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Civil

A. General

1. Campus Overview / History

The University of Washington Seattle campus covers approximately 640 acres with about 240 buildings owned by the University. There is a total elevation change of 215 feet from edge of shoreline to the highest elevation. Approximately half the campus borders on Lake Washington / Portage Bay while the other half connects directly to City of Seattle owned streets. The utilities serving the University must provide for a wide range of space usage including offices, acid waste, wet labs, athletic facilities, kitchens and medical facilities.

The campus grounds were turned over to the University after the closing of the Alaska / Yukon Pacific Exposition (A.Y.P.E.) which ended in 1909. The new University grounds included three permanent and some twelve temporary buildings from the Expo along with the overall rough grading of the property.

Completion of the channel on the south edge of campus, now known as the Montlake Cut, was completed in 1916 connecting Lake Washington to Lake Union, dropping the water surface in Lake Washington to its present level, permanently defining the border between the campus and the surrounding bodies of water.

2. Public and Private Property

The Seattle main campus is owned by the State of Washington and as such, is public property. No street right of way exists on campus, only the right of way defining the boundary between University and City of Seattle owned land. Most of the utilities on the campus are owned and operated by the University. A few non-University owned utilities exist on campus but there are almost no easements defining their location.

3. Montlake Landfill

The eastern third of the Seattle campus is an old City landfill which has been closed since 1966. This landfill (some 70 feet deep in places) is constructed over a thick peat mat and is capped with a clay soil. The landfill and underlying peat is a constant source of methane and leachate. Construction in this area, and within a 1000-foot buffer, is monitored by the Montlake Landfill Committee (MLC). The MLC meets on a regular basis, or as needed, to comment on the unique requirements for construction proposed in this area of campus.

4. Utility Locates

All projects are to include drawing and specification notes to indicate that the Contractor shall notify the Utility Notification Center (811) at least two full working days before digging. Note that the University maintains records online for designers to research the University utility system at their leisure and generally from their office. This is intended to limit the use of the 811 system

for design purposes. See the "record drawings" section for an explanation of this system and how to gain access.

5. Record Drawings

The University maintains a record drawing system documenting the overall utilities, as-built drawings of the individual systems and building connection points. This record drawing library is called the Facilities Information Library (F.I.L.) and can be accessed online. Access to this system is granted through the UW Project Manager. The UW PM can grant access for the duration of individual projects. Note there is a document contained in Section G4 of the online help system within F.I.L. that has quick hyperlinks to the most common and the most up to date record drawings.

Engineering Services can assist with navigation through F.I.L. Full access is required prior to getting help with using the system. Contact the UW PM for access rights first. Request full access to all drawings.

B. Surveying

This section applies to design standards and procedures involved in the field location and plotting of all-natural objects and surface improvements. This section also includes the requirements for submittal of plans and files to the University.

1. The surveyor is to provide Engineering Services (ES) an AutoCAD copy of any topographic surveys created as soon as they are available. ES will only use these surveys to assist in design development and coordination within the campus grounds. Email them to the ES Civil Engineer.
2. All topographic surveys must be stamped by a Professional Surveyor licensed in the State of Washington.

   The Seattle location is mostly contained within:
   Horizontal Datum used: **NAD 83/91**
   Vertical Datum used: **NAVD 88**

3. On the survey, note any University control monuments encountered. These monuments are designated by a unique number as shown on record drawing 915-C-09. Monuments with numbers in the 500's are new and will not appear on the record.

4. Mapping

a. Preferred mapping scale is 1 inch to 20 feet. Symbol size should be computed based on this scale. Contour interval shall be 1 foot; 2 feet is allowable on steep slopes for clarity of the drawings.
b. "Hard" surface (i.e. pavement, concrete) spot elevations shall be 0.01' accuracy. "Soft" surface (i.e. grass, dirt) spot elevations shall be 0.1' accuracy. "Soft" surface (i.e. grass, dirt) spot elevations shall be 0.1' accuracy.
c. Include all ground floor elevations of existing buildings and slab structures within the survey. Verify and show all storm and sanitary sewer inlet and outlet invert elevations at manholes by field measurement as well as rim elevations. Show all underground utilities.
d. Provide a note on the survey which clearly states all assumptions and limitations in the survey.

