SECTION 22 14 53

RAINWATER HARVESTING AND MODULAR WATER STORAGE SYSTEMS

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rainwater Harvesting System Including the Following:
   1. Rainwater pre-filters.
   2. Storage tanks.
   3. Distribution pumps.
   4. Controls.
   5. Water treatment.

B. Modular Water Management and Storage System Including the Following:
   1. Stacking modules, baseplates, and endplates.
   2. Inspection chambers.
   3. Accessories.

1.2 RELATED SECTIONS

A. Division 2 - Site Construction.

B. Division 15 - Mechanical.

C. Section 22 14 00 - Facility Storm Drainage.

1.3 REFERENCES

A. International Organization for Standardization (ISO):
   1. ISO 9001 - Quality management systems - Requirements.

B. Underwriters Laboratories (UL):
   1. UL 508 - Standard for Industrial Control Equipment.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: For system components; include dimensions, capacities, operating characteristics, utility connections, and accessories.

C. Shop Drawings:
   1. For Rainwater Harvesting Systems: Include system layout, components, and

accessories.

2. For Modular Water Storage Systems:
    a. Include engineering, safety factors, specific gravities, atmospheric pressures, project specific loading conditions and capacities, system layout, components, and accessories.
    b. Excavation and base preparation shall be provided in accordance with the shop drawings and Engineer's recommendations.
    c. System shall be sized in accordance with national standards and hydraulic impact.
    d. Unless otherwise shown on shop drawings, sub-grade excavation and preparation shall be executed in accordance with earthwork Drawings and Division 2 specifications.
    e. Unless otherwise shown on shop drawings, sub-surface drainage materials shall be executed in accordance with earthwork Drawings and Division 2 specifications.

D. Closeout Submittals: Operation and maintenance data.
1. Provide instructions on operation, calibration, troubleshooting, and servicing equipment.
2. Include layout drawings, parts lists, and component manufacturer's product data.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data:
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

C. Verification Samples: Two representative units of each type, size, pattern and color.

D. Shop Drawings: Include details of materials, construction and finish. Include relationship with adjacent construction.

1.6 QUALITY ASSURANCE

A. System Integrator: RainHarvest Systems LLC (800) 654-9283. Russ Jackson.

B. Manufacturer Qualifications:
1. Minimum 10 years experience in work of this Section.
2. Successful completion of minimum of 10 previous projects of similar scope and complexity.
3. Maintain ISO 9001 production facilities including quality management protocols for every production batch.

C. Installer Qualifications:
1. Successful completion of 3 previous projects of similar scope and complexity.
2. Maintain factory trained technicians on staff providing field service and warranty work.
3. Minimum 3 years experience in work of this Section.
4. For Modular Water Storage Systems:
    a. Installer: Certified by manufacturer and responsible for the following:
        1) Tour, inspect and discuss condition of sub-grade, drainage structures and other preparatory work.

2) Review required inspections and testing procedures.
3) Review safety precautions relating to installation.
4) Use products manufactured or approved by manufacturer.
5) Follow installation instructions and other contract documents (shop drawings, specifications, approvals, configuration report and manufacturer's recommendations).
6) Use construction machinery described in manufacturer's installation and maintenance instructions.

D. Excavation Safety: In accordance with OSHA requirements.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver system components until time needed for installation, and after proper protection can be provided.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

C. Protect from damage due to weather, excessive temperature, and construction operations.

D. Leave protective coverings in place until just prior to installation.

E. Store modular water storage system components on smooth surfaces, free from dirt, mud and debris.

F. Handle modular water storage system components with forklifts and manufacturers recommended equipment during transportation and site construction. System components shall be protected from damage during delivery.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: RainHarvest Systems, LLC, which is located at: 4475 Alicia Lane; Cumming, GA 30028; Toll Free Tel: 800-654-9283; Tel: 770-889-2533; Fax: 770-889-2577 ; Email: request info (rkauk@rainharvest.com); Web: http://www.rainharvest.com
1. Acceptable Manufacturers for Storage Tanks:
a. Graf.

b. RainHarvest Systems.
c. Atlantis D-Raintank.
d. RainFlo Corrugated Steel Tanks.
e. RainFlo FRP Rainwater Storage Tanks.
f. RainFlo FRP Panel Tanks.
g. Norwesco.
h. Chem-Tainer.

