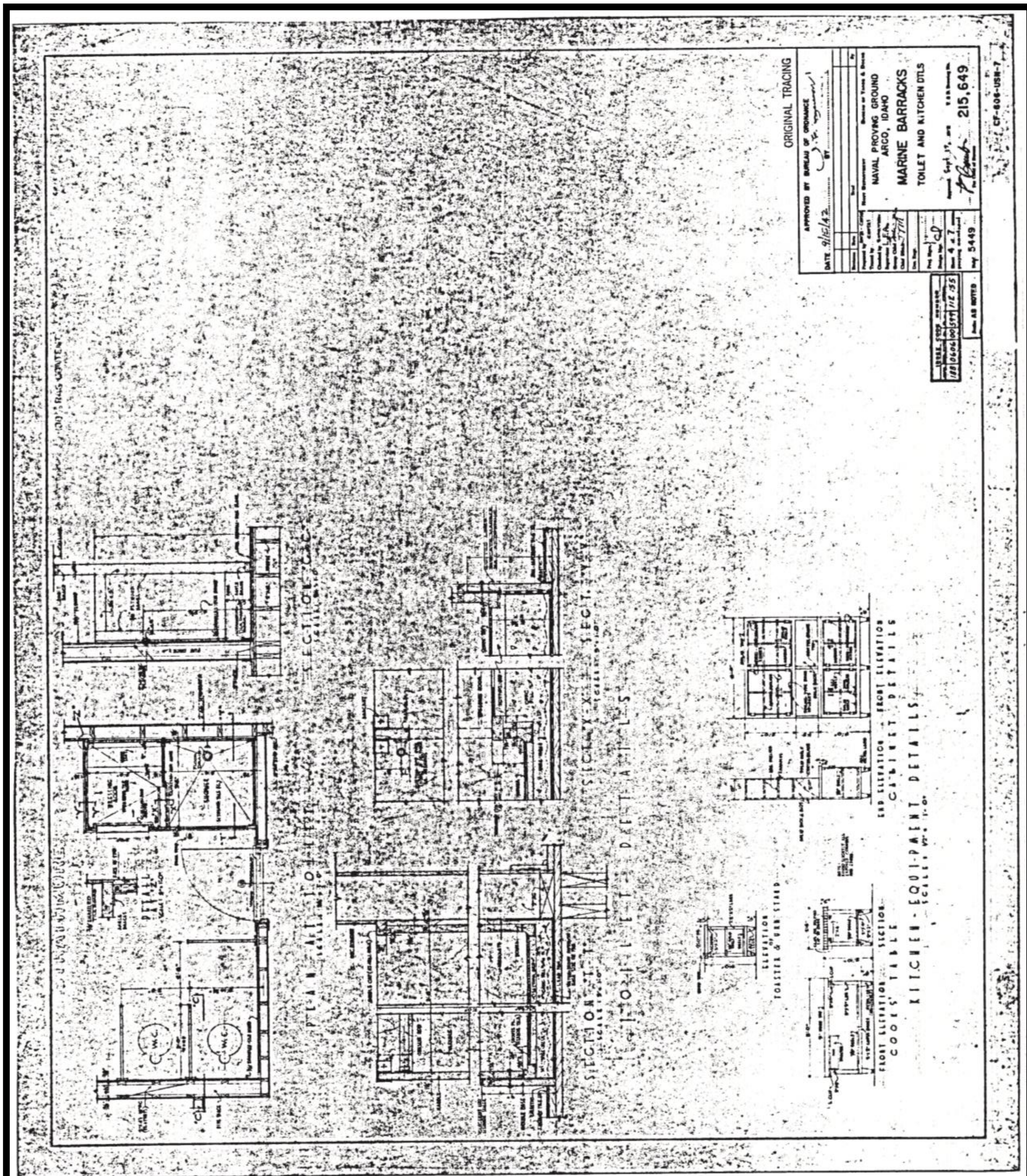


Figure 5.95: INL drawing number 112155 (CF-606-USN-7); marine barracks (CFA-606, extant), toilet and kitchen details; September 1942.

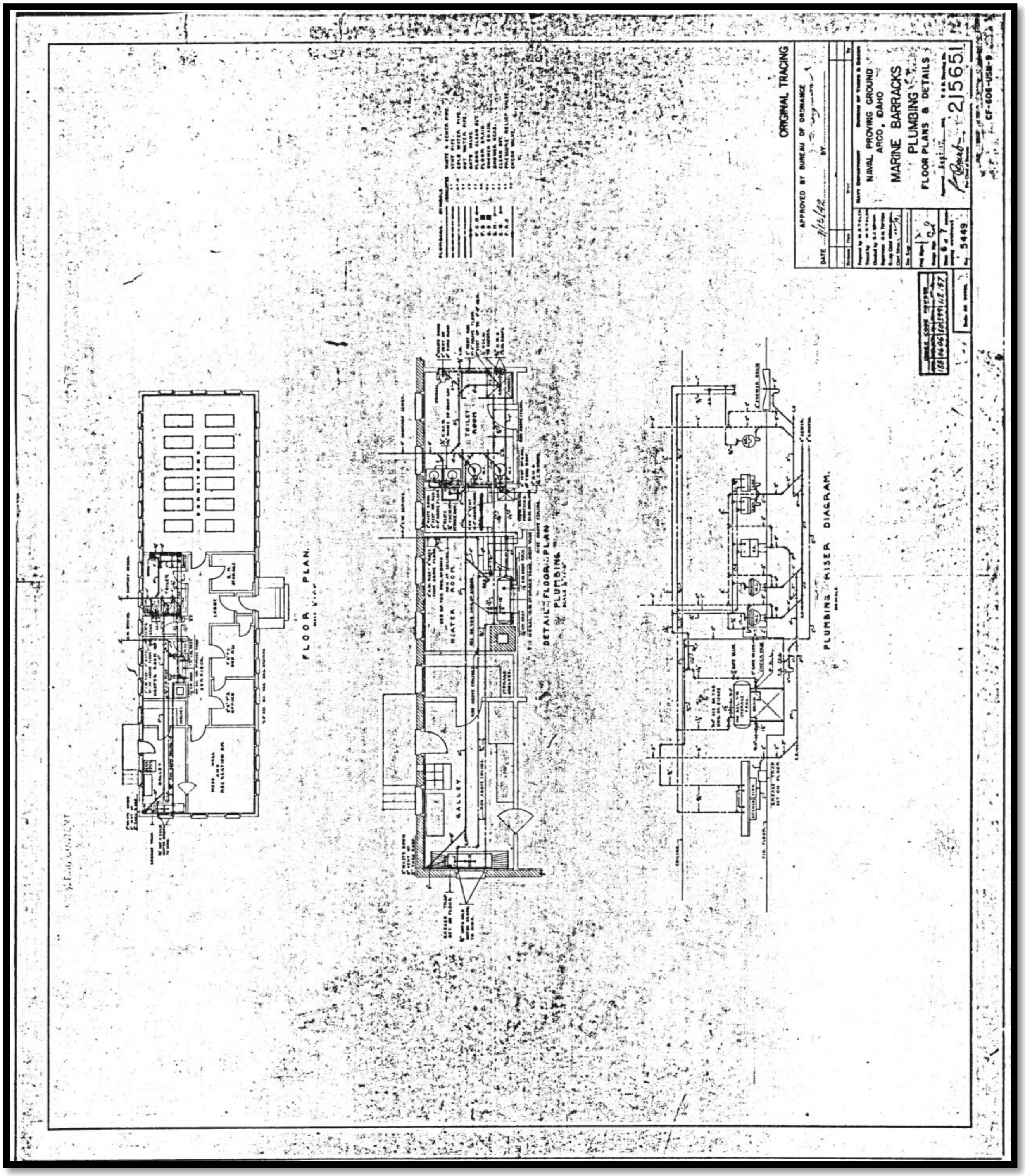


Figure 5.96: INL drawing number 112157 (CF-606-USN-9); marine barracks (CFA-606, extant), plumbing, floor plans and details; September 1942.

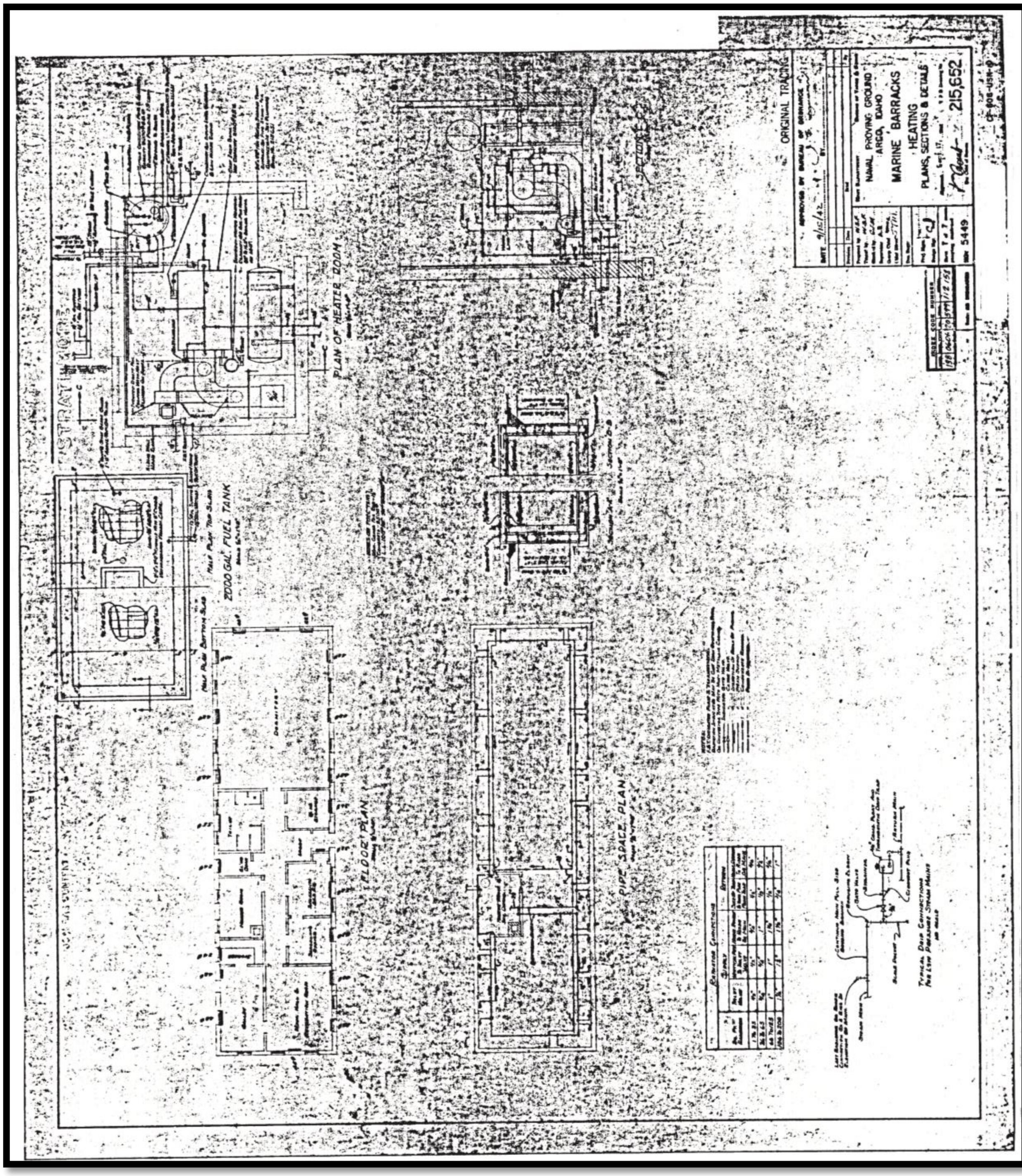


Figure 5.97: INL drawing number 112158 (CF-606-USN-10); marine barracks (CFA-606, extant), heating, plans, sections, and details; September 1942.

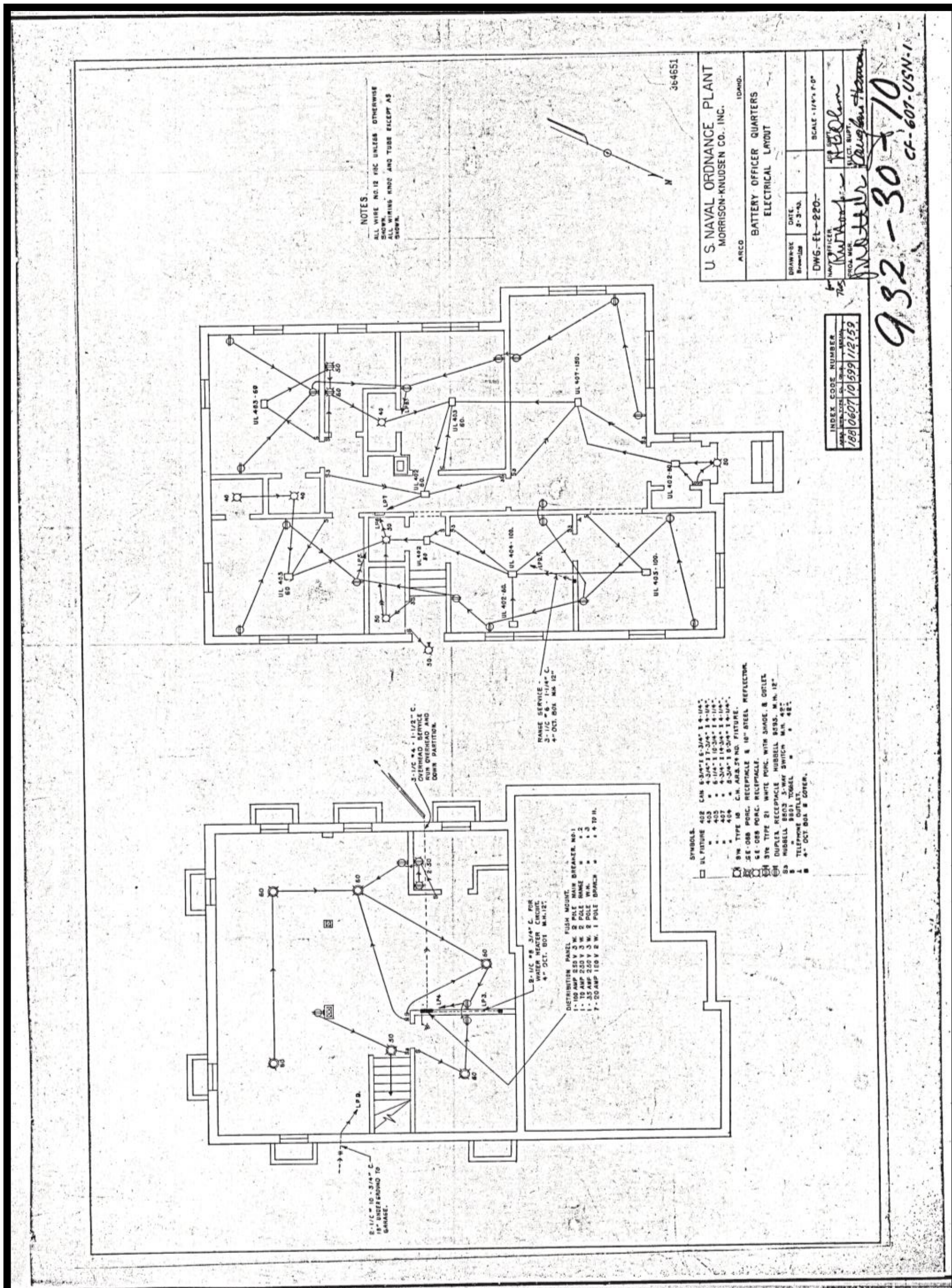


Figure 5.98: INL drawing number 112159 (CF-607-USN-1); battery officer quarters (CFA-607, extant), electrical layout; March 1943.

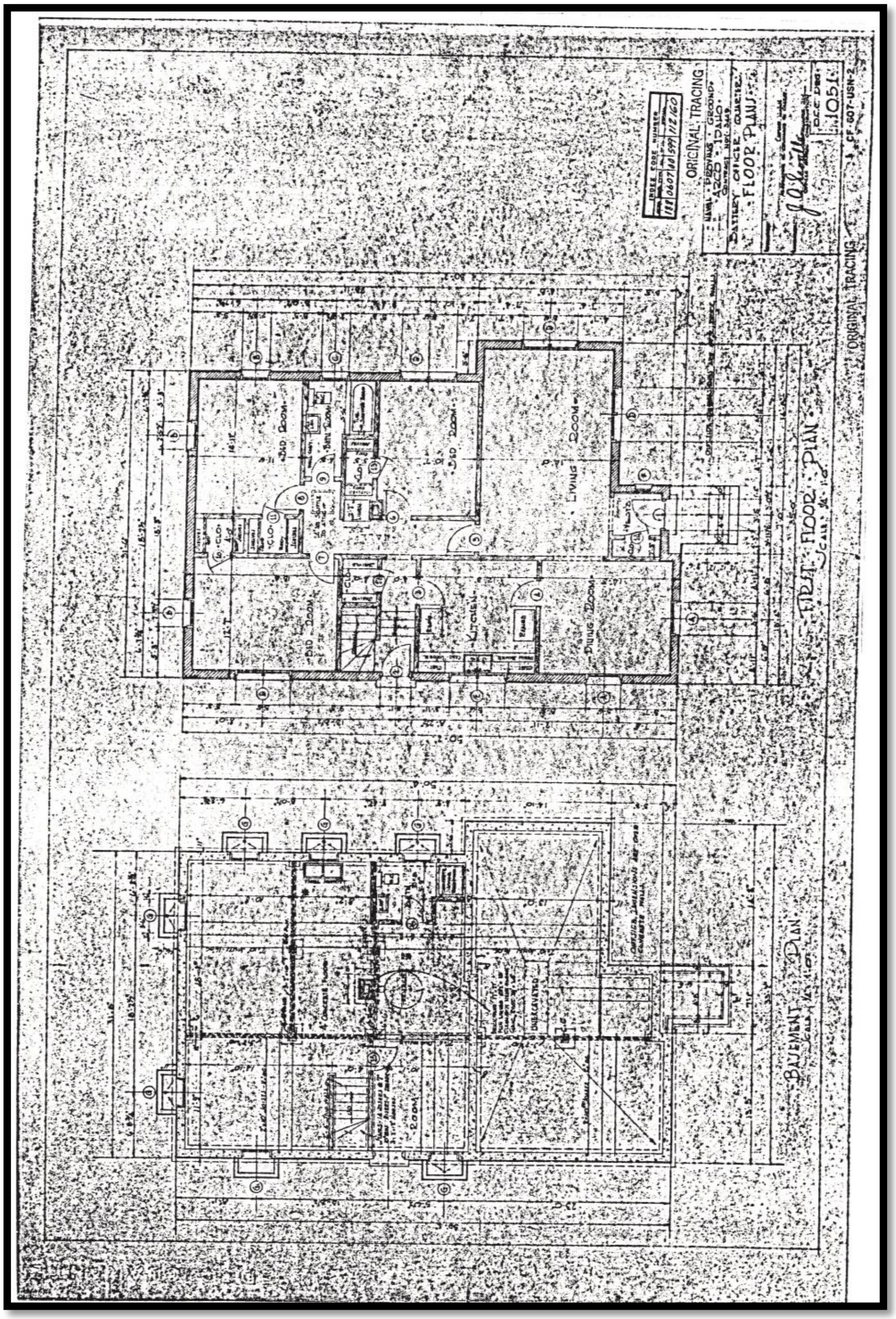


Figure 5.99: INL drawing number 112160 (CF-607-USN-2); battery officer quarters (CFA-607, extant), floor plans; March 1943.

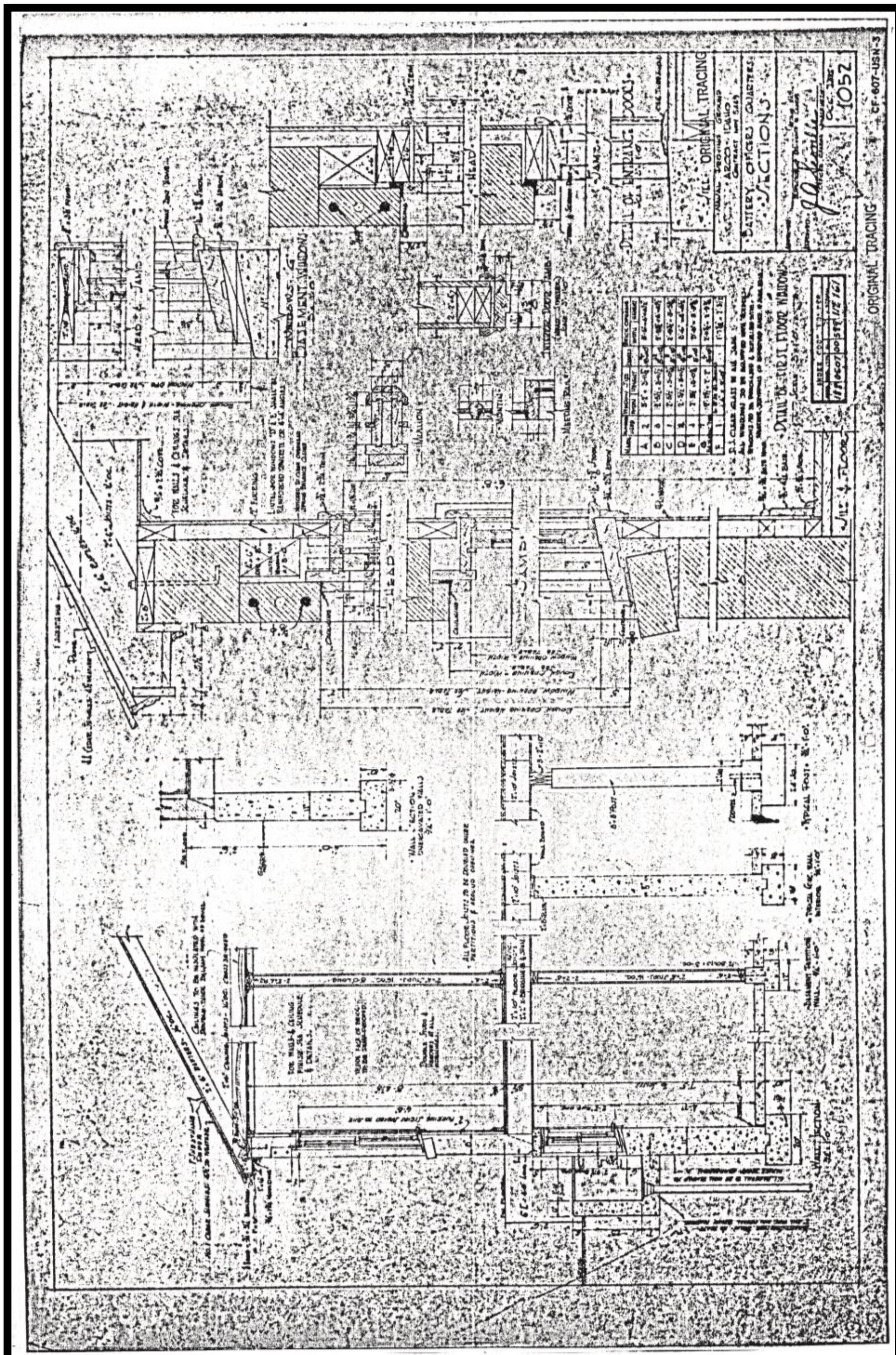


Figure 5.100: INL drawing number 112161 (CF-607-USN-3); battery officer quarters (CFA-607, extant), sections; March 1943.

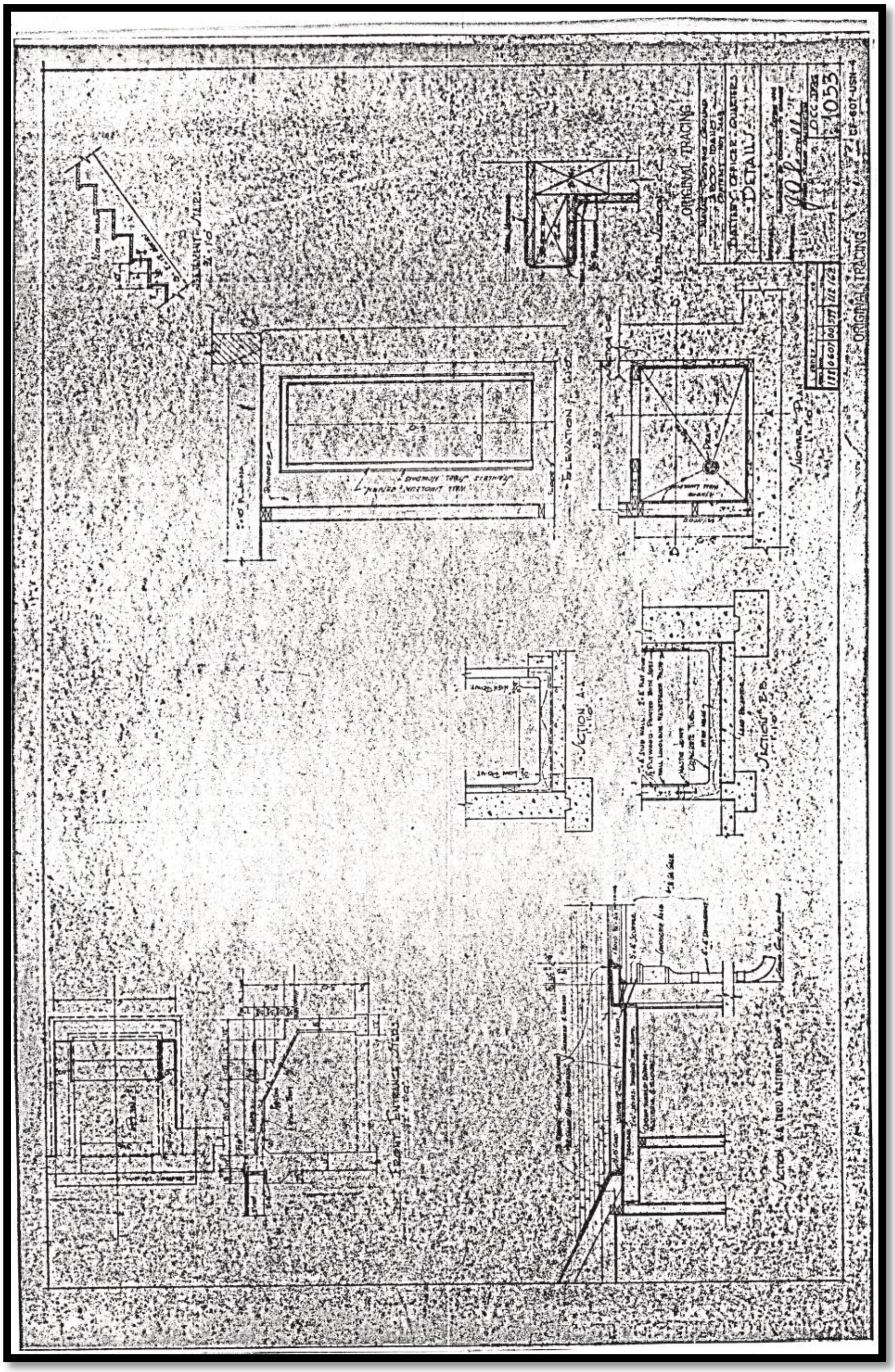


Figure 5.101: INL drawing number 112162 (CF-607-USN-4); battery officer quarters (CFA-607, extant), details; March 1943.

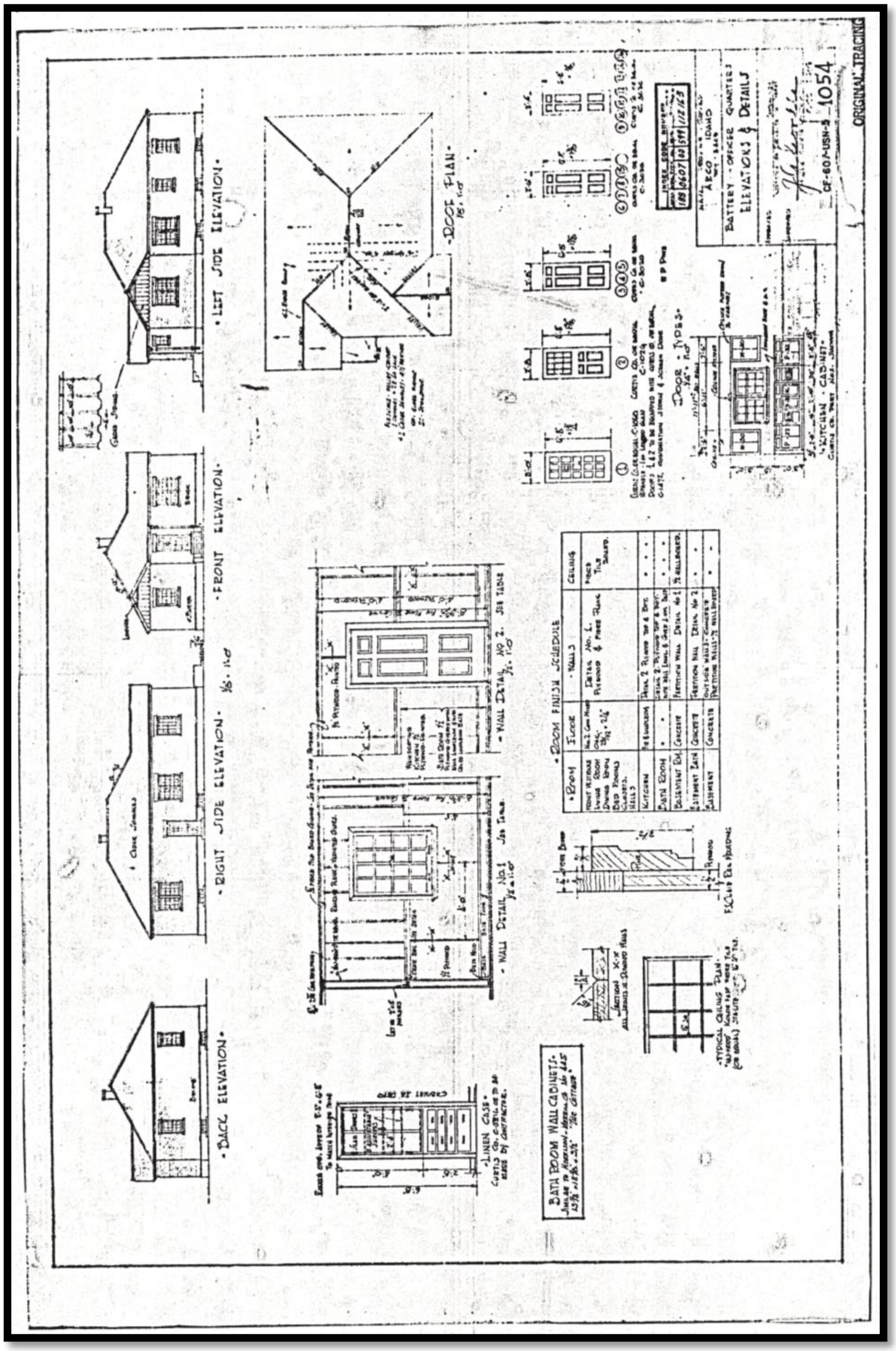


Figure 5.102: INL drawing number 112163 (CF-607-USN-5); battery officer quarters (CFA-607, extant), elevations and details; March 1943.

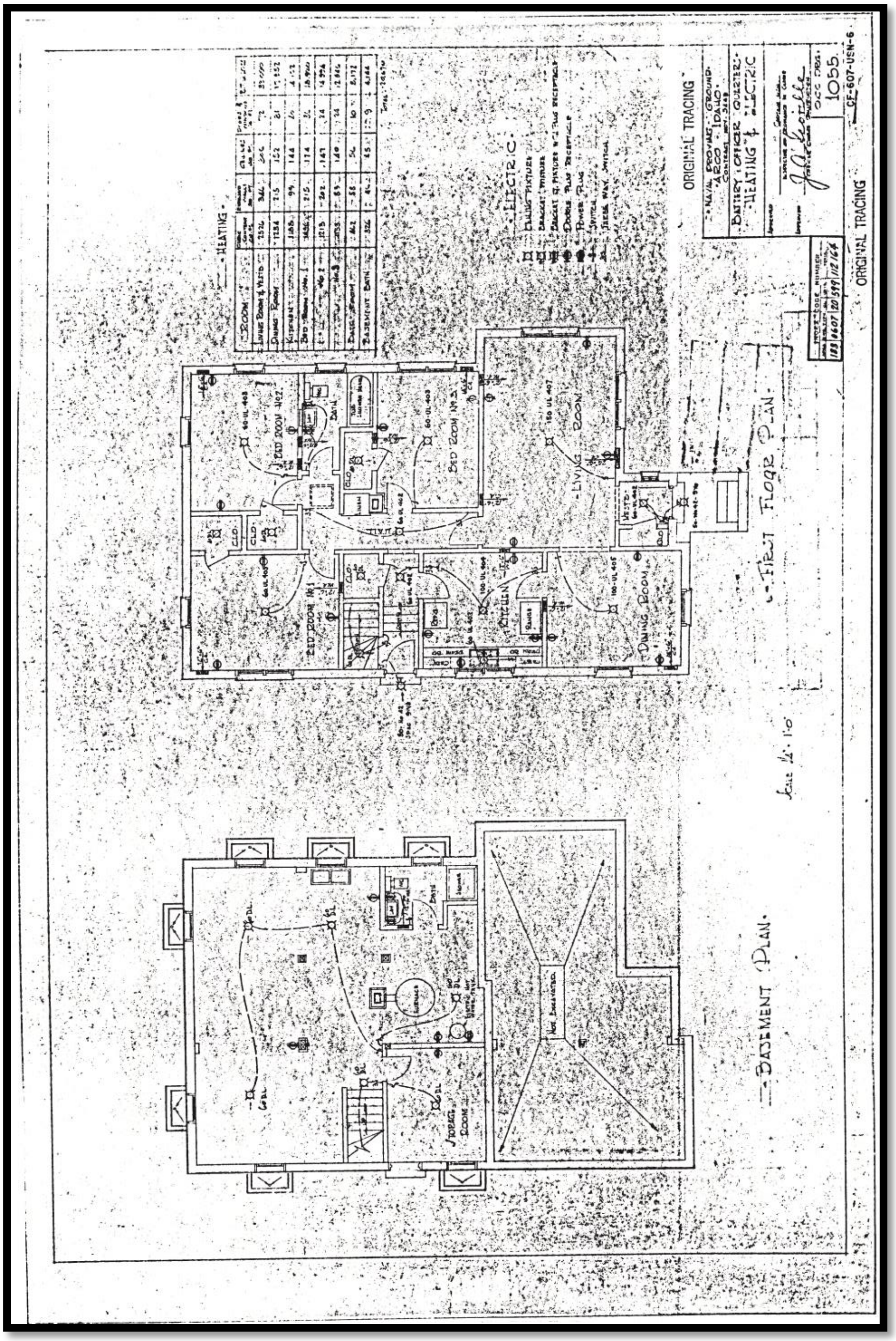


Figure 5.103: INL drawing number 112164 (CF-607-USN-6); battery officer quarters (CFA-607, extant), heating and electric; March 1943.

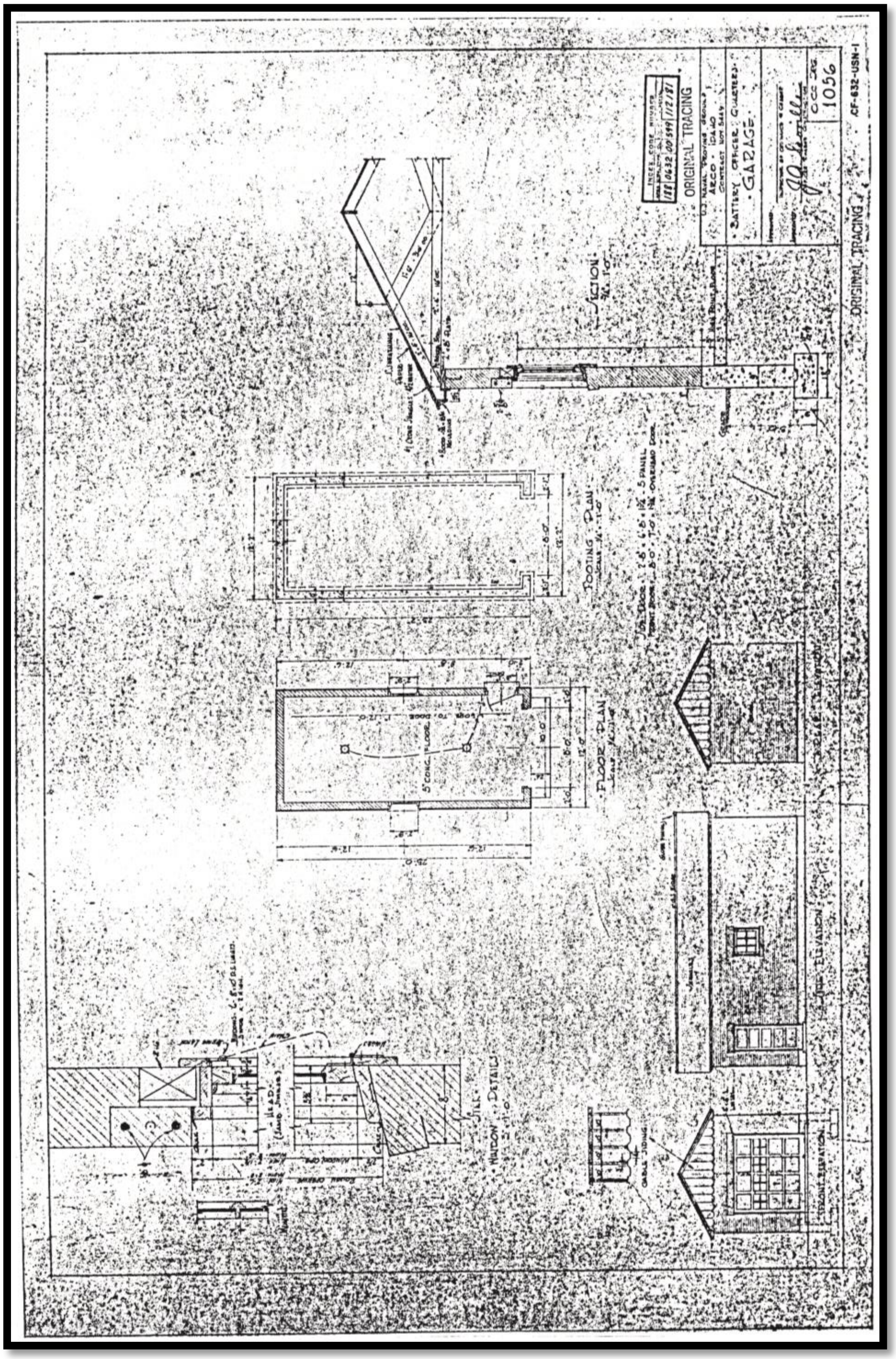


Figure 5.104: INL drawing number 112181 (CF-632-USN-1); battery officer quarters, garage (CFA-632, extant), elevations, plan, section, and details; ca. 1943.

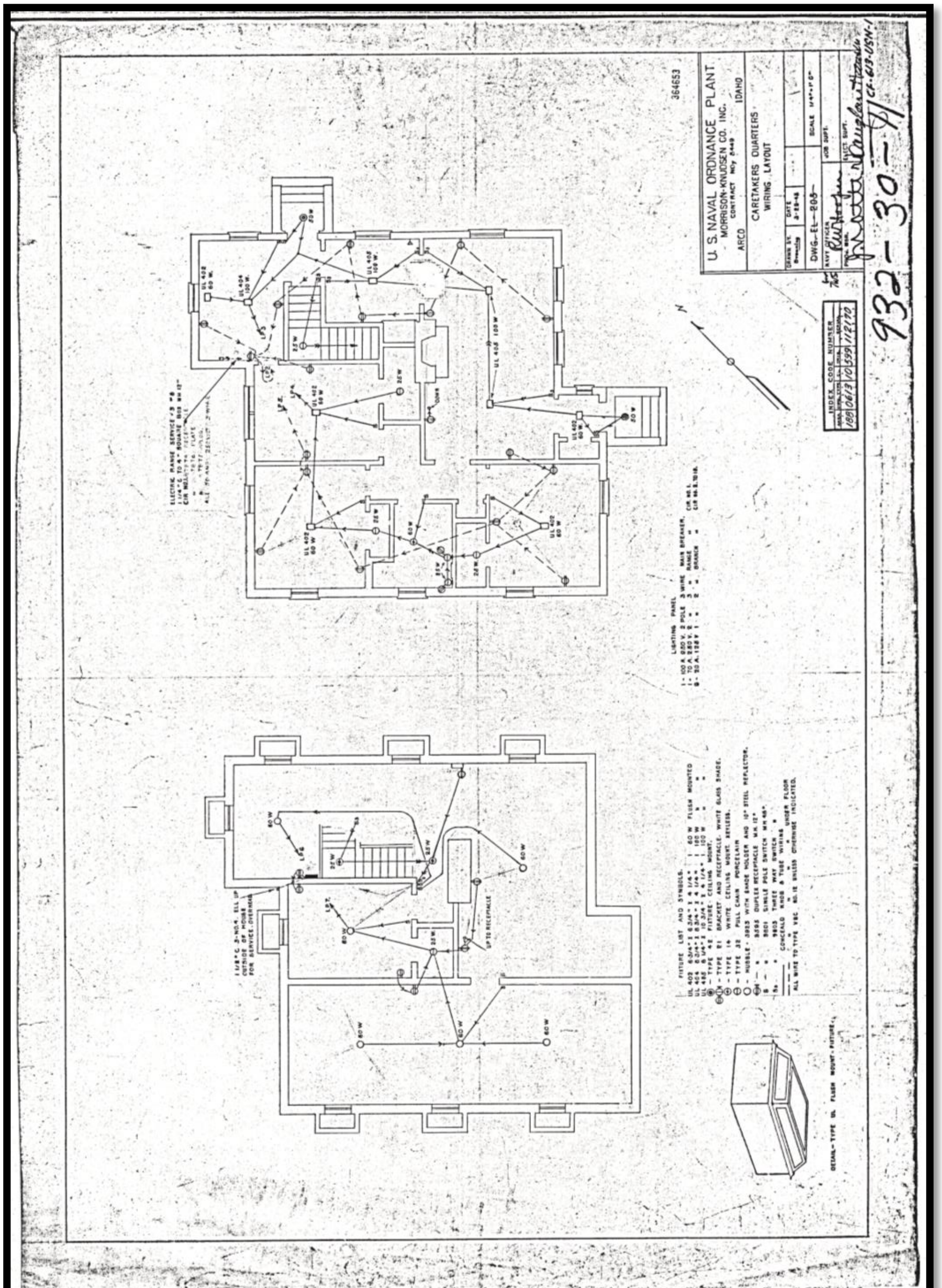


Figure 5.105: INL drawing number 112170 (CF-613-USN-1); caretaker's quarters (CFA-613, extant), wiring layout; March 1943.

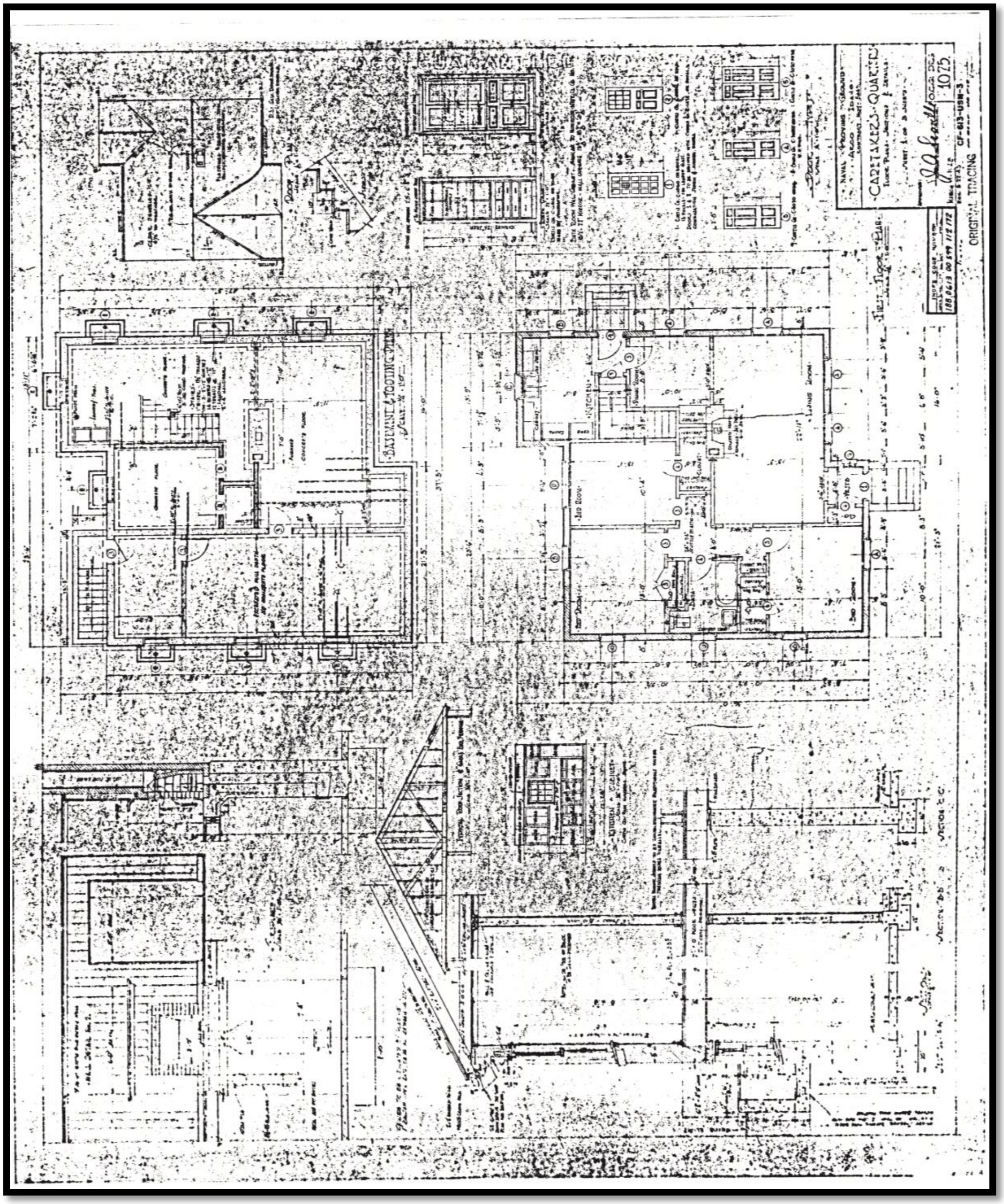


Figure 5.106: INL drawing number 112172 (CF-613-USN-3); caretaker's quarters (CFA-613, extant), floor plans, sections, and details; sheet 1 of 3; March 1943.

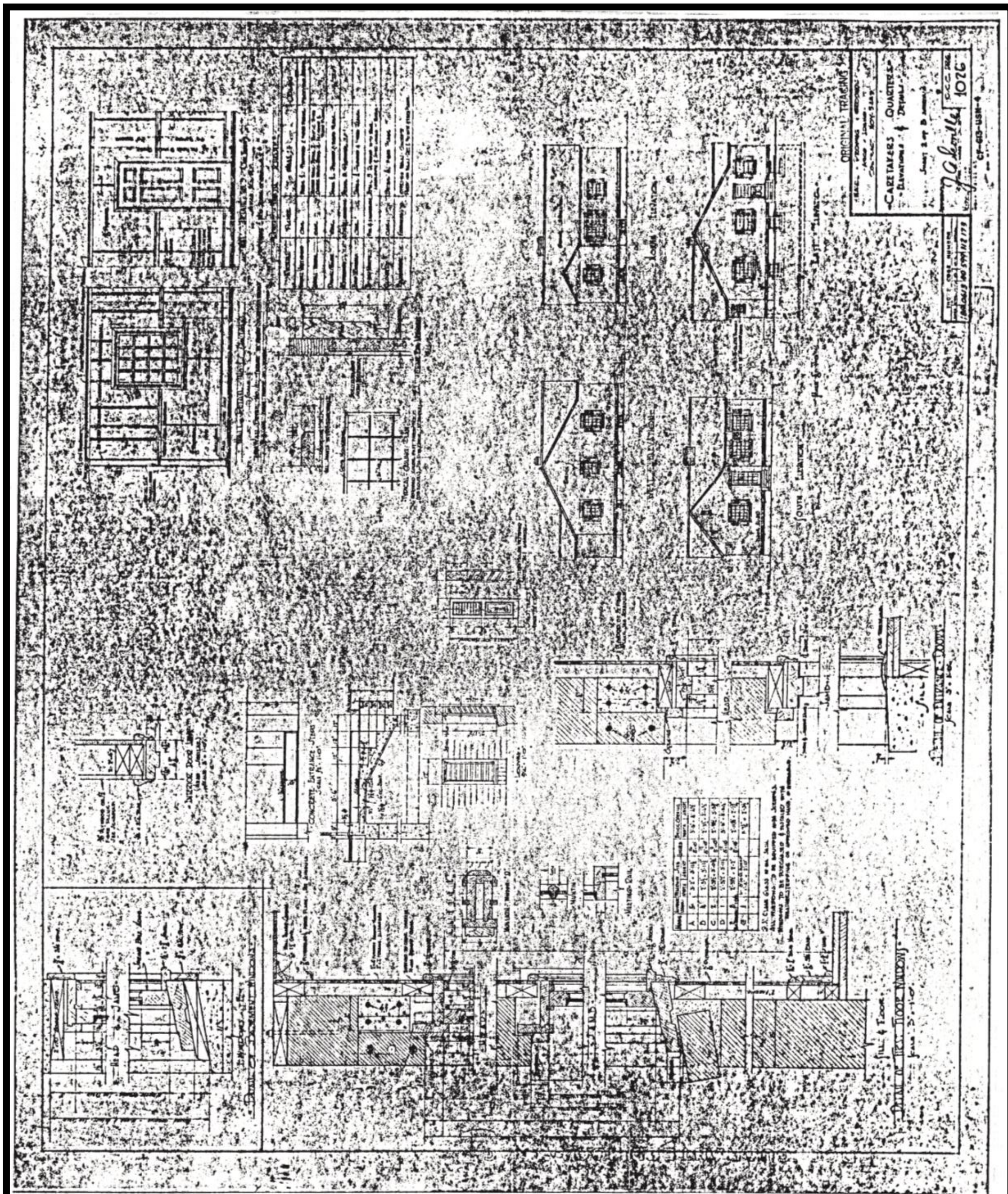


Figure 5.107: INL drawing number 112173 (CF-613-USN-4); caretaker's quarters (CFA-613, extant), elevations and details; sheet 2 of 3; March 1943.

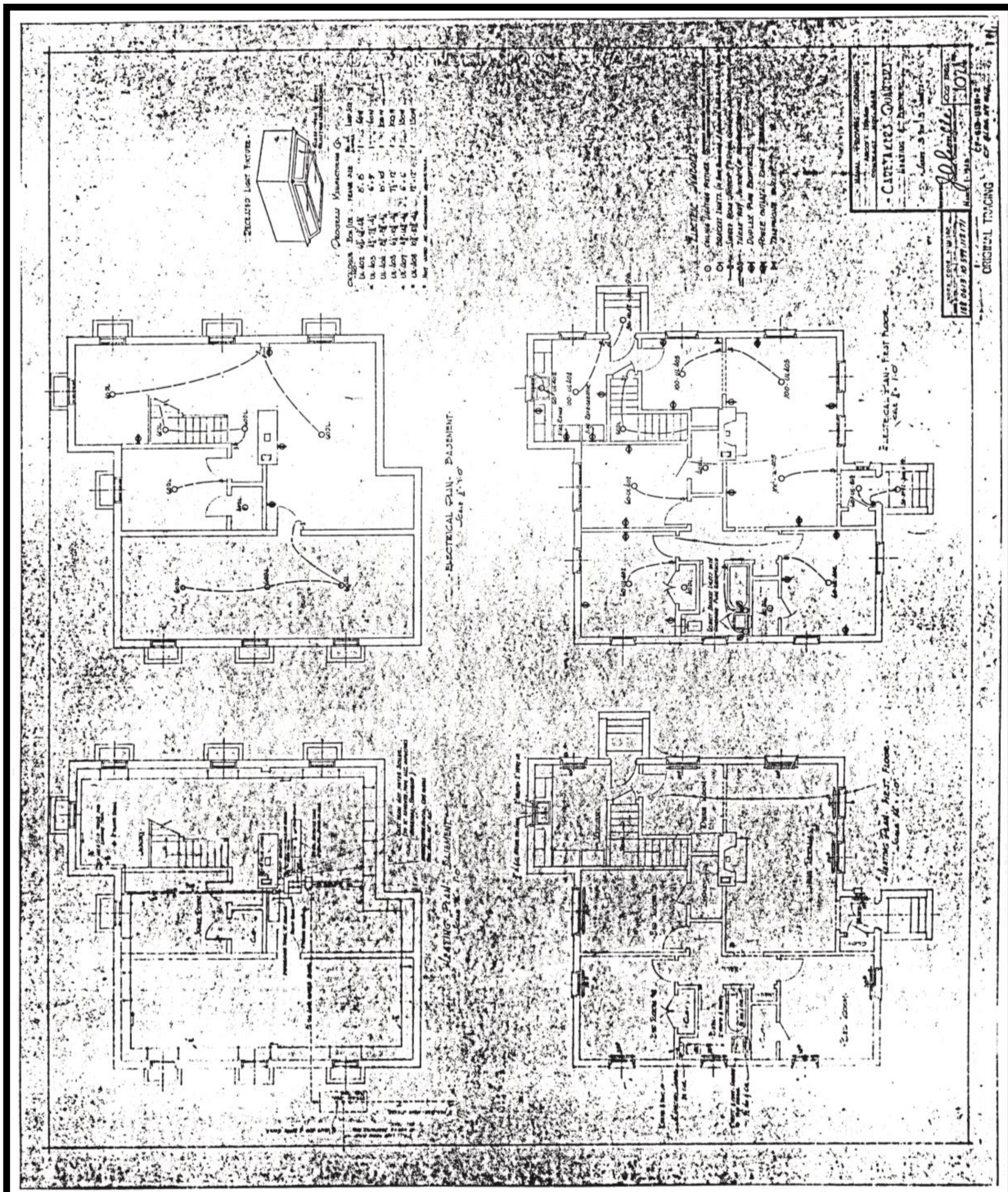


Figure 5.108: INL drawing number 112171 (CF-613-USN-2); caretaker's quarters (CFA-613, extant), heating and electrical; sheet 3 of 3; March 1943.

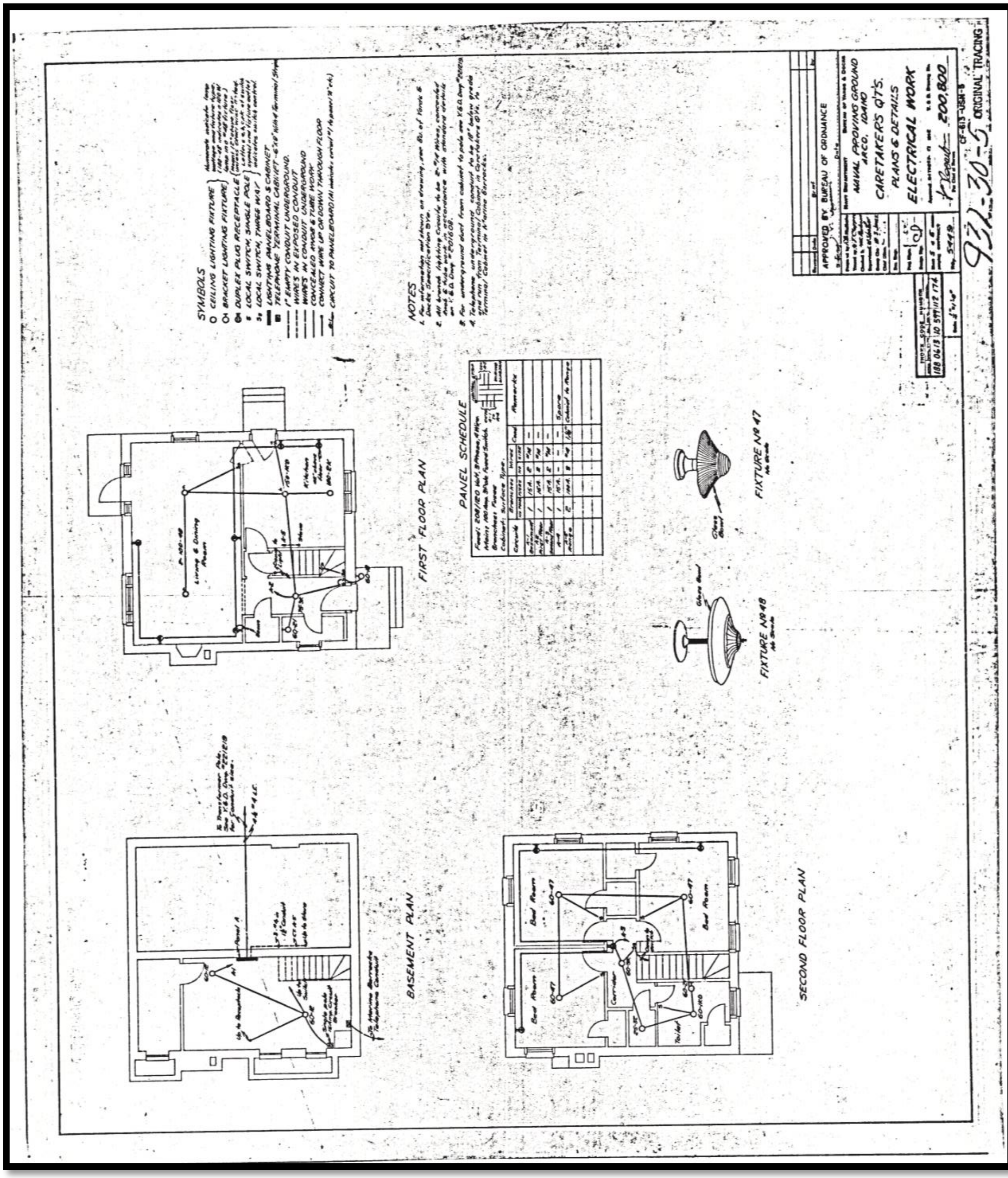


Figure 5.109: INL drawing umber 112174 (CF-613-USN-5); caretaker's quarters (CFA-613, extant), plans and details, electrical work; March 1943.

