
Executive Summary

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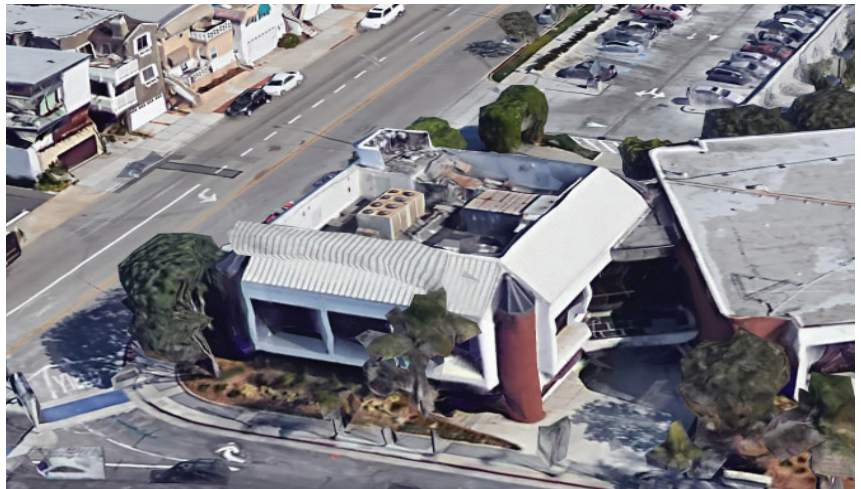
Introduction

In 2019, the City of Manhattan Beach contracted with Kitchell to assess the existing Heating, Ventilation and Air Conditioning (HVAC) systems for the City Hall building located at 1400 Highland Avenue, Manhattan Beach, CA 90266 with the intent of providing recommendations for system upgrades. The building HVAC systems serve the City Council Chambers, the departments of Finance, Parks and Recreation, Community Development, Human Resources, Information Technology and Management Services.

Originally built in 1974, the building consists of two levels with approximately 27,500 square feet of office and administrative spaces. The configuration of the building has been modified multiple times through the years as follows: a partial HVAC retrofit in 1985, a partial renovation for public accessibility around 1995, and site improvements within the Civic Center parking garage to provide access on the east side of City Hall in 2007.

The HVAC systems serving the building consist of multiple air handling units, air cooled chillers, hydronic pumps, exhaust fans, and variable air volume systems (VAV). The HVAC systems have reached the end of their industry standard expected useful service life and are experiencing operational problems including regular system failures. The rusted internal components of the HVAC system have begun to fail, leading to an increased volume of maintenance calls related to thermal discomfort. The frequency of the thermal discomfort has negatively impacted the productivity and operations throughout the facility, to the extent that secure doors must remain open to allow for proper ventilation. The facility maintenance staff has also responded to multiple urgent interventions during off hours, to provide temporary solutions for failures. Continuous use of the existing systems in their current state will spread the corrosive air throughout the internal building systems, leading to further degradation and operational failures.

As part of the analysis, Kitchell developed recommendations to remediate the thermal comfort issues and improve the HVAC systems performance. Kitchell concluded that due to the current condition of the HVAC systems and existing deficiencies, a considerable upgrade to the existing system is required. A phased approach is recommended to prioritize the HVAC upgrades into budget packages. The phased approach will not remediate all issues related to the deterioration of the existing system. However, the phased approach will address the immediate needs required to resolve the failing equipment. By providing the system upgrades, the equipment energy efficiency could be improved by an estimated 30% based on listed SEER ratings by manufacturers.



An alternate recommendation to provide a complete HVAC system replacement with a variable refrigerant flow (VRF) system has been developed for consideration. The VRF system would allow for the greatest enhancement to the building system, energy performance and occupant thermal comfort. Additionally, because the fan coils are directly treating occupied spaces, this could improve energy usage beyond the 50% based on the improvements of SEER ratings as listed by manufacturer.

Summary of Project Goals and Recommendations

Kitchell's team of licensed architects and engineers collaborated with the City of Manhattan Beach to define the project goals:

- I. Conduct an objective assessment of City Hall's current HVAC system equipment and performance
- II. Prioritize critical system improvements into manageable budget packages
- III. Develop alternative system improvement options

Kitchell's analysis recommends the replacement of all the air handlers, chillers, roof exhaust fans, variable air volume (VAV) boxes, rooftop ductwork and HVAC control system upgrades to resolve thermal comfort and performance issues.

Kitchell has prioritized the system improvements into manageable budget packages for like-for-like system improvements and repairs, in order of criticality. The budget packages and design improvement options are designed with the intent of keeping the building operational and minimize disruptions to the operation of the building.

