FINAL SUBMITTAL

BOILER/CHILLER PLANT STUDY
Veterans Administration Medical Center
Spokane, Washington
Department of Veterans Affairs

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PART ONE: EXECUTIVE SUMMARY

This report is the final document summarizing the process of defining concepts for replacing the existing boiler and chiller plant and its aging equipment most of which is nearing or past its expected useful life expectancy. The new plant would also provide capacity for the expected future growth of the Hospital campus. Because the laundry facility is currently attached to the existing plant, most options considered include scenarios for it as well as the plant.

STEP ONE: INITIAL OPTION DEVELOPMENT

Step one took a broad look at the possible siting options for the new plant and impacts on laundry and the rest of the campus. This resulted in six concepts that were either retained for further consideration or eliminated. Diagrams of these six options are located in Appendix B and descriptions of each option and the decision on each one were as follows:

Option 1 (see drawing M-1, Appendix B)

Retain the existing chiller plant in its current location and expand the plant with a new boiler room expansion to the east in the general location of the existing cooling towers.
This option was ruled out because it would encroach on Building 6A which is owned by the State and cannot be eliminated. This option would also interfere with significant underground utilities.

Option 2 (see drawing M-1, Appendix B)

Retain the existing chiller plant in its current location and expand the plant with a new boiler room expansion to the west into the parking lot between Buildings #2 and #3.
This option was ruled out because the expansion to the west of he existing plant would encounter gas, water, and sewer mains as well as partial demolition of building #3 (with no place to relocate the Building #3 functions). This option would also require remodeling of the Laundry and loading dock and does not appear to be a cost effective option.

Option 3 (see drawing M-2, Appendix B)

Retain the existing chiller plant in its current location and expand the plant with a new boiler room expansion to the east, and north of the existing cooling tower location, into the area currently occupied by Building #6A.
This option was ruled out because it would encroach on Building 6A which is owned by the State and cannot be eliminated. This option would also interfere with significant underground utilities.

Option 4 (see drawing M-3, Appendix B)

Demolish Building #6A and the Laundry area of building #2. Retain the existing chiller plant in its current location and construct a new Laundry Building or Addition to the east in the general location of Building #6A. Construct a new boiler room addition in the location currently occupied by the Laundry.
This option was ruled out for the same reasons as the above options.

Option 5 (see drawing M-4, Appendix B)

Demolish the existing Warehouse Buildings #14 and 14A and construct a new Boiler/Chiller Plant building in that location.
This Option was considered a reasonably good location but was ruled out because it would also require construction of a replacement warehouse and therefore not considered a cost effective option.

Option 6 (see drawing M-5, Appendix B)

Construct a new Boiler/Chiller Plant building along the west edge of the property near the existing Generator Building #39.

This option was determined to be carried forward as one of the three viable options to be included in step 2 of the study.

Cogeneration
As part of Step One, we were requested to consider utilizing cogeneration to produce both power and heat as part of this plant replacement. The results of this investigation are included in Appendix C of this report. In general, it was determined that a cogeneration plant is not a viable for this project.

STEP TWO: CURRENT PLANT REPLACEMENT OPTIONS
The following three options were developed based upon the results of analyzing the initial six concepts. The descriptions below are summaries. These Options along with advantages, disadvantages and rough order of magnitude cost projections are further described in Part Three of this report.

Option #1

This option would provide a new Central Heating and Cooling Plant with an adjacent connected new Laundry facility near the west perimeter of the property. New medium-voltage switches, medium-voltage feeders and pad-mounted transformers to serve the boiler, chiller and laundry functions in the new building would be provided. The existing Plant building including laundry could be cleared out and used for other functions as needed.

Refer to drawing A1.1 in Appendix A.

Option #2

This option would provide a new Central Heating and Cooling Plant near the west perimeter of the property. New medium-voltage switches, medium-voltage feeders and pad-mounted transformers to serve the boiler and chiller functions in the new building would be provided.

Under this option the Laundry would remain in its current location and expand into the space vacated by the boilers after the new Central Plant is in operation and the existing boilers are removed from the existing Plant Building #2.

Refer to drawing A1.2 in Appendix A.

Option #3

This option would provide a new Laundry facility near the west perimeter of the property. New medium-voltage switches, medium-voltage feeders and a pad-mounted transformer to serve the laundry functions in the new building would be provided.

After the new Laundry facility is completed the existing Laundry facility at Building #2 would need to be demolished to allow a new Boiler Plant to be constructed in its place adjacent to the existing boiler and chiller plant. A new pad-mounted transformer to serve the renovated boiler building would be provided.

Refer to drawing A1.3 in Appendix A.

PART TWO: OPTIONS SUMMARY AND EVALUATIONS:

A. The following page summarizes the advantages and disadvantages identified for each option. Each item is scored from 1 to 3 with 1 being most desirable.

SUMMARY OF ADVANTAGES & DISADVANTAGES (1=most desireable, 3=least desireable)

Advantages	OPTION 1	OPTION 2	OPTION 3
Shortest construction period	1	2	3
Proximity to Generator Building	2	2	3
Distance From North Property Line (noise/fumes)	2	2	3
Possible Fuel Sharing with Gen Bldg	2	2	3
Laundry close to heating & cooling equip	1	3	3
Construction of new laundry while exist is operational	2	3	2
Access for Equip replacement & Parking	2	2	3
New boiler/chillers in operation before existing removed	2	2	3
Access to exist Primary U.G steam & chilled lines	2	2	1
Laundry Access to exist U.G steam & chilled lines	2	2	3
Proximity to natural gas main	2	2	3
New facility=better access/organization	2	2	3
Use of existing building for other uses	2	2	3
Capacity for future campus expansion	3	3	3
Could be expanded to to free up space in bldg 3	2	2	3
Allows const of site power dist w/o interrupting plant functions	3	3	3
Could change boiler & laundry to 480V	3	3	3
Laundry not relocated - space to expand	3	1	3
Existing Trans & SWBD remain in bldg 2	3	1	3
Existing 1,500 KVA Trans removed.	3	1	3
Existing Trans may be used for exist bldg	1	3	3
Could use existing fuel tanks (1980)	3	3	1
Access to boilers for replace/add	3	3	3
Existing cooling towers remain (raise structure)	2	2	1
Existing chillers remain (sig piping changes)	2	2	1
Disadvantages			
Cost	3	1	2
Relocation of existing cooling equip phased	3	3	1
Requires additional piping to connect to exist pipe system	3	3	1
Laundry further from heating & cooling plant	1	3	3
Longest construction duration (phasing)	1	2	3
Have to demo exist boilers for future chiller	1	1	3
Change Steam Distribution Pressure	1	1	3
Laundry distance from plant requires more piping	1	2	2
TOTAL ADVANTAGES	55	55	66
TOTAL DISADVANTAGES	14	16	18
TOTAL SCORE	69	71	84

PART THREE: EXISTING PLANT CONDITIONS AND CAPACITIES

STEAM PLANT CONDITION AND CAPACITIES

1. The existing steam plant consists of three 11,000 lb/hr built in place boilers operating at 125 psi. (954 combined Boiler Horse Power) In the winter, two of the three boilers operate with the third operating as standby. The boiler system was installed in 1949 and, although very well maintained, is well past the ASHRAE recommended life span of 40 years. The plant serves the hospital heating, and domestic hot water systems through heat exchangers. In addition it serves the laundry adjacent to the boiler room in the plant building.

2. The existing boiler plant is essentially “land locked” with no feasible means to stage replacement at the current location.

3. Under any of the options described below, new boilers and all accessories, i.e. – boiler feed pump, etc will be provided. The existing plant will need to maintain operation until the new boiler plant is operational and a changeover can be accomplished.

4. Ground source heat pumps were also considered as part of this investigation; however the domino effect makes this option not feasible. The current hospital is heated from steam from the central plant. In order to get the full utilization of a ground source heat pump system for both heating and cooling, the entire hospital would need to be converted to heating hot water with low temperature heating water, which would not be cost effective.

EXISTING CHILLED WATER SYSTEM ISSUES

1. The Existing plant consists of three 450 ton centrifugal chillers with variable speed drives and a plate and frame heat exchanger. These chillers are still relatively new as they were installed in 2008 and they are reasonably efficient rated at 0.452 KW/ton. The chillers are connected to a common chilled water header with common primary chilled water pumps that serve a variable flow secondary pumping system for distribution to the buildings on campus. A common condenser water header is also employed to deliver condenser water to the chillers from the cooling towers.