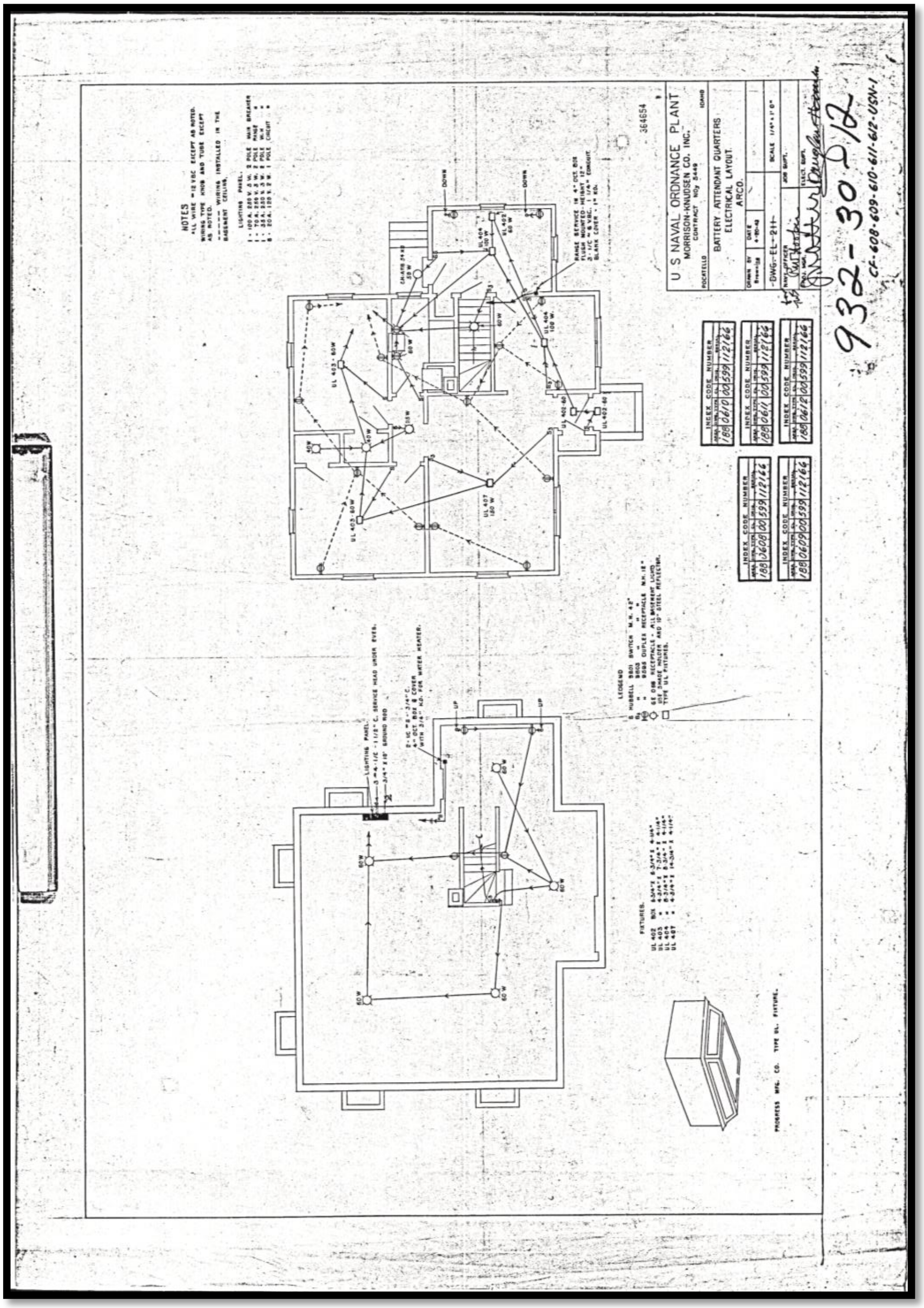


Figure 5.110: INL drawing number 112165 (CF-609-610-USN-1); battery attendant quarters (non-extant), electrical layout; April 1943.

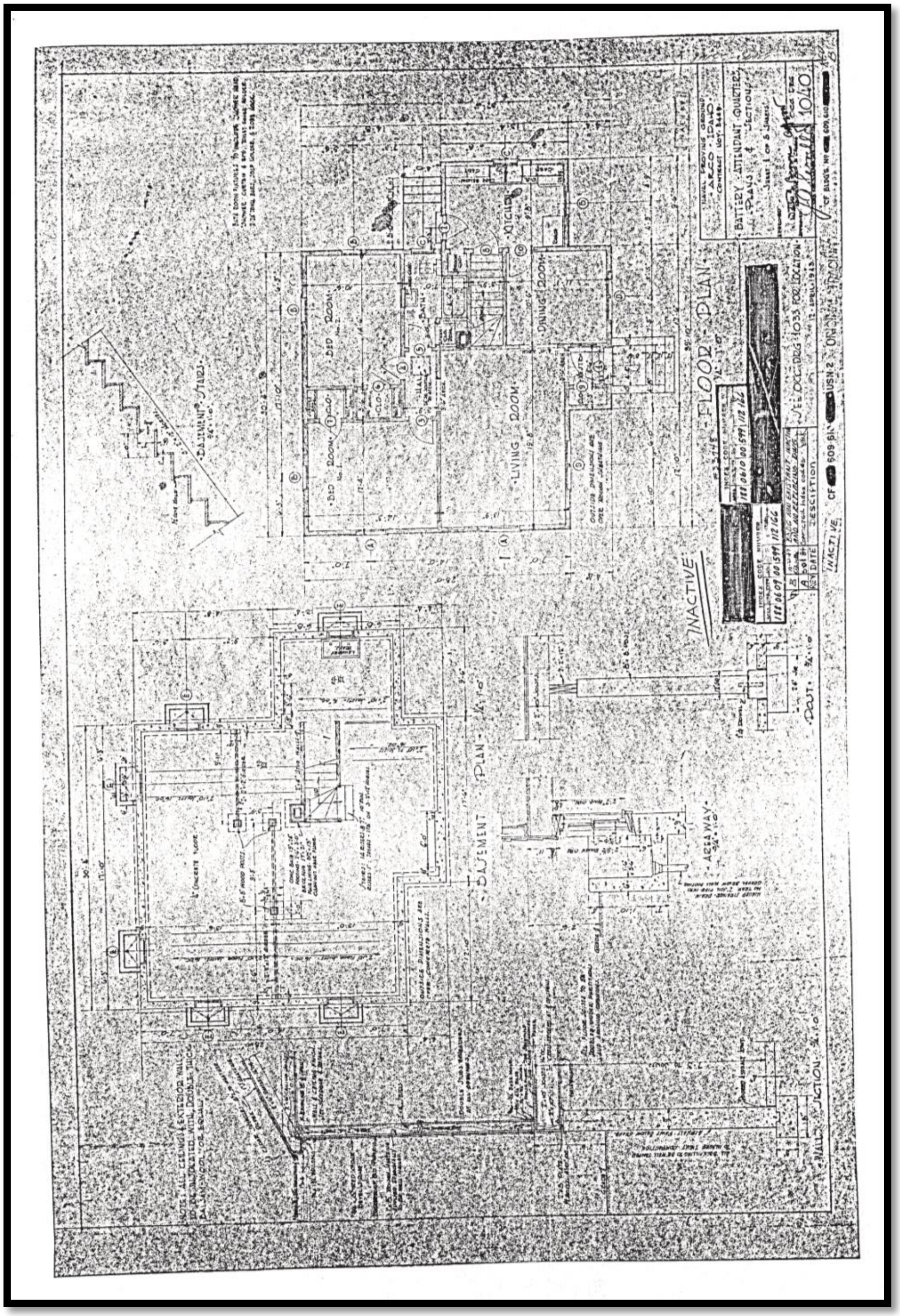


Figure 5.111: INL drawing number 112166 (CF-609-610-USN-2); battery attendant quarters (non-extant), plans and sections; sheet 1 of 5; April 1943.

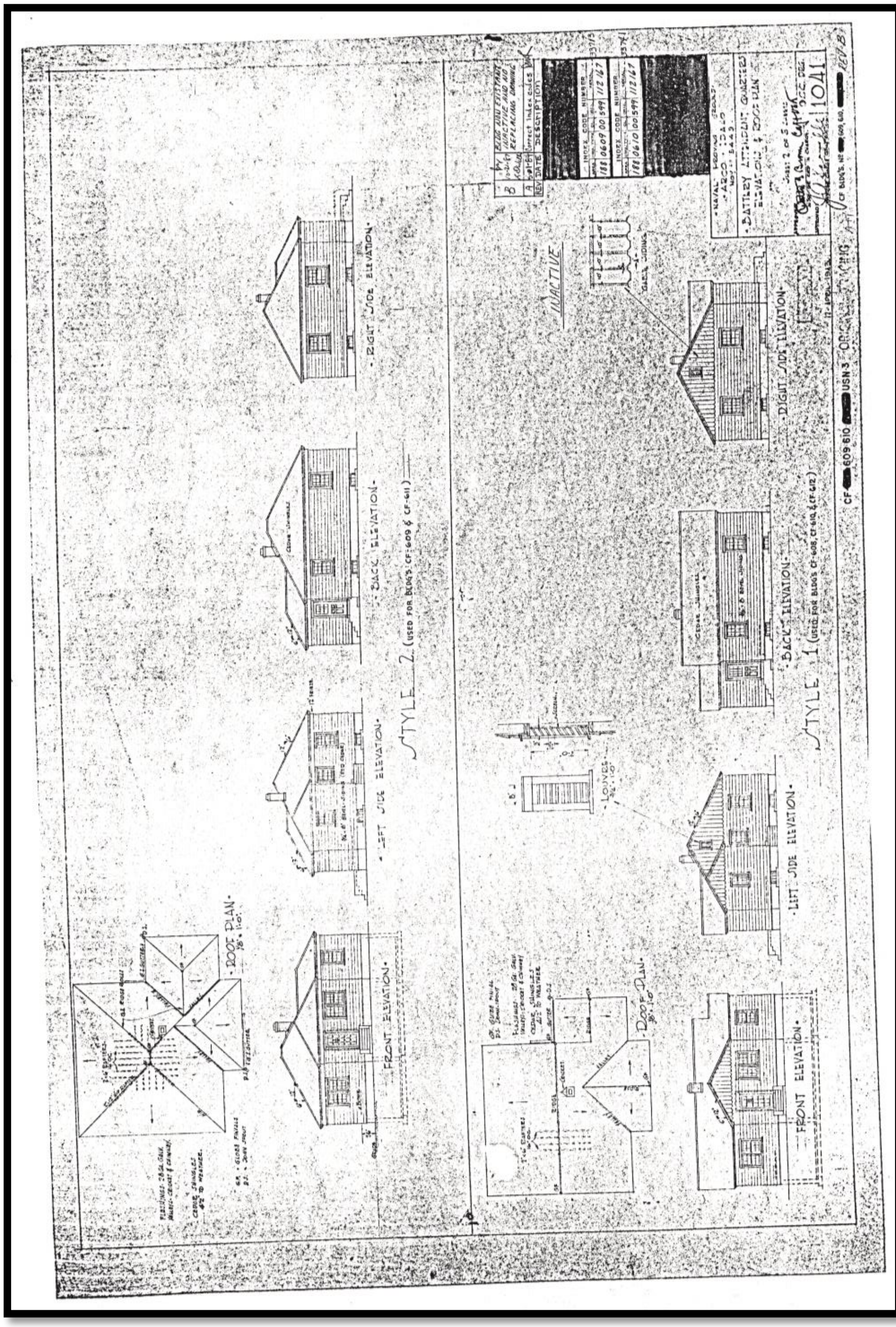


Figure 5.112: INL drawing number 112167 (CF-609-610-USN-3); battery attendant quarters (non-extant), elevation and roof plan; sheet 2 of 5; April 1943.

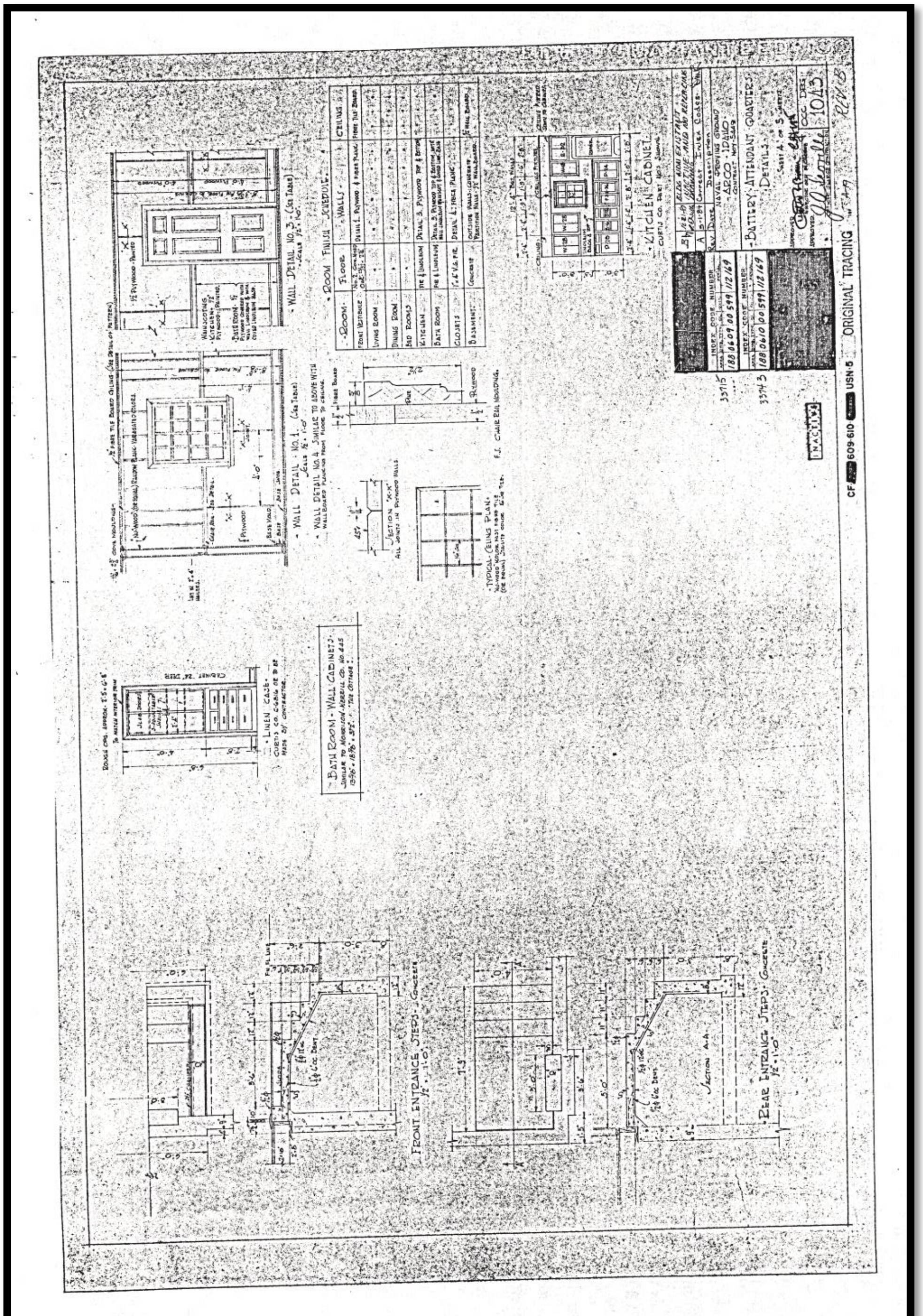


Figure 5.113: INL drawing number 112168 (CF-609-610-USN-4); battery attendant quarters (non-extant), sash and doors; sheet 3 of 5; April 1943.

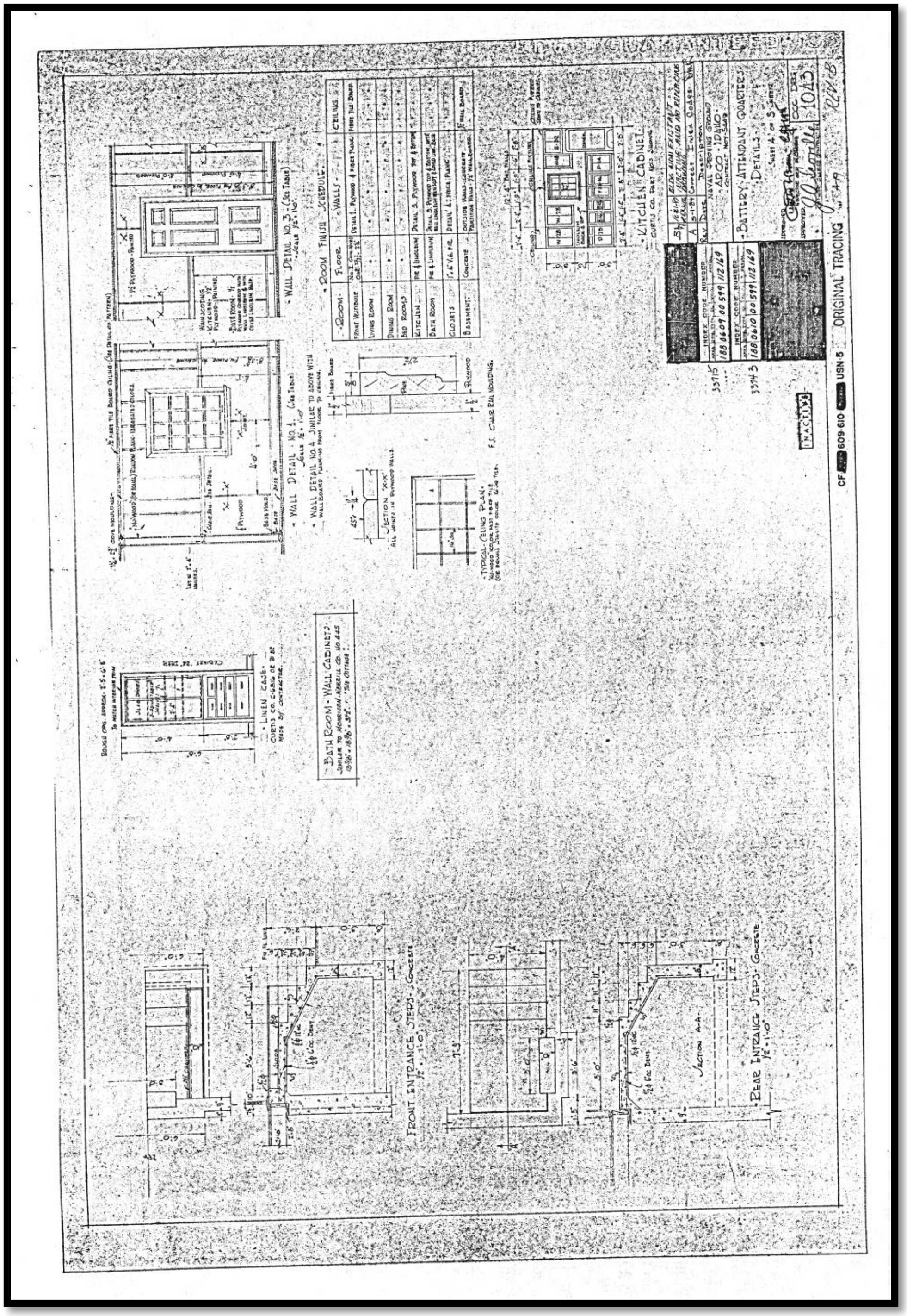


Figure 5.114: INL drawing number 112169 (CF-609-610-USN-5); battery attendant quarters (non-extant), details; sheet 4 of 5; April 1943.

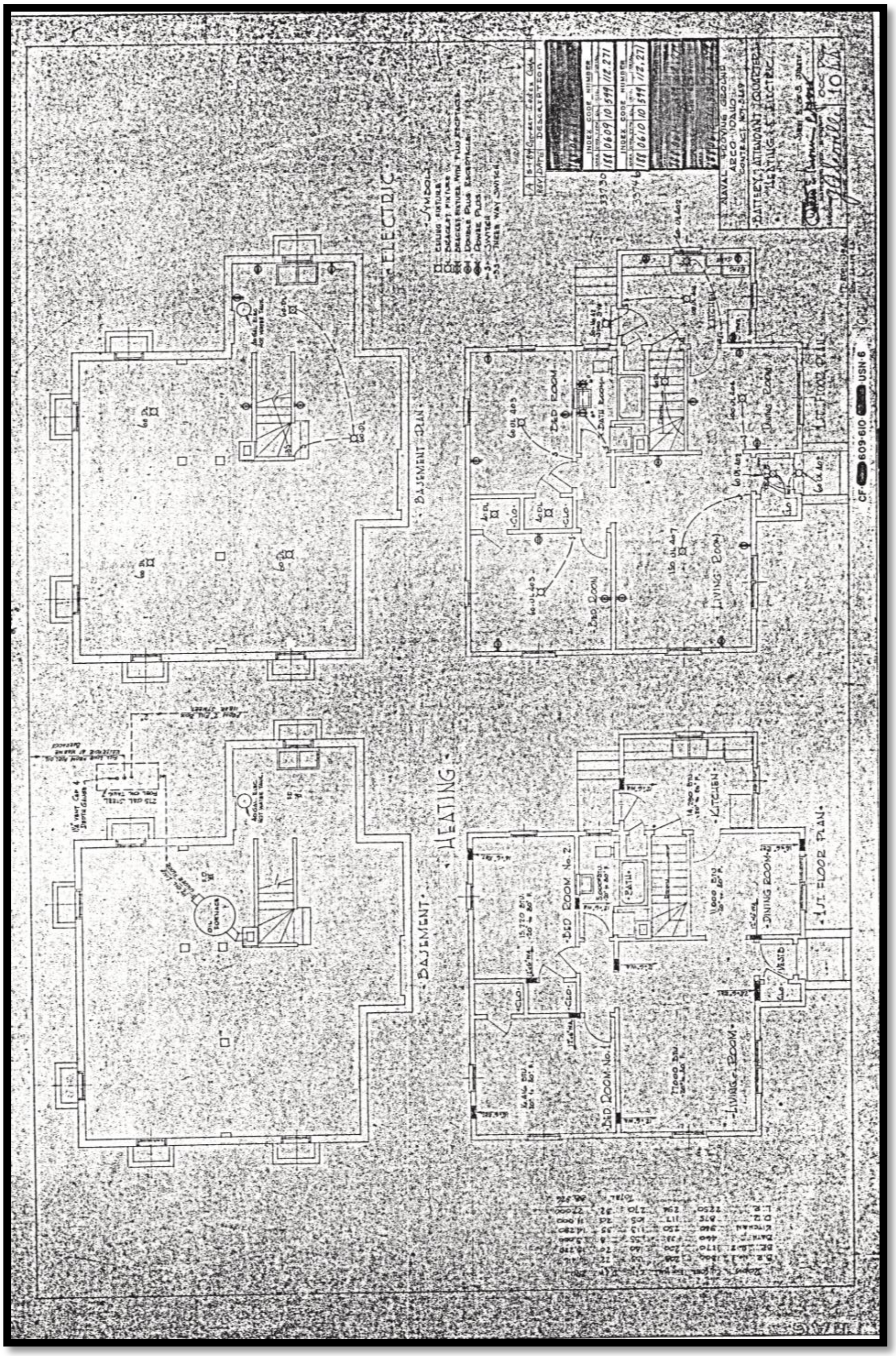


Figure 5.115: INL drawing number 112271 (CF-609-610-USN-6); battery attendant quarters (non-extant), heating and electric; sheet 5 of 5; April 1943.

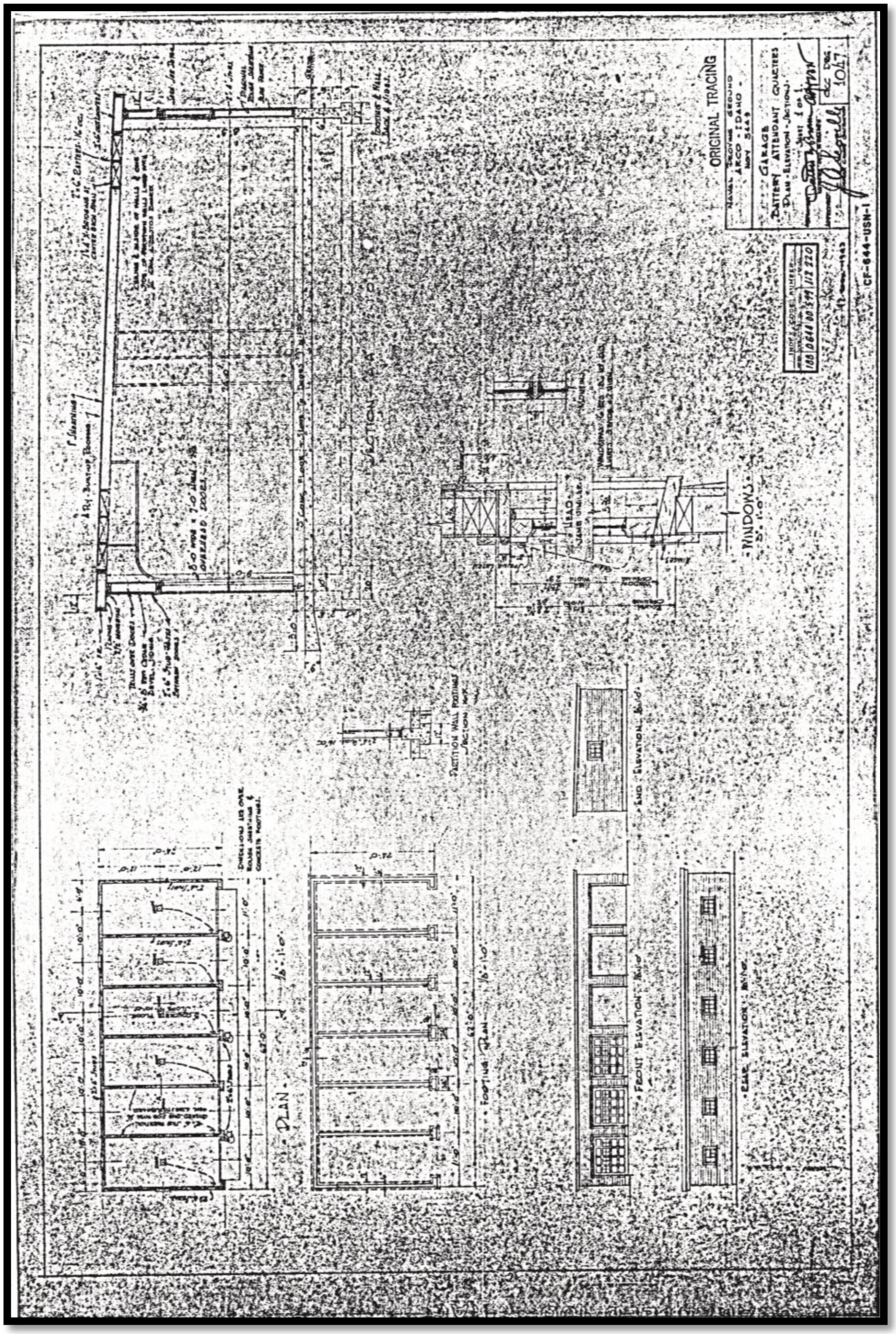


Figure 5.116: INL drawing number 112220 (CF-644-USN-1); battery attendant quarters, garage (CFA-644, non-extant), plan, elevation, sections; sheet 1 of 1; 1943.

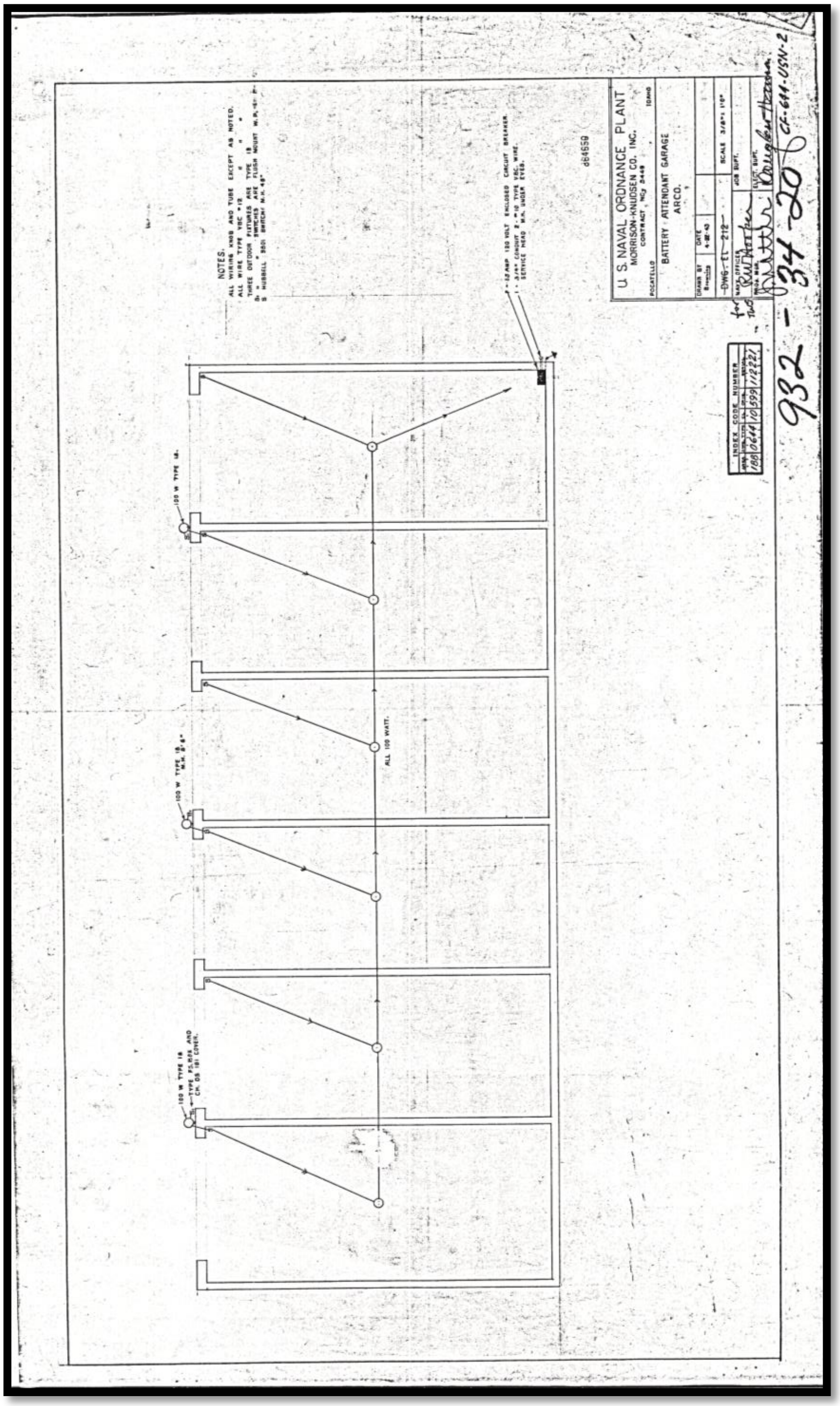


Figure 5.117: INL drawing number 112220 (CF-644-USN-2); battery attendant quarters, garage (CFA-644, non-extant), wiring diagram; April 1943.

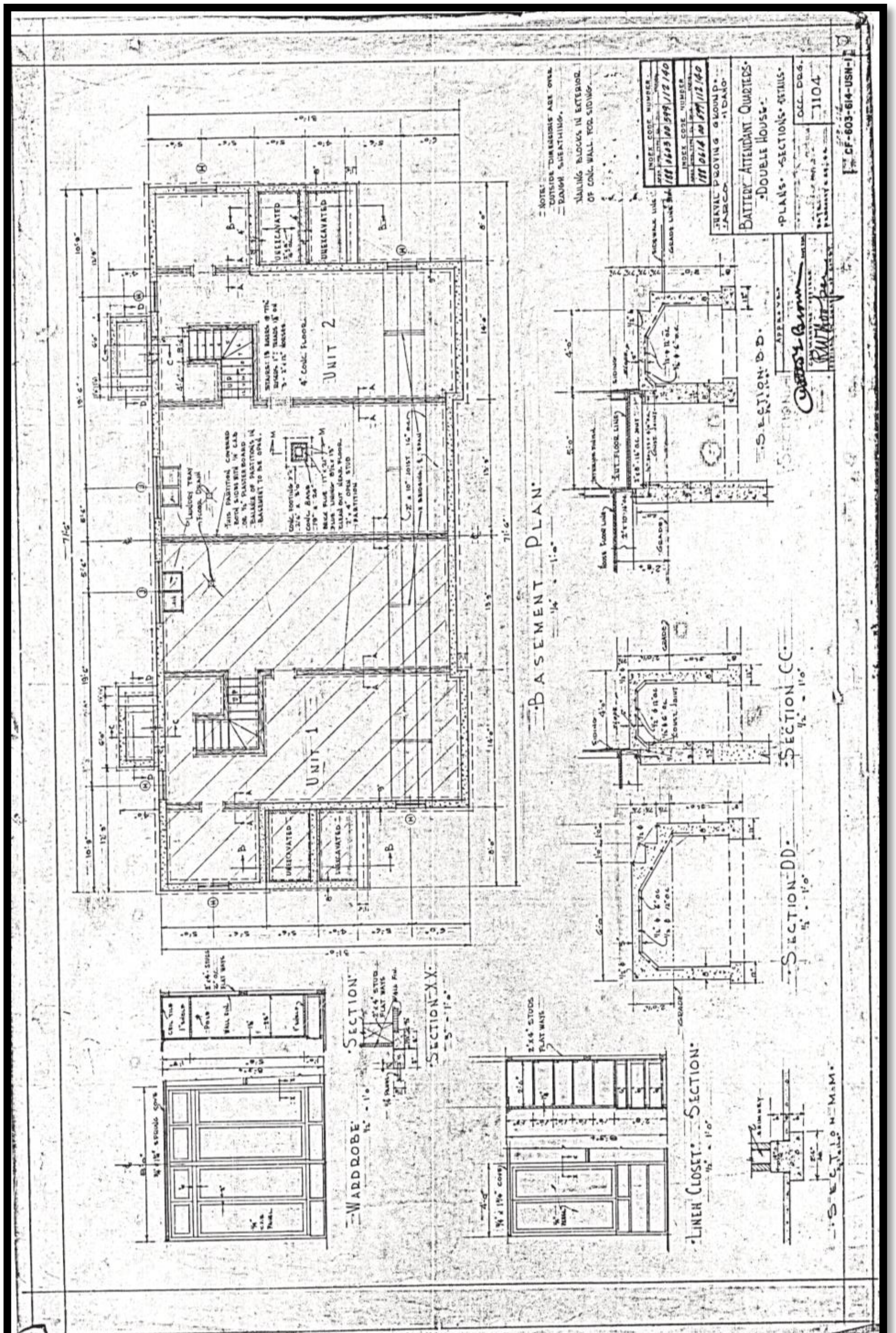


Figure 5.118: INL drawing number 112140 (CF-603-614-USN-1); battery attendant quarters, double house (non-extant), plans, sections, and details; February 1942.

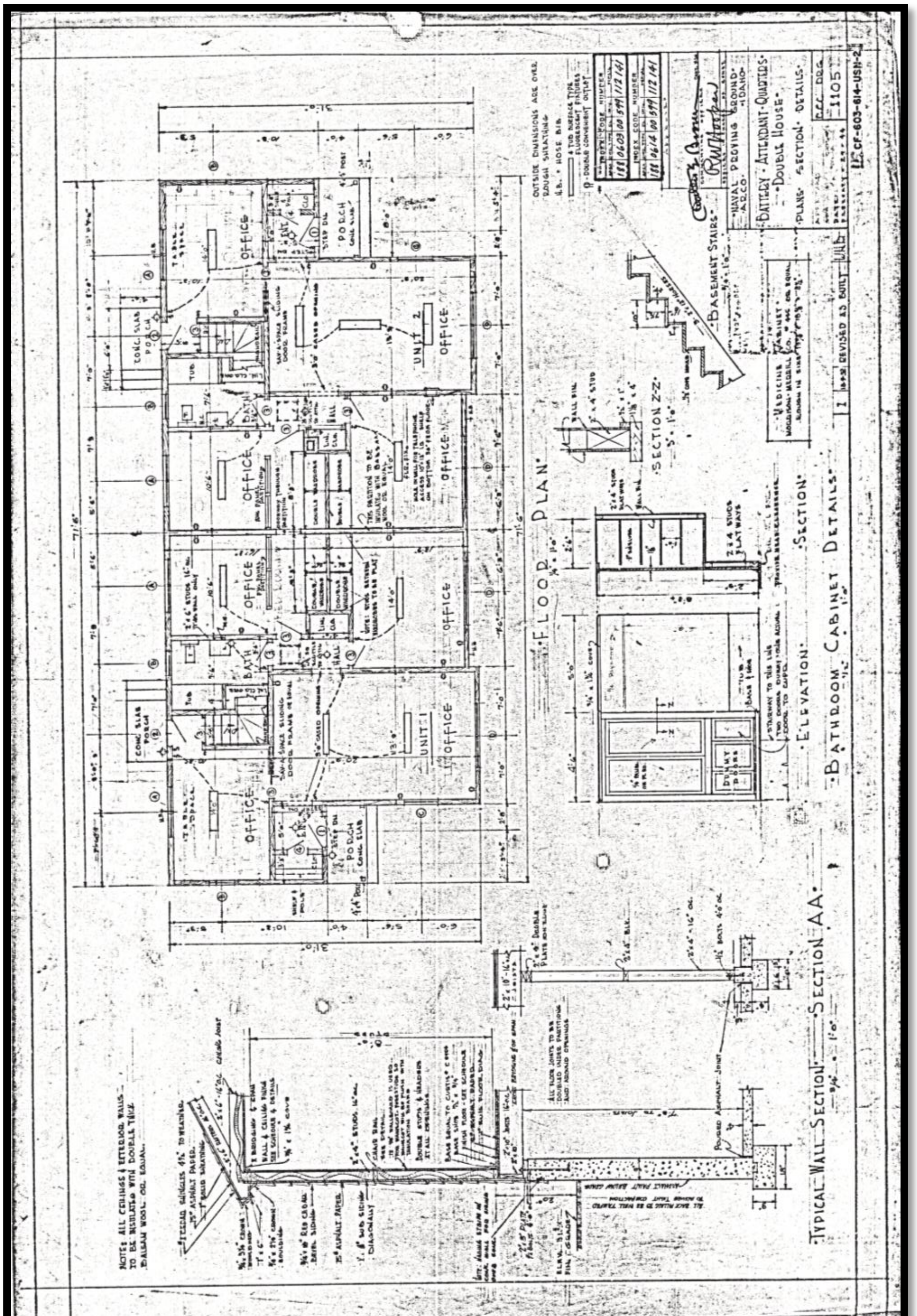


Figure 5.119: INL drawing number 112141 (CF-603-614-USN-2); battery attendant quarters, double house (non-extant), plans, sections, and details; February 1942.

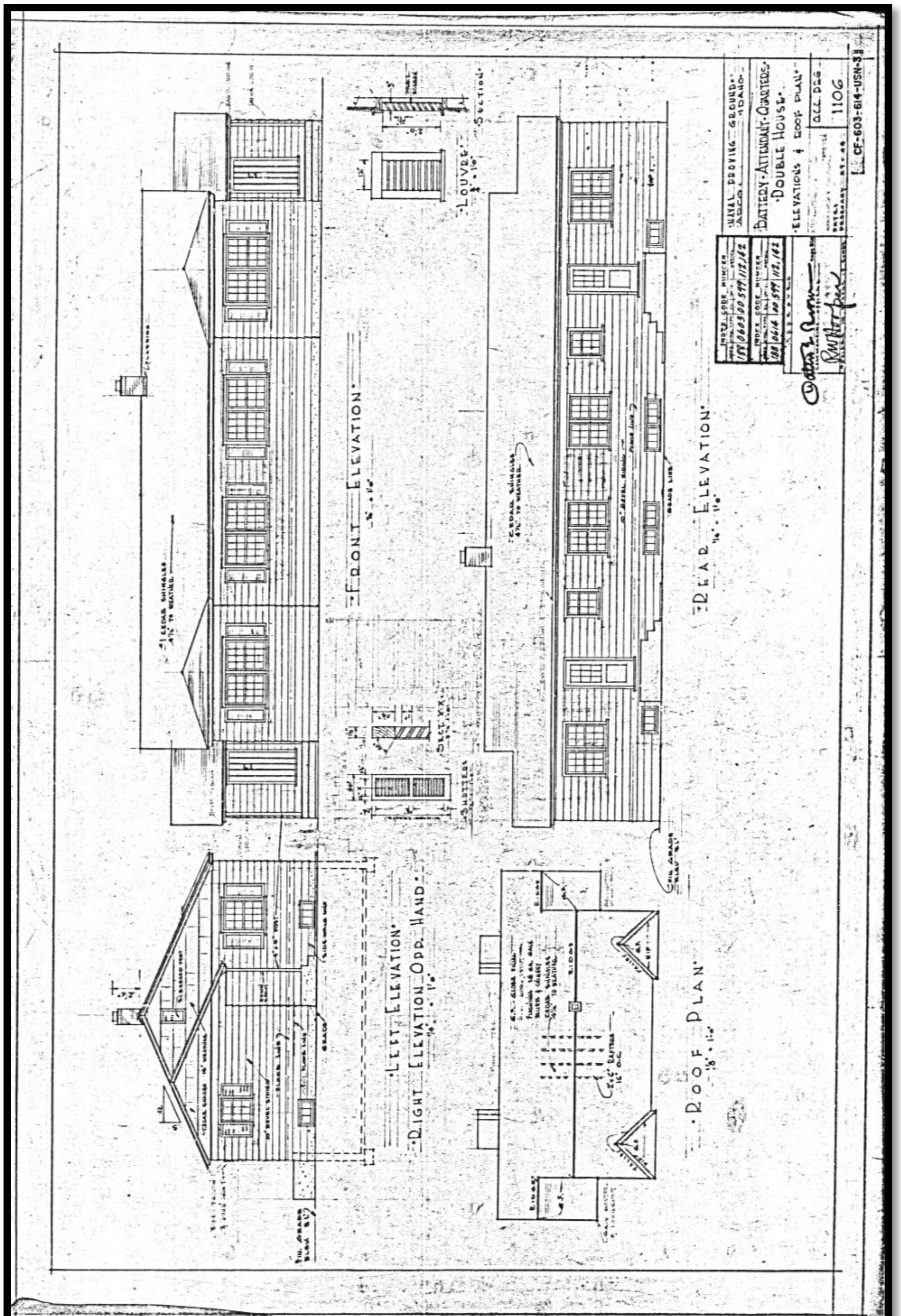


Figure 5.120: INL drawing number 112142 (CF-603-614-USN-3); battery attendant quarters, double house (non-extant), elevations and roof plan; February 1942.

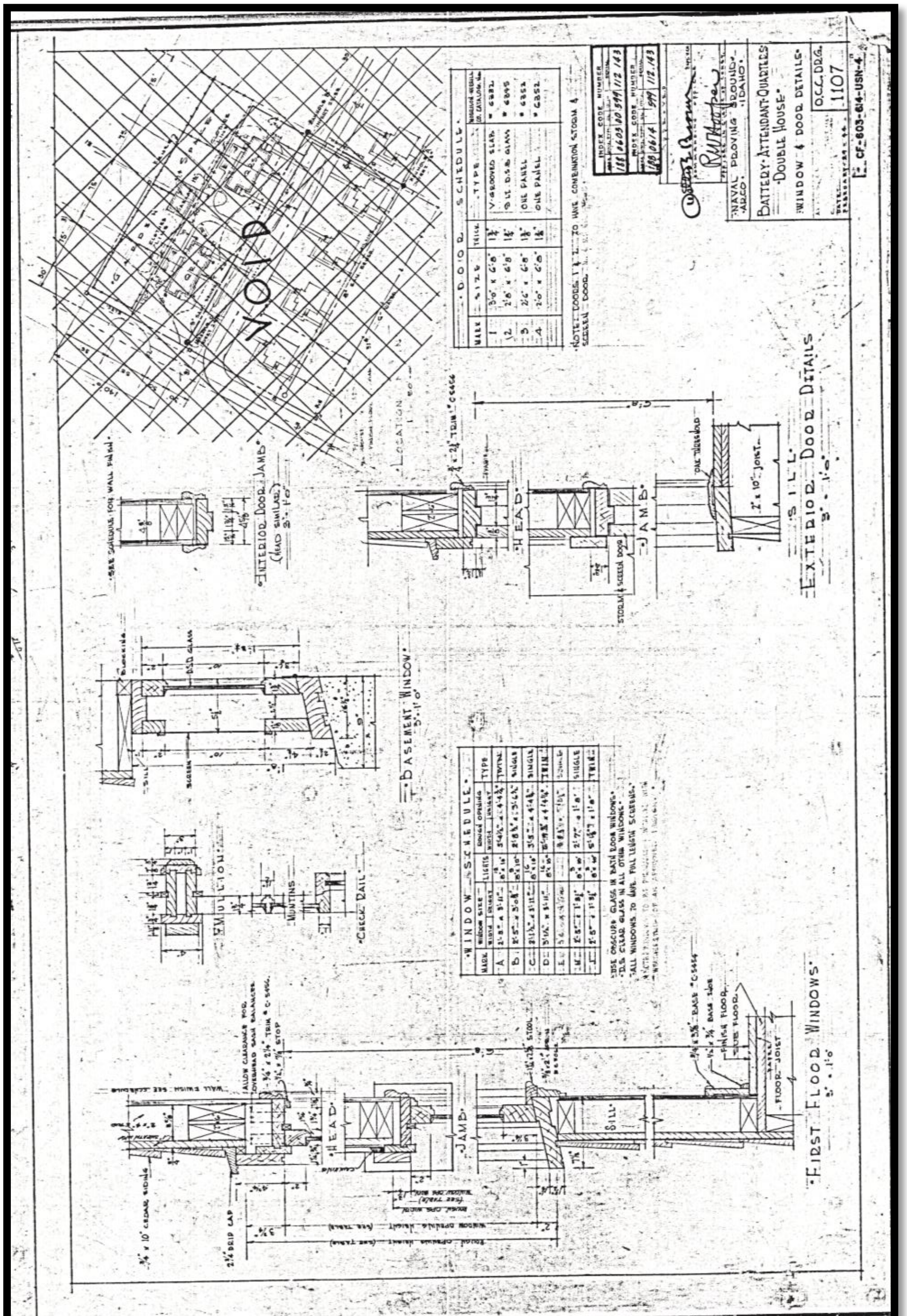


Figure 5.121: INL drawing number 112143 (CF-603-614-USN-4); battery attendant quarters, double house (non-extant), window and door details; February 1942.

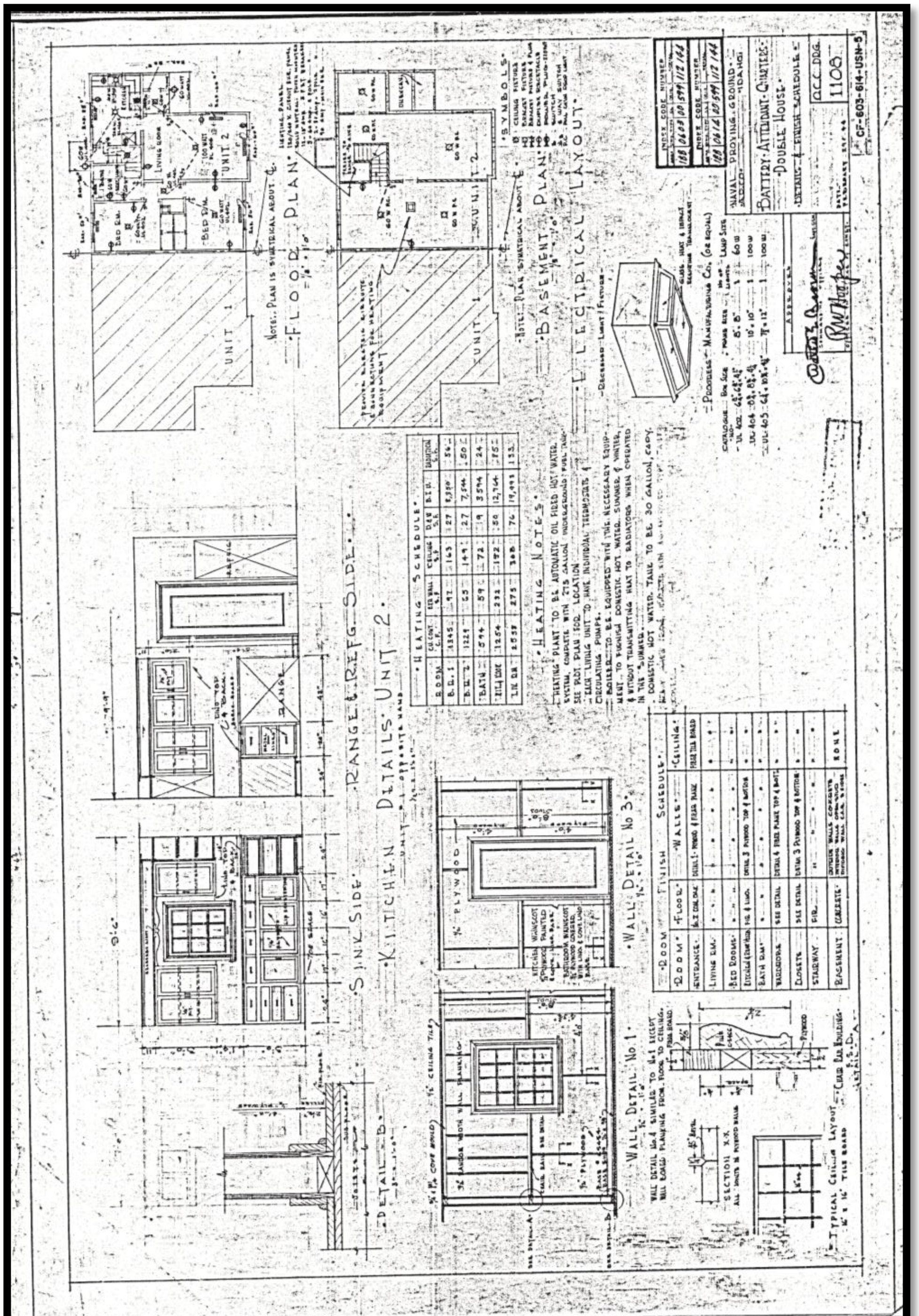


Figure 5.122: INL drawing number 11214 (CF-603-614-USN-5); battery attendant quarters, double house (non-extant), details and finish schedule; February 1942.

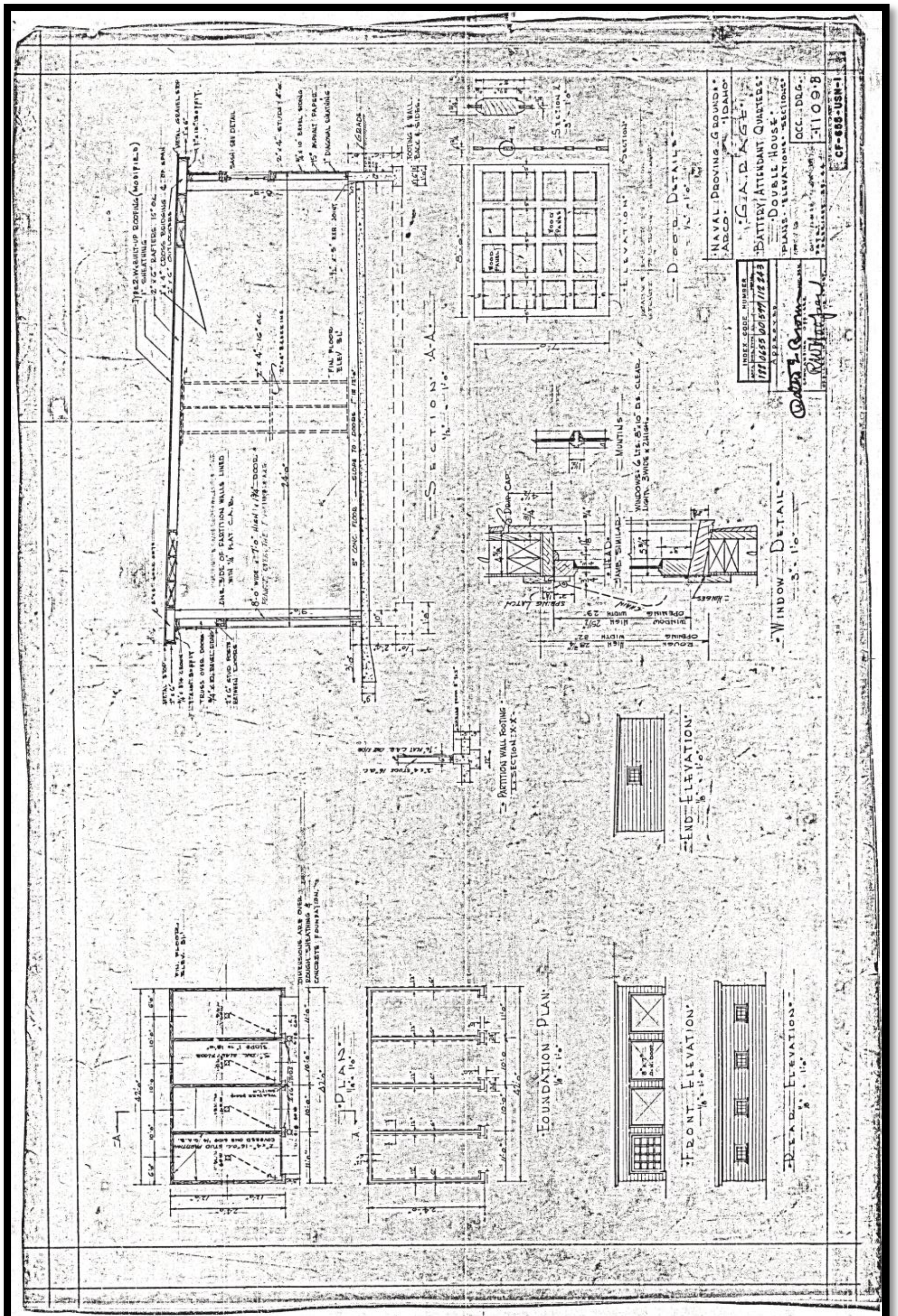


Figure 5.123: INL drawing number 112243 (CF-655-USN-1); battery attendant quarters, double house, garage (non-extant), plans, elevations, and sections; February 1942.

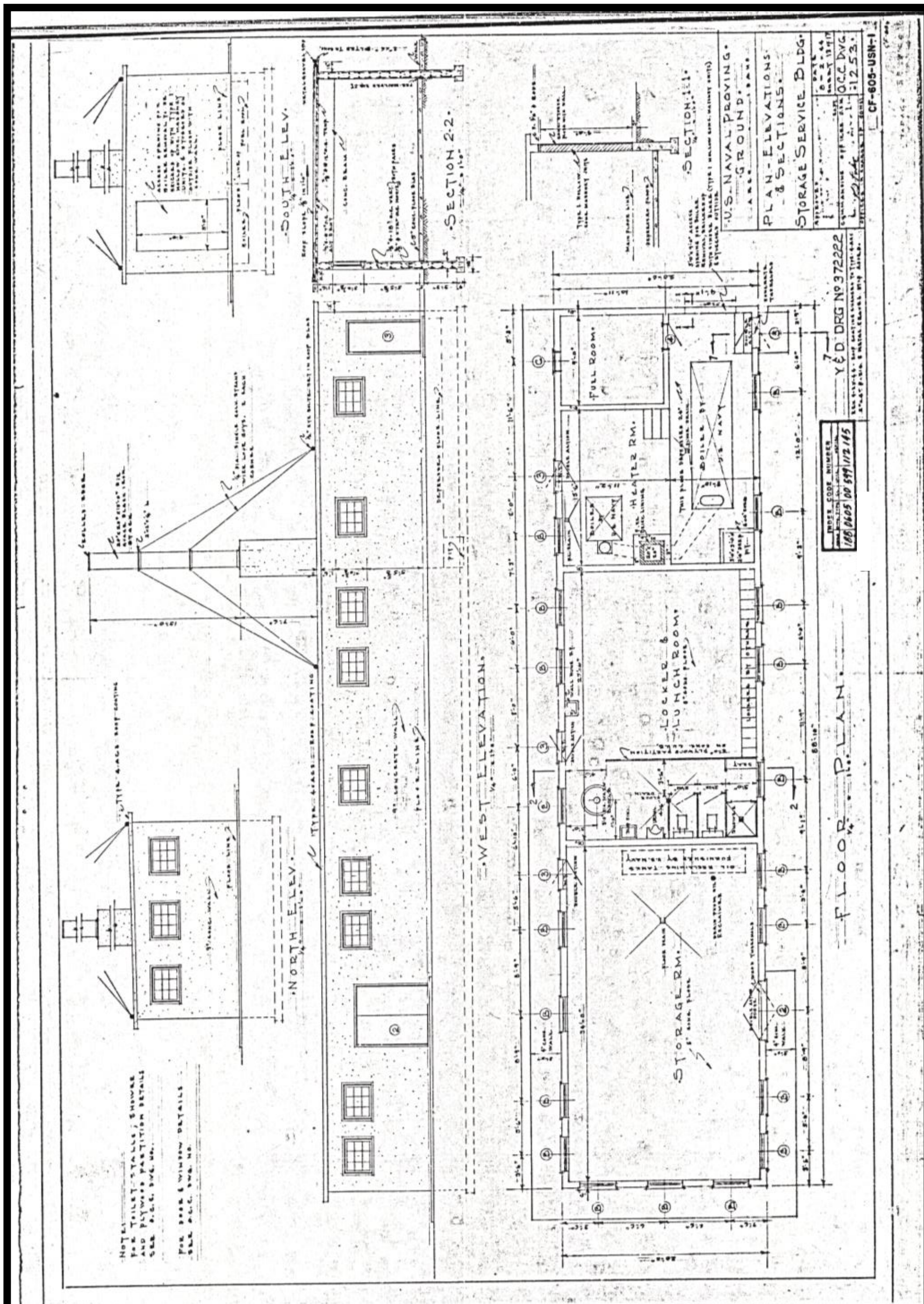


Figure 5.124: INL drawing number 112145 (CF-655-USN-1); storage service building (CFA-605, non-extant), plans, elevations, and sections; August 1944.

