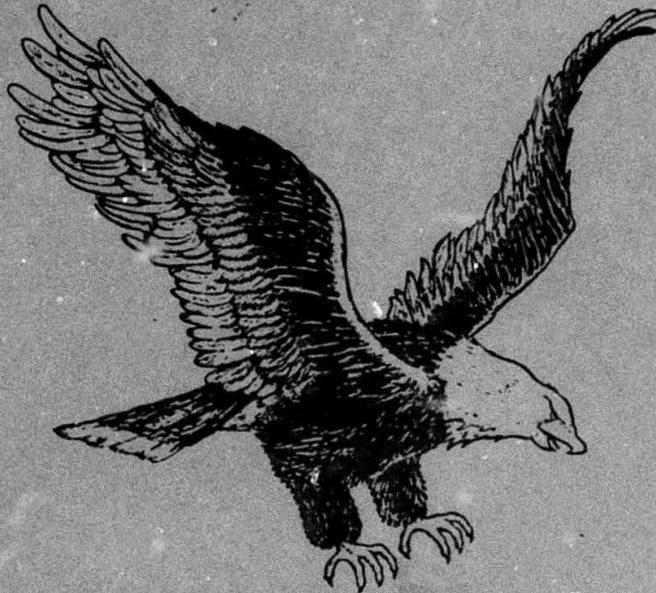


INSTALLATION RESTORATION
AT
FRANKFORD ARSENAL,
PHILADELPHIA, PENNSYLVANIA

①

PHASE I - DETAILED SURVEY AND ALTERNATIVES ASSESSMENT
ENVIRONMENTAL IMPACT ASSESSMENT

APRIL 1978



DEPARTMENT OF THE ARMY
OFFICE OF THE PROJECT MANAGER
FOR
CHEMICAL DEMILITARIZATION AND INSTALLATION RESTORATION
ABERDEEN PROVING GROUND, MARYLAND 21010

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This document is an environment impact assessment covering the detailed sampling and analysis to establish the magnitude of contamination and assessing alternative courses of action for decontamination and/or disposition of Frankford Arsenal.		

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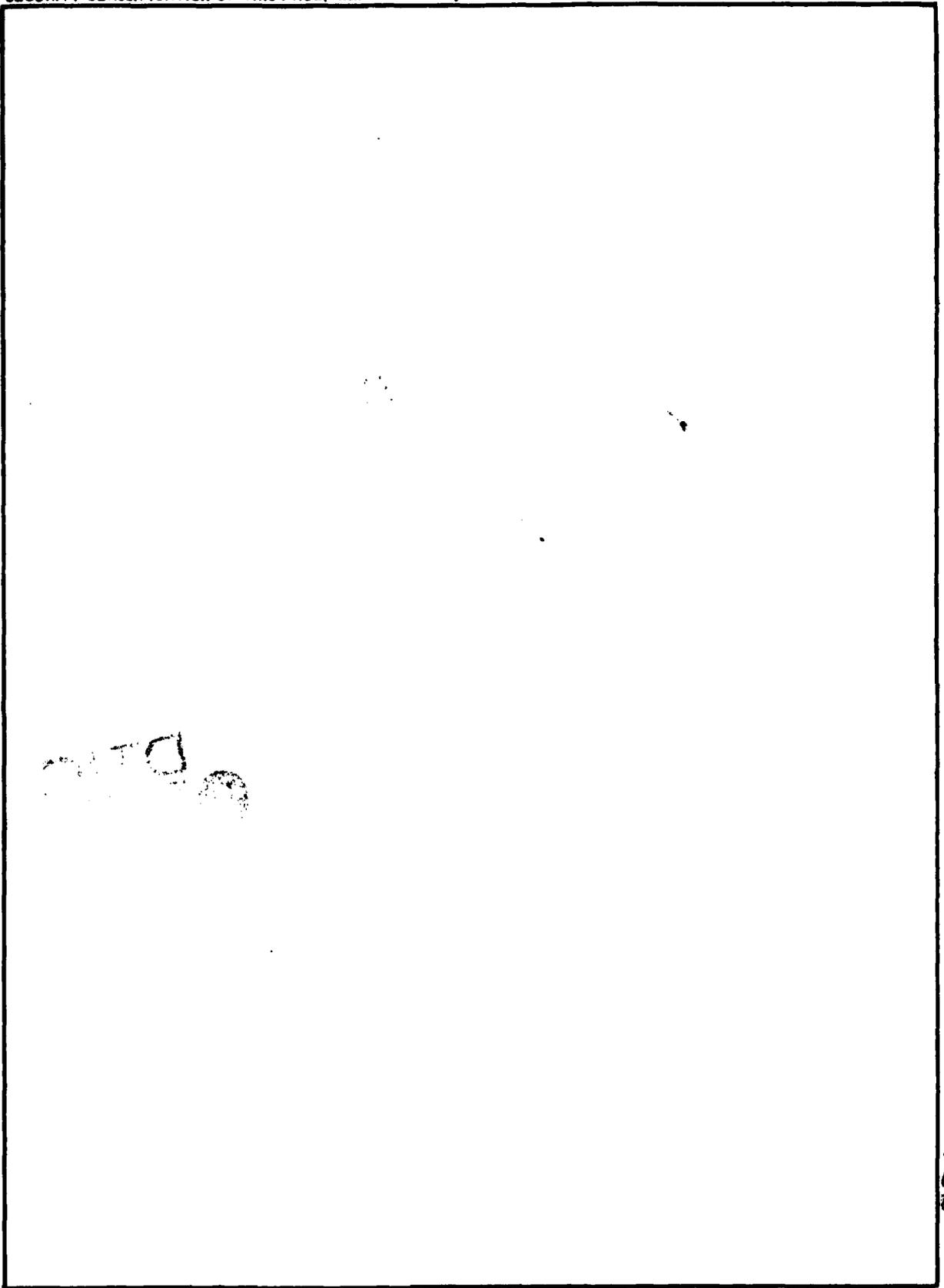
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DEPARTMENT OF THE ARMY
OFFICE OF THE PROJECT MANAGER
FOR
CHEMICAL DEMILITARIZATION AND INSTALLATION RESTORATION