2. Acceptable Manufacturers for Pumps and Pump Skids:
   a. RainHarvest Systems.
   b. Goulds.
   c. RainFlo.
   d. Dab.
3. Acceptable Manufacturers for Controls and Float Switches:
   a. RainHarvest Systems.
   b. RainFlo.
4. Acceptable Manufacturers for Rainwater Filters, Storage Tank Accessories, and Purification Kits:
   a. GRAF.
   b. UV Pure.
   c. Viqua.
   d. Pentek.
   e. RainFlo.
   f. Shelco.
   g. Strain-rite.
   h. Amiad.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 RAINWATER HARVESTING SYSTEMS

A. Rainwater Harvesting Systems: Components as manufactured by RainHarvest Systems, LLC unless otherwise specified.
   1. System Description: Custom rainwater harvesting system consisting of manufactured components integrated into an automated system. The system shall collect rainwater from the roof and convey rainwater through roof drains, downspouts and conveyance piping, self-cleaning, gravity fed pre-filters. Filtered rainwater will travel through the pre-filter and into a rainwater storage tank. Water will be drawn out of the storage tank and pumped through a packaged pumping system to the irrigation/plumbing system. The pumping system will be designed to provide water at the desired design point on an on-demand basis.
   2. Design Requirements: Filter, store, and distribute harvested rainwater.
   3. Water Disinfection Methods: May include sediment filtration, ultraviolet treatment, chlorine injection, carbon filtration, or a combination thereof.
   4. Assemble and test purification system in factory prior to shipment to Project site.
   5. Hydrostatically test prefabricated pump assembly in factory prior to shipment to Project site.

B. Components:
   1. Rainwater Pre-filters: Gravity-fed self-cleaning.
   2. Rainwater Pre-Filters:
      a. Model: No. _____.
      b. Description: High efficiency, self-cleaning above/below ground

rainwater filter with 350 micron stainless steel filter insert and for ____ sq ft (____ sq m) of collection surface.

c. Rainwater Inlet: _____.
d. Overflow Outlet: _____.
e. Outlet to Tank: _____.

3. Rainwater Storage Tanks:
   a. Graf Carat S Tank Below Ground Rainwater Storage System of __ gal (__ L).
   b. Graf EcoBloc Below Ground Rainwater Storage System of __ gal (__ L).
   c. Atlantis D-Raintank Below Ground Rainwater Storage System of __ gal (__ L).
   d. RainFlo Single Wall, Fiberglass Below Ground Rainwater Storage System of __ gal (__ L).
   e. RainFlo Corrugated Steel Above Ground Rainwater Storage System of __ gal (__ L).
   f. Norwesco HDPE Above Ground Rainwater Storage System of __ gal (__ L).
   g. Chem-Tainer HDPE Above Ground Rainwater Storage System of __ gal (__ L).
   h. RainFlo Above Ground FRP Panel Tank of __ gal (__ L).
4. Pump Systems: RainFlo pump system capacity ___ gal per min at ___ psi (__L per min at __ kPa).
   a. RainFlo Packaged Pump System: Manufactured specifically for distribution of rainwater.
   b. Pump shall be of stainless steel construction.
   c. Plumbed to allow for removal without entering tank.
   d. Connected to power supply by power cable and waterproof connections.
5. Pump Control System: Control panel UL 508 listed, and incorporate the following components:
   a. NEMA ___ enclosure.
   b. Single point power connection.
   c. Circuit breaker control power protection.
   d. Individual pump circuit breakers.
   e. Ventilated and fan-cooled enclosure, with positive cabinet pressure.
   f. Variable frequency drives/pump controller will control pumps on an "on-demand" basis via a pressure transducer.
   g. Current limit selector switch to set current limit to match motor SFA.
   h. Alarms indicated by light sequence, audible alarm, or digital readout.
   i. System shall automate switching between rainwater and auxiliary water supply automatically.
   j. System shall display rainwater storage tank level.
6. Rainwater System Control: Continuous water level measurement with automatic switchover to a backup water supply. Controller must activate a 3-way valve based on programmed water levels in the rainwater system controller.
7. Water Treatment Systems: RainHarvest Systems water treatment systems are comprised of multiple components designed to disinfect water for indoor plumbing applications. Under no circumstances should treated water from a rainwater harvesting system be used for potable purposes unless the system has been installed in accordance with and inspected per the local authority having jurisdiction, and the water quality tested to applicable standards.
8. Water Treatment System Components:
   a. Sediment Filtration: _____ inches (_____ microns).
   b. UV Disinfection: _____ gal per min (____ L per min).