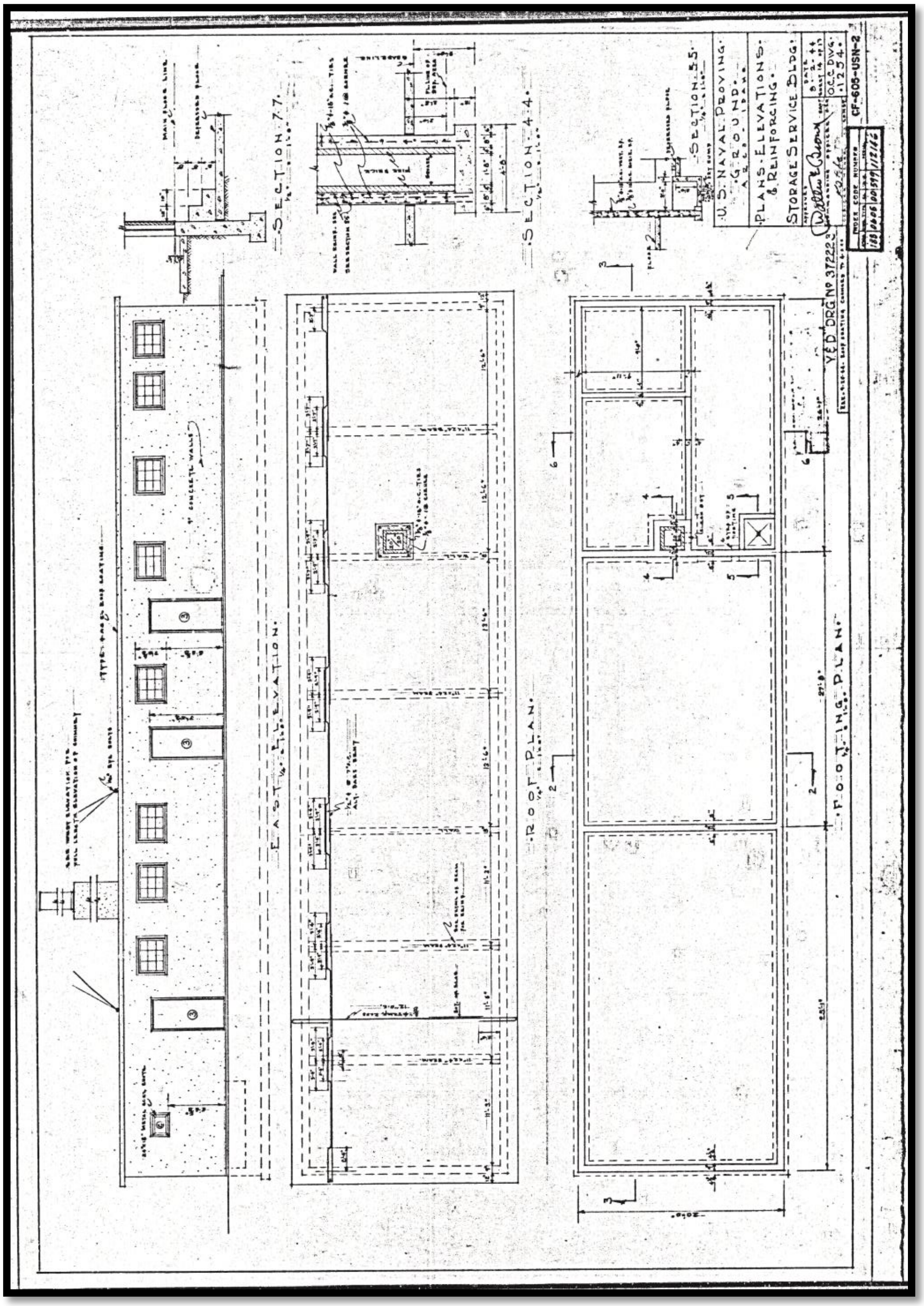


Figure 5.125: INL drawing number 112146 (CF-605-USN-2); storage service building (CFA-605, non-extant), plans, elevations, and reinforcing; August 1944.

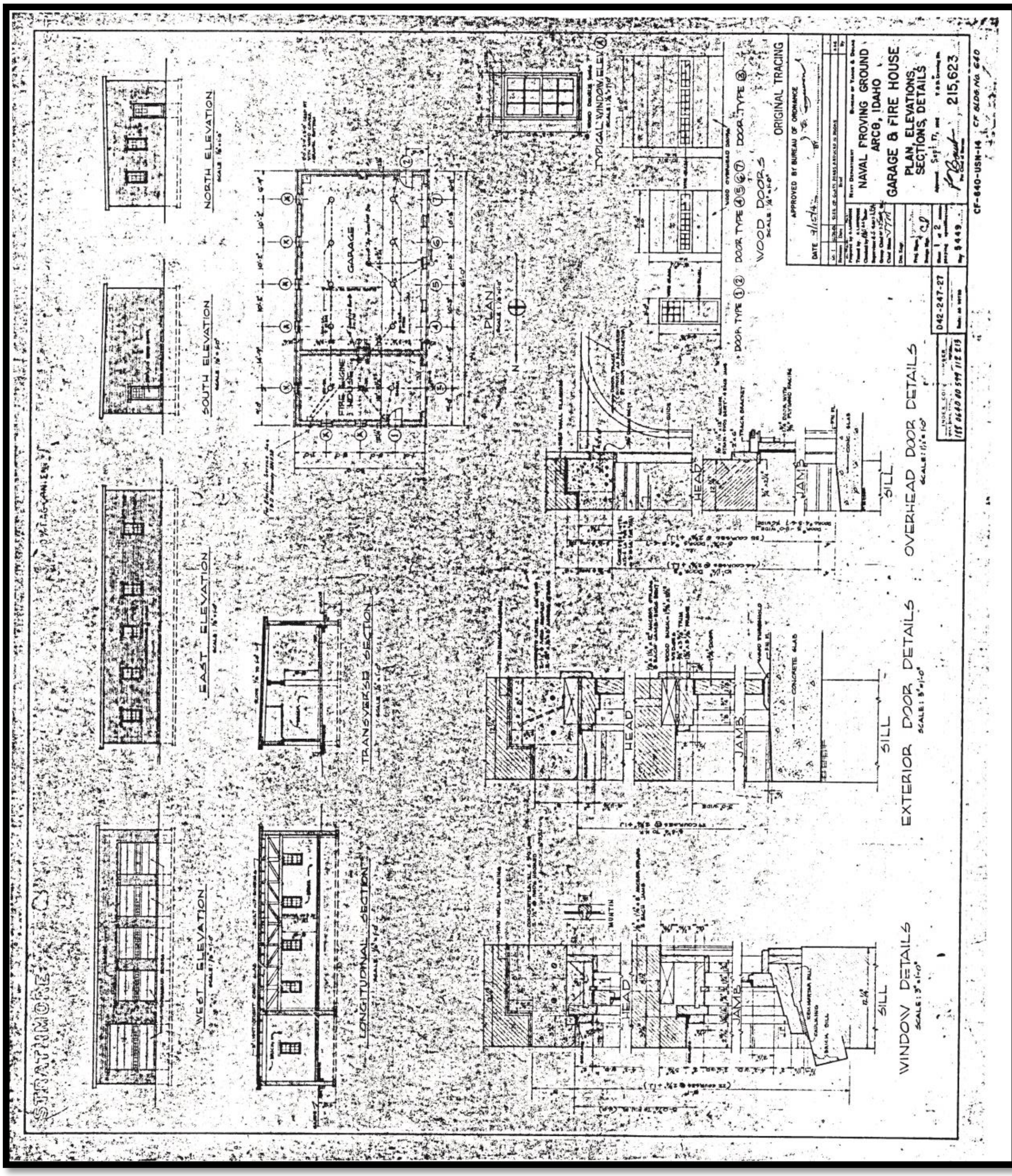


Figure 5.126: INL drawing number 112213 (CF-640-USN-14); garage and fire house (CFA-640, non-extant), plan, elevations, sections, and details; September 1942.

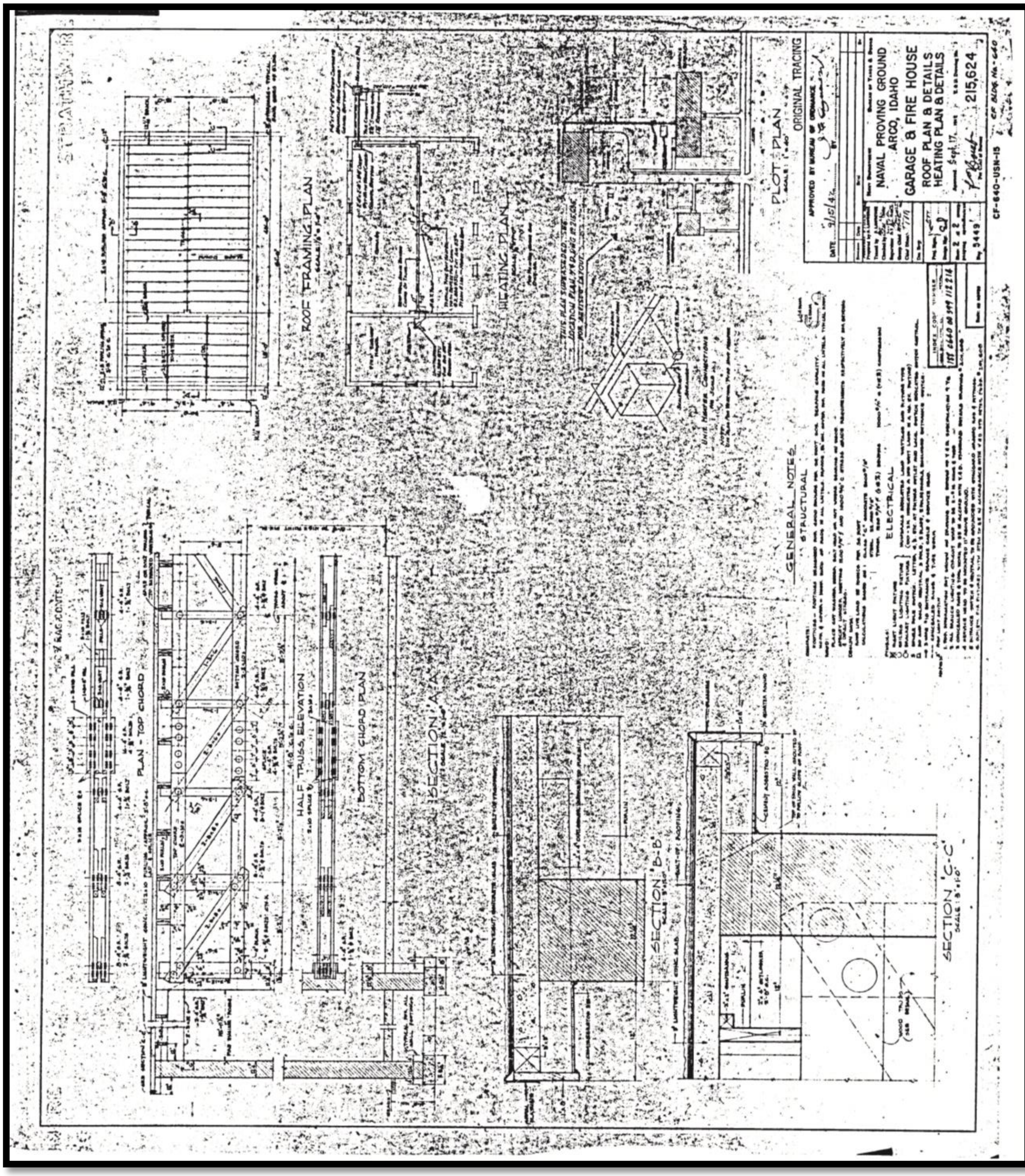


Figure 5.127: INL drawing number 112214 (CF-640-USN-15); garage and fire house (CFA-640, non-extant); roof plan and details, heating plan and details; September 1942.

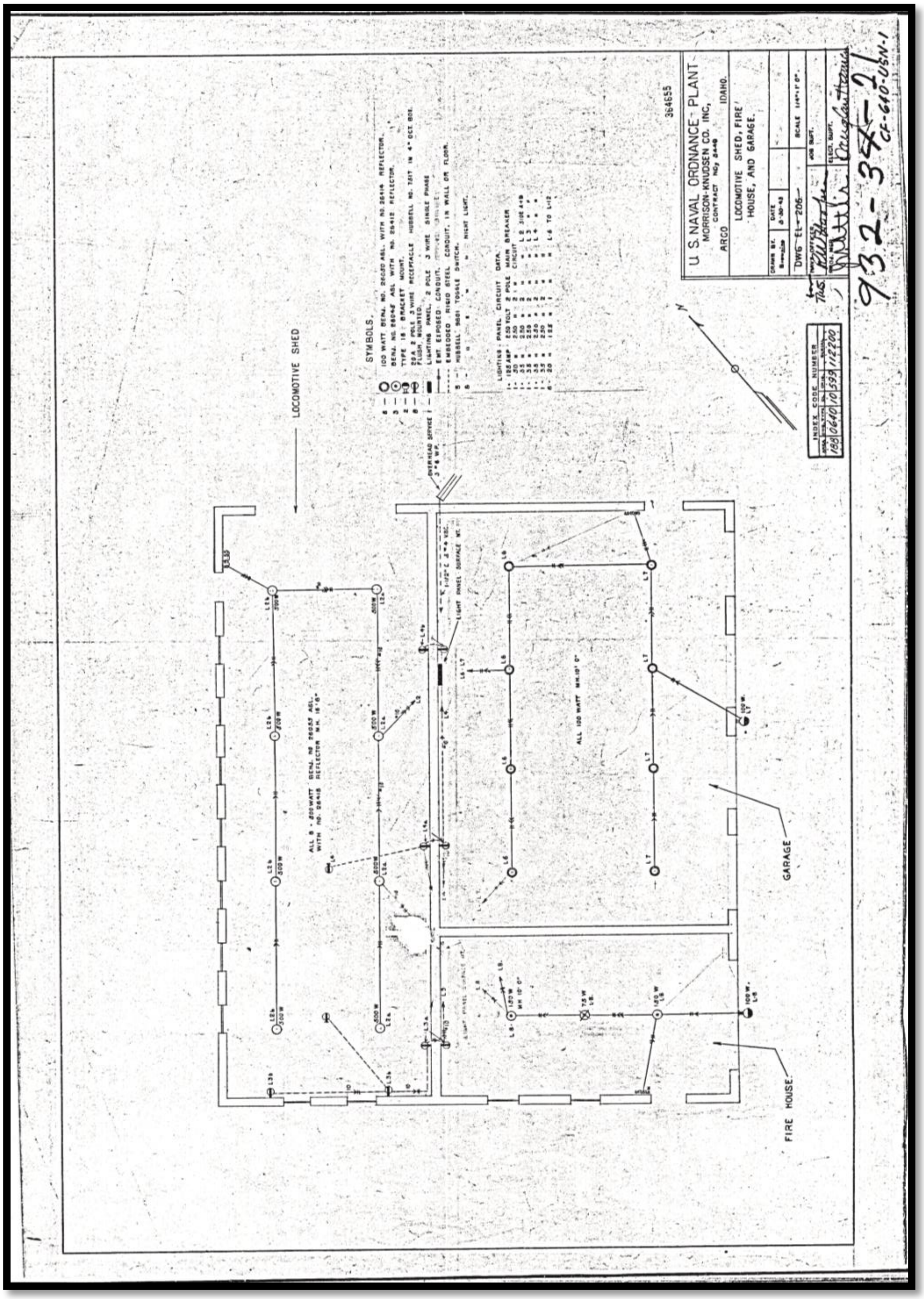


Figure 5.128: INL drawing number 112200 (CF-640-USN-1); locomotive shed, fire house, and garage (CFA-640, non-extant); March 1943.

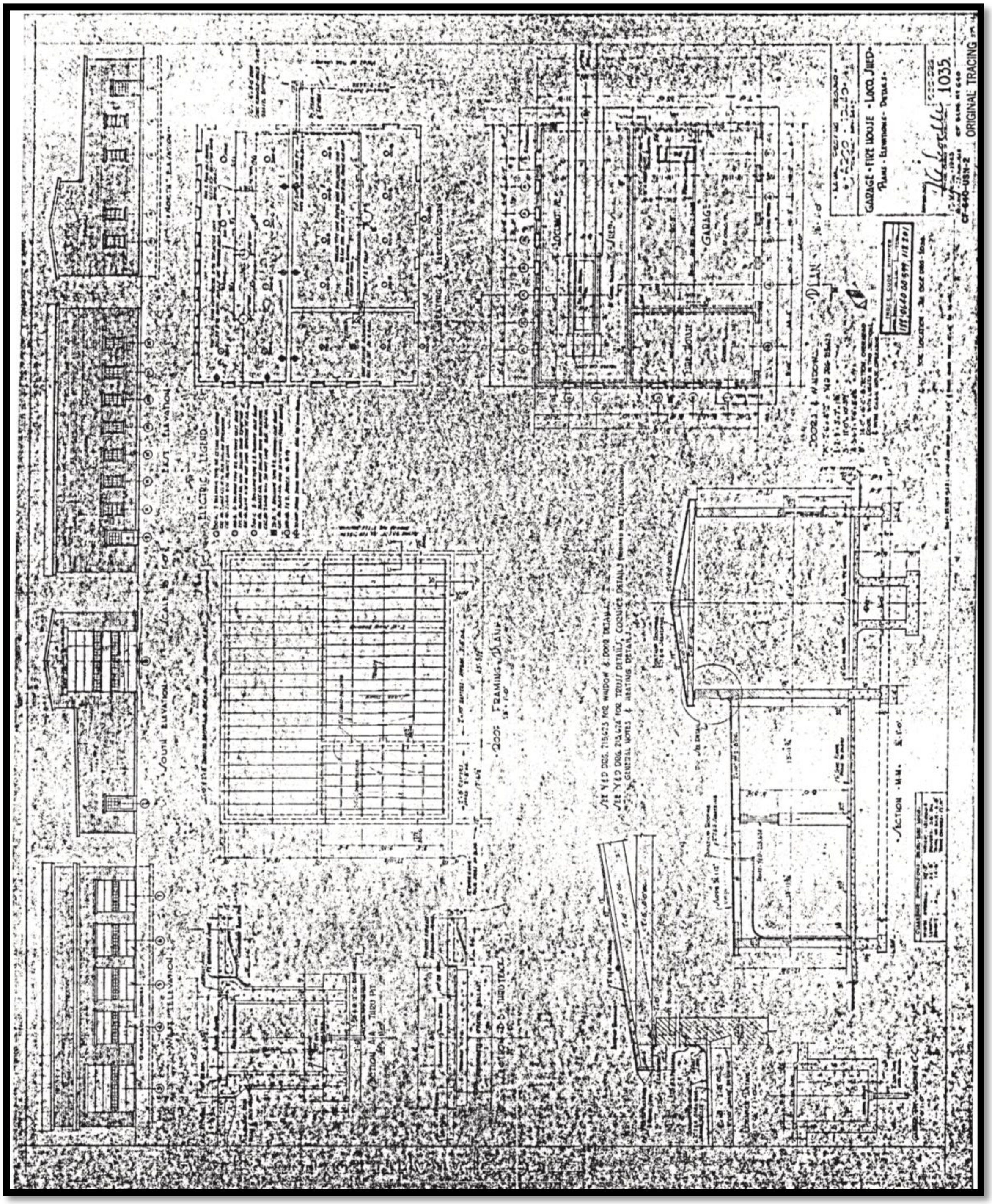


Figure 5.129: INL drawing number 112201 (CF-640-USN-2); locomotive shed, fire house, and garage (CFA-640, non-extant), plans, elevations, and details; March 1943.

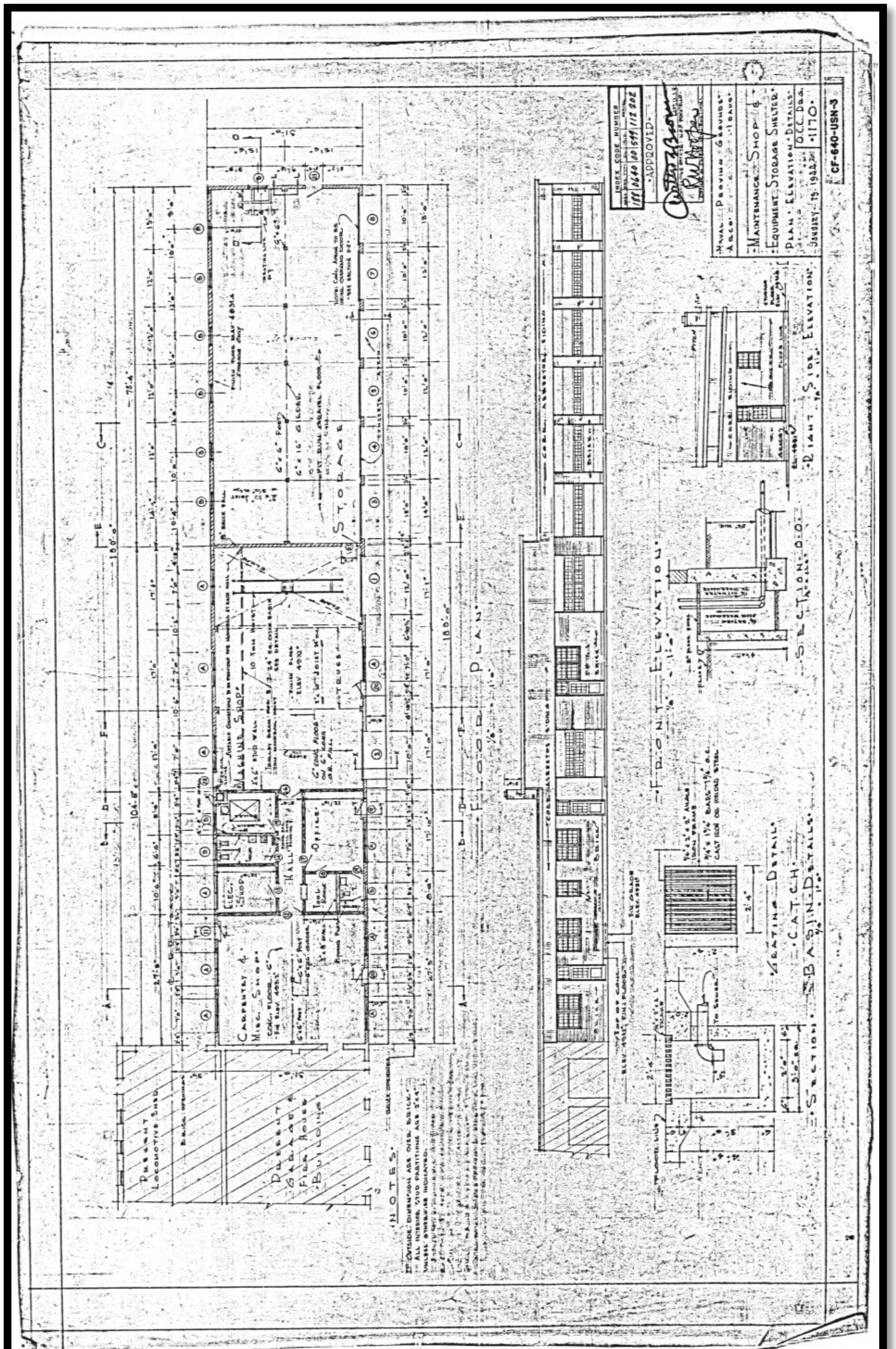


Figure 5.130: INL drawing number 112202 (CF-640-USN-3); maintenance shop and equipment storage shelter (non-extant); plan, elevation, and details; January 1944.

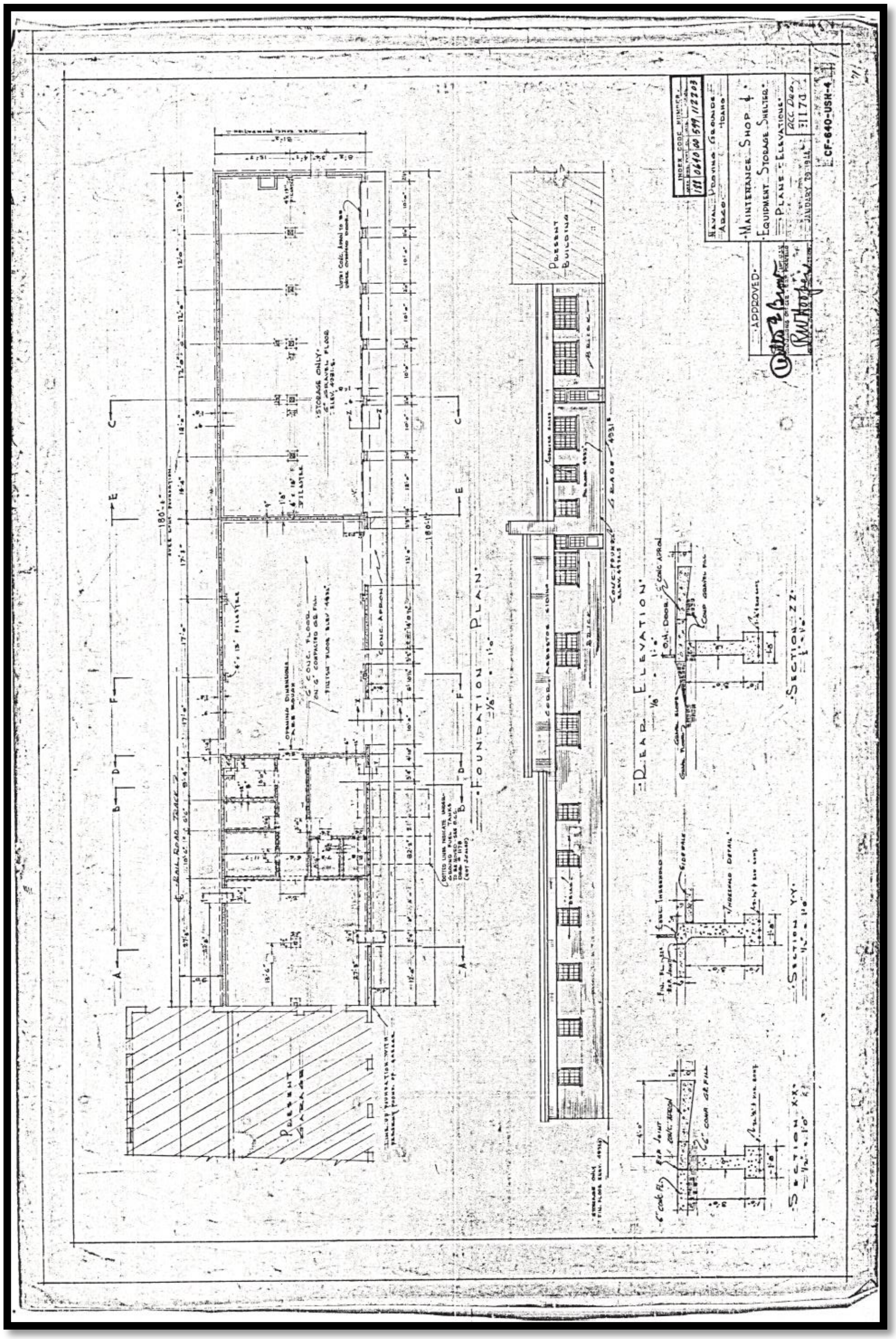


Figure 5.131: INL drawing number 112203 (CF-640-USN-4); maintenance shop and equipment storage shelter (non-extant), plans and elevations; January 1944.

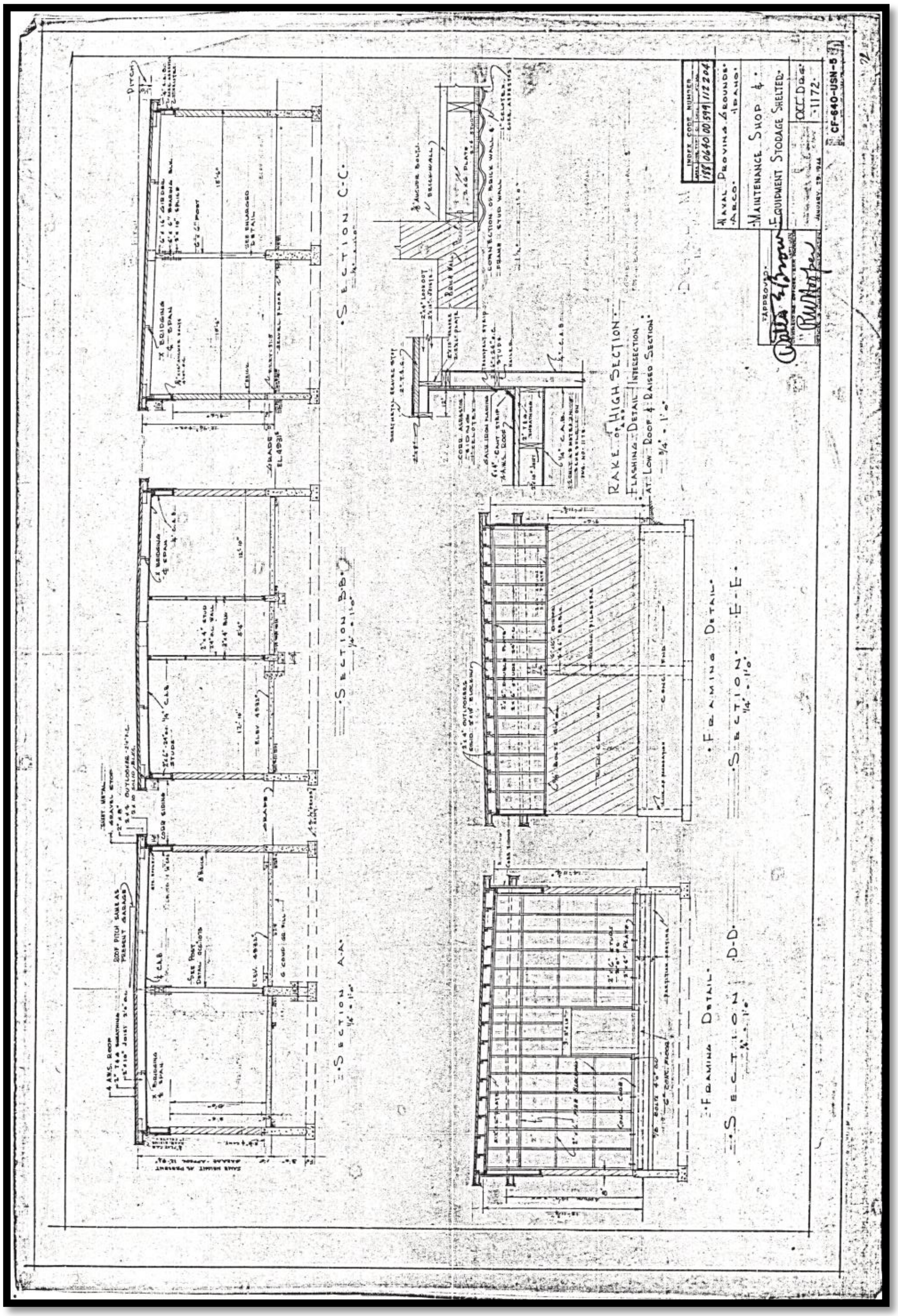


Figure 5.132: INL drawing number 112204 (CF-640-USN-5); maintenance shop and equipment storage shelter (non-extant), sections and details; January 1944.

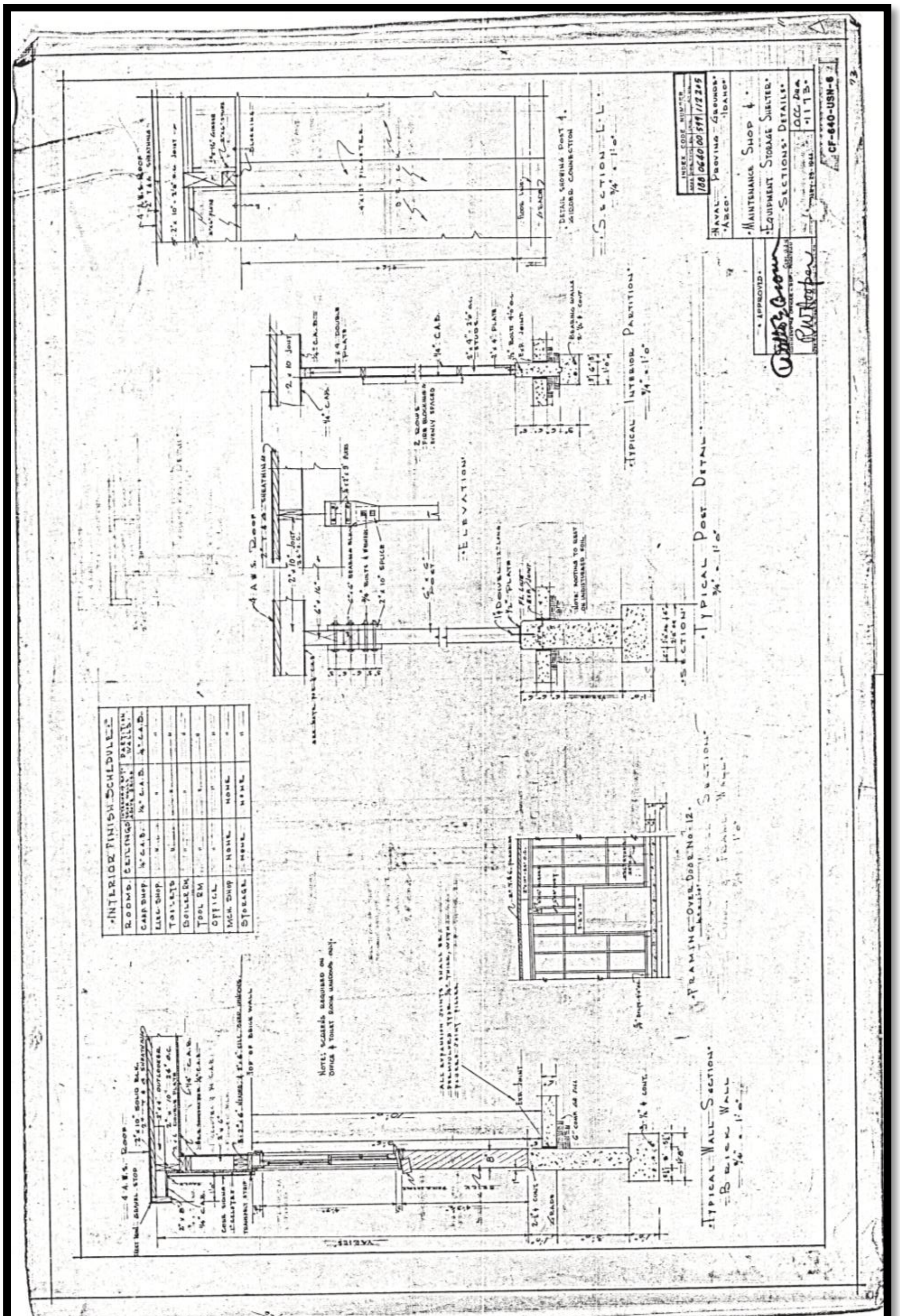


Figure 5.133: INL drawing number 112205 (CF-640-USN-6); maintenance shop and equipment storage shelter (non-extant), sections and details; January 1944.

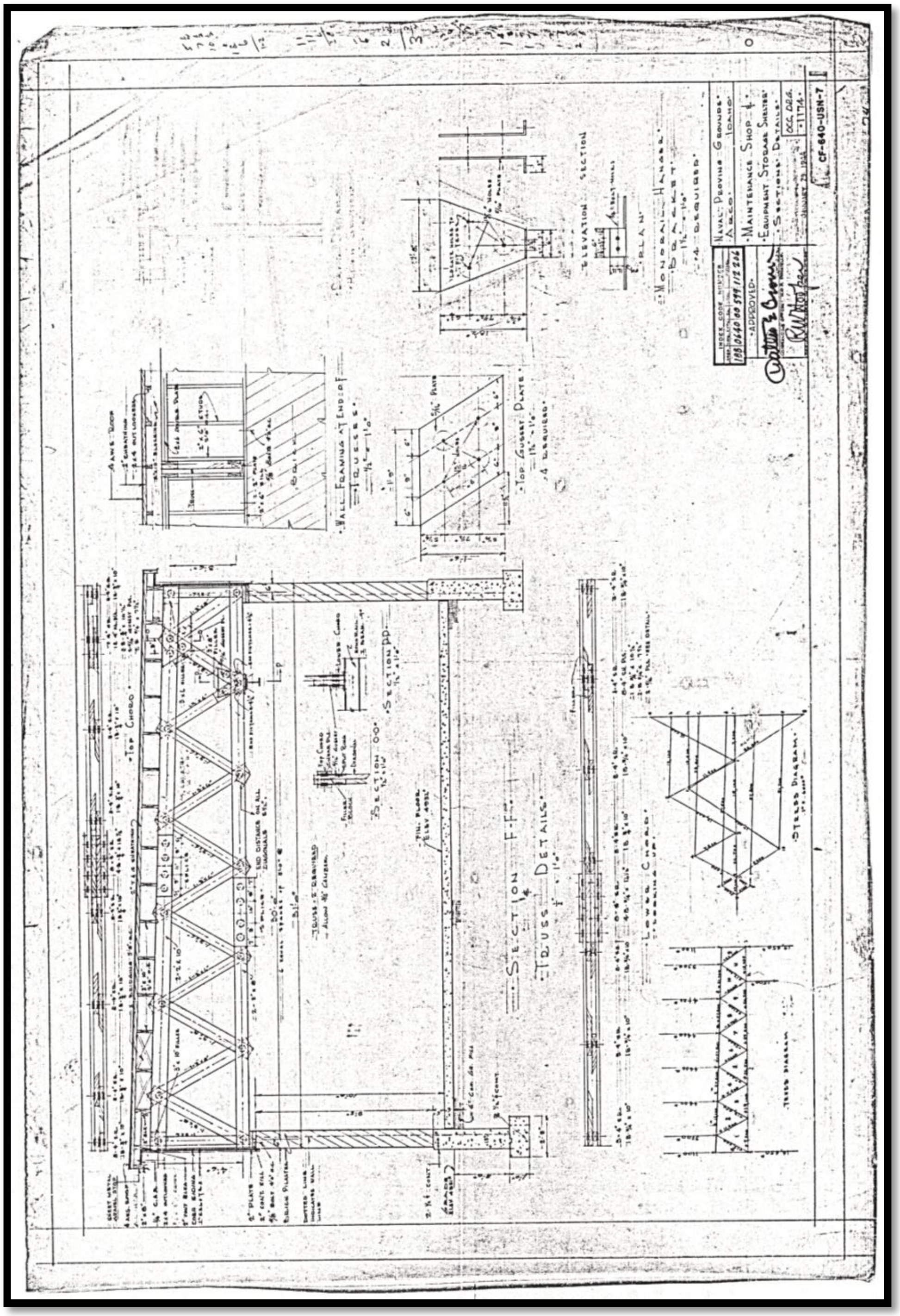


Figure 5.134: INL drawing number 112206 (CF-640-USN-7); maintenance shop and equipment storage shelter (non-extant), sections and details; January 1944.

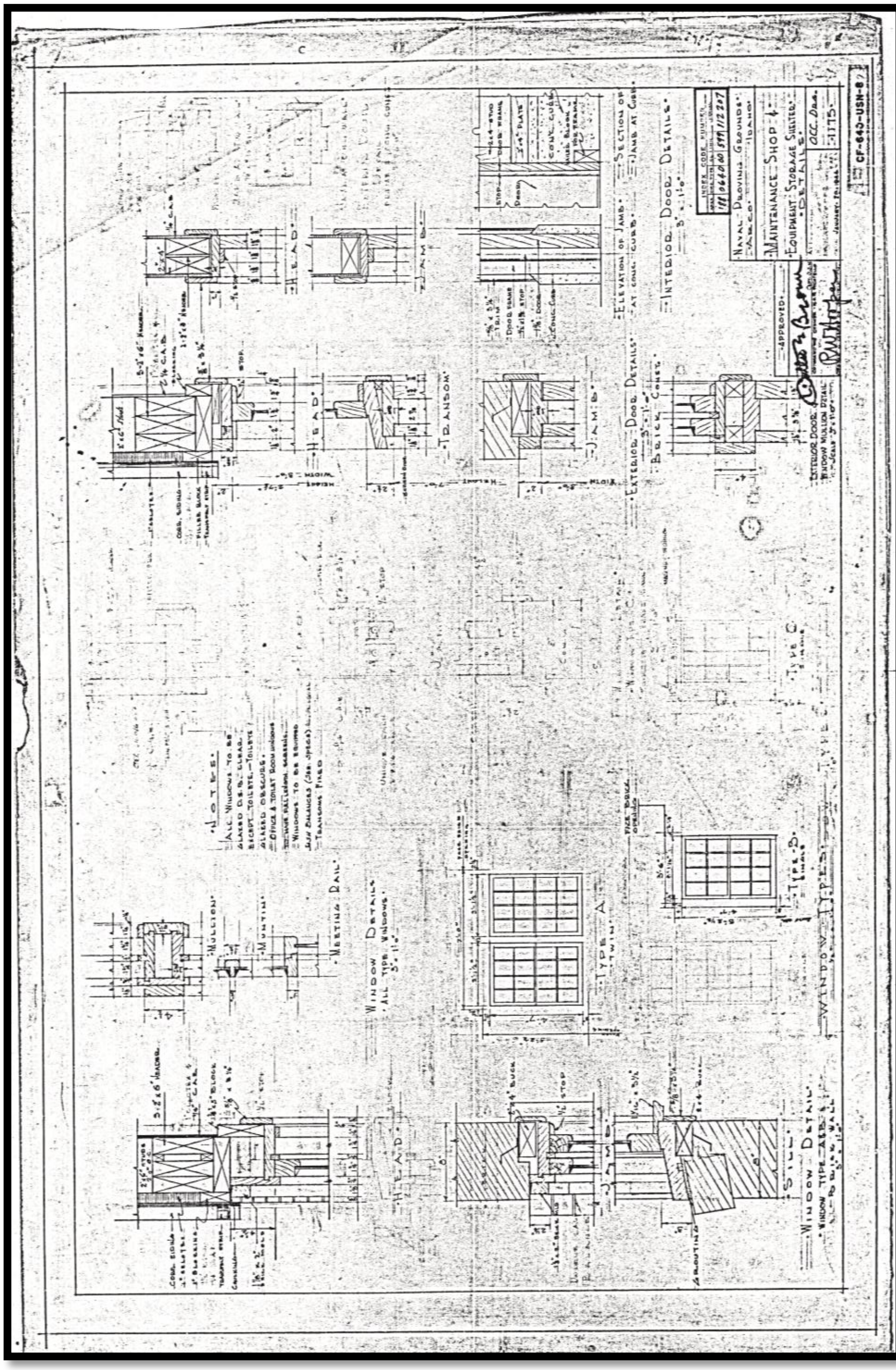


Figure 5.135: INL drawing number 112207 (CF-640-USN-8); maintenance shop and equipment storage shelter (non-extant), details; January 1944.

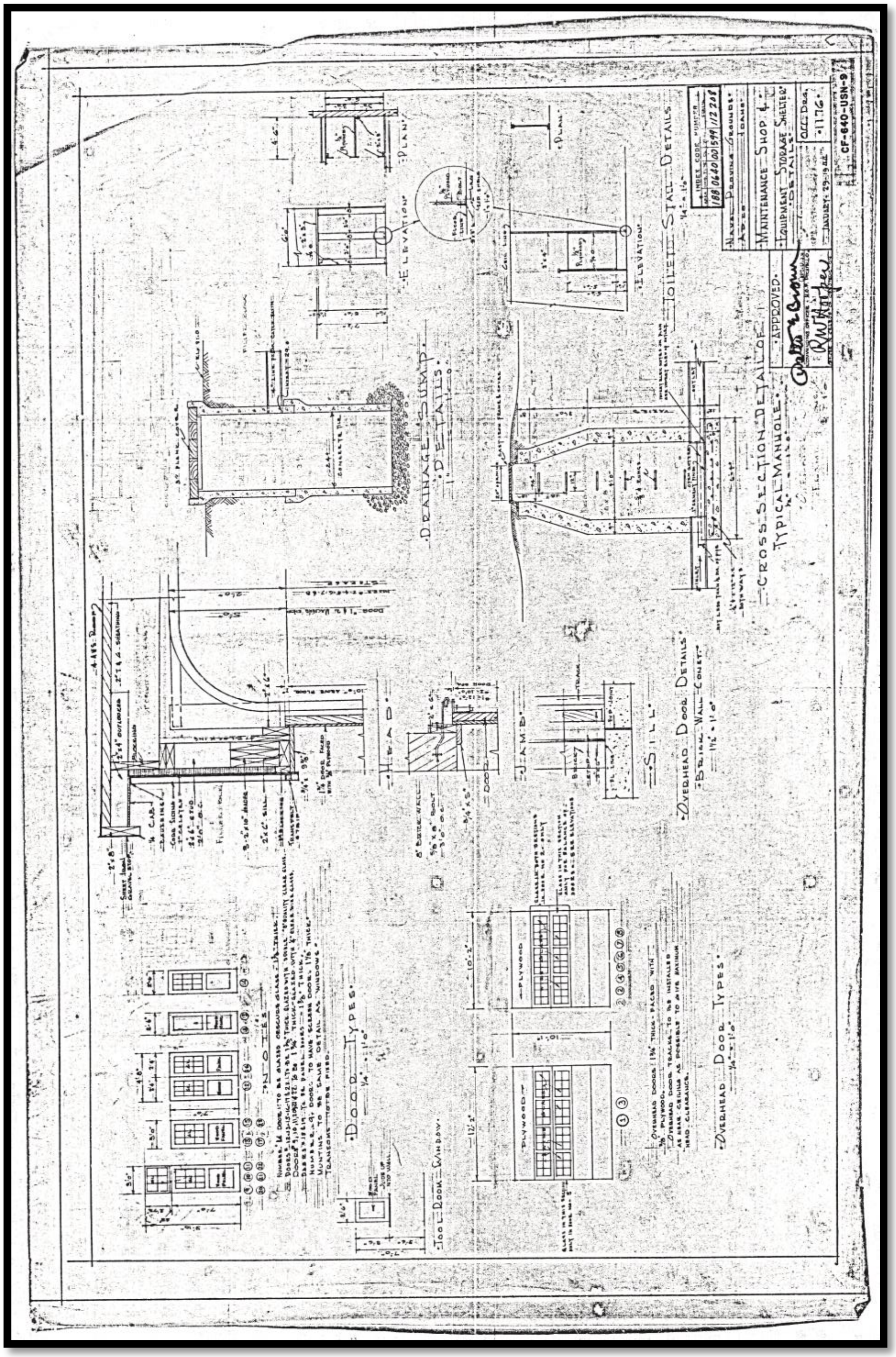


Figure 5.136: INL drawing number 112208 (CF-640-USN-9); maintenance shop and equipment storage shelter (non-extant), details; January 1944.

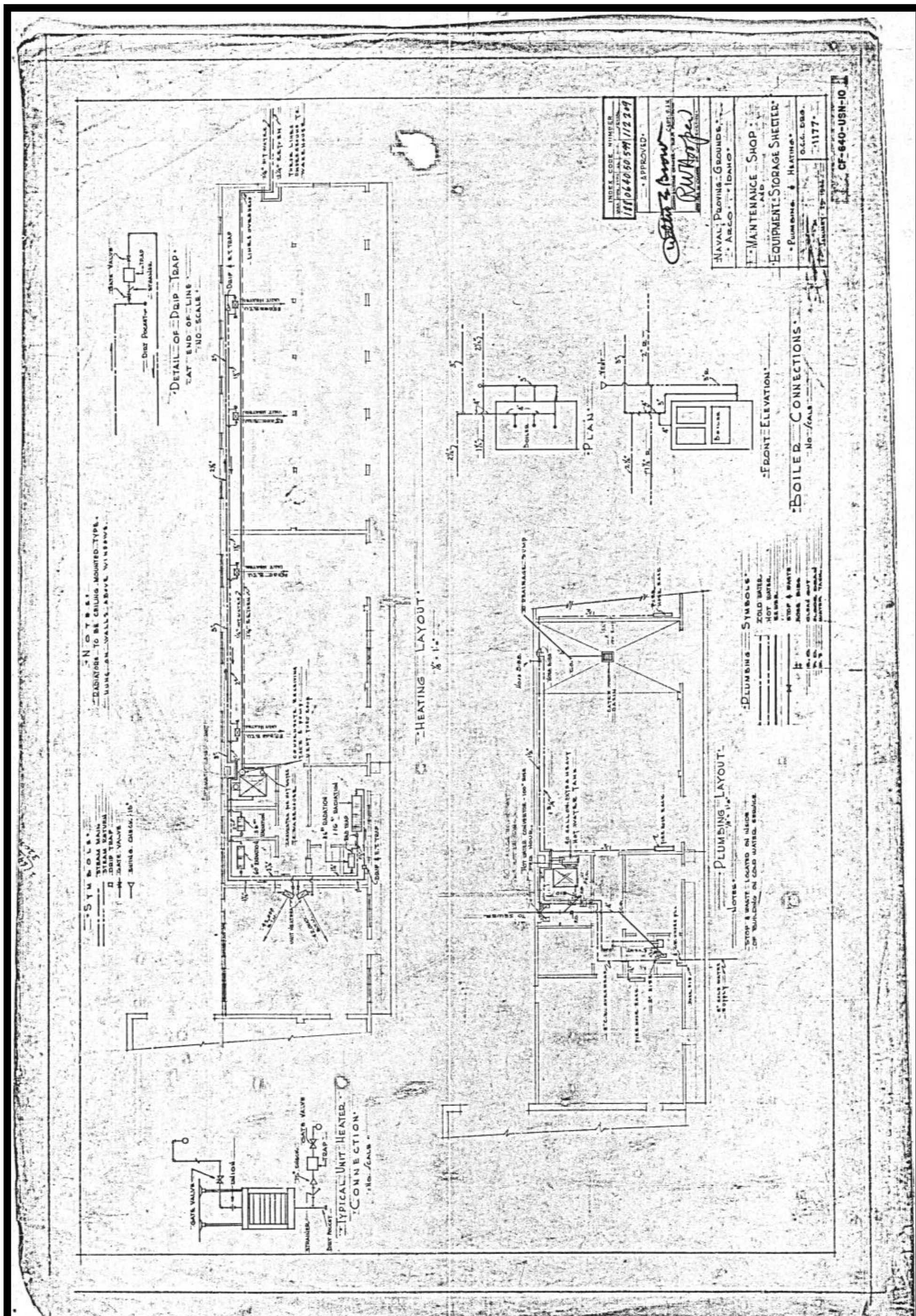


Figure 5.137: INL drawing number 112209 (CF-640-USN-10); maintenance shop and equipment storage shelter (non-extant), plumbing and heating; January 1944.

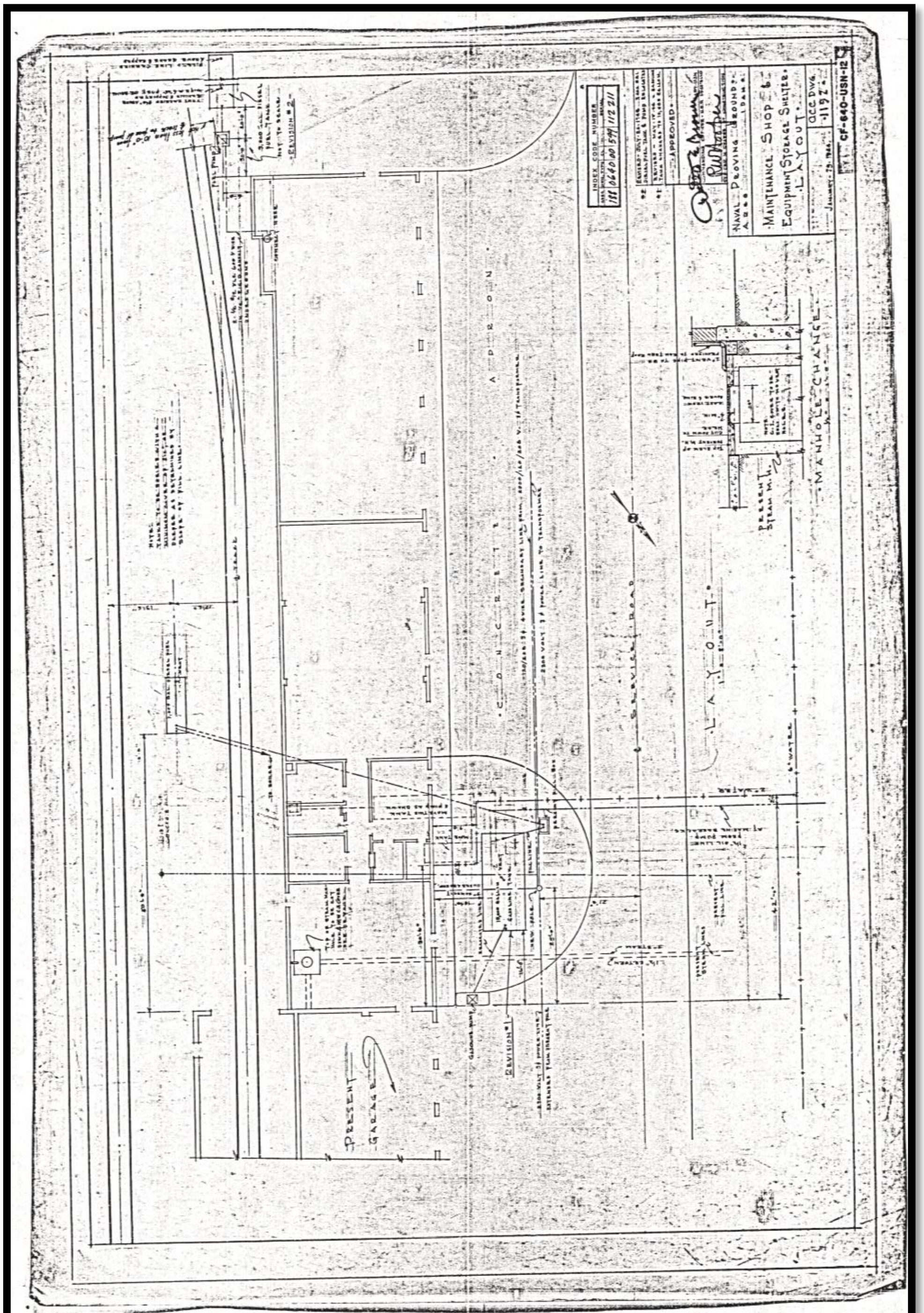


Figure 5.138: INL drawing number 112211 (CF-640-USN-12); maintenance shop and equipment storage shelter (non-extant), layout; January 1944.

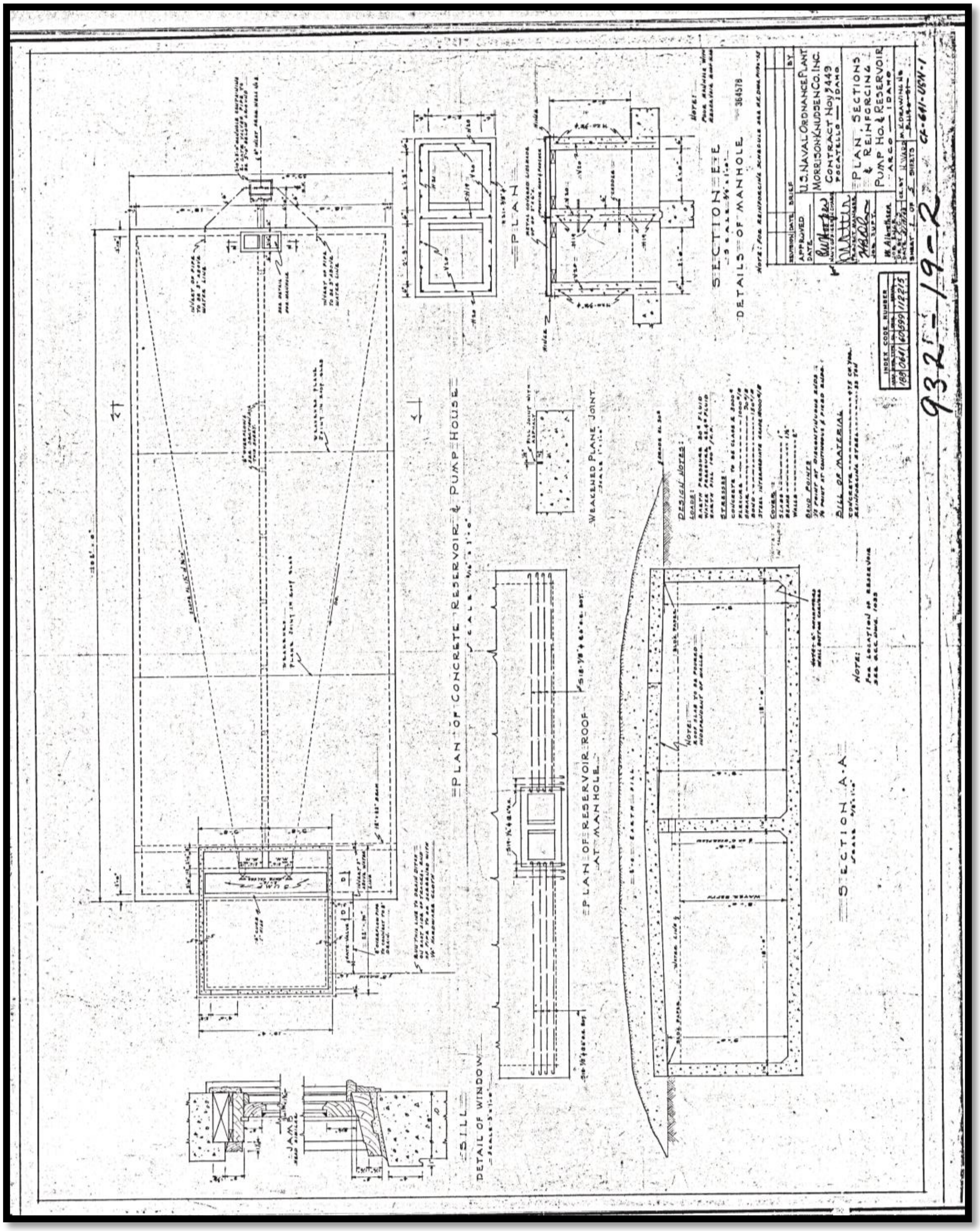


Figure 5.139: INL drawing number 112212 (CF-640-USN-13); maintenance shop and equipment storage shelter (non-extant), revised floor plan and details; March 1944.