INSTALLATION RESTORATION
AT
FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA

PHASE 1 - DETAILED SURVEY AND ALTERNATIVES ASSESSMENT

ENVIRONMENTAL IMPACT ASSESSMENT

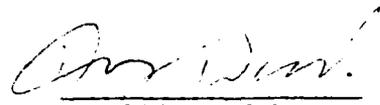
APRIL 1978

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SUMMARY SHEET

INSTALLATION RESTORATION
AT
FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA

PHASE 1 - DETAILED SURVEY AND ALTERNATIVES ASSESSMENT

ENVIRONMENTAL IMPACT ASSESSMENT

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1. Name of Action: (X) Administrative () Legislative
2. The proposed action consists of conducting detailed sampling and analysis to establish the magnitude of contamination and assessing alternative courses of action for decontamination and/or disposition of Frankford Arsenal. If the findings of this survey indicate decontamination is required, detailed methodology for the decontamination program will be developed and the actual decontamination operations will be undertaken. This action is consistent with DoD and DA guidance to the Project Manager for Chemical Demilitarization and Installation Restoration and is desirable from an environmental viewpoint.
3. The alternative to the proposed action is no action. This would be inconsistent with the position of the Federal Government and the City of Philadelphia that reuse of Frankford Arsenal proceed as rapidly as possible.
4. It is concluded that this action will not have a significant impact on the environment and will not be environmentally controversial. This is not a major Federal action, and preparation of an Environmental Impact Statement is not required.

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I. INTRODUCTION.

A. Background.

1. Location and Size. Frankford Arsenal (FFA) is located in the northeast section of Philadelphia, Pennsylvania. The 110-acre Arsenal complex consists of 120 permanent, 56 semi-permanent, and 36 temporary buildings and structures. The roadnet consists of eight miles of streets and roadways (Figure 1).

2. Organization and Mission. Prior to 1976 the Arsenal had the responsibility for researching, developing, designing, engineering, procuring, supplying, and/or servicing military materiel in the performance of national support and special missions on specified materiel, equipment, and systems.

Primary responsibilities were as follows:

a. Operated as a commodity center for small caliber munitions, cartridge activated and propellant actuated devices, related test and handling equipment, and multi-purpose testing equipment.

b. Conducted research in the fields of optics, metallurgy, material degradation, tracers, and laser countermeasures.

c. Performed national procurement for assigned commodities and for fire control materiel.

d. Performed support mission responsibilities for fire control materiel in support of US Army field units.

e. Performed national industrial mobilization planning for assigned procurement items.

FFA was considered the small arms ammunition capital of the country, producing not only munitions for military use but match ammunition for civilian competition.

3. History. The land that now constitutes FFA is believed to have been the site of an Indian encampment, perhaps as late as 1755. Two months after the War of 1812 was declared, Philadelphia was mentioned as a possible location for an arsenal. The first formal acquisition of land for FFA began on 27 May 1816 when the Assistant Commissary General, Colonel George Bombard, procured for the Government 20.21 acres from Frederick and Catherine Fraley for the sum of \$7,680.76. This purchase date is recognized as the inauguration of the US Arsenal of Frankford Creek.



Figure 1. MAP OF THE FRANKFORD ARSENAL.

The second acquisition on 8 April 1837 of 3.03 acres was for \$3,000.

The third acquisition on 27 December 1849 added another 38.98 acres at a cost of \$20,000.

The fourth acquisition of 28.26 acres on 2 March 1917 was for the purchase price of \$125,000.

The last two purchases were from the Edwin H. Fittler Company; 8.84 acres on 10 May 1943 for \$130,000, and 8.66 acres on 13 August 1951 for \$140,000.

Captain Joseph Rees, the Arsenal's first commander, reported on 16 December 1816 that the barracks and the wharf were completed. The Arsenal was completed in 1830 (Figure 2).

