

1 inch = 20 FEET

0 10 20 40 60

(Graphic Scale - Feet)

ZONED R-3
S 20° 34' 22" W
ZONED PUB

JEFFERSON CITY COUNTRY CLUB
518 SOUTH COUNTRY CLUB DRIVE
USE: COUNTRY CLUB



Patrick P. Kremer, PE - Engineer
MOP PE-2012018094

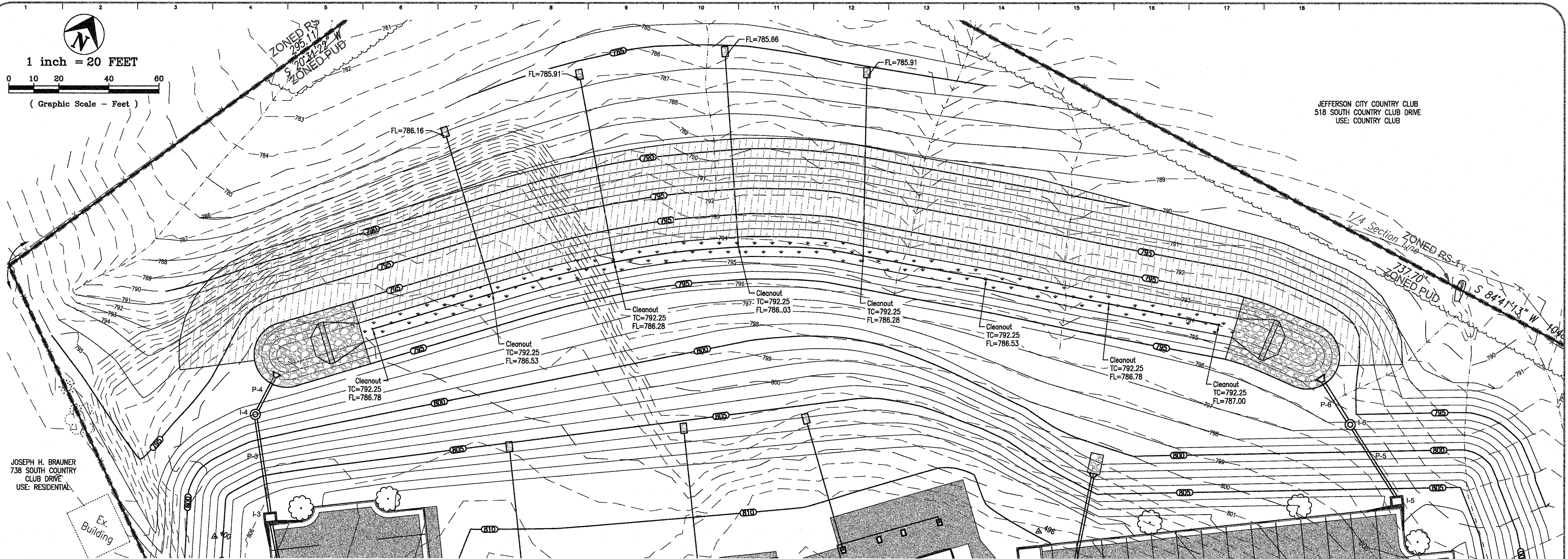
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CIVIL ENGINEER & MO STATE AUTHORITY #001668
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The Architects Alliance
Missouri State Certificate of Authority #000143
631 West Main Street
Jefferson City, Missouri
(573)636-5000 phone

STORMWATER QUALITY DETAILS

MISSOURI SOYBEAN INNOVATION CENTER
NEW OFFICE BUILDING
734 S. COUNTRY CLUB DRIVE
JEFFERSON CITY, MISSOURI

PROJECT NO. 1813
DATE 9/12/2018
C-202
SHEET 6 OF 8



STORMWATER QUALITY BIORETENTION/FILTRATION BASIN
SCALE: 1"=20'

BIORETENTION FACILITY PROJECT CONDITIONS

- Backfill, grading, top soil replacement, and sodding and seeding shall occur prior to installation of the bioretention aggregate underdrain or bioretention soil mixture.
- All contributing drainage areas shall be stabilized prior to beginning construction on the bioretention facility based on the construction plans.
- Bioretention facilities shall not be used as sediment control facilities.
- No heavy equipment shall operate within the perimeter of a bioretention facility during excavation, underdrain placement, backfilling, planting or mulching of the facility.
- Any evidence of clogging of the underdrain or underdrain gravel due to unstabilized upstream drainage areas or other negligence by the contractor shall result in removal of the clogged material and re-installation.

