

DIVISION 2 - SITEWORK

02000 GENERAL

A. Design Considerations

1. The A/E shall coordinate all sitework with the University Architect, Campus Landscape Architect, and Project Manager, including landscape design and construction outside of the building line to the limits of the project. Landscaping can include regrading, topsoiling, seeding or sodding, plantings, irrigation, lighting, site furniture and above ground site improvements of all types, and other site work as required.
2. See Sidewalk Detail in Part IV, the Standard Details Section of this Manual for size and scoring pattern. Only concrete is acceptable for pedestrian sidewalks.
3. Bollards shall be installed wherever the need exists to prevent non-university vehicles from entering authorized areas or to prevent vehicular traffic onto sidewalks. Bollards shall be per the Bollard Detail in Part IV, the Graphic Details section of this Manual.
4. A Mowing Edge shall be installed at all trees (by Landscape Contractor) and around perimeter of the Building (by General Contractor) per the Mowing Edge Detail in Part IV, the Graphic Details section of this Manual.
5. Fencing shall be per section 02821 of this division, and shall be placed around all climbing hazards such as cooling towers.

B. Special Documentation Requirements

1. All site drawings shall be drawn in the same scale.

C. Materials and Methods of Construction

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02XXX SITE SURVEY

1. Early in the design process, the University will provide site surveys to the A/E. Surveys will be prepared by a licensed surveyor and will indicate, to the best knowledge of the surveyor, the surface features of the land, including contours, improvements and all subsurface improvements readily ascertained from the surface without excavation, and will include information available from the University and by municipal sources on underground utilities. The University cannot guarantee the accuracy of the information contained in the survey. The A/E shall verify locations of all underground utilities.
2. Survey drawings shall be included in a set of documents and shall be plainly marked "For Information Only" in appropriate size letters.

02010 SUBSURFACE INVESTIGATION

1. The University will provide to the A/E geotechnical services performed by a New Jersey licensed soils engineer, including boring logs, engineering analysis and recommendations based upon the A/E's preliminary plans. The University cannot be held responsible for the accuracy of these soils investigations, and they are provided as a guide to the A/E in design of the project. The A/E will assist the University by providing a general plan of the area to be investigated and indicating locations where borings are required. At least two borings will be requested for parking lot areas and major roadways, in addition to the borings requested for the building itself. The minimum borings for a building shall be six, with one boring for every 2,500 sq. ft. of built-over area. Borings shall be to depth no less than the expected depth of excavation for the project.
2. Copies of only the boring logs will be included in the project manual or shown on the drawings. The logs shall be marked "For Information Only" in appropriate letters.
3. All excavation for Rutgers University projects shall be unclassified excavation, meaning that whatever material is encountered during excavation must be removed. If the soils reports indicate large quantities of rock at the elevations of the building footings, this procedure may be modified, with the permission of the Project Manager. The Contractor shall be instructed to stop excavation if anything of archaeological value is encountered.

4. The University will hire a Soils Engineer to perform inspection and testing of all earthwork. Soils Engineer shall be a Professional Engineer licensed in the state of New Jersey and possess professional liability insurance in the minimum amount of \$500,000. Soils Engineer shall provide all field and laboratory services required to:
 - a. Test and evaluate all samples of proposed fill materials to determine optimum moisture density relationship in accordance with ASTM D 1557.
 - b. Test all samples to assure compliance with gradation requirements of this Specification. Grain size analysis shall be performed in accordance with ASTM D 422.
 - c. Determine depth of topsoil stripping.
 - d. Inspect all proof rolling and determine the presence of any local soft pockets.
 - e. Inspect excavation in natural soil to determine if bearing stratum meets design criteria.
 - f. Inspect and test compacted fill to determine compliance with these Specifications. ASTM D 1556M, ASTM D 2167 or ASTM D 2922 shall determine Field densities.
 - g. Keep written records of all tests and field instructions, and summaries of these reports shall be mailed weekly to A/E, University, University Code Official, and Contractor. Final written summaries shall be provided upon completion of work.
5. Foundation elevations shall be shown at elevation of suitable bearing.
6. Prior to performing any excavation, call (1-800-272-1000) for Utility mark outs.

02221 BUILDING DEMOLITION

A. Design Considerations

1. When a building is to be demolished, without new construction in its place, all foundation walls shall be removed to a point 3'-0" below grade. All basement slabs below the 3'-0" level need not be demolished, but must be broken into approximately 4' square areas or less to allow drainage of water.

2. Through the Project Manager, REHS must be contacted for an asbestos determination. Any asbestos containing materials shall be removed prior to demolition activities.
3. Prior to any demolition of basement floors or making connections into old underground waste systems it is required that REHS and the Rutgers University Utilities Department be contacted.

B. Special Documentation Requirements

1. Require the Contractor to hire the services of a New Jersey licensed surveyor to document the location of all foundations left in place below the 3'-0" location, as well as abandoned utilities, and utilities relocated as required by the demolition work. Survey shall become part of the as-built drawing requirements of the Contractor at completion of the work.

C. Materials and Methods of Construction

1. All demolition debris shall be removed from the University property and disposed of by lawful means. Refer to Division 1 of these Design Standards for construction waste management and recycling requirements. Backfill of buildings shall be with clean fill, compacted to at least 95% minimum density for cohesive material and 95% relative density for cohesionless material. Area shall be topsoiled and seeded unless otherwise directed by the Project Manager.
2. All utilities shall be cut and capped. The location of the preceding cuts / caps shall be annotated on the as-built survey provided by the Contractor.
3. Concrete, block, or brick must be broken up to the point where it will minimize voids in the fill. Although this size is interpretative, a good rule of thumb is 8 inches in diameter.

02060 UNDERGROUND TANK REMOVAL

1. For information and specifications on removal per Rutgers requirements, see the Project Manager. REHS shall be contacted for all tank removals.
2. See Division 15, Section 15483.
3. All site drawings shall be drawn in the same scale.

02070 SELECTIVE DEMOLITION OF ROOFING

1. “When laboratory testing determines that asbestos containing roofing and/or flashing material exists and is to be removed, the A/E shall refer to Sections 02071 (applicable to asbestos containing roofing) or 02072 (applicable to asbestos containing flashing only) for specification requirements.”
2. Existing roofing membrane(s), membrane flashings and vapor retarder materials are to be tested for the presence of asbestos. The A/E is responsible for taking samples, in quantities and locations sufficient to meet the requirements of Rutgers Environmental Health and Safety (REHS) Department. Sample locations should be combined with the roofing material testing required in Item #A.1 above, to minimize the total number of test locations taken on the roof. REHS shall be notified in advance and will have a representative present during sampling. Samples taken by the A/E shall be turned over to the REHS representative. REHS will be responsible for the laboratory testing of all samples and the results will be provided to the A/E for use in preparing the appropriate construction documents.