c. Chlorine injection: _____ ppm.
d. Dye injection: _____ ppm.
e. Ozone Injection/Recirculation System: ____ lbs per hr (____ grams per hr)

9. Storage Tank Accessories:
   a. Floating Filter and Hose:
      1) RainHarvest Model: No. 333009.
      2) Description: 2 inch (51 mm) Stainless steel filter housing and mesh fabric, and polyethylene floating ball.
10. Overflow Siphon:
   a. Model: No. 330108.
   b. Description: Polyethylene overflow device with support strut and clamp for 4 inch (102 mm) overflow piping.

C. Accessories:
1. Bulkhead Fittings: Sized to match system inlet, outlet, pump flow rate, vents, and other penetrations.
2. Vent Assembly: PVC rodent-proof cap for tank air and vacuum relief; extend from top of tank to above grade.
3. Waterproof Electrical Connection Box: Located in manway, field installed.

2.3 MODULAR WATER STORAGE SYSTEMS

A. Modular Water Storage Systems:
1. System Description: Integrated water management solution for stormwater infiltration, retention, detention, rainwater harvesting or firewater tanks. System includes inspection components with site specific configurability without special tools that allows high volume storage and high pressure jetting for cleaning and maintenance.
2. System Components: From same manufacturer ensuring component compatibility.
3. Engineering Requirements: Adequate support for project design loads, excavation, subsurface conditions, testing, inspection, and safety requirements Perspecified design criteria.
4. Assemble and test purification system in factory prior to shipment to Project site.
5. UV-stabilizer to be protected from sunlight exposure.

B. Modular Water Storage Systems: EcoBloc Inspect Flex as manufactured by RainHarvest Systems, LLC unless otherwise specified.
1. Engineering Design Criteria for Systems:
   a. Loading Conditions: Verified through compression tests during production.
   b. Long-Term Resistance: Verified in laboratory tests by certified testing laboratory approved by local jurisdiction.
   c. Achieve equal lateral strength in every direction.
   d. General limits of installation shall include safety factors.
   e. Maximal Depth Below Grade: 16 ft and 4.8 inches (5 m).
   f. Tank Height for Pedestrian Loading Applications: 15 ft and 7 inches (4.75 m)
   g. Tank Height for HS-25 Vehicular Applications: 13 ft and 9.4 inches (4.2 m) plus earth covering.
   h. Meet design criteria without additional soil stabilization equipment and without Geogrid.
   i. Sustainable 50 year usable life including safety factors per manufacturer's operating guidelines.

2. Storage Criteria for Systems:
    a. Capable of storing water products with specific gravity up to 1.1.
    b. Vented to atmospheric pressure.
    c. Capable of storing products identified in manufacturer's limited warranty.
    d. Use and storage of critical biological and chemical ingredients or concentration shall be in accordance with manufacturer's recommendations.
3. Material Requirements of Systems:
    a. Manufactured with first generation upcycled materials.
    b. Long term properties must be reported by laboratory tests.
4. System Module Capacities and Dimensions:
    a. Gross Volume: 54.2 US gal (205 L).
    b. Net Volume: 51.5 US gal (195 L).
    c. Nominal Size: 31.5 x 31.5 x 12.6 inches (800 x 800 x 320 mm).
5. Connections: Allow full drainage and venting of tanks.
    a. Perforated Openings: Up to 8 inches (203 mm), with adaptor plates for pipes up to 20 inches (508 mm).
    b. Manufacturer's EcoBloc Inspect flex base plates and end plates as recommended by manufacturer.
6. Inspections of Installed Systems:
    a. Allow inspection and high pressure jetting.
    b. Be able to move inspection devices inside structure.