2. The current load (per the Arculus report dated March 2012) is such that only one of the existing 450 ton chillers needs to run till outside ambient temperatures get up to about 90˚F. With the three chillers there is never a need for more than two of the chillers to operate at any given time; so one chiller is fully redundant.

    a. That same level of redundancy is not available in the cooling towers. There is a 3 cell tower shown on the 2000 drawings and a newer single cell tower shown on the 2008 drawings for a total of 4 cells at 675 GPM each. This yields a total capacity of 2700 GPM. Each chiller design capacity is based on 1350 GPM of condenser water flow so two chillers at full capacity would require 2700 GPM. Therefore the existing cooling tower flow capacity would serve two chillers at full capacity; but there is no redundant cell to maintain service for two chillers if any one cooling tower cells should fail.
    b. Since one chiller at 450 tons can handle the system cooling load at 90˚F; and if we assume that an average 72˚F room temperature (18˚F Delta-T) results in a 450 ton load; then it would thus indicate that two chillers would be able to handle a load of about 900 tons corresponding to a Delta-T of about 36˚F or 108˚F outside ambient. This indicates that current plant cooling capacity should still allow for some additional load growth.

3. Based on the above, additional cooling tower capacity should be provided to maintain redundancy in the event of failure of one of the tower cells so that the tower redundancy would at least match the chiller capacity and redundancy.

    a. The existing 3-cell cooling tower is the oldest and was installed about 2000 while the newer single cell tower was installed about 2008. It would therefore be recommended that that 3-cell tower be replaced with a total of 4-cells of similar capacity to each of the existing cells so that there would be a total of five cells and any four cells would provide capacity to operate two of the three chillers. This would provide redundancy in the cooling towers that would match the chiller redundancy.

        1. Some modest oversizing of the new cooling towers could also improve the efficiency of the chillers by providing colder condenser water.

4. As noted in the Arculus report there are several issues with the piping and pump arrangement that need to be corrected which will require significant piping revisions in the plant. Whether the chiller plant remains in its present location, or is relocated to a new location with a new Central Boiler/Chiller Plant, some significant repiping will be required.

    a. The cooling tower outlets should be significantly higher than the condenser water pump suction location. This will involve elevating the towers if they remain in their present location or locating them at a higher location if they are relocated for either a plant expansion or for a new plant. A roof location could also be considered.
    b. The chilled water system air separators and the expansion tank should be located near the suction side of the system secondary pumps to better serve the entire system. They are currently in the primary chilled water circuit; and under certain conditions much of the flow could bypass this location limiting the effectiveness of air and dirt removal from the system.
    c. Separate primary pumps and condenser water pumps should be provided for each chiller and for the heat exchanger. Due to the capacity in the plant there is a fully redundant chiller so it would not be necessary to have any and every pump/chiller combination available. However additional piping and valving could allow for manual selection of a particular pump and chiller combination in the event of failure even with dedicated primary chilled water and condenser water pumps.
    d. VFD's should be added to condenser water pumps for soft starts and more efficient operation.
    e. The condenser water pumps should be remounted to correct alignment issues.

5. The chilled water piping in the plant should be located so that it does not interfere (as it currently does) with access to service the compressors and motors on the chillers. This means that the piping should not be located directly over the top of the chillers in a way that does not allow equipment to lift the compressor motor off the top of the chiller.

    a. The mains could be located beyond the ends of the chillers instead of directly over the top of the chillers.
    b. It would be well to consider piping the primary chilled water pumps directly to the chillers as recommended in the Arculus report to help with flow and balance problems. This would also facilitate the piping modifications discussed above to clear the service access for the compressors.

6. Any consideration to relocate the cooling equipment to a new plant location should make provisions for plant expansion to accommodate future load increases.

7. The current chiller room is about 2000 sq.ft. If a new location is considered it should be 2500 – 3000 sq.ft. to allow room for the addition of a future chiller for more capacity and to provide for better equipment access.

EXISTING ELECTRICAL DISTRIBUTION SYSTEM CONDITIONS

1. The VAMC owns and maintains its own 13,200Y/7620-VAC, three-phase, medium-voltage power distribution system. The system was upgrade in multiple phased between 2008 and 2012. The service equipment is metal-clad switchgear located in Building 38. Three (3) 1,500-kW/1,875-kVA, diesel-fired generators, located in Building 39, provide backup power to the entire site through a tie-breaker in the metal-clad switchgear. Power is distributed from Building 38 via four (4) underground ductbanks operating in two (2) open loops. One (1) loop is designated at the emergency loop, the other as a normal-power loop. The overcurrent setting on the main circuit breakers is 240-amperes. The overcurrent settings on the feeder breakers are 192-amperes.

2. Pad-mounted switches provide connection points for pad-mounted transformers located near each building. There are two locations along the west property line where vaults intended to support future pad-mounted switches have been installed. The vaults contain active normal-power and emergency-power 13.2-kV feeders.

3. The Boiler Plant is fed with a 750-kVA, 208Y/120-VAC, three-phase, four-wire, pad-mounted transformer with a loop-feed primary switch. The switch allows the transformer to be manually connected to either a normal-power or emergency-power feeder. The 750-kVA transformer also feeds loads in the Laundry Building. Critical loads in the Boiler Plant are fed from a separate 150-kVA, 208Y/120-VAC, three-phase, four-wire, pad-mounted transformer that also has a loop-feed primary switch.

4. The Chiller Plant is fed with a 1,500-kVA, 480Y/277-VAC, three-phase, four-wire, pad-mounted transformer with a loop-feed primary switch.

5. The high electrical demand for the entire site over the past 12-months has been 1608-KW with an estimated power factor of 90% which implies a demand of 1,787-kVA. This demand equates to a maximum load of 78-amperes. The high demand over the last four calendar years has increased from 1533-kW in 2009 to 1609-kW in 2012 which indicates a growth in electrical load of approximately 5% over the period.

PART FOUR: CURRENT PLANNING OPTIONS:

OPTION 1 - CONSTRUCT A NEW CENTRAL HEATING AND COOLING PLANT AND LAUNDRY BUILDING NEAR THE WEST PERIMETER OF THE PROPERTY

A. DESCRIPTION

1. This option would provide a completely new facility for the chillers, boilers and laundry in an undeveloped area west of the south end of the Parking Lot which is south of Building #14 as shown on Drawing A1.1 in Appendix A.

2. This new plant building would require about 14,500 sq.ft. which includes 8000 sq.ft. for the Laundry and about 6,500 sq.ft. for the boiler and chiller plant. The cooling towers would be located on the roof of this new facility.

   a. The proposed size of the facility provides room for the future addition of another boiler and another chiller. It also provides the additional program space need by the Laundry that is currently unavailable.
   b. All of the heating equipment (boilers, feed-water systems, etc. would be new).
   c. The existing chillers would be relocated from the existing facility to this new facility.
   d. One existing cooling tower would be relocated to this new facility and the remaining cooling towers would be new.

3. New underground steam and chilled water would need to be run from this plant location to intercept the existing underground piping near the Hospital. The chilled water piping would be pre-insulated direct bury piping and the steam and pumped condensate return would be run in a concrete utilidor.

4. The proposed semi-hardened construction of the new building would be cast-in-place concrete walls with either cast-in-place or precast concrete roof structure. Floors will be slab-on-grade, recessed where required to retain potential spills.

5. Under this Option, new pad-mounted switches and pad-mounted transformers would be installed near the new building. Transformer secondary voltages would be 480Y/277-VAC, three-phase, four-wire. One transformer would be provided for the boiler and laundry loads and a separate transformer would be provided for the chiller loads.

B. ADVANTAGES

1. This option would likely have the shortest construction duration since phase two just requires removal of existing equipment.

2. This would locate the new facility closer to the existing generator building to consolidate similar functions such as fuel delivery and maintenance closer together.

3. This location would be further from the north property line and other buildings as it may impact emission considerations for cooling tower plumes or boiler exhaust.

4. This location may allow sharing the existing fuel tanks with the Generator Building #39 to provide back-up fuel for the boilers. (Additional equipment for ‘polishing’ the fuel may need to be added).

5. This would keep the Laundry close to the heating and cooling equipment.

6. This would allow construction of the new laundry facility before the existing Laundry is taken off line which would avoid down-time for the Laundry.

7. This location would allow good access for future installation and/or replacement of boilers and chillers. There is also room for a parking lot for the government owned vehicles which are managed by plant personnel.

8. This would allow the entire new boiler and chiller plant to be placed in operation before shutting down the existing boilers and taking them out of service.
9. There is reasonably good access to the existing underground steam and chilled water services that would allow for a tie-in to feed back into the existing systems.