BIORETENTION SOIL MIXTURE

The Bioretention Soil Mixture shall be a uniform mix, free of stones, stumps, roots or similar objects larger than two inches. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations. The planting of soil shall be free of Bermuda grass, Quicgrass, Johnson grass, or other noxious weeds as specified under RSMO 263.

The Bioretention Soil Mixture shall be a mixture of planting soil, mulch, and sand consisting of the following:

Planting Soil	30%
Shredded 2x Hardwood Mulch*	20%
Sand	50%

*Shredded hardwood bark mulch shall consist of the bark from hardwood trees which has been milled and screened to a maximum of 4 in. particle size and provide a uniform texture free from sawdust, foreign materials, and artificially introduced chemical compounds that would be detrimental to plant or animal life. It shall be aged a minimum of 12 months.

The planting soil shall contain no more than 10% clay to achieve sufficient permeability.

The planting soil shall be tested and shall meet the following criteria:

pH range	5.2 - 7.0
organic matter	1.5 - 4% (by weight)
magnesium	35 lb/ac
phosphorus (phosphate - P205)	75 lb/ac
potassium (potash - K2O)	85 lb/ac
soluble salts	not to exceed 500 ppm

All bioretention areas shall have a minimum of one test. Each test shall consist of both the standard soil test for pH, phosphorus, and potassium and additional tests of organic matter, and soluble salts. A textural analysis is required from the site stockpiled topsoil. If topsoil is imported, then a textural analysis shall be performed for each location where the topsoil was excavated.

Since different labs calibrate their testing equipment differently, all testing results shall come from the same testing facility.

Should the pH fall out of the acceptable range, it may be modified (higher) with lime or (lower) with iron sulfate plus sulfur.

COMPACTION

A. It is very important to minimize compaction of both the base of the bioretention area and the required backfill. When possible, use excavation hoses to remove original soil. If bioretention areas are excavated using a loader, the contractor shall use wide track or marsh track equipment, or light equipment with turf tires. Use of equipment with narrow tracks or narrow tires, rubber tires with large lugs, or high pressure tires will cause excessive compaction resulting in reduced infiltration rates and is not acceptable. Compaction will significantly contribute to design failure.

B. Compaction can be alleviated at the base of the bioretention facility by using a primary tilling operation such as a chisel plow, ripper, or subsider. These tilling operations are to restructure the soil profile through the 12 inch compaction zone. Substitute methods must be approved by the Architect. Rototillers typically do not till deep enough to reduce the effects of compaction from heavy equipment.

C. When backfilling the bioretention facility, place soil in 12" to 18" lifts. Do not use heavy equipment within the bioretention basin. Heavy equipment can be used around the perimeter of the basin to supply soils. Grade bioretention materials with light equipment such as a compact loader or a dozer/loader with marsh tracks.

PLANTINGS

A. See Bioretention Facility plans for a list of plant species

B. All plants, unless otherwise permitted, shall conform to the standards of the current edition of American Standards for Nursery Stock as approved by the American Standards Institute. All plant grades shall be those established in the current edition of American Standards for Nursery Stock.

C. All plant materials shall have normal, well developed branches and a vigorous root system. They shall be healthy plants free from physical defects, plant diseases, and insect pests.

D. Shade and flowering trees shall be symmetrically balanced. Major branched shall not have V shaped crotches capable of causing structural weakness.

E. Trunks shall be free of unhealed branch removal wounds greater than 1 in. diameter.

F. Shade trees shall have a single main trunk. Trunks shall be free of branches below the following heights:

1 1/2" to 2 1/2" caliper	5' height
3" caliper	6' height

G. Plant materials shall be able to tolerate saturated soil conditions for the length of time anticipated in the design storm event, as well as snow melt chemicals and other anticipated runoff constituents.

UNDERDRAIN

A. Underdrains shall be discharged as shown on plan.

B. Pipe shall be 6" schedule 40 PVC at a minimum of 0.5% slope.

C. Stots shall be not more than 1/8" wide and 1 1/2" long. The centerline of the stots shall not be less than 30 degrees or more than 65.5 degrees from the pipe centerline. Perforations shall be at 3" maximum centers.

D. Underdrain aggregate shall meet the requirements of Missouri Standard Specifications for Highway Construction, Aggregate for Drainage Section 1009.3.1.

