

EXPANSION CAPABILITY PLAN STEPS I, II & III

FORT HUACHUCA, ARIZONA

**PREPARED UNDER THE DIRECTION OF:
DEPARTMENT OF THE ARMY,
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA**

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PRELIMINARY

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Steps I, II and III

For

Expansion Capability Plan
Fort Huachuca, Arizona

Prepared Under the Direction of

Department of the Army

Sacramento District, Corps of Engineers

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Contractual Recap

This Expansion Capability Plan is submitted in accordance with Modification P00001 of Contract No. DACA 05-77-C-0196.

This document is the preliminary submittal of Steps I, II and III of the Expansion Capability Plan as authorized by AR-210-23, Master Planning for Army Installations - Emergency Expansion Capability and outlined by TB ENG 354, Installation Expansion Capability Guide.

Emphasis has been placed on describing and analyzing the utility systems and training facilities of Fort Huachuca to meet criterion for rapid expansion.

Review time for this preliminary submission is anticipated to be 30-45 days from date of receipt.

Ten copies have been submitted for distribution thusly:

- 8 copies to Sacramento District, Corps of Engineers
- 2 copies to Fort Huachuca, Directorate of Facilities Engineering

PREFACE

Fort Huachuca Expansion Capability Plan

(Contract No. DACA 05-77-C-0196)

The first Expansion Capability Plan (Steps I, II, III and IV) for Fort Huachuca was developed by this firm, Clifford S. Nakata and Associates, and submitted to Fort Huachuca and the Sacramento District, Corps of Engineers in June 1978. These documents were subsequently approved and established the maximum supportable population within nine months at 23,300 persons. The limiting factor to rapid expansion at Fort Huachuca was identified during this investigation as the delivery capacity of the water pumps. However, since the time of the previous submittals, a contract has been awarded to connect the additional wells to the distribution system. Construction is currently underway and completion is scheduled for Spring of 1980. As the additional pumping capacity will raise the population threshold based on water supply significantly, this modification (P00001) to the Expansion Capability Plan Contract is intended to revise the limits to expansion of Fort Huachuca.

The purpose of this submission is to delineate the revised population thresholds and to identify the limiting factor to rapid growth of Fort Huachuca. The objective of this plan is to determine the total potential of the installation through a series of analyses:

Step I - Utility Analysis. Emphasis has been placed on describing the present utility systems and examining alternatives for raising or eliminating population thresholds. Populations supportable within a reasonable period of time have been identified.

Step II - Training/Mission Analysis. Emphasis has been placed on documenting training facility types and identifying the missions most likely to grow in the event of expansion. Population supportable based on mission growth has been identified.

Step III - Summary of Utility and Training Analyses. The limitations to growth for Fort Huachuca have been identified and expressed in terms of population.

Step IV - Cantonment Analysis. An introduction to the Cantonment Analysis has been provided delineating the mix of the population expansion. The increase in personnel by mission has been identified.

PHASE I

PHASE I is principally an accounting and evaluating of existing facilities. The following three documents comprise Phase 1 of the Master Plan:

The BASIC INFORMATION MAPS delineate at appropriate scales existing features of the installation and region. The following maps comprise the Basic Information Maps:

- Regional Map
- Airspace Utilization Map
- Flight Hazard Strip Map
- Airfield Map
- Reservation Map
- General Site Map
- General Road Map
- General Utilities Map
- General Telephone System Map
- General Storm Drainage Map
- General Recreation Map
- General Tree Cover Map

The ANALYSIS OF EXISTING FACILITIES/ENVIRONMENTAL ASSESSMENT REPORT provides in narrative form a brief description and evaluation of existing facilities, physical features and environmental quality of the installation.

The BUILDING INFORMATION SCHEDULE provides specific data in tabular form for each building identified by number on the General Site Map.

PHASE II

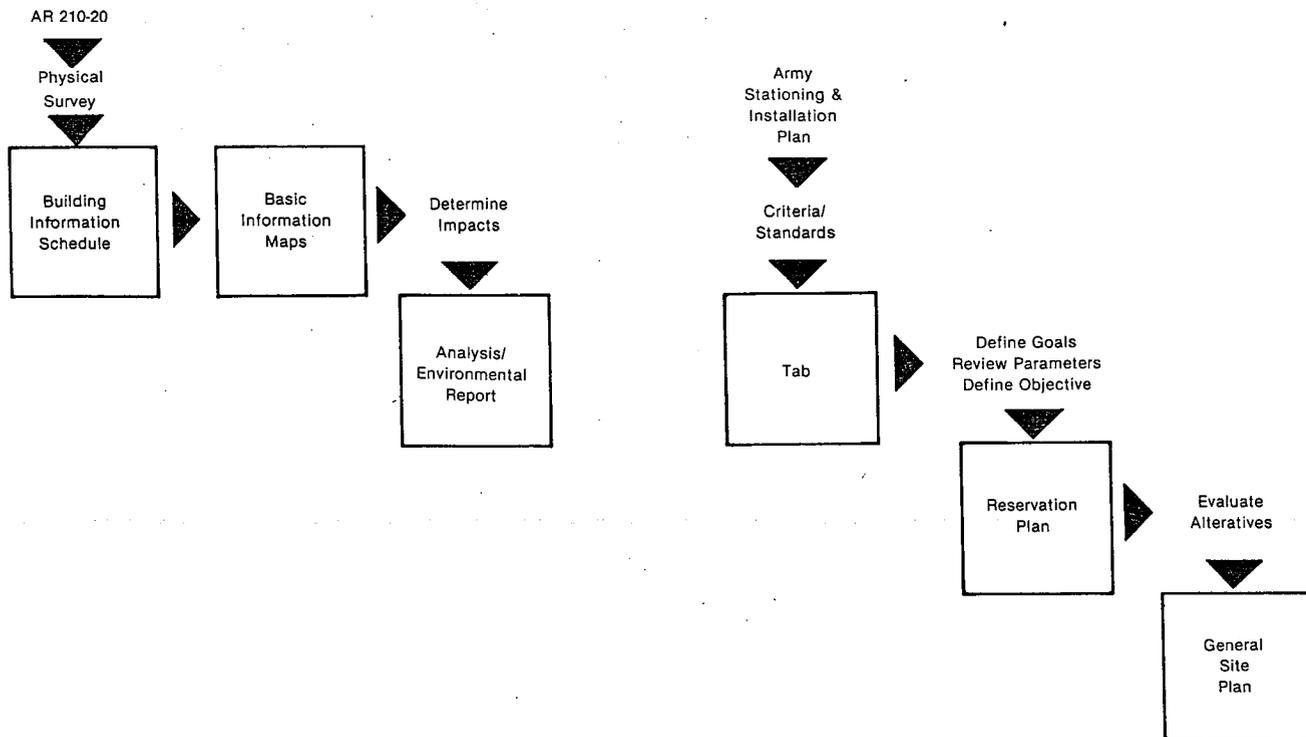
PHASE II of the Master Plan is an analysis of future requirements and a plan for the orderly and comprehensive development to perform the mission of the installation. Phase II consists of the following documents:

The TABULATION OF EXISTING AND REQUIRED FACILITIES becomes the basis for subsequent planning and development of the installation. This report lists the scope of all existing facilities and all additional facilities required for the future development of the installation to accomplish assigned missions. The Army Stationing and Installation Plan forms the basis for future requirements.

The RESERVATION PLAN delineates the proposed land-use plan for the installation based on requirements outlined in the Tabulation of existing and Required Facilities.

The GENERAL SITE PLAN delineates the siting of all existing and proposed structures. This plan is developed in consonance with the Reservation Plan and the Tabulation of Existing and Required Facilities.

The ANALYTICAL/ENVIRONMENTAL ASSESSMENT REPORT is a narrative analysis of the plans and provides information not readily apparent by viewing the plans. It includes an environmental assessment, an energy appraisal, and a consideration of effect for those installations having places of historical significance.



PHASE III

PHASE III consists of the completion of other plans for future development based upon Department of the Army approved General Site Plan. This phase may include the following:

- Regional Plan
- Airspace Utilization Plan
- Flight Hazard Strip Plan
- Airfield Plan
- General Road Plan
- General Utilities Plan
- General Telephone System Plan
- General Storm Drainage Plan
- General Recreation Plan
- General Tree Cover Plan

These plans and counterparts to the Basic Information Maps, delineating those facilities recommended for modification, improvement and new construction in order to develop the installation properly.

In certain cases, comprehensive utility analyses may be required to accurately assess the impact of proposed construction upon the existing utility systems. These analyses may dictate physical monitoring and testing of the individual utility systems in order to provide an appropriate data base.

PHASE IV

PHASE IV, or EXPANSION CAPABILITY PLAN, presents the total potential expansion capability of the installation in logical increments and related to best mission capability. The plan is accomplished in five steps as follows:

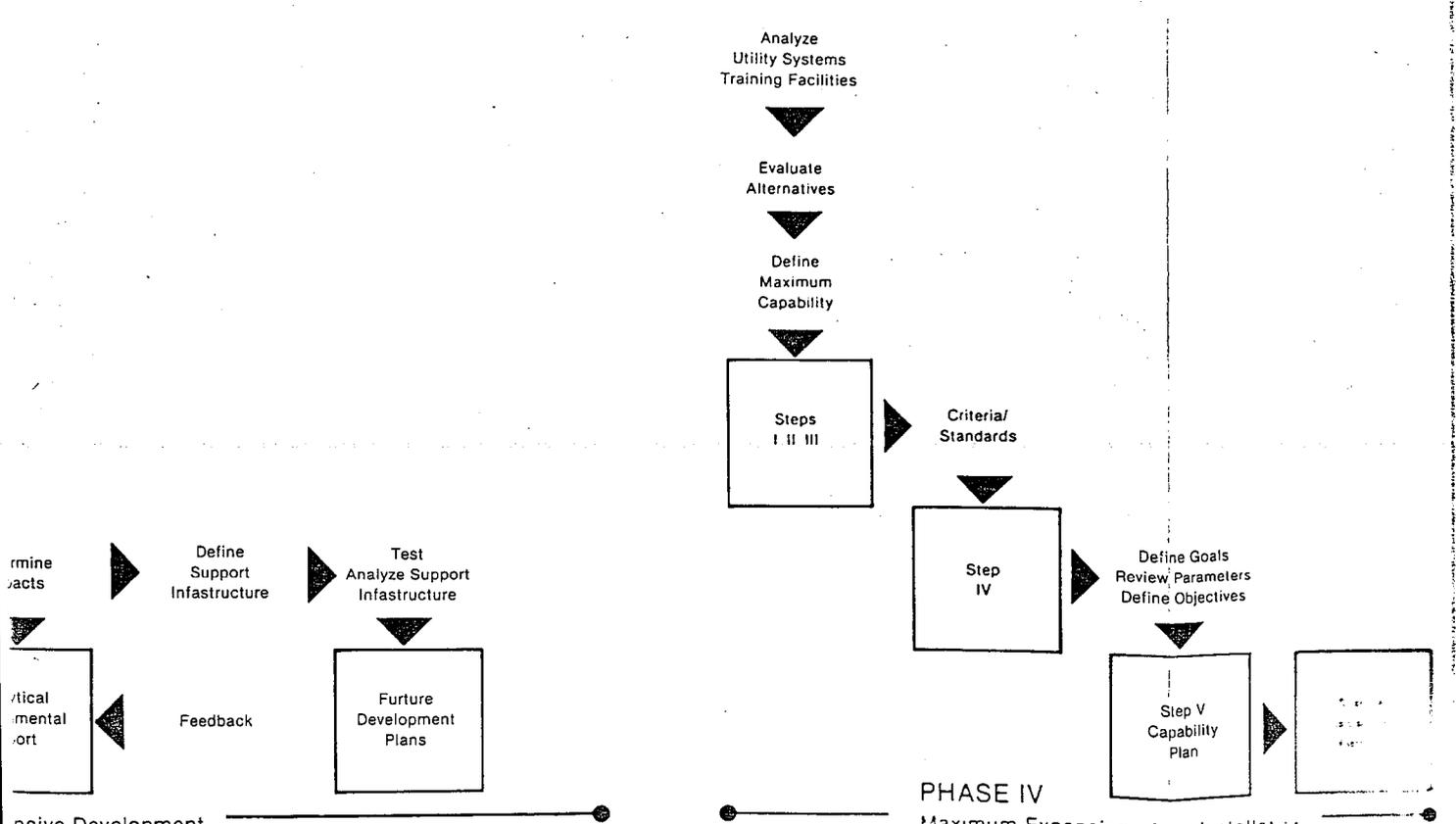
Step I - UTILITY ANALYSIS - Each component of the utility systems is investigated to identify the weakest link to potential expansion. Corrections to the system are identified thereby raising the population thresholds.

Step II - TRAINING ANALYSIS. The various range and maneuver areas are analyzed to determine the maximum number of personnel that could be trained in an emergency.

Step III - SUMMARY - The maximum support capability of the installation is established in terms of actual population. The limiting factor to growth is identified establishing the basis for Step IV.

Step IV - CANTONMENT ANALYSIS - The incremental growth from the current strength to the maximum population identified in Step III is delineated in tabular form. Numbers and types of facilities as well as the associated cost for development are identified.

Step V - CAPABILITY PLAN - The plan is a graphic depiction of the growth in the event of expansion. The CAPABILITY ANALYTICAL/ENVIRONMENTAL ASSESSMENT REPORT identifies the impact of the planned growth upon the environment.



UNITED STATES ARMY
MASTER PLANNING SEQUENCE

The Master Plan for an established installation is an integrated series of documents which presents in graphic, narrative and tabular form the present composition of the installation, the maximum expansion capability of the installation as well as a plan for an orderly and comprehensive development to perform its various missions in the most efficient and economical manner over a 20-year period.

Development of Army Installations must be accomplished in a manner that will lead to effective fulfillment of Army missions at minimum cost. Such development requires a careful appraisal of the many factors involved, including inherent energy postures and environmental aspects and impact. Due to the immobility of structures and hence long-range implications of construction of facilities with a given design and location, planning associated with construction of facilities is of special significance, particularly as it relates to the development of Army installations.

Master Planning for Army Installations is a continuous process which embraces changes in existing conditions, technological advancements and force structure modifications. The Master Plan consists of ten inter-related documents developed in four primary phases. The accompanying description details the requirements for each phase of the Master Planning sequence.

Define Goals
Review Parameters
Define Objectives

Step V
Capability
Plan

Step V
Capability
Report



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ASSUMPTIONS

1. The current reservation boundary establishes the geographical limitation to expansion.
2. The structure of the installation is present if it now exists or is under construction.
3. The existing post land use pattern will not be disrupted during expansion.
4. Growth during expansion will be based on a percentage increase of existing units.
5. The time frame for expansion is limited to nine months.
6. No new family housing will be constructed during expansion.
7. Existing family housing will not be diverted to other uses.
8. No additional dependents will be housed on Post during expansion.
9. All military living off Post prior to expansion will continue to live off Post.
10. Civilian employees will increase during expansion.
11. All environmental regulations and restrictions observed and complied with during normal operations will also be met during expansion.
12. No major changes in training and maneuver areas are anticipated during emergency expansion. Current range and maneuver area utilization is addressed in Sections 2.8 and 2.9 of this report.
13. There is no austerity type family housing, originally designed as barracks, which can be returned to troop housing.
14. Permanent type barracks which have been converted to other uses will not be returned to troop housing.
15. Hospital bed deficiencies will be met by temporary diversion of existing educational facilities to ward space. New facilities will be required to satisfy MEDDAC mission requirements.

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Step 1

utility analysis

Step I

UTILITY SYSTEMS ANALYSIS

FORT HUACHUCA

EXPANSION CAPABILITY PLAN

STEP I

UTILITY ANALYSIS - FORT HUACHUCA EXPANSION CAPABILITY PLAN

1.1 PREVIEW OF UTILITY SYSTEMS:

1.1.1 General:

The utility systems at Fort Huachuca consist of several components, or subsystems. Each of these systems is planned, constructed, operated and maintained under the direction of the Directorate of Facilities Engineering, Fort Huachuca.

The electrical, gas (heating), solid waste and communication (telephone) systems are affected by contractual agreements with public and private contractors. No agreements exist for the water, sanitary sewer or storm drainage systems.

Permits through the Arizona State Department of Health, Bureau of Water Quality Control, Division of Environmental Health Services affect the operation of the sewage treatment plant. The Division of Solid Waste and Vector Control is the permitting agency affecting the operation of the sanitary land fill.

1.1.2 Method of Utility System Analysis:

Each utility system is given a description, an analysis for quick remedy and its maximum expansion potential. A recapitulation of past consumption or loading has been provided to establish a basis for comparison to design per capita consumption/contribution figures listed in the appropriate technical manuals. The current carrying capacity of each utility system has been translated to an expression of supportable population. The analysis for remedy of utility system components becomes a crucial part of this investigation. How could the present infrastructure be modified to raise or eliminate the population thresholds within nine months? Four alternatives for eliminating the constraints have been addressed:

Alternative No. 1: Increasing capacity by decreasing per capita consumption of the resource by conservation measures for the duration of the "emergency". Graphs have been provided delineating the population supportable over a wide range of per capita consumption.

Alternative No. 2: Increasing capacity of the Utility System Component by transition from normal operating capacity to full design capacity.

Alternative No. 3: Increasing capacity of the Utility System by the addition of rental or lease equipment. This alternative has advantages when the duration of the "emergency" is temporary in nature.

Alternative No. 4: Increasing the capacity of the Utility System through a construction program. This alternative is the most difficult as design, production, delivery, and construction times must be subjectively evaluated.

These alternatives provide a yardstick for the installation master planner to evaluate expansion based on a series of remedies for the existing utility systems.

The procedure for the individual utility analyses is to establish the current capacity of the system in terms of population and, by addressing the four alternatives, identify the maximum population supportable by that utility system within nine months.

.1.3

Determination of Effective Population:

The population at Fort Huachuca is broken into residents and non-residents. The resident or full-time population consists of those military personnel and their dependents living at Fort Huachuca. The non-resident or part-time population consists of military and civilian personnel living off and working on the Post.

Historically, the resident population and one-third of the non-resident population equals the effective population. This effective population is used throughout these utility calculations in obtaining a realistic per capita consumption figure based on historical loadings and populations. When warranted, the design population (effective population times capacity factor) has been considered which provides for reasonable increases in population, variations in demands and uncertainties as to actual requirements for projects of the same type and for unusual peak demands.

The effective population for Fort Huachuca during fiscal years, 1977, 1978 and 1979 is shown in Table 1.1.1.

Table 1.1.1

EFFECTIVE POPULATION
FY 1977 thru FY 1979

| | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> |
|-------------|----------------|----------------|----------------|
| October | 12,316 | 12,651 | 12,048 |
| November | 12,415 | 12,742 | 12,115 |
| December | 12,327 | 12,529 | 11,906 |
| January | 12,337 | 12,524 | 12,018 |
| February | 12,344 | 12,460 | 12,138 |
| March | 12,360 | 12,237 | 12,118 |
| April | 12,665 | 12,362 | 12,090 |
| May | 12,469 | 12,306 | 11,977 |
| June | 12,421 | 12,171 | 11,933 |
| July | 12,400 | 12,062 | 12,066 |
| August | 12,501 | 12,095 | 12,027 |
| September | 12,521 | 12,044 | 11,990 |
| (Average) = | 12,423 | 12,348 | 12,036 |

As shown in the table, the effective population ranged from a monthly low of 11,933 to a monthly high of 12,742, a difference of about 7%. This relative stability in the effective population should insure reliability in per capita consumption figures based on historical data. The average effective population utilized during the subsequent analyses corresponds to the time period of the utility data.

1.2 WATER SYSTEM:

1.2.1 System Description (Refer to Figure 1.2.1):

a. Source:

The primary source of water for Fort Huachuca, as well as the surrounding area, is a regional ground water basin. This aquifer consists of elements: a regional underground aquifer and a floor plain aquifer. The regional aquifer consists of the saturated portions of alluvial deposits that are quaternary and tertiary in age and the floor plain aquifer consists of alluvial deposits of recent age. The aquifer is maintained by recharge that enters as mountain front recharge from the Huachuca Mountains as runoff flows northeasterly towards the Babocomari and San Pedro Rivers. Ground-water underflow also contributes to the recharge of the aquifer. Conservative estimates place the capacity of this aquifer at 13.4 million acre feet.⁵

Presently, water for Fort Huachuca is obtained from deep wells and from collection systems in the Huachuca Canyon and the Garden Canyon spring areas. As summarized in Table 1.2.1, eight wells supply the majority of water to the installation. These wells draw water from the underground aquifer in which the static water level averages 500 feet below ground level. The combined delivery capacity of the eight wells is 8,760 gallons per minute. None of the wells have auxiliary power capabilities.

TABLE 1.2.1

WELL CHARACTERISTICS

| Well No. | Well diam., in. | Well depth, ft. | Pumping capacity, gpm | Production vs. drawdown, gpm/ft. | Storage gal. |
|----------|-----------------|-----------------|-----------------------|----------------------------------|--------------|
| 1 | 14 | 702 | 510 | 15.4 | 50,000 |
| 2 | 14 | 710 | 750 | 17.1 | 50,000 |
| 3 | 18-16 | 802 | 700 | 17.7 | 50,000 |
| 4 | 18 | 807 | 700 | 40.7 | 50,000 |
| 5 | 18-16 | 800 | 750 | 6.2 | 50,000 |
| 6 | 16 | 1,200 | 750 | 37.5 | 50,000 |
| 7* | 16 | N/A | 1,500 | N/A | N/A |
| | | | 800 | N/A | N/A |
| 8* | 16 | N/A | 1,500 | N/A | N/A |
| | | | 800 | N/A | N/A |
| | | | <u>8,760</u> Total | | |

will be developed for subse
s. Pertinent data to be in
is summarized below and
in the text of the report.

capacities

ations/Capacities

ilities/Locations

Mains

GENERAL WATER SYSTEM MAP



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* These wells are currently connected to the distribution system under Contract No. DACA 09-79-C-0053 dated June 1979. Remaining information is unavailable at this time.

The spring collection systems in Garden and Huachuca Canyons supplement the water production from the wells. Water production from these systems averaged about 8 million gallons per month for the period FY 1971 thru FY 1978.

b. Treatment:

All wells at Fort Huachuca deliver water of potable quality. Tests indicate the water quality is suitable for domestic use and public supply. The potable water receives no treatment except chlorination and fluoridation. At an average dosage of .5 mg/liter, chlorine consumption for potable water equals about 2.1 tons per year.

c. Distribution System:

Potable water is delivered to the distribution system and storage reservoirs by booster pumps located at the wells and throughout the distribution system. As shown in Table 1.2.2, the capacities of the booster pumps at the wells equals 8,250 gallons per minute.