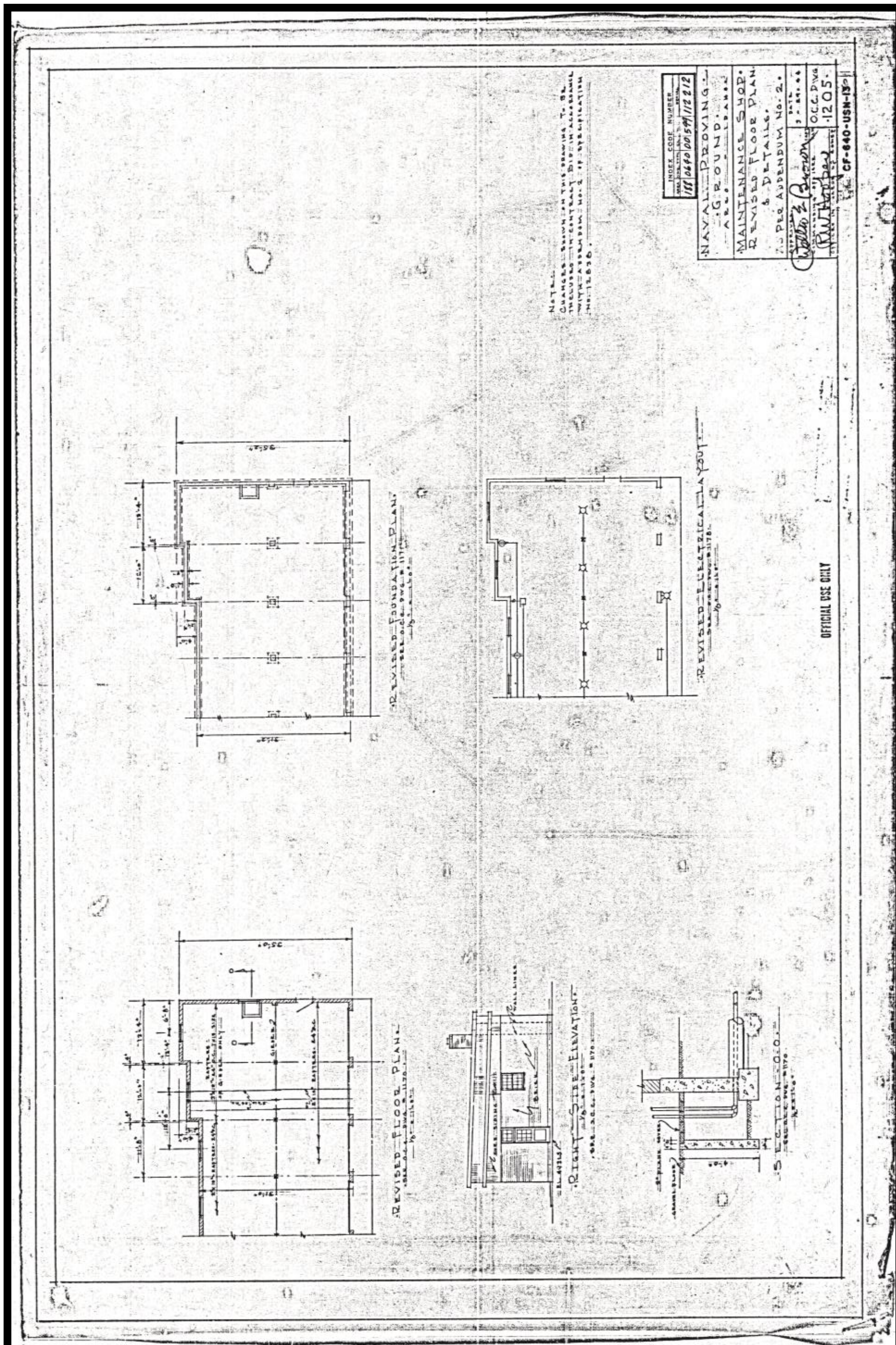


Figure 5.140: INL drawing number 112215 (CF-641-USN-1); pump house and reservoir (CFA-641, non-extant), plan, sections, and reinforcing; sheet 1 of 5; ca. 1943.

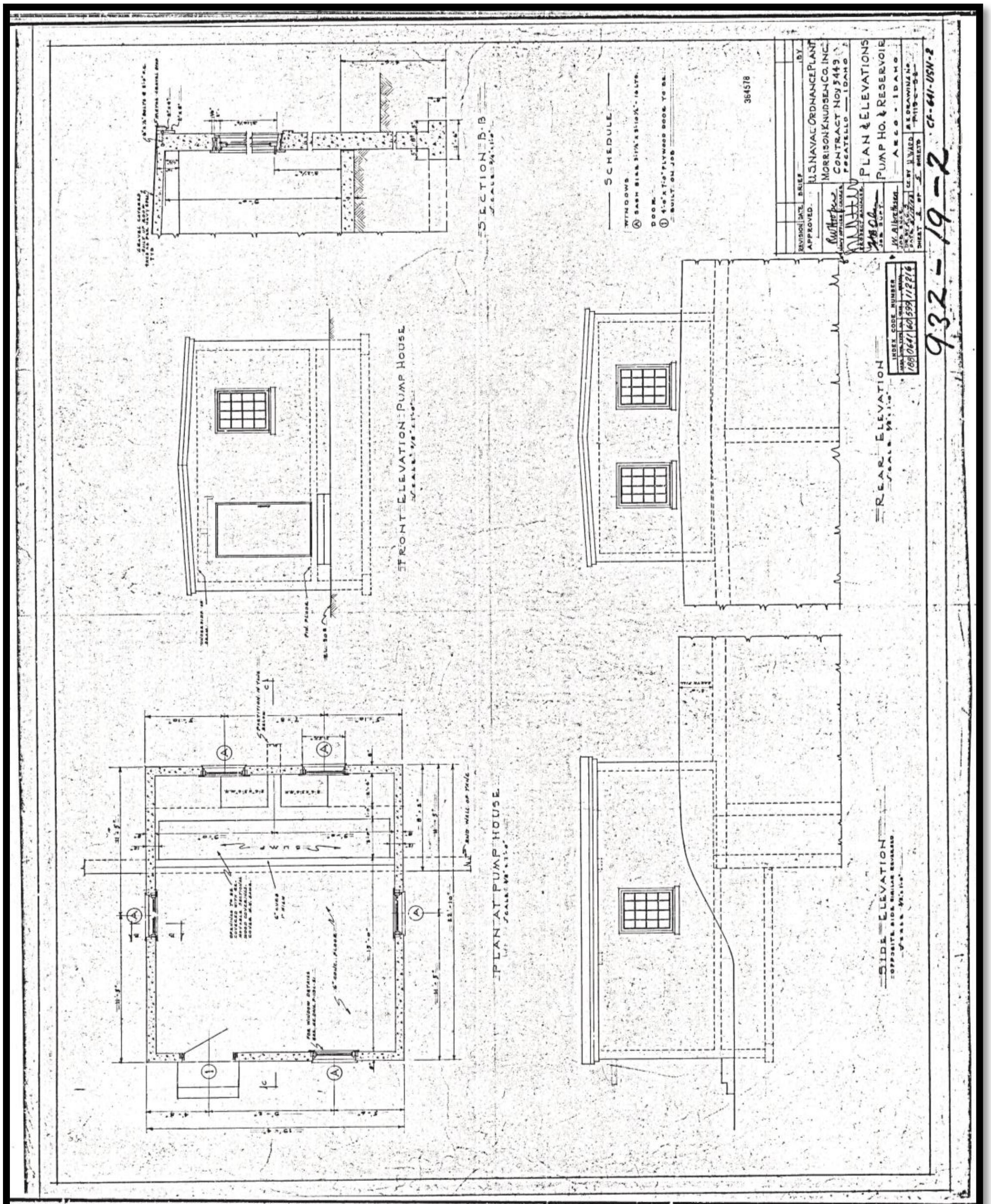


Figure 5.141: INL drawing number 112216 (CF-641-USN-2); pump house and reservoir (CFA-641, non-extant), plan and elevations; sheet 2 of 5; ca. 1943.

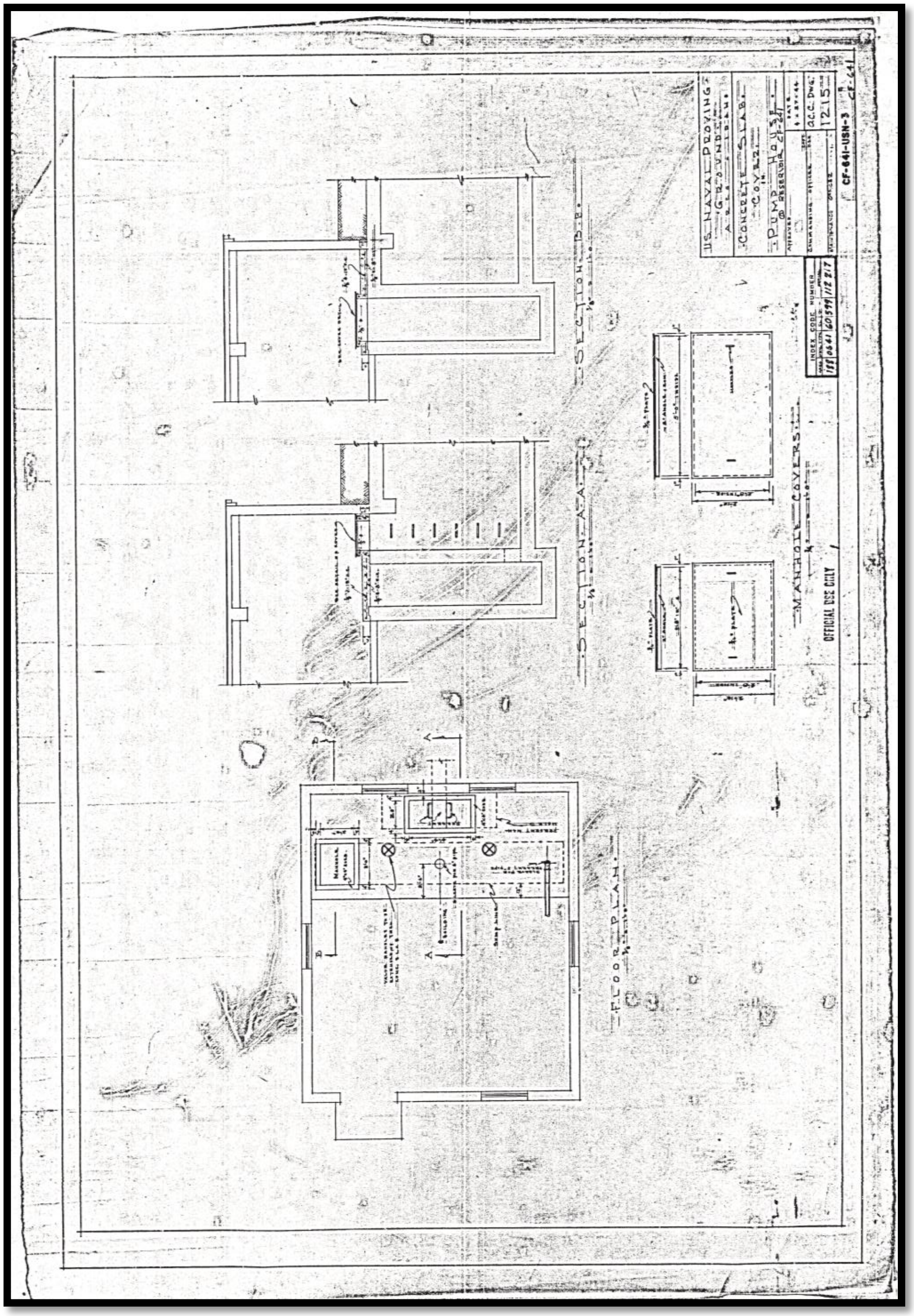


Figure 5.142: INL drawing number 112217 (CF-641-USN-3); pump house and reservoir (CFA-641, non-extant), concrete slab cover; ca. 1943.

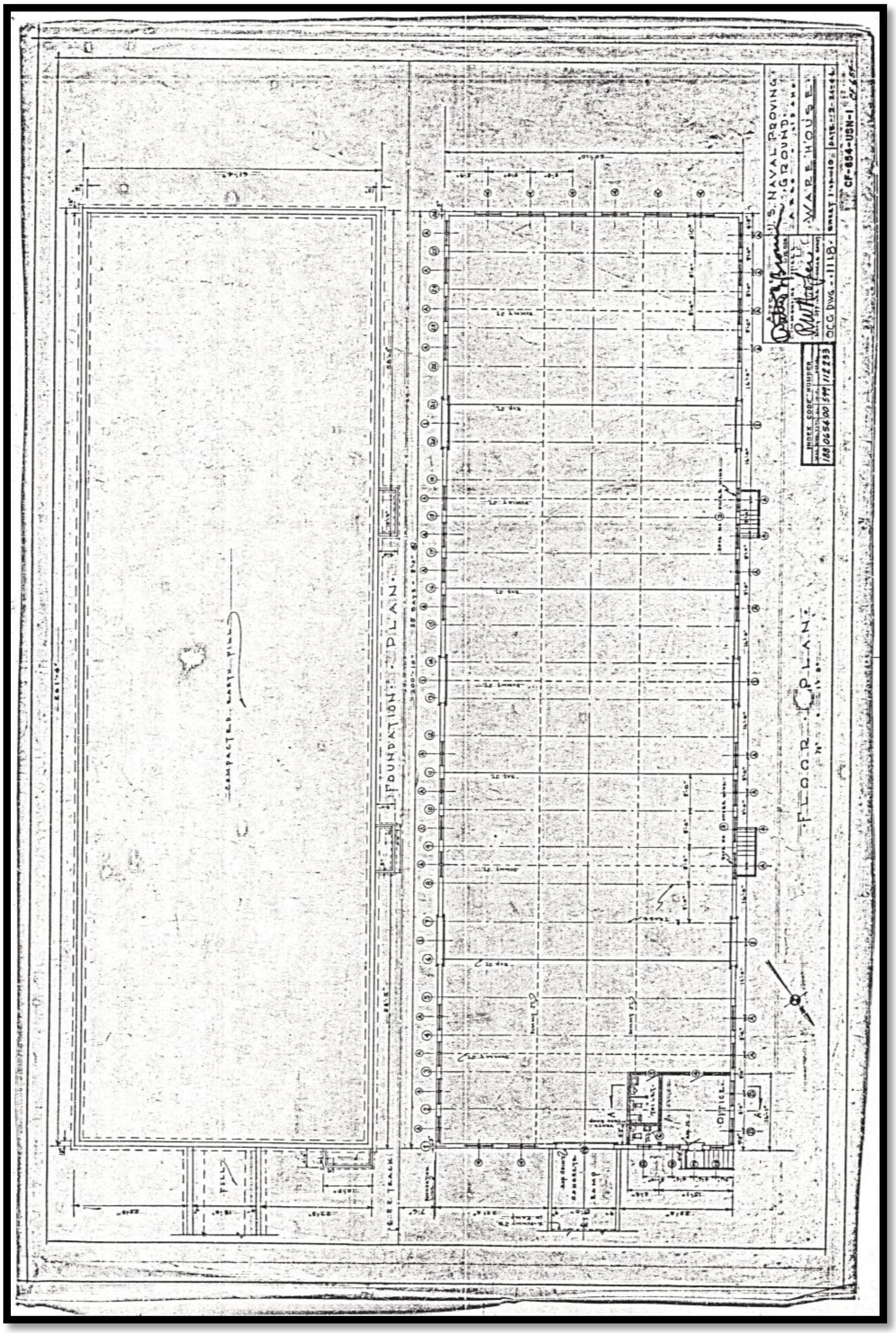


Figure 5.143: INL drawing number 112233 (CF-654-USN-1); warehouse (CFA-654, non-extant), floor plan; sheet 1 of 10; February 1944.

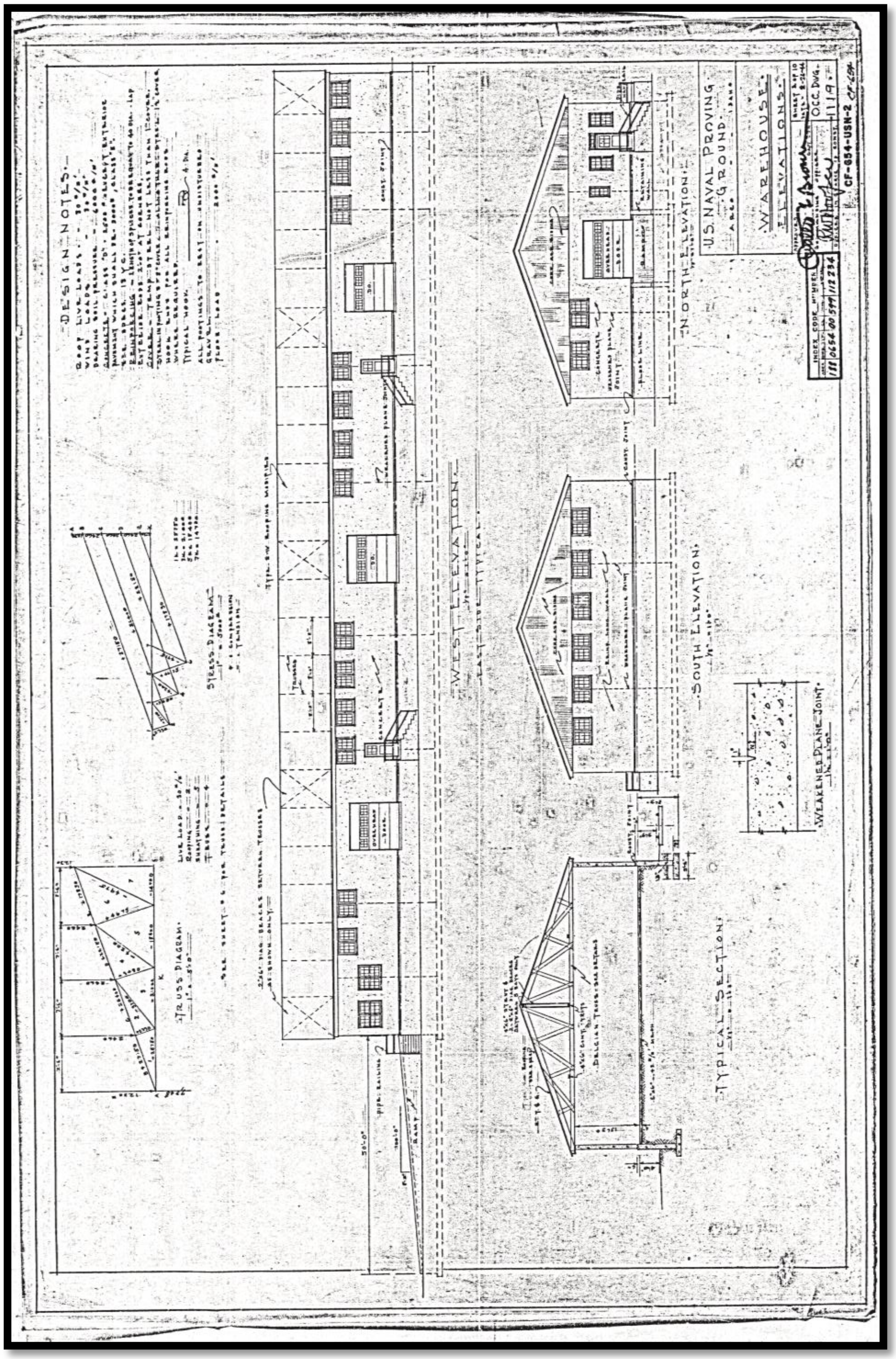


Figure 5.144: INL drawing number 112234 (CF-654-USN-2); warehouse (CFA-654, non-extant), elevations; sheet 2 of 10; February 1944.

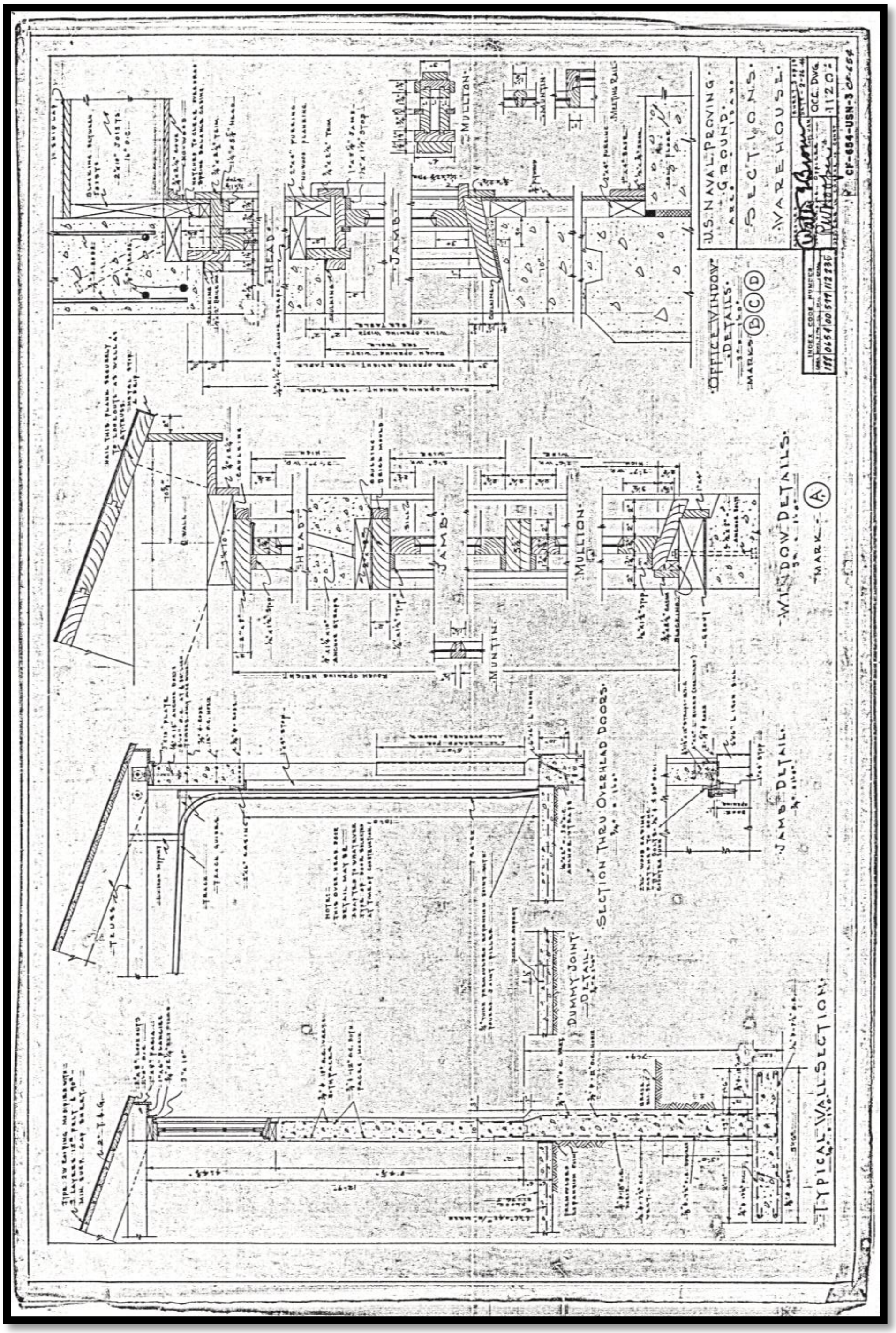


Figure 5.145: INL drawing number 112235 (CF-654-USN-3); warehouse (CFA-654, non-extant), sections; sheet 3 of 10; February 1944.

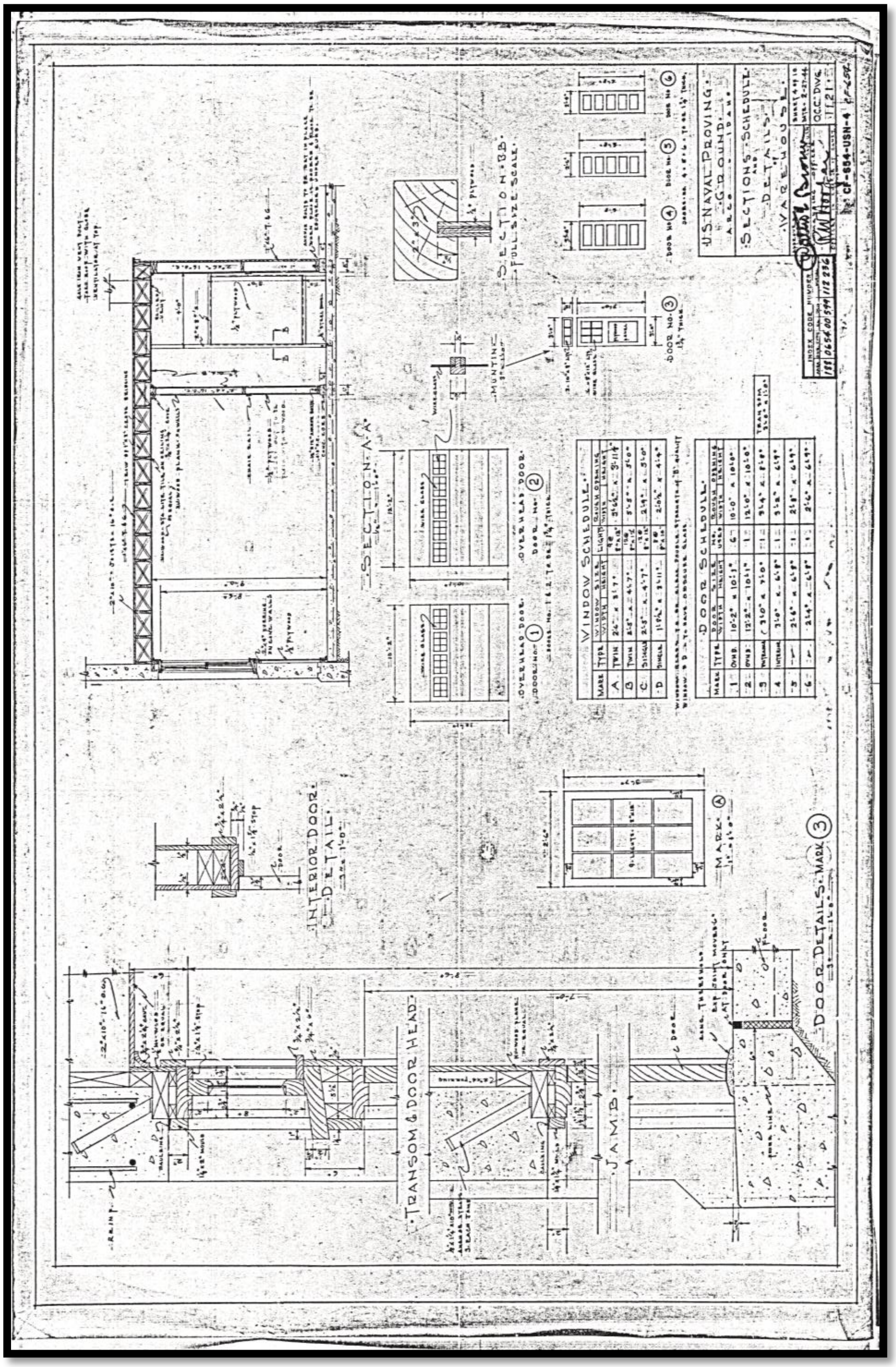


Figure 5.146: INL drawing number 112236 (CF-654-USN-4); warehouse (CFA-654, non-extant), sections, schedule, and details; sheet 4 of 10; February 1944.

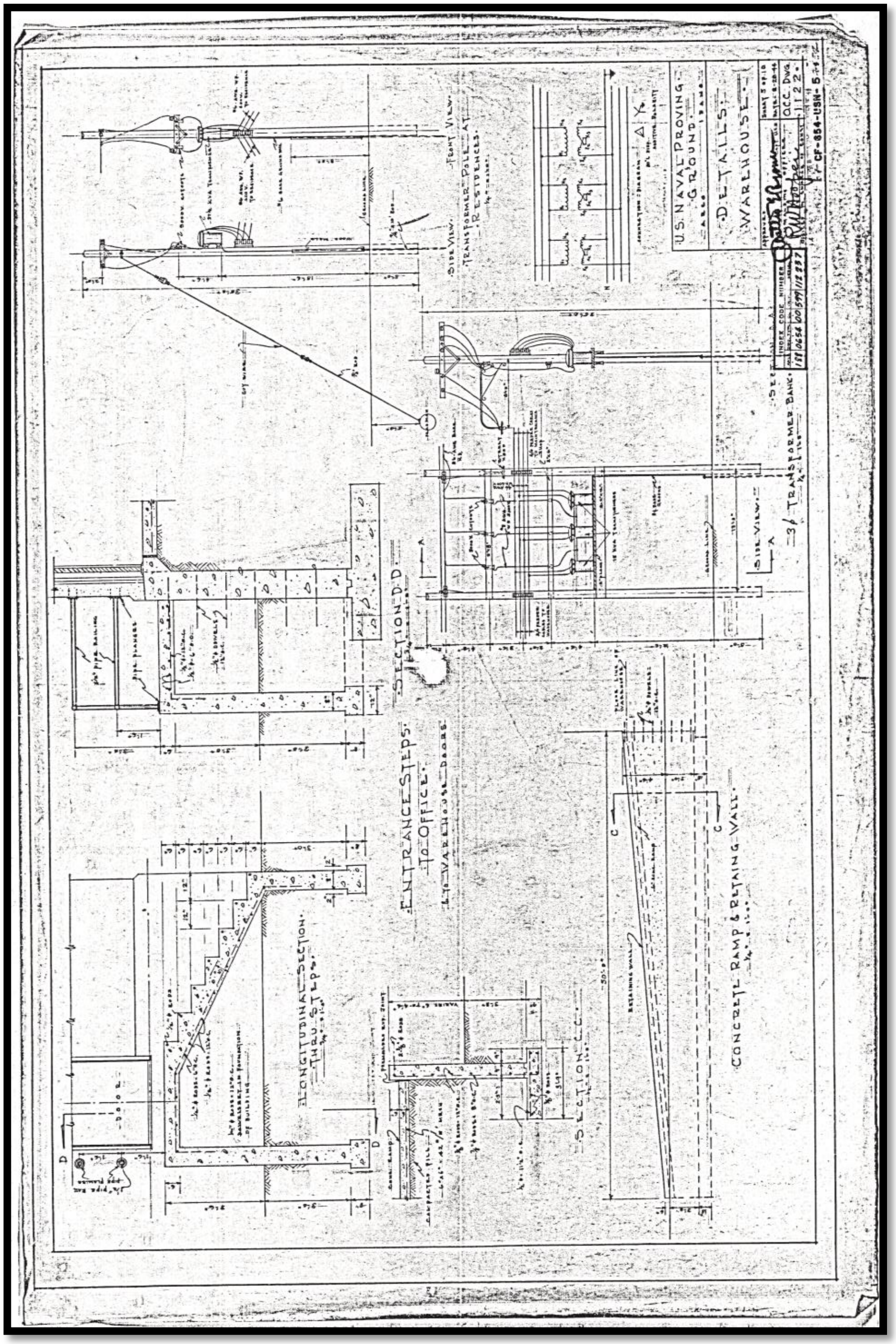


Figure 5.147: INL drawing number 112237 (CF-654-USN-5); warehouse (CFA-654, non-extant), details; sheet 5 of 10; February 1944.

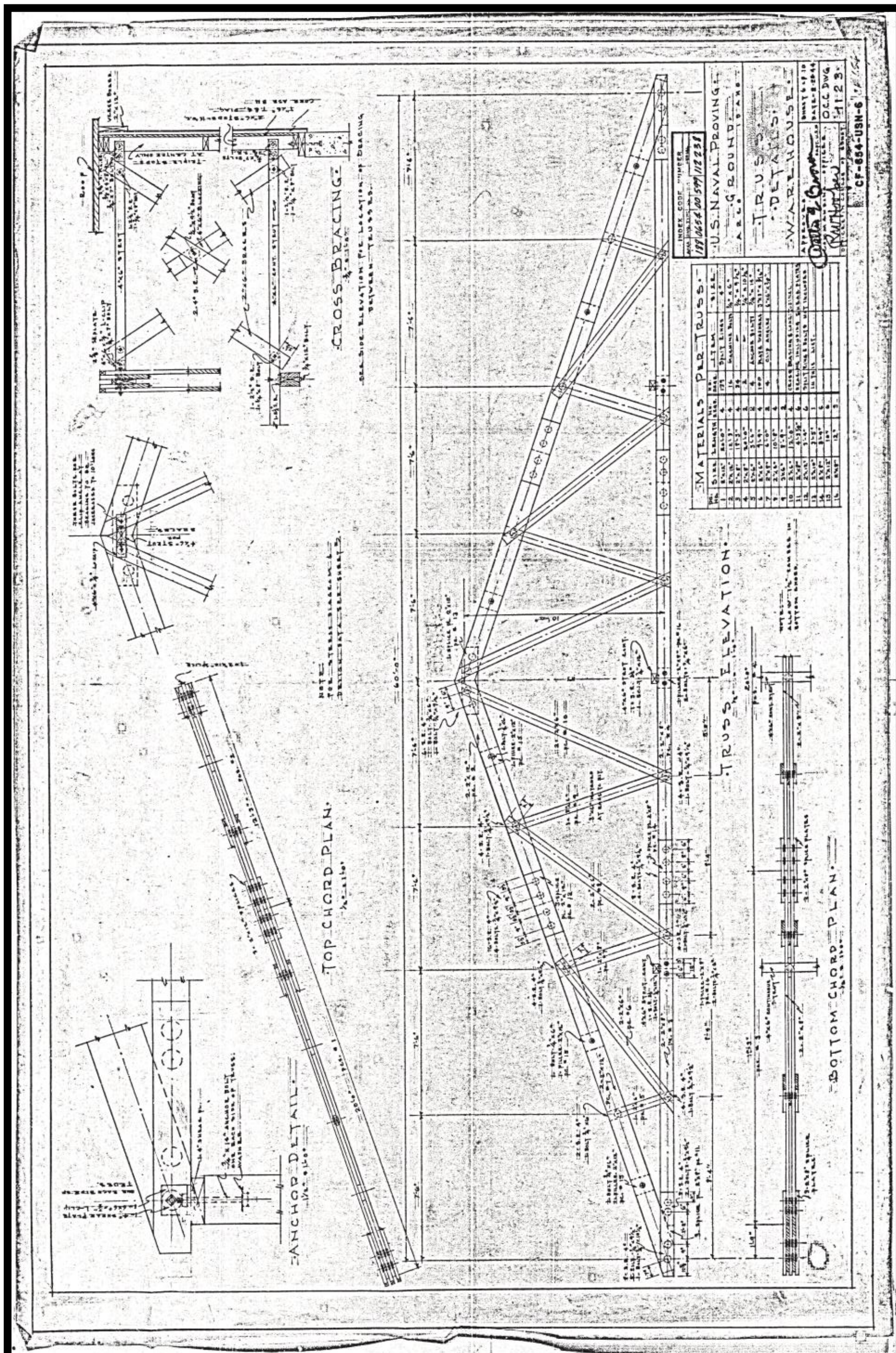


Figure 5.148: INL drawing number 112238 (CF-654-USN-6); warehouse (CFA-654, non-extant), truss details; sheet 6 of 10; February 1944.

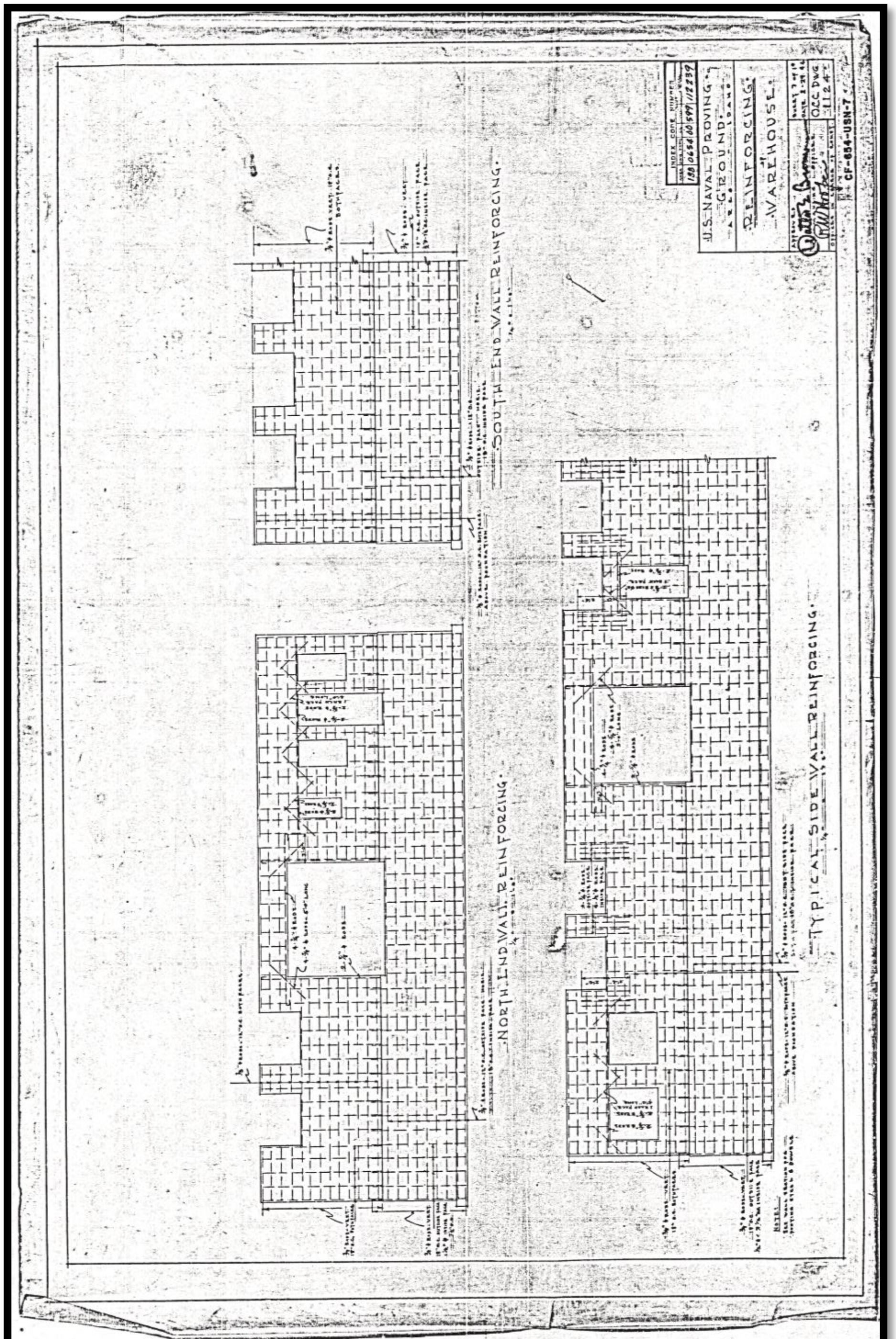


Figure 5.149: INL drawing number 112239 (CF-654-USN-7); warehouse (CFA-654, non-extant), reinforcing; sheet 7 of 10; February 1944.

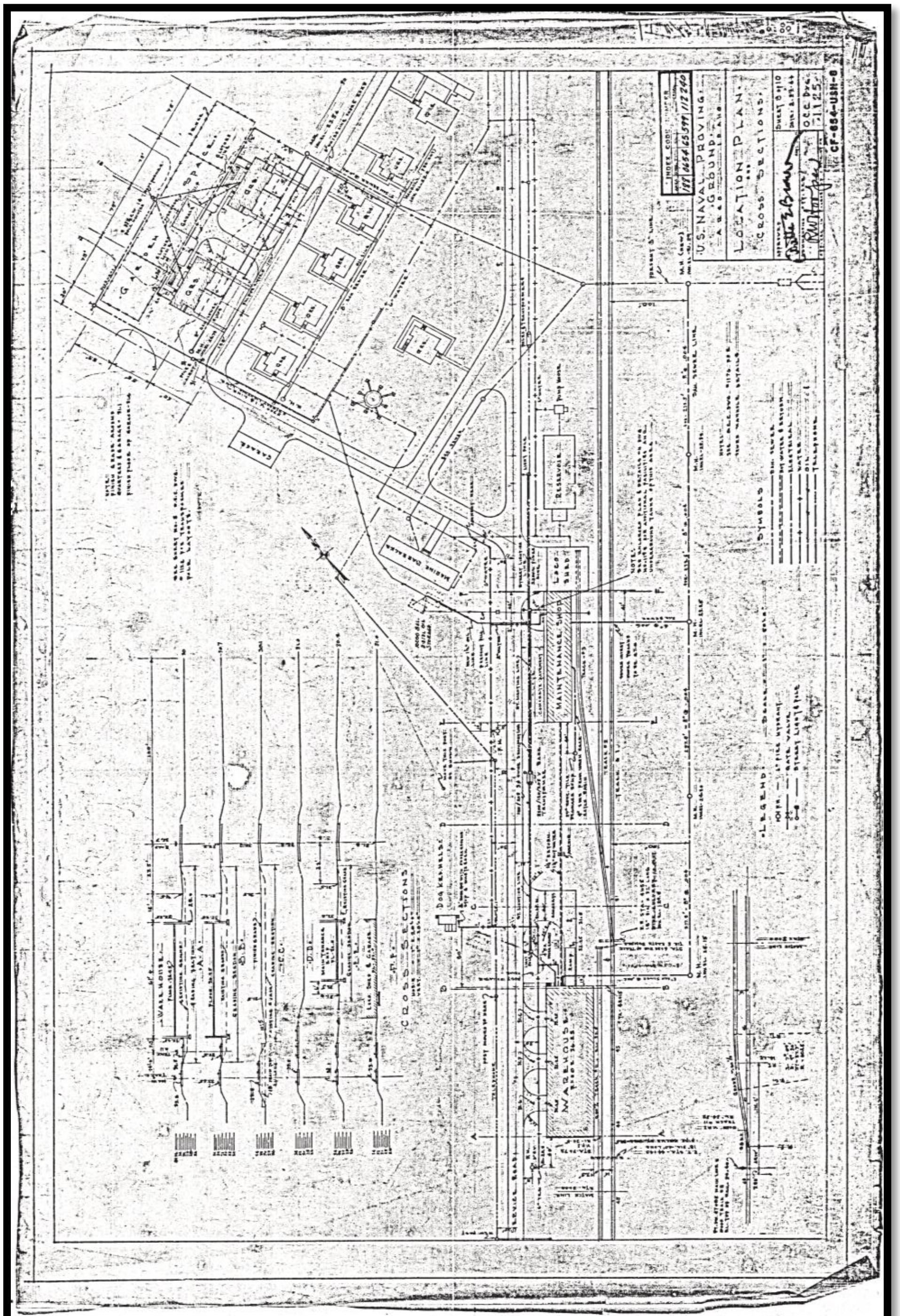


Figure 5.150: INL drawing number 112240 (CF-654-USN-8); warehouse (CFA-654, non-extant), location plan and cross sections; sheet 8 of 10; February 1944.

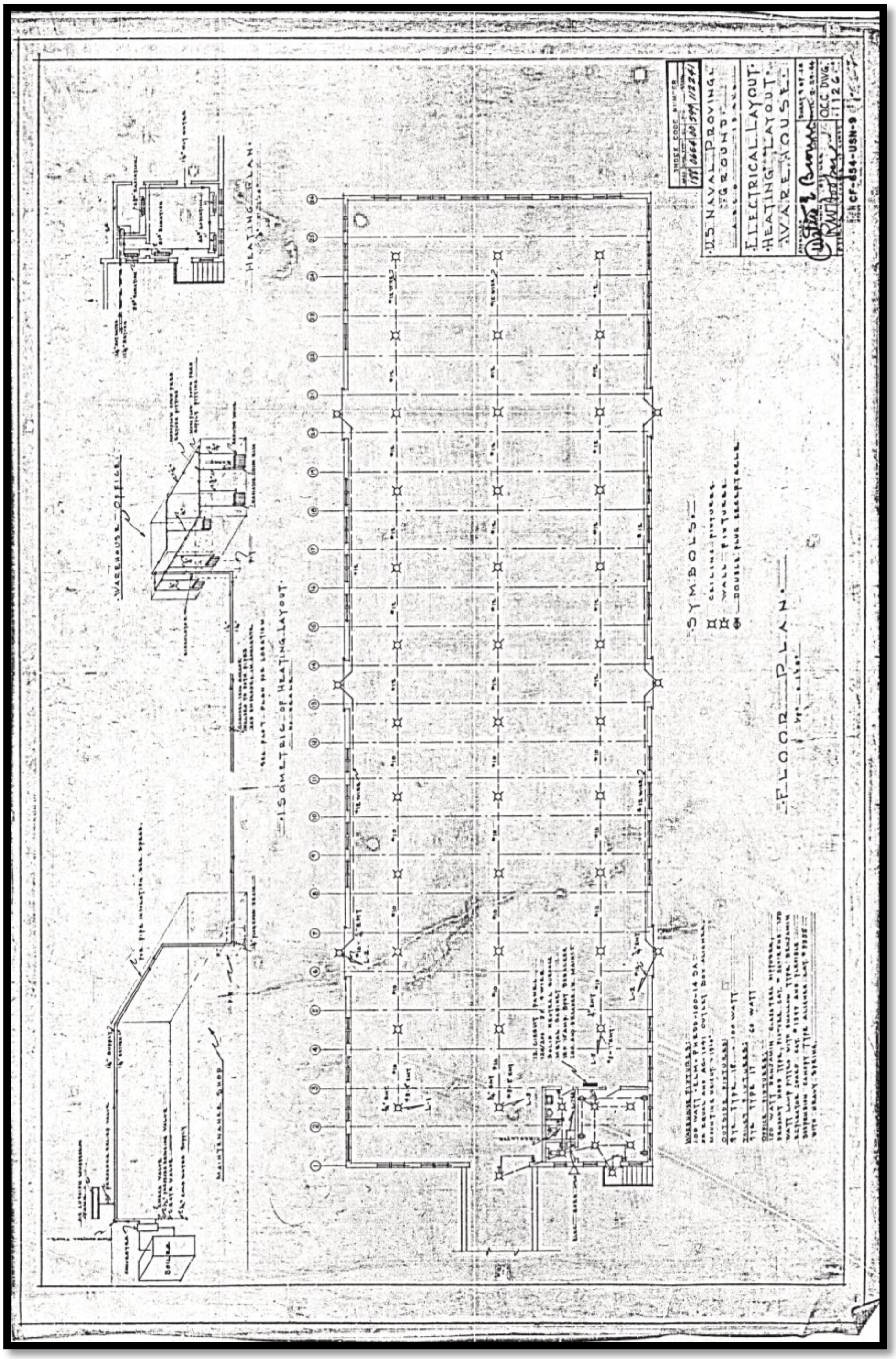


Figure 5.151: INL drawing number 112241 (CF-654-USN-9); warehouse (CFA-654, non-extant), electrical layout and heating layout; sheet 9 of 10; February 1944.

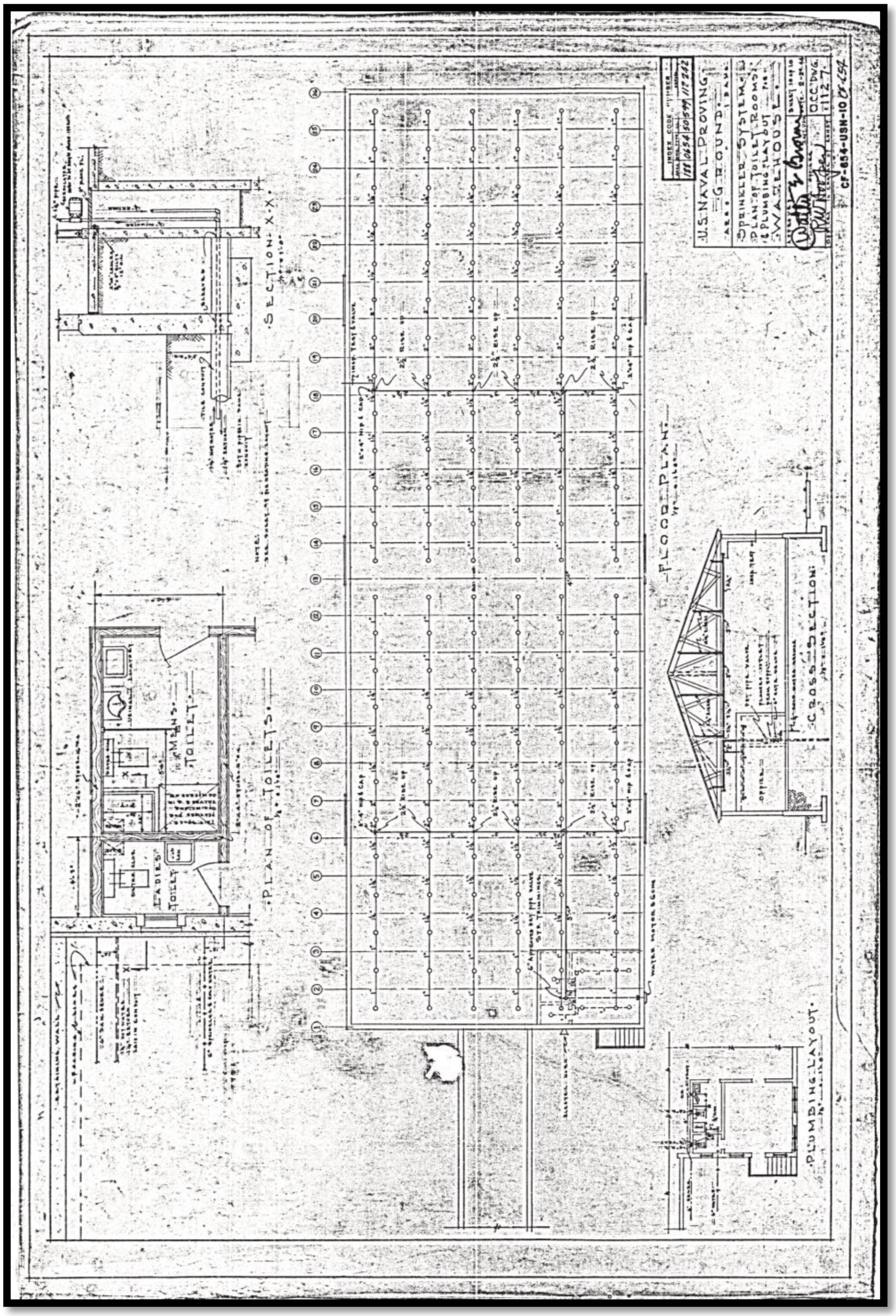


Figure 5.152: INL drawing number 112242 (CF-564-USN-10); warehouse (CFA-654, non-extant), sprinkler system, plan of toilet rooms, and plumbing layout; sheet 10 of 10; February 1944.

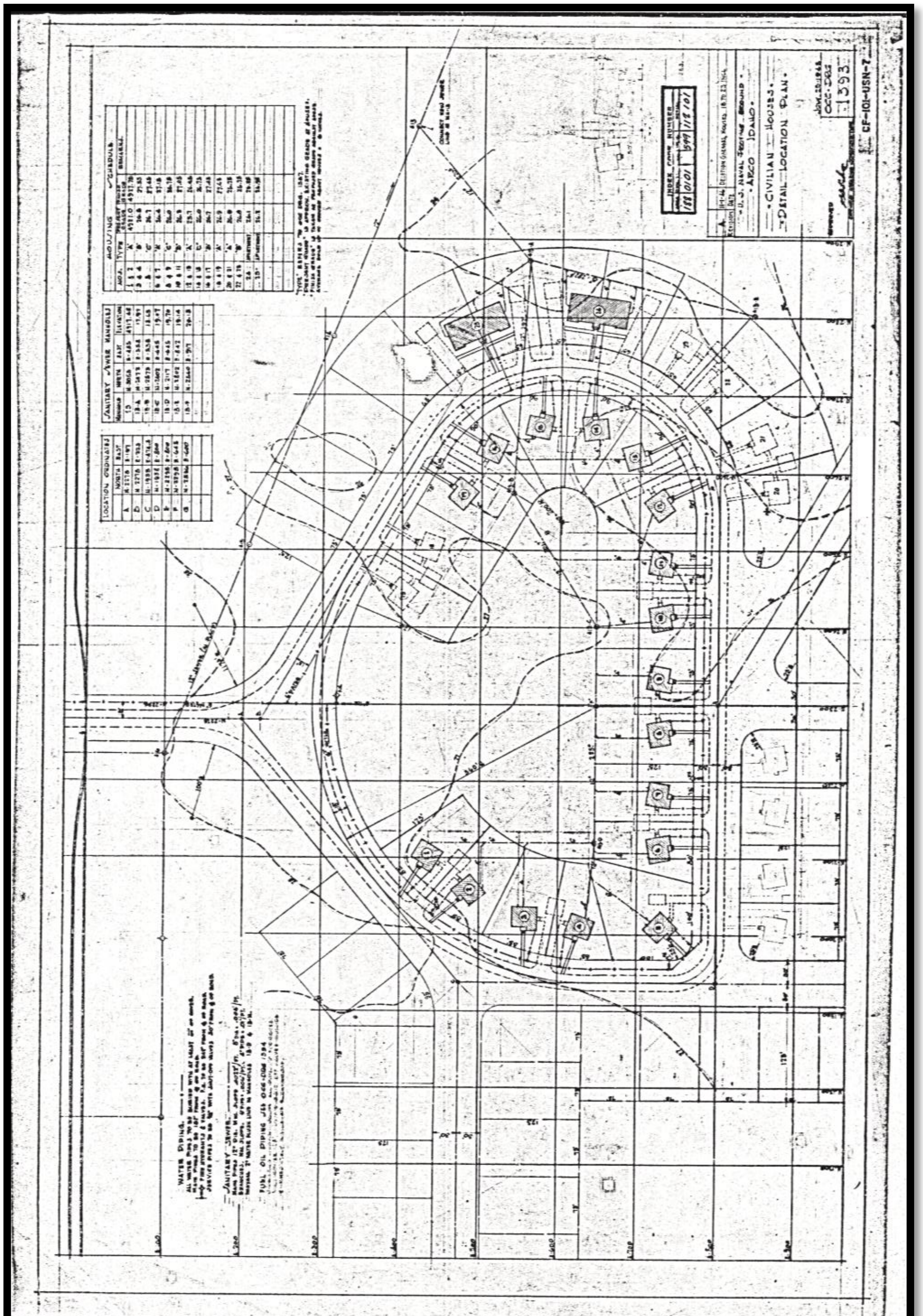


Figure 5.153: INL drawing number 1121010 (CF-101-USN-7); civilian houses (non-extant), location plant and detail; July 1945.

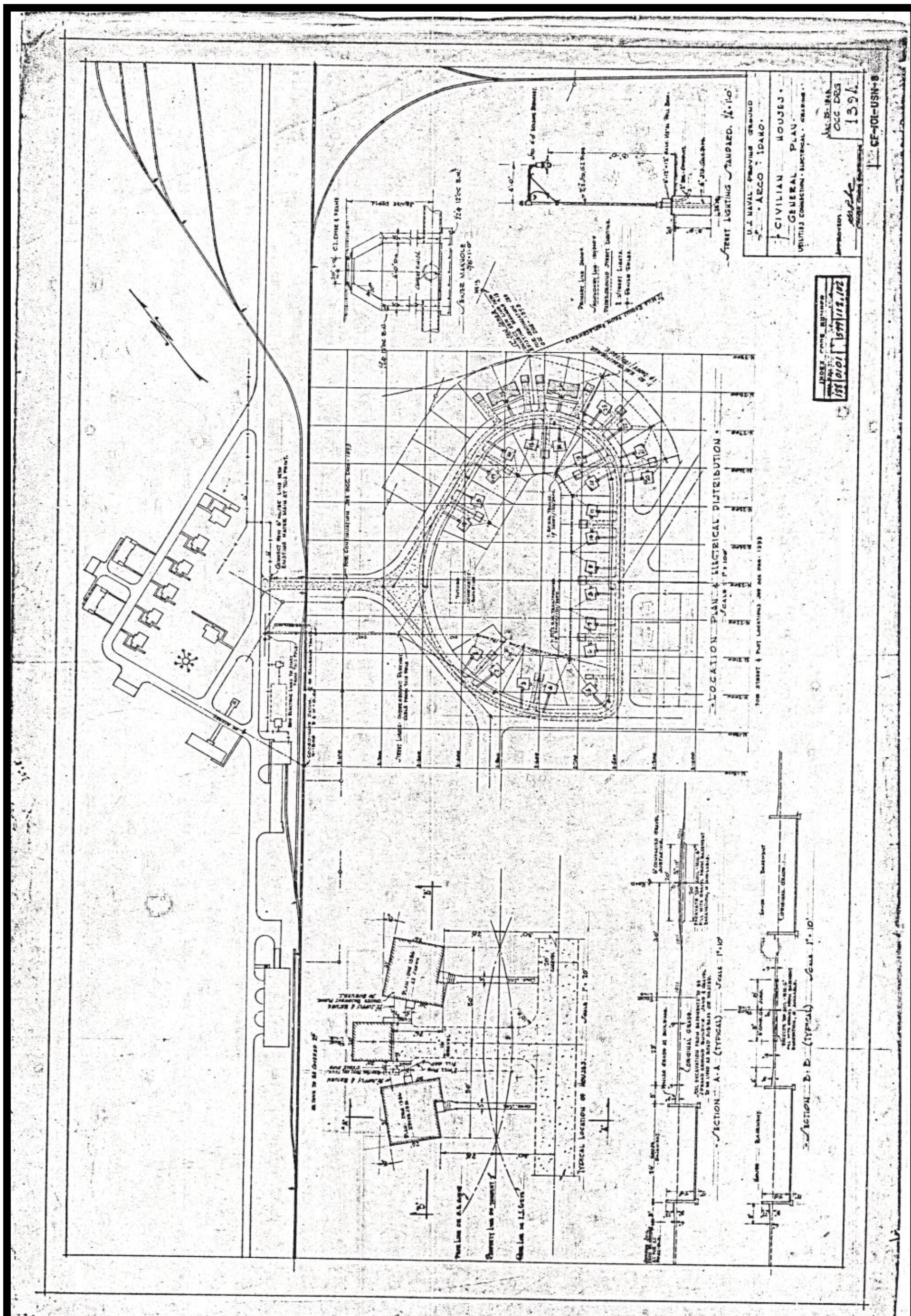


Figure 5.154: INL drawing number 112102 (CF-101-USN-8); civilian houses (non-extant), general plan, utilities connection, electrical, and grading; July 1945.