EXAMINATION

A. Examine all upstream drainage areas for proper stabilization prior to beginning work on the bioretention facility. Bioretention facilities shall not be constructed until all contributing drainage areas are stabilized.

B. Examine areas to receive underdrains for completion of excavation to elevations and slopes indicated, and obstructions which would interfere with the underdrains system installation.

EXCAVATION

A. The bioretention facility shall be excavated to the dimensions, side slopes, and elevations shown on the plans.

B. The method of excavation shall minimize the compaction of the bottom of the bioretention facility. Excavators and backhoes, operating on the ground adjacent to the bioretention facility, shall be used to excavate the facility if possible. Low ground-contact pressure equipment may also be used for excavation. No heavy equipment shall be allowed on the bottom of the bioretention facility. Excavated materials shall be removed from the bioretention facility site.

C. **GEOTEXTILE FABRIC**

A. The contractor shall place geotextile fabric between the excavated subgrade and the aggregate underdrain. Geotextile fabric shall also be placed between the aggregate underdrain and the bioretention soil mixture.

PLACEMENT AND COMPACTION OF THE BIORETENTION SOIL MIXTURE

A. The Bioretention Soil Mixture shall be placed and graded using low ground-contact pressure equipment or by excavators and/or backhoes operation on the ground adjacent to the bioretention facility.

B. No heavy equipment shall be used within the perimeter of the bioretention facility before, during, or after the placement of the Bioretention Soil Mixture.

C. The Bioretention Soil Mixture shall be placed in horizontal layers not to exceed 12 inches for the entire area of the bioretention facility.

D. The Bioretention Soil Mixture shall be compacted by saturating the entire area of the bioretention facility after each lift is placed until water flows from the underdrain. An appropriate downstream sediment control device shall be used to treat any sediment-laden water discharged from the underdrain.

E. If the Bioretention Soil Mixture becomes contaminated with sediment during the construction of the facility, the contaminated material shall be removed and replaced with uncontaminated material at no additional cost to the Owner.

F. Final grading of the Bioretention Soil Mixture shall be performed after a 24 hour setting period. Final elevations shall be within 2 inches of the elevations shown on the plans.

PLANT INSTALLATION

A. Trees, Shrubs, and other plant materials specified for Bioretention Facilities shall be planted as specified in the plans and applicable landscaping standards.

B. Root stock of the plant material shall be kept moist during transport and on-site storage. The plant root ball shall be planted so 1/8th of the ball is above final grade surface.

C. Set and maintain the plant straight during the entire planting process.

D. Thoroughly water ground bed cover after installation.

E. Trees shall be braced using 2" x 2" stakes only as necessary and for the first growing season only. Stakes are to be equally spaced on the outside of the tree ball.

F. Grasses and legume seed should be drilled into the soil to a depth of at least 1 inch. Grass and legume plugs shall be planted following the non-grass cover planting specifications.