10. The natural gas main is reasonably accessible to this location.

11. The new location of the chiller plant would give opportunities for repiping that would result in better maintenance access to equipment for repair or replacement as well as improving some operational issues. Even in the existing plant location an expansion would require some repiping to resolve operational issues; but the existing plant location does not have the space to provide the degree of maintenance and service access space that a new facility could provide.

12. By relocating the boiler and chiller functions to a completely new facility the entire existing facility could then be used for other purposes.

13. The new chiller plant would include capability for expansion if future loads should require additional cooling capacity.

14. Though not included in the cost estimates additional space could be added to this facility to replace the Engineering Offices in building #3 and free up building #3 for other uses.

15. This Option provides the advantage of being able to construct the site power distribution system without disrupting the exiting boiler, chiller and laundry functions.

16. This option provides the opportunity to change the voltage for the boiler and laundry to 480-VAC to more easily accommodate larger loads.

17. The existing transformers may be appropriate for the future uses of the existing buildings.

C. DISADVANTAGES

1. A new plant in this location could require more cost for the cooling plant than expanding the existing location.

    a. The existing chillers, pumps and newer cooling towers would need to be relocated to the new plant location.

2. The relocation of the cooling equipment would need to be phased to maintain chilled water to the facilities during the cooling season. Part of the cooling plant could be relocated to the new facility and be put on line before taking the rest of the existing cooling plant off line. For example, one

tower and chiller with their respective pumps could be relocated to the new facility and be placed in operation to handle partial loads in the fall and the rest of the equipment could be relocated during the winter months when cooling loads are at a minimum. Likewise, one of the system secondary chilled water pumps could be relocated so that either plant could provide chilled water at reduced capacity during the interim period.

3. Additional lengths of piping and utilidors would be required to connect the new plant to the existing piping systems.

D. ROUGH ORDER OF MAGNITUDE COST PROJECTION – OPTION 1

1. Based upon the above descriptions and best assumptions at the time of this report, the potential estimated costs of construction for this option are:

General Construction:	$2,800,500
Mechanical Construction:	$4,057,000
Electrical Construction:	$547,400
Electrical Site Distribution:	$761,400
OH&P, Cont., Escal. @ 35%:	$2,858,205
TOTAL:	$11,024,505

2. The above costs do not include Laundry equipment. The equipment is near or past its useful life and will need replaced soon whether it remains in its current location, or is moved. The laundry equipment is therefore being considered an equipment expense outside the scope of this boiler-chiller plant study.

3. The total cost includes escalation (inflation) that should cover the project should it not bid until 2014. Should the project be delayed beyond that, inflationary pressures costs will likely put upward pressure on these cost projections.

4. These costs are only construction costs and do not include soft costs (fees, furnishings, etc).

OPTION 2 - CONSTRUCT A NEW CENTRAL HEATING AND COOLING PLANT NEAR THE WEST PERIMETER OF THE PROPERTY AND MAINTAIN THE LAUNDRY IN ITS CURRENT LOCATION IN BUILDING #2

A. DESCRIPTION

1. This option would provide a completely new facility for the chillers and boilers in an undeveloped area west of the south end of the Parking Lot which is south of Building #14 as shown on Drawing A1.2 in Appendix A.

2. This new plant building would require about 6,500 sq.ft. for the boiler and chiller plant. The cooling towers would be located on the roof of this new facility.

   a. The proposed size of the facility provides room for the future addition of another boiler and another chiller.
   b. All of the heating equipment (boilers, feed-water systems, etc. would be new).
   c. The existing chillers would be relocated from the existing facility to this new facility.

d. One existing cooling tower would be relocated to this new facility and the remaining cooling towers would be new.

3. New underground steam and chilled water would need to be run from this plant location to intercept the existing underground piping near the Hospital. The chilled water piping would be pre-insulated direct bury piping and the steam and pumped condensate return would be run in a concrete utilidor.

4. The proposed semi-hardened construction of the new building would be cast-in-place concrete walls with either cast-in-place or precast concrete roof structure. Floors will be slab-on-grade, recessed where required to retain potential spills.

5. Under this Option, new pad-mounted switches and pad-mounted transformers would be installed near the new building. Transformer secondary voltages would be 480Y/277-VAC, three-phase, four-wire. One transformer would be provided for the boiler loads and a separate transformer would be provided for the chiller loads.

B. ADVANTAGES

1. This would locate the new facility closer to the existing generator building to consolidate similar functions such as fuel delivery and maintenance closer together.

2. This location would be further from the north property line and other buildings as it may impact emission considerations for cooling tower plumes or boiler exhaust.

3. This location may allow sharing the existing fuel tanks with the Generator Building #39 to provide back-up fuel for the boilers. (Additional equipment for ‘polishing’ the fuel may need to be added).

4. This location would allow good access for future installation and/or replacement of boilers and chillers. There is also room for a parking lot for the government owned vehicles which are managed by plant personnel.

5. This would allow the entire new boiler and chiller plant to be placed in operation before shutting down the existing boilers and taking them out of service.

6. There is reasonably good access to the existing underground steam and chilled water services that would allow for a tie-in to feed back into the existing systems.

7. The natural gas main is reasonably accessible to this location.

8. The new location of the chiller plant would give opportunities for repiping that would result in better maintenance access to equipment for repair or replacement as well as improving some operational issues. Even in the existing plant location an expansion would require some repiping to resolve operational issues; but the existing plant location does not have the space to provide the degree of maintenance and service access space that a new facility could provide.

9. By relocating the boiler and chiller functions to a completely new facility a portion of the existing facility could then be used for other purposes, including additional space for the laundry if that is desired.

10. The new chiller plant would include capability for expansion if future loads should require additional cooling capacity.

11. The existing Laundry would not need to be relocated; but could be expanded into the space vacated by the boilers after the new Central Plant is operating and the old boiler plant and chillers are removed from Building #2.

12. Though not included in the cost estimates additional space could be added to this facility to replace the Engineering Offices in building #3 and free up building #3 for other uses.

13. This Option provides the advantage of being able to construct the site power distribution system without disrupting the exiting boiler and chiller functions.
14. This option provides the opportunity to change the voltage for the boiler functions to 480-VAC to more easily accommodate larger loads.

15. The existing 150-kVA transformer and associated switchboard in the Building 2 would remain to serve the Laundry.

16. The existing 1,500-kVA transformer would be removed.

C. DISADVANTAGES

1. The Laundry would be further from the heating and cooling plant and would require changing the steam pressure supplied to the other buildings from 100 to 125 psi (with corresponding changes in the Pressure Reducing Stations in those buildings); or providing a separate 125 psi main from the Plant to the laundry.

    a. The cost estimates assume that the first stage Pressure Reducing Valves at the PRV stations in the buildings could readjusted to accept the 125 psi steam instead of the current 100 psi.

2. The new plant in this location could require more cost for the cooling plant than expanding the existing location.

    a. The existing chillers, pumps and newer cooling towers would need to be relocated to the new plant location.

3. The relocation of the cooling equipment would need to be phased to maintain chilled water to the facilities during the cooling season. Part of the cooling plant could be relocated to the new facility and be put on line before taking the rest of the existing cooling plant off line. For example, one tower and chiller with their respective pumps could be relocated to the new facility and be placed in operation to handle partial loads in the fall and the rest of the equipment could be relocated during the winter months when cooling loads are at a minimum. Likewise, one of the system secondary chilled water pumps could be relocated so that either plant could provide chilled water at reduced capacity during the interim period.

4. Additional lengths of piping and utilidors would be required to connect the new plant to the existing piping systems.

D. ROUGH ORDER OF MAGNITUDE COST PROJECTION – OPTION 2

1. Based upon the above descriptions and best assumptions at the time of this report, the potential estimated costs of construction for this option are:

General Construction:	$2,009,500
Mechanical Construction:	$3,950,200
Electrical Construction:	$277,500
Electrical Site Distribution:	$702,500
OH&P, Cont., Escal. @ 35%:	$2,428,895
TOTAL:	$9,368,595

2. The above costs do not include Laundry equipment. The equipment is near or past its useful life and will need replaced soon whether it remains in its current location, or is moved. The laundry equipment is therefore being considered an equipment expense outside the scope of this boiler-chiller plant study.
3. The total cost includes escalation (inflation) that should cover the project should it not bid until 2014. Should the project be delayed beyond that, inflationary pressures costs will likely put upward pressure on these cost projections.