The distribution system consists primarily of cast iron and concrete piping although there is a relatively high usage of steel. Sizes for distribution mains range from 10 to 16 inches in diameter. As shown in Figure 1.2.1 previously, three pressure zones are created by the differences in elevations:

Zone A: From the Post cemetery at elevation 5,200 feet to Von Herman Circle at elevation 4,920 feet.

Zone B: From Henry Circle at elevation 5,030 feet to Faison Circle at elevation 4,810 feet.

Zone C: From the lower boundary of Zone B to the northern boundary of the installation at elevation 4,400 feet.

Pressures range from about 40 to 110 pounds per square inch from Zones A to C with an average pressure of about 60 pounds per square inch maintained in the system.

TABLE 1.2.2

BOOSTER PUMPING CAPACITIES

| <u>Location</u> | <u>Pump No.</u> | <u>Capacity (GPM)</u> | <u>Total Head (Ft)</u> |
|----------------------|-------------------------|-----------------------|------------------------|
| Wells 1 & 2 | 1 | 450 | 700 |
| | 2A | 700 | 270 |
| | 2B | 700 | 715 |
| Well 3 | 3 | 900 | 320 |
| Well 4 | 4 | 900 | 320 |
| Well 5 | 5 | 900 | 320 |
| Well 6 | 6 | 700 | 290 |
| Well Field Boosters* | (3 pumps @ 1000 gpm ea) | 3,000 (total) | 436 |
| | (subtotal) | 8,250 | |
| Booster Station B* | (3 pumps @ 1000 gpm ea) | 3,000 | 360 |
| | (2 pumps @ 1000 gpm ea) | 2,000 | 265 |
| Wherry Booster Sta. | 6A | 560 | 252 |
| | 6B | 590 | 252 |
| | 6C | 520 | 252 |
| | 6D | 680 | 252 |
| Zone B Reservoir | 7A | 500 | 240 |
| | 7B | 500 | 240 |
| | 7C | 500 | 240 |

* These pumps are being installed under the current contract; therefore, capacities are theoretical.

Zone A, the old post area, is supplied primarily by a 10 inch steel pipe served by Booster Pumps 7A, 7B and 7C which have a total pumping capacity of 1,500 gallons per minute. The 10 inch main serving this zone can supply 2,500 gallons per minute as a conservative estimate.

Zone B is supplied by two sources: Pumps 1 and 2A draw from Wells 1 and 2 which have a combined capacity of 1,150 gallons per minute. These discharge through one 16 inch into one 12 inch steel core concrete pipe. This main is capable of carrying 4,000 gallons per minute which is well in excess of the maximum pumping capacity.

The Wherry Booster Station, located in Zone B, draws from a 3 million gallon storage reservoir and has a total pumping capacity of 2,350 gallons per minute. The discharge line is a 14 inch asbestos cement pipe which is capable of handling 5,000 gallons per minute.

Zone C is supplied by two reservoirs with a total storage capacity of 3.5 million gallons. These reservoirs discharge into 12, 14, and 18 inch looped mains.

d. Storage:

Total water storage at Fort Huachuca equals 5.25 million gallons. Storage facilities are a combination of reservoirs and elevated tanks as shown in Table 1.2.3.

WATER STORAGE FACILITIES

| <u>No. Facilities</u> | <u>Capacity (Gallons)</u> | <u>Remarks</u> |
|-----------------------|---------------------------|----------------|
| 2 | 250,000 Total | Reservoirs |
| 1 | 1,500,000 | Reservoir |
| 1 | 3,000,000 | Reservoir |
| 1 | 500,000 | Elevated tank |

The two existing reservoirs serving the old post area (Zone A) are supplied by spring water and runoff from Huachuca Canyon as well as by Booster Pumps 7A, 7B and 7C. These pumps can supply about 1.4 million gallons per day. About 15 percent of the population is located in Zone A.

The majority of the population, 60 percent, is located in Zone B. Storage capacity consists of a 1.5 million gallon reservoir at an elevation of 5,110 feet. The Wherry Booster Station consisting of four pumps (6A, 6B, 6C, 6D) with a combined capacity of 1.9 million gallons per day supplies this reservoir. Two wells (7 & 8) are currently being connected to the distribution system and will also supply this reservoir. Booster pumps will provide an additional 2.88 million gallons per day capacity.

Storage capacity for Zone C consists of a 3.0 million gallon reservoir and an elevated .5 million gallon tank. About 25 percent of the population occupies this Zone.

1.2.2 System Loading:

The details of the water consumption at Fort Huachuca for the three year period October 1977 thru September 1979 is delineated in Table 1.2.4:

TABLE 1.2.4

WATER CONSUMPTION
FY 77 THRU FY 79
(Thousand Gallons)

| <u>Month</u> | <u>FY 77</u> | <u>FY 78</u> | <u>FY 79</u> | <u>Average (FY 78, 79)</u> |
|--------------|---------------|---------------|---------------|----------------------------|
| October | 54,991 | 54,495 | 66,019 | 58,502 |
| November | 48,167 | 52,152 | 48,704 | 50,428 |
| December | 49,434 | 48,099 | 50,845 | 49,472 |
| January | 50,016 | 44,702 | 49,871 | 47,287 |
| February | 56,712 | 40,363 | 44,453 | 42,408 |
| March | 52,621 | 55,126 | 59,571 | 57,349 |
| April | 46,650 | 61,222 | 74,824 | 68,023 |
| May | 60,000 | 70,713 | 91,162 | 80,938 |
| June | 75,537 | 90,869 | 93,522 | 92,196 |
| July | 71,179 | 88,678 | 99,404 | 94,041 |
| August | 66,483 | 79,116 | 87,846 | 83,481 |
| September | <u>63,685</u> | <u>72,595</u> | <u>88,666</u> | <u>80,631</u> |
| TOTALS | 695,475 | 758,130 | 854,887 | 804,756 |

Rates of water consumption fell during fiscal year 77 because two wells were not operational and water was rationed. The higher consumption rates in the summer months reveal the influence of warm weather uses, particularly irrigation. Notable information determined from the water consumption data to be utilized in the subsequent system analysis is summarized in Table 1.2.5.

TABLE 1.2.5

WATER DATA FOR SYSTEM ANALYSIS

| | <u>FY 78</u> | <u>FY 79</u> | <u>Average</u> |
|--|--------------|--------------|----------------|
| Average Daily Consumption (Gallons Per Day) | 2,077,068 | 2,342,156 | 2,209,612 |
| Average Daily Per Capita Consumption (Gallons Per Capita Per Day) | 168 | 195 | 181 |
| Averaged Peak Daily Consumption (Gallons Per Day) | 2,811,554 | 3,094,418 | 2,952,986 |
| Averaged Peak Per Capita Consumption (Gallons Per Capita Per Day) | 232 | 258 | 245 |

The average daily per capita consumption of 195 gallons per person per day for fiscal year 1979 represents a 15 percent increase over the previous year. Data for the period fiscal years 1974 thru 1976 revealed an average daily per capita consumption of from 191 to 238 gallons per person per day. Overall the trend reflects decreased consumption for the past decade and reflects a confidence factor in utilizing the average per capita consumption figure for FY 78 and FY 79 of 181 gallons per person per day in the subsequent analysis.

This historical data sufficiently accounts for or "averages out" factors accommodated in using a capacity factor; thus, none is applied in the subsequent calculations so that a more realistic estimate of Fort Huachuca's growth potential can be extrapolated. Taking a two year average seems to be a more reliable approach than taking an average of one year's three high months per capita usage as suggested in TB ENG 354 (See Reference 4).

1.2.3 System Analysis

a. Source:

The first item to consider is the capacity of the aquifer. The transmissivity of the aquifer is estimated at 8,000 gallons per day per foot at the northeast boundary of the installation, and is capable of delivering about 80 million gallons per day to the wells. This can be translated to a population supportable of about 442,000 persons:

$$\frac{80 \text{ million gallons per day}}{181 \text{ gallons per person per day}} = 441,989 \text{ persons}$$

As summarized in the Report on Water Supply, Fort Huachuca and Vicinity, Arizona, this aquifer could supply the projected water demands for 1200 years based on a population of 55,000 persons.⁵ The report also states that cones of depressions have developed in the area due to regional pumping activity. The depression cone in which Fort Huachuca is located extends for about four miles, parallel to the mountain front. This cone is presently about one and one-half miles wide.

A discussion of alternatives for increasing the population supportable based on the regional aquifer capacity is not warranted as the capacity is so large.

The second item to consider is the well capacity and spring collection system capacity. The collection systems in Huachuca and Garden Canyon average about 350,000 gallons per day, but this supply can drop well below 100,000 gallons per day in the warm months. As a result of this fluctuation in production and the fact that the time of year and duration of the expansion is unknown, water production from the canyon collection systems is excluded from the subsequent calculations. This will increase the confidence factor in the population supportable based on well production only.

The eight wells that draw water from the aquifer have a combined capacity of 8,760 gallons per minute as listed in Table 1.2.1 previously. This translates to a supportable population of about 46,500 persons:

$$\frac{(8,760 \text{ gallons per minute})(60 \text{ min/hr})(16 \text{ hr})}{181 \text{ gallons per person per day}} = 46,461 \text{ persons}$$

Alternative one, conservation, is delineated in Figure 1.2.2 which delineates population supportable over a wide range of per capita consumption.

Alternative two, transition from normal operating capacities to full design capacities, is not applicable as supportable population has been calculated by using rated capacities.

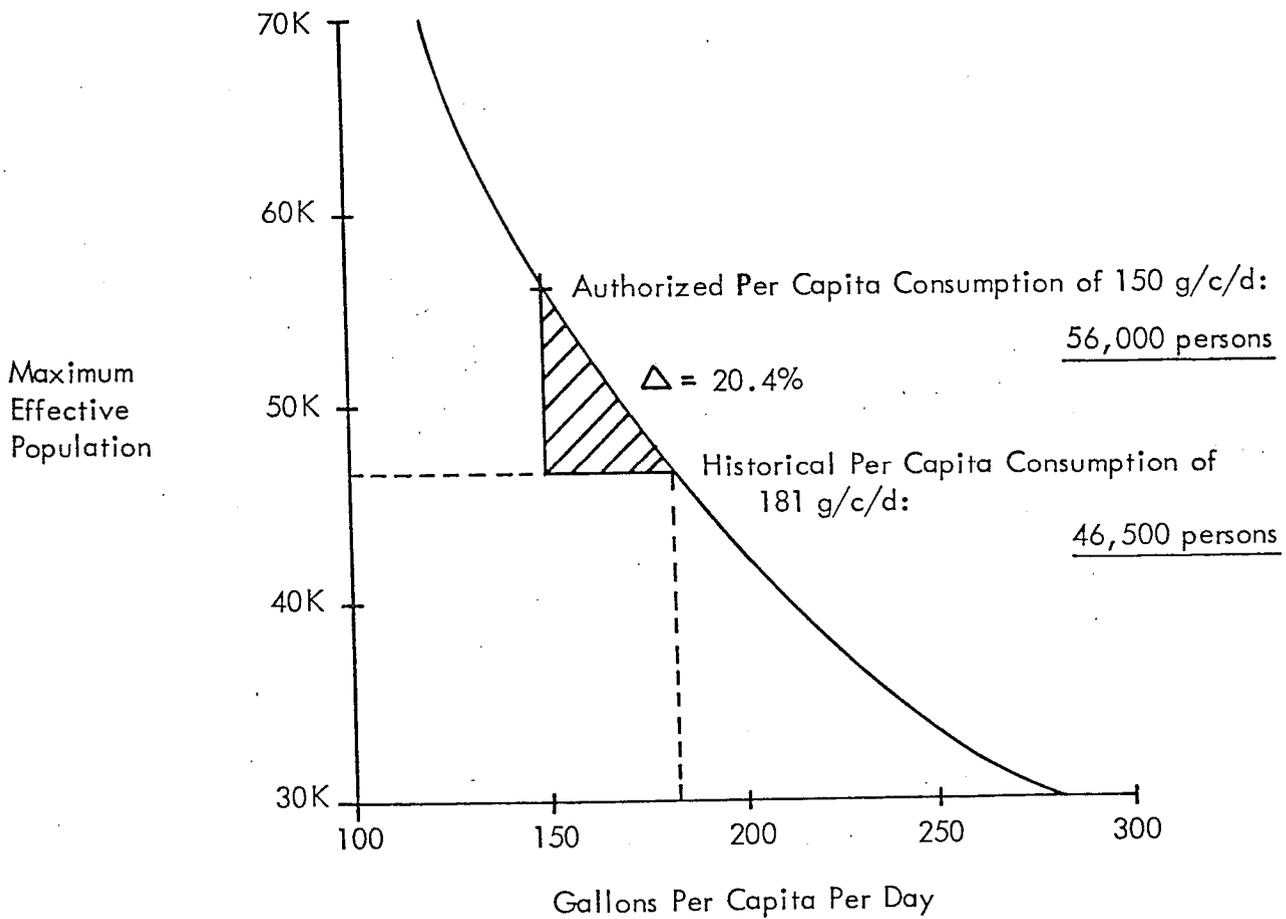
Alternative three, increasing population by the addition of rental or lease equipment, is possible by trucking in supplies of additional water. The worthiness of this alternative is questionable in light of the current supportable population.

Alternative four, increasing the population threshold by drilling additional wells is certainly feasible. This alternative will be further clarified in Step III of this analysis.

Figure 1.2.2

WELL CAPACITIES VERSUS PER CAPITA CONSUMPTION

This graph is based on rated well pump capacities totalling 8,760 gallons per minute. This total includes existing capacities (4,160 gpm) and the two wells currently under contract (4,600 gpm).



The Per Capita Consumption at Fort Huachuca approaches the amount authorized by TM 5-813-1 of 150 gallons per capita per day when irrigation demands are eliminated. The shaded area represents the potential increase in supportable population when conservation procedures are initiated.

b. Distribution System:

1. Booster Pumping Stations: As stated in Table 1.2.2 previously, the capacities of the booster pumps total 8,250 gallons per minute. This total includes 5,250 gallons per minute currently existing and 3,000 gallons per minute being installed at the new well field. Although the rated capacities of the existing pumps (Nos. 1, 2A, 2B, 3, 4, 5, 6) are 5,250 gallons per minute, previous investigations indicate that these pumps can deliver water at a total combined rate of 4,400 gallons per minute, or 4.23 million gallons per day based on a 16 hour operating period.²² Taking into account the static head between wellhead and reservoir plus a friction head of about 74 feet, the total delivery capacity is reduced to 2865 gallons per minute, or 2.75 million gallons per day. Friction head would fluctuate over a 16 hour period depending upon peak demand so that an average between these sets of figures, or 3,632 gallons per minute is a reasonable assumption. Utilizing the same procedure for the new wells, a conservative estimate of 2500 gallons per minute can be obtained (85 percent of 3000 gpm).

The realistic delivery capacity of the booster pumps is then a sum of the existing and the new capacities, or 6132 gallons per minute. This translates to a supportable population of about 32,500 persons:

$$\frac{(6132 \text{ gpm})(60 \text{ min/hr})(16 \text{ hr})}{181 \text{ gallons/person/day}} = 32,523 \text{ persons}$$

The first alternative, conservation, is shown in Figure 1.2.3 which delineates population over a wide range of per capita consumption based upon true delivery capacity.

The second and third alternatives are not applicable.

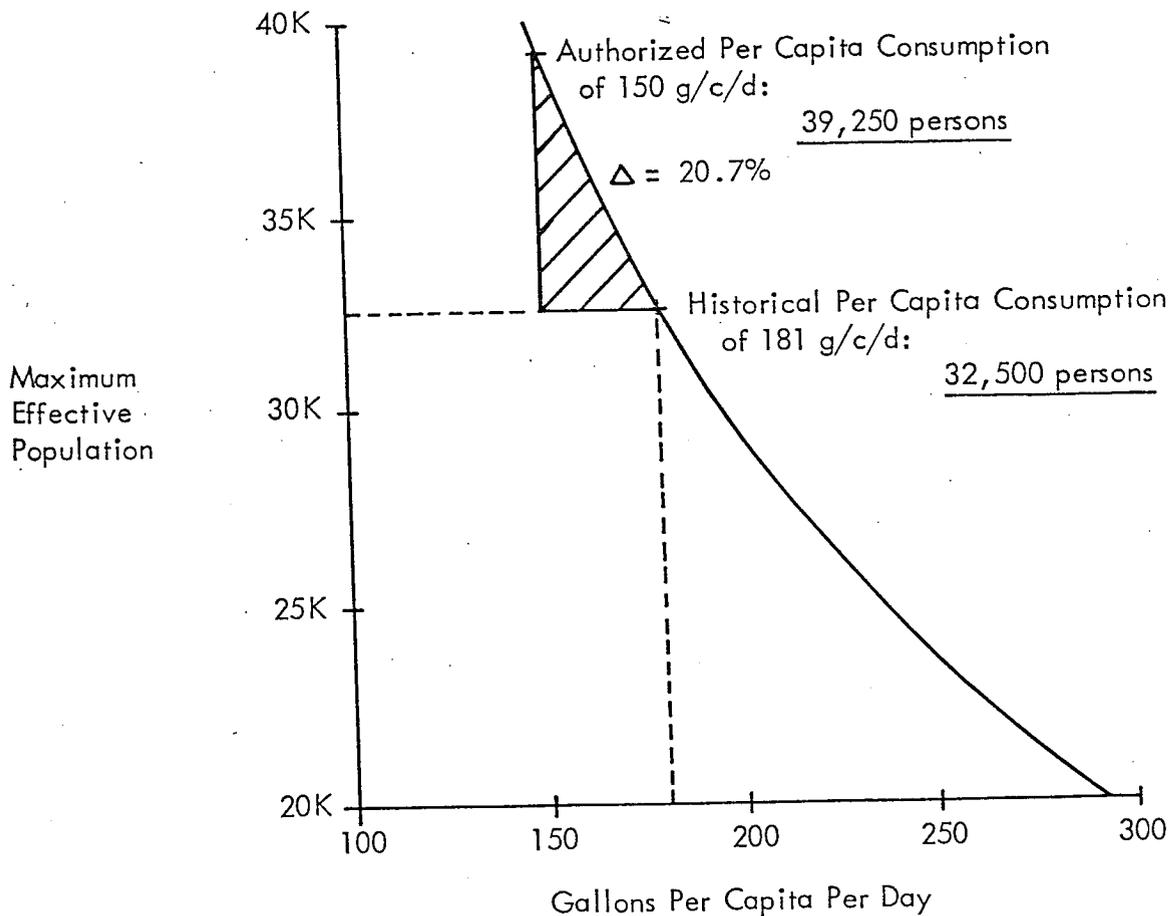
The fourth alternative, enhancing system capability by the addition of increased pumping capacity, would raise the population threshold correspondingly. The necessity for exercising this option will be placed into perspective in Stepp III, the summary of this report.

2. Distribution Network: The analysis of the distribution network does not revolve around identifying supportable population but centers around capacities of the distribution mains in relation to the booster pumping capabilities. The distribution network for each zone has been described in the system description previously (Section 1.2.1). Pertinent information is summarized in Table 1.2.6:

Figure 1.2.3

BOOSTER PUMPING CAPABILITIES VERSUS PER CAPITA CONSUMPTION

The following graph is based on the true delivery capacity of the pumps of 6,132 gallons per minute. This includes existing capacities (3,632 gpm) and the booster stations under contract (2,500 gpm).

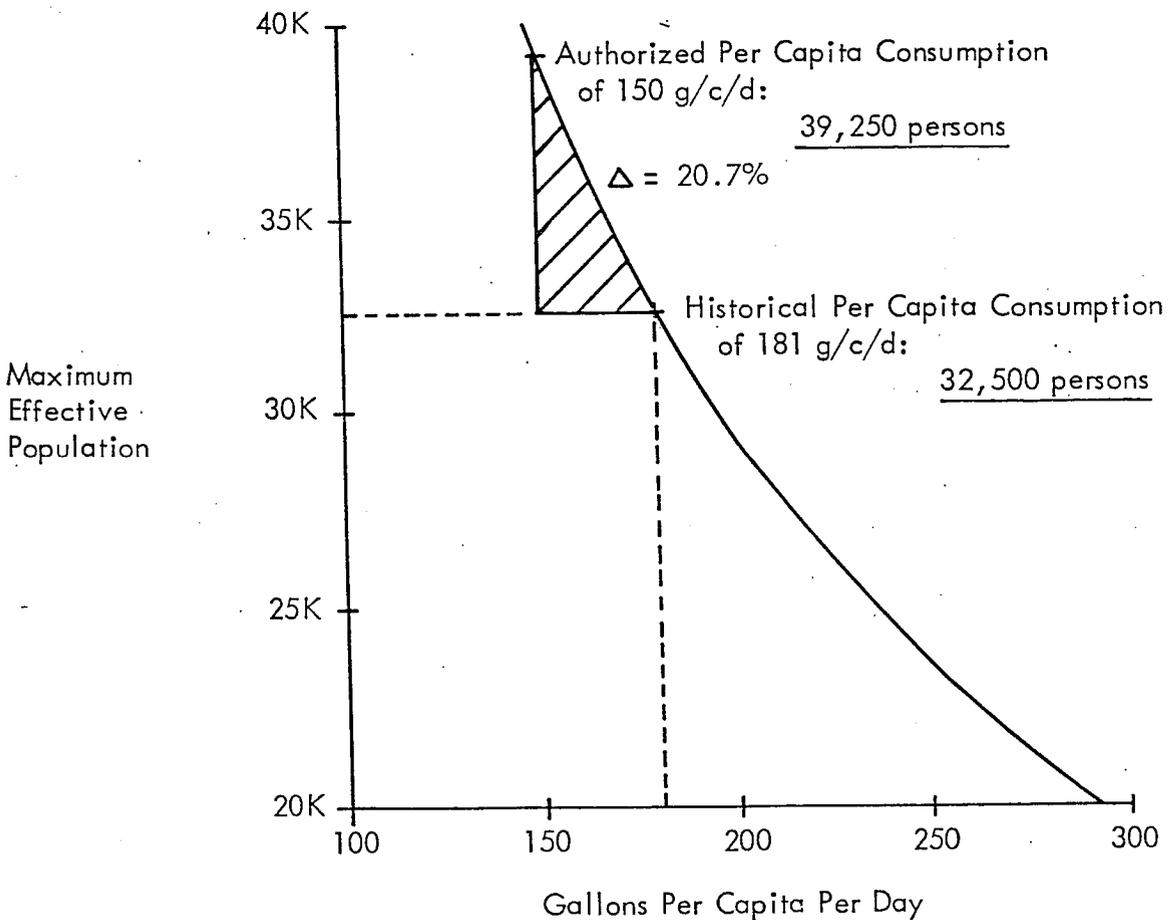


The Per Capita Consumption at Fort Huachuca approaches the amount authorized by TM 5-813-1 (150 g/c/d) when irrigation demands are eliminated. The shaded area represents the potential increase in supportable population when conservation procedures are initiated.