e. Identify all buildings shown wholly or partially on the finished drawings by name and accented by shading or crosshatching. When feasible include at least two points upon the building face as far apart as practical. These points will assist the University in locating and rotating floor plans onto the campus map.
f. Field-locate all trees and major vegetation and record location on the map. Identify tree size, type and ID tag numbers on the map. Note the actual canopy of the tree. (Protect existing shrubs, trees and lawn areas during the progress of fieldwork; under no circumstances will their removal be permitted.) Canopies are to be drawn to scale. Do not use one symbol of one size for all trees within the survey unless preapproved by ES.
g. Locate all tunnels and tunnel manholes. Show floor and ceiling elevations of tunnels where applicable.
h. Include a general vicinity map, small scale, on the finished drawings.
i. Use abbreviations as shown in City of Seattle standard plan 002.

5. AutoCAD

a. All CAD files that are final versions are to be purged of unused blocks, layers, line-types, etc. All externally referenced drawings are to be inserted into the drawing (bond) and any special fonts included on the CD. Under no circumstance should the CAD drawing modify the "standard" styles. All modified styles should have a unique name.
b. For CAD files include the exact limits of the survey. Providing the triangulated irregular network (TIN) boundary as a closed polyline will satisfy this requirement. This line work should be turned off and not plotted on the paper copy. This will be used by the University to "cookie cutter" surveys into the campus master base map.
c. For legibility, avoid using the "simplex" font in any AutoCAD drawings.
d. Provide all non-standard fonts with each AutoCAD file.
e. To assist in the coordination of projects during the design development phase, email a curtesy copy of the Topographic Survey (AutoCAD Version) to:

James Morin PE
UW Engineering Services
morinj@uw.edu

Official, signed versions are still to be submitted as part of the project closing documents.

6. Topographic Map, Drafting

a. Drafting and layout standards.
b. All lettering on drawings shall be 1/8-inch minimum height at final plot scale.
c. Major callouts such as building names, street names, elevations, and dimensions require use of single-stroke vertical Gothic lettering.
d. All lettering to be clear and uniform in appearance and line density.
e. Use Leroy or other lettering devices where applicable, but in no instances place lettering, either pencil or ink, over or through any prior notes, callouts, or legends.
f. Diazo sepia, sepia mylar, slicks, or sticky back on mylar are not acceptable.
g. Provide a ½ inch border on the top, bottom and right side of the sheet.
h. Provide a 1-inch binding edge on the left side of the sheet.

i. Preferred sheet sizes for the University of Washington Facility Management Office standard sizes. Typical sheet sizes to trim lines are as follows:

18”x24”
30”x42”
36”x48”

j. Do not provide sheet size larger than 36" x 48”.
k. Provide identical size for all sheet sizes for any given survey.
l. Surveyors shall consult with the Architect/ Engineer project consultants to ensure that the topographic drawings will be the same size as the design drawings.

C. Earthwork / Grading

This section applies to the design and installation of earthwork and backfill.

1. No stockpiling of excavation materials is allowed unless the Geotechnical Engineer provides inspection services to assure compliance with their recommendations as to the use and stockpiling of the excavation material. Submit report from Geotechnical Engineer to Engineering Services prior to material placement that verifies compliance with Geotechnical recommendations. All stockpile locations and covering measures shall be included in the Temporary Erosion Control plan.
2. No native material may be used in landscaped areas up to sub-grade and no closer than three feet from the building. Discuss this with Geotechnical Engineer and Engineering Services for approval.
3. No recycled material is allowed without coordination with Engineering Services.
4. Identify shoring constraints in the construction documents. For example, “provide a shoring design, or specify vertical shoring, where a sloped excavation would undermine existing structures, utilities, or pavement.”
5. All excavation and backfill work shall conform to the following codes, regulations and standards:
   a. WSDOT-APWA Standard Specifications for Road, Bridge and Municipal Construction, most current edition (not including Measurement and Payment provisions)
   b. City of Seattle Supplement to the Specification for Road, Bridge and Municipal Construction, most current addition.
   c. ASTM Test method D1557 modified for density of soils
6. **All excavated material shall be treated in the following ways:**
   a. Removed from campus at no cost to the University
   b. Used for wall backfill outside 18 inches measured from the face of foundation wall
   c. Used in landscape areas to subgrade
   d. Follow the recommendations of the Geotechnical Engineer
7. Backfill for walls: The first 18 inches behind any wall shall meet City of Seattle Supplement Requirement for Mineral Aggregate Type 17. The remaining backfill behind the wall can be either excavated material or Mineral Aggregate Type 17 as in City of Seattle Supplement.
8. Backfill for utility trenches shall be per City of Seattle specifications.
9. For final grading the designer shall pay close attention to preventing pools of water in hardscape areas. Limits grades to a minimum of 1.5% unless approved by Engineering Services.

10. For landscape planters consider the travel path for runoff and excess irrigation water across pedestrian and vehicle areas and provide area drains or gravel French drains.
11. DO NOT use round rock in any areas exposed to foot traffic, mowers or grass edgers.
12. Grading coordination between Civil and Landscape (if separate contracts) is essential to prevent standing water.

D. Roadways

This section applies to the design and construction of roadways.

1. Fire service is provided to the University by the Seattle Fire Department. Emergency access roads should conform to the Seattle Fire Code Article 9, SFD Administrative Rules, and referenced standards. See drawing 901RU-02 for University Campus Map Fire Lanes and Fire Hydrants.
2. The University road system is designed with student safety as the main concern. When designing new or modifying existing roadways; pedestrian movement, sight distance, speed and conflict points should be considered to maximize pedestrian safety and visibility.
3. Cross walks crossing Stevens Way and Memorial Way shall be made with a 10-foot wide, 12-inch thick, dark grey colored concrete and scored with 2' x 2' square pattern or preapproved pattern.
4. Stevens Way, Memorial Way and Pend Oreille Road are subject to Metro Bus traffic and are to be designed with pavement sections that can handle such traffic. Typically, this is 10-inch concrete over 6-inch crushed surfacing base course section panels.
5. Vehicular PCC paving shall be used in service areas, loading docks, and access roads leading to loading docks, and shall have a minimum thickness of 8 inches over 4 inches of Crushed Surfacing Base Course. Additional pavement section may be needed as a result of the traffic and wheel loading study.
6. Vehicular Asphalt paving shall be a minimum of 3 inches Asphalt Concrete HMA Cl ½" over 6 inches if Crushed Surfacing Top Course. Additional pavement section may be needed as the result of the traffic and wheel load study.
7. Vehicular PCC and Asphalt paving shall meet latest requirements of Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT).
8. Provide a flexural strength of a least 3,000 psi at final strength for concrete for vehicular PCC paving. Use high-early cement when it is necessary to open the area to traffic after seven days of curing.
9. Provide concrete for PCC paving with a silica fume additive when (a) the slope of the paving exceeds a 6 percent grade or (b) within 60 feet of a stop sign.
10. The University of Washington shall retain a testing lab to monitor and test all rock, concrete and asphalt samples and check the density of the subgrade before placing the surfacing materials.
11. The specifications shall call for testing of the concrete for vehicular paving to be in accordance with ASTM C 78 Standard Testing Method for Flexural Strength of Concrete (using a simple beam with third point loading)
12. After edging, apply a medium broom finish transversely to vehicular PCC paving.
13. Saw cut joints as soon as possible (approximately 8 to 10 hours after pouring).
14. For long sections of vehicular PCC paving, a test sample showing final surface texture shall be made available at the site prior to initial pour. University Staff shall inspect the test sample. The

Construction Coordinator shall make inspection arrangements with the Contractor and University Staff.

E. Curb

This section applies to the details and placement of curbing. The University prefers the use of cast-in-place concrete curb along roadways and barrier curb within parking areas. The use of extruded curb is limited. Coordinate with Engineering Services on all proposed curb types and locations.

1. Place curbing between all pedestrian traffic and vehicle traffic. Place concrete curb and gutter between all roadway surfaces and sidewalks, and between all roadways and planting areas.
2. In general, surface runoff should not be directed to flow along the toe of extruded curb.
3. Rolled curb may not be used unless approved by Engineering Services.
4. In limited areas extruded curb may be allowed to separate traffic from pedestrians. Coordinate with Engineering Services.
5. It is encouraged to include extruded curb along the back edge of sidewalk to prevent sluffing of material from slopes on to the sidewalk. Coordinate with Engineering Services.
6. Provide concrete curbs with a minimum compressive strength of 3,000 psi at 28 days.
7. See City of Seattle Standard detail 410 and 411 for cast-in-place and doweled curb.
8. See City of Seattle Standard detail 412 for extruded curb.
9. See University Detail SD-C-67 for Barrier Curb.

