

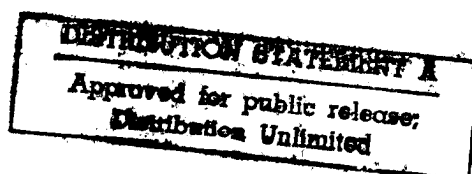
**BASEWIDE ENERGY CONSERVATION  
STUDY AND SYSTEM PLAN  
FORT HOOD, TEXAS**

**FINAL REPORT  
Executive Summary**

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DECEMBER 1979  
PREPARED FOR  
FORT WORTH DISTRICT, CORPS OF ENGINEERS  
FORT WORTH, TEXAS  
CONTRACT NO. DACA63-78-C-0145

PREPARED BY  
BLACK & VEATCH  
CONSULTING ENGINEERS  
KANSAS CITY, MISSOURI



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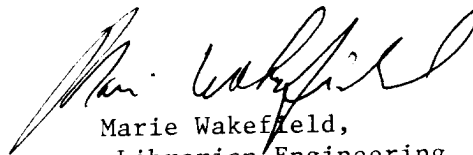


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## GENERAL

The purpose of this volume is to present a summary of the results of the Basewide Energy Conservation Study and System Plan for Fort Hood, Texas. The overall objective of this study is to develop a systematic approach to facilitate the reduction of energy consumption at Fort Hood by approximately 20 percent per square foot. However, such a study would be incomplete if the goals established by the Major Army Command (MACOM) and assigned by Presidential Executive Order 12003 and the Department of Defense were not considered. In addition, the Department of the Army has established a goal for reduction of total facility energy consumption by at least 25 percent by FY 85 and a reduction of 50 percent by FY 2000 using FY 75 as the base year. Other pertinent goals include reducing facility use of petroleum fuels by 75 percent and eliminating use of natural gas by FY 2000.

This summary presents data from the study on the following:

- Existing energy consumption
- Source energy reductions due to energy conservative techniques
- Savings utilizing central energy monitoring and control systems
- Use of alternate energy sources
- Total Energy and Selective Energy Systems
- Operational and planning recommendations.

Fort Hood utilizes electricity and natural gas as energy sources. Propane gas and some fuel oil is also used but to a very small extent

by comparison. Table 1 is a compilation of building area and annual energy consumption for FY's 1975, 1976, 1977, and 1978.

TABLE 1  
Building Area and Yearly Energy Consumption  
in Million Btu

	<u>FY 75</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>
Area, sf (1)	18,255,105	20,001,027	21,064,450	21,060,282
Electricity (2)	2,341,777	2,457,939	2,665,730	2,787,636
Natural Gas (3)	<u>1,915,128</u>	<u>1,640,550</u>	<u>1,903,111</u>	<u>1,882,306</u>
Total	4,256,905	4,098,489	4,568,841	4,669,942

- (1) FY 78 as of 30 April; all others as of 30 September
- (2) 11,600 Btu per kW/hr was assumed
- (3) Actual Btu from gas bills was used (FY 76 thru FY 78)
- (4) FY is Oct-Sept

Since the majority of energy consumed at Fort Hood is used for environmental control, an obvious means of energy reduction is to upgrade the building envelopes and to control the operating time of the environmental control equipment. These improvements offer a large energy savings and a substantial cost reduction.

Additionally, replacing existing equipment with high efficiency equipment will often result in economically attractive energy reduction and also offer the opportunity to select the energy source desired.

In establishing their goal, the Department of the Army Advisory Group on Energy provided the following guidance on achieving the 25 percent reduction in total Army energy consumption:

Energy Conservation Investment Program (ECIP)	12%
Energy Management	8%
New Construction	5%

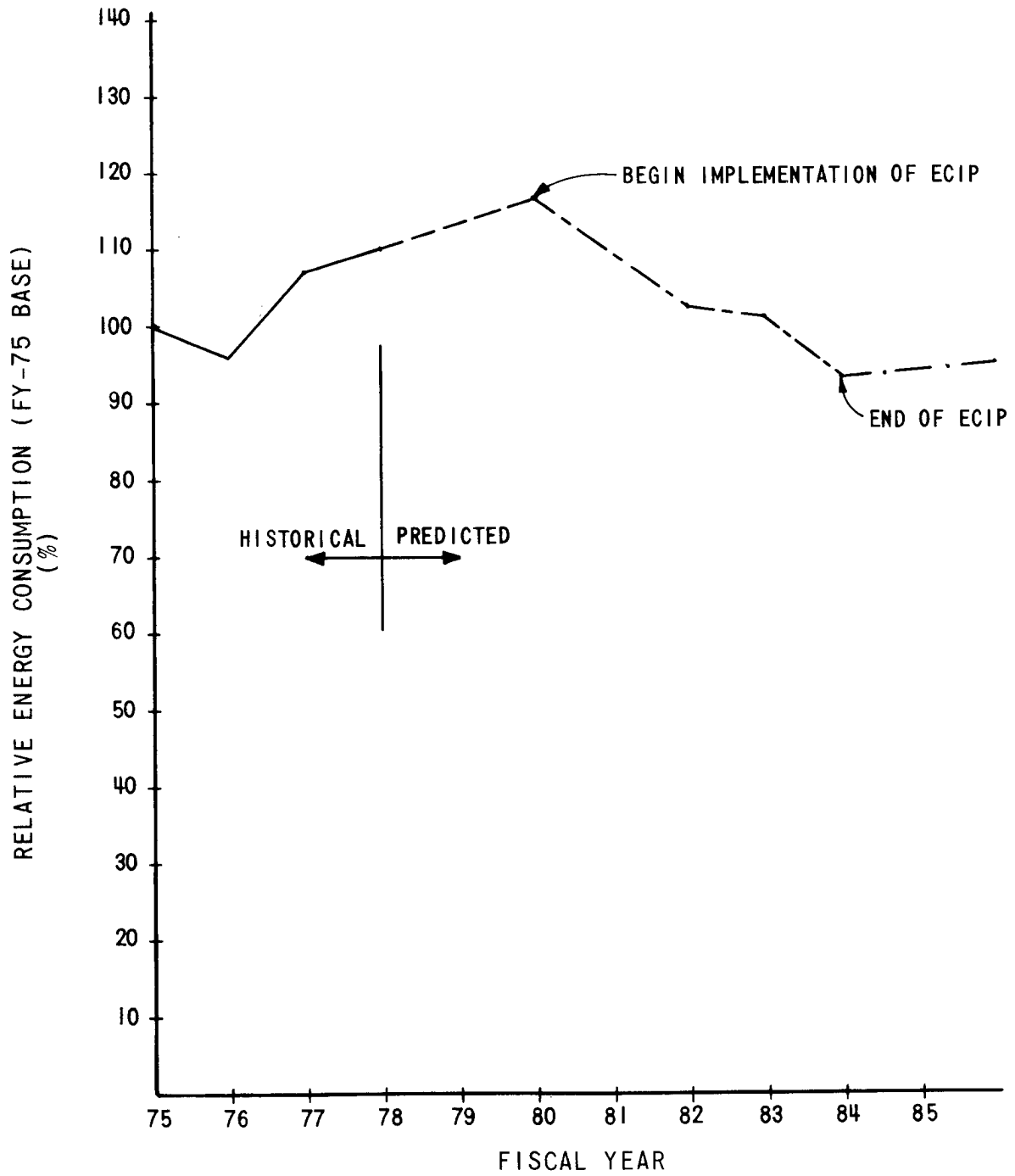
Figure 1 indicates the current status of energy consumption at Fort Hood. Since 1975, basewide energy consumption has increased at approximately 3 percent per year. Concurrently, the total building area of the post has increased at approximately 5 percent per year. There is no reason to believe that this trend toward more efficient, new buildings will be reversed, but there are indications that the increase rate of building area will be slowed or stopped within the next few years. More than 200 temporary buildings are scheduled for demolition in the next two years, indicating that the ever-expanding requirement for floor space is abating.

Implementation of the Energy Conservation Investment Program as described in this study is expected to reduce basewide energy consumption by approximately 6 percent per year through the end of FY 84 when the program will be completed. Upon completion of the ECIP, the energy consumption rate will undoubtedly begin to rise, but at a rate considerably below that of the past few years. While the move to more energy-efficient buildings, processes and equipment will retard growth in energy consumption, increased use of energy-consuming equipment will tend to accelerate the growth rate.

Although the energy consumption per square foot of building area has decreased by approximately 5 percent since 1975, the trend since

# TOTAL BASEWIDE ENERGY CONSUMPTION

## FIGURE 1



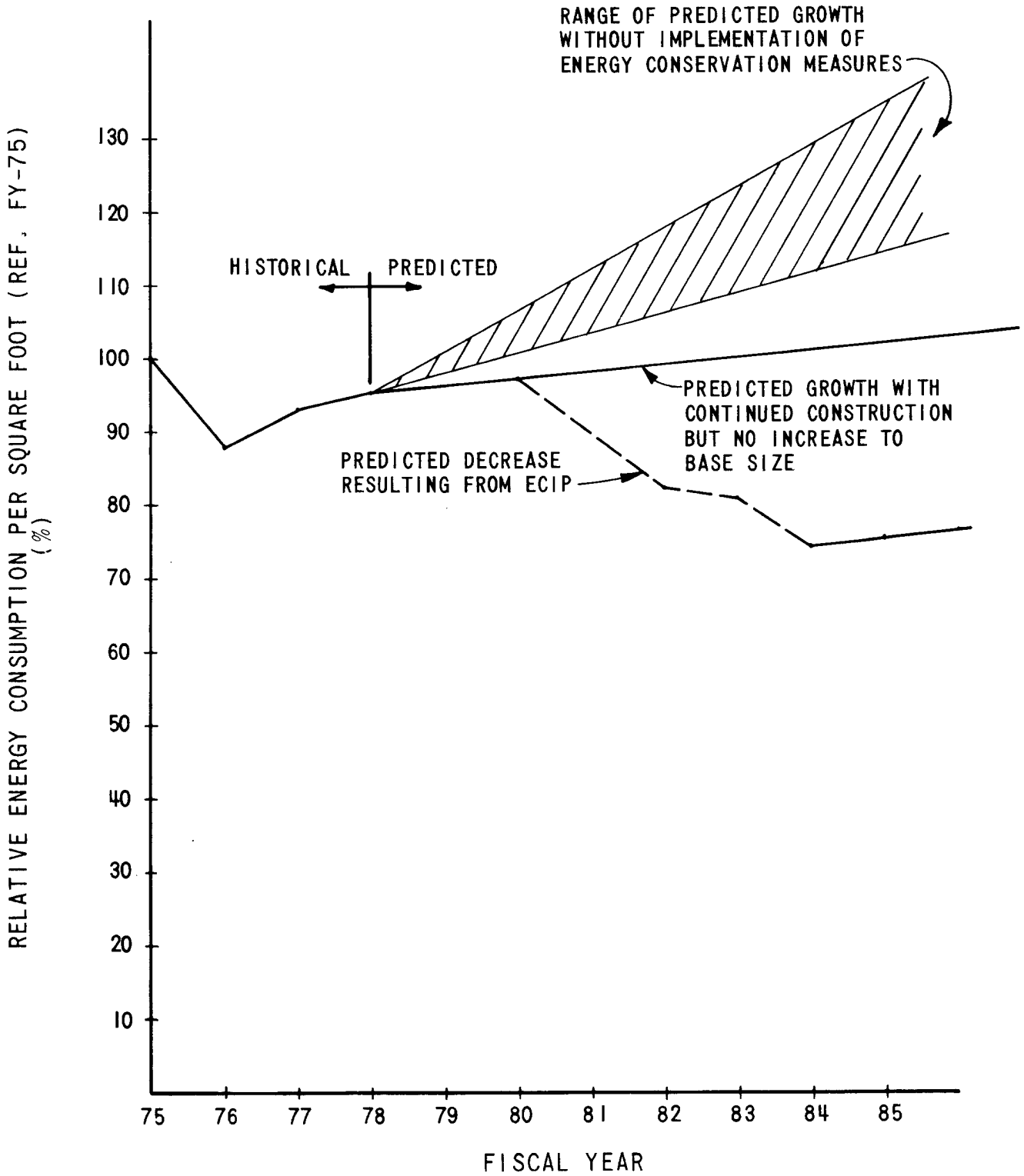
1976 has been to increase consumption about 1 percent per year. Normal growth rate will range from 3 to 6 percent per square foot per year, but the Army's ongoing program for energy conservation has moderated this rate. Figure 2 illustrates the unitized energy consumption. Continuing the current policies, without additional conservation efforts, would maintain energy consumption below the FY 75 quantities until 1983. The Energy Conservation Investment Program is expected to reduce the unitized energy consumption to 75 percent of the FY 75 consumption by FY 85. At the completion of the ECIP, consumption will again begin to rise, surpassing 1975 consumption by the year 2010.

