

STRUCTURAL SURVEY

FORT DUPONT STATE PARK



DIVISION OF PARKS & RECREATION



DNREC

STATE OF DELAWARE



FDVP

GREDELL & ASSOCIATES
STRUCTURAL ENGINEERS

702 N. WEST STREET - WILMINGTON, DELAWARE 19801 - 302-428-7400
8 THE GREEN - DOVER, DELAWARE 19901 - 302-734-7400

AUGUST 1993

FINAL 11/9/93

FORT DUPONT STATE PARK

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DIVISION OF PARKS AND RECREATION

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GREDELL & ASSOCIATES
Structural Engineers
702 N. West Street
Wilmington, DE 19801
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EXECUTIVE SUMMARY

This report addresses the structural condition of fifteen (15) historic buildings and facilities at Fort DuPont State Park. The park is situated on approximately 185 acres along the east bank of the Delaware River immediately south of Delaware City, Delaware.

- o The land and improvements were transferred by custodial resolution from the State of Delaware, Department of Health and Social Services to DNREC, Division of Parks and Recreation. By the resolution, a total of twenty-five buildings and structures were transferred to the Division. Of these, fifteen are included in this study.
- o The park offers the opportunity to provide an interpretive recreational facility situated in an historic, military setting.
- o As early as 1863, fortifications were constructed at "Fort DuPont" as a complement to fortifications at Pea Patch Island (Fort Delaware) at Fort Mott in New Jersey. Substantial portions of the battery still remain, including several powder magazines and the battery including the gun mounts.
- o During the early 1900's, Fort DuPont was the headquarters for the Delaware River and Bay, Coast Artillery Regiments. During this period, the Officer's Quarters, Headquarters, NCO Club, Gymnasium/Post Exchange, Horse Barn and Quartermasters Buildings were constructed.
- o In 1922, the command of Fort DuPont changed hands to the Army Corps of Engineers. During this period, an Officers Residence was constructed.
- o Starting in 1940, the Works Progress Administration (WPA) carried out a fairly large building program including POW Barracks, Pole Shed and a Guard Tower. These facilities were constructed as part of a stockade which housed approximately 1,000 prisoners of war.
- o The findings and recommendations of this report are based on visual observations and selective probings of accessible portions of the structure. We have provided our recommendations based on three levels of priority - stabilization, preservation and restoration.
- o This report deals with the structural condition and integrity of the exterior envelope and does not include concerns regarding building interiors. However, it is important to recognize that conservation of these buildings must include provisions for heat and ventilation. Otherwise, condensation and thermal effects will adversely affect the performance of these buildings.

- o Alterations to several buildings since the initial construction have resulted in material, and in some cases, dimensional changes. For example: Asphalt shingles appear in place of original slate roofing; porches have been added or removed, original siding has been replaced with current materials. As a result of these modifications, we have defined "preservation" as work on original fabric to protect it from future deterioration and the replacement of deteriorated, non-original portions of the building envelope as required to preserve the structural elements within. We have defined "restoration" as the repair or replacement to match materials used in the original construction. In most cases, original materials can be determined from archived photos and drawings.

The following table is provided to summarize our cost estimates and show the total costs for stabilization, preservation or restoration of all the buildings in this study. In the event that not all buildings will receive the same extent of work, individual quantities should be increased for contingencies and engineering services since these markups are added to the subtotals of each column.

Bldg.	Description	Stabilization	Preservation	Restoration
101	Officers Quarters	0	32,440	38,550
104	Headquarters	0	6,515	32,687
106	NCO Club	0	16,575	76,625
107	Gym/PX	1,000	26,898	28,658
109	Residence	0	3,470	4,110
111	Horse Barn	0	9,210	18,214
115	Quartermasters Building	0	26,266	45,534
117	1863 Earthen Bunker	0	7,100	19,700
118	Batteries Reed & Gibson	11,500	704,943	880,092
119	Powder Magazines	0	4,850	29,165
120	Battery Richie	5,500	177,989	197,490
121	Brick Tower Foundation	983	9,312	28,033
122	POW Barracks East Building	2,346	25,133	77,609
	West Building	0	26,120	53,480
124	Pole Shed	1,660	18,670	31,270
125	POW Guard Tower	5,250	22,625	34,025
Subtotals		\$28,239	\$1,118,116	\$1,595,242
Contingencies (20%)		<u>5,648</u>	<u>223,623</u>	<u>319,048</u>
		\$33,887	\$1,341,739	\$1,914,290
Architect/Engineer		<u>5,083</u>	<u>134,174</u>	<u>191,429</u>
Administration (Average)				
Project Totals		<u>\$38,970</u>	<u>\$1,475,913</u>	<u>\$2,105,719</u>

INTRODUCTION

Since early colonial times, the growth, development and protection of the Delaware River was paramount in the minds of both military and civilian interests. Control of the river was best achieved at a location where the river was narrow, thereby enabling shoreline fortifications to be more effective in dealing with unfriendly intruders who were headed upriver.

In the early 19th century, military officials realized the strategic advantages of fortifying the Delaware River in the vicinity of Delaware City where the river could be controlled with fortifications on both sides and from Pea Patch Island located at near mid-river. By 1825, a fort was erected at Pea Patch Island; however, it did not survive due to subsidence of the foundations and a fire in 1831.

With the opening of the Chesapeake and Delaware Canal in 1829, the strategic importance of a fortification immediately down river was all the more realized. In 1849, the construction of Fort Delaware, as we recognize it today, was begun. The fort was constructed of cut and dressed granite stone, which was quarried in Maine and Massachusetts, set on timber grillage supported by timber piles. By January 1861, the fortification was ready for armament.

According to available records, the first artillery battery located on the Delaware shoreline, in the vicinity of Delaware City, was constructed in 1863. The battery consisted of a gun emplacement and several powder magazines encased in concrete and covered with several feet of earth. Substantial portions of the battery still remain, including the bunkers (No. 119)** and mounts for the gun emplacements (No. 117).

In 1898, the artillery battery just down river of Delaware City was expanded. On July 22, 1898, the site was named Fort DuPont after Rear Admiral Samuel Francis DuPont, a Civil War Naval Officer.

Constructed on a 112 acre tract of land, the Fort combined with Fort Delaware and Fort Mott in New Jersey and became what was considered an impregnable harbor defense. During this period, Batteries Richie (No. 120), Reed and Gibson (No. 118) were constructed for positioning the larger guns at the Fort. Noteworthy is that during the same period, Fort Delaware on Pea Patch Island was modified for the larger "disappearing" guns.

During the early 1900's, Fort Dupont was the headquarters for the Delaware River and Bay, Coast Artillery Regiments. During this period, the Officers' Quarters (No. 101), Headquarters (No. 104), NCO Club (No. 106), Gymnasium/Post Exchange (No. 109), Horse Barn (No. 111), and the Quartermasters Buildings (No. 115) were constructed; although in some instances they were constructed for other uses than those of present day.

In 1922, the command of Fort DuPont changed hands to the Army Corps of Engineers. During this period, a Residential Building (No. 109) was constructed. Starting in 1940, the Works Progress Administration (WPA) carried out a large building program which included several new buildings and facilities. These include the POW Barracks (No. 122), Pole Shed (No. 124) and the Guard Tower (No. 125). These facilities were constructed as part of a stockade

which housed approximately 1,000 German prisoners of war.

In 1945, Fort DuPont was declared government surplus and in 1947 was formally turned over to the State of Delaware for the establishment of the Governor Bacon Health Center which was officially dedicated on October 28, 1948.

In March 1993, approximately 185 acres of land were transferred by custodial resolution from the State of Delaware, Department of Health and Social Services to DNREC, Division of Parks and Recreation for the purpose of establishing a recreational complex known as Fort DuPont State Park.

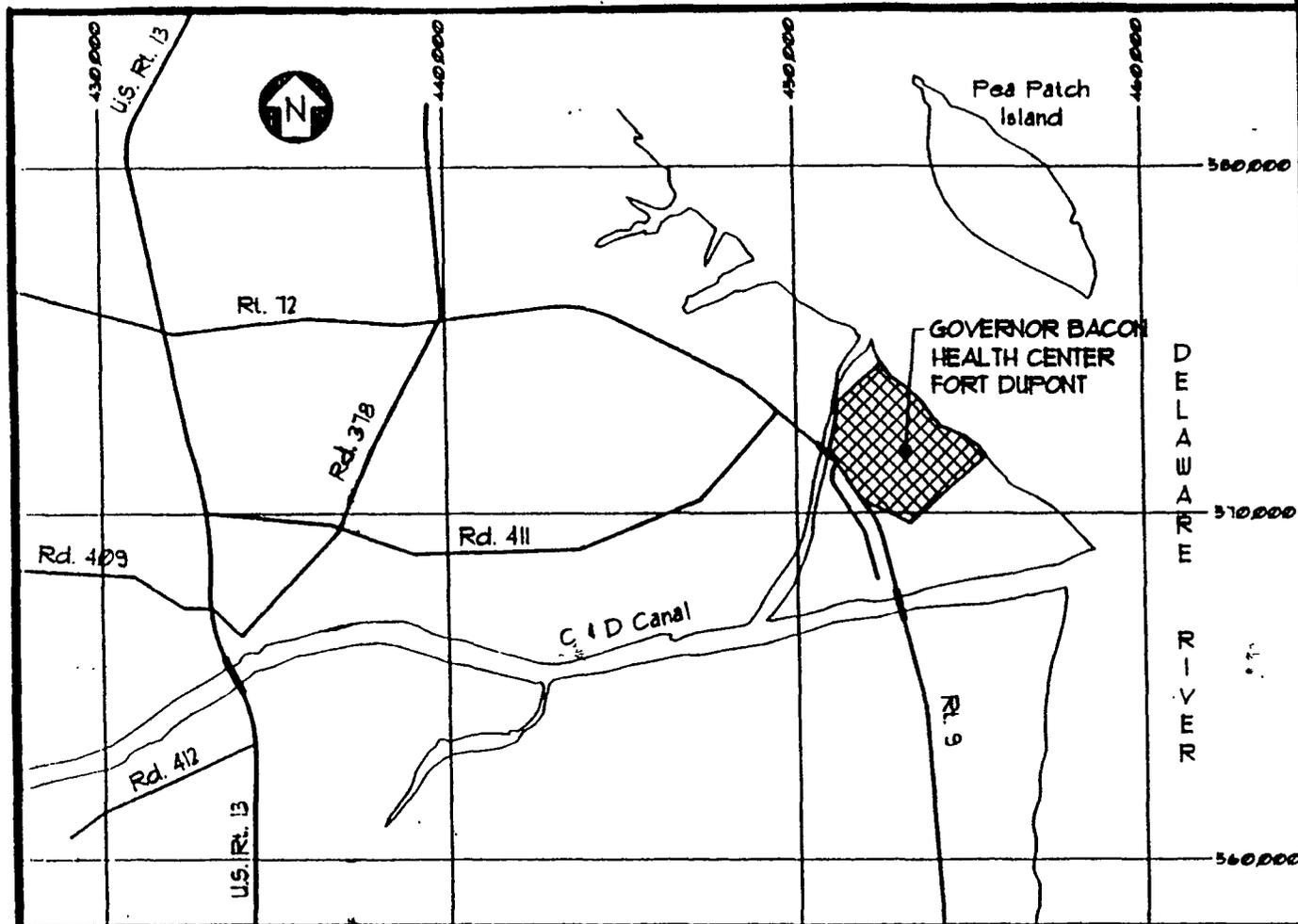
This study is dedicated to determining the structural condition and the integrity of the exterior envelope for fifteen (15) buildings and facilities as indicated on the following plan of Fort DuPont State Park.

Our review was based on visual observations and selective probings of these portions of the structure which were accessible. Where structural elements of the building could not be accessed without extensive demolition, our findings are provided based on the observed alignment of the building (ie. leans, sags and other misalignments indicate failure of the structure). We have provided our recommendations based on the three levels of priority for the proposed work - stabilization, preservation and restoration.

It is significant to note that our assessment does not provide for the interiors of the buildings. However, it is important to recognize that the conservation of these buildings must include provisions for both heat and ventilation within. Without such provisions, condensation and thermal movement will adversely affect interior finishes. In order to quantify the significance of these concerns, decisions must be made as to how the interiors of the buildings will be utilized in the proposed park facility.

We have prepared order of magnitude estimates of construction cost for the various priorities selected. These estimates are based on experience and Means Building Construction Cost Data prepared by R.S. Means Company, Inc., 1993.

** {Numerical identification of buildings and facilities transferred from State of Delaware Department of Health and Social Services to DNREC, Division of Parks and Recreation}.

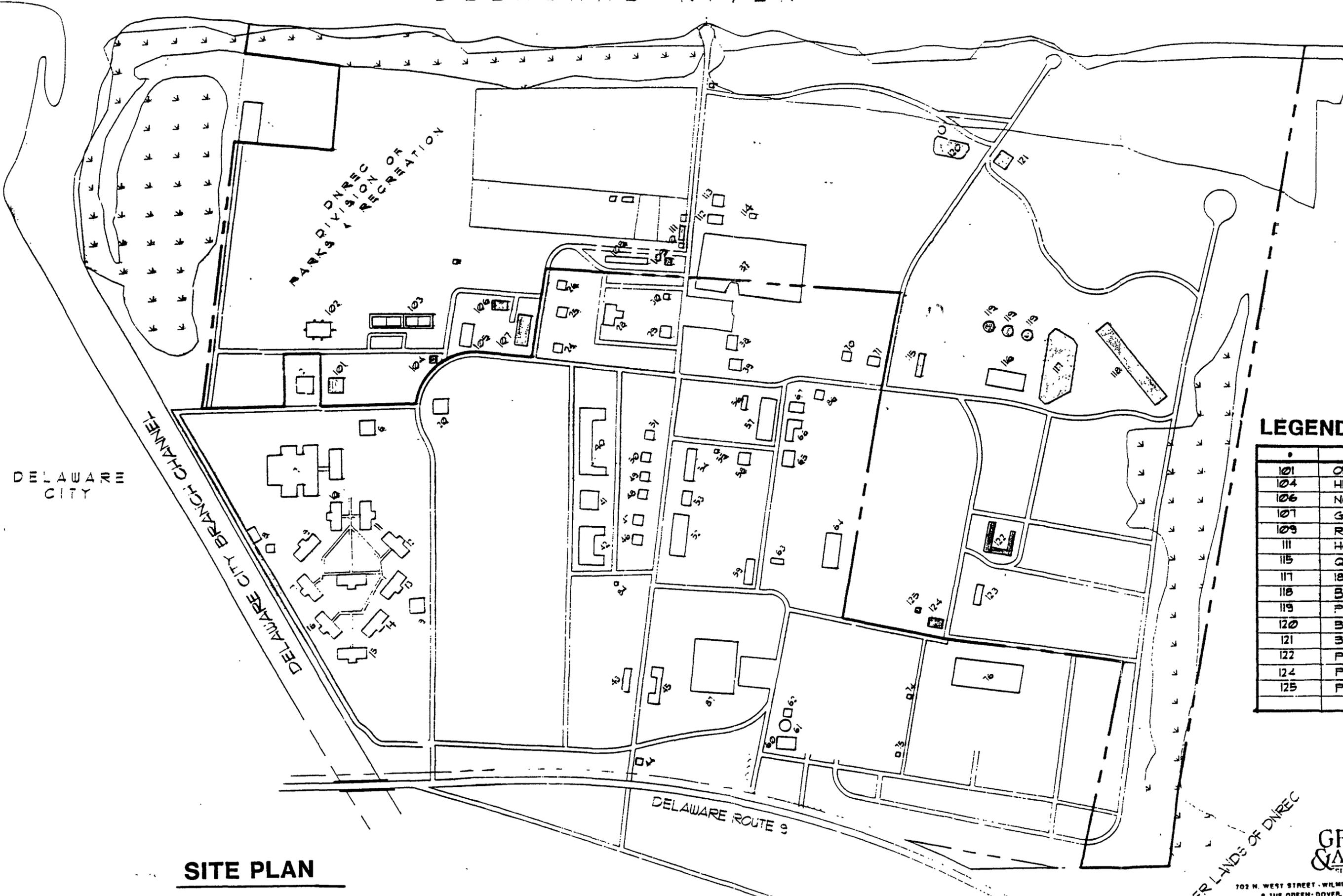


LOCATION MAP

SCALE: 1" = 1 MILE

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MARKS DIVISION OF RECREATION

DELAWARE CITY

DELAWARE CITY BRANCH CHANNEL

DELAWARE ROUTE 9

OTHER LANDS OF DNREC



LEGEND

•	NAME
101	OFFICER'S QUARTERS
104	HEADQUARTERS
106	NCO CLUB
107	GYM/PX
109	RESIDENCE
111	HORSE BARN
115	QUARTERMASTER'S BLD
117	1863 EARTHEN BUNKER
118	BATTERIES REED & GIBSON
119	POWDER MAGAZINES
120	BATTERY RICHIE
121	BRICK TOWER FOUNDATION
122	P.O.W. BARRACKS
124	POLE SHED
125	P.O.W. GUARD TOWER

SITE PLAN

SCALE: 1" = 300.00'

GREDELL & ASSOCIATES
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OFFICERS' QUARTERS



CIRCA 1910



1993

OFFICERS' QUARTERS

Officers' Quarters - Building 101

DESCRIPTION

The building is a two story, brick, residential structure with load bearing exterior walls constructed over a full basement. The building is constructed as a duplex, with 2 separate residential units symmetric about a central party wall. The building is currently vacant.

FINDINGS

The main block of the duplex is rectangular in plan with a small projection at the rear of the building. There is a full width covered porch across the front elevation. At the rear elevation, a full width timber deck exists. On either side elevation, a large one story bay window projects out at the first floor. The walls are brick, with timber floor and roof framing.

Although the floor and roof framing was not exposed, there were no visible signs of distress which would indicate any structural deficiencies.

1. Historical

Our research of archival information resulted in discovering that the structure was constructed circa 1910, for a total cost of \$13,384.75 as shown by a photograph taken soon after construction. Comparing the original photo with the present, it can be observed that with the exception of the porch structures, the building has undergone few alterations.

2. Brickwork

In general, the brick is hard and in good condition. The pointing of the brick piers supporting the front porch is in poor condition. Approximately 100 square feet of exterior brick requires repointing.

3. Concrete

The concrete step located at the bottom of the front porch stairway is severely deteriorated due to freeze/thaw damage. See photos 7, 15 & 16. There are three piers supporting the rear deck that exhibit loose, spalled concrete which requires repair.

4. Floors

A majority of the porch decking is severely weathered with portions of the decking cupped and/or rotted. The porch framing at the outboard sections is deteriorated; especially at the post bearings.

See photos 6, 7, and 8. The porch stairs have several rotted/deteriorated treads and risers. See photo 7. At the front porch railing there is an accumulation of wood dust directly below the railing on the deck structure; evidence of an active infestation of wood boring insects (probably carpenter bees). See photos 9 and 10. The porch skirting frames are broken and cracked at several locations. See photo 6. The interior floor framing is in relatively good condition. There were no indications of structural distress.

5. Roofs

Although not exposed, the roof lines are straight and true indicating no signs of structural distress. The original structure had a slate roof which has been replaced with asphalt shingles. The shingles are in good condition. The porch has a standing seam metal roof which was observed to be in good condition. The front porch gutters are in need of replacement. See photo 5. There are several downspouts which require replacement. See photo 11. The integral gutters exhibit signs of corrosion. There was some water damage observed in the ceiling of the rear bedrooms exterior; however, it appears that the cause of the damage has been previously rectified.

6. Millwork

At the eaves, the cornice molding, fascia and especially soffit boards are deteriorated requiring replacement. See photo 12.

7. Doors and Windows

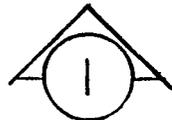
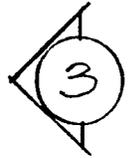
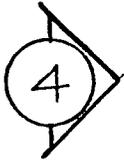
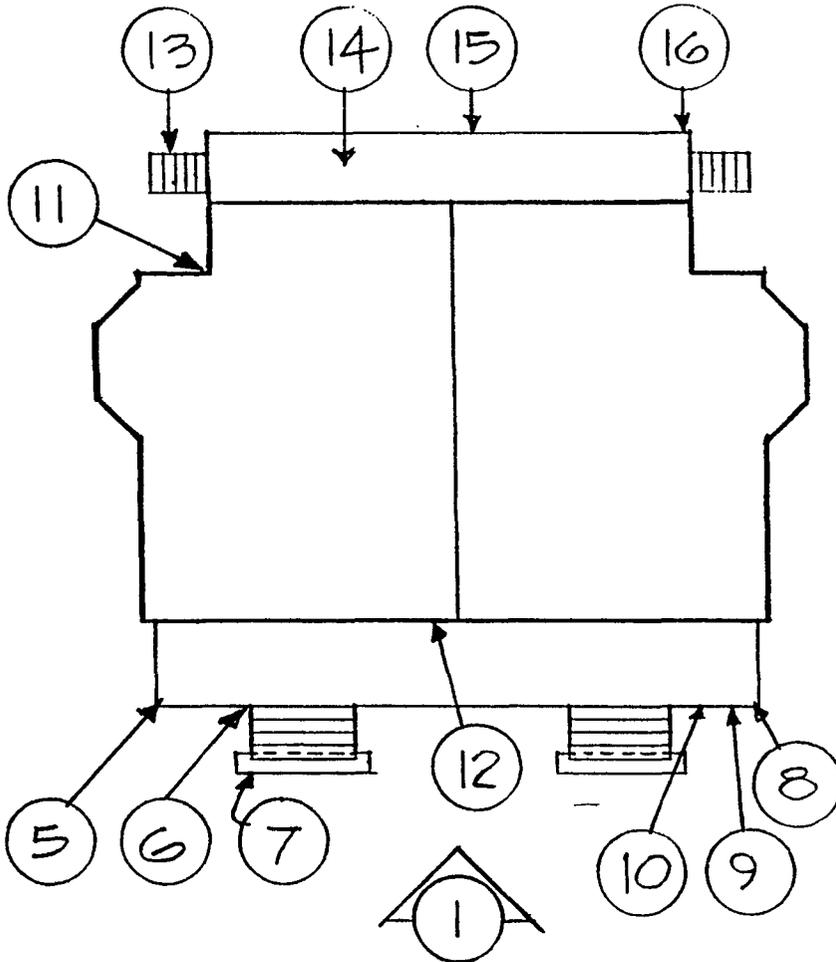
There are several windows which have damaged screens, broken lites, missing or inoperable storm windows. Both front doors need to be re-worked to become operable; one door is currently boarded up. See photo 1. The basement exterior doors are boarded shut. There are also several basement windows which are presently covered. There is a considerable amount of leaves in the basement door areaways. The drains appear clogged.

8. Finishes

The paint on the front porch is in extremely poor condition. See photo 8. The window trim, soffits, and fascia require stripping and repainting. It is highly probable that the existing paint is lead based, which will require special removal and disposal considerations. The rear deck requires repainting.

9. General

Several pipes visible in the basement appear to be wrapped with asbestos insulation. There is a considerable amount of old furniture and stored materials scattered throughout both units.



SUSSEX AVE.

KEY PLAN
PHOTOGRAPHS

OFFICERS' QUARTERS (101)

**GREDELL
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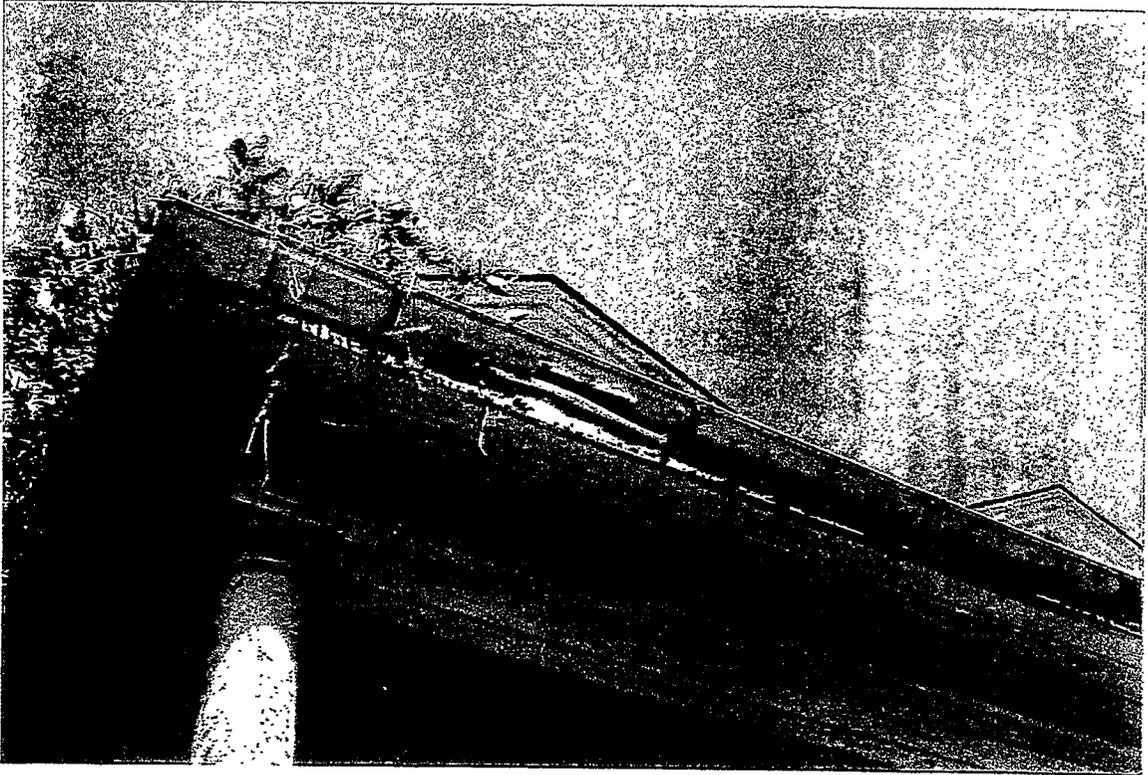
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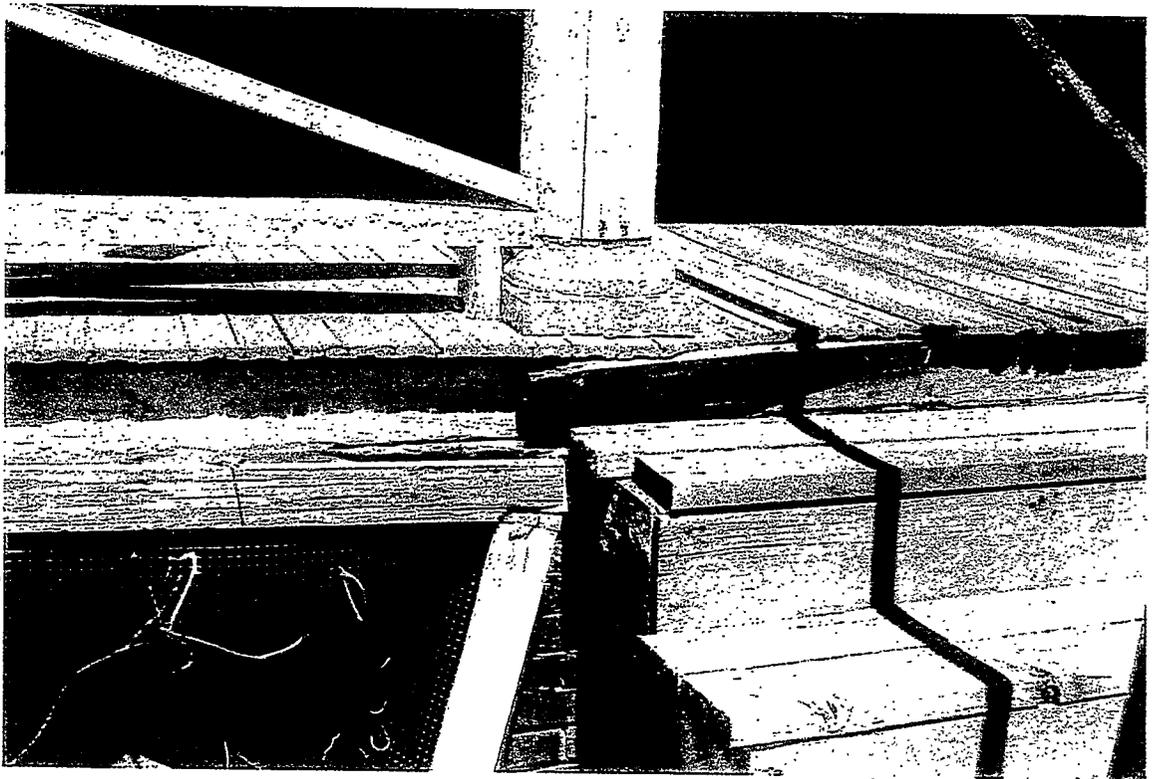
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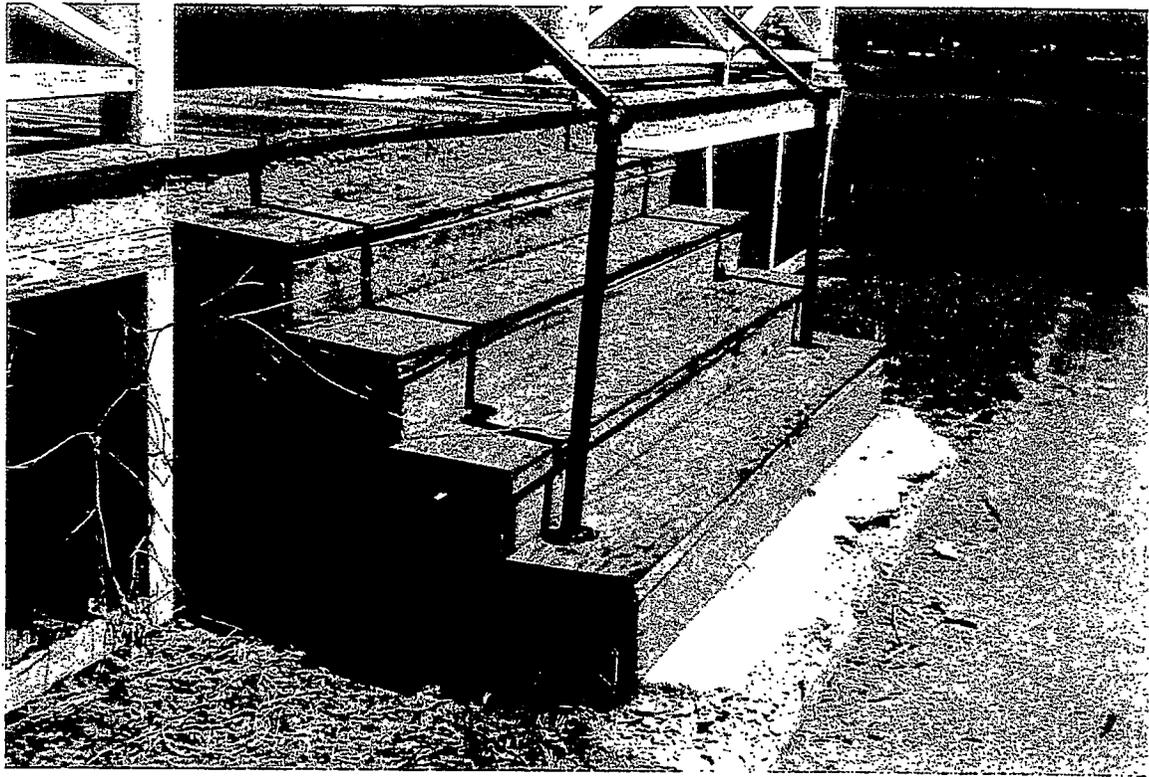
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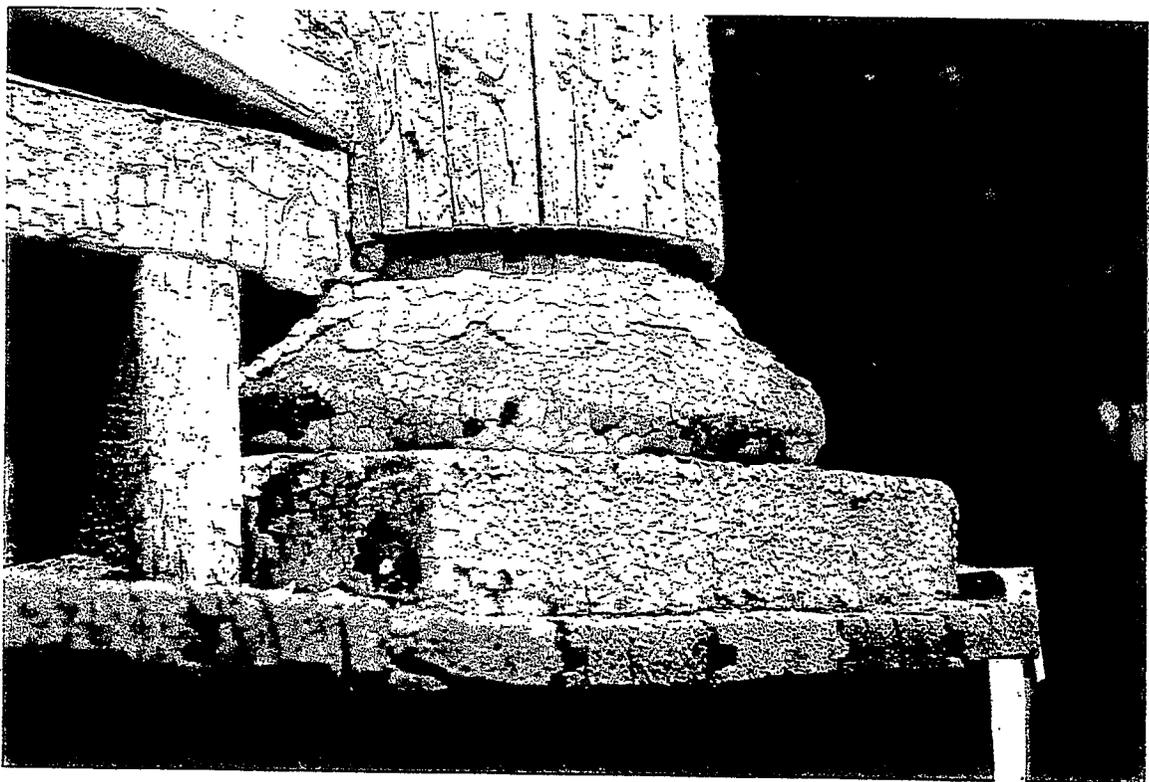
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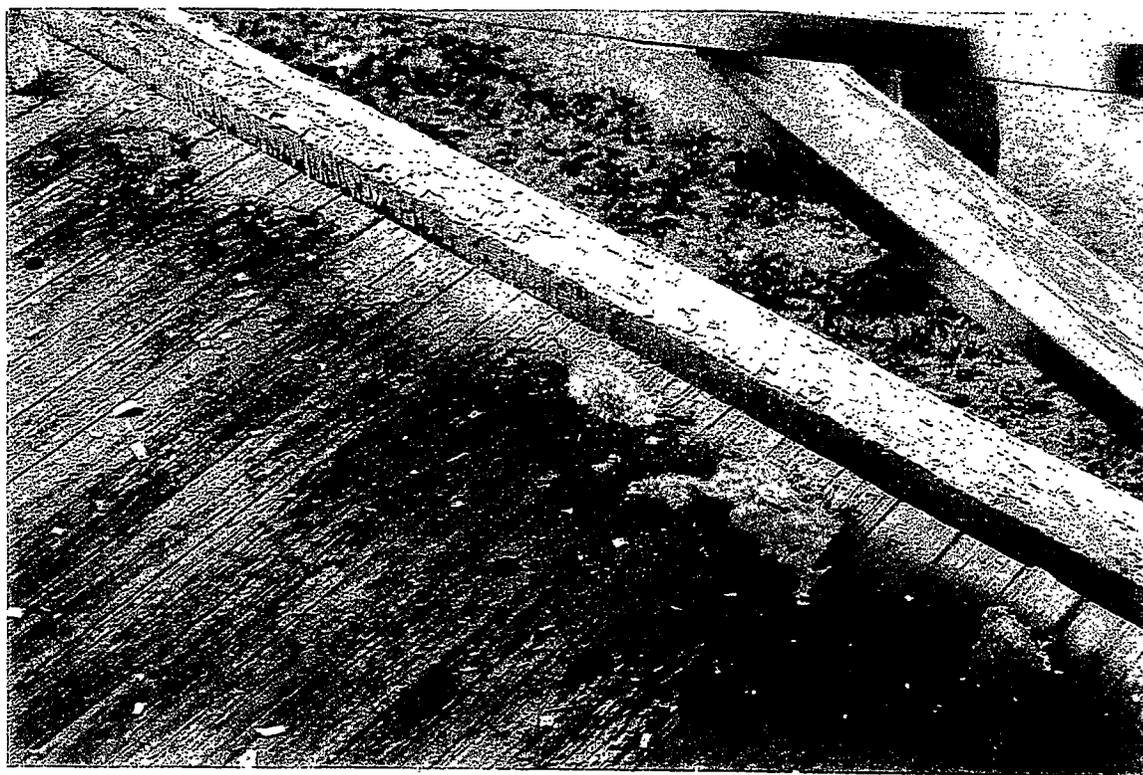
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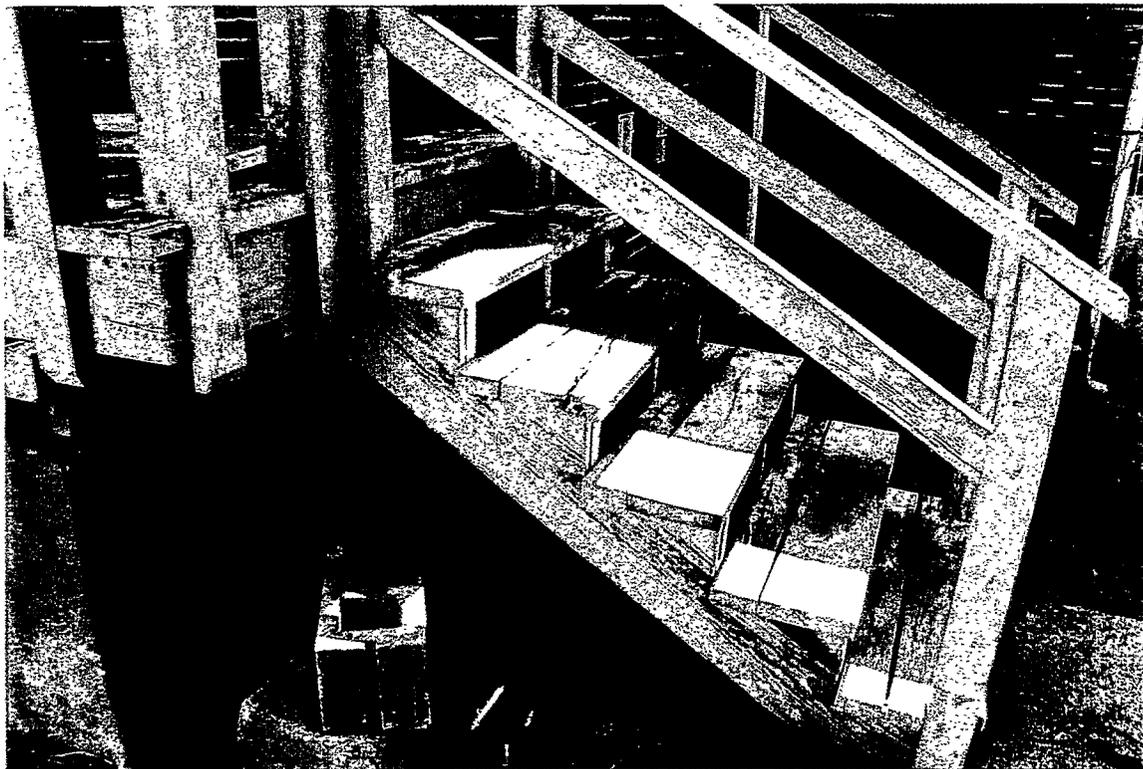
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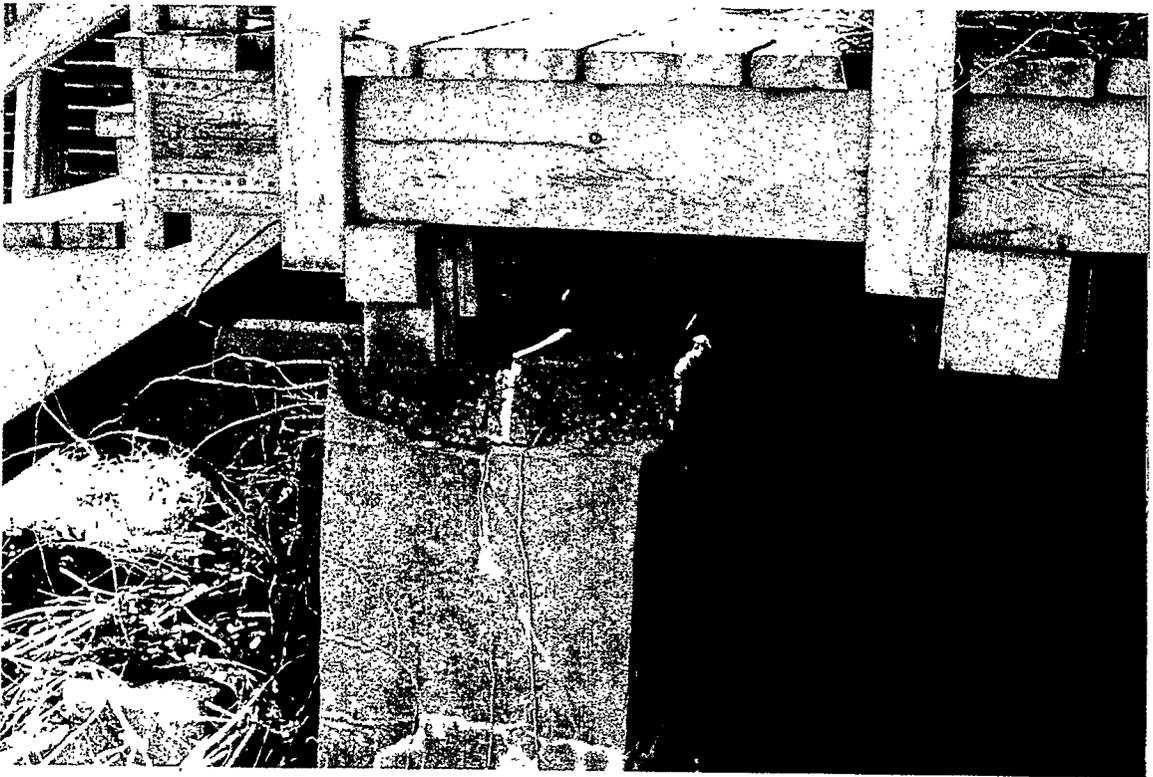
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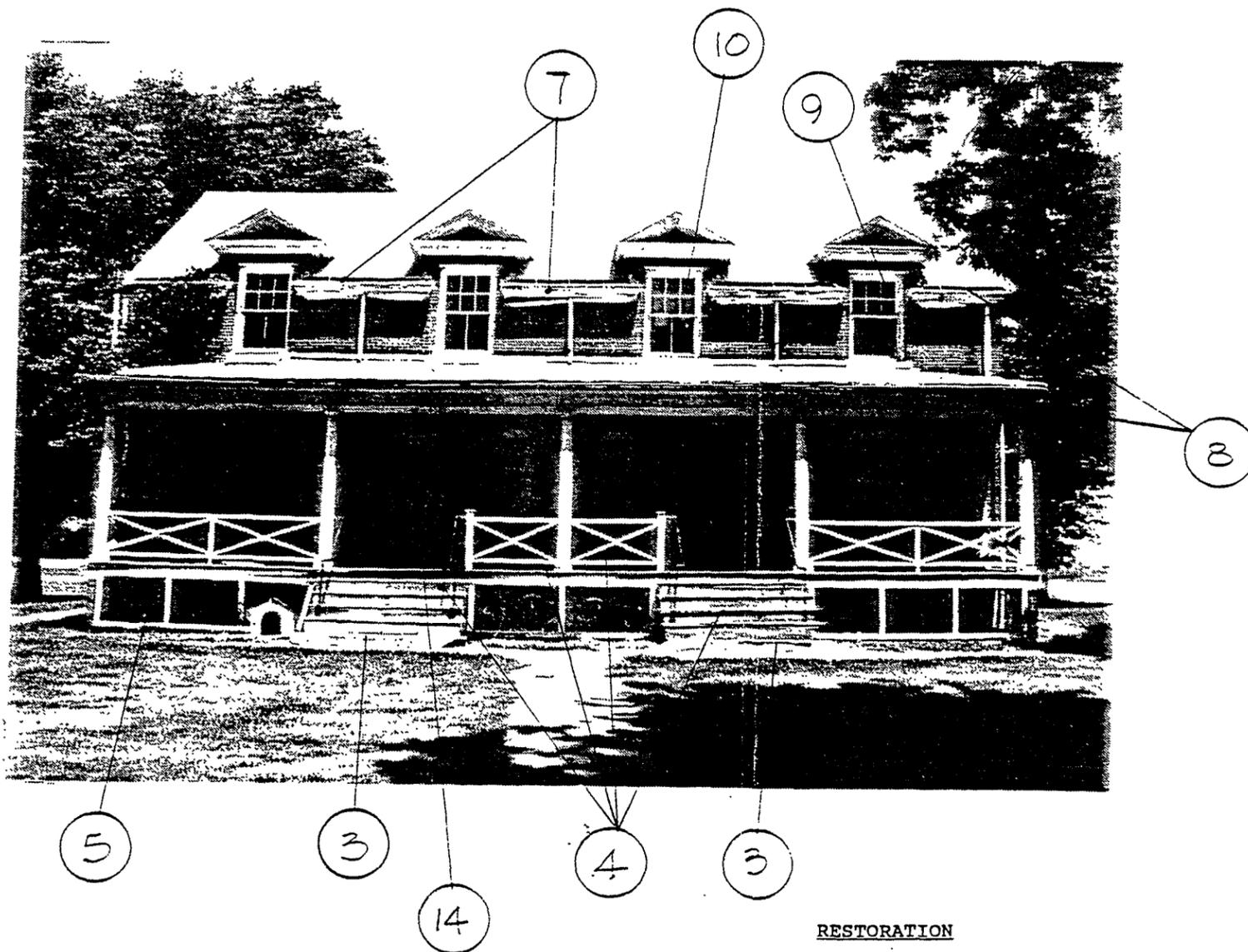
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15



16



STABILIZATION

No work required.

PRESERVATION

1. Repoint exterior walls. (Approximately 100 sq. ft. req'd.)
2. Repoint front porch piers.
3. Remove deteriorated concrete at porch step landings. Provide similar repairs at rear deck piers.
4. Replace front porch railing, decking, and deteriorated stair treads and risers.
5. Restore front porch skirting to allow for access below porch and to prevent access by unwanted animals.
6. Replace deteriorated/rotted wood in rear deck steps and deck structure.
7. Repair deteriorated exterior millwork at eaves.
8. Repair/replace all gutters.
9. Replace/repair windows and doors including screens.
10. Strip and repaint all exterior window casings/sills, porches, gutters and eaves. Investigate if special precautions are necessary due to lead based paint.
11. Clean out debris at basement door areaways and provide positive drainage.
12. Obtain the services of an exterminator to inspect and treat the entire structure for any active infestation.

RESTORATION

13. Rebuild front porch to match original construction.
14. Replace doors to match original construction.
15. Rebuild rear porch similar to front porch.

RECOMMENDATIONS
OFFICERS' QUARTERS
BLDG. 101

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PRELIMINARY COST ESTIMATE

OFFICERS' QUARTERS - BUILDING 101

Stabilization

No Work Required.

Subtotal Stabilization \$ 0

Preservation

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Repoint exterior walls	100	S.F.	\$ 1.50	\$ 1,500.00
2.	Repoint piers	60	L.S.		\$ 500.00
3.	Repair concrete landings & piers	20	L.S.		\$ 550.00
4.	Front Porch				
	a. railing	70	L.F.	\$ 20.00	\$ 1,400.00
	b. decking	400	S.F.	\$ 10.00	\$ 4,000.00
	C. stairs	2	EA	\$ 600.00	\$ 1,200.00
5.	New front porch skirting	160	S.F.	\$ 10.00	\$ 1,600.00
6.	Repair/replace rotted rear deck & stairs	800	S.F.	\$ 10.00	\$ 8,000.00
7.	Repair cornice molding	50	L.F.	\$ 10.00	\$ 500.00
8.	Repair/replace all gutters	100	L.F.	\$ 3.50	\$ 350.00
9.	Repair/replace windows & doors with screens	32	EA	\$ 320.00	\$10,240.00
10.	Repaint exterior	2000	S.F.	\$.80	\$ 1,600.00
11.	Remove debris at basement door areaways		L.S.		\$ 500.00
12.	Wood boring insect inspection		L.S.		<u>\$ 500.00</u>

Subtotal Stabilization & Preservation \$32,440.00

Contingencies 20% \$ 6,488.00

\$38,928.00

Eng. & Admin. 15% \$ 5,839.00

Total Project Cost \$44,767.00

Restoration (Alternate)

13. Rebuild front porch to match original construction	350 SF	S.F.	\$ 27.29	\$ 9,550.00
14. Replace doors to match original construction	4	EA	\$ 1,200.00	\$ 4,800.00
15. Rebuild rear porch similar to front porch	280 SF	S.F.	\$ 27.29	<u>\$ 7,640.00</u>

Subtotal Restoration \$21,990.00

Alternate Project Cost to Restore Structure to Original Construction

Subtotal Stabilization & Preservation \$32,440.00

Add Restoration Subtotal \$21,990.00

Deduct Item 4 -\$ 6,600.00

Deduct Item 6 -\$ 8,000.00

Deduct Doors from Item 9 -\$ 1,280.00

Subtotal Alternate \$38,550.00

Contingencies 20% \$ 7,710.00

\$46,260.00

Eng. & Admin. 15% \$ 6,939.00

Total Alternate Project Cost \$53,199.00

HEADQUARTERS

Sub-Admin

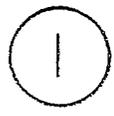
86



CIRCA 1901



1993



HEADQUARTERS

Headquarters - Building 104

DESCRIPTION

The headquarters building is a two story, frame structure over a full basement, founded on concrete foundation walls faced with a stone ashlar veneer. The building is rectangular in plan comprising approximately 2,500 square feet. The building currently houses office space for the Delaware Bay Marine Institute.

FINDINGS

1. Historical

From our review of archival information, we understand the structure was constructed circa 1901 for a total cost of \$4,095.00. A comparison of the original photo to the present structure reveals that the structure once had a covered porch at the front elevation which has been removed. It is also evident that the original clapboard siding has been replaced with a pressed fiberboard siding.

2. Concrete

The exterior foundation walls are concrete and in good condition with no visible signs of distress. The basement was found to be dry.

3. Floors

There are two intermediate 8" brick bearing walls running front to back and form the central hallway. The walls support the 2-1/2x12 floor joists spaced at 16" o.c. and spanning transversely (side to side). The framing is in good condition. The basement ceiling consists of wood lath and plaster. Above the boiler area, a pressed tin ceiling was observed.

4. Roofing

The asphalt roof shingles are somewhat weathered, especially on the south elevation; an indication that points towards roof replacement requirements. See Photo 7. There are some missing downspouts which will require replacement. See photos 8 and 9. Water was noted to be dripping from along the front gutters indicating that the gutters do not slope adequately. The tree limbs on the left elevation are rubbing against the building and should be pruned. See photos 4 and 8. The wall and roof framing were not exposed for inspection, however, there were no visible signs of distress.

5. Doors and Windows

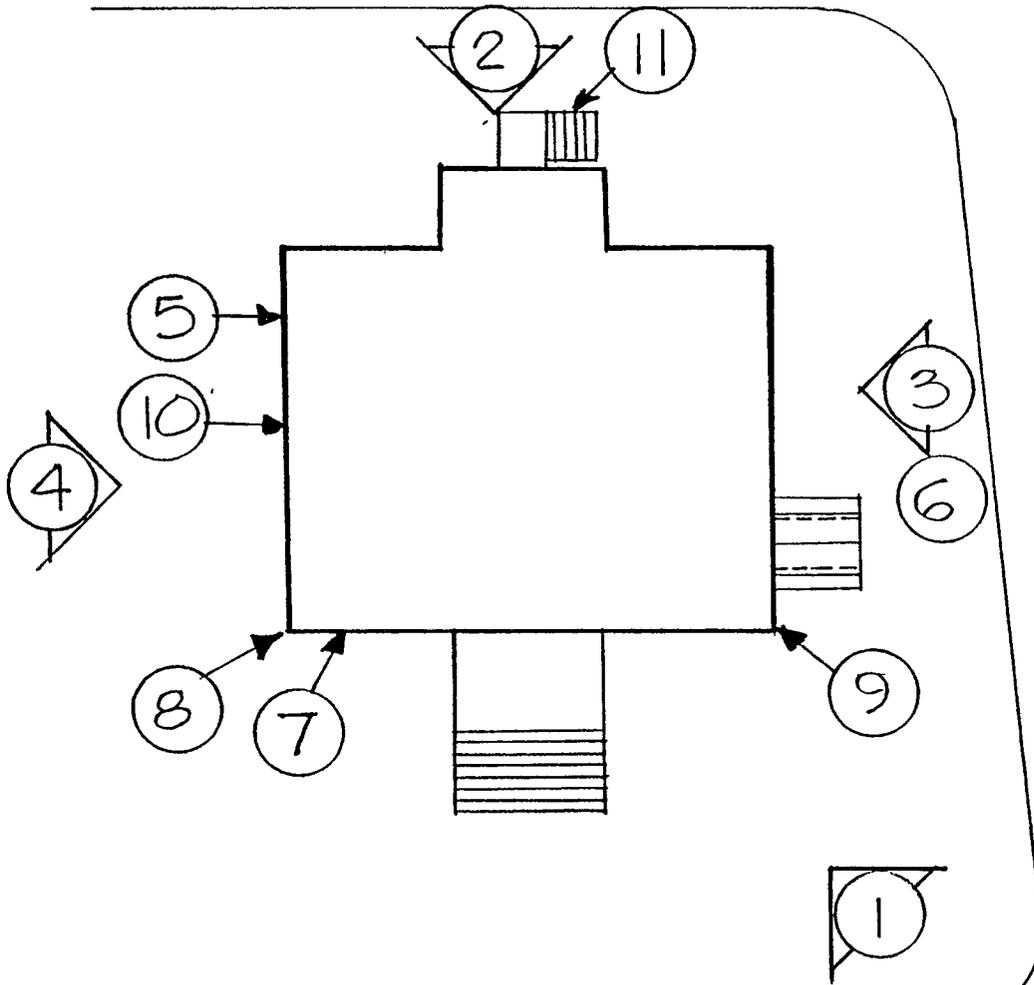
The exterior doors and window trim is in need of repainting. On the right elevation, a set of storm doors provide access to the basement. At the head of the doors, a 3x3 angle is mounted to the exterior wall which requires repainting and caulking. The stone facing below the doors require repointing. The doors do not seal tightly and thereby allow rodents to access the basement. See photo 6. Ripped, torn or missing screens were observed on several windows. See photo 5. The windows require reglazing and the storm windows require repairs to become operable. There are some windows which are cracked and will require replacement. See photo 10. The black wrought iron railing at the front stairway is in need of repainting. In addition, there are several welds which need repair. See photo 1.

6. Finishes

The rear deck and steps are weathered and require repainting. See photos 2 and 11. There are a few locations where pieces of siding are missing. The plaster walls exhibit minor cracks and bulges.

7. General

Piping in the basement appears to be wrapped in asbestos insulation.



SUSSEX AVE.