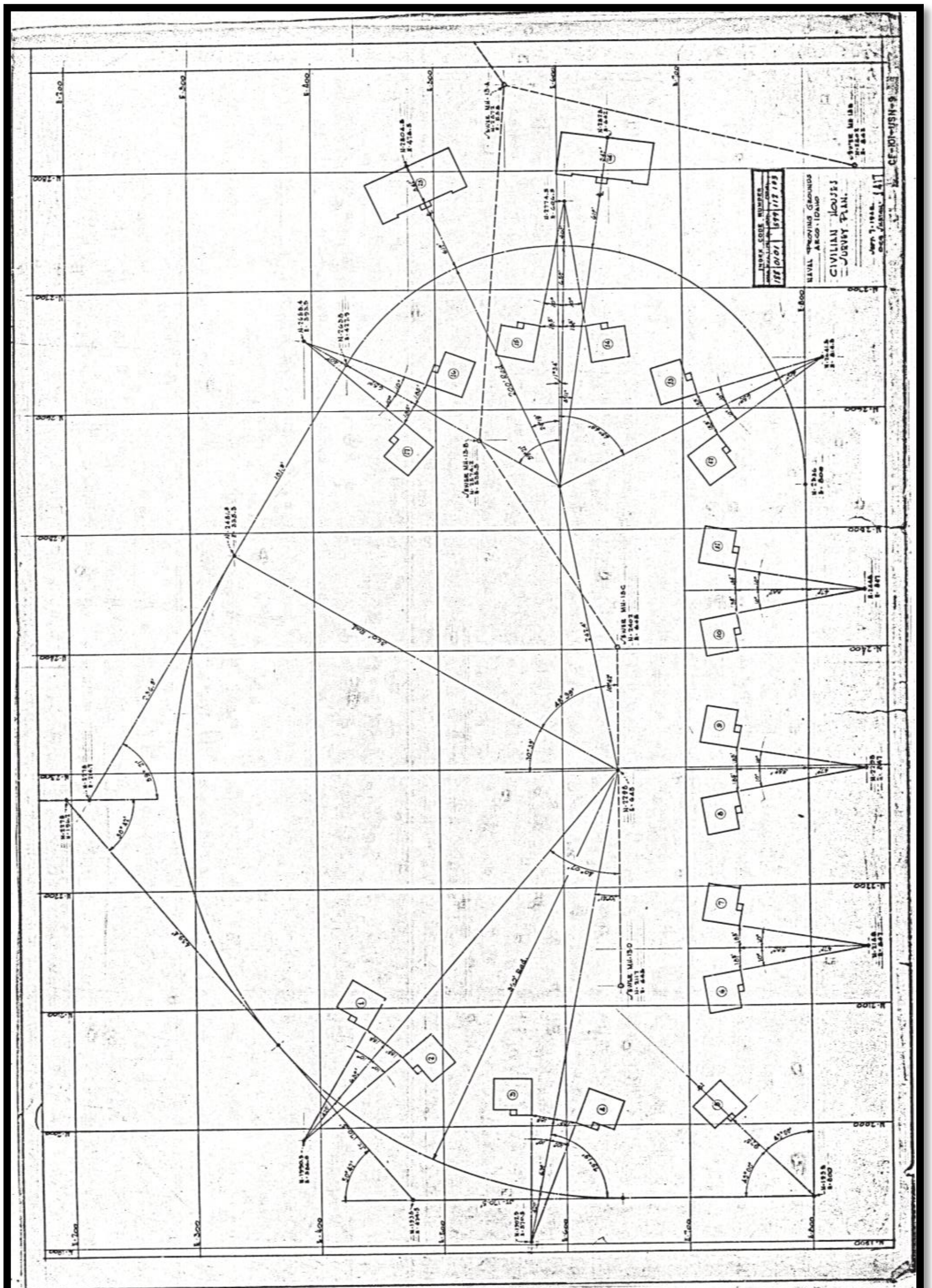


Figure 5.155: INL drawing number 112103 (CF-101-USN-9); civilian houses (non-extant), survey plan; September 1945.

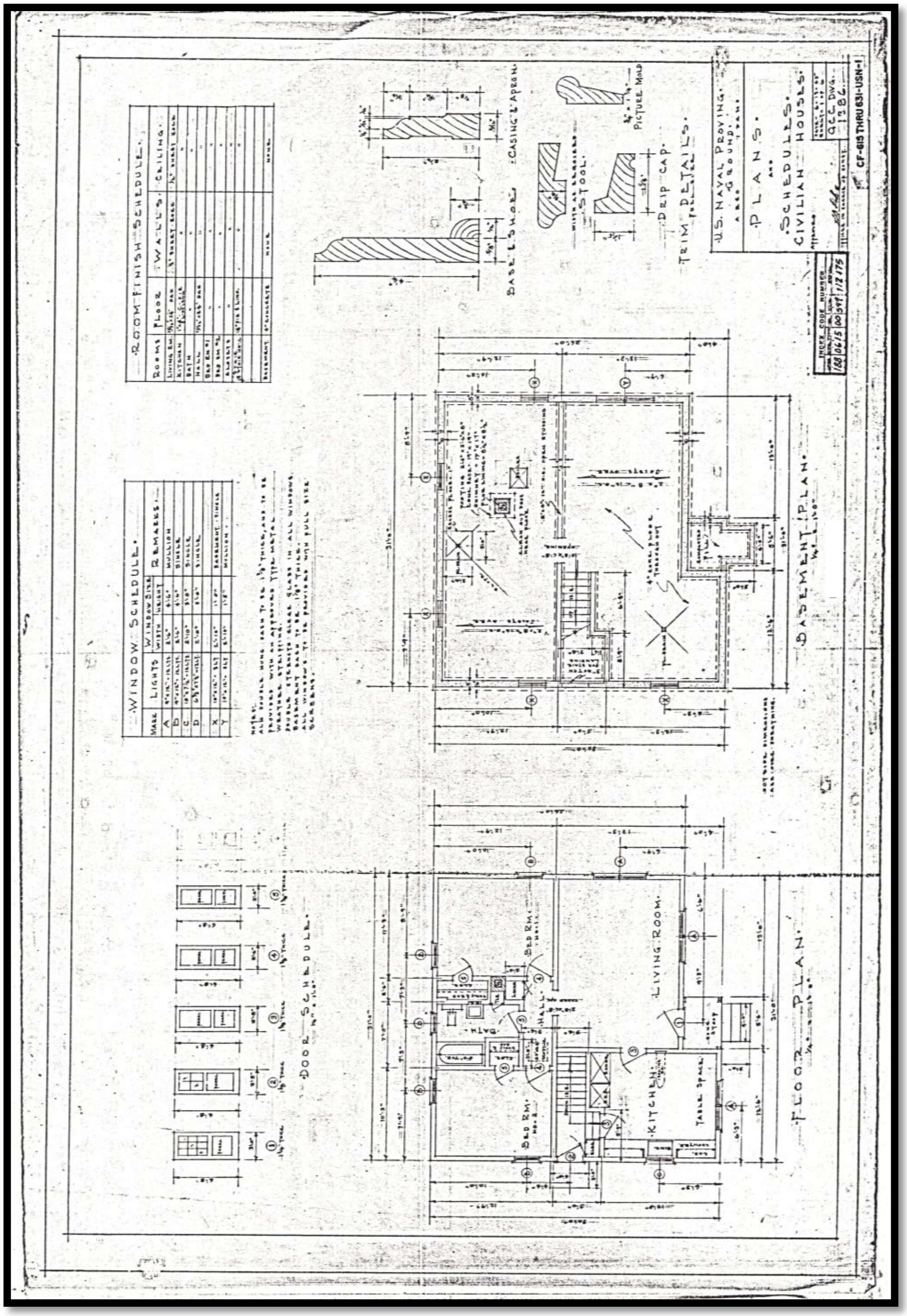


Figure 5.156: INL drawing number 112175 (CF-615-631-USN-1); civilian houses (non-extant), plans and schedules; ca. 1943.

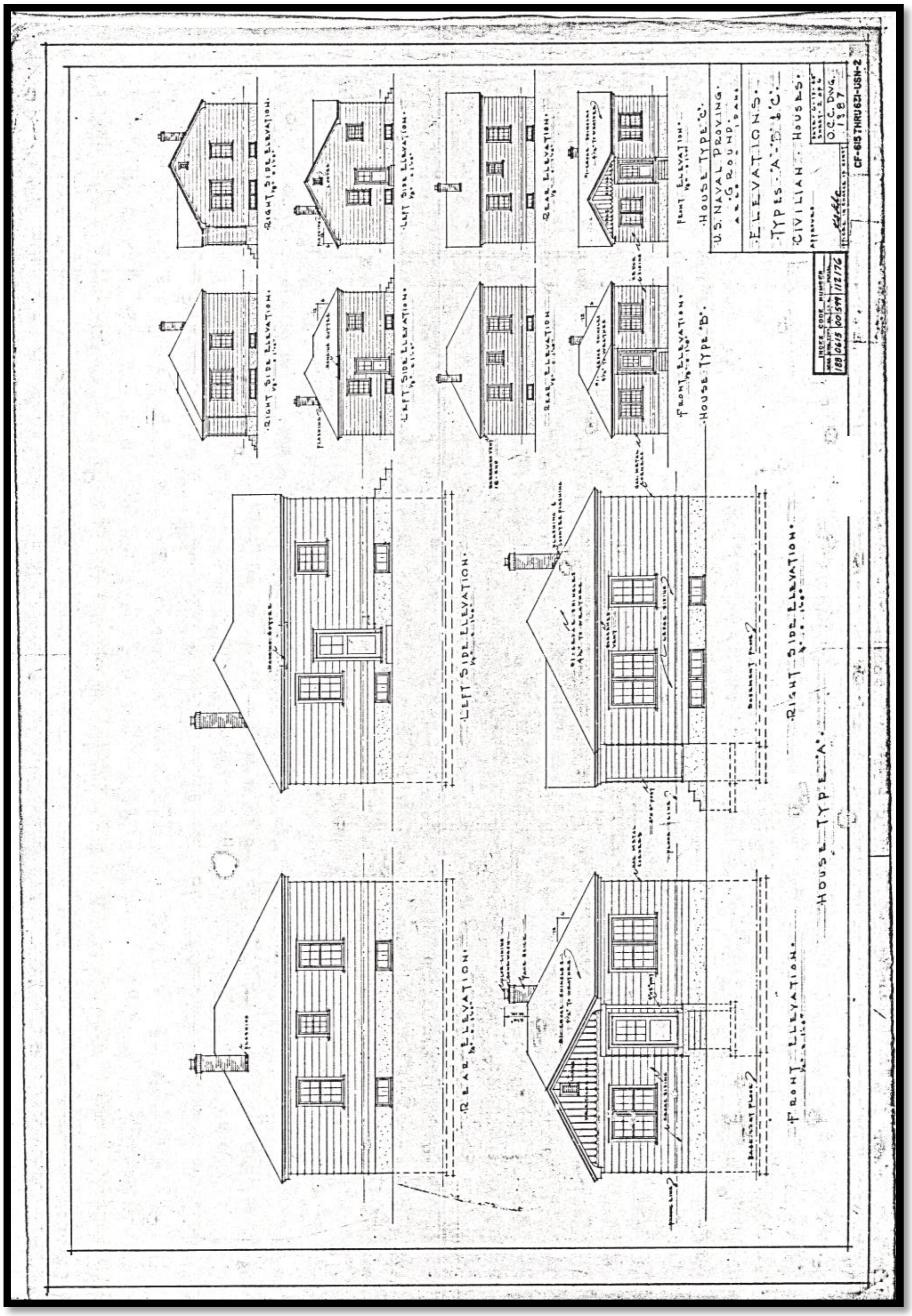


Figure 5.157: INL drawing number 112176 (CF-615-631-USN-2); civilian houses (non-extant), elevations, types "A", "B", and "C"; ca. 1943.

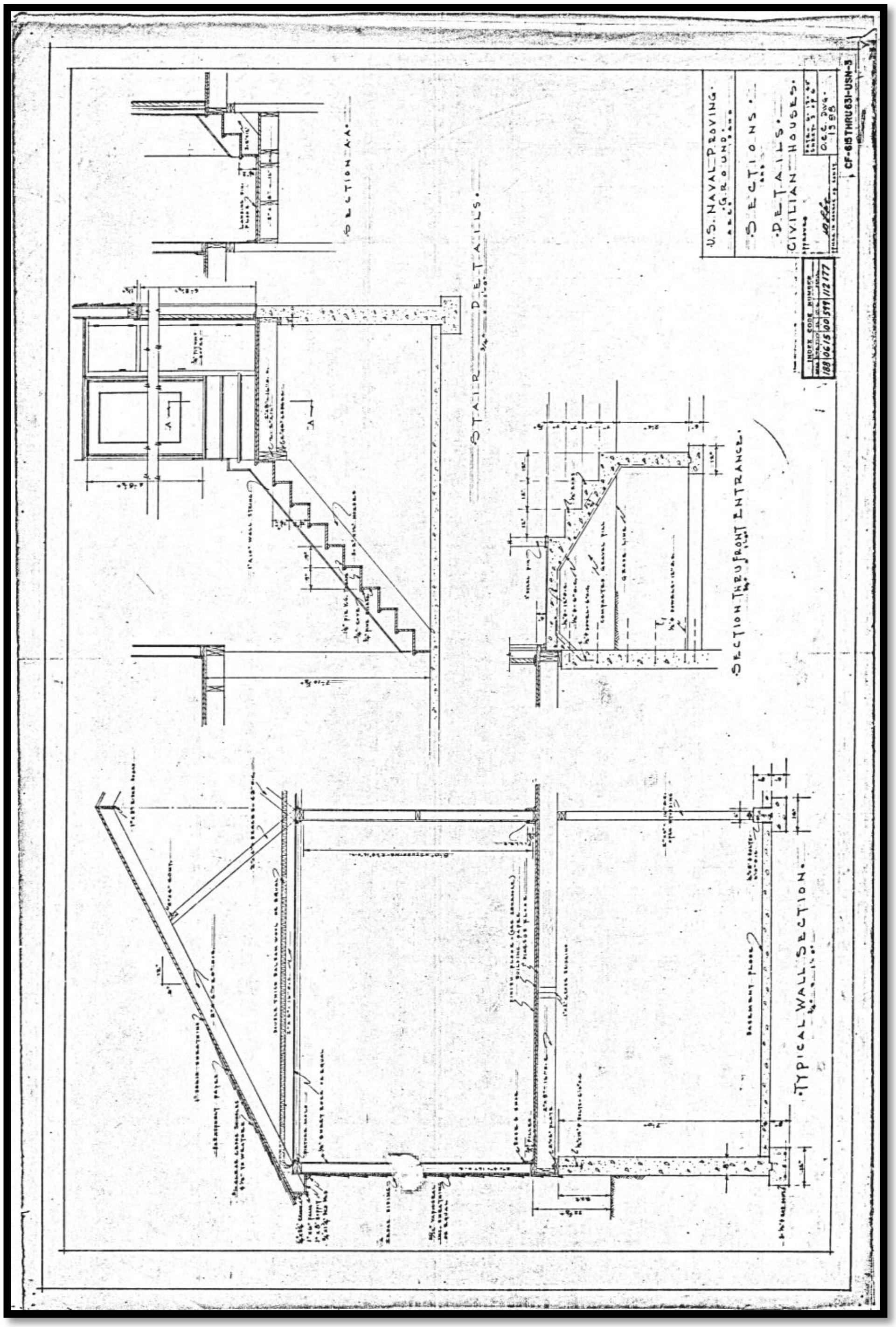


Figure 5.158: INL drawing number 112177 (CF-615-631-USN-3); civilian houses (non-extant), sections and details; ca. 1943.

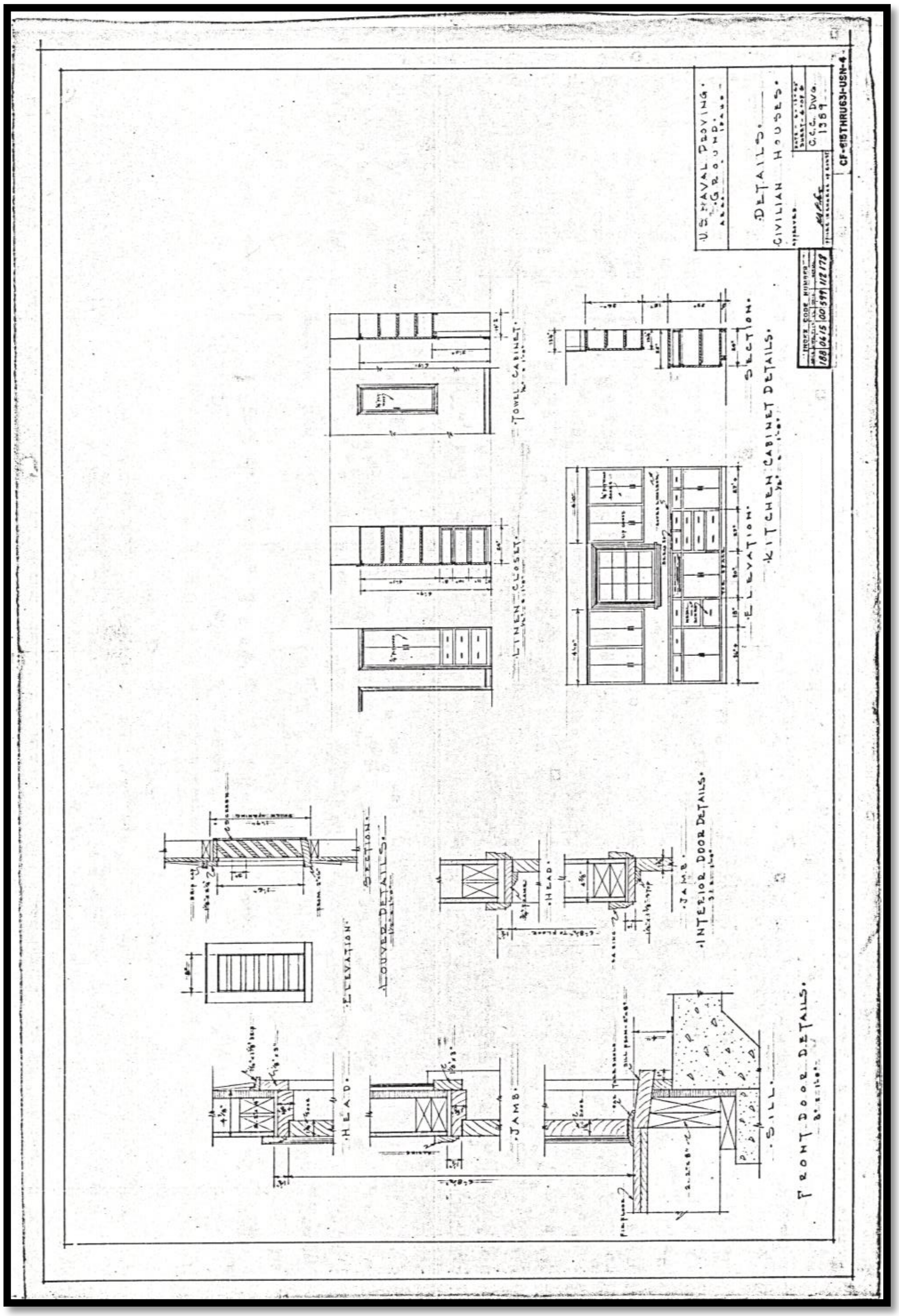


Figure 5.159: INL drawing number 112178 (CF-615-631-USN-4); civilian houses (non-extant), details; ca. 1943.

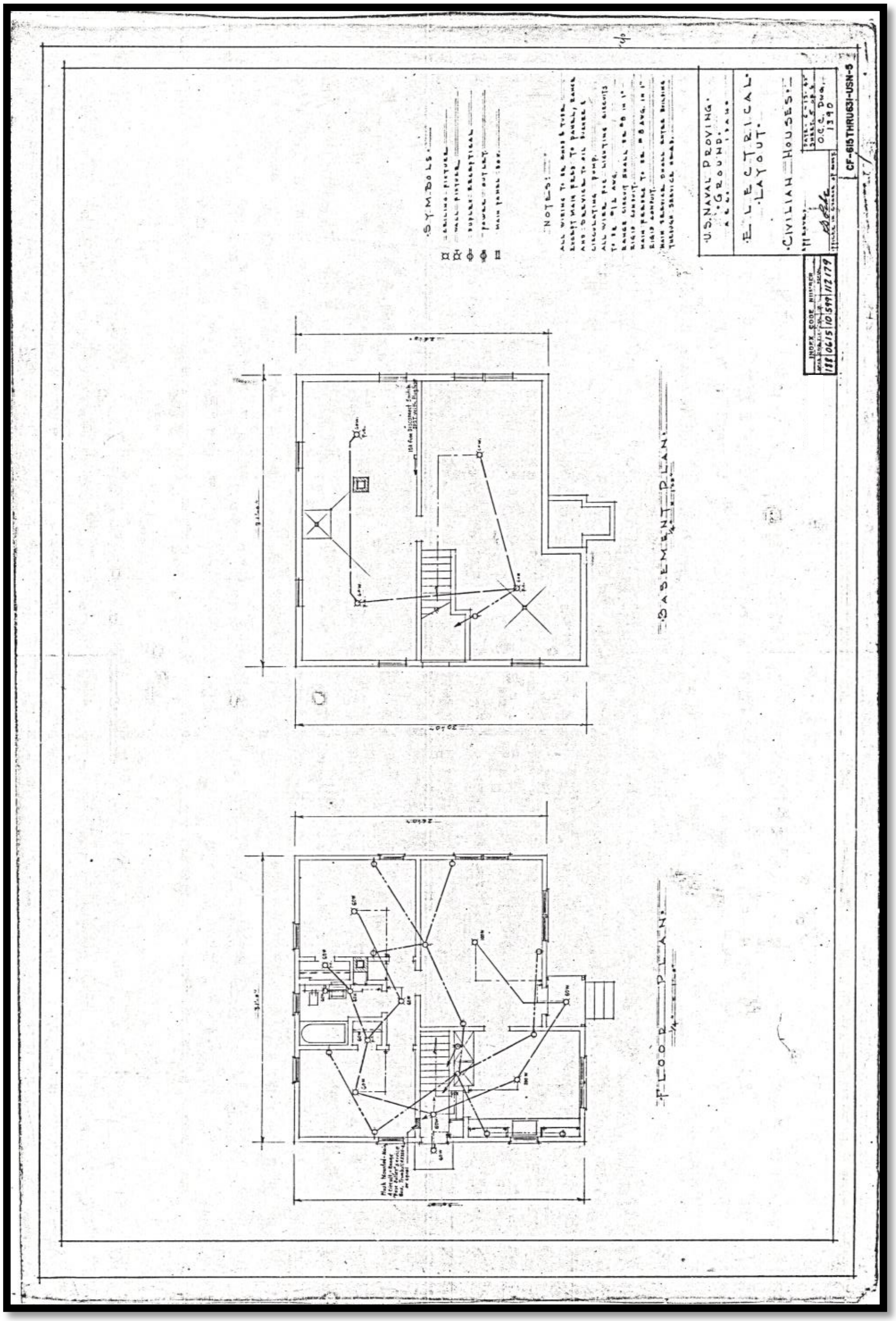


Figure 5.160: INL drawing number 112179 (CF-615-631-USN-5); civilian houses (non-extant), electrical layout; ca. 1943.

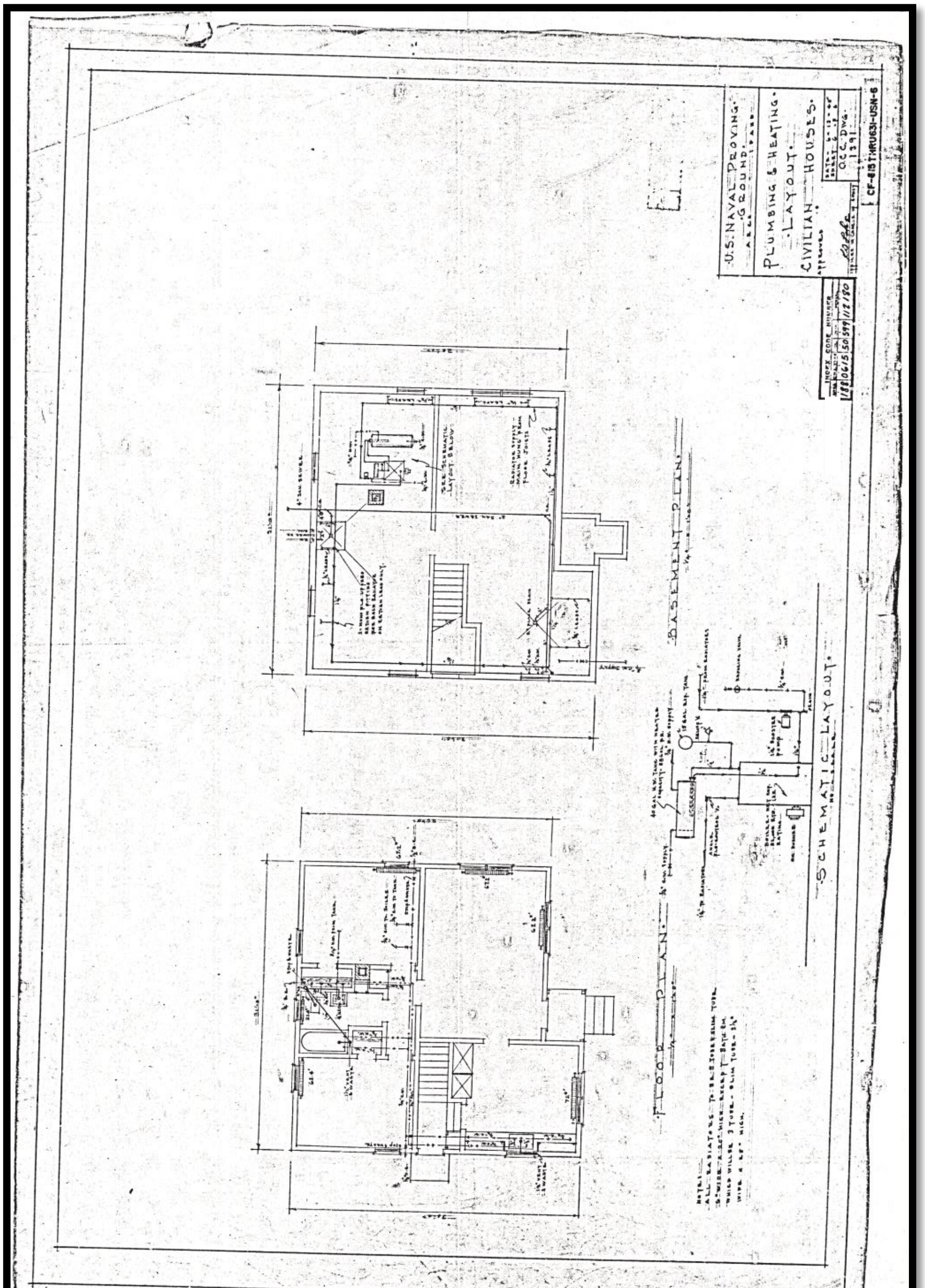


Figure 5.161: INL drawing number 112180 (CF-615-631-USN-6); civilian houses (non-extant), plumbing and heating layout; ca. 1943.

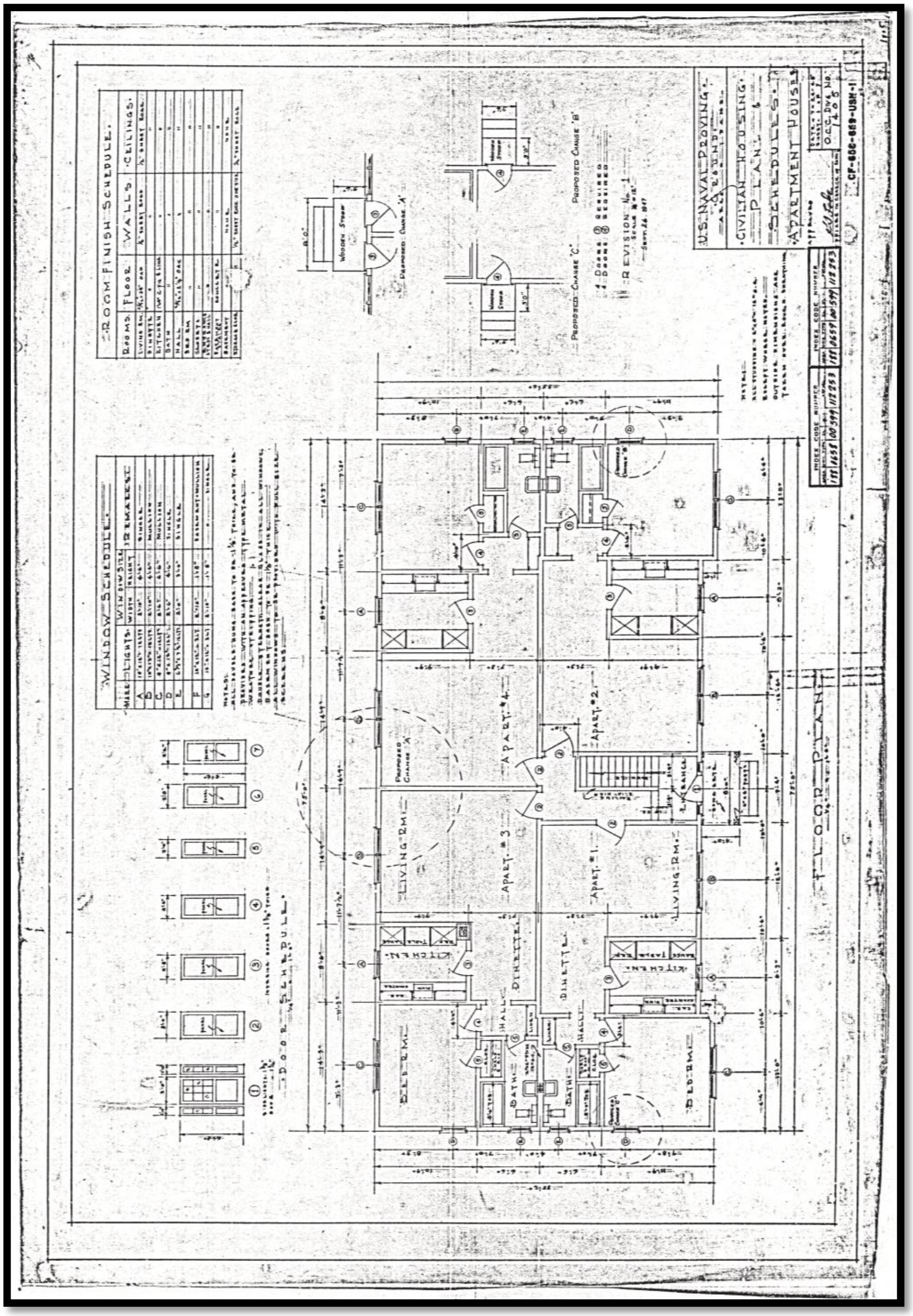


Figure 5.162: INL drawing number 112253 (CF-658-659-USN-1); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), plan and schedules; sheet 1 of 7; July 1945.

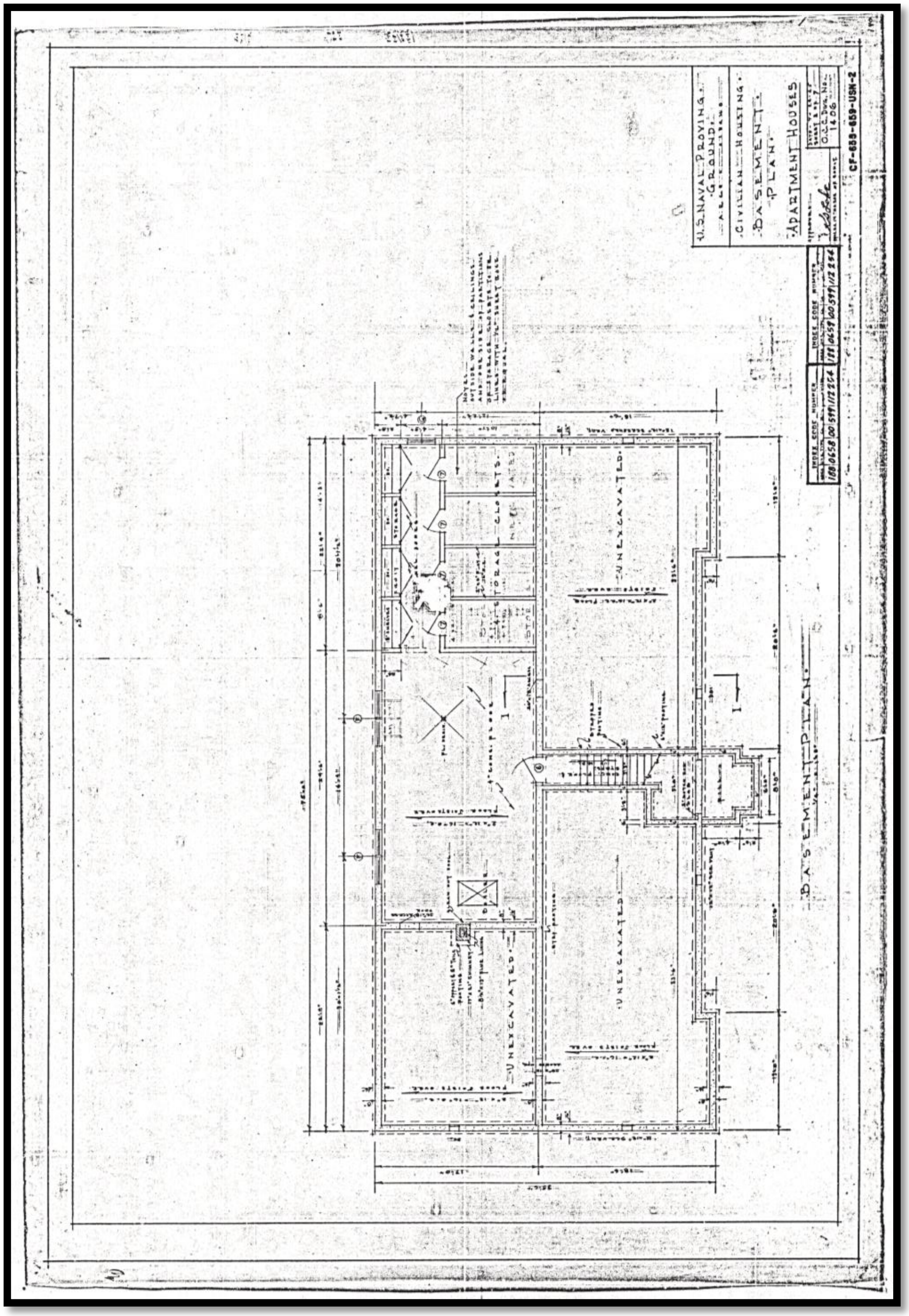


Figure 5.163: INL drawing number 112254 (CF-658-659-USN-2); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), basement plan, sheet 2 of 7; July 1945.

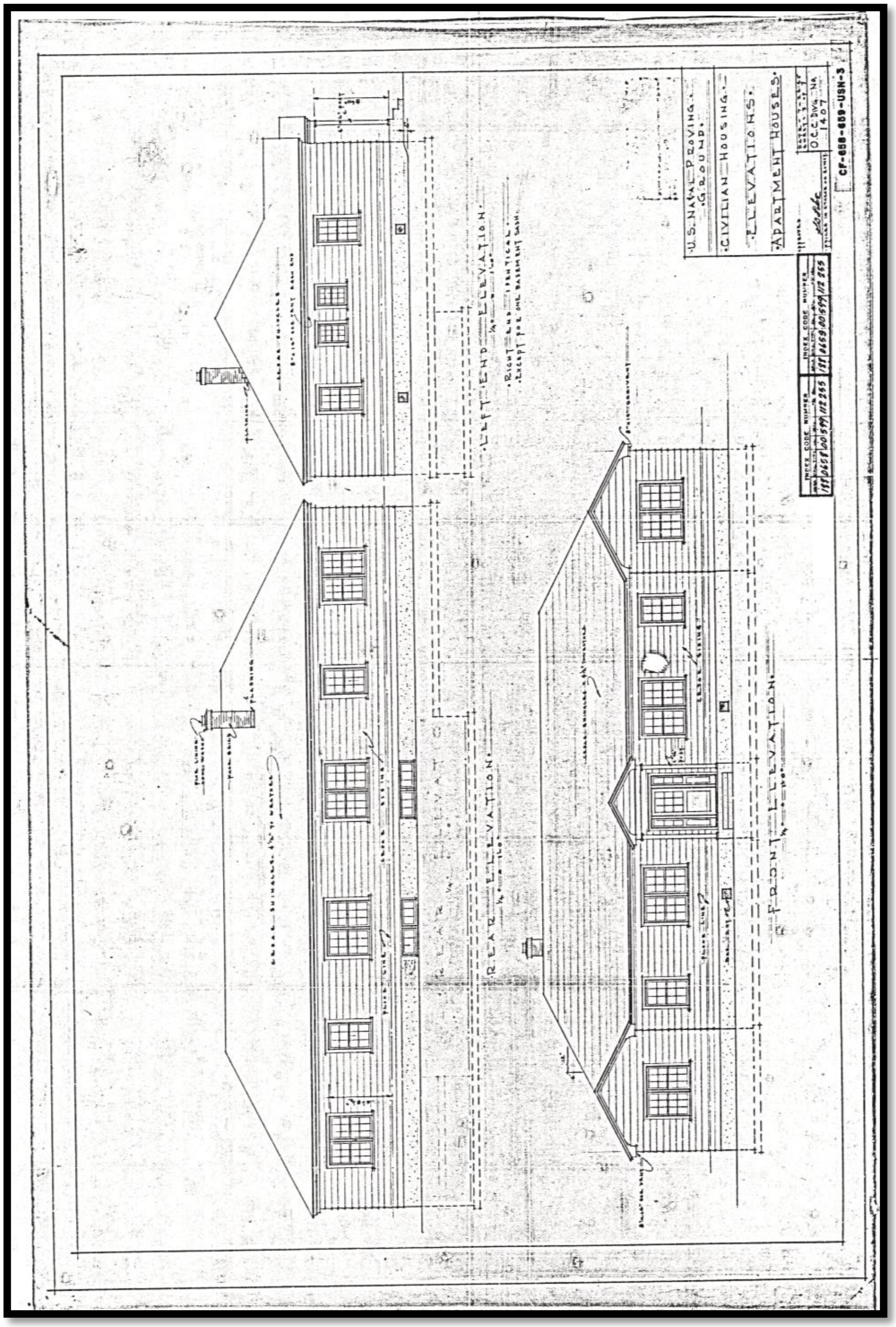


Figure 5.164: INL drawing number 112255 (CF-658-659-USN-3); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), elevations; sheet 3 of 7; July 1945.

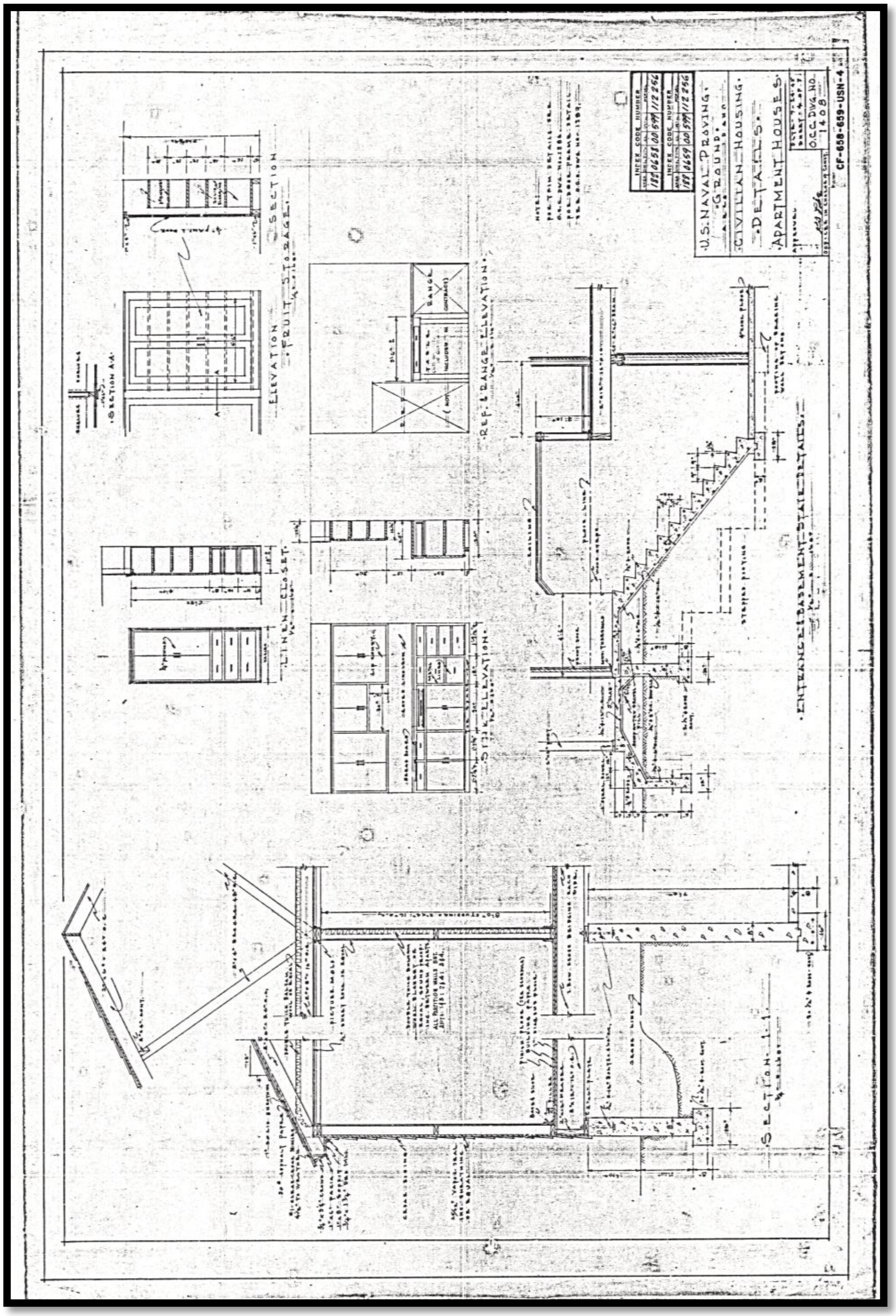


Figure 5.165: INL drawing number 112256 (CF-658-659-USN-4); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), details; sheet 4 of 7; July 1945.

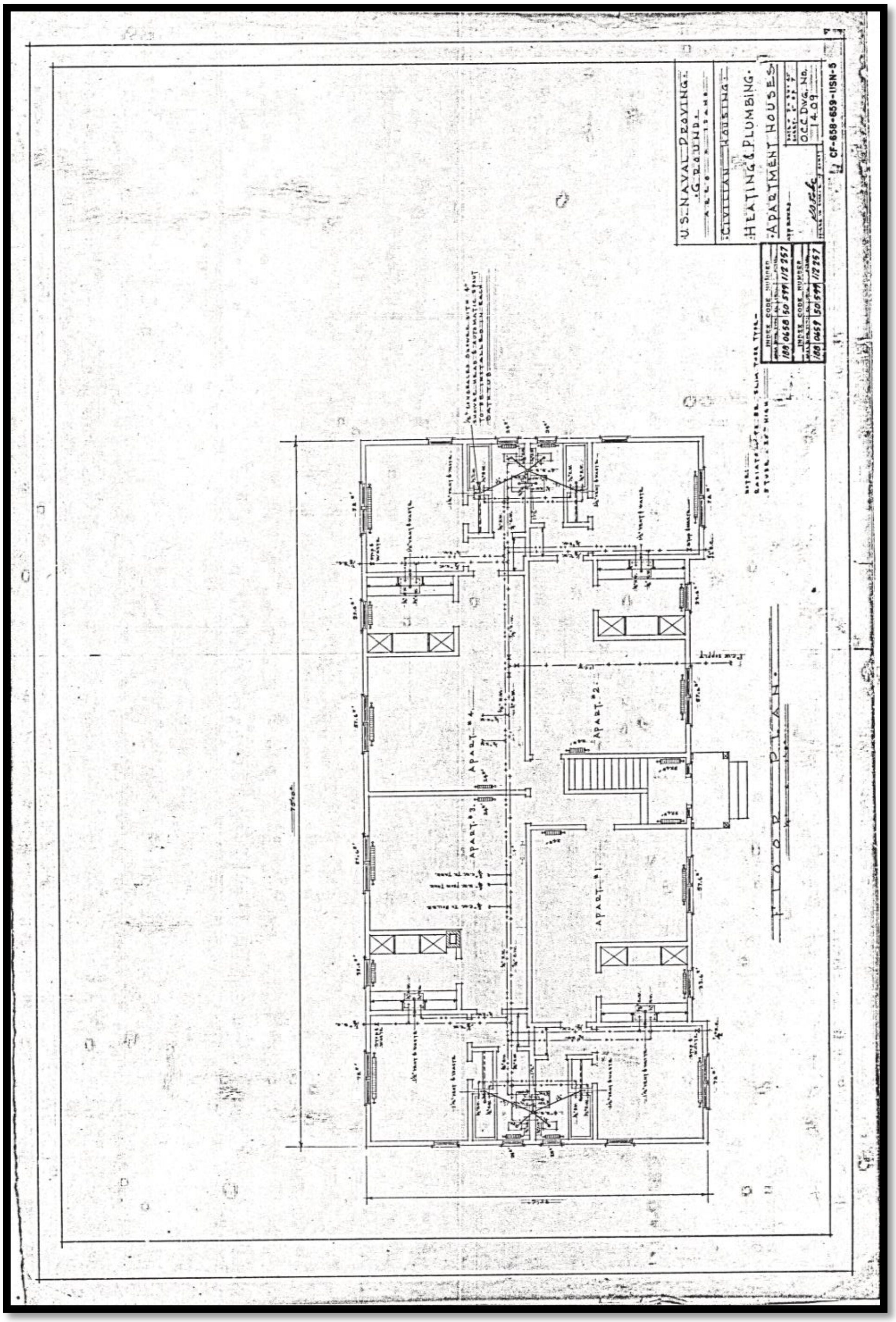


Figure 5.166: INL drawing number 112257 (CF-658-659-USN-5); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), heating and plumbing; sheet 5 of 7; July 1945.

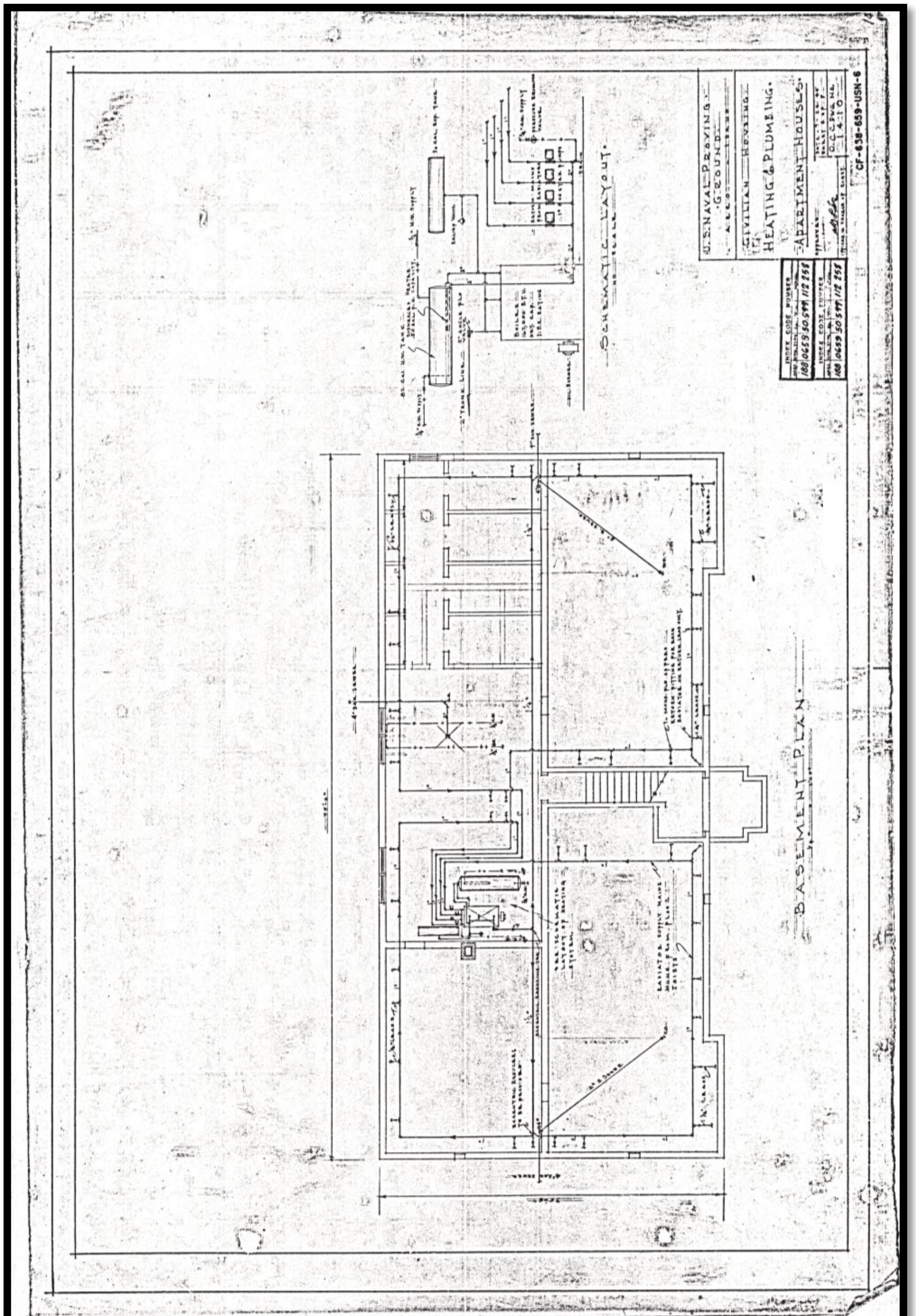


Figure 5.167: INL drawing number 112258 (CF-658-659-USN-6); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), heating and plumbing; sheet 6 of 7; July 1945.

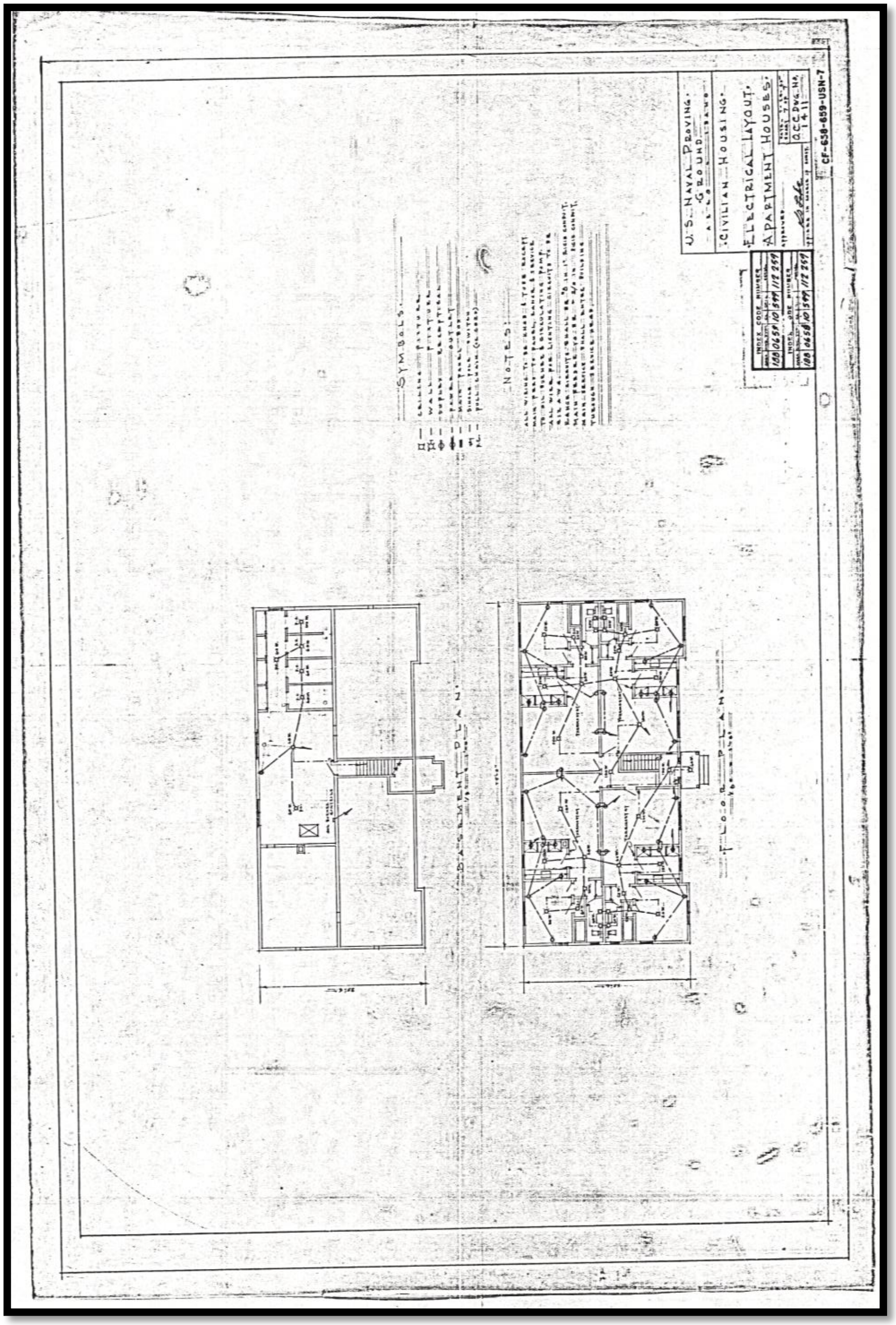


Figure 5.168: INL drawing number 112259 (CF-658-659-USN-7); civilian housing, apartment buildings (CFA-658 and CFA-659, non-extant), electrical layout; sheet 7 of 7; July 1945.

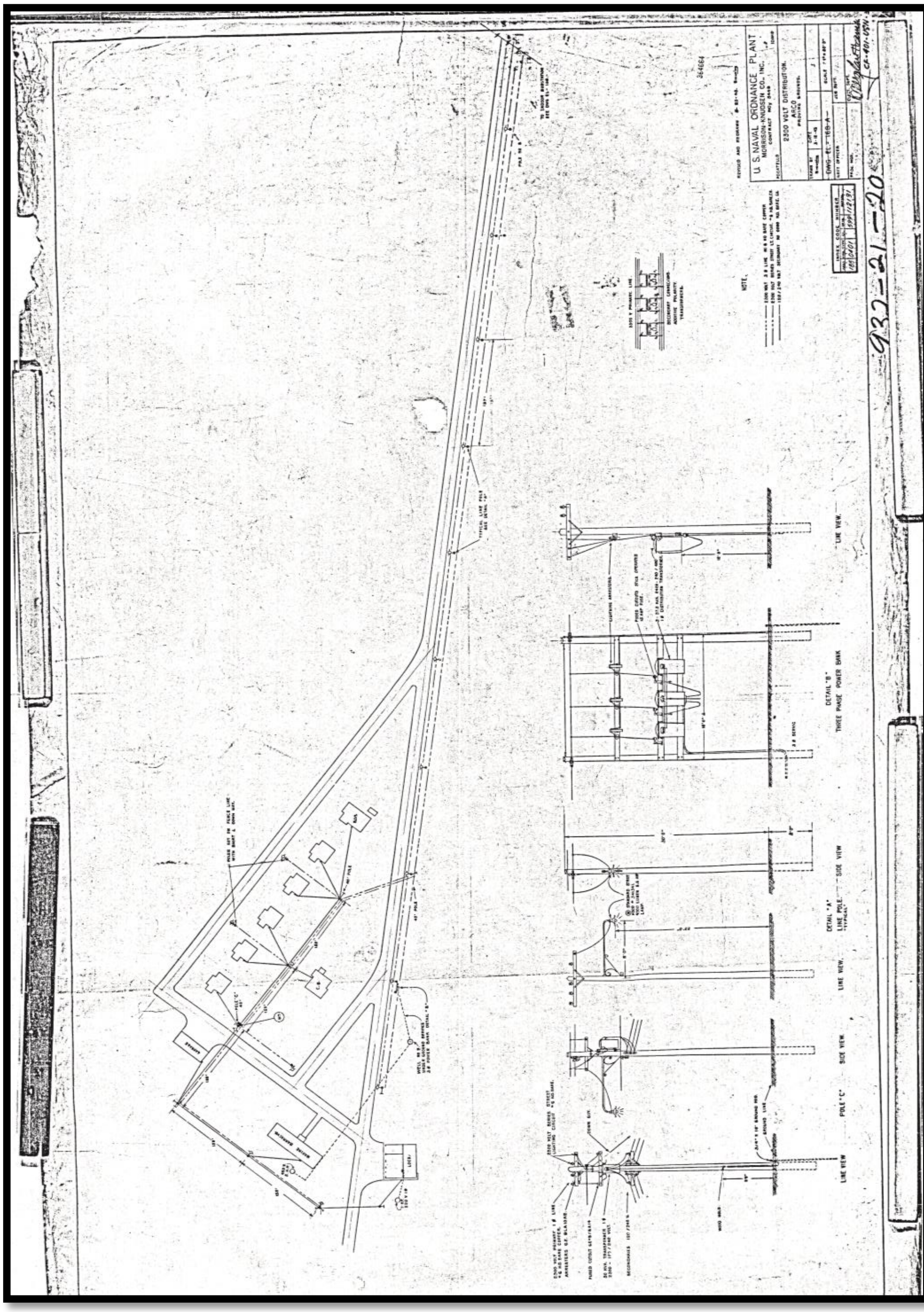


Figure 5.169: INL drawing number 112131 (CF-401-USN-3); residential area (CFA), 2300 volt distribution; March 1943.