It is obvious that long range predictions (beyond 5 years) of energy consumption are nebulous at best. Future conservation requirements and energy policies may result in acceptance of many conservation projects that are not economically attractive at this time. Many of the projects evaluated in this study may become desirable if energy costs escalate faster than these calculations assume.

Many energy conserving schemes were evaluated under criteria established for the Energy Conservation Investment Program. The results of the analyses resulted in five projects being programmed for FY 81 and FY 82, and seven projects being recommended for FY 83 and FY 84.

Several projects that were very promising when first evaluated failed to meet ECIP guidelines because of the implementation of building temperature restrictions. These projects, which are discussed later, should be considered when maintenance or replacement money is available.

UNITIZED ENERGY CONSUMPTION  
MM BTU/SF  
FIGURE 2



Additionally, several energy saving projects do not qualify for ECIP consideration since they were not "capital investment" projects but normal maintenance items. These projects, which are discussed later, should be accomplished in future maintenance programs.

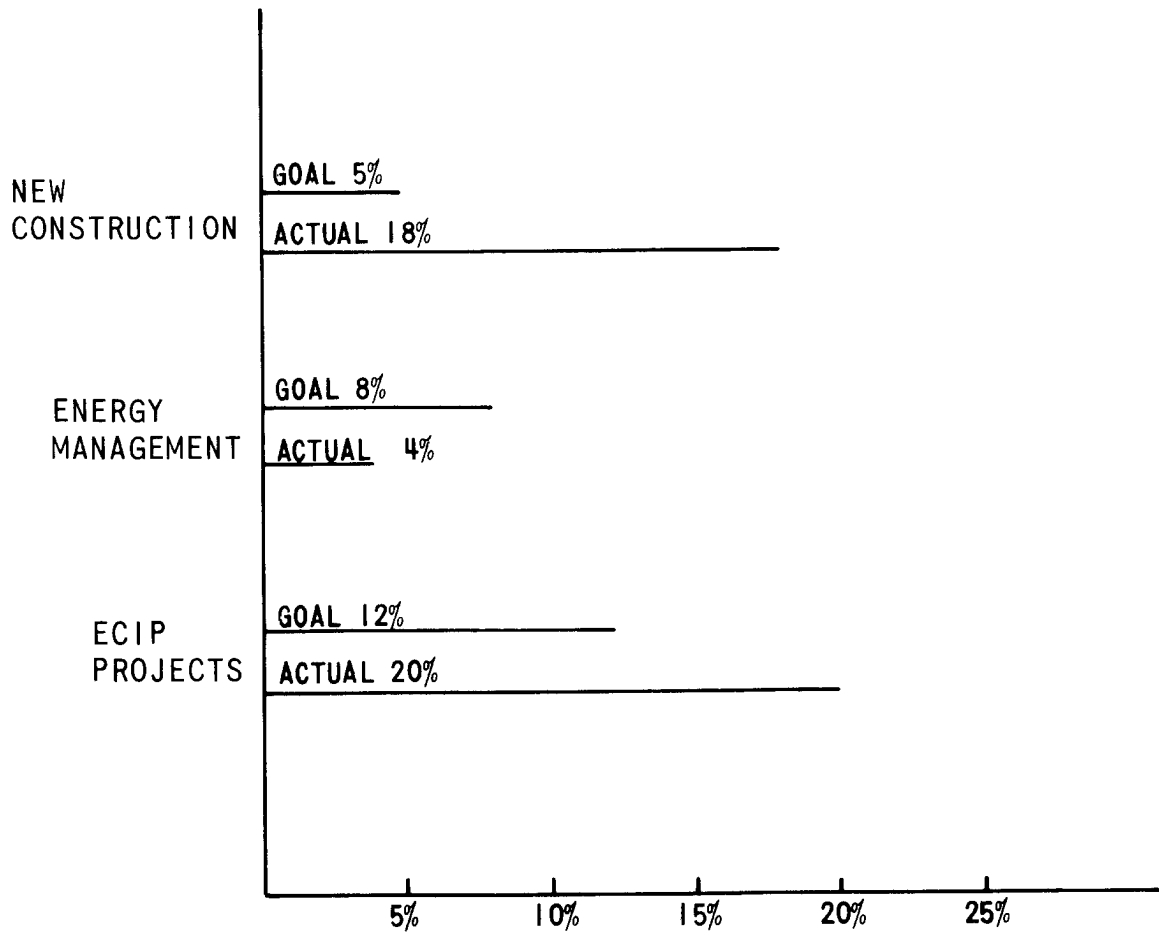
## ENERGY CONSERVATION CONSIDERATIONS

Each energy conservation item considered is listed in Table 1 along with its evaluation criteria. To be selected for inclusion in an energy conservation project, each item was required to have a benefit to cost ratio greater than 1.0, an E/C ratio greater than 17, and a payback period less than the expected life of the facility. All evaluations were based on 1981 cost data for the initial rankings. Items meeting the ECIP criteria were grouped for minimum disruption and ranked for inclusion in a particular fiscal year program.

In order to evaluate compliance with the goals for energy conservation, the FM Control System and the Oxygen Control System for Boilers are considered energy management savings. Savings from new construction are estimated to be equal to the difference between the expected annual growth of 3 percent and the actual annual growth of 1 percent. The remainder of the recommended energy conservation items are considered as ECIP savings. Figure 3 shows the extent of compliance with the goals.

Fifty energy conservation items were evaluated under ECIP criteria. Twenty-four items were recommended. All 50 items, and the evaluation criteria for each, are listed in Table 2.

Projects that required no capital investment, but should be considered as part of the maintenance program, include reduction of fresh air intake and use of energy-efficient low impedance fluorescent light bulbs. Projects recommended when replacement is required would include high efficiency electrical appliances such as kitchen ranges and water heaters,



ENERGY SAVINGS AFTER FY84

FIGURE 3

installation of heat pumps with a "hot tap" heat recovery system for domestic water heating, exterior roof insulation in family housing with vaulted ceilings, and the replacement of electrical motors with high efficiency motors.

Conservation items meeting ECIP criteria were grouped into projects consisting of work to be done on a given type of building. This was done to minimize the length of disruption to building occupants. In some instances, it was necessary to separate types of modifications to a given building in order to maintain separation of contractors and to obtain lower costs to the Government. All family housing items, except the FM Control System, were grouped together and assigned to FY 84. Table 3 lists each recommended project, grouped according to fiscal year, and shows project cost and energy savings. All costs in Table 3 are based on FY 81.

Project numbers referenced in Table 3 are temporary numbers applied for the purposes of this report and will not be seen on the final programming documents.

TABLE 2

## Summary of Energy Conservation Items

<u>Item</u>	<u>Benefit to Cost</u>	<u>E/C</u>	<u>Payback Period Years</u>
FM Control System for Nonresiden- tial Facilities	4.11	99.00	3.00
Permanent Barracks - Storm Windows & Solar Film	1.41	32.81	12.6
Permanent Barracks - Weatherstripping & Calking	13.35	287.36	1.37
Permanent Barracks - Flow Control Shower Heads	38.56	293.29	1.52
Permanent Buildings - Insulation Storm Windows & Solar Film	5.11	110.35	3.57
Temporary Buildings - Insulation, Storm Windows & Solar Film	2.10	42.38	9.18
Temporary Buildings - Weatherstripping & Calking	7.21	155.14	2.53
Load Balancing for Buildings	0.90	18.0	19.0
Low Voltage Transformers			
Motor Capacitors	0.011	0.22	1,510
Incandescent Light Replacement			
Offices	2.55	21.1	5.18
Warehouses	1.50	18	11.1

TABLE 2

Summary of Energy Conservation Items  
(Cont'd)

<u>Item</u>	<u>Benefit to Cost</u>	<u>E/C</u>	<u>Payback Period Years</u>
Recreational Field Light Replacement	2.51	32.2	5.4
Solar			
Barracks Hot Water	0.71	13.3	26.6
Swimming Pool Heating	1.4	25.3	13.6
Solar Pond - Barrack DHW	0.92	17.1	20.7
Voltage Conversion			
Voltage Conversion of Existing Primary Conductor for Feeder No. 7 from 4.16 kV to 12.5 kV	0.022	0.233	765.98
Voltage Conversion of Existing Primary Conductor (477 MCM ACSR) for Feeder Nos. 7, 14, and 16 from 12.5 kV to 25.0 kV	0.072	0.744	238
Power Factor Improvement Reduction of Losses in Primary Distribution System by Power Factor Improvements	0.88	8.76	20.58
Reduction of Losses in Primary Distribution System by Power Factor Improvement (N.F.H.)	0.17	0.63	100.48
Street Light Replacement			
Street Lighting Replacement 450 wt Hg with 250 wt HPS	0.46	14.01	45.28
Street Lighting Replacement 450 wt Hg with 200 wt HPS	0.66	17.09	29.2

TABLE 2

Summary of Energy Conservation Items  
(Cont'd)

<u>Item</u>	<u>Benefit to Cost</u>	<u>E/C</u>	<u>Payback Period Years</u>
Street Lighting Replacement 250 wt Hg with 150 wt HPS	0.23	8.58	118.4
Street Lighting Replacement 175 wt Hg with 100 wt HPS	0.16	7.22	367.4
Primary Conductor Replacement			
Replacement of Existing 2/0 AWG Copper Primary Conductor with 477 MCM ACSR Conductor on Distribution Feeder Ckt. No. 1	2.58	23.30	6.59
Replacement of Existing 1/0 AWG Copper Primary Conductor with 477 MCM ACSR Conductor on Distribution Feeder No. 2	2.12	19.74	8.03
Replacement of Existing 4/0 AWG Copper Primary Conductor with 477 MCM ACSR Conductor on Distribution Feeder Ckt. No. 1	2.07	17.32	8.17
O <sub>2</sub> Controls for Large Boilers	2.8	49.82	6.75
Energy Recovery from Solid Waste	0.74	22.47	86.90
Nonbarracks Permanent Buildings under 10,000 sq. ft			
Ceiling Insulation, Storm Windows and Solar Film	1.96	42.76	9.26
Calking and Weatherstripping	8.05	170.92	2.27

TABLE 2  
 Summary of Energy Conservation Items  
 (Cont'd)

<u>Item</u>	<u>Benefit to Cost</u>	<u>E/C</u>	<u>Payback Period Years</u>
FM Control System	5.07	104.92	2.32
Weatherstrip & Calk	2.60	83.03	4.67
Flow Restrictive Shower Heads	8.95	255	1.39
Insulation for Vaulted Type Ceilings (Pershing Park)	0.28	7.25	61.58
Heat Pump	0.63	16.65	24.18
Hot Tap	1.36	46.23	8.82
Storm Windows			
Storm Windows Unair-conditioned Units	1.02	29.59	12.20
Storm Windows A/C Units	2.38	78.12	5.1
Storm Windows w/Solar Film A/C Units	1.2	41.94	9.92
Furnace Modifications			
Automatic Flue Dampers	0.37	10.42	34.04
Vent Restrictors	0.87	24.86	14.26
Furnace Derating	0.60	17.20	20.62
Replacing Kitchen Light Fixtures	1.73	34.54	9.53
Replacing Bathroom Light Fixtures	0.68	19.9	24.2
Dryer Peak Control	3.06	--	3.9

TABLE 2

Summary of Energy Conservation Items  
(Cont'd)

<u>Item</u>	<u>Benefit to Cost</u>	<u>E/C</u>	<u>Payback Period Years</u>
Solar			
Domestic Water Heating (per unit)	0.51	9.5	37.4
SPH/DHW System (per unit)	0.52	9.7	36.5
Air-conditioning (per unit)	0.35	3.3	54
Utility Meter Installation (per unit)	0.36	20.5	78
Energy Monitoring Control System	0.75	33.4	19.3
Modifications & Facilities for Use of Waste Oil as Boiler Fuel	6.33	43.3	3.7