02071 REMOVAL OF ASBESTOS CONTAINING ROOFING MATERIAL

A. Design Considerations

1. All Contract Documents shall adequately address the proper removal, transportation and disposal of ACRM. In addition, for purposes of future risk management, Rutgers has developed procedures and requirements that may exceed current regulatory requirements concerning ACRM, which must also be incorporated into the Contract Documents for any project where ACRM exists and will be removed. The requirements of this section apply when roofing material in the “field” of the roof contains asbestos and is being removed, whether or not the flashing material contains asbestos.

B. Special Documentation Requirements

1. Section 02071, located in Part IV of this Manual, has been prepared by Rutgers and is to be included, as written, in the Project Manual for all projects involving the removal of ACRM. With the exception of “style” changes, paragraph 1.1.B is the only paragraph the A/E is permitted to modify for content, unless specifically approved in writing by the Asst. Vice President for Planning and Development and the Director of Rutgers Environmental Health and Safety department.

C. Materials and Methods of Construction

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02080 PIPED UTILITIES – BASIC MATERIALS AND METHODS

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02085 INTERCEPTORS

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02090 ENVIRONMENTAL PLANNING AND DESIGN

All Rutgers earth disturbance projects, regardless of size, must comply with all applicable State of New Jersey and Federal environmental permitting regulations. University Facilities Planning and Development (Planning) is the designated liaison between the Federal and New Jersey State environmental review agencies and the University and its assigns. All projects must be submitted to Planning for review at the designated phases (see Attachment 2 for review schedule).

Planning will conduct an environmental review of the project to determine the necessary environmental compliance requirements. Planning will assist in the application submission and/or will request an environmental consultant in some instances. Planning is the official signature for Rutgers and as such must approve and sign the application forms, submit the application package and act as the liaison with the appropriate environmental review agency.

University review procedures and criteria checklists have been developed to facilitate environmental permitting. Planning staff is available to the university community for consultation.

Environmental compliance is required on all earth disturbance activities on Rutgers owned or leased lands including, but not limited to:

- Construction projects by campus personnel and outside contractors
- Operations and maintenance activity by campus personnel and outside contractors
- All earth disturbance including:
 - New Construction
 - Renovations
 - Utility Projects
 - Landscape Projects

1. Soil Erosion and Sediment Control Act, Chapter 251:

A. Design Considerations

The State of New Jersey enacted the Soil Erosion and Sediment Control Act, Chapter 251 in order to prevent and/or eliminate non point source pollution from construction projects. Specific design guidelines can be obtained through the appropriate soil conservation district or through the University Facilities Office of University Planning and Development (Planning).

Projects on Rutgers owned or leased lands disturbing greater than 5,000 square feet of earth must have a soil erosion and sediment control certification prior to construction start, however, all Rutgers construction projects regardless of their size must comply with this Act. Projects less than 5,000sf do not need certified plans prior to construction start, but still must be reviewed by Planning for compliance. Failure to comply with this regulation can result in fines and or work stoppage.

B. Special Documentation Requirements

Rutgers requires that the A/E (Consultant) provide the University Facilities Office of University Planning and Development (Planning) the necessary documents to file with the appropriate Soil Conservation District (SCD) at least 90 days prior to any land disturbance. By law the SCD has 30 days to review the project. If the project requires additional information, the SCD has an additional 30 days. This process can continue until the SCD is satisfied with the submitted documents. The documents required for permitting include soil erosion and sediment control plan(s),

soil erosion and sediment control details and runoff calculations.

The specific requirements can be obtained through the appropriate soil conservation district. In order to ensure a timely and expeditious certification process, Planning strongly encourages its involvement throughout the entirety of the project. Please see attachment 2 to view the entire environmental permitting process and Planning's role. The Consultant will be responsible for any changes required by Rutgers or the soil conservation district if the plans are deemed not in compliance with the soil erosion and sediment control standards. Once the Consultant completes the final 100% soil conservation district application submission package, it shall be remitted to Planning who will file the certification package and be the prime contact with the soil conservation district. Construction can only proceed after the soil conservation district issues a partial report of compliance. If the project is changed for any reason after the project is certified by the SCD, the plans must be recertified through a revision process led by Planning. All submissions to the SCD's must be signed and sealed by a New Jersey State Licensed Professional Engineer.

C. Materials and Methods of Construction

72 hours prior to any soil disturbance, the contractor shall notify the SCD. The certified soil erosion and sediment control plans must be kept at the construction site at all times. The SCD and Rutgers makes random site inspections to ensure soil erosion and sediment control compliance. The contractor must allow the SCD and/or Rutgers access to all construction site areas. If the inspection reveals a violation of the soil erosion and sediment control standards, a notification will be issued by the SCD and/or Rutgers detailing the site deficiencies or violation(s). Upon receipt of the letter, the contractor will have 5 working days to remediate that violation or the SCD and/or Rutgers may suspend any work, issues fines or other penalties until the deficiencies are corrected.

If the project is a building construction or renovation, a temporary certificate of occupancy can only be issued after the SCD issues a temporary report of compliance.

The project is not completed until the SCD issues a complete report of compliance. This is issued when permanent stabilization has been established (usually after one complete growing season) and all details on the certified soil erosion and sediment control plans are properly installed.

Site stabilization has become especially prudent as strict New Jersey Department of Environmental Protection (NJDEP) and Federal Environmental Protection Agency (EPA) stormwater regulations took effect early in 2004.

If the project does not require a SCD certification, the project must at a minimum include the following measures:

1. Silt fences on the downslope side
2. Tracking pad to prevent soil on construction vehicles' wheels from leaving the site
3. Storm sewer inlet protection
4. Street cleaning
5. Tree Protection

Upon construction completion, the area must be at a minimum:

1. Mulched
2. Tacked
3. Reseeded with perennial grasses or as directed by the University Horticulturist or the University Landscape Architect.

2. New Jersey Department of Environmental Protection (NJDEP) Phase II Stormwater Management Regulations:

As a requirement of the U.S. Environmental Protection Agency's Phase II rules, the NJDEP developed a stormwater regulatory program to establish minimum design and performance standards to address stormwater runoff from new development and redevelopment projects. The Phase II rules require that Rutgers incorporate minimum control measures into their designs for new development and redevelopment projects. The purposes of these rules are to promote the health, safety and welfare within the University and its watershed by minimizing the harm to the environment by stormwater from campus through provisions designed to:

- A. Manage stormwater runoff impacts at their source by regulating activities that cause the problems by using minimum structural controls, relying on natural processes.
- B. Provide review procedures and performance standards for stormwater planning and management.
- C. Utilize and preserve the existing natural drainage systems to the maximum extent practical.
- D. Focus on infiltration of stormwater, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.