4. These costs are only construction costs and do not include soft costs (fees, furnishings, etc).

OPTION 3 - CONSTRUCT A NEW LAUNDRY BUILDING NEAR THE WEST PERIMETER OF THE PROPERTY AND CONSTRUCT A NEW BOILER ROOM ADDITION IN THE LOCATION CURRENTLY OCCUPIED BY THE LAUNDRY

A. DESCRIPTION

1. The current Laundry area in Building #2 has a higher floor level and lower roof than the existing boiler room and would need to be demolished to allow construction of a new boiler room in that location with adequate volume for the new boiler plant.

2. This option would provide a completely new 8000 sq.ft. facility for the Laundry in an undeveloped area west of the south end of the Parking Lot which is south of Building #14 as shown on Drawing A1.3 in Appendix A.

3. After the new Laundry building is constructed and the Laundry is in operation it would then be necessary to demolish the existing Laundry portion of Building #2 and construct a new boiler room in that area.

4. The proposed semi-hardened construction of the new building would be cast-in-place concrete walls with either cast-in-place or precast concrete roof structure. Floors will be slab-on-grade, recessed where required to retain potential spills.

5. Under this Option, new pad-mounted switches and a pad-mounted transformer would be installed near the new building. Transformer secondary voltage would be 480Y/277-VAC, three-phase, four-wire. A single transformer would be provided for the new building. The existing 150-kVA transformer would be replaced with a 480-VAC unit for the boiler loads and the existing 1,500-kVA transformer would be retained to serve the chiller loads.

B. ADVANTAGES

1. The existing Laundry could remain in operation until the new Laundry is on line.

2. This location would allow the ability to utilize the existing fuel tanks without the need to relocate them. The original fuel tanks were replaced with double-wall fiberglass tanks in about 1980. The fuel lines would need to be extended further north to the new boiler location.

3. This location could allow better access to the north side of the new boiler room addition for future installation and/or replacement of boilers.

4. The existing cooling towers could remain in their current location if the support structure is raised to elevate the cooling towers for better NPSH at the condenser water pump locations.

    a. The older 3-cell cooling tower should still be replaced as discussed above to provide for additional capacity and redundancy.

5. The chillers could remain in place though significant piping revisions would be required to correct existing problems.

6. This Option provides the advantage of being able to construct the site power distribution system without disrupting the exiting laundry functions.

7. This option provides the opportunity to change the voltage for the laundry functions to 480-VAC to more easily accommodate larger loads.

C. DISADVANTAGES

1. This would require the longest construction period of either of the other options because the new Laundry would need to be constructed and be in operation (to avoid downtime for the Laundry) before the demolition could even begin for the boiler plant. Then after demolition of the existing Laundry construction of the new boiler room could finally begin. It is therefore likely that the new boiler plant would be 6-12 months later getting on line with this option than with Options #1 or #2.

2. The current chiller room does not allow sufficient space for another chiller if additional cooling capacity is required for future expansion. A future chiller could, however, be added in the space vacated by the existing boilers.

3. Due to its remote location with respect to the heating and cooling plant separate steam, condensate, and chilled water would need to be run to the new Laundry.

4. The Laundry would be further from the heating and cooling plant and would require changing the steam pressure supplied to the other buildings from 100 to 125 psi (with corresponding changes in the Pressure Reducing Stations in those buildings); or providing a separate 125 psi main from the Plant to the laundry.

    a. The cost estimates assume that the first stage Pressure Reducing Valves at the PRV stations in the buildings could readjusted to accept the 125 psi steam instead of the current 100 psi.

D. ROUGH ORDER OF MAGNITUDE COST PROJECTION – OPTION 3

1. Based upon the above descriptions and best assumptions at the time of this report, the potential estimated costs for this option are:

General Construction:	$3,304,500
Mechanical Construction:	$3,311,200
Electrical Construction:	$281,400
Electrical Site Distribution:	$691,900
OH&P, Cont., Escal. @ 35%:	$2,656,150
TOTAL:	$10,245,150

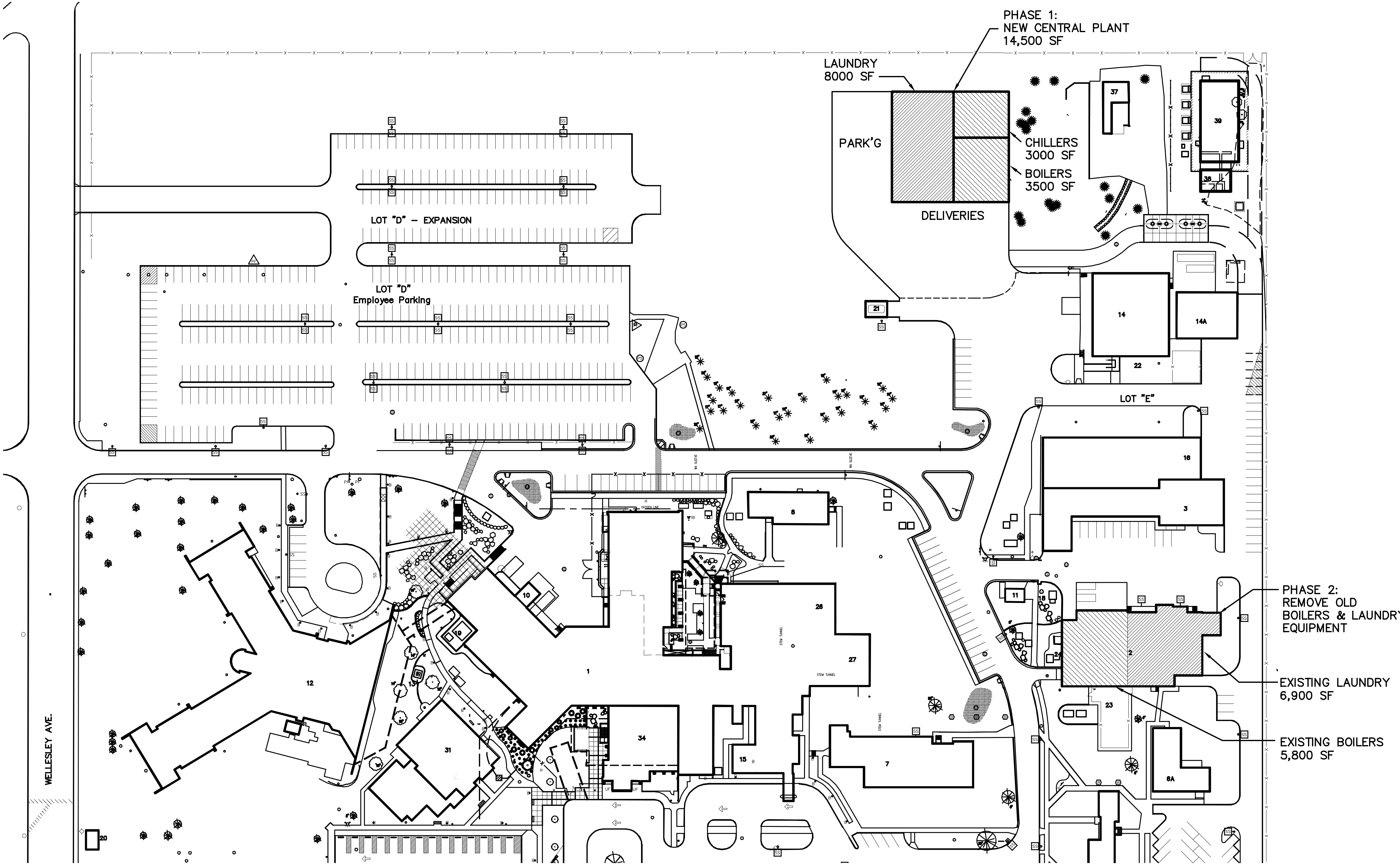
2. The above costs do not include Laundry equipment. The equipment is near or past its useful life and will need replaced soon whether it remains in its current location, or is moved. The laundry equipment is therefore being considered an equipment expense outside the scope of this boiler-chiller plant study.

3. The total cost includes escalation (inflation) that should cover the project should it not bid until 2014. Should the project be delayed beyond that, inflationary pressures costs will likely put upward pressure on these cost projections.