TABLE 3

## Recommended ECIP Projects

<u>Project Number</u>	<u>Fiscal Year</u>	<u>Project Description</u>	<u>Construction Cost</u> (FY 81)	<u>Annual Energy Savings</u> (MegaBtu)	<u>E/C</u>
T-881	81	FM Control System for Nonresidential Facilities	\$ 637,226	63,054	99.0
T-883	81	Permanent Buildings Insulation Storm Windows & Solar Film	1,732,424	191,165	110.4
T-886	81	Family Housing FM Control System	886,787	93,038	104.9
TOTAL FY 81			\$3,256,437	347,257	106.6
T-882	82	Permanent Barracks - Storm Windows & Solar Film	2,922,719	92,609	32.8
T-882	82	Permanent Barracks - Weatherstripping & Calking	226,495	65,086	287.4
T-882	82	Permanent Barracks - Flow Control Shower Heads	59,551	40,600	718.0

TABLE 3

Recommended ECIP Projects  
(Cont'd)

<u>Project Number</u>	<u>Fiscal Year</u>	<u>Project Description</u>	<u>Construction Cost</u> (FY 81)	<u>Annual Energy Savings</u> (MegaBtu)	<u>E/C</u>
T-885	82	Temporary Buildings - Insulation, Storm Windows & Solar Film	\$1,411,428	59,816	42.4
T-885	82	Temporary Buildings - Weatherstripping & Calking	86,935	13,487	155.1
TOTAL FY 82			\$4,707,128	271,598	57.7
T-889	83	Solar Swimming Pool Heating	140,536	3,561	25.3
T-894	83	O <sub>2</sub> Controls for Large Boilers	292,551	15,362	49.8
T-891	83	Nonbarracks Permanent Buildings under 10,000 sq. ft. Ceiling Insulation, Storm Windows and Solar Film	431,378	18,446	42.8
T-891	83	Calking and Weather- stripping	17,962	3,070	170.9

TABLE 3

Recommended ECIP Projects  
(Cont'd)

<u>Project Number</u>	<u>Fiscal Year</u>	<u>Project Description</u>	<u>Construction Cost</u> (FY 81)	<u>Annual Energy Savings</u> (MegaBtu)	<u>E/C</u>
T-893	83	Modifications on Facilities for Use of Waste Oil as Boiler Fuel	\$ 232,949	10,085	43.3
T-887	83	Incandescent Light Replacement Offices Warehouses	119,978 245,975	2,534 4,411	21.1 18
<b>TOTAL FY 83</b>			<b>\$1,481,329</b>	<b>57,469</b>	<b>38.8</b>
T-884	84	Family Housing Weatherstrip & Calk	1,041,916	86,514	83.0
T-884	84	Family Housing Flow Restrictive Shower Heads	218,376	55,697	255.0
T-884	84	Unair-conditioned Family Housing Storm Windows	283,292	8,384	29.6

TABLE 3

Recommended ECIP Projects  
(Cont'd)

<u>Project Number</u>	<u>Fiscal Year</u>	<u>Project Description</u>	<u>Construction Cost</u> (FY 81)	<u>Annual Energy Savings</u> (MegaBtu)	<u>E/C</u>
T-884	84	Air-conditioned Family Housing Storm Windows	\$2,048,796	160,054	78.1
T-884	84	Replacing Kitchen Light Fixtures	156,023	5,389	34.5
TOTAL FY 84			\$3,748,403	316,038	84.3

## ALTERNATE ENERGY SOURCES

The reduction of reliance on critical fuels and elimination of natural gas usage dictate the study of alternate energy sources. Solar energy has gained national recognition as a promising energy source. For some applications, solar energy is a reliable, cost-effective means of supplying energy. For other applications, it is not suitable. The principal applications of interest for solar energy on military bases are domestic hot water (DHW) systems, DHW/space heating, swimming pools, and air-conditioning.

Several variations of each of these applications were evaluated against ECIP guidelines. The addition of solar heating to the Abrams Field House swimming pool met ECIP criteria and is recommended for FY 83. The other applications did not meet ECIP criteria.

Another alternate energy source is solid waste fuels. Fort Hood is approaching a solid waste generation rate of 100 tons per day, at which point the establishment of resource recovery facilities for source separation and materials and/or energy recovery will be required.

The economics of a resource recovery system without a ready market for recovered energy is highly questionable. A steam generator must have a steady and reliable market for the steam it produces, with a reasonably short transmission distance. Such a condition does not exist at Fort Hood. Energy recovery from solid waste will not meet ECIP guidelines.

Waste engine lubricating oil has been considered for use as boiler fuel for many years. In the past, the cost of collecting, processing, and delivering waste oil has been greater than the cost of new fuel oil.

The Fort Hood Directorate of Industrial Operations estimates purchases of 300,000 gallons of No. 2 fuel oil yearly. If all buildings with oil-firing capacities were to actually use oil, the total Fort Hood requirement would be approximately 700,000 gallons of No. 2 fuel oil yearly.

Waste oil is available in amounts ranging from 250,000 to 375,000 gallons per year from tactical vehicles only. Collection of this resource is being partially accomplished now, and the current unrecovered portion, along with additional waste lubricating oil from other sources, could probably be collected without great exertion.

Use of waste oil as a supplement to purchased fuel oil is environmentally acceptable and meets ECIP criteria. This project is recommended for implementation in FY 83.

The remaining alternatives are solid fuels or synthetic gas derived from solids. Solid fuels may be fired directly in boilers designed for the particular fuel to be burned or in boilers converted to the proper configuration. Either method is technically feasible, but neither may be economically feasible. Boilers of less than 20,000,000 Btuh capacity are poor candidates for coal firing due to the high cost of the necessary coal handling facilities. There are no boilers larger than this at Fort Hood.

Synthetic gas may be produced from coal or biomass; either process requires an appreciable investment in plant and operating personnel. The calorific value of the gases produced will depend upon the process chosen. Biomass conversion does not merit indepth investigation since the available biomass consists of only human sewage and organic garbage. It is doubtful that sufficient quantities of gas could be produced from such a small input. Coal gasification may have some merit provided that the calorific value of the gas produced is sufficient to satisfy the requirements of the post.

As an alternative to synthetic gas or the conversion of small individual boilers to solid fuel firing, a new central steam generating plant and steam distribution system may be considered. Such a plant would consist of multiple stoker-fired boilers, capable of accepting coal, solid waste, refuse derived fuels, pelletized wood products, or a combination of fuels. If a central steam generating plant and distribution system is to be built, then a relatively small additional investment would result in a selective energy plant producing electricity as a byproduct.

## UTILITY SYSTEMS

The electrical distribution system at Fort Hood is in satisfactory condition with adequate capacity to meet the anticipated future load growth.

Due to the normal growth of the system over a period of time, some feeder segment conductors may not be adequately sized for the present loading. Situations may exist when the conductor is thermally adequate but may be causing excessive losses and voltage drop. Replacement of selected overhead conductor segments with larger conductors was evaluated on the basis of cost savings resulting from reduced demand (kW) and energy losses (kWh) for the Fort Hood distribution system network.

Secondary benefits such as increased load capacity, improved voltage regulation, and improved overall system reliability attributed to new construction were not assigned any monetary value for this evaluation.

The results indicate that the payback periods for conductor replacement projects are favorable based on the energy savings at existing loads. Energy savings will increase as the load increases, thus making the project more attractive.

Fort Hood is served by the Texas Power & Light Company (TP&L). The TP&L service contract does not have a power factor penalty clause at this time. Therefore, power factor improvement was evaluated only the basis of cost savings resulting from reduced demand (kW) and energy losses (kWh).

The overall size of the power factor improvement capacitors for the Fort Hood main cantonment area and North Fort Hood was based on improving

the estimated 87.0 percent average power factor to 95.0 percent during peak load conditions. This total kvar of capacitors was then assumed to be distributed over the complete system as standardized units of about 300 kvar each, and installed at load centers or near the end of the feeder lines.

The power factor improvement project for Fort Hood main cantonment area has a marginal payback period. Although 2,592 million Btu of energy could be saved per year, the economics preclude implementation of this energy conservation measure. The power factor improvement project for the North Fort Hood area does not qualify for implementation under the ECIP criteria.

Generally, the economic advantages of higher voltages are not adequate to justify massive conversion of the existing lower voltage facilities. In the case of Fort Hood, the existing feeder circuit loading is comparable to the normal design criteria with sufficient capacity for anticipated future load growth. Additionally, since the present loading of these feeders is very light, the resultant savings in demand and energy losses is minimal.

Voltage conversion of existing feeder circuits does not qualify for implementation based on energy savings. In addition, conversion of some of the feeder circuits to a voltage different from the remainder of the system would reduce the flexibility of the various feeders to be connected or switched during critical periods. Conversion would also increase the inventory of materials due to a multi-voltage system, and could reduce personnel safety.

Replacement of mercury vapor luminaires with high pressure sodium luminaires will result in energy savings. However, the high replacement cost of the luminaires precludes this project since the ECIP criteria of benefit-to-cost ratio, energy savings-to-cost ratio and payback are not met as shown in Table 2.

In summary, existing mercury vapor luminaires should be replaced with or modified for high-pressure sodium luminaires as replacement becomes necessary during the normal maintenance program. In cases where higher lighting levels are required or new installations are planned, high-pressure sodium luminaires should be considered.

## ENERGY MONITORING AND CONTROL SYSTEM

Small buildings with simple environmental systems do not require the full capabilities of an Energy Monitoring and Control System in accordance with the Inter-agency Guide Specification. Energy and electrical demand savings are sufficient to justify a simple FM Radio Control System providing automatic on/off control and demand reduction. This system consists of a programmable controller, an FM radio transmitter and multiple receiver/switches. Each receiver/switch is tuned to accept a control signal on one specific frequency which is broadcast by the FM transmitter under control of the programmable controller. This system is utilized on temporary and permanent buildings with less than 40 tons of air-conditioning capacity, and on air-conditioned family housing units.

Larger, more complex buildings require control functions of more complexity than an FM system can supply. Hardwired Energy Monitoring and Control Systems can provide this control, as well as many other functions, but at a much higher cost. A completely new system, conforming to the Inter-agency Guide Specification, will not meet ECIP criteria. However, the energy savings possible with automated control are substantial and should not be ignored, nor should the associated savings due to more efficient maintenance functions, security control, and other operations which may be affected by the system capabilities.

A true basewide EMCS for Fort Hood requires approximately 50 miles of data transmission cable and would control approximately 200 buildings. Although the cost of connecting each building (including all sensors,

controllers and internal wiring) can be economically justified, the savings are not great enough to overcome the cost of the central equipment and data transmission system.

## ECIP PROJECTS

### T-881 - FM Control System for Nonresidential Facilities

This project will consist of installing an FM radio controller in a central building. FM radio control switches will be installed on 198 chillers and package units and air handlers on temporary buildings, and 129 of the same on permanent buildings' air-conditioning systems for demand control. Also, 724 radio switches will be installed in 267 temporary buildings on the heating units for nighttime and weekend setback of space temperature. Six-hour timers, to provide local override of radio switches, will be installed in 40 percent of the buildings with temperature setback.

### T-882 - Energy Conservation Modifications to Permanent Barracks

This project will consist of installing operable storm windows, with solar film and half screens, over existing windows; weatherstripping all doors; calking foundations and other cracks; and installing flow control shower heads.

### T-883 - Energy Conservation Modifications to Permanent Barracks

This project will consist of installing operable storm windows, with solar film and half screens, over existing windows in air-conditioned buildings occupied over 12 hours per day; insulating ceilings in buildings having an existing U-value greater than 0.10; weatherstripping doors; and calking foundations and other cracks.

### T-884 - Energy Conservation Modifications to Family Housing

This project will consist of weatherstripping all doors; calking foundations and other cracks; installing flow control shower heads; installing operable storm windows, with half screens, over existing windows; and replacing selected incandescent fixtures with fluorescent lights in 5,236 family housing units.

### T-885 - Energy Conservation Modifications to Temporary Buildings

This project will consist of adding floor insulation and sheathing to air-conditioned temporary buildings; adding insulation to the ceiling of air-conditioned temporary buildings that have a U-value greater than 0.10; weatherstripping doors; calking cracks; and installing operable storm windows, with solar film and half screens, over existing windows in air-conditioned temporary buildings.

