PHASE I

APPENDIX 1

Building HVAC Summary

HORSETOOTH ENGINEERING, LLC

6/18/2015

- Cap all underground ductwork. Seal all transfer air into the corridor from the classrooms. Remove the basement MZ unit, this will require cutting up and disassembling the unit to get it out of the basement.
- Install VUVs per classroom and office areas. Wood structure and little space to route duct does not allow for a central AHU or RTU solution.
- Install an RTU for the gym/cafeteria. Route DuctSox or spiral duct through the space.
- Install a packaged DX RTU for the administration area.
- New controls system for the whole school

Recommendations for 2010 Bond project

- The monies slated for the 2017 HVAC updates from the 2010 Bond will not be enough to upgrade the HVAC system appropriately. With the exception of the boiler, this building needs an entire HVAC system replacement that has significant architectural and structural impacts.
- The PSD administration has to determine how those monies will best be spent.
    - If doing something to improve comfort now is the number one priority, then Horsetooth Engineering recommends the following:
        - Install VUVs in as many of the classrooms as is possible within the budget. These should have a cooling coil installed.
        - Install a relief hood through the roof at each classroom that a VUV is installed.
        - Cap holes in floor, transfap Tf6.6( )s r 0 Td(08 Tc -0.001 Tw<1 Tfp)2(d)-1r11.ID 33

Existing Infrastructure

- In 2002 a classroom addition was constructed on the south side. This area is served by a CV RTU providing heating and ventilating only. An adjacent existing classroom is also served by this unit. The administration area was also remodeled, a packaged DX RTU now serves this space.
- 1994 consisted of a small addition and an infill.
    - A portion of building was constru

- Upgrade the temperature controls system and components in any remaining equipment.
- Replace boilers if budget allows.
- Replace heating water piping in 1962 and 1966 areas if budget allows.
- Leave all other equipment as is. If budget allows for more work to be done, the following is recommended, in order of priority due to age of equipment.
    - Replace the gym AHU with a new RTU. Route Ductsox through the space for supply air.
    - Flex room UVs should be replaced with a RTU. Space for a future cooling coil should be provided for future.
    - Next would be replacement of the RTUs installed in 1994 and 2002 serving the classrooms and media center. Provide VUVs for the classrooms and a dedicated RTU for the media center, all with space for a future cooling coil.

o If the administration feels that an air conditioning Bond is to pass in the near term and that a total replacement of the HVAC at this school, including air conditioning is imminent, then Horsetooth Engineering recommends the following:

- Replace the gym AHU with a new RTU, since this space will not be receiving air conditioning in the future anyway (as long as PSD policy does not change from its current stance)
- Install new RTU with space for future cooling coil for the flex space.
- Replace the boilers with high efficiency boilers that can be optimized once the total HVAC replacement project is undertaken.
- Upgrade controls for the heating plant, gym RTU and flex RTU.

CLP ELEMENTARY SCHOOL

Existing Infrastructure

- 2015 HVAC updates that were installed in the 1972 part of the building are air conditioning ready. Some of the original ductwork from 1972 was reused, if air

conditioning is to be installed, it would be prudent to replace the ductwork that is reaching the end of its service life at that time.

- In 2007 an expansion of the cafeteria to the west was constructed. New and relocated UVs were part of the project.
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- Replace ductwork in the 1972 area that the 2010 Bond project budget was unable to address
- Install new RTU and remove existing UVs for the cafeteria
- Replace office area packaged DX RTU with a new VAV packaged DX RTU for operation during afternoon and summer times when no students are there to avoid running the chiller for only a portion of the school
- Install new RTU and remove existing VAVs for the NE classrooms
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- 1948 was the original construction of the building. All HVAC systems were replaced in 1992.
- Kitchen has recently had new make-up air units and exhaust installed.

Air Conditioning Strategies

- Install VUVs per classroom in the original construction (1948 area). Little space to route duct does not allow for a central AHU or RTU solution.
- Install a new RTU and spiral ductwork or DuctSox for the gym/cafeteria.
- Install a new RTU for the media center.
- Install VUVs for the 1992 and 2006 addition classrooms
- Install a packaged DX RTU for the administration area.
- Install chiller and route chilled water to new RTUs and VUVs.
- Install an evaporative cooling section in the recently installed make-up air unit for the kitchen.
- New controls system for the whole school

Life Cycle Needs Due to Aging Equipment

- Install VUVs per classroom in the original construction (1948 area). Little space to route duct does not allow for a central AHU or RTU solution.
- Install a new RTU and spiral ductwork or DuctSoxj/TT1 1 Tl6y3(al)166he3(a)3(ig).7(l2.4(/.3(6-4.4

distribute to the VUVs. Install branch valves for future expansion of the pipe network.

- Upgrade the temperature controls system and components in any remaining equipment.
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- x New controls system for the whole school

LAB/POLARIS SCHOOL @ MOORE

Existing Infrastructure

- x In 2006 a gym addition was constructed. This area is served by a heating and ventilating only RTU.
- x 1996 a boiler was installed to convert the 1956 basement MZ from gas-fired to hot water heat.
- x 1994 consisted of multiple additions and in infill.
  - o A portion of building was constructed to connect the original 1956 construction to the 1966 building. This infill area is served by a CV RTU with heating and ventilating only.
  - o Two classrooms were added to the south end of the 1966 construction. This area is served by a CV RTU that is heating and ventilating only. Two classrooms were also added to the north end of the 1958 construction, these rooms are served by underground duct that was installed in the 1958 construction to allow for 2 more classrooms to be served from the basement MZ.
- x In 1991 the 1966 construction on the east part of the building was converted to hot water heat. A boiler room was added on the north side of the 1966 construction. This heating system serves the infill area and classrooms on the

- Kitchen has no make-up air unit. It relies only on transfer air from the gym/cafeteria. There is a small duct from the basement MZ that provides heat to the eastern part of the kitchen.
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- Rebalance the existing MZ unit to account for removed zones if the budget does not allow all underground duct zones to be replaced with new VUVs. Note: this is not recommended.
- Upgrade the temperature controls system and components in the existing MZ unit, if it must remain – note that this is not recommended.
- Upgrade controls on all existing equipment to remain.
- Remove 1966 MZs and ductwork, install new VUVs with a cooling coil. Existing casework makes VUVs challenging.
- Install a central ducted relief via exhaust fan on a VFD for the 1966 area.
- Size piping to new VUVs for future 2-pipe changeover.

o If the administration feels that an air conditioning Bond is to pass in the near term or that a total replacement of the HVAC at this school with or without air conditioning is imminent, then Horsetooth Engineering recommends the following:

- Upgrade the controls on the existing MZ and the heating plants.