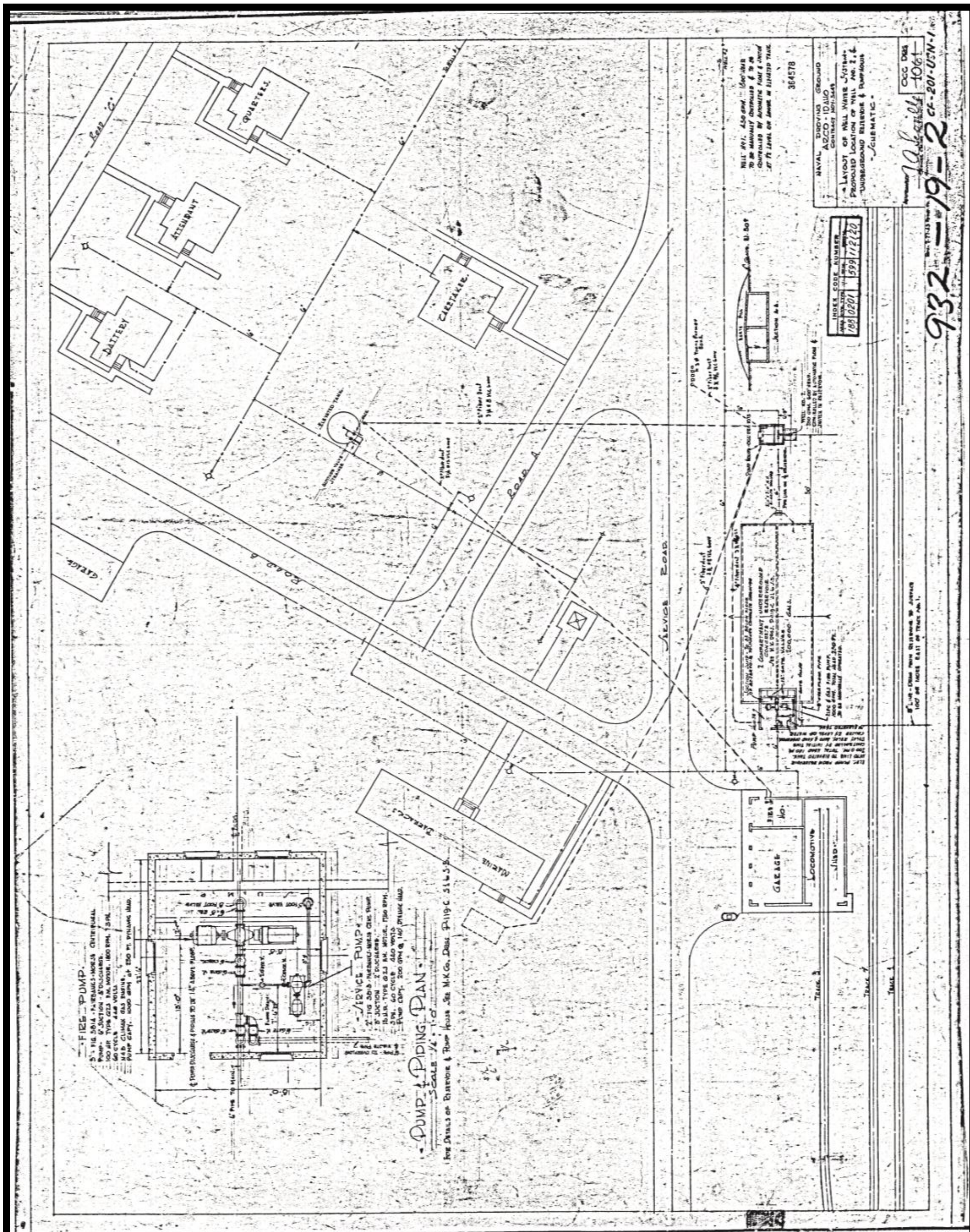


Figure 5.170: INL drawing number 112120 (CF-201-USN-1); residential area (CFA), layout of well water system, proposed location of well no. 2, underground reservoir, and pump house, schematic; ca. 1943.

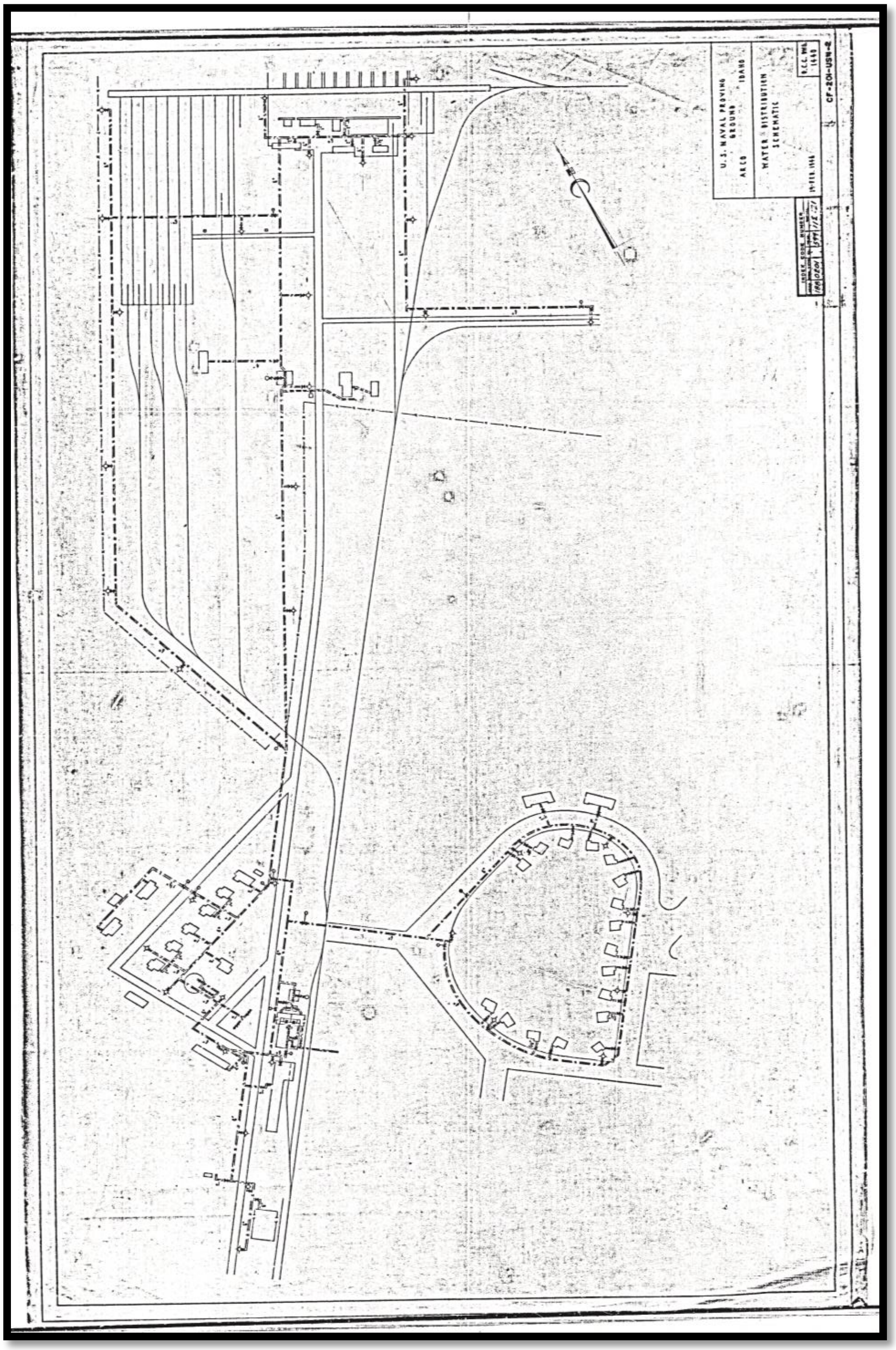


Figure 5.171: INL drawing number 112121 (CF-201-USN-2); emplacement and residential areas (CFA), water distribution schematic; February 1946.

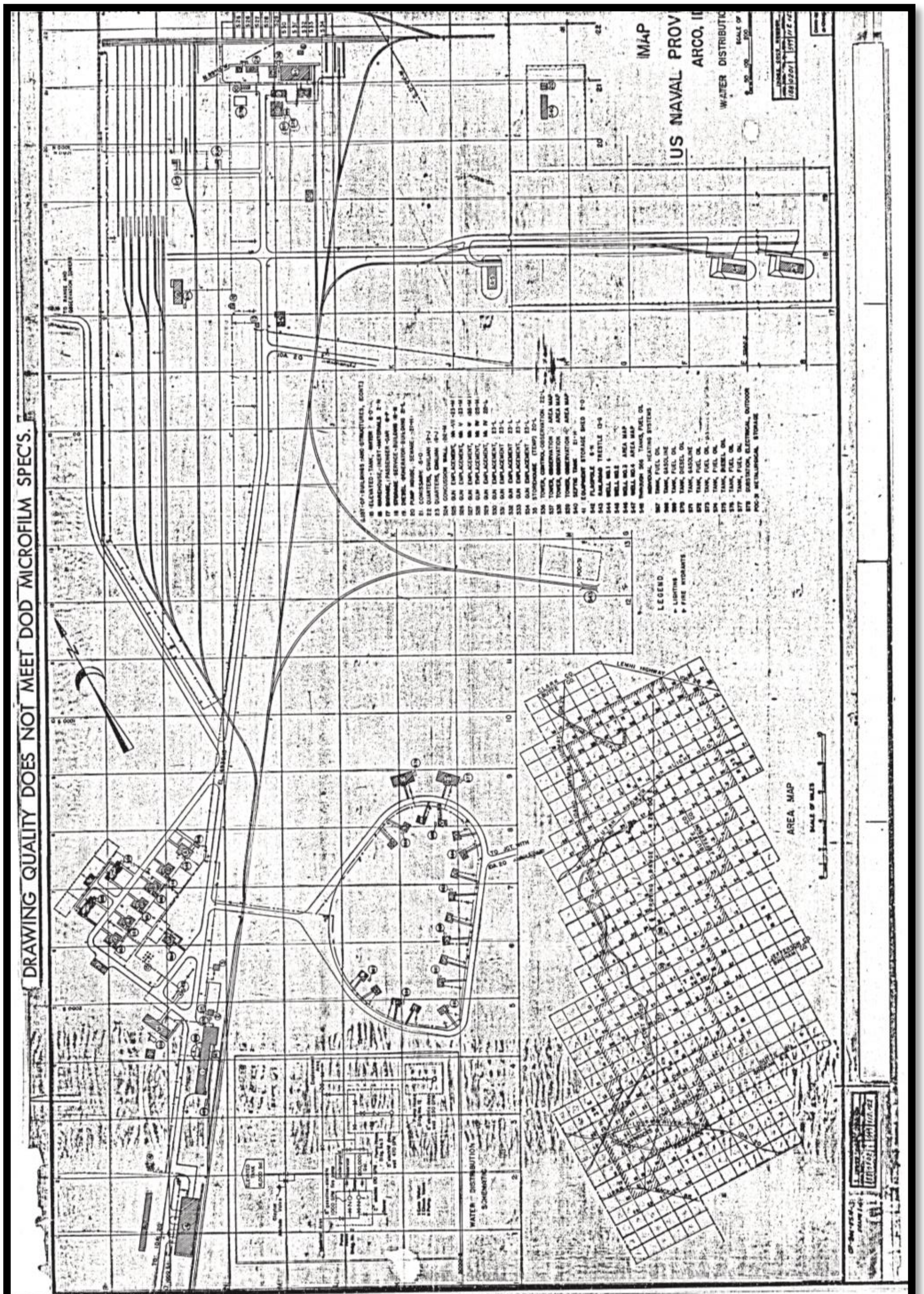


Figure 5.172: INL drawing number 112122 (CF-201-USN-3); emplacement and residential areas (CFA), water distribution system; frame 1 of 2; ca. 1943.

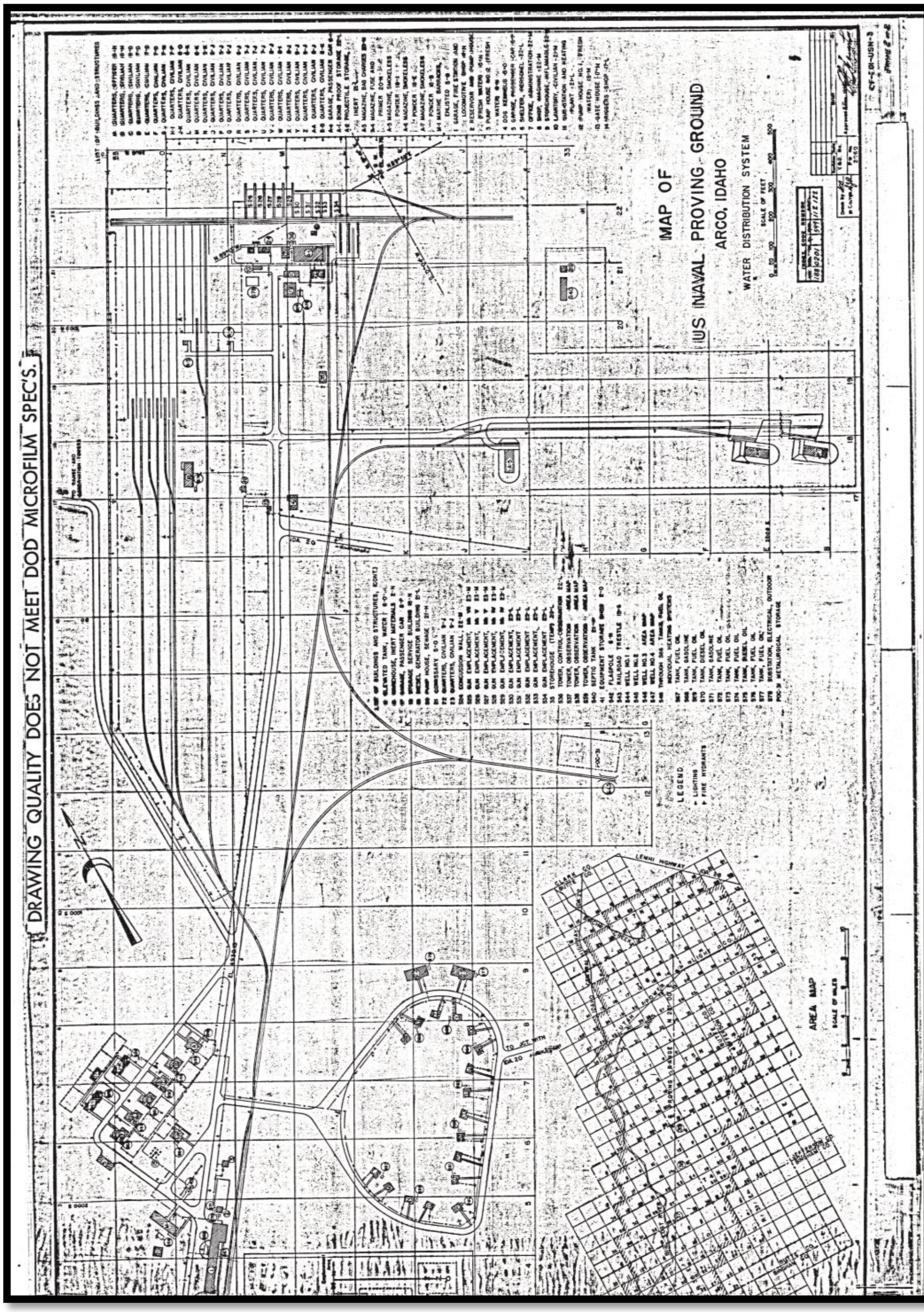


Figure 5.173: INL drawing number 11212202 (CF-201-USN-3); emplacement and residential areas (CFA), water distribution system; frame 2 of 2; ca. 1943.

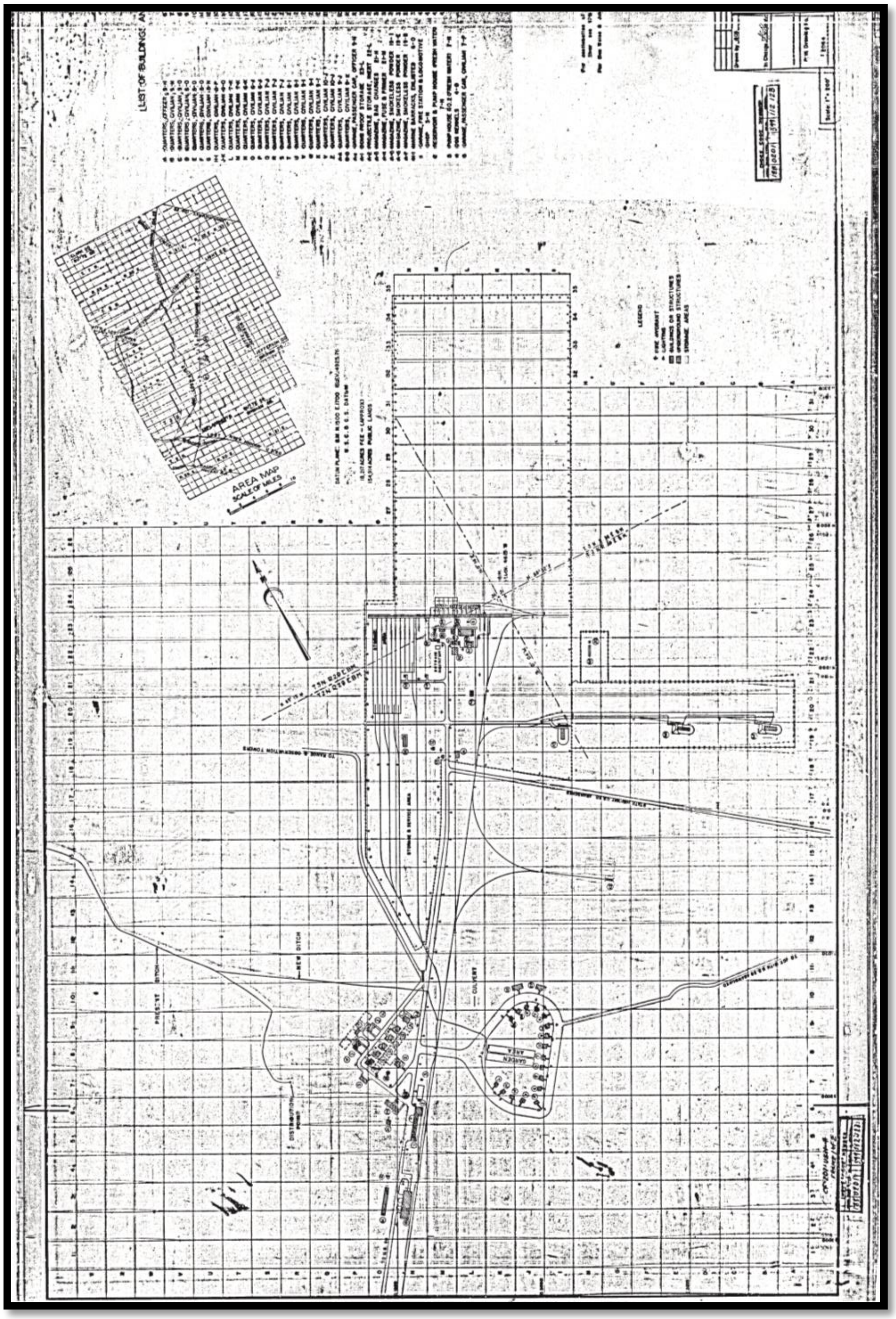


Figure 5.174: INL drawing number 112123 (CF-201-USN-4); emplacement and residential areas (CFA), irrigation system; frame 1 of 2; March 1943.

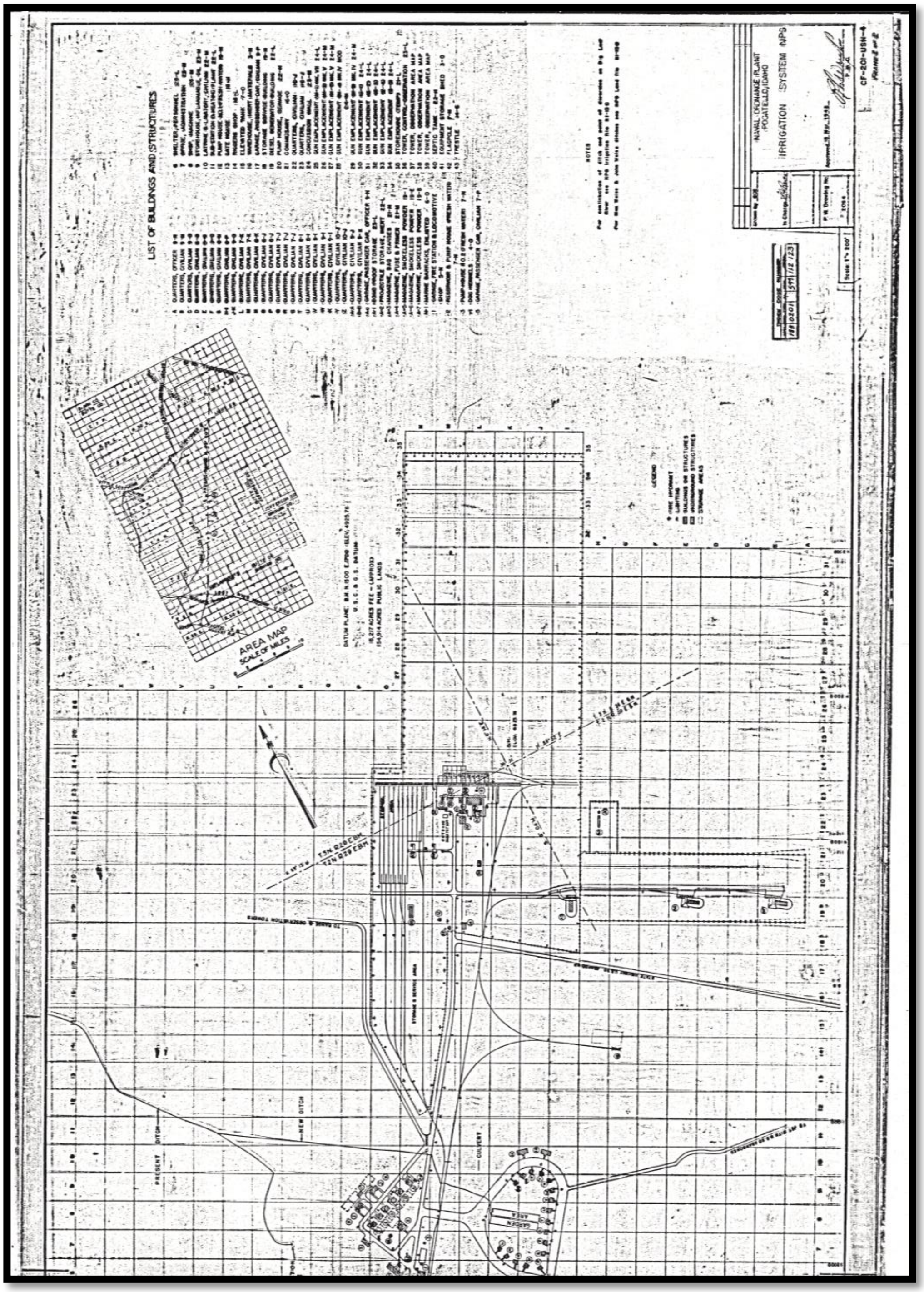


Figure 5.175: INL drawing number 11212302 (CF-201-USN-4); emplacement and residential areas (CFA), irrigation system; frame 2 of 2; March 1943.

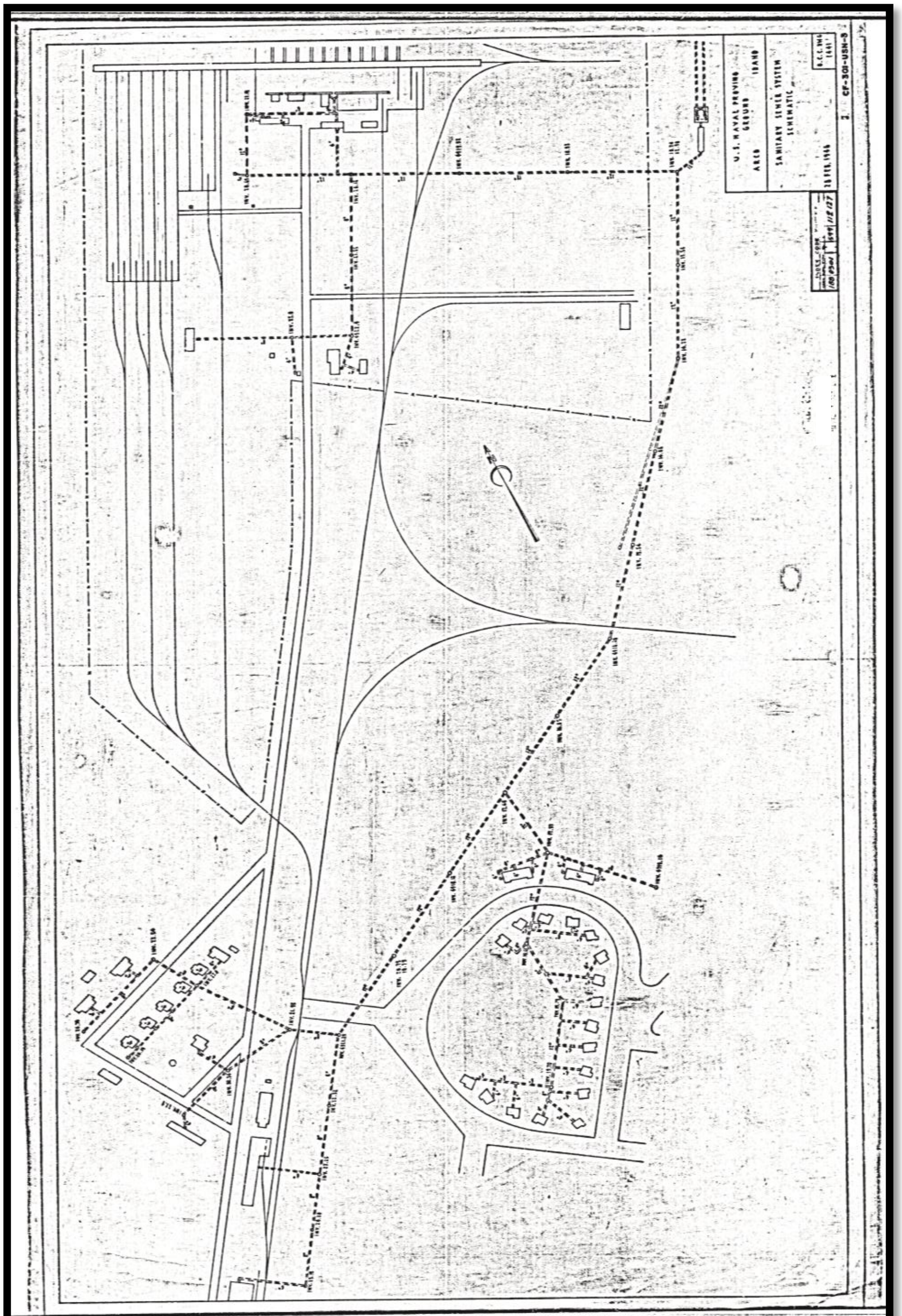


Figure 5.176: INL drawing number 112127 (CF- 301-USN-3); emplacement and residential areas (CFA), sanitary sewer system, schematic; February 1946.

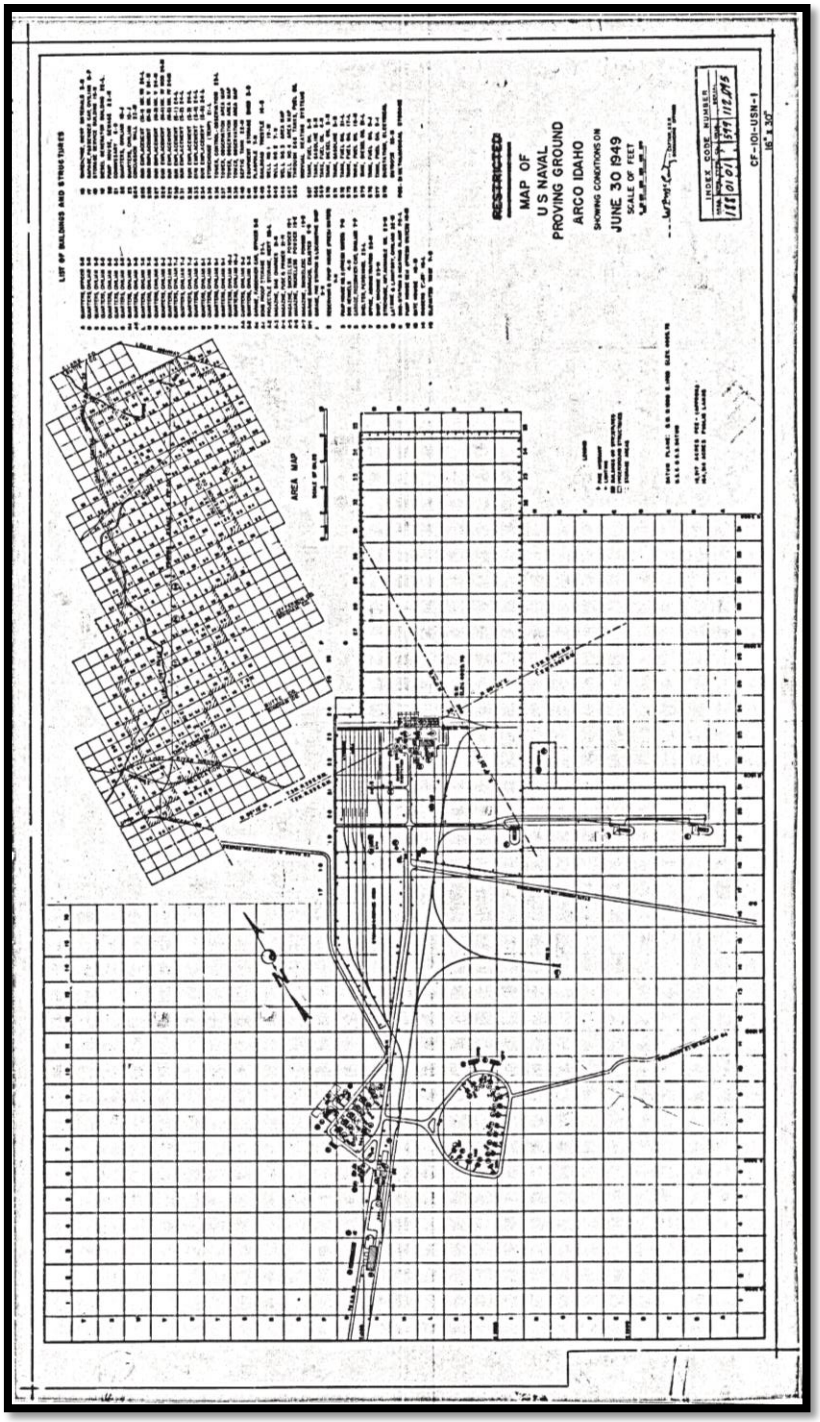


Figure 5.177: INL drawing number 112095 (CF-101-USN-1); map of Arco NPG with individual buildings, features, and structures identified; June 1949.

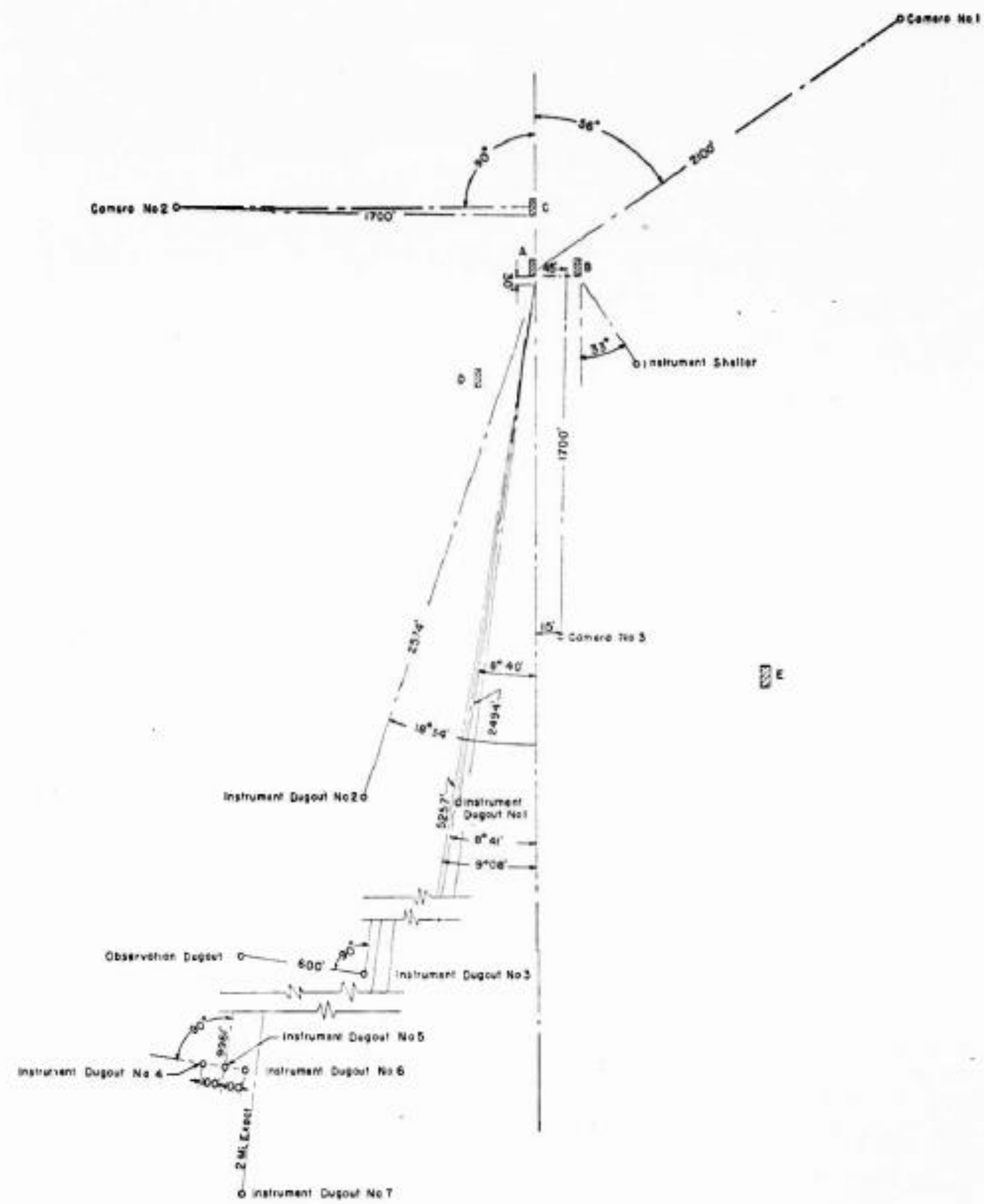


FIGURE 2. Location of primary and secondary elements.

Figure 5.178: "Location of primary and secondary elements" for ANSEB igloo tests, 1945 (Thompson 1948, 4).

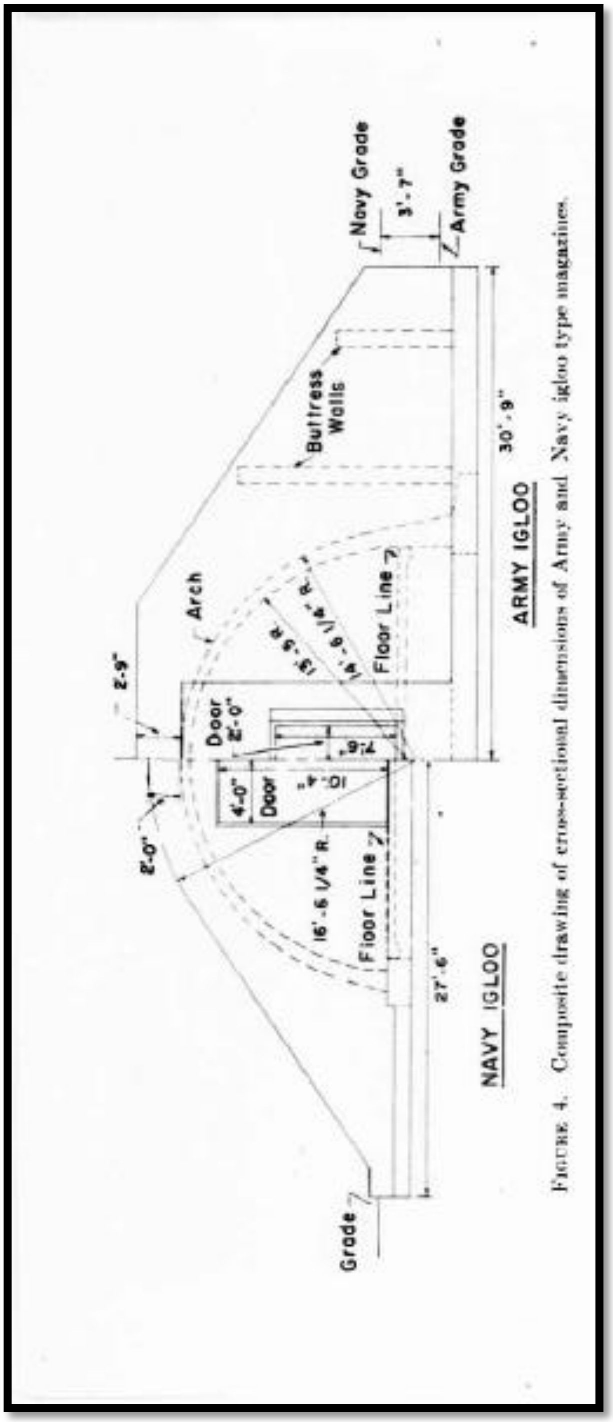


Figure 5.179: "Composite drawing of cross-sectional dimensions of Amy and Navy igloo type magazines" used in 1945 ANSEB igloo tests (Thompson 1948, 6).

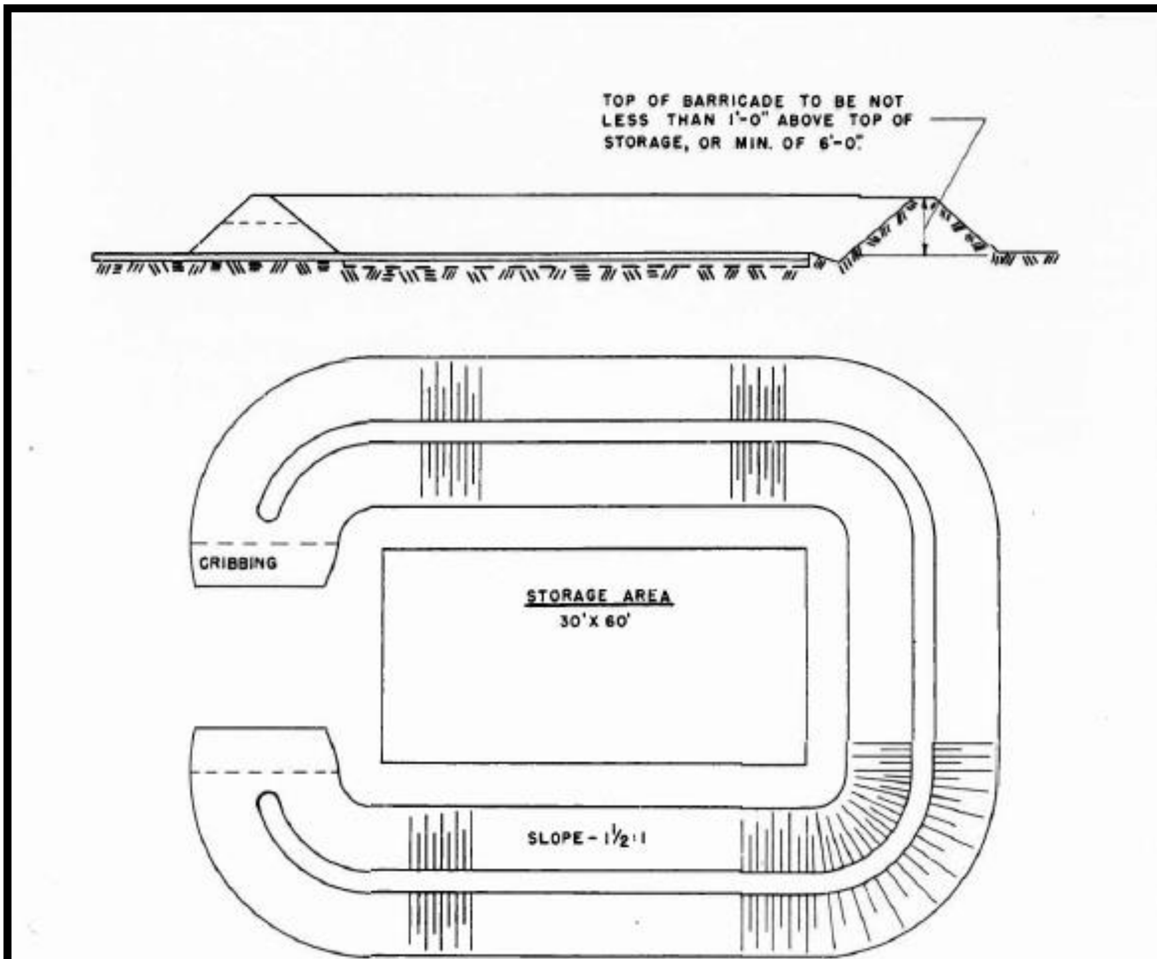


FIGURE 7. Typical revetment plan and profile.

Figure 5.180: "Typical revetment plan and profile" used in 1945 ANESB igloo tests (Thompson 1948, 7).

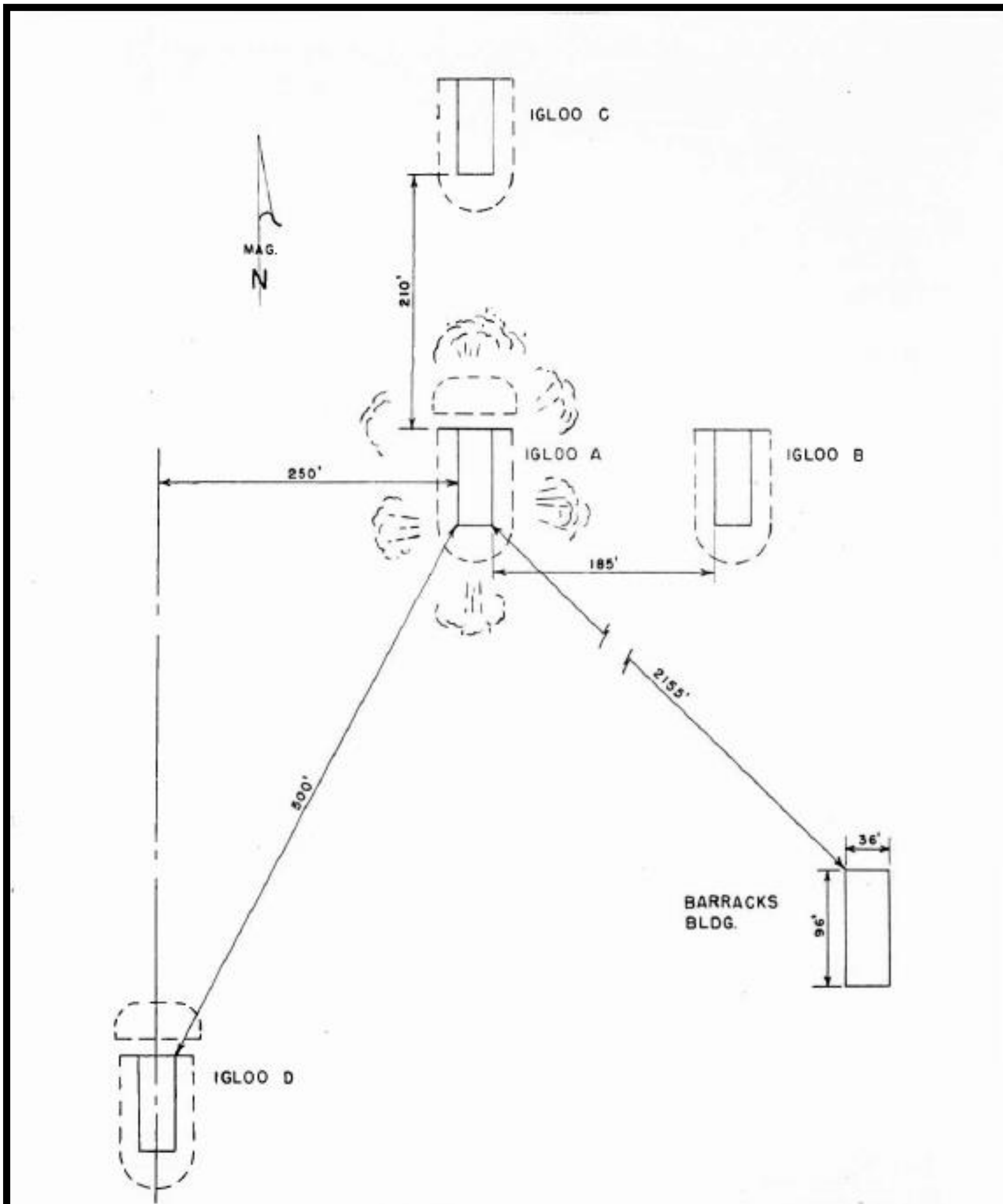


FIGURE 13. Field layout, Test 1.

Figure 5.181: "Field layout, test [no.] 1", ANESB igloo tests, 1945 (Thompson 1948, 13).

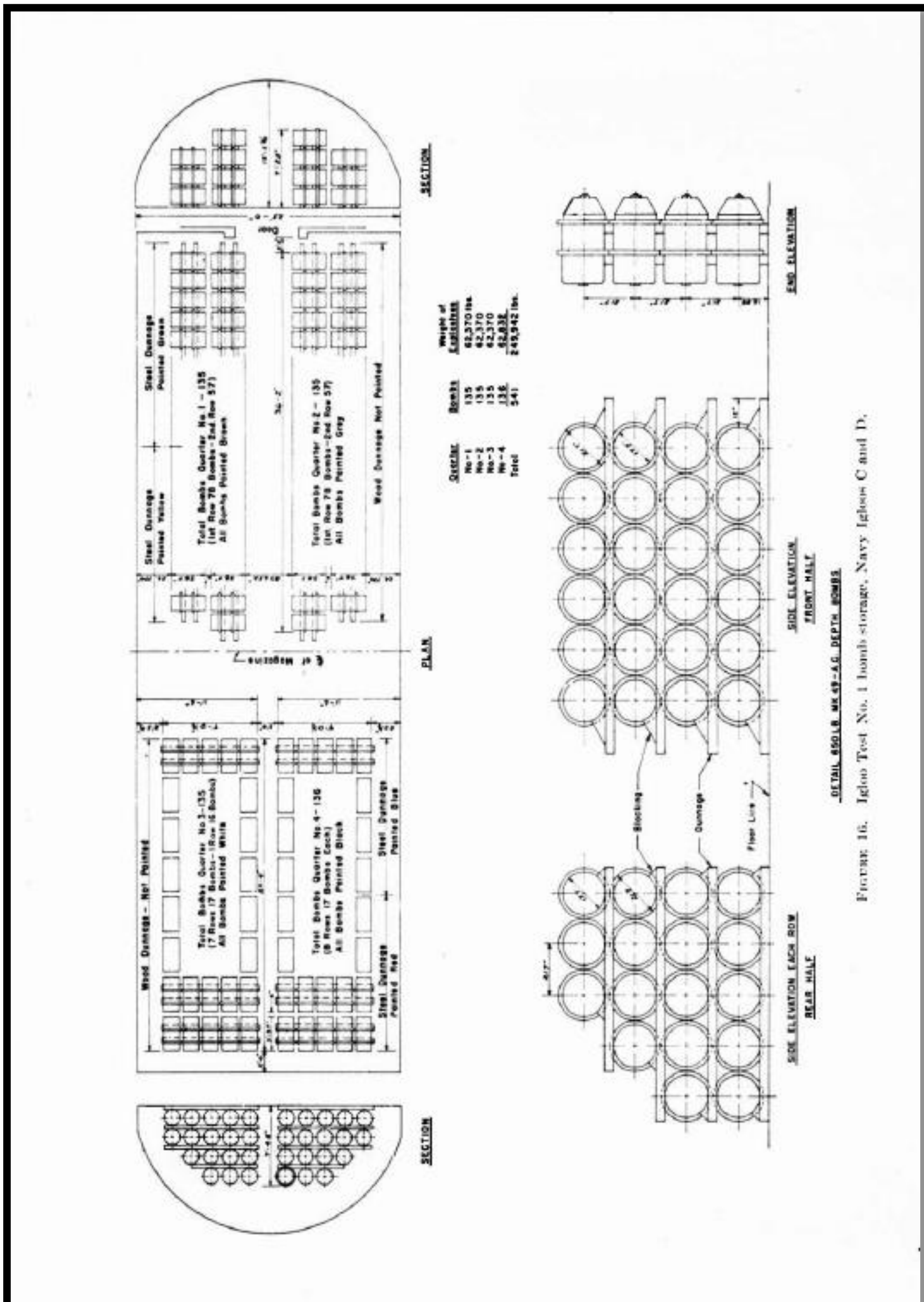


Figure 5.182: "Igloo test no. 1 bomb storage, Navy igloos C and D", ANESB igloo tests, 1945 (Thompson 1948, 15).

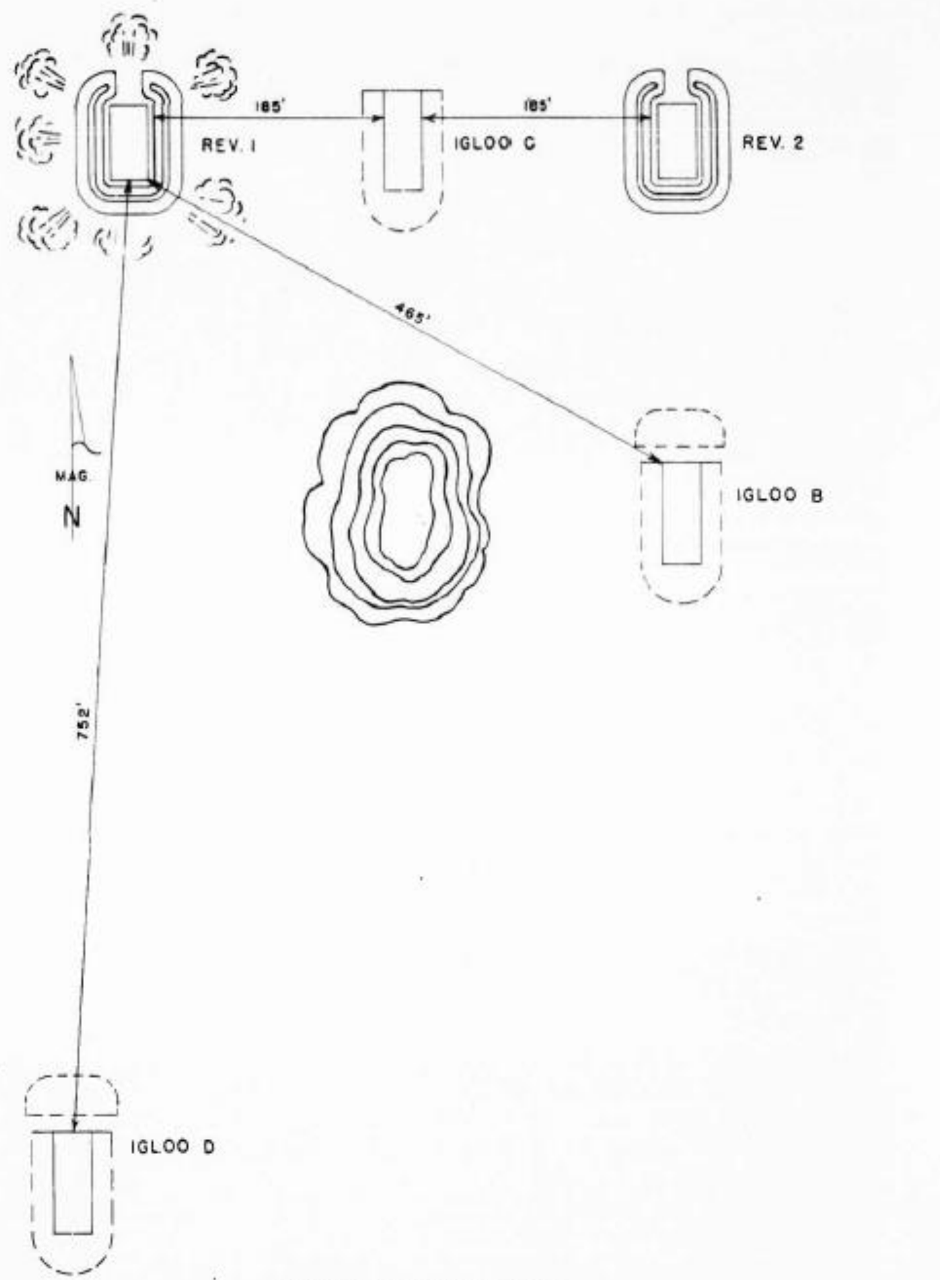


FIGURE 63. Field layout, Test 2

Figure 5.183: "Field layout, test [no.] 2", ANESB igloo tests, 1945 (Thompson 1948, 52).

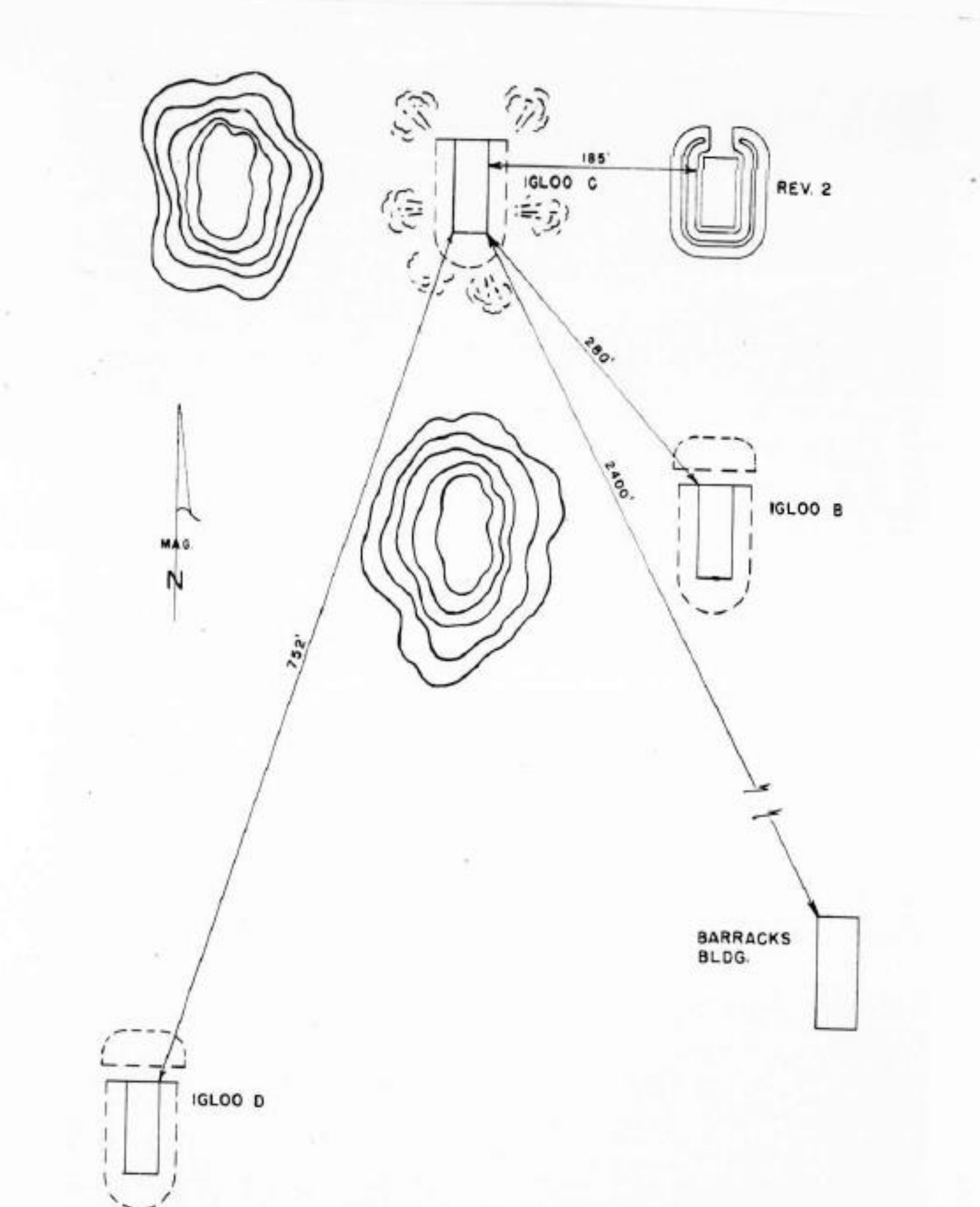


FIGURE 73. Field layout, Test 3.

Figure 5.184: "Field layout, test [no.] 3", ANESB igloo tests, 1945 (Thompson 1948, 61).