T-886 - FM Control System for Family Housing

This project will consist of installing FM radio control switches on 4,904 residential central air-conditioner compressors for demand control and temperature shutoff. Central control equipment will be provided under Project No. T419.

T-887 - Energy Conservation Incandescent Lighting Replacement

This project will consist of replacing incandescent lighting in temporary administration buildings and temporary warehouse storage type buildings with fluorescent lighting. This project involves 153 buildings.

T-888 - Energy Conservation Recreational Field Lighting

This project will consist of replacing incandescent lighting at 16 recreational fields with high intensity discharge (HID) lighting.

T-889 - Solar Heated Swimming Pool, Abrams Field House

This project will consist of installing a solar heating system for the indoor swimming pool at Creighton W. Abrams Field House (Building 23001). The solar collectors will be roof-mounted fin-tube type.

T-890 - Energy Conservation Replacement of Primary Conductors

This project will consist of replacing existing copper 2/0 and 4/0 AWG primary conductors on distribution feeder Ckt. No. 1 and 1/0 AWG primary conductor on distribution feeder Ckt. No. 2 with new 477 MCM ACSR conductors.

T-891 - Energy Conservation Modifications to Permanent Buildings Under 10,000 S.F.

This project will consist of installing operable storm windows, with solar film and half screens, over existing windows in air-conditioned buildings occupied over 12 hours per day; insulating ceilings in buildings having an existing U-value greater than 0.10; weatherstripping doors; and calking foundations and other cracks. This project involves 78 buildings.

T-893 - Modifications and Facilities for Use of Waste Oil as Boiler Fuel

This project will consist of modifications to existing oil-fired boilers at Bldg. No. 39043 enabling the use of waste vehicle oil as a supplemental fuel, and the construction of a central POL facility for collecting and processing waste vehicle oil.

T-894 - Energy Conservation Automated Control System for Large Boilers

This project will consist of the installation of modern combustion control systems utilizing continuous monitoring and control of flue gas oxygen content in 19 large boilers at 13 buildings.

## TOTAL ENERGY/SELECTIVE ENERGY

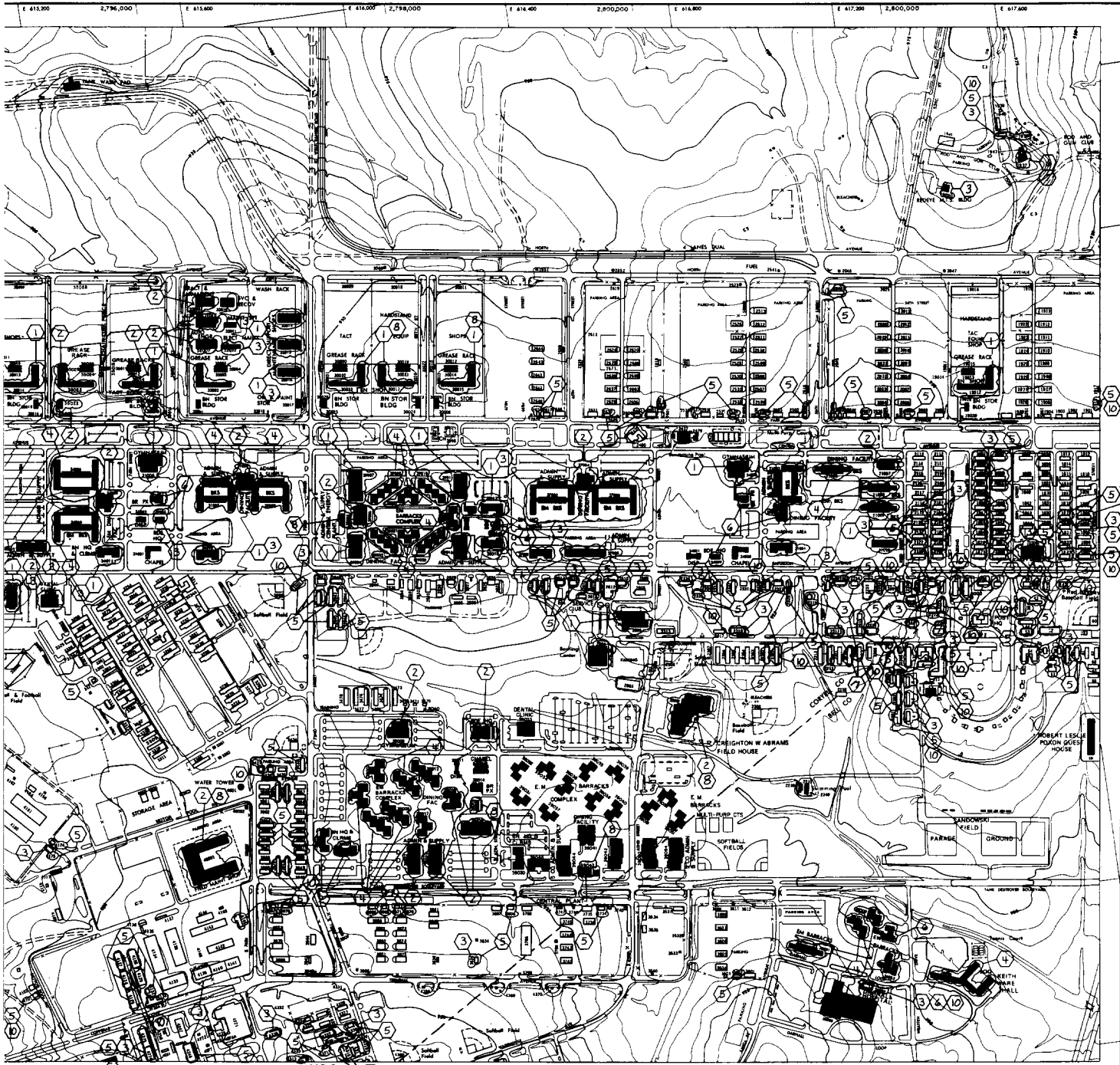
Total Energy or Selective Energy systems basically produce electricity and utilize heat rejected by the generating process to satisfy other needs. A Selective Energy plant supplies a portion of the electrical requirements while a Total Energy plant satisfies all electrical requirements. The systems utilize heat rejected in condensing steam for return to a boiler, or the heat contained in the exhaust gases and cooling water of an internal combustion engine. This waste heat can be reclaimed to some extent and used to satisfy the requirement for space heating, domestic water heating, and absorption cooling processes.

Several Selective and Total Energy concepts were considered. The concepts are impaired by the lack of an existing steam distribution system at Fort Hood. Based on ECIP guidelines, neither a Selective Energy nor a Total Energy system is considered acceptable. It is recommended that the conventional system be retained.

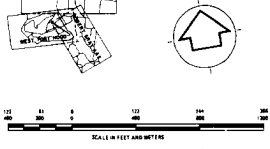
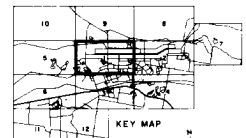


BUILDING MODIFICATIONS LEGEND		LEGEND	
1	INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS. INSULATE CEILING.	BUILDING, PERMANENT	
2	INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS.	BUILDING, SEMI-PERMANENT	
3	INSTALL FM RADIO CONTROL SYSTEM.	BUILDING, TEMPORARY	
4	INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS.	ROADS AND PARKING	
5	INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND OPENING TO FLOOR.	TRAIL, UNIMPROVED	
6	INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.	FENCE, BARBED WIRE	
7	INSTALL SOLAR POOL HEATING SYSTEM.	FENCE, CHAIN LINK	
8	INSTALL OXYGEN ANALYSIS COMBUSTION CONTROL SYSTEM.	FENCE AND BOUNDARY	
9	INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLOUORESCENT KITCHEN LIGHT FIXTURES.	EMERGENCY	
10	INSTALL FLOUORESCENT LIGHT FIXTURES.	DRAINAGE CHANNEL	
11	INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.	BRIDGE	
12	REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.	CLAVET	
13	INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS. AND CEILING INSULATION.	RESERVATION BOUNDARY	
14	INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS.	INDEX CONTOUR	
15	INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLOUORESCENT KITCHEN LIGHT FIXTURES.	INTERMEDIATE CONTOUR	
16	INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLOUORESCENT KITCHEN LIGHT FIXTURES. WEATHERSTRIP ALL DOORS AND CALC ALL OPENINGS.	DEPRESSION CONTOUR	
		NOISE CONTOUR	
		AIRSPACE CORRIDORS	

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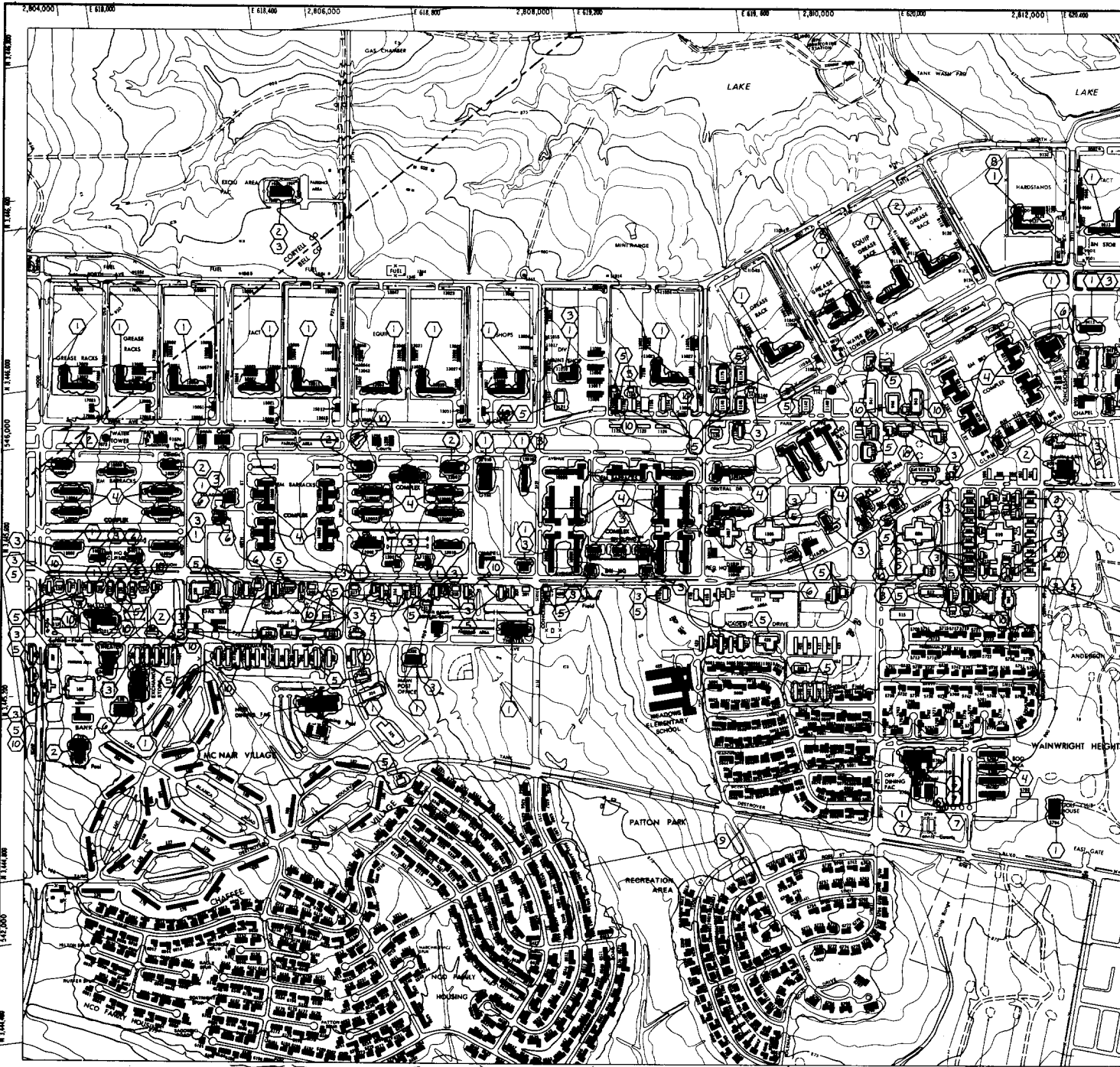