F. Sidewalk

This section applies to the design and construction of sidewalks, curbs and ramps.

1. Sidewalks at the University of Washington are used by pedestrians, lifts and trucks. Pavement / Concrete sections must be designed to accommodate these loads.
2. Sidewalks can be constructed using concrete or asphalt. Concrete Sidewalks shall be Class 5 (1-1/2") with a minimum thickness of 4 inches over 3 inches of Crushed Surfacing Base Course. Surface texturing, joint details and joint layout shall be in accordance with Standard Plan 420.
3. Asphaltic Concrete Sidewalks shall be HMA Cl ½", with a minimum thickness of 3 inches over 4 inches of Crushed Surfacing Base Course. Use tack coat between all concrete surfaces and new asphaltic concrete. Place tack coat on the surface between all joints to concrete or other asphaltic concrete.
4. For ADA ramps use the City of Seattle standard plan 422 using **WHITE** detectable warning areas instead of "City of Seattle Safety Yellow".
5. The University of Washington shall retain a testing lab to verify sub grade compaction, slump, and strength of concrete, etc.
6. After edging the PCC sidewalk, brush it with a fiber hair brush in a transverse direction.
7. Cure the PCC sidewalk by an approved liquid curing compound.
8. Permeable Pavement
    a. In general, the use of permeable asphalt is only allowed for parking areas that are temporary (Less than 10 years)
    b. Permeable concrete must follow the latest ACI specifications.
    c. Evaluate the following when considering the use of Permeable Concrete:

d. The cost of long-term maintenance
e. The limitations in re-striping in the future
f. The need for special equipment to clean and deep clean
g. The dangers of landscapers stockpiling soils on the pavement and plugging it
h. The inability to plow for snow removal
i. The special requirements for storm structures and grates

G. Parking

Transportation Services (206) 221-3701

H. Utilities

This section applies to the storm water conveyance system.

1. The University storm water conveyance system was originally constructed when the City of Seattle was a combined sewer/storm system. Approximately 20% of the Seattle Campus is still a combined system. Refer to University record drawing 805RU-02 for the complete layout of the storm water conveyance system.
2. For safety and operations, avoid the use of ANY round aggregate for applications that are open to the surface and can be walked on, mowed or edged.
3. Provide engineering calculations used to size all conveyance piping.
4. Do not propose to pump storm water without prior consent from Engineering Services.
5. Provide a manhole, full-sized clean-out, or catch basin at changes in pipe direction or diameter.
6. Install clean-outs at all proposed connections to buildings.
7. Backfill around storm structures with CDF.
8. Use thru curb inlets at low spots in roadway profiles.
9. Do not downsize pipe diameters. Match crown elevations in structures as much as feasible.
10. Storm structures in landscape areas and hill sides not collecting water, should have solid lids with rim elevations 6-inchs higher than the final uphill grade.
11. Drains and cleanouts in grass areas shall be built low so that mowers will not strike them.
    a. Provide structure numbering on the plans.
    b. Provide narrative of downstream conveyance system 500 feet from site.
12. All products, materials, and equipment shall conform to WSDOT/APWA Standards.
13. Piping: SDR 35 PVC pipe per ASTM D3034 for sizes 12 inches in diameter and below, and reinforced concrete pipe per ASTM 67 for sizes above 12 inches in diameter. Exception: Use ductile iron pipe, or ductile iron sleeve, where high surface loads exist, under roadways, and where minimum cover cannot be achieved.
14. Pipe connections: Use fittings made of the same material as the connecting pipe. Use an appropriate adapter when changing materials (e.g. when penetrating a concrete manhole with a PVC pipe).
15. Exterior below grade pipe penetrations: Link-Seals, or approved substitution
16. Refer to following City of Seattle (COS) Standard Plans:
    a. Catch Basin (COS 240a); install inlet pipe invert at least 6 inches above outlet pipe invert.

b. Catch Basin (COS 242); install inlet pipe invert at least 6 inches above outlet pipe invert.
c. Catch Basin and Inlet Installation (COS 260b)
d. Catch Basin and Inlet Installation (COS 260a)
e. Typical Catch Basin Connection (COS 261)
f. Inlet (COS 252)
g. Inlet (COS 250)

17. Inlet Frame (COS 262)
18. Inlet Frame (COS 263)
19. Inlet Frame & Grate (COS 264)
20. Manhole (COS 201a)
21. Drop Connection (COS 233)
22. 8" Clean-out (COS 280)
23. Typical Trench Section (COS 284)
24. Pipe Bedding (COS 285)

I. Water Quality / Onsite Stormwater Management (OSM)

This section covers the design and selection of water quality / onsite stormwater management facilities.