LIVERMORE ELEMENTARY SCHOOL

Existing Infrastructure

x 2000 Addition is served by 2 residential style furnaces. The computer lab and the room adjacent to it are air conditioned. The classroom on the northwest is not air conditioned. These furnaces are fixed outside air only and do not have economizers.

x 1993 a boiler was added to heat the original 1952 construction area on the south via baseboard radiation. At this time, an air handler was installed to provide ventilation air to the original 1952 area. Also, an air handler was installed to serve the classroom and library on the east side that were an addition in 1980.

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x 1980 a major addition to the north of the original 1952 construction was constructed. A gym/cafeteria, media center, classroom and restrooms were created. The gym is served by an air handler in the boiler room that was installed in 1980. S0. S. 12(r)3( )8b3.f16.4(n)-4.4(0 -1.4 Tc 0 Tw 27.9 0 Td((/ish)-4.4(na)3.oT((/

- In 1986 a media center addition was constructed on the north side, adjacent to the kitchen. This area is served by the 1994 RTU and is now a special needs room.
- In 1966 an annex was built to the northeast of the building. It is served by two MZ RTUs. The drawings indicate that the eastern most 2 classrooms have underground as well as overhead supply duct.
- 1962 was the original construction of the building.
    - All classrooms are served by UVs.
    - Some interior rooms have ceiling hung UVs.
    - The gym/cafeteria is served by an indoor AHU in the boiler room. It provides supply air via underground duct.
- A packaged DX RTU serves the computer lab in the 1962 area.
- Kitchen has no make-up air unit. It relies only on transfer air from the gym.

Air Conditioning Strategies

- Install VUVs per classroom on the south half of the building (1962 area). Wood structure and little space to route duct does not allow for a central AHU or RTU solution.
- Install a cooling coil in the 1994 RTU.
- Install VAVs in 1994 duct for zoning.
- Cap all underground ductwork for the gym/cafeteria. Install a new RTU with cooling coil. Route exposed spiral duct or Ductsox through the space.
- Install VUVs for all areas on the 1966 portion of the building.
- Install chiller and route chilled water to new AHU, existing RTUs and new VUVs.
- Replace all ductwork in the 1966 construction area.
- Install a make-up air unit with evaporative cooling for the kitchen.
- Install a packaged DX RTU for the admin area
- New control system for whole school.

Life Cycle Needs Due to Aging Equipment

- Install VUVs per classroom on the south half of the building (1962 area). Wood structure and little space to route duct does not allow for a central AHU or RTU solution.
- Cap all underground ductwork for the gym/cafeteria. Install a new AHU. Route exposed spiral duct or Ductsox through the space.
- Install VUVs for all areas on the 1966 portion of the building.
- Replace all ductwork in the 1966 construction area.

- Replace boilers and heating water piping (installed in 1962 and 1966). Route heating water to the new VUVs, VAVs, AHUs and RTUs.
- Install a make-up air unit with evaporative cooling for the kitchen.
- Install a packaged DX RTU for the admin area
- New control system for whole school.

Recommendations for 2010 Bond project

- The monies slated for the 2016 HVAC updates from the 2010 Bond will not be able to replace all of the aging equipment that is on the Bond list.
- The PSD administration has to determine how those monies will best be spent.
    - If doing something to improve comfort now is the number one priority, then Horsetooth Engineering recommends the following:
        - Install VUVs for each classroom in 1962 and 1966 areas. A cooling coil should be installed in each VUV. Remove ductwork in 1962 and 1966 areas.
        - Install a cooling tower similar to what has been done at Irish, Riffenburgh and Beattie.
        - Route chilled water pipe from the tower across the roof to a few specific areas and then drop down into the ceiling and distribute to the VUVs. Install branch valves for future expansion of the pipe network.
        - Replace the gym/cafeteria AHU with a new AHU. Route Ductsox through the space for supply air.
        - Install a cooling coil in the RTU installed in 1994 and route chilled water piping from the cooling tower to this RTU.
        - Upgrade the temperature controls system and components in any remaining equipment.
        - Leave all other equipment as is. If budget allows for more work to be done, the following is recommended, in order of priority due to age of equipment.
            - Replace boilers
            - Replace heating water piping in 1962 and 1966 areas

    - If the administration feels that an air conditioning Bond is to pass in the near term and that a total replacement of the HVAC at this school, including air conditioning is imminent, then Horsetooth Engineering recommends the following:

- ƒ Replace the gym/cafeteria AHU with a new AHU that has a cooling coil for future connection.
- ƒ Replace the boilers with high efficiency boilers that can be optimized once the total HVAC replacement project is undertaken.
- ƒ Upgrade controls for the heating plant, gym RTU and 1994 RTU.

PUTNAM ELEMENTARY SCHOOL

Existing Infrastructure

- x The 2014 project related to the 2010 Bond consisted mainly of adding variable frequency drives to the existing AHU fan motors to improve energy efficiency. Budget constraints limited the work for this school.
- x 1997 consisted of multiple additions and renovations

- 1955 was the original construction of the building. A MZ unit was installed in the basement. Supply duct was all routed underground. Return air was transferred from the classrooms into the corridor. One large central return air opening in the corridor is connected to the MZ.
- Kitchen has no make-up air unit. It relies only on transfer air from the gym/cafeteria. There is a small duct from the basement MZ that provides heat to the eastern part of the kitchen, from below.

Air Conditioning Strategies

- Cap all underground ductwork. Seal all transfer air into the corridor from the classrooms. Remove the basement MZ unit, this will require cutting up and disassembling the unit to get it out of the basement.
- Install VUVs per classroom on the east half of the building (from the entry way east). Wood structure and little space to route duct does not allow for a central AHU or RTU solution.
- Install a cooling coil in AHU supply main for the cafeteria.
- Remove the media center DX cooling coil and install a chilled water coil.
- Remove the DX RTUs on the infill and install VUVs in place.
- Install VUVs for on the western portion of the building (1966 and 1994 classrooms.
- Install chiller and route chilled water to existing AHUs and new VUVs.
- Replace all ductwork in the 1966 construction area.
- Reuse 1991 and 1999 boilers to route heating water to the new VUVs.
- Install a make-up air unit with evaporative cooling for the kitchen.
- Packaged DX administration RTU to remain.
- New control system for whole school.

