DEPARTMENT OF HEALTH SERVICES

CAPITAL EAST END COMPLEX

BUILDING OPERATIONS PLAN

June 4, 2007

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SECTION 1
INTRODUCTION

This introduction contains:

- A statement about the intended use of this plan
- A summary of the property
- A summary of Energy Star information
- A description of continuous monitoring systems
- An overview of building systems

1.1 How to Use this Plan

This plan contains information about the current operational needs of the building and how to meet them. The contents of this plan were gathered directly from existing building equipment manuals, previous commissioning reports, and documents submitted for LEED-EB certification.

This plan is intended to be a living document – its contents must be revised as the operational needs of the building evolve.

Note: When this building is retro-commissioned as part of the DGS RCx Program (see SECTION 5: COMMISSIONING AND RETRO-COMMISSIONING on page 29), a Systems Manual will be created. Any recommendations, procedures, or policies contained in the Systems Manual should supersede those contained in this Building Operations Plan

1.2 Summary of the Property

The Department of Health Services (DHS), Capital Area East End building complex is comprised of four buildings (051-054) and a parking garage.

The buildings are located in downtown Sacramento, California, and have been continuously occupied since April 2003.

The building attained a version 2.0 LEED-NC certification January 5, 2004 (LEED-NC project number 0134).

1.3 Energy Star

For the 12 month period ending November 2006, the DHS building complex has an Energy Star rating score of 86.

1.4 Continuous Monitoring

The DHS building complex utilizes a computerized building automation system – Honeywell Enterprise Building Integrator (EBI). The EBI automation system includes controls and sensors for the heating, cooling, lighting, and safety systems.

Sensors are continuously monitored. Alarms indicate when conditions are beyond normal operating limits and trend logs are used to determine when equipment is in need

of adjustment or repair and to keep the building's interior operating conditions at peak performance.

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1.5 Building Systems Overview

The DHS building complex has a central plant. The central plant includes electric and gas engine chillers, cooling towers, gas fired hot water boilers, a system of recovering hot water from the gas-fueled chillers, and primary – secondary pumps.

The central plant serves four large buildings that employ VAV air systems with hot water reheat.

The building systems described below include:

- Chiller
- Lighting
- Air Handling
- Meters (gas and electric)

1.5.1 Chiller

The chiller plant includes two 1275 ton electric centrifugal chillers fitted with variable speed drives, and three 384 ton gas engine driven centrifugal chillers with variable engine speed. All chillers are water cooled and each has a dedicated primary chilled water pump and condenser water pump. Six cooling towers provide the heat rejection for the chillers. The towers are configured in three pairs, each pair having connected basins. Cooling towers employ a single set of condenser water headers and each tower has entering and leaving water isolation valves (under BMS control) to isolate the tower when its use is not required. The tower fans employ variable speed drives. All the primary chilled water pumps and condenser water pumps are constant speed.

Chilled water distribution is accomplished with a primary - secondary - tertiary system.

1. Each chiller has a primary pump that circulates through the chiller into a primary loop within the plant.
2. A single secondary pump (with in-place backup pump) circulates chilled water through the underground distribution mains to maintain a minimum differential pressure within the mains as measured by a DP sensor at the end of the mains at Building 172.
3. A primary loop decoupling line allows chilled water to bypass in either direction when primary flow is greater or less than secondary flow.
4. At each of the four buildings served, a tertiary pump connects to the distribution mains and pumps into the distribution system within the building to maintain a minimum differential pressure at the end of the building's distribution network(s).

An automatically operated isolation valve isolates each building from the chilled water mains when it is unoccupied, and a bypass check valve enables chilled water flow into the building without tertiary pump operation at low load conditions when the building isolation valve is open. Constant flow bypass valves at the

ends of the distribution network in each building allow a small amount of chilled water to bypass to maintain chilled water flow through the mains at low load conditions to ensure chilled water at temperature is available at all times.

Because the cooling system provides chilled water for some computer rooms in the building served, the cooling system is expected to operate 24 X 7 all year long. However, the chilled water system will shut down automatically when all the buildings are unoccupied and all building chilled water isolation valves are closed.

1.5.2 Lighting

The DHS building complex building complex uses a PC-based lighting control system (EBI) that has the capability of generating trend reports displaying on and off times of each lighting control point.

The reports are generated monthly to identify lighting usage outside of the normal programmed lighting schedules.

1.5.3 Air-Handling

The DHS building complex utilizes variable air volume (VAV) systems. Air is supplied from eleven (11) large supply fans located in the rooftop penthouses. There are two (2) HVAC systems per building. Building 051 has separate north and south halves – each half of Building 051 has two (2) HVAC systems. Additionally, there is an auditorium in building 052 with its own HVAC system.

The HVAC systems utilize large outside-air louvers in conjunction with dedicated outside-air ventilation fans for economizer operation. The ten (10) non-auditorium HVAC units use two outside air intakes, minimum and economizer. The IAQ (Indoor Air Quality) intake supplies the minimum required outside air and has a precooler and preheating coil that conditions the outside air. An economizer brings in additional outside air when conditions are appropriate. Depending on the temperature conditions both or only one of the outside air intakes may be open.

Air is returned from the zones with ceiling-mounted return grilles and a ceiling plenum. Room exhaust air is removed through ceiling-mounted return grilles and dedicated ductwork located in each ceiling plenum that provides a path to the roof-mounted exhaust fans.

Fans, louvers, supply dampers and fan coils are all controlled with the Honeywell EBI system.

1.5.4 Meters

The DHS building complex is served by natural gas and electric utilities. The DHS building complex is served by two gas meters: one main gas meter for the main building complex and one gas meter for a small retail space. Six electric meters serve the DHS building complex needs and one electric meter serves the small retail space.

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SECTION 2
OCCUPANCY AND OPERATING SCHEDULES

This section contains information about the intended hours of occupancy and operating schedules for the eight day-types (Monday through Friday and holidays).

2.1 Tenant Occupancy Schedules

Below are tenant occupancy schedules, listed by building.

Note: Building and Property Management maintenance staff will be on-site 12 hours a day, seven days a week with normal building maintenance services performed from 8:00 a.m. to 5:00 p.m., Monday through Friday.

Building 051				
Number of Floors	Space Type	Days Occupied per Week	Average Hours Occupied	Occupied on Holidays? (Y/N)
6	Office	5	8	N

Building 052				
Number of Floors	Space Type	Days Occupied per Week	Average Hours Occupied per Day	Occupied on Holidays? (Y/N)
6	Office	5	8	N

Building 053				
Number of Floors	Space Type	Days Occupied per Week	Average Hours Occupied per Day	Occupied on Holidays? (Y/N)
7	Office	5	8	N

Building 054				
Number of Floors	Space Type	Days Occupied per Week	Average Hours Occupied per Day	Occupied on Holidays? (Y/N)
7	Office	5	8	N

2.2 Holidays

All State holidays are observed.

Traditionally, State holidays include:

- January 1st (New Year's Day)
- the third Monday in January (Martin Luther King Jr's Birthday)
- February 12th (Lincoln's Birthday)
- the third Monday in February (Washington's Birthday)
- March 31st (Cesar Chavez' Birthday)
- the last Monday in May (Memorial Day)
- July 4th (Independence Day)
- the first Monday in September (Labor Day)
- the second Monday in October (Columbus Day)
- November 11th (Veteran's Day)
- Thanksgiving Day and the day after Thanksgiving
- December 25th (Christmas Day)

2.3 Partial and After-hours Operations

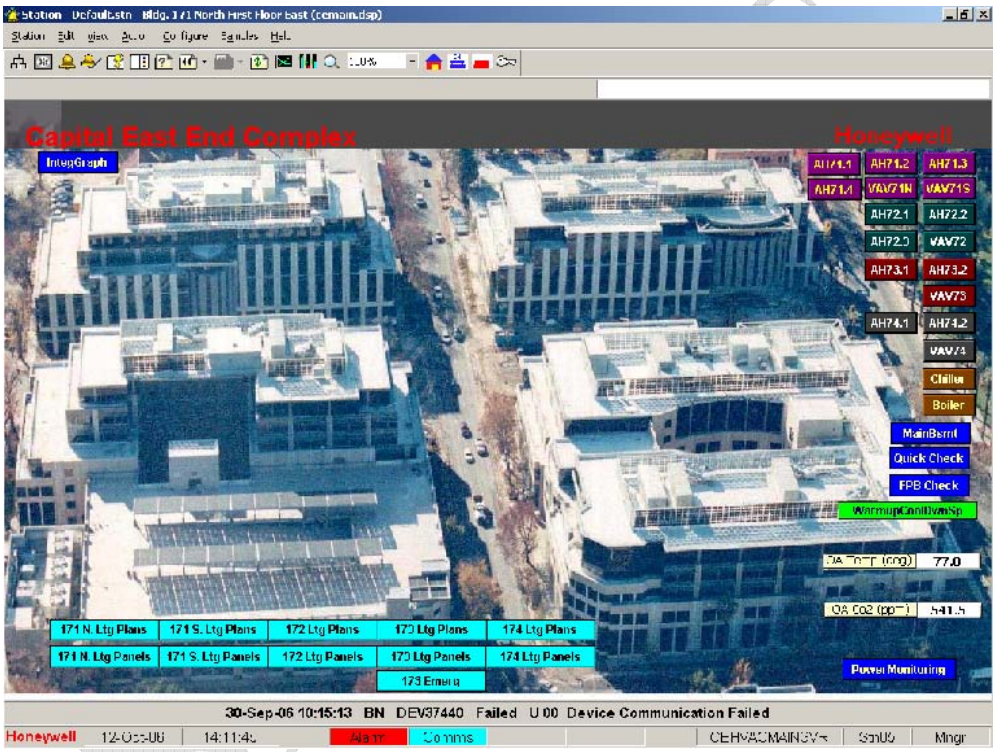
Heating, ventilating and air conditioning (HVAC) is available Monday through Friday, 6:00 a.m. to 6:00 p.m. The HVAC control system has programmed start-stop times that provide both comfort and energy efficiency during the building hours. After hours use must be requested, in writing, in advance, through the Program Support Branch.