Figure 1.2.3

BOOSTER PUMPING CAPABILITIES VERSUS PER CAPITA CONSUMPTION

The following graph is based on the true delivery capacity of the pumps of 6,132 gallons per minute. This includes existing capacities (3,632 gpm) and the booster stations under contract (2,500 gpm).



The Per Capita Consumption at Fort Huachuca approaches the amount authorized by TM 5-813-1 (150 g/c/d) when irrigation demands are eliminated. The shaded area represents the potential increase in supportable population when conservation procedures are initiated.

TABLE 1.2.6

DISTRIBUTION NETWORK

| <u>Zone</u> | <u>Supply Main Size</u> | <u>Main Capacity (gpm)</u> | <u>Pumping Capacity (gpm)</u> |
|-------------|-------------------------|----------------------------|-------------------------------|
| A | 10" | 2,500 | 1,500 |
| B | 12" | 4,000 | 1,150 |
| | 14" | 5,000 | 2,350 |
| C | 12" | 4,000 | N/A |

As shown in the table, the capacities of the distribution mains exceed the pumping capacities of the pumps. The major distribution network does not pose a roadblock to expansion. The effect of expansion sitings upon the water network will be further analyzed pending development of the Expansion Capability Plan, Step V of this plan.

A discussion of alternatives is not warranted for the water distribution network; however, a construction program should alleviate any problems posed. It can be expected that additional service mains will be necessary to provide water to the expansion areas.

c. Storage:

Total storage capacity must be provided in an amount not less than the greatest of the following items:

Item one, 50 percent of the total daily domestic consumption plus all industrial and other demands. Other demands include the amount necessary to replenish in 48 hours, the storage required for fire protection and normal operation.

Item two, the fire demand (This amount may be reduced by the amount of water available during the period of the fire demand under emergency conditions). In case of electrical power failure, the water supply of Fort Huachuca will be reduced to the natural flows from Huachuca Canyon and Garden Canyon, which averages 350,000 gpd but which may drop well below 100,000 gpd in the warm months. Therefore, surface supplies cannot be depended upon to meet emergency minimum water requirements. This limitation means that water would have to be brought in by rail or truck unless emergency power capability is installed. For the subsequent calculations no emergency water is considered available.

Assuming an industrial demand of 10 percent of the total daily domestic consumption and a fire demand of 3000 gallons/min for 4 hours, the governing items can be expressed as follows:

$$\begin{aligned} \text{Item one: } & (.5)(x)(150 \text{ g/c/d})(1.1) + \frac{(3000 \text{ gpm})(60 \text{ min/hr})(4 \text{ hr})}{2 \text{ days}} \\ & = 82.5x + 360,000 \text{ ga/day} \end{aligned}$$

$$\begin{aligned} \text{Item two: } & \frac{(.5)(x)(150 \text{ g/c/d})}{6} + (3000 \text{ gpm})(60 \text{ min/hr})(4 \text{ hr}) \\ & = 12.5x + 720,000 \text{ gallons} \end{aligned}$$

$$\text{Item three: } 95x + 1,080,000 \text{ gallons}$$

Item three is the largest of the three items and thus governs storage requirements. This can be translated to a supportable population of about 44,000 persons:

$$95x + 1,080,000 \text{ gal} = 5,250,000 \text{ gal}$$

$$x = 43,895$$

The first alternative, conservation, would have a direct correlation to storage requirements as domestic consumption is a factor in the calculation.

The second alternative is not applicable.

The third alternative is not applicable.

The fourth alternative, enhancing the system by a construction program, would raise the population threshold significantly. The addition of auxiliary powered pumps would decrease the storage requirement and thusly increase the supportable population. The addition of storage tanks would also increase the population threshold. The determination of the necessity and suitability of this alternative will be clarified in Step III.

1.2.4 Summary of Water System Limitations:

The population supportable based on the components of the water system is delineated in Table 1.2.7 along with the alternatives available for expansion. The previous discussion explains how the numbers were derived and why a recommended alternative is reasonable. The overall perspective of the water system in relationship to the other utility systems will be clarified in the Summary of Utility System Limitation, Section 1.7 of this report.

TABLE 1.2.7

| WATER SYSTEM ANALYSIS EXPANSION POSSIBILITIES | | ALTERNATIVES | | | |
|--|------------------------------|----------------------|-------------------------------|---------------------------|----------------------|
| | | 1 | 2 | 3 | 4 |
| UTILITY SYSTEM COMPONENT | CURRENT OPERATING CONDITIONS | CONSERVATION PROGRAM | TRANSITION TO DESIGN CAPACITY | RENTAL OR LEASE AGREEMENT | CONSTRUCTIVE PROGRAM |
| (1) Source: | | | | | |
| Aquifer | 442,000 | Reasonable | N/A | N/A | N/A |
| Wells | 46,500 | See Figure 1.2.2 | N/A | N/A | Reasonable |
| (2) Distribution System: | | | | | |
| Booster Stations | 32,500 | See Figure 1.2.3 | N/A | N/A | Reasonable |
| Distribution Network | 32,500 | Reasonable | Reasonable | N/A | Reasonable |
| (3) Storage Facilities | 44,000 | Reasonable | N/A | N/A | Reasonable |

1.3 WASTE SYSTEM:

1.3.1 Sanitary Sewer System:

a. System Description:

1. Sewage Treatment: Fort Huachuca is served by two sewage treatment plants. In general, Wastewater Treatment Plant No. 1 serves the southeast portion of the main cantonment area and Plant No. 2 serves the remainder of the Post. Performance data for the two plants is shown in Table 1.3.1.

TABLE 1.3.1 SEWAGE TREATMENT PLANT PERFORMANCE DATA

| | <u>Plant No. 1</u> | <u>Plant No. 2</u> |
|-----------------------------------|-------------------------------|-------------------------------|
| Design Capacity | 1.2 mgd | 1.8 mgd |
| Observed Flow (1976) | 0.3 mgd | 0.7 mgd |
| BOD ₅ (1976): Influent | 272 mg/l | 293 mg/l |
| Effluent | 5-25 mg/l | 10-25 mg/l |
| % Removal | 94% (Avg.) | 94% (Avg.) |
| Suspended Solids: | | |
| Influent | 124 mg/l | 150 mg/l |
| Effluent | 5-25 mg/l | 10-25 mg/l |
| % Removal | 90% (Avg.) | 92% (Ave.) |
| Trickling Filter Loading | 1,835 | 2,872 |
| lb. BOD/acre | | |
| ft/day | (32% of max.) ² | (57% of max.) ² |
| Trickling Filter Hydraulic | 24.4 avg. | 2.5 avg. |
| Loading, Mgal/acre/day | (61% of max.) ² | (6% of max.) ² |
| Secondary clarifier detention | 9.9 avg. | 6.1 avg. |
| Time, hours | (4.0 times min.) ² | (2.4 times min.) ² |

² Estimated from standard texts, e.g. Metcalf and Eddy, Wastewater Engineering. New York: McGraw Hill (1972).

Both plants operate on the same principle, as illustrated in Figure 1.3.1. The treatment sequence is as follows:

- a. Mechanical screening
- b. Primary clarification
- c. Trickling filter secondary treatment
- d. Secondary clarification

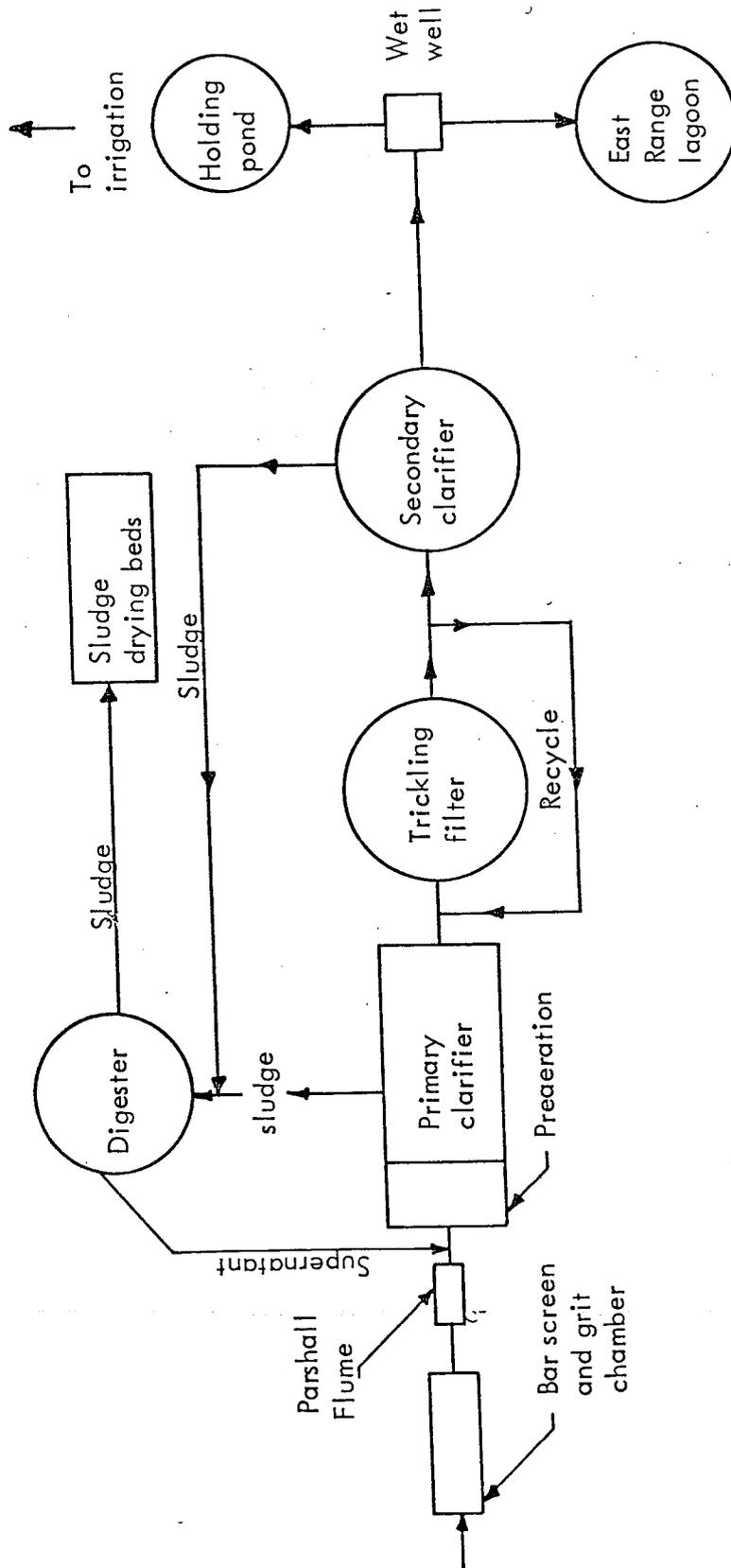
Sludge from primary and secondary clarification is sent to digesters, and while effluent is sometimes used for irrigation of the golf course and Chaffee Parade Field, most is sent to the East Range lagoon which discharges to a dry arroyo. Grease, skimmings, and grit are sent to a landfill owned by Huachuca City. Sludge is dried in drying beds and used as a soil conditioner on the Post. The NPDES permit to the Post expired on 1 September 1977 and there will be no renewal application because the Post discharges no effluent to waterways. In the future, however, the Resource Conservation and Recovery Act (RCRA) of 1978 may have implications for Fort Huachuca. The receiving pond of the East Range lagoon will be classified as an "open dump" under the Resource Conservation and Recovery Act definitions, and the lagoon will probably be analyzed for its effect on ground water in the vicinity by the Arizona Department of Health Services, Bureau of Water Quality Control. If it is determined that the ground water is adversely affected by the lagoon, Fort Huachuca will receive notice to halt this environmental impact within five years or else cease operations. The Act is now law, and regulations were made effective at the end of 1979.

2. Sewage Collection System: Wastewater generated in the main cantonment area is collected in a sewer system based on 6- and 8-inch collector pipes in the administrative and residential areas of the Post and is delivered to the sewage treatment plants by 12- and 15 inch mains. All flows are gravity except in the case of one small lift station at the AUP Field Test Building, and there are not collection points ahead of the treatment plants.

Fifteen septic tanks and one package treatment plant treat minor sewage flows from several points which do not discharge either to sewers or to waterways.

Because of the low groundwater level, infiltration into the sewer system does not occur although heavy rainfalls may cause some surface water inflow through manholes.

SEWAGE TREATMENT SCHEMATIC



This figure is a schematic diagram of the treatment principle employed at plants 1 and 2 at Fort Huachuca.

b. System Loading:

Sewage flows over the 10 month period July 1978 thru April 1979 averaged 40.3 million gallons per month. Flows for fiscal year 1977 averaged significantly less or 32.8 million. This increase in sewage flow can be attributed to increased water consumption over the corresponding time periods. Per capita contribution averaged 110 gallons per capita per day.

Industrial wastes are sewered only in limited quantities. The sanitary sewer receives boiler blowdown waters and the filter backwash water from two swimming pools. Also, up to 40 gallons per day of photoprocessing solutions are discharged to this sewer. Washracks and motor pools send their effluents to ravines, ponds or collection points instead of sewers, and the effluent from the Post laundry flows to the East Range lagoon.

c. System Analysis:

1. Sewage Treatment Plants: The first alternative, decreased flows, is delineated in Figure 1.3.2.

The second alternative, transition to design capacity, would result in a supportable population of 27,300: based on the historical per capita consumption of 110 gallons/capita/day.

$$\frac{3.0 \text{ million gallons/day capacity}}{110 \text{ gallons/capita/day}} = 27,272 \text{ persons}$$

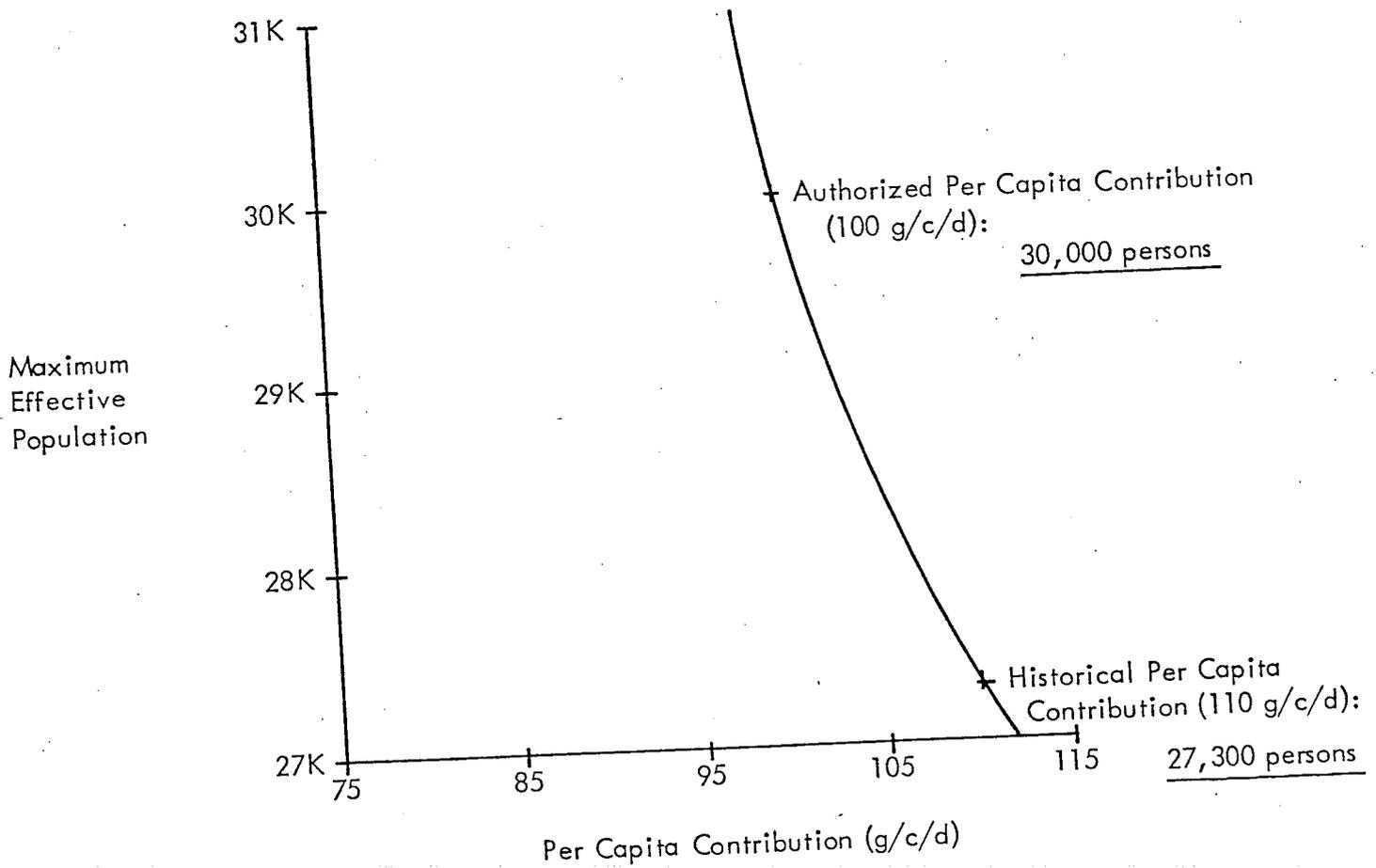
The third alternative is not available.

The fourth alternative, a construction program, would raise the population threshold significantly. Additional capacity could be obtained quickly by building sewage lagoons. Even a greatly increased volume of sewage would not threaten the aquifer or the waterways of the arid region. Conservatively, 25,000 people could be served by the existing sewage treatment plants and collection system, and additional lagoons could double plant capacity again. However, whether the collection system might be a limiting factor would depend upon the distribution and location of the increase in population.

2. Sewage Collection System: It is anticipated that no critical deficiencies will be present in the collection system under expansion. This is so because the areas where primary expansion is expected are serviced by

SEWAGE TREATMENT CAPACITIES

This graph is based on the combined treatment plant capacities of 3.0 million gallons per day.



15" collectors which can presumably handle the additional flows. Both sewage treatment plants are terminuses for collection systems that drain downhill from high ground on the west side of the garrison areas. Collection lines presently are not a limitation.

Alternative one is not applicable.

Alternative two is not applicable.

Alternative three is not applicable.

Alternative four is a reasonable solution to handling additional flow if necessary. It is anticipated new lines could be added as needed within nine months.

1.3.2

Storm Drainage System:

a. System Description:

Storm water from the main cantonment area is collected in a storm drainage system consisting of open channels and closed conduits which discharge to natural drainage ravines. Storm water from heavy rainfalls generally flows several miles into the surrounding desert and either evaporates or percolates into the ground. The nearest receiving stream, the Babocamari River, is about eight miles northeast of the main cantonment area and is usually dry.

Storm water from the remainder of the Post flows through natural drainage ravines which eventually empty to the Babocamari or San Pedro Rivers about two miles from the Post boundary.

b. System Analysis:

The average annual rainfall at Fort Huachuca is about 14.26 inches per year. The maximum precipitation occurs during the summer months from July thru September. Moderate to heavy rains are, in general, a daily occurrence. The existing systems are adequate, except during heavy rains when flash flooding occasionally happens on roads. Also, portions of family housing areas along Division Drive experience draining problems and flooding occasionally during heavy storms. Any expansion in this area shall have to consider potential problems from flooding of small washes and arroyas. Also, some flooding problems are evident during heavy rains around building 912 at Libby Field. Proper site assessment prior to structure placement during site planning shall have to be employed here also.

A discussion of alternatives is not warranted for the storm drainage collection system as the collection system is not a function of population but a function of rainfall. It is anticipated that a construction program, Alternative Four, would alleviate potential problem areas when considering expansion sitings.

1.3.3 Solid Waste Disposal System:

a. System Description:

A civilian contractor collects said solid wastes at Fort Huachuca and discards them at the Huachuca City landfill. The installation disposes of an average of 42,000 pounds of solid waste per day, about 30% of the total daily landfill contribution.

b. System Analysis:

No discussion of alternatives is warranted as the service is provided by private contractor and it is assumed additional service could be procured through a similar arrangement under expansion.

1.3.4 Summary of Waste System Limitations:

Alternatives available for expanding the waste system at Fort Huachuca are shown in Table 1.3.2. The previous discussion explains how the numbers were derived and why a recommended alternative is reasonable. No single component can be considered a limiting factor to expansion, in light of the effect of the alternatives available.

TABLE 1.3.2

WASTE SYSTEM ANALYSIS

EXPANSION POSSIBILITIES

ALTERNATIVES

| UTILITY SYSTEM COMPONENT | CURRENT OPERATING CONDITIONS | EXPANSION POSSIBILITIES | | | |
|---|------------------------------|---------------------------|------------------------------------|--------------------------------|---------------------------|
| | | 1 CONSERVATION PROGRAM | 2 TRANSITION TO DESIGN CAPACITY | 3 RENTAL OR LEASE AGREEMENT | 4 CONSTRUCTION PROGRAM |
| (1) Sanitary Sewer System: Treatment Plant | N/A | See Figure 1.3.2 | 27,300 | N/A | 50,000 |
| Collection System | 25,000 | Reasonable | N/A | N/A | Reasonable |
| (2) Storm Drainage System | N/A | N/A | N/A | N/A | Reasonable |
| (3) Solid Waste System Transportation | N/A | Reasonable | N/A | N/A | N/A |
| Sanitary Landfill | Unknown | Reasonable | N/A | N/A | Reasonable |

HEATING SYSTEM:

System Description:

Natural gas is used to heat all permanent buildings at Fort Huachuca. Previously (March 1977), the installation was limited to a maximum of 5,666 MCF on a peak day; however, the Arizona Public Service Company notified the installation in February, 1979, that the usage could be increased without fear of interruptible service. The previous limit (5,666 MCF) is about 150 percent the average daily consumption in January, the coldest month, and about equal to the maximum consumption rate experienced on any single winter day.

Arizona Public Service Company supplies gas to Fort Huachuca through two high pressure (400 psi) mains which are owned by El Paso Natural Gas Co. One main parallels Whitside Road to a pressure regulating and metering station located north of the Cold Storage Area, and the other parallels Highway 92 to a regulating and metering station located at Brainard Road and Carter Street.

Distribution from the two metering stations is accomplished through a coated and wrapped steel piping system which is owned and maintained by the Government. The metering station at Brainard and Carter feeds all of Section Five and that portion of Section Four bounded by Hatfield on the north, Sixth on the south and Arizona on the east. The station at the Cold Storage Area serves the remainder of Section Four and all of Section Two.*

Operating pressure in the Post distribution system is 45 pse with reducing stations to regulate flow. Cathodic protection, which has been installed in some areas of the piping system, seems to have alleviated the problem of corrosion.

Systems presently in use range from individual space heaters to central boiler plants of varying sizes. The major systems rated in thousands of Btu's per hour (MBH) are shown in Table 1.4.1:

* The section numbers refer to the areas delineated on the General Gas Maps of the Basic Information Maps.

TABLE 1.4.1

MAJOR HEATING SYSTEMS

| <u>BUILDING</u> | <u>NAME</u> | <u>TOTAL</u> |
|-----------------|------------------|--------------|
| 22528 | Shop | 5,021 |
| 45001 | Hospital | 13,400 |
| 51001 | Barracks | 6,114 |
| 51005 | Riley Barracks | 11,600 |
| 52004 | Mess | 5,360 |
| 52107 | Mess | 4,915 |
| 52204 | Barracks | 5,428 |
| 61801 | Greely Hall | 19,400 |
| 72908 | Maintenance Shop | 5,021 |
| 90201 | Laundry | 21,000 |

Note: The plant buildings 51005, 61801, and 90201 also provide domestic hot water.

The remainder of the systems on Post are smaller (under 5,000 MBH) individual plants, including some electric and LPG units in small enclosures.

1.4.2

System Loading:

The rate of natural gas consumption over the past five years is summarized in Table 1.4.2 below:

TABLE 1.4.2

NATURAL GAS CONSUMPTION

| <u>MONTH</u> | <u>AVG. CONSUMPTION (therms*)</u> | <u>AVG. EFF. POPULATION</u> |
|--------------|---------------------------------------|---------------------------------|
| January | 1,167,573 | 13,423 |
| February | 953,696 | 13,527 |
| March | 930,653 | 13,322 |
| April | 935,767 | 13,452 |
| May | 412,920 | 13,324 |
| June | 229,003 | 13,287 |
| July | 249,132 | 12,547 |
| August | 233,621 | 12,330 |

TABLE 1.4.2 continued

| <u>MONTH</u> | <u>AVG. CONSUMPTION (therms*)</u> | <u>AVG. EFF. POPULATION</u> |
|--------------|---------------------------------------|---------------------------------|
| September | 244,041 | 12,429 |
| October | 361,409 | 12,491 |
| November | 696,601 | 12,522 |
| December | 916,359 | 12,171 |

* 1 therm = 10^5 Btu

Average use is 47.35 million Btu/cap/year. The high desert climate of the Fort Huachuca area has about 2,500 standard heating degree days per year (ASHRAE Handbook and Product Directory, 1976 Systems) so that the specific energy consumption at the Fort is approximately

$$\frac{4,735 \times 10^7}{2,500} = 18,940 \text{ Btu/cap/deg. day}$$

This is a reasonable average for an army post having the large amount of exterior building surface (due to the large number of buildings per effective population) found at Fort Huachuca. Therefore, it should probably be considered the basic requirement for this Post.

1.4.3 System Analysis:

The analysis of the heating system at Fort Huachuca is dependent upon the present and projected amount of heated space and not on per capita demand. The discussion of the alternatives is by necessity general in scope.

The supply of natural gas is not limiting at the present time. Historically, the ceiling on supplies for a given day has been about equal to demand; however, the annual limits on natural gas have been eliminated. This current classification is subject to change based on the monthly and annual demand.

A study made in March, 1977 by Lowry-Sorensen-Millcoxon Engineers determined that buildings with a capacity of five million Btu's could be converted to an alternate fuel system. Within the nine month expansion time frame, it would be possible to provide fuel oil storage for these buildings.

Fort Huachuca is in an ideal geographical position to obtain a major portion of the heating requirements from solar energy. At least 70 percent of all such needs could be met by solar energy.

The first alternative, conservation, would have a direct correlation to population. As heating demand drops, additional buildings could be heated, thus supporting additional populations.

The second alternative, transition to design capacity, is not applicable.

The third alternative, addition of supplies by rental or lease agreement, is not available.

Alternative Four, construction, is a reasonable solution to providing additional heating capacities. As any expansion for an emergency would involve the construction of temporary buildings only, it is anticipated that these facilities could be heated by fuel oil systems at locations where the current system could not be expanded. Further analysis of the heating system will be necessary pending completion of the plan, Step V of this Expansion Capability Plan.

1.4.4

Heating System Limitations:

The alternatives available for expanding the heating system are shown in Table 1.4.3. The previous discussion explains why a recommended alternative is reasonable. As heating demand is a function of space, a population figure was not derived; however, further expansion is possible by exercising Alternative Four.

TABLE 1.4.3

HEATING SYSTEM ANALYSIS

EXPANSION POSSIBILITIES

| <u>UTILITY SYSTEM COMPONENT</u> | <u>CURRENT OPERATING CONDITIONS</u> | <u>ALTERNATIVES</u> | | | |
|---------------------------------|-------------------------------------|----------------------|-------------------------------|---------------------------|----------------------|
| | | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> |
| Heating System | N/A | CONSERVATION PROGRAM | TRANSITION TO DESIGN CAPACITY | RENTAL OR LEASE AGREEMENT | CONSTRUCTION PROGRAM |
| | | Reasonable | N/A | N/A | Reasonable |

¹ Note: It is anticipated that a construction program would raise the threshold based on the current system. Alternative fuels and expansion of the current system will be identified in Step V of this report.

1.5 ELECTRICAL SYSTEM:

1.5.1 System Description:

a. Power Supply:

Tuscon Gas and Electric Company provides primary electrical power to Fort Huachuca through a 138 KV transmission line from the Vail Substation, a transmission substation fed by four regional generation sources. The Vail Substation is owned and maintained by Tuscon Gas and Electric Company. Integrity of the power supply to the transmission line is secure, although the line is subject to power outages. Fort Huachuca is the sole customer on the 138 KV line.

The primary service line feeds the installation's government owned substation located west of Greely Hall on Arizona Street. This substation is a three winding unit (138/44/13.8 KV) with fan forced ventilation and has a capacity of 25,000 KVA.

b. Alternate Power Supply:

In the event the Tuscon Gas and Electric Company's Vail Substation was damaged beyond repair, the company has a 25,000 KVA mobile transformer which could be moved and connected within four days. Delivery of a new transformer could be expected to take six to eight months.

A secondary 46 KV backup transmission line can supply power to Fort Huachuca from the Tuscon Gas and Electric South Substation located near Sahuarita, Arizona, a distance of approximately 60 miles. To bring this secondary transmission service on line, the switches between the Sahuarita substation and the main transformer must be manually closed and the 46 KV switch at the installation's substation must be manually opened. These manual operations delay emergency power supply to Fort Huachuca for a period of two hours.

c. Distribution System:

The distribution system consists of eight 13.8 KV circuits (six aerial, two underground) in addition to circuits 1 and 2 which are the main breaker and capacitor bank, respectively. Circuits 3, 4, 5 and 6 feed the residential areas, and line 5 partially serves the Post water wells. Circuit 7 serves the Old Post, and circuits 8 and 10 serve Greely Hall (underground). It should be noted that circuit 9 is the only one leading from the breaker serving outlying areas, including the airfield. A new circuit will supply power for the new water wells.

These government owned and maintained circuits feed out of the main substation through individual breakers. The trip setting on each breaker is currently set at 200 amperes, but the maximum capacity of each breaker is 600 amperes. The main breaker has a rated capacity of 1,500 amperes, but is currently set at 750 amperes.

1.5.2 System Loading:

The pertinent electrical consumption/demand information for fiscal years 1977 through 1979 is summarized in Table 1.5.1:

TABLE 1.5.1

ELECTRICAL DEMAND

FISCAL YEARS 1977 THRU 1979

| | <u>TOTAL KWH</u> | <u>AVERAGE KVA DEMAND</u> | <u>EFFECTIVE POPULATION</u> | <u>KVA PER CAPITA</u> | <u>AVERAGE POWER FACTOR</u> |
|----------------|----------------------|-------------------------------|---------------------------------|---------------------------|---------------------------------|
| 1977 | --- | 10,664 | 12,423 | .858 | 91.93% |
| 1978 | 64,853,054 | 11,243 | 12,348 | .911 | 91.1 % |
| 1979 | 66,538,800 | 11,461 | 12,036 | .952 | 90.75% |
| 3 Year Avg. | N/A | 11,123 | 12,269 | .907 | 91.25% |

As shown in the table, the demand trend has shown an increase of about 7% for the three year period.

1.5.3 System Analysis:

a. General:

Fort Huachuca is a multiple mission installation and the Electronic Proving Ground is involved in the testing of electrical systems which frequently creates a high KVA demand. Projecting maximum supportable populations based upon average per capita demand can be misleading, particularly if the largest user of electrical energy were to require a greater proportion of the total demand during expansion. For the purposes of this analysis, it is assumed that this proportion of total demand by user will remain reasonably constant. This is consistent with the population distribution subsequently developed in the introduction to Step IV.

b. Power Supply:

Discussions with Tuscon Gas and Electric Company revealed that the 138 KV primary transmission line could conservatively handle four times the present demand. This can be translated to a supportable population of about 49,000 persons:

$$(4)(12,269 \text{ avg. effective population}) = 49,076 \text{ persons}$$

The government owned substation has a capacity of 25,000 KVA as previously discussed and can support a population of about 27,600 persons:

$$\frac{25,000 \text{ KVA}}{.907 \text{ KVA/Capita}} = 27,563 \text{ persons}$$

The first alternative, conservation, is delineated in Figure 1.5.1 which delineates population versus average per capita demand.

The second alternative is not applicable.

The third alternative, enhancing system capability by the addition of rental or lease equipment, could significantly increase this population threshold. Tuscon Gas and Electric Company has a 25,000 KVA mobile transformer which would double existing capacity. The Sulphur Springs Valley Electric Cooperative also owns a mobile substation (10 MVA-115-69/14.4-7.2KV) which should be compatible with the 13.8 KV Intrapost Distribution System.

The fourth alternative, a construction project, would also raise the threshold. By adding additional fan cooling capabilities to the existing transformer at the installation's substation, the capacity could be increased to 41,667 KVA. This translates to a supportable population of about 46,000 persons:

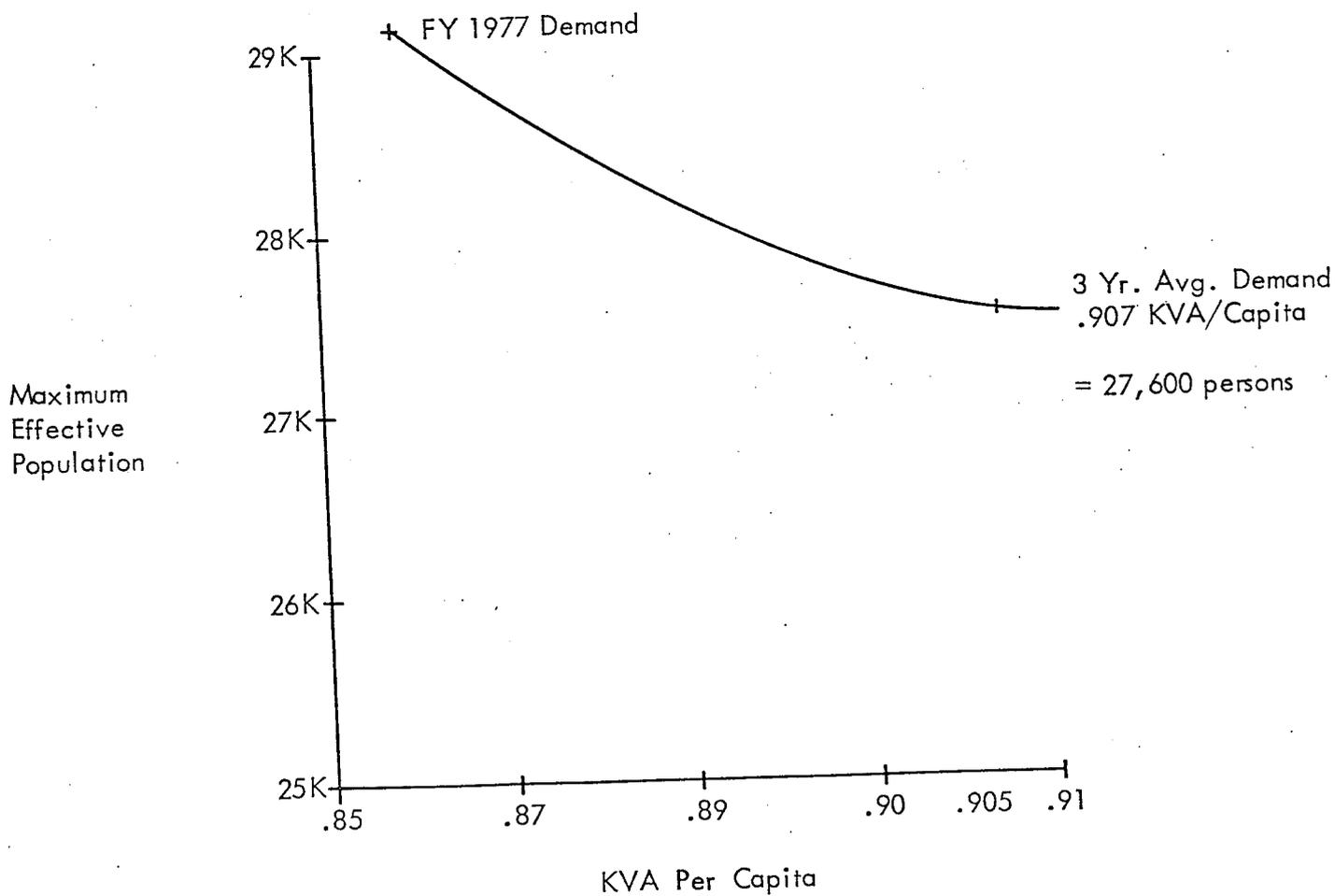
$$\frac{41,667 \text{ KVA}}{.907 \text{ KVA/Capita}} = 45,939 \text{ persons}$$

Construction of a permanent secondary substation near the main gate would permit connection to the Sulphur Springs Valley Electric Cooperative's 69 KV line which runs parallel to Arizona Highway 90 with a 115 KV/69 KV transmission substation near Fort Huachuca's north gate. The connection could be made in nine months provided the system is planned beforehand and a schedule of the necessary equipment and sources is determined in advance.

Figure 1.5.1

ELECTRICAL POWER CAPABILITIES VERSUS PER CAPITA DEMAND

This graph is based on the existing capacity of the existing installation substation capacity of 25,000 KVA.



c. Distribution System:

A continuous maintenance program keeps the installation's distribution system in average condition. Expansion would necessitate additional secondary distribution service requiring enlargement of the inventory of poles, wires, insulators and other electrical components. This inventory is limited at the present time and additional supplies would be necessary to meet any new demand.

As breaker coordination and the line capacities on the secondary site of each distribution breaker are the only limitations to increasing the capacity of each line, it is anticipated that the necessary upgrading or addition of electrical distribution service could be accomplished within nine months through a construction program.

1.5.4 Summary of Electrical System Limitations:

The alternatives available for expanding the electrical system at Fort Huachuca are delineated in Table 1.5.2. The previous discussion explains how the numbers were derived and why a recommended alternative is reasonable.

The current distribution system could constitute the limiting factor to expansion. If expansion should occur in areas not presently served or with minimum service, then the distribution service would have to be provided. There are several general 13.8 KV lines to outlying areas, but the capability to expand into these areas could be limited by the material inventory necessary to accomplish an expansion program.

The hospital, the airfield and the communications center have emergency backup generation. However, emergency power for the hospital could be inadequate if relied on for more than a day. Further study should be made of the feasibility of additional emergency power for the hospital as any increase in the mission will require additional standby generation capacity.

TABLE 1.5.2

ELECTRICAL SYSTEM ANALYSIS

EXPANSION POSSIBILITIES

| UTILITY SYSTEM COMPONENT | ALTERNATIVES | | | |
|-----------------------------|---------------------------|------------------------------------|--------------------------------|---------------------------|
| | 1 CONSERVATION PROGRAM | 2 TRANSITION TO DESIGN CAPACITY | 3 RENTAL OR LEASE AGREEMENT | 4 CONSTRUCTIVE PROGRAM |
| (1) Electrical Supply: | | | | |
| Transmission Lines | Reasonable | 49,000 | N/A | N/A |
| (2) Installation Substation | See Figure 1.5.1 | N/A | 55,126 | 45,939 |
| (3) Distribution System | Reasonable | N/A | N/A | Reasonable |

1.6

COMMUNICATIONS SYSTEMS:

1.6.1

System Description:

a. Telephone Systems:

Two telephone systems serve Fort Huachuca. Mountain Bell Telephone provides service to the family housing areas while the Post's own system handles all other telephone communications, including interpost calls.

Up until January, 1978, 3600 of the available 4000 lines were in use. Now, an additional 96 channels per line are available. This provides more than adequate capacity for the future. Plans also exist for a new digital switch.

Eight hour battery units are available to power the telephone exchange in an emergency.

A Mountain Bell exchange near the main gate serves the family housing areas. In the past this company has responded quickly to demand for new lines and has cooperated with the Army during expansion moves. Although its cooperation may be expected during any expansion, the areas of expansion may fall outside the company's lines. Therefore, new inventory, including vehicles, machinery, poles, cable, and mounting hardware would have to be provided by the Army.

b. Radio Communications:

Fort Huachuca has a radio communications system at the airfield and also a Post emergency radio communications system. The system at the airfield, which is backed up by three emergency generation units to prevent communication blackouts, is connected to the Federal Aviation Administration network for air traffic reports and navigational aids.

1.6.2

System Analysis:

Since 1978 the telephone communications system has had adequate capacity for any major expansion. The only obstacles to such an expansion are parts inventory and the availability of qualified installation personnel. Additional telephone installation personnel would have to be brought in for any expansion as maintenance of the present system, which is about 38% aerial and 62% underground, occupies the full time of present maintenance personnel. Inventory must be ordered, shipped, received and otherwise handled before any

major expansion could take place, and installers would have to be transferred or contracted from the civilian sector. The standby eight hour battery capacity should be sufficient in an emergency if repair operations are normal.

The communications system at Fort Huachuca could be expanded within the time frame for expansion, nine months, by exercising Alternative Four, a construction program.

Utility Systems Summary:

The populations supportable by each of the utility systems at Fort Huachuca are identified in Table 1.7.1. The previous sections explain the rationale behind the figures and why a recommended alternative is feasible.

In a sort of domino fashion, the water booster stations ultimately limit growth at Fort Huachuca. Although this capacity could be increased during expansion, the effective population threshold of 32,500 is considered a reasonable limit for the installation expansion. This represents an effective population of greater than 250 percent of current populations. At this population threshold, it can be expected that the utility distribution/collection systems will also limit expansion. Specific corrections will be identified pending the siting of the facilities required, Step V.

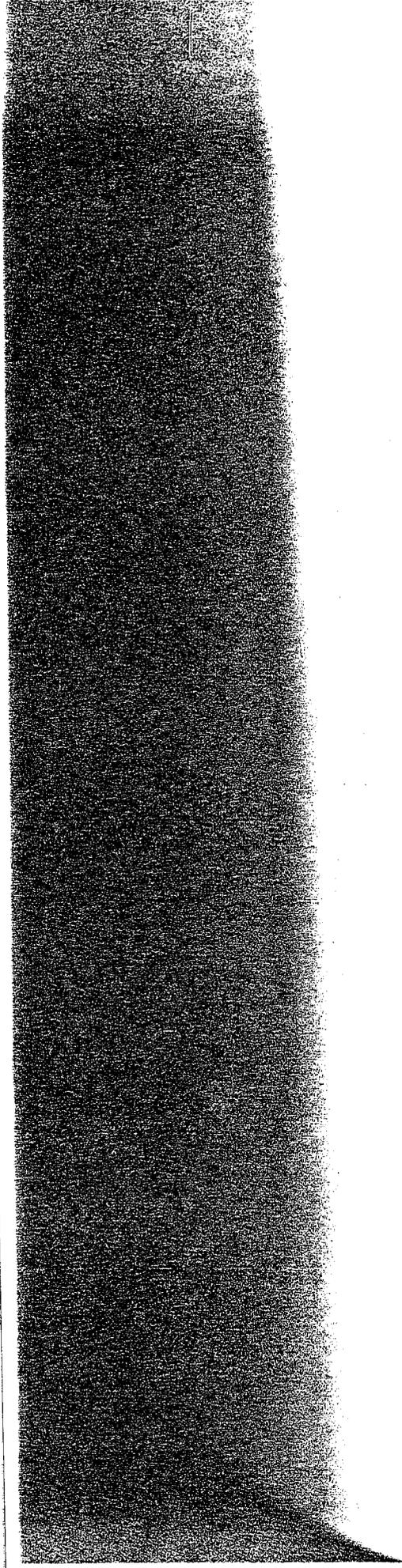
TABLE 1.7.1

UTILITY SYSTEM ANALYSIS
EXPANSION POSSIBILITIES

| DESCRIPTION OF UTILITY SYSTEM FACILITIES | CURRENT OPERATING CONDITIONS | 1 | | 2 | | CONSTRUCT PROGRAM |
|--|------------------------------------|-------------------------|-------------------------------------|---------------------------------|------------|----------------------|
| | | CONSERVATION PROGRAM | TRANSITION TO DESIGN CAPACITY | RENTAL OR LEASE AGREEMENT | | |
| (1) Water ^A | 32,500 | Reasonable | N/A | N/A | Reasonable | |
| (2) Waste ^B | 25,000 | Reasonable | 27,300 | N/A | Reasonable | |
| (3) Heating ^C | N/A | Reasonable | N/A | N/A | Reasonable | |
| (4) Electrical ^D | 27,600 | Reasonable | N/A | 55,100 | 45,900 | |
| (5) Communications | N/A | N/A | N/A | Reasonable | Reasonable | |

Notes:

- A. Table 1.2.7
- B. Table 1.3.2
- C. Table 1.4.3
- D. Table 1.5.2



Step II

mission analysis

Step II

MISSION ANALYSIS

FORT HUACHUCA

EXPANSION CAPABILITY PLAN

Step II

MISSION ANALYSIS

FORT HUACHUCA

EXPANSION CAPABILITY PLAN

STEP II

MISSION ANALYSIS - FORT HUACHUCA EXPANSION CAPABILITY PLAN

2.1 GENERAL DESCRIPTION OF MISSION AND INFLUENCE ON ANALYSIS:

2.1.1 Mission and Organization:

Fort Huachuca began as a cavalry post during the Indian Wars and its proximity to Mexico resulted in its playing an important part in the Villa Punitive Expedition. The fort remained a cavalry post until World War II when it became an Army Training Center with full infantry divisions engaged in basic and field training. In addition, miscellaneous units such as 372nd Infantry Regiment, 827th Tank Battalion, 715th MP Battalion, 3551st Ordnance Company and many others of various strengths utilized its facilities on an irregular basis for specialized training. This installation was closed in the summer of 1947 and, in the summer of 1948; 76,541.58 acres were designated excess and permanently disposed of to the State of Arizona, the Arizona Game and Fish Commission, and the original owners.