C. Modular Water Storage Systems: EcoBloc Maxx as manufactured by RainHarvest Systems, LLC unless otherwise specified.
1. Engineering Design Criteria for Systems:
    a. Loading Conditions: Verified through compression tests during production.
    b. Long-Term Resistance: Verified in laboratory tests by certified testing laboratory approved by local jurisdiction.
    c. Achieve equal lateral strength in every direction.
    d. General limits of installation shall include safety factors.
    e. Maximal Depth Below Grade: 16 ft and 4.8 inches (5 m).
    f. Tank Height for Pedestrian Loading Applications: 15 ft and 7 inches (4.75 m).
    g. Tank Height for HS-20 Vehicular Applications: 13 ft and 9.4 inches (4.2 m) plus earth covering.
    h. Meet design criteria without additional soil stabilization equipment and without Geogrid.
    i. Sustainable 50 year usable life including safety factors per manufacturer's operating guidelines.
2. Storage Criteria for Systems:
    a. Capable of storing water products with specific gravity up to 1.1.
    b. Vented to atmospheric pressure.
    c. Capable of storing products identified in manufacturer's limited warranty.
    d. Use and storage of critical biological and chemical ingredients or concentration shall be in accordance with manufacturer's recommendations.
3. Material Requirements of Systems:
    a. Manufactured with first generation upcycled materials.
    b. Long term properties must be reported by laboratory tests.
4. System Module Capacities and Dimensions:
    a. Gross Volume: 59.4 US gal (225 L).
    b. Net Volume: 57.3 US gal (217 L).

c. Nominal Size: 31.5 x 31.5 x 13.8 inches (800 x 800 x 350 mm).

5. Connections: Allow full drainage and venting of tanks.
   a. Perforated Openings: Up to 8 inches (203 mm), with adaptor plates for pipes up to 20 inches (508 mm).
   b. Manufacturer's EcoBloc Inspect flex base plates and end plates as recommended by manufacturer.
6. Inspections of Installed Systems: Compatible with modules that are inspectable.

D. Modular Water Storage Systems: EcoBloc Light as manufactured by RainHarvest Systems, LLC unless otherwise specified.
   1. Engineering Design Criteria for Systems:
      a. Loading Conditions: Verified through compression tests during production.
      b. Long-Term Resistance: Verified in laboratory tests by certified testing laboratory approved by local jurisdiction.
      c. Achieve equal lateral strength in every direction.
      d. General limits of installation shall include safety factors.
      e. Maximal Depth Below Grade: 7 ft and 4.6 inches (2.25 m).
      f. Tank Height for Pedestrian Loading Applications: 7 ft and 4.6 inches (2.25 m).
      g. Tank Height for HS-10 and HS-15 Vehicular Applications: 4 ft and 9.1 inches (1.45 m) plus earth coverings.
      h. Meet design criteria without additional soil stabilization equipment and without Geogrid.
      i. Sustainable 50 year usable life including safety factors per manufacturer's operating guidelines.
   2. Storage Criteria for Systems:
      a. Capable of storing water products with specific gravity up to 1.1.
      b. Vented to atmospheric pressure.
      c. Capable of storing products identified in manufacturer's limited warranty.
      d. Use and storage of critical biological and chemical ingredients or concentration shall be in accordance with manufacturer's recommendations.
   3. Material Requirements of Systems:
      a. Manufactured with first generation upcycled materials.
      b. Long term properties must be reported by laboratory tests.
   4. System Module Capacities and Dimensions:
      a. Gross Volume: 59.4 US gal (225 L).
      b. Net Volume: 57.9 US gal (219 L).
      c. Nominal Size: 31.5 x 31.5 x 13.8 inches (800 x 800 x 350 mm).
   5. Connections: Allow full drainage and venting of tanks.
      a. Perforated Openings: Up to 10 inches (254 mm), with adaptor plates for pipes up to 20 inches (508 mm).
      b. Manufacturer's EcoBloc Inspect flex base plates and end plates as recommended by manufacturer.
   6. Inspections of Installed Systems: Compatible with modules that are inspectable.