For more information about how accommodations are made, see the BUILDING HANDBOOK on page 39.

SECTION 3
BUILDING-LEVEL EQUIPMENT PERFORMANCE

This section contains operational policies pertaining to building-level equipment performance for all installed equipment at the DHS building complex.

Space temperature, space pressurization, and building envelope conditions are continuously monitored using Honeywell Enterprise Building Integrator (EBI) Building Automated Control System (BACS).



For a complete list of building equipment, see APPENDIX A: EQUIPMENT LIST on page 31.

3.1 Space Temperature

The following sections contain information about space temperature performance criteria, test and measurement capabilities, and documentation requirements.

3.1.1 Performance Criteria

The buildings' interior environments are designed to be controlled between 70 to 74 deg F.

3.1.2 Test and Measurement

The BACS is capable of evaluating the systems performance by logging short and long-term historical data according to parameters set up by the operator (sample rate, duration, change of value, etc.). This information is then used to investigate and/or correct equipment performance, building interior conditions and to document indoor air quality issues.

In each of the buildings in the DHS complex, floors two (2) through six/seven (6/7) contain an average of 15 monitored interior space temperature sensor locations on each floor. There is average of 22 temperature sensors locations on the first floor of each building.

Each sensor reading can be analyzed for identification of times when space conditions read outside of the building's design settings of 70 to 74 degrees. All space sensors that were found to be outside of the designed settings can be carefully analyzed for duration of error.

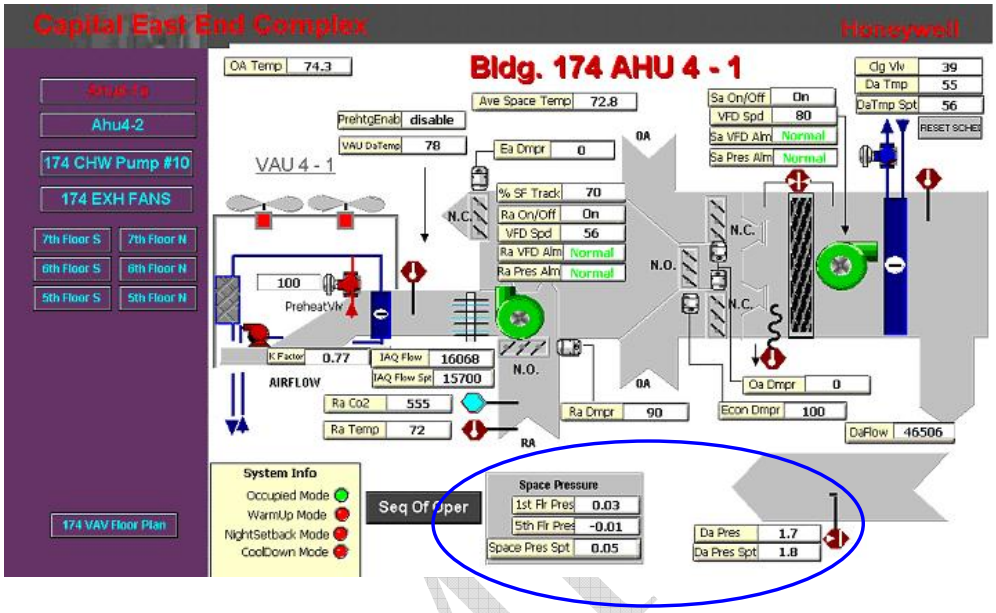
3.1.3 Documentation Requirements

BACS set points are continuously monitored and alarms indicate when conditions are beyond normal operating limits.

Trend logs and alarm summary reports are used to determine when equipment is in need of adjustment or repair and to keep the building's interior operating conditions at peak performance. See the example below:

3.2 Space Pressurization

Space pressurization is monitored and controlled using the BACS.



The building space pressurization set point for all buildings in the DHS complex is 0.05. The BACS automatically adjusts air delivery to meet the set point.

3.3 Building Envelope

Buildings in the DHS complex must be caulked and sealed to minimize air filtration.

As part of scheduled Operations and Maintenance, annual inspections of the following building penetrations will be performed:

- Basic envelope integrity (no holes, gaps, or openings)
- Doors and door jams
- Window and window frames
- Backdraft and mechanically operated dampers when fans are off

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SECTION 4
SYSTEM-LEVEL EQUIPMENT PERFORMANCE

This section contains operational policies pertaining to system-level equipment performance for all installed equipment at the DHS building complex.

For a complete list of building equipment, see APPENDIX A: EQUIPMENT LIST on page 31.

4.1 Cooling System Modes and Sequences

The following sections contain information regarding energizing, loading, and unloading/de-energizing chillers.

4.1.1 Mode Scheduling

The automatic Electric, Gas, and Combined Electric/Gas Cooling Modes are set according to a seven day time schedule and are in effect according to that schedule unless the operator switches the chilled water system to Manual Mode or all of the building chilled water isolation valves in the secondary circuit are closed, at which time the system switches to the Off Mode.

At that point all chilled water system equipment is shut down until one of the buildings served by the central plant once again requires cooling and signals so by reopening one or more of the a chilled water isolation valves.

At such time, the system is restarted in the Electric, Gas, or Combined Electric/Gas Cooling mode based on the time schedule in effect.

4.1.2 Minimum Plant Load

Minimum chilled water load is important for effective operation of the electric chillers. Minimum chilled water loads may temporarily modify plant operation and place the plant in a different operating mode. An advisory alert message is displayed to indicate that the plant minimum load has triggered a plant mode change. The plant shall automatically revert back to the selected mode (if set in seven day time clock) and display an advisory alert message when the minimum enabling load is once again reached.

This minimum load mode change is required when the plant is in electric cooling mode (**ECLGMODE**) or Combined Electric/Gas Cooling Mode (**CCLGMODE**)

- The plant mode shall change to Gas Cooling Mode (**GCLGMODE**) when the plant cooling load (as calculated by the secondary loop Btu meter) is drops below 275 tons (adjustable).
- Electric Cooling Mode (ECLGMODE) or the Combined Electric/Gas Cooling Mode (CCLGMODE) shall be enabled when the plant cooling load (as calculated by the secondary loop Btu meter) rises above 325 tons (adjustable).

The enabling value is higher than the disabling value minimum load to ensure that the plant operation is stable.

4.1.3 Electric Cooling Mode

The system is placed in the Electric Cooling Mode whenever the variable ECLGMODE turns on. The system may also start up in the Electric Cooling Mode if the system has been in the OFF Mode or subject to an emergency shutdown and is now returning to service while the Electric Mode is scheduled.

Start Sequence

When the chilled water system is switched to the Electric Cooling Mode, it operates according to the following sequence:

1. All plant chillers are initially commanded OFF (electric and gas)
2. Both electric chillers are enabled to operate at 100% capacity.
3. Isolation valves in next two cooling towers in sequence are opened.
4. After 1 minute (adjustable) the lead electric chiller is commanded ON. Chilled water and condenser water pumps are automatically commanded ON in sequence by chiller.
5. The lag chiller is started according to Steps 3 and 4 above:
    - if the lead electric chiller fails to start, or shuts down due to a fault, then in 2 minutes the lag electric chiller is commanded ON, or
    - if the plant cooling load (as calculated by the secondary loop Btu meter) is greater than 700 tons (adjustable) then the lag electric chiller is started, or
    - if the lead chiller has been operating for at least 30 minutes and secondary chilled water supply temperature has been at least 2 deg F (adjustable) above set point for at least 5 minutes.
6. Lead (and lag) electric chiller(s) modulate to maintain chilled water set point and, if both machines are running, share cooling load equally.

Stop Sequence

When the chilled water system is in the Electric Cooling Mode and both electric chillers have been operating for at least 30 minutes, and:

- when the plant cooling load (as calculated by the secondary loop Btu meter) drops below 675 tons (adjustable), or
- if the primary return chilled water falls at least 5 deg F below the secondary return chilled water temperature continuously for at least 5 minutes,

Then the lag chiller is stopped according to the following sequence:

1. Lag chiller is commanded OFF and primary chilled water and condenser pump are commanded OFF by chiller control.
2. After 1 minute (adjustable), tower isolation valves are closed.