4. These costs are only construction costs and do not include soft costs (fees, furnishings, etc).

Appendix A

PLANS OF CURRENT OPTIONS 1, 2 AND 3



PARTIAL SITE PLAN - OPTION 1

Scale: 1" = 100'

XSITE-OPTION-1

0 50' 100' 200'

REVISIONS

DEPT. OF VETERANS AFFAIRS
REPLACE BOILERS
VAMC SPOKANE
N. 4815 ASSEMBLY, SPOKANE, WA

NAC | ARCHITECTURE

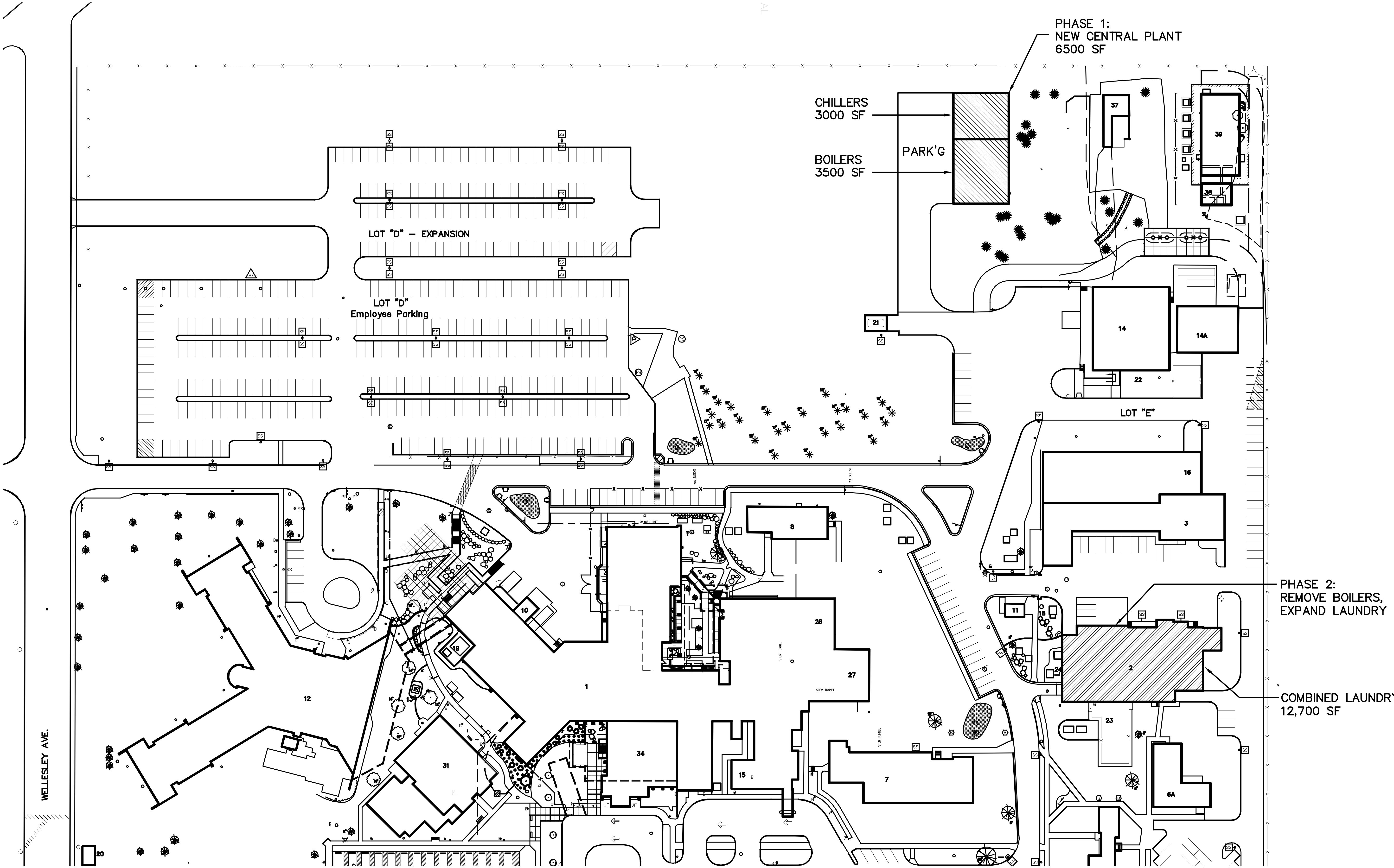
1203 W RIVERSIDE AVE | SPOKANE WA 99201-1107 | P: 509.838.8240 | F: 509.838.8261

NAC NO	111-12025
FILE	A1-1
DRAWN	WWR
CHECKED	MRO
DATE	7-18-2012

A
1.1

OPTION 1

WWW.NACARCHITECTURE.COM



PARTIAL SITE PLAN - OPTION 2

Scale: 1" = 100'

XSITE–OPTION–1

0 50' 100' 200'

REVISIONS

DEPT. OF VETERANS AFFAIRS

REPLACE BOILERS
VAMC SPOKANE

N. 4815 ASSEMBLY, SPOKANE, WA

NAC | ARCHITECTURE

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NAC NO	111-12025
FILE	A1-2
DRAWN	WWR
CHECKED	MRO
DATE	7-18-2012

A
1.2

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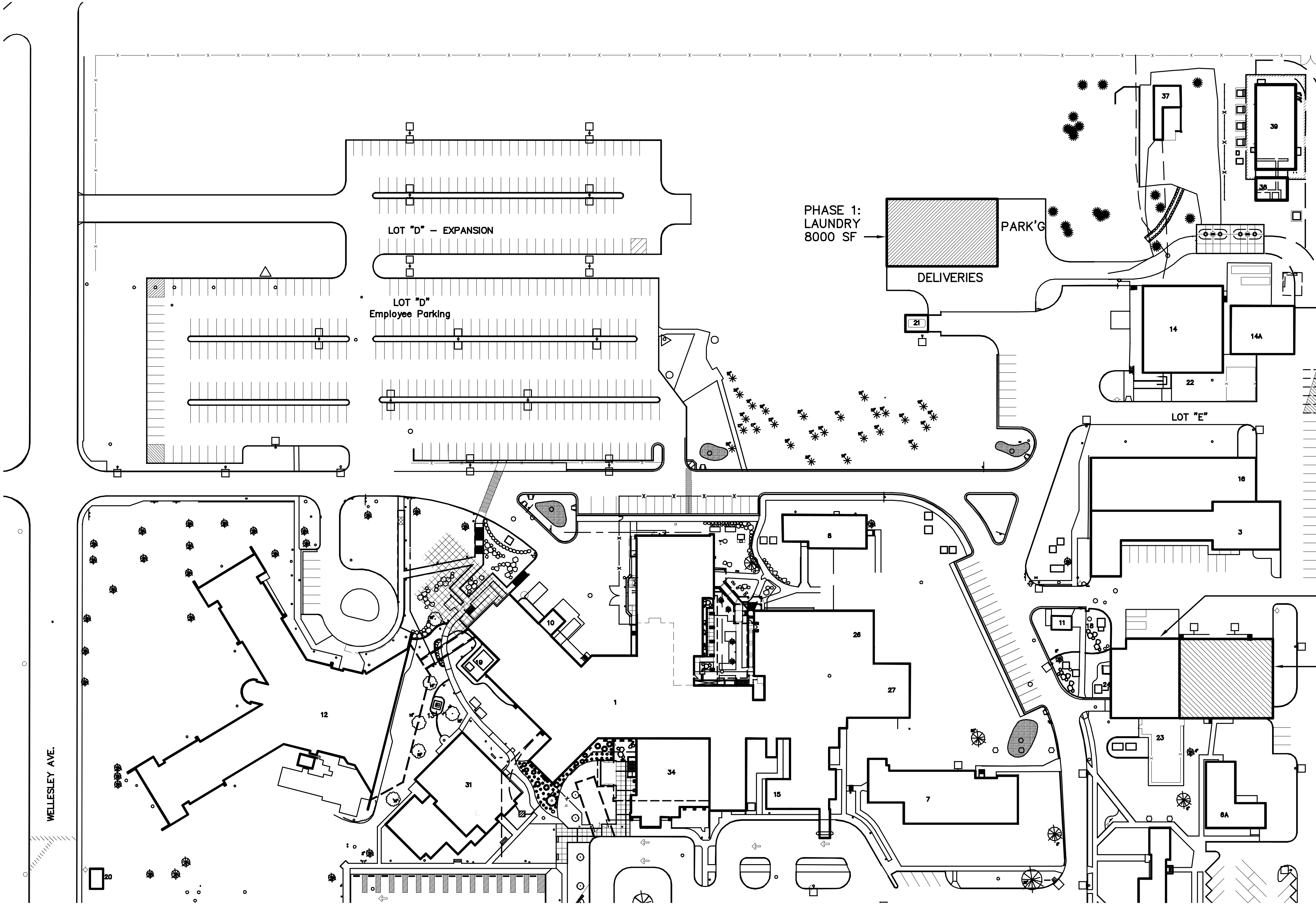
OPTION 2