- LEGEND**
- BUILDING, PERMANENT
  - BUILDING, SEMI-PERMANENT
  - BUILDING, TEMPORARY
  - ROADS AND PARKING
  - TRAIL, UNIMPROVED
  - FENCE, BARBED WIRE
  - FENCE, CHAIN LINK
  - FENCE AND BOUNDARY
  - RAILROAD
  - DRAINAGE CHANNEL
  - BRIDGE
  - CULVERT
  - RESERVATION BOUNDARY
  - INDEX CONTOUR
  - INTERMEDIATE CONTOUR
  - DEPRESSION CONTOUR
  - NOISE CONTOUR
  - AIRSPACE CORRIDORS



<b>FORT HOOD</b> KILLEEN, TEXAS		
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
MASTER PLAN BASIC INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>		
RECOMMENDED BY THE BRIGADE PLANNING BOARD FOR APPROVAL		
DATE		
APPROVED & CONTROLLED BY: [Signature]	DATE	DRAWING NO.
IN ACCORDANCE WITH THE POLICY OF THE CHIEF OF ENGINEERS	DEC. 1979	
DATE	SHEET NO.	PAGE NO.
	1 OF 1	

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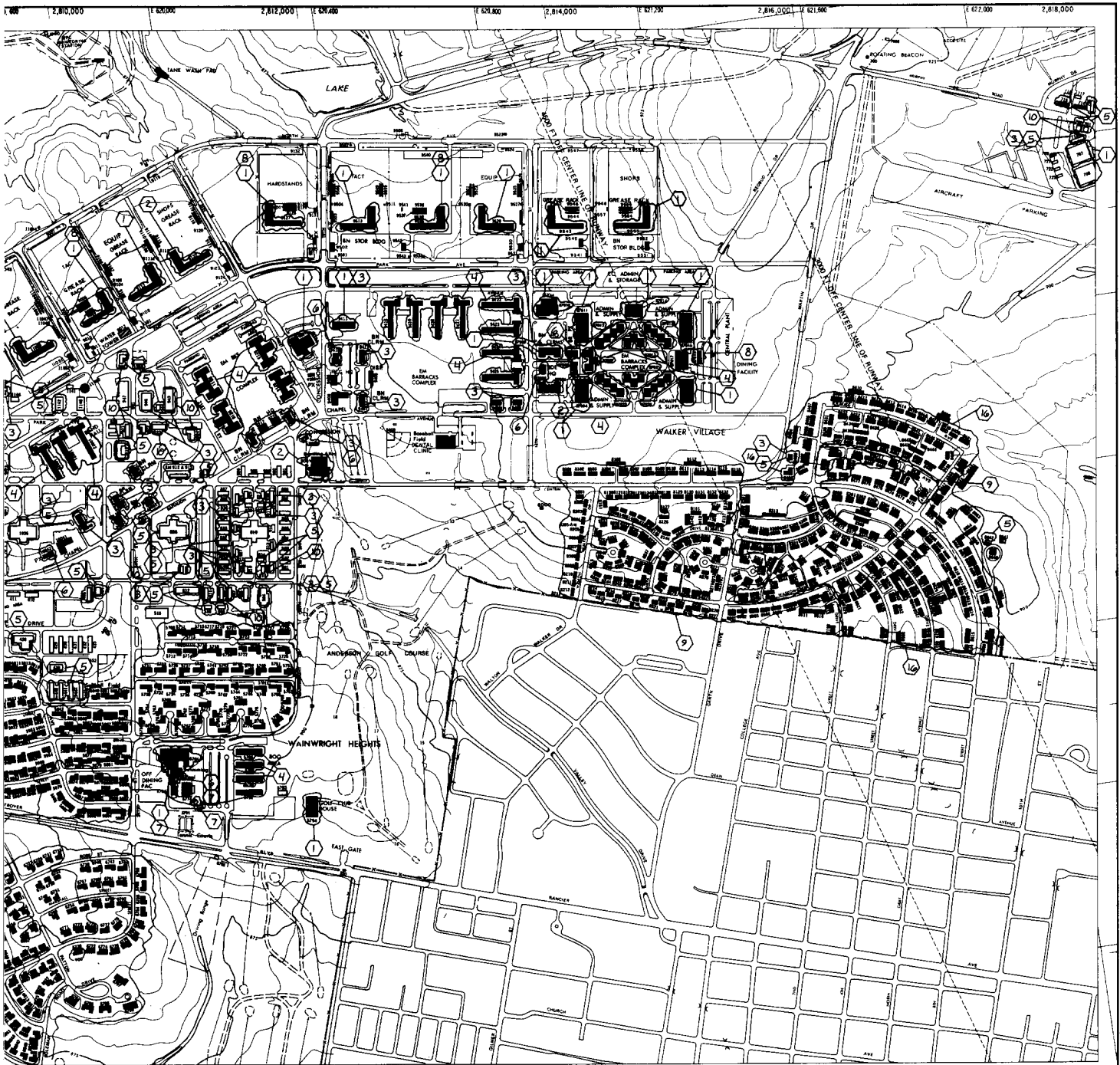
BUILDING MODIFICATIONS LEGEND

- |  |   |
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| <p>1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS. INSULATE CEILING.</p> <p>2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS.</p> <p>3 INSTALL FM RADIO CONTROL SYSTEM.</p> <p>4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS.</p> <p>5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND WEATHERSTRIP TO FLOOR.</p> <p>6 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.</p> <p>7 INSTALL SOLAR POOL HEATING SYSTEM.</p> <p>8 INSTALL OXYGEN ANALYSIS COMBUSTION CONTROL SYSTEM.</p> | <p>9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES.</p> <p>10 INSTALL FLUORESCENT LIGHT FIXTURES.</p> <p>11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.</p> <p>12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.</p> <p>13 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS. ADD CEILING INSULATION.</p> <p>14 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS.</p> <p>15 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES.</p> <p>16 INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES. WEATHERSTRIP ALL DOORS AND CAULK ALL OPENINGS.</p> |
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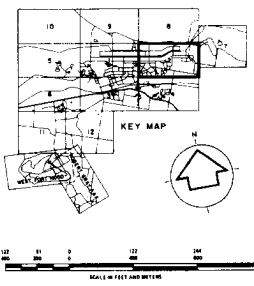
LEGEND

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| <p>BUILDING, PERMANENT</p> <p>BUILDING, SEMI-PERMANENT</p> <p>BUILDING, TEMPORARY</p> <p>ROADS AND PARKING</p> <p>TRAIL, UNIMPROVED</p> <p>FENCE, BARBED WIRE</p> <p>FENCE, CHAIN LINK</p> <p>FENCE AND BOUNDARY</p> <p>RAILROAD</p> <p>DRAINAGE CHANNEL</p> <p>BRIDGE</p> <p>CULVERT</p> <p>RESERVATION BOUNDARY</p> <p>INDEX CONTOUR</p> <p>INTERMEDIATE CONTOUR</p> <p>DEPRESSION CONTOUR</p> <p>NOISE CONTOUR</p> <p>AIRSPACE CORRIDOR</p> |  |
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- LEGEND**
- BUILDING, PERMANENT
  - BUILDING, SEMI-PERMANENT
  - BUILDING, TEMPORARY
  - ROADS AND PARKING
  - TRAIL, UNIMPROVED
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  - INDEX CONTOUR
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  - NOISE CONTOUR
  - AIRSPACE CORRIDOR



<b>FORT HOOD</b> KILLEEN, TEXAS	
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS	
MASTER PLAN BASIC INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>	
RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL	
DATE	
APPROVED & SUBMITTED ON BY BRANCH COMMANDER	DATE
APPROVED BY THE CHIEF OF ENGINEERS	DATE
DATE	
DRAWING NO	
SHEET NO	37
FILE NO	

2



BUILDING MODIFICATIONS LEGEND

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| <ul style="list-style-type: none"> <li>1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. INSTALL FLOW CONTROL SHOWER HEADS.</li> <li>2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES.</li> <li>3 INSTALL FM RADIO CONTROL SYSTEM.</li> <li>4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. INSTALL FLOW CONTROL SHOWER HEADS.</li> <li>5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES.</li> <li>6 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.</li> <li>7 INSTALL SOLAR POOL HEATING SYSTEM.</li> <li>8 INSTALL EITHER ANALYSIS COMBUSTION CONTROL SYSTEM.</li> </ul> | <ul style="list-style-type: none"> <li>9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES.</li> <li>10 INSTALL FLUORESCENT LIGHT FIXTURES.</li> <li>11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.</li> <li>12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.</li> <li>13 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES.</li> <li>14 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS.</li> <li>15 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES.</li> <li>16 INSTALL FLOW CONTROL SHOWER HEADS. WEATHERSTRIP ALL DOORS AND GALS ALL OPERABLES.</li> </ul> |
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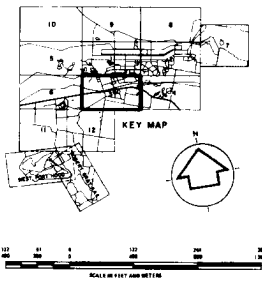
LEGEND

- BUILDING, PERMANENT
- BUILDING, SEMI-PERMANENT
- BUILDING, TEMPORARY
- ROADS AND PARKING
- TRAIL, UNIMPROVED
- FENCE, BARBED WIRE
- FENCE, CHAIN LINK
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- RAILROAD
- DRAINAGE CHANNELS
- BRIDGE
- CLAYBET
- RESERVATION BOUNDARY
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSION CONTOUR
- NOISE CONTOUR
- AIRSPACE CORRIDORS

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- LEGEND**
- BUILDING, PERMANENT
  - BUILDING, SEMI-PERMANENT
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<b>FORT HOOD</b> KILLEEN, TEXAS		
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
MASTER PLAN BASE INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>		
<small>RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL.</small>		
DATE		
APPROVED & CONTROLLED BY: <small>BY NAME COMMANDER &amp; POSITION TO THE CHIEF OF WORKS</small>	DATE <b>DEC-1978</b>	DRAWING NO.
DATE	SHEET NO. 3 OF 12	FILE NO.

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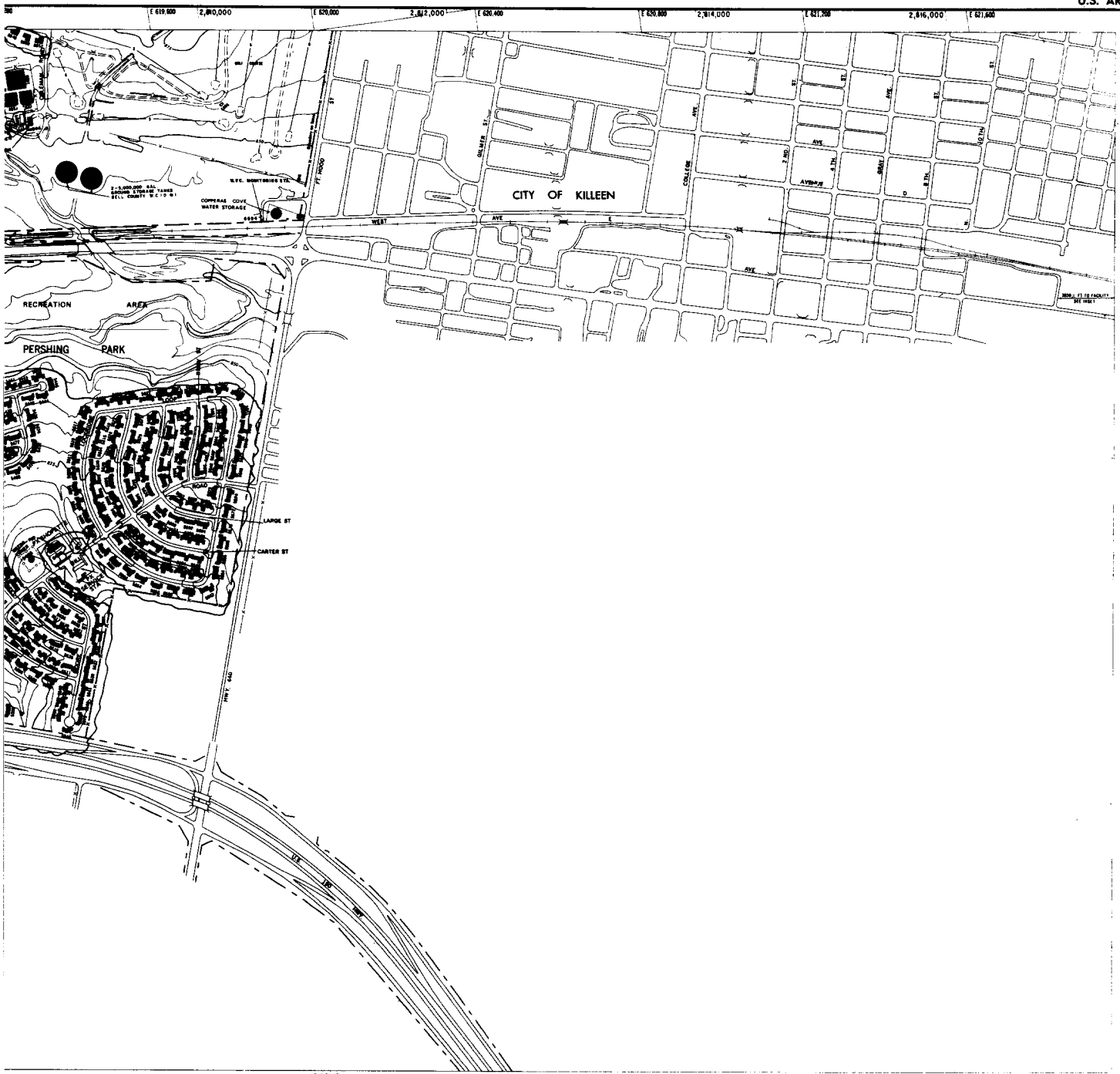
BUILDING MODIFICATIONS LEGEND