If the plant cooling load (as calculated by the secondary loop Btu meter) drops below 275 tons (adjustable) then the plant mode switches to Gas Cooling Mode (GCLGMODE). The plant shall automatically revert back to the Electric Cooling Mode (if set in seven day time clock) and display an advisory alert message when the minimum enabling load is once again reached.

4.1.4 Gas Cooling Mode

The system is placed in the Gas Cooling Mode whenever the variable GCLGMODE turns on. The system may also start up in the Gas Cooling Mode if the system has been in the OFF Mode or subject to an emergency shutdown and is now returning to service while the Gas Mode is scheduled.

Start Sequence

When the chilled water system is switched to the Gas Cooling Mode, it operates according to the following sequence:

1. All plant chillers are initially commanded OFF (electric and gas)
2. Isolation valves in the next cooling tower in sequence are opened.
3. After 1 minute (adjustable) the lead gas chiller is commanded ON. Chilled water and condenser water pumps are automatically commanded ON in sequence by chiller.
4. The 1st lag chiller is started according to Steps 2 and 3 above:
    - if the lead gas chiller fails to start, or shuts down due to a fault, then in 2 minutes the lag gas chiller is commanded ON, or
    - if the plant cooling load (as calculated by the secondary loop Btu meter) is greater than 350 tons (adjustable) then the 1st lag gas chiller is started, or
    - if the lead chiller has been operating for at least 15 minutes and secondary chilled water supply temperature has been at least 2 deg F (adjustable) above set point for at least 5 minutes.
5. The 2nd lag chiller is started according to Steps 2 and 4 above:
    - if the 1st lag gas chiller fails to start, or shuts down due to a fault, then in 2 minutes the 2nd lag gas chiller is commanded ON, or
    - if the plant cooling load (as calculated by the secondary loop Btu meter) is greater than 725 tons (adjustable) then the 2nd lag gas chiller is started, or
    - if the 1st lag chiller has been operating for at least 15 minutes and secondary chilled water supply temperature has been at least 2 deg F (adjustable) above set point for at least 5 minutes.
6. Lead (and lag) gas chiller(s) modulate to maintain chilled water set point and, if multiple machines are running, share cooling load equally

Stop Sequence

When the chilled water system is in the Gas Cooling Mode and more than one gas chiller has been operating for at least 15 minutes, and:

- three gas chillers are running - when the plant cooling load (as calculated by the secondary loop Btu meter) drops below 700 tons (adjustable), or
- two gas chillers are running - when the plant cooling load (as calculated by the secondary loop Btu meter) drops below 325 tons (adjustable), or
- if the primary return chilled water falls at least 5 deg F below the secondary return chilled water temperature continuously for at least 5 minutes,

Then the gas chiller is stopped according to the following sequence:

1. Gas chiller is commanded OFF and primary chilled water and condenser pump are commanded OFF by chiller control.
2. After 1 minute (adjustable), tower isolation valves are closed.

When the plant cooling load (as calculated by the secondary loop Btu meter) exceeds 1127 tons (adjustable) then plant operating mode is changed to the Combined Electric/Gas cooling Mode (CCLGMODE).

4.1.5 Combined Electric/Gas Cooling Mode

The system is placed in the Combined Electric/Gas Cooling Mode whenever the variable CCLGMODE turns on. The system may also start up in the Combined Electric/Gas Cooling Mode if the system has been in the OFF Mode or subject to an emergency shutdown and is now returning to service while the Gas Mode is scheduled.

Start Sequence

When the chilled water system is switched to the Combined Electric/Gas Cooling Mode, it operates according to the following sequence:

1. Plant chillers are initially commanded OFF (electric and gas). If plant is switching from electric cooling mode and either electric chiller(s) was running then only the lag chiller is commanded OFF.
2. If an electric chiller is to be started, isolation valves in next two cooling towers in sequence are opened.
3. If an electric chiller is to be started, after 1 minute (adjustable) the lead electric chiller is commanded ON. Chilled water and condenser water pumps are automatically commanded ON in sequence by chiller.
4. The lead electric chiller is commanded to a 40% maximum capacity (not to exceed value, adjustable).
5. If the lead electric chiller fails to start or shuts down due to a fault, then in 2 minutes the lag electric chiller is commanded ON. The lag electric chiller is commanded to a 40% maximum capacity also.
6. The lead gas chiller is started:
    - if the plant cooling load (as calculated by the secondary loop Btu meter) is greater than 480 tons (adjustable) then the lag gas chiller is commanded ON, or
    - if the lead electric chiller has been operating for at least 15 minutes and secondary chilled water supply temperature has been at least 2 deg F (adjustable) above set point for at least 5 minutes.
7. Isolation valves in the next cooling tower in sequence are opened.
8. After 1 minute (adjustable) the lead gas chiller is commanded ON. Chilled water and condenser water pumps are automatically commanded ON in sequence by chiller.
9. The 1st lag gas chiller is started:
    - if the lead gas chiller fails to start, or shuts down due to a fault, then in 2 minutes the 1st lag gas chiller is commanded ON, or

- if the plant cooling load (as calculated by the secondary loop Btu meter) is greater than 840 tons (adjustable) then the 1st lag gas chiller is started, or
- if the lead gas chiller has been operating for at least 15 minutes and secondary chilled water supply temperature has been at least 2 deg F (adjustable) above set point for at least 5 minutes.

10. The 2nd lag gas chiller is started:
    - if the 1st lag gas chiller fails to start, or shuts down due to a fault, then in 2 minutes the 2nd lag gas chiller is commanded ON, or
    - if the plant cooling load (as calculated by the secondary loop Btu meter) is greater than 1200 tons (adjustable) then the 2nd lag gas chiller is started, or
    - if the lead and 1st lag gas chillers have been operating for at least 15 minutes and secondary chilled water supply temperature has been at least 2 deg F (adjustable) above set point for at least 5 minutes.
11. If further increased cooling load needs to be satisfied, the electric chiller is allowed to run above 40% maximum capacity. Gas chillers operate under local chiller control to maintain set point.

Stop Sequence

When the chilled water system is in the Combined Electric/Gas Cooling Mode and more than one gas chiller has been operating for at least 15 minutes, and:

- three gas chillers are running - when the plant cooling load (as calculated by the secondary loop Btu meter) drops below 1175 tons (adjustable), or
- two gas chillers are running - when the plant cooling load (as calculated by the secondary loop Btu meter) drops below 810 tons (adjustable), or
- one gas chiller is running - when the plant cooling load (as calculated by the secondary loop Btu meter) drops below 455 tons (adjustable), or
- if the primary return chilled water falls at least 2 deg F below the secondary return chilled water temperature continuously for at least 5 minutes,

Then the gas chiller is stopped according to the following sequence:

1. Gas chiller is commanded OFF and primary chilled water and condenser pump are commanded OFF by chiller control.
2. After 1 minute (adjustable), tower isolation valves are closed.

If the plant cooling load (as calculated by the secondary loop Btu meter) drops below 275 tons (adjustable) then the plant mode switches to Gas Cooling Mode (GCLGMODE). The plant shall automatically revert back to the Combined Electric/Gas Cooling Mode (if set in seven day time clock) and display an advisory alert message when the minimum enabling load is once again reached.

4.1.6 Manual Mode

When the chilled water system is switched to the Manual Mode by an operator, the variable **MANUALCLG** turns on and operation of the chillers, condenser pumps, primary chilled water pumps, and isolation valves remains fixed, subject to further manual changes and commands by the operator.

The Manual Mode permits the operator to operate any combination of chiller(s) and tower(s) in the event of a failure or under special maintenance or operational circumstances.

In Manual Mode, the system no longer issues any automatic sequencing commands to the chillers or tower isolation valves, primary chilled water pumps, or condensing water pumps until Manual Mode is turned off.

The system does continue to operate the tower fan for each tower cell if its isolation valves for the cell are open such that an 80 deg F (adjustable) leaving tower water temperature is maintained. Also, in the Manual Mode, the secondary chilled water pump continues to operate to maintain the desired chilled water pressure at the ends of the distribution mains, and the system is not subject to shutdown by the Cooling Off Mode while the operating in the Manual Mode.

4.1.7 Chiller Off Mode

The chilled water system is set to the Chiller Off Mode (**CHROFF**) if all of the chilled water isolation valves in the buildings served by the central plant are closed due to a lack of demand for cooling in the buildings. If all valves are closed while operating in either the Electric, Gas, or Combined Electric/Gas Cooling Modes, the chilled water system switches to Off Mode. In the Off Mode, all chilled water system equipment is immediately shut down. Off Mode does not effect operation if the system is in Manual Mode. Once the system is in Off Mode, it returns to normal operation when one or more of the building chilled water isolation valves is reopened signally a demand for cooling.