- E. Meet legal water quality requirements under N.J.A.C. 7:8.
- F. Maintain existing flows and quality of streams and watercourses
- G. Provide for proper operations and maintenance of all permanent stormwater management best management practices that are implemented on University property.
- H. Prevent scour and erosion of stream banks and stream beds.

A. Design Considerations

The design shall comply with the applicable design and performance standards established under N.J.A.C. 7:8 for major development at a public complex (Rutgers University) unless determined exempt by the Facilities Office of University Planning and Development. The stormwater design shall incorporate to the maximum extent practical Best Management Practices-Low Impact Development Techniques as stipulated in the New Jersey Stormwater Best Management Practices Manual, April 2004. The stormwater design shall be incorporated into the project's site design at the earliest possible design phase. Rutgers Planning shall ensure the design's compliance with all applicable rules, laws, regulations and master planning guidelines.

Low Impact Development-Best Management Practices are:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss
2. Minimize impervious surfaces and break-up and disconnect the flow of runoff over impervious surfaces
3. Maximize the protection of natural drainage features and vegetation
4. Minimize the decrease in "time of concentration" from pre-construction to post construction. "Time of Concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of interest within the watershed.
5. Minimize land disturbance including clearing and grading
6. Minimize soil compaction

7. Provide low-maintenance landscaping that encourages retention of planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides
8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas.
9. Provide other source controls to prevent or minimize the use of exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff.
 - a. Site design features that help to prevent accumulation of trash and debris in drainage systems
 - b. Site design features that help to prevent discharge of trash and debris from drainage systems
 - c. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants

B. Special Documentation Requirements

Several documents are required for individual projects that trigger the Phase II stormwater rules. These include:

1. A signed and sealed public complex low impact development checklist shall be submitted as part of the project's deliverables (see attachment 3)
2. Stormwater narrative showing reductions in stormwater runoff on the 2-10-100 storm events (review section N.J.A.C. 7:8 for more detailed information)
3. Maintenance plan if best management practices-low impact development techniques are utilized
4. Other documentation as determined by the University Facilities Office of Planning and Development

C. Materials and Methods of Construction

Construction methods and materials should be consistent with the N.J.A.C. 7:8 stormwater regulations, Rutgers Stormwater and Landscape Management Master Plan, recommendations by the University Landscape Architect, the University Horticulturist and the Rutgers University Facilities Planning and Development Department. The plant palette and related materials should be consistent with the project site's soil type as determined by a soil

analysis and the United States Department of Agriculture Natural Resources Conservation Service.

Construction materials will be determined by NJDEP stormwater guidelines, including the standard storm drain inlet (see attachment 4) the University Design Standards, and as determined by the project's site conditions. Final review and approval of all construction methods and materials will be done by Rutgers.

3. New Jersey Pollution Discharge Elimination System (NJPDES) General Permit No. NJG0088323 Stormwater Discharge associated with Construction and Mining Activity:

The Statewide stormwater permitting program for construction and mining activity, regulated by the NJDEP, is intended to improve the State's water quality of streams, rivers, etc, by regulating construction practices. Its purpose is to prevent or reduce waste and waste handling. The permit is enforced by a joint effort of the soil conservation district and the NJDEP

The construction general permit authorization regulates all construction site activities on sites greater than 1 acre of disturbance, including clearing and grading, material storage, waste handling. The construction site waste requirements include material management to prevent or reduce waste and waste handling. Construction site waste include, waste building material and rubble, chemical waste, litter, sanitary sewage and septage, contaminated soils and concrete truck washout. Waste handling will also include spill and discharge control and reporting.

A. Design Considerations

The permit must be filed at least 90 days prior to land disturbance in conjunction and along with the soil conservation district's soil erosion and sediment control certification. The projects design and construction site management must keep in mind all roll-off dumpsters and/or other waste containers must be at least 50 feet from any stormwater day lighted conveyance system, must be covered and all waste must be separated by type and to the maximum extent practical recycled.

If this permit is required the A/E shall prepare all necessary documentation such that the permit can be obtained at 90% design completion. See Soil Erosion and Sediment Control Plan section above for details on sequencing this work.

B. Special Documentation Requirements

The contractor or their designate will be required to fill out a report of compliance on a weekly basis and at the project's completion. At project's end, the weekly compliance reports and final compliance reports must be submitted to Rutgers signed by the contractor signifying that all permit requirements have been fulfilled. (See Attachment 1.)

4. Environmental Permitting (Other):

Regulatory compliance reviews shall be completed in conjunction with Rutgers University Facilities Planning and Development Department on all projects with a potential for any environmental impacts to the outdoor (natural) environment regardless of project size. Projects requiring such reviews include, but are not limited to, those involving wetlands issues; coastal or waterway impacts during or following construction; or projects that will significantly change land use. During the review, Rutgers Facilities Department of Planning or its designee will:

- Ensure compliance with all Federal and State environmental regulations
- Ensure protection of natural resources, including wetlands, waterways and open space
- Review all plans and projects with potentially significant impacts to the natural environment
- Act as the liaison between Federal and State Environmental review agencies and Rutgers.
- Act as the liaison with environmental consultant, design team and Rutgers.

All construction projects regardless of size must be reviewed by the Planning for a determination of regulatory requirements.

Potential regulations include:

- Freshwater Wetlands Protection Act:

New Jersey's Freshwater Wetlands Protection Act was enacted in 1987 and is codified at NJSA 13:9B-1et seq. If a freshwater wetland is suspected, a licensed surveyor and environmental consultant will be retained to provide all plans and documentation necessary for compliance approvals. Design will accommodate found wetlands and their attendant transition areas and appropriate permit applications and mitigation plans will be applied for and secured prior to bid of project.

- Flood Hazard Control Act:

The Flood Hazard Control Act (NJSA 58:16A-50 et seq.) These rules set forth uses permitted and prohibited in flood plains. All watercourses no matter how small have a flood plain. Rutgers desires to limit the development in a floodplain. If development of a flood plain is determined necessary a licensed surveyor and environmental consultant will be retained to provide all plans and documentation necessary for compliance approvals. Design will limit impervious cover within the flood plain and flood fringe and appropriate permit applications and or mitigation plans will be applied for and secured prior to bid of project.