E. Modular Water Storage Systems: Vario 800 Shaft System as manufactured by RainHarvest Systems, LLC unless otherwise specified.
   1. Engineering Design Criteria for Systems:
      a. Loading Conditions: Verified through compression tests during production.
      b. Long-Term Resistance: Verified in laboratory tests by certified testing

laboratory approved by local jurisdiction.
c. Achieve equal lateral strength in every direction.
d. General limits of installation shall include safety factors.
e. Maximal Depth Below Grade: 16 ft and 4.8 inches (5 m).
f. Tank Height for Pedestrian Loading Applications: 15 ft and 7 inches (4.75 m).
g. Tank Height for HS-25 Vehicular Applications: 13 ft and 9.4 inches (4.2 m) plus earth covering.
h. Meet design criteria without additional soil stabilization equipment and without Geogrid.
i. Sustainable 50 year usable life including safety factors per manufacturer's operating guidelines.
j. Be able to use as inlet, filter, inspection and choke shaft.
k. Enable free positioning within the EcoBloc system.
l. Enable easy access with a clear width of 23.6 inches (600 mm).

2. Storage Criteria for Systems:
a. Capable of storing water products with specific gravity up to 1.1.
b. Vented to atmospheric pressure.
c. Capable of storing products identified in manufacturer's limited warranty.
d. Use and storage of critical biological and chemical ingredients or concentration shall be in accordance with manufacturer's recommendations.

3. Material Requirements of Systems: Manufactured with first generation upcycled materials and glass fiber reinforcement.

4. System Module Capacities and Dimensions:
a. Gross Volume: 60.7 US gal (230 L).
b. Gross Volume: 113.5 US gal (420 L).
c. Nominal Size: 31.5 x 31.5 x 14 inches (800 x 800 x 355 mm).
d. Nominal Size: 31.5 x 31.5 x 26 inches (800 x 800 x 660 mm).

5. Connections:
a. Perforated Openings: Up to 8 inches (203 mm) for inspection access and matching with inspection lanes.
b. Shaft System Perforated Openings: Up to 8 inches (203 mm).
c. Shaft System Perforated Openings: Up to 12 inches (304 mm).
d. Shaft System Perforated Openings: Up to 16 inches (406 mm).
e. Include manufacturer's Vario 800 flex base/cover set as recommended by the manufacturer.

6. Inspections of Installed Systems: Compatible with modules that are inspectable.

F. Accessories for Modular Water Storage Systems: As manufactured by RainHarvest Systems, LLC unless otherwise specified.

1. Connectors for System Modules: Requirements.
a. Interconnect with modular clip system creating a stable, uniform system.
b. Use connectors only for horizontal connections.

2. Geotextile:
a. Specific Weight: 6 oz per sq yd (200 g per sq m).
b. CBR: 528.3 to 539.5 lb (2.35 to 2.40 kN).
c. Opening Width: 0 to 0.004 inch (0 to 100 µm).
d. Water Permeability: 1268 to 1427 US gal per min (80 to 90 L per sq m).

3. Adaptor Plates: For pipes up to 20 inches (508 mm).

4. Venting Ends: 4 inch (100 mm) pipe.

5. Choke Drains: 4 inch (100 mm) with flow rate of 0.26 to 1.72 US gal per sec (1.0 to 6.5 L per sec).

6. Choke Drains: 6 inch (152.4 mm) with flow rate of 0.53 to 4.22 US gal per sec (2.0 to 16.1 L per sec).
7. Geomembrane:
    a. Basis of Design: PE-HD-Geomembrane.
    b. Minimum Thickness: 0.08 inch (2 mm).

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals and in proper relationship with adjacent construction.

B. Arrange equipment so that components requiring removal or maintenance are readily accessible without disturbing other components. Arrange for clear passage between components.

C. Connect to utility supplies and equipment.

D. Do not bury components deeper than manufacturer's recommended depth or in a manner that would exceed engineering loads.

E. Do not bury Graf filters deeper than manufacturer's recommended depth unless a vault is installed.

F. Ground components in accordance with component manufacturer's instructions.

G. Install prefilters at time storage tanks are installed.

3.3 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

C. System Integrators:
1. Installation oversight and technical support.
2. Terminate and test control system wiring and operation of electrical components.
3. Demonstrate proper pump and controls operation.
4. Make adjustments to meet user-defined system performance.
5. Review operation and maintenance procedures with Owner's representative.

3.4 CLEANING AND PROTECTION

A. Clean and protect products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION