PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Coordinate synthetic grass surfacing for play areas with work before and after, especially:
   1. Play structures.
   2. Playground fence.
   3. Walkways

B. Definitions (based on CPSC 325):
   1. Synthetic Grass Assembly: Combination of synthetic grass carpet, shock-absorbing course, Geotextile fabric and drainage course.
   2. Fall height (1.8): The vertical distance between the highest play surface on a piece of equipment and the protective surface beneath it.
   3. Critical height (1.8, 2.4): Fall height below which a life-threatening head injury would not be expected to occur, as determined by tests following ASTM F1292.
   4. Use/Fall/Protected areas (1.8, 5.3): Areas under and around equipment onto which a child falling or exiting would be expected to land; normally within 6 ft. from equipment.
   5. Unprotected area: Areas outside of the use/fall/protected play areas.
   6. Play area: The total protected and unprotected play areas.
   7. Shock-absorbing course: The shock-absorbing permeable course located directly beneath the synthetic grass.
   8. Shock-absorbing course thickness: Thickness necessary to prevent life-threatening head injury for each critical height location at playground equipment.
   9. Drainage Course: Salt-free, angular sand manufactured from recycled concrete.
   10. Permeability: The quantity of cool water drained per square foot in a given time using specified test; “drained” meaning no visible ponded water.
   11. Options: Limits of Contractor’s choice in designing surfacing assemblies.
1.2 OVERALL PERFORMANCE

A. Design, for the approval of the A/E and the Board, a synthetic grass system with protected and unprotected areas that meet CPSC, ADA and other requirements as indicated within this Specification.

B. Coordination:
   1. Design the synthetic grass system to accommodate the playground equipment and its foundations (both specified in another section and shown on the Drawings).

C. Properties:
   1. Permeability:
      a. Synthetic grass carpet alone (blades and backings): 10 in. of water/hour minimum.
   2. Impact Attenuation: CPSC-compliant impact attenuation figures (Head Injury Criteria and G-max) for fall heights from each item of playground equipment in this Work; as calculated based upon test figures for this protective surfacing; ASTM F1292, F2223.
   3. Slip Resistance: Synthetic grass, following ADA requirements, shall have a static coefficient of friction (SCoF) value of 0.50 or greater; ASTM D2047, using the James machine and a dry leather shoe heel on a dry traffic surface.
   4. Accessibility: ASTM F1951: Entire synthetic grass area shall be accessible to handicapped persons.
   5. Ultraviolet Radiation Resistance: Installed synthetic grass shall not show significant fading or embrittlement when compared with the approved record sample (or sample on file at MDCPS Facilities Design & Standards) within 8 years of installation.
   6. Sanitation: Synthetic grass shall be manufactured with an anti-microbial Ag-bearing resin, such as Microban by AlphanSan, integrated into the turf fiber.
   7. Cleaning / Maintaining: Synthetic grass shall be cleanable / maintainable by power brooming or vacuuming, with option of hosing or wet scrubbing for hard dirt.

1.3 REFERENCES (Latest version of the following documents)

A. American Society for Testing and Materials (ASTM):
1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm with a minimum of 5 years experience in installing synthetic grass assemblies that can supply a list of 10 completed projects with play equipment and fall zones, and that used the proposed synthetic grass and shock-absorbing products.
   1. The projects shall be similar in size, design and complexity to this project, and each listed project shall bear the client name, a person to contact, and phone number.
   2. The installer shall supply a letter from the proposed synthetic grass producer certifying that the installer has a workforce trained in installing its product, that the installer’s work is of good quality, and that installer is approved by the producer.

B. Contractor’s Design Submittal: The Contractor and his proposed installer shall make design submittals that select and coordinate products and means of execution for the synthetic grass assembly work.
   1. The Contractor’s design shall produce an assembly that performs as specified, and that follows the detailed specification of product properties and their installation.
   2. The A/E and Board will review the Contractor’s proposed design submittals for conformity to the specified descriptive and performance criteria until approval is given.