- Stream Encroachment Permit:

If the project will impact a stream or drainage swale, a stream encroachment permit issued by the New Jersey Department of Environmental Protection may be required. If a stream is encountered, then the attendant stream encroachment permit application shall be made using the services of a licensed surveyor and or environmental consultant. The permit shall be secured prior to bid of the project.

- Coastal Area Facilities Review Act:

The Coastal Area Facilities Review Act (CAFRA, NJSA 13:19-1 et seq.) CAFRA is the legal foundations for implementation of the state's coastal zone management program federally mandated under the Coastal Zone Management Act (16 USC 1451 et seq.) CAFRA regulates construction activities on or near a beach or dune in certain counties in New Jersey. If a Construction project is proposed on or near a beach or dune a licensed surveyor and environmental consultant will be retained to provide all plans and documentation necessary for compliance approvals.

On occasion, a project will require permits from multiple agencies, including the Army Corps of Engineers, Coast Guard, NJDEP, EPA, and others. If these permits are required the application(s) shall be made using the services of a licensed surveyor and or environmental consultant. The permit(s) shall be secured prior to bid of the project.

- Other regulations, rules, guidelines and/or laws.

5. Stormwater Drainage Systems:

A. Design Considerations

The design for all stormwater systems should meet all State and Federal laws, rules and regulations.

The storm drainage system should be designed for positive drainage away from all surface structures that are not intended to receive drainage such as building foundations, manholes, cleanouts, fire hydrants, valve boxes, light poles, junction boxes, conduit, etc.

Volume and velocity calculations for stormwater running onto the site in addition to the anticipated runoff from the site must be prepared early in the design process. These calculations are a requirement as part of the environmental rules, laws and regulations as stated elsewhere in this section and are required by Rutgers for any project that will alter the existing drainage patterns. Additionally, Rutgers may require a survey with topography to better understand the existing drainage patterns. All projects must also conform to the Stormwater and Landscape Management Master Plan. Projects that alter drainage include curbing, sidewalk installation, paving projects, etc.

Designs should incorporate to the maximum extent practical best management practices-low impact development (see section 2—stormwater drainage systems above)

Drywells shall only be used when they can be connected to an existing stormwater conveyance system

Stormwater systems shall at no time be connected to a sanitary system

All stormwater systems shall be designed to the 100-year storm unless otherwise indicated by a New Jersey licensed professional engineer.

All catch basins, storm manholes, inlets, and all other structural stormwater collection systems shall be designed in accordance with industry standards or the recommendations by Rutgers Utilities, The Office of the University Architect, Rutgers Facilities Office of Planning or other University department.

Storm drain design and retrofit shall be in accordance with Attachment C of the NJPDES Master General Permit (See Attachment 4).

No stormwater drainage system shall have standing water lasting longer than 72 hours unless specifically designed to accommodate ponding and if determined desirable by Rutgers University.

Maintenance of storm drainage systems:

University owned drainage control, flood control, and erosion control facilities shall be regularly maintained. Accumulations of silt, trash, litter, or stagnant water which create a health or safety hazard or which endanger the design function of the facility are not permitted. Excessive growth or accumulation of woody vegetation in channels, swales, retention and detention systems, and on dams and levees, shall not be permitted. Active erosion due to wind or water associated with drainage control, flood control, and erosion control facilities shall not be permitted. The drainage control, flood control and erosion control facilities shall be repaired in a timely fashion if damage to the system.

B. Special Documentation Requirements

A maintenance log documenting the inspection of all the stormwater drainage system components is required on an annual basis.

C. Materials and Methods of Construction

The storm drainage system shall be constructed in accordance with the aforementioned rules and regulations and as determined by Rutgers Facilities.

Where down spouts are utilized, these should be tied into adjacent storm drainage.

Road grates shall be Campbell Foundry Company #2617, or approved equal. These grates are bicycle safe grates. See Attachment 4 for additional information.

Materials and methods of construction will be dictated by the rules and regulations that govern stormwater management and soil erosion and sediment control. If there are ambiguities with regard to the methods and materials, Rutgers Facilities will review

proposed solutions and have final decision on any construction method or material used.

Attachment 1— Construction Site Compliance Report Weekly and Final

Attachment 2— Environmental Permitting Procedures for Capital Projects

Attachment 3—Public Complex Stormwater General Permit Post-Construction Program Design Checklist for Individual Projects

Attachment 4—Design Standards—Storm Drain Inlets (Attachment C of Rutgers Phase II Stormwater General Permit)

NOTE: ATTACHMENTS WILL BE PROVIDED BY THE UNIVERSITY OFFICE OF PLANNING AND DEVELOPMENT, UPON REQUEST.

02100 SITE PREPARATION

1. Topsoil shall be stripped to the depth determined by the Soils Engineer, usually not less than 4". Topsoil shall be stockpiled in accordance with the requirements of the Soil Conservation District in locations as directed by the A/E, or elsewhere on University property. Under no circumstances shall topsoil be removed from University property. Topsoils shall not be mixed with subsoils or other site debris.
2. Where site demolition is required, provide site demolition drawings showing extent of removal of vegetation, trees, shrubs and other improvements such as sidewalk, parking areas, etc.

02231 TREE PROTECTION, TRIMMING AND REPLACEMENT

A. Design Considerations

1. The Contractor, while working the site, is responsible for protecting all existing trees to remain such that they will be free from any damage. If damage is done, the Contractor shall be responsible for replacement of damaged trees. All existing trees to remain affected by construction activities shall be protected with temporary chain link fencing per the detail in Part IV, to the drip line of the tree.

B. Special Documentation Requirements

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C. Materials and Methods of Construction

1. Tree replacement and protection is as follows, and at the direction of the Campus Landscape Architect or University Horticulturalist:

TREE PROTECTION/REPLACEMENT SPECS

- a. Contractor shall take all precautions necessary to protect existing trees scheduled to remain against injury or damage, including cutting, breaking, or skinning of roots, trunks or branches; smothering by stockpiled construction materials, excavated materials or vehicular traffic within branch spread.

- 1) Interfering branches of trees scheduled to remain may be removed when acceptable to the University Architect and Campus Landscape Architect. It cannot be assumed that permission will be granted. The Contractor must obtain permission from University Facilities prior to such activities.