KEY PLAN
PHOTOGRAPHS

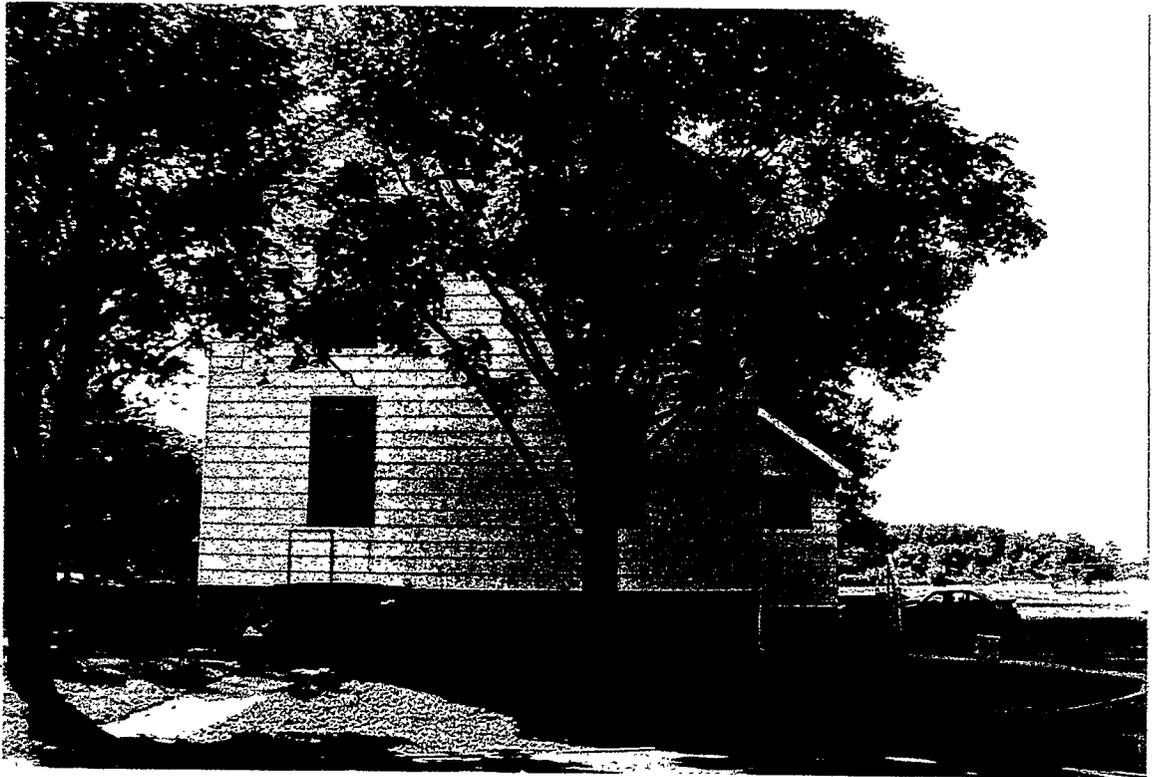
HEADQUARTERS (104)

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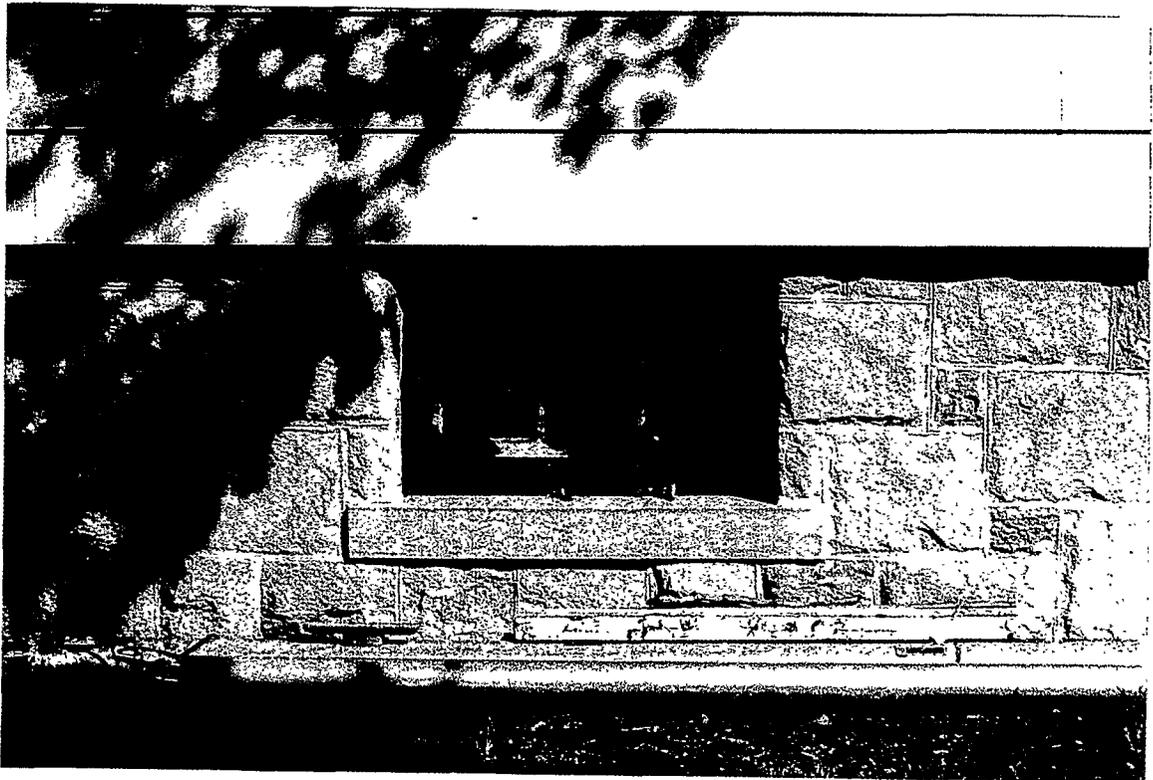
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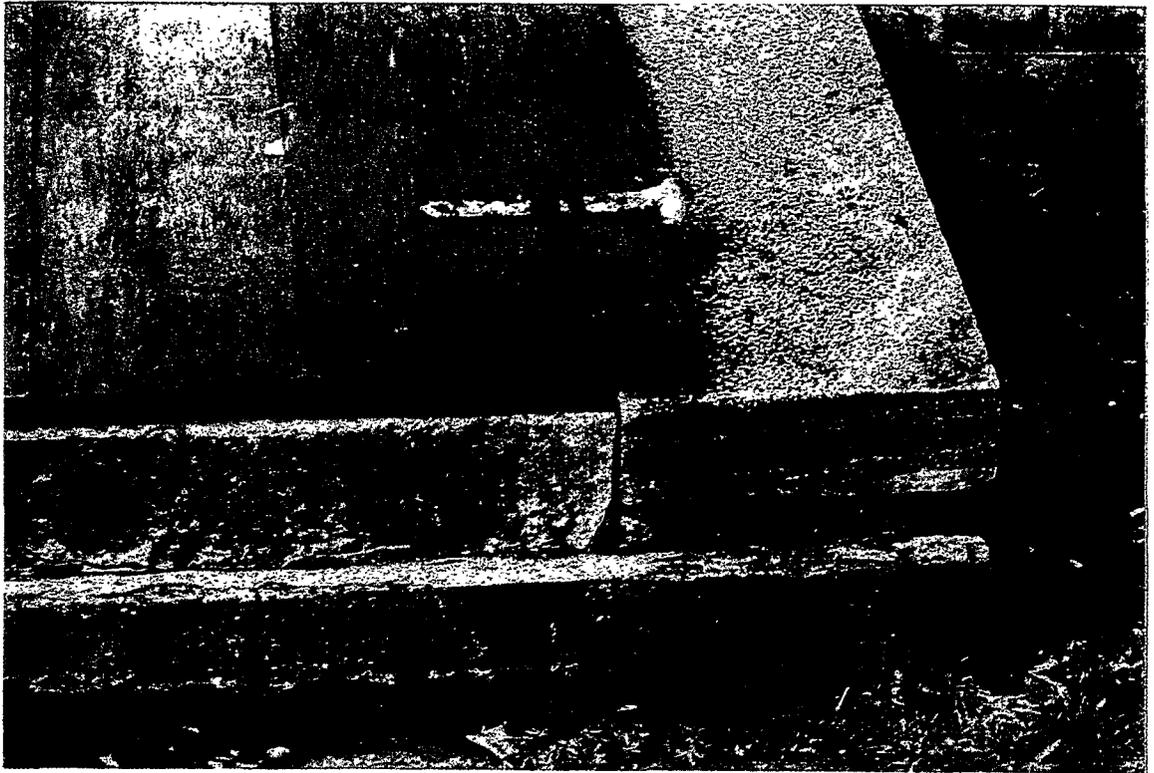
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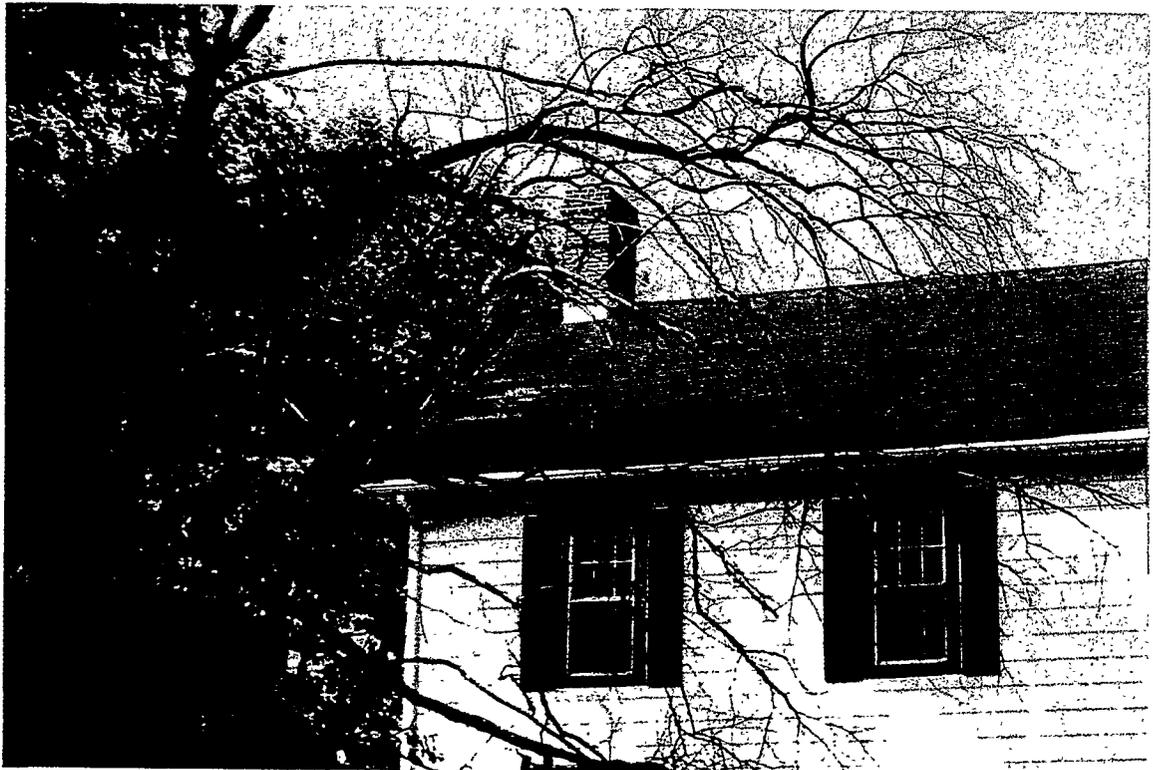
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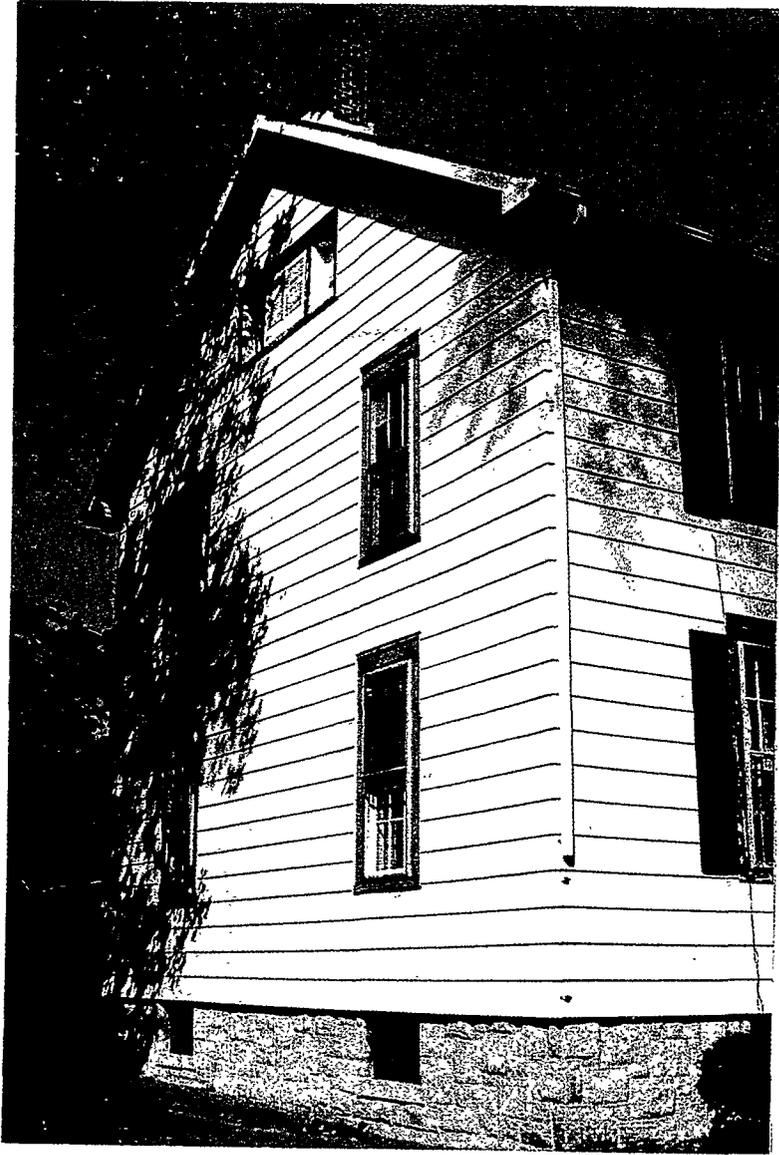
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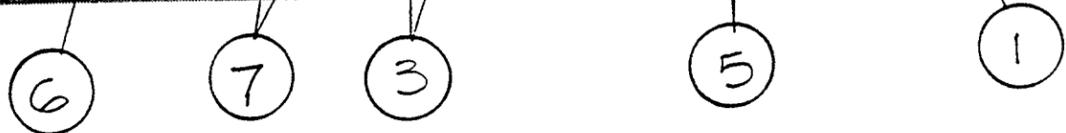
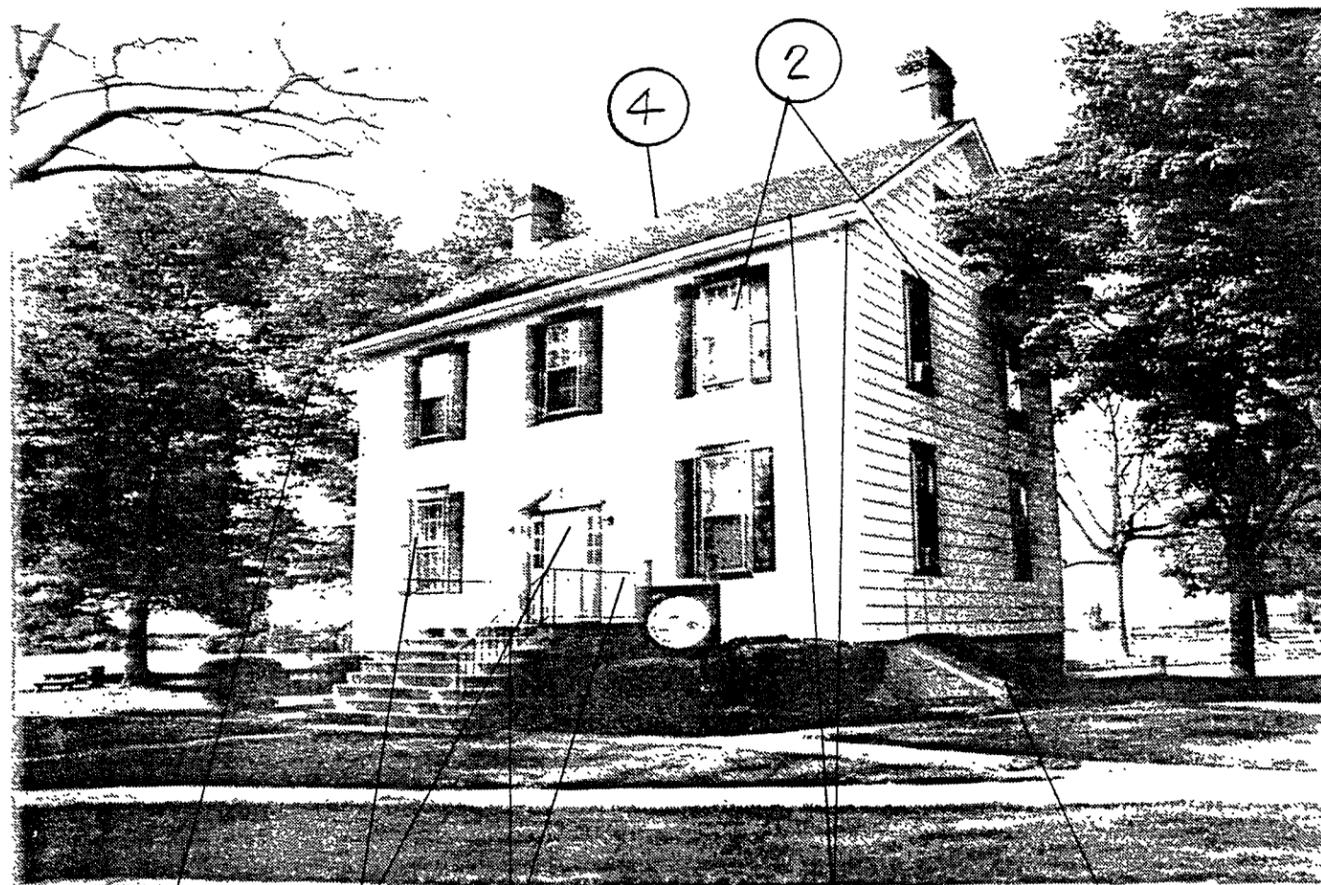
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STABILIZATION

No work required.

PRESERVATION

1. Repair basement exterior doors to provide weathertight seal.
2. Repair/replace broken windows and screens.
3. Repair and repaint iron railing at front entrance.
4. Replace asphalt roof shingles.
5. Repair/replace missing downspouts. Re-hang front gutter to provide positive slope.
6. Prune tree on left side.
7. Strip and repaint all exterior wood trim and doors. Investigate possible lead based paint removal.

RESTORATION

8. Rebuild front porch as originally constructed.
9. Remove existing siding and replace with wood siding.
10. Remove shutters.
11. Replace roofing with slate.

RECOMMENDATIONS

HEADQUARTERS

BLDG. 104

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

702 N. WEST STREET - WILMINGTON, DELAWARE 19801 • 302-429-7400
5 THE GREEN - DOVER, DELAWARE 19801 • 302-734-7400

PRELIMINARY COST ESTIMATE

HEADQUARTERS - BUILDING 104

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
No work required.					
Subtotal Stabilization					\$ 0

Preservation

1.	Repair exterior basement doors		L.S.		\$ 320.00
2.	Repair/replace broken windows & screens	10	EA	\$ 320.00	\$ 3,200.00
3.	Repair & repaint iron railing at front entrance	28	L.F.	\$ 20.00	\$ 560.00
4.	Replace asphalt roof shingles	16	SQ	\$ 110.00	\$ 1,760.00
5.	Repair/replace gutter & downspout	50	L.F.	\$ 3.50	\$ 175.00
6.	Prune tree on left side	1	EA	\$ 500.00	<u>\$ 500.00</u>

Subtotal Stabilization & Preservation	\$ 6,515.00
Contingencies 20%	<u>\$ 1,303.00</u>
	\$ 7,818.00
Eng. & Admin. 15%	<u>\$ 1,173.00</u>
Total Project Cost	<u>\$ 8,991.00</u>

Restoration (Alternate)

7.	Rebuild porch as orig. constr.	240	S.F.	\$ 27.30	\$ 6,552.00
8.	Remove & replace exist. siding with orig. clapboard	2120	S.F.	\$ 3.50	\$ 7,420.00
9.	Remove shutters	10	EA	\$ 60.00	\$ 600.00
10.	New slate roof (incl. tear off of exist. asphalt shingles)	16	SQ	\$ 870.00	<u>\$13,920.00</u>

Subtotal Restoration \$28,492.00

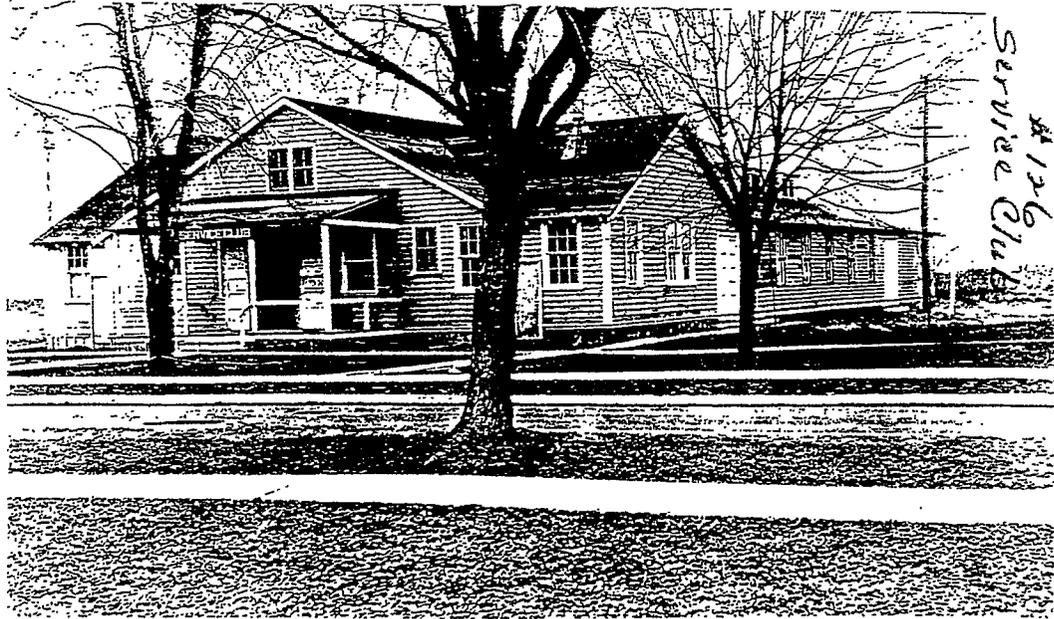
Alternate Project Cost to Restore Structure to Original Construction

Subtotal Stabilization & Preservation \$ 6,515.00
Add Subtotal Restoration \$28,492.00
Deduct Item 3 -\$ 560.00
Deduct Item 4 -\$ 1,760.00

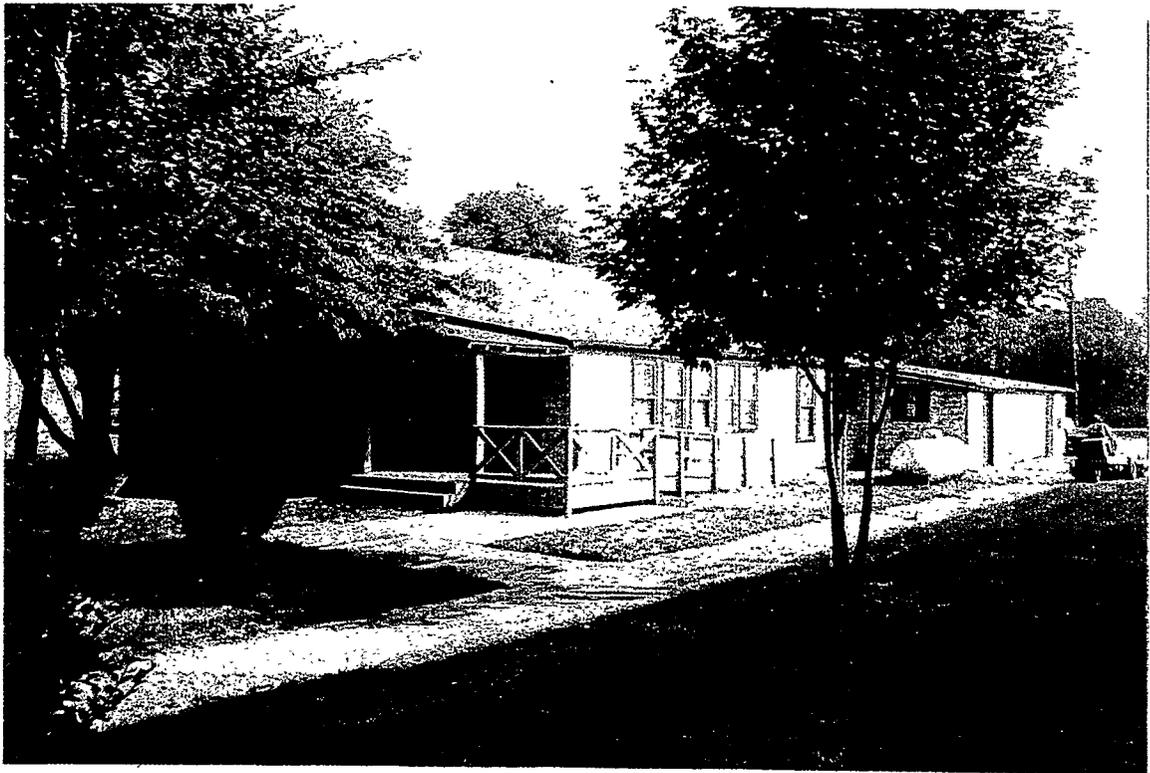
\$32,687.00
Contingencies 20% \$ 6,537.00
\$39,224.00
Eng. & Admin. 15% \$ 5,884.00

Total Alternate Project Cost \$45,108.00

NCO CLUB



CIRCA 1930



1993

NCO CLUB

NCO CLUB - BUILDING 106

DESCRIPTION

Constructed circa 1919, the single story wood frame structure is constructed over a low crawl space. The perimeter foundation walls are concrete masonry and the interior piers are brick. The storage/utility room projections on either side are constructed on concrete slabs. The present footprint comprises approximately 5,000 square feet.

FINDINGS

The structure is comprised of two large rooms joined by a corridor and flanked by several smaller rooms including offices, restrooms and storage rooms. The front room houses the library and meeting room of the Fort Delaware Society. The rear room was once a bar area, with the original bar and kitchen area to one side. It is currently a storage and work room for the Society.

1. Historical

From information obtained from the Delaware State Archives (attached is an original photo), the building was originally referred to as the Service Club. The original photograph indicates several transformations have occurred since constructed in 1919. According to archival information, the original structure cost \$4,800 to construct.

2. Floor

Although not exposed, the floor framing was stiff and appeared to be adequately sized for strength and deflection. The bar room floor has several undulations in the flooring including several damaged floor tiles.

3. Roof

The roof framing was not visible except in the shed roofed storage room behind the kitchen. At this location the roof framing was 2x6 rafters spaced at 24" o.c. spanning approximately 10 feet. With the exception of some water stains, the framing was in good condition. The main roof is gable form. The rafter spans are supported midway between the side bearing walls and ridge on an intermediate beam which spans approximately 10'6" between columns wrapped with 1x trim. A permanent fiber board ceiling conceals the framing. With the exception of some water stains, the roof framing does not exhibit any signs of distress. The ceiling of the storage room adjacent to the fireplace exhibits visible water damage in the roof decking. See photo 14. The large rear room ceiling exhibits water stains and black discoloration on the

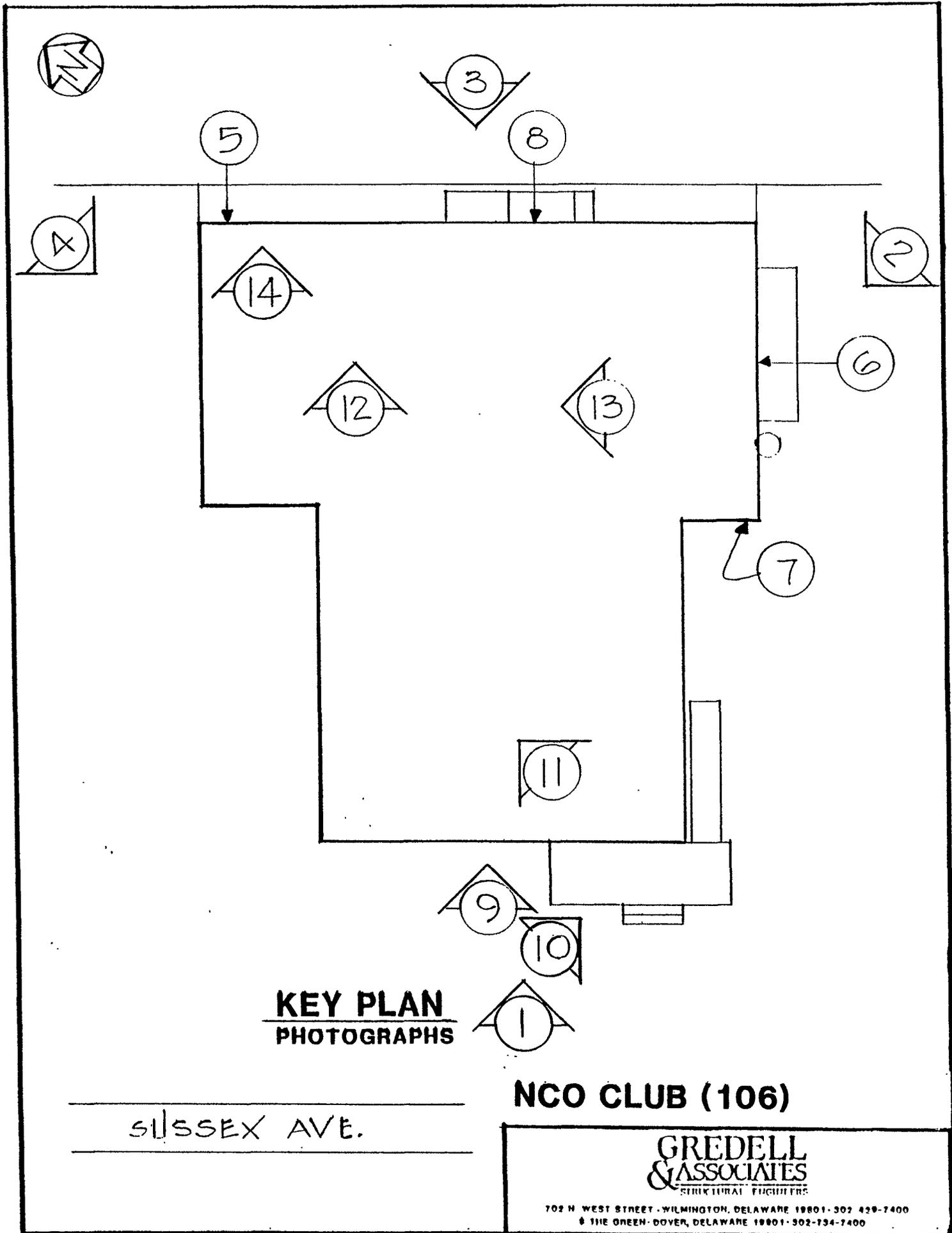
originally white ceiling. In the rear room, moldings at ceiling beam/column intersection are horizontally misaligned approximately 1-1/2 inches, see photo 12. The roof shingles are fairly new and generally in good shape. Some gaps in the eave of the shed roof adjacent to the kitchen area are visible above the door. There are no roof gutters on the building.

4. Exterior Walls

The exterior wall studs were observed to be 2x4 spaced at 16" o.c. Although concealed by finishes, at one location where a portion of siding was missing, the studs were in good condition. Although not exposed, we suspect that some studs will require splicing at their bases due to the observed rot in the siding and sill plate. The siding is typically severely weathered and the existing paint has chipped and peeled. The lower 2 feet of siding is rotted and decayed. At some locations the siding is missing from the building. See photos 5, 6, and 7. Special precautions should be taken to determine if paint is lead based. The existing sill plate is severely deteriorated at several locations. Attempts to insulate the building are made obvious by the matrix of 3 inch diameter holes which have been drilled through the siding enabling foam insulation to be blown in the wall cavity. At several locations, the holes require re-plugging, or paint. See photo 8. At several locations along the foundation, large holes are visible indicating that a ground hog resides under the structure. A workman currently rebuilding the front porch indicated he noticed evidence of inactive termite damage adjacent to the old deck where some siding was removed.

5. Doors and Windows

The rear entrance door has daylight visible around the frame indicating it is not weathertight. At the furnace room, the exterior door behind the bar is not sealed tightly. An odor of oil was observed in this space also. Several windows in the front room are cracked. Door and window trim require painting and replacement of rotted boards at isolated locations. Several windows are boarded up.



**KEY PLAN
PHOTOGRAPHS**

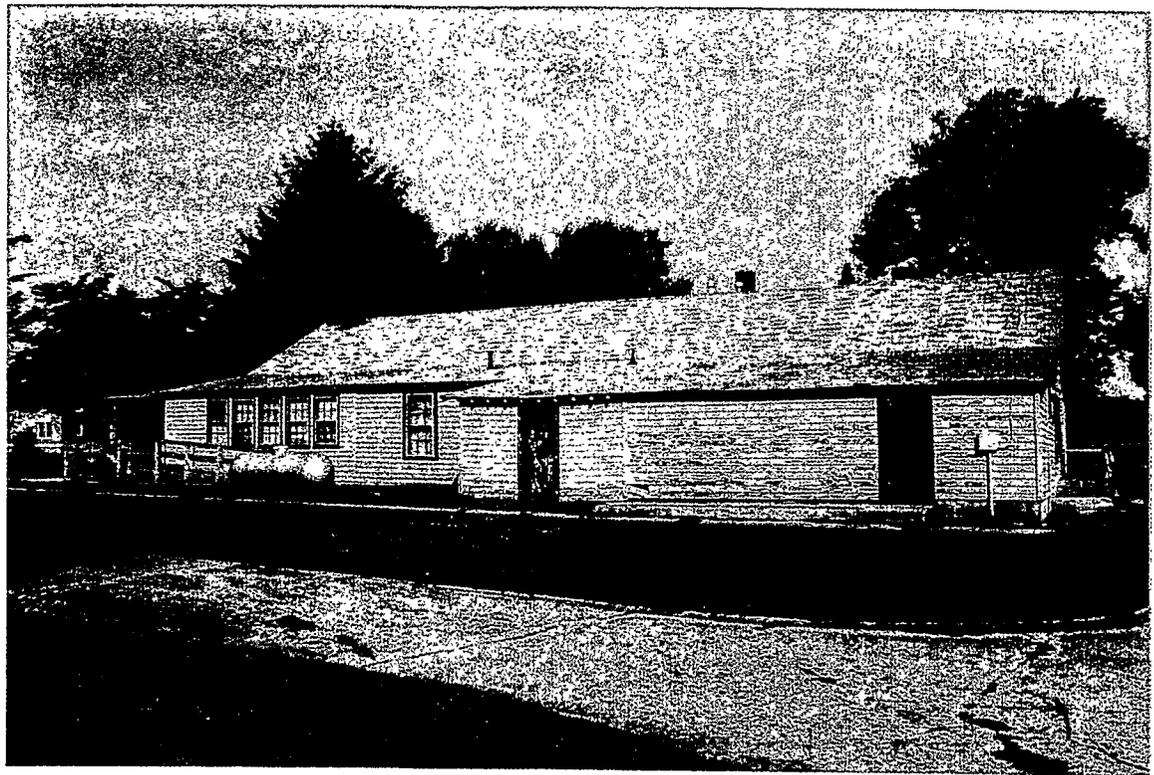
NCO CLUB (106)

SUSSEX AVE.

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 STRUCTURAL ENGINEERS
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 4 THE GREEN - DOVER, DELAWARE 19901-302-734-7400



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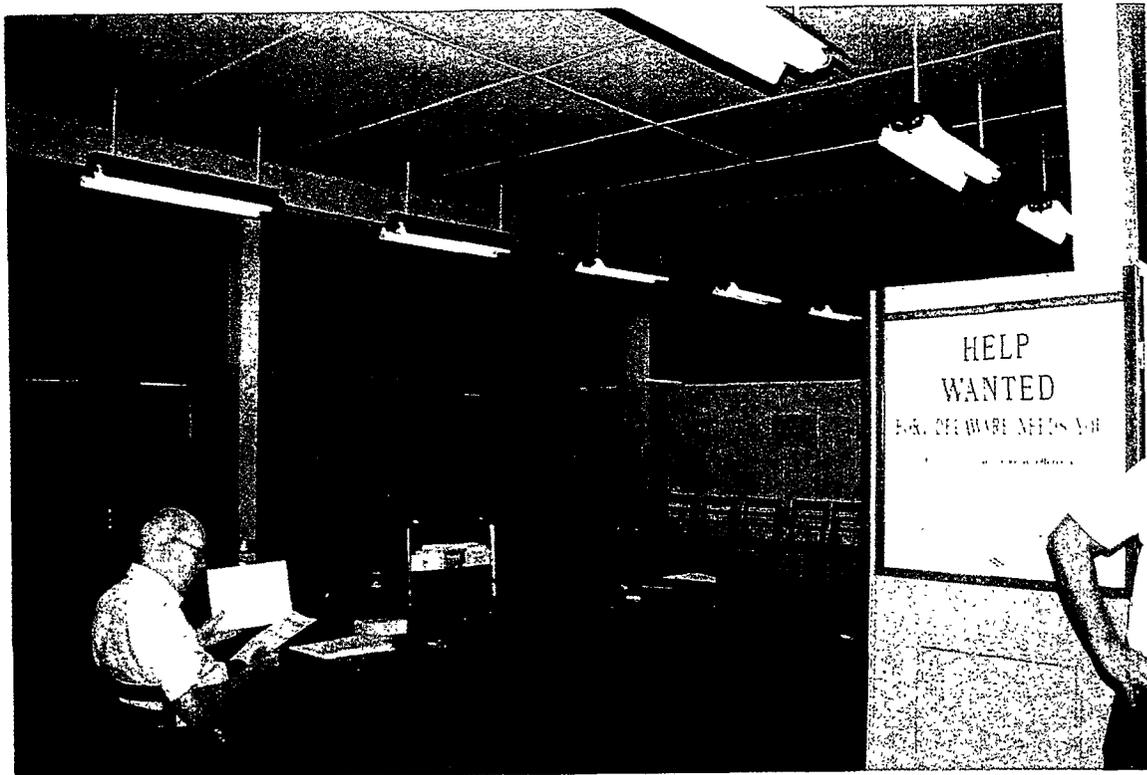
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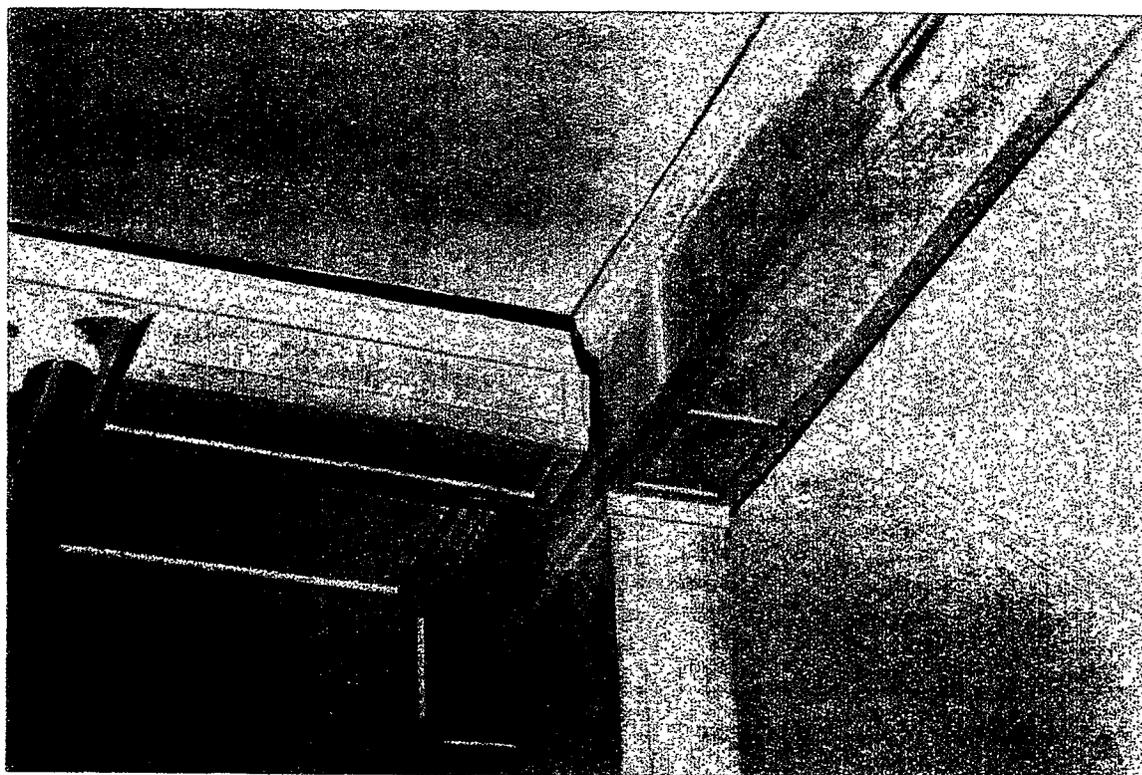
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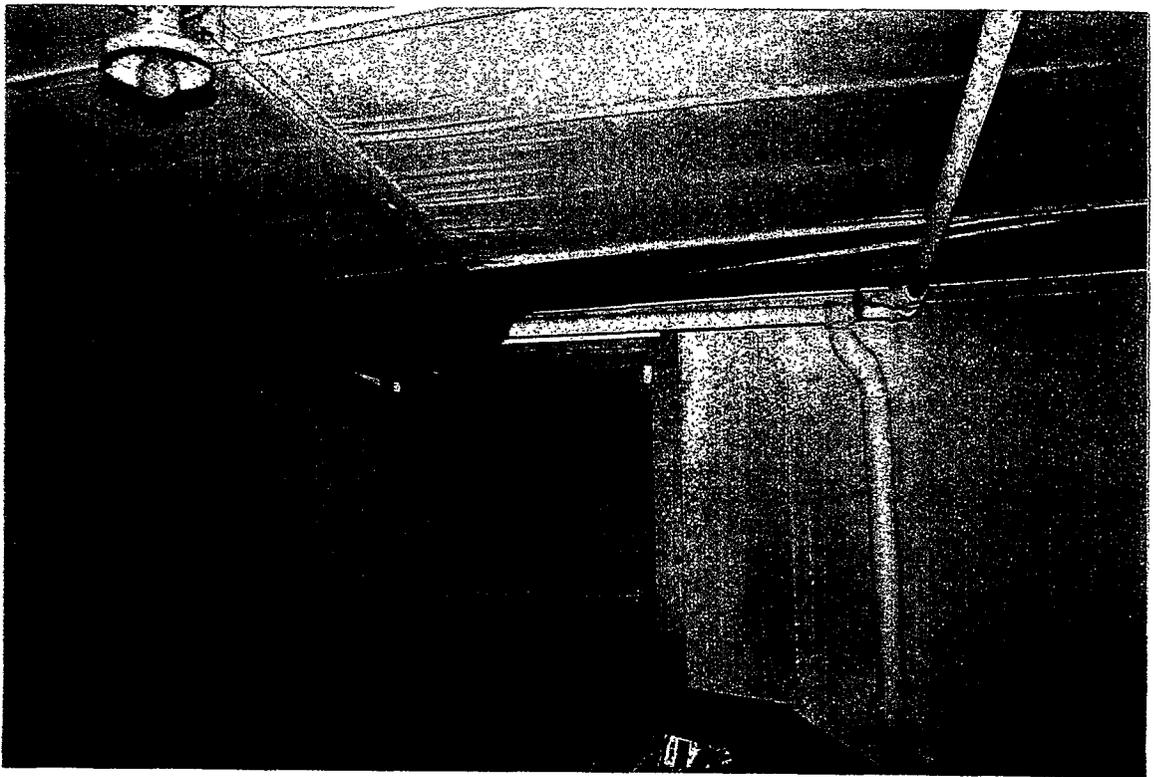
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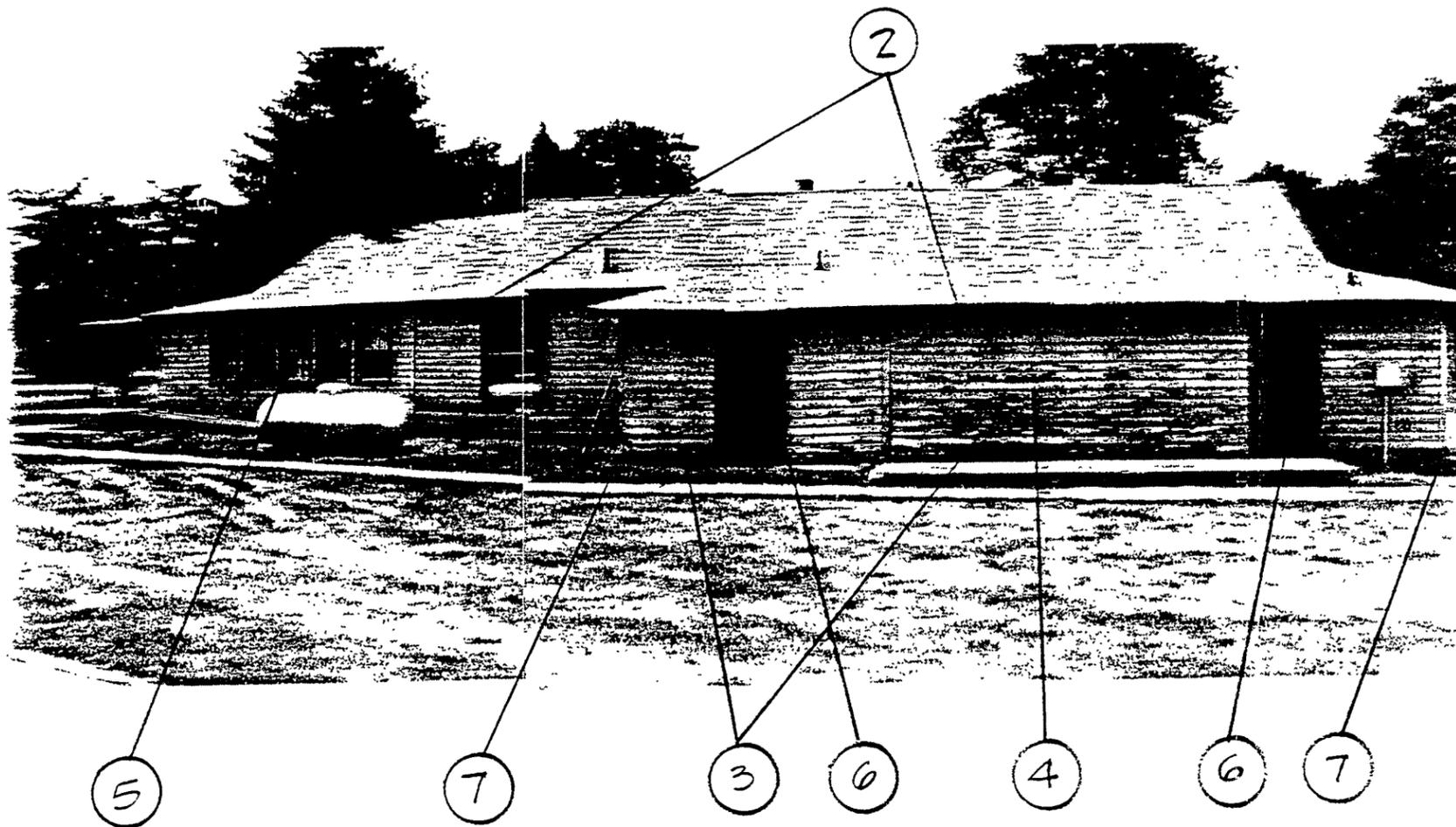
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STABILIZATION

No work required.

PRESERVATION

1. Repair/replace roof decking and ceiling structure in storage room adjacent to fireplace.
2. Provide gutters and downspouts.
3. Replace rotted siding and sill plate. Inspect wall studs, splice as required.
4. Strip and repaint all siding and trim including windows. Undertake special precaution regarding the possibility of lead based paint.
5. Repair broken windows, reglaze, repair storm windows.
6. Repair/replace exterior doors to provide weather-tight seal.
7. Eliminate rodent access.
8. Consult termite expert for inspection to determine if any active infestation.

RESTORATION

9. Reframe roof, create shed dormers at rear of building.
10. Replace/relocate doors and windows to conform to original construction.

RECOMMENDATIONS

NCO CLUB BUILDING 106

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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PRELIMINARY COST ESTIMATE

NCO CLUB - BUILDING 106

Stabilization

No Work Required.

Subtotal Stabilization \$ 0

Preservation

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Repair/replace roof decking & ceiling framing	225	S.F.	\$ 10.00	\$ 2,250.00
2.	Provide gutters & downspouts	370	L.F.	\$ 3.50	\$ 1,295.00
3.	Replace rotten siding & repair studs	240	S.F.	\$ 10.00	\$ 2,400.00
4.	Repaint exterior trim	1000	S.F.	\$.80	\$ 800.00
	a. Surface prep.	1000	S.F.	\$ 2.35	\$ 2,350.00
5.	Repair existing windows & frames	26	EA	\$ 200.00	\$ 5,200.00
6.	Repair/replace exterior doors	4	EA	\$ 320.00	\$ 1,280.00
7.	Eliminate rodent access		L.S.		\$ 500.00
8.	Wood boring insect inspection		L.S.		\$ 500.00

Subtotal Preservation \$16,575.00

Contingencies 20% \$ 3,315.00

\$19,890.00

Eng. & Admin. 15% \$ 2,984.00

Total Project Cost \$22,874.00

Restoration (Alternate)

9.	Reframe roof includes new shed dormers	3000	S.F.	\$ 10.50	\$31,500.00
10.	Replace/relocate doors & windows	30	EA	\$ 1,200.00	\$36,000.00

Subtotal Restoration \$67,500.00

Alternate Project Cost to Restore Structure to Original
Construction

Subtotal Stabilization & Preservation \$16,575.00

Add Restoration Subtotal \$67,500.00

Deduct Item 1 -\$ 2,250.00

Deduct Item 5 -\$ 5,200.00

Subtotal Alternate \$76,625.00

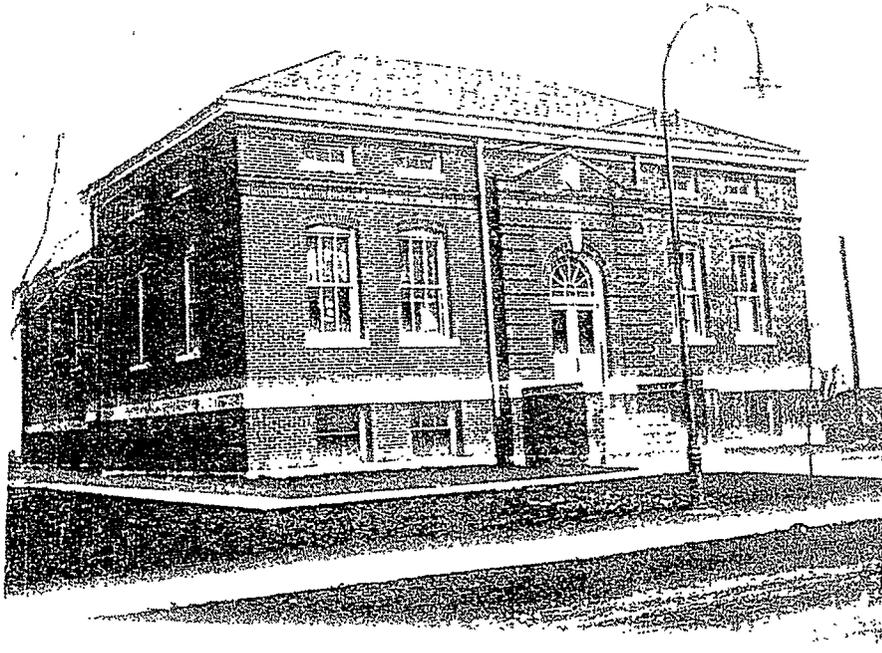
Contingencies 20% \$15,325.00

\$91,950.00

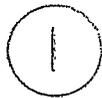
Eng. & Admin. 14% \$12,873.00

Total Project Cost \$104,823.00

GYM/PX



CIRCA 1906



1993

GYM/PX

Gym/PX - Burton Hall- Building 107

DESCRIPTION

The Gym/PX building, known as Burton Hall is a one and a half story load bearing brick structure over a full basement. Shaped in plan, in the form of a "T", the building footprint comprises approximately 3,700 square feet per level. Once serving as the Fort's post exchange and gymnasium, the structure is currently vacant and used only for storage purposes.

FINDINGS

The structure is actually constructed as a bi-level. Entering the structure from the main entrance, there are stairs leading up or down. Proceeding up, you enter the main floor level. The main level houses a gymnasium with hardwood flooring. At the front of the building, there is a central hallway with large rooms flanking either side. A narrow stairway leads to a balcony area for viewing the gymnasium. From the balcony, there is an access to the attic space above the front portion of the building.

Proceeding downward from the front entrance, you enter the basement area. Flanking either side of the central hallway are two classrooms adjoined by storage rooms. Proceeding towards the rear of the building, a two lane bowling alley is provided below the gymnasium. Adjacent to the bowling alleys and separated by a central brick bearing wall are the boiler rooms.

1. Historical

From our research of archival information, we understand that the structure was constructed circa 1907 for a cost of \$23,632. The walls and foundations are constructed of brick, and the floors and roof are framed in wood. Originally a slate roof, the building is presently roofed with asphalt shingles.

2. Brickwork

Approximately 25 percent of the total building exterior brick masonry requires repointing especially at the upper 10 feet of wall. See photos 6 and 7. There are some loose bricks observed above the lintel at the doorway between the boiler room and the coal room.

3. Concrete

The concrete steps at the front entrance suffer from freeze/thaw damage and are cracked and spalled. See photo 8. The areaway steps are in similar condition.

4. Floors

The gym flooring although worn, appears to be in sound condition. At the base of the stairs in the basement floor, there is a large amount of rot observed in the wood flooring. See photo 14. The first floor joists are 2x12's spaced at 16" o.c. and appear to be in good condition since most framing is concealed by finishes. The bowling alley floors are deteriorated and show signs of rot. There is evidence of water damage which does not appear recent. See photo 16. The floor tiles are cracked and chipped in front rooms, hallway and entrance foyer.

5. Roof

The roof is clad with fiberglass shingles which are in excellent condition. Upon review of the attic, it is evident that "recent" work has been completed on the eaves. Roof decking has been replaced with new plywood; we estimate within the last 5 years. Rafters do not exhibit any signs of rot. The roof is hip framed with 2x8 rafters spaced at 16" o.c. Tongue and groove wood sheathing is nailed to the rafters. The rafters span between 6x8 purlins which are supported on timber trusses which clear span the width of the building. In general, all roof framing is in good condition. See photo 20. An exception occurs at three posts which exhibit infestation damage. At one instance, a probe was inserted 3 inches into the post. See photos 21 and 22. The gutters are missing for a majority of the building, as are the downspouts. See photos 12 and 13. The roof over the shed addition along the west side leaks. Water stains are visible on the ceiling.

6. Millwork

The cornice molding, fascia and soffit are rotted and deteriorated at several locations. See photo 12 and 13. All exterior wood trim, doors and windows require stripping and repainting. We suspect that the existing paint is lead based. Portions of the front door are missing and is need of paint and caulking. See photo 8. At the exterior gymnasium door, the head molding is missing exposing the wall cavity to the elements.

7. Doors and Windows

With the exception of the attic windows, all the windows and doors have been boarded up. Many windows have broken glass and require repair and reglazing. See photos 1, 2, 4, 5 & 19. The areaway doors leading into the boiler room are boarded up. See photos 9 & 17.