REVISIONS



PARTIAL SITE PLAN - OPTION 3

Scale: 1" = 100'

XSITE–OPTION–1

0 50' 100' 200'

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REPLACE BOILERS
VAMC SPOKANE
N. 4815 ASSEMBLY, SPOKANE, WA

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NAC NO	111-12025
FILE	A1-3
DRAWN	WWR
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DATE	7-18-2012

A
1.3

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OPTION 3

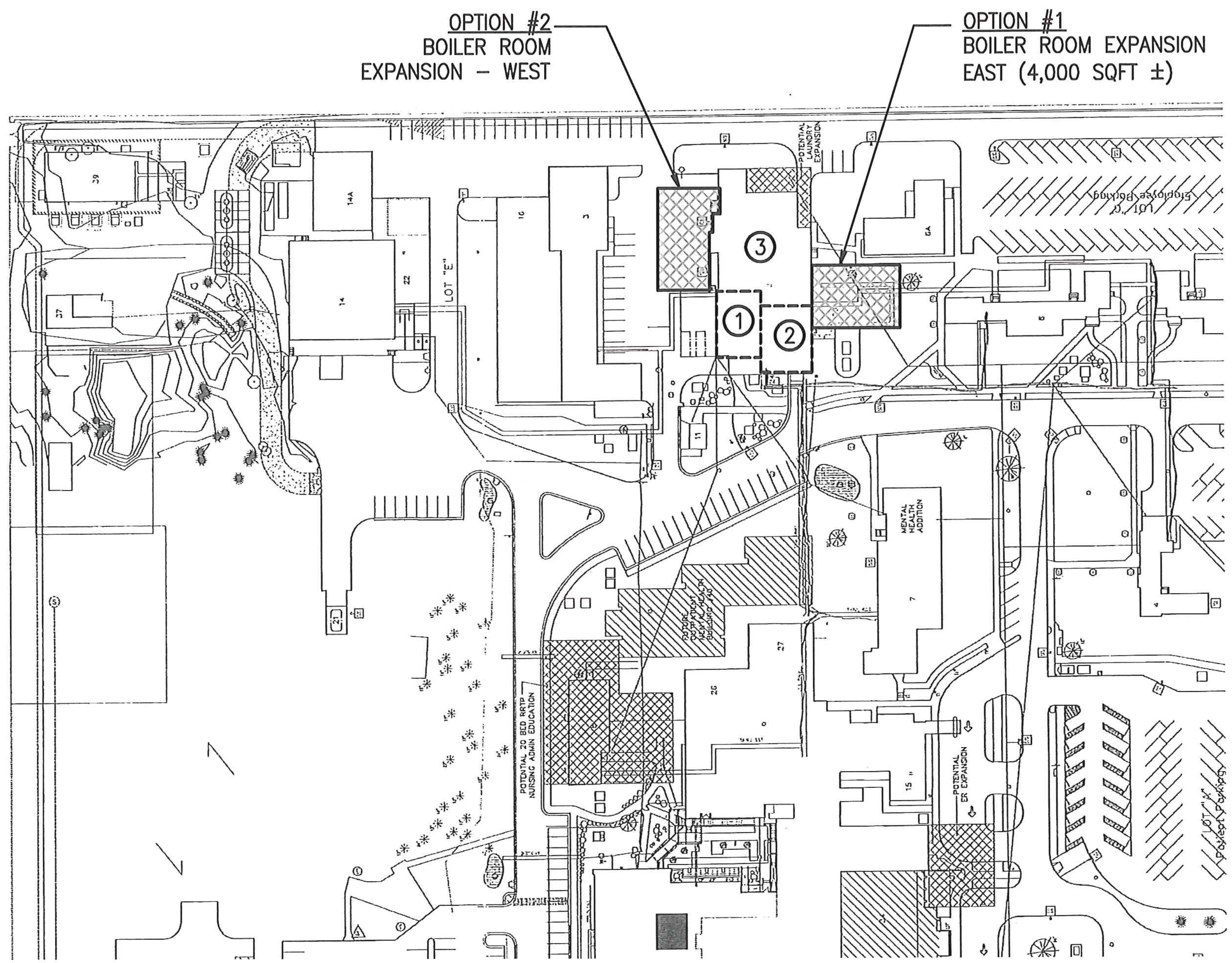
Appendix B

PLANS OF INITIAL OPTIONS 1 THRU 6

MW
CONSULTING ENGINEERS
N. 222 Wall Street Suite 200
Spokane WA 99201
T. 509.838.9020
F. 509.838.1123

KEYNOTES:

1. EXISTING BOILER ROOM
2. EXISTING CHILLER ROOM
3. EXISTING LAUNDRY



BOILER PLANT REPLACEMENT FEASIBILITY STUDY

PROJECT: 668–12–105

MW
CONSULTING ENGINEERS
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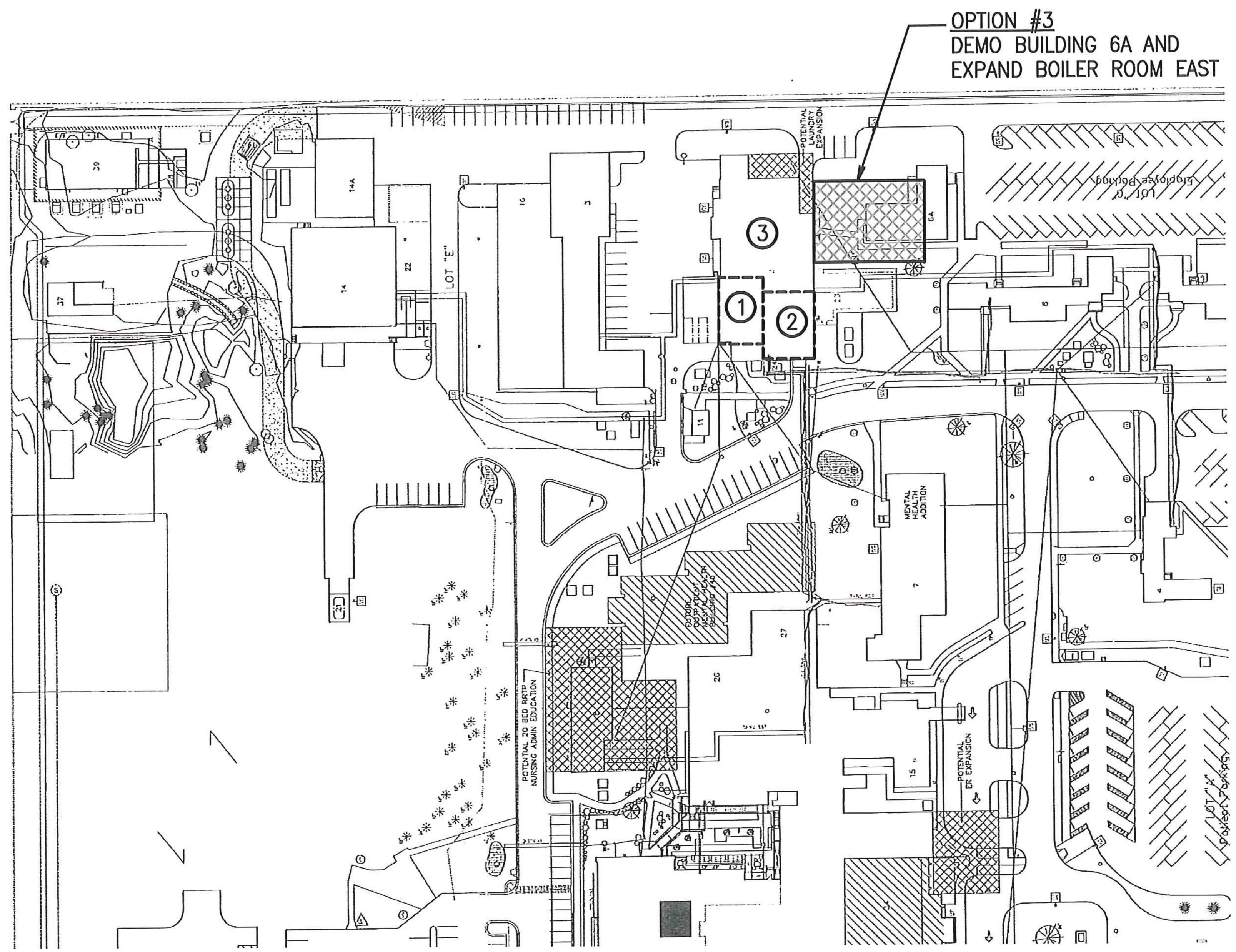
Spokane WA 99201
T. 509.838.9020
F. 509.838.1123