- 2) Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to University Facilities. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

- b. Should an existing tree be damaged to the extent that it is deemed to be a complete loss by University Facilities, or if, due to the Contractor's negligence, a tree on the construction site dies within one year of project completion, the Contractor shall replace the tree according to the following requirements:

- 1) Tree Replacement Formula: One square inch of caliper lost will equal one square inch of caliper replaced. This formula is based on tree trunk diameter at breast height. Example: loss of one 12" caliper (same as 6" radius) tree would require replacement with nine (9) 4" caliper trees. [Area of Circle = $3.14 \times r^2 = 3.14 \times (6^2) = 3.14 \times (36) = 113.04$ sq. in. Assuming 4" caliper trees (same as 2" radius) will be planted as replacements, calculate the area of a 4" caliper tree: $3.14 \times (2^2) = 12.56$ sq. in. Divide the area of the 4" caliper tree into the area of

the 12" caliper tree to determine the number of 4" caliper trees required to replace the loss of the 12" caliper tree. $113.04/12.56= 9$ trees.]

2. Installation: Contractor will be responsible for planting the replacement tree(s) at a location designated by the OFD. Installation practices and a one-year guarantee shall hold as described in Section 02900 -Landscaping.
 3. Materials: The replacement tree(s) shall be of the same species and variety as the tree(s) lost, or of a species and variety identified by the Campus Landscape Architect. If the species and variety is not available, a substitute must be proposed in writing to University Facilities and approved by university Facilities. The Contractor will be notified of approval of substitution within seven days. Minimum caliper of replacement tree(s) shall be 2 ½ - 3".
- c. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at Contractor's expense.

02300 EARTHWORK

A. Design Considerations

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B. Special Documentation Requirements

1. This section of the Specifications shall contain all earthwork requirements for the project. Divisions 15 and 16 shall cross reference the Division 2 Earthwork Section. Do not repeat or reiterate earthwork requirements in Division 15 or 16 as this may cause conflicts and confusion.

C. Materials and Methods of Construction

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02510 WATER DISTRIBUTION

A. Design Considerations:

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B. Special Documentation Requirements:

1. A CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND PIPE shall be completed and submitted by the Contractor to the University Construction Code Official, Factory Mutual Engineering, and the Office of Facilities Project Administration Representative responsible for the project on an approved form. The contractor shall provide a hydraulic design placard at the main riser base.

C. Materials and Methods of Construction:

1. FIRE PROTECTION:
 - a. Reference Standards: Installation of underground fire protection mains shall comply with the following standards:
 - 1) NFPA No. 24, *Private Fire Service Main and Their Appurtenances*
 - 2) Factory Mutual Data sheet 3-10, *Fire Service Mains*
 - b. Underground mains shall be cement lined ductile iron mechanical joints. Retaining glands shall be the mechanical joint wedge action type.
 - c. Depth of Cover: The depth of cover over fire protection water mains shall be not less than 4 1/2 feet, measured from the top of the pipe to finished grade.
 - d. Pipe Joints: All bolted joint assemblies shall be cleaned and thoroughly coated with asphalt or other corrosion-retardant material after installation of the assembly and prior to inspection and backfilling.
 - e. Anchoring: Mechanical joints shall be utilized on all tees, plugs, hydrant branches and bends. These joints on underground pipe shall be restrained against movement. Restraint shall be via thrust blocks, and/or rods and clamps.

f. Thrust Blocks: Thrust blocks shall be provided at all tees, plugs, caps, bends and hydrants and shall be of concrete mix having not less than 2,000 psi strength at 28 days. Thrust blocks shall be poured between the underground pipe and undisturbed earth, leaving the pipe joint accessible for inspection and repair, and not obstructing the fire hydrant drain ports. Thrust blocks shall be sized in accordance with table 8-6.2.7 of NFPA-24.

g. Flushing: Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made to sprinkler, standpipe, or other fire protection system piping in order to remove foreign materials which may have entered the pipe during the course of the installation. The minimum rate of flow shall be not less than the demand rate of the system or the following rates, which ever is the greater:

Pipe Size	Flow Rate
4"	400 gpm
5"	600 gpm
6"	750 gpm
8"	1000 gpm

h. Fire Hydrant: The University standard fire hydrant is Model A-423 (Centurion), manufactured by the Mueller Company. The hydrant shall contain one 4-1/2" National Standard Fire Hose Thread (NST) pumper outlet and two 2-1/2" NST hose outlets. The pumper outlet shall be adjusted to face in the direction prescribed by the University Construction Code Official, and such adjustment, if necessary, shall be made by the installing contractor prior to acceptance of the installation by the University Construction Code Official.

- 1) All fire hydrants shall be set on a gravel bed of at least 12" deep, minimum to ensure quick drainage from the ports provided near the base of the hydrant barrel.
- 2) The center of the pumper connection shall be not less than 12" above final grade.

i. Inspections and Tests: No underground fire protection pipe assembly or fire hydrant shall be backfilled prior to

inspection and approval of the installation by the University Construction Code Official or his designee.

- 1) A hydrostatic test shall be performed on the underground fire protection pipe assembly upon completion of the installation. All components, such as valves, fittings, hydrants, etc. shall be installed prior to the final test. The Contractor may conduct preliminary testing for his benefit; however the University will not accept such preliminary testing in lieu of the final required inspections and tests. The hydrostatic test shall be performed for not less than two hours, and shall be witnessed by the Construction Code Official or his designee. A Utilities representative should also witness the hydrostatic test.

2. DOMESTIC WATER:

- a. Water mains 3" and above shall be ductile iron cement lined, mechanical joint with wedge action retaining glands.
- b. All fittings shall be mechanical joint with wedge action retaining glands.
- c. Cover exterior pipes per Factory Mutual requirements (or minimum 3'-6")

02525 WATER SUPPLY WELLS

RESERVED

02530 SANITARY SEWERAGE

A. Design Considerations:

RESERVED

B. Special Documentation Requirements:

RESERVED

C. Materials and Methods of Construction:

1. Hubless cast iron pipe is not acceptable below grade.
2. Minimum cover under roads for Sanitary Sewer systems shall be 3'-6" and minimum slope shall be 1" in 15'-0" (.55% slope).
3. All new sanitary lines shall go to a manhole.

02532 PACKAGED PUMPING STATIONS

RESERVED

02535 CHEMICAL WASTE STORAGE

RESERVED

02540 SEPTIC TANK SYSTEMS

RESERVED

02552 GROUND-LOOP HEAT PUMP PIPING

RESERVED

02551 HYDRONIC DISTRIBUTION

A. Design Considerations:

RESERVED

B. Special Documentation Requirements:

RESERVED

C. Materials and Methods of Construction:

1. LOW TEMPERATURE HOT WATER:
 - a. Underground low temperature hot water piping 2" and smaller should be socket weld and Schedule 80 carbon steel.