The first budget package identifies the critical system improvements that will have the greatest impact to thermal comfort, HVAC performance and efficiency. Each subsequent package is formatted to provide solutions that improve building performance over time and includes architectural and electrical elements that would potentially be affected.

1. Critical Replacement Items (Package 1) | [\$1,358,937] *with Add Alternates*

Package 1 identifies critical replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These critical items include equipment replacement required to keep the building HVAC operational and have the greatest impact on the improvement of user thermal comfort, overall mechanical performance, and energy usage.

The additive alternates identifies necessary replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These necessary items include equipment replacement phased to continue the improvement of energy usage by detaching the basement server room from the main system, improve thermal comfort for the basement occupants, and improve mechanical performance for the exhaust fans that are at the end of their expected useful service life due to salt-air corrosion.

It was observed that all exposed outdoor mechanical air handlers and chilling equipment, ductwork, and piping are in extremely poor condition. This is in great part due to the salt-air corrosion and the age of the HVAC equipment, ductwork, piping and controls. The majority of the equipment is past its useful life and it was noted that several ductwork systems were not connected.

- ▶ **New external ductwork and connection of all capped or improperly mounted ductwork.** A new external air distribution will significantly enhance airflow performance and minimize monthly utility costs due to system losses.
- ▶ **Replacement of roof mounted air-cooled chiller.** Providing a new air cooled chilling plant with current technology and enhanced unit operating efficiencies will minimize maintenance and high operating costs.
- ▶ **Replacement of air handler (AH-1).** A new AH-1 air handler will provide improved heating, cooling and ventilation air to all areas of the first floor level to ensure occupant comfort levels are achieved.
- ▶ **Replacement of heating hot water and chilled water pumps.** New hydronic water pumps will ensure flow of heating and chilled water is provided to air handler coils for optimum heating and cooling system performance.

- ▶ **Replacement of rooftop chilled/heating hot water piping.** Providing a new hydronic piping system including valves and gauges will eliminate the existing water leaks and improve air handler heating and cooling coil performance and overall system control. A new piping system will minimize monthly operating costs and allow proper monitoring of HVAC equipment operation.
- ▶ **Building energy management control system upgrades.** A new energy management system will provide optimum room temperature control for individual thermal zones and allow HVAC components to be quick responding in order to satisfy thermal zone comfort requirements.
- ▶ **HVAC system test and balance.** An HVAC system test and balance will ensure all airflows and hydronic flows have been recorded and adjusted to meet the specific engineering heating and cooling requirements. This will provide optimum system performance and eliminate wasted system energy.
- ▶ **General building work.** Provide new equipment curbs and patch existing roof where affected by the mechanical work.
- ▶ **Electrical work.** Provide new disconnect switches and feeders to new HVAC equipment. Provide new overcurrent protection (starters or circuit breakers).
- ▶ **Additive Alternate 1: Replacement of air handler (AH-2).** A new AH-2 air handler for the Assembly Room area will provide improved heating and cooling performance and provide the code required ventilation air needed for this high occupancy area.
- ▶ **Additive Alternate 2: Replacement of basement air handler (AH-3) and associated internal ductwork.** A new AH-3 air handler will provide improved heating, cooling and ventilation air to all areas of the basement floor level to ensure occupant comfort levels are achieved.
- ▶ **Additive Alternate 3: Replacement of roof exhaust fans.** New roof exhaust fans will provide improved ventilation air to all areas throughout all floors.
- ▶ **Additive Alternate 4: New redundant dedicated split system serving data server room.** A new redundant dedicated split system serving the data server room will eliminate wasted system energy from the main HVAC by dedicating and isolating the consistent energy load to a smaller single zone.
- ▶ **Additive Alternate 5: HVAC system test and balance for equipment approved in additive bid alternate.** An HVAC system test and balance will ensure all airflows and hydronic flows have been recorded and adjusted to meet the specific engineering heating and cooling requirements. This will provide optimum system performance and eliminate wasted system energy.
- ▶ **Additive Alternate 6: Electrical work for equipment approved in additive bid alternate.** Provide new disconnect switches and feeders to new HVAC equipment. Provide new overcurrent protection (starters or circuit breakers).
- ▶ **Additive Alternate 7: General building work for equipment approved in additive bid alternate.** Provide new equipment curbs and patch existing roof where affected by the mechanical work.