1. All cost analysis should include the cost of land used or parking units displaced.

Cost

2. WQ and OSM facilities shall be selected based on the complete life cycle cost to the University. This cost shall include all maintenance, servicing and replacement over 50 years.
3. Selection and design of WQ and OSM shall be to minimize maintenance impacts to the University.

Access

4. Maintenance access to facilities shall be evaluated for each proposed facility. This will include such items as push mower access, access to service storm structures, gardener safety, and the dangers of using weed trimmers on small aggregates.
5. Structures within the facility need to be located for ease of service.

Design

6. Cleanouts are needed to maintain all conveyance pipes.
7. Maximum slope for wet, mowable surfaces is 4:1.
8. Locate access/inspection/cleanout openings to underground facilities in areas with no traffic or parking conflicts.
9. Include a structure immediately upstream of all WQ or OSM facilities with a turned down elbow to prevent floatables from entering the facility.
10. Include a method to take the facility offline for servicing.
11. All facilities that include an underdrain shall be designed to minimize stagnant water in the underdrain system. This may require sloping of the bottom or adding weep-holes to drain this water off.

12. Splash Pads/Blocks must be designed to prevent erosion and scouring of the soil surfaces.
13. All facilities relying on soil percolation shall have a route of failure evaluated to protect surrounding areas and impacts on pedestrians.
14. Each facility shall be designed so “short circuiting” of the system is avoided.
15. If a liner system is proposed, care needs to be taken to detail liner penetrations and method off attachment to the facility wall. Engineering Services approval is needed for these details.
16. Any weirs or other devices designed to spread or disperse flow shall be designed with the ability to field adjust over the lifetime of the facility to account for settling and construction imperfections.
17. Where feasible, combine WQ and OSM into one facility.

J. Sanitary Sewer

This section relates to the design and construction of Sanitary Sewer systems.

1. The University sanitary sewers drain to King County Metro Truck sewers located on Montlake Boulevard, Pacific Street, and Pacific Place. Refer to University drawing 805RU-1 for a map detailing the campus sanitary sewer distribution system.
2. Coordinate with Engineering Services all new connection points to the University system.
3. The areas east of Montlake Blvd. and south of NE Pacific Street are mostly served by Sewer lift stations. See 805RU-01 for the locations of all lift stations.
4. Refer to University drawings 875RU-A through 875RU-E for all existing utilities. The above drawings are updated regularly but are schematic and may not be accurate or complete for some areas of campus.
5. Avoid the use of back water valves on side sewers. The Civil designer is to coordinate with the Mechanical designer early in the design process for situations requiring a back-water valve. A cost/benefit analysis must be done to compare the feasibility of such devices.
6. For side sewers, provide a cleanout approximately five feet from buildings. Minimum side sewer slope is 2.00%.
7. Refer to Utility Corridor Arrangement drawing (see Roadways section) for preferred piping placement under roadways.
8. Avoid the use of lift stations. Where lift stations are necessary discuss with Engineering Services. Provide remote high-level alarms, self-priming pumps, and auxiliary power with an automatic transfer switch.
9. Connect laboratory acid resistant waste lines and sanitary sewer pipe outside the building in an acid waste resistant / sanitary waste manhole as shown in detail SD-C-34.
10. Provide manhole numbers on the plans.
11. Pipe sizes, slopes, lengths, points of connection, trench and bedding details, connection and joint details, manhole sizes, , and clean-out details. Show horizontal separation between sewer and water. Show crossing utilities on profile.
12. Plan(s) showing all existing underground tunnels and utilities (power, communications, gas, water, storm drain, sanitary sewer, and street lighting.) A survey drawing may be adequate for this purpose, providing it has been reviewed to ensure that all utilities are included and that each utility is clearly distinguishable from other drawing information.
13. All products, materials, and equipment shall conform to WSDOT/APWA Standards.
14. Piping: SDR 35 PVC pipe per ASTM D3034 for sizes 12 inches in diameter and below, and reinforced concrete pipe per ASTM 67 for sizes above 12 inches in diameter. Exception: Use

ductile iron pipe or a ductile iron sleeve where high surface loads exist, under roadways, and where minimum cover cannot be achieved.