4.2 Cooling Equipment Set points

4.2.1 Secondary Chilled Water Pumps

A single secondary chilled water pump has the capacity to meet peak chilled water flow requirements. The second pump is a standby. The secondary chilled water pump operates continuously unless a an emergency chilled water system shutdown occurs or the system switches to the Off Mode at which time the secondary pump is shut down with the other cooling equipment.

Under normal operation, the secondary chilled water pump operates to maintain the secondary chilled water differential pressure set point SCWDPSP as measured at the end of the chilled water distribution mains. This set point is set to 30 feet (adjustable) maximum and is operated according to a reset schedule based on outside air temperature as follows:

RESET SCHEDULE	
60 deg F or less	10 feet
80 deg F or greater	30 feet

The standby (lag) secondary chilled water pump automatically starts and operates if the lead secondary pump fails. The lead secondary chilled water pump is manually set by setting the variable SCWPLEAD to the value 1 (Secondary CW Pump 11 leads) or 2 (Secondary CW Pump 12 leads).

In the event of a lead pump failure, the lag pump starts immediately and operates to maintain the desired system conditions, while the lead pump remains commanded "ON." An alarm is initiated to alert the operator to the failed condition. As soon as the lead pump once again begins operating, the alarm state is cleared and the system resumes normal operation. In the event of a lag pump failure, the lag pump remains commanded "ON" regardless of flow change and an alarm is initiated to alert the operator to the failed condition. As soon as the lag pump once again begins operating, the alarm state is cleared and the system resumes normal operation.

The secondary chilled water pumping operates continuously at all times in all automatic modes or manual mode, unless the system is in the Off Mode, or a refrigerant alarm is detected (REFALM), or a manually-activated emergency shutdown alarm is detected (EMGALM) in which case all chilled water equipment is shut down and remains off until the condition is cleared and the operator issues a Chilled Water System Reset, CPRESET. Anytime a refrigerant alarm is detected, the control system automatically operates the chiller room ventilation in its "Purge" cycle.

4.2.2 Tertiary Chilled Water Pumps

A single tertiary chilled water pump is provided for each building served. The tertiary chilled water pump operates only at outdoor air temperature above 65 deg F (adjustable) and is commanded ON only when the building's minimum differential pressure falls 5 feet below set point continuously for 5 minutes. Once turned on, the building's tertiary chilled water pump operates continuously until the pump speed falls to below 45% for 5 minutes at which point it is shut down.

When the tertiary chilled water pump in each building operates, the speed is controlled to maintain the building chilled water differential pressure set point B12xDPSP as measured by multiple sensors at the end of the building's chilled water distribution network.

The sensor with the lowest pressure controls the pump at all times. This set point is set to 30 feet (adjustable) maximum and is operated according to a reset schedule based on outside air temperature as follows:

RESET SCHEDULE	
60 deg F or less	10 feet
80 deg F or greater	30 feet

4.2.3 Cooling Towers

Cooling towers are automatically staged with chillers. The lead and lag sequence of the cooling towers is accomplished by setting the variable CTLEAD to the value 1 through 6.

The lead/lag sequence operates as follows:

CTLEAD COOLING TOWER SEQUENCE	
1	1 - 2 - 3 - 4 - 5 - 6
2	2 - 3 - 4 - 5 - 6 - 1
3	3 - 4 - 5 - 6 - 1 - 2
4	4 - 5 - 6 - 1 - 2 - 3
5	5 - 6 - 1 - 2 - 3 - 4
6	6 - 1 - 2 - 3 - 4 - 5

Whenever a gas chiller is commanded ON, a single cooling tower is brought on line. When an electric chiller is brought on line, the next two cooling towers in sequence as set by the operator are brought on line. Similarly when chillers are shut down, the lag towers in sequence are shut down.

Cooling Tower Water Temperature Control
Cooling tower fans operate to maintain an 80 deg F (adjustable) leaving tower water temperature set point whenever the outside air temperature is above 100 deg F.

Between 60 deg F and 100 deg F outside air temperature, operate tower fans of on-line towers to provide a leaving tower water temperature according to the following formula:

LEAVING TOWER WATER TEMPERATURE SETPOINT = 30 + OAT / 2

At or below outside temperatures of 60 deg F, cooling tower fans operate to maintain a 55 deg F leaving tower water temperature set point (adjustable, to be as cold as allowed by electric chiller manufacturer).

When multiple towers are operating, all tower fans operate at identical speeds to maintain a leaving tower water temperature set point. Minimum fan speed is 30%.

If the leaving tower water temperature falls to 55 deg F (adjustable), the tower fans of the on-line towers shut down and restart when the tower leaving water temperature rises 5 deg F above the shut down temperature.

When a tower is shut down, the isolation valves are closed and the tower fan is shut down.

4.2.4 Chillers

The lead gas chiller can be manually set by setting the variable GCHLRLEAD to the value 1 (Chiller 1 leads), 2 (Chiller 2 leads), or 3 (Chiller 3 leads).

Additional chillers are brought on line according to the following sequence:

GCHLRLEAD CHILLER SEQUENCE	
1	1 - 2 - 3
2	2 - 3 – 1
3	3 – 1 - 2

Adjustment of the chilled water temperature set point is accomplished by adjusting the set point temperature at each chiller. Note that at all times, all chillers must have identical chilled water supply temperature set points. Any adjustment to the chilled water supply temperature requires an adjustment to the control program for proper sequencing.

Energizing
The lead electric chiller can be manually set by setting the variable ECHLRLEAD to the value 4 (Chiller 4 leads and Chiller 5 is lag) or 5 (Chiller 5 leads and Chiller 4 is lag).

Additional chillers are sequenced on based on calculated plant load or an inability to maintain secondary chilled water temperature set point, CHWST-SP. When operating in GCLGMODE, all the gas chillers are sequenced on line. When operating in ECLGMODE, both electric chillers are sequenced on line. When operating in CCLGMODE one electric chiller is first brought on line (capacity limited) and then gas chillers are sequenced on line.

Any chiller that shows a fault for five minutes is automatically removed from sequence by the control system and remains off line until the fault has been corrected at which time it reenters the proper sequence. Note: To eliminate the possibility of false start attempts, the control contractor shall ensure that the "fault" signal from each chiller registers continuously through the start and stop commands until the fault has been corrected.

Loading
Under normal chiller mode operation, the chilled water supply temperature is 42 deg F. Chiller start logic is either based on calculated plant load or chilled water temperature. Anytime the chilled water supply temperature rises to 44 deg F (adjustable) or higher continuously for 5 minutes, the next chiller in sequence is started. Except for a fault condition, another chiller cannot be added until at least 15 minutes after one has been added. A fault condition results in a shutdown of the chiller with the fault and an immediate start of the next chiller in sequence.

Unloading and De-energizing
Chillers are taken off line based on calculated plant load or the difference between the secondary chilled water return temperature and the primary chilled water return temperature. For chilled water temperature logic:

- If all gas or all electric chillers are operating (GCLGMODE or ECLGMODE), a chiller is sequenced off if the primary chilled water temperature falls 5 deg F lower than the secondary chilled water temperature continuously for 5 minutes.

- If during operation of the combined electric/gas cooling mode (CCLGMODE), a gas chiller is operating, it is stopped when the primary chilled water temperature falls 2 deg F lower than the secondary chilled water temperature continuously for 5 minutes. Once a chiller is shut down, another cannot be stopped for a minimum of 5 minutes.

4.3 Boiler Sequences and Setpoints

The following sections contain information about:

- Modes of boiler operation
- Secondary heating water pumps
- Lead and lag boilers
- Heat recovery exchanger

4.3.1 Modes of Boiler Operation

Because the hot water heating system is employed to heat domestic hot water as well as provide space heating in the building served, the system is intended to operate continuously 24 hours per day, seven (7) days per week.

Note: Turning on the variable HTGOFF can shut down the system. When shut down this way, all heating water system equipment is shut down including the secondary heating water pumping.

4.3.2 Secondary Heating Water Pumps

A single secondary heating water pump has the capacity to meet peak heating water flow requirements. The second pump is a standby. The secondary heating water pump operates continuously except when the system has been shut down by the operator.

Under normal operation, the secondary heating water pump operates to maintain a minimum secondary heating water differential pressure set point SHWDPSP as measured at the top of each of the heating water users in each building. This set point is set to 30 feet (adjustable) maximum and is operated according to a reset schedule based on outside air temperature as follows:

SECONDARY HEATING WATER PUMP RESET SCHEDULE		
75 deg F or greater	10ft	4.3psi
40 deg F or less	30ft	13.0psi

The standby (lag) secondary heating water pump automatically starts and operates if the lead secondary pump fails. The lead secondary heating water pump is manually set by setting the variable SHWPLEAD to the value 5 (Secondary HW Pump 5 leads) or 6 (Secondary HW Pump 6 leads).

In the event of a lead pump failure, the lag pump starts immediately and operates to maintain the desired system conditions, while the lead pump remains commanded “ON”. An alarm is initiated to alert the operator to the failed

condition. As soon as the lead pump once again begins operating, the alarm slate is cleared and the system resumes normal operation. In the event of a lag pump failure, the lag pump remains commanded “ON” regardless of the flow change and an alarm is initiated to alert the operator to the failed condition. As soon as the lag pump once again begins operating normally, the alarm state is cleared and the system resumes normal operation.