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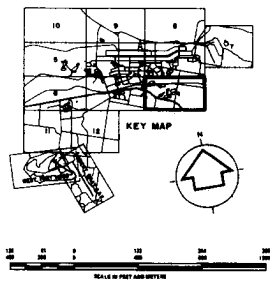
LEGEND

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| <p>BUILDING PERMANENT</p> <p>BUILDING SEMI-PERMANENT</p> <p>BUILDING TEMPORARY</p> <p>ROADS AND PARKING</p> <p>TRAIL UNIMPROVED</p> <p>FENCE BARBED WIRE</p> <p>FENCE CHAIN LINK</p> <p>FENCE AND BOUNDARY</p> <p>RAILROAD</p> <p>DRAINAGE CHANNEL</p> <p>BRIDGE</p> <p>CULVERT</p> <p>RESERVATION BOUNDARY</p> <p>HIGH CONTOUR</p> <p>INTERMEDIATE CONTOUR</p> <p>DEPRESSION CONTOUR</p> <p>NOISE CONTOUR</p> <p>AIRSPACE CORRIDORS</p> |  |
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- LEGEND**
- BUILDING, PERMANENT
  - BUILDING, SEMI-PERMANENT
  - BUILDING, TEMPORARY
  - ROADS AND PARKWAYS
  - TRAIL, UNIMPROVED
  - FENCE, BARBED WIRE
  - FENCE, CHAIN LINK
  - FENCE AND BOUNDARY
  - RAILROAD
  - DEMANDED CHANNEL
  - BRIDGE
  - CULVERT
  - RESERVATION BOUNDARY
  - INDEX CONTOUR
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  - NOISE CONTOUR
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<b>FORT HOOD</b> KILLEEN, TEXAS		
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
MASTER PLAN BASIC INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>		
<small>REVISIONS BY THE REGULATION PLANNING BOARD FOR APPROVAL</small>		
DATE		
<small>DESIGNED &amp; CHECKED BY: [Signature]</small>	DATE DEC 1979	DRAWING NO.
DATE	<small>DRAWING NO.</small> SHEET NO. 4 OF 12	FILE NO.

2



BUILDING MODIFICATIONS LEGEND

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|---|---|
| <p>1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. INSTALL FLOW CONTROL SUMMER HEADS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> <p>2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> <p>3 INSTALL PH RADIO CONTROL SYSTEM.</p> <p>4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL SUMMER HEADS.</p> <p>5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND WEATHERSTRIP TO FLOOR.</p> <p>6 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.</p> <p>7 INSTALL SOLAR POOL HEATING SYSTEM.</p> <p>8 INSTALL OXYGEN ANALYSIS COMBUSTION CONTROL SYSTEM.</p> | <p>9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SUMMER HEADS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL SUMMER HEADS.</p> <p>10 INSTALL FLUORESCENT LIGHT FIXTURES.</p> <p>11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.</p> <p>12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.</p> <p>13 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. ADD CEILING INSULATION.</p> <p>14 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> <p>15 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> <p>16 INSTALL FLOW CONTROL SUMMER HEADS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> |
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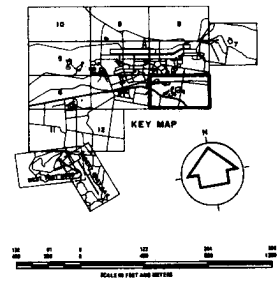
LEGEND

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|--------------------------|--|
| BUILDING, PERMANENT      |  |
| BUILDING, SEMI-PERMANENT |  |
| BUILDING, TEMPORARY      |  |
| ROADS AND PARKING        |  |
| RAIL, UNIMPROVED         |  |
| FENCE, BARBED WIRE       |  |
| FENCE, CHAIN LINK        |  |
| FENCE AND BOUNDARY       |  |
| RAILROAD                 |  |
| DRAINAGE CHANNEL         |  |
| BRIDGE                   |  |
| CULVERT                  |  |
| RESERVATION BOUNDARY     |  |
| INDEX CONTOUR            |  |
| INTERMEDIATE CONTOUR     |  |
| DEPRESSION CONTOUR       |  |
| NOISE CONTOUR            |  |
| AIRSPACE CORRIDORS       |  |

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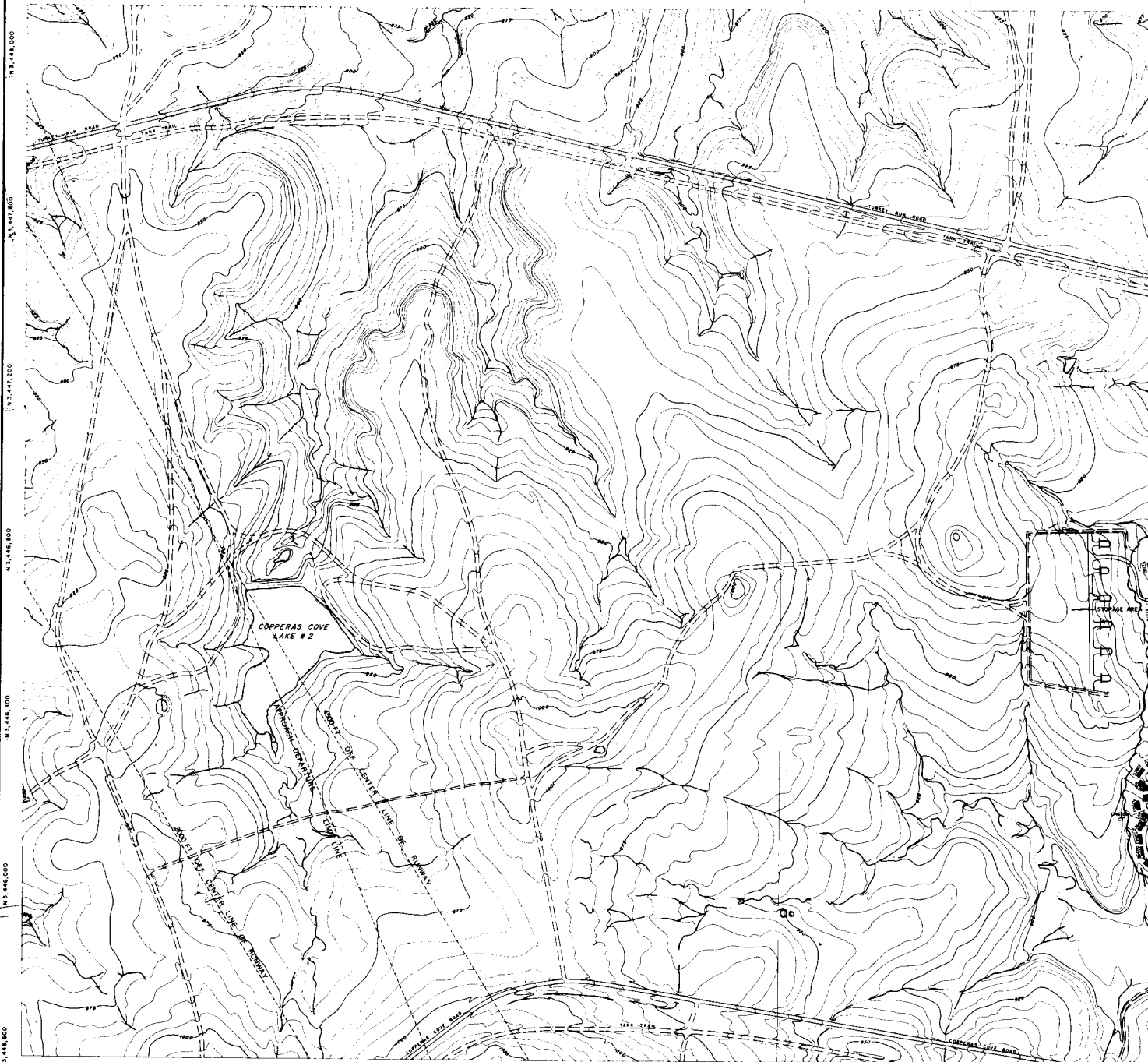


- LEGEND**
- BUILDING, PERMANENT
  - BUILDING, SEMI-PERMANENT
  - BUILDING, TEMPORARY
  - ROADS AND PARKING
  - RAIL, UNIMPROVED
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  - INDEX CONTOUR
  - INTERMEDIATE CONTOUR
  - DEPRESSION CONTOUR
  - NOISE CONTOUR
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<b>FORT HOOD</b> KILLEEN, TEXAS		
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
MASTER PLAN BASIC INFORMATION MAPS		
<b>GENERAL ENERGY CONSERVATION MAP</b>		
<small>RECOMMENDED BY THE CONSTRUCTION PLANNING BOARD FOR APPROVAL.</small>		
DATE	DATE	DRAWING NO.
	DEC 1972	
DATE	SHEET NO.	FILE NO.
	4 OF 12	

(2)



BUILDING MODIFICATIONS LEGEND

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| <p>1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING.</p> <p>2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> <p>3 INSTALL FM RADIO CONTROL SYSTEM.</p> <p>4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL, SUMMER HEADS.</p> <p>5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND WEATHERSTRIP TO FLOOR.</p> <p>6 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.</p> <p>7 INSTALL SOLAR POOL HEATING SYSTEM.</p> <p>8 INSTALL SYSTEM ANALYSIS COMBUSTION CONTROL SYSTEM.</p> | <p>9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL, SUMMER HEADS. INSTALL FLOORESCENT KITCHEN LIGHT FIXTURES.</p> <p>10 INSTALL FLOURESCENT LIGHT FIXTURES.</p> <p>11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTS.</p> <p>12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.</p> <p>13 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. ADD CEILING INSULATION.</p> <p>14 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL, SUMMER HEADS. INSTALL FLOORESCENT KITCHEN LIGHT FIXTURES.</p> <p>15 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.</p> |
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LEGEND

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|--------------------------|--|
| BUILDING, PERMANENT      |  |
| BUILDING, SEMI-PERMANENT |  |
| BUILDING, TEMPORARY      |  |
| ROADS AND PARKING        |  |
| TRAIL, UNIMPROVED        |  |
| FENCE, BARBED WIRE       |  |
| FENCE, CHAIN LINK        |  |
| FENCE AND BOUNDARY       |  |
| RAILROAD                 |  |
| DRAINAGE CHANNEL         |  |
| BRIDGE                   |  |
| CAUVET                   |  |
| RESERVATION BOUNDARY     |  |
| INDEX CONTOUR            |  |
| INTERMEDIATE CONTOUR     |  |
| DEPRESSION CONTOUR       |  |
| NOISE CONTOUR            |  |
| AIRSPACE CORRIDORS       |  |

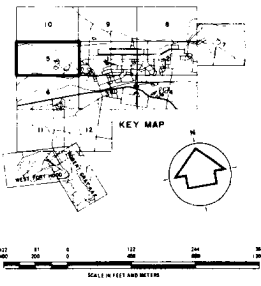
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E 611,200 E 611,400 E 612,000 E 612,200 E 612,400 E 613,200



LEGEND

- BUILDING, PERMANENT
- BUILDING, SEMI-PERMANENT
- BUILDING, TEMPORARY
- ROADS AND PARKING
- TRAIL, UNIMPROVED
- FENCE, BARBED WIRE
- FENCE, CHAIN LINK
- FENCE AND BOUNDARY
- RAILROAD
- DRAINAGE CHANNEL
- BRIDGE
- CULVERT
- RESERVATION BOUNDARY
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSION CONTOUR
- NOISE CONTOUR
- AIRSPACE CORRIDORS



<b>FORT HOOD</b> KILLEEN, TEXAS	
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS	
MASTER PLAN BASIC INFORMATION - MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>	
RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL	
DATE	
DESIGNED & COORDINATED BY: [NAME] APPROVED BY THE DISTRICT COMMANDER	DATE DEC 1979
DATE	DRAWING NO.
	SHEET NO. 8 OF 12
	FILE NO.