15. The Construction Coordinator shall make test arrangements with the Contractor and shall notify University Engineering Staff as to the date and time of testing. University staff must witness and approve all testing before the sewer may be placed in service.
16. Refer to the following City of Seattle (COS) Standard Plans:

    a. Manhole (COS 201b)
    b. Drop Connection (COS 233a)
    c. 8" Clean-out (COS 280)
    d. Typical Trench Section (COS 284)
    e. Pipe Bedding (COS 285)

K. Water

This section applies to the design and installation of water distribution systems.

1. Refer to drawing 804-RU-02 for the layout of the water distribution system.
2. Refer to University drawings 875RU-A through 875RU-E for all utilities. The above drawings are updated regularly, but are schematic and may not be totally accurate, complete, or up to date for all areas of the campus.
3. Design and install water distribution piping in accordance with American Water Works Association (AWWA) and the City of Seattle standards.
4. Design with bell and spigot and thrust blocks. On unstable ground (East Campus) consider using FM approved restrained mechanical joints. Discuss with Engineering Services.
5. Locate backflow preventers in basement mechanical rooms. Do not locate in vaults or pits without discussing with Engineering Services.
6. Coordinate with Engineering Services the need for water meters. Water meters are used as part of the campus energy system.
7. Provide separate fire and domestic services. Provide a post indicator valve on the fire service, preferably 40 feet away from the building, or on or near blank wall. Shared (water/fire) single services need to be approved by the UW Fire Protection Engineer.
8. Do not install water piping below slabs on grade.
9. Bury mains with 36 inches of cover from finish grade to top of pipe.
10. Coordinate Fire Hydrant locations with Engineering Services and UW EH &S.
11. Do not use restrained mechanical joints on existing mains without verifying existing pipe material.
12. The preferred location of vaults is away from areas of pedestrian traffic.
13. Provide building isolation valve.
14. Additional valves may be required by Engineering Services to minimize the disruption of water shutdowns during construction and for overall operations of the campus.
15. All products, materials, and equipment shall conform to AWWA and NFPA 24 standards.
16. Main pipe and fittings: Ductile iron with cement lining
17. Main line valves: Resilient seated gate valves per AWWA C509
18. Fire hydrants: (In order of preference) Waterous Pacer, Kennedy K81A or Mueller Super Centurion 250. Wet-taps: 300 series corrosion resistant steel sleeves, shells, lugs, bolts, washers, and nuts

19. Exterior below grade pipe penetrations: Link-Seals, or approved substitution
20. Environmental Health & Safety Design Guide – Sprinkler Protection and Standpipes
21. The following City of Seattle (COS) Standard Plans are approved for use where applicable:
    a. Connections to Existing Watermains (COS 300a)
    b. Connections to Existing Watermains (COS 300b)
    c. Hydrant Setting Detail (COS 310a). Exception: Paint with one coat of red oxide primer and one coat of University of Washington Green Sash Enamel.
    d. Cast Iron Valve Box & Operating Nut Extensions (COS 315a)
    e. Watermain Thrust Blocking Vertical Fittings (COS 330a)
    f. Watermain Thrust Blocking Vertical Fittings (COS 330b)
    g. Watermain Thrust Blocking Horizontal Fittings (COS 331a and 331b)
    h. Sewer and Water Spacing & Clearances (COS 286a and 286b)
    i. Typical Trench Section (COS 284)
    j. Pipe Bedding (COS 285)

L. Natural Gas

This section applies to the underground natural gas distribution system.