Life Cycle Needs Due to Aging Equipment

- Cap all underground ductwork. Seal all transfer air into the corridor from the classrooms. Remove the basement MZ unit, this will require cutting up and disassembling the unit to get it out of the basement.
- Install VUVs per classroom on the east half of the building (from the entry way east). Wood structure and little space to route duct does not allow for a central AHU or RTU solution.
- Install VUVs for on the western portion of the building (1966 classrooms).
- Replace all ductwork in the 1966 construction area.
- Install a make-up air unit with evaporative cooling for the kitchen.

- x New control system for whole school.

RED FEATHER ELEMENTARY SCHOOL

Existing Infrastructure

- x 1997 modular was built as an addition to the west of the original 1986 construction. The furnace serving this area was recently replaced in 2013. This unit does not have an economizer. Supply and return air are overhead.
- x 1984 was the original construction of the school. Three residential furnaces serve this area. One furnace serves the classrooms on the north and east. Another furnace serves the 2 south facing classrooms. The third furnace serves the gym/cafeteria. All areas received new furnaces in 2013.
- x Gym supply and return air is delivered via sidewall, from the same wall.
- x Kitchen currently has no exhaust and has supply and return air from the furnace serving the gym/cafeteria

Air Conditioning Strategies

- x Add a DX cooling coil to the furnaces installed in 2013. Ductwork revisions would be required to install a new cooling coil.

Exhaust fans should be installed for the kitchen and return air removed.

Exposed spiral duct or DuctSox should be installed

- 1972 the southeast classroom and multi-purpose room was built. Two new furnaces serving this area were installed in 2005. These units do not have an economizer.
- 1960 east classroom is served by a furnace installed in 2005. It also serves the east classroom built in 2005.
- 1896 classroom is also served from the furnace serving the other 2 east classrooms that was installed in 2005. Last summer, this area also received new windows and doors.
- Kitchen currently has no exhaust, supply or return air.

Air Conditioning Strategies

- Add a DX cooling coil to the furnaces installed in 2005. Ductwork revisions would be required to install a new cooling coil.

Exhaust fans should be installed for the kitchen.

- 1992 consisted of multiple replacements for the mechanical system.
    - New unit ventilators were installed for the majority of the 1919 portion of the building.
    - An air handler was installed for the eastern half of the lower floor of the 1919 portion of the building.
    - The western half of the lower floor in the 1919 portion of the building appeared to receive unit heaters only. Ventilation is assumed to have been intended via operable windows.
    - Site visit observations noted newer windows in the 1919 portion of the building. These were included in the 1992 project.
    - A new gym AHU was installed in the 1953 portion of the building.
    - New boilers and heating water piping were installed to serve the 1953 and 1919 areas of the building. It appears as though this new boiler plant was tied into the 1988 boiler plant to allow for redundancy.
- In 1988 a classroom addition was constructed on the south end of the building, adjacent to the gym constructed in 1953. This area is served by unit ventilators and its own boiler system. Ceiling unit ventilators serve the media center that was also built at this time.
- 1953 a gym addition was constructed to the south of the original 1919

- x Install VUVs per classroom, workrooms and a RTU for the media center.
- x Media Center RTU
- x New AHU for the 1st floor of the 1919 area.
- x Install building exhaust fans for pressure relief in economizer mode. Duct from fans to relief grilles.
- x New control system for the whole school.

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- The gym and auxiliary gyms are served by heating and ventilating AHUs hung below the ceiling. These are original to the building and should be replaced with RTUs for better maintenance access.
- Locker rooms have exhaust only, make-up air is transferred from the gym.
- Tech Ed areas received new heating and ventilating fan coil units in 2012. Space for a cooling coil to be installed is available.
- All classrooms in the 1967 area are served by heating and ventilating RTUs with VAV zoning. These were installed in 2012. The heating coil provided in the unit is oversized to allow for future 2-pipe air conditioning strategy via chilled water. Ductwork and piping in the 1967 area should all be replaced.
- Computer labs are served by a packaged DX cooling RTU.
- The kitchen received a newaurwe30 Td[(e)b30 3 /TTw 0.3 0 Td[(u)-(w)6.4 0 Td(w)6.u.4(t)9

Existing Infrastructure

- 2015 HVAC updates that were installed in the five southeast classrooms of the 1988 addition and are air conditioning ready.
- 1997 the computer lab 128 and classrooms 109 through 111C were air conditioned with packaged DX units.
- 1992 addition and remodel equipment is not air conditioning ready and should be replaced.
- 1988 RTU has had a significant load removed from it during the 2015 HVAC updates. This unit should be removed and sized appropriately for the load that it now serves. Ductwork is fiber board and has been repaired many times. Duct should be removed and replaced.
- Indoor air handler serving the 1984 addition that functions as the cafeteria is not air conditioning ready and should be replaced. UVs serving the industrial science are also not air conditioning ready and should be replaced.
- North portion of the building was initially built in 1947 and is served by an air handling unit in the basement. It serves the gym as well as most of the classrooms in the original north part of the building.
    - The HVAC in this portion of the building needs to be completely removed and replaced. All ceiling systems, lights, and cabling above the ceiling should be removed. Asbestos abatement should be anticipated due to the age of the building and ceiling systems observed.
    - The extent of work required in this area will be so extensive that the work will not be able to be completed during a typical summer break. Moving of students and staff should be included in any plan to improve/update the HVAC system in this portion of the building.
- Kitchen make-up air unit and evaporative cooler should be replaced.

Air Conditioning Strategies

- Install chiller and route chilled water to 2015 VUVs and all other new equipment that will be required to air condition the building.
- Install VUVs in the 1947/1962 areas of the building. Structure and space does not allow for other systems to be cost effectively installed. All other classrooms should also be served by VUVs.
- Route chilled water on roof and drop into space when required.
- Install new RTUs, for media center, music room, and cafeteria.
- Provide Packaged DX RTU for the administration area.
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- 1993 the boilers were replaced and two science rooms were added to the south end, each received a ceiling hung UV that remains today.
- 1980 the cafeteria was expanded further to the south and four classrooms were added to the south of the 1959 construction. These areas received HVAC updates in 2007.
- 1976, the auxiliary gym and weight room were added, along with a few classrooms and remodel of 3 adjacent rooms. These are all served by 2 AHUs in the mezzanine mechanical room off the auxiliary gym.
- 1972 classrooms were added to the east end of the building. These have UVs that were replaced in 2007.
- 1959 was the original construction. Primarily consisted of under window UVs for the classrooms and mezzanine mounted air handlers serving the gym and auditorium. The air handlers were refurbished in 2007 and unit ventilators replaced as discussed above.

Air Conditioning Strategies

- Install VUVs for the 1959, 1972, and 1980 classrooms, replacing the under window UVs or ceiling hung UVs that are currently installed.
- Install RTUs and AHUs for the areas currently served by RTUs and AHUs such as the media center, auditorium, administration, weight room, cafeteria, and gyms.
- Route chilled water on roof and drop into space when required.
- Install new heating water piping in all of the building except the 2007 additions.
- Replace all ductwork installed in the 1959 and 1976 areas.
- Install a chiller and route chilled water to new RTUs, AHUs and VUVs.
- Packaged DX RTU for administration
- Add evaporative cooler section to 2007 makeup air unit.
- New Controls entire school.
- Due to the type of equipment installed in 2007 that does not have room for cooling coils, and the age of the older equipment that was not replaced in 2007, this building warrants a complete HVAC replacement if air conditioning was to be considered.

Life Cycle Needs Due to Aging Equipment

- Install RTUs and AHUs for the areas currently served by RTUs and AHUs such as the media center, auditorium, administration, weight room, cafeteria, and gyms.
- Install new heating water piping in all of the building except the 2007 additions.
- Replace all ductwork installed in the 1959 and 1976 areas.

- Packaged DX RTU for administration
- New Controls entire school.

Even if air conditioning is not to be installed; the 1959, 1976, and 1980 spaces that did not receive an update in 2007 are due for an equipment, ductwork, and piping replacement.

LINCOLN MIDDLE SCHOOL

Existing Infrastructure

- 1995 Addition consists of constant volume reheat RTUs. 1 of them, in the northeast corner, has packaged DX cooling. Some air from this unit has also been distributed to one of the adjacent classrooms in the 1974 portion of the building.
- The boilers are original to the building in 1974. They work well still and could be considered as perhaps an item to leave alone in the scheduled 2016 HVAC updates.
- Piping and ductwork is all original to the building in 1974. Replacement of the systems should be within 0-5 years.
- The classroom and office spaces are served from MZ RTUs installed in 1974
- The gyms are served from indoor air handlers hung beneath ceiling. Maintenance access to these units is very challenging.
- Locker rooms do not have direct fresh air supply, only exhaust. (4i2(

- 2012 HVAC updates that were installed in the classrooms, music and Tech Ed rooms are air conditioning ready. The VUVs have a 4-row heating coil that can have chilled water piping routed to it for 2-pipe system air conditioning.
- 2012 RTUs that were installed for the administration, hearing impaired, and band room have space for a cooling coil to be installed.
- 2006 RTU serving the cafeteria also has space for a cooling coil to be added.
- 1997 Gym addition heating and ventilating RTU is in good condition.
- One computer lab is served from a packaged DX RTU installed in 2012. The other computer lab also has a packaged DX RTU that was installed in earlier years by PSD.
- Kitchen make-up air unit and evaporative cooler was replaced in 2012.

Air Conditioning Strategies

- Install chiller and route c2illedt Coban12

- 1 furnace was installed to heat the kitchen/restrooms/corridor adjacent to the gym/cafeteria.
- Another furnace was installed to heat the corridor/lobby/offices created in 2003.

x Gym construction date is believed to be 1968.

x The 2 southeast classrooms appear to be built quite some time ago. Perhaps the 1940s or 1950s

x The 4 west classrooms were likely the original construction. This appears to be around the turn of the 20th century. These spaces are heated by baseboard heat. Ventilation is only provided via operable windows. One classroom that is now adjacent to the 2003 corridor no longer has operable windows to the outside.

Air ConditioningStrategies

x Install new furnaces and condensing units for all the areas currently served by furnaces.

x Install new packaged DX RTU for the administration area.

x Install VUVs in each of the 4 classrooms in the original building. Each VUV shall have a corresponding DX condensing un1p8 Tc -e 16.4(D)ngf D3(di)3.r Tf-24R e.

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- This strategy is able to deliver 65 to 70 degree air into the classrooms during the hottest days of the year.
- Heating water piping and boilers were installed in 1995

Life Cycle Needs Due to Aging Equipment

- Install new RTUs for the 3 RTUs serving the 1971 area. Energy Code and best practice will require zoning control in these areas to be revised to VAV. All ductwork in these areas to be removed and replaced.
- Install new RTU on gym/cafeteria.
- Replace gym/cafeteria ductwork and all ductwork from 1971 that was reused in 2014.

IRISH ELEMENTARY SCHOOL

Existing Infrastructure

- 2014 HVAC updates installed a "tempered air" system utilizing a cooling tower to create cool water that was routed via roof mounted piping to a number of rooftop units.
  - This strategy is able to deliver 65 to 70 degree air into the classrooms during the hottest days of the year.
  - A new RTU serving the 2006 southeast addition is air conditioning ready.
  - Heating water piping and boilers were installed in 1993 and were all reused in the 2014 HVAC updates.
  - A new RTU serves the media center area that was added in 1989. This unit is air conditioning ready.

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- Kitchen has no makeup air. It relies only on transfer air from the gym/cafeteria.

Air Conditioning Strategies

- Install chiller and reuse chilled water piping installed in 2014 that is currently connected to the cooling tower.
- Rebalance chilled water flows at new RTUs installed in 2014.
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The area served by this unit now has VAV zoning and some new ductwork. Existing ductwork downstream of the new VAVs was reused. Sections of duct in this area that remain from 1970 should be replaced. The RTU and zoning scheme is air conditioning ready.

- The two classrooms north of the cafeteria are served by a new RTU installed in 2014 and is air conditioning ready.
- Existing MZ RTUs from 1967 were retrofitted with cooling coils and all ductwork was reused. These units and the associated ductwork should be replaced. Budget constraints and prioritization of improved comfort resulted in these RTUs remaining in place during the 2014 HVAC updates project.

- In 2002 a gym addition was constructed. Equipment is relatively new and gyms are not to be air conditioned. Air handling equipment should be replaced in 15-20 years.
- The RTU serving the cafeteria is original from 1967. This unit should be replaced and piping extended to this area to provide air conditioning.
- Kitchen has no makeup air. It relies only on transfer air from the cafeteria.