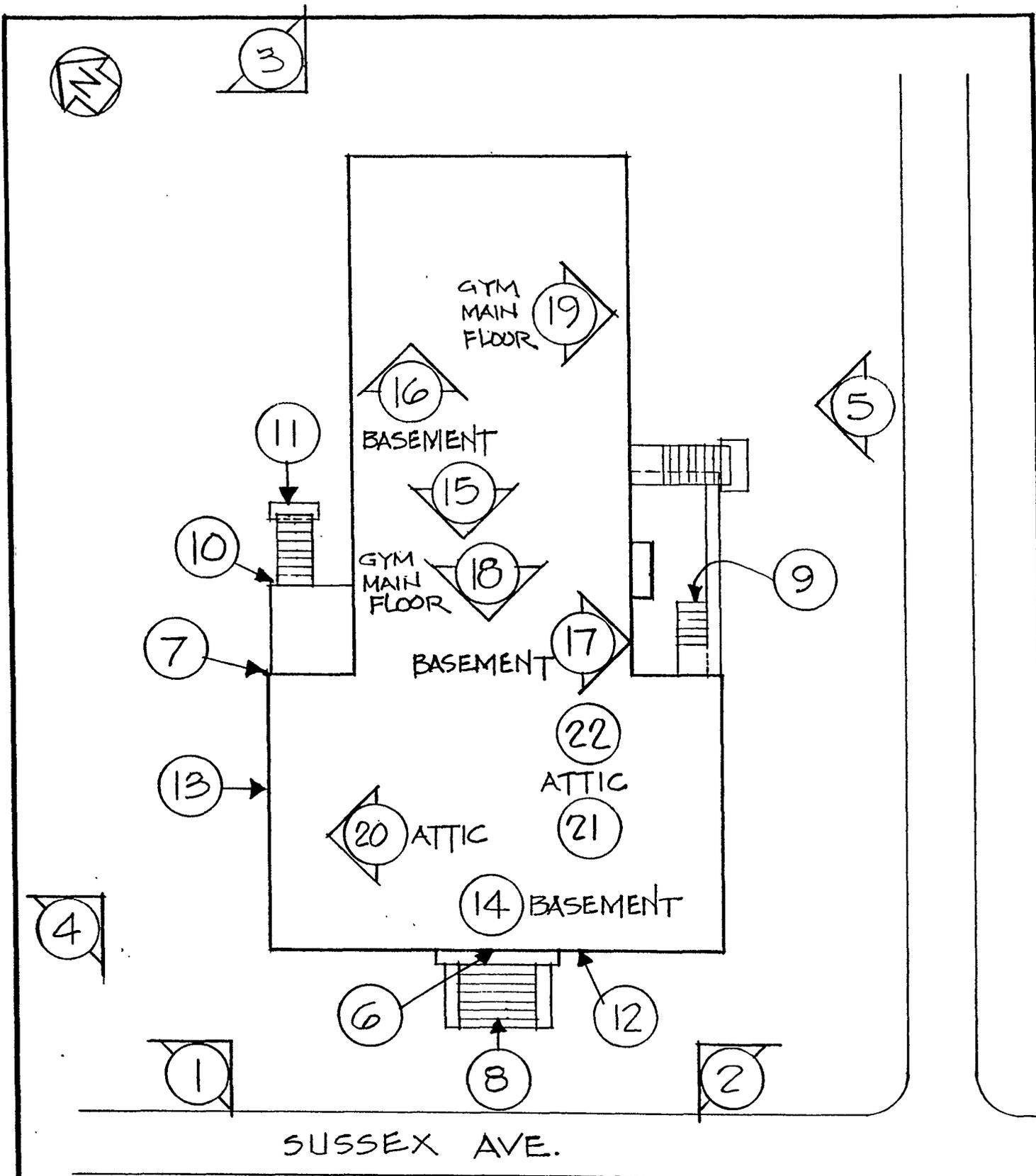
8. Interior Finishes

Interior trim wall and ceiling paint is in bad condition, peeling and chipping noted throughout the interior. Most of the peeling

and chipping is attributed to the lack of heating and ventilation in the building.

9. General

The gym is occupied by office furniture, chairs, desks and mattresses. Suspected asbestos insulation was found on many exposed pipes in the basement ceiling. See photo 15.



KEY PLAN

PHOTOGRAPHS.

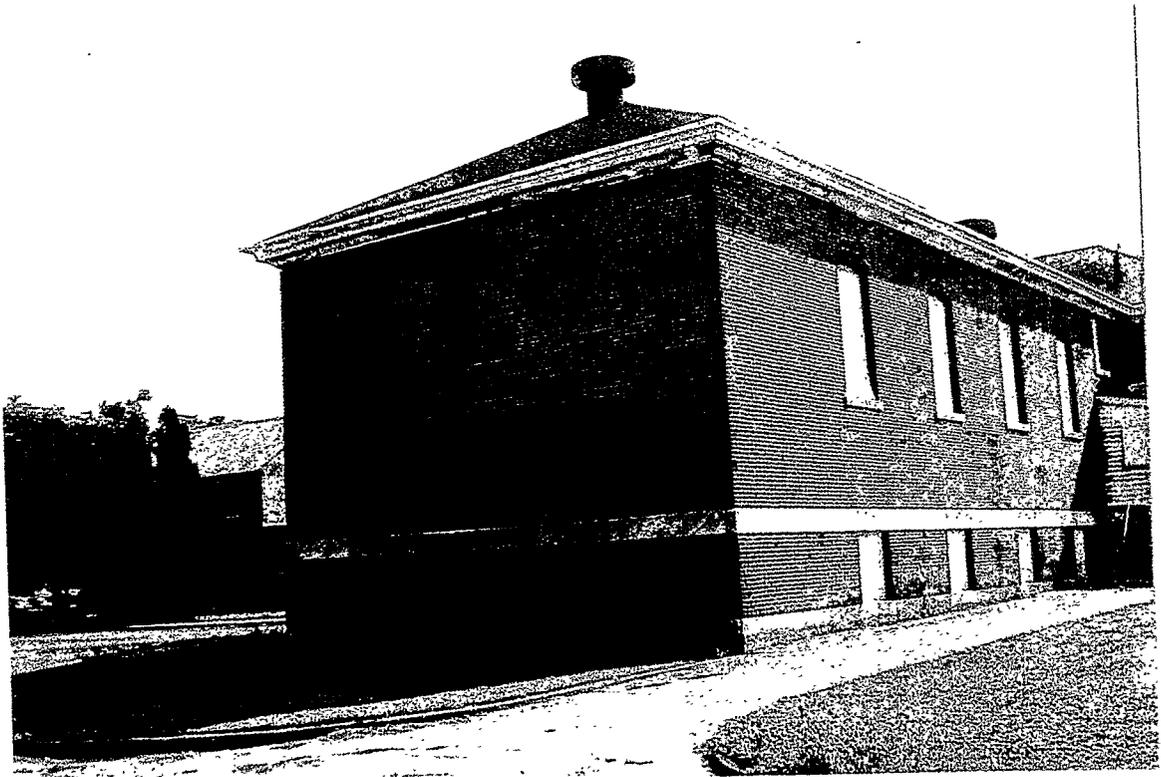
GYM/PX (107)

GREDELL & ASSOCIATES
STRUCTURAL ENGINEERS

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8 THE GREEN - DOVER, DELAWARE 19901-302-734-7400



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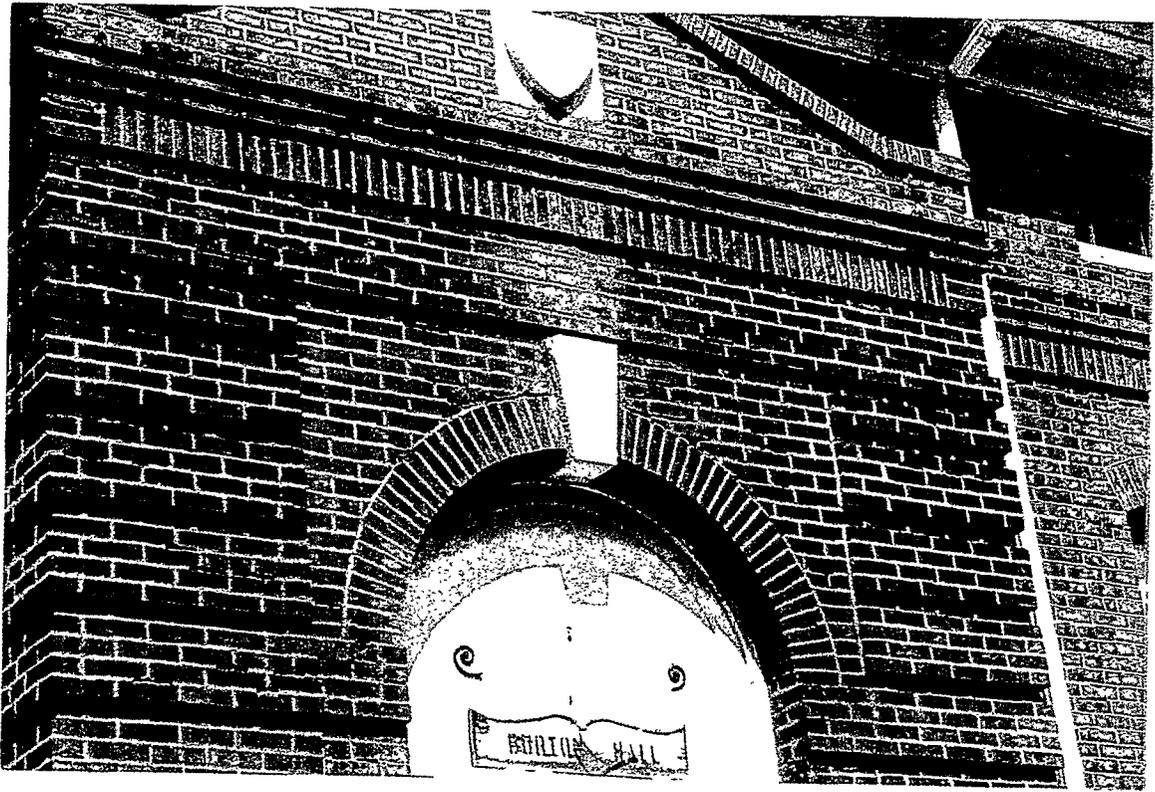
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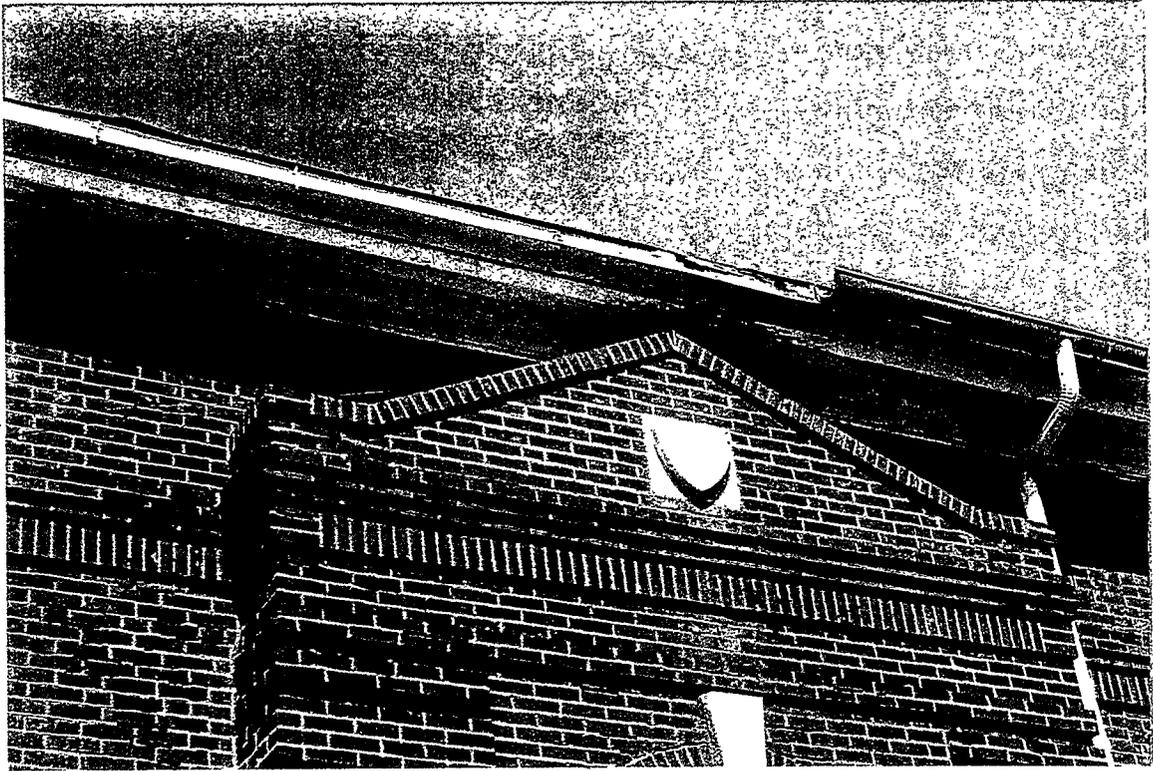
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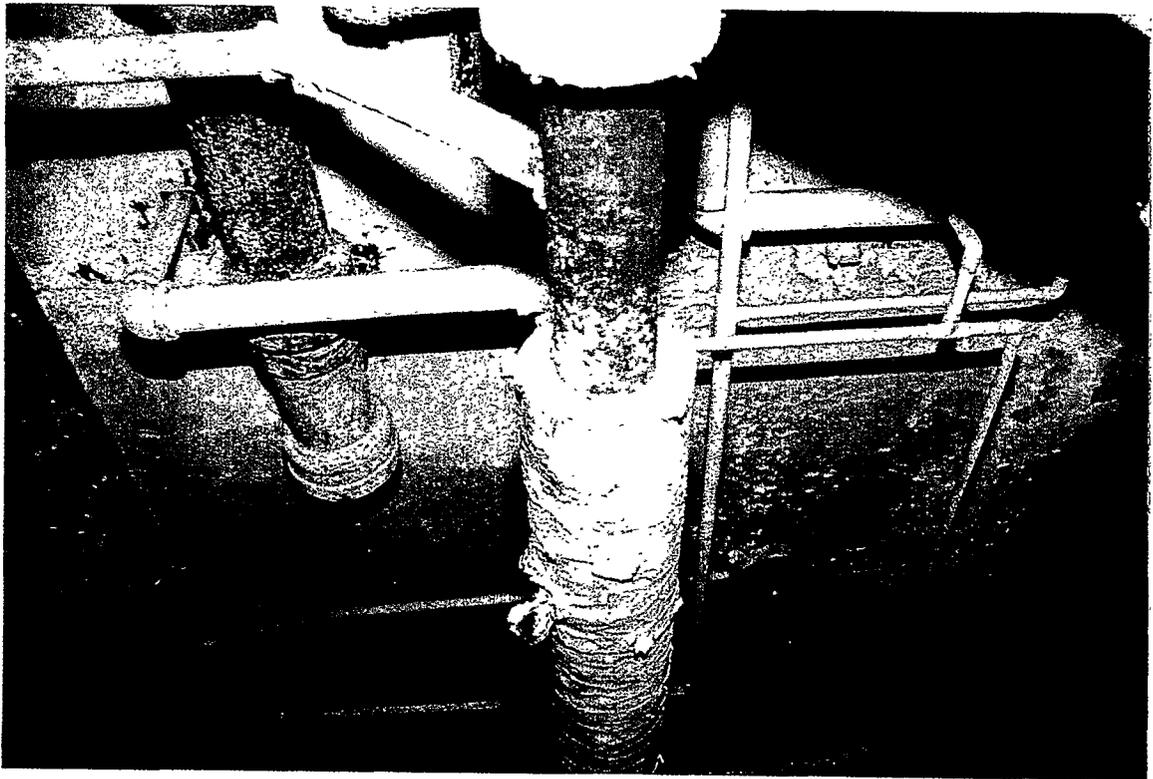
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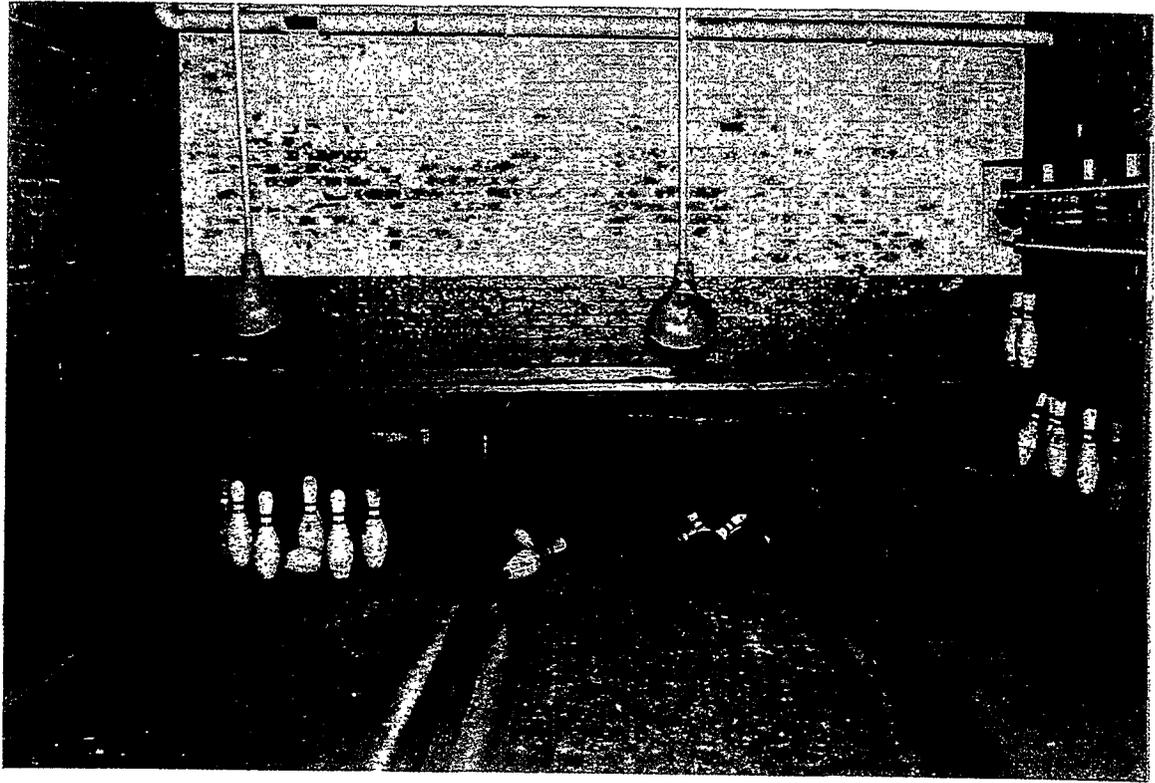
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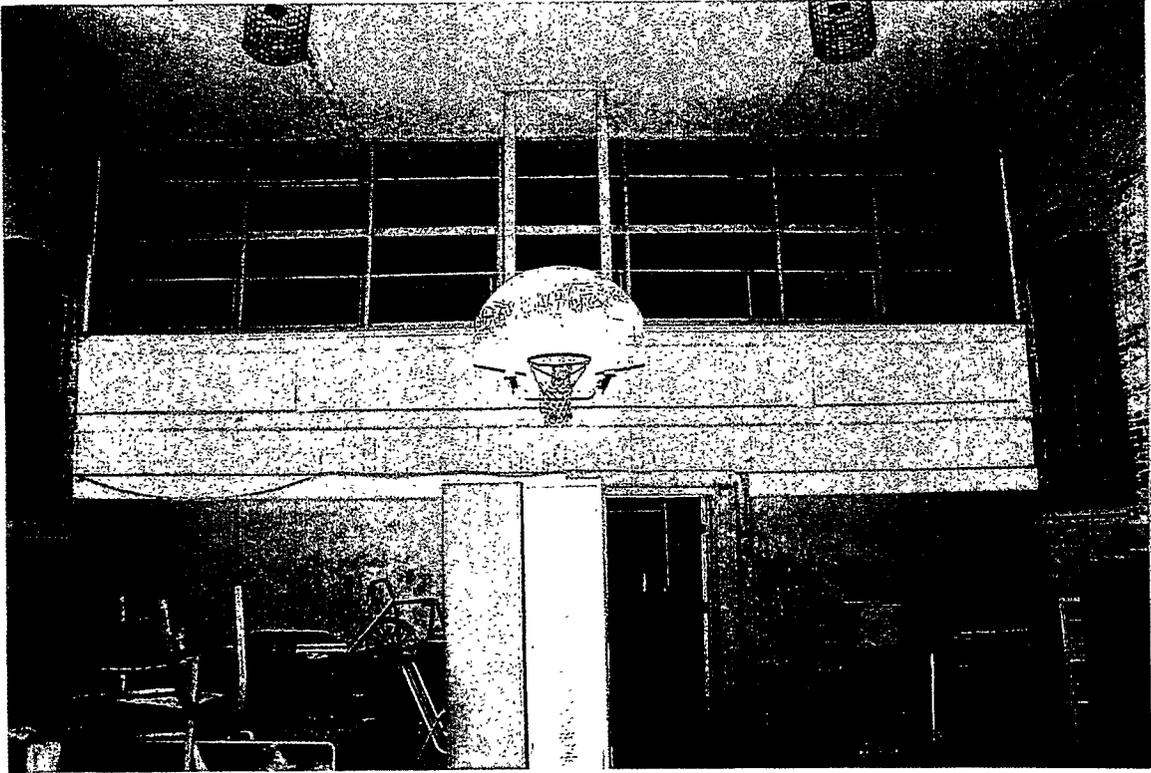
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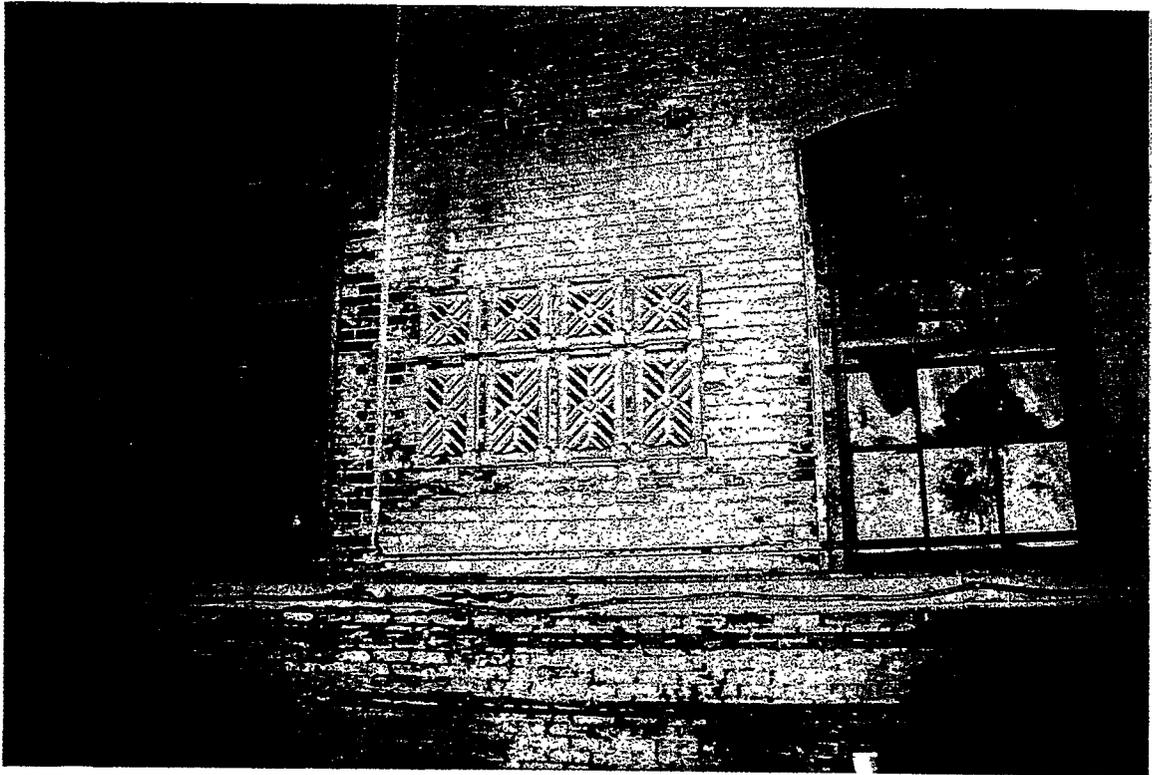
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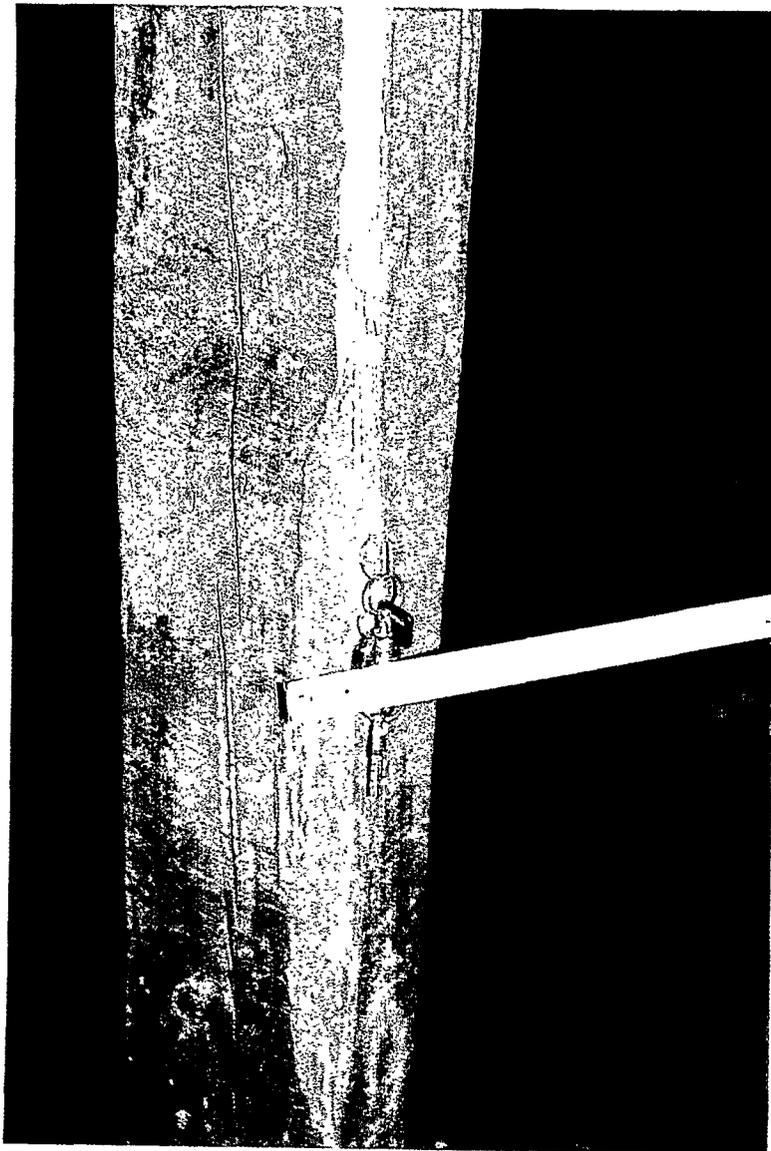
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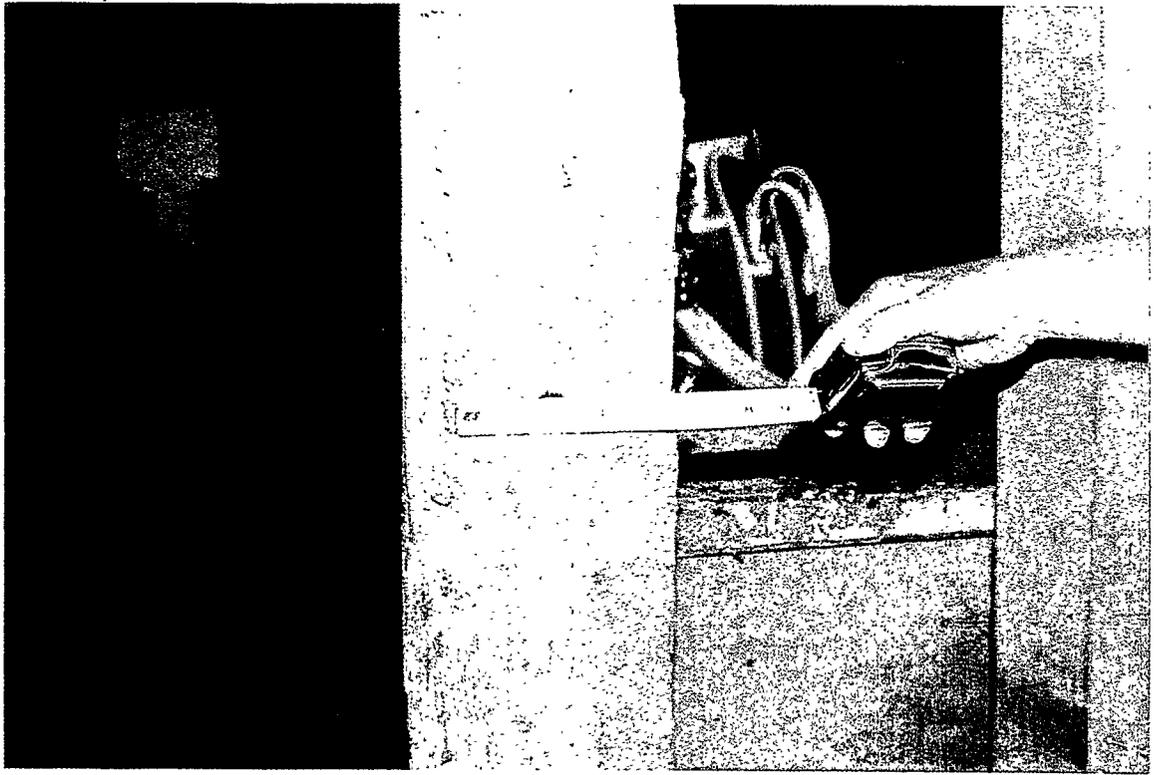
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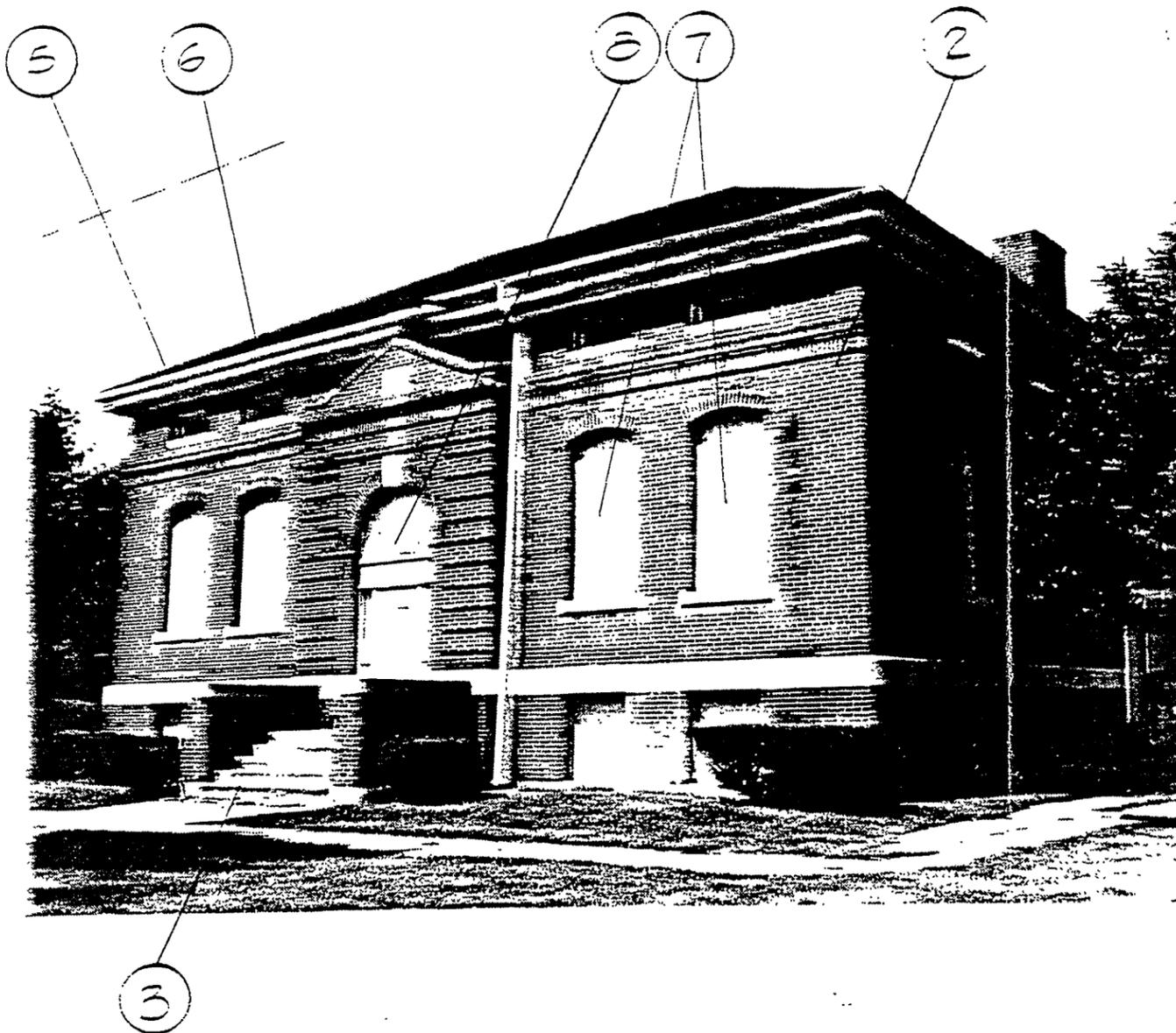
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STABILIZATION

1. Replace/supplement deteriorated and damaged 6x6 posts in attic framing.

PRESERVATION

2. Repoint approximately 25% of total exterior brick masonry.
3. Remove loose spalled concrete on exterior stairs and repair at front entrance and side areaway.
4. Replace west elevation shed roof shingles and deteriorated sheathing.
5. Replace gutters and downspouts.
6. Repair/replace rotted cornice molding, fascia and soffits.
7. Repair all windows and doors.
8. Repaint exterior millwork, windows and doors.
9. Obtain inspection services of an exterminator to ascertain extent, if any, of an active infestation.

RESTORATION

10. Repair windows and doors to match original photograph.

RECOMMENDATIONS

GYM /PX (BURTON HALL)

BUILDING 107

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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1 THE GREEN · DOVER, DELAWARE 19801 · 302-734-7400

PRELIMINARY COST ESTIMATE

GYM/PX - BURTON HALL - BUILDING 107

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Supplement attic framing	1	L.S.	\$ 1,000.00	<u>\$ 1,000.00</u>
Subtotal Stabilization					\$ 1,000.00

Preservation

2.	Repoint brick masonry	2000	S.F.	\$ 1.50	\$ 3,000.00
3.	Remove and patch exterior concrete	50	S.F.	\$ 7.35	\$ 367.50
4.	Replace shed roof	1	L.S.		\$ 2,500.00
5.	Replace gutters and downspouts	200	L.F.	\$ 3.50	\$ 700.00
6.	Replace cornice, molding, fascia & soffits	80	L.F.	\$ 20.00	\$ 1,600.00
7.	Repair windows and doors	44	EA	\$ 320.00	\$14,080.00
8.	Repaint exterior millwork, windows and doors	1000	S.F.	\$ 3.15	\$ 3,150.00
9.	Exterminator Inspection	1	L.S.		<u>\$ 500.00</u>

Subtotal Stabilization & Preservation \$26,897.50

Contingencies 20% \$ 5,380.00

\$32,277.00

Eng. & Admin. 15% \$ 4,842.00

Total Project Cost \$37,119.50

Restoration (Alternate)

10.	Replicate doors	2	EA	\$ 1,200.00	<u>\$ 2,400.00</u>
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Subtotal Restoration \$ 2,400.00

Alternate Project Cost to Restore Structure to Original
Construction

Subtotal Stabilization & Preservation \$26,897.50
Add Restoration Subtotal \$ 2,400.00
Deduct Doors from Item 7 -\$ 640.00

Subtotal Alternate \$28,657.50
Contingencies 20% \$ 5,731.50

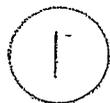
Eng. & Admin. 15% \$ 5,158.00

Total Project Cost \$39,547.00

RESIDENCE



CIRCA 1933



1993

RESIDENCE

Residence - Building 109

DESCRIPTION

The residence is a two story brick duplex constructed over a full basement. The exterior walls are load bearing brick laid up in common bond, with timber floor and roof framing. The existing gable form roof is clad with slate shingles. The building footprint is rectangular in plan, with a flat roofed one story enclosed porch flanking each side. A screened-in porch is seen at the rear elevation.

FINDINGS

1. Historical

From our review of archival information, we understand that the structure, originally designated as N.C.O. Quarters, was constructed circa 1933 for a total cost of \$13,126.06.

2. Brickwork

The exterior foundation walls are 12 inch brick walls which are in good condition. At four locations where the enclosed porch attaches to the main structure, there are step cracks in the brick masonry indicating settlement of the porch foundations. See photos 6, 7, 8 & 9. The dining room window heads (both units) adjacent to the porch exhibit cracked and spalled mortar joints. See photo 10. The brick foundation walls are in good condition. The basement is damp; some standing water was noted near the sump pit.

3. Concrete

The front entrance steps for the west unit exhibits cracks and spalls due to freeze/thaw action which require partial demolition and repair. See photo 11.

4. Framing

The first floor framing is made up of 2x10 joists spaced at 16" o.c. and are framed front to back. There is a W10 steel beam which supports the floor framing. Although not exposed, the second floor and roof framing do not exhibit any visual indications of structural distress. The screened porches at the rear elevation have a considerable amount of rot/deterioration in the boxed columns and beams. The floors of the enclosed porches and the main first floor are uninsulated. The kitchen floor tiles in the right unit are cracked and missing at locations. Generally, they are in poor shape.

5. Roofing

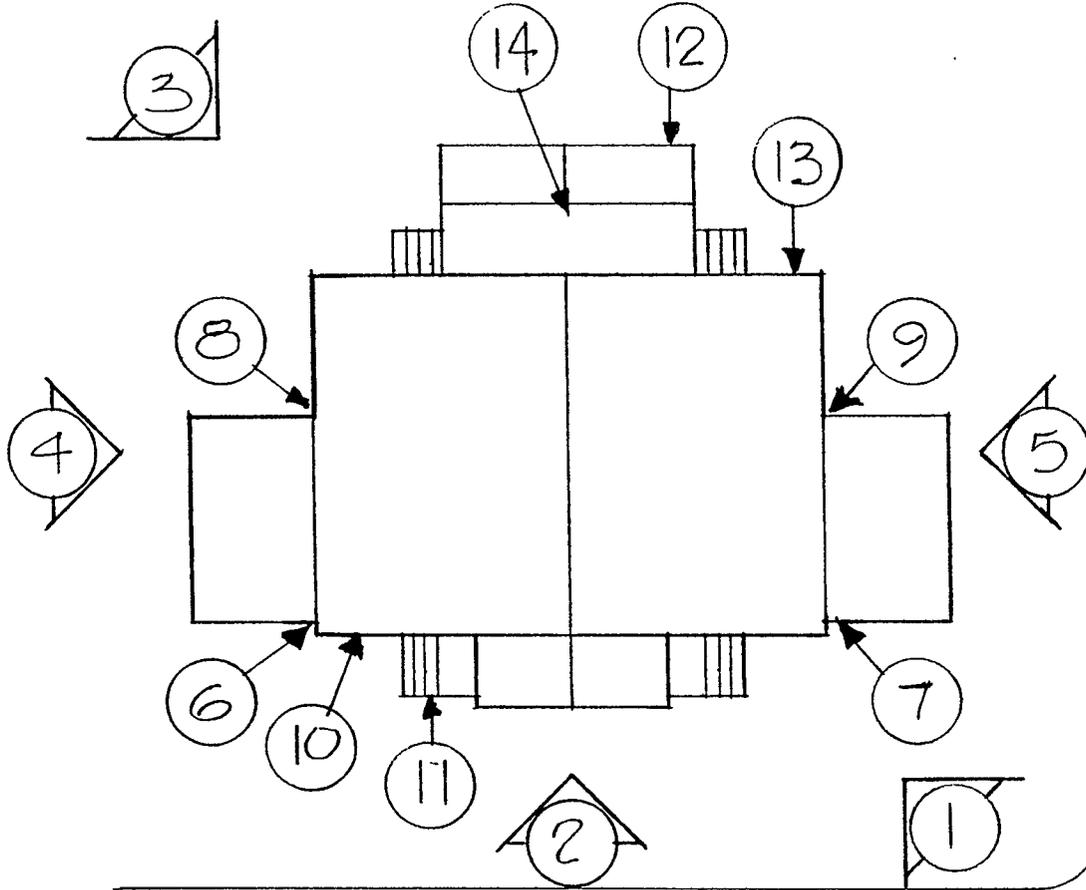
The slate shingles are in good condition. The gutters and downspouting are rusted through at several locations.

6. Windows and Doors

The rear, exterior doors to the basement are rotted and the frames are deteriorated. See photo 12. Some screens were observed to be damaged or missing. Several windows require repair. At several locations the sash was observed to have broken counterweights.

7. Finishes

The exterior door and window trim require repainting. Also, the porch trim and iron railings require painting. There are minor cracks in the plaster ceilings and walls. There are some cracks in the plaster walls located behind the radiators in both units sun porches. These cracks are reflected through the brick masonry on the exterior.



WILMINGTON AVE.

KEY PLAN

PHOTOGRAPHS

RESIDENCE (109)

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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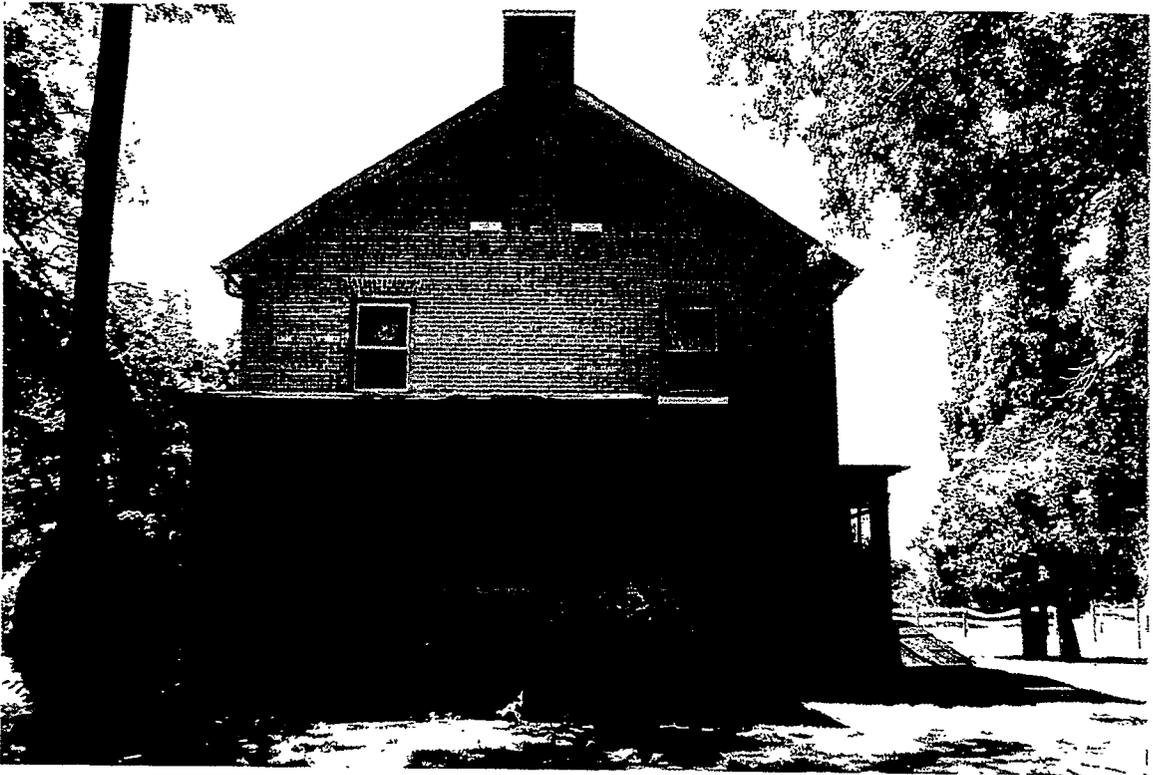
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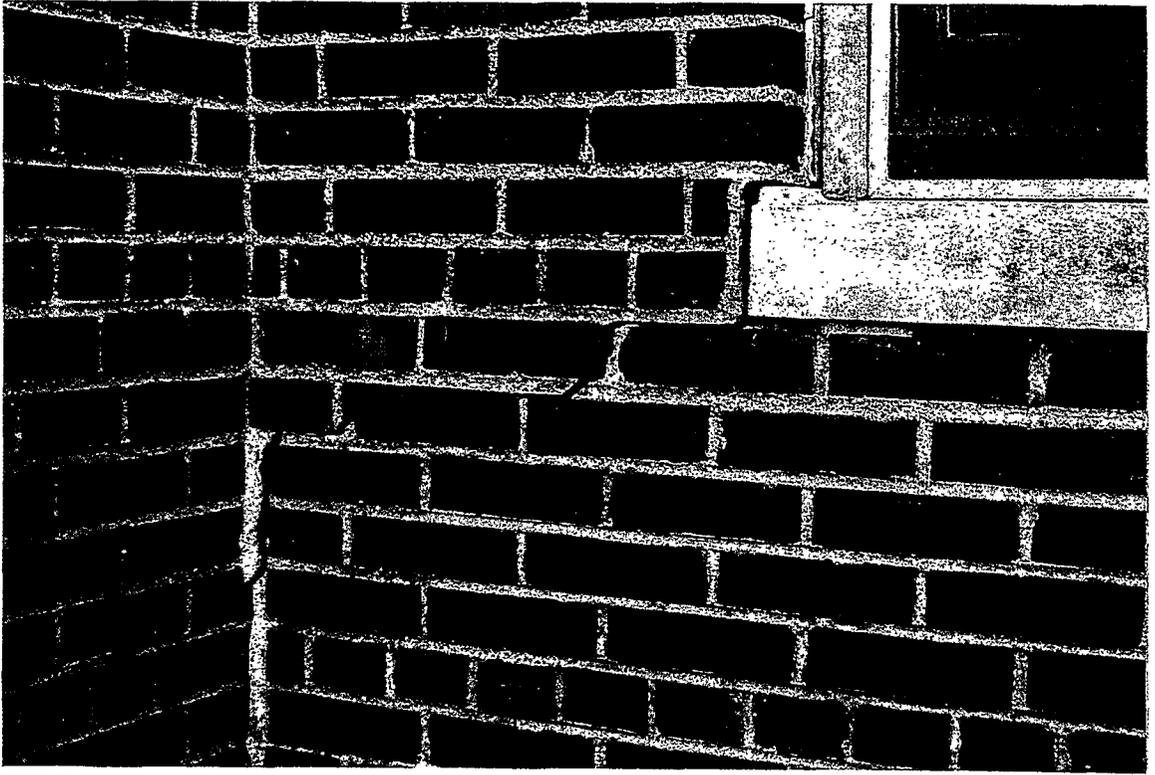
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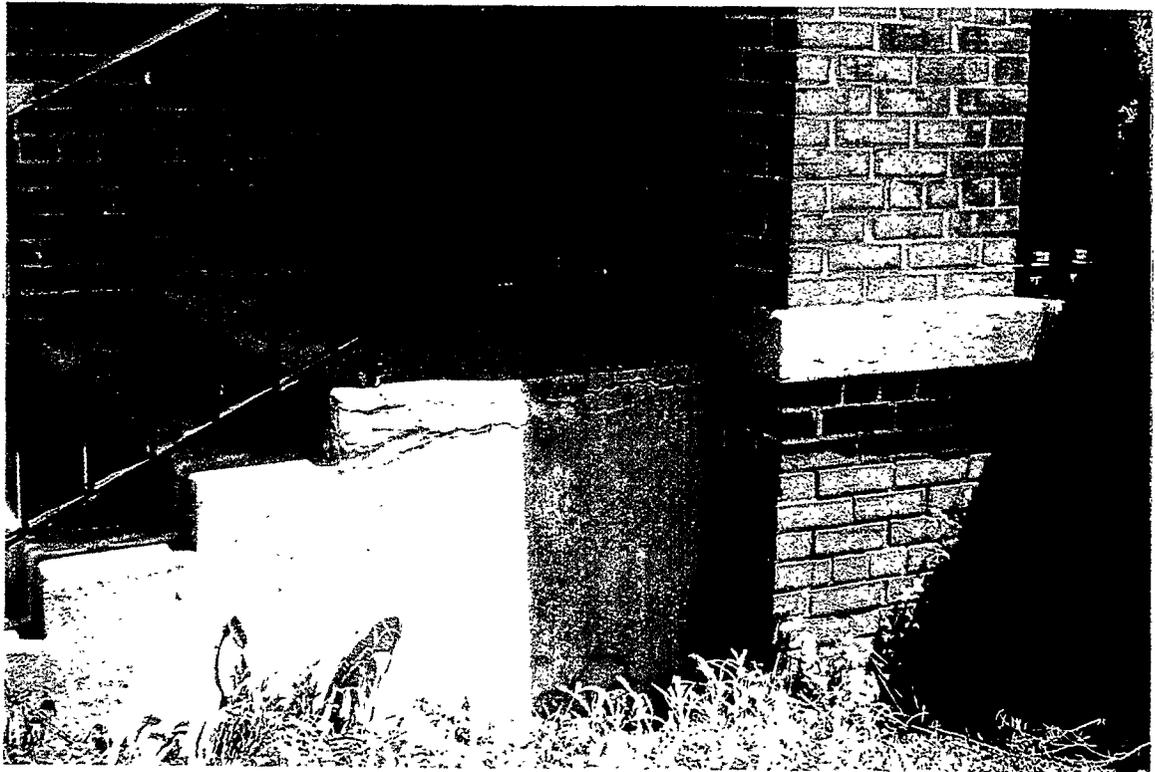
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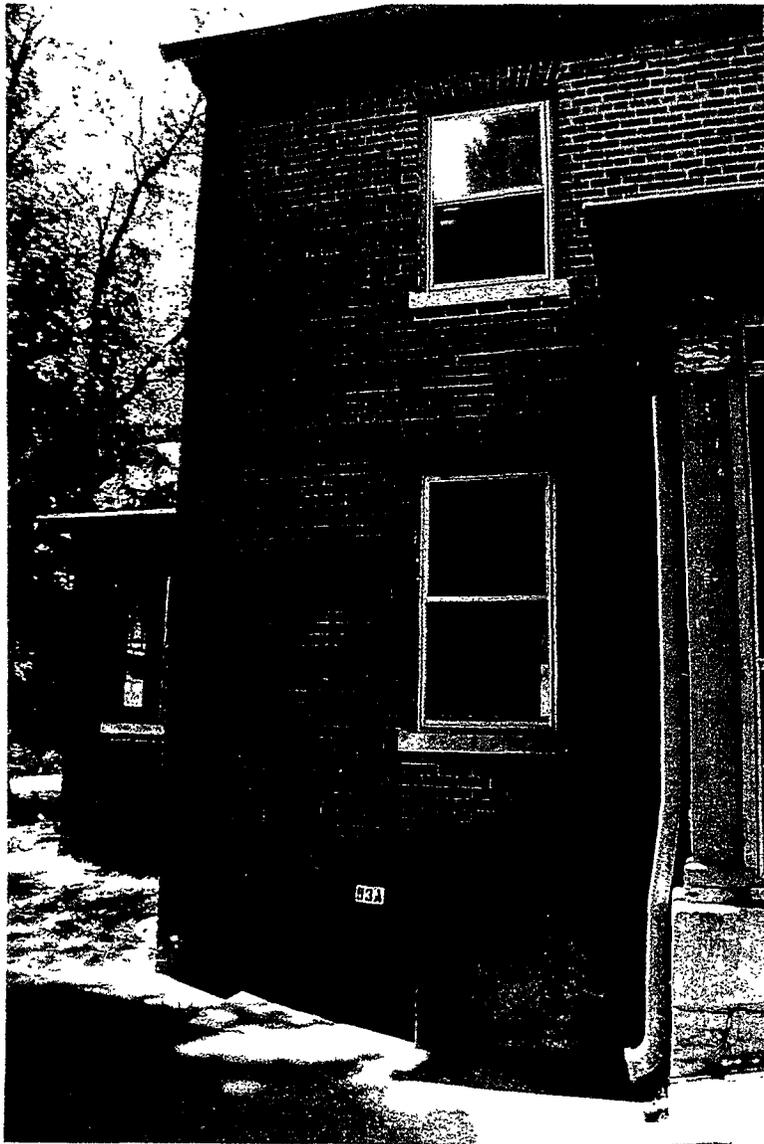
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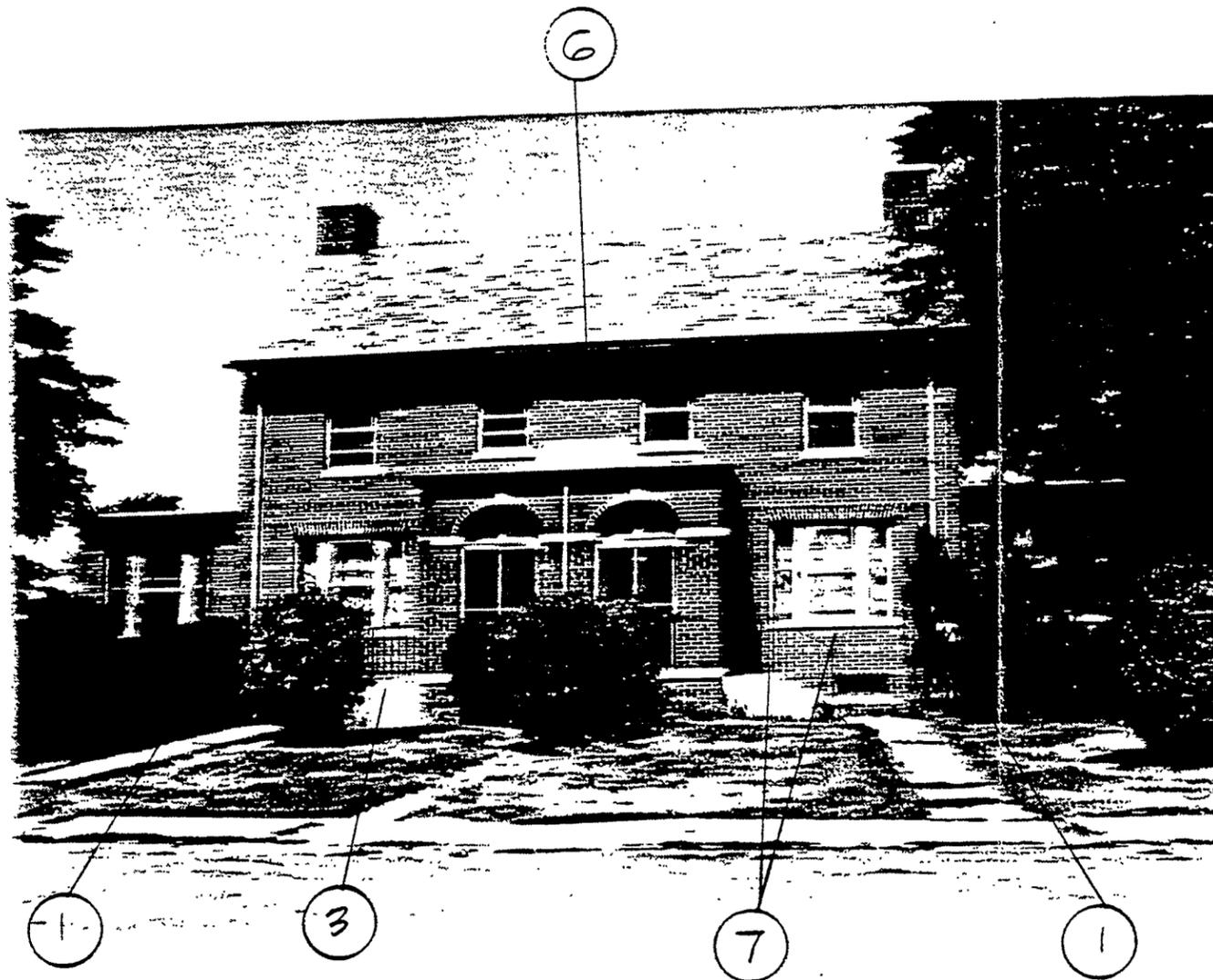
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13



14



STABILIZATION

No work required.

PRESERVATION

1. Caulk the exterior settlement cracks at four locations adjacent to the sun porch.
2. Repoint cracked mortar joints at dining room window lintels.
3. Chip and patch left unit front stairs.
4. Replace rotted wood at screened porches.
5. Repair/replace rotted basement doors. Provide weathertight seal.
6. Repair sagging gutter along front elevation. Replace rusted gutters.
7. Repaint all exterior wood trim including porches and railings.

RESTORATION

8. Repaint exterior trim and gutters to match original color.

RECOMMENDATIONS

RESIDENCE

BLDG. 109

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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5 THE GREEN - DOVER, DELAWARE 19901 - 302-734-7400

PRELIMINARY COST ESTIMATE

RESIDENCE - BUILDING 109

Stabilization

No Work Required.