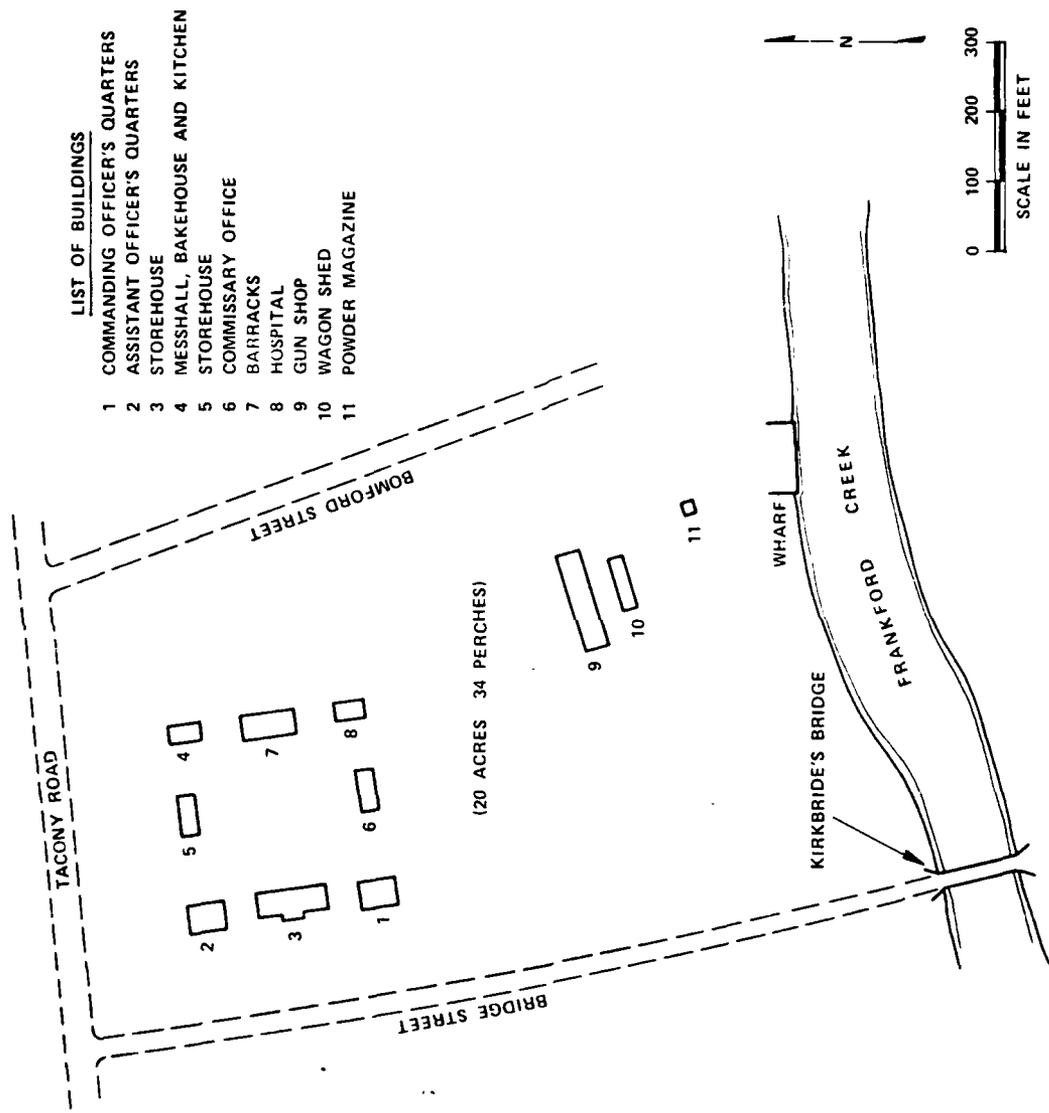
Until the war with Mexico in 1846, the chief Arsenal activities were repair of artillery and infantry equipment, proving and testing musket and rifle powder, and serving as a general storage and distribution depot for ammunition, small arms, artillery, and cavalry equipment. From the Mexican War to the Civil War, the Arsenal engaged mainly in storage, preservation, and repair of ordnance stores, fabricating small quantities of ammunition and other miscellaneous items.

In March 1853 the first power-driven machinery was introduced into FFA for the manufacture of percussion caps, bullets, cartridges, and other small arms ammunition items. The personnel complement at that time consisted of 1,550 people.

Just prior to the Spanish American War, the first research work on smokeless propellants was begun at the Arsenal. In 1894 the Arsenal initiated research work in explosives. Captain Dunn developed the explosive known as "Dunnite," a variation of which was Explosive D (ammonium picrate) utilized by the military as recently as World War II.

During World War I FFA small arms ammunition production increased. Reports from the field and tests conducted elsewhere proved the Arsenal's ammunition superior to all others. Therefore, the Arsenal manufactured all .30 caliber tracer, incendiary, and armor piercing ammunition for the Army and Navy aircraft. The Arsenal produced 232 million rounds during the period of January 1917 through November 1918.

During World War II approximately 1.4 billion rounds of service ammunition were produced from January 1942 through August 1945. The Arsenal was heavily involved in research and development work in the commodity areas of fire control instruments and small arms ammunition, and to some extent artillery ammunition projectiles and cartridge cases.



- LIST OF BUILDINGS**
- 1 COMMANDING OFFICER'S QUARTERS
 - 2 ASSISTANT OFFICER'S QUARTERS
 - 3 STOREHOUSE
 - 4 MESSHALL, BAKEHOUSE AND KITCHEN
 - 5 STOREHOUSE
 - 6 COMMISSARY OFFICE
 - 7 BARRACKS
 - 8 HOSPITAL
 - 9 GUN SHOP
 - 10 WAGON SHED
 - 11 POWDER MAGAZINE

Figure 2. FRANKFORD ARSENAL, 1832.

The small arms ammunition production increased to a rate of 8 million rounds per day. The personnel complement of FFA at the height of World War II was 22,000 people.

Production experience during World War II made it imperative that gages be designed to insure the interchangeability of all future manufactured materiel. Frankford's gage mission was expanded to cover gage design and inspection equipment for all small arms ammunition, artillery ammunition, and fire control materiel.

Although early history of the Arsenal refers to a "laboratory," laboratory work, as presently understood, began in 1864. Captain Theodore T. S. Laidley, the Arsenal's 17th commander, conducted experimental tests on the effect of powder explosions on the iron framework of buildings.

From 1900 the Arsenal laboratory was regarded as the most knowledgeable source of information on the subject of explosives in the United States.

Some notable FFA achievements were the development of recoilless weapons systems which placed artillery fire power in the hands of the infantry; cartridge actuated devices providing escape systems for aircraft personnel; spiral wrapped cartridge cases which used less critical material; small arms cartridge cases; welded over-lay rotating bands which increased projectile production quantities; and the casting of titanium, a critically needed metal developed for effective military use.

The Army-wide reorganization of 1962 brought FFA under the control of US Army Munitions Command (MUCOM), a part of the Army Materiel Command (AMC) complex, as part of a move to decentralize field operations.

As a result of a recent reorganization action, the FFA mission was transferred and closure of the Arsenal was directed by the Department of Defense. The closure action is described in a FFA Environmental Impact Assessment dated 3 September 1975. In accordance with the Federal Property Act and AR 405-90, FFA prepared and forwarded on 16 January 1976 a report of excess to the Chief of Engineers. The Frankford Arsenal Caretaker Activity (FACA) is responsible for implementing closure under the control of the US Army Armament Materiel Readiness Command (ARRCOM). On 23 June 1977 HQ ARRCOM requested the Project Manager for Chemical Demilitarization and Installation Restoration (PM CDIR) to assume the technical direction of the decontamination of FFA under the purview of the PM CDIR Charter.

4. Current Considerations. The years of operations at FFA have resulted in the potential for explosive, radiological, and industrial chemical contamination of the structures and grounds. Since FFA has been declared excess to the needs of the Army, the assessment of the contamination falls under the Charter of the DA Project Manager for Chemical Demilitarization and Installation Restoration. The primary focus of the contamination assessment is to provide information relative to the need for decontamination of the Arsenal prior to certification for release by the responsible command (ARRCOM) under the provisions of AR 405-90.

For purposes of this phase of the installation restoration effort, FFA has been divided into four areas (Figure 3), based on potential for contamination as indicated by a search of government records.

a. Area "A": This area consists of approximately 10 acres in the northwest corner of the Arsenal. Included are 26 buildings, structures, and miscellaneous facilities. It contains the oldest structures, of which nine have been designated historic, and was estimated to be free of contamination by the PM CDIR records search team.

A statement of clearance for Area "A" was forwarded to ARRCOM 18 November 1977 upon completion of detailed radiological, explosive, and industrial chemical surveys.

b. Area "B": This area consists of approximately 16.5 acres in the northwest corner of the Arsenal. Included are 42 buildings, structures, and miscellaneous facilities which were suspected of minimal contamination.

All buildings and land areas within these boundaries have been surveyed for radiological, explosive, and industrial chemical contamination. In December 1977 twenty-six structures in Area "B" were cleared for release. The underground sanitary and storm sewers and the following 16 structures were not cleared: 23, 39, 40, 106, 107, 108, 109, 119, 201, 202, 202A, 203, 204, 206, 207, and 233. Evaluation of these structures and sewer lines will be included in the contract effort for Areas "C" and "D."

c. Areas "C" and "D": These areas consist of approximately 83 acres in the central and western section of the Arsenal. Included are 144 buildings, structures, and miscellaneous facilities which are suspected of having the highest potential for contamination. The proposed action involves an evaluation of Areas "C" and "D" for contamination which will be accomplished under contract.

5. National Register of Historic Places. Within FFA, nine structures have been placed on the National Register of Historic Places (Table 1) (see Figure 1). A historical survey of FFA will be completed in FY78 under contract to the Baltimore District Corps of Engineers. The proposed action will coordinate closely with the historical survey to ensure no disruptions of potential historically or archaeologically significant sites.

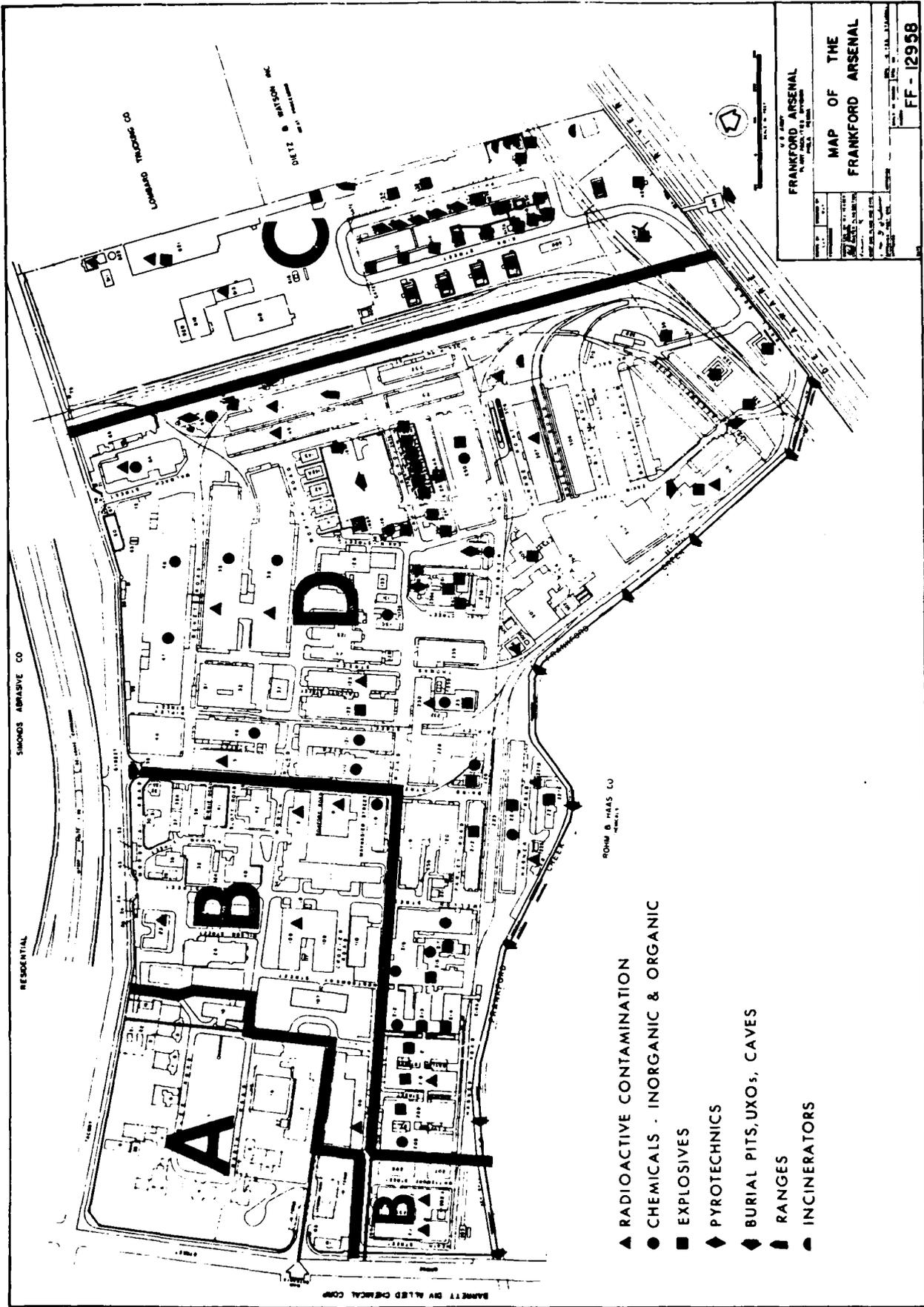


FIGURE 3.

TABLE 1
FRANKFORD ARSENAL STRUCTURES
NATIONAL REGISTER OF HISTORIC PLACES

<u>Bldg</u>	<u>Constructed</u>	<u>Use</u>	<u>Registry Number</u>
1	1813 (acquired 1816)	Quarters	78
2	1812 (acquired 1816)	Quarters	79
3	1816	Quarters	80
4	1820	Quarters	81
5	1820	Quarters	82
6	1817	Quarters	83
11	1850	Office	84
14	1817	Quarters	85
15	1835	Quarters	86

B. Environmental Setting.

FFA is located northwest of the Delaware River within the boundaries of the City of Philadelphia in a highly industrialized area.

1. Geology.

a. FFA lies in the physiographic province of the Coastal Plain, directly southeast of the boundary between this province and the Piedmont province (See Figure 4). This inner or landward margin of the Coastal Plain is called the Fall Line, and is identified topographically by an abrupt transition from the rolling hills of the Piedmont to the flat lowlands of the Coastal Plain. The Penn-Central railroad tracks directly north of FFA follow the Fall Line.

The topographic differences between the two provinces reflect the differences in composition and structure of the rock materials underlying their surfaces. The Piedmont is underlain by dense, hard crystalline rocks that offer considerable resistance to erosion and support an uneven hilly surface, which stands well above the general level of the adjacent Coastal Plain. The Coastal Plain is underlain by soft, unconsolidated deposits that yield readily to the processes of erosion and form low, nearly flat plains and broad shallow valleys.

The land surface has a gentle slope from the Fall Line southeast to the Delaware River. The general level of the land surface rises from sea level along the river to about 40 feet above mean sea level at the Fall Line. The highest elevation on FFA is 20 feet above mean sea level in the northwest portion of the Arsenal.

b. In general, the geology of the Coastal Plain area of southeastern Pennsylvania can be described as Quaternary and Cretaceous sediments overlying consolidated early Paleozoic deposits.

Under the Arsenal, bedrock consists of pre-Cretaceous mica schist which is at a depth of 26 feet at the northern boundary and 64 feet at the southeastern corner of the Arsenal. Unconsolidated sand, gravel, silt, and fill overlie the Cretaceous sediments. The Philadelphia District Corps of Engineers estimate that a strip of land approximately 300 feet wide, adjacent to Frankford Creek and the Delaware River, consists largely of fill materials.

All soil on FFA is classified as Urban land by the Soil Conservation Service. The Urban land is a land type that consists of areas that are built up and occupied by urban structures and works. Most of the FFA soils have been smoothed, disturbed, or filled in prior to construction of Arsenal facilities. At the present time, much of the soil surface is obscured by buildings and pavement.

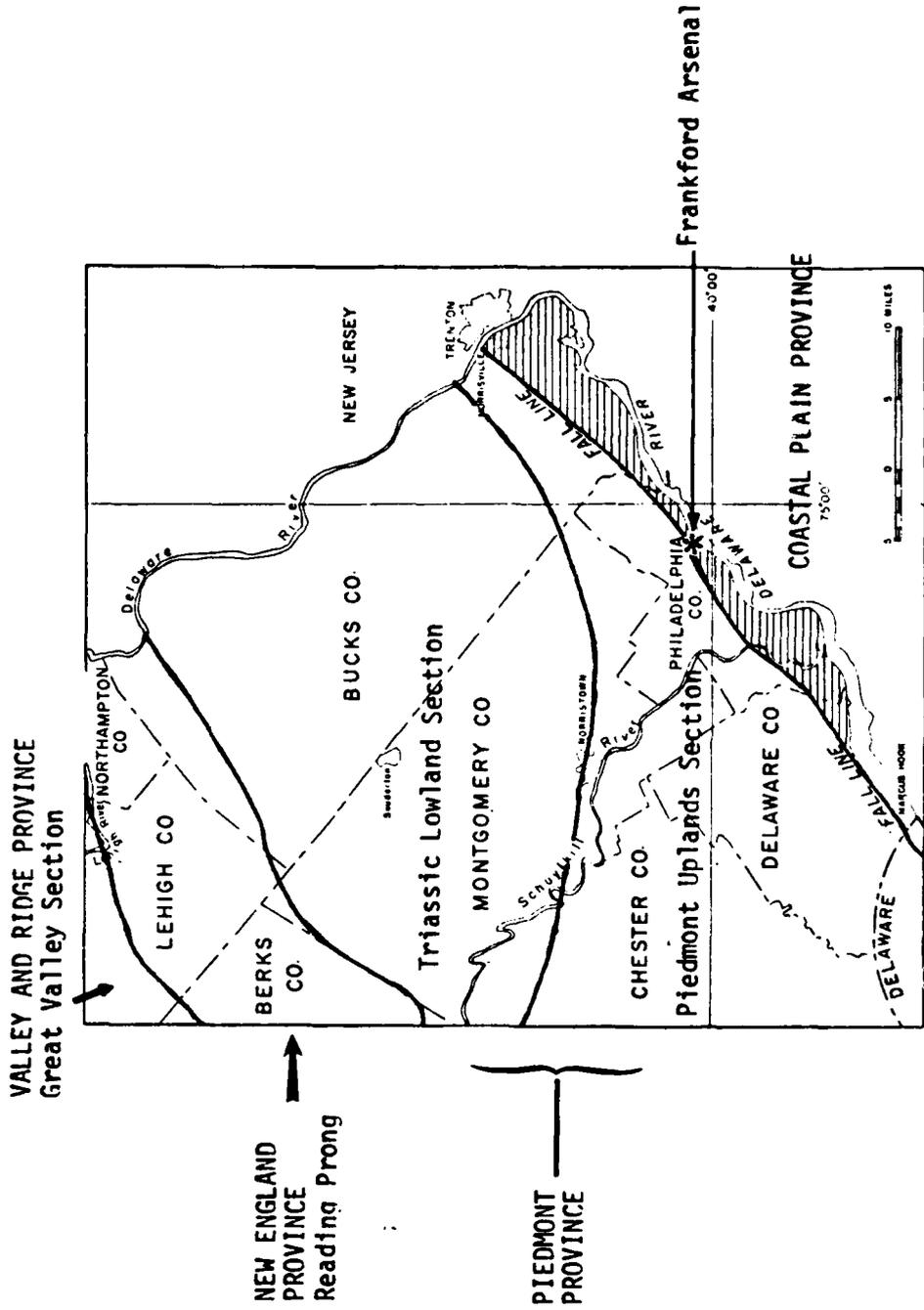


Figure 4. PHYSIOGRAPHIC PROVINCES MAP OF SOUTHEASTERN PENNSYLVANIA.