Air Conditioning Strategies

- Install chiller and reuse chilled water piping installed in 2014 that is currently connected to the cooling tower.
- Rebalance chilled water flows at new RTUs installed in 2014.
- Install new RTUs for the 3 RTUs serving the 1967 area. Energy Code and best practice will require zoning control in these areas to be revised to VAV. All ductwork in these areas to be removed and replaced.
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TEMPERED – LESS THAN 30 YEARS – RELATIVELY ADAPTABLE

Kruse Elementary School

Existing Infrastructure

- 2014 HVAC updates installed a “tempered air” system utilizing a cooling tower and VUVs
  - This strategy is able to deliver 65 to 70 degree air into the classrooms during the hottest days of the year.
  - Air quantities are 1,200 to 2,000 CFM per classroom depending on number of exterior walls and orientation (east, west, north, south)
  - Air is delivered into the classrooms via exposed spiral ductwork up high with sidewall diffusers. Air quantity varies between 50 and 100% based on how much heat or cooling the room requires.
  - Zoning per individual classrooms is provided.
  - Fan coil units that also receive cool water from the tower were installed6.7(i)-2.4(n)-6.3(

- 2015 HVAC updates will install a “tempered air” system utilizing a cooling tower and VUVs
    - This strategy is able to deliver 65 to 70 degree air into the classrooms during the hottest days of the year.
    - Air quantities are 1,200 to 2,000 CFM per classroom depending on number of exterior walls are orientation (east, west, north, south)
    - Air is delivered into the classrooms via exposed spiral ductwork up high with sidewall diffusers. Air quantity varies between 50 and 100% based on how much heat or cooling the room requires.
    - Zoning per individual classrooms is provided.
    - Fan coil units that also receive cool water from the tower will be installed in corridor, work areas, cafeteria and office areas.
    - New pumps and piping to work with the 2-pipe system for heating and cooling will be installed.
- 2015 HVAC updates also included new packaged DX RTUs for the computer lab and Comm Data rooms.
- 1993 was the original construction of the building.
    - Media Center is provided with heating and ventilation by an indoor AHU installed in 1993. This unit should be replaced in the next 10-15 years.
    - The AHU serving the gym is original from 1993. This unit should be replaced in the next 10-15 years.
    - A residential style evaporative cooler serves the kitchen and should be replaced with a make-up air unit providing evaporative cooling in the next 0-3 years.
    - Boilers should be anticipated to be replaced in 15-20 years

Air Conditioning Strategies

- Install a chiller and connect to existing piping.
- Install a cooling coil in the supply duct main for the Media Center.
- Install a new make-up air unit for kitchen with evaporative cooling.
- Packaged DX RTU for admin

Life Cycle Needs Due to Aging Equipment

- Install a new make-up air unit for kitchen with evaporative cooling.

McGrawElementary School

Existing Infrastructure

- 2014 HVAC updates installed a “tempered air” system utilizing a cooling tower and VUVs
    - This strategy is able to deliver 65 to 70 degree air into the classrooms during the hottest days of the year.
    - Air quantities are 1,200 to 2,000 CFM per classroom depending on number of exterior walls are orientation (east, west, north, south)
    - Air is delivered into the classrooms via exposed spiral ductwork up high with sidewall diffusers. Air quantity varies between 50 and 100% based on how much heat or cooling the room requires.
    - Zoning per individual classrooms is provided.
    - Fan coil units that also receive cool water from the tower were installed in corridor, work areas, cafeteria and office areas.
    - New pumps and piping to work with the 2-pipe system for heating and cooling were installed.
- 2014 HVAC updates also included new packaged DX RTUs for the computer lab and Comm Data rooms.
- A new kitchen make-up air unit with evaporative cooling was also installed in 2014.
- 1992 was the original construction of the building.
    - Media Center is provided with heating and ventilation by an indoor AHU installed in 1992. This unit should be replaced in the next 10-15 years.
    - The AHU serving the gym is original from 1992. This unit should be replaced in the next 10-15 years.
    - Boilers should be anticipated to be replaced in 15-20 years

Air Conditioning Strategies

- Install a chiller and connect to existing piping.
- Install a cooling coil in the supply duct main for the Media Center.
- Packaged DX RTU for admin

Traut Elementary School

Existing Infrastructure

- 2015 HVAC updates will install a “tempered air” system utilizing a cooling tower and VUVs
    - This strategy is able to deliver 65 to 70 degree air into the classrooms during the hottest days of the year.

- Air quantities are 1,200 to 2,000 CFM per classroom depending on number of exterior walls are orientation (east, west, north, south)
- Air is delivered into the classrooms via ceiling diffusers. Air quantity varies between 50 and 100% based on how much heat or cooling the room requires.
- Zoning per individual classrooms is provided.
- New pumps and piping to work with the 2-pipe system for heating and cooling were installed.

x 2015 HVAC updates also included new packaged DX RTUs for the media center, admin area, and music department.

x 1993 was the original construction of the building.
- Cafeteria is provided with heating and ventilation by a RTU installed in 1993. This unit should be replaced in the next 10-15 years.
- Heating and ventilating RTUs serve the gyms. These units should be replaced in the next 10-15 years.
- The locker rooms are only exhausted and heated, no direct makeup air is provided. Makeup air is transferred from the gym.
- An evaporative cooler serves the kitchen and should be replaced with

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Life Cycle Needs Due to Aging Equipment

- Replace duct from 1967 that was reused in the 2012 project due to budget constraints.

Improvement Strategies for DOAS

- Install a cooling coil in RTUs installed in 2012.
- Install a DX split condensing unit for each of the 2012 RTUs.
- Deliver 55 degree air to the classroom.