Subtotal Stabilization \$ 0

Preservation

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Caulk exterior settlement cracks	40	L.F.	\$ 2.55	\$ 102.00
2.	Repair/replace basement doors	2	Sets	\$ 320.00	\$ 640.00
3.	Chip & patch left unit front stairs	50	S.F.	\$ 4.85	\$ 242.50
4.	Repaint exterior wood trim	405	S.F.	\$.80	\$ 324.00
	a. surface prep.	405	S.F.	\$ 2.35	\$ 951.75
5.	Repair/replace gutter	160	L.F.	\$ 3.50	\$ 560.00
6.	Repoint mortar joints at lintels	24	S.F.	L.S.	\$ 150.00
7.	Replace rotten wood at screened porches	50	S.F.	\$ 10.00	\$ <u>500.00</u>

Subtotal Stabilization & Preservation \$ 3,470.25

Contingencies 20% \$ 694.00

\$ 4,164.25

Eng. & Admin. 20% \$ 833.00

Total Project Cost \$ 4,997.25

Restoration (Alternate)

8.	Repaint exterior trim & gutters to match original color	405	S.F.	\$ 4.73	\$ <u>1,915.65</u>
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Subtotal Restoration \$ 1,915.65

Alternate Project Cost to Restore Structure to Original
Construction

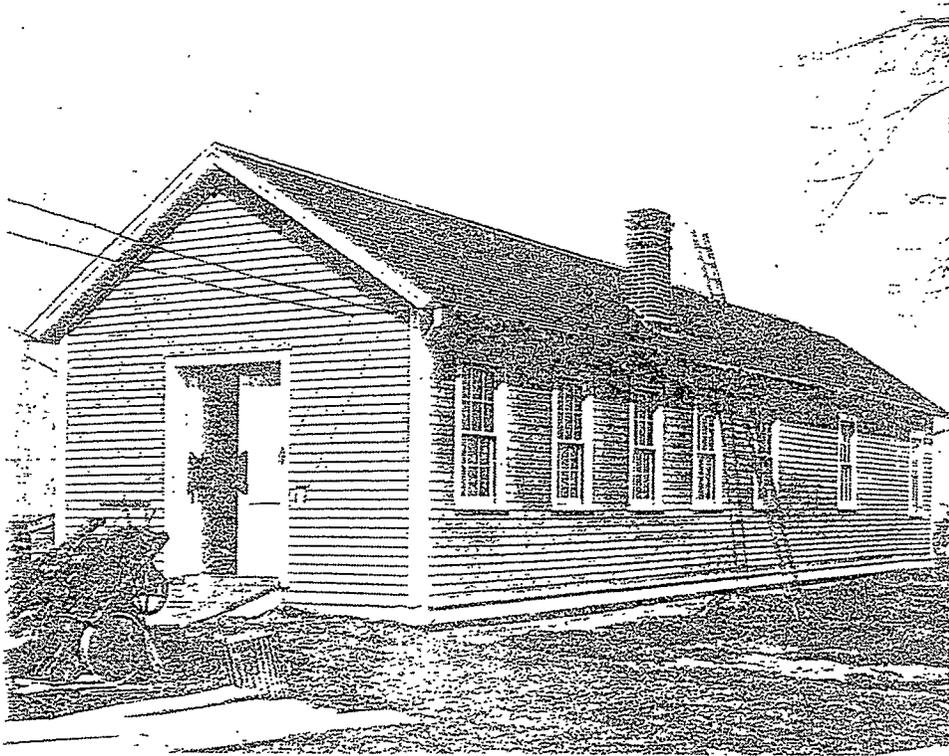
Subtotal Stabilization & Preservation \$ 3,470.25
Add Restoration Subtotal \$ 1,915.65
Deduct Item 4 - \$ 1,275.75

Subtotal Alternate \$ 4,110.15
Contingencies 20% \$ 822.00

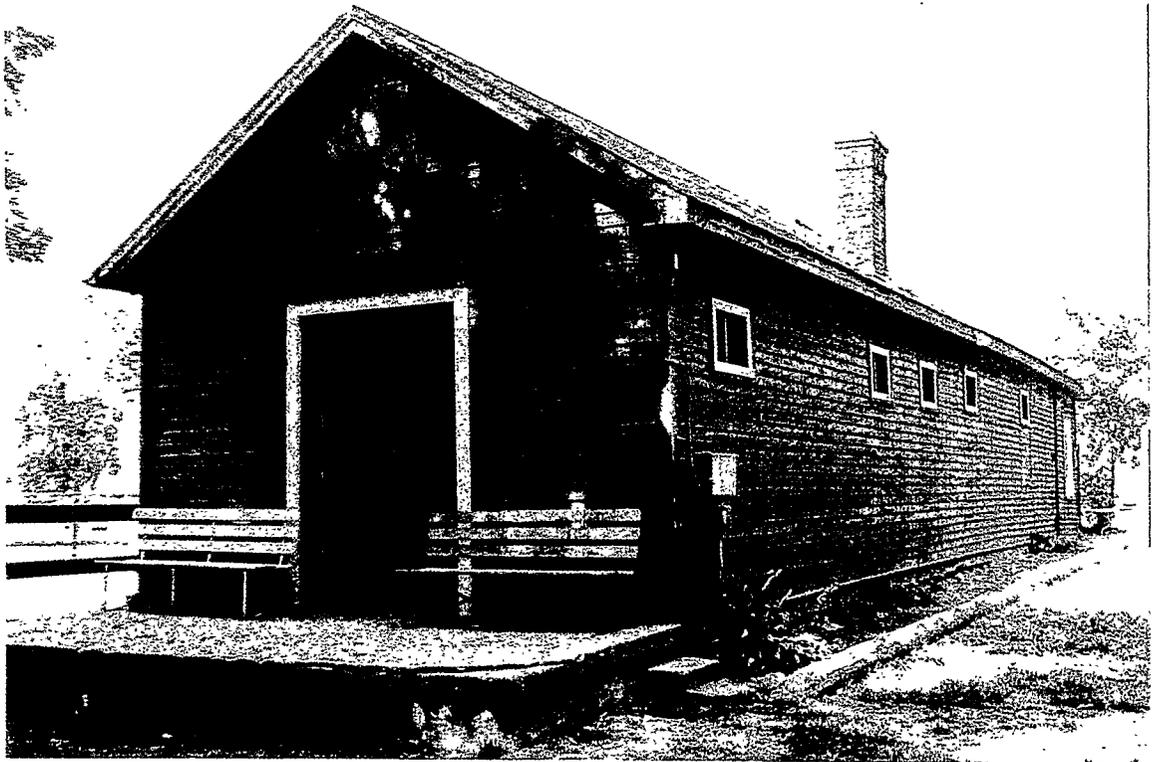
Eng. & Admin. 20% \$ 4,932.15
\$ 986.00

Total Alternate Project Cost \$ 5,918.15

HORSE BARN



CIRCA 1902



1

HORSE BARN

Horse Barn - Building 111

DESCRIPTION

The horse barn is a single story, wood frame structure founded on brick foundation walls. The basic rectangular footprint comprises approximately 1200 square feet. The structure currently serves as a horse barn which is leased by the town of Delaware City.

FINDINGS

The structure has been converted into a horse stable. The structure has been expanded an additional 30 feet, making the total structure approximately 72 feet long.

There is an office/storage room at the front entrance which uses the original sliding doors. The main room has been subdivided into five horse stalls.

At the rear a hay/storage room exists. As part of the stable conversion, the windows along the east elevation were removed and replaced with smaller units. Also, on the front gable end wall, an additional access door to the attic was installed. Presently, the interior walls and ceilings are lined with plywood.

1. Historical

From information obtained from the State Archives, we understand the structure was originally constructed circa 1902 for a cost of \$1,360.00. The structure was originally referred to as the Ordinance Repair Shop. The original structure was only 30 feet long. Later, the building was expanded an additional 12 feet.

2. Brickwork

The pointing of the brick chimneys exhibit signs of deterioration. The brick chimneys do not bear on foundations. They are supported on steel plate and brackets bolted to the exterior wall. We observed no visible indications of structural distress with the assembly. See Photo 13.

3. Concrete

At the front entrance, a concrete slab 8 feet wide is situated and is elevated approximately 18 inches above grade. There is a portion of the concrete topping which has disbonded and requires repair. See Photo 12. The floors are concrete slab on grade which appear in good condition.

4. Framing

The wall framing is 2x8 and 3x8 studs varying from 12 inches to 18

inches on center. With the exception of some rot in the sills, the wall framing is in good condition. Although not exposed, the roof structure does not exhibit any signs of structural distress. The rafter tails are in good condition with no indication of deterioration. The majority of framing is concealed by plywood sheathing.

5. Roofing

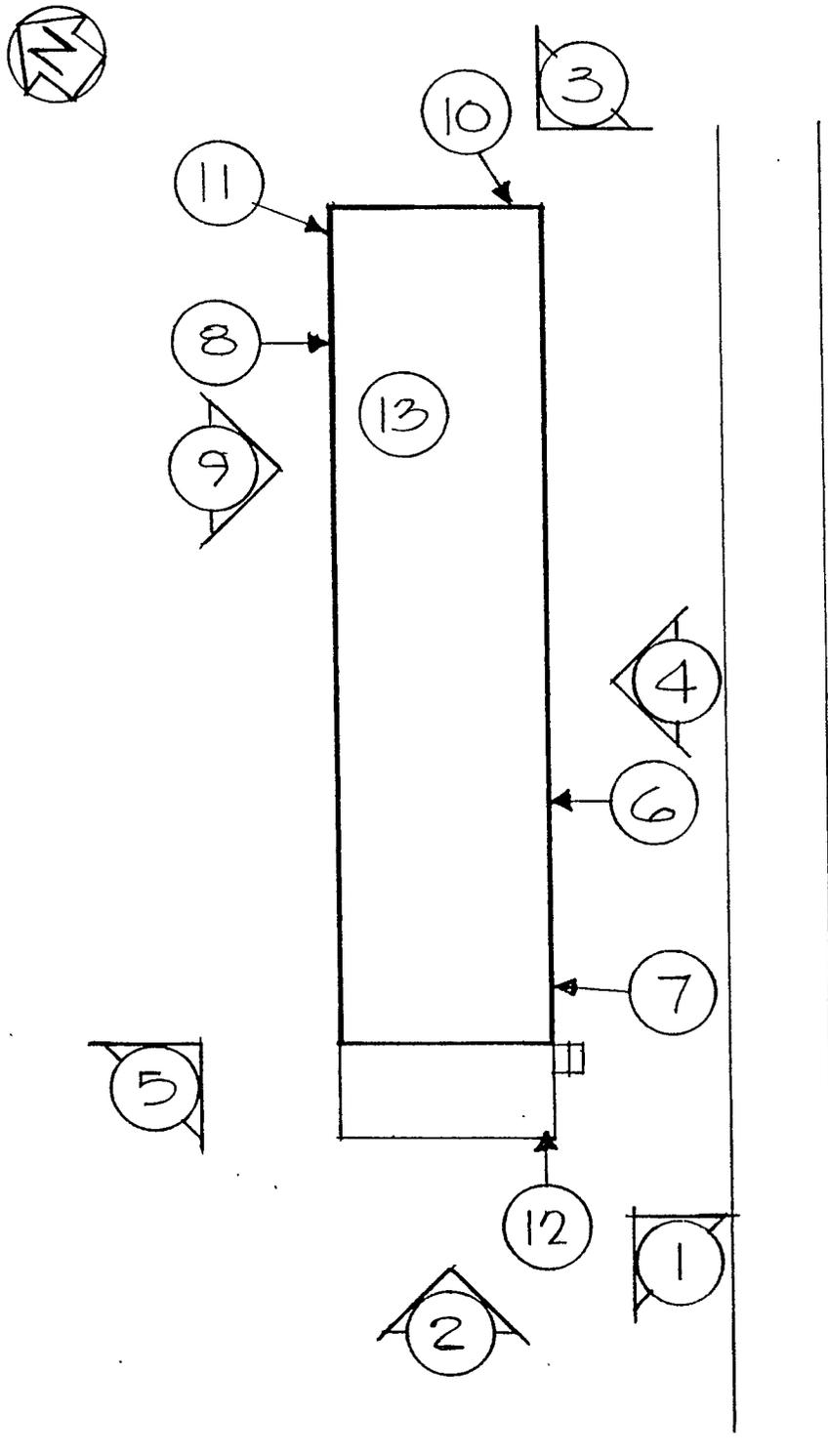
The existing roofing is slate which in general, is in fair condition. There are, however, individual slates which have become loose, especially near the chimney on the east elevation. Photo 6. There is a section of flashing at the roof which is missing at the chimney. Photo 5 & 6. Gutters along the east elevation are nonexistent. A section of gutter is missing along the west elevation. The downspouts are either missing or unconnected to the gutters. See photos 5 & 7.

6. Exterior Walls

For the most part, the clapboard siding is in fair condition; however, we estimate approximately 20 percent is in need of replacement. See photos 8, 9, & 10. The exterior is in need of repainting. See photo 7. The lower 4 feet of siding along the corral elevation has been covered with plywood indicating that this portion of siding may require replacement. See photos 8 & 9. The storage room addition at the rear 12 feet has settled considerably from the floor level of the main structure. The siding extends to grade at this end and exhibits signs of rot. The timber sill plate is also rotted and requires replacement. Voids are visible in the foundation walls suggesting that the addition was constructed on a slab on grade with no exterior foundation walls. See Photos 9, 10 & 11.

7. Windows and Doors

The windows are in poor condition. Many require reglazing. Several sills along the west elevation are rotted and require replacement. A few windows are boarded up. Some rot was observed at the window sills.



KEY PLAN

PHOTOGRAPHS

HORSE BARN (111)

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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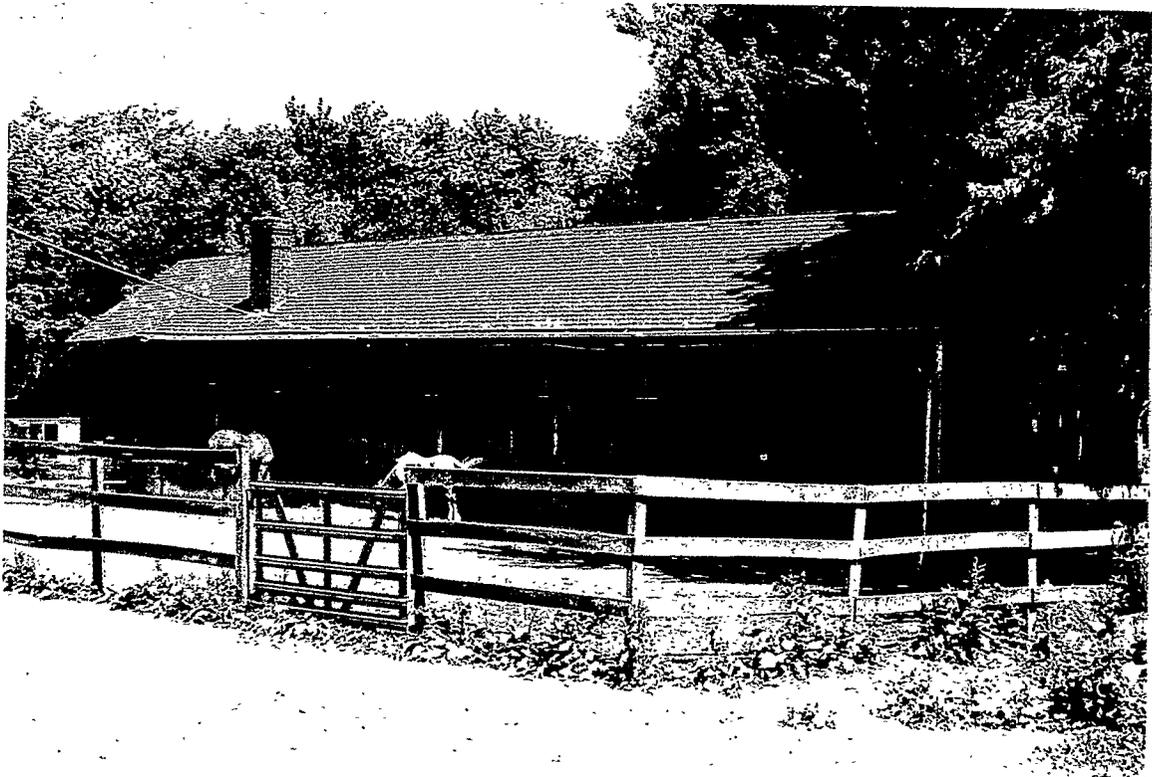
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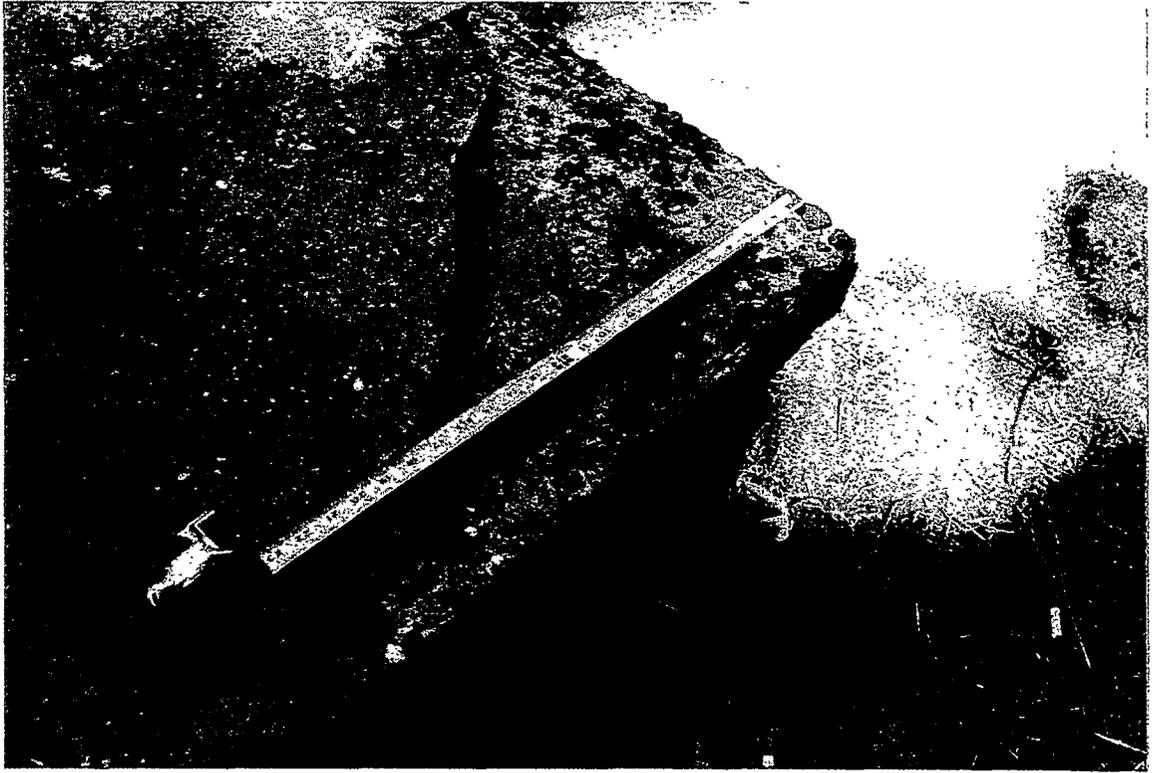
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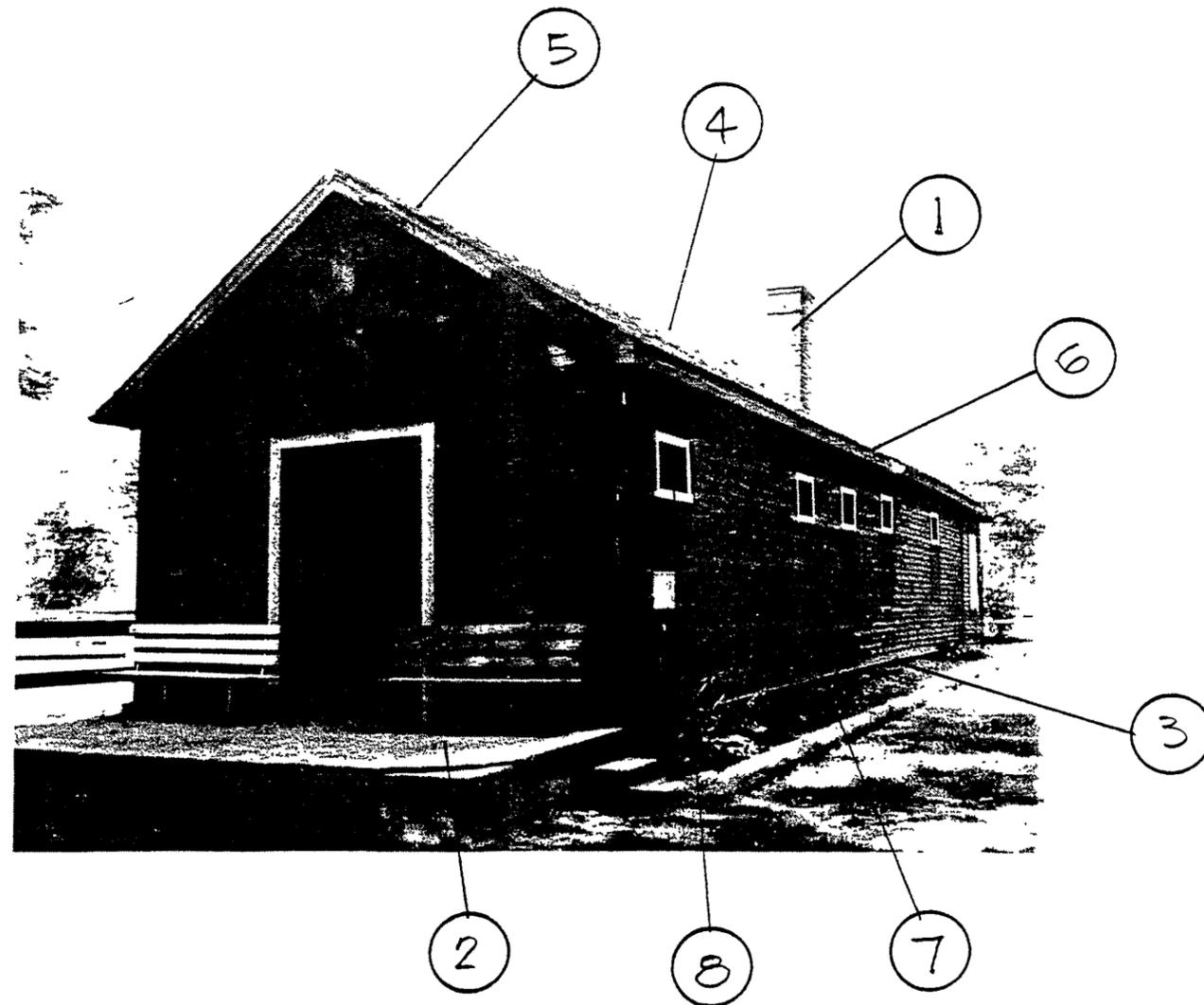
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12



13



STABILITATION

No work required.

PRESERVATION

1. Repoint approximately 20 sq. ft. of brick on the chimneys.
2. Patch entrance slab.
3. Replace rotted sill plate, approximately 40 lineal feet at end storage room.
4. Repair loose slate shingles.
5. Repair/replace missing ridge flashing.
6. Repair/replace gutters and downspouts.
7. Replace 20% of the clapboard siding.
8. Repair/reglaze all windows to render them operable. Replace rotted sills.
9. Repaint exterior siding and trim.

RESTORATION

10. Remove and replace windows to match original.
11. Remove attic access door at front gable wall.

RECOMMENDATIONS

HORSE BARN

BLDG. 111

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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PRELIMINARY COST ESTIMATE

HORSE BARN - BUILDING 111

Stabilization

No Work Required.

Subtotal Stabilization \$ 0

Preservation

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Repoint chimneys	20	S.F.	\$ L.S.	\$ 250.00
2.	Patch entrance slab	120	S.F.	\$ 2.55	\$ 306.00
3.	Replace sill plate at end storage room	40	L.F.	\$ 20.00	\$ 800.00
4.	Repair loose slate shingles	210	S.F.	\$ 8.70	\$ 1,827.00
5.	Replace ridge flashing	72	L.F.	\$ 3.50	\$ 252.00
6.	Repair/replace gutters & downspouts	120	L.F.	\$ 3.50	\$ 420.00
7.	Replace 20% of clapboard siding	410	S.F.	\$ 3.50	\$ 1,435.00
8.	Repair/replace all windows	7	EA	\$ 320.00	\$ 2,240.00
9.	Repaint exterior siding & trim	2100	S.F.	\$.80	\$ 1,680.00

Subtotal Stabilization & Preservation \$ 9,210.00

Contingencies 20% \$ 1,842.00

\$11,052.00

Eng. & Admin. 20% \$ 2,210.00

Total Project Cost \$13,262.00

Restoration (Alternate)

10.	Replace windows to match original	7	L.S.	\$ 1,200.00	\$ 8,400.00
11.	Remove attic access door at front gable wall frame & install siding to match original		L.S.		\$ 1,000.00

12. Remove existing slab
at entrance and install
timber ramp to match
original construction

L.S.

\$ 2,150.00

Subtotal Restoration \$11,550.00

Alternate Project Cost to Restore Structure to Original
Construction

Subtotal Stabilization & Preservation \$ 9,210.00

Add Restoration Subtotal \$11,550.00

Deduct Item 8 -\$ 2,240.00

Deduct Item 2 -\$ 306.00

Alternate Subtotal \$18,214.00

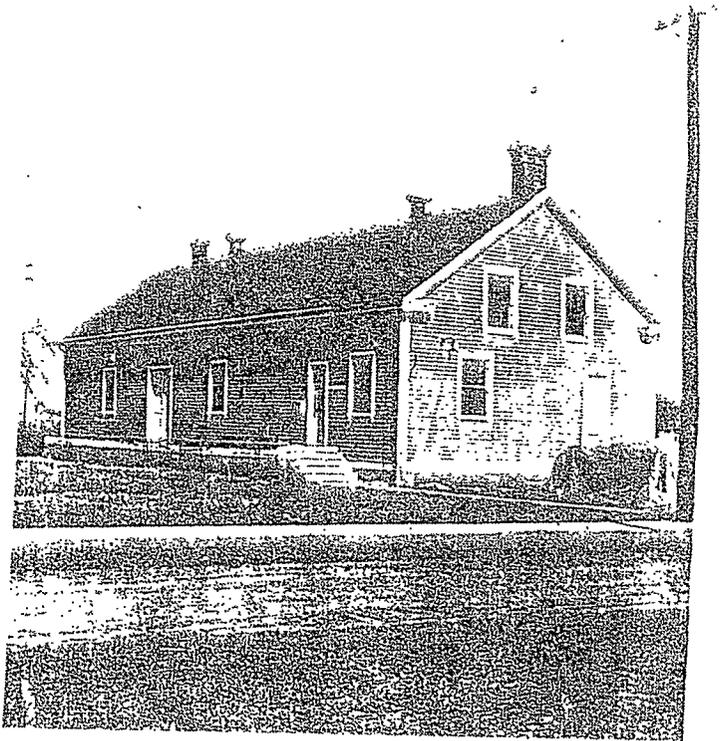
Contingencies 20% \$ 3,643.00

\$21,857.00

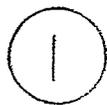
Eng. & Admin. 15% \$ 3,279.00

Total Alternate Project Cost \$25,136.00

QUARTERMASTER'S BLDG.



CIRCA 1901



QUARTERMASTER'S BLDG.

QUARTERMASTER'S BUILDING - BUILDING 115

DESCRIPTION

The Quartermaster's Building is a 1-1/2 story, wood frame structure founded on brick masonry piers. Rectangular in plan, the building footprint comprises 2,500 square feet per floor. The structure is currently boarded shut with access by a locked door. The building currently serves as a storage warehouse.

FINDINGS

1. Historical

A review of archival information determined that the structure was originally referred to as the "ordinance storehouse." Constructed circa 1901, the original cost for construction was \$3,850.00.

2. Brickwork

The brick masonry piers which support the building are in good condition.

3. Floors

The floor framing consists of full size 3x12 joists supported on 8x8 beams and columns at 12 feet o.c. There is some rotted flooring in the attic floor at the front of the building. See photo 15.

4. Roof

The roof is framed as a gable with 2x8 rafters spaced 16" o.c. and are supported on intermediate 6x8 purlins which span between 6x6 posts spaced 10 feet on center. There are a few locations where the roofing is deteriorated at the eave along the east side of the building. See photo 14. The slate roofing is in fair condition. Some repairs/replacement is required along the east eave. See photo 2. The integral gutters exhibit signs of corrosion in places. Downspouts are missing.

5. Exterior Walls

The exterior wall studs are 2x6 at 16" o.c. balloon framed. The framing extends 3 feet high above the second floor where it accepts the roof rafters. The wall sheathing is diagonal 1x6. In general, the timber framing is in good condition. See photos 12 & 13. The siding is severely weathered and approximately 50% is in need of replacement. The entire exterior requires painting. See photos 4 & 5. There are bee infestations at the southeast corner and along the north, projected rake assembly. See photo 8. There is a considerable amount of vegetation which requires removal around the

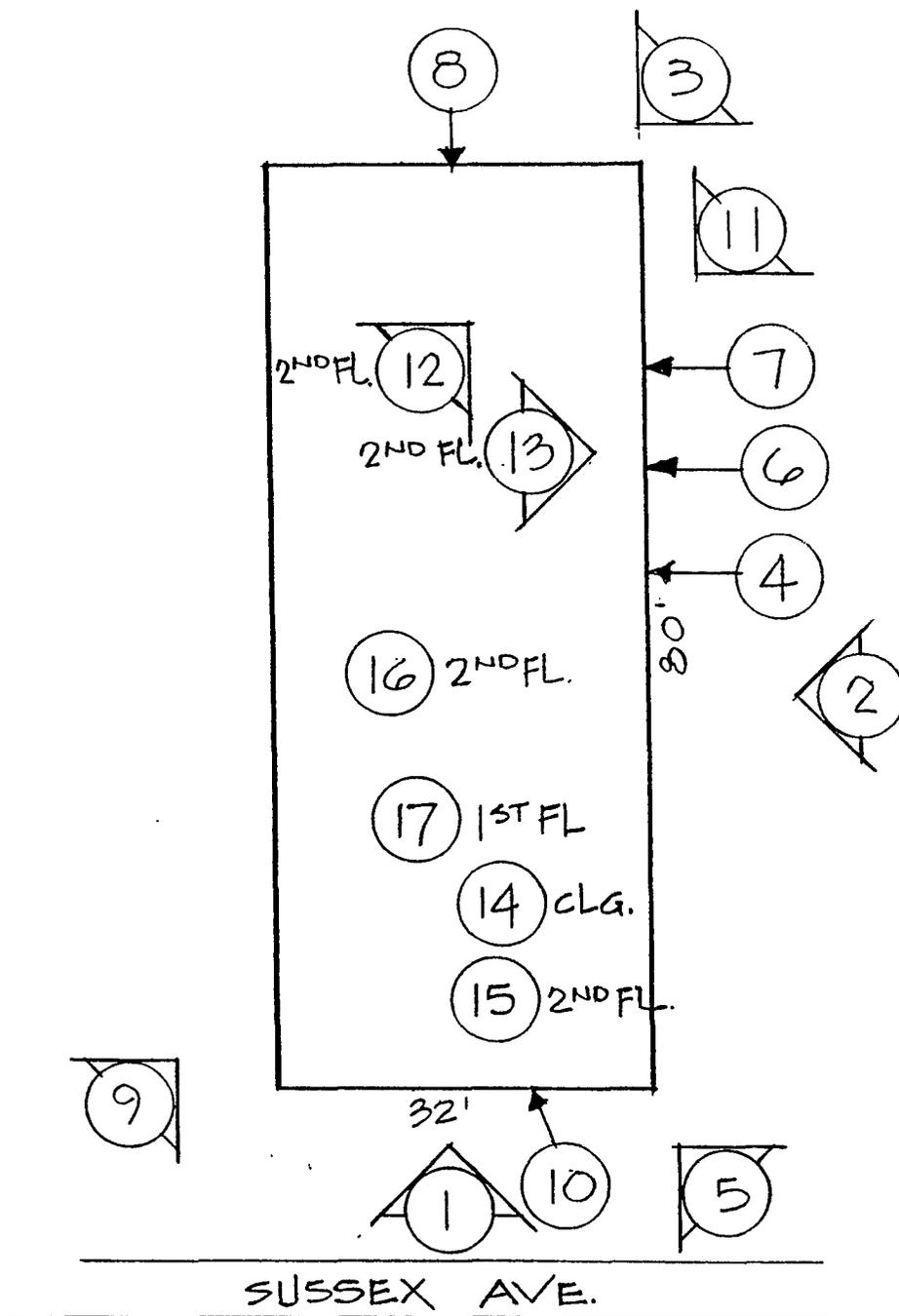
building. At locations, the vines have grown under the siding. See photos 5 & 11.

6. Doors and Windows

All doors and windows are boarded up. Most of the sash is missing glass or are broken. See photos 1, 2, 3 & 5. There is some rotted thresholds at the exterior doors which require replacement. See photo 7. The left side door entrance requires exterior steps to allow safe entry to the building. See photo 9.

7. General

Interior paint is peeling, a result of inadequate ventilation and heating. Piping in first floor ceiling has suspected asbestos insulation. See photo 17. There is an original freight elevator which we understand is operable which is located near the center of the building. See photo 16.



KEY PLAN
PHOTOGRAPHS

QUARTERMASTER'S BLDG. (115)

GREDELL
& ASSOCIATES
STRUCTURAL ENGINEERS

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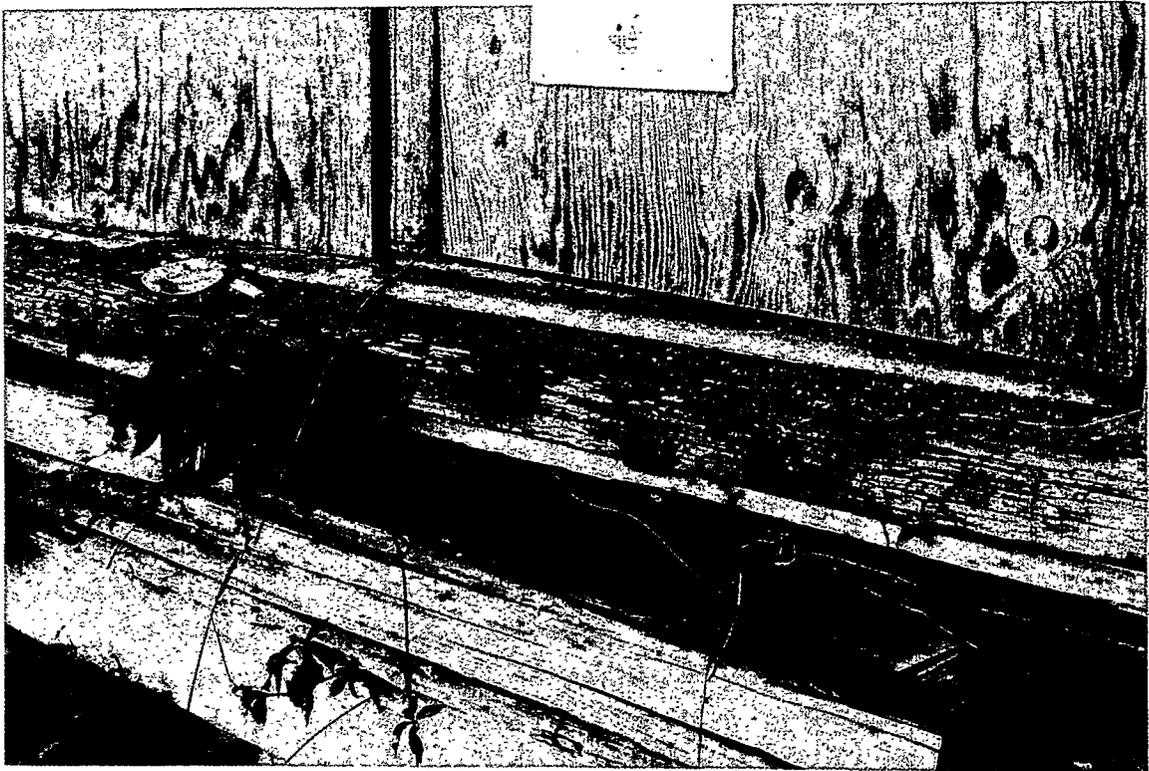
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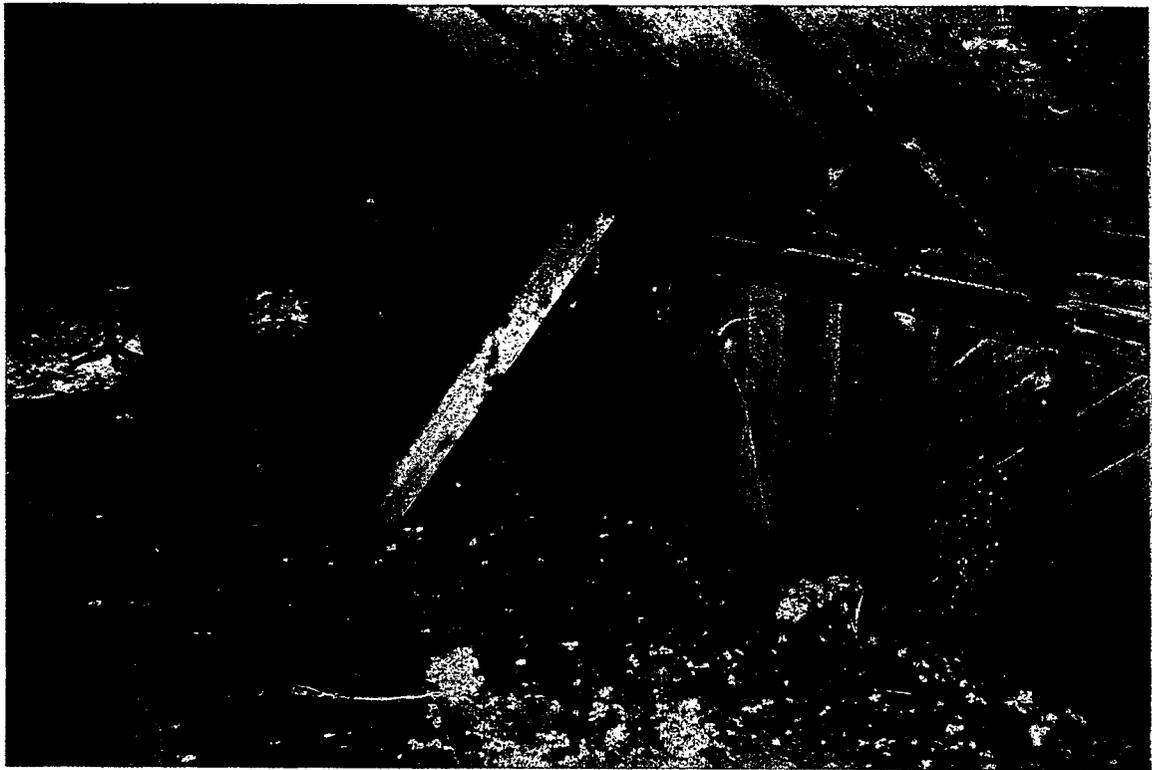
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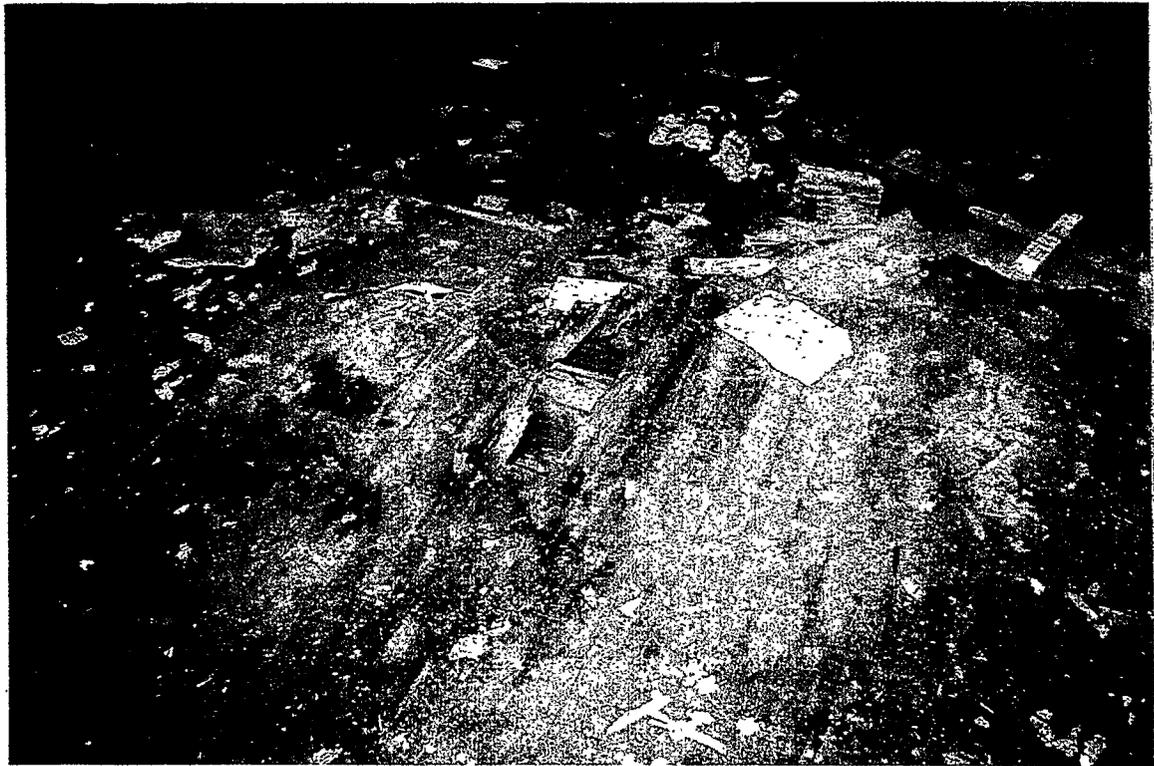
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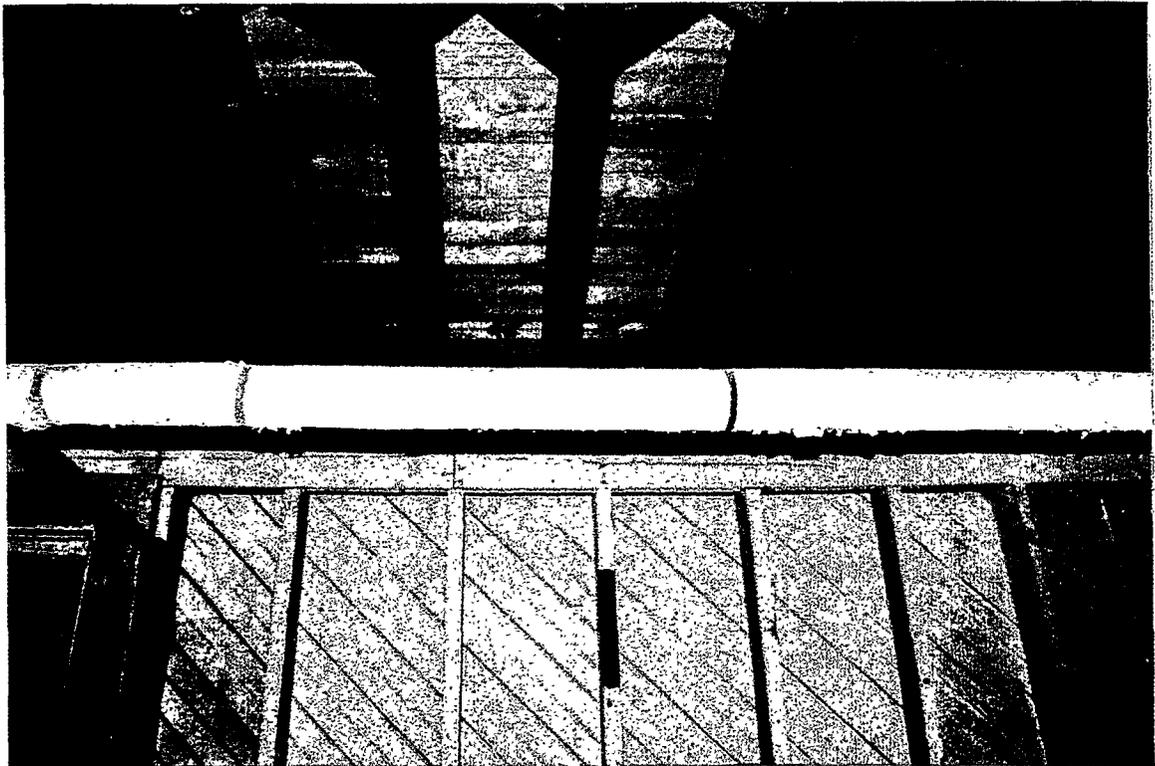
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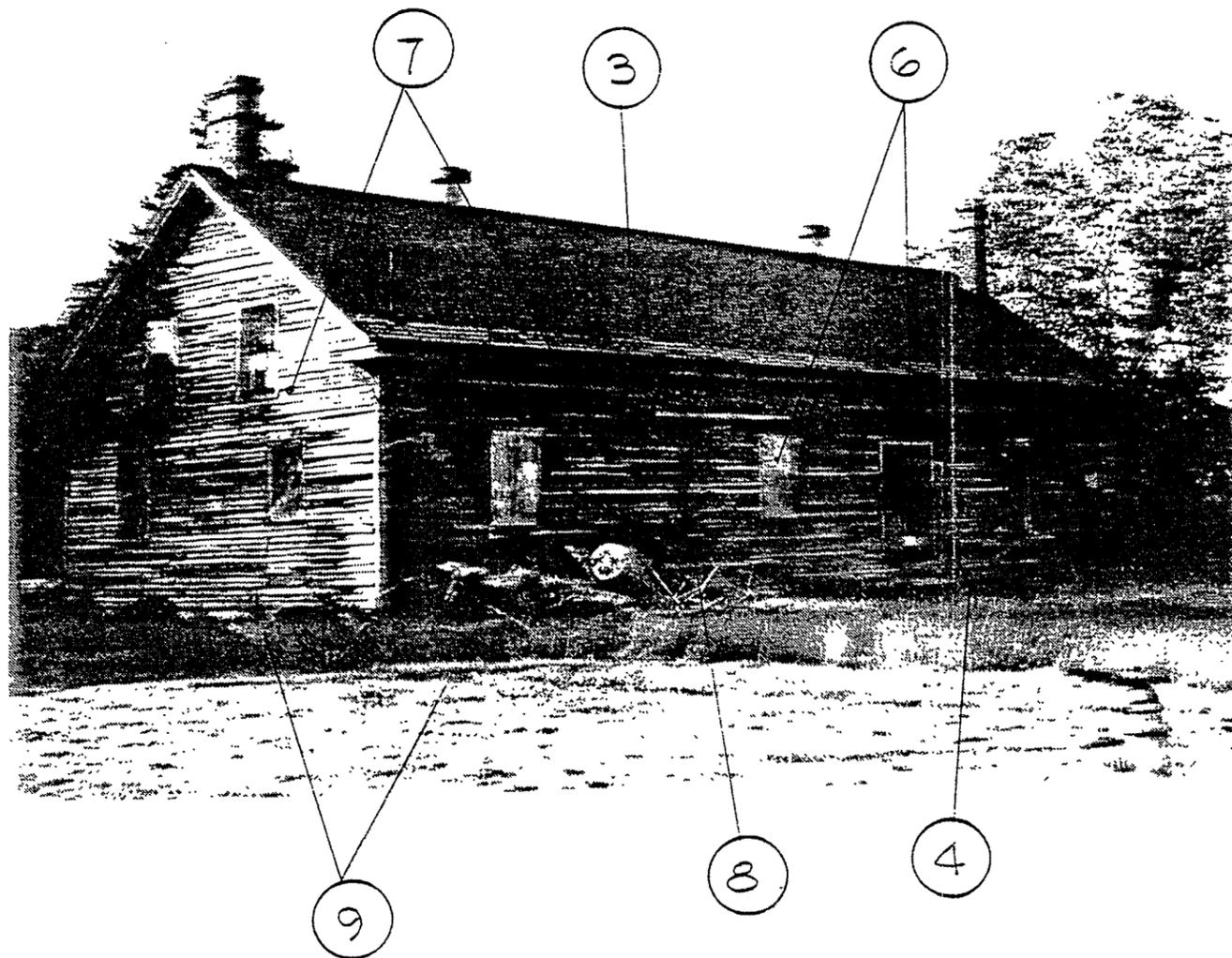
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16



17



STABILIZATION

No work required.

PRESERVATION

1. Remove bee infestations.
2. Replace rotted attic flooring.
3. Repair/replace deteriorated roof decking and slate shingles at roof leaks.
4. Remove the vertical boards which enclose the crawl space below the building.
5. Provide access stairs and railings to building entrances.
6. Replace/repair all windows and doors. Replace rotted sills, thresholds and millwork.
7. Replace 50% of clapboard siding to match.
8. Repaint entire exterior.
9. Remove perimeter debris and vegetation.

RESTORATION

10. Replace/repair doors and windows to replicate original construction.
11. Provide front entry stairs and loading dock along left side of structure.

RECOMMENDATIONS

QUARTERMASTER'S BLDG.

BLDG. 115

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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PRELIMINARY COST ESTIMATE

QUARTERMASTER'S BUILDING - BUILDING 115

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
No work required.					
Subtotal Stabilization					\$ 0

Preservation

1.	Remove perimeter vegetation		L.S.		\$ 1,000.00
2.	Replace all windows & doors	16	EA	\$ 320.00	\$ 5,120.00
3.	Remove & replace 50% of siding	1560	S.F.	\$ 3.50	\$ 5,460.00
4.	Repaint entire exterior	3120	S.F.	\$.80	\$ 2,496.00
5.	Roof decking & slate shingle repair	480	S.F.	\$ 10.55	\$ 5,064.00
6.	Remove shingles, roof decking right side eaves	160	S.F.	\$ 10.55	\$ 1,688.00
7.	Remove bee infest.		L.S.		\$ 500.00
8.	Provide access stairs & railings at entrance	2	EA	\$ 500.00	\$ 1,000.00
9.	Replace rotted attic flooring	160	S.F.	\$ 6.80	\$ 1,088.00
10.	Replace missing crawl space skirting	600	S.F.	\$ 4.75	\$ 2,850.00
Subtotal Stabilization & Preservation					\$26,266.00

Contingencies 20% \$ 5,253.00

\$31,519.00

Eng. & Admin. 15% \$ 4,728.00

Total Project Cost \$36,247.00

Restoration (Alternate)

11.	Replace doors & windows to replicate orig. const.	16	EA	\$ 1,200.00	\$19,200.00
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12. Provide front entry
stairs & loading
dock along left side 200 S.F. \$ 24.70 \$ 4,940.00

13. Repaint exterior to
match orig. color 3120 S.F. \$ 1.20 \$ 3,744.00

Subtotal Restoration \$27,884.00

Alternate Project Cost to Restore Structure to Original
Construction

Subtotal Stabilization & Preservation \$26,266.00

Add Restoration Subtotal \$27,884.00

Deduct Item 2 -\$ 5,120.00

Deduct Item 8 -\$ 1,000.00

Deduct Item 4 -\$ 2,496.00

Subtotal Alternate \$45,534.00

Contingencies 20% \$ 9,107.00

\$54,641.00

Eng. & Admin. 15% \$ 8,196.00

Total Alternate Project Cost \$62,837.00

1863 EARTHEN BUNKER



1



2

1863 EARTHEN BUNKER

1863 EARTHEN BUNKER - STRUCTURE 117

DESCRIPTION

The 1863 Earthen Bunker is a fortification which has been elevated on earth to provide both strategic firing position and cover for a powder magazine below. The gun placements are adjacent to a gravity retaining wall consisting of alternate courses of brick masonry and cast-in-place concrete. The decking in the vicinity of the gun placements is of "corduroy" construction made up of timber planks set on and infilled with concrete. Both the wall and the deck construction is considered somewhat unique; however, the appearance and craftsmanship leaves much to be desired.

FINDINGS

1. Gun Emplacements

The only visible evidence of the guns are the remaining anchor bolts onto which the guns were mounted. The retaining walls are in fair condition with some pointing required. Vegetative growth, especially trees adjacent to the walls pose a threat to the integrity of the walls.

The timber decking is in poor condition requiring repair and in some instances replacement, depending on the extent of the deterioration.

2. Powder Magazine

The condition of the brick masonry vault is excellent with both brick and mortar sound and intact. The cut stone granite portal and side walls are in good condition.

3. General

There are no real structural items of concern. However, access to the bunker is not well marked, nor is there a clear path leading to the various elements of the bunker.



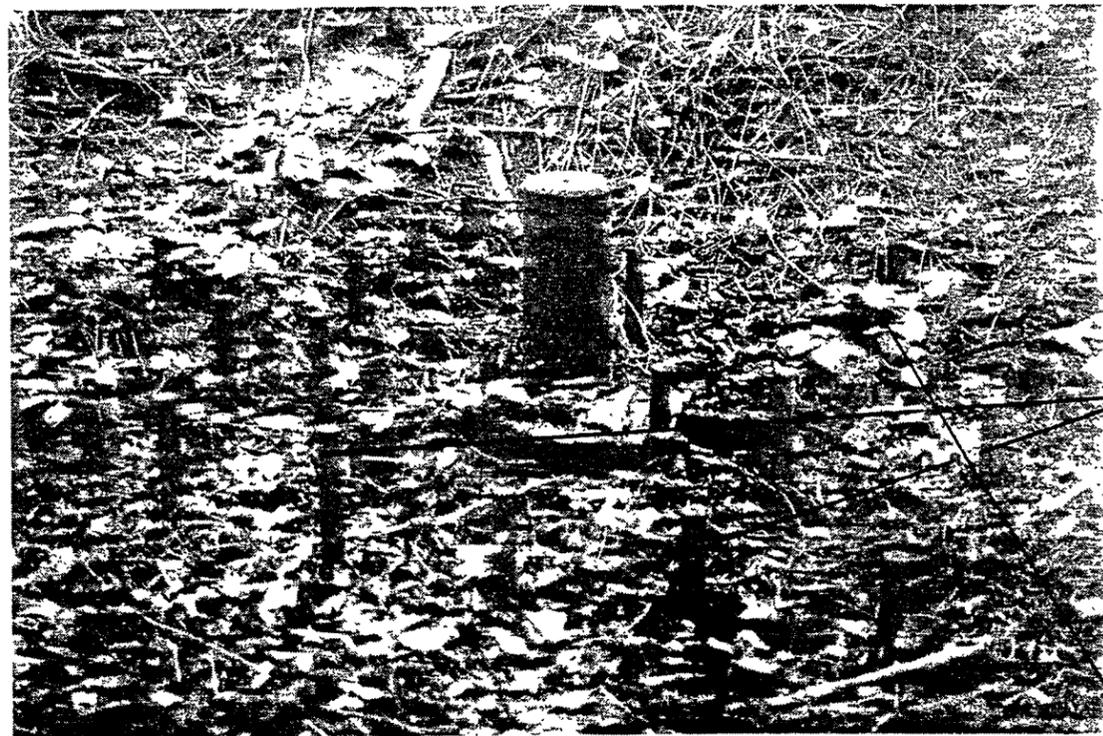
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2



1

2

STABILIZATION

No work required.

PRESERVATION

1. Provide easier markings and access to and around the bunker. Remove vegetation as required to make a clear path.
2. Provide protection on all projecting anchor bolts which pose a safety hazard.

RESTORATION

3. Rebuild corduroy decking at gun mount locations.

RECOMMENDATIONS

1863 EARTHEN BUNKER

BLDG. 117

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

702 N. WEST STREET - WILMINGTON, DELAWARE 19801 • 302-429-7400
5 THE GREEN • DOVER, DELAWARE 19901 • 302-734-7400

PRELIMINARY COST ESTIMATE

EARTHEN BUNKER - BUILDING 117

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
No work required.					
Subtotal Stabilization					\$ 0

Preservation

1.	Provide easier markings & access, remove vegetation		L.S.		\$ 5,600.00
2.	Provide protection on projecting anchor bolts	60	EA	\$ 25.00	<u>\$ 1,500.00</u>

Subtotal Stabilization & Preservation \$ 7,100.00

Contingencies 20% \$ 1,420.00

\$ 8,520.00

Eng. & Admin. 20% \$ 1,704.00

Total Project Cost \$10,224.00

Restoration (Alternate)

3.	Rebuild corduroy decking	1200	S.F.	\$ 10.50	<u>\$12,600.00</u>
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Alternate Project Cost to Restore Structure to Original Construction

Subtotal Stabilization & Preservation \$ 7,100.00

Add Subtotal Restoration \$12,600.00

Subtotal \$19,700.00

Contingencies 20% \$ 3,940.00

\$23,640.00

Eng. & Admin. 15% \$ 3,546.00

Total Alternate Project Cost \$27,186.00

BATTERIES REED & GIBSON



BATTERIES REED & GIBSON

1

BATTERIES REED AND GIBSON - STRUCTURE 118

DESCRIPTION

The Batteries Reed and Gibson is a rectangular concrete structure housing the support of 4 large gun emplacements. The structure in plan is approximately 450 feet long by 60 feet wide and is elevated approximately 20 feet. An earthen embankment is provided on the sides of the structure at three sides. There are three main levels: ground floor, rifle mount level and roof/upper deck level.

From our research of information obtained from the National Archives in Washington, D.C., we obtained portions of the original drawings dated 1898.

The structure is essentially a concrete mass with emplacements for (2) 12 inch rifles and (2) 8 inch rifles. The 12 inch rifles are situated at either end, the north and south flanks, while the (2) 8 inch rifles are centrally located.

At the west elevation, the grade is natural. There are several doorways to chambers below each rifle emplacement. Typical of each emplacement is a shot chamber, ammunition hoist, shell storage, and power storage room. There are remnants of a trolley rail mounted to the ceiling in each chamber for the movement of the rounds from storage to the firing line.

The two interior 8 inch rifle emplacements have a set of concrete stairs which lead to the rifle mount level. There are no interior stairs at the 12 inch rifle emplacements at either flank. Access to the rifle mount level is either by a ships ladder down from the upper roof deck, or from a set of steel and timber stairs of which only a few remnants remain.

At each of the four emplacements on the rifle mount level, there is a concrete roofed canopy adjacent to each ammunition hoist opening. The construction is structural steel framing encased in concrete that supports an elevated concrete slab.

As a result of our review of the battery structure, the following conditions were observed:

Roof/Upper Deck Level

1. At several locations, construction joints have opened allowing vegetation to grow in the cracks. Photo 4.
2. The roof of the structure was at one time coated with a bitumastic coating. Practically none of this coating currently remains. Photo 4.

3. There are no railings adjacent to pit areas or along the west elevation. Photos 4, 7 & 9.

Rifle Mount Level

4. The concrete has deteriorated at several locations. Cracks and spalls from freeze/thaw damage are visible throughout the entire structure. Photos 7, 8, 9, 11 & 13.
5. Vegetation has grown in several cracks, and in the bituminous coating on the rifle mount level. Photos 9 & 12.
6. At each gun mount, several projecting anchor bolts occur which pose a safety hazard. Photos 8, 9 & 14.
7. Attached to the western wall, a wood and steel angle frame walkway connects adjacent emplacements. This deck is severely decayed and rotted and is impassible. The steel is in fair condition; however, the timber requires replacement. Photo 16.
8. There is a pipe railing along the western elevation, however, several portions are missing and the post mountings have deteriorated. Photos 5, 10, 15 & 17.

Ground Floor Level

9. Many doors are either deteriorated or are missing. Photo 18.
10. External stairways leading up to the rifle mount level are missing. Photo 17.
11. Entering the various chambers, the ceilings are moist, with visible calcium deposits forming stalactites. The ceiling structure is comprised of cement plaster over steel, wide flange beams and hollow clay tile arches. Due to the presence of moisture, several areas of plaster have collapsed. The steel beams are severely corroded. Photos 19 & 21.
12. At each emplacement, and attaching each chamber, is a crane rail mounted to the ceiling. At most locations, this rail has been completely corroded. Photos 22 & 23.
13. At the ammunition hoist shafts, the steel framing heading the openings is in very poor condition. There are several locations where no section remains. Photos 19 & 20.
14. Directly below the ammunition hoist on the concrete floor are several projecting anchor bolts and/or depressions in the slab which pose a safety hazard.
15. A considerable amount of debris is found throughout the

chambers of each emplacement.

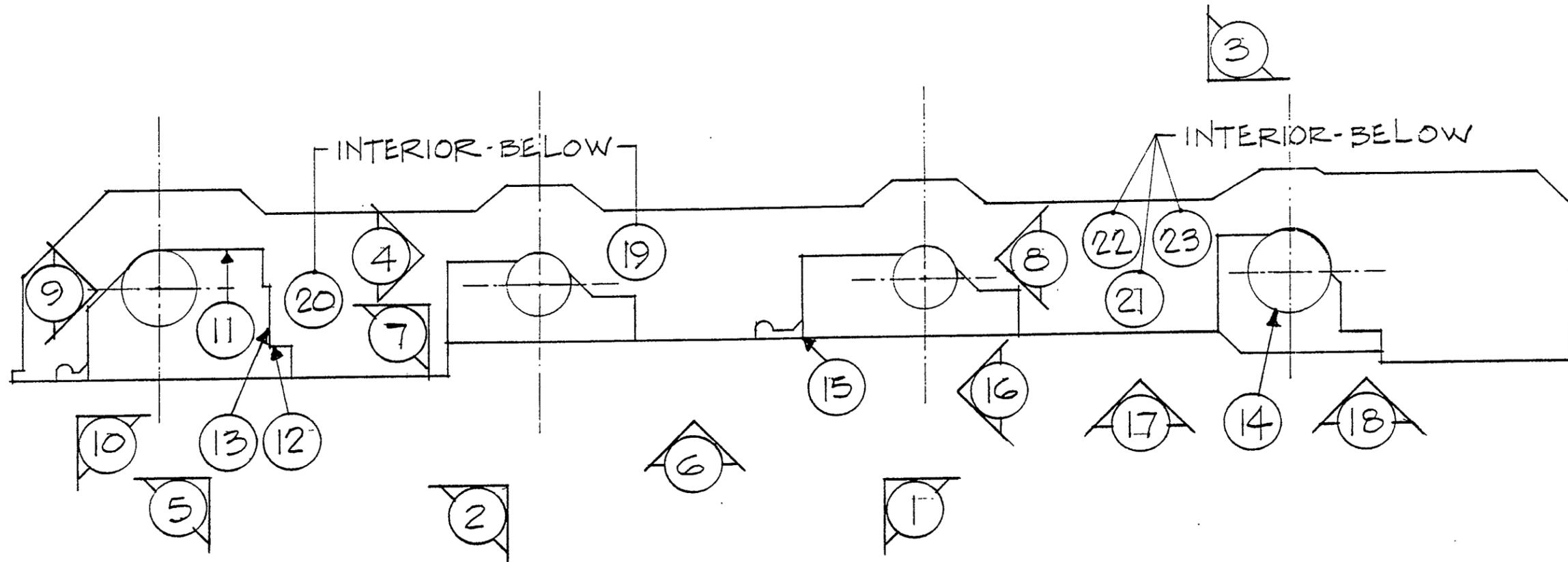
16. Although most vegetation has been cut back, there is still a considerable amount which should be cut back and maintained.

FINDINGS

Concrete

1. As part of our review, we selectively took two cores of concrete in the roof deck. This was done to ascertain the quality and condition of the existing concrete. As a result of laboratory testing and chemical evaluation, we have determined that the concrete is in good condition with a compressive strength of in excess of 4,000 psi. The only undesirable quality is the high chloride ion content of over 8 pounds per cubic yard. This leads to the conclusion that river water was used to cast the concrete. Because of the high chloride content, and with the presence of moisture, the deterioration of encased structural steel is of primary concern.
2. The deterioration of the concrete is readily seen at the vertical faces of the structure where a pattern of distress is observed. The pattern is dominated by horizontal lines which mark the construction joints where consecutive pours of concrete interface. Large, angular trap rock uses for coarse aggregate tends to provide a mix that is harsh and difficult to consolidate. As a result, poor bond was achieved at the "cold" joint which resulted in a weakness at the vertical surface.
3. Water has entered these cracks which occur at most horizontal construction joints. During cold weather, the concrete has been subjected to freeze/thaw damage. The older concrete is extremely susceptible to this type of damage since air-entrainment was not provided in early concrete mixes. Although freeze/thaw damage is most severe at the underside of each cold joint, freeze/thaw damage occurs in the vertical surfaces to an average depth of approximately 6 inches. However, at some locations, freeze/thaw damage runs as deep as 18 inches along the upper sections of the walls.
4. Elevated sections of roof and decking are framed with structural steel which is encased in the concrete. Constant moisture in concrete of high chloride content has caused the embedments to corrode. As a result, the embedments have expanded causing the concrete to split and spall allowing even more moisture to enter the section. As temperatures drop during the colder months, freeze/thaw damage causes additional deterioration in these sections.

5. Structural steel beams are provided to support the concrete above the rooms and corridors. Where finishes are plaster, hollow clay tile is provided as the substrate. The tiles are set between the webs of the beams. Where concrete is the finish surface, no tile is provided. Moisture in the tile and the concrete has consumed most of the steel sections. The by-products of corrosion have caused the section to expand causing distress in the tile and the concrete which surrounds the member. As a result, tiles and concrete in the ceiling have become loose and are subject to dislodgement. In addition, there is concern for the structural capacity of the concrete above the rooms to safely span between the walls; especially in the larger areas such as the powder magazines. Here the deteriorated concrete section is limited in depth, by the asphaltic waterproofing course, to 3-1/2 feet and must span approximately 20 feet. Although the resulting shear stresses at the support walls are fairly low, the tension in the non-reinforced section at mid span is of concern.
6. The concrete wash surfaces on the upper deck are in fair condition with some areas of localized deterioration. In addition, control and construction joints are not sealed; allowing water to penetrate the interior.
7. Although available documentation is not complete, we presume that drainage from the gun pits was provided by cast iron pipes embedded in the concrete. These pipes have no doubt deteriorated in the chloride laden concrete. We believe these to be a primary source of the water problems below.



KEY PLAN

PHOTOGRAPHS

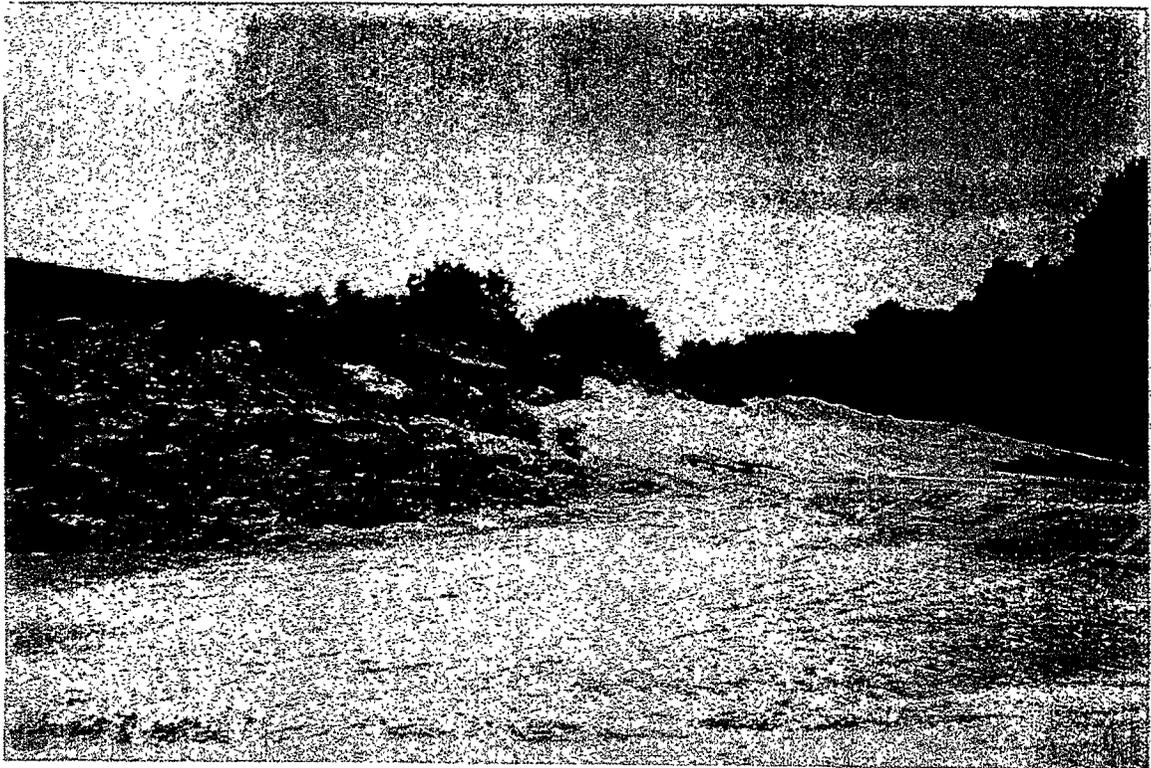
BATTERIES REED & GIBSON (118)

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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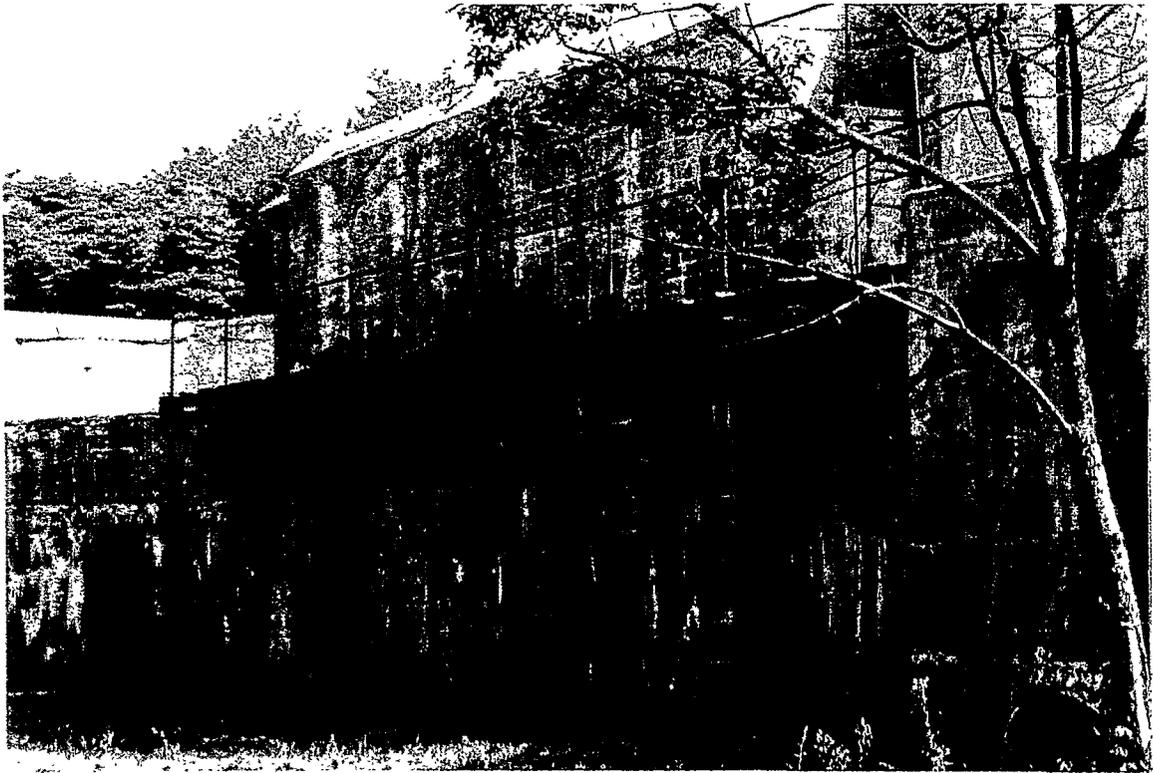
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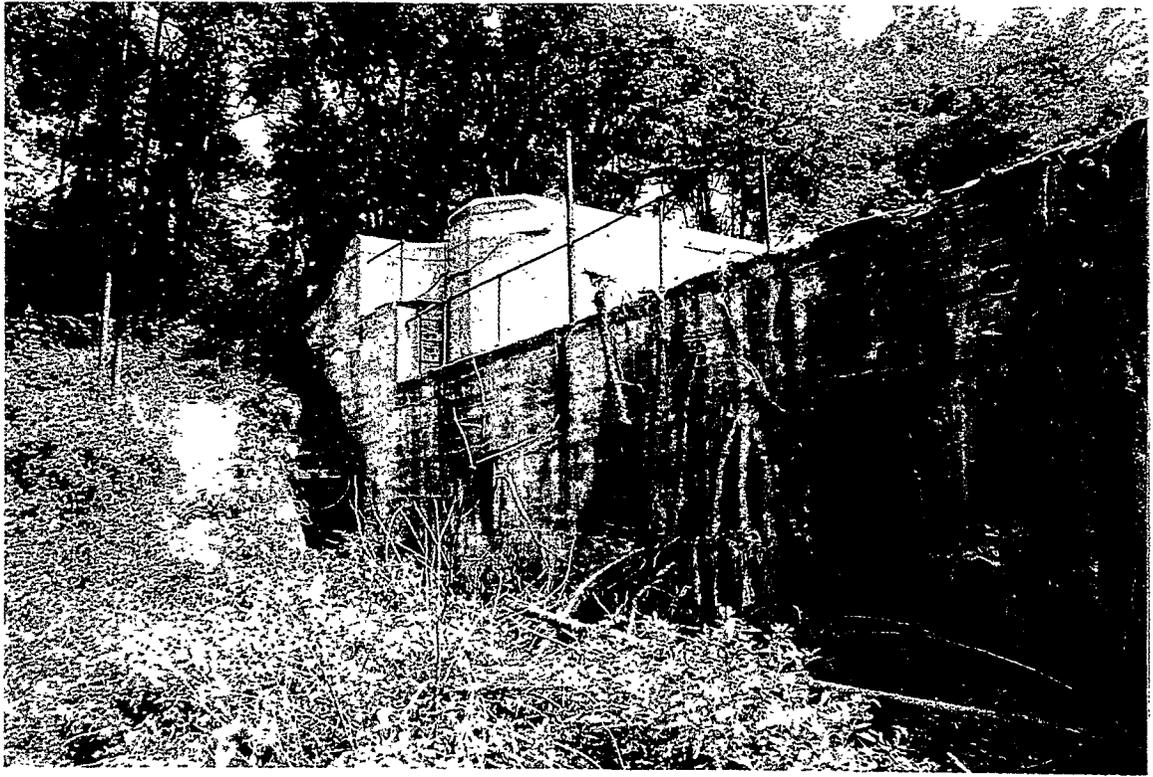
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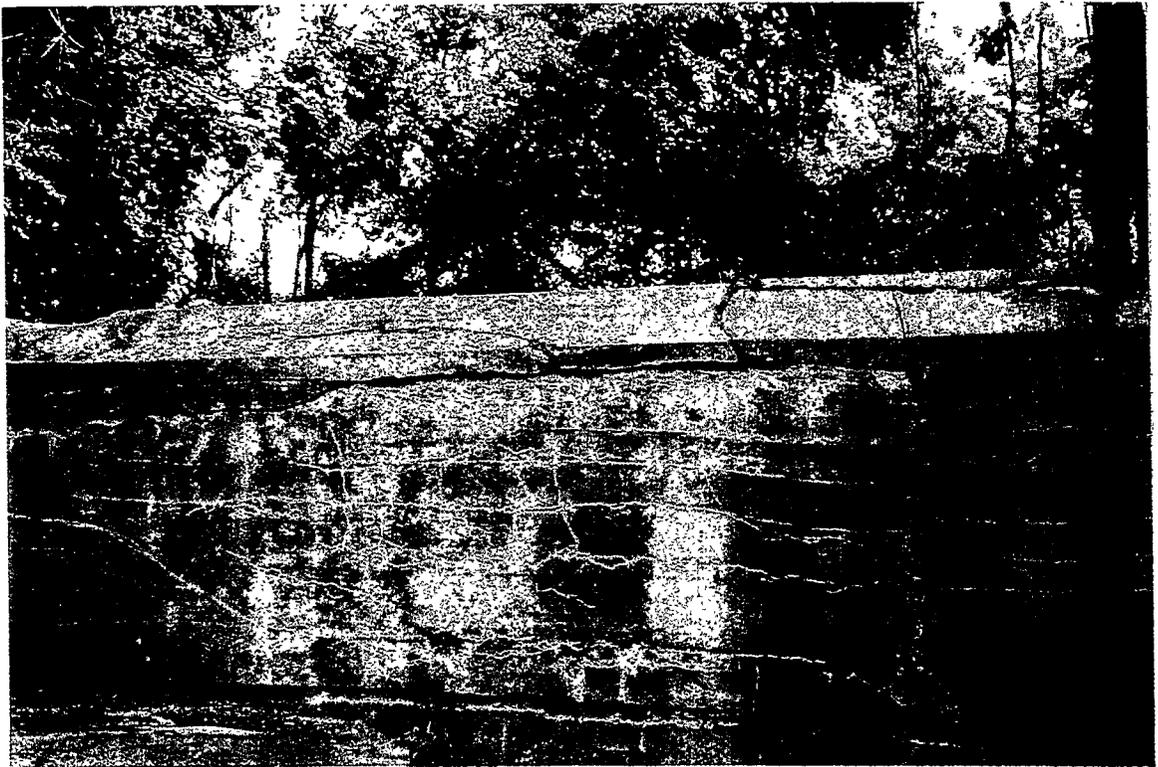
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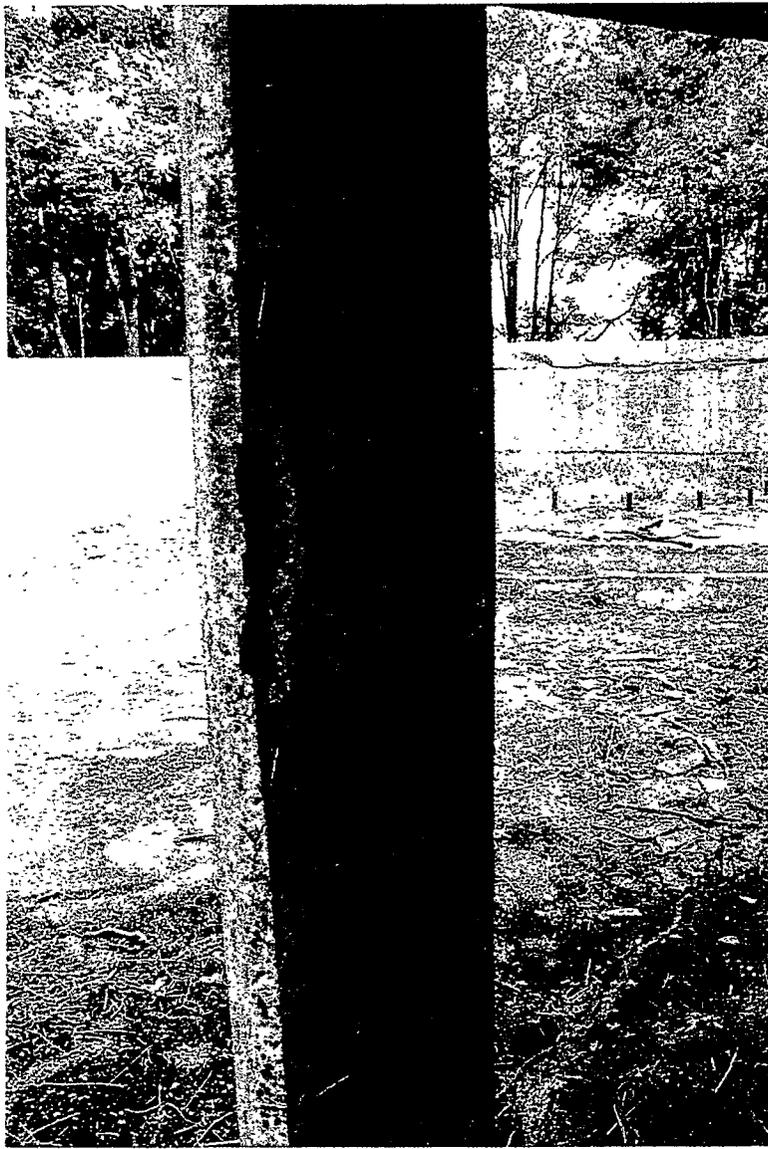
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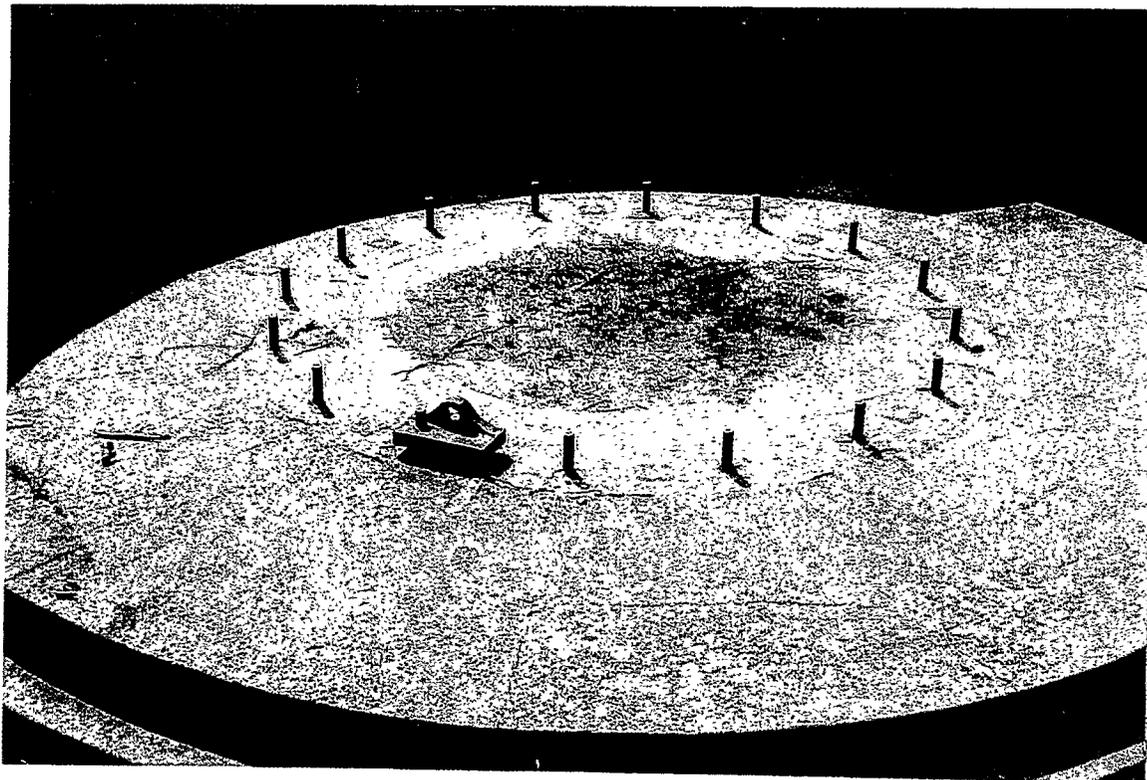
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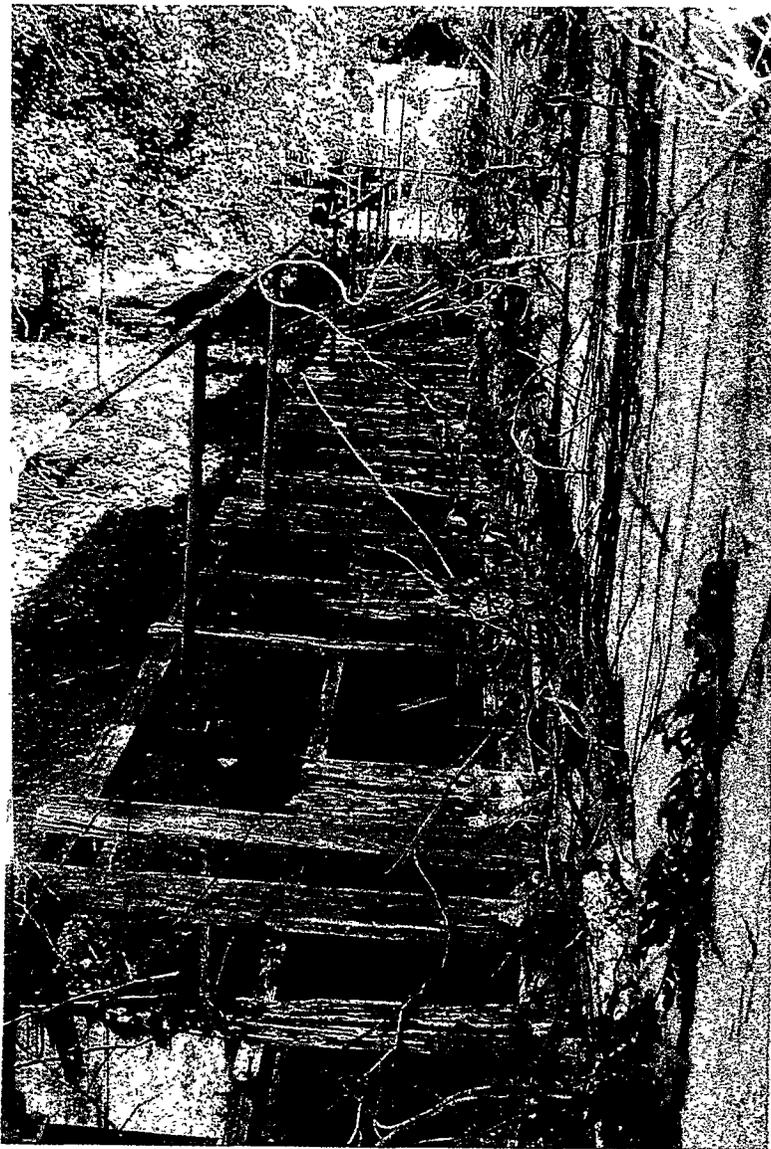




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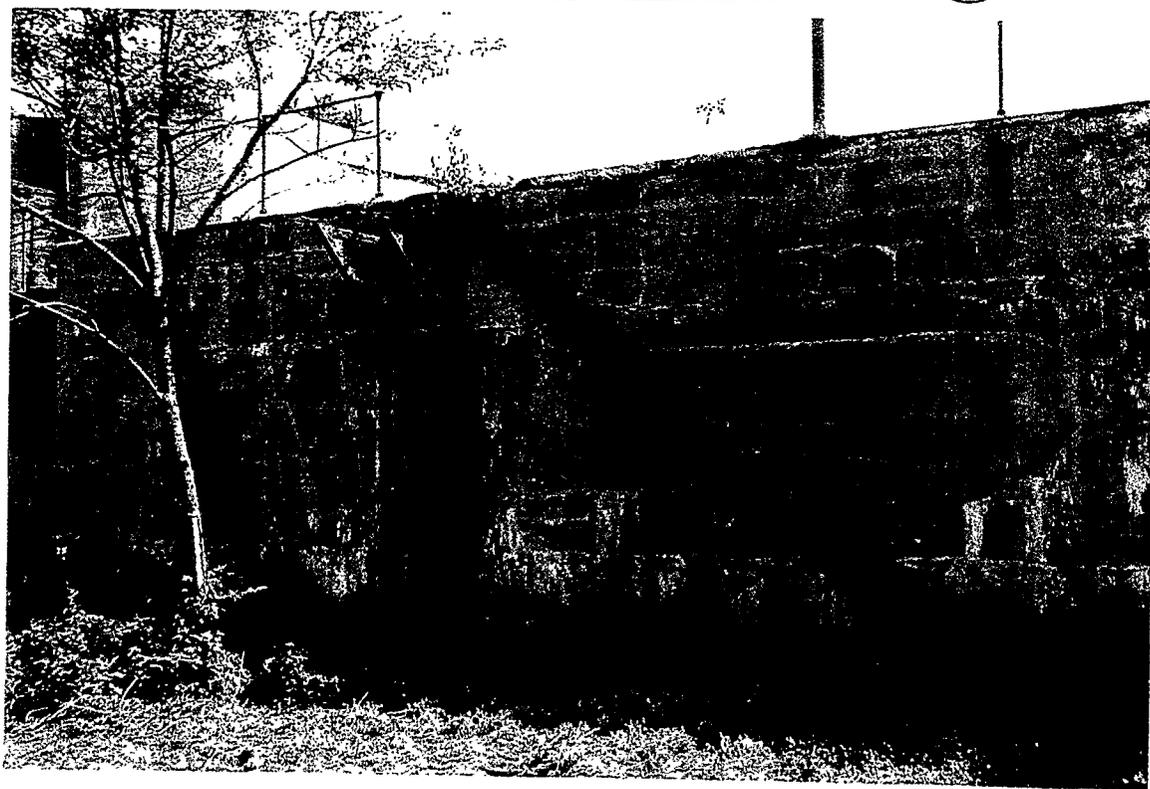


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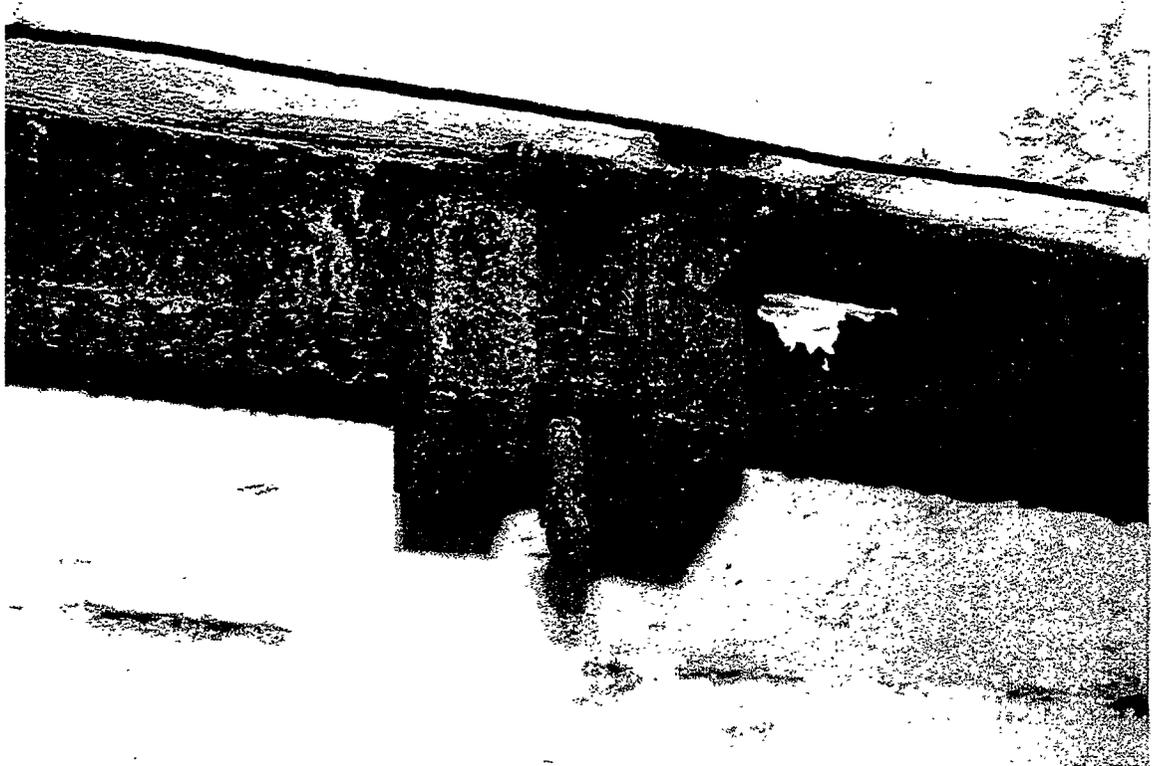
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STABILIZATION

1. Barricade structure from access.

PRESERVATION

2. Provide shoring for overhead concrete in rooms, corridors and shafts.
3. Remove structural steel embedments at ceilings and vertical shafts. Replace all steel with galvanized sections. Apply shotcrete to sound concrete substrate and rebuild section.
4. Remove deteriorated concrete on all vertical surfaces which have been damaged by freeze/thaw. Install steel reinforcement bars each way connected to stainless steel embedments. Shotcrete vertical surfaces to build section to the original level of concrete. Provide steel trowel finish on final coat to achieve uniform appearance.
5. Provide positive drainage from gun pits. Auger diagonal shaft through concrete to grade at exterior of building.
6. Remove deteriorated concrete at flatwork portions of the gun pits. Cast in place replacement concrete to the original lines. Provide sealant at all construction joints to assure a watertight deck.
7. Install waterproof bitumastic coating over entire "roof" structure as originally provided. At lower gun areas, install membrane and overlay with concrete wear deck.
8. Railings - Provide additional pipe railing to supplement existing portions along the western elevation at rifle mount levels.
9. Stairways and connecting walkways blast clean and paint all steel frame brackets. Re-attach to concrete with galvanized anchor bolts. Provide stairs between grade and rifle mount decks at two locations. Replace timber decking with treated lumber.
10. Provide anchor bolts protectors on all projected anchor bolts.
11. Remove all vegetation.

RESTORATION

12. Restore all doors and gates.

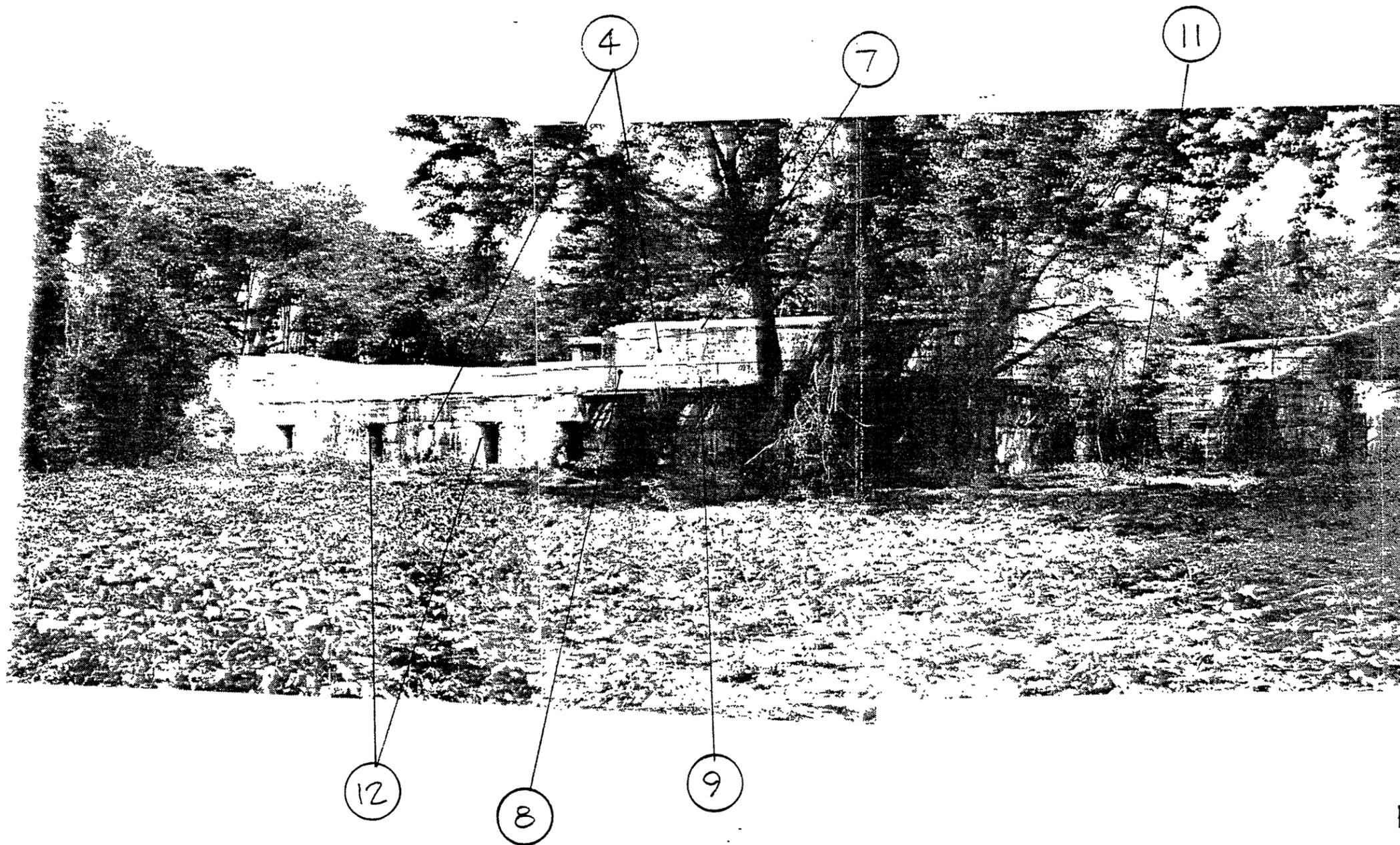
RECOMMENDATIONS

BATTERIES REED & GIBSON

BLDG. 118

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RECOMMENDATIONS

BATTERIES REED & GIBSON

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PRELIMINARY COST ESTIMATE

BATTERIES REED & GIBSON - BUILDING 118

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Barricade structure from access		L.S.	\$	<u>\$11,500.00</u>
Subtotal Stabilization					\$11,500.00

Preservation

2.	Shoring for overhead concrete	7200	S.F.	\$.71	\$ 5,112.00
3.	Remove exist. struct. steel & replace with galv. sections	44	TON	\$ 3,137.00	\$138,028.00
3a.	Apply shotcrete to ceilings (incl. plaster & terra cotta tile removal	7200	S.F.	\$ 10.74	\$77,328.00
4.	Remove deter. concrete on vertical surf. Install steel reinf. Apply shotcrete to orig. thickness & finish	17500	S.F.	\$ 20.16	\$352,800.00
5.	Provide drains at gun pits	120	L.F.	\$ 61.96	\$ 7,435.20
6.	Remove deteriorated concrete & install new at gun pits	2800	S.F.	\$ 4.85	\$13,580.00
7.	New bitumastic coating at roof surface	23000	S.F.	\$ 1.86	\$42,780.00
8.	New railings at west elevation adjacent to rifle mounts	220	L.F.	\$ 21.00	\$ 4,620.00
9.	Remove, blast, prime, paint & reinstall stairs, walkway steel & brackets		L.S.	\$	\$42,560.00
9a.	Replace timber decking	840	S.F.	\$ 10.00	\$ 8,400.00

10.	Provide anchor bolt protectors on projected bolts	72	EA	\$ 25.00	\$ 1,800.00
11.	Remove all vegetation		L.S.	\$	<u>\$10,500.00</u>
	Subtotal Preservation				\$704,943.20
	Contingencies 20%				<u>\$140,989.00</u>
					\$845,932.20
	Eng. & Admin. 11%				<u>\$ 93,053.00</u>
	Total Project Cost				<u>\$938,985.20</u>

Restoration (Alternate)

12.	Restore doors and gates	12	EA	\$12,480.00	\$149,760.00
13.	Replace rolled trolley rails on ceiling	6.5	TON	\$ 3,906.00	<u>\$ 25,329.00</u>
	Subtotal Restoration				\$175,149.00

Alternate Project Cost to Restore Structure to Original Construction	Subtotal Preservation	\$704,943.20
	Add Restoration Subtotal	<u>\$175,149.00</u>
		\$880,092.20
	Contingencies 20%	<u>\$176,018.00</u>
		\$1,056,110.20
	Eng. & Admin. 10%	<u>\$105,611.00</u>
Total Alternate Project Cost		<u>\$1,161,721.20</u>



Date In 7/5/96 Due Date 7/5/96 Time 12:00 p Account _____
 Cust./Acct. Name DNKE P.O. # _____
 Address _____ Last _____ First _____ Work # 739-5284
 Contact Karen Meyer Job Name _____ Home # _____

B&W Color Over size

1:1 8.5 x 11
 1:2 8.5 x 14
 2:2 11 x 17
 2:1

copies @ size % on W paper type

In Out

by _____ pads of _____ Laminat

SB WB FB TB VB Spine Color _____ TABS

PC PCR Front Back NPC

Comments/Instructions AS IS

Ivory dividers

Pricing:
 CC/120/55/8 1/2 x 11
 FS/82/55/W
 FS/20/0/HP
 FS/110/55/Card

Counter: X Key Op: HH Finishing: HH Quality Checked: (a) Karen Meyer

B&W Color Over size

1:1 8.5 x 11
 1:2 8.5 x 14
 2:2 11 x 17
 2:1

copies @ size % on _____ paper type

In Out

by _____ pads of _____ Laminat

SB WB FB TB VB Spine Color _____ TABS

PC PCR Front Back NPC

Comments/Instructions _____

Pricing:
 Aux/20/hand solds/.10^{ea}
 Bind/1/Re-bind
 3bind/1/over 1"/2.95

Counter: _____ Key Op: _____ Finishing: _____ Quality Checked: _____

ON HOLD

POWDER MAGAZINES

STABILIZATION

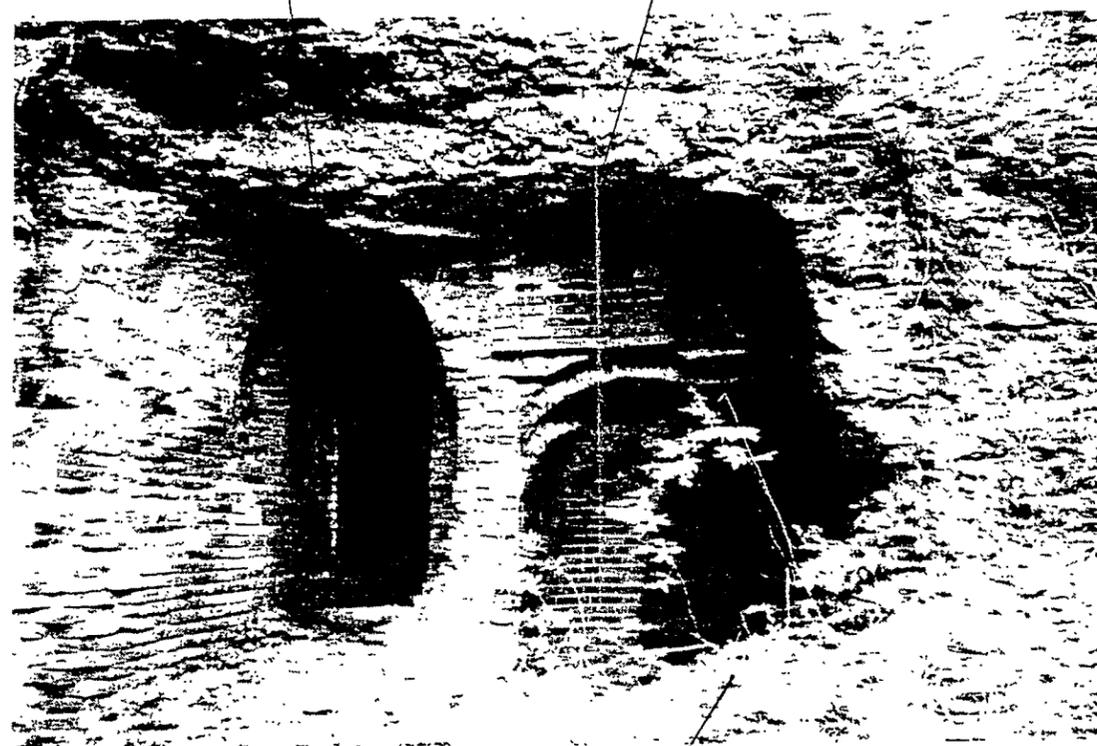
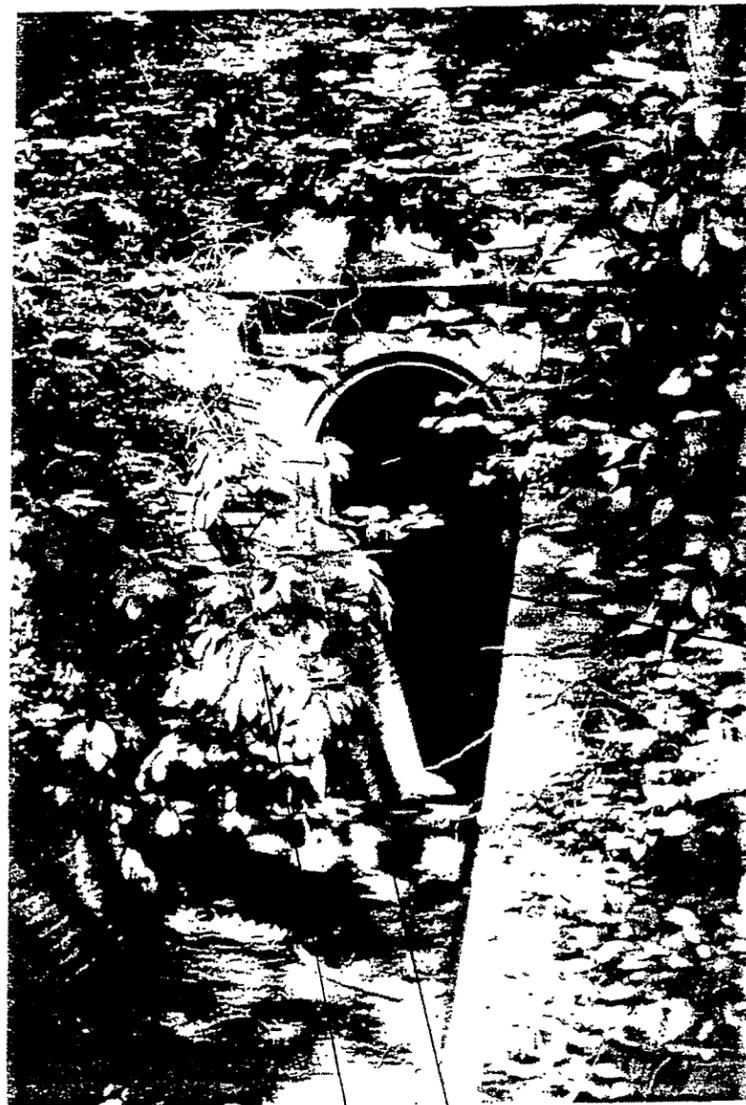
No work required.

PRESERVATION

1. Provide a clear accessway to each magazine. Remove all vegetation as required.
2. Remove debris found in each magazine.
3. Provide additional fill at the first magazine entranceway.
4. Repoint exterior brick and stone masonry.

RESTORATION

5. Rebuild the entranceway to the double room magazine similar to match the others.



RECOMMENDATIONS

POWDER MAGAZINES

BLDG. 119

**GREDELL
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BATTERY RICHIE

BATTERY RICHIE - STRUCTURE 120

DESCRIPTION

The Battery Richie is a concrete gun battery which originally housed two 5 inch guns.

The battery is comprised of three separate levels: ground floor level, gun mount level and the upper/roof deck level. At the north, east and south elevations, the concrete structure is surrounded by an earth berm raised to the level of the upper deck of the battery structure.

There are two magazine rooms at the ground floor level which are symmetric about the plan. On either side is a run of concrete steps which lead up to an intermediate landing and continue upward to each gun mount level. The gun mount level is approximately 4 feet below the upper/roof deck level.

As a result of our review, the following conditions were observed:

1. The lower level rooms were clean and dry. The ceiling is structured with wide flange structural steel embedded in the concrete. The ceilings were in good condition with minor surface cracking and spalling below the steel beams as a result of ongoing corrosion.
2. Exterior doors, except for the north magazine room have been removed. At this location, the door was severely corroded and inoperable. See photo 10.
3. Portions of the concrete steps at the north side have deteriorated from freeze/thaw damage. See photo 7.
4. The walls in general, exhibit minor cracking and spalling throughout. There is a horizontal construction joint at the interface of wall and roof slab. This joint has become distressed at several locations. See photos 3, 5 & 6.
5. At each gun mount, there is a circular anchor bolt pattern projecting 4 inches above the slab. These bolt projections are hazardous to public safety. See photo 8.
6. Portions of the handrailing are missing on the north side. See photos 2 & 3.
7. There is an armored cable draped across the west elevation which obstructs access to doorways and the steps. See photos 3 & 4.
8. The walls, although observed to be dry, exhibit exudations at

cracks in the west wall and at magazine room window openings. See photos 3 & 9.

9. The upper/roof deck level exhibits several construction joints which have cracks and spalls. There is the remains of a black bituminous coating which is essentially non-existent. See photos 4 & 5.

BATTERY RICHIE ANNEX

DESCRIPTION

Located adjacent to the battery is a small single gun emplacement constructed of reinforced concrete.

As a result of our review, the following conditions were observed:

1. The vegetation is overgrown.
2. Concrete is spalled and disbonded at several locations.
3. The center opening in floor deck requires protection to prevent pedestrians from falling.
4. There is no access stairs to the deck level.

FINDINGS

Concrete

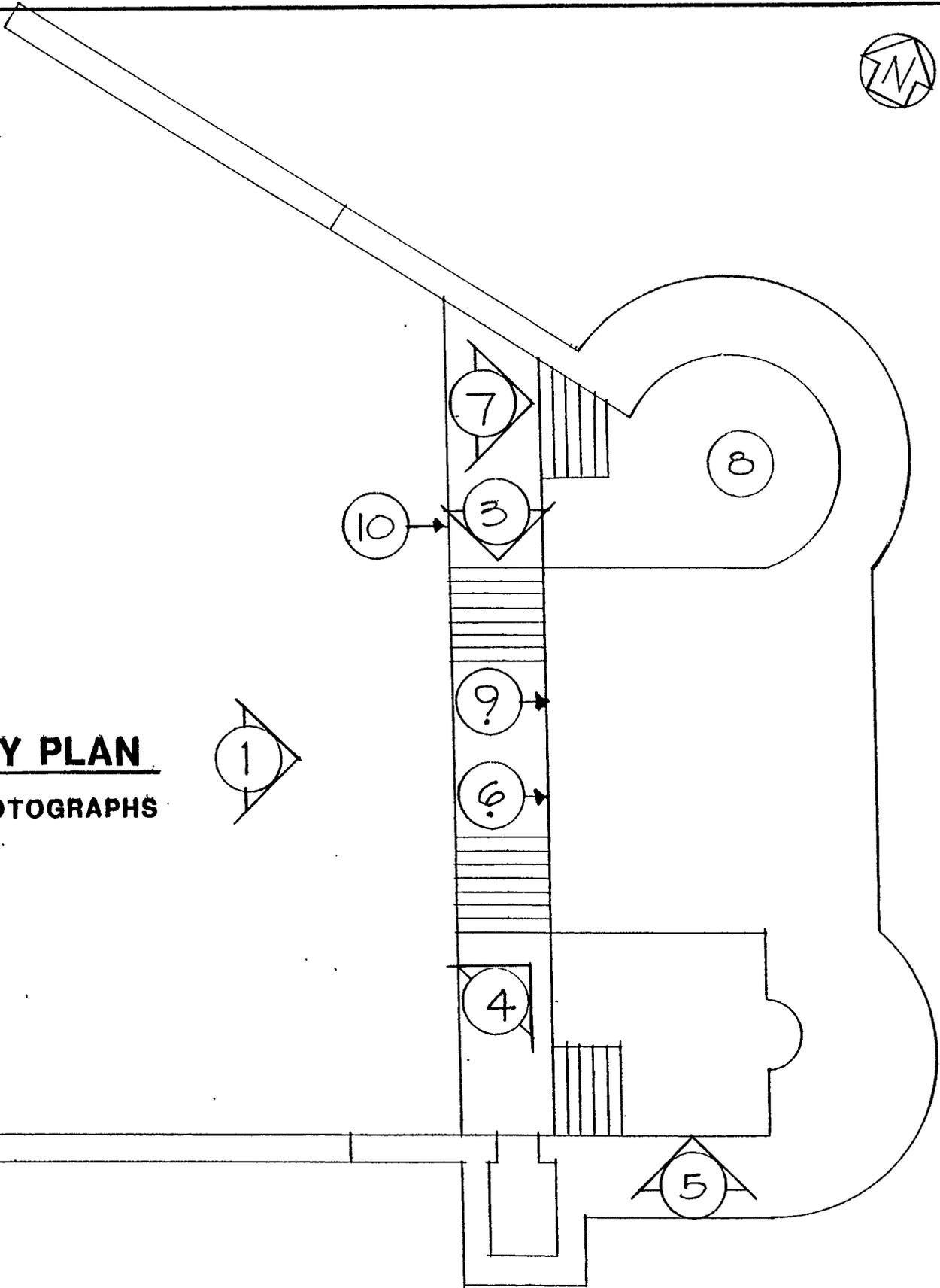
1. The deterioration of the concrete is readily seen at the vertical faces of the structure where a pattern of distress is observed. The pattern is dominated by horizontal lines which mark the construction joints where consecutive pours of concrete interface. Large, angular trap rock uses for coarse aggregate tends to provide a mix that is harsh and difficult to consolidate. As a result, poor bond was achieved at the "cold" joint which resulted in an opening at the vertical surface.
2. Water has entered these cracks which occur at most horizontal construction joints. During cold weather, the concrete has been subjected to freeze/thaw damage. The older concrete is extremely susceptible to this type of damage since air-entrainment was not provided in early concrete mixes. Although freeze/thaw damage is most severe at the underside of each cold joint, freeze/thaw damage occurs in the vertical surfaces to an average depth of approximately 6 inches. However, at some locations, freeze/thaw damage runs as deep as 18 inches along the upper sections of the walls.
3. Elevated sections of roof and decking are framed with

structural steel which is encased in the concrete. Constant moisture in concrete of high chloride content has caused the embedments to corrode. As a result, the embedments have expanded causing the concrete to split and spall allowing even more moisture to enter the section. As temperatures drop during the colder months, freeze/thaw damage causes additional deterioration in these sections.

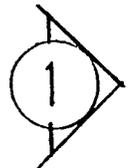
4. Structural steel beams are provided to support the concrete above the rooms and corridors. Where finishes are plaster, hollow clay tile is provided as the substrate. The tiles are set between the webs of the beams. Where concrete is the finish surface, no tile is provided. Moisture in the tile and the concrete has consumed most of the steel sections. The by-products of corrosion have caused the section to expand causing distress in the tile and the concrete which surrounds the member. As a result, tiles and concrete in the ceiling has become loose and is subject to dislodgement. In addition, there is concern for the structural capacity of the concrete above the rooms to safely span between the walls; especially in the larger areas such as the powder magazines. Here the deteriorated concrete section is limited in depth by the asphaltic waterproofing course to 3-1/2 feet and must span approximately 20 feet. Although the resulting shear stresses at the support walls are fairly low, the tension in the non-reinforced section at mid span is marginal at best.
5. The concrete wash surfaces on the upper deck are in fair condition with some areas of localized deterioration. In addition, control and construction joints are not sealed; allowing water to penetrate the interior.



2



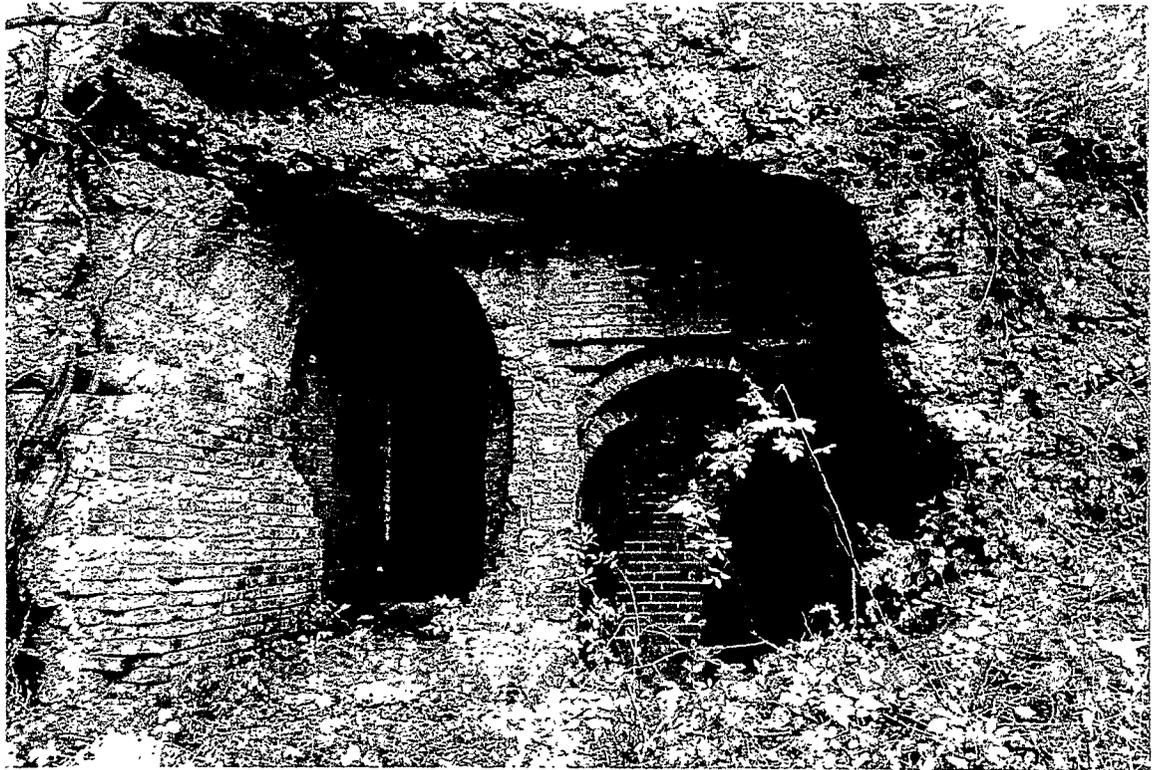
KEY PLAN
PHOTOGRAPHS



BATTERY RICHIE (120)

GREDELL & ASSOCIATES
STRUCTURAL ENGINEERS

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POWDER MAGAZINES

POWDER MAGAZINES - STRUCTURE 119

DESCRIPTION

Located west of the Reed & Gibson gun battery are three (3) powder magazines. The bunker structures consist of brick masonry vaults encased in concrete and covered with earth. Although covered with vegetation and surrounded by trees, the complex can be seen as large mounds projecting above the surrounding flat topography.

FINDINGS

For the most part, the structures are in good condition (see photos 5 and 6) except at the westernmost location where the entranceway to the double vault has been partially demolished.

The vaults are laid up in common bond with alternate courses of stretchers and headers. The brick work was done by artisans as demonstrated by the bonding at the corners. The masonry, both brick and mortar is in good condition except at the exposed entranceways where the pointing has deteriorated in the weather.

A 12" diameter tree which is growing at the entrance to the central bunker makes access somewhat difficult. In general, all larger vegetation growing on the bunkers adversely affects the structure as root systems exert forces on the construction below.

The entranceways are faced with a panel of cut granite stone. A rounded head is provided for a timber door which once hung on bronze pintels still in place. The remains of one door was found in front of the entrance to the easternmost bunker. Brick masonry retaining walls project outward from the entrance panel. The brick receives a stone coping by stepping. The surface of the stone is of uniform slope following the contour of the earthen surrounds. Exterior stone and brick requires repointing.

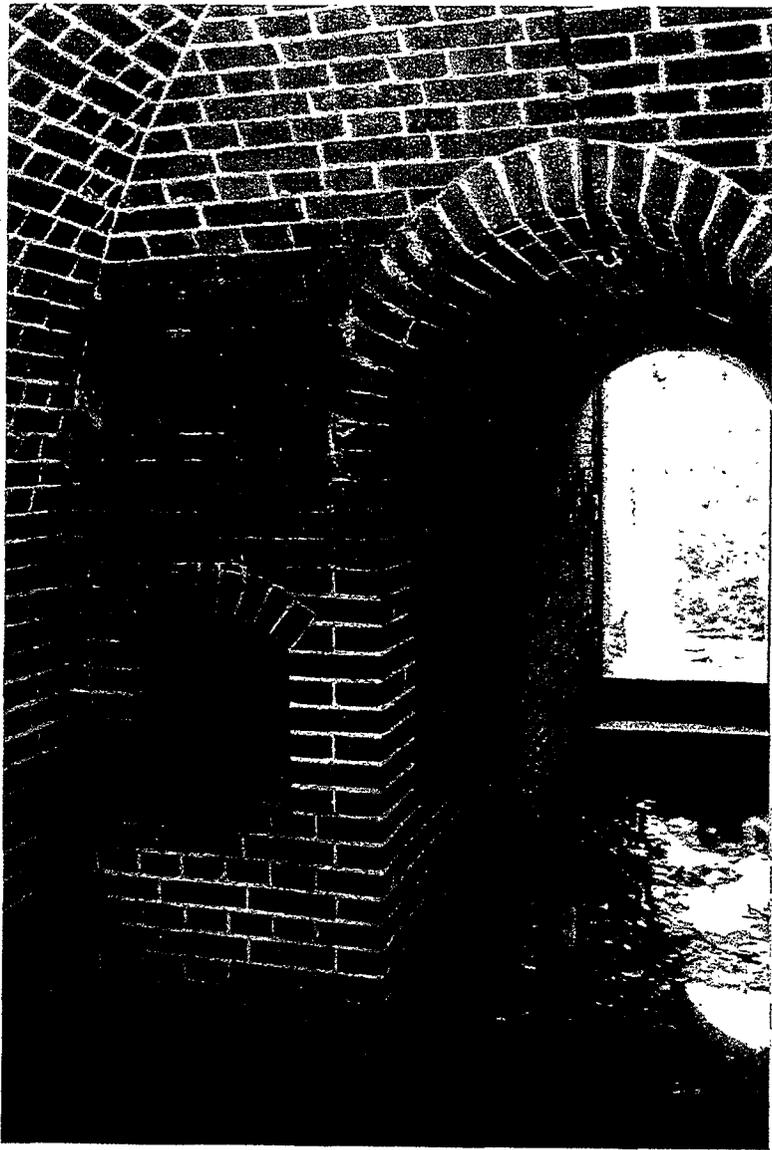
Access to all three magazines is partially obstructed by vegetation.



3

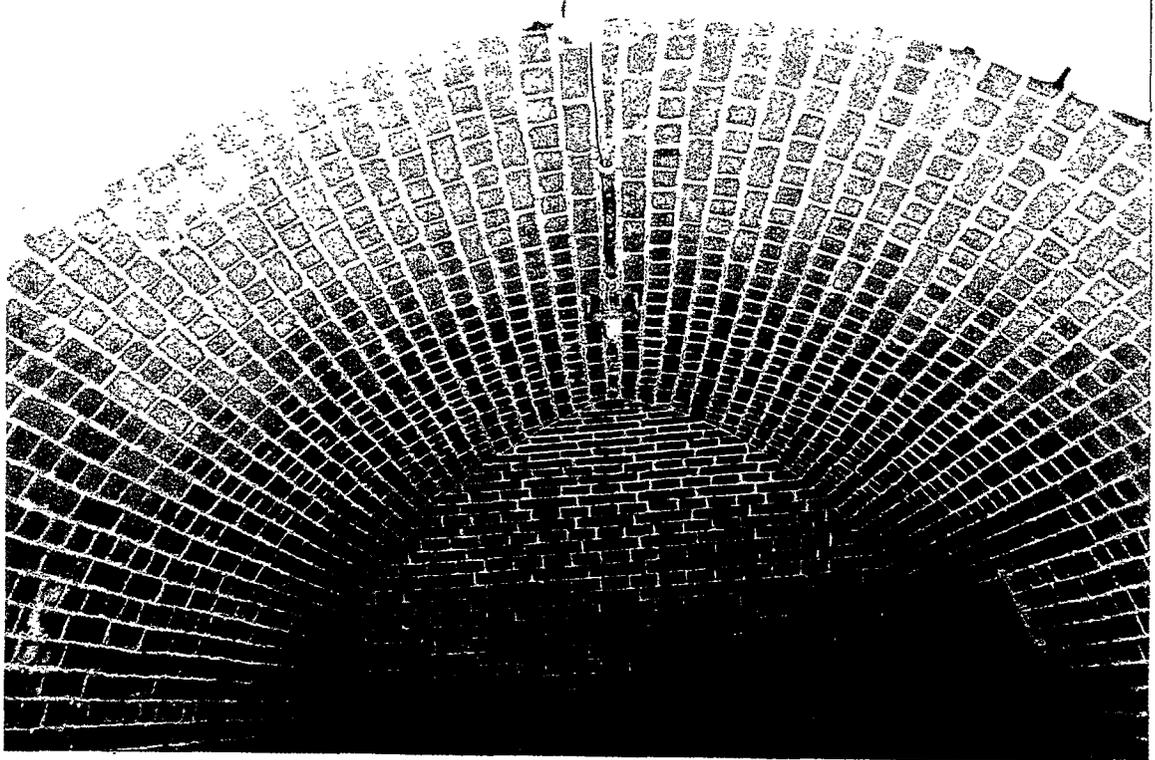


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PRELIMINARY COST ESTIMATE

POWDER MAGAZINES - BUILDING 119

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated</u> <u>Quantity</u>	<u>Unit</u>	<u>Unit</u> <u>Cost</u>	<u>Total</u>
No work required.					
Subtotal Stabilization					\$ 0

Preservation

1.	Provide clear passage at each entrance. Remove all vegetation.		L.S.		\$ 2,600.00
2.	Remove debris found in each magazine		L.S.		\$ 1,500.00
3.	Provide additional fill at first magazine entranceway		L.S.		\$ <u>750.00</u>

Subtotal Stabilization & Preservation \$ 4,850.00
Contingencies 20% \$ 970.00

\$ 5,820.00
Eng. & Admin. 20% \$ 1,164.00

Total Project Cost \$ 6,984.00

Restoration (Alternate)

4.	Rebuild entranceway to double room magazines	250	S.F.	\$ 29.50	\$ 7,375.00
		44	YDS	\$ 385.00	\$ <u>16,940.00</u>
					(concrete)

Subtotal Restoration \$24,315.00

Alternate Project Cost to Restore Structure to Original Construction

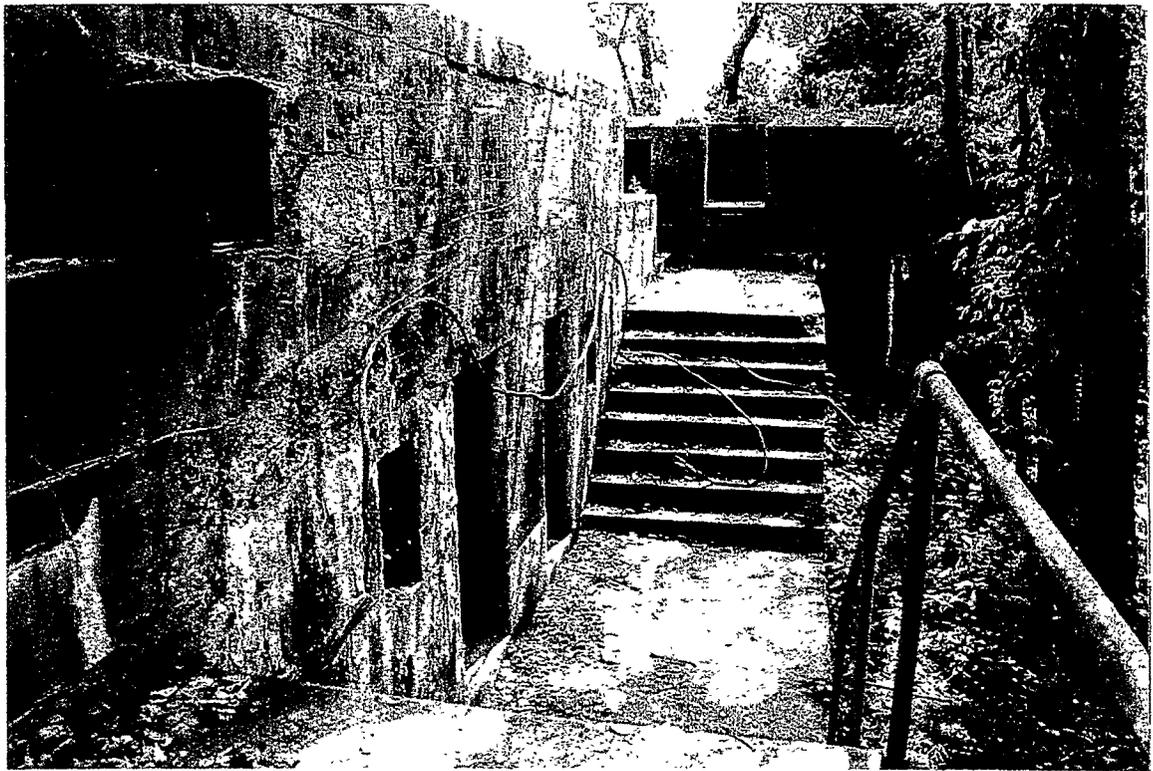
Subtotal Stabilization & Preservation \$ 4,850.00
Add Subtotal Restoration \$ 24,315.00

\$29,165.00
Contingencies 20% \$ 5,833.00

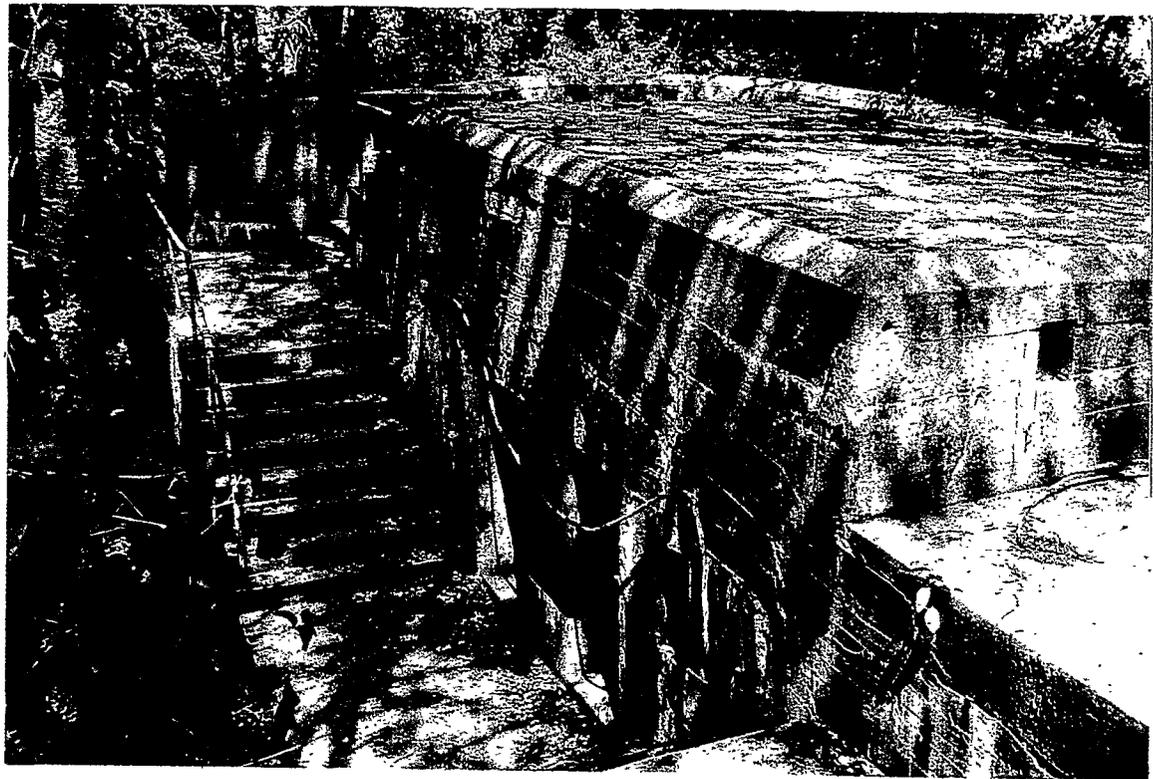
\$34,998.00
Eng. & Admin. 15% \$ 5,250.00

Total Alternate Project Cost \$ 40,248.00

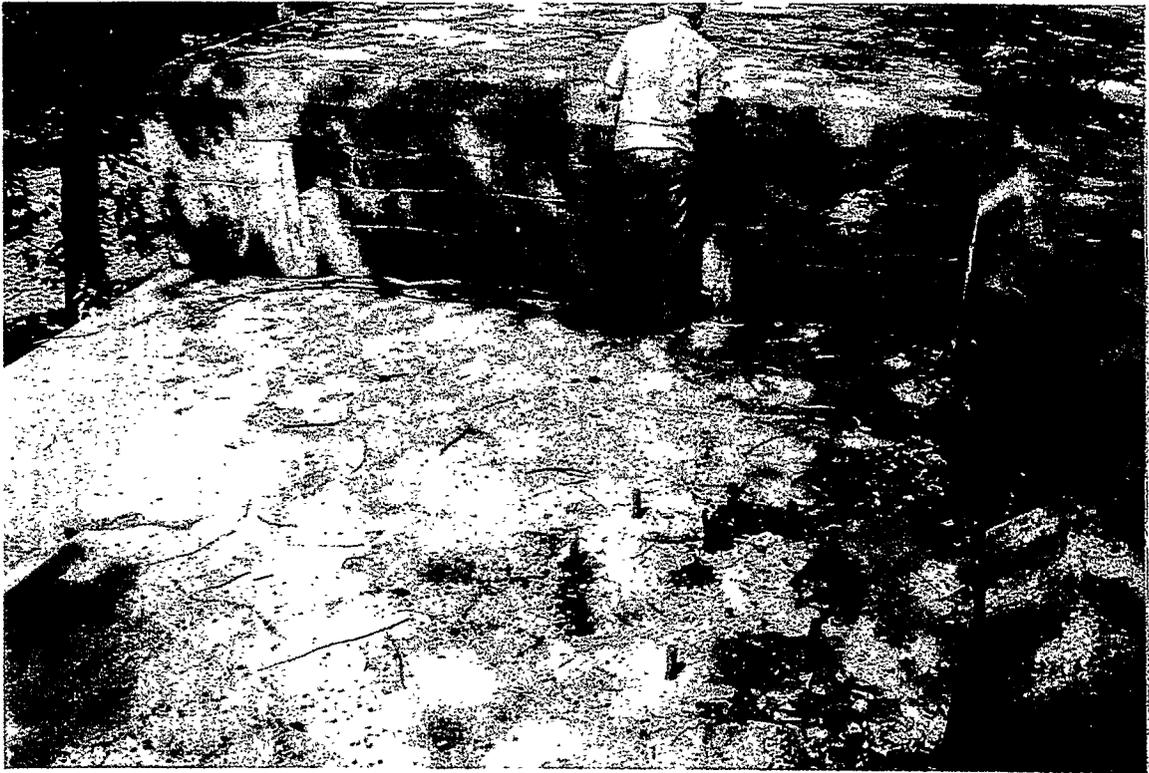
BATTERY RICHIE



3



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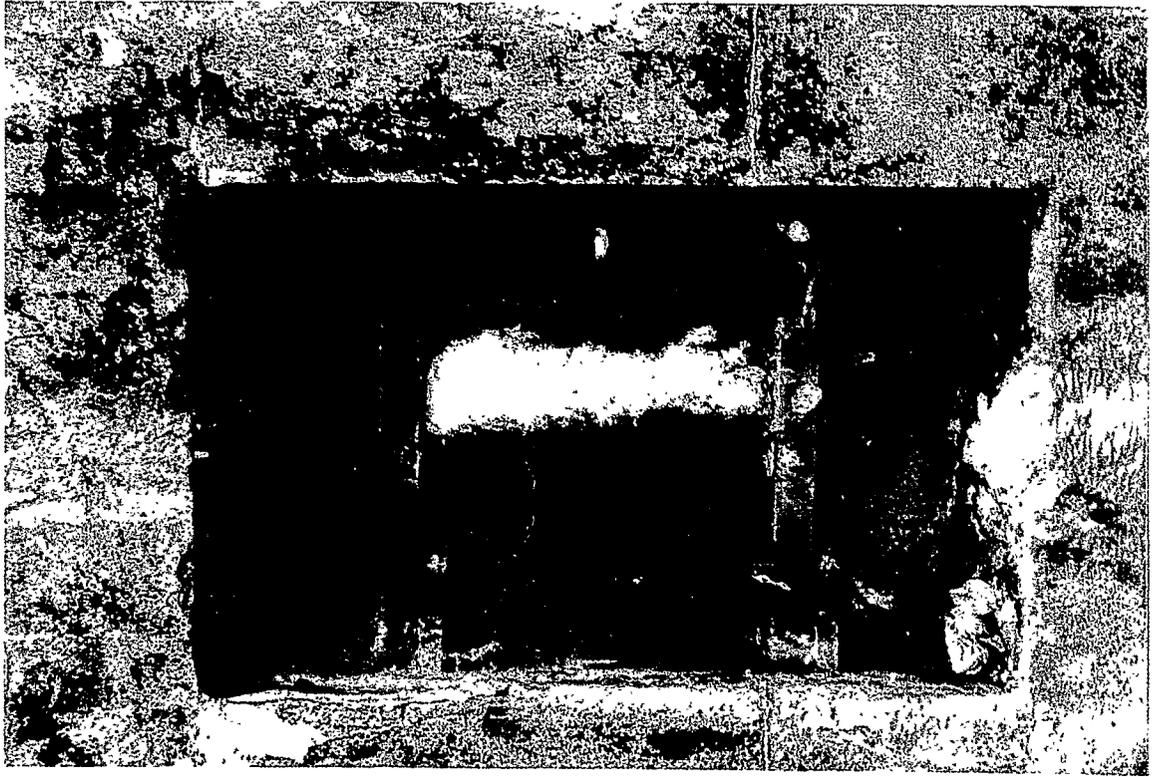
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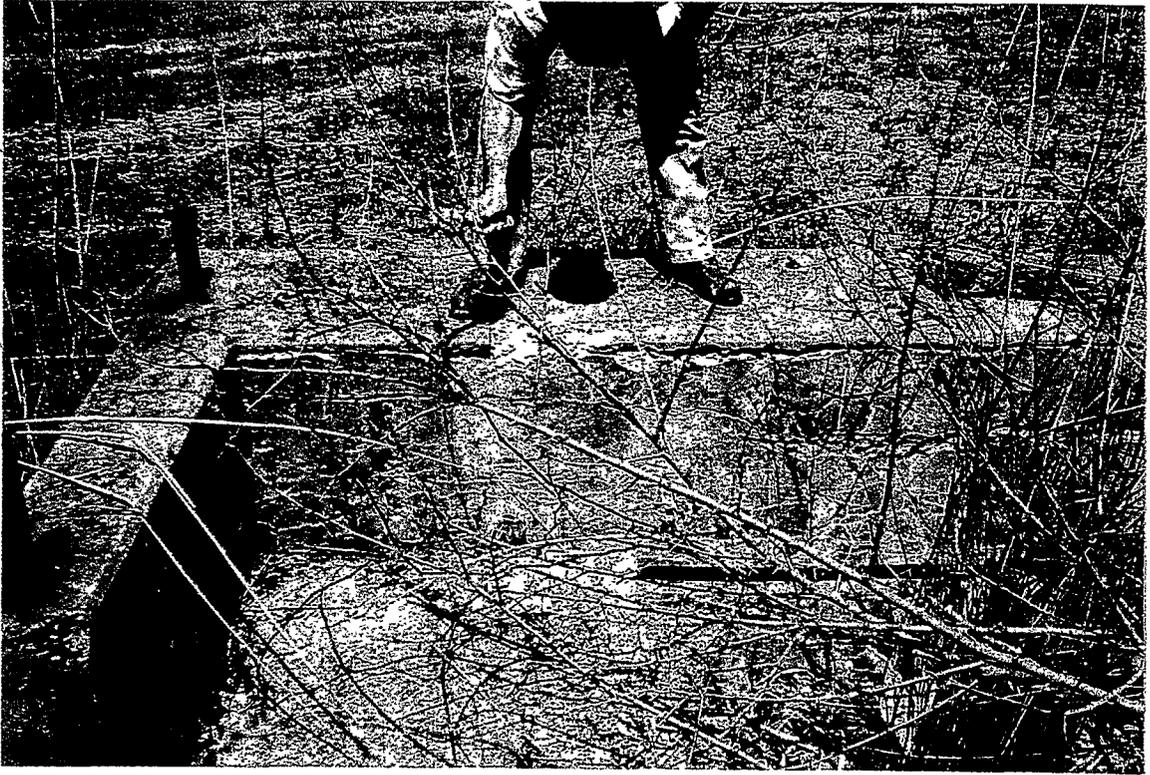
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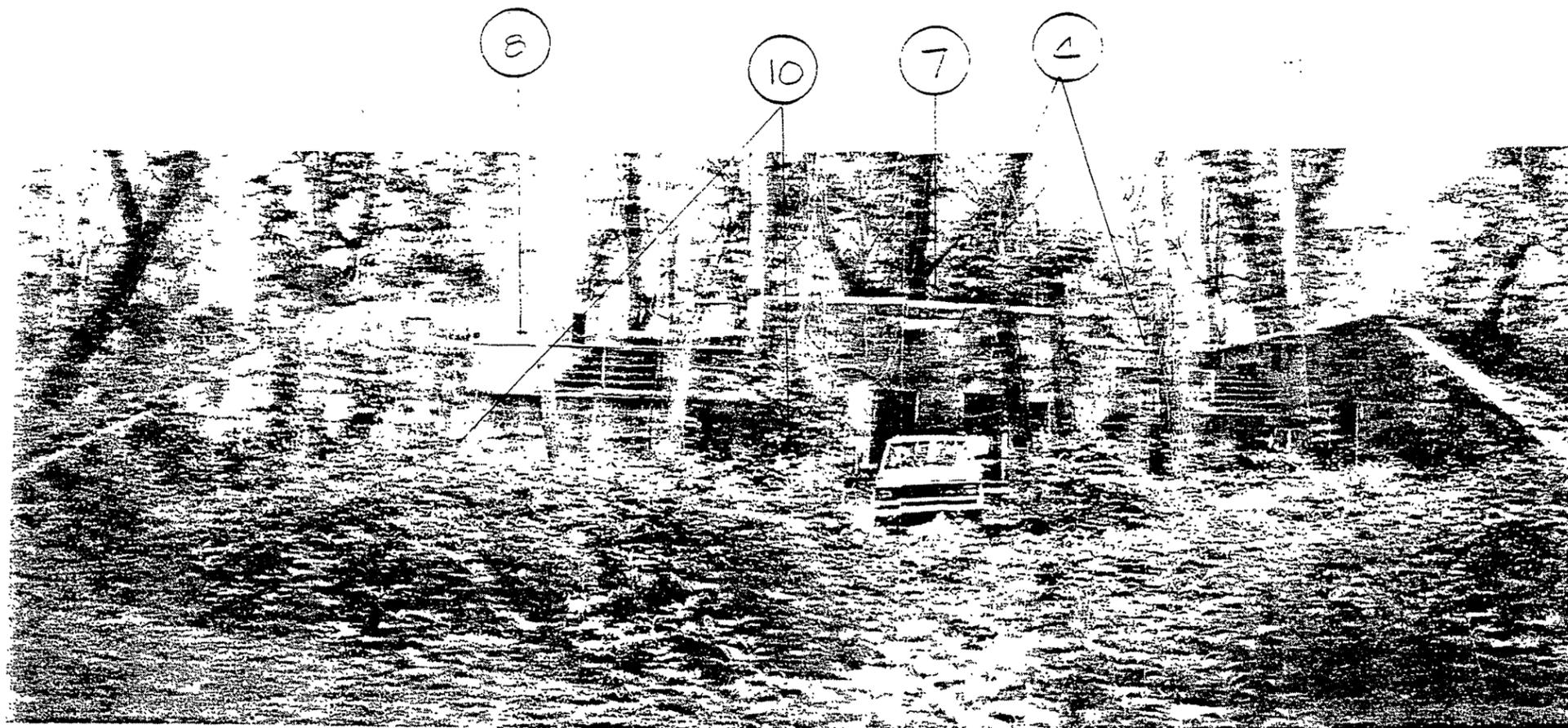
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10



11



STABILIZATION

1. Remove loose deteriorated concrete on walls and all overhead locations.

PRESERVATION

2. Provide shoring for overhead concrete in rooms, corridors and shafts.
3. Remove structural steel embedments at ceilings and vertical shafts. Replace all steel with galvanized sections. Apply shotcrete to sound concrete substrate and rebuild section.
4. Remove deteriorated concrete on all vertical surfaces which have been damaged by freeze/thaw. Install steel reinforcement bars each way connected to stainless steel embedments. Shotcrete vertical surfaces to build section to the original level of concrete. Provide steel trowel finish on final coat to achieve uniform appearance.
5. Provide positive drainage from gun pits. Auger diagonal shaft through concrete to grade at exterior of building.
6. Remove deteriorated concrete at flatwork portions of the gun pits. Cast in place replacement concrete to the original lines. Provide sealant at all construction joints to assure a watertight deck.
7. Install waterproof bitumastic coating over entire "roof" structure as originally provided. At lower gun areas, install membrane and overlay with concrete wear deck.
8. Railings - Provide additional pipe railing to supplement existing portions along the western elevation at rifle mount levels.
9. Provide anchor bolts protectors on all projected anchor bolts.
10. Remove all overgrown vegetation.

RESTORATION

11. Restore/replace all doors and steel plate window shutters.

RECOMMENDATIONS

BATTERY RICHIE

BLDG. 120

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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PRELIMINARY COST ESTIMATE

BATTERY RICHIE - BUILDING 120

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Barricade structure		L.S.	\$	<u>\$ 5,500.00</u>
Subtotal Stabilization					\$ 5,500.00

Preservation

2.	Shoring for overhead concrete	1800	S.F.	\$.71	\$ 1,278.00
3.	Remove exist. structural steel & replace with galv. sections	10	TON	\$ 3,137.00	\$31,370.00
3a.	Apply shotcrete to ceilings	1800	S.F.	\$ 10.74	\$19,332.00
4.	Remove deter. concrete from vertical surfaces Install steel reinf. & shotcrete	5200	S.F.	\$ 20.16	\$104,832.00
5.	Auger diagonal drain shafts	65	L.F.	\$ 61.96	\$ 4,027.40
6.	Remove deteriorated concrete & install new at gun pits	1030	S.F.	\$ 4.85	\$ 4,995.50
7.	Install bitumastic coating at roof	2324	S.F.	\$ 1.86	\$ 4,322.64
8.	Additional pipe railings at exist. rifle mount	92	L.F.	\$ 21.00	\$ 1,932.00
9.	Provide anchor bolt protectors on	16	EA	\$ 25.00	\$ 400.00
10.	Remove surrounding vegetation		L.S.		<u>\$ 5,500.00</u>
Subtotal Preservation					\$177,989.54
Contingencies 20%					<u>\$35,598.00</u>
Eng. & Admin. 13%					\$213,587.54 <u>\$27,766.00</u>
Total Project Cost					<u>\$241,353.54</u>

Restoration (Alternate)

11. Restore/replace
doors & windows 5 EA \$ 3,900.00 \$19,500.00

Subtotal Restoration \$19,500.00

Alternate Project Cost to Restore Structure to Original
Construction

Subtotal Preservation \$177,989.54
(Stabilization Not Required)

Add Restoration Subtotal \$19,500.00

\$197,489.54

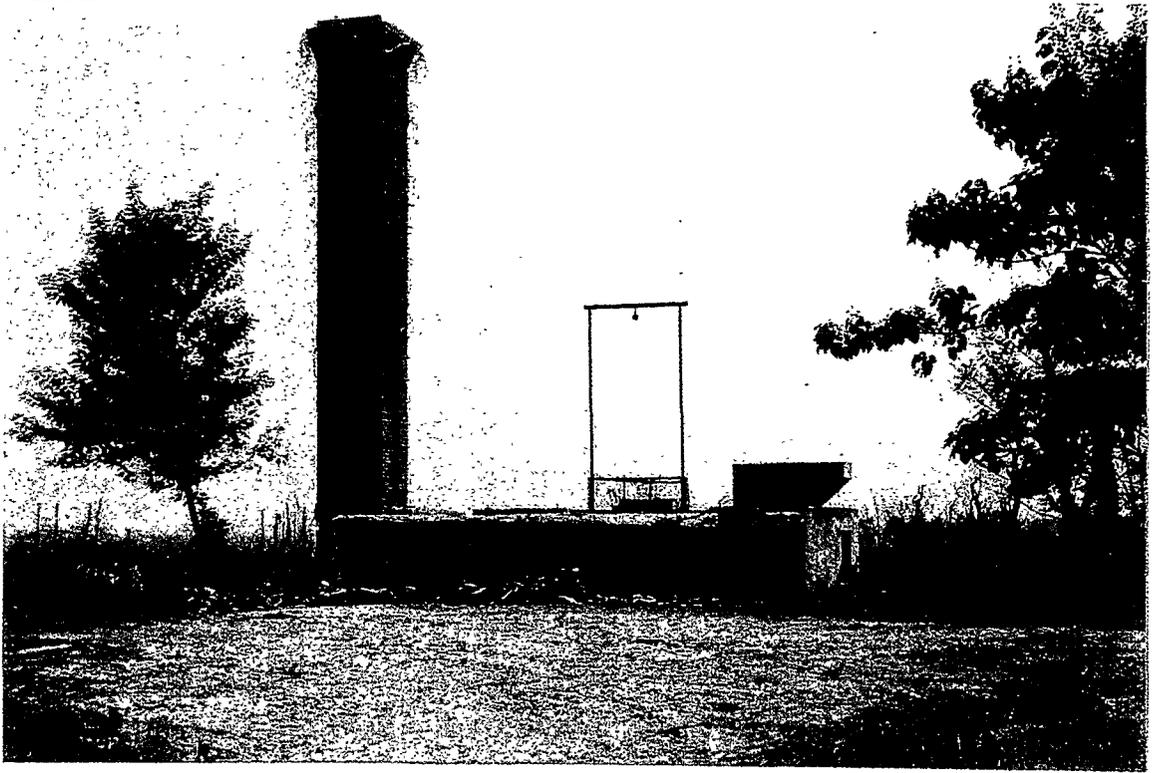
Contingencies 20% \$39,498.00

\$236,987.54

Eng. & Admin. 13% \$30,808.00

Total Alternate Project Cost \$267,795.54

BRICK TOWER FOUNDATION



1



2

BRICK TOWER FOUNDATION

BRICK TOWER FOUNDATION - STRUCTURE 121

DESCRIPTION

The brick tower foundation is a reinforced concrete incinerator structure housing three brick masonry ovens. The ovens are vented through an adjacent 4 feet square by 30 feet high brick chimney.

FINDINGS

1. Brickwork

The brick on the chimney is in good condition. There are a few isolated locations where some missing and/or loose bricks require repair.

The brick masonry ovens appear to be in fair condition. The chimney is fitted with ladder rungs mounted on one face which allows the chimney to be climbed. See photos 6 & 9.

2. Concrete

The entire structure is constructed of cast in place concrete. At one time a small building was erected on the concrete decking. Only the concrete curb once supporting the walls remains. With the exception of the porch/loading dock, the concrete is in fair condition.

At the elevated loading dock area, the concrete is deteriorated due to freeze/thaw action. See photos 2, 3, 5, 7 & 8.

3. Floor

The loading dock slab structure is 6 inches thick reinforced with #4 at 6" o.c. flexural reinforcement, and #4 at 12" o.c. temperature reinforcement. The elevated slab is unsafe and requires removal. The remaining slab where the enclosure was situated is in fair condition. A 6 inch curb runs along the perimeter with anchor bolts projecting at 4 feet on center. See photo 8. At the center of the floor, a covered circular opening provides access to the ovens. A steel pipe boom is situated above the grating. See photos 1, 4 & 7. Upper floor requires a protective railing along perimeter and at stair opening.

4. Doors

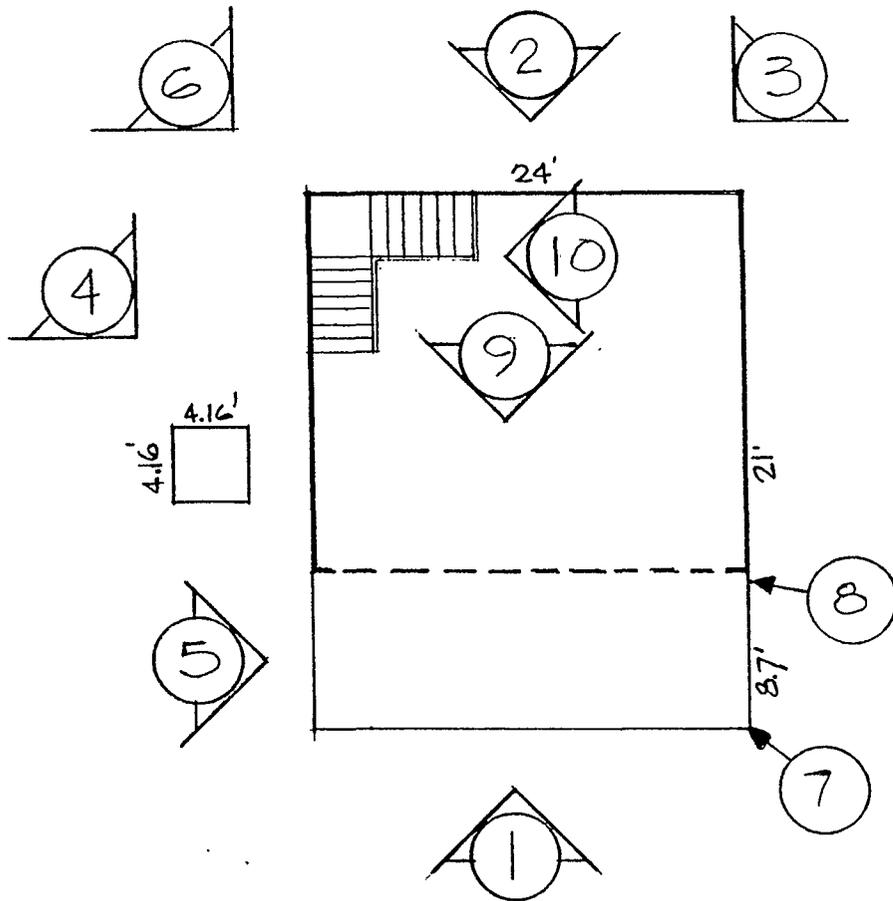
At the rear entrance, grade is 4 to 6 feet lower than at the front. There is a sliding wooden door which is presently open. The door is inoperable and deteriorated. The lites are missing and require replacement. See photo 10.

5. Windows

For the most part, window frames are in place, however, they are in bad condition. See photos 2 & 3.

6. General

The site requires regrading to provide positive drainage from the doorway. Although no documentation is available, it appears that an exterior stairway has been removed from the lower level doorway, allowing the surrounding earth to be eroded by rainwater and carried into the oven room. See photos 2 & 6. The site is littered with debris which requires removal both inside and out. See photos 9 & 10.



DIRT ROAD

KEY PLAN

PHOTOGRAPHS

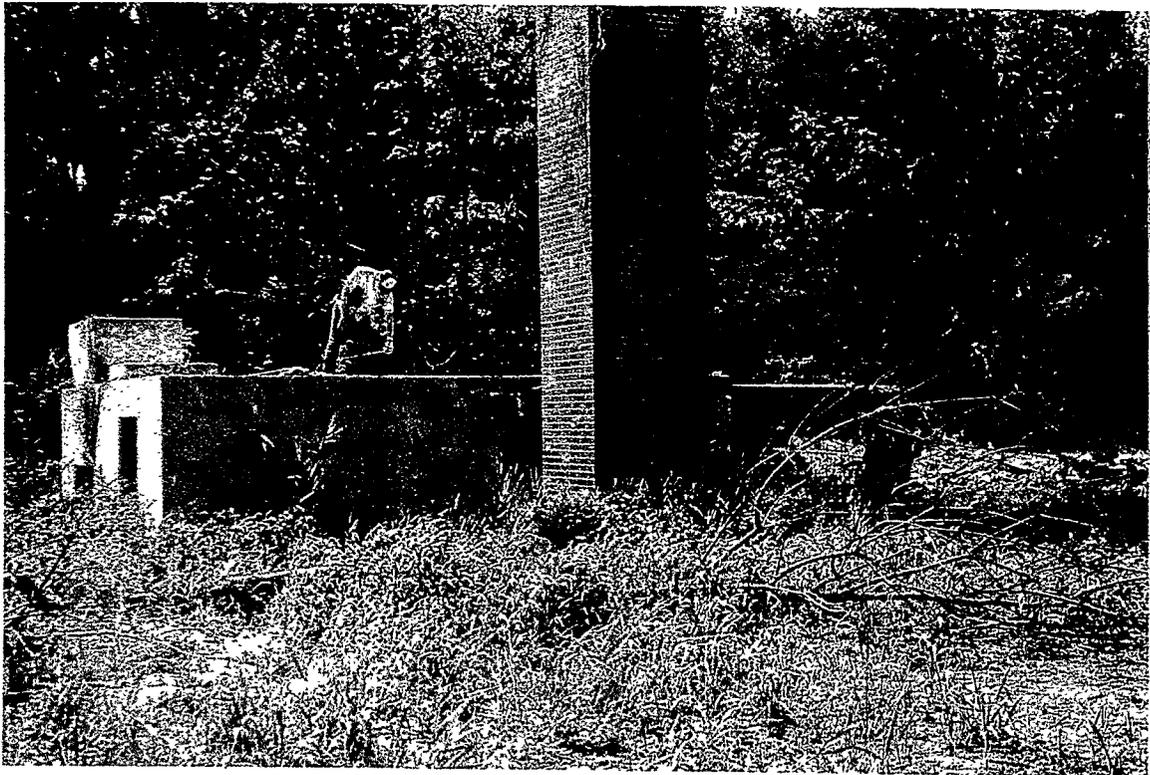
BRICK TOWER FOUNDATION (121)

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

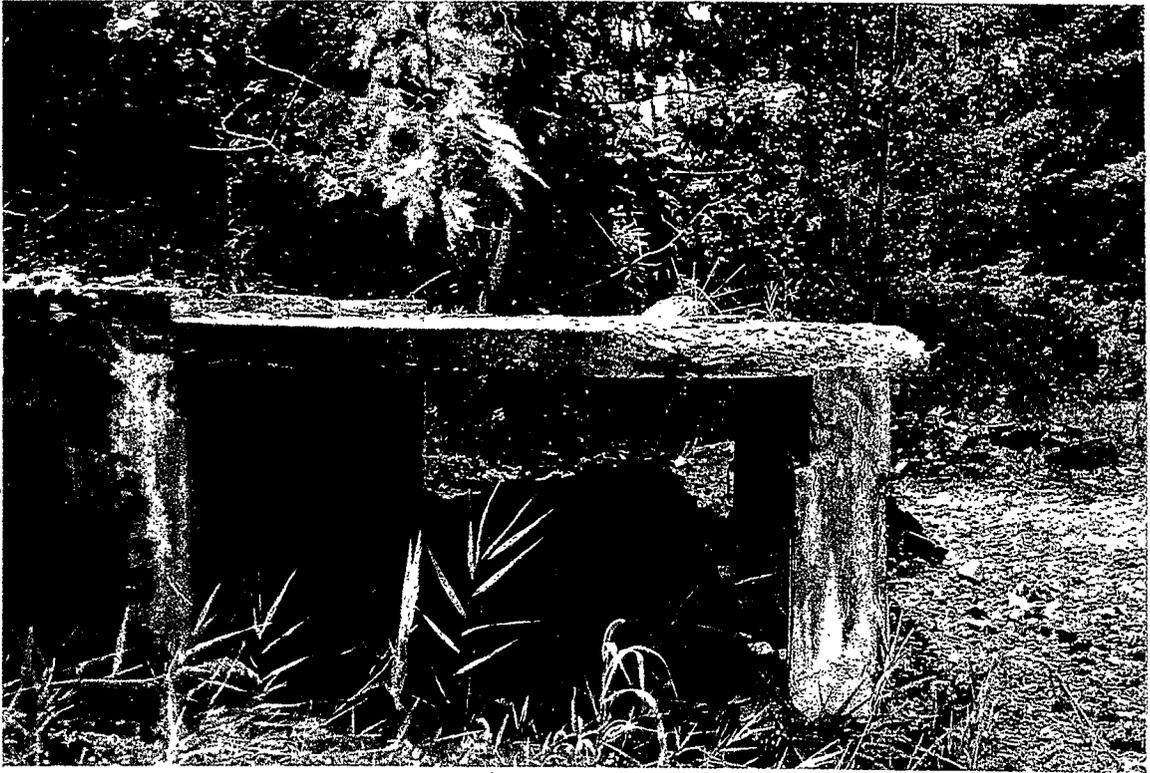
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8 THE GREEN - DOVER, DELAWARE 19801-302-734-7400



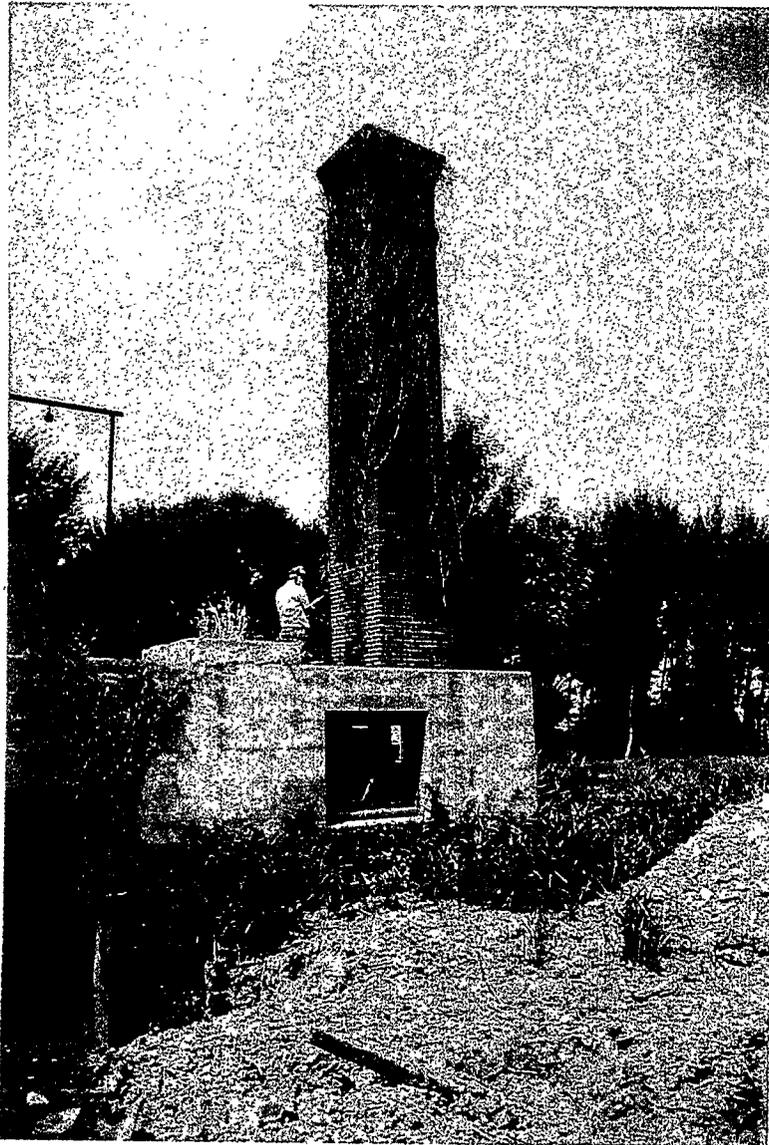
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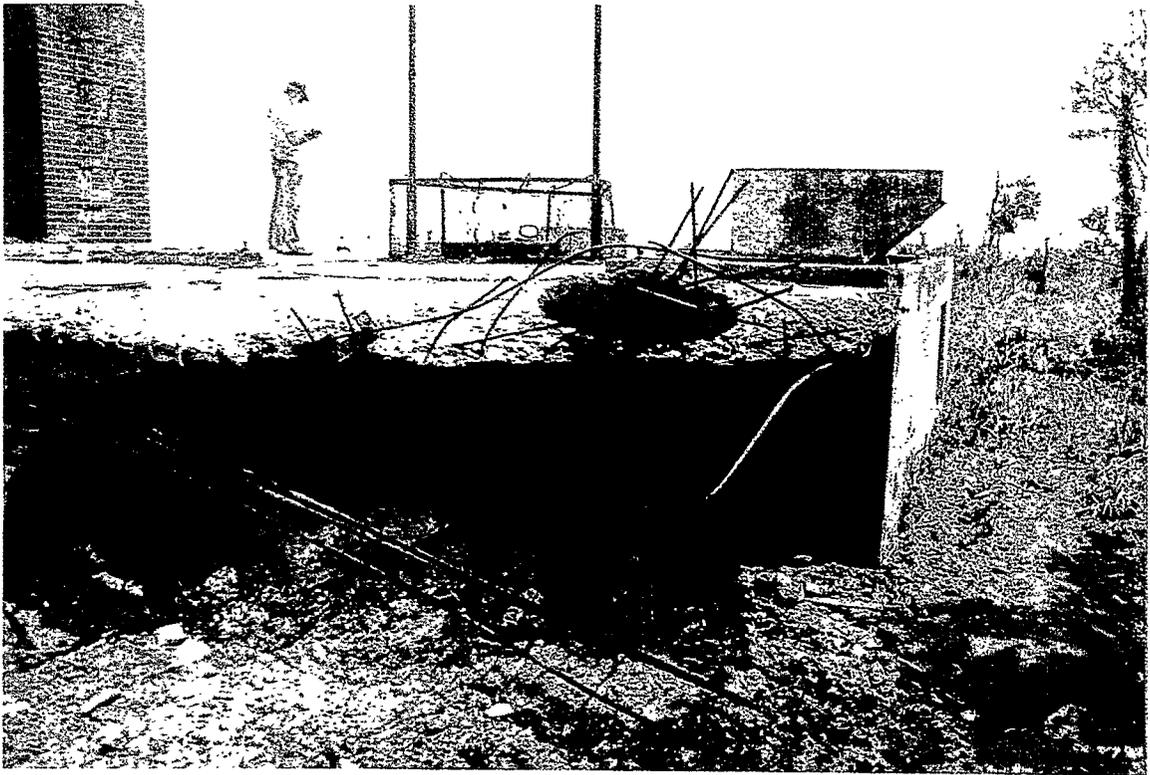
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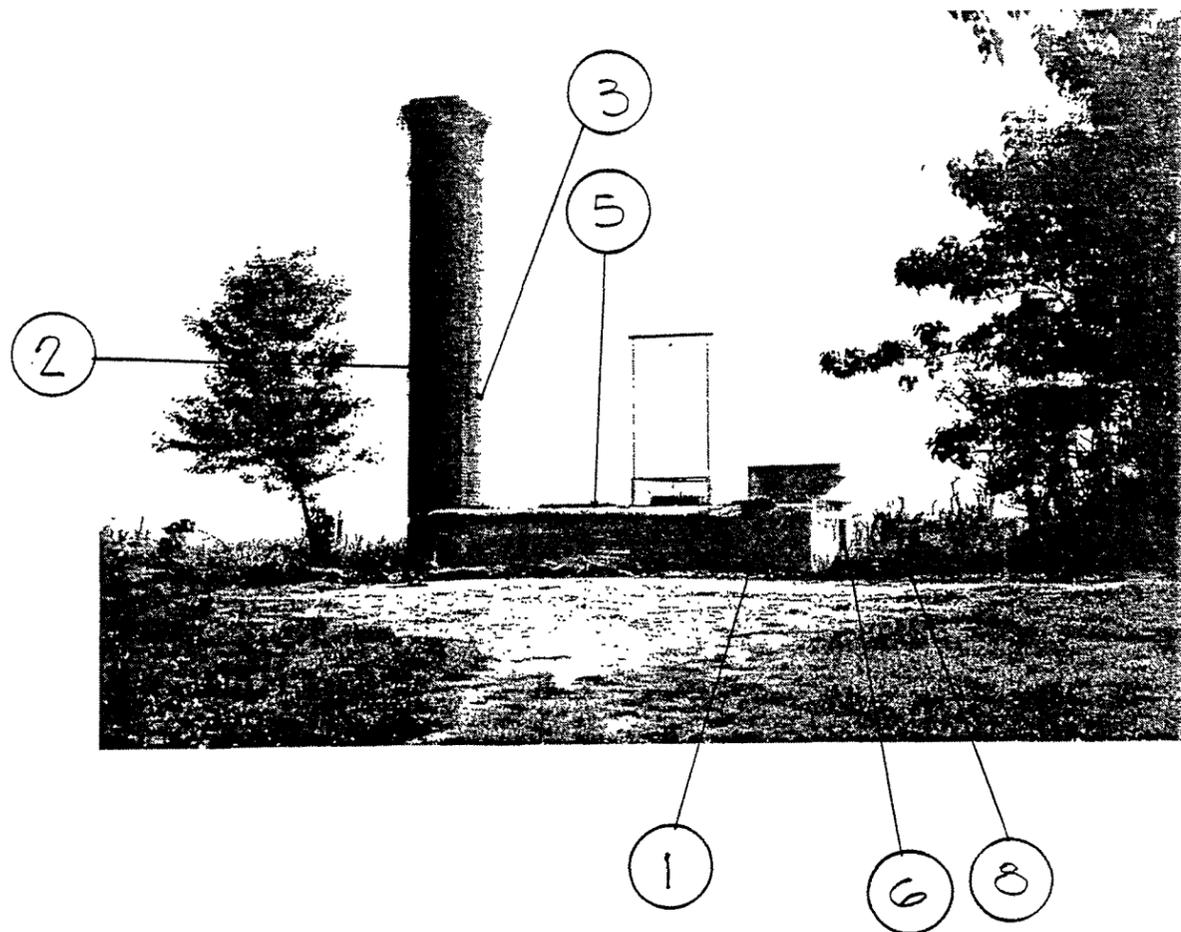
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9



10



STABILITY

1. Remove front loading dock structure or repair the concrete slab and provide a new pier.

PRESERVATION

2. Repair loose/missing bricks in chimney.
3. Block access of potential climbers from the chimney.
4. Provide protective covers on projecting anchor bolts.
5. Provide protective handrailing along upper slab perimeter and stairway.
6. Repair/replace windows and doors.
7. Regrade rear elevation to provide positive drainage away from doorway.
8. Remove vegetation around and on structure.

RESTORATION

9. Rebuild front loading dock/porch slab and piers.
10. Rebuild structure above slab to conform to original construction.

RECOMMENDATIONS

BRICK TOWER FOUNDATIONS

BLDG. 121

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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6 THE GREEN · DOVER, DELAWARE 19801 · 302-734-7400

PRELIMINARY COST ESTIMATE

BRICK TOWER - BUILDING 121

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Remove front loading dock structure	216	S.F.	\$ 4.55	\$ <u>982.80</u>
Subtotal Stabilization					\$ 982.80

Preservation

2.	Repair loose, missing bricks	50	S.F.	\$ 24.75	\$ 1,237.50
3.	Block access to chimney		L.S.		\$ 750.00
4.	Provide protective covers on projecting anchor bolts		L.S.		\$ 500.00
5.	Provide protective handrailing slab perim. & stairway	138	L.F.	\$ 21.25	\$ 2,932.50
6.	Repair/replace windows & doors	3	EA	\$ 320.00	\$ 960.00
7.	Regrade rear elev.		L.S.		\$ 1,200.00
8.	Remove vegetation		L.S.		\$ <u>750.00</u>
Subtotal Preservation					\$ 8,330.00

Subtotal Stabilization & Preservation \$ 9,312.80
 Contingencies 20% \$ 1,863.00

\$11,175.80

Eng. & Admin. 20% \$ 2,235.00

Total Project Cost \$13,410.80

Restoration (Alternate)

9.	Rebuild loading dock slab & piers (Does not include Item 1 above)	120	cu. ft.	\$ 156.00	\$18,720.00
Subtotal Restoration					\$18,720.00

Alternate Project Cost to Restore Structure to Original
Construction

Subtotal Stabilization & Preservation \$ 9,312.80
Add Restoration Subtotal \$18,720.00

Contingencies 20% \$28,032.80
\$ 5,606.00

Eng. & Admin. 15% \$33,638.80
\$ 5,046.00

Total Alternate Project Cost \$38,684.80

P.O.W. BARRACKS

P.O.W. BARRACKS - BUILDING 122

DESCRIPTION

The P.O.W. Barracks is actually two separate rectangular shaped buildings attached by a covered walkway, forming a U-shaped complex. Both buildings are single story, timber frame structures with gable form roofs. On the outboard exterior walls of each building, a covered loading dock is situated. Each building is 25 feet wide and varies in length; one is 100 feet long and the other is 128 feet long. The buildings are currently used for storage.