KEYNOTES:

① EXISTING BOILER ROOM

② EXISTING CHILLER ROOM

③ EXISTING LAUNDRY



M-2

6–26–2012

MW# 2012.228.01

BOILER PLANT REPLACEMENT FEASIBILITY STUDY

PROJECT: 668–12–105

MW
CONSULTING ENGINEERS
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Spokane WA 99201
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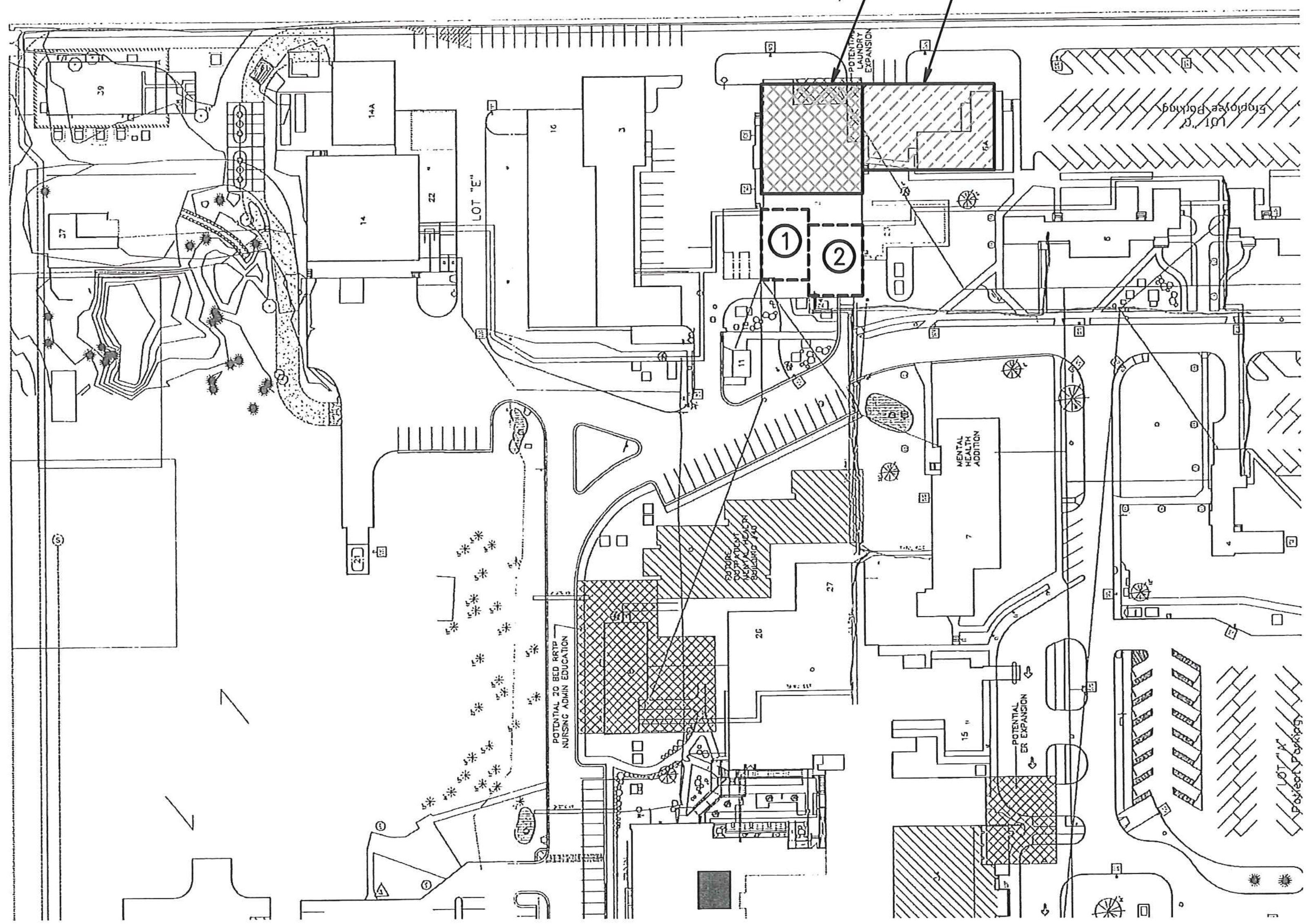
KEYNOTES:

1. EXISTING BOILER ROOM
2. EXISTING CHILLER ROOM

OPTION #4
DEMO EXISTING LAUNDRY AND REPLACE WITH NEW BOILER ROOM

DEMO BUILDING 6A AND REPLACE WITH NEW LAUNDRY BUILDING OR ADDITION



BOILER PLANT REPLACEMENT FEASIBILITY STUDY

PROJECT: 668–12–105

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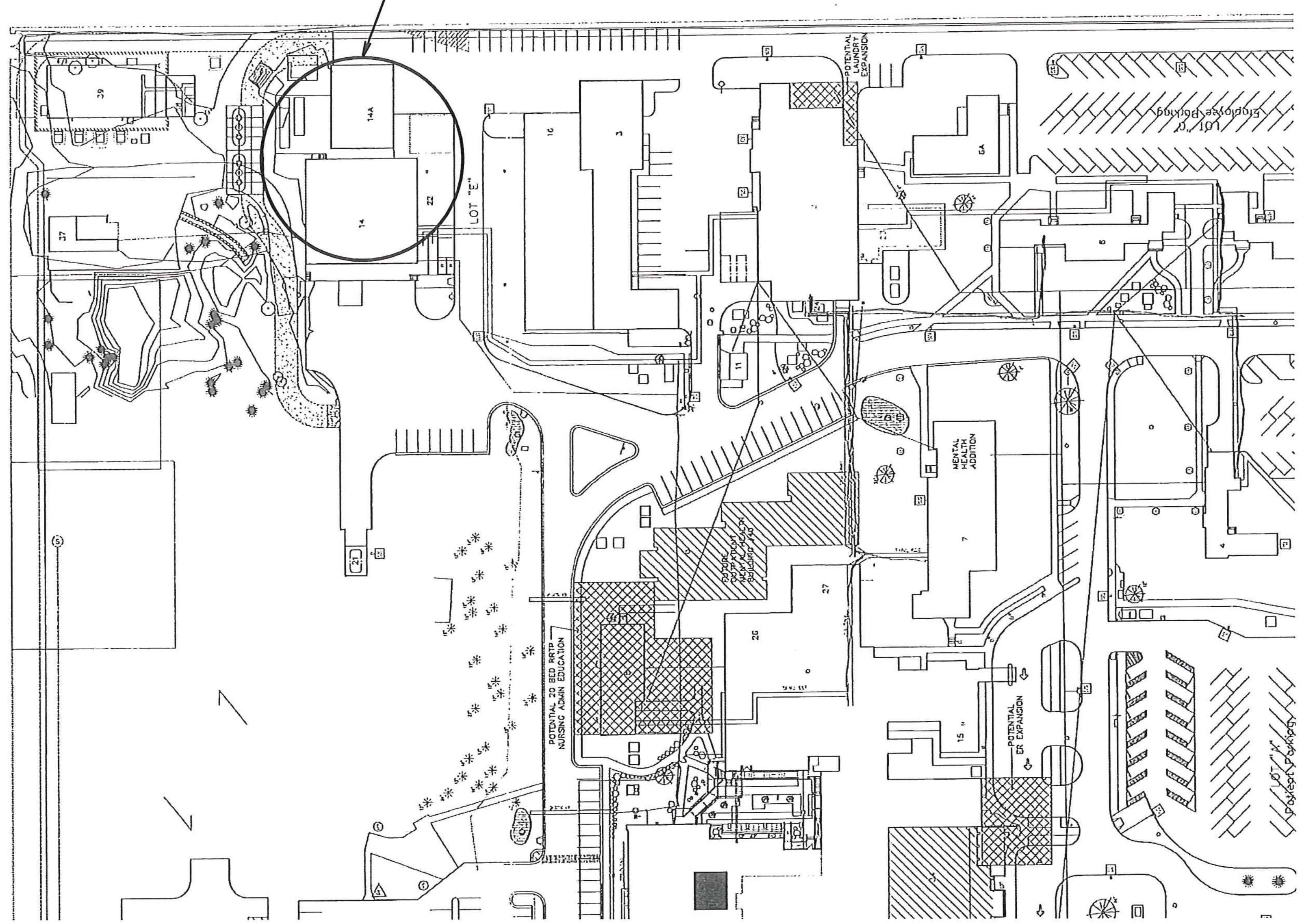
OPTION #5
DEMO EXISTING WAREHOUSE 14/14A AND CONSTRUCT NEW BOILER/CHILLER PLANT IN THAT LOCATION