- b. Foam glass insulation with Multi-Therm outside jacket or approved equal shall be used on underground low temperature hot water pipe.
2. CHILLED WATER:
- a. Underground Chilled Water mains 3" and above shall be ductile iron cement lined, mechanical joint with wedge action retaining glands.
 - b. All underground chilled water fittings shall be mechanical joint with wedge action retaining glands.
3. HIGH TEMPERATURE HOT WATER:
- a. Certified welders are required for HTW work or high pressure work.
 - b. All new H.T.H.W. systems should be the Multi-Therm 500 Perma-Pipe System.
 - c. Do not use sheet metal sleeves through outside walls. Sleeves shall be pipe conforming to ASTM A 120. At outside walls provide "leak plate" and install "Linkseal".
 - d. Minimum cover for High Temperature Hot Water (HTHW) lines shall be 4'-0" from top of pipe to finished grade. Road crossing shall have a reinforced concrete slab 8" thick or cover shall be extended to 6'-0" below road surface.
 - e. For additional high temperature hot water piping requirements refer to *Section 15181 – Hydronic Piping*.

02553 NATURAL GAS DISTRIBUTION

RESERVED

02554 FUEL OIL DISTRIBUTION

A. Design Considerations:

RESERVED

B. Special Documentation Requirements:

1. All documentation requirements shall be coordinated with REHS.

C. Materials and Methods of Construction:

1. Underground Storage Tanks:
 - a. All Installations, Modifications and Upgrades of Underground Storage Tank (UST) Systems shall be done in accordance with the UST regulations as required by the New Jersey Administrative Code (N.J.A.C.) 7:14B. Any questions concerning Environmental Regulations governing the removal or remediation of UST's should be addressed by contacting Rutgers Environmental Health and Safety Department.
 - b. Use # 2 fuel oil type systems.
 - c. All new underground tank installations shall consist of double wall underground tank with a primary welded steel tank and a secondary FRP laminate outer tank, as manufactured by Plasteel Elutron or approved equal. The tank shall meet all required UL and Factory Mutual standards. At a minimum, the tank shall include a tank access manway, piping sump, fill port, interstitial monitoring port and vent connections.
 - d. The hold-down concrete pad shall be sized to prevent the underground tank from floating. Preferred backfill material is pea gravel. However, the backfill material shall be as confirmed with the equipment manufacturers.
 - e. All product piping shall be double wall piping system. All components of the piping system shall be made of non-corrosive materials, or if metallic, such as fittings and couplings, isolated from corrosion causing agents. The piping shall be sloped back to the sump mounted on the underground tank and monitored by the tank monitoring system.
 - f. All underground vent piping shall be non-corrosive, non-degradable, and resistant to attack from microbial growth. The piping shall have sufficient strength to withstand

design underground burial loads. Above ground vent riser piping shall be Schedule 40 galvanized steel piping.

- g. All tank systems shall include a tank monitoring system. The system shall monitor the interstitial of the underground tank, the interstitial of the underground piping, and the amount of product in the tank. The system shall also be capable of performing tank tightness tests. Audible and visual alarms shall be a part of the monitoring system. The monitoring system shall be a Veeder Root TLS 350. For tank installations 1,000 gallons or smaller, a Veeder Root TLS 300 may be used.
 - h. The tank shall include a grade level spill containment manhole with a cover color-coded to meet NJDEP regulations.
 - i. The vent line shall include an overfill prevention valve.
 - j. A concrete pad shall be appropriately designed and installed over the tank at grade level to protect the tank from anticipated loading.
 - k. All above ground tanks shall be a double wall tank with an interstitial monitoring port or shall be a tank inside a self contained dike. The double wall tanks may be a concrete encased steel tank or a double wall steel tank. The secondary tank shall be 110% of the primary tank capacity. If a self-contained dike is used, provisions must be made to keep water from collecting inside the dike. The dike shall be sized to maintain 110% of the tank capacity. All above ground tanks must meet UL and Factory Mutual standards. A tank tightness test shall be conducted on each tank and its associated piping after completion of the installation.
2. Manufacturers of oil storage tanks, piping and appurtenances must be approved by Rutgers.

02555 STEAM DISTRIBUTION

RESERVED

02565 LIQUID PETROLEUM GAS DISTRIBUTION

RESERVED

02620 SUBDRAINAGE

RESERVED

02630 STORM DRAINAGE

A. Design Considerations

1. During design identify and calculate stormwater running onto the site in addition to the anticipated runoff from the site. Prepare calculations to support a stormwater system of capacity to control both. Calculations shall be prepared early in the design process and be integral in the establishment of finish exterior elevations.
2. Trench type storm drains are to be avoided.
3. Road grates shall be Campbell Foundry Company #2617, or approved equal. These grates are bicycle safe grates.
4. The top of lawn grates shall be set 1/2" below finished grade level to facilitate drainage. Lawn grates shall be round.
5. Specify that Contractor shall clean interior of piping after installation.
6. Manholes: Specify precast concrete, 4000 psi minimum with rubber gasket joints. Wall to be 5" thick with aluminum drop front ladder rungs, 12" oc.
 - a. Base, as a minimum, shall be 6" thick with #4 bars 12" o. c. both ways. Manhole openings shall be 30" diameter with roadway type frame and cover by Campbell or Neenah Foundries, or approved equal. Entire interior concrete surface shall receive 2 coats "Drycon" as manufactured by I. P. A. Systems, Inc. See sketch in Part IV.
7. Where down spouts are utilized, these should be tied into adjacent storm drainage.

02666 POND AND RESERVOIR LINERS

RESERVED

02525 GRANITE CURBS (MOVE)

1. The University preferred curbing material is granite “Belgium Block” curbs. Decision concerning the use of concrete or granite curbs is a function of cost and existing conditions. Check with the University Architect for determination.
2. All granite curbs shall conform to the standard granite curb detail shown in Part IV of this Manual. Concrete used with granite curbs shall be formed of minimum 4500 psi concrete.

02528 CONCRETE CURBS (MOVE)

1. The University preferred curbing material is granite “Belgium Block” curbs. A decision concerning the use of concrete or granite curbs is a function of cost and existing conditions. Check with the University Architect for determination.
2. All exterior concrete shall be air entrained. Where concrete curbs are required, they shall conform to the standard concrete curb detail shown in Part IV of this Manual. Concrete curbs shall be formed of minimum 4500 psi concrete.