4.3.3 Lead and Lag Boilers

The lead gas boiler is manually set by setting the variable BLRLEAD to the value 1 (Boiler 1 leads), or 2 (Boiler 2 leads).

Boilers are operated at all times under normal operation. The lag boiler is sequenced based on an inability to maintain secondary water temperature set point, H\VST-SP. The heating water temperature is reset according to outside air temperature according to the following reset schedule:

LAG BOILER RESET SCHEDULE	
30 deg F or less	180 deg F
60 deg F or greater	150 deg F

If the lead boiler indicates a shutdown due to a fault for five minutes, the lag boiler is started and the lead boiler is automatically removed from sequence by the by the control system and remains offline until the fault has been corrected at which time it reenters the proper sequence.

Note: To eliminate the possibility of false start attempts, the control contractor shall ensure that the ‘fault’ signal from each boiler registers continuously through the start and step commands until the fault has been corrected.

Under normal boiler operation, anytime the secondary heating water supply temperature falls 5 deg F (adjustable) or lower than the set point continuously for five (5) minutes, the lag boiler is started. Except for a fault condition, lag boiler cannot be added until at least 15 minutes after the lead boiler has been in operation.

The lag boiler is taken offline based on the difference between the primary and secondary water temperatures. If the lag boiler is operating, it is sequenced off if the difference between the primary supply and return water temperature falls to less than ½ (adjustable) the difference between the secondary supply and return heating water temperature continuously for 5 minutes.

The lead boiler is taken offline if the heat recovery provides adequate heating. If the actual primary heating water temperature rises for than 5 deg F (adjustable) above the preset heating water temperature set point continuously for five (5) minutes, when the heat recover mode is active, the lead chiller I shut down and the heat recovery operates alone to provide heating. If the heating water temperature falls more than 10 deg F (adjustable) below the heating water temperature set point continuously for 15 minutes, or heat recovery is shut down while operating as the sole source of heating, then the lead boiler is restarted.

The primary heating water pump associated with each boiler is operated by the internal boiler controls and operates for 5 minutes after the shutdown of the boiler. Adjustment of the heating water temperature set point in accordance with the outside air temperature when the system is operating in the heating mode is accomplished automatically by the DCC system through the boiler panel interface.

4.3.4 Heat Recovery Heat Exchanger

The heat recover heat exchanger is operated whenever a gas chiller has been online for five minutes and so long as the heating system has not been shut down manually. Anytime a gas chiller has been online for 10 minutes (adjustable), the heat exchanger is operated according to the following sequence.

Hot water supply set point is calculated as follows:
Set point = 150+((70-OAT)x3)

Below 60 deg F outside air temperature, set point is 180 deg F. Above 70 deg F outside air temperature, the set point is 150 deg F.

HWP-4 is operated when the gas chiller is operating. The VFD is controlled to maintain hot water supply temperature is set at or above set point for 30 minutes. It is restarted if hot water supply temperature drops 10 deg F below set point for 15 minutes.

4.4 Air-Handling Units

Air-handling units' modes and controls are discussed below.

4.4.1 Modes of Operation

The following sections discuss various modes of operation, their uses, and impacts to the HVAC system.

4.4.1.1 Occupied Mode

The system operates in occupied mode whenever the occupancy schedule indicates an occupied time period (adjustable from EBI).

4.4.1.2 Setback Mode

The system operates in setback mode when a space temperature sensor senses temperature below the unoccupied heating set point of 55 deg F adjustable or above the unoccupied cooling set point of 85 deg F adjustable.

4.4.1.3 Warm Up Mode

The system operates in warm up mode when the system is running prior to scheduled occupancy time as determined by the optimum start program and the space temperature is lower than the occupied heating set point of 69 deg F (adjustable). The warm up mode is disabled once the set point is achieved or the occupancy schedule begins.

The following space sensors are referenced and averaged for both warm up mode and cool down mode.

SPACE SENSORS									
AHU 1.1	**AHU 1.2**	**AHU 1.3**	**AHU 1.4**	**AHU 2.1**	**AHU 2.2**	**AHU 3.1**	**AHU 3.2**	**AHU 4.1**	**AHU 4.2**
1-122	1-108	1-170	1-153	2-115	2-108	3-113	3-105	4-115	4-104
1-230	1-213	1-266	1-255	2-219	2-207	3-224	3-205	4-214	4-206
1-323	1-309	1-369	1-363	2-325	2-308	3-326	3-309	4-333	4-309
1-425	1-405	1-475	1-461	2-422	2-412	3-434	3-405	4-423	4-407
1-534	1-505	1-567	1-562	2-523	2-505	3-521	3-509	4-521	4-506
1-623	1-607	1-670	1-658	2-619	2-610	3-617	3-604	4-620	4-608
						3-720	3-709	4-721	4-707

4.4.1.4 Cool Down Mode

The system operates in cool down mode when the system is running prior to scheduled occupancy time as determined by the optimum start program and the space temperature is higher than the occupied cooling set point of 75 deg f (adjustable). The cool down mode is disabled once the set point is achieved or the occupancy schedule begins.

4.4.1.5 Unoccupied Mode

The system does not operate whenever the operating schedule indicates an unoccupied time period unless mode is overridden by setback mode or operator input.

4.4.1.6 Fire Mode

The system runs in this mode based on input from the fire alarm system. This mode shall have priority over all other control modes and will be controlled via hardwired interlock fire alarm system. All dampers and fans can be controlled manually controlled by at the fire smoke control panel in the fire control room. This mode is required for only selected units on the two buildings that are code defined as high rise. Specific units are 3-1 and 4-1.

4.4.2 Controls

The following sections discuss controls, their uses, and impacts to the HVAC system.

4.4.2.1 Start/Stop Control

The fans are factory wired to stop on low inlet pressure at the return/exhaust fans, high discharge pressure at the return/exhaust fans, low inlet pressure at the supply fans, or high discharge pressure at the supply fans. A low mixed air temperature limit and duct smoke detector interlock are wired in series with the factory wired pressure switches to stop the fans if either device is in alarm. Both supply fans are started automatically in occupied, warm up, cool down, and setback modes. Both return fans are software interlocked to start when the supply fans are running.

4.4.2.2 Temperature Control

Dampers are hardwire interlocked to spring return to their "normal" position if the low mixed air limit trips. Dampers and cooling coil control valve are also positioned to their “normal” position if the system is off.

Outside (minimum and economizer) and exhaust dampers are normally closed. Return dampers are normally open. The cooling coil control valve is normally closed. The minimum outside air damper is an integral airflow monitor/controller and damper.

During the warm up mode the outside air damper, minimum outside air damper and exhaust air damper are closed and the return dampers are open. The cooling coil valve is closed and the ventilation air-handling unit (AHU) is off.

During the cool down mode, if outside air temperature is greater than the return air temperature, the main outside air damper is closed, the main return air damper is open, the minimum outside air damper is closed. The ventilation AHU indirect evaporative cooling is disabled. All other controls operate as described under occupied mode.

During occupied mode the main return and outside air dampers and exhaust damper and cooling coil valve modulate in sequence to maintain the supply air temperature at set point.

When enabled at the AHU graphic, the preheat heat valve shall be modulated in sequence with the other temperature control components to maintain the supply air temperature set point. (hot water must be manually valved over at each AHU before the preheat control enable point is set to enable)

4.4.3 Economizers

The following sections discuss the economizer modes and impacts to the HVAC system.

4.4.3.1 Non-Economizer Mode

When return air temperature is below outside air temperature, the rooftop AHU is in non-economizer mode:

- The IAQ damper is open and functioning under automatic minimum fresh air control with the return air fan/return air dampers to maintain minimum ventilation air set point.
- The main economizer dampers are fully closed.

4.4.3.2 Economizer Mode

When the return air temperature is above the outside air temperature, the unit is in economizer mode. This mode can have two conditions:

1. Unit is in full economizer mode and maintains or exceeds unit supply air temperature. IAQ damper is closed. The main economizer dampers are fully open.
2. Unit is in partial economizer mode to maintain minimum unit supply air temperature (unit blends outside air and return air to maintain set point). The

IAQ damper is closed until it is opened based on a minimum main economizer damper position. The main economizer dampers modulate downward from 100% open to 60% (adjustable) when the IAQ damper will open and then the economizer dampers will close. Minimum fresh air control will take over to maintain minimum ventilation air set point.

4.4.4 Discharge Air Temperature Reset

Discharge air temperature is reset per the following schedule:

OUTSIDE AIR TEMP	DISCHARGE AIR SETPOINT
>=65	55
=<50	65

- If the return air temperature is less than the outside air temperature, the main outside and return dampers and the exhaust air damper are positioned for full recirculation. The return damper at the top of the shaft modulates to maintain minimum outside air flow, as sensed by the IAQ damper. The IAQ damper is fully opened at set point, and the main outside air damper is fully closed.
- If the discharge air temperature cannot be maintained, then indirect evaporative cooling is enabled, and then the cooling valve is modulated to maintain discharge air temperature set point.
- If the return air temperature is greater than the outside air temperature economizer mode is enabled. The return air damper and the outside air economizer damper are modulated together to maintain discharge air temperature set point.