In February 1951, the U. S. Air Force reoccupied the Post and in April 1951, the Department of the Army assumed administrative control and began extensive rehabilitation for the mission of training aviation engineer troops. Huachuca was closed again in 1953 and then, in 1954, reactivated. It has remained open ever since.

In 1954 the Army Electronic Proving Ground (USAEPG), commenced its mission involving electronic systems. This mission includes research and testing of electronic systems and equipment. Specialized individual and unit training is also provided.

The U. S. Army Communications Command established its headquarter at Fort Huachuca in 1967. This command encompasses the greatest number of personnel on the installation and the operation is primarily administrative. The 11th Signal Group, a Forces Command (FORSCOM) unit, is attached to the Communications Command and supports the communications mission world-wide. This unit is the largest of the Table of Organization and Equipment units assigned to Fort Huachuca and trains at the installation utilizing equipment requiring minimum distances from built-up areas, absence of foreground vegetation and antenna clearances. The units comprising the Communications Command are listed below:

Headquarters, United States Army Communications Command
U. S. Army Communications - Electronics Engineering Installation Agency
U. S. Army Communications Command Agency - Fort Huachuca
U. S. Army Communications Systems Agency
11th Signal Group
U. S. Army Air Traffic Control Activity
U. S. Army Communications Management Information Systems Activity

The U. S. Army Combat Surveillance School has combined with the U. S. Army Intelligence School to form the U. S. Army Intelligence Center and School (USAICS). This Training and Doctrine Command (TRADOC) activity includes both classroom instruction and field training for officer and enlisted students. Training requirements are directed by TRADOC and a special group, the Combined Arms Team (CAT), which demonstrates weapons, equipment, and tactics for the students.

Other major commands supported by Headquarters Fort Huachuca, which provides station services, are Joint Test Element (TRI-TAC) and U. S. Army Medical Department Activity (MEDDAC). TRI-TAC tests and evaluates all new electronic and communication equipment before it can be adopted by any branch of the service. The major portion of its personnel is made up of TDY personnel taken not only from the Army but from other branches of the service and from the civilian sector to test equipment in the development stage. Much of TRI-TAC's equipment is mobile and the testing can be conducted anywhere on Post and even off-Post. Because of the transitory nature of its personnel, there are few general training requirements for this group.

Fort Huachuca's training areas and ranges are available to various units of the Army Reserve, National Guard, ROTC and other Department of Defense personnel. The largest of these units is the 8th BN/40th Armor which occupies several buildings in the 800 area, using them for barracks, offices, and for storage and maintenance of M-60 tanks and other equipment. The 40th Armor uses the tank ranges and maneuver areas for one weekend each month and for two weeks during the summer. It has had strengths of 120 men on occasional weekends. Except for the intelligence school's use of a few tanks for demonstration purposes, the 40th Armor is the only organization which uses tanks on the installation.

Reserve units vary in strength and the use of the training facilities change from year to year so there are no firm yearly figures for such utilization. At the present time units such as the 40th Armor are the only ones utilizing certain training areas. It is assumed that during capability expansion the Reserve units will be supported but will not grow in strength above present levels.

Strength levels for active units presently utilizing the training facilities are listed in Table 2.1.1:

MILITARY STRENGTH LEVELS OF
UNITS UTILIZING TRAINING FACILITIES

| <u>Officer</u> | <u>WO</u> | <u>Enlisted</u> | <u>Total</u> |
|----------------|------------|-----------------|--------------|
| 209 | 48 | 2,315 | 2,572 |
| 202 | 15 | 711 | 928 |
| 349 | 33 | 643 | 1,025 |
| 37 | 5 | 286 | 328 |
| 97 | 16 | 1,102 | 1,215 |
| 66 | 13 | 446 | 525 |
| 100 | - | 226 | 326 |
| 89 | 19 | 505 | 613 |
| <u>1,149</u> | <u>149</u> | <u>6,234</u> | <u>7,532</u> |

Mission on Analysis:

At Huachuca consists of many commands and tenant units, this attempt to examine the constraints to expansion based on the missions of each tenant unit. By comparing present requirements and capabilities and expansion capabilities, limiting factors to mission expansion can be identified. This analysis of mission expansion potential is general in scope as guidance furnished in TB ENG 354, Installation Capability Guide, does not address growth of the type of units at Huachuca.

This assessment procedure expresses expansion capability as a function of expansion capacity based on mission rather than effective populations; as mission expansion capability translates into population relative to mission needs at the defined expansion capacity, an "effective population" can be developed. This analysis meets the intent of TB ENG 354, that is to identify a maximum supportable population.

Mission Analysis:

The objective of this mission analysis can be stated as defining by an order of magnitude percentage, the extent each mission could reasonably grow within a period of nine months and translating this mission expansion capability to an effective population. Each mission involves different characteristics and contributing variables; however, the analysis must be somewhat standardized.

to provide continuity. A series of alternatives has been identified for each mission and the resulting effect upon mission growth qualified. The following alternatives provide a degree of uniformity for analyzing the potential growth of the mission:

Alternative One: Increase Manpower

Alternative Two: Increase number of working shifts.

Alternative Three: Increase efficiency by adding sophisticated equipment.

Alternative Four: Increase working area through a construction program.

The analysis provides the installation master planner a yardstick for evaluating mission growth based on several alternatives to current operation. Logically, maximum mission growth will involve a combination of these alternatives.

To facilitate this mission analysis, the functions of Fort Huachuca have been classified into the following categories:

- Research, storage, and maintenance missions
- School and administrative
- Communications mission
- Medical mission
- Support mission

According to AR-210-23, Master Planning for Army Installations - Emergency Expansion Capability, the following criteria should be considered when assessing expansion capability for different types of missions:

- ..Research & Maintenance: "...assess capability of existing facilities, recommend areas best suited for mobilization expansion, and identify limiting factors to support functions.... The ease of expansion should also be addressed."
- ..School: "...expansion capability is determined by extending a balanced expansion of the school or administration as shown for full mobilization to the maximum potential capability of the land area of this installation."
- ..Communications: "...Communication requirements ... will be accomplished as directed by HQ U. S. Army Communications Command."

In the analysis that follows, each mission is given a description with reference to mission activities for each relevant unit. The operational characteristics for each mission are also outlined, including land area, facilities, and personnel.

A subjective analysis of the alternatives and resulting effect upon potential mission growth is then discussed and expressed as an order of magnitude percentage. This order of magnitude is then attempted to be apportioned to each tenant activity and unit within each major function of research, school, and communications.

2.2 MISSION DESCRIPTION:

2.2.1 Research Activities:

a. U. S. Army Electronic Proving Ground:

1. General: The Electronic Proving Ground was established at Fort Huachuca in 1954 to test military electronic equipment being developed for the Army. The Electronic Proving Ground's current mission is to assure the performance, quality and the soldier operator/maintenance interface with the electronic equipment used by individual soldiers and units throughout the Army. The Electronic Proving Ground's responsibility includes tests of surveillance, communications of all kinds, avionics, automatic data processing, meteorology and electronic warfare activities, sensors and remotely piloted vehicles. The Electronic Proving Ground is one of the activities and installations of TECOM, the Army's Test and Evaluation Command, a major part of the U. S. Army's Material Development and Readiness Command (DARCOM).

2. Operational Characteristics: The Electronic Proving Ground's area of operations includes facilities on Fort Huachuca, the Electromagnetic Environmental Test Facility operated by contract in Tucson and several field test sites across southern Arizona. Examples of test operations have included high speed digital transmissions, surveillance systems of Mohawk OV-ID aircraft, engineering tests of landing controls, and tests involving the USD-501 Canadian Drone and electronic counter-measures type equipment.

3. Active Strength: The current active strength of the Electronic Proving Ground is 328 military and 196 civilians or a total of 524 persons.

b. U. S. Army Security Agency Test and Evaluation Center:

1. General: The U. S. Army Security Agency Test and Evaluation Center was established at Fort Huachuca in 1954 and is a major subordinate command of the United States Army Security Agency. The center manages and performs the Development Test (DT) mission, testing new equipment to be used by the Army Security Agency and conducts equipment demonstration as required. The center plans, programs and carries out continual improvement of instrumentation, facilities and methodology for testing of sophisticated electronic equipment being developed for future use by the security agency.

2. Operational Characteristics: While most tests are carried out at Fort Huachuca, the U. S. Army Security Agency Test and Evaluation Center is often called on to conduct tests throughout the U. S. Equipment tested may range from an individual electronic unit such as a receiver or antenna to a high complex integrated system with combined ground and airborne elements.

3. Active Strengths: The total active strength of the U. S. Army Security Agency Test and Evaluation Center is 196 personnel including 148 military and 48 civilians.

2.2.2 School and Administrative Activities:

a. The U. S. Army Intelligence Center and School:

1. General: The mission of the Intelligence Center is to develop the intelligence doctrine, material requirements, organizations and training programs and literature necessary to support the tactical commander, and to provide resident and non-resident intelligence training for active and reserve military sister services, foreign military and designated civilian personnel. The Intelligence Center is organized into four directorates:

- .. Directorate of Combat Development: responsible for development of intelligence doctrine, organization and equipment requirements.
- .. Directorate of Training Developments: develops training management programs.
- .. Directorate of Training: responsible for actual training of personnel.
- .. Directorate of Evaluation and Resources: responsible for evaluating efforts of the U. S. Army Intelligence Center and School.

2. Active Strength: The U. S. Army Intelligence Center and School has a full time strength of 938 permanent party and an average of 850 students.

2.2.3 Communications Activities:

a. U. S. Army Communications Command:

1. General: Fort Huachuca is headquarters for the U. S. Army Communications Command (USACC) - a major Army command responsible for the world-wide communications vital to the defense of the nation and the Free World. It

commands the diverse activities of over 30,000 military and civilian personnel all over the globe.

USACC is responsible for, among other things:

- ..engineering, installing, operating and maintaining the Army's portion of the global Defense Communications System.
- ..communications-electronic support for Army bases worldwide.
- ..management of the acquisition, engineering and installation of modern fixed communications systems used by O & M commanders.
- ..Army Air Traffic Control
- ..communications security, logistics support to all world theatres of operation.
- ..quick reaction communications to support contingency requirements.

2. Operational Characteristics: Within the DCS network which the USACC directs are major switching systems which provide voice and record communications serving National Command Authorities and military forces. These systems include: Automatic Digital Network (AUTO DIN), the Automatic Voice Network (AUTO VON), and the Automatic Secure Voice Communications System (AUTO SEVOCOM).

3. Active Strength: The total active strength for all USACC units is 4320 with 2710 civilians and 1610 military.

TABLE 2.2.1

DISTRIBUTION OF PERSONNEL

U. S. ARMY COMMUNICATIONS COMMAND

| <u>USACC Tenant Unit</u> | <u>OFF</u> | <u>WO</u> | <u>ENL</u> | <u>MIL</u> | <u>CIV</u> | <u>TOTAL</u> |
|------------------------------|------------|-----------|------------|-------------|-------------|--------------|
| HQ USACC | 59 | 7 | 39 | 105 | 567 | 777 |
| HQ USACEEIH | 49 | 12 | 171 | 232 | 501 | 965 |
| USACC AGENCY | 2 | | 106 | 108 | 52 | 268 |
| USAATCA | 8 | 1 | 18 | 27 | 35 | 89 |
| USACOMISA | 3 | | 15 | 18 | 146 | 182 |
| USARCCO | 3 | | 5 | 8 | 45 | 61 |
| USA CSA | | | | | | |
| Fort Huachuca | 8 | | 7 | 15 | 19 | 49 |
| CEI BN | 21 | 10 | 541 | 572 | 59 | 1203 |
| Subtotal | <u>153</u> | <u>30</u> | <u>902</u> | <u>1085</u> | <u>1424</u> | <u>3594</u> |

2.2.4 Medical Activities:

a. U. S. Army Medical Department Activity:

1. General: The U. S. Army Medical Department Activity (MEDDAC) provides health care to eligible individuals. MEDDAC is composed of the following activities: Raymond W. Bliss Army Hospital, Dental Activity, Veterinary Activity, Health and Environmental Activity and Mental Hygiene Consultant Service.

2. Operational Characteristics: The Raymond W. Bliss Army Hospital is the largest single element of the Medical Department activity. Both in-patient and out-patient care are provided to personnel authorized by the Department of the Army in a 110 bed facility with three wards: Ward 1 - delivery, nursery and OB-GYN ward; Ward 2 - medical ward, includes acute care unit; Ward 3 - surgical ward, includes pediatric section.

Dental Activity: composed of dental headquarters with five separate dental treatment facilities.

Health and Environmental Activity: provides complete health and environmental program with programs in occupational health, health nursing and environmental sanitation.

Mental Hygiene: provides out-patient social work service for psychiatric or psychological counseling, consulting service for other hospital departments, parental education, other social counseling and referral.

3. Active Strength: The total MEDDAC strength equals 549 persons including 223 civilians and 326 military personnel.

2.2.5 Support Activities:

a. Headquarters, Fort Huachuca:

1. General: Headquarters, Fort Huachuca manages the diverse functions and services that keep the 73,000 acre installation operating so that other missions on post may concentrate on their primary missions.

Responsibilities include: police and fire protection, bus and taxi service, building and ground maintenance, payroll, supply distribution, commissary, communications system, water and sewer system, real estate management, family housing, court, legal and hospital services, religious services, sports program, youth activities, welfare and entertainment activities. In addition, Fort Huachuca supports Reserve and National Guard Units.

2. Active Strength: The total active strength is 1811 including 525 military and 1286 civilians.

b. Libby Army Airfield:

1. General: The airfield, a facility of USACC and HY Fort Huachuca, supports post tenant organizations and transient aircraft with air traffic control facilities: Terminal Visual Omni Range (TVOR), Non-directional Low Frequency Beacon, a Ground Controlled Approach (GCA), radar, and complete Air Traffic Control (ATC). Also facilities include refueling, parking, crash rescue services, aircraft maintenance and flight planning and filing facilities. ATC services are provided for Fort Huachuca Aviation Club, USAIC, USAEPG, USASATEC and the 40th Signal Battalion. Civilian aircraft also use the airfield as a joint use facility with Lena Vista Municipal Airport.

2.3 MISSION EXPANSION ANALYSIS:

2.3.1 General:

The mission analysis involves addressing the four alternatives listed previously and qualifying the impact of these alternatives upon potential growth of the installation's missions as a whole. As indicated in Section 2.1.3, presently assigned missions are assumed to expand. The pattern of incremental growth shall accrue to all missions in a proportion to that delineated in Step IV of this report. This analysis shall simply attempt to qualify in general terms what factors shall be influential in determining how the missions shall grow and to what levels of incremental growth.

2.3.2 Analysis:

Alternative One, increasing mission tenant activities by hiring additional personnel, would have a significant impact on mission growth. Those factors limiting personnel growth are basically time and space, both for working and cantonment. Assuming space is not a limiting factor in cantonment of additional military personnel, the work place space capacity to accommodate additional personnel is the basic consideration.

However, if we assume that facility additions are capable of being added within nine months, this factor too is not critically limiting. Therefore, as a rough estimation of overall mission expansion capability based simply on how many additional personnel can be brought in with the space available, at least 80-100% increase in personnel could be accommodated and as high as 200 % depending on the degree of capability expansion.

Alternative Two, increasing mission expansion capability by adding more work shifts would impact mission growth. Presently there is one daily shift for personnel for all missions except medical and some support missions. Assuming that all missions could expand to more than one shift, expansion could be at least to +100% with one additional shift or +200% with two additional shifts.

However, it is not likely the existing missions are conducive to requiring a work force employed round the clock. Since almost all missions involve more than simple production type tasks and involve complex skilled work, 3rd and perhaps 2nd shift operations would not be conducive to accurate and efficient work. However, if we assume one additional shift as possible, there is an increase in mission capability of up to 100% possible. Any mission expansion beyond this level with additional shifts would require additional facilities.

Alternative Three, increase equipment sophistication would not in itself directly impact mission expansion unless these additions involved increased functions of the various tenant activities. If indeed, new programs or responsibilities with the requisite equipment are added, mission expansion capability may be increased. However, without additional direction by any tenant activity and its respective command, no additional responsibilities and related equipment are expected under expansion beyond those which they already have.

Alternative Four, increased efficiency of operation by adding new facilities, would impact mission expansion. New facilities, as indicated in the previous alternatives would avail the opportunities to both increase personnel on existing shifts and to increase the number of shifts.

Based on a comparison of the mission expansion capability considering the previous alternatives, an expansion capability potential of 350% or the current population has been roughly estimated as the order of magnitude of increase available. This is based on a three shift operation (at 250% of current efficiency) and providing space for an additional 12,000 persons (prorated on a three shift operation). This can be translated to a supportable effective population of about 42,000 persons:

$$(12,036 \text{ persons})(350\% \text{ mission increase}) = 42,126 \text{ persons}$$

The alternatives available for expansion of mission activities are delineated in Table 2.3.1.

TABLE 2.3.1

MISSION ANALYSIS

EXPANSION POSSIBILITIES

| | <u>CURRENT OPERATING CONDITIONS</u> | <u>ALTERNATIVES</u> | | | |
|-----------------|---|------------------------------------|----------------------------------|--|---------------------------------------|
| | | <u>1 INCREASE MANPOWER</u> | <u>2 INCREASE SHIFTS</u> | <u>3 SOPHISTICATED EQUIPMENT</u> | <u>4 CONSTRUCTION PROGRAM</u> |
| Current Mission | 12,036 | 25,000 | 30,000 | Reasonable | 12,000 |

Note: Maximum capacity equals 42,000 persons based on a three shift operation and providing space for an additional 12,000 persons (prorated to a three shift operation). Refer to Section 2.3.2 for discussion.

2.4 TRAINING FACILITY DESCRIPTION:

2.4.1 Range and Training Areas:

a. General:

The 73,344 total acres at Fort Huachuca are roughly divided into a 5,551-acre cantonment area, including Libby Airfield, and three other areas called the East, West and South Ranges.

b. East Range (Refer to Figure 2.4.1)

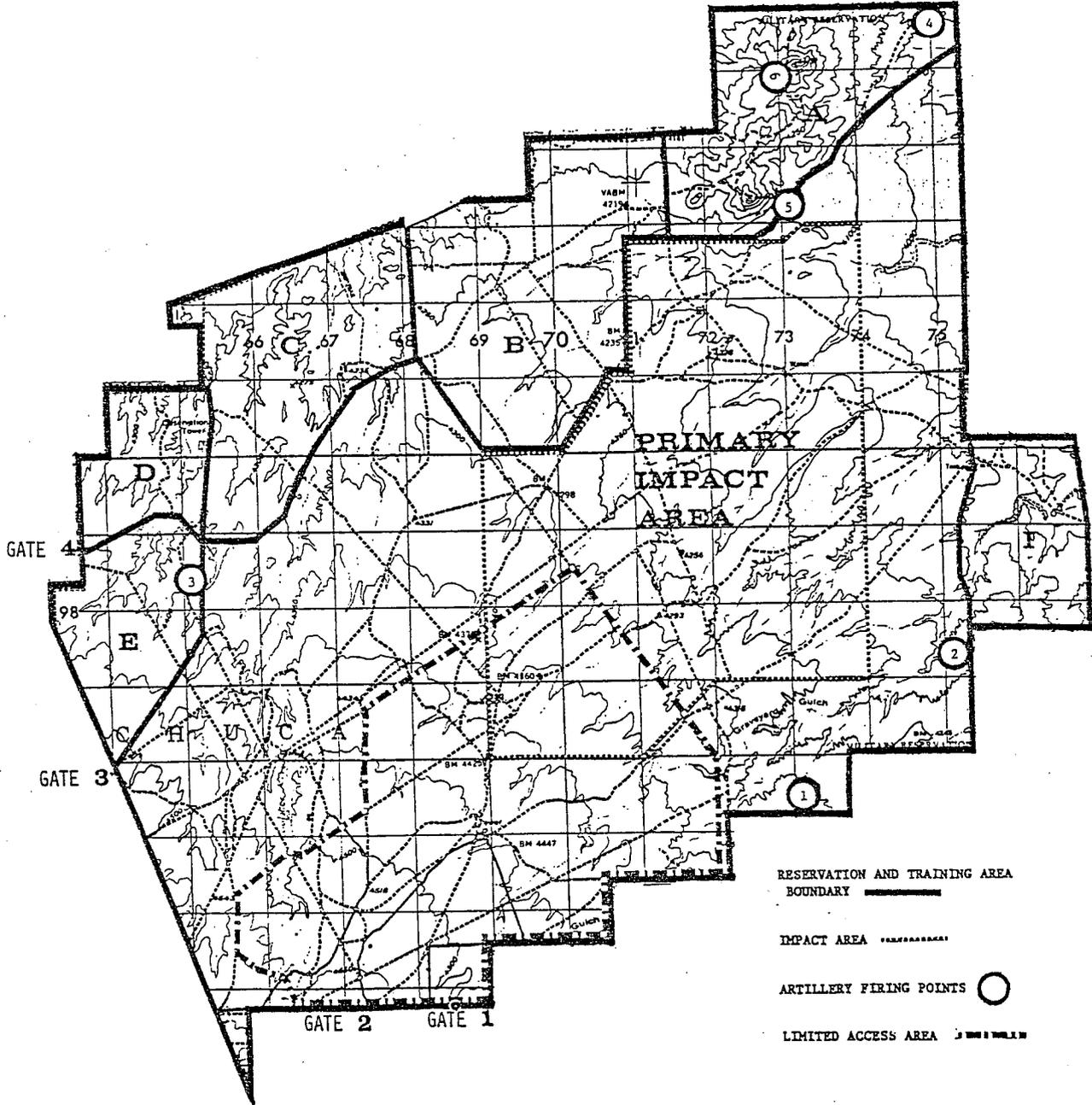
This is the largest range, with approximately 28,544 acres, and encompasses the entire land area of the East Reservation. Located directly north of the Sierra Vista community and northeast of the Fort Huachuca cantonment area, the East Range is separated by Arizona Highway 90 from the cantonment area and the West and South Ranges. Of its four control gates, all off of Highway 90, two are along the south property line and two along the west property line after the highway makes a 90-degree turn.

The range is divided into training areas totalling 10,827 acres and lettered A through E and I; with the remaining 17,717 acres set aside as impact area. Because of the possible existence of unexploded ordnance, impact areas are not scheduled for bivouac or maneuvers. Also, during the summer rainy season, water turns the soil to mud and creates erosion which leaves large gullies making this range less desirable for maneuvering of tanks and armored personnel carriers (APC). USAEPG maintains a number of permanent test facilities, such as radar spokes and antennas, and also has several test buildings just north of the main gate.