02741 HOT MIX ASPHALT PAVING

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

VALUE PAVEMENT TYPE	MIN. CBR	TYPE	TYPE & THICKNESS OF BASE COURSE	TYPE & THICKNESS OF SURFACE COURSE
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<p>Type A Light Duty Traffic: Sidewalks, Multi-use pathways, play surfacing.</p>	<p>10</p>	<p>Mix HMA 9.5mm P.G. 64-22 3" in 2 lifts</p>	<p>NA</p>
<p>Type B Medium to Heavy Duty vehicular traffic. Automobile and Truck</p>	<p>10</p>	<p>Mix HMA 19mm P.G. 64-22 5" in 2 lifts</p>	<p>Mix HMA 12.5 P.G. 64-22 2" in 1 lifts</p>
<p>Type C Heavy Duty Traffic. Roads with heavy truck and bus traffic.*</p>	<p>10</p>	<p>Mix HMA 19mm P.G. 76-22 9" in 4 lifts.</p>	<p>NA</p>

Refer to New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, Division 900- Materials for mix descriptions

***Shall also include all access roadways used for service and emergency vehicles.**

02751 CEMENT CONCRETE PAVEMENT

A. Design Considerations

1. In general all permanent sidewalks shall be poured concrete. If temporary walkways are required, they may be asphalt. Concrete will not be accepted if graffiti is present. Concrete with graffiti or other defacement shall be removed by the Contractor and replaced at Contractor's expense.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. Rutgers' standard sidewalk is minimum 6' wide, constructed of 4500 psi air entrained concrete reinforced with 6 x 6 #10 welded plain cold drawn steel wire fabric, with hand wood float finish (see detail in Part IV). Sidewalks shall be minimum 4" thick, on compacted base of naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand, Type I-5 complying with NJDOT.
2. Transverse contraction joints shall occur at a maximum of 8' - 0" on center for 6' - 0" wide sidewalks. Transverse expansion joints with premolded joint fillers shall occur at a maximum of 24'-0" on center. Premolded joint fillers shall be 1/2" thick asphalt impregnated fiber board conforming to ASTM C 1751. Contraction joints shall be made with tools that provide slightly curved edges and no flats on the surface of the sidewalk. See scoring detail for University pattern in Part IV, Standard Details section of this Manual.

02810 IRRIGATION SYSTEMS

A. Design Considerations

1. All new buildings shall have interior piping and fixtures installed to accept an irrigation system whether the exterior irrigation system is to be part of the new building construction or not. Preparation shall include a location within an appropriate Mechanical or Electrical Equipment Room for a controller, with designated circuit breaker, pipe sleeves through the foundation, and empty 1" conduit with pull rope to a point 5' outside the building, 3' - 0" below grade, with shutoff valve inside the building in an accessible location. Conduit and pipe sleeves shall be capped and clearly identified. Regardless of the system being installed, a backflow preventer must be installed as part of irrigation system under the building contract. Rainfall sensors must be included in the design of system. Irrigation system design will be by A/E.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

02821 CHAIN LINK FENCES AND GATES

A. Design Considerations

1. Black Vinyl chain link fencing is required around all climbing hazards and at grade mechanical and electrical equipment (i.e. cooling towers, emergency generators, etc.).

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

02870 SITE AND STREET FURNISHINGS

A. Design Considerations

1. Site furnishings are to be provided under the Landscape work which will be provided by the A/E as part of their scope of basic services. Rutgers has adopted the following standard site and street furnishings for use:
 - a. Refer to *Standards for Campus Site Furnishings*, Part **XX** of the Design Standards Manual.
2. All benches shall be securely mounted on hard surfaces (concrete walks, plazas, etc.) in accordance with the manufacturer's specifications and construction details provided.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

02920 LAWNS AND GRASSES

A. Design Considerations

1. Sod is preferred over seed, especially near the building perimeter. Sod is always to be used in interior courtyards. Decision as to the use of seed or sod will be a budgetary decision. Hydroseeding is not preferred, but is acceptable only under the following specification: Grass seed shall be incorporated into the top ¼ inch of topsoil by hand rake or slice-seeder before applying hydromulch fiber. The hydromulch mixture can include fertilizer, lime, dye and tackifier.
2. The University's Senior Landscape Architect will indicate the type of lawn treatment that will prevail.

B. Special Documentation Requirements

1. Submit seed vendor's certifications including blue tag and interagency certification for required grass seed mixture, indicating percentages by weight of mix, net weight, year of production, date and location of packaging, and percentages of purity, germination, and weed seed for each grass species.

C. Materials and Methods of Construction

1. Sod shall be certified Kentucky blue grass grown locally near the area of proposed site work. The soil in which the sod is grown at the sod farm shall be physically and chemically compatible with the soil at the work site. Sod shall be 12-18 months old and 1" thick, 12" - 18" wide and 2' - 6' in length cut in strips. All sod shall be inspected and approved by the Campus Landscape Architect or University Horticulturalist prior to installation. Sod will be installed the same day it is harvested at the sod farm. If the sod is "hot" and decomposing in any manner, it will be rejected. Likewise, any sod that is dry will not be accepted.
2. All new lawn areas sodded or seeded shall have the entire perimeter staked and roped off immediately upon completion. Stakes shall be no less than 30" high installed, and string banner shall be two strands stake to stake, or a single strand of durable twine with fluorescent flagging between the stakes. The stakes shall be installed every eight (8) feet in consistent straight lines or curves.
3. Straw Mulching: Salt hay with nonasphaltic liquid tackifier is preferred. Finished grades having slopes in excess of 20% shall be mulched with erosion control fabric run vertically from top to

bottom of slope and stapled with wire staples .125” in diameter or greater and spaced at 4’ intervals. In areas of high velocity runoff such as receiving swales and drainage ditches, fabric of sufficient strength and density shall be used and installed in direction of flow and stapled at 2’ intervals. The decision to use straw mulch or hydromulch will be made by the Campus Landscape Architect or University Horticulturalist according to site location and conditions.

4. All seeding shall be accomplished with a mechanical slice-seeder. Follow up with an application of hydrofiber mulch. A starter fertilizer can be applied (granular or tank mixture in hydro seeder). Fertilizer and lime rates will be per soil testing recommendations. Rutgers School of Environmental and Biological Sciences (Cook College) has a testing lab and can be contacted at 732-932-9295 for directions.
5. PERMANENT LAWN SEEDING SPECIFICATIONS (All seed variety selections from Rutgers Cooperative Extension, Cook College.):
 - a. **Full Sun Mixture** (minimum seven to ten hours of direct sunlight):

50% Kentucky Bluegrass, consisting of at least two varieties: Glade, Apex, Alpine, Blackstone, Ram I, America, Apollo, Brilliant, SRX2284, SRX2394;

20% Perennial Ryegrass, consisting of at least two varieties: Allstar, Gator III, SRX4801, Pennant II, Palmer III, Seville II, Fiesta II, Radiant;

15% Chewings Fescue, consisting of one variety: Ambassador, Banner III, Jamestown II, SR5000, Shadow II, Magic or Victory II;

15% Hard Fescue, consisting of one variety: Aurora, Aurora E+, Ecostar, Nordic, Osprey, Reliant II, SR 3000, SR3100 or Warwick.