MULCHING

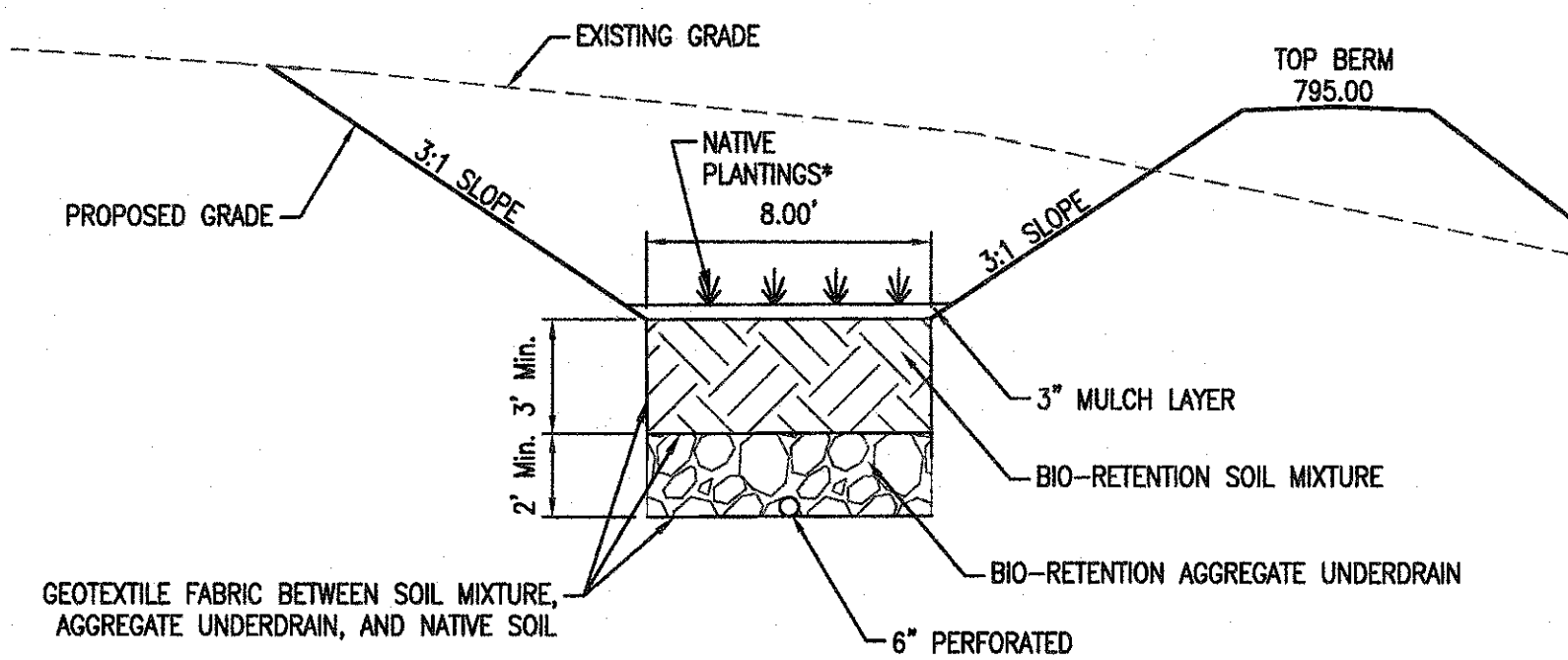
A. Once all plant materials are installed, the entire bioretention facility shall be mulched to a uniform thickness of 3 inches. Well aged (6 months - 12 months) shredded hardwood bark mulch is the only acceptable mulch.

B. Mulching shall take place immediately after grading and planting to reduce silt accumulation.

MAINTENANCE AND GUARANTEE

A. Maintenance, after final acceptance of the bioretention facility, will be performed by the Owner.

B. All plantings shall be guaranteed to be in a vigorous growing condition after a one year period from final acceptance.



BIORETENTION CROSS SECTION
NOT TO SCALE

*-NATIVE PLANTINGS SHALL CONSIST OF AN INTER-DISPersed MIXTURE OF THE FOLLOWING PLANT SPECIES:

FRINGED SEDGE	Carex crinita
PALM SEDGE	Carex maskingumensis
SOFT RUSH	Juncus effusus
SWITCHGRASS	Panicum virgatum
PRairie CORD GRASS	Spartina pectinatis

THE PLANTINGS SHALL BE MINIMUM GALLON CONTAINERIZED PLANTS, PLANTED IN STAGGERED ROWS OF 4' ON CENTER THROUGHOUT THE SURFACE OF EACH BIO-RETENTION CELL. FOLLOWING PLANTING, A 3" THICK LAYER OF SHREDDED HARDWOOD BARK MULCH SHALL BE PLACED ON THE PLANTED AREA.

MAINTENANCE REQUIREMENTS - BIORETENTION

Activity	Frequency
Initial Maintenance	
Water plants daily for two weeks	Daily
Water plants weekly for first growing season	Weekly
Weed once monthly during the first two growing seasons	Monthly, Seasonally
Perpetual Maintenance	
Remove litter and debris	Monthly
Remove sediment	As needed
Remove mulch void areas	As needed
Treat diseased trees and shrubs	As needed
Mow turf areas to keep grass 3-4 inches tall	Seasonally, as needed
Repair erosion at inflow points	As needed
Unplug underdrain	As needed
Regulate soil pH	Seasonally
Remove and replace dead and diseased vegetation	Semiannual
Replace tree stakes and wire until trees are established (at least first 3 years)	Annually
Replace mulch every 2-3 years prior to wet season	Every 2-3 years



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(TOLL FREE)

MISSOURI ONE CALL SYSTEM, INC.

NOTE: The Contractor will be responsible to call the Missouri One Call System 1-800-344-7483 and have the underground utilities marked or remarked prior to any construction.

NOTE: UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES, HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN.

Space Reserved for Approving Authority