In the northeast corner lies Hill 4440, the observation post for two mortar and one artillery range. They can accommodate more than one unit but cannot allow more than two firing at the same time from designated firing points at fixed targets. The East Range also contains a fixed-wing airstrip for tactical, proficiency and emergency use.

A summary of the East Range acreage by designated areas is delineated in Table 2.4.1, and the East Range facilities are provided in Table 2.4.2.

EAST RANGE



RESERVATION AND TRAINING AREA
BOUNDARY **—————**

IMPACT AREA **-----**

ARTILLERY FIRING POINTS **○**

LIMITED ACCESS AREA **-----**

TABLE 2.4.1

EAST RANGE TRAINING AREA ACREAGES

| <u>TRAINING AREA</u> | <u>ACREAGE</u> |
|----------------------|----------------|
| A | 1,544 |
| B | 1,567 |
| C | 1,221 |
| D | 1,634 |
| E | 976 |
| F | 735 |
| G | 1,046 |
| H | 953 |
| I | 2,151 |
| Impact Area | 6,097 |
| Impact Area | <u>11,620</u> |
| Total | <u>28,544</u> |

TABLE 2.4.2

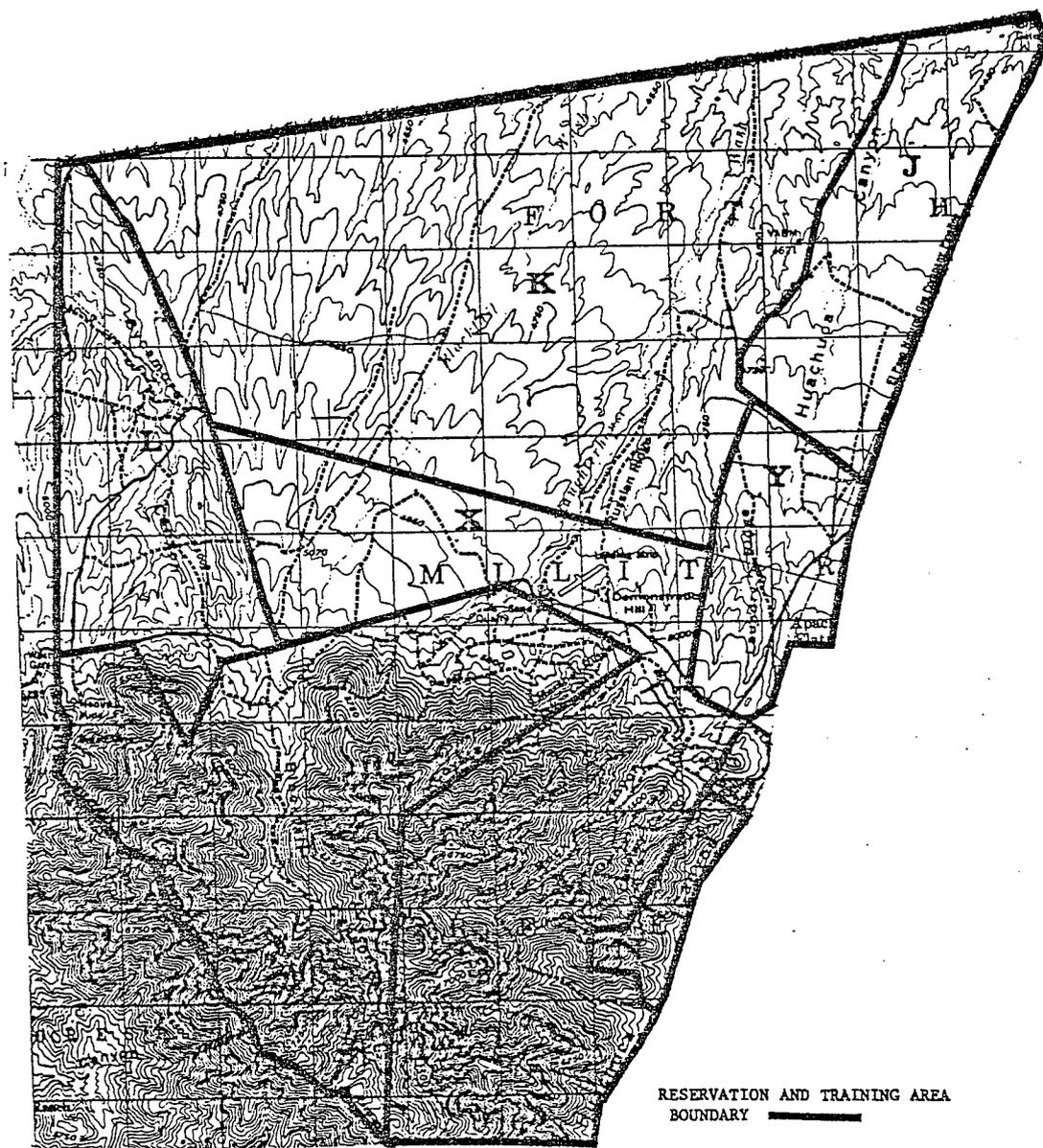
EAST RANGE FACILITIES

| | | | |
|----|-----------------|---|---|
| 19 | 81-mm mortar | 1 | 81-mm range consists of an impact area and firing point #5 |
| 20 | 4.2-in. mortar | 1 | Consists of an impact area and firing point #6 |
| 21 | 105-mm Howitzer | 4 | Weapon 105-mm Howitzer, towed & self-propelled consisting of an impact area & firing points #1 through #4 |

c. West Range (Refer to Figure 2.4.2):

Located to west of the cantonment area, this section contains 18,259 acres in the northern portion of the West Reservation. Approximately 15,178 acres are allotted to designated training areas J through N, X and Y with the remaining 3,081 acres used as an impact area. Training area K, consisting

WEST RANGE



of 5,801 acres, is the only approved tract maneuver area on the Post. Training area L, 1,792 acres, contains the land navigation course. Area X, 1,605 acres, has helicopter pads for tactical proficiency and emergency operations and also contains Sentinel Hill which may be used as fire direction control center or for conducting demonstrations.

A summary of the West Range Acreage by designated areas is delineated in Table 2.4.3.

TABLE 2.4.3

| <u>WEST RANGE TRAINING AREA ACREAGES</u> | |
|--|----------------|
| <u>TRAINING AREA</u> | <u>ACREAGE</u> |
| J | 1,448 |
| K | 5,801 |
| L | 1,792 |
| M | 3,383 |
| N | 293 |
| X | 1,605 |
| Y | 856 |
| Impact Area | 3,081 |
| Total | <u>18,259</u> |

d. South Range (Refer to Figure 2.4.3):

This range is located to the south of the cantonment area and contains a total of 20,990 acres, including almost all of that part of the Huachuca Mountains which are located on the Post. It has eight training areas, O through V, comprising 12,245 acres; the remaining 8,745 acres are set aside as impact areas. A rappelling tower, training mockups, physical combat proficiency test area, and leadership reaction course, as well as all of the small arms and tank ranges, 1 through 9 and 11 through 18, are located in this range. The gas chamber building T77420, located in the cantonment area off Center Street and just to the northeast of the Transportation Motor Pool, is also listed as a South Range facility.

Range 14 contains five tank tables with a total of 121 firing points. When tanks are firing on this range, adjacent ranges, or approximately 80 per cent of all ranges, are unusable. At such times only three other ranges can continue activities. A new range, no. 13, has just been constructed to meet requirements for a subcaliber tank range, and range no. 18 is planned to fulfill

Figure 2.4.3

SOUTH RANGE

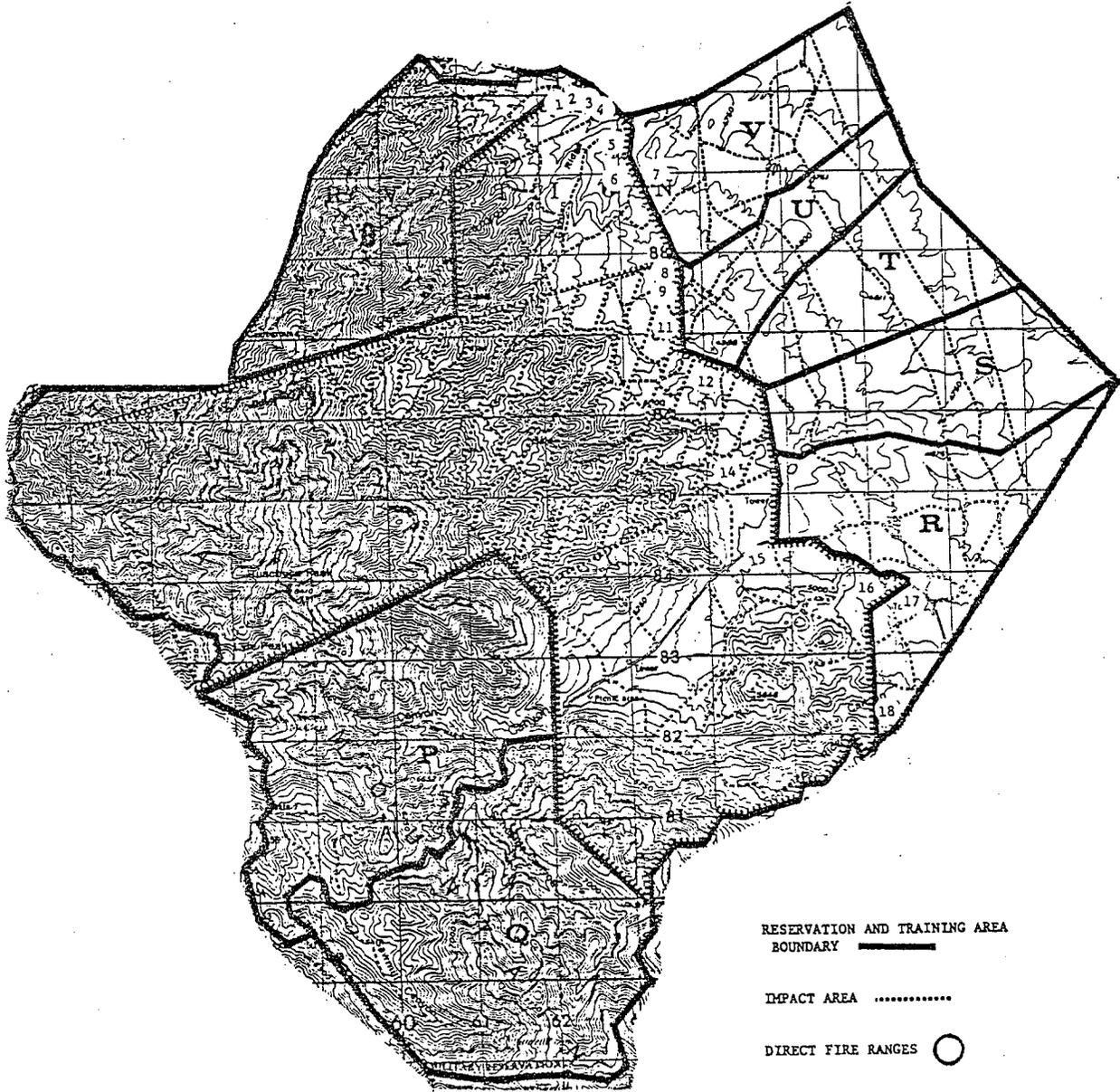
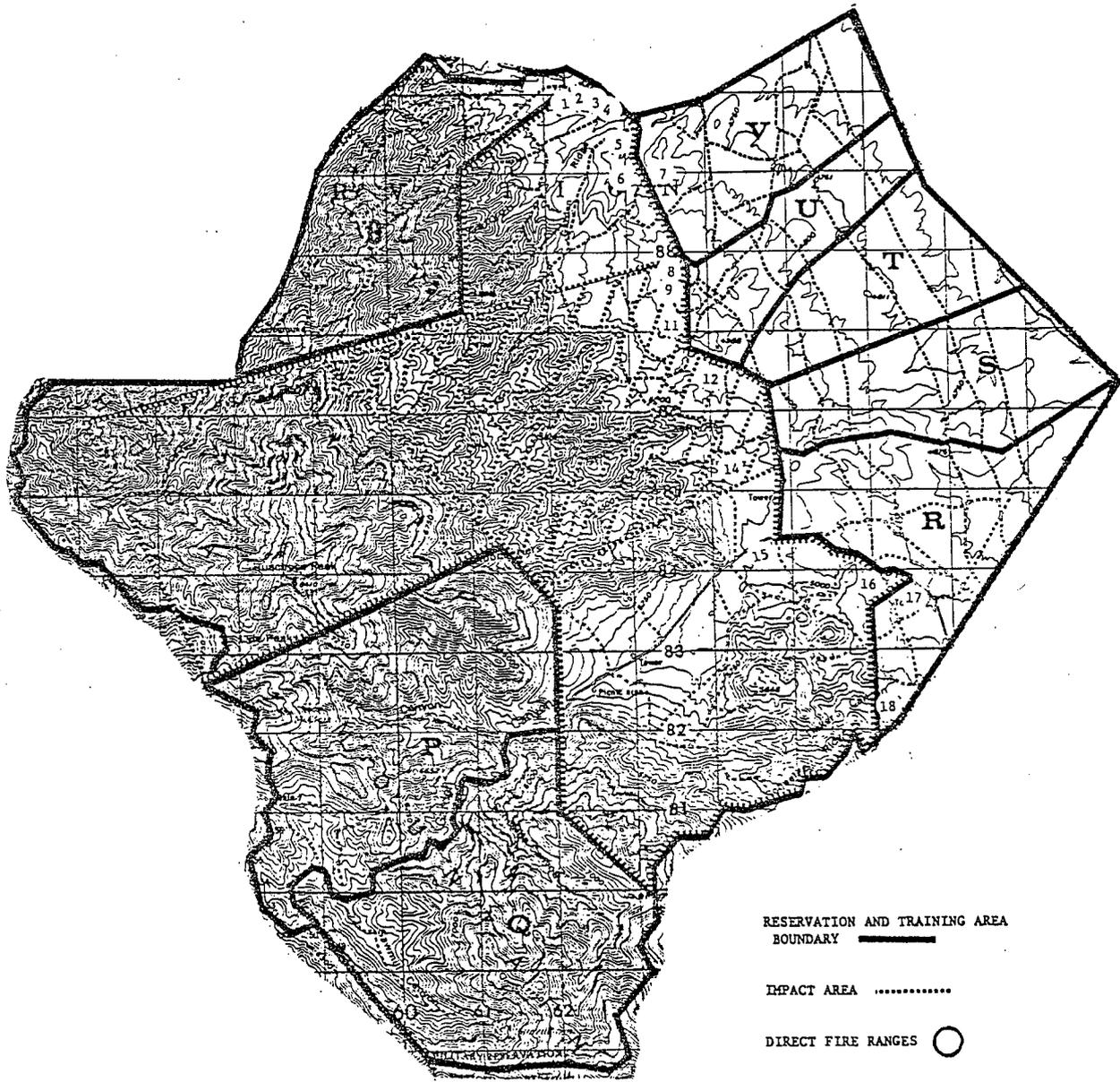


Figure 2.4.3

SOUTH RANGE



RESERVATION AND TRAINING AREA
BOUNDARY **—————**

IMPACT AREA ○

DIRECT FIRE RANGES ○

requirements for a tank table that is not now available. At the present time there is no 50-caliber qualification machine gun range, but the resources for one are available and it could be constructed if needed.

A summary of the South Range acreage by designated areas is delineated in Table 2.4.4.

TABLE 2.4.4

SOUTH RANGE TRAINING AREA ACREAGES

| <u>TRAINING AREA</u> | <u>ACRES</u> |
|----------------------|---------------|
| O | 2,021 |
| P | 2,501 |
| Q | 2,331 |
| R | 1,489 |
| S | 1,132 |
| T | 906 |
| U | 686 |
| V | 1,179 |
| Impact Area | 2,015 |
| Impact Area | 3,177 |
| Impact Area | 1,199 |
| Impact Area | 2,354 |
| Total | <u>20,990</u> |

A summary of the South Range facilities and capabilities is provided in Table 2.4.5.

TABLE 2.4.5

SOUTH RANGE FACILITIES

| <u>Range No.</u> | <u>Type</u> | <u>Firing Points</u> | <u>Remarks</u> |
|------------------|---|----------------------------|--|
| 1 | M-60 machine gun | 30 | |
| 2 | Rifle marksmanship | 110 | Trainfire 25-75 meters M-14 & M-16 rifle |
| 3 | Unit marksmanship | 20 | 22-caliber rifle |
| 4 | small bore Junior Rifle Club | 30 @ 25m, 4 @ 50 m | Assigned to ADYA, scheduled by DPTSEC |
| 5A | Competition pistol | 25 | Standard targets at 25 & 50 m |
| 5B | Standard pistol course | 4 | Pop-up targets |
| 5C | Standard law enforcement course | 2 | Lineage silhouettes |
| 6 | Hand grenade | 8 | |
| 7 | Skeet & Trap | 2 skeet & 1 trap course | Assigned to and scheduled by Personnel & Community Activities Directorate |
| 8 | Known Distance rifle | 50 | M-14 & M-16 rifle distances 100, 200, 300, 500, 600 and 1,000 yards |
| 9 | Rifle marksmanship field & night fire | 35 | M-14 & M-16 rifle pop-up targets located at 75, 175, and 300 meters |
| 11 | 90, 106 recoilless rifle field firing, 50-caliber machine gun field firing, Claymore mine pits, LAW, & 3.5 rocket launcher range | 12 | Weapons 106 mm, .50 caliber, machine gun, .90 mm (all recoilless), M18A1 Claymore, 3.5 rocket launcher & 66 mm LAW |
| 12 | 40 mm grenade launcher, M-79 & M-203 qualification & familiarization | 12 (3 lanes) | Weapons 40 mm grenade launcher, M-79, M-203 |
| 13 | Subcaliber tank | | New Construction |

continued

TABLE 2.4.5 continued

| <u>Range No.</u> | <u>Type</u> | <u>Firing Points</u> | <u>Remarks</u> |
|------------------|---|-----------------------|---|
| 14 | Tank tables I, II, & III Tank tables IV Tank tables VI Rifle marksmanship, record fire | 6 8 | Weapons M-16 .22 caliber device, 50-caliber, 7.62 mm machine guns, 40 mm grenade launcher, 105 mm tank gun M-14 & M-16 rifles - pop-up targets located at a distance of 50 to 350 meters |
| 15 | Rifle marksmanship, record fire | 16 w/ foxholes | M-16 rifle & M-60 machine gun course has ten targets to represent personnel in the defense of the objective & four targets to represent an enemy counterattack. There are 10 demolition pits to represent indirect fire support. Machine gun simulators are used to represent enemy fire. |
| 16 | Squad attack course | Squad size unit | M-16 rifle, pop-up targets |
| 17 | Close combat course | 5 firing lanes | M-16 rifle, M160 machine gun course has 12 targets to represent personnel in the defense of an objective and 14 targets to represent enemy fire. |
| 18 | Rifle platoon attack course | Platoon size units | |

2.4.2 Open Operational Areas:

a. General:

Fort Huachuca's three ranges contain a total of 67,793 acres, and if the 2,837 acres of Libby Army Airfield are included, there are 70,630 acres of land available for open training and firing ranges.

b. Impact Areas:

A total of 29,543 acres is designated as impact areas on the three ranges. The largest of the impact areas is the relatively flat 17,717 acres in the East Range. Only the heavier ordnance uses this range. The other impact areas, in the West and South Ranges, are located in the rugged terrain of the Huachuca Mountains. Impact areas in the South Range receive fire from small caliber weapons, grenade launchers and the 105-mm tank weapon.

Impact areas are restricted areas and, unless they have been cleared by Explosion Ordnance Disposal (EOD) personnel, are not available for other uses. The impact area in the West Range has not been used in over 20 years but is still designated an impact area as it has not been cleared.

c. Training Areas:

Twenty-four designated training areas containing 38,250 acres are available for the various training and testing requirements at the post. The relatively level training areas in the East Range can be treacherous for use by tracked vehicles, particularly after rain. In addition, this is the only approved maneuver area on the post for tracked vehicles. However, it could not accommodate both armor and infantry exercises simultaneously. Five of the designated training areas, M, N, O, P and Q comprising approximately 10,529 acres, are situated in the rugged terrain of the Huachuca Mountains. These offer the only available terrain on post for mountain training and actual rappelling from cliffs.

Open operational areas of Fort Huachuca are more than adequate to meet the requirements of the present missions, including support requirements for Army Reserve and National Guard units, with training areas large enough to accommodate battalion size infantry units in nonfiring exercises; and while many of the training areas are somewhat remote, they are easily accessible by motorized transportation and no undue loss in training time occurs because of the locations of training aids and firing ranges.

d. Cantonment Area Training Facilities:

The cantonment area has several miscellaneous training facilities in addition to the already mentioned NBC chamber.

USAICS classrooms have been located in 46 temporary buildings until permanent facilities can be constructed. Twenty-seven different courses of varying duration attended by over four thousand students were taught in 1977. Classrooms are presently used approximately 200 days per year on the basis of a normal 8-hour day. Existing classrooms could accommodate an increased number of students by extending the hours and increasing the days per year.

A 50,000 square foot field house with indoor olympic standard swimming pool and two outdoor swimming pools is available for training purposes. Chaffee Parade Field, located off Irwin Street, offers a five-battalion capacity and the capability of expansion.

e. Off-Post Areas:

Fort Huachuca controls 38,036 additional acres through leases and permits from other Federal agencies, the State of Arizona, private individuals, and public land withdrawals. The largest of these areas is the Wilcox Dry Lake encompassing 29,128 acres and the Gila Bend area of 8,729 acres.

The Wilcox Dry Lake, approximately 40 air miles northeast of Fort Huachuca provides land for a USAEPG Radar Geometric Fidelity complex and Radar Geology Test area. The Radar Geometric Fidelity complex covers 35 square miles on a land surface that is flat and level, free of vegetation, and dry except during the raining season. The northern portion of Wilcox Dry Lake was once used for equipment testing by U. S. Army Security Agency Test and Education Center (USASATEC). The unoccupied east and south areas are currently being used by the U. S. Air Force as an emergency drop area for bombs and fuel tanks and as a crash site.

The Gila Bend area is used primarily for testing of communications-electronics and navigational and surveillance systems or devices involving aircraft or missiles.

Numerous other sites of small acreage throughout the general area are periodically obtained under short-term leases for test purposes.

2.5 TRAINING FACILITY ANALYSIS:

2.5.1 Training Requirements by Units:

Because of the large number of units, both active and reserve, using Fort Huachuca's training facilities, special request forms must be submitted to the Plans, Training and Security Directorate (DPTSEC) Training Division (Tng. Div.). This form is also submitted when an area is needed for a testing operation. There has been no conflict for training time between active and reserve units as the latter train on weekends and for several weeks during the summer.