4.4.5 Variable Air Volume Modulation

4.4.5.1 Fan Volume Control

The supply fan volume is gradually increased from minimum to maximum until duct static pressure set point is reached. VFD fan control is modulated to maintain a constant 1.8inw (adjustable) of static pressure.

The return fan volume control initiates immediately after fan starting.

- During economizer operation the return fan volume is varied to maintain the differential pressure between building interior and exterior at .05-inch water gauge (adjustable).
- During minimum outside air (non-economizer) operation, the return fan speed is 80% (adj of the supply fan speed. a pid controls transition between modes)

4.4.5.2 Minimum Outside Air Flow Controls

When the air handler is determined to used minimum outside air, the minimum outside air damper (also call indoor air quality damper, IAQ) is commanded open. The top of the shaft damper (also called return isolation damper) shall wait for at least three (3) minutes before modulating to maintain the minimum outside air flow set point of:

- 15,700 CFM FOR AHU4.1, 4.2
- 15,000 CFM FOR AHU1.1, 1.2, 1.3, 1.4, 3.1, 3.2
- 11,500 CFM FOR AHU2.1, 2.2

Modus pressure transmitters will be used to measure the air velocity pressures, coming from the air flow measuring station in the minimum air intake, to calculate the volume of air coming in (in cfm).

The return isolation damper shall not close to less than 10%.

4.5 Water Systems

4.5.1 Water Fixture Efficiency

There are three (3) main water meters serving all four (4) buildings (051-054). One (1) meter is for the make-up water for the cooling tower. The other two (2) are main meters; one (1) for the two (2) high rise buildings (053 and 054), and the other for the two (2) low rise buildings (051 and 052).

The building's fixture water usage calculations are calculated based on the most recent annual gallon usage from City of Sacramento utility water bills minus irrigation and retail space usage.

The results of water use audits demonstrate the buildings meet Energy Policy Act of 1992 requirements.

4.5.2 NPDES Requirements

This facility is not regulated by the EPA NPDES Clean Water Act requirements and therefore does not need to demonstrate NPDES permit compliance, including the use of any required oil separators, grease interceptors and other filtration for in-building generated discharges and proper disposal of any wastes collected.

4.6 Lighting Systems

The DHS Buildings use PC-based Enterprise Building Integrator (EBI) lighting control systems that can generate trend reports displaying on and off times of each lighting control point.

Comment [g2]: EAcr5.1-5.3 narrative

The reports are generated monthly to identify lighting usage outside of the normal programmed lighting schedules.

4.7 Monitoring Systems

A Tridium software package (VYKON™ Energy Suite and EBI Power Monitoring) is used to track equipment performance and energy usage.

Comment [g3]: EAcr5.1-5.3 narrative

The following power monitoring points are installed for providing kW/hr usage:

- Hi voltage (lighting)
- Low voltage (Plug loads)
- Heating and cooling equipment

The data gathered is evaluated by comparing past energy usage and benchmarks. From the comparisons it can be determine if the building is meeting the required State of California energy conservation measures set fourth by Executive Orders S-12-04 and D-15-00.

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SECTION 5
COMMISSIONING AND RETRO-COMMISSIONING

5.1 Commissioning

The Department of Health Services (DHS), Capital Area East End building complex underwent “post-acceptance phase” commissioning after its construction was complete and it was occupied. Post-acceptance phase commissioning was completed in November, 2005.

5.2 Retro-commissioning

The DGS has instated a retro-commissioning (RCx) program that will:

- reduce energy usage and demand
- increase occupant comfort
- improve equipment service life and reliability
- reduce the volume of emergency and trouble calls for the building’s maintenance staff

The Department of Health Services buildings, East End Complex, is grouped with buildings due to be retro-commissioned in March of 2009.

5.2.1 Plan

The RCx program will be implemented by Retro-Commissioning (RCx) Contractors who shall develop and identify all strategies and measures that will optimize the operation and functionality of the building’s systems and pieces of equipment, including how these systems function together. The RCx Contractor shall then prioritize the strategies and measures by criticality and by cost-effectiveness.

The RCx Contractor shall collect and review documentation and technical information related to the building operation (i.e. current design and operational intent, systems & hardware manuals, warranties, building specifications & drawings, design requirements, Title 24 applicable requirements and regulations, utility billings, tenant and building needs and requirements, etc.). The RCx Contractor will then develop a comprehensive building specific operation and retro-commissioning plan that meets the current requirements of the building.

5.2.2 Testing

The Contractor shall perform a systematic and rigorous investigation, evaluation and analysis of all existing major energy consuming systems and equipment associated with the building. These generally are, but shall not be limited to:

- HVAC and chilled water systems
- domestic hot water systems
- hydronic systems
- lighting
- controls and building or energy management systems.

5.2.3 Reporting

In addition to the RCx services outlined above, at completion of the RCx project all collected data, trends, calculations, findings, evaluation results, recommendations and instructions as to how to operate the systems and the building shall be delivered to the State in a binder titled “Systems Manual”.

The Systems Manual is intended to be used for the day-to-day operation of the building. It will be continuously referenced in order to maintain building energy consumption and optimized performance. It will also provide a basis for training new operations staff.

APPENDIX A: EQUIPMENT LIST

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
051-ACU-A	Mammoth Air Handling Unit 1-1	051-ROOF			6/14/2002	5/1/2003	0.00	0.00	0.00	Y
051-ACU-A	Mammoth Air Handling Unit 1-2	051-ROOF			6/14/2002	5/1/2003	0.00	0.00	0.00	Y
051-ACU-A	Mammoth Air Handling Unit 1-3	051-ROOF			6/14/2002	5/1/2003	0.00	0.00	0.00	Y
051-ACU-A	Mammoth Air Handling Unit 1-4	051-ROOF			6/14/2002	5/1/2003	0.00	0.00	0.00	Y
051-ACU-A	Basement AHU B-1	051-BSMT					0.00	0.00	0.00	Y
051-ACU-A	Basement AHU B-2	051-BSMT					0.00	0.00	0.00	Y
051-ACU-A	Basement AHU B-6	051-BSMT					0.00	0.00	0.00	Y
051-ACU-A	Basement AHU B-7	051-BSMT					0.00	0.00	0.00	Y
051-ACU-F	Fancoil Unit in Bldg 171	051-FLOOR-01					0.00	0.00	0.00	Y
051-ACU-F	Fan Powered Box 1-251	051-FLOOR-02					0.00	0.00	0.00	Y
051-ACU-F	Fan Powered Box 1-251	051-FLOOR-02					0.00	0.00	0.00	Y
051-ACU-F	Fan Powered Box 1-252	051-FLOOR-02					0.00	0.00	0.00	Y
051-ACU-	Elevator room heatpump 01	051-ROOF					0.00	0.00	0.00	Y
051-ACU-	Electrical room heatpump 02	051-ROOF					0.00	0.00	0.00	Y
051-ACU-	Elevator room heatpump 04	051-ROOF					0.00	0.00	0.00	Y
051-ACU-	Electrical room heatpump 05	051-ROOF					0.00	0.00	0.00	Y
051-ACU-P	051-ACU-CRAC-01	051-FLOOR-01					0.00	0.00	0.00	Y
051-ACU-	Ventilating Air Unit 1-1	051-ROOF					0.00	0.00	0.00	Y
051-ACU-	Ventilating Air Unit 1-2	051-ROOF					0.00	0.00	0.00	Y
051-ACU-	Ventilating Air Unit 1-3	051-ROOF					0.00	0.00	0.00	Y