FINDINGS

1. Historical

Our research of information in the State Archives yielded information on only one building, the 100 foot long structure. This building was constructed in 1941 for a total cost of \$6,800. This structure was originally designated as a storehouse.

2. Floor

The foundation walls are concrete and support floors made up of 2x10 joists spaced at 16" o.c. At the rear portion of the longer, west building, the floor is a concrete slab. The front half of the west building has a timber frame floor which has been overlaid with plywood. There is a 10x10 area which has deteriorated from moisture and should be replaced. The rear portion of the west building is on a concrete slab. The concrete is in good condition as is the wall and roof framing. See photo 20. The east building has a timber floor over a crawl space. At the rear of the building there is a portion of floor, 12 feet by 24 feet which needs to be replaced in its entirety. The side entrance porch on the west building requires the 2x10 decking to be replaced due to rot. The east building, (100 foot long), has a concrete porch/loading dock at the front entrance which is 2 feet above grade. The slab has cracked near the center due to settlement. Adjacent to the concrete deck, a timber deck has rotted decking which has been overlaid with 1x decking.

3. Roof

Both buildings are framed similarly. The roof framing consists of 2x8 rafters spaced at 24 inches o.c. which are tied by 2x4 ceiling joists (See photo 21). The roof decking is 1x6 tongue and groove stock. The covered walkway is a gable framed roof with 2x4 rafters and ceiling joist frames spaced approximately at 7 feet on center. At each frame a double 2x4 column extends to a pocket in the walkway slab. See photos 14 & 15. The covered walkway roof structure is in poor condition. There are several holes in the

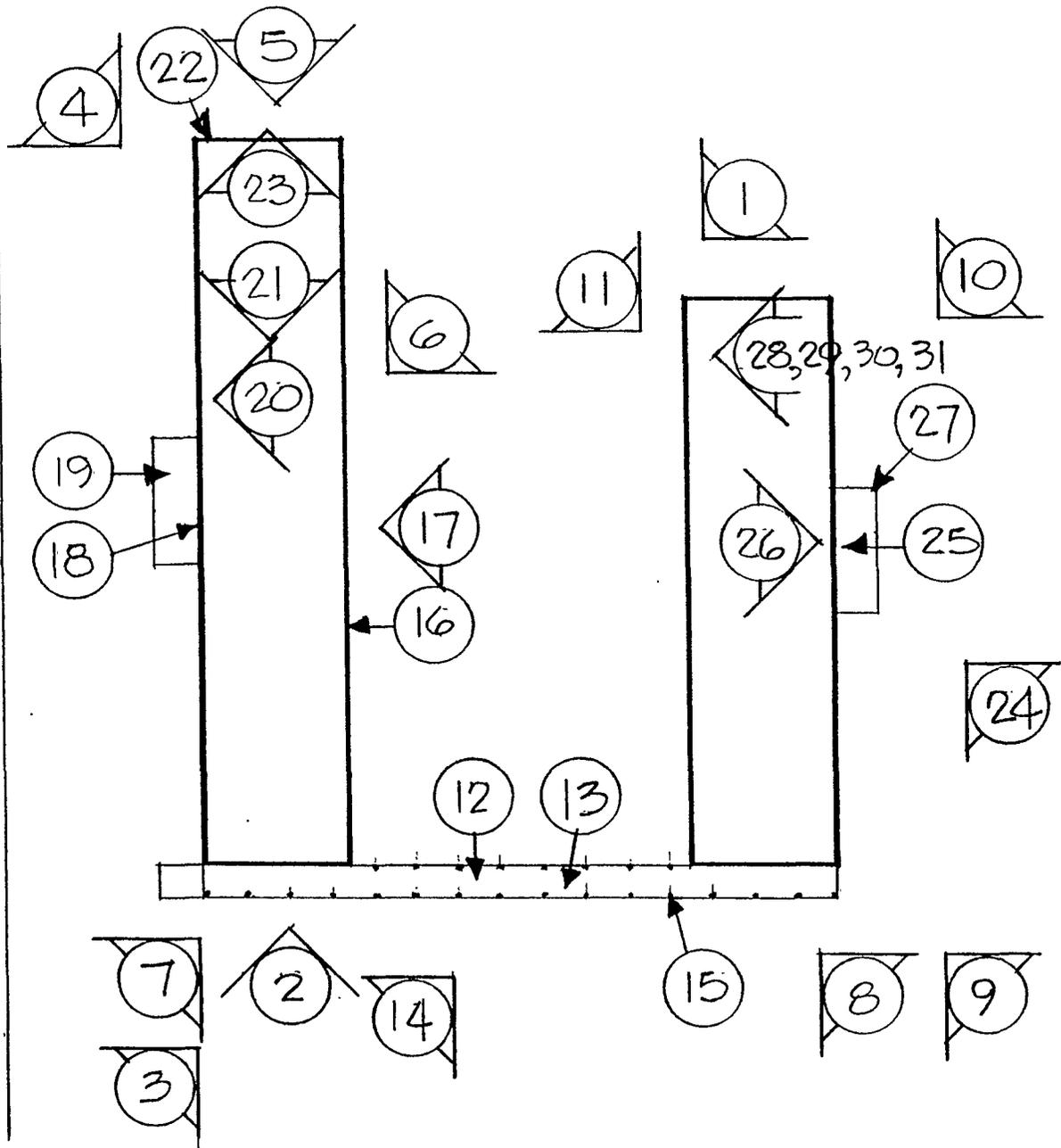
roof and some portions have collapsed. Rot in the decking is a prevalent condition. The supporting (2) 2x4 columns are rotten at their slab bearings. The entire roof structure is in need of replacement. See photos 12, 13, 14 & 15. The west building roof is covered with a corrugated metal roofing which overlays rolled roofing. There are several locations where the roofing has become loose. See photos 4, 6 & 19. The corrugated roofing at the porch of the larger building is deteriorated and in need of repair/replacement. See photo 27. The east building is roofed with asphalt shingles and subsequently patched with rolled asphalt roofing. The porch/loading dock roof on the side of the east building is concealed by overgrown vegetation. The porch has partially collapsed and requires demolition. See photos 10, 24, 25 & 26. There are four large roof vents along the east building; two of them require repairs. See photos 10 & 11. The roof framing at the rear of the east building is rotted and requires replacement. The wall plate and studs in this area require replacement. See photos 28, 29, 30 & 31. There are no gutters or downspouts.

4. Exterior Walls

The exterior walls are framed by 2x4 studs spaced at 24" o.c. and are sheathed by 1x6 tongue and groove decking laid diagonally (See photo 20). At every fourth roof rafter, there is a knee brace which extends to the wall stud. These braces only occur in the longer building. The exterior walls are clad with wood clapboard siding. The existing paint is severely weathered and the entire exterior requires repainting. See photos 1 & 5. Approximately 25% of the clapboard siding of the lower portion of the wall requires replacement. See photos 5, 16 & 22. The loading dock at the rear of the west building appears to have been added after the building was constructed. Creation of the loading dock caused the foundation wall to be undermined and now requires underpinning. See photo 5. The entire perimeter of the complex requires that all the overgrown vegetation be removed. At portions of the structure, vines have actually grown up under the siding and has caused the siding to separate from the sheathing. See photos 5, 9 and 10.

5. Doors and Windows

Approximately 50% of the windows are in need or repair. Many of the frames and sash are rotted. See photos 5, 16 & 22. The overhead door at the end of the longer building requires replacement. The adjacent windows need complete replacement. See photos 5 & 22. Along the courtyard side of the east building, towards the rear, a set of doors are bound shut. The door sill here is rotted. See photo 11. Adjacent to the rotted areas at the rear of the east building, the exterior doors are blocked by an oil line running from the tank outside. See photo 30.

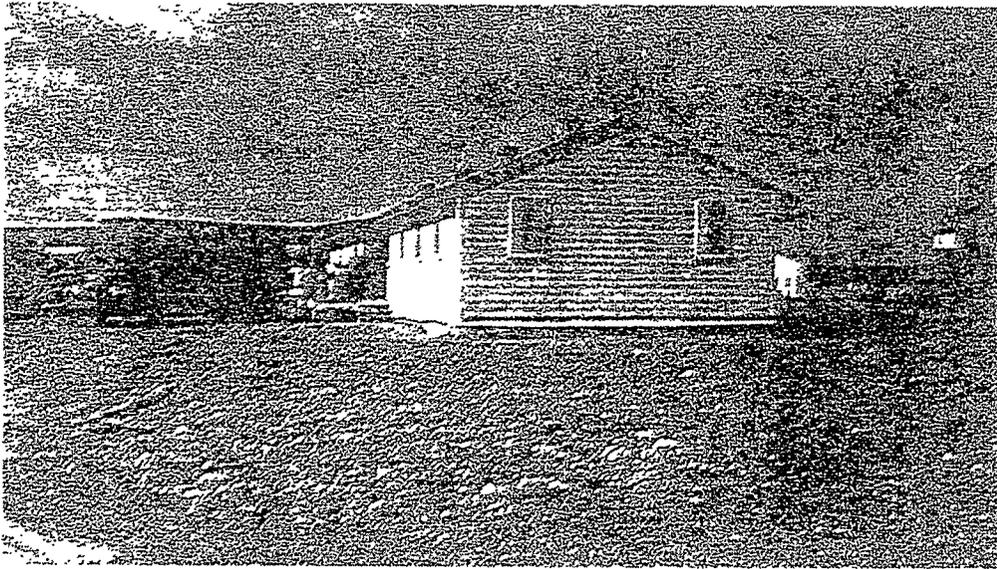


KEY PLAN
PHOTOGRAPHS

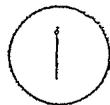
P.O.W. BARRACKS (122)

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

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CIRCA 1941



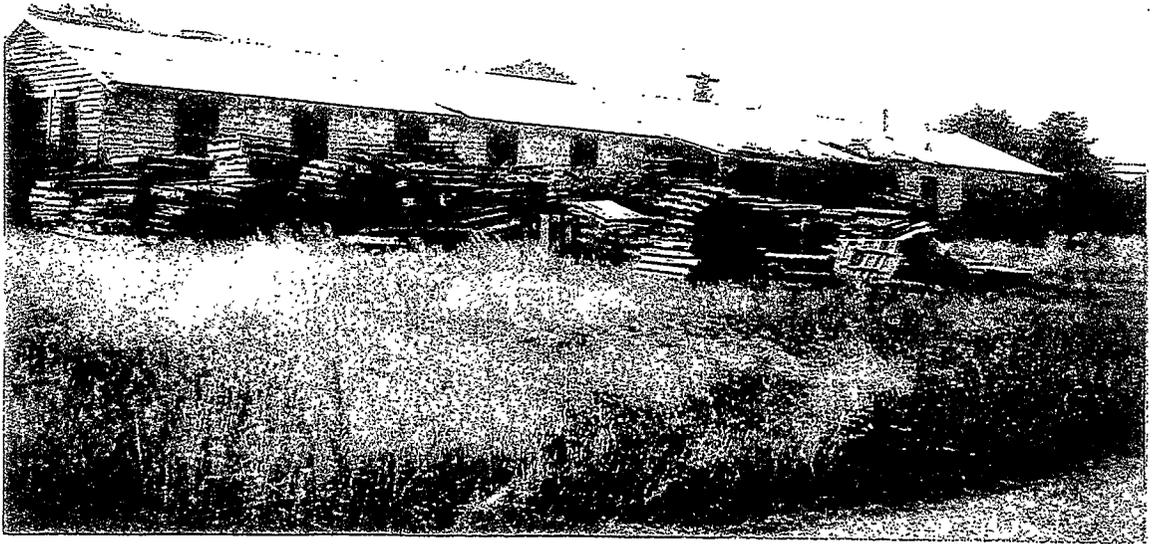
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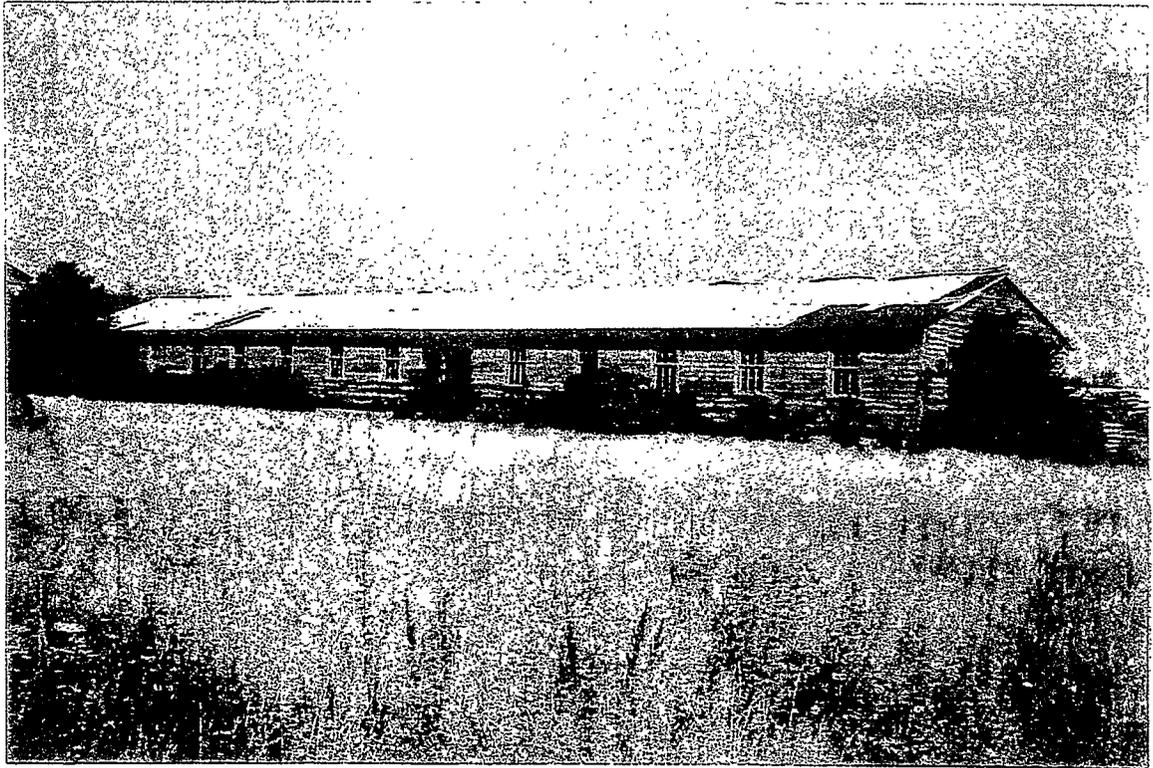
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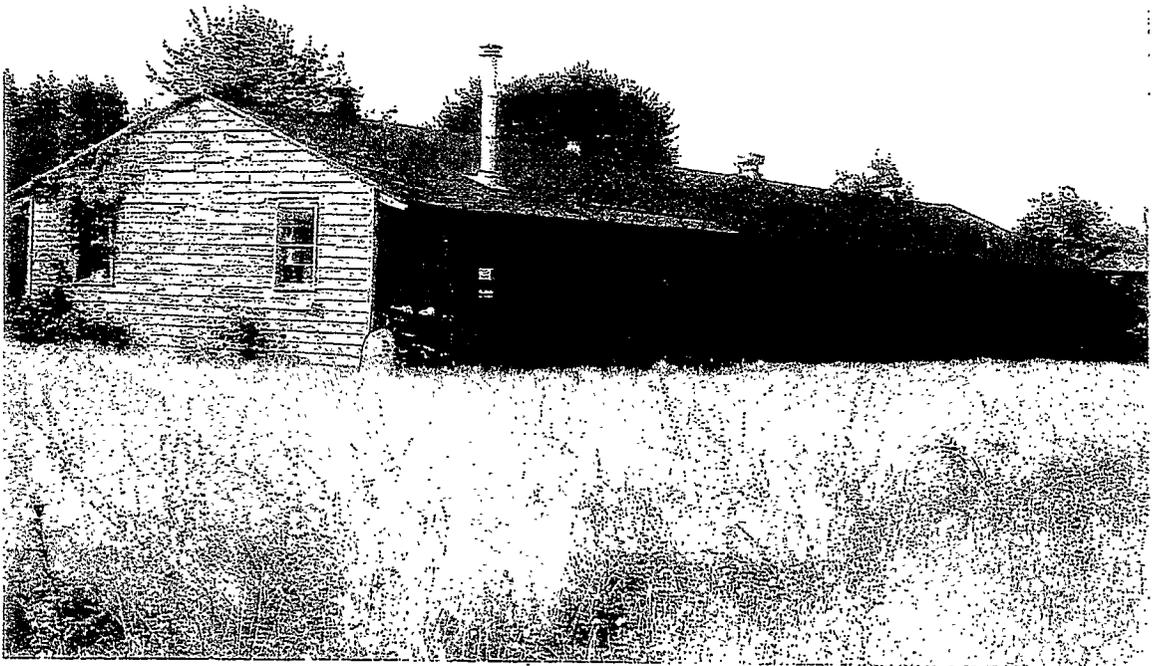
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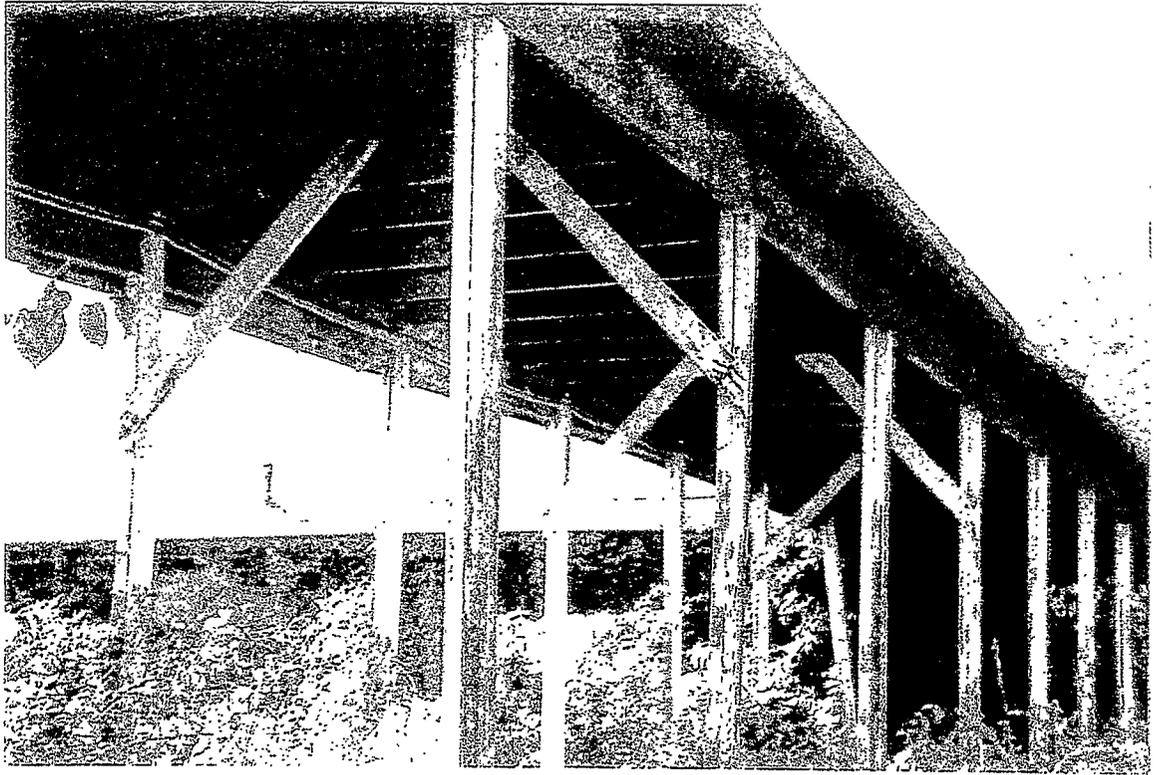
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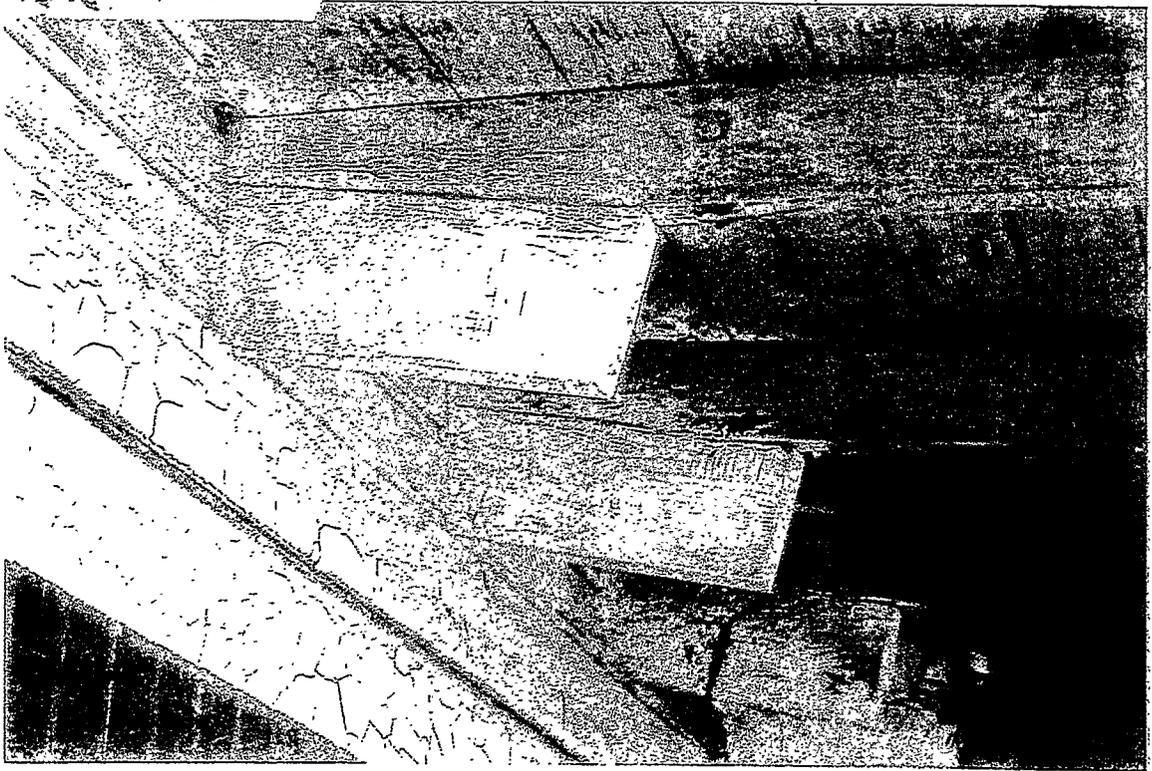
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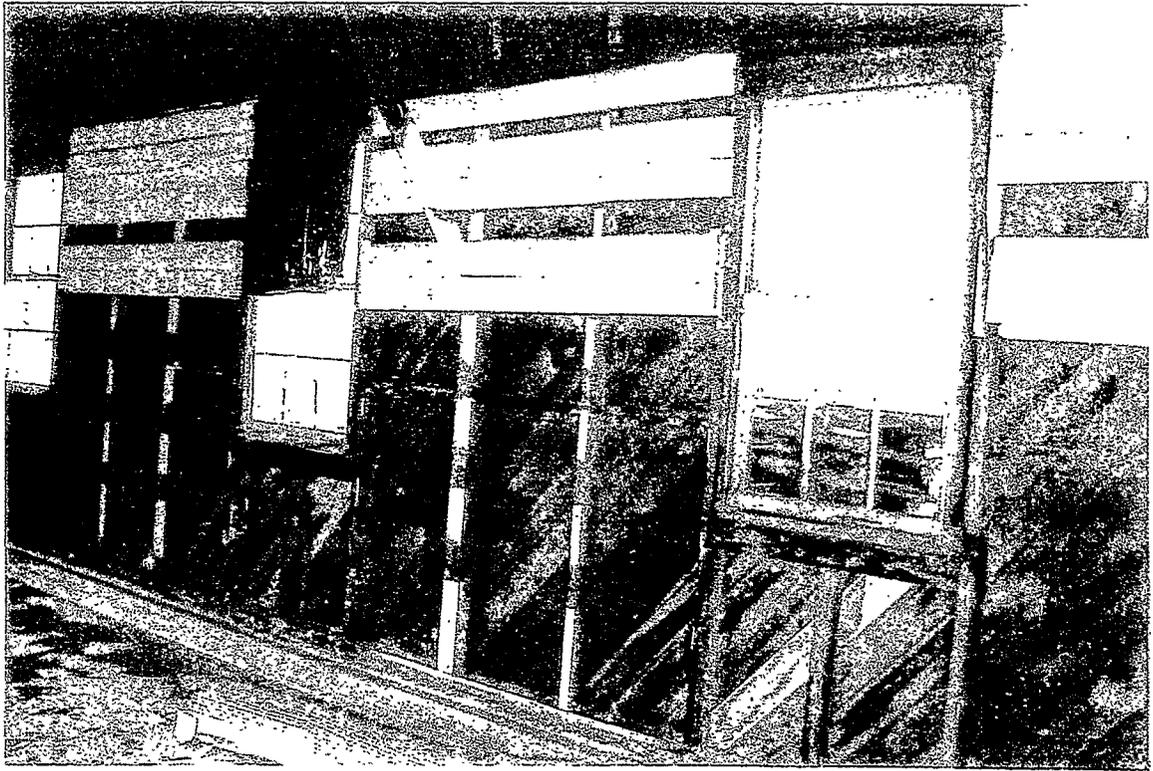
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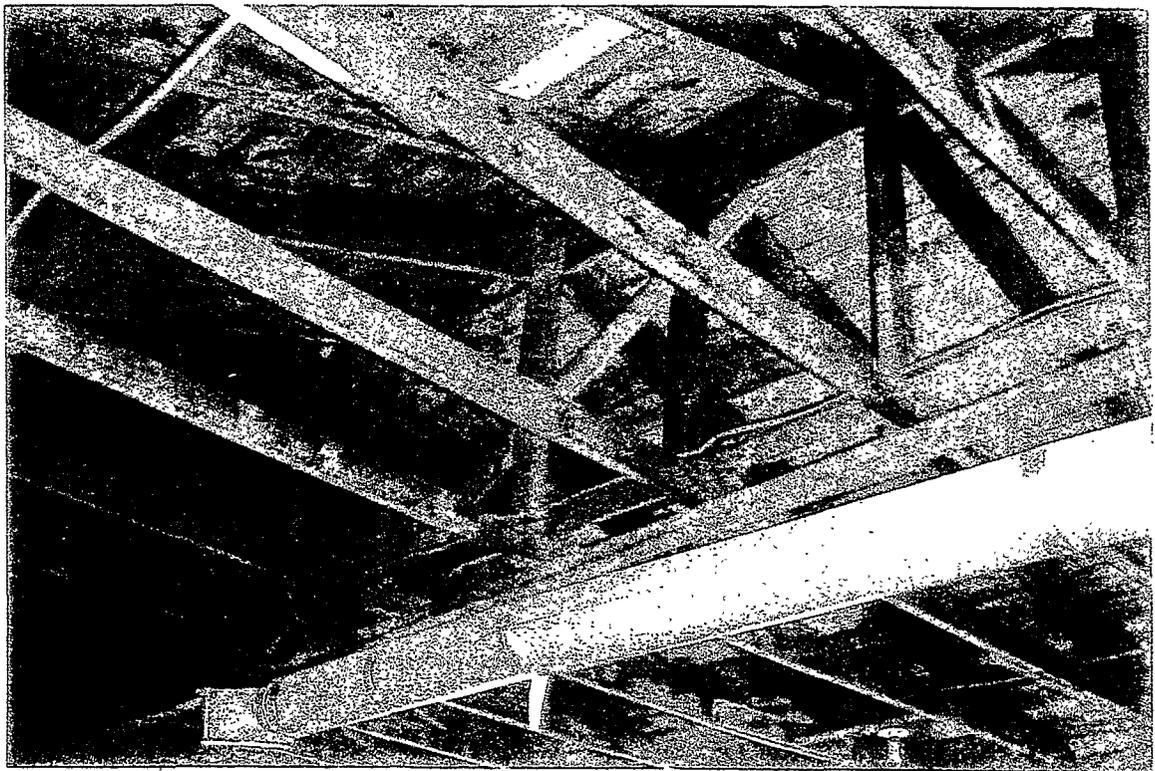
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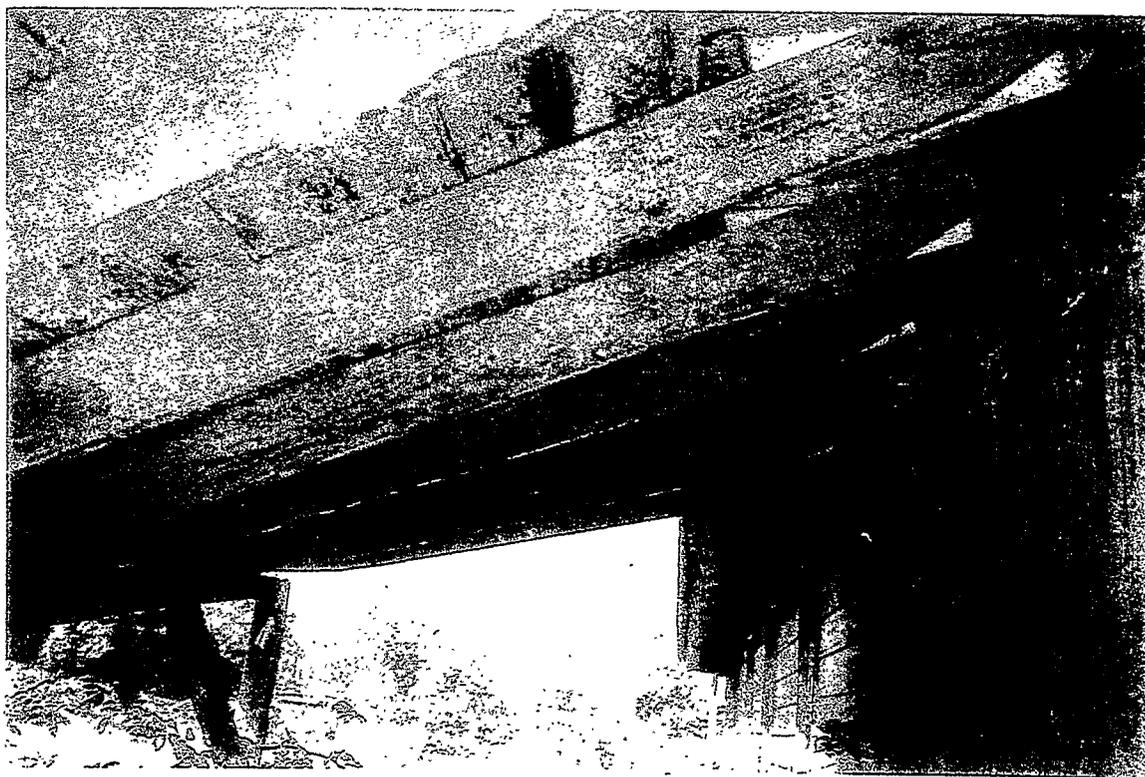
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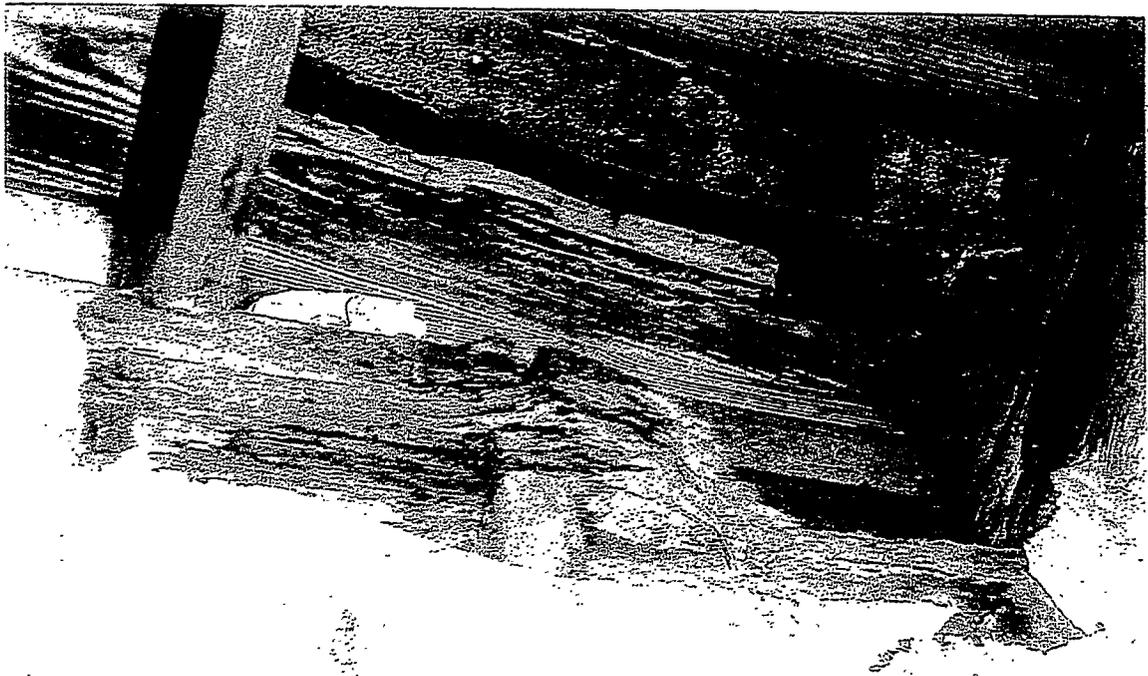
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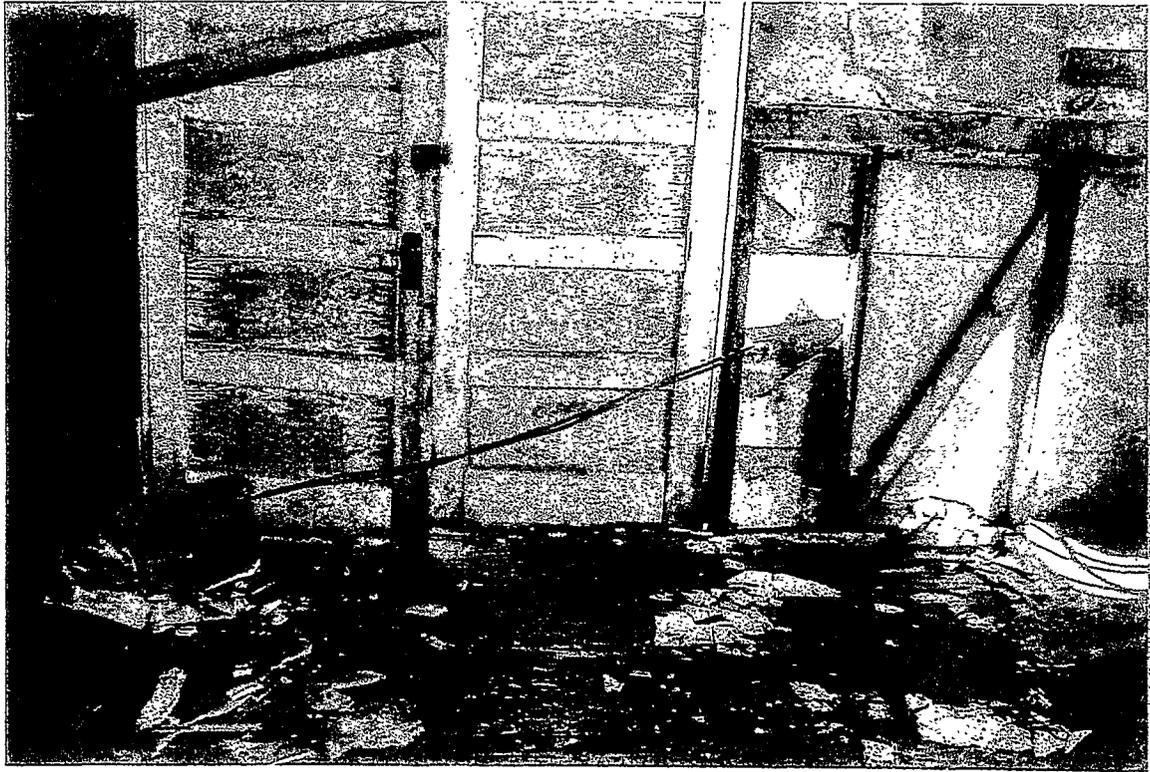
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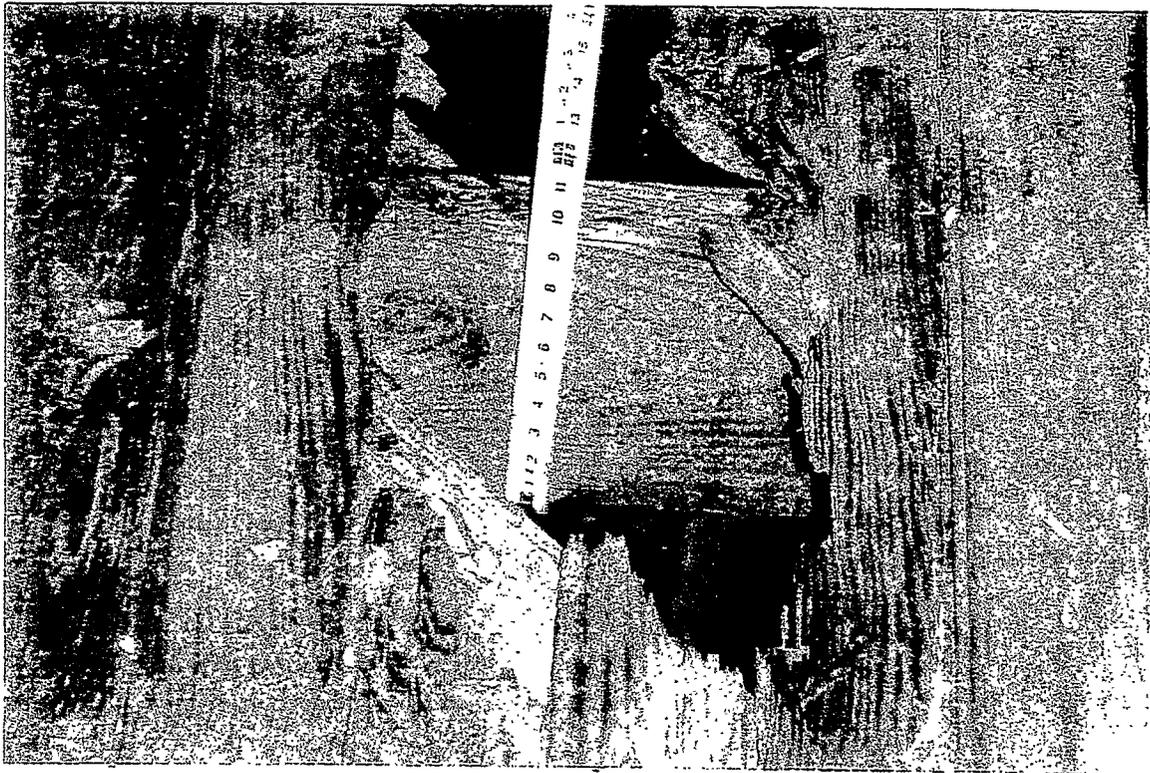
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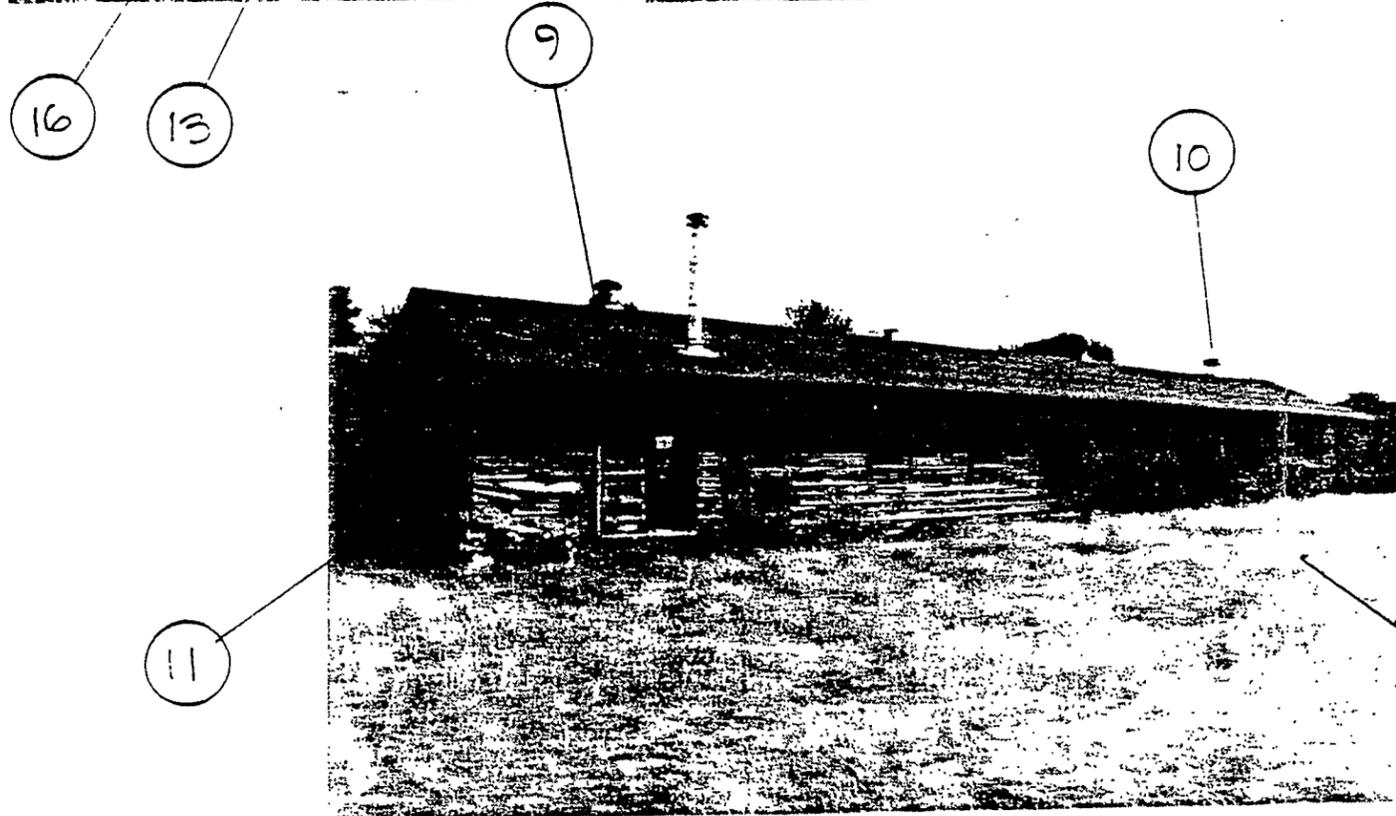
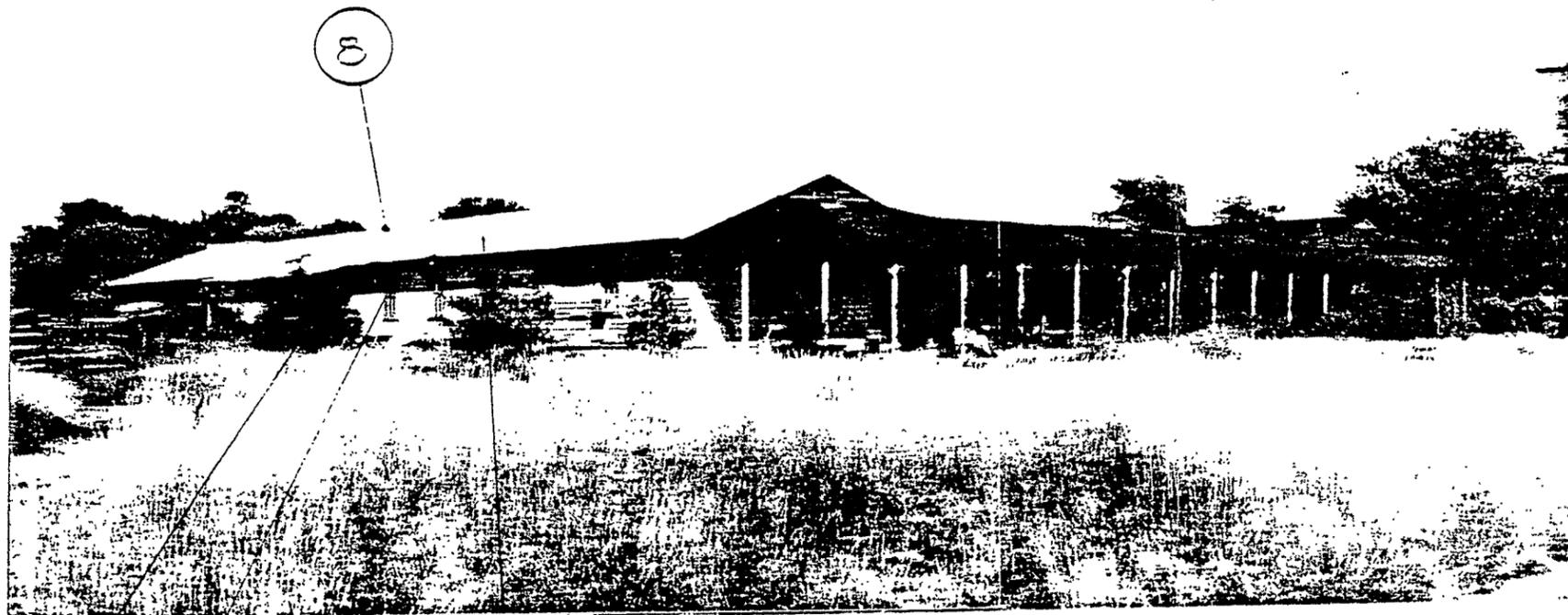
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STABILIZATION

1. Remove covered walkway roof framing in its entirety.
2. Remove east building outboard porch which has partially collapsed.

PRESERVATION

3. Replace 12'x24' portion of floor framing in east building. Also, replace 12'x12' portion of roof framing and roofing.
4. Replace decking in 10'x10' area in west building.
5. Replace east building front slab. Replace timber decking.
6. Underpin loading dock foundation wall.
7. Replace west building outboard porch decking.
8. Repair/replace damaged corrugated roofing.
9. Provide gutters and downspouts on each building.
10. Repair/replace roof vents.
11. Replace 25% of clapboard siding.
12. Repaint entire exterior.
13. Replace/repair and reglaze 50% of the windows.
14. Replace overhead garage doors in west building.
15. Relocate oil line at exterior doors at east building.
16. Remove overgrown vegetation at building exterior.

RESTORATION

17. Rebuild covered walkway and outboard porch on east building.
18. Restore original windows and doors.

RECOMMENDATIONS

P.O.W. BARRACKS

BLDG. 122

**GREDELL
& ASSOCIATES**
STRUCTURAL ENGINEERS

702 N. WEST STREET - WILMINGTON, DELAWARE 19801 - 302-429-7400
5 THE GREEN - DOVER, DELAWARE 19801 - 302-734-7400

PRELIMINARY COST ESTIMATE

EAST POW BARRACKS - BUILDING 122

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Remove covered walkway in its entirety	800	S.F.	\$ 2.55	\$ 2,040.00
2.	Remove east side porch	120	S.F.	\$ 2.55	<u>\$ 306.00</u>
Subtotal Stabilization					\$ 2,346.00

Preservation

3.	Replace floor & roof framing	432	L.S.	\$ 10.50	\$ 4,536.00
4.	Replace front slab	200	S.F.	\$ 8.68	\$ 1,736.00
	a. Replace timber decking	200	S.F.	\$ 10.00	\$ 2,000.00
5.	Provide gutters & downspouts	250	L.F.	\$ 3.50	\$ 875.00
6.	Repair/replace roof vents	4	EA	\$ 475.00	\$ 1,900.00
7.	Replace 25% of clapboard siding	750	S.F.	\$ 3.50	\$ 2,625.00
8.	Repaint exterior	3000	S.F.	\$.80	\$ 2,400.00
9.	Replace/repair 50% of windows	12	EA	\$ 320.00	\$ 3,840.00
10.	Relocate oil line		L.S.		\$ 475.00
11.	Remove vegetation		L.S.		<u>\$ 2,400.00</u>
Subtotal Preservation					\$22,787.00

Subtotal Stabilization & Preservation	<u>\$25,133.00</u>
Contingencies 20%	\$ 5,026.60
	\$30,159.60
Eng. & Admin. 15%	<u>\$ 4,523.94</u>
Total Project Cost	<u>\$34,683.54</u>

Restoration (Alternate)

- | | | | | | |
|-----|---|-----|------|-------------|--------------------|
| 12. | Rebuild covered
walkway & outboard
porch to match
orig. const. | 920 | S.F. | \$ 27.30 | \$25,116.00 |
| 13. | Restore original
windows & doors | 26 | EA | \$ 1,200.00 | <u>\$31,200.00</u> |

Subtotal Restoration \$56,316.00

Alternate Project Cost to Restore Structure to Original Construction

Subtotal Stabilization & Preservation \$25,133.00

Add Restoration Subtotal \$56,316.00

Deduct Item 9 -\$ 3,840.00

Subtotal Alternate \$77,609.00

Contingencies 20% \$15,521.80

\$93,130.80

Eng. & Admin. 15% \$13,969.62

Total Alternate Project Cost \$107,100.42

PRELIMINARY COST ESTIMATE

WEST POW BARRACKS - BUILDING 122

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
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No work required.

Preservation

1.	Replace floor decking	100	S.F.	\$ 7.85	\$ 785.00
2.	Underpin loading dock foundation wall		L.S.		\$ 5,000.00
3.	Replace porch decking	100	S.F.	\$ 10.50	\$ 1,050.00
4.	Repair/replace corrugated roofing	2400	S.F.	\$ 2.16	\$ 5,184.00
5.	Provide gutters & downspouts	350	L.F.	\$ 3.50	\$1,225.00
6.	Replace 25% of clapboard siding	815	S.F.	\$ 3.50	\$ 2,852.50
7.	Repaint exterior	3260	S.F.	\$.80	\$ 2,608.00
8.	Replace/repair 50% of windows	12	EA	\$ 320.00	\$ 3,840.00
9.	Replace overhead garage doors	1	EA	\$1,175.00	\$ 1,175.00
10.	Remove vegetation		L.S.		<u>\$ 2,400.00</u>

Subtotal Preservation \$26,119.50
Contingencies 20% \$ 5,223.90

\$31,343.40

Eng. & Admin. 15% \$ 4,701.51

Total Project Cost \$36,044.91

Restoration (Alternate)

11.	Restore original windows & doors	26	EA	\$1,200.00	<u>\$31,200.00</u>
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Subtotal Restoration \$31,200.00

Alternate Project Cost to Restore Structure to Original Construction

Subtotal Stabilization & Preservation \$26,119.50
Add Restoration Subtotal \$31,200.00
Deduct Item 8 -\$ 3,840.00

Subtotal Alternate \$53,479.50
Contingencies 20% \$10,695.90

Eng. & Admin. 15% \$64,175.40
\$ 9,626.31

Total Alternate Project Cost \$73,801.71

POLE SHED

PRELIMINARY COST ESTIMATE

POLE SHED - BUILDING 124

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Replace N/S bracing		L.S.		\$ 1,240.00
2.	Repair/replace roof framing, sheathing & roofing at eaves	40	S.F.	\$ 10.50	\$ 420.00
Subtotal Stabilization					\$ 1,660.00

Preservation

3.	Re-roof front half	13	SQ	\$ 110.00	\$ 1,430.00
4.	Provide gutters & downspouts	200	L.F.	\$ 3.50	\$ 700.00
5.	Rebuild cornice trim at front eave	60	L.F.	\$ 10.00	\$ 600.00
6.	Replace deteriorated siding	1400	S.F.	\$ 3.50	\$ 4,900.00
7.	Paint exterior	3600	S.F.	\$.80	\$ 2,880.00
8.	Remove exterior vegetation		L.S.		\$ 1,500.00
9.	Rework sliding doors incl. timber replacement		L.S.		\$ 5,000.00

Subtotal Preservation \$17,010.00

Subtotal Stabilization & Preservation \$18,670.00
Contingencies 20% \$ 3,734.00

\$22,404.00

Eng. & Admin. 15% \$ 3,361.00

Total Project Cost \$25,765.00

Restoration (Alternate)

10.	Provide windows & doors to match orig. construction	8	EA	\$ 1,200.00	\$ 9,600.00
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11. Provide sliding doors
along front elev. 2 EA \$ 4,000.00 \$ 8,000.00

Subtotal Restoration \$17,600.00

Alternate Cost to Restore Structure to Original Construction

Subtotal Stabilization & Preservation \$18,670.00

Add Restoration Subtotal \$17,600.00

Deduct Item 9 -\$ 5,000.00

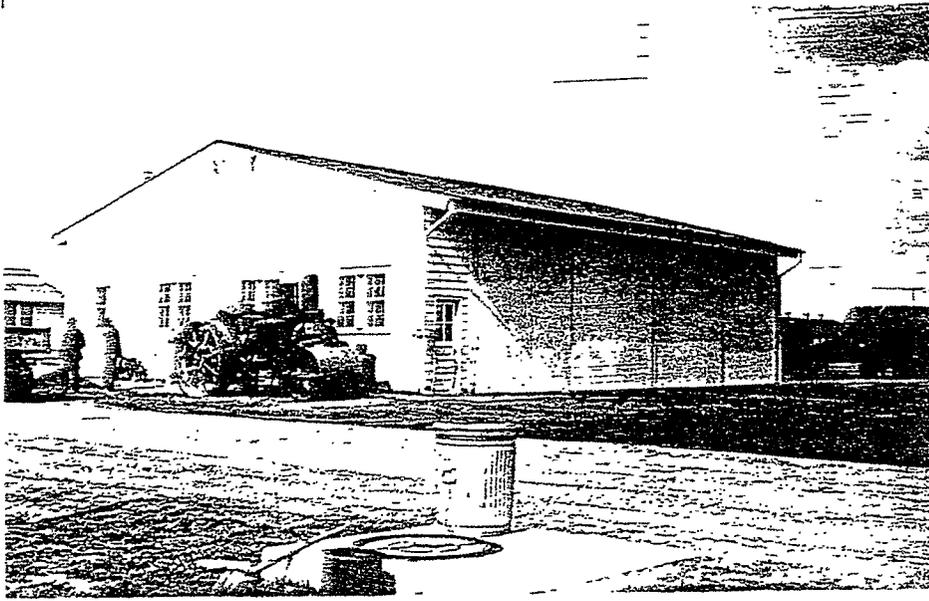
Subtotal Alternate \$31,270.00

Contingencies 20% \$ 6,254.00

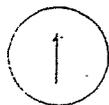
\$37,524.00

Eng. & Admin. 15% \$ 5,629.00

Total Alternate Project Cost \$43,153.00



CIRCA 1941



1993

POLE SHED

Pole Shed - Building 124

DESCRIPTION

The pole shed is a single story timber frame structure founded on concrete foundations. The building footprint is rectangular in plan and comprises approximately 2400 square feet. The structure is essentially divided into 4 large garage bays with large sliding doors along the rear elevation. On the front elevation (facing west) there are rails indicating that at one time doors were also along the front similar to the rear. The structure is currently being utilized as a storage warehouse by the National Guard.

FINDINGS

1. Historical

Our review of archival information yielded that the structure was constructed circa 1941 for a total cost of \$7,840.00. Originally the structure was designated as the Radio Shelter.

2. Floor

The concrete floor slabs are in fair condition. The column bases are attached to concrete pier foundations with steel angles and bolts. These connections are in good condition with only minor surface corrosion evident. See photo 8.