1. Puget Sound Energy (PSE) supplies high-pressure (above 60 PSI) natural gas to the main campus via a connection located at the south end of the power plant. The University owns all the natural gas piping supplied from that location on the main campus. University facilities at other locations, such as west campus, are served by PSE and are metered separately. See University drawing 806-RU-02 for more information.
2. The lower campus around the Medical Center / Hospital is served by a separate gas distribution system.
3. Refer to University drawings 875RU-A through 875RU-E for utilities. These drawings are updated regularly but are schematic and may not be completely accurate.
4. Design and install natural gas service and distribution piping in accordance with American Society of Mechanical Engineers Code for Gas Transmission and Distribution Piping Systems (ASME B31.8).
5. Bury piping with 36 inches of cover from finish grade to top of pipe. Use Seattle aggregate No. 9 for pipe bedding. Refer to the section on earthwork backfill requirements.
6. All products, materials, and equipment shall conform to ASME B31.8 “Gas Transmission & Distribution Piping Systems”.
7. Pipe and fittings: SDR 11 polyethylene with an accessible and properly grounded tracer wire. Use prefabricated fittings for transition from plastic to steel. Above-ground piping shall be steel. Use prefabricated fittings, designed to prevent stress from being transferred to the underground plastic pipe, when transitioning from underground polyethylene to above ground steel.
8. Valves: AGA or API listed polyethylene ball valve, with 2-inch square operator nut
9. Valve Boxes: Cast iron, two-section box. Include top section with cover and “GAS” lettering.
10. Exterior below grade pipe penetrations: Link-Seals, or approved substitution
11. Fabricate, install, and inspect all gas distribution and service piping in accordance with ASME B31.8. Include an air test at 90 PSI for 4 hours with no allowable pressure drop.
12. Installation shall be by PSE approved contractor.

13. Connect and activate new lines under the supervision of University staff.
14. University staff must inspect all gas piping installations before backfill.
15. Valves, piping, and fittings shall be heat fusion bonded polyethylene. Connections to steel piping shall be welded.
16. The University Construction Coordinator shall make test arrangements with the Contractor and shall notify University Engineering Services staff as to the date and time of testing. University staff shall witness testing before gas lines are placed in service.
17. Note all special requirements for separation and crossing the University Steam pipe.

M. Subsurface Structures

Tunnels

This section applies to reinforced concrete utility tunnels and trenches.

1. Refer to University drawings 875RU-A through 875RU-E for utilities not routed through campus utility tunnels. The above drawings are updated regularly but are schematic and may not be accurate or complete.
2. Do not install water, gas, sewer, or storm drain piping in utility tunnels or utility trenches.
3. Locate tunnels and manholes based on existing and planned facilities. New facilities shall be planned to avoid hindering egress out of tunnel system and to avoid affecting tunnel ventilation.
4. Avoid locating manholes in roadways. Do not locate manholes in walkways unless approved by Engineering Services. Tunnel manhole covers, if placed in paved areas, shall meet AASHTO H20 loading criteria and ADA requirements.
5. Slope floors towards the piping side of the tunnel to minimize water on walking surfaces.
6. Provide a tunnel drain as shown on tunnel and trench sections.
7. Provide for drainage of storm water entering the top manhole grating and offset the manhole opening to prevent rain water from entering the tunnel.
8. At top manhole grating at grade, provide steel grated ventilation openings with security locks bolted from below.
9. Provide connections for tunnel underdrains with cleanouts and maintenance structures.

Vaults

This section applies to the Civil Engineers component for new vaults and underground chambers.

Drains

1. Coordinate with other disciplines as to providing floor drains.
2. The University prefers gravity drains or gravel sump drains.

Lids / Grates

1. Coordinate with Structural as to final location, elevation, and load ratings for vault lids.
2. Coordinate location of openings to a spot outside any roads or walkways.
3. Assume H-20 rating.

Buildings

This section applies to the Civil Engineering component for the design of new underground buildings.

Top Surface

1. In general, guide the design development of underground buildings to avoid any low spots and the reliance on individual "roof" slab drains to convey excess storm or irrigation water off the top of an underground structure.
2. If a drain is unavoidable, in a low spot on the top of an underground structure, provide an inspection port directly over the drain structure to allow for monitoring and servicing of the drain.
3. Provide a perimeter drain along the outside edge of the structure to convey excess rain/irrigation water away from the structure. Provide cleanouts at 50-foot spacing minimum.

Perimeter Drain

1. Underground structures are to be assessed for how complete the water proofing needs to be. If the space below is to be occupied, provide redundant conveyances to assure no seepage in the event the water proofing fails. On garage structures this need may not be as great.