Following is an example of how training areas are utilized by the different units:

| <u>Unit</u> | <u>Off</u> | <u>WO</u> | <u>EM</u> | <u>Areas Used</u> |
|-------------|------------|-----------|-----------|---|
| USACC | 169 | 46 | 1,547 | SAR, SR, A J, LX, O, R, S, T, V |
| USAICS | | | | |
| Perm Party | 202 | 25 | 692 | Mortar, Arty, SAR, SR, ER, A-E |
| Students | 418 | 25 | 757 | I-M, O-Y |
| USAEPG | 33 | 2 | 245 | SAR, SR, ER, A-D, I-M, R, S, U, V, X, Y |
| HQFH | 71 | 14 | 621 | SAR, P, Q, S, T, U, V |
| MEDDAC | 104 | -- | 242 | P, Q, V |
| OTHERS | 20 | 5 | 161 | SAR, SR, ER, A, C, D, J, K, L, M, S, U, V |

Note: SAR indicates small arms range
 SR indicates non-live fire on South Range
 ER indicates non-live fire on East Range

In addition to the above units, there were 17 Army Reserve and other military groups which used the facilities throughout the year, mostly on weekends.

The annual Utilization Survey Report for 1976 and 1977, based on a 240-260 day year, is delineated in Table 2.5.1:

TABLE 2.5.1

UTILIZATION OF TRAINING AREAS

| <u>Area/Ranges</u> | <u>1976 Man-Day Usage</u> | <u>1977 Man-Day Usage</u> |
|--------------------|-------------------------------|-------------------------------|
| A | 3,134 | 2,393 |
| B | 990 | 1,414 |
| C | 2,539 | 1,604 |
| D | 1,929 | 1,398 |
| E | 1,372 | 908 |
| I | 1,840 | 1,212 |
| J | 7,079 | 2,083 |
| K | 11,811 | 4,831 |
| L | 33,696 | 3,889 |
| M | 19 | 281 |
| N | --- | 281 |
| O | 331 | 632 |
| P | 310 | 625 |
| Q | 218 | 664 |
| R | 14,112 | 4,527 |
| S | 3,178 | 3,850 |
| T | 4,555 | 3,122 |
| U | 5,212 | 7,601 |
| V | 10,473 | 10,007 |
| X | 20,639 | 17,493 |
| Y | 3,177 | 447 |
| Arty & Mortar (ER) | --- | 46,625 |
| Small Arms Range | 143,275 | 179,590 |
| SR | 26,228 | 9,767 |
| ER | 6,317 | --- |
| NBC Chamber | --- | 1,563 |
| PT Field | --- | - 4,739 |
| Total | 302,434 men/yr | 311,616 men/yr |
| Avg./260-day year | 1,165 men/day | 1,200 men/day |

The 1976 report did not include a notation of use for artillery and mortar fire on the East Range or the NBC chamber and PT field, and the 1977 report did not note any none-live fire on the East Range. Variation in utilization of the different facilities between these two years can be attributed in part to an increase in reserve units from 17 in 1976 to 21 in 1977 and the fact that some of the reserve

units which trained at Huachuca in 1976 did not train there in 1977. Practically every unit, active and reserve, used the small arms range.

The Intelligence School (USAICS), 11th Signal Group, and the 8th Bn/40th Armor were the heaviest users of the facilities and had the most personnel. Of these it is assumed that under emergency expansion only USAICS would remain at the post and request training facilities.

The lettered training areas are open maneuver areas and the specific requirements of the units using them govern the types of training exercises performed. Areas V and X, located nearest the cantonment areas, received some of the heaviest usage, probably because these are level and open as well as the most accessible. Less used areas M, N, O, P and Q, located in the Huachuca Mountain Range, have steep rocky bluffs and are used for rappelling practice. Training personnel estimate that on an average the training facilities are utilized only to about 20 percent capacity. Thus, it is assumed utilization of training facilities could be increased to accommodate 400% additional personnel than are presently utilizing the facilities.

2.5.2 Maximum Training Capability:

Although training is a necessary requirement for all army personnel, it is not the primary activity at Fort Huachuca and the training facilities would not constitute the limiting factor to emergency expansion. They are under-utilized at the present time while providing training support to a number of units which would not be supported in emergency expansion.

Assuming that training requirements will remain the same for all active army personnel stationed at the post, the rifle ranges, physical training course and the NBC chamber would basically represent the most needed and used training facilities. Based upon the assets of three rifle ranges, 2, 9, and 15, it is estimated that approximately 100 men could complete the firing requirement of the Combat Readiness Marksmanship Proficiency-Standard Course (Army Subject Schedule No. 23-20) within an eight-hour period. The physical training course could process a company, i.e. 200 men, in two hours or less and the NBC chamber exercise could handle 200 men in a 3 to 4 hour period.

From TB ENG 354, Table E, using a 6 day week and a 12 hour day for 52 weeks at 75 percent capacity, annual available training hours would be 2800. Therefore, the rifle ranges could accommodate during a year's time the following military strength:

$$\frac{2,800 \text{ hours} \times 100 \text{ men}}{8\text{-hour period}} = 35,000 \text{ men}$$

This figure would result in rather strenuous utilization of the rifle ranges; however, if they were needed, additional rifle range, PT courses and NBC chamber facilities could be constructed within an emergency expansion period.

Under present mission training requirements Fort Huachuca's training facilities are theoretically capable of accommodating military strengths up to 35,000 men without building new facilities. However, it should be born in mind that training areas are also used by USAEPT, TRI-TAC, and others for testing electronic and communication equipment and during expansion it is expected that these operations would increase.

If Huachuca were to be considered for combat training, it is estimated that training facilities would be adequate for non-firing maneuvers of a battalion size infantry unit.

The property to the south and west of the West Reservation is under control of the U. S. Forest Service or is open range land. While there does not appear to be any requirement for additional open operational areas, it is possible agreements could be made for utilization of this land if it were needed.

2.5.3 Summary of Training Facility Analysis:

The opportunities available for expansion of the training facilities at Fort Huachuca are delineated in Table 2.5.2. It is anticipated that the population threshold could be raised through a construction program, Alternative Four.

TABLE 2.5.2

TRAINING FACILITIES ANALYSIS

EXPANSION POSSIBILITIES

| | <u>ALTERNATIVES</u> | | | |
|-------------------------------------|-----------------------------|--------------------------------------|----------------------------------|-----------------------------|
| | <u>1</u> | <u>2</u> | <u>3</u> | |
| <u>CURRENT OPERATING CONDITIONS</u> | | | | 4 |
| | <u>CONSERVATION PROGRAM</u> | <u>TRANSITION TO DESIGN CAPACITY</u> | <u>RENTAL OR LEASE AGREEMENT</u> | <u>CONSTRUCTIVE PROGRAM</u> |
| Training Facilities | N/A | 35,000 | Possible | Reasonable |

Step III
summary of utility
& mission analyses

Step III

SUMMARY OF UTILITY
AND MISSION ANALYSES

FORT HUACHUCA

EXPANSION CAPABILITY PLAN

STEP III

SUMMARY OF UTILITY AND TRAINING ANALYSIS

FORT HUACHUCA EXPANSION CAPABILITY PLAN

3.1 SUMMARY OF UTILITY AND TRAINING/MISSION CONDITIONS THAT LIMIT EXPANSION CAPABILITY:

3.1.1 Limits to Expansion:

The constraints to growth pose population thresholds for the utility systems, training facilities, and mission facilities for Fort Huachuca as follows:

Utilities: 32,500 effective population
Training: 35,000 military personnel
Mission: 42,100 effective population

The limiting factor to growth at Fort Huachuca is the capacity of the booster pumping stations in the water system. As this population, 32,500 persons, is an effective population, the actual military population will be somewhat less as subsequently developed in Step IV. The following additional utility corrections will be necessary to support this maximum population:

Waste System: Provide aerated sewage lagoons to provide additional treatment capacity of .5 mgd and expand distribution system.

Electrical System: Provide additional fan cooling capacity to the government-owned installation substation to increase capacity to 29,500 KVA and extend distribution system.

Heating System: Provide alternative heating systems to expansion facilities (fuel oil). Expansion of natural gas system to be identified pending development of plan.

Water System: Expand distribution system to service expansion facilities.

This report thus concludes with an introduction to the Cantonment Analysis, Step IV, in which the population mix of the 32,500 persons is identified. The Capability Tabulations, Capability Plan and Analytical/Environmental Report follow in subsequent tabulations.

Step IV

cantonment analysis

Step IV

INTRODUCTION TO
CANTONMENT ANALYSIS

FORT HUACHUCA
EXPANSION CAPABILITY PLAN

STEP IV

CANTONMENT ANALYSIS - FORT HUACHUCA EXPANSION CAPABILITY PLAN

4.1 INTRODUCTION TO CANTONMENT ANALYSIS:

4.1.1 General:

Step IV of the Expansion Capability Plan for an established installation constitutes an analysis of the remaining physical assets of the installation other than utilities and training facilities in order to determine their capacity to accommodate the population established as a feasible maximum in Step III, then to establish the required additional facilities based on that number.

The cantonment analysis has been accomplished by completing three objectives as summarized below:

Objective 1 - Determination of the number of tabulations required and the respective strength levels.

Objective 2 - Determination of personnel assignment.

Objective 3 - Determination of the additional facilities required and the associated cost of development.

The accomplishment of these objectives is outlined in Sections 4.2, 4.3, and 4.4 respectively.

4.1.2 Assumption Clarification:

Presently assigned missions at Fort Huachuca will continue and grow during expansion. The projected pattern of incremental growth is shown on the following Table 4.1.1 "Projected Pattern of Incremental Growth." This table was developed from the Fort Huachuca Mobilization Plan (FHMP (U)) dated 29 June 1977 and Change No. 1 dated 19 September 1977. The mobilization plan is classified "Confidential" and is not included as part of this report.

This Table defines the percentage growth of each mission during expansion. The mix of the population increase is developed in subsequent sections.

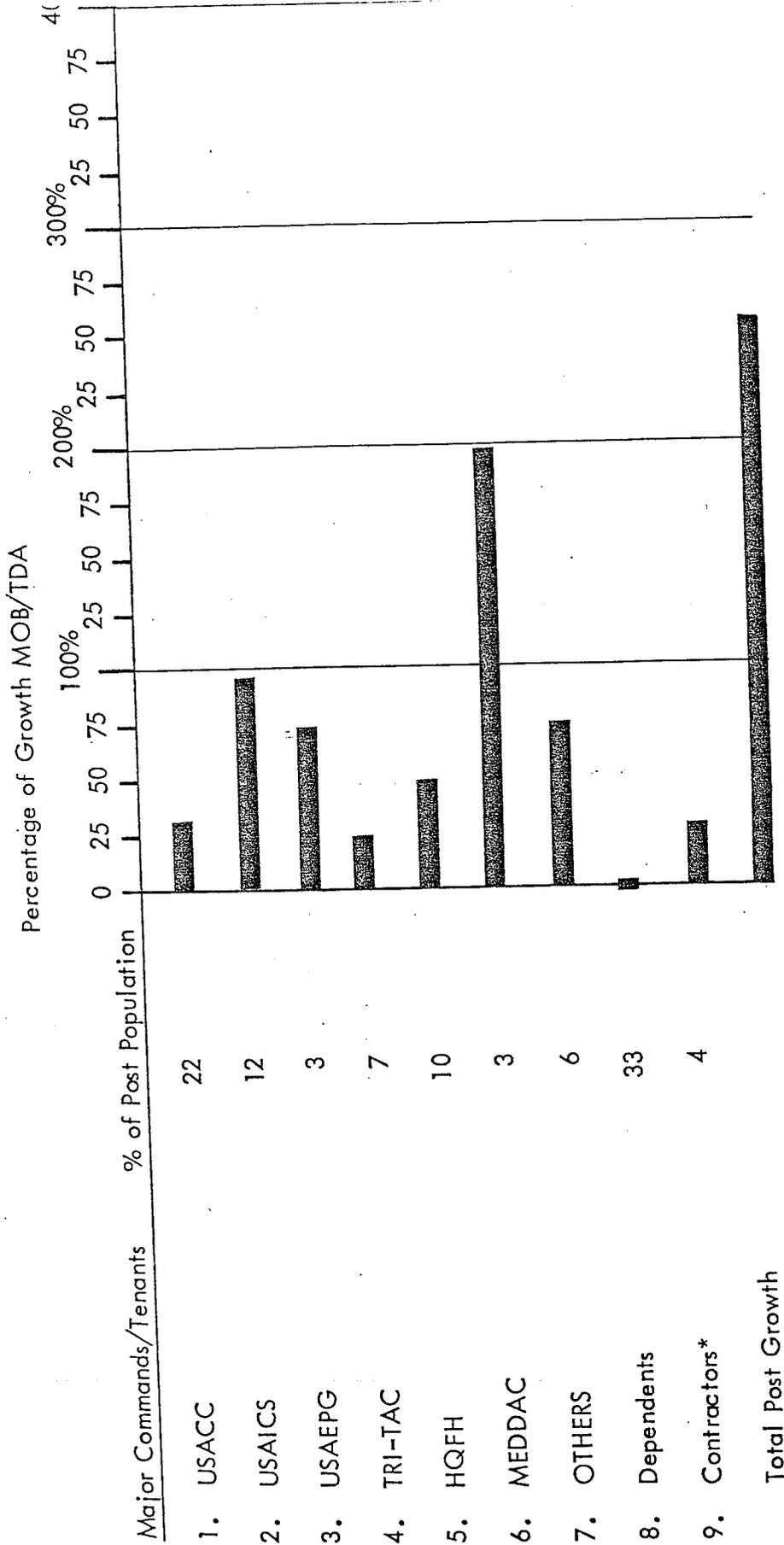
4.1.3 Maximum Military Strength:

The maximum population derived in Step III of 32,500 persons is an effective population and includes all personnel including civilian employees and

TABLE 4
RELATIONSHIP OF INCREMENTAL GROWTH

EXPANSION CAPABILITY PLAN

Fort Huachuca, Arizona



* Includes Non-Appropriated Fund Employees

dependents. A review of the present population trends is necessary to identify the equivalent military population for an effective population of 32,500 persons. The fiscal year 1979 trend reveals the following characteristics:

| | |
|---------------------------|--------|
| Total On-Post Population | 9,958 |
| Total Off-Post Population | 6,230 |
| Total Population | 16,188 |
| Effective Population | 12,036 |

The percentage of On-Post Population to "Effective Population" is approximately 83 percent:

$$\frac{9,958}{12,036} = 82.74\%$$

The following population characteristics were also revealed in the analysis of the fiscal year 1979 statistics:

| | | |
|---|--------------|----------------|
| Average Military Population (On-Post): | 4,183 | |
| Average Military Population (Off-Post): | <u>1,675</u> | |
| | 5,858 | Total Military |
| Average Dependent Population (On-Post): | 5,775 | |
| Average Civilian Employment: | 4,560 | |

This data checks with the average effective population of 12,036 over the same period:

$$\begin{aligned} \text{Effective Population} &= (4,183 + 5,775) + (1/3)(1,675 + 4,560) \\ &= 12,036 \text{ persons.} \end{aligned}$$

The key point in the above analysis is the ratio of civilian to effective population of about 38 percent. This percentage is assumed to increase to 45% at the maximum expansion increment.

The military strength at the maximum expansion level of 32,500 persons can then be determined as follows:

| |
|---|
| 32,500 Effective Population |
| - 5,775 (On-Post Dependents) |
| <u>26,725</u> |
| - 4,875 Civilian Employees (1/3)(.45)(32,500) |
| <u>21,850 Total Military Strength</u> |

The total military strength at the maximum expansion increment is 21,850 persons. The population mix by mission is further defined in the subsequent sections.

DETERMINATION OF THE NUMBER OF TABULATIONS REQUIRED AND THE
RESPECTIVE STRENGTH LEVELS: (Objective 1)

Four tabulations (A, B, D₁ and D₂) will be presented for the Fort Huachuca Cantonment Analysis to delineate the incremental growth from the current military strength of 5,858 (Effective Population = 12,036) to the maximum military strength of 21,850 (Effective Population = 32,500) persons.

Tabulation A is based on the number of personnel that can be housed in the existing permanent and semi-permanent housing assets. As summarized in Appendix 4-1, the strength level of this tabulation is established as 8,696 military personnel.

Tabulation B is based on the number of personnel that can be housed in the existing temporary housing assets plus the Tab A level. As summarized in Appendix 4-1, these temporary assets total 3,752 spaces establishing the strength level for Tab. B at 12,448 military personnel.

Tabulation D-1 is a 5,000 man increment establishing the military strength level at 17,448 persons.

Tabulation D-2 is the final increment of 21,850 military personnel.

DETERMINATION OF PERSONNEL ASSIGNMENT (Objective 2):

The breakout of personnel for each strength level is delineated in Table 4.3.1. The projected expansion is based on the incremental expansion of each mission as developed in Table 4.1.1 previously and the analysis of current population mix. Further breakouts of the population mix delineated in Table 4.3.1, including ratio and numbers of civilian and military personnel by mission will be delineated in the Capability Tabulations themselves.

TABLE 4.3.1

EXPANSION POPULATION MIX BY MISSION

| | <u>TAB A</u> | <u>TAB B</u> | <u>TAB D-1</u> | <u>TAB D-2</u> |
|--------------------------|-----------------------|------------------------|------------------------|------------------------|
| (1) Effective Population | 15,408 | 19,737 | 25,765 | 32,500 |
| (2) Civilians | 6,163 (40%) | 7,895 (40%) | 10,950 (42.5%) | 14,625 (45%) |
| (3) Off-Post Military | $\frac{1,675}{7,838}$ | $\frac{1,675}{9,570}$ | $\frac{1,675}{12,625}$ | $\frac{1,675}{16,300}$ |
| (4) Time 2/3 | 5,228 | 6,383 | 8,421 | 10,867 |
| (5) Total 1 & 4 | 20,636 | 26,120 | 34,186 | 43,367 |
| (6) Dependents | $\frac{5,775}{28\%}$ | $\frac{5,775}{22.1\%}$ | $\frac{5,775}{16.9\%}$ | $\frac{5,775}{13.3\%}$ |
| (7) 5 minus 6 | 14,861 | 20,345 | 28,411 | 37,592 |
| USACC | 4,544 (22%) | 5,720 (22%) | 7,525 (22%) | 9,541 (22%) |
| USAICS | 3,095 (15%) | 4,440 (17%) | 6,222 (18.2%) | 8,240 (19%) |
| USAEPG | 825 (4%) | 1,306 (5%) | 1,709 (5%) | 2,602 (6%) |
| TRI-TAC | 1,445 (7%) | 1,828 (7%) | 2,393 (7%) | 3,036 (7%) |
| HQ-FH | 2,270 (11%) | 2,873 (11%) | 4,102 (12%) | 5,204 (12%) |
| MEDDAC | 619 (3%) | 1,306 (5%) | 2,393 (7%) | 3,469 (8%) |
| OTHERS | 1,238 (4%) | 1,828 (7%) | 2,700 (7.9%) | 3,330 (7.7%) |
| CONTRACTORS | $\frac{825}{4\%}$ | $\frac{1,045}{4\%}$ | $\frac{1,367}{4\%}$ | $\frac{2,168}{5\%}$ |
| | 20,636 (100 %) | 26,120 (100%) | 34,186 (100%) | 43,367 (100%) |

4.4 DETERMINATION OF ADDITIONAL FACILITIES REQUIRED AND THE ASSOCIATED COST OF DEVELOPMENT (Objective 3):

4.4.1 General:

This objective dictates the development of the Capability Tabulations delineating the incremental growth from the current effective population of about 12,000 persons to the maximum supportable effective population of 32,500 persons. The Capability Tabulations are separately bound documents; preliminary submission is scheduled for February, 1980.

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7. HQ DA, TM 5-813-2, Water Supply Water Sources, 15 July 1965 with Change 1, 3 October 1973.
8. HQ DA, TM 5-813-13, Water Supply Water Treatment, 2 September 1966, with Change 1, 28 February 1974.
9. HQ DA, TM 5-813-4, Water Supply Water Storage, July 1965.
10. HQ DA, Tm 5-813-5, Water Supply Water Distribution Systems, August 1965.
11. HQ DA, TM 5-813-6, Water Supply for Fire Protection.
12. HQ DA, TM 5-813-7, Water Supply for Special Projects, March 1975.
13. HQ DA, TM 5-814-1, Sanitary and Industrial Waste Sewers, August 1966.
14. HQ DA, TM 5-814-2, Sewage and Industrial - Waste Pumping Stations, August 1965.
15. HQ DA, TM 5-814-3, Sewage Treatment Plants, August 1965.
16. HQ DA, TM 5-820-4, Drainage for Areas Other than Airfields.
17. HQ DA, AR 420-47, Refuse Collection and Disposal, 18 September 1967.

18. HQ DA, AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution and Dispensing Systems, 18 November 1976.
19. HQ DA, TM 5-484-1, Fuel Supply Facilities Gas Distribution, October 1965.
20. HQ DA, TM 5-811-1, Electrical Power Supply and Distribution, July 1965.
21. HQ DA, TB ENG 259, Repairs and Utilities Utilization Targets and Evaluation.
22. Blanton and Company, Investigation and Recommendations for Upgrading the Water System at Fort Huachuca, Arizona.

APPENDIX 4-1

FORT HUACHUCA EXPANSION CAPABILITY PLAN

4A1. Housing Analysis

4A1.1 Permanent and Semi-Permanent Housing

The different levels of expansion capability are dependent upon the permanent, semi-permanent, temporary and site facility housing assets. The initial level of expansion is the maximum strength that can be accommodated in the existing permanent and semi-permanent troop housing facilities at emergency space allowances (AR 415-50). The military strength that the permanent and semi-permanent housing assets can support will be used for Tabulation A.

4A1.2. Bachelor Housing

BOQs and VOQs

There are four permanent buildings with quarters for 304 officers. Each of the four buildings have rooms of various size designed for single occupancy. All of the rooms have a bath or shared bath and most of the rooms have a kitchen or kitchenette. A review of the building plans for each building was made to determine if or how many additional officers the buildings could billet. A summary of the assets of the different buildings is as follows:

| <u>Bldg. No.</u> | <u>No. of Units</u> | <u>Area/Unit (SF)</u> | <u>Remarks</u> |
|------------------|---------------------|-----------------------|-------------------------------------|
| 43083 | 180 | 225 | W/bath & kitchenette |
| 43084 | 32 | 255 | Studio, w/bath & shared kitchenette |
| | 8 | 336 | BR, LR, w/bath & kitchenette |
| 43085 | 20 | 270 | Studio, w/bath & kitchenette |
| | 4 | 295 | BR, LR, w/bath & kitchenette |
| 43086 | 60 | 196 | Studio w/shared bath |
| Total | 304 | | |

All of the above units were found to be large enough to accommodate two officers under emergency space allowances. The existing permanent BOQs will house 608 officers.