Eyestone Elementary School

Existing Infrastructure

- 2012 HVAC updates installed a "tempered air" system utilizing indirect evaporative cooling Dedicated Outside Air Systems (DOAS) for portions of the building.
  - This strategy is to deliver outside air into the classrooms that is approximately 24 degrees cooler than the outside air temperature during the warmer parts of the year. For instance – at 95 degrees outside, the air delivered to the classroom is 71 degrees.
  - A future cooling coil could be installed in these units, downstream of the heating coil.
  - Exterior classrooms on the north and south side of the 1972/1988 construction and exterior classrooms in the 1992 addition are served by these units.
  - VAV boxes regulate air flow quantity into each zone/classroom. Maximum air quantity for each classroom is between 800 and 1,000 cfm.
  - Air is supplied via ceiling diffusers.
  - Return air is pulled from down low. An exposed spiral duct is installed in each classroom that goes to the floor. A return grille is installed near floor level in the spiral duct. Many of these were observed to be blocked, by furniture, etc.
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- Install a new RTU for the cafeteria

- Install a new RTU for the cafeteria to replace ceiling mounted UVs

- Air is delivered into the classrooms via floor displacement ventilation diffusers. The strategy is to deliver the air down in the occupant zone in lieu of overhead at the ceiling.
- No zoning for individual classrooms is provided. They all receive the same quantity and temperature of air.
- Fan coil units that provide heating and ventilation only were installed in corridor, work areas and office areas. PSD staff has added economizers to the fan coils in the administration area to increase outside air quantities for warmer times of the year.
- Return grilles were not observed in the classrooms. Most likely the space between the ceiling and exposed roof joists was determined to be enough free area for return air to get back to the RTU.
- A packaged DX RTU was installed to cool the Comm Data rooms.

x Heating water piping and boilers were installed in 1989 and were all reused in the 2013 HVAC updates. Heat is provided by baseboard radiation at the exterior walls, which was installed in 2013.
x A packaged DX RTU serves the computer lab. The system is from 1989, replacement should be anticipated in the next 0-3 years.
x The cafeteria is heated and ventilated via 4 ceiling mounted unit ventilators installed in 1989.
x Media Center is provided with heating and ventilation by an indoor AHU installed in 1989. This unit should be replaced in the next 10-15 years.
x The AHU serving the gym is original from 1989. This unit should be replaced in the next 10-15 years.

Air Conditioning Strategies

x Remove RTUs installed in 2013.
x Install new RTUs capable of delivering 1,000 to 1,500 cfm per classroom.
x Reuse supply duct installed in 2013 to the greatest extent possible and install VAV boxes to provide airflow zone control at each classroom, corridor and work areas.
x Install new return air duct main to new RTUs. Utilize plenum return from each classroom.
x Install return grilles in each classroom.
x Install chiller and route chilled water piping to new RTUs.
x Install chilled water coil in existing supply duct main serving the media center.
x Install new RTU for the cafeteria and route chilled water to the new RTU.

- Install new packaged DX RTUs for the computer lab and administration areas.
- Install a new make-up air unit with evaporative cooling for the kitchen.

Life Cycle Needs Due to Aging Equipment

- Install a new RTU for the cafeteria to replace ceiling mounted UVs

Improvement Strategies for DOAS

- Install return air grilles at the ceiling, opposite the displacement diffuser. Install 2 small grilles in opposite corners.
- Install a cooling coil in RTUs installed in 2013.
- Install a DX split condensing unit for each of the 2) 2013 RTUs.
- Deliver 55° air to the classroom. 600 CFM of 55 degree air will be able to

- Air quantities and fan speed are varied depending on the mode that the air handler is in.
  - In heating mode the goal is to deliver 400 cfm per classroom, slightly over Code required ventilation air
  - In tempering mode the goal is to deliver 600 cfm per classroom
- Air is delivered into the classrooms via floor displacement ventilation diffusers. The strategy is to deliver the air down in the occupant zone in lieu of overhead at the ceiling.
- No zoning for individual classrooms is provided. They all receive the same quantity and temperature of air.
- Fan coil units that provide heating and ventilation only were installed in corridor, work areas and office areas. PSD staff has added economizers to the fan coils in the administration area to increase outside air quantities for warmer times of the year.
- Heating water piping and boilers were installed in 1986 and were all reused in the 2013 HVAC updates.
- Baseboard radiation installed during 2013 project provides heat for the classrooms.
- Ductwork installed in 2013 was incorrectly installed by the contractor and is smaller than specified by the engineer due to not accounting for duct liner thickness. Due to time constraints with school opening, PSD was unable to have the contractor correct the installation.

x The 2001 gym addition is served by a heating and ventilation only RTU.
x Unit ventilators serve the Music and Art classrooms that were added in 1994.
x A packaged DX unit serves the computer lab. It was installed in the mid-1990s and should be replaced within the next 3-5 years.
x The cafeteria and media indoor AHUs provide heating and ventilation only. They are original to the 1986 building construction.
x Kitchen make-up air unit is also original to the building.

Air Conditioning Strategies

x Remove RTUs installed in 2013.
x Install new RTUs capable of delivering 1,000 to 1,500 cfm per classroom.
x Replace supply duct installed in 2013 and install VAV boxes to provide airflow zone control at each classroom, corridor and work areas.
x Install new return air duct main at new RTUs
x Install chiller and route chilled water piping to new RTUs and AHUs.

- Install new AHUs for the cafeteria and media center. Route chilled water to the new AHUs.
- Install new packaged DX RTUs for the computer lab and administration areas.
- Install new make-up air unit with evaporative cooling for the kitchen

Life Cycle Needs Due to Aging Equipment

- Install new AHUs for the cafeteria and media center.
- Install new packaged DX RTUs for the computer lab and administration areas.
- Install new make-up air unit with evaporative cooling for the kitchen
- Install a boiler to provide redundancy for the boiler plant

Improvement Strategies for DOAS

- Install additional return air grilles at the ceiling, opposite the displacement diffuser. Install 2 small grilles in opposite corners.
- Install a cooling coil in RTUs installed in 2013.
- Install a DX split condensing unit for each of the 2) 2013 RTUs.
- Deliver 55° air to the classroom. 600 CFM of 55 degree air will be able to compensate for the heat gain from the lights and people. As the day warms up the room temperature may creep up, however, if the room is precooled overnight with the 55° air from the RTU, the room will stay comfortable for most of the day.
- Reuse supply duct installed in 2013 and install VAV boxes to provide airflow zone control at each classroom. Rework supply mains to install 2 or 3 ceiling diffusers in the middle of each classroom in lieu of the displacement ventilation diffusers.
    - Displacement ventilation diffusers are not designed for temperatures below 63° F. Discomfort will likely result if occupants feet are in contact with 55° F air.
    - Due to the air volume available to be delivered to each classroom, supplying 63° air via displacement ventilation is not anticipated to

- This strategy is to deliver outside air into the classrooms that is approximately 20 degrees cooler than the outside air temperature during the warmer parts of the year. For instance