2. Impending Replacement Items (Package 2) | [\$332,639]

Package 2 identifies impending replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These impending items will improve the user thermal comfort and mechanical performance by replacing all existing variable air volume (VAV) terminals, with and without reheat capabilities, at both basement and first floor levels, replacing supply and return air diffusers and grilles at the basement and first floor levels. The VAV terminals have been updated since the original construction; however, the dampers, actuators and valves are slow responding due to age of the components and the outdated pneumatic controls. The existing diffusers are performing poorly due to age. Additional electrical circuits will be provided as necessary.

- ▶ **Replacement of VAV boxes and associated ductwork.** New VAV boxes will provide improved ventilation air and air distribution controllability to all areas throughout all floors.
- ▶ **Replacement of air distribution devices.** New air distribution boxes will provide improved air distribution to all areas throughout all floors improving thermal comfort to the occupant.
- ▶ **Electrical work.** Provide new feeders to new VAV boxes. Provide new overcurrent protection (circuit breakers).

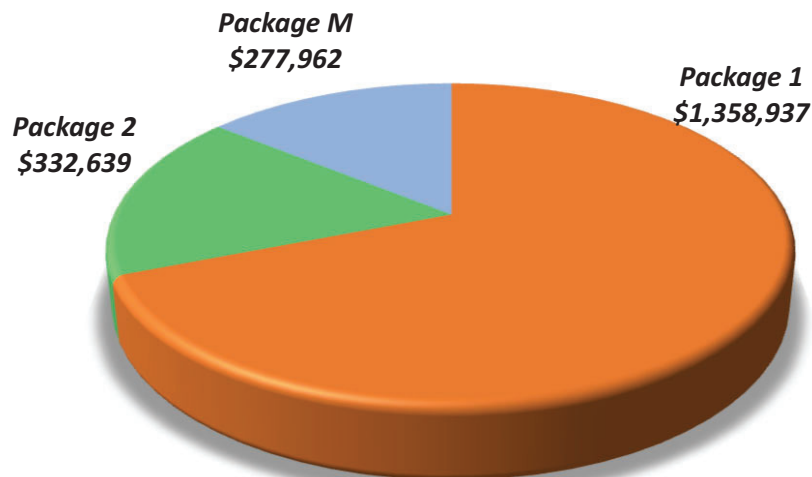
3. Maintenance Items (Package M) | [\$277,962]

Package M identifies all work that can be accomplished by the City's in-house staff. This work is supplemental to all previous package improvements and is required based on specific work conducted. Removal and replacement of bird screens and the removal and reinstallation of existing ceiling and light fixtures will be required to accommodate the replacement of existing HVAC systems. Removal and reinstallation of existing light fixtures will require replacement of existing lighting controls in order to meet Title 24.

- ▶ **Remove and reinstall light fixtures to accommodate HVAC work.** Accommodates HVAC upgrades and improvements impacted by work above the ceiling.
- ▶ **Remove and reinstall suspended ceiling to accommodate impacted HVAC work.** Accommodates HVAC upgrades and improvements impacted by work above the ceiling.
- ▶ **Remove and replace bird screen.** Removal will allow construction material access for the roof level HVAC upgrades and improvements. Providing a new replacement bird screen mesh will prevent wildlife interference once the work is complete.

City of Manhattan Beach			
Budget Packages Cost Summary			
Package 1	Package 2	Package M	Total
Critical Replacement Items	Impending Replacement Items	Maintenance Items	
\$1,358,937	\$332,639	\$277,962	\$1,969,538

BUDGET PACKAGE COST SUMMARY



PACKAGE NO.	COST ESTIMATE	THERMAL COMFORT IMPROVEMENTS	ENERGY IMPROVEMENTS	LONGEVITY IMPROVEMENTS
1	\$1,358,937	HIGH	HIGH	HIGH
2	\$332,639	MODERATE	MODERATE	HIGH
M	\$277,962	LOW	LOW	LOW
VRF Design Alternate	\$3,282,687	HIGH	HIGH	HIGH

Conclusion

A phased approach is recommended to prioritize and address the key needs of replacing the main failing systems over the span of manageable budget packages. The phased approach will address the immediate needs required to resolve the failing equipment. It will not solve all issues experienced by the deterioration of the existing system as a like-for-like equipment replacement will not improve user controllability, individual system energy efficiencies (SEER/EER) and system performance to anticipate system longevity.

The design alternate recommendation to provide a variable refrigerant flow (VRF) system redesign will allow for the largest flexibility of individual office thermal comfort control, but will also provide the greatest enhancement to the building's system and energy performance.