2. Water Flow Pattern.

a. Surface. FFA obtains its water from the City of Philadelphia. Surface drainage from precipitation is collected by a system of road drains and discharged to either the Delaware River or Frankford Creek through the storm drainage system.

The Delaware River passes along the southeast boundary of FFA. Frankford Creek previously flowed along the southern boundary of FFA and discharged into the Delaware River. Diversion of this flow has caused the abandoned creek bed to become a backwater of the Delaware River which extends up the former creek bed to Bridge Street and is referred to as the Frankford Creek Ditch.

b. Subsurface. The ground water at FFA exists under water table conditions and occurs at depths ranging from 3 to 24 feet. Ground water within FFA boundaries is not used. Recharge to the groundwater system comes from precipitation. The regional pattern of groundwater movement is from the highest area on the Coastal Plain, near the Fall Line, toward the Delaware River. Discharge from the groundwater system flows into the Delaware River, although the tidal nature of the river affects the flow rate near the river.

3. Climate. The weather in the vicinity of Frankford Arsenal is strongly influenced by the presence of the Delaware River and the Delaware Estuary. The average minimum rainfall is 43.7 inches, while the maximum rainfall is 53.5 inches. The minimum average temperature ranges from 28°F to 42°F in January to the average maximum of 69°F to 95°F in July. The highest temperature ever recorded in Philadelphia was 106°F and the lowest temperature ever recorded was -11°F. The prevailing winds are from the northwest during winter and the average velocity is 9.6 miles per hour while the maximum ever recorded in this area was 88 miles per hour. The average summer humidity is 68 percent. Thunderstorms are frequent during the summer, occurring in the late afternoon of hot humid days.

4. Socio-Economic. Frankford Arsenal and the surrounding area are part of a highly industrialized area. Two large chemical manufacturers are neighbors. This phase of the installation restoration effort will utilize contractor workforce. Although local hiring may take place on a temporary basis, this will not affect the current authorized workforce at FFA.

5. Flora and Fauna. Frankford Arsenal consists of 86 improved acres and 24 unimproved acres. Due to the industrialized nature of the site, FFA has not had a wildlife management program. FFA vegetation is primarily lawn and trees. The following paragraph, taken from a paper, "Through the Years Since 1814," dated 30 June 1953, is worthy of note:

About 1854 Commodore Matthew Perry came from the Orient to visit his brother-in-law, Major Hagner, who was then in command at Frankford Arsenal. He brought as a gift a dozen seedlings of the rare Empress of India (Paulownia) trees. Nourished and cherished for nearly a hundred years, these trees have grown to great height and diameter. Each May the trees with dozens of their seedlings wave their purple, plume-like clusters of blossoms which fill the boughs before the leaves appear. (See Figure 5.)

A list of the 27 different trees was obtained from the General Tree Cover Map of FFA and is given in Table 3.

Faunal diversity is limited by the nature of the urbanized area to small mammals such as squirrels, mice, and rats, and to birds normally found in cities such as pigeons, doves, starlings, and sparrows. There are no rare or endangered species habitats at FFA.

6. Area History and Archaeology. As late as 1755, the land which comprises FFA was considered to be the possible site of an Indian encampment. As mentioned earlier, nine FFA structures have been designated as historical sites, and the Arsenal will be the subject of a historical survey during 1978. If any Indian artifacts or items of historical interest are discovered during this action, work at that site will cease until examination of the find by Pennsylvania State officials.



Figure 5. LOCATION OF "EMPRESS OF INDIA" TREES.

TABLE 2. TREES ON FRANKFORD ARSENAL

Maple	Princess (Empress of India)
Birch	Plane
Dogwood	Cherry
Hawthorne	Peach
Beech	Plum
Ash	Flowering Cherry
Ginkgo	Pear
Holly	Oak
Walnut	Locust
Kocheuteria	Sassafras
Magnolia	Arbor Vitae
Apple	Elm
Flowering Crab	Sauleaf Zelhova
Mulberry	

C. Description of the Proposed Action.

1. General. A contractor will be utilized to determine the qualitative and quantitative degree of contamination and establish the economic alternatives for decontamination. The contractor will evaluate the areas designated "C" and "D" (Figure 3), plus the underground sanitary and storm sewers and Buildings 23, 39, 40, 106, 107, 108, 109, 119, 201, 202, 202A, 203, 204, 206, 207, and 203 within the boundaries of Area "B" (Figure 3).