- Reuse supply duct installed in 2013 to the greatest extent possible and install VAV boxes to provide airflow zone control at each classroom, corridor and work areas.
- Install new return air duct main to new RTUs. Utilize plenum return from each classroom.
- Install chiller and route chilled water piping to new RTUs.
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- 2012 HVAC updates installed a “tempered air” system utilizing indirect evaporative cooling Dedicated Outside Air Systems (DOAS)
    - This strategy is to deliver outside air into the classrooms that is approximately 14 degrees cooler than the outside air temperature during the warmer parts of the year. For instance – at 85 degrees outside, the air delivered to the classroom is 71 degrees.
    - Air quantities and fan speed are varied depending on the mode that the air handler is in.
        - In heating mode the goal is to deliver 300 cfm per classroom, slightly over Code required ventilation air
        - In tempering mode the goal is to deliver 600 cfm per classroom
    - Air is delivered into the classrooms via floor displacement ventilation diffusers. The strategy is to deliver the air down in the occupant zone in lieu of overhead at the ceiling.
    - No zoning for individual classrooms is provided. They all receive the same quantity and temperature of air.
    - Fan coil units that provide heating and ventilation only were installed in corridor, work areas and office areas. PSD staff has added economizers to the fan coils in the administration area to increase outside air quantities for warmer times of the year.
    - Heating water piping installed in 1977 was reused in the 2012 HVAC updates.
    - The 1977 boiler was replaced in 2012. However, this building only has 1 boiler, there is no redundancy for heating.
    - Baseboard radiation installed during 2012 project provides heat for the classrooms.
- The 2001 cafeteria addition is served by a heating and ventilation only ERV.
- The 1995 classroom addition is serveionsRV3 fandveititn oanoanyR[Td2 b)U5.0g.

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TAVELLE ELEMENTARY SCHOOL

Existing Infrastructure

- 2012 HVAC updates installed a "tempered air" system utilizing indirect evaporative cooling Dedicated Outside Air Systems (DOAS)
  - This strategy is to deliver outside air into the classrooms that is approximately 14 degrees cooler than the outside air temperature during the warmer parts of the year. For instance – at 85 degrees outside, the air delivered to the classroom is 71 degrees.
  - Air quantities and fan speed are varied depending on the mode that the air handler is in.
    - In heating mode the goal is to deliver 300 cfm per classroom, slightly over Code required ventilation air
    - In tempering mode the goal is to deliver 600 cfm per classroom
  - Air is delivered into the classrooms via floor displacement ventilation diffusers. The strategy is to deliver the air down in the occupant zone in lieu of overhead at the ceiling.
  - No zoning for individual classrooms is provided. They all receive the

- An addition in 1970 to the southeast was served by a MZ RTU. Also, one classroom was added in the southwest corner. These areas are now served from equipment installed in the 2012 HVAC updates project.
- The original construction of the building is believed to be in 1967 – the same time as Irish, Riffenburgh and Bauder. The Bauder documents show prototype floor plans of other schools, including Tavelli. The MZs serving the classrooms and office areas were removed during the 2012 HVAC project. The MZ serving the cafeteria and kitchen remains in place; this unit provides heating and ventilation only.
- Kitchen make-up air is provided by transfer air from the cafeteria – no dedicated make-up air unit is installed.

Air Conditioning Strategies

- Remove RTUs installed in 2012.
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to the fan coils in the administration area to increase outside air quantities for warmer times of the year.

- Heating water piping and boilers were installed in 1988 and were all reused in the 2012 HVAC updates. Heat is provided by baseboard radiation at the exterior walls, which was installed in 2012.
- A packaged DX RTU installed by PSD serves the computer lab. Replacement should be anticipated in the next 5-7 years.
- The cafeteria is heated and ventilated via 4 ceiling mounted unit ventilators installed in 1988.
- Media Center is provided with heating and ventilation by an indoor AHU installed in 1988.
- The AHU serving the gym is original from 1988. This unit should be replaced in the next 10-15 years.
- Kitchen make-up air unit and evaporative cooler was replaced in 2012.

Air Conditioning Strategies

- Remove RTUs installed in 2012.
- Install new RTUs capable of delivering 1,000 to 1,500 cfm per classroom.
- Reuse supply duct installed in 2012 to the greatest extent possible and install VAV boxes to provide airflow zone control at each classroom, corridor and work areas.
- Install new return air duct main to new RTUs. Utilize plenum return from each classroom.
- Install return grilles for each classroom.
- Install chiller and route chilled water piping to new RTUs.
- Install chilled water coil in existing duct main serving the media center.
- Install new RTUs for the cafeteria and route chilled water to the new RTU.
- Install new packaged DX RTUs for the computer lab and administration areas.

Life Cycle Needs Due to Aging Equipment

- Install a new RTU for the cafeteria to replace ceiling mounted UVs

Improvement Strategies for DOAS

- Install return air grilles at the ceiling, opposite the displacement diffuser. Install 2 small grilles in opposite corners.
- Install a cooling coil in RTUs installed in 2012.
- Install a DX split condensing unit for each of the 2) 2012 RTUs.

- Deliver 55° air to the classroom. 600 CFM of 55 degree air will be able to compensate for the heat gain from the lights and people. As the day warms up

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- High efficiency boilers were installed in 2008 as well.
- Kitchen does not have any dedicated make-up air unit. Make-up air is via transfer air from the adjacent cafeteria RTU.

FULLANA LEARNING CENTER

Existing Infrastructure

- 2006 a residential style evaporative cooler was installed for the kitchen. The kitchen and storage rooms on the east end have no heat if the indoor AHU is not running. Doors to the gym and storage areas must be left open to insure no pipes freeze during cold spells.
- 1974 Building installed furnaces with DX condensing units – residential type installation. Total of eight furnaces was installed in the early education classroom and office area. Furnaces appear to have been replaced in 1996. Condensing units are replaced as they fail.
    - Return air path in some areas appears to have been comprised in various floor plan remodels that have happened through the years. Future HVAC projects should examine and rectify these issues.
    - Return duct is underground in some places.
    - Ductwork is 40 years in service, replacement should be done in the next 0-5 years.
- 1974 an indoor AHU with gas-fired duct furnace was installed for the Gym/Cafeteria.
    - Ductwork and AHU is 40 years in service, replacement should be done in the next 0-5 years.
- Annex has hot water heat from a small boiler that just serves the Annex. Heat is via UVs. Cooling is via ceiling mounted fan coils with condensing units on the east end at grade. Relief air for economizer mode is via barometric dampers under the high windows on the west side.