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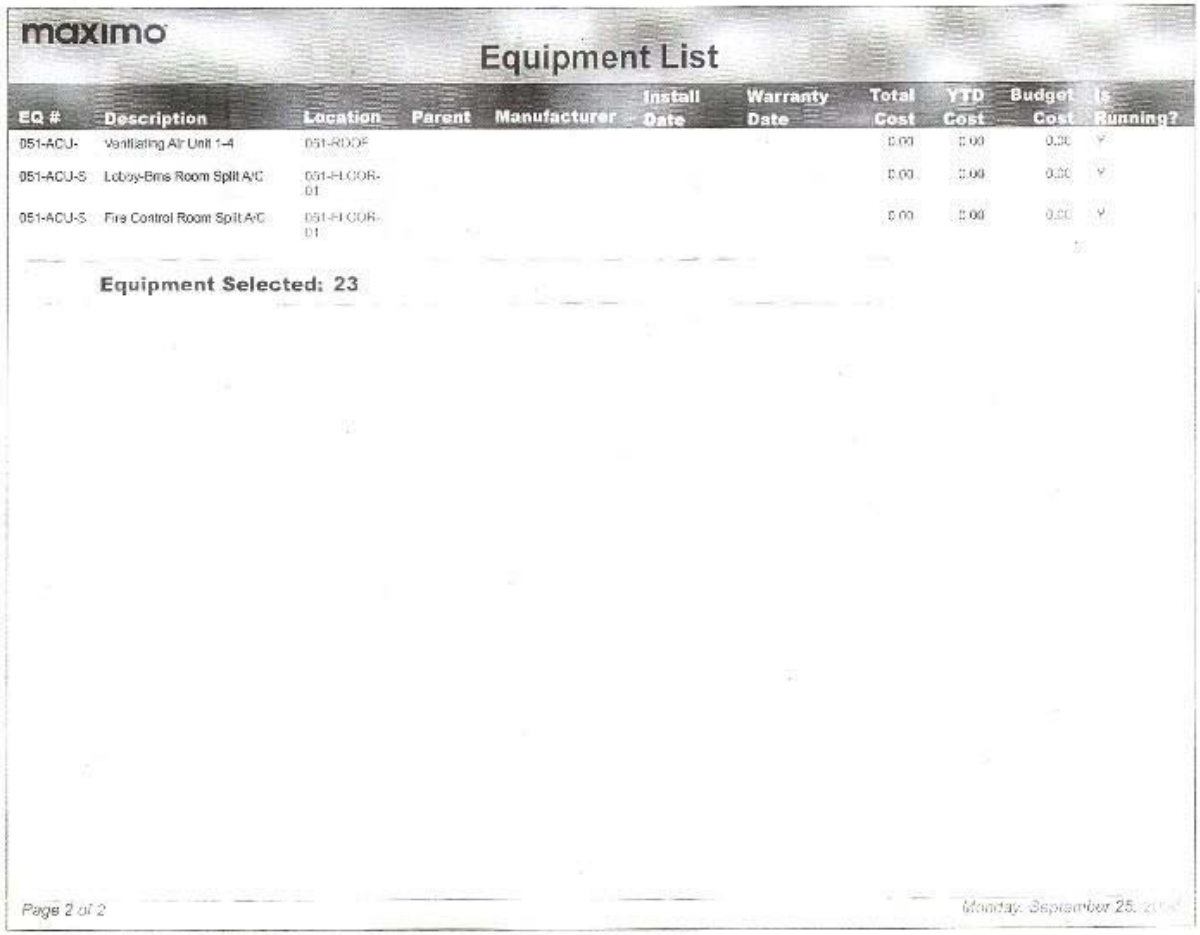

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
051-ACU-	Ventilating Air Unit 1-4	051-ROOF					0.00	0.00	0.00	Y
051-ACU-S	Lobby-Bms Room Split A/C	051-FLOOR-01					0.00	0.00	0.00	Y
051-ACU-S	Fire Control Room Split A/C	051-FLOOR-01					0.00	0.00	0.00	Y

Equipment Selected: 23

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
052-ACU-A	Mammoth Air Handling Unit 2-1	052-ROOF			6/14/2002	6/13/2003	0.00	0.00	0.00	Y
052-ACU-A	Mammoth Air handling Unit 2-2	052-ROOF					0.00	0.00	0.00	Y
052-ACU-A	AHU for Auditorium 2-3	052-ROOF					0.00	0.00	0.00	Y
052-ACU-A	Basement Ahu-55	052-BSMT					0.00	0.00	0.00	Y
052-ACU-F	Parcel Unit in Bldg 172	052-FLOOR-01					0.00	0.00	0.00	Y
052-ACU-F	Fan Powered Box 2-201	052-FLOOR-02					0.00	0.00	0.00	Y
052-ACU-F	Fan Powered Box 2-202	052-FLOOR-02					0.00	0.00	0.00	Y
052-ACU-F	Fan Powered Box 2-203	052-FLOOR-02					0.00	0.00	0.00	Y
052-ACU-F	Fan Powered Box 2-204	052-FLOOR-02					0.00	0.00	0.00	Y
052-ACU-	Elevator room heatpump 01	052-ROOF					0.00	0.00	0.00	Y
052-ACU-	Electrical room heatpump 02	052-ROOF					0.00	0.00	0.00	Y
052-ACU-P	052-ACU-CRAC-2-01	052-FLOOR-04					0.00	0.00	0.00	Y
052-ACU-	Ventilating Air Unit 2-1	052-ROOF					0.00	0.00	0.00	Y
052-ACU-	Ventilating Air Unit 2-2	052-ROOF					0.00	0.00	0.00	Y
052-ACU-S	UPS room split A/C 02	052-BSMT					0.00	0.00	0.00	Y
052-ACU-S	Lobby EMS Room split A/C	052-FLOOR-01					0.00	0.00	0.00	Y
052-ACU-S	Fire Control Room Split A/C	052-FLOOR-01					0.00	0.00	0.00	Y

Equipment Selected: 17

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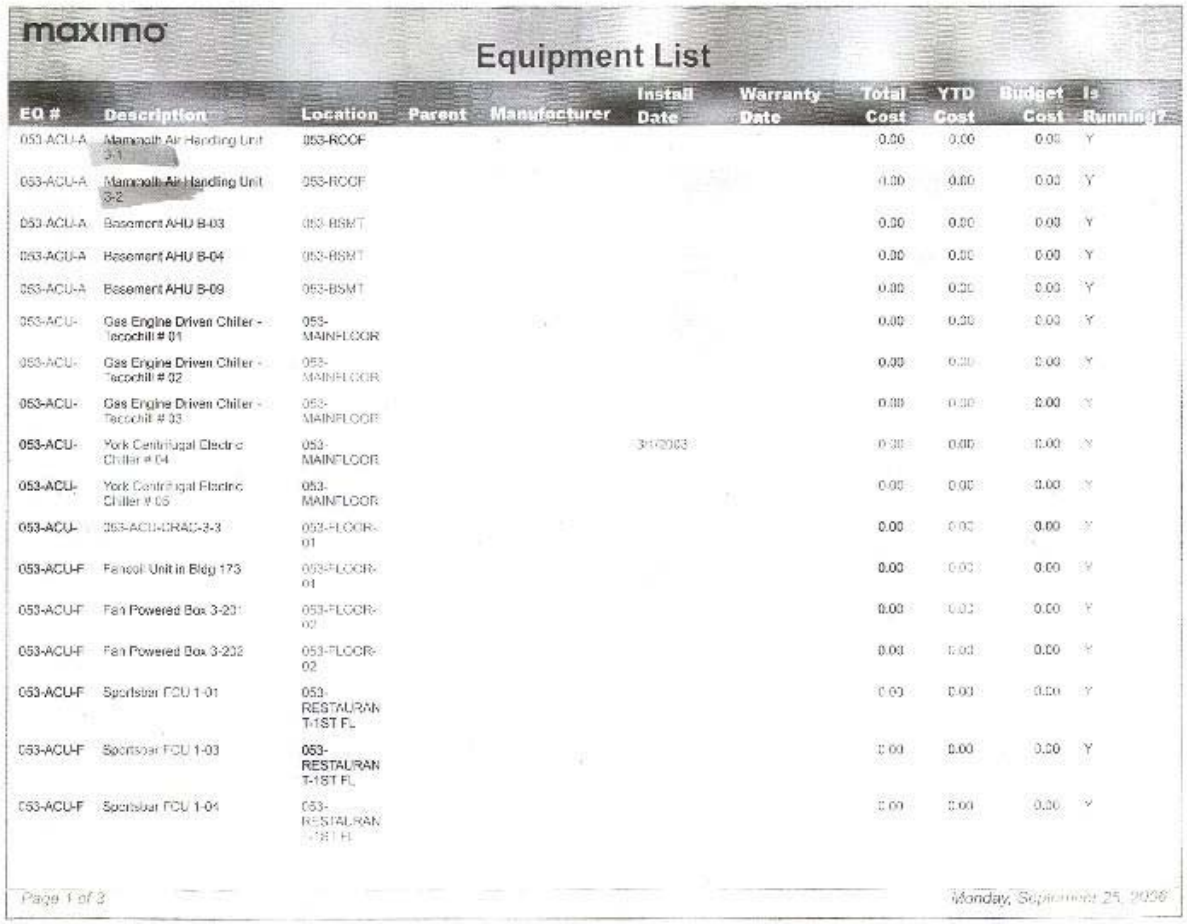