3. Roof

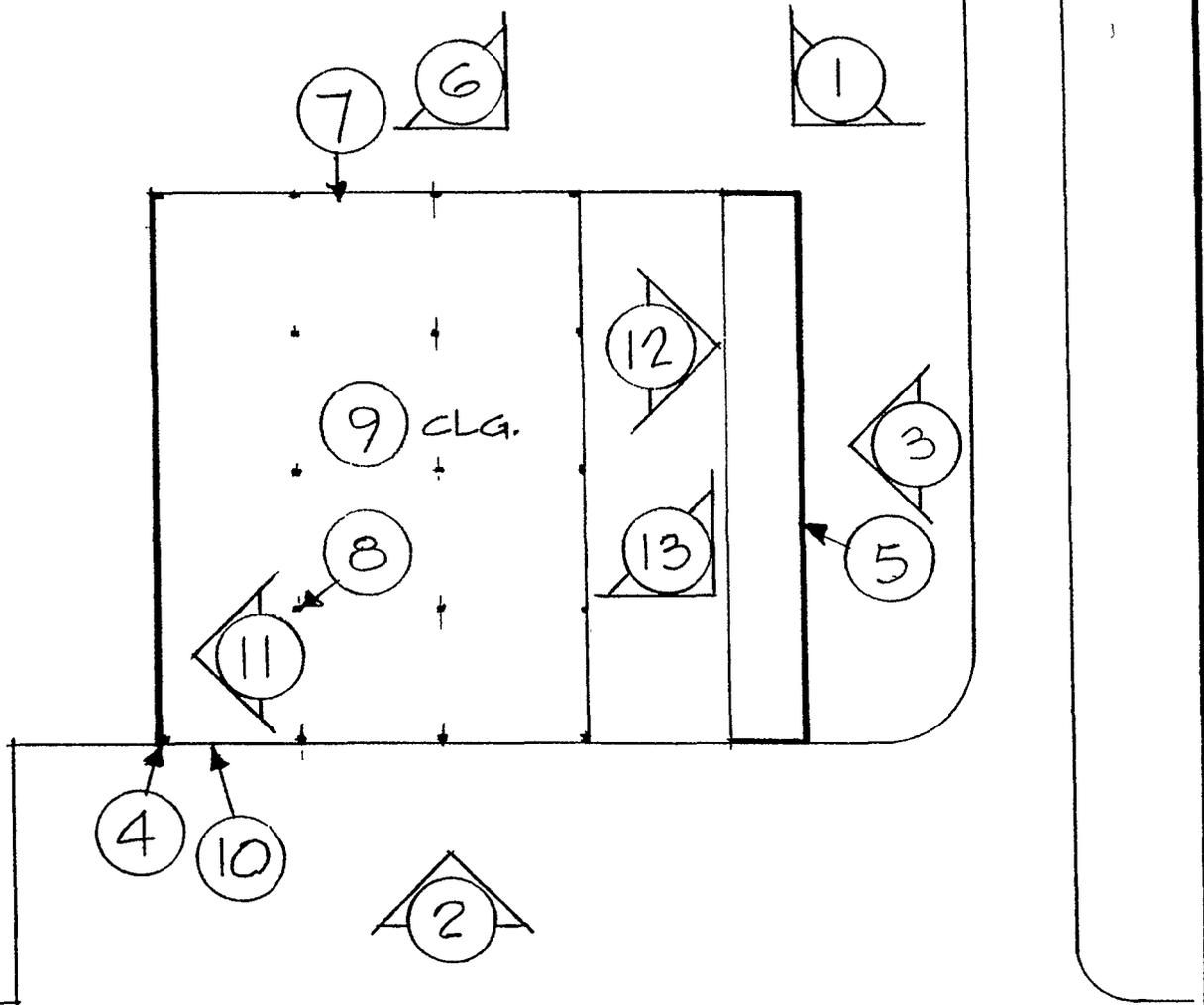
The roof structure is framed by five longitudinal bents spanning east-west in the building. There are two exterior bents, and three interior bents. Each bent includes a row of five built up (3) 2x8 columns which are knee-braced to the longitudinal wood trusses which span between the columns. Spanning between each truss are 2x8 rafters at 24" o.c. There are 2x6 ceiling joists spaced alongside the rafters at 24" o.c. The roof is completely deteriorated along the eaves at both elevations of the building. The rafters, decking and roofing are in need of replacement. Also, portions of the west end wall requires stud and sheathing. See photos 10, 11, 12, & 13. The front half of roofing requires replacement. See photo 2. The eave section is rotted at most locations along the south elevation and should be replaced completely. See photos 4 & 10. Daylight is visible through most of the roof along the front eaves. See photo 11. It was observed that transverse x-bracing between bents originally provided has been removed to provide for accessibility in the building interior. The gutters and downspouts are missing in their entirety. See photos 2 and 4.

4. Exterior Walls

The end walls are framed with 2x6 studs spaced 24" o.c. and are doubled at window openings. The walls are overgrown with vegetation which requires removal. See photos 1, 2, 3, 4, & 7. Portions of the siding are missing on the east wall. See photos 3 & 5. Forty percent of the exterior siding is in need of replacement. The building needs to be repainted. See photo 5.

5. Doors and Windows

The four large doors across the rear of the building are observed to be derailed from their tracks. There are portions of these doors which have deteriorated timber. See photos 1, 6, & 7. The door trim is severely weathered and requires painting. See photo 1. The right end wall exhibits evidence of originally having windows. The existing headers are still visible and the openings have since been infilled.



POLE SHED
PHOTOGRAPHS

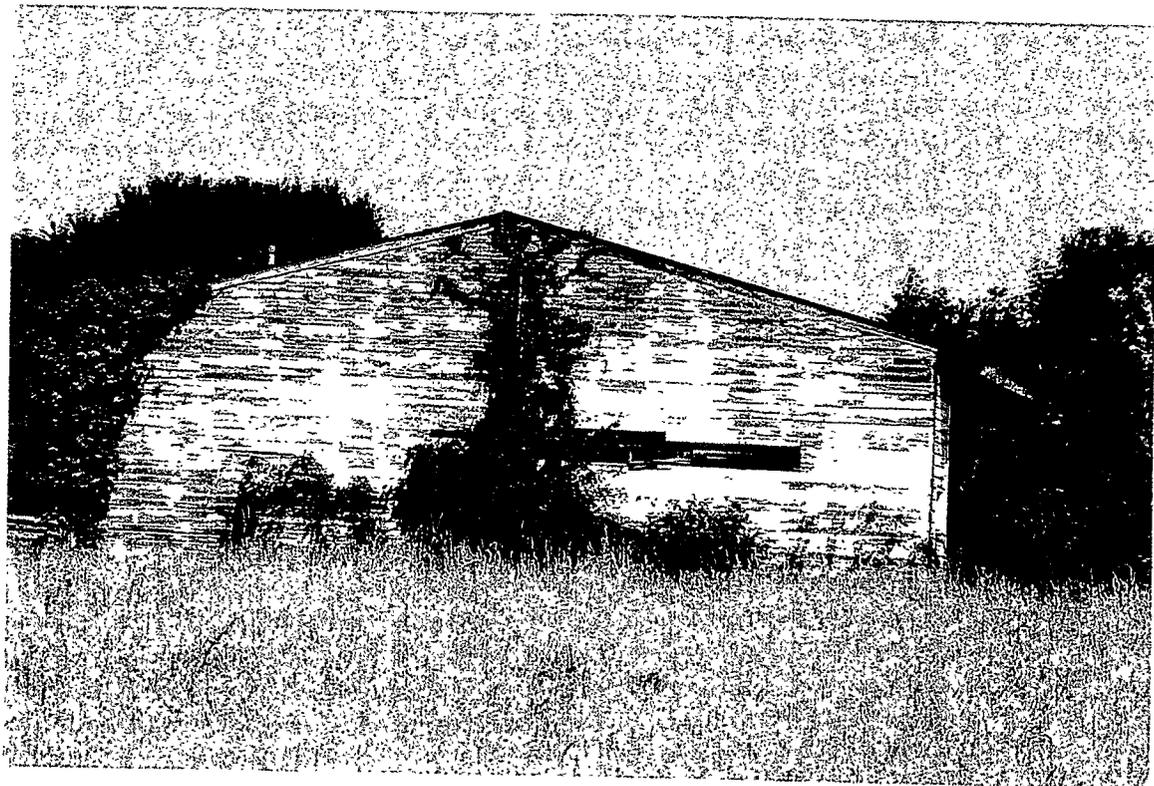
POLE SHED (124)

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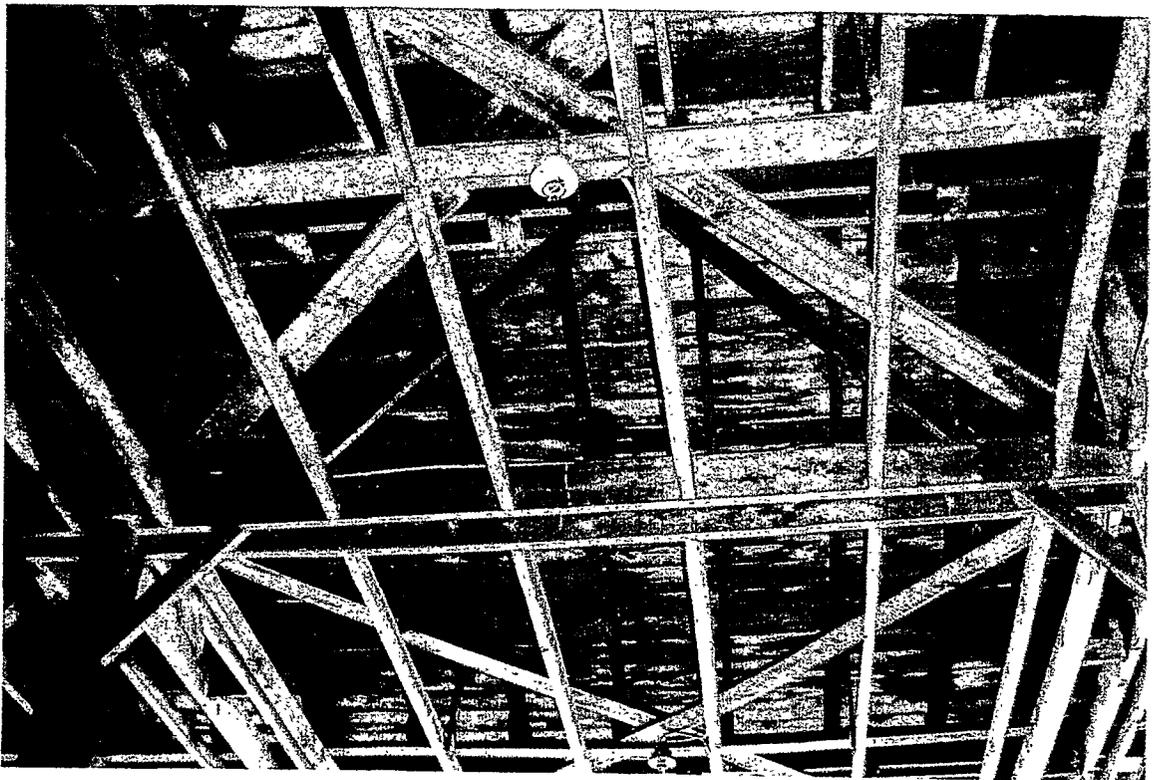
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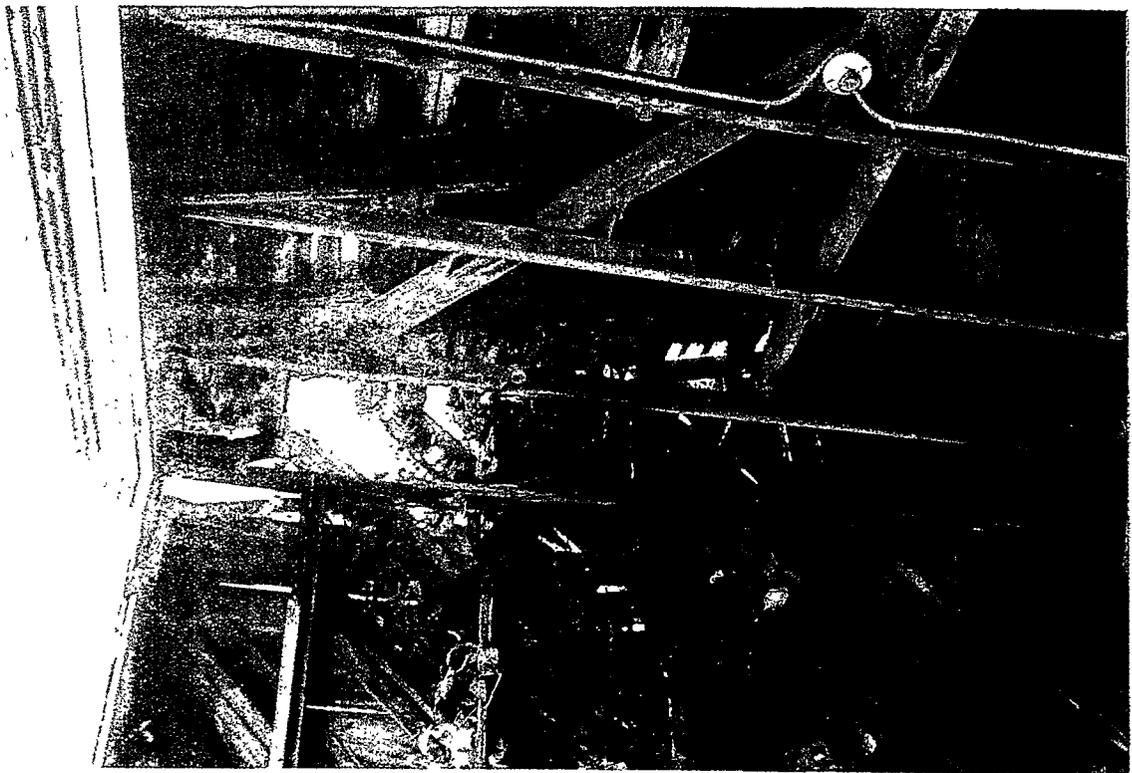
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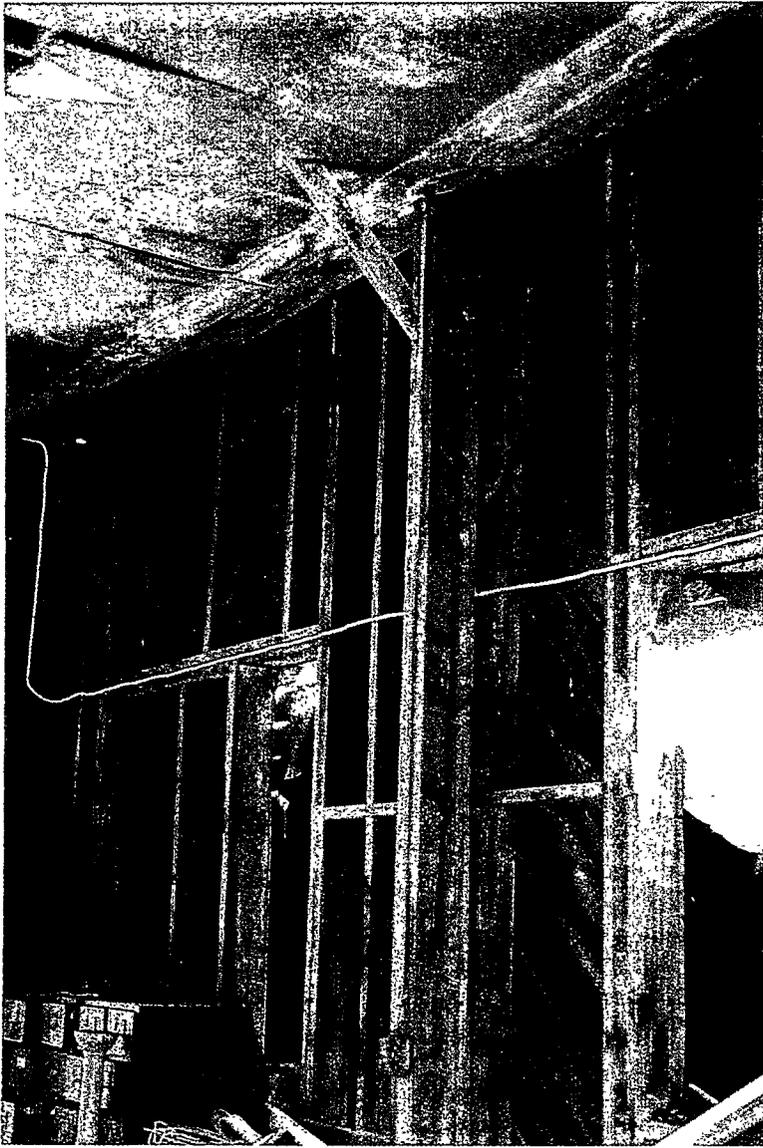
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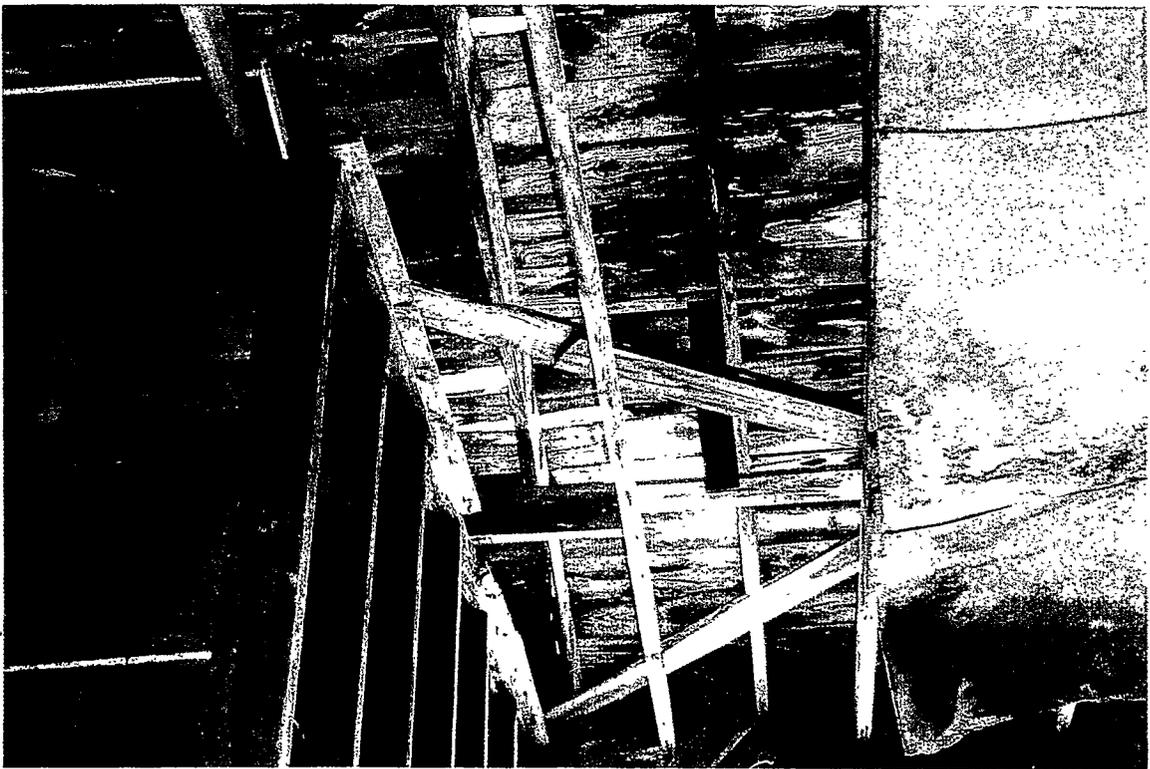
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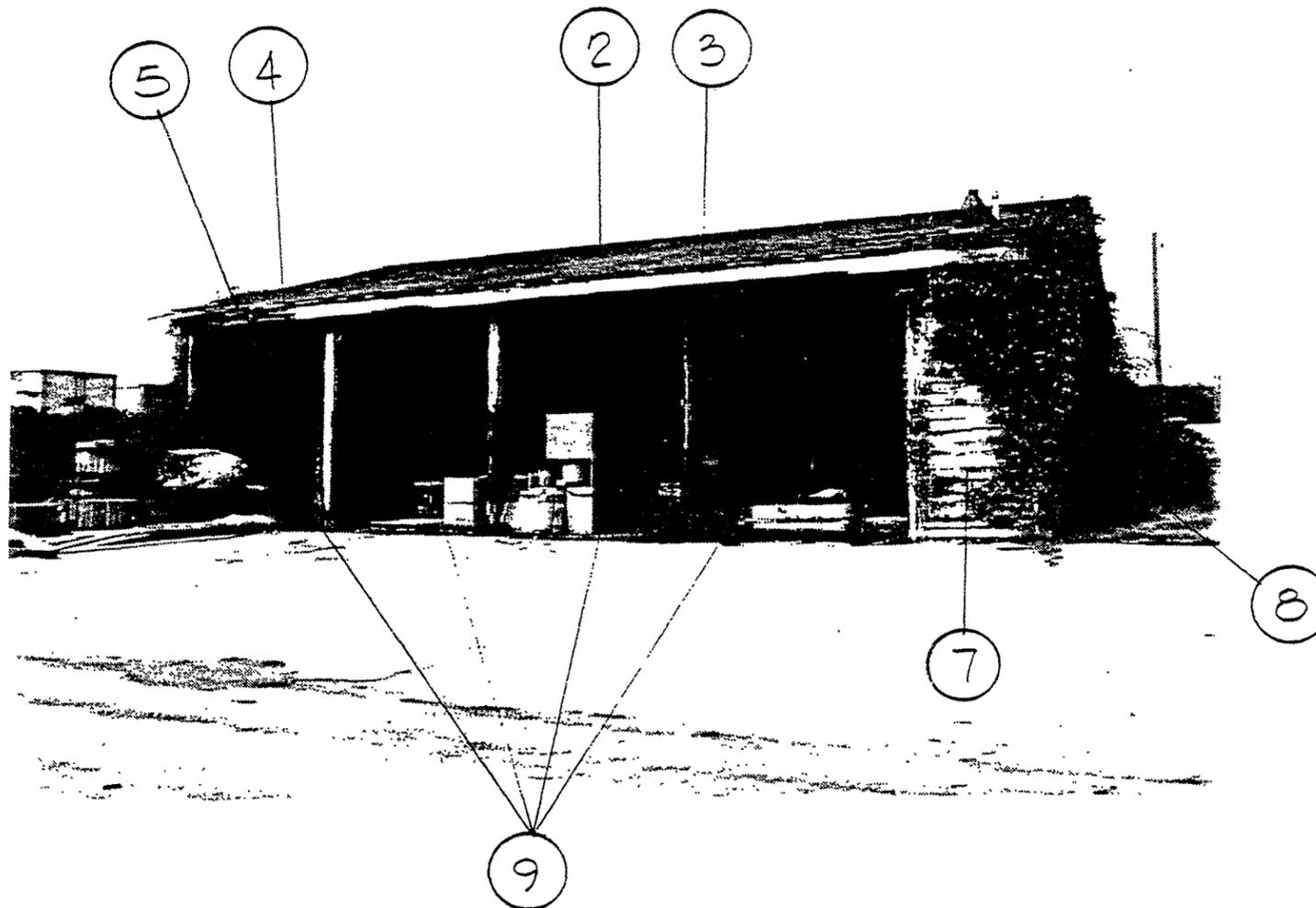
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STABILIZATION

1. Replace the north-south cross bracing at each run of interior columns.
2. Repair and replace deteriorated roofing, framing, and sheathing along the front eaves on each end to create a watertight structure.

PRESERVATION

3. Re-roof front half of building.
4. Provide gutters and downspouts.
5. Rebuild cornice molding, fascia and soffit at front eaves.
6. Replace approximately 40% of the siding on the building.
7. Paint exterior.
8. Remove exterior vegetation.
9. Rework sliding doors to render them operable.
Replace deteriorated timber door panels.

RESTORATION

10. Provide windows and doors to match original construction
Provide sliding doors along front elevation.
11. Re-shingle the entire roof.

RECOMMENDATIONS

POLE SHED

BLDG. 124

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P.O.W. GUARD TOWER



CIRCA 1941



①

P.O.W. GUARD TOWER

P.O.W. GUARD TOWER - BUILDING #125

DESCRIPTION

The P.O.W. Guard Tower is an approximately 25 feet high steel frame observation tower which is located immediately northwest of the Pole Shed Building.

FINDINGS

The skeleton structure consists of four L4x4x3/4, legs spaced 12 feet apart at the base. Each leg is founded on 31 inch square concrete piers with 15"x15"x1" steel base plates. The angle legs are battered as they span vertically to the concrete observation deck 21.5 feet above grade. The deck structure is a structural 4" thick concrete slab which spans 9 feet between perimeter angles. There are ship ladder type stairs which lead to a 2'x3' hatchway in the deck floor.

Standing on the deck, there are concrete walls 5 feet high which are cast between steel angle bracing. A 16 inch high opening above the walls provides a 360 degree view. The roof is hip framed with steel shapes encased in concrete. Each side of the tower is braced by two panels of 1" diameter steel rod bracing. At the core of the frame is another steel angle tower 3 feet square which is laced with flat bar x-bracing. At the top and bottom of this central tower is a 3 feet high section of steel plate in lieu of the bracing. See photo 6.

1. Historical

The only archival information found regarding the P.O.W. Tower was a picture of an adjacent structure which had the tower in the background.

2. Framing

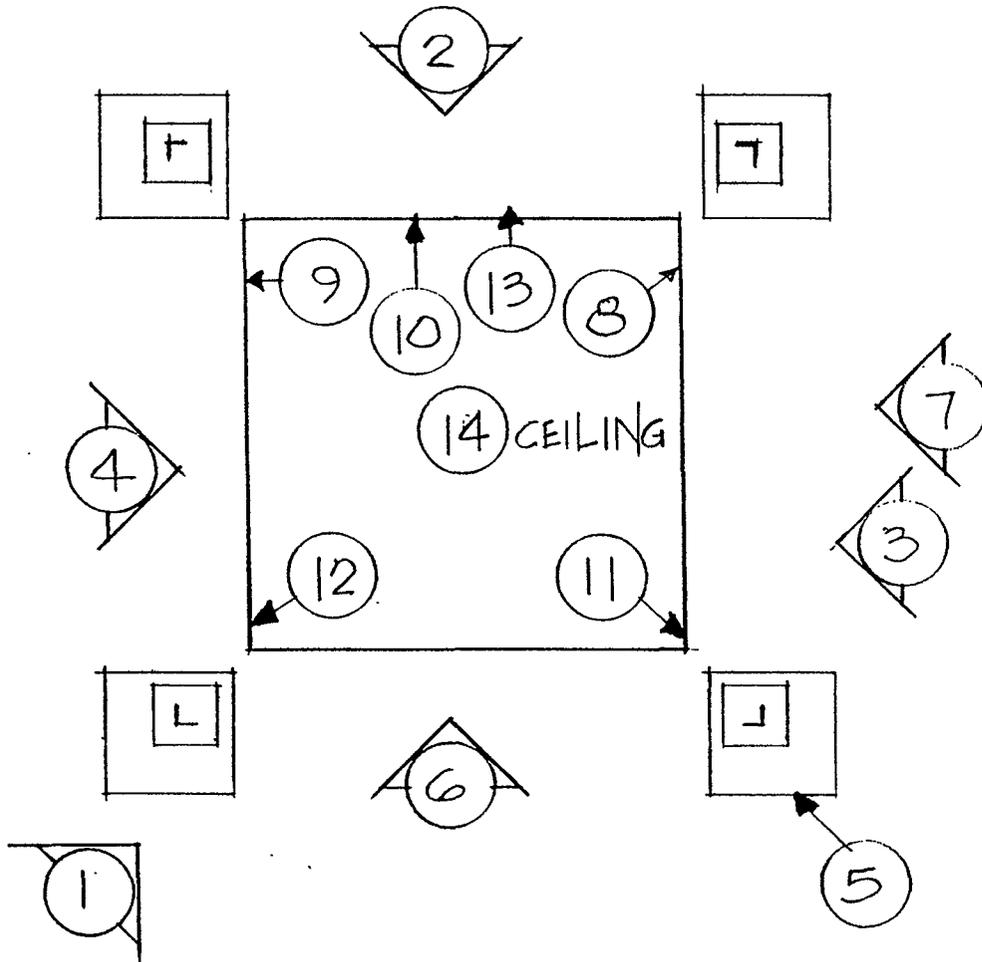
The steel framing, with the exception of some minor surface corrosion, is in good condition. However, where steel has been encased in concrete, the corrosion has caused the surrounding concrete to become distressed. Light angle framing forming the eave section at the roof is extremely corroded to the extent that complete sections are missing.

3. Concrete

The concrete deck is in fair condition. The concrete wall infill and roof deck have spalled and/or cracked primarily due to the expansive forces accompanying the steel frame corrosion.

4. General

On the deck slab there are two gun mounts. One is based in a triangular block of concrete with three projecting anchor bolts. Adjacent to the triangular mount, a semi-circular wood deck is built 8 inches above the concrete floor. Centrally located on the wood deck is a pipe post which served possibly as a gun support. There remains a considerable amount of vines and vegetation which clings to the structure. Leaders from the vegetation find their way into cracks in the concrete. Subsequent growth causes additional distress in the assembly.

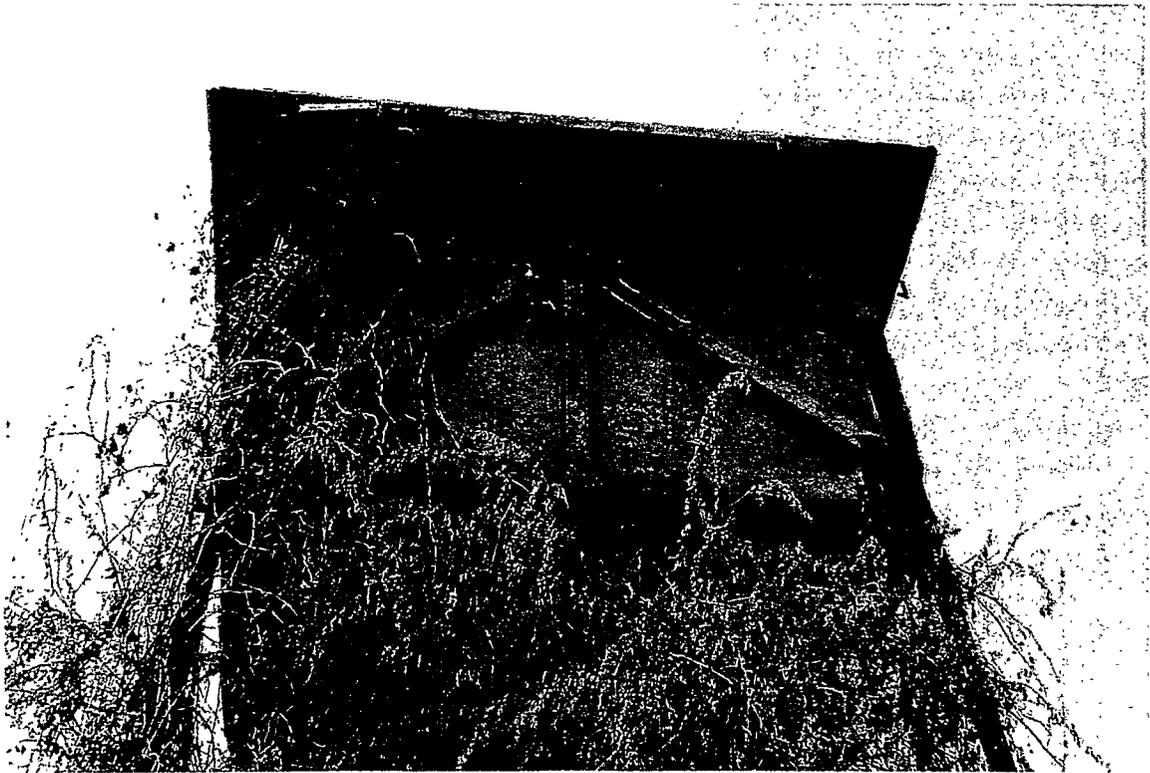


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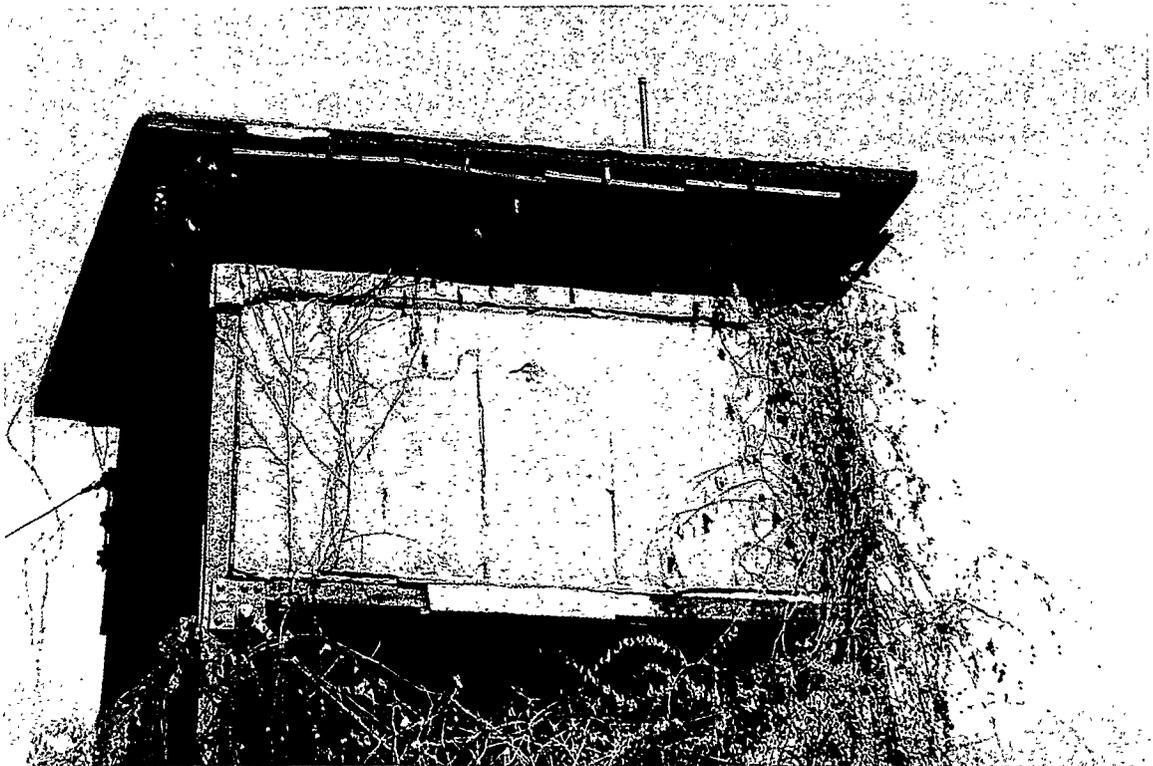
KEY PLAN
PHOTOGRAPHS

P.O.W. GUARD TOWER (125)

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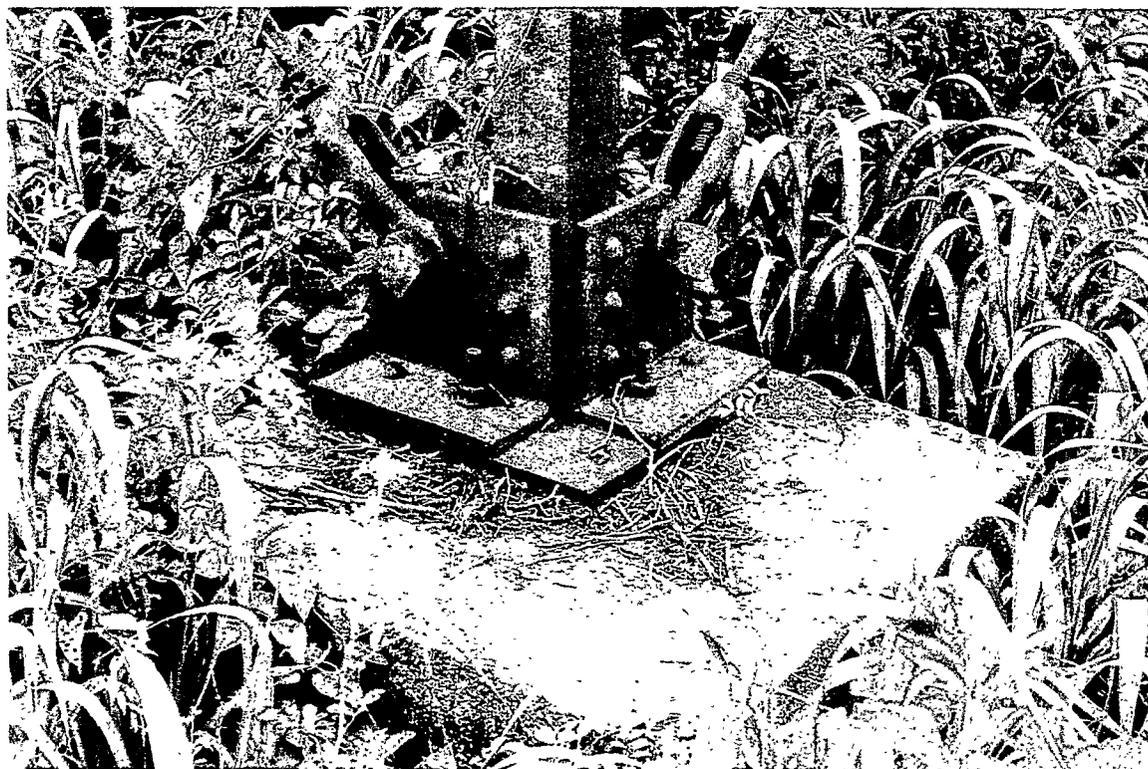
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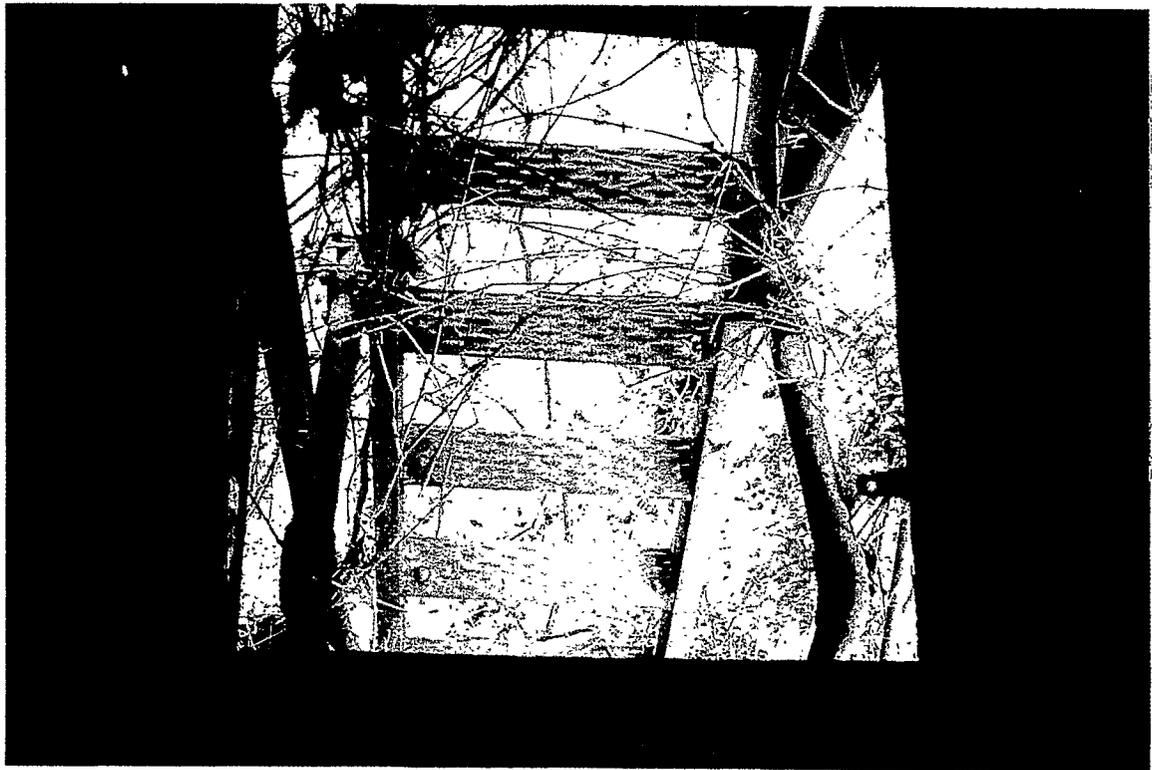
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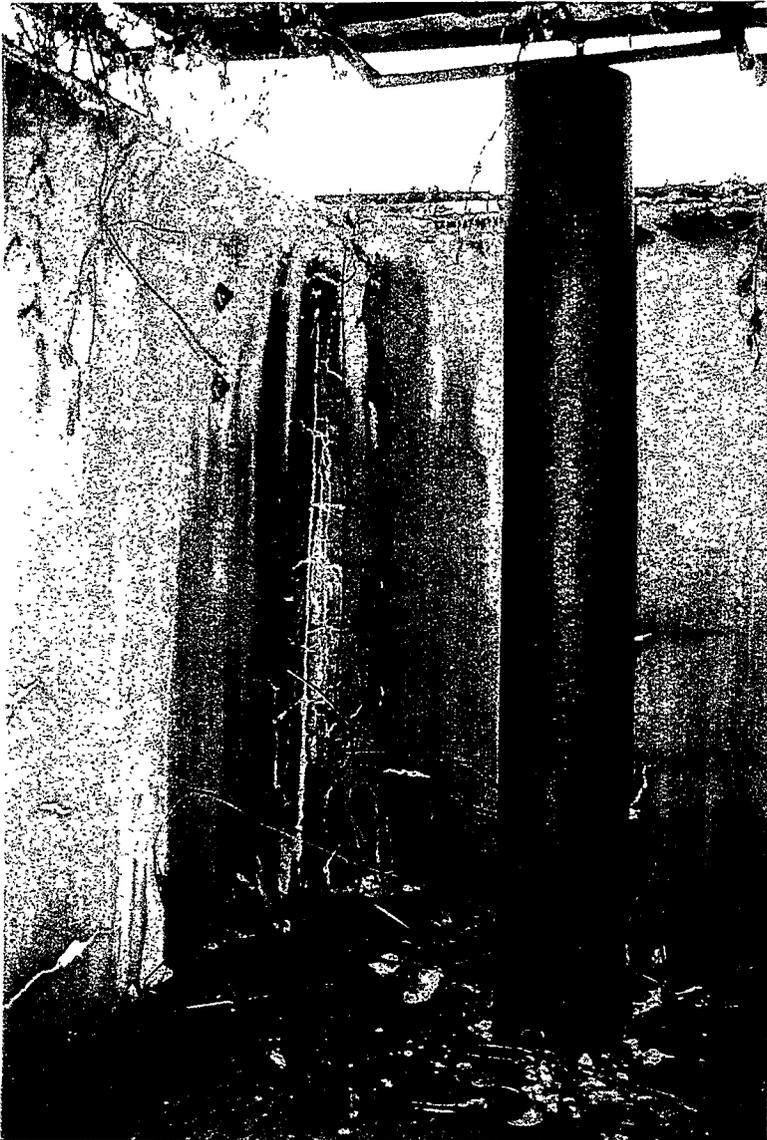
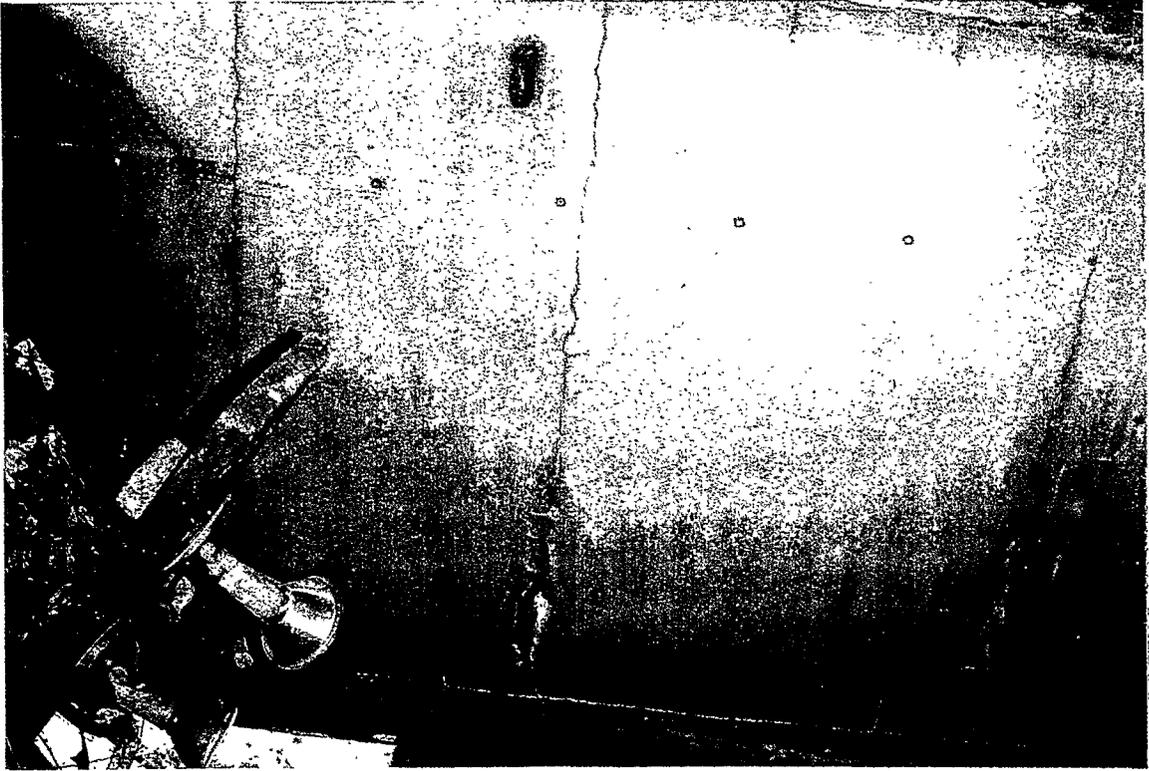


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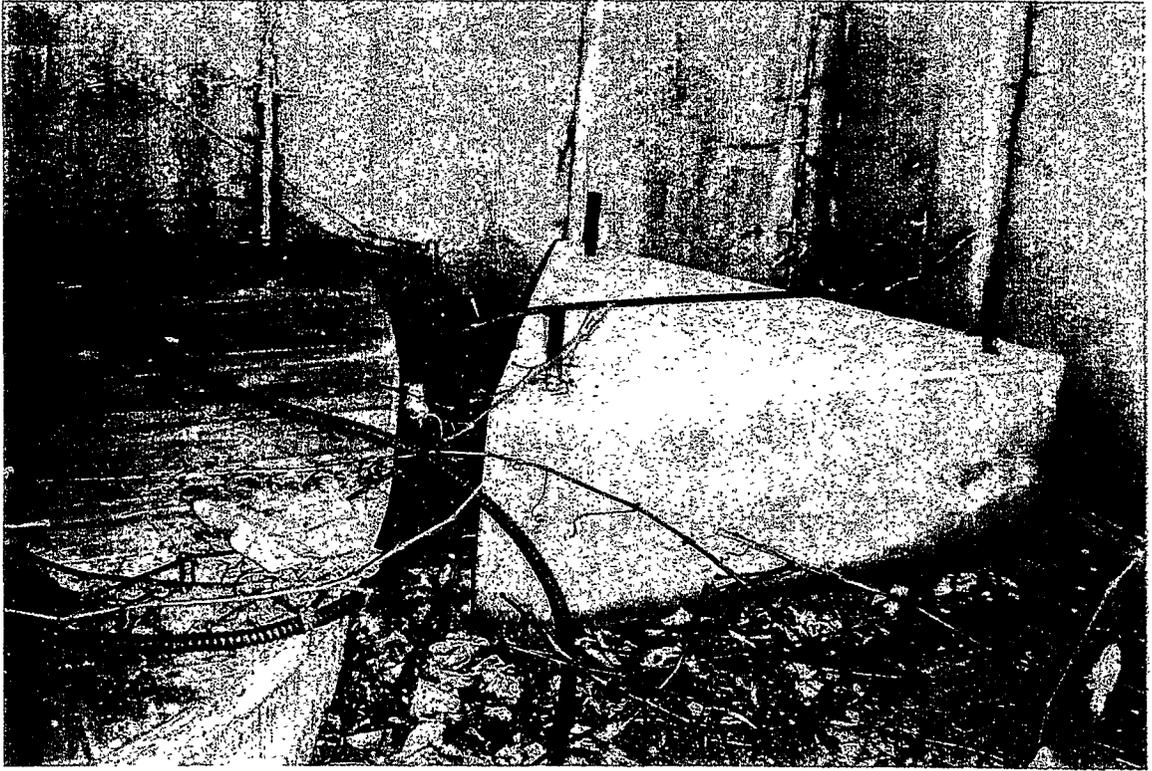
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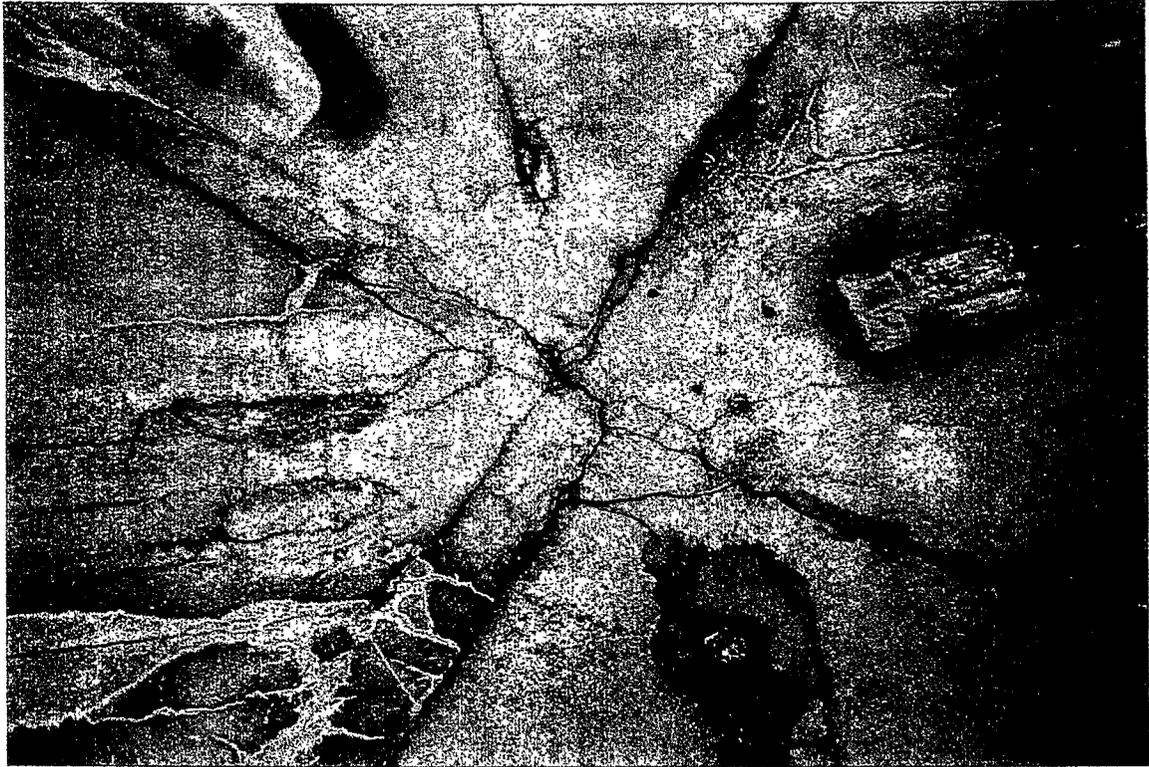
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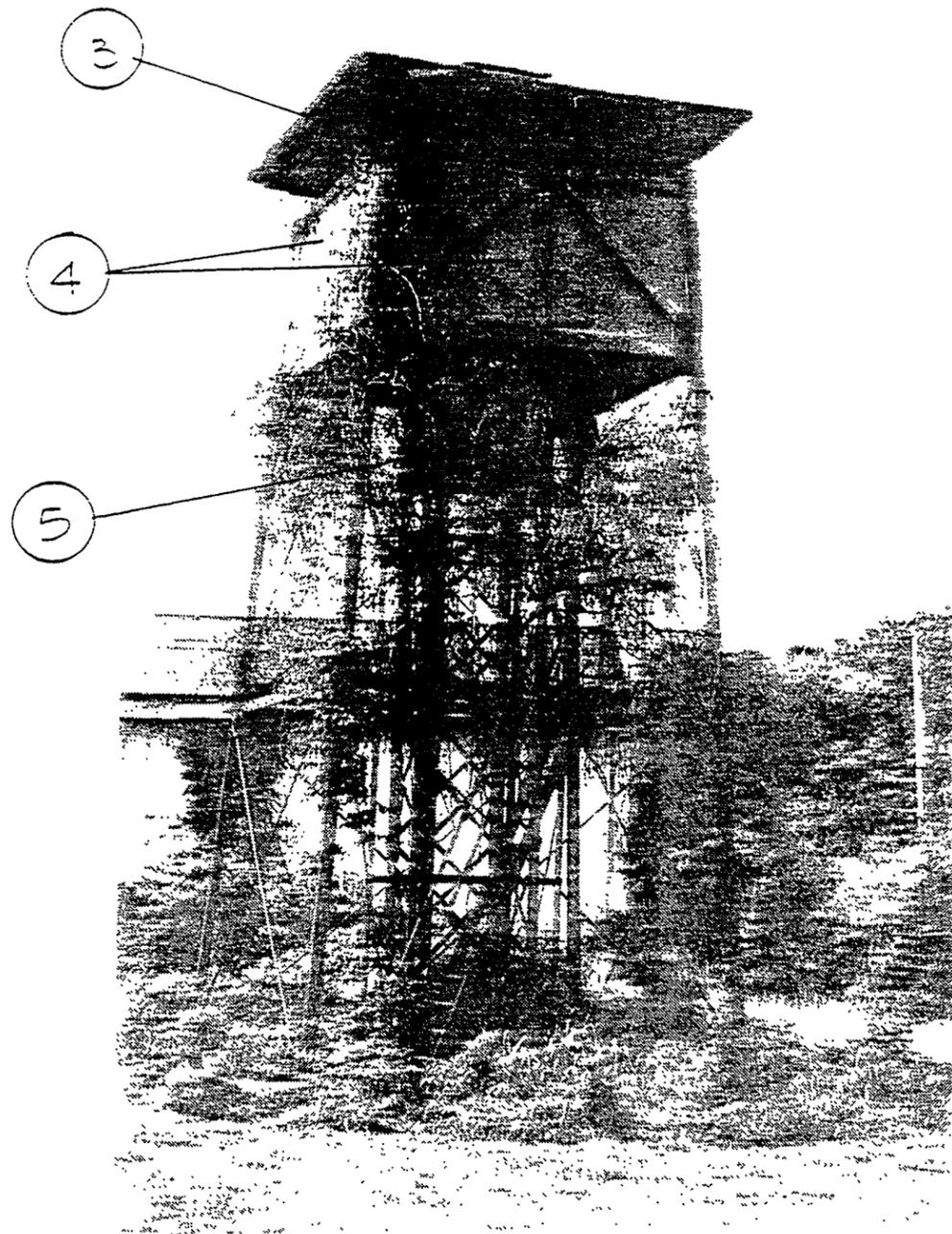
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14.



STABILIZATION

1. Remove all loose, spalled and otherwise distressed concrete.

PRESERVATION

2. Remove all concrete as required to expose steel. Blast clean and paint corroded steel with a rust inhibitive paint system.
3. Replace corroded angles at cornice and eave along roof.
4. Provide steel railings to replace removed concrete on walls. Provide a wood sheathing material to replace removed concrete.
5. Remove vegetation.

RESTORATION

6. Recast concrete walls and roof to match original construction.

RECOMMENDATIONS

P.O.W. GUARD TOWER

BLDG. 125

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PRELIMINARY COST ESTIMATE

POW GUARD TOWER - BUILDING 125

Stabilization

<u>Item</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
1.	Remove spalled loose concrete		L.S.		\$ 5,250.00
Subtotal Stabilization					\$ 5,250.00

Preservation

2.	Remove concrete wrap from steel. Blast & paint all steel		L.S.		\$11,750.00
3.	Replace corroded angles along roof		L.S.		\$ 4,875.00
4.	Provide steel mesh or grating to replace removed concrete	400	S.F.	\$ 9.75	\$ 3,900.00
5.	Remove vegetation		L.S.		\$ 2,100.00
Subtotal Preservation					\$22,625.00
Contingencies 20%					\$ 4,525.00
					\$27,150.00
Eng. & Admin. 15%					\$ 4,073.00
Total Project Cost					*\$31,223.00

* Note: Item 1 is not required in this case.

Restoration (Alternate)

6.	Recast concrete walls & roof to match original construct.	200	cu. ft.	\$ 93.50	\$18,700.00
Subtotal Restoration					\$18,700.00

Alternate Cost to Restore Structure to Original Construction

Preservation Subtotal	\$22,625.00
Add Restoration Subtotal	\$18,700.00
Deduct Concrete Removal in Item 2	-\$ 3,400.00
Deduct Item 4	-\$ 3,900.00
Subtotal Alternate	\$34,025.00
Contingencies 20%	\$ 6,805.00
	\$40,830.00
Eng. & Admin. 15%	\$ 6,125.00
Total Alternate Project Cost	\$46,955.00