Equipment Replacement Strategies

- Install new furnaces and condensing units in Early Childhood area. Replace duct while work is done. Condensing furnaces are probably not feasible due to no presence of floor drains in existing furnace closets. Cooling coil condensate currently drains out through the wall. Find feasible solution for return air to all furnaces that can allow existing underground duct to be abandoned.
- Install new gas-fired, DX RTrainT3tE60( )16.tate

- Install hot water heat, DX cooling indoor AHU in ceiling of Annex. VAV with 3 zones for each room. Create platform and access for unit. Patch UV outside air louvers and barometric relief damper openings in exterior wall.
- Add some gas-fired unit heaters on the east end where the kitchen and storage is to prevent pipes from freezing during cold spells – this will eliminate relying on staff to open doors.

Life Cycle Needs Due to Aging Equipment

- Install new gas-fired, DX RTU for the gym/cafeteria. Replace duct while work is done.
- Install hot water heat, DX cooling indoor AHU in ceiling of Annex. VAV with 3 zones for each room. Create platform and access for unit. Patch UV outside air louvers and barometric relief damper openings in exterior wall.
- Add some gas-fired unit heaters on the east end where the kitchen and storage is to prevent pipes from freezing during cold spells – this will eliminate relying on staff to open doors.

Recommendations for 2010 Bond project

- The monies slated for the 2017 HVAC updates from the 2010 Bond will likely allow for replacement of much of the equipment at this school.
- The updates to implement are listed below in order of priority, in case the allocated monies fall short.
    - Replace the existing AHU for the gym. Provide with a space for a future cooling coil since this space is also the cafeteria. Install new gas-fired RTU. Distribute air via Ductsox in the gym. Route some supply air into the kitchen area. Install a gas-fired unit heater in the water entry room where the existing AHU is installed.
    - Remove the existing unit ventilators, DX fan coils and barometric dampers in the Annex. Install a VAV air handler in the attic space. Provide three VAV boxes for zoning.
    - Replace boiler in the Annex
    - Replace furnaces with new DX coils and condensing units for the classroom and office areas.
        - Install new ductwork. Supply and return. Cap existing underground return. The duct is reaching the end of its service life.

- Note that the existing furnace rooms have no floor drains so condensing furnaces are probably an unlikely strategy. DX condensate currently discharges to grade. Gas heat exchanger condensate is not allowed to drain to storm like cooling coil condensate.

RICE ELEMENTARY SCHOOL

Existing Infrastructure

- This school was built in 2007. It is not "air conditioned" in the traditional sense. However, with the sustainable building construction and system installed – it has, according to PSD personnel, consistently provided adequate comfort in the warmer times of the year.
- The 2007 system consists of the following
  - VAV RTUs
  - VAV reheat zoning at each classroom, office area, etc
  - Cooling tower to create10.3(h(las)11.2.3(i)1u18 Tw 0.23U)-980h1116.3(w)2.6(v)1 to c

    - The entire addition is air conditioned by a number of constant volume packaged DX RTUs.
    - Zone control is achieved via duct reheat coils.
    - A boiler was installed to serve this area of the building.
- In 1982, 3 classrooms were added on the northeast side of the building. Each classroom is now served by a VUV with a DX cooling coil. The VUVs were installed in 2012.
- In 1979 locker rooms were built to the east and are still served by the original equipment. The original boiler still serves this portion of the building.
- 1978 a gym was constructed to the north of the original school, which is no longer standing. The gym is still served from 1978 equipment.
- Kitchen make-up air is from cafeteria transfer only, no dedicated make-up air unit exists.
- The corridors in the 1993 addition have very little to no air provided into them.

Equipment Replacement Strategies

- Install a new chiller and route chilled water piping to RTUs.
- Install new VAV RTUs for all areas.
- Install new ductwork and VAV boxes in the 1980 areas that have not been recently remodeled.
- Install new VAV boxes in the 1993 areas for VAV zone control to bring these areas up to current Energy Code and reduce utility costs.
- Provide supply and return air into the corridors.
- Install new AHUs for the gym and locker rooms.
- Ceiling diffusers throughout the original construction areas should be replaced.
- Install a dedicated make-up air unit with evaporative cooling for the kitchen.

Life Cycle Needs Due to Aging Equipment

- New Gym RTU

RTUs were added. Air quantity varies between 600 and 1,000 cfm. Ductwork from 1971 was reused in many locations.
    - Tempered air is delivered into the spaces from the RTUs
    - Air into each space is via ceiling diffusers
    - VAV boxes provide airflow control for each zone.
    - Heat is provided by reheating at the VAV boxes
    - Return air grilles are located down low
- New boilers were installed in both boiler rooms in 2012.
- Kitchen was provided with new evaporative cooling make-up air units in 2012.
- A gym addition was built in 2005. The gym is heating and ventilating only. The addition to the east side of the locker rooms is air conditioned by a packaged DX RTU.
- In 1994 significant additions were made to the building. Most of these areas are air conditioned via constant volume packaged DX RTUs.
    - Zone control is via reheat coils at each classroom.
- 1971 original construction consisted of mostly MZ RTUs. These systems provide heating and ventilation only. Areas such as Tech Ed, gyms, and locker rooms are still served by the original equipment. The auditorium, stage and theater rooms are served from three indoor AHUs installed in a mezzanine accessible from the roof; these units are original equipment as well.

Equipment Replacement Strategies

- Install a new chiller and route chilled water piping to RTUs.
- Install new RTUs for all the areas served by 1994 and 1971 era equipment
    - All areas that are to be air conditioned will receive cooling coils.
    - Areas such as gyms, will be heating and ventilation only.
- Install new ductwork and VAV boxes in the 1971 areas that have not been recently remodeled in 2012.
- Install new VAV boxes in the 1994 areas for VAV zone control to bring these areas up to current Energy Code and reduce utility costs.
- Install new AHUs with cooling coils in the roof mezzanine that serve the auditorium, theater, and stage areas. Significant structural modifications may be required to remove and replace these units.
- Ceiling diffusers throughout the 1971 original construction areas should be replaced.
- Install cooling coils in 2012 DOAS RTUs.

Life Cycle Needs Due to Aging Equipment

- Install new RTUs for all the areas served by 1994 and 1971 era equipment
    - Areas such as gyms, will be heating and ventilation only.
- Install new ductwork and VAV boxes in the 1971 areas that have not been recently remodeled in 2012.
- Install new VAV boxes in the 1994 areas for VAV zone control to bring these areas up to current Energy Code and reduce utility costs.
- Install new AHUs in the roof mezzanine that serve the auditorium, theater, and stage areas.
- Ceiling diffusers throughout the 1971 original construction areas should be replaced.

Improvement Strategies for DOAS

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