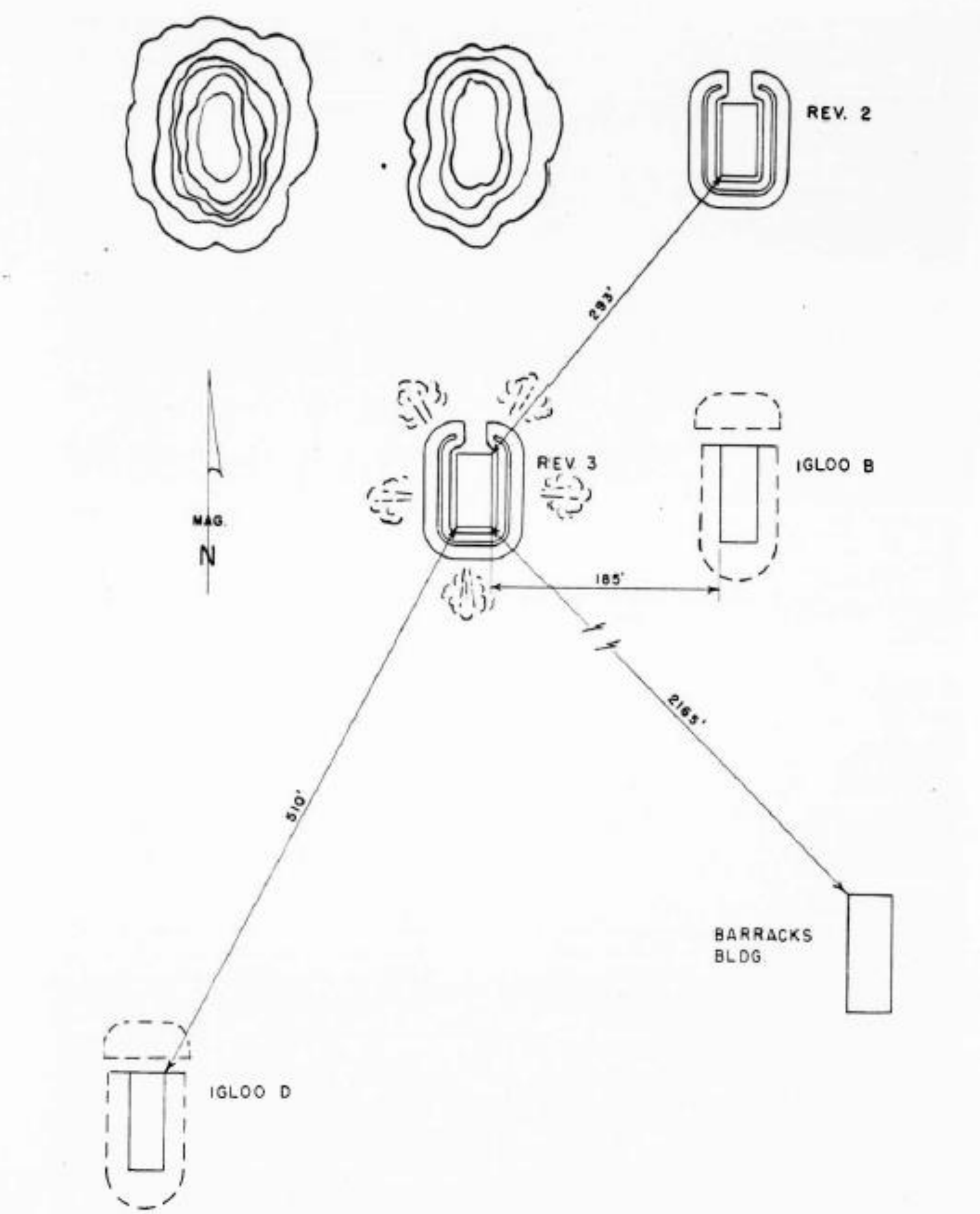


FIGURE 85. Field layout, Test 4.

Figure 5.185: "Field layout, test [no.] 3", ANESB igloo tests, 1945 (Thompson 1948, 69).

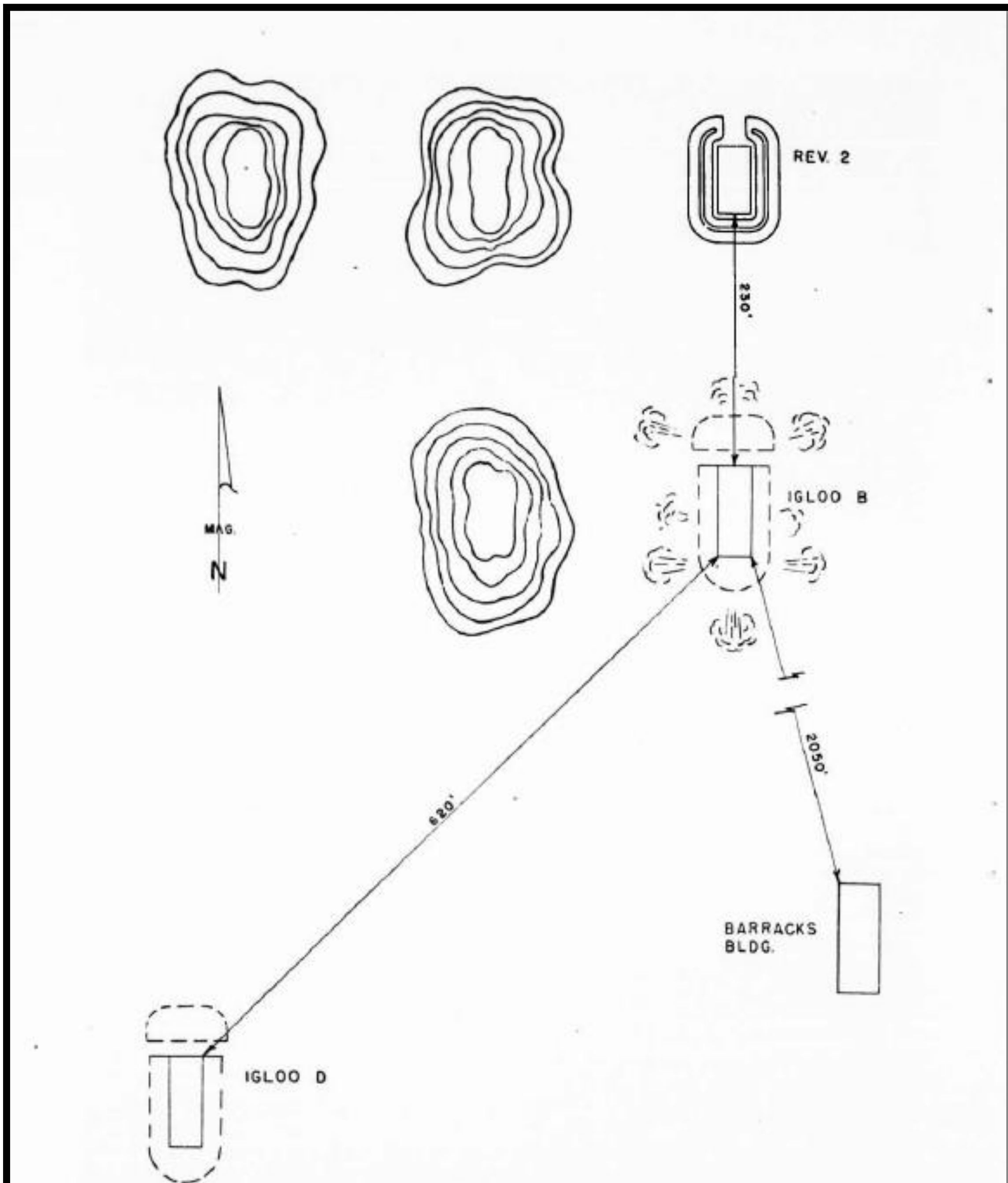


FIGURE 93. Field layout, Test 5.

Figure 5.186: "Field layout, test [no.] 5", ANESB igloo tests, 1945 (Thompson 1948, 76).

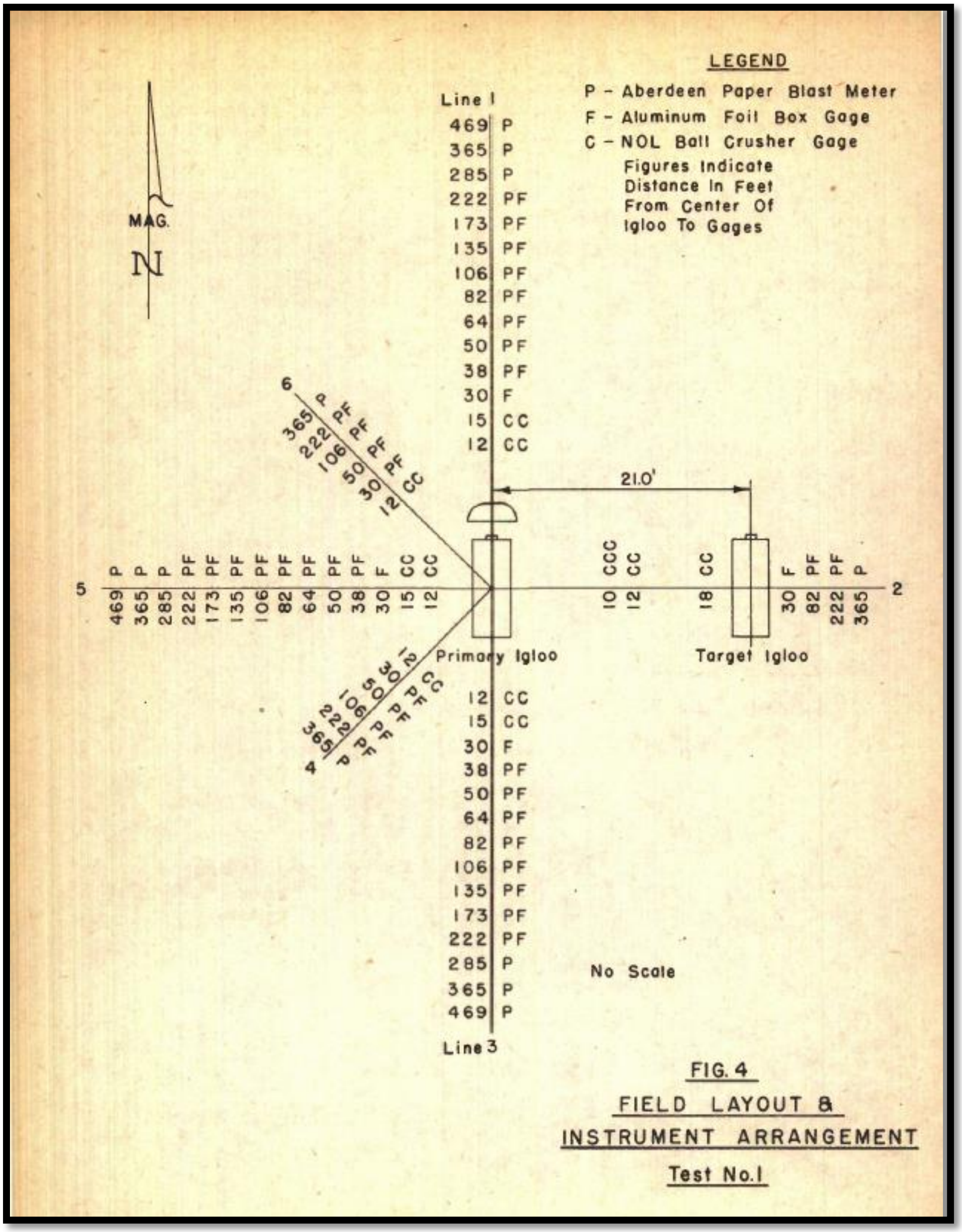


Figure 5.187: "Field layout and instrument arrangement test no. 1", ANESB scale model igloo tests, 1946 (Mann 1947, 6).

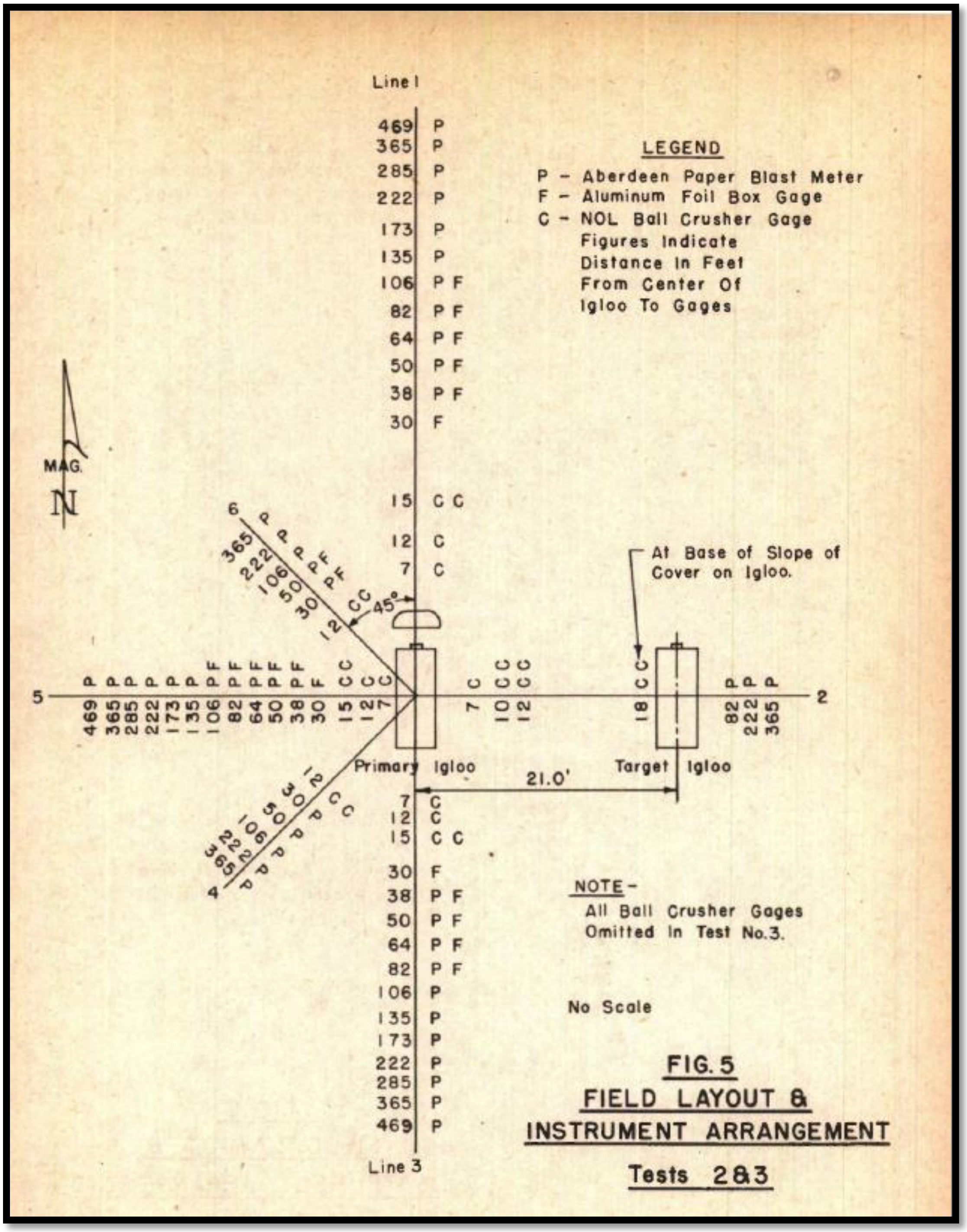


Figure 5.188: "Field layout and instrument arrangement tests 2 and 3", ANESB scale model igloo tests, 1946 (Mann 1947, 7).

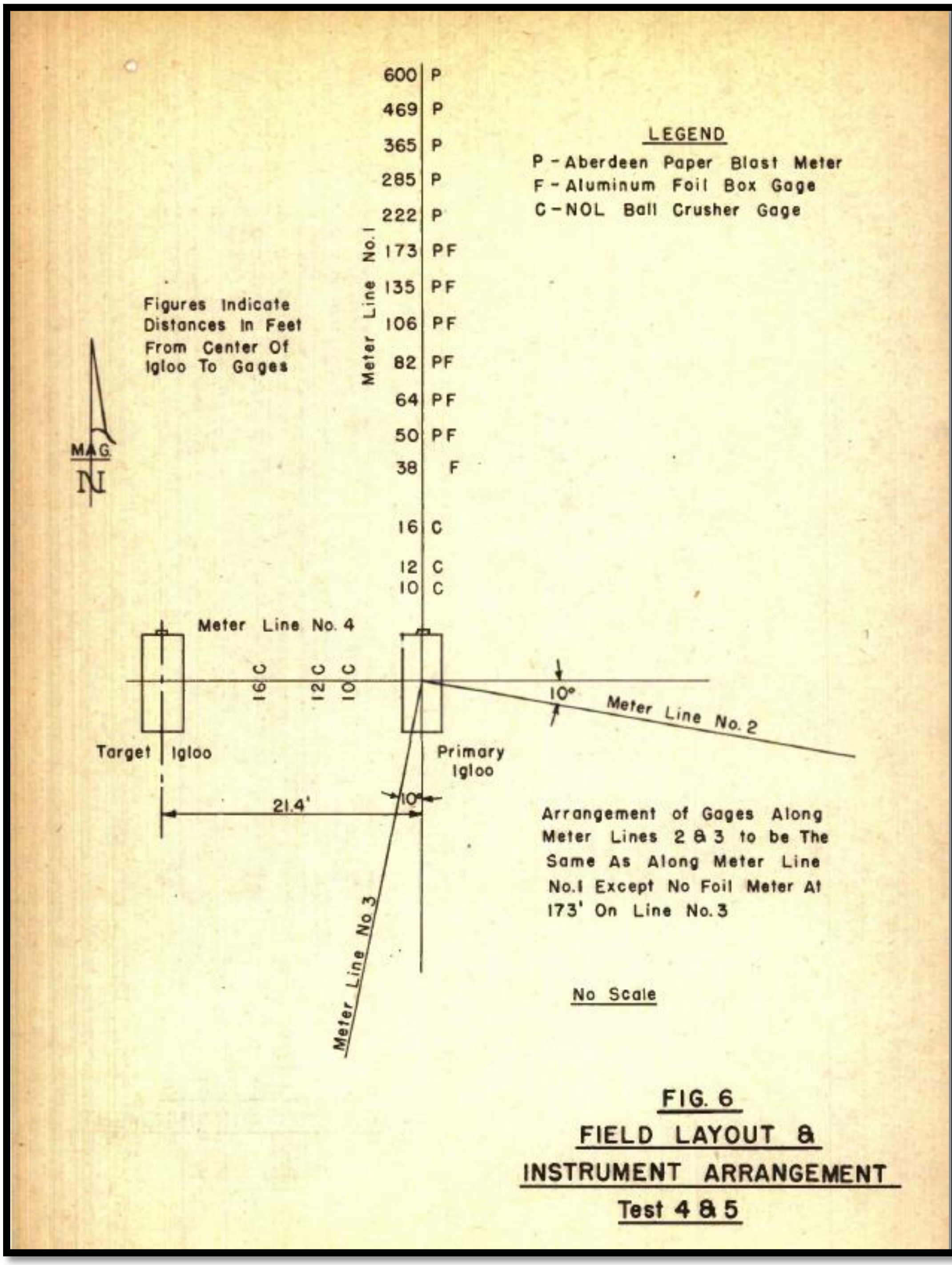


Figure 5.189: "Field layout and instrument arrangement tests 4 and 5", ANESB scale model igloo tests, 1946 (Mann 1947, 8).

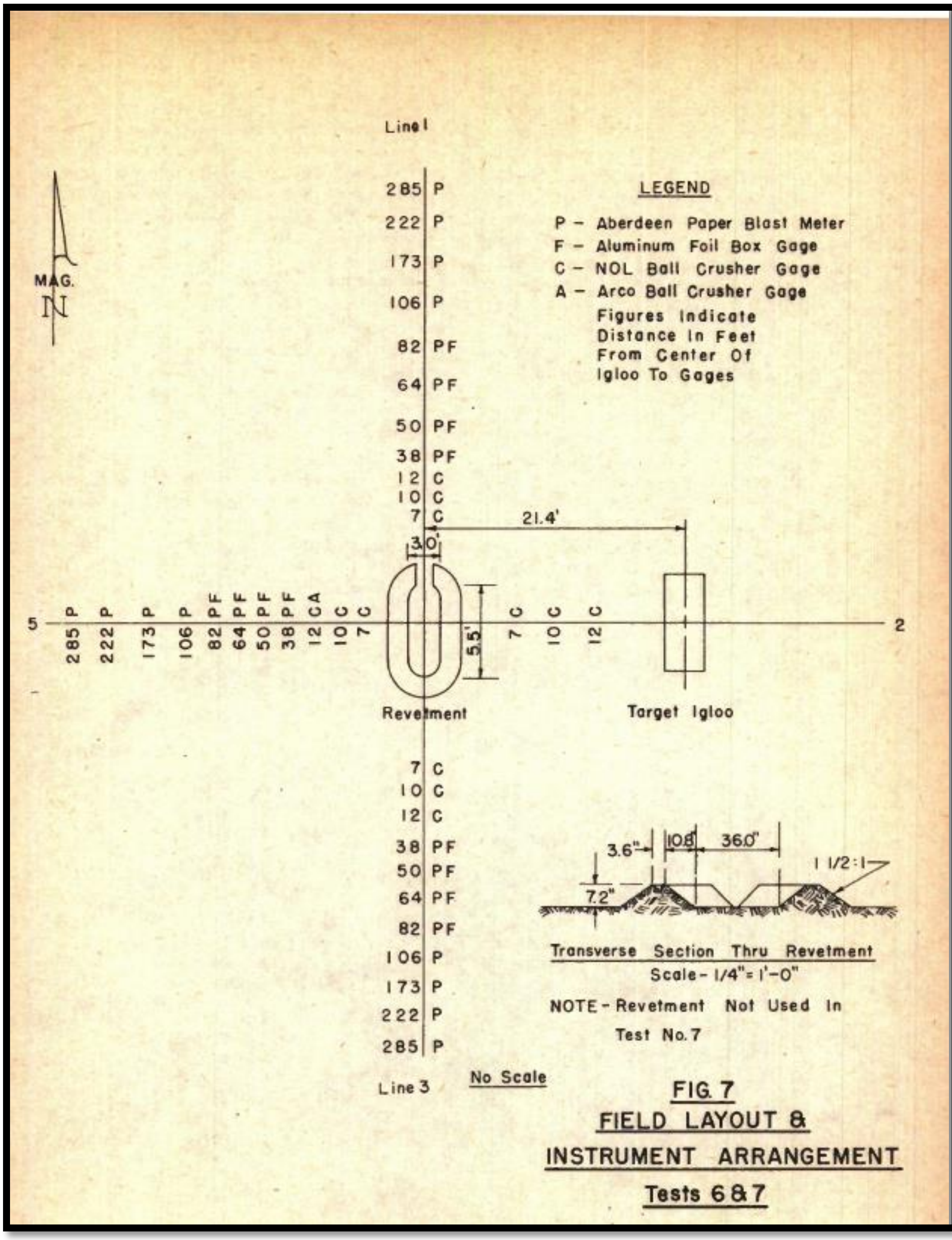


Figure 5.190: "Field layout and instrument arrangement tests 6 and 7", ANESB scale model igloo tests, 1946 (Mann 1947, 9).

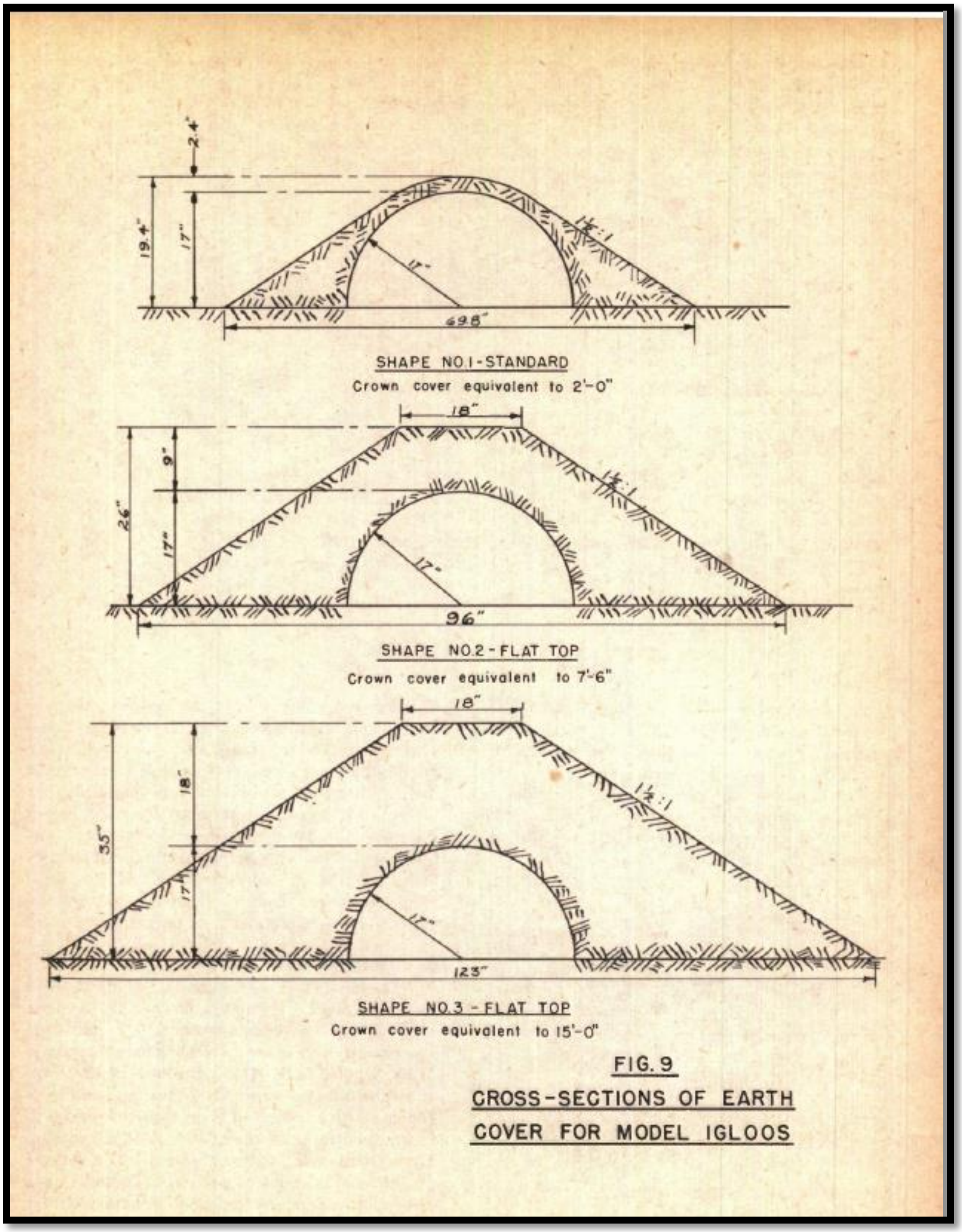


Figure 5.191: "Cross-sections of earth cover for model igloos", ANESB scale model igloo tests, 1946 (Mann 1947, 11).

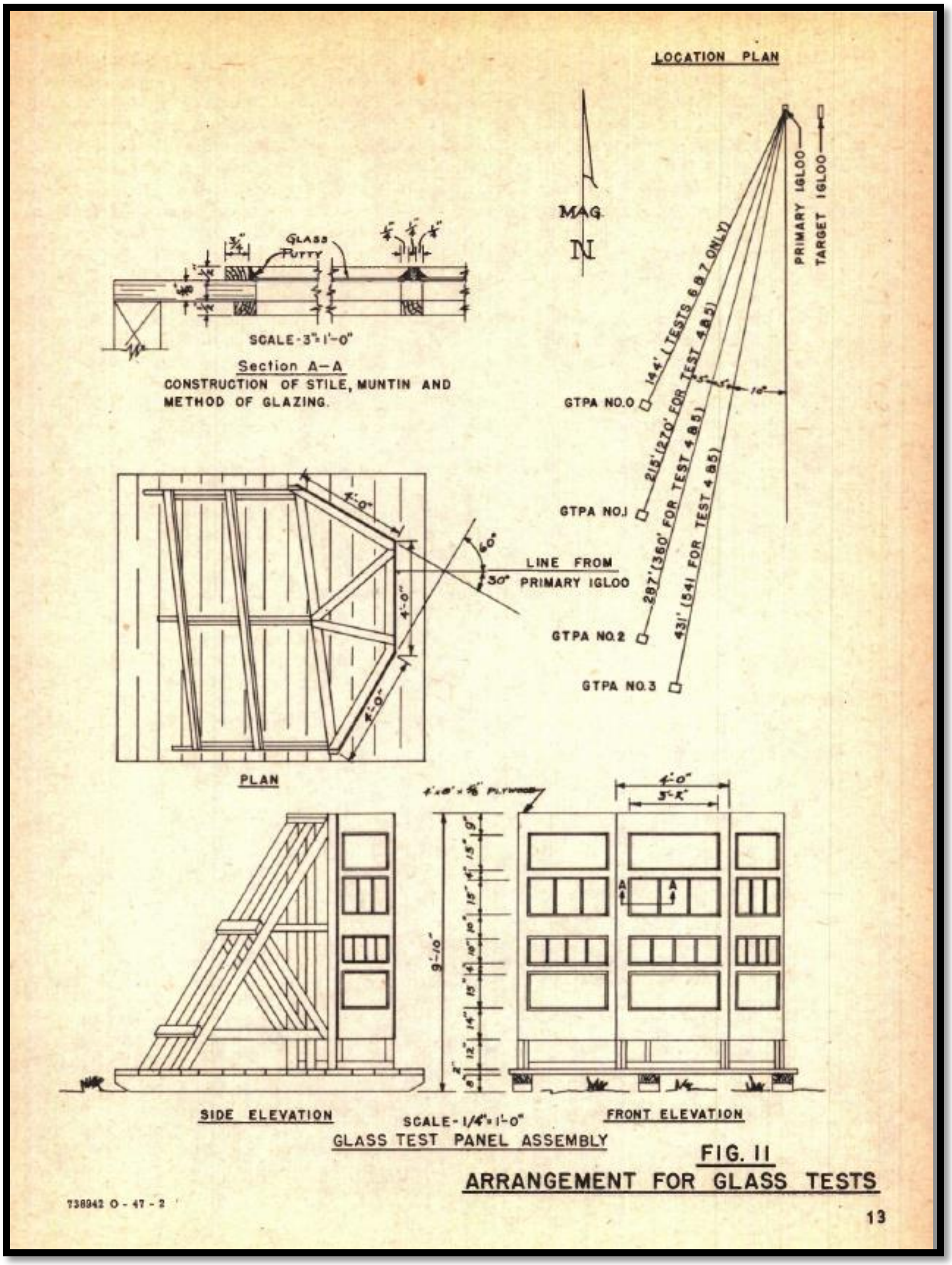


Figure 5.192: "Arrangements for glass tests", ANESB scale model igloo tests, 1946 (Mann 1947, 13).

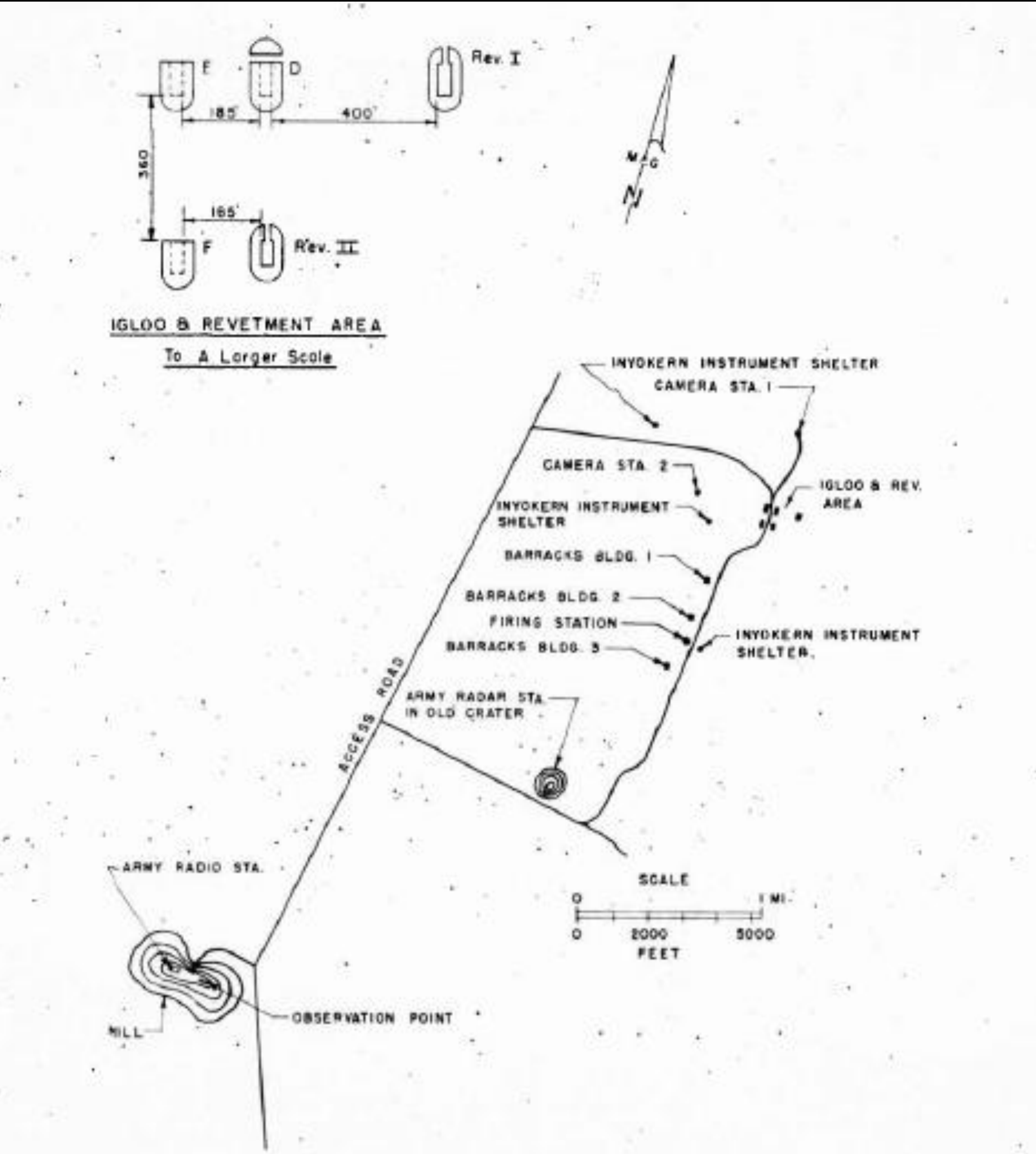


FIGURE 1. Location Plan of Test Structures

Figure 5.193: "Location plan of test structures" used in ANESB full scale igloo tests, 1946 (Mann 1948, 5).

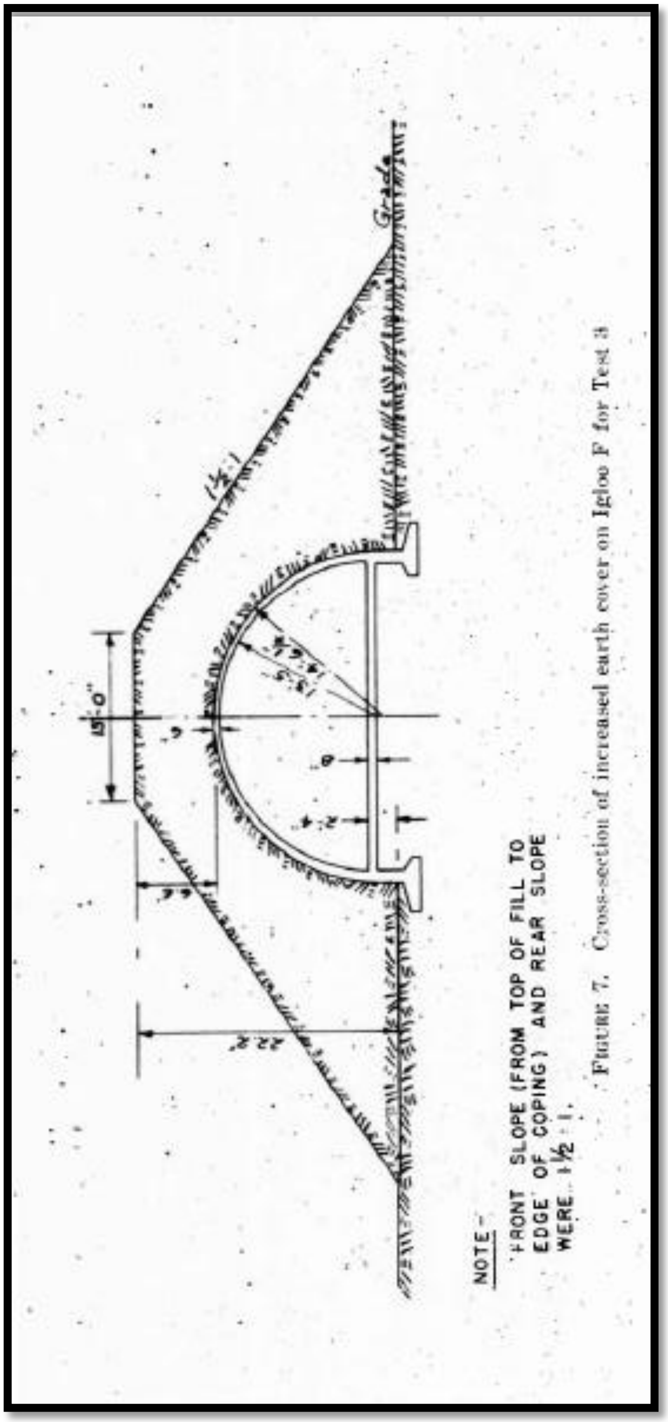


FIGURE 7. Cross-section of increased earth cover on Igloo F for Test 3

Figure 5.194:"Cross-section of increased earth cover on igloo F for test [no.] 3", ANESB full scale igloo tests, 1946 (Mann 1948, 9).

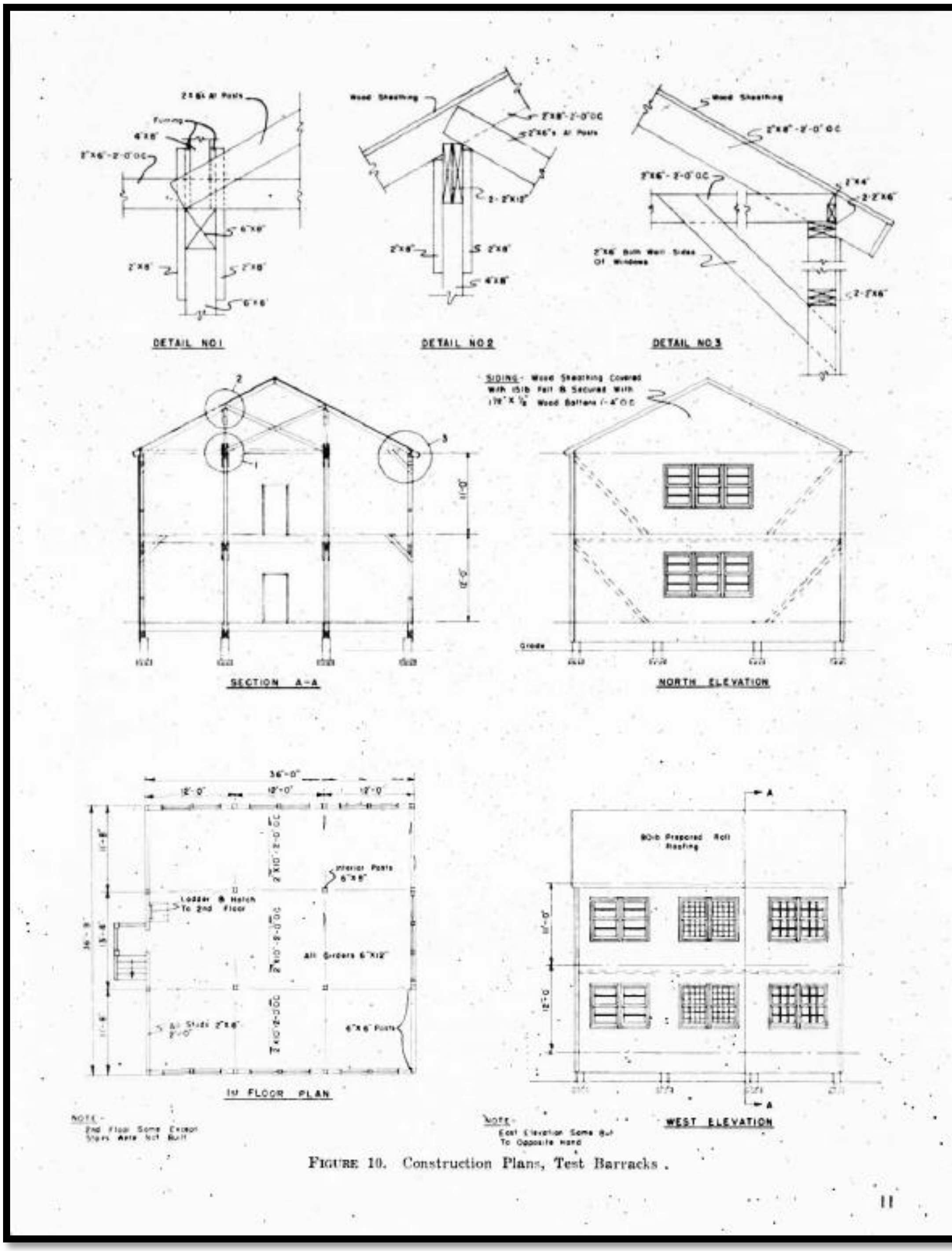


FIGURE 10. Construction Plans, Test Barracks.

11

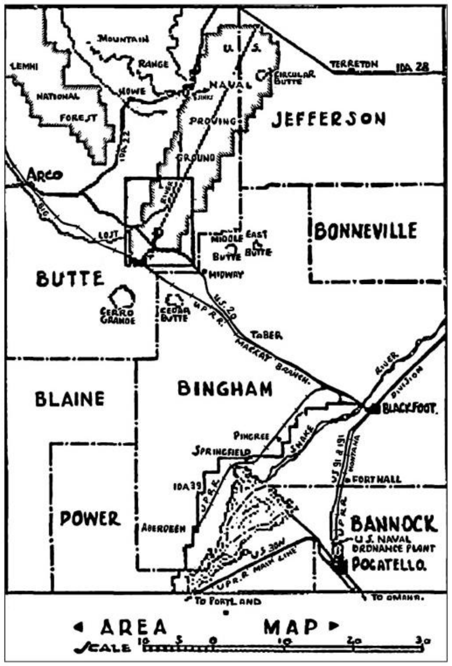
Figure 5.195: "Construction plans [for] test barracks", used in ANESB 1946 full scale igloo tests (Mann 1948, 11).

6 REDUCED COPIES OF ARCO NPG MAPS

The following maps are reduced scale, electronic copies of the Arco NPG maps produced from information gathered during archival research and field survey for this HALS documentation; map order and subject are listed below.

Sheet 1	Title Sheet
Sheet 2	Arco NPG and Bombing Ranges, 1943
Sheet 3	Scoville, NPG, 1943
Sheet 4	Proofing Area, Scoville, 1943
Sheet 5	Residential Area, Scoville, 1943
Sheet 6	Scoville, NPG, 1946
Sheet 7	Proofing Area, Scoville, 1946
Sheet 8	Residential Area, Scoville, 1946
Sheet 9	Mass Detonation Area, 1945
Sheet 10	Scale Model, Barrier Wall, and Railcar Detonation Sites, 1945-1946
Sheet 11	Mass Detonation Area, 1946
Sheet 12	INL, 2014
Sheet 13	CFA, INL, 2014

•U.S. NAVAL PROVING GROUND•
•ARCO • IDAHO•



Above: Reproduction of an original vicinity map for the Arco Naval Proving Ground, dated February 1942 (INL Drawing Number 112099, CF-101-USN-5).
The proximity of the Arco Naval Proving Ground to the U.S. Naval Ordnance Plant is illustrated, as well as the transportation infrastructure provided by the existing Union Pacific Railroad.

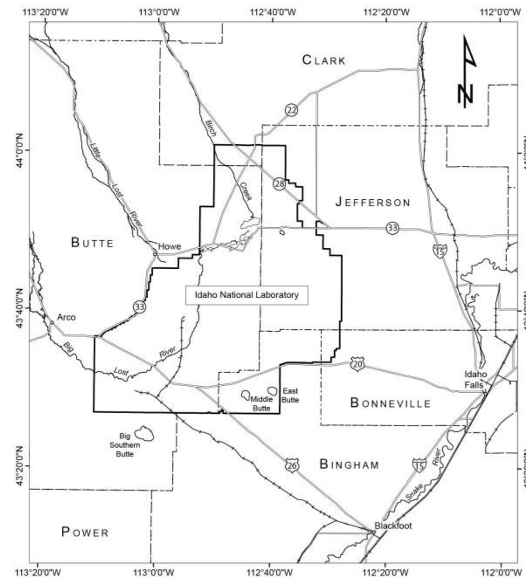
The Arco Naval Proving Ground (NPG) was one of five specialized ordnance facilities established in the nation during World War II that conducted research and experiments. Victory in the Pacific theater relied partly on the performance of battleship guns and the Arco NPG was the only proving ground where the Big Guns used by the Pacific Fleet were tested. The Arco NPG was the terminus of an elaborate logistical system that began with the guns on ships like USS Missouri and USS Wisconsin. After repeated combat firing wore out the rifling, the guns were shipped to the coast, sent by rail overland to Pocatello, relined, sent to the proving ground, test-fired, and scored for accuracy. The guns then returned to action the way they had come and entered battle once more.

In addition to naval ordnance testing, the U.S. Navy allowed the Army to use lands adjacent to the Arco NPG for high altitude aerial bombing ranges. Over 40,000 pilots were trained at the Pocatello Army Air Base and many flew day and night training missions over Twin Buttes Bombing Range and Arco High Altitude Bombing Range. Hundreds of men lost their lives while doing so, including seven men whose B-24 Liberator went down near Twin Buttes Bombing Range while on a night mission. Later, the two military branches joined forces to conduct tests that contributed greatly to determining safe storage and transport of conventional ordnance.

The Arco NPG provided the core setting for the present-day Idaho National Laboratory. Infrastructure such as roads and rail sidings influenced the location of later facilities. Beyond the proofing and residential centers, the NPG had altered the desert landscape. Explosives tests and gun firings required their own infrastructure such as concrete and wood targets and camera and instrument shelters. The tests and firings produced impact craters and left a variety of ruins on the desert floor – piles of shattered concrete and twisted metal, wood pieces and window glass shards, bomb shells and even unexploded projectiles. The latter, a hazardous legacy that remained unattended until many decades later.

Aside from being a tribute to the logistical excellence of the U.S. military, the NPG's association with the great battleships of the war and with World War II and postwar military research and testing are nationally significant. The NPG was the only proving ground of its kind west of the Mississippi River and is one of very few sites in Idaho that contributed to American victory during World War II, in addition to revising national standards for the safe storage and transport of conventional ordnance.

Based on evaluations conducted in 1993 and 1997, historians determined that the then-remaining Arco NPG structures, currently within the boundary of Idaho National Laboratory, were significant to the nation's history through their association with World War II. Through ensuing discussions with the Idaho State Historic Preservation Office (SHPO), it was further determined that the infrastructure and associated landscape were also significant. In early 2013, the Department of Energy Idaho Operations Office (DOE-ID) notified the Idaho SHPO, the Advisory Council on Historic Preservation (ACHP), and DOE-Headquarters Federal Preservation Officer, of their intent to demolish the vacant buildings World War II buildings. Through the National Historic Preservation Act (NHPA) Section 106 consultation process, measures to mitigate the adverse impacts of demolition were determined and agreed to through a Memorandum of Agreement (MOA) between DOE-ID, the Idaho SHPO, and ACHP. The completion of a Historic American Landscape Survey (HALS) was undertaken as part of this mitigation process by the staff of the Cultural Resource Management Office at Idaho National Laboratory.



Reproduction of Capt. John Scoville's signature
(INL Drawing Number 11210502, CF-102-USN-2).

Index for Drawing Sheets

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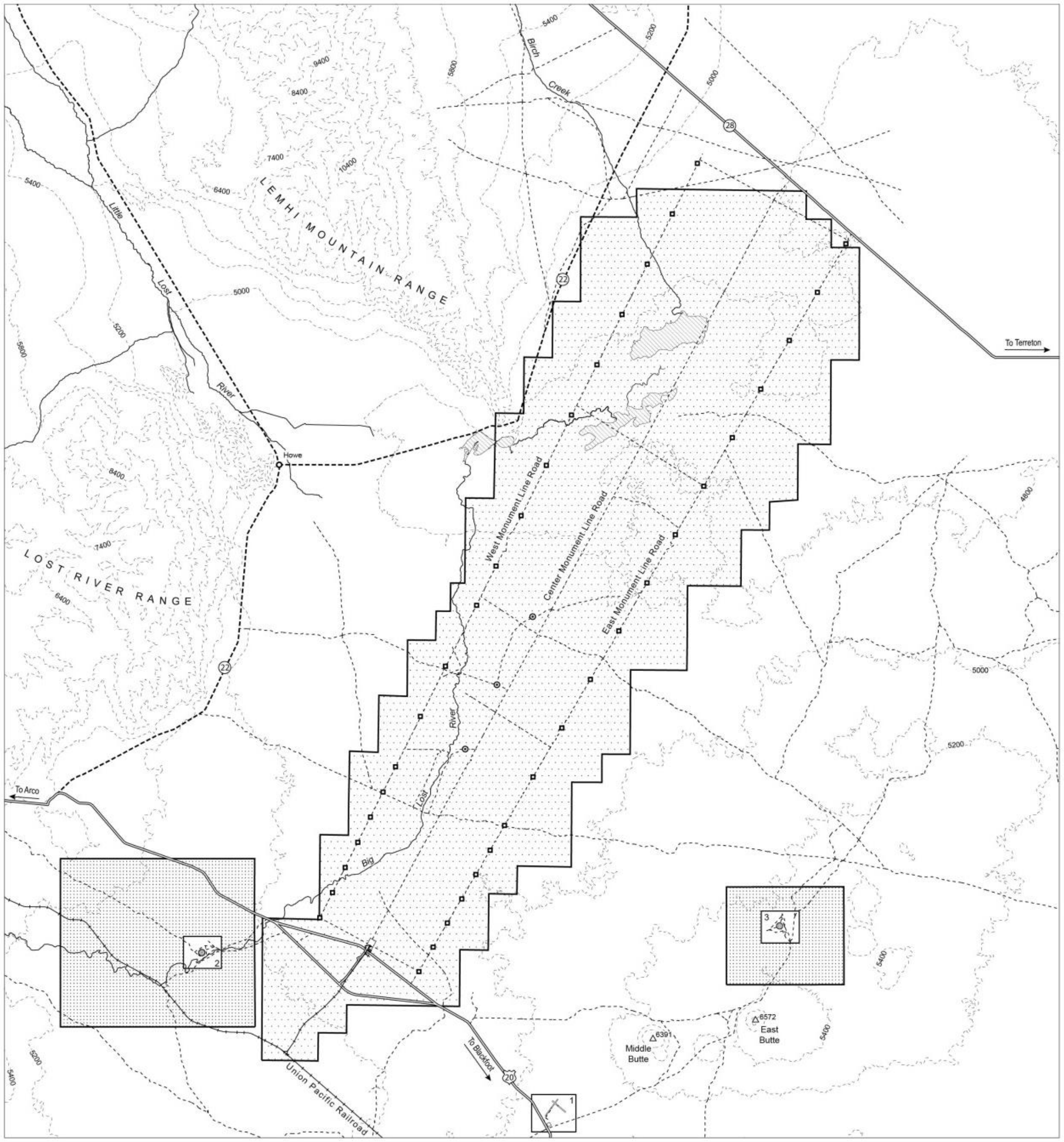
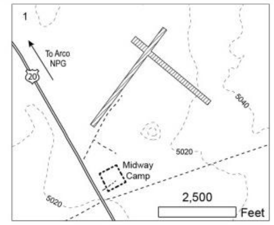
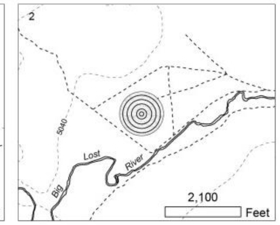




Midway Camp and Landing Strip

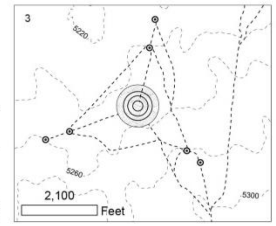


Arco High Altitude Bombing Range

Army Air Corps at the Arco NPG

The Army Air Corps used the High Altitude Bombing Range at Arco (2), and a second bombing range at Twin Buttes (3), between 1943 and 1945. Each bombing range had a circular target scraped in the desert surface and lime defining the target rings. At the bombing ranges pyramid targets and lighting were constructed, as well as observation towers. B-17 and B-24 bombers, flying out of Pocatello Army Air Force Base, dropped sand-filled practice bombs during both day and night training flights.

In addition to the bombing ranges, a landing strip and camp, comprised of approximately 20 structures, were located to the south of the Arco NPG range at Midway (1), along U.S. Highway 20.



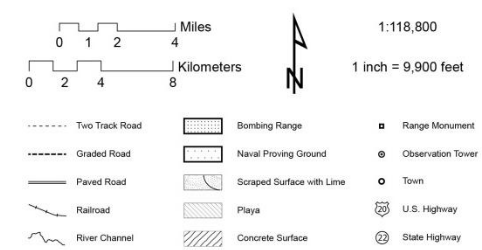
Twin Buttes Bombing Range

The Arco NPG was completed in August 1943 and formally opened on November 11th 1943 as an outlying facility of the Pocatello Naval Ordnance Plant (NOP). The Arco NPG served as an ordnance testing facility during and after World War II, as well as a home to both military and civilian workers. Between 1943 and 1947, guns from the Pacific Fleet that had been relined at the Pocatello NOP were test fired at the Arco NPG before being shipped back for battle use. Through public land withdrawal and purchase the U.S. Navy had created a facility spanning 271 square miles of desert on the eastern Snake River Plain in Idaho, approximately 65 miles northwest of Pocatello. The flat area of sand and gravel between the mountain ranges to the northwest and exposed lava to the southeast provided ideal conditions for the proofing ground.

The proofing range at the Arco NPG was nine miles wide at its terminus and 30 miles in length, trending in a northeasterly direction. The three access roads, West Monument Line Road, Center Monument Line Road, and East Monument Line Road, extended along the length of the Arco NPG and defined the firing range. The Monument Line Roads were named for the concrete monuments along the West and East Monument Line Roads used to calculate the range of the proofed ordnance. A total of 38 range monuments lined the West and East Monument Line Roads, 19 on each road, at intervals of one mile for the first six miles and two mile intervals for the remaining length of each road. Three observation towers were located along Center Monument Line Road. At the southeastern end of the range the Arco NPG was divided into two areas; a proofing area, where the guns were test fired, and a residential area, where the military and civilian personnel were housed.

During 1943 the U.S. Navy also granted the Army permission to conduct training for high altitude bombing crews on the lands adjacent to the Arco NPG. The Arco High Altitude Bombing Range (2) was located to the west of the Arco NPG and the Twin Buttes Bombing Range (3) to the east, with an additional area, Midway (1), to the south.

Arco Naval Proving Ground and Bombing Ranges, 1943



NOTE: DRAWINGS REPRESENT THE KNOWN HISTORIC LANDSCAPE OF THE ARCO NPG. FURTHER RESEARCH MAY IDENTIFY ADDITIONAL FEATURES.

DELINEATED BY: MARIE P. HOLMER, 2015

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IDAHO NATIONAL ENGINEERING LABORATORY, ARCO NAVAL PROVING GROUND

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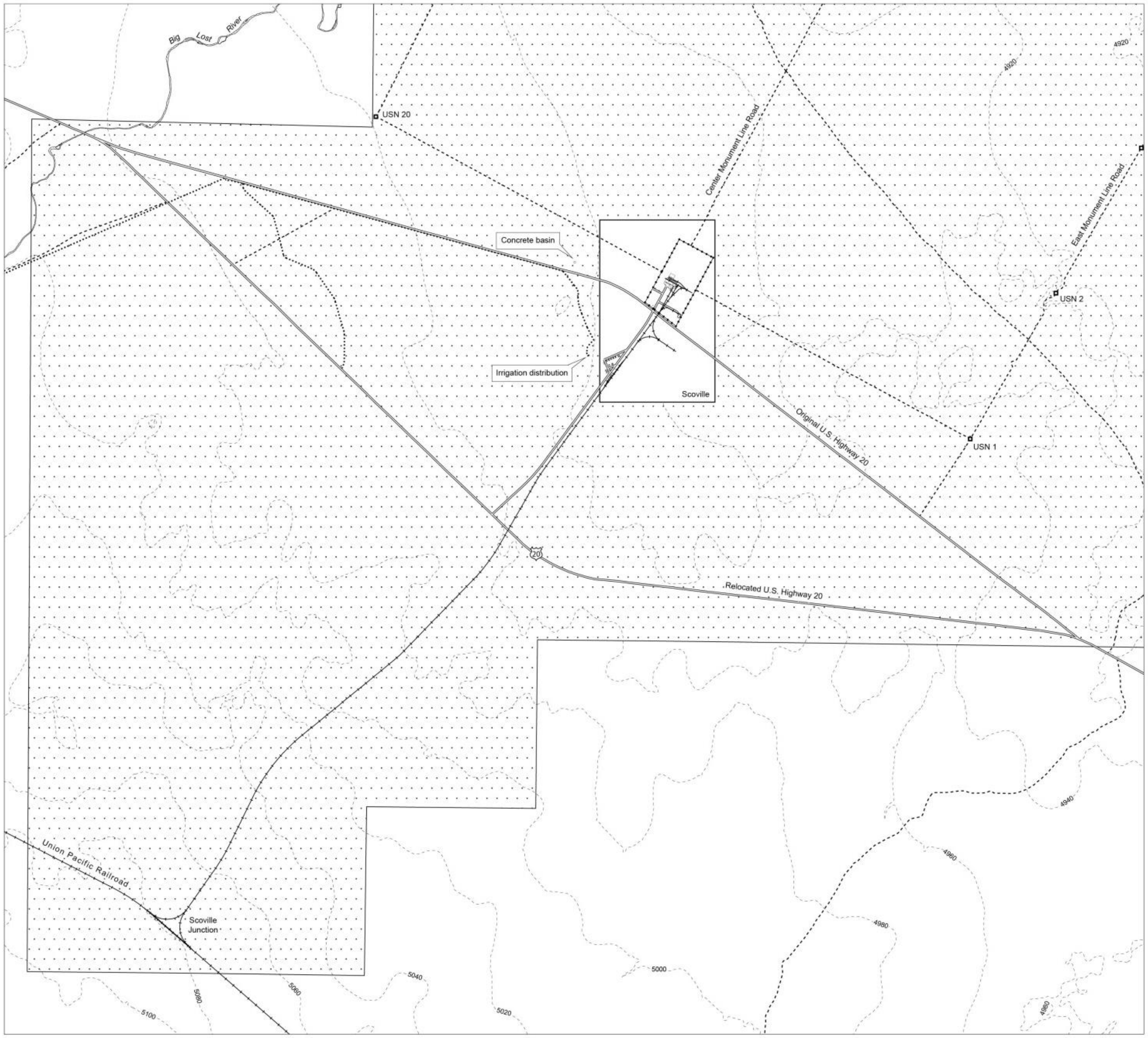
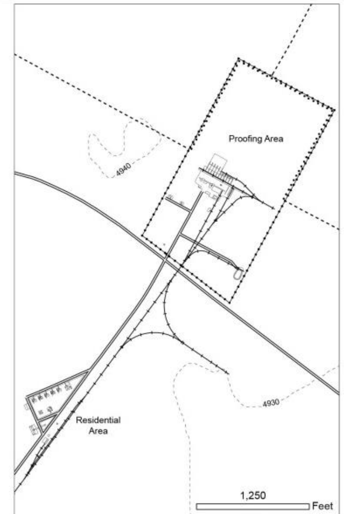
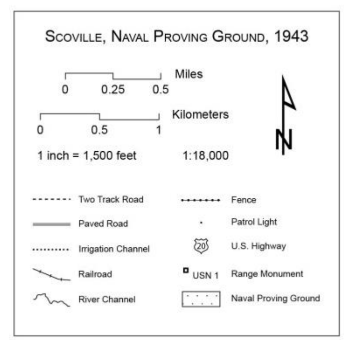




The Arco NPG was accessible at the southern end by U.S. Highway 20, which provided road links to Midway and Blackfoot to the southeast and Arco to the west. One section of the highway running through the NPG was rerouted to accommodate the construction of the proofing and residential areas but the original road remained intact and provided a connection to West and East Monument Roads. Each range monument was marked with a United States Navy (USN) number, beginning with USN 1 at the southern end of East Monument Line Road and concluding with USN 38 at the far north end of West Monument Line Road. Access by rail for the transport of the guns from the Pocatello NOP was via the Union Pacific Railroad line to Arco. The construction of a spur at the Scoville siding allowed the transportation of Naval shipments to the proofing area and was named for the Naval commander who developed the site.