2

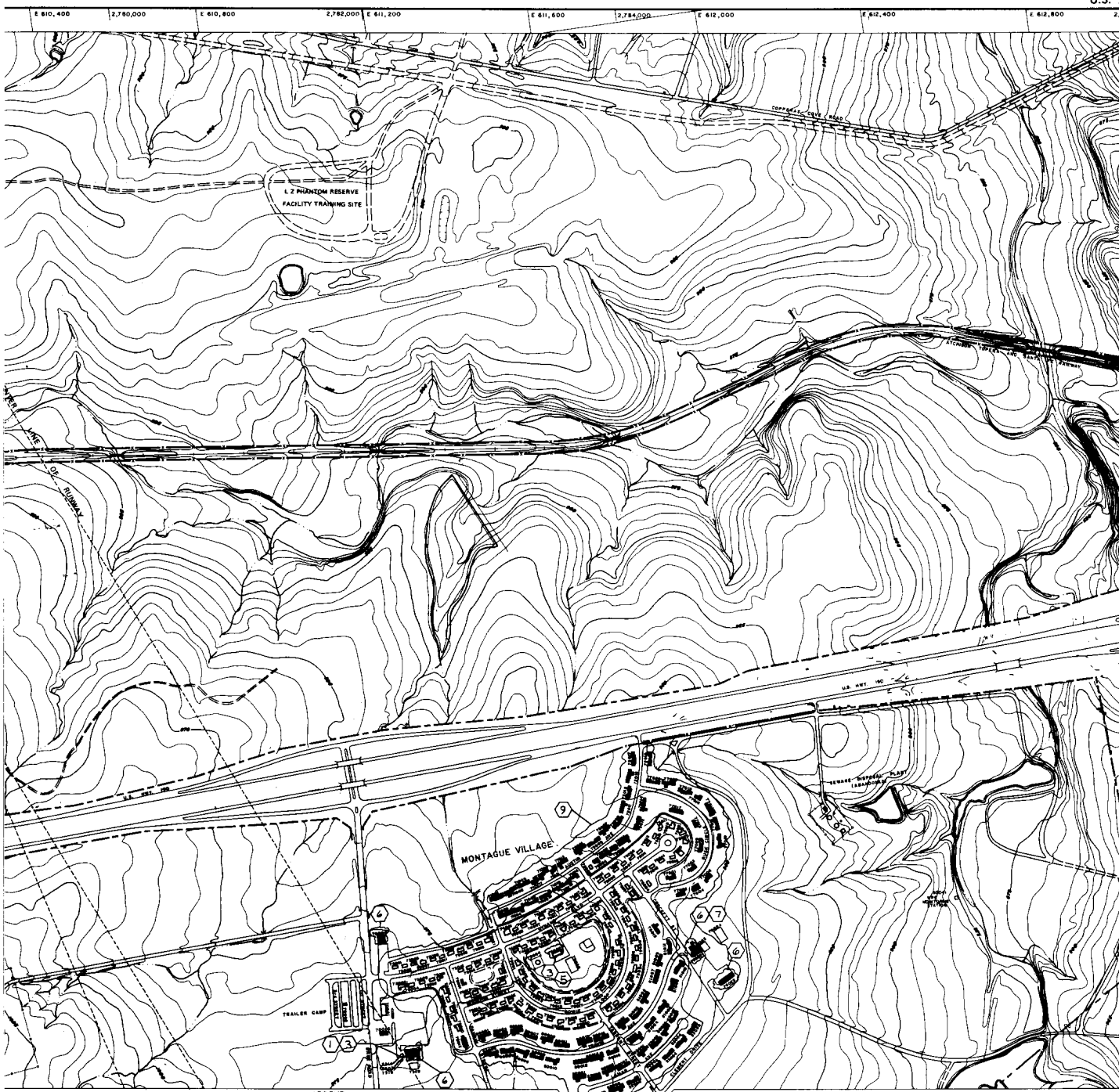


BUILDING MODIFICATIONS LEGEND

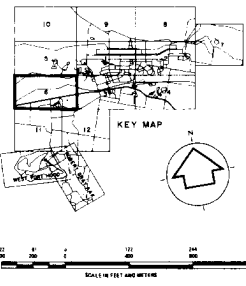
- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS. INSULATE CEILING.</li> <li>2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS.</li> <li>3 INSTALL FM RADIO CONTROL SYSTEM.</li> <li>4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS. INSULATE CEILING.</li> <li>5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND SHEATHING TO FLOOR.</li> <li>6 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.</li> <li>7 INSTALL SOLAR POOL HEATING SYSTEM.</li> <li>8 INSTALL OXYGEN ANALYSIS COMBUSTION CONTROL SYSTEM.</li> </ul> | <ul style="list-style-type: none"> <li>9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES.</li> <li>10 INSTALL FLUORESCENT LIGHT FIXTURES.</li> <li>11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.</li> <li>12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.</li> <li>13 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS. ADD CEILING INSULATION.</li> <li>14 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS.</li> <li>15 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES. WEATHERSTRIP ALL DOORS AND CALK ALL OPENINGS.</li> </ul> |
|---|--|

- LEGEND
- |                          |  |
|--------------------------|--|
| ROAD, PERMANENT          |  |
| BUILDING, SEMI-PERMANENT |  |
| BUILDING, TEMPORARY      |  |
| ROADS AND PARKING        |  |
| TRAIL, UNIMPROVED        |  |
| FENCE, BARBED WIRE       |  |
| FENCE, CHAIN LINK        |  |
| FENCE AND BOUNDARY       |  |
| RAILROAD                 |  |
| DRAINAGE CHANNEL         |  |
| BROGE                    |  |
| CULVERT                  |  |
| RESERVATION BOUNDARY     |  |
| INDEX CONTOUR            |  |
| INTERMEDIATE CONTOUR     |  |
| DEPRESSION CONTOUR       |  |
| NOISE CONTOUR 1          |  |
| AIRSPACE CORRIDORS       |  |

1



- LEGEND**
- |                          |  |
|--------------------------|--|
| BUILDING, PERMANENT      |  |
| BUILDING, SEMI-PERMANENT |  |
| BUILDING, TEMPORARY      |  |
| ROADS AND PARKING        |  |
| TRAIL, UNIMPROVED        |  |
| FENCE, BARBED WIRE       |  |
| FENCE, CHAIN LINK        |  |
| FENCE AND BOUNDARY       |  |
| RAILROAD                 |  |
| DRAINAGE CHANNEL         |  |
| BRIDGE                   |  |
| CULVERT                  |  |
| RESERVATION BOUNDARY     |  |
| INDEX CONTOUR            |  |
| INTERMEDIATE CONTOUR     |  |
| DEPRESSION CONTOUR       |  |
| NOISE CONTOUR            |  |
| AIRSPACE CORRIDORS       |  |



<b>FORT HOOD</b> KILLEEN, TEXAS	
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS	
MASTER PLAN BASIC INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>	
RECOMMENDED BY THE METEOROLOGICAL PLANNING BOARD FOR APPROVAL	
DATE	_____
APPROVED & FORWARDED BY: [Signature Line]	DATE DEC. 1979
DATE	DRAWING NO.
_____	_____
_____	SHEET NO.
_____	8 OF 12
_____	FILE NO.
_____	_____

2

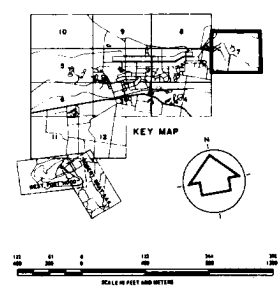




**LEGEND**

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
[Solid black rectangle]	BUILDING, PERMANENT	[Thin black outline]	BUILDING, TEMPORARY	[Thick black outline]	BUILDING, PER TO BE BUILT
[Dashed line]	ROADS AND PARKING	[Dashed line]	RAIL, UNIMPROVED	[Dashed line]	FENCE, BARBED WIRE
[Dashed line]	FENCE, CHAIN LINK	[Dashed line]	FENCE AND BOUNDARY	[Dashed line]	RAILROAD
[Dashed line]	DRAINAGE CHANNEL	[Dashed line]	WEDGE	[Dashed line]	CLAYEST
[Dashed line]	RESERVOIR BOUNDARY	[Dashed line]	INDIC CONTOUR	[Dashed line]	INTERMEDIATE CONTOUR
[Dashed line]	DEPRESSION CONTOUR	[Dashed line]	NOISE CONTOUR	[Dashed line]	AIRSPACE CORRIDORS

- BUILDING MODIFICATIONS LEGEND**
- 1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING.
  - 2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.
  - 3 INSTALL IN RADIO CONTROL SYSTEM.
  - 4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS.
  - 5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND WEATHER TO FLOOR.
  - 6 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS.
  - 7 INSTALL SOLAR POOL HEATING SYSTEM.
  - 8 INSTALL OXYGEN ANALYSIS COMBUSTION CONTROL SYSTEM.
  - 9 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.
  - 10 INSTALL FLUORESCENT LIGHT FIXTURES.
  - 11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.
  - 12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.
  - 13 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. ADD CEILING INSULATION.
  - 14 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.
  - 15 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.
  - 16 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.



<b>FORT HOOD</b> KILLEEN, TEXAS	
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS	
MASTER PLAN BASIC INFORMATION MAPS	
<b>GENERAL ENERGY CONSERVATION MAP</b>	
RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL	
DATE	_____
APPROVED & FORWARDED TO THE HEAD OF THE DISTRICT BY NAME AND POSITION	DATE
_____	DEC 1979
DATE	DRAWING NO.
_____	7 OF 12
_____	FILE NO.
_____	_____

2











ITEM	SYMBOL	ITEM	SYMBOL
BUILDING, PERMANENT		DAM	
BUILDING, TEMPORARY		SHOWERS	
PAVEMENTS (walk, parking, apron, etc.)		DRAINAGE CHANNEL	
TRAIL OR BARTH ROAD		WASH AREAS	
FENCE, BARBED WIRE		CHANNEL LINING	
FENCE, CHAIN LINK		INDEX CONTOUR	
OBSERVATION BOUNDARY		INTERMEDIATE CONTOUR	
RESERVATION BOUNDARY		NOISE CONTOUR	
RESERVATION BOUNDARY		AIRSPACE CORRIDOR	
RAILROAD			
BRIDGE			
CULVERT			
VENT			

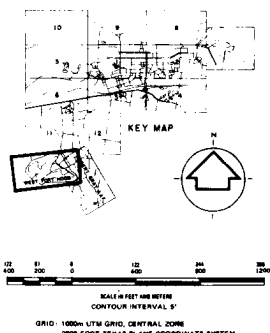
- BUILDING MODIFICATIONS LEGEND**
- 1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING.
  - 2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING. INSULATE FLOOR CONTROL. SUMMER HEADS.
  - 3 INSTALL FM RADIO CONTROL SYSTEM.
  - 4 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING. INSULATE FLOOR CONTROL. SUMMER HEADS.
  - 5 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE CEILING. ADD INSULATION AND WEATHER TO FLOOR.
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  - 8 INSTALL OXYGEN ANALYSIS COMBUSTION CONTROL SYSTEM.
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  - 10 INSTALL FLUORESCENT LIGHT FIXTURES.
  - 11 INSTALL HIGH INTENSITY DISCHARGE LIGHT LIGHTING.
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  - 16 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSULATE FLOOR CONTROL. SUMMER HEADS. INSTALL FLUORESCENT LIGHT FIXTURES.