There are seven permanent enlisted barracks of various size and shape. Each of the buildings is separated into individual rooms housing 1-4 people depending on the size of the room and the grade of the enlisted person. Some of the rooms have baths and others use central toilet facilities. In addition to the living quarters the buildings also contain lounges, dayrooms, mail rooms, company supply, administration, classrooms and storage areas. A study of the building plans of each building was made to determine how many more enlisted personnel could be housed using the 55 SF minimum space allowance for enlisted personnel set forth in TB ENG 354. The following summary of the building plan review shows existing occupancy and maximum capacity for each building.

Building No. 31122 (Alchisay Barrack)

| <u>Floor</u> | <u>Mn/Rm</u> | <u>Area/rm(SF)</u> | <u>No.Rms</u> | <u>Exist Occupancy (Mn)</u> | <u>Emerg.Cap.(Mn)</u> |
|--------------|--------------|--------------------|---------------|-----------------------------|-----------------------|
| 1st | 2 | 155 | 1 | 2 | 2 |
| 1st | 2 | 175-200 | 10 | 20 | 30 |
| 1st | 3 | 265 | 1 | 3 | 4 |
| 1st | 3 | 275 | 4 | 12 | 20 |
| 1st | 4 | 345-380 | 8 | 32 | 48 |
| 1st | 1(NCO) | 230-265 | 10 | 10 | 40 |
| 1st | 1(NCO) | 275 | 2 | 2 | 10 |
| 2nd | 2 | 175 | 11 | 22 | 33 |
| 2nd | 3 | 265 | 1 | 3 | 4 |
| 2nd | 3 | 275-300 | 6 | 18 | 30 |
| 2nd | 4 | 350-360 | 2 | 8 | 12 |
| 2nd | 2(NCO) | 220-270 | 18 | 36 | 72 |
| 2nd | 2(NCO) | 290-320 | 2 | 4 | 10 |
| 3rd | 2 | 175 | 9 | 18 | 27 |
| 3rd | 2 | 256 | 1 | 2 | 4 |
| 3rd | 3 | 300 | 4 | 12 | 20 |
| Subtotal | | | 90 | 204 | 366 |

The Alchisay Barrack also contains over 14,000 SF in lounges, dayrooms, administration, supply and other space related to company organizational requirements.

Building No. 51001 (Gosseum Barrack)

| <u>Floor</u> | <u>Mn/Rm</u> | <u>Area/rm(SF)</u> | <u>No.Rms</u> | <u>Exist Occupancy (Mn)</u> | <u>Emerg. Cap.(Mn)</u> |
|--------------|--------------|--------------------|---------------|-----------------------------|------------------------|
| 1st | 1(NCO) | 220-255 | 14 | 14 | 56 |
| 2nd | 2 | 155 | 2 | 4 | 4 |
| 2nd | 2 | 170 | 5 | 10 | 15 |
| 2nd | 3 | 310 | 2 | 6 | 10 |
| 2nd | 3 | 330 | 1 | 3 | 6 |
| 2nd | 4 | 345-370 | 10 | 40 | 60 |
| 2nd | 2(NCO) | 210-220 | 2 | 4 | 6 |
| 2nd | 2(NCO) | 225-255 | 5 | 10 | 20 |
| 3rd | 2 | 165-185 | 14 | 28 | 42 |
| 3rd | 2 | 240-260 | 4 | 8 | 16 |
| 3rd | 3 | 310 | 2 | 6 | 10 |
| 3rd | 4 | 340-360 | 14 | 56 | 84 |
| Subtotal | | | 75 | 189 | 329 |

This building also has over 11,000 SF of space for lounges, dayrooms, company administration, supply and storage. The 36th Army Band also has over 5,000 SF operational area in a first floor wing of this building.

Building No. 51005 (Riley Barrack)

| <u>Floor</u> | <u>Mn/Rm</u> | <u>Area/rm(SF)</u> | <u>No.Rms</u> | <u>Exist Occupancy (Mn)</u> | <u>Emerg. Cap.(Mn)</u> |
|--------------|--------------|--------------------|---------------|-----------------------------|------------------------|
| 1st | 3 | 270 | 78 | 234 | 390 |
| 2nd | 3 | 270 | 110 | 330 | 550 |
| 3rd | 3 | 270 | 110 | 330 | 550 |
| 4th | 3 | 270 | 110 | 330 | 550 |
| Subtotal | | | 408 | 1,224 | 2,040 |

Riley Barrack is the newest and largest of the barracks. It has close to 30,000 SF of space devoted to battalion headquarters, administration, classrooms, dayrooms, lounges, storage and other space necessary for battalion echelon.

Building No. 52106

| <u>Floor</u> | <u>Mn/Rm</u> | <u>Area/rm(SF)</u> | <u>No. Rms</u> | <u>Exist Occupancy (MN)</u> | <u>Emerg. Cap. (Mn)</u> |
|--------------|--------------|--------------------|----------------|-----------------------------|-------------------------|
| 1st | 2 | 220 | 2 | 4 | 8 |
| 1st | 4 | 350 | 8 | 32 | 48 |
| 1st | 1(NCO) | 215-235 | 5 | 5 | 20 |
| 1st | 2(NCO) | 215-235 | 5 | 10 | 20 |
| 2nd | 2 | 220 | 8 | 16 | 32 |
| 2nd | 4 | 350 | 12 | 48 | 72 |
| 2nd | 1(NCO) | 215-235 | 5 | 5 | 20 |
| 2nd | 2(NCO) | 215-235 | 5 | 10 | 20 |
| 3rd | 2 | 220 | 8 | 16 | 32 |
| 3rd | 4 | 350 | 12 | 48 | 72 |
| 3rd | 2(NCO) | 215-235 | 10 | 20 | 40 |
| Subtotal | | | 80 | 214 | 384 |

Buildings 52106, 52108 and 52109 are the same size and shape and would have the same emergency capacity except that building 52106 has two orderly rooms on the first floor instead of two rooms for enlisted personnel as in the other two buildings. Building 52106 has over 2,500 square feet devoted to dayroom, mail room, lounges and storage.

Building Nos. 52108 and 52109

| <u>Floor</u> | <u>Mn/Rm</u> | <u>Area/rm(SF)</u> | <u>No. Rms</u> | <u>Exist Occupancy(MN)</u> | <u>Emerg. Cap. (Mn)</u> |
|--------------|--------------|--------------------|----------------|----------------------------|-------------------------|
| 1st | 2 | 220 | 4 | 8 | 16 |
| 1st | 4 | 350 | 8 | 32 | 48 |
| 1st | 1(NCO) | 215-235 | 5 | 5 | 20 |
| 1st | 2(NCO) | 215-235 | 5 | 10 | 20 |
| 2nd | 2 | 220 | 8 | 16 | 32 |
| 2nd | 4 | 350 | 12 | 48 | 72 |
| 2nd | 1(NCO) | 215-235 | 5 | 5 | 20 |
| 2nd | 2(NCO) | 215-235 | 5 | 10 | 20 |
| 3rd | 2 | 220 | 8 | 16 | 32 |
| 3rd | 4 | 350 | 12 | 48 | 72 |
| 3rd | 2(NCO) | 215-235 | 10 | 20 | 40 |
| Subtotal | | | 82 | 218 | 392 |

Buildings 52108 and 52109 each have approximately 2,700 square feet of space used for lounges, dayrooms and storage.

Building No. 52204 (Healis Barrack)

| <u>Floor</u> | <u>Mn/Rm</u> | <u>Area/rm(SF)</u> | <u>No.Rms</u> | <u>Exist Occupancy(Mn)</u> | <u>Emerg.Cap.(Mn)</u> |
|--------------|--------------|--------------------|---------------|----------------------------|-----------------------|
| 1st | 1(NCO) | 220-240 | 14 | 14 | 56 |
| 1st | 2(NCO) | 220-260 | 13 | 26 | 52 |
| 2nd | 2(NCO) | 220-235 | 7 | 14 | 28 |
| 2nd | 2 | 165 | 7 | 14 | 21 |
| 2nd | 3 | 275-300 | 3 | 9 | 15 |
| 2nd | 4 | 330-360 | 10 | 40 | 60 |
| 3rd | 2 | 170 | 14 | 28 | 42 |
| 3rd | 2 | 240 | 4 | 8 | 16 |
| 3rd | 3 | 300 | 2 | 6 | 10 |
| 3rd | 4 | 330-260 | 14 | 56 | 84 |
| Subtotal | | | 88 | 215 | 384 |

The Healis Barrack is the same size and shape as the Gosseum Barrack (Building 51001) except that it has quarters for NCOs in the wing occupied by 26th Army Band. There is also approximately 7,500 square feet of company administration, storage, supply, dayroom and lounges in this barrack.

4 4A1.4 Family Housing

Family housing both on-post and off-post is counted as an asset for the initial stage of expansion.

Fort Huachuca has a total of 2,056 family housing units of which 1,955 are listed as permanent and 101 are considered sub-standard or temporary. The 2,056 units provide housing for 692 officers and 1,364 enlisted personnel. The 101 temporary units were included with 1,955 permanent units as assets for the initial stage of expansion.

As stated previously, 2,145 military personnel live off-post. This total figure is further identified as 406 officers and 1,739 enlisted personnel. It is assumed that these people will continue to live off-post during emergency expansion.

4A1.5 Permanent and Semi-Permanent Housing Summary

Fort Huachuca has a number of guest houses not previously mentioned that could be included as permanent housing. However, because of the potential high number of visitors likely to be generated by the different missions these buildings were assumed to remain guest houses and not included as possible housing assets for permanent party personnel.

Permanent and semi-permanent housing assets showing maximum capacity are summarized in the following table:

PERMANENT AND SEMI-PERMANENT HOUSING ASSETS

| | <u>Assets in Number of Spaces</u> | | |
|------------------|-----------------------------------|---------------|-------------------------|
| | <u>Existing Capacity</u> | <u>Factor</u> | <u>Maximum Capacity</u> |
| Officers | | | |
| BOQs & VOQs | 304 | 2 | 608 |
| Family Housing | 692 | 1 | 692 |
| Off-Post Housing | 406 | 1 | 406 |
| Subtotal | 1,402 | | 1,706 |
| Enlisted | | | |
| BEQs | 2,482 | * | 3,887 |
| Family Housing | 1,364 | 1 | 1,364 |
| Off-Post Housing | 1,739 | 1 | 1,739 |
| Subtotal | 5,585 | | 6,990 |
| Total | 6,987 | | 8,696 |

*Based on the proceeding building plan study allowing approximately 55 SF per person net sleeping area and then reducing the total by 400 spaces to allow for unit integrity.

The 1,706 officers and 6,990 enlisted personnel are approximately 20% and 80% of the 8,696 military and the proportion of officers to enlisted personnel is maintained.

All permanent and semi-permanent housing assets are accounted for, none are available for the next level of expansion.

4A2 Temporary Housing

The next level of expansion is based on the maximum number of troops that can be housed in the existing temporary barracks.

Fort Huachuca has numerous temporary buildings designed as barracks for use during World War II. Some of these buildings have been modernized for continued barracks use, others have been converted after remodeling to other uses, others have been diverted and still others remain vacant with plans to dispose of them.

There are 74 structures listed in the Bachelor Housing Inventory of March 1978 that are available for troop housing. Several of these barracks have been remodeled with individual rooms and baths for use as BOQs. However, all of the occupied temporary barracks are presently occupied by enlisted personnel. Under emergency expansion some of the temporary buildings will have to be used for officers quarters. Maintaining the same percentage of officers and enlisted personnel mentioned earlier in this report, requires that all the existing temporary buildings remodeled as BOQs plus others not considered BOQs at the present time be assigned to officers when emergency expansion occurs. It is assumed that there is some flexibility in the assignment of temporary barracks and that under emergency conditions adjustment can be made. This will provide for a balance of officers to enlisted personnel and the maximum military strength for Tabulation B.

In assessing the maximum capacity of the different temporary barracks it was assumed that a minimum 100 SF per officer and 55 SF per enlisted personnel would be adequate.

A review of all the available building plans was made to determine maximum capacity. When building plans were not available the figures on the Bachelor Housing Inventory furnished by the Bachelor Housing Branch of the Housing Services Office were used. Capacities shown on this inventory as 90 SF per person were multiplied by a factor of 1.64 to get capacities at the 55 SF per person emergency allowance figure.

The following list of buildings shows which temporary barracks were assigned to officers and which to enlisted. The first twenty-two buildings assigned to officers are buildings with separate rooms and in some cases connecting baths. These buildings are designated BOQs on Fort Huachuca's Installation Inventory of Military Real Property dated September 30, 1977. The remainder of the buildings are open bay barracks structures that are presently designated enlisted barracks. The selection of these buildings maybe somewhat arbitrary, a better determination of the barracks assignment can be made under the planning procedures of Step V.

BACHELOR OFFICERS HOUSING

(Temporary Barracks)

| | <u>Building No.</u> | <u>Total Square Feet</u> | <u>Existing Capacity</u> | <u>Maximum Capacity</u> |
|----|---------------------|------------------------------|------------------------------|-----------------------------|
| 1 | 51024 | 5,627 | 12 | 24 |
| 2 | 66055 | 7,670 | 24 | 36 |
| 3 | 66056 | 7,890 | 19 | 36 |
| 4 | 66151 | 8,040 | 44 | 44 |
| 5 | 67102 | 4,720 | 8 | 16 |
| 6 | 67103 | 4,720 | 8 | 16 |
| 7 | 70334 | 4,130 | 9 | 17 |
| 8 | 70335 | 5,674 | 23 | 23 |
| 9 | 72321 | 5,015 | 48 | 48 |
| 10 | 84105 | 8,034 | 36 | 44 |
| 11 | 67104 | 4,720 | 8 | 16 |
| 12 | 67105 | 4,720 | 8 | 16 |
| 13 | 67106 | 4,720 | 8 | 16 |
| 14 | 67125 | 4,720 | 8 | 16 |
| 15 | 67126 | 4,720 | 8 | 16 |
| 16 | 67127 | 4,720 | 8 | 16 |
| 17 | 67128 | 4,720 | 8 | 16 |
| 18 | 67129 | 4,720 | 8 | 16 |
| 19 | 71216 | 3,540 | 10 | 20 |
| 20 | 71217 | 3,540 | 9 | 17 |
| 21 | 72219 | 4,425 | 10 | 20 |
| 22 | 72220 | 4,425 | 10 | 20 |
| 23 | 67202 | 4,720 | 24 | 24 |
| 24 | 67203 | 4,720 | 24 | 24 |
| 25 | 67204 | 4,720 | 24 | 24 |
| 26 | 67205 | 4,720 | 24 | 24 |
| 27 | 67206 | 4,720 | 24 | 24 |
| 28 | 67207 | 4,720 | 24 | 24 |
| 29 | 67209 | 4,720 | 24 | 24 |
| 30 | 67226 | 4,720 | 24 | 24 |
| 31 | 67227 | 4,720 | 24 | 24 |
| 32 | 67228 | 4,720 | 24 | 24 |
| | Total | | 574 | 749 |

BACHELOR ENLISTED HOUSING

(Temporary Barracks)

| | <u>Building No.</u> | <u>Total Square Feet</u> | <u>Existing Capacity</u> | <u>Maximum Capacity</u> |
|----|---------------------|------------------------------|------------------------------|-----------------------------|
| 1 | 67229 | 4,720 | 38 | 68 |
| 2 | 68225 | 4,720 | 38 | 68 |
| 3 | 80020 | 5,310 | 49 | 80 |
| 4 | 81002 | 5,310 | 49 | 80 |
| 5 | 81020 | 5,310 | 49 | 80 |
| 6 | 81028 | 5,310 | 49 | 80 |
| 7 | 82001 | 5,310 | 49 | 80 |
| 8 | 82002 | 5,310 | 49 | 80 |
| 9 | 82007 | 5,310 | 49 | 80 |
| 10 | 82008 | 5,310 | 49 | 80 |
| 11 | 82009 | 5,310 | 49 | 80 |
| 12 | 82020 | 5,310 | 49 | 80 |
| 13 | 82021 | 5,310 | 49 | 80 |
| 14 | 82027 | 5,310 | 30 | 49 |
| 15 | 82028 | 5,310 | 30 | 49 |
| 16 | 83001 | 5,310 | 49 | 80 |
| 17 | 83002 | 5,310 | 27 | 44 |
| 18 | 83007 | 5,310 | 44 | 72 |
| 19 | 83008 | 5,310 | 44 | 72 |
| 20 | 83009 | 5,310 | 44 | 72 |
| 21 | 83020 | 5,310 | 49 | 80 |
| 22 | 83021 | 5,310 | 49 | 80 |
| 23 | 83022 | 5,310 | 49 | 80 |
| 24 | 83026 | 5,310 | 44 | 72 |
| 25 | 83027 | 5,310 | 44 | 76 |
| 26 | 83028 | 5,310 | 44 | 72 |
| 27 | 84001 | 5,310 | 49 | 80 |
| 28 | 84002 | 5,310 | 49 | 80 |
| 29 | 84003 | 5,310 | 49 | 80 |
| 30 | 84007 | 5,310 | 49 | 80 |
| 31 | 84008 | 5,310 | 49 | 80 |
| 32 | 84009 | 5,310 | 49 | 80 |
| 33 | 84020 | 5,310 | 49 | 80 |
| 34 | 84021 | 5,310 | 49 | 80 |
| 35 | 85003 | 6,060 | 30 | 49 |
| 36 | 85007 | 5,310 | 49 | 80 |
| 37 | 85008 | 5,310 | 49 | 80 |
| 38 | 85009 | 5,310 | 49 | 80 |
| 39 | 85027 | 5,310 | 49 | 80 |
| 40 | 85028 | 5,310 | 49 | 80 |
| | Total | | 1,892 | 3,003 |

4A2.1. Temporary Housing Summary

Temporary housing assets showing maximum capacity is summarized in the following table:

TABLE 4-6B

TEMPORARY HOUSING ASSETS

Assets in Number of Spaces

| | <u>Existing Capacity</u> | <u>Factor</u> | <u>Maximum Capacity</u> |
|----------------------|--------------------------|---------------|-------------------------|
| Officers BOQs | 574 | * | 749 |
| Enlisted Barracks | 1,214 | * | 3,003 |
| Total | 1,788 | | 3,752 |

* Based on the analysis of building plans and information furnished by the Housing Service Office

Temporary housing assets provide living quarters for an additional 3,752 military personnel 749 officers and 3,003 enlisted personnel. All temporary housing facilities are accounted for and subsequent levels of expansion will be accomplished by using site facilities.

In using all existing permanent, semi-permanent and temporary troop housing 2,455 officers and 9,993 enlisted personnel a total of 12,448 military have been accommodated. The maximum capability strength is 16,445 composed of 3,430 officers and 13,015 enlisted. This leaves 975 officers and 3,022 enlisted personnel or a total of 3,997 military that must be housed in site facilities.

HAMILTON AND ASSOCIATES PROPOSED BLANKET PURCHASE ORDER AGREEMENT

| Item No | Stock No | Description | Unit | Price | Total |
|---------|-----------------|--|-------|-------|-------|
| 1. | 3439 00255 9935 | Flux Soldering Paste 4oz Cn (Min 24 Cn) PM # 84502 | Cn | .89 | 1.15 |
| 2. | 4010 00J59 2098 | Coupling Bead Chain Type A 3/16" 500 1 R1 (100 min) 53321 # 53321 | ea ft | .31 | .12 |
| 3. | 4010 00J59 2113 | Coupling Bead Chain Type B 3/16" # 53322 | ea ft | .52 | .05 |
| 4. | 4510 00J59 0012 | Tank Ballkorky Flapper Reg Min 36 # 40201 | ea | 1.53 | 1.61 |
| 5. | 4510 00J59 0001 | Stopper Drain P-M 52583 | ea | 4.82 | 1.98 |
| 6. | 4510 00J59 0014 | Stem SHWRSZ3-5/8 In Kohler Niedecken MXR # 05166 | ea | 5.10 | 5.36 |
| 7. | 4510 00J59 0017 | Stopper Pop Up 4 In AM STD NO52416 | ea | 1.78 | 1.87 |
| 8. | 4510 00J59 0019 | Seat Faucet 28th 7/16" DIA 3/8H PM11140 (Min 100) | ea | .42 | .48 |
| 9. | 4510 00J59 0022 | Seat Faucet 27th 5/8D 3/8H PM NO 11223 (Min 100) | ea | .41 | .43 |
| 10. | 4510 00J59 0023 | Seat Faucet 24th 21/320 13/32H-PM 11145 (Min 100) | ea | .67 | .73 |
| 11 | 4510 00J59 0030 | Head Shower PR/ PEISTER 973-051A (12 Min) PM Replacement Head # 26835 | Pr | 2.78 | 2.92 |
| 12 | 4510 00J59 0031 | Seat Faucet 20th 1/2"X5/16" PM11115 (100 Min) | | .34 | .37 |
| 13 | 4510 00J59 0040 | Seat Faucet 27th 1/2" Dia 9/32 H PM 11137 (100 Min) | ea | .32 | .34 |
| 14 | 4510 00J59 0041 | Seat Faucet 20th 3/4" Dia 3/8 PM 11202 | | | .73 |
| 15 | 4510 00J59 0050 | Arm Wast Bend SJ Pat 1 1/2"X23" (12 Min) # 54504 | ea | 10.21 | 9.09 |
| 16 | 4510 00J59 0051 | Cap Escuteon F/AMER Stand Aquar Faucet # 18168 | ea | 2.38 | 2.50 |
| 17 | 4510 00J59 0053 | Screw Clo 1/2X2-1/2 W/Nut Wash (100 Min) # 43821 | ea | .23 | .31 |
| 18 | 4510 00J59 0065 | Kit Replace Part F/Chicago Faucet #18008 (12 Min) | | 2.56 | 2.91 |
| 19 | 4510 00J59 0066 | Washer Fiber gasket 27/32" OD 25/32" 17644 (100 Min) | ea | .05 | |
| 20 | 4510 00J59 0067 | Washer Fiber Gasket 15/16" OD 13/16" 17657 (Min 100) | ea | .07 | .08 |
| 21 | 4510 00J59 0068 | Washer Fiber Gasket 1" OD 27/32" 17663 (Min 25) | ea | .09 | |
| 22 | 4510 00J59 0069 | Nuts Slip 2X2 Chrome Plated (50 Min) # 53507 | ea | .81 | .92 |
| 23 | 4510 00J59 0071 | Kit repair F/Delta Lav Faucet 502-14417 (12 Min) | Kt | 1.82 | 1.91 |

2001/11