The residential area at the Arco NPG was located half a mile to the southwest of the proofing area and accessed by Main Street, which ran between the original and relocated section of U.S. Highway 20. Irrigation was channeled from the Big Lost River utilizing some of the existing channels from historic construction efforts prior to the arrival of the U.S. Navy. In addition, a concrete basin of unknown use, located west of the proofing area, was constructed and marked 1943.



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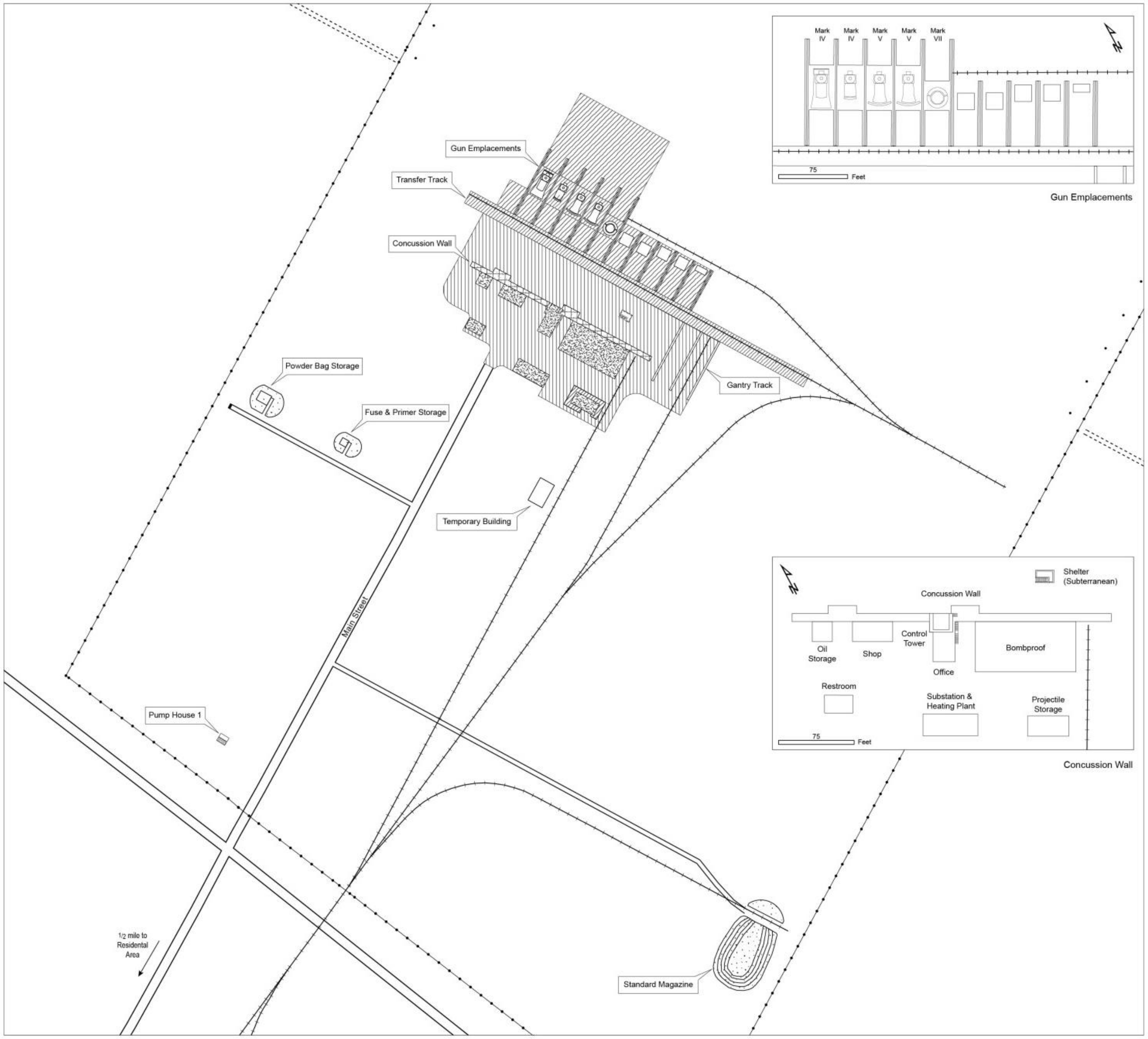
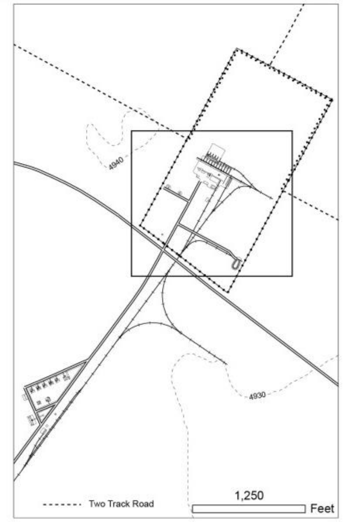
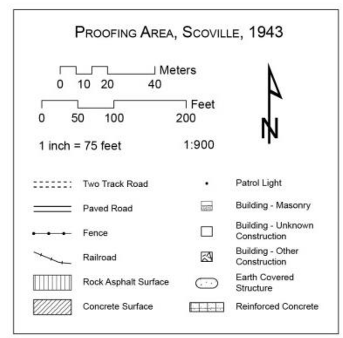




In 1943 the proofing area at the Arco NPG provided for 10 gun emplacements of various types. The railroad spur from Scoville junction brought guns directly to the emplacements where they were transferred from the railroad using a 250-ton gantry crane at the southeast end of the emplacements. A transfer track could then move guns to the appropriate emplacement for testing.

The gun emplacements were separated from the rest of the proofing area by an 8 foot thick, 315 foot long reinforced concrete concussion wall. The exception being an underground shelter for personnel located between the concussion wall and the gun emplacements. Adjoining the concussion wall were bombproof, office, shop and oil storage buildings. Located above the office, and on top of the concussion wall, was a reinforced control tower and walkway. Additional proofing area structures included restrooms, projectile storage and infrastructure support, including a substation, heating plant and one of two well pump houses at the Arco NPG. Three earth covered bunkers, power bag, fuse and primer, and a standard magazine, provided storage for testing supplies. All of the proofing activities were contained within a fenced area and past the gun emplacements were concrete patrol light structures, illuminating the fence line and beyond.



NOTE: DRAWINGS REPRESENT THE KNOWN HISTORIC LANDSCAPE OF THE ARCO NPG. FURTHER RESEARCH MAY IDENTIFY ADDITIONAL FEATURES.

DELINEATED BY: MARIE P. HOLMER, 2015

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UNITED STATES DEPARTMENT OF THE INTERIOR

IDAHO NATIONAL ENGINEERING LABORATORY, ARCO NAVAL PROVING GROUND

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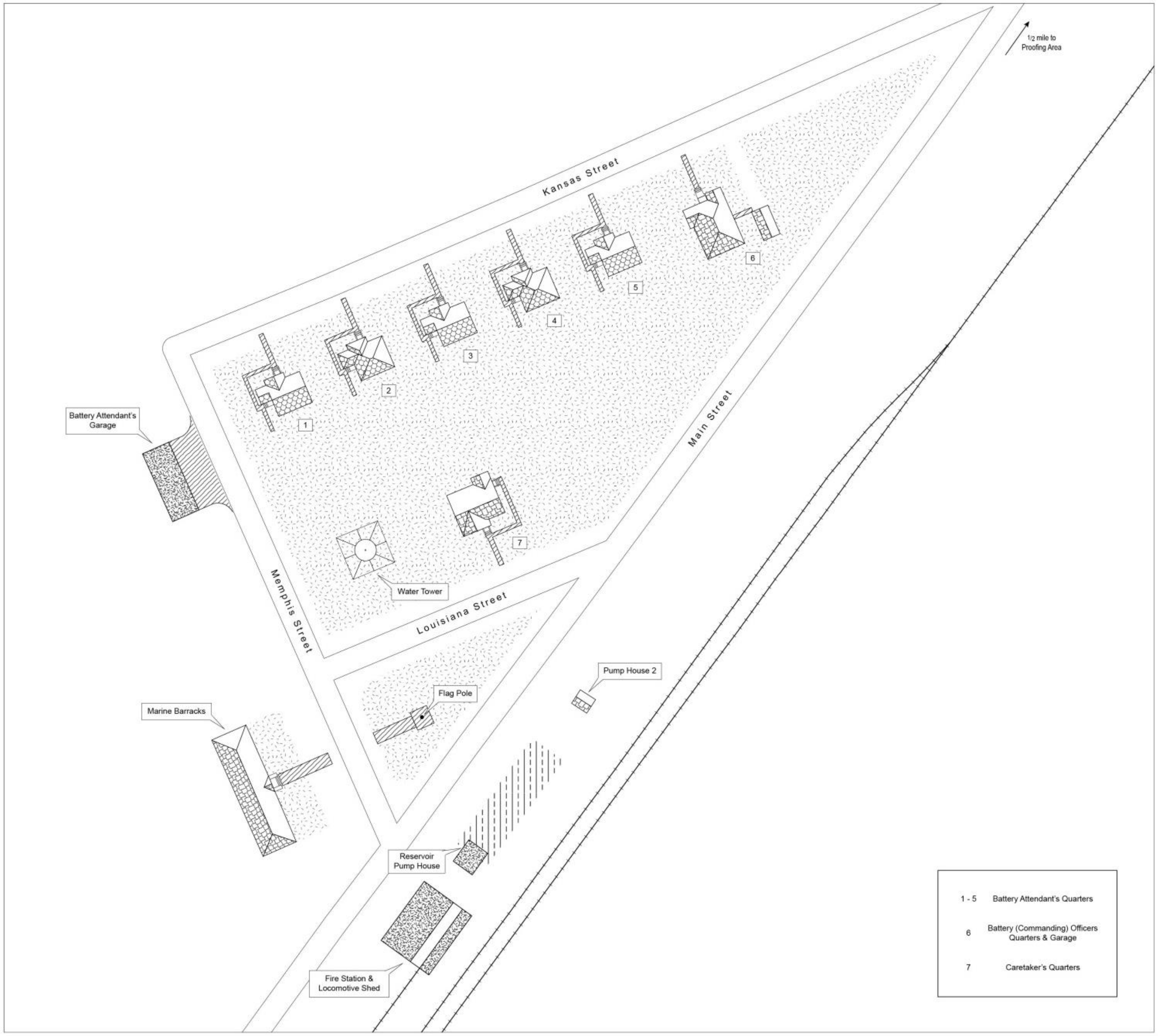
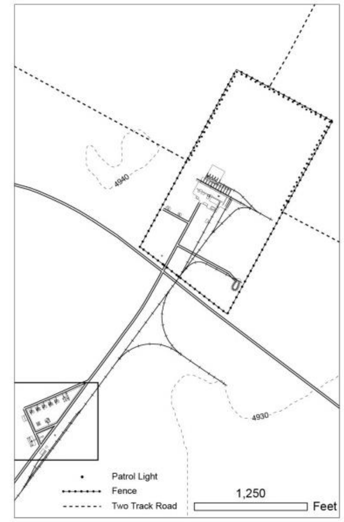
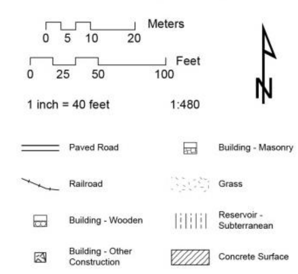




The residential area of the Arco NPG housed the civilian workers, their families, and military personnel. Civilians were housed in one of five wooden homes on Kansas Street in the residential area, referred to as battery attendants quarters. A garage for the battery attendant's quarters, also of wooden construction, was located on Memphis Street and provided parking for each of the five attendant quarters. An additional masonry house was designated for the caretaker of the facility on Louisiana Street. The military personnel at the facility included Marines assigned to guard the Arco NPG, who were housed in a masonry barracks building adjacent to the battery attendant's garage. The commanding officer, who was provided with a masonry home and an adjacent single car, masonry garage, was housed on the same street as the battery attendant's quarters.

The second of two well pump houses was located on Main Street in the residential area, along side a pump house for an underground reservoir. An elevated water tower was also constructed next to the caretaker's quarters. The locomotive shed, garage and fire station were all located in a single building at the southern end of the residential area. Finally, a flag pole located in front of the marine barracks completed the residential area at the time of opening in 1943.

Residential Area, Scoville, 1943



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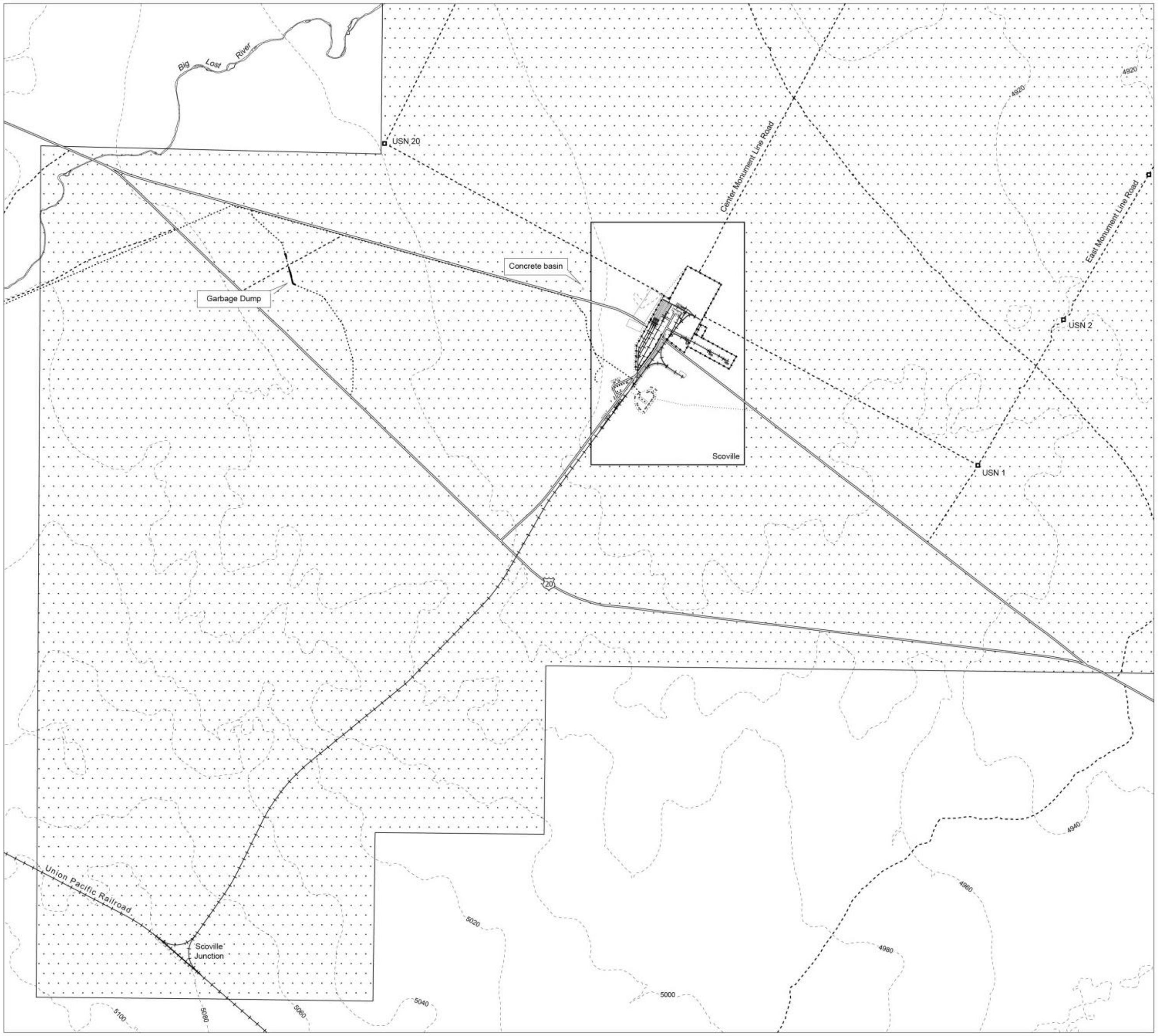
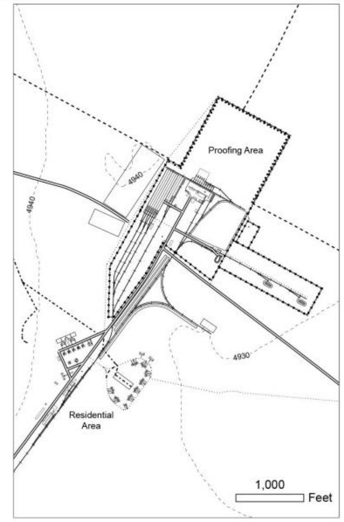
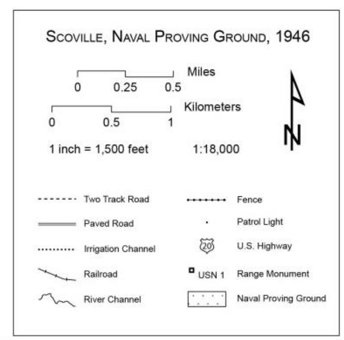




In the years immediately following the construction of the Arco NPG, expansion of the facilities in both the proofing and residential areas continued. From 1943 onwards the residential area saw the addition of civilian housing, as well as buildings to support operations at the Arco NPG. The construction of two battery attendant's double houses opposite the original civilian houses was followed by a new civilian development after the war when two apartment buildings and 17 houses were built in a loop southeast of Main Steet. The permanent residence of personnel at the remote location required the addition of a garbage dump, which was located to the west of the residential area in an abandoned section of historic irrigation channel, between the old and new sections of U.S. Highway 20. The increased civilian population also saw the addition of another irrigation channel to accomodate the gardens of the more recent permanent residents.

Beginning in 1944 the proofing range beyond the immediate Scoville area took on an additional role as an explosive safety testing site. The large amount of munitions produced during World War II necessitated a review of the existing safe storage guidelines to accommodate increased capacity and proximity to inhabited buildings. Numerous controlled detonations took place at the Arco NPG to establish new safe storage parameters under a variety of experimental conditions.



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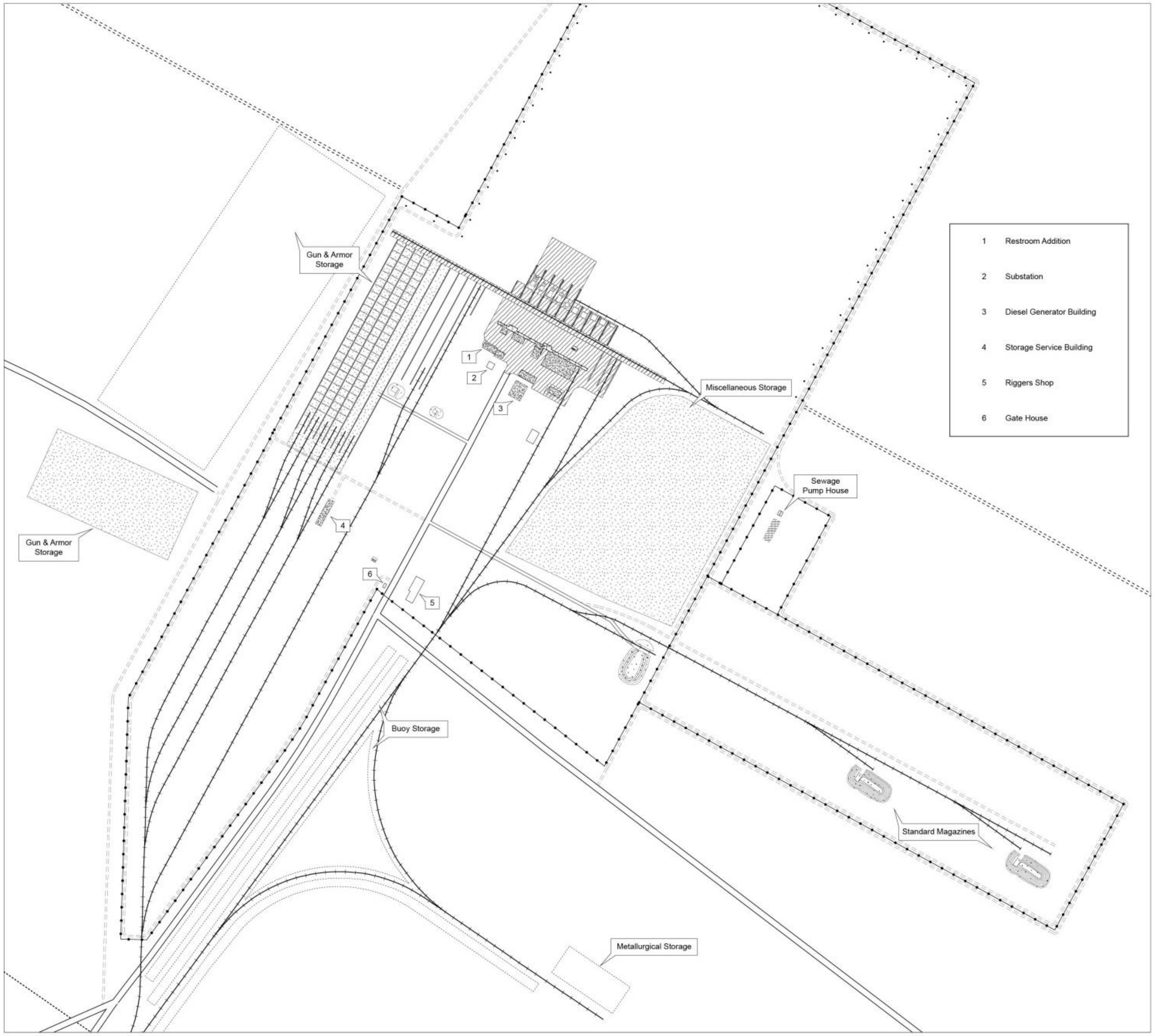
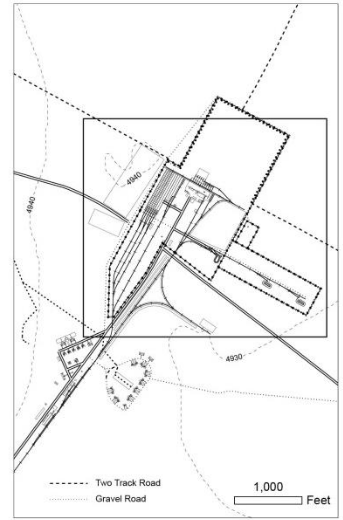


1	Restroom Addition
2	Substation
3	Diesel Generator Building
4	Storage Service Building
5	Riggers Shop
6	Gate House



The storage capacity of the proofing area increased significantly between 1943 and 1946. The addition of new track to the Scoville railroad spur to create gun and armor storage at the western edge of the gun emplacements was accompanied by the extension of the transfer track for moving guns to and from the emplacements. The expansion of the rail access at the proofing area extended to another two standard magazines and also included the addition of track to the metallurgical storage south of the proofing area. To accommodate not only increased proofing activities but also the repair of other Naval property at the site, additional storage for guns, armor, buoys, and miscellaneous equipment was located on unimproved and gravel areas adjacent to the proofing area.

Several buildings constructed included a riggers shop, a storage service building and a diesel generator building. The exisiting restroom at the proofing area was also extended to provide spearate men's and women's facilities. As a result of the increased infrastructure and storage capacity the fenced area was extended and gravel patrol roads formed a perimeter around the exterior and, in part, interior of the proofing area.

Proving Area, Scoville, 1946

Meters: 0, 40, 80
Feet: 0, 210, 420
1 inch = 150 feet — 1:1,800

Two Track Road	Patrol Light
Paved Road	Building - Masonry
Gravel Road	Building - Unknown Construction
Fence	Building - Other Construction
Railroad	Earth Covered Structure
Gravel Storage Area	Septic Tank
Unimproved Storage Area	Reinforced Concrete
Concrete Surface	

NOTE: DRAWINGS REPRESENT THE KNOWN HISTORIC LANDSCAPE OF THE ARCO NPG. FURTHER RESEARCH MAY IDENTIFY ADDITIONAL FEATURES.

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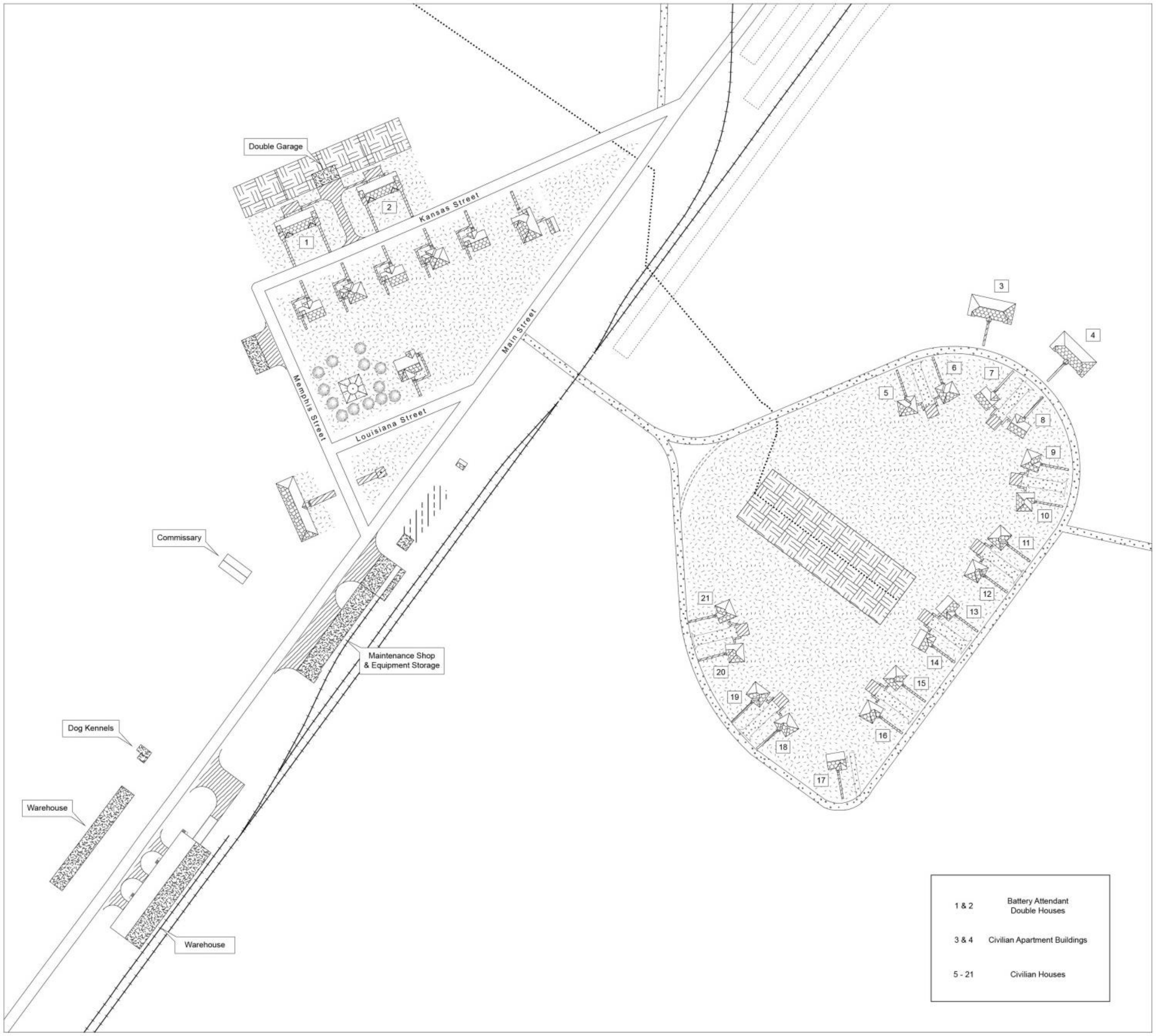

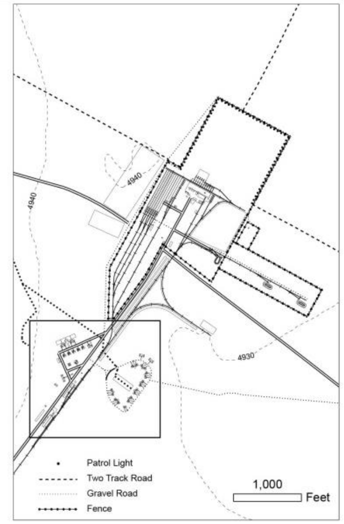

The expansion of the civilian accommodation at the Arco NPG not only reflected the increase in war time workers at the facility but also the distance some were travelling to and from Arco, a 22 mile journey, often dangerous in winter conditions. The construction included two battery attendant double quarters in the original residential area, consisting of two buildings, each accommodating two families, and a four car garage between the two buildings. After the war, a total of 17 civilian houses were constructed in a new loop southeast of the residential area and another two apartment buildings, accommodating four apartments in each, were built on the exterior of the loop. All of the new civilian homes were wooden construction. The center of the loop was a grass area behind the houses with a garden for the residents, complete with an irrigation channel.

Additional support buildings constructed included two warehouse buildings along Main Street and the extension of the original fire station and locomotive shed to include a maintenance shop and equipment storage. The dog kennels housing the Marine patrol dogs were located on Main Street behind the Marine barracks building, as was the Commissary, or "Store", for the residents at Arco NPG.

Residential Area, Scoville, 1946

Meters: 0, 20, 40
Feet: 0, 110, 220
1 inch = 80 feet 1:960

Paved Road	Building - Other Construction
Gravel Road	Deciduous Tree
Two Track Road	Grass
Irrigation Ditch	Reservoir - Subterranean
Railroad	Concrete Surface
Building - Masonry	Garden
Building - Wooden	Unimproved Storage Area
Building - Unknown Construction	

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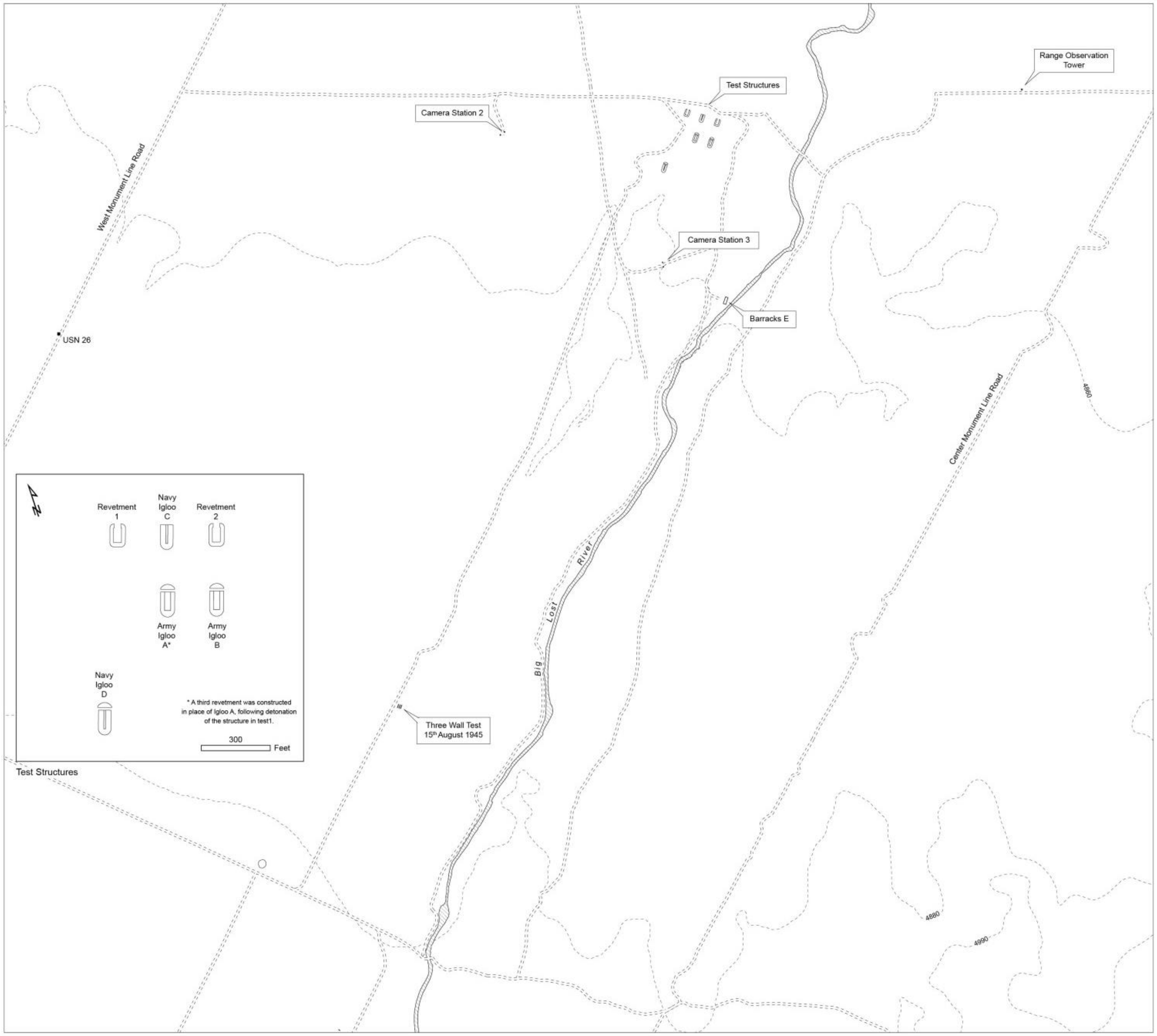
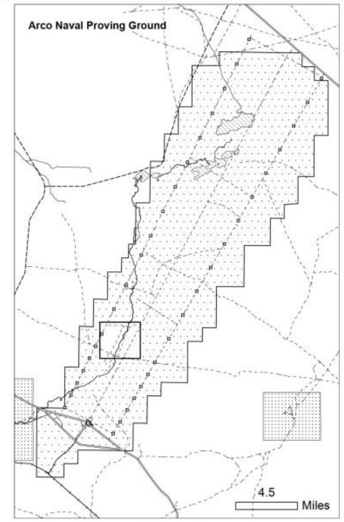
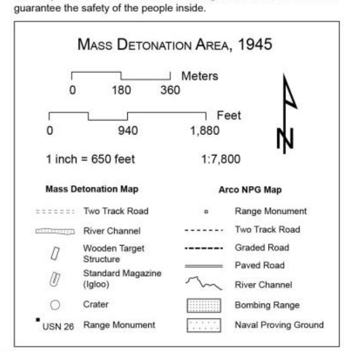




The testing of ordnance at the Arco NPG began in 1944 as the site offered an isolated, government owned facility with personnel and construction supplies on hand to conduct a large number of different experimetal detonations. One of the earliest tests conducted was the "Three Wall Test", which represented cooling bays at munitions loading plants. The detonation of 20,000 pounds of ordnance in each bay completely destroyed the test structure and demonstrated the storage practice was unsafe.

The mass detonation area, located on the proofing range at the Arco NPG, is named for the large scale experimental testing of Army and Navy standard magazines, or igloos, beginning in 1945. Between August 29th and October 31st of that year a total of seven tests were conducted to assess the impact of detonation in one igloo on the integrity of surrounding igloos and revetments (earth barricaded open storage), which were also loaded with ordnance. A wooden barracks building was constructed to assess damage at existing distance recommendations for inhabited buildings. A total of seven agencies took part in recording the experiments from instrument stations across the area while cameras captured the detonations from concrete bunkers. These tests demonstrated distances between igloos could be safely reduced but the inhabited building distance tested could not guarantee the safety of the people inside.



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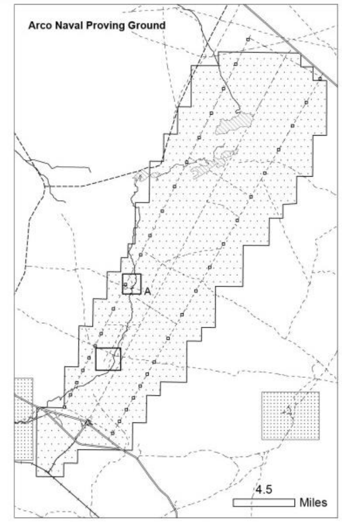

On the proofing range north of the mass detonation area, an experimental detonation to test "missile distance and hazard" of railroad box cars in a classification yard (Inset Map A) was undertaken. Five box cars were positioned on a short track, constructed for the test, and each one loaded with 30,000 pounds of explosive. The tests determined that positioning of ammunitions trains at a proximity of less than one-half mile, or parallel to each other, in a classification yard was unsafe.

Following the "Three Wall Test" in 1945 the experimental investigation of barrier wall structures continued and a number of tests were conducted in an area south of mass detonation. Six barrier walls were constructed to test the effectiveness for screening against sympathetic detonations and constant tests for standard dividing walls at storage facilities. The investigation into propagation of detonation between storage igloos continued in July and August 1946 near the barrier wall test site, but at a reduced scale. One-tenth linear scale model igloos and revetments were constructed, along with three glass test panels to examine recommended safe distances for inhabited buildings. While the scale model tests were able to provide comparative data to full scale tests, some results were determined to be inaccurate representations of the full scale igloo tests.

Scale Model, Barrier Wall and Railcar Detonation Sites, 1945-46

0 110 220 Meters

0 575 1,150 Feet

1 inch = 400 feet 1:4,800

N

Scale Model, Barrier Wall and Railcar Maps

Two Track Road
River Channel
Concrete Wall
Crater

Arco NPG Map

Range Monument
Two Track Road
Graded Road
Paved Road
River Channel
Bombing Range
Naval Proving Ground

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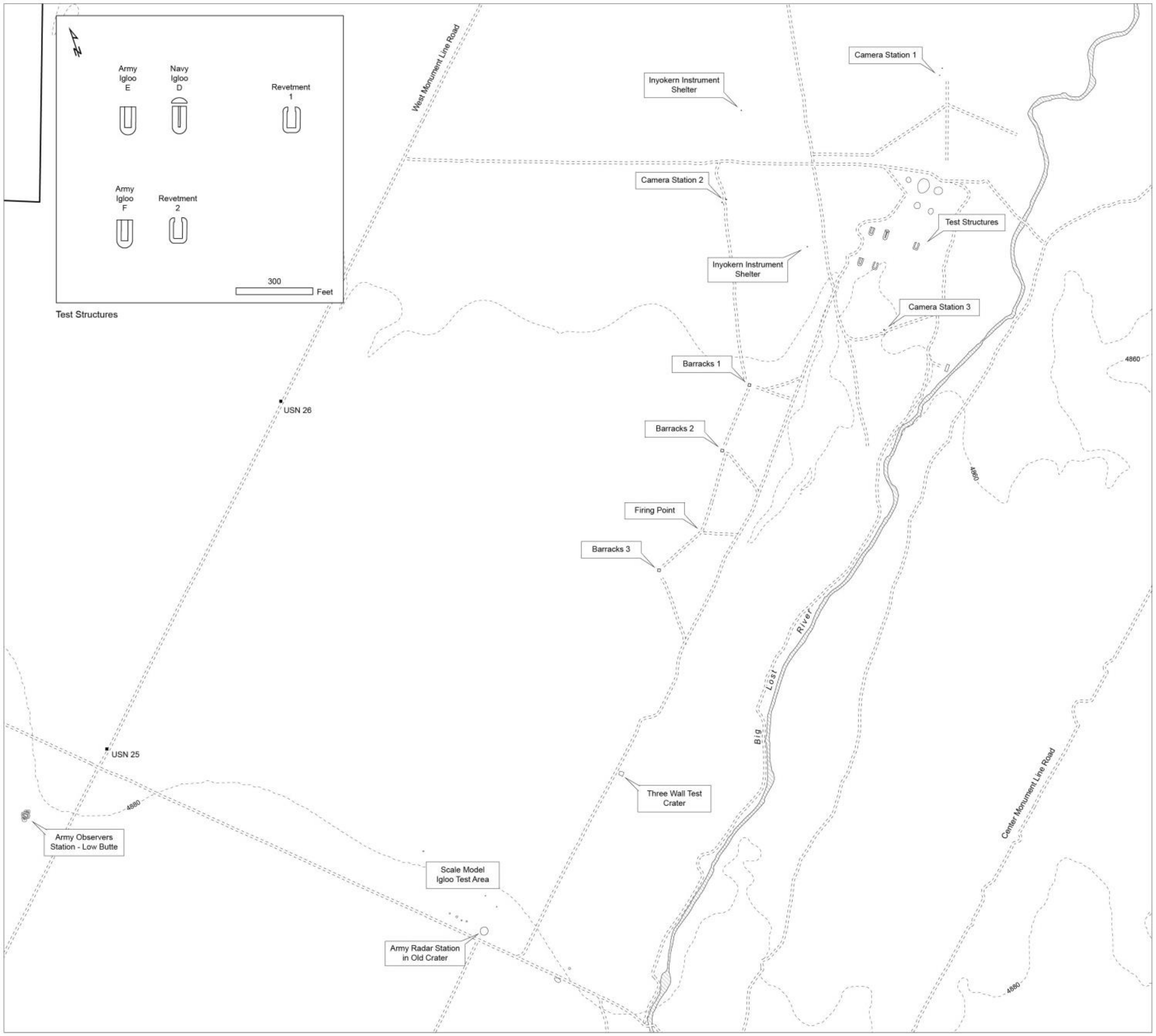
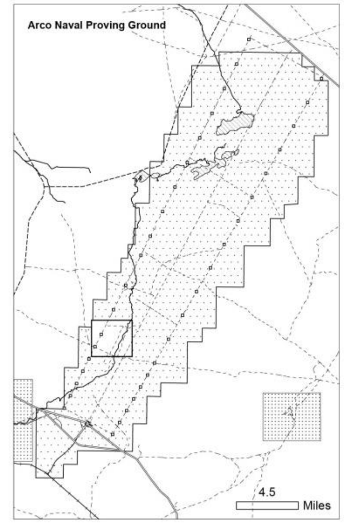
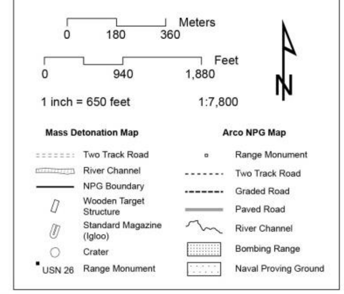




Full-scale igloo detonation testing resumed in 1946 with the aim of testing a capacity double that of the tests conducted in 1945 at the new, reduced distances established in the earlier tests. The 1945 tests had also demonstrated the standard distance for inhabited buildings to be ineffective so the tests in 1946 included the construction of three additional barracks buildings at increasing distances from the test igloos. An Army radar station was set up in a large crater southwest of the test area and observers were stationed on top of a low butte on the far side of West Monument Road. An additional camera station and associated personnel bunker were constructed north of the igloos, as well as Inyokern instrument shelters made from railroad ties, which were named for the Bikini-type foil gauges provided by the Naval Ordnance Test Station, Inyokern.

Five tests were conducted at the igloo test site in October 1946. The increase in explosives from 250,000 to 500,000 pounds during the tests established an extremely low risk of propagation from detonation at the reduced distance between igloos of 185 feet. The barracks damage was consistent with the 1945 tests and, although severe, damage decreased significantly with distance from the test site. As such the recommended minimum distance for inhabited buildings was not reduced.

Mass Detonation Area, 1946



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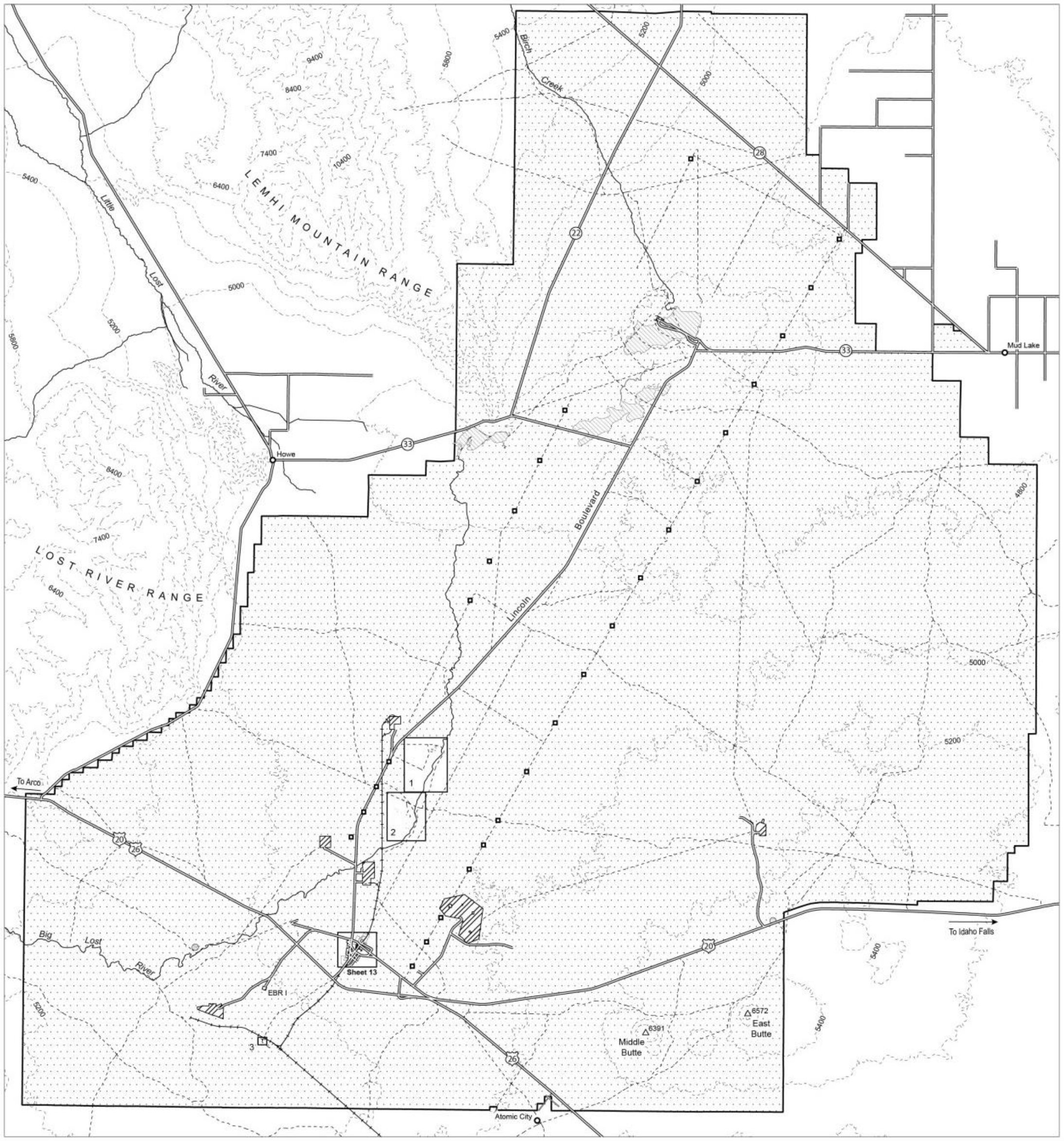
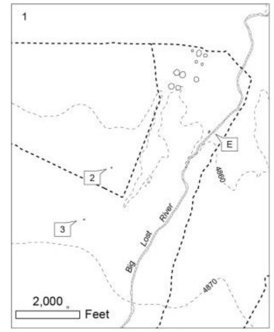
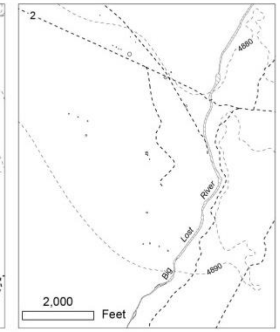




Mass Detonation Area



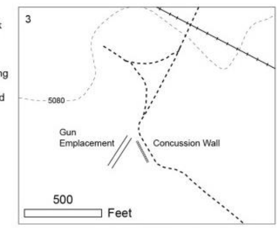
Barrier Wall Detonation Site

Explosives Testing Sites

The remnants of the explosives safety testing that took place at the Arco NPG can mostly be seen in the form of craters, only some of which can be associated with specific tests. Isolated structures remain at the mass detonation area (1) including concrete camera and firing stations, wooden instrument shelters and foundation posts for the barracks test buildings (Barracks 2, 3, and E). Six of the barrier walls remain standing at the original test site (2), surrounded by craters.

Naval Ordnance Test Facility (NOTF)

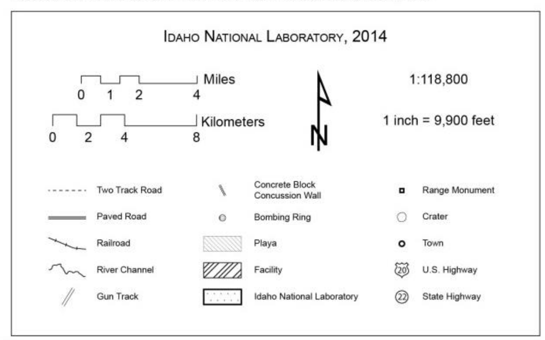
Proofing activities on the desert near Arco briefly resumed between 1968 and 1970 during the Vietnam War. However, the development of the NRTS on the Arco NPG range resulted in the creation of the NOTF (3), which was located south of the original proofing area. At this time, guns were instead fired toward Big Southern Butte, southwest of the new gun emplacement.



Naval Ordnance Test Facility (NOTF)

In 1949 the Arco NPG landscape became a nuclear energy research site when the Atomic Energy Commission (AEC) acquired the facility and adjoining land to establish the National Reactor Testing Station (NRTS). Today, what remains of the Arco NPG landscape resides within the 890 square miles of the Idaho National Laboratory (INL) under the jurisdiction of the Department of Energy Idaho Operations Office (DOE-ID). The infrastructure of the Arco NPG influenced the development of what is now the INL site in the subsequent years. The residential and proofing areas are now part of the Central Facilities Area (CFA) and sections of both West and Center Monument Line Roads are integrated into Lincoln Boulevard, which serves as a connector between State Highway 33 at the north of the site and U.S Highway 20/26 at the south. The remainder of the proofing range roads are partially accessible on West and Center Monument Line Roads and the entire length of East Monument Line Road, now referred to as T-17, is extant. Of the 38 original range monuments on West and East Monument Roads, 27 have been recorded on the present landscape.

Other INL facilities and isolated remnants of Arco NPG testing are located on a secure site that is inaccessible to the general public. One exception is the Experimental Breeder Reactor I (EBR I) due to designation as a National Historic Landmark the facility has been converted into an interpretive center for the public.



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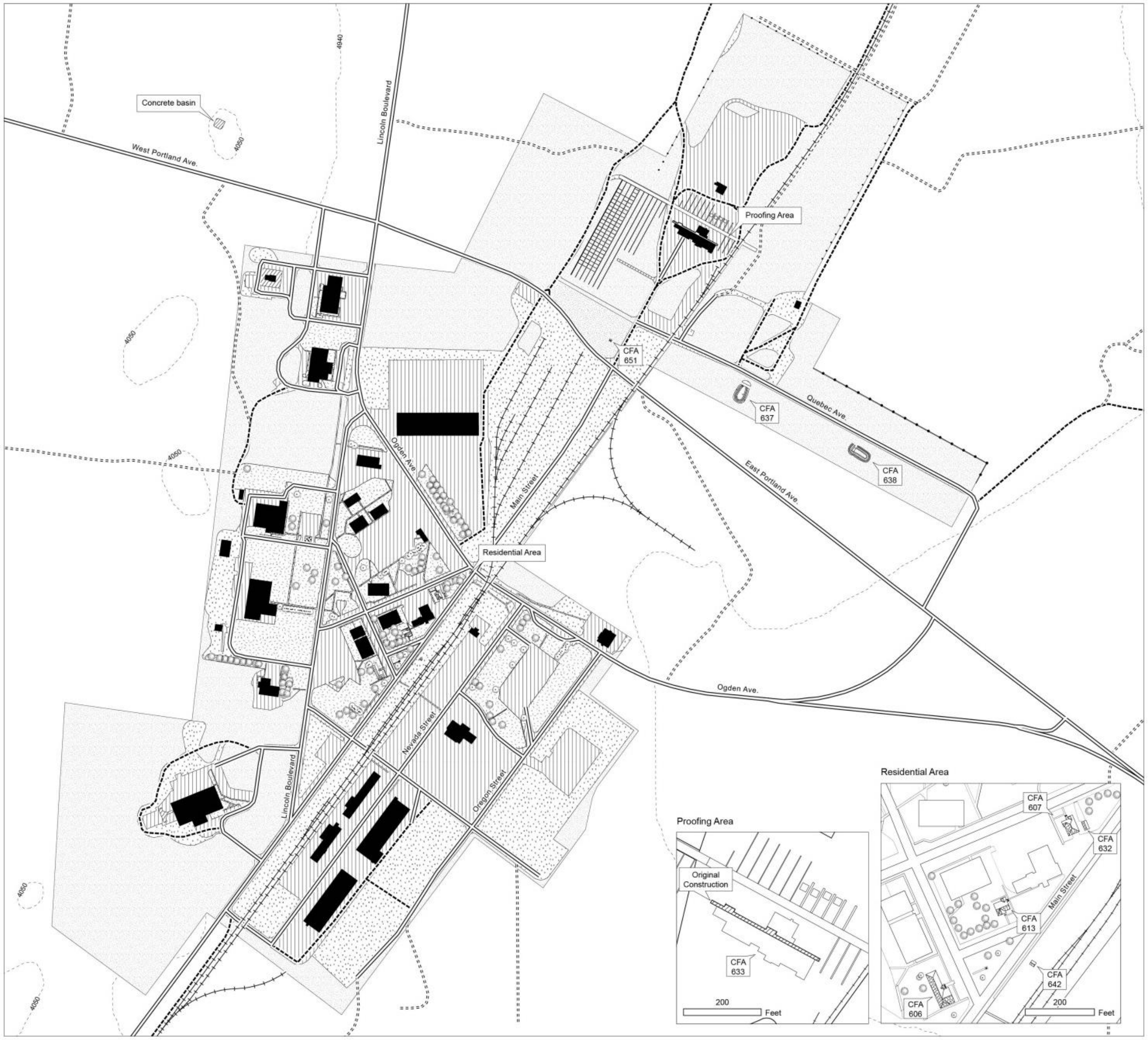

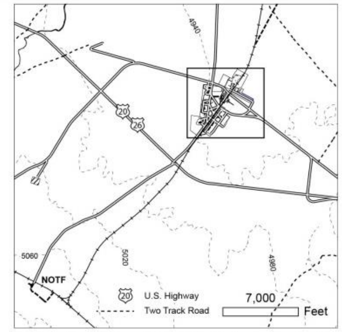

The Central Facilities Area at Idaho National Laboratory developed around the infrastructure of the Arco NPG proofing and residential areas. Immediately following the acquisition of the proving ground by the Atomic Energy Commission, buildings were repurposed to accommodate the needs of the NRTS. One battery attendants double house became the dispensary and other homes were turned into offices or laboratories. Over the years the buildings that could not be repurposed have been removed from the site, most prior to the mid-2000s. Of those that remain the two pump houses, one in the former proofing area (CFA-651) and one in the former residential area (CFA-642), and the explosive magazines (CFA- 637 and CFA-638) are in use today. The concussion wall (CFA-633) and adjoining structures have seen multiple additions in recent years and some of the associated proofing area structures are partially extant. Concrete alleys delineate the gun emplacement area to the northeast of the concussion wall and in the storage area the the west, where a number of timber planking support structures remain in place. Partial rail track from the Arco NPG is extant in the CFA area and the main Scoville spur remains intact and in use, including a later northern extension of the line. The 250-ton gantry crane used to transfer the guns still stands at the eastern end of the concussion wall. A number of the original concrete patrol lights mark the area where the proofing area fence once ran.

The former residential buildings remaining from the Arco NPG, like many of the buildings in the former proofing area, are vacant and include the commanding officers quarters (CFA-607) and garage (CFA-632), the caretaker's quarters (CFA-613), and the Marine barracks (CFA-606). The Marine barracks were extended at some point following the transfer of the Arco NPG. Other structures remaining from the World War II era include the concrete basin west of the proofing area and the garbage dump used by the residents of the Arco NPG.

Central Facilities Area, Idaho National Laboratory, 2014

Meters: 0 100 200
Feet: 0 300 600 900

1 inch = 300 feet 1:3,600

N

Two Track Road	Tree - Deciduous
Graded Road	Tree - Coniferous
Paved Road	Earth Covered Structure
Railroad	Disturbed Ground
River Channel	Grass
Fence	Gravel
Patrol Light	Concrete
Building - Masonry	Asphalt
Building - Post 1949 Construction	

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