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
053-ACU-A	Mammoth Air Handling Unit 3-1	053-ROOF					0.00	0.00	0.00	Y
053-ACU-A	Mammoth Air Handling Unit 3-2	053-ROOF					0.00	0.00	0.00	Y
053-ACU-A	Basement AHU B-03	053-BSMT					0.00	0.00	0.00	Y
053-ACU-A	Basement AHU B-04	053-BSMT					0.00	0.00	0.00	Y
053-ACU-A	Basement AHU B-09	053-BSMT					0.00	0.00	0.00	Y
053-ACU-	Gas Engine Driven Chiller - Tecochill # 01	053-MAINFLOOR					0.00	0.00	0.00	Y
053-ACU-	Gas Engine Driven Chiller - Tecochill # 02	053-MAINFLOOR					0.00	0.00	0.00	Y
053-ACU-	Gas Engine Driven Chiller - Tecochill # 03	053-MAINFLOOR					0.00	0.00	0.00	Y
053-ACU-	York Centrifugal Electric Chiller # 04	053-MAINFLOOR			3/1/2003		0.00	0.00	0.00	N
053-ACU-	York Centrifugal Electric Chiller # 05	053-MAINFLOOR					0.00	0.00	0.00	Y
053-ACU-	053-ACU-GRAD-3-3	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-F	Fancoil Unit in Bldg 173	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-F	Fan Powered Box 3-201	053-FLOOR-02					0.00	0.00	0.00	Y
053-ACU-F	Fan Powered Box 3-202	053-FLOOR-02					0.00	0.00	0.00	Y
053-ACU-F	Sportsbar FCU 1-01	053-RESTAURANT-1ST FL					0.00	0.00	0.00	Y
053-ACU-F	Sportsbar FCU 1-03	053-RESTAURANT-1ST FL					0.00	0.00	0.00	Y
053-ACU-F	Sportsbar FCU 1-04	053-RESTAURANT-1ST FL					0.00	0.00	0.00	Y

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
053-ACU-F	Sportsbar FCU 1-05	053-RESTAURANT-1ST FL					0.00	0.00	0.00	Y
053-ACU-F	Sportsbar FCU 1-06	053-RESTAURANT-1ST FL					0.00	0.00	0.00	Y
053-ACU-	Elevator Room A/C 3-1	053-ROOF					0.00	0.00	0.00	Y
053-ACU-	Electrical Room A/C 3-3	053-ROOF					0.00	0.00	0.00	Y
053-ACU-	Elevator Machine Room A/C P1	053-P-ROOF					0.00	0.00	0.00	Y
053-ACU-	Elevator Machine Room A/C P2	053-BASEMENT					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-1	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-2	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-4	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-5	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-6	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-7	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-P	053-ACU-CRAC-3-8	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-	Ventilating Air Unit 3-1	053-ROOF					0.00	0.00	0.00	Y
053-ACU-	Ventilating Air Unit 3-2	053-ROOF					0.00	0.00	0.00	Y
053-ACU-S	Lobby Server Room Sanyo Split System Heat Pumps	053-FLOOR-01					0.00	0.00	0.00	Y
053-ACU-	BPM Shop Split A/C 01	053-BSMT					0.00	0.00	0.00	Y
053-ACU-	Central Plant Split A/C	053-ROOF-CP					0.00	0.00	0.00	Y

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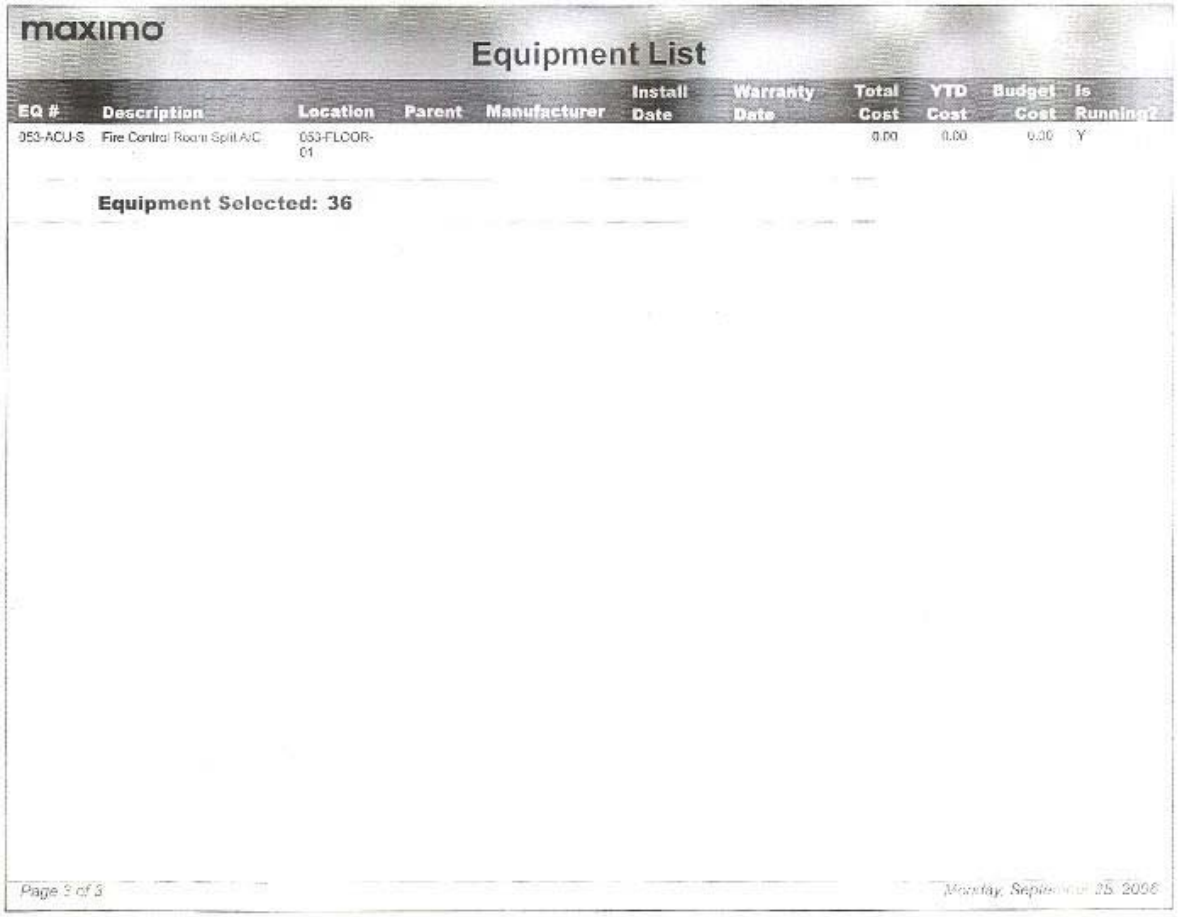

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
053-ACU-S	Fire Control Room Split A/C	053-FLOOR-01					0.00	0.00	0.00	Y

Equipment Selected: 36

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
054-ACU-A	Mammoth Air Handling Unit 4-1	054-ROOF					0.00	0.00	0.00	Y
054-ACU-A	Mammoth Air Handling Unit 4-2	054-ROOF					0.00	0.00	0.00	Y
054-ACU-A	Basement AHU B-3	054-BSMT					0.00	0.00	0.00	Y
054-ACU-A	Basement AHU B-8	054-BSMT					0.00	0.00	0.00	Y
054-ACU-F	Fancoil Unit in Bldg 174	054-FLOOR-01					0.00	0.00	0.00	Y
054-ACU-F	Fan Powered Box 4-201	054-FLOOR-02					0.00	0.00	0.00	Y
054-ACU-F	Fan Powered Box 4-202	054-FLOOR-02					0.00	0.00	0.00	Y
054-ACU-	Elevator room A/C 4-1	054-ROOF					0.00	0.00	0.00	Y
054-ACU-	Electrical room A/C 4-2	054-ROOF					0.00	0.00	0.00	Y
054-ACU-	Electrical room A/C 4-3	054-ROOF					0.00	0.00	0.00	Y
054-ACU-P	054-ACU-CRAC-4-1	054-FLOOR-04					0.00	0.00	0.00	Y
054-ACU-P	054-ACU-CRAC-2-1	054-FLOOR-02					0.00	0.00	0.00	Y
054-ACU-P	054-ACU-CRAC-2-2	054-FLOOR-02					0.00	0.00	0.00	Y
054-ACU-P	054-ACU-CRAC-4-2	054-FLOOR-04					0.00	0.00	0.00	Y
054-ACU-P	054-ACU-CRAC-7-1	054-FLOOR-07					0.00	0.00	0.00	Y
054-ACU-	Ventilating Air Unit 4-1	054-ROOF					0.00	0.00	0.00	Y
054-ACU-	Ventilating Air Unit 4-2	054-ROOF					0.00	0.00	0.00	Y
054-ACU-S	BPM Breakroom Split A/C	054-FLOOR-01					0.00	0.00	0.00	Y
054-ACU-S	Lobby-Bms Room Split A/C	054-FLOOR-01					0.00	0.00	0.00	Y

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Equipment List

EQ #	Description	Location	Parent	Manufacturer	Install Date	Warranty Date	Total Cost	YTD Cost	Budget Cost	Is Running?
054-ACU-S	CSR Room split A/C	054-FLOOR-01					0.00	0.00	0.00	Y
054-ACU-S	Fire Control Room split A/C	054-FLOOR-01					0.00	0.00	0.00	Y

Equipment Selected: 21

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APPENDIX B:
BUILDING HANDBOOK

See the attached building handbook for more information.

DEPARTMENT OF GENERAL SERVICES

REAL ESTATE SERVICES DIVISION

BUILDING AND PROPERTY MANAGEMENT BRANCH

BUILDING HANDBOOK

EAST END COMPLEX
Blocks 171 through 174
SACRAMENTO, CALIFORNIA