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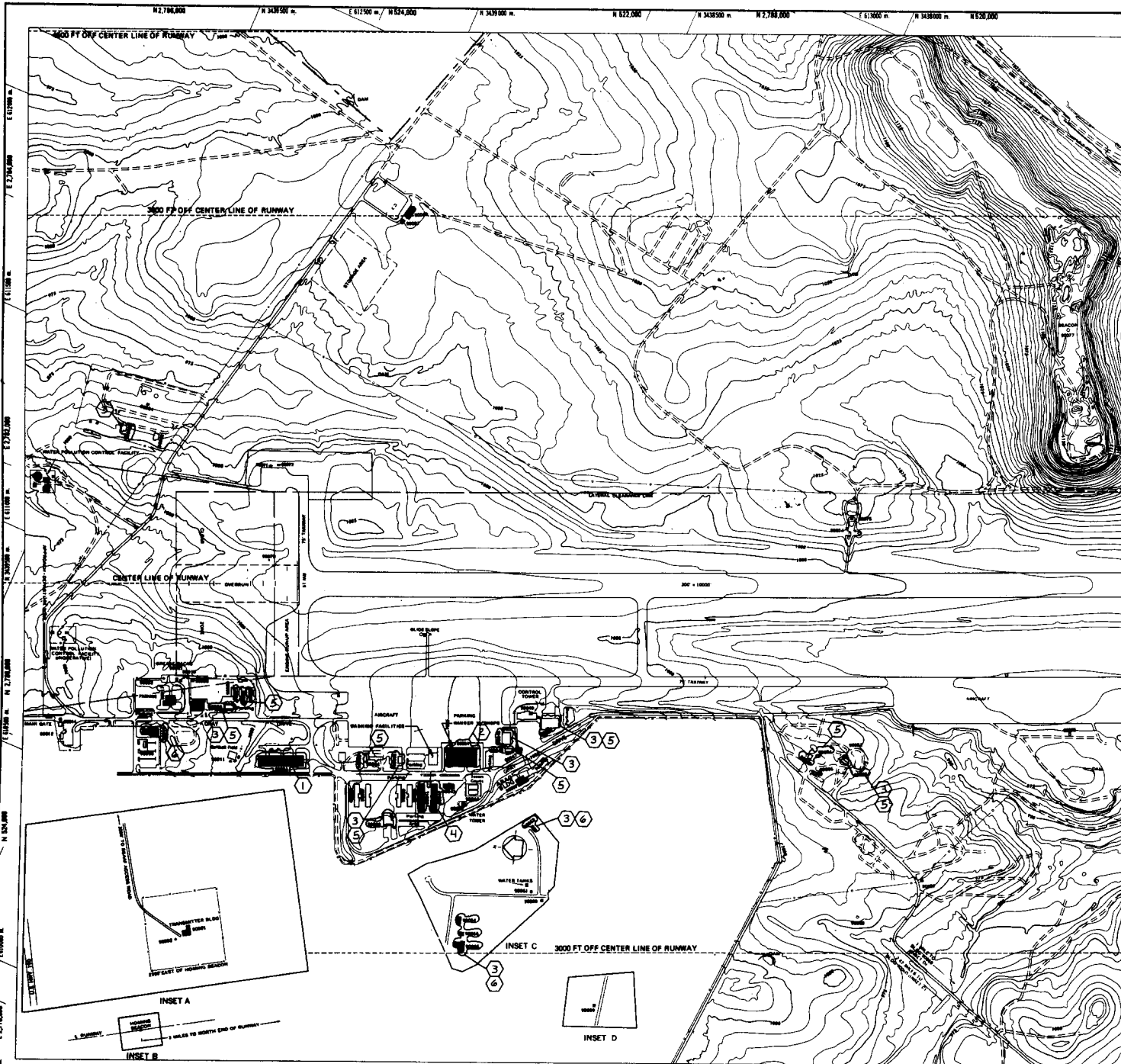
**BUILDING MODIFICATIONS LEGEND**

- 9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE.
- 10 INSTALL FLUORESCENT LIGHT FIXTURES.
- 11 INSTALL HIGH INTENSITY DISCHARGE LIGHT FIXTURES.
- 12 REPLACE PRIMARY ELECTRICAL DISTRIBUTION CONDUCTORS.
- 13 INSTALL PERMANENT STORM WINDOWS WITH HALF SCREENS. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE.
- 14 INSTALL PERMANENT STORM WINDOWS WITH HALF SCREENS. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE.
- 15 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE.
- 16 INSTALL LIGHT FIXTURES WITH HALF SCREENS. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE. REPAIR/REPLACE ALL OTHERS WITH ALL OPERABLE.



<b>FORT HOOD</b> KILLEEN TEXAS	
U. S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS 76102	
MASTER PLAN BASIC INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>	
<small>RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL</small> DATE: _____ APPROVED & COMMENTED BY: _____ & FORWARDED TO THE CHIEF OF MAPS: _____ DATE: <b>DEC. 1979</b> SHEET NO. <b>1 OF 1</b> FILE NO. _____	

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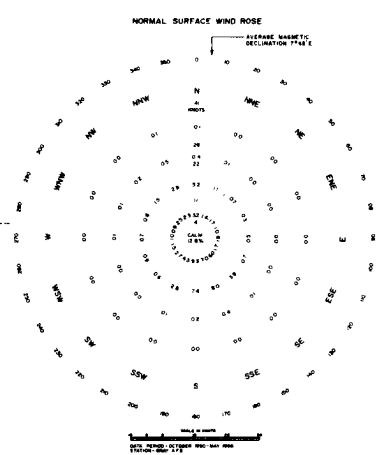
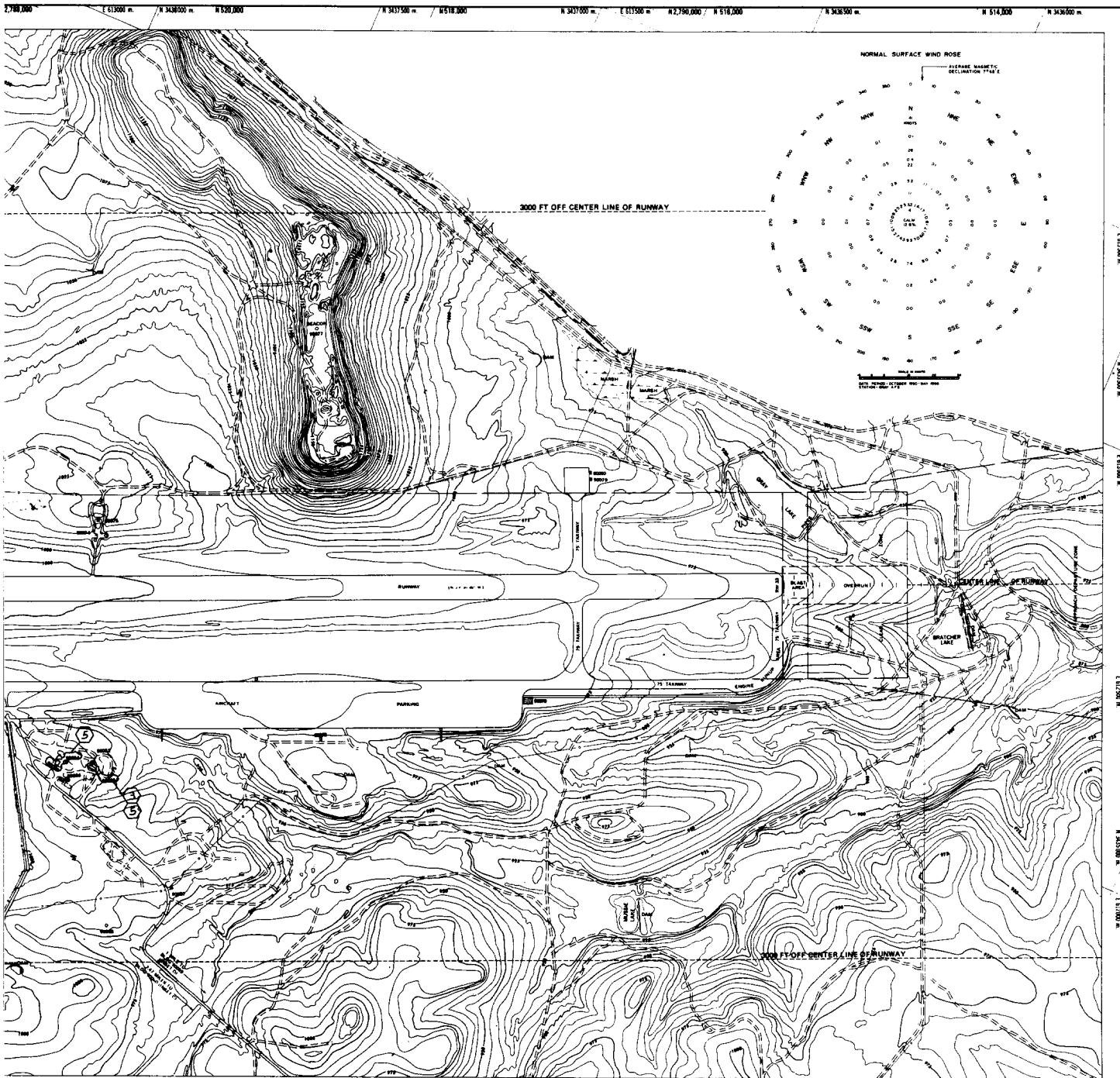
LEGEND

Symbol	Description	Symbol	Description
[Solid Black]	BUILDING, PERMANENT	[Dashed Line]	INDEX CONTOUR
[Hatched]	BUILDING, SEMI-PERMANENT	[Dotted Line]	INTERMEDIATE CONTOUR
[Dotted Line]	BUILDING, TEMPORARY	[Dashed Line]	NOISE CONTOUR
[Dashed Line]	PAVEMENTS (asphalt, portland cement, etc.)	[Dashed Line]	AIRSPACE CORRIDORS
[Dashed Line]	TRAIL OR EARTH ROAD		
[Dashed Line]	FENCE, BARBED WIRE		
[Dashed Line]	FENCE, CHAIN LINK		
[Dashed Line]	RESERVATION BOUNDARY		
[Dashed Line]	RESERVATION BOUNDARY		
[Dashed Line]	RAILROAD		
[Dashed Line]	BRIDGE		
[Dashed Line]	CAVITY		
[Dashed Line]	OUTLINE OF AREA LIMITS		

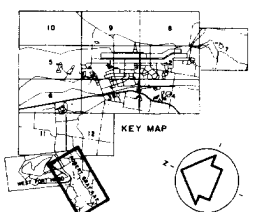
BUILDING MODIFICATIONS LEGEND

- 1 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPERINGS. INSULATE CEILINGS.
- 2 INSTALL OPERABLE STORM WINDOWS WITH SOLAR FILM AND HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALK ALL OPERINGS.
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- 16 INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES. WEATHERSTRIP ALL DOORS AND CALK ALL OPERINGS.

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- MS LEGEND**
- 9 INSTALL OPERABLE STORM WINDOWS WITH HALF SCREENS. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS. INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES.
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  - 16 INSTALL FLOW CONTROL SHOWER HEADS. INSTALL FLUORESCENT KITCHEN LIGHT FIXTURES. WEATHERSTRIP ALL DOORS AND CALL ALL OPENINGS.



**NOTE**  
 DUE TO OASA AIRBORNE AIR FORCE CRITERIA WERE USED FOR RUNWAY APPROACH ZONES CLEAR ZONES AND LATERAL CLEARANCES



<b>FORT HOOD</b> KILLEEN, TEXAS	
U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS 76102	
<b>MASTER PLAN</b> BASIC INFORMATION MAPS <b>GENERAL ENERGY CONSERVATION MAP</b>	
RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL	
DATE:	DATE: DEC. 1979
APPROVED & FORWARDED BY: (Signature)	APPROVED BY: (Signature)
DATE: 1 OF 1	FILE NO.:

N 337,000 m. E 41,900 m. N 343,000 m. N 349,500 m. N 516,000 m. N 343,700 m. E 61,950 m. N 2,750,000 m. N 516,000 m. N 348,500 m. N 514,000 m. N 348,000 m.

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