M-4

6–26–2012

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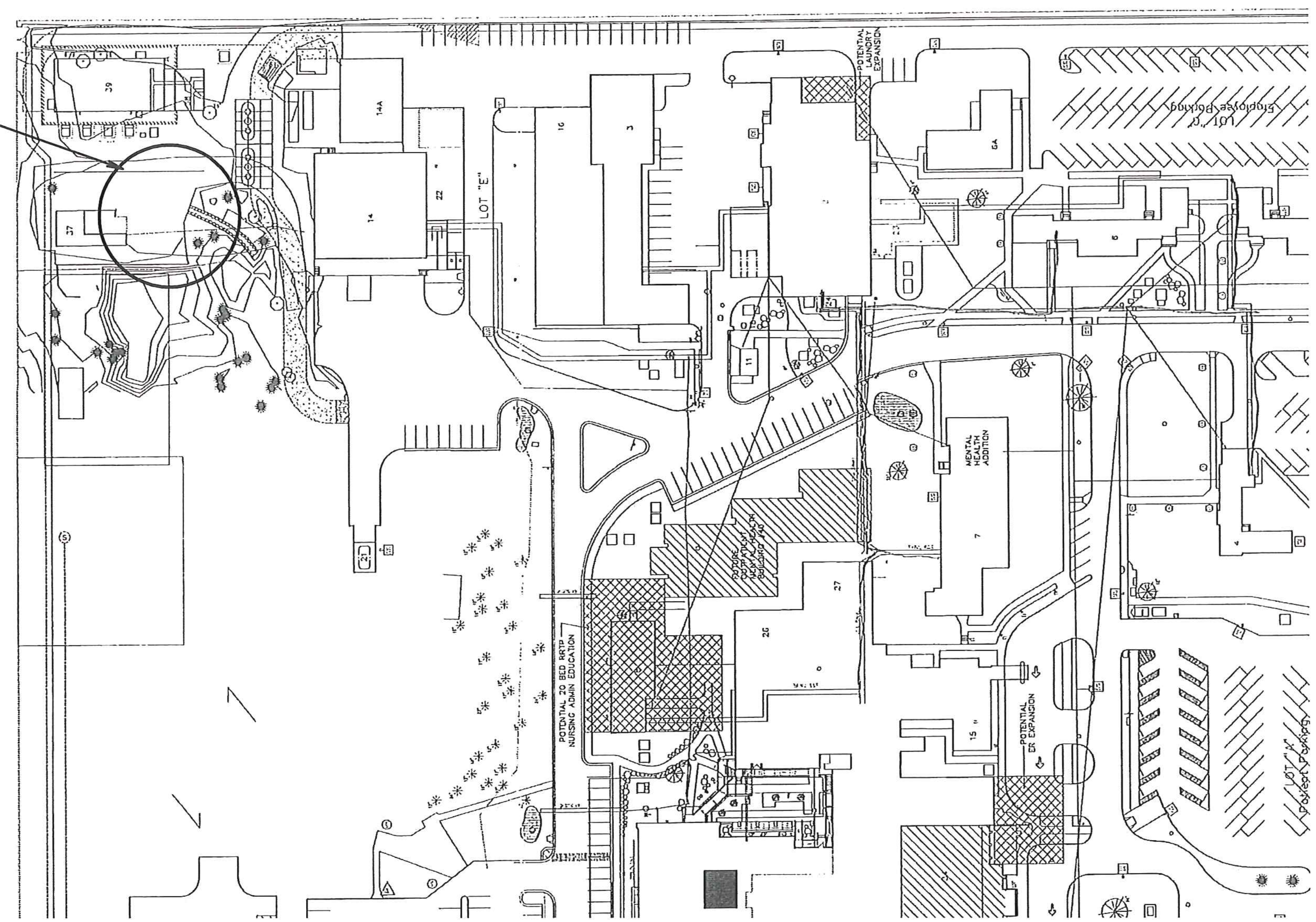
OPTION #6
CONSTRUCT NEW BOILER/CHILLER PLANT ALONG WEST EDGE OF PROPERTY NEAR GENERATOR BLDG #39 (MAY REQUIRE RELOCATION OF HEALING ARTS CENTER #37)



Appendix C

CO-GENERATION INVESTIGATION

The following is a basic high level look at the viability of utilizing cogeneration to produce both power and heat as part of the plant replacement. Based on available electrical data, it appears a "right sized" plant would be approximately 1 megawatt. We reviewed two options as follows:

Option 1 – Internal Combustion Engine Cogeneration System

These are typically the cheapest option though they don't come in very small sizes (for efficient units) making it challenging to perfectly match the load. For simplicity of analysis, a 1400kW unit was used which data was readily available for. Assuming we could size the system perfectly such that we get full utilization of the waste heat the system still doesn't make a lot of sense based on the economics as shown below:

- Net Present Value (NPV) (over 10 years with a discount rate of 8%) = -$457,961 (yes, that is a negative)
- IRR = 5.62%
- Simple Payback =8 years (note that this was assuming that waste heat could be readily utilized at source – which is not the case for this specific project).

Option 2 – Microturbine Cogeneration System

These are typically more expensive than Internal Combustion engines though typically come in smaller sizes (for efficient units) making it much easier to match the load. A 250 kW unit was used for this analysis, though the results can easily be scaled up. From an economic perspective these make even less sense as shown below:

- NPV (over 10 years with a discount rate of 8%) = -$275,010 (negative also)
- IRR = 0.11%
- Simple Payback =10+ years (note that this was assuming that waste heat could be readily utilized at source – which is not the case for this specific project).

When looking at the financial viability of options for a project, simple payback is often used as the primary evaluation criteria. This can often be a problem as it doesn't factor in the time value of money and how that may affect the analysis. Net Present Value (NPV) and Internal Rate of Return (IRR) are two alternate ways to look at the economics of a project that take this into account. NPV tells you what the present value (accounting for the time value of money) of a project is assuming a specific discount rate. In essence, when NPV is positive, it means that the project will give a positive return on investment that is greater than the discount rate or cost of capital. IRR is a way to determine what the discount rate needs to be in order for the NPV to be positive. When the IRR of a project is greater than the discount rate, then it means that the project will yield a positive NPV and is an investment worth pursuing. The discount rate is often referred to as the minimum acceptable rate of return or hurdle rate because it is the rate that all projects will be compared against and should yield a greater rate of return on. This rate is usually set by an organization based on what they could get with other investment strategies. In order for a project to make sense, it should be at least as good as the other investment options. This, the IRR should be greater than the discount rate for a project to be economically viable.

Other Co-Generation Considerations

Heat Redundancy

The cogeneration would provide pre-heat for the steam boilers which would reduce boiler load at all times of cogeneration operation, however any of the options considered would still require a full boiler plant capacity in addition to the cogeneration (in case the cogeneration fails, full N+1 would still be required at the heating level)

Noise

Diesel generators operate once a week for mandatory testing. They also operate upon loss of utility system power. Cogeneration systems operate all the time. Thus, implementing a cogeneration strategy will result in continuous noise in the vicinity of the hospital, clinics, and surrounding residential areas.

Emissions

Diesel generators emit exhaust once a week for mandatory testing. They also operate upon loss of utility system power. Thus, implementing a cogeneration strategy will result in continuous emissions in the vicinity of the hospital, clinics, and surrounding residential areas. In addition, further investigation will be required with the EPA to determine exact restrictions and regulations.

Space

The development of the generator/cogeneration plant will consume some space that will not, therefore, be available for program. The more cogeneration provided, the more space will be consumed.

Conclusion

Based on the above considerations and a meeting on June 18th, 2012, we have found that a cogeneration plant is not a viable option for a number of reasons. The primary reason is how to utilize the waste heat effectively in a facility that is predominately steam. The co-generation process produces hot water at approximately 150 degrees F. If the existing facility utilized heating hot water from the central plant this would become a more viable solution as the entire infrastructure would be in place. The main buildings on this campus however, are set up to utilize steam for heating, and convertors for domestic hot water. A change over to heating hot water would not be feasible due to the cost of new hot water piping, pumps, etc. and converting all of the existing steam coils and steam heat exchangers over to hot water. New heating hot water piping would need to be routed from the boiler plant to the buildings and all steam coils would need to be changed out to heating hot water.

END OF REPORT