   Monitoring wells should be provided to assess how much water is present and provide a location to pumps out excess water

Storm System Design Criterion

1. The use of ANY round aggregate shall have pre-approval from Engineering Services. In general, its use should be avoided in any surface areas that can come in contact with mowers, trimmers or can be walked on.
2. Design and install storm sewers and appurtenances in accordance with WSDOT/APWA Standard Specifications and the City of Seattle Directors Rules.
3. Design storm drains to convey a 25 year, 24-hour storm event. Pipe can surcharge at this flow as long as 50-year storm event does not overtop rim elevation based on backwater calculations. Provide backwater calculations to Engineering Services.
4. Provide narrative describing impacts of 100-year storm event on downstream areas.
5. Where applicable provide knockout or stub out and cap pipe from structures for future connections.
6. For CB's in curb line, next to sidewalk, stub out and cap a 6" pipe to the back of sidewalk.
7. Minimum pipe slope is 0.5%.
8. Minimum pipe size is 6", generally.
9. Minimum pipe size is 8" in roadways.
10. 4" pipe may be used with consent from Engineering Services
11. Maximum Manhole spacing is 300 feet.
12. Maximum CB spacing in roadways shall be 150 feet.
13. Install redundant Storm Structures with thru curb inlets at all low spots in roads or ask for exception from Engineering Services.
14. Bury pipe with at least 24 inches of cover from finish grade to top of pipe.

15. Maintenance is of prime importance to the University. Locate all proposed structure so that they can easily be reached for servicing. Consider structures with no sump in locations where access is difficult directly near the structure. Minimize the use of structures that require maintenance.
16. Include clean outs in locations as outlined in the Uniform Plumbing Code. In general, at all locations where pipe changes direction and no more than 50 feet in pipe length.
17. Consider double cleanouts that allow pipe access in both directions, for pipe near or under hardscape and buildings.
18. Provide minimum 12" clear separation between all storm pipe and other utilities and ducts.

Sanitary Sewer Design Criterion

1. Design and install all sanitary sewer mains, side sewers (laterals), sewer lift stations, telemetering facilities, and sewer system appurtenances in accordance with WSDOT/APWA Standard Specifications and the Washington State Department of Ecology "Criteria for Sewage Works Design."
2. Bury mains with at least 36 inches of cover from finish grade to top of pipe. Use Seattle aggregate No. 9 for pipe bedding.
3. Shallow manholes (4-feet deep) are discouraged. If needed locate these manholes out of traffic areas and away from student gathering spots.
4. Generally, use pipe that is 6 inches or larger in diameter. Sewer pipe 4 inches in diameter may be specified if approved by Engineering Services.
5. For gravity sewers, provide a manhole every 300 feet or less, and at changes in pipe direction or diameter.
6. Cleanouts are to be installed at changes in pipe direction and at least every 100 feet of side sewer.
7. 8-inch side sewers generally require a manhole at connection points with the main. Coordinate this with Engineering Services.
8. Use 54-inch diameter manholes (minimum) unless approved by Engineering Services.
9. Rim elevations. For manholes on hillsides or landscape areas set rim elevations 6-inchs above the adjacent uphill elevation. Avoid setting manholes in grass areas. If unavoidable set rims low to avoid lawn mower damage.
10. 18-inches is the maximum step down in manhole inverts without a drop. When drops are needed the University prefers inside drop connections per City of Seattle detail.
11. Pipe connections: Use fittings made of the same material as the connecting pipe. Use an appropriate adapter when changing materials (e.g. when penetrating a concrete manhole with a PVC pipe.)
12. Exterior below grade pipe penetrations: Link-Seals, or approved substitution
13. Manhole lids: Locking, Ductile iron, permanently marked "SEWER".
14. If practical, do not locate manholes and cleanout structures under parking stalls, high traffic areas, or locations not easily accessible by vactor trucks.
15. All sewer pipe with a depth of 18 feet or more must be ductile iron.
16. If a building is proposing a separate acid resistant waste (ARW) line then provide a manhole near the building that combines the waste and ARW lines.
17. All sewer pipe shall be identified by installation of a 16-gauge solid tracer wire attached to the top of the pipe and by "sewer" warning tape installed 18-inches above the pipe.
18. Maximum 6-inch side sewer length shall be 200 feet with a cleanout at 100 foot intervals and at the end.