Seeding Rate: 3 – 4 pounds per 1000 s.f.
 - b. **Shady Mixture** (less than five hours of direct sunlight):

10% Chewings Fescue, consisting of one variety: Ambassador, Banner II, Jamestown II, SR5000, Shadow II, Magic or Victory;

40% Creeping Red Fescue, consisting of at least two varieties: Badger, Cindy, Fenway, Flyer, Jasper, Pathfinder, Shademaster II, Vista, Shademark, Salem;

40% Kentucky Bluegrass, consisting of at least two varieties: Glade, Apex, Alpine, Blackstone, America, Brilliant, SRX2284, SRX2394;

10% Hard Fescue, consisting of one variety: Aurora, Aurora E+, Ecostar, Nordic, Osprey, Reliant II, SR3000, SR3100 or Warwick.

Seeding Rate: 4 – 5 pounds per 1000 s.f.

6. OPTIMUM SEEDING TIMES:
 - a. Spring, March 15 – May 15.
 - b. Fall, August 15 – October 15.
 - c. Seeding is not recommended at other times.
7. Any deviations, changes or alternatives to these specifications must be approved by the Senior Landscape Architect or University Horticulturalist.
8. TEMPORARY/STABILIZATION SEEDING: Tri-Plex Perennial Ryegrass (varieties from sunny mixture). Seeding Rate: 5 pounds per 1000 s.f.
9. INSPECTIONS: Inspections will be made by the Campus Landscape Architect or University Horticulturalist at completion of the following tasks:
 - a. At completion of the soil loosening phase to insure that the minimum depths have been achieved.
 - b. At completion of the removals and /or screening phase to insure that specified dimension material has been removed.
 - c. At completion of the top soiling phase to insure that full depth of cover has been achieved.

- d. At completion of the fine grading phase to insure that specified slopes, uniformity and positive drainage have been achieved.
 - e. At completion of the seeding and mulching phase to insure adequate coverage.
 - f. At the end of the 60 Day Maintenance Period to insure adequate percentage of growth and coverage as specified has been achieved.
 - g. It is the responsibility of the Contractor to notify the Project Manager of the completion of each task in writing for approvals prior to proceeding to the next phase. Unsatisfactory conditions must be corrected at Contractor's expense before beginning next phase tasks.
10. Close-Out: Contractor shall contact University Facilities to arrange an on-site meeting, to include the Project Manager, University Facilities Operations and Services, Ground, Campus Landscape Architect and/or University Horticulturalist, to discuss landscape maintenance procedures going forward, and to deliver landscape maintenance manual.

02930 EXTERIOR PLANTS

A. Design Considerations

- 1. All new lawns and plantings shall have an underground irrigation system. See Section 02810.

B. Special Documentation Requirements

- 1. Guarantee of Plants:
 - a. Specify that the Contractor shall guarantee newly installed plants for a period of one year after date of acceptance against defects, including death and unsatisfactory growth. Trees which are not healthy, are dying, or the design value of which, in the opinion of the OFD, has been destroyed through root damage, loss of branches, bark damage, etc., shall be replaced by the Contractor at no cost to the Owner. Exceptions are defects resulting from abuse or damage by

others, or unusual phenomena or incidents which are beyond landscape installer's control.

- b. Specify that plants which are determined to be defective shall be replaced at the proper season or planting time after the guarantee period is complete, and replacement plants will be guaranteed by the Contractor for an additional growing season under an extended guarantee at no additional cost.
- c. Specify that, during the guarantee period, the Contractor shall, from time to time, inspect the watering and other maintenance practices carried on by the Owner and promptly report to the Owner any practices which he considers unsatisfactory and not in his interests or good horticultural practices. The failure of the Contractor to inspect or report shall be construed as an acceptance by him of the Owner's maintenance practices and shall not thereafter claim that any defects which may later develop are the result of such practice.

C. Materials and Methods of Construction

- 1. Preparation of Sub grade: Specify that subsoil shall be ripped or tilled to a depth of 5" and graded to remove all ridges and depressions so that it will be parallel to proposed finished grade. Remove stones over 1" in any dimension, sticks, rubbish and other extraneous matter.
- 3. Specify that all topsoil shall be tested against the following Specifications:

a. Physical Analysis (Soil Texture):

Quantity Percent by oven dry weight	Size Fraction inches	Range of Particle Diameter mm
Less than 2% gravel	larger than 1	25
Less than 3% gravel	1/4 to 1	6-25
Less than 10% gravel	2/25 to 1/4	2-6
40% to 65% sand	1/500 to 2/25	.05-2.0

25% to 60% silt	1/12,500 to 1/500	.002-.05
Less than 20% clay	smaller than 1/12,500	.002

- 1) Amounts of sand, silt, and clay - determined by official hydrometer method or mechanical analysis of the soil. Gravel sized particles should be determined by separation on screens with appropriate size openings.
- 2) Soil should be free of undecomposed organic material like roots, sticks, leaves and paper and of any other undesirable trash like glass, plastic or metal fragments that would have to be removed before seeding or planting.

b. Chemical Analysis:

- 1) Organic matter content (% oven dry weight of soil):
Sandy Loam, 1.25% to 20%; Loam and Silt Loam, 2.5% to 20%.
- 2) On soil with less than 10% organic matter, use wet oxidation method of analysis. On soil with more than 10% organic matter, use loss on ignition method of analysis.
- 3) Soil reaction - pH of 4.5 to 7.0
Soluble salt content: Conductivity (ECe, millimhos per centimeter):
Less than 1.00 mmhos/cm for a 1:1 soil: water ratio;
Less than 0.50 mmhos/cm for a 1:2 soil: water ratio;
Less than 0.33 mmhos/cm for a 1:3 soil: water ratio.

5. Plant Materials: All plants, including trees, shrubs, vines, groundcovers, annuals and perennials shall comply in form and vitality with industry standards as described in the American Standard for Nursery Stock as published by the American Association of Nurserymen. All plant material shall be inspected by the Campus Landscape Architect or University Horticulturalist prior to being delivered to the site. All shade trees, flowering and ornamental trees, and evergreen trees shall be tagged in the nursery field by the Campus Landscape Architect or University Horticulturalist.

6. Plant Installation: All trees shall be installed according to the standards as prescribed by International Society of Arboriculture and as shown in Part IV, Standard Details section of this Manual. The final location of all plant

material shall be according to plan and shall be approved in the field by the Campus landscape Architect or University Horticulturalist prior to planting.