2. Specific.

a. The proposed contract requires the submission, for approval by the Government, of a detailed sampling and analysis plan which shall develop the data needed to determine the qualitative and quantitative contamination of Frankford Arsenal. Direction will be given such that plans will be designed to gather the data needed to formulate and assess alternatives for decontamination operations. The plan shall include, at a minimum, a discussion of the instrumentation and method to be used for the sampling and analysis; the components to be determined; the analytical procedures to be employed; and the location and number of samples to be taken. Once the degree of contamination has been determined, the contractor shall formulate and assess alternatives for decontamination for unrestricted use. The alternatives proposed by the contractor should appear promising from either economic, technical, or environmental perspectives. Each alternative which is formulated shall include a detailed cost estimate and schedule. The formulation of alternatives should be based on the results of surveys accomplished by the contractor.

b. The contractor will be required to conform to all applicable Federal, state, and local safety requirements and ensure all OSHA requirements are met. The contractor shall submit for approval a documented safety program plan which should identify and assess both potential and real hazards; and submit procedures directed toward reducing potential accidents.

c. The contractor shall submit a plan which shall consider the extent of the environmental contamination. The plan should be limited to only the accumulation of data necessary to evaluate and assess the alternatives for decontamination.

d. A plan shall be submitted which shall include surface and subsurface water, soil, sediment, and biological sampling for residual explosives and heavy metals. Boreholes shall be drilled, subsurface soil samples shall be taken and analyzed for potential contamination. Sediment and water samples shall also be taken of the Frankford Creek and the portion of the Delaware River within the boundaries of Frankford Arsenal.

e. A data management plan shall be formulated to describe all data handling steps, ranging from the collection sheets through data reduction. The contractor will closely coordinate with the Project Manager for Chemical Demilitarization and Installation Restoration development of a computerized information system for the Univac 1108 and the onsite terminal.

II. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES,
AND CONTROLS.

A. The City of Philadelphia and Pennsylvania State Legislators, as well as the Federal Government, have expressed concern that release of FFA proceed as rapidly as possible. However, release of facilities cannot be accomplished until they are certified clear for release by US Army Armament Materiel Readiness Command. The proposed action is to evaluate the extent of contamination at FFA and determine methods and costs of decontamination to release the property. It is part of the DA effort to ensure that Army policy concerning FFA is consistent with local land use plans.

B. This action is consistent with DoD and DA and the PM CDIR charter.

III. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT.

A. General. This action will have no adverse impact upon the environment. The action is being taken to determine the most feasible alternative for FFA decontamination/disposition consistent with environmental and cost guidance. Survey operations will be conducted in accordance with applicable Federal, state, and local health and safety requirements, to ensure the safety of the workers, and to ensure that the public domain is not subject to adverse effects.

B. Air Quality.

1. Occupational exposure to airborne material, such as industrial chemicals and radioactive particulates, shall be controlled as outlined in applicable Federal, state, and local regulatory requirements.

2. Primary alteration to air quality will arise from exhausts of drilling and excavation equipment, slightly increased vehicular traffic, and dust raised during this action. Operation of the equipment will be intermittent and of short duration, thus exhaust fumes will be naturally dissipated with negligible effect on air quality.

C. Water Quality. The proposed action will not adversely affect water quality. Although localized sediment disturbances in the Delaware River and Frankford Creek will occur during sampling, these temporary conditions will be naturally dissipated. Localized disturbances of ground water will occur by drilling. The required drilling will be accomplished in accordance with accepted techniques. There will be no change in the quantity or quality of groundwater flow. All drilled holes will be cased and backfilled to prevent surface runoff from entering the hole.

IV. ALTERNATIVES TO THE PROPOSED ACTION.

A. No Action. This would be inconsistent with policy as outlined in Section II. It would dictate that the facility could never be released to the public domain since the extent of contamination would not be known and therefore could not be decontaminated. This alternative would require that DA commit resources to secure the site from access to the public and to maintain unused facilities.

B. Operational Alternatives. Operational alternatives for the decontamination of FFA will be contractor developed, based on the results of the proposed survey action.

V. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED.

As indicated in Section III, the proposed action will not have an adverse impact on the quality of the environment, nor will the action be environmentally controversial.

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

A. Short Term. No use of the lands and facilities is currently planned by DoD. There are several institutions interested in the leasing portions of the facility; however, release cannot be accomplished until the areas are certified free of contamination hazards.

B. Long Term. The proposed action will lead to decisions for future actions which will ultimately enhance the long-term productivity of the site.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES.

A. Historical or Archaeological Disruption. No disruption of significant historical or archaeological sites is anticipated. A historical survey will be underway concurrent with the proposed action to complete the decontamination of historically significant structures.

B. Natural Resources. No natural resources will be disrupted by this action, nor will it affect any endangered or threatened species of flora and fauna.

C. Materials. Small quantities of gasoline and diesel fuel will be consumed by equipment during this action.

D. Manpower. The survey will require approximately 17,000 manhours of effort during a five-month period.

E. Cost. Approximately \$500,000 is the estimated cost of the action.

VIII. OTHER INTERESTS AND CONSIDERATIONS OF FEDERAL POLICY THAT OFFSET
THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTIONS.

As stated in Section V, this action will not result in any adverse environmental effects; and, as stated in Section II, Federal, state and local interests urge the reuse of FFA as rapidly as possible. Decontamination and release of the site is therefore desirable. The proposed survey action will determine factors necessary for further operations to allow release.

IX. CONCLUSIONS.

The proposed action will not have a significant impact on the environment and it is not environmentally controversial. This is not a major federal action and the preparation of an Environmental Impact Statement (EIS) is not required.