1.5 DESIGN SUBMITTALS

A. Contractor’s Design, following the specified overall performance requirements. Submit, the following for approval by A/E and Board before the record submittals:
   1. Layout of play area. Synthetic grass assembly showing fence, border, and each item of playground equipment, its footings, its fall height(s), and its use/fall/protected zones.
   2. Thickness of shock-absorbing material necessary to comply with CPSC requirements at each critical fall height location as calculated for Head Injury Criteria and G-max, following ASTM F1292 test results.
   3. Sections cut through synthetic grass assembly at and outside use/fall/protected zones, showing products used in each course.
   5. Each product selected for use in protective surfacing assembly, with its description.
   6. Text of Special Warranties on letterheads of synthetic grass assembly installer and synthetic grass producer.
   7. Quality Reports. Submit, for approval by A/E and Board before record submittals:
      a. Qualifications of synthetic grass producer.
      b. Qualifications of protective surfacing assembly installer

1.6 RECORD SUBMITTALS

Follow 01330

A. When the synthetic grass assembly design submittals have been approved, submit:
   1. Product Data: In addition to design submittal revisions required for approval:
      a. Submit documents attesting to accessibility, flammability, lead-free pigments, anti-slip and anti-microbial qualities.
   2. Shop Drawings: Shop Drawings shall include the following:
      a. Layout of synthetic grass, shock-absorbing course, Geotextile fabric, drainage course, edging and curbing details, location of playground equipment and
Footings, location of perimeter fencing, size and location of the impact mats, location of all seams, sloping and other provisions for drainage.

b. Section cut through the synthetic grass, shock-absorbing course, Geotextile fabric and drainage course, showing in detail the type and height of each course, each edging condition and how impact mats are incorporated.

3. Samples:
   b. Seam assembly consisting of two 12 in. x 24 in. pieces of synthetic grass joined along the 24 in. length.
   c. Plastic bags containing at least 2 oz. of: Drainage course sand; Rubber mulch; Infill for synthetic grass (if applicable).
   d. 4 in. long piece of rubber timber curb (if applicable) with spike.
   e. 12 in. long piece of composite edging board.
   f. Fasteners for securing edging to concrete and synthetic grass to edging.

4. Quality Reports:
   a. Field permeability tests of:
      1) Compacted soil, immediately after excavation, before continuing installation.
      2) Shock-absorbing course over drainage course with Geotextile fabric in place.
      3) Completed synthetic grass assembly.

1.7 SPECIAL WARRANTIES

Follow 01786

A. Entire Synthetic Grass Assembly (products and installation):
   1. Scope of Special Warranty of Entire Assembly: Replace all components of defective protective surfacing that show defects.
      a. “Defective synthetic grass”: As specified below in warranty of synthetic grass.
      b. “Defective shock-absorbing course”: Defects such as reduction in volume, cohesion, or draining efficiency, growth of plants, vermin, or odor in course, excessive rutting or washboarding of course surface, excessive shifting or settling of boards or pads within course.
      c. Name the installer of the entire assembly as the entity issuing the limited warranty to the benefit of the Board (Miami-Dade County Public Schools).
      d. In satisfying the warranty the installer of the assembly shall remove defective work and replace it, including products, labor, delivery and taxes.
   2. Warranty period / duration: From date of Substantial Completion of the Work until 8 years after that date.

B. Synthetic Grass:
   1. Scope of Special Warranty of Synthetic Grass: Replace rolls of defective synthetic grass that shows defects.
      a. “Defective”: Synthetic grass that shows such defects as embrittlement, rot, failure to drain, or significant color change, matting or loss of grass tufts under traffic, or shrinkage, over more than 2% of a roll’s surface during warranty period. The infill, seaming tape and fastenings shall be considered part of the carpet.
      b. Name the synthetic grass producer as the entity issuing the limited warranty in the interest of the Board (Miami-Dade County Public Schools).
c. In satisfying the warranty the producer shall provide products to replace defective components and affected other components, including delivery and taxes.

2. Warranty period / duration: From date of Substantial Completion of the Work until 8 years after that date

PART 2 PRODUCTS

2.1 BORDER

A. All synthetic grass areas shall have a permanent “border” element around its entire perimeter. Border elements shall consist of exterior walls, concrete sidewalks or other surfaces pre-approved by M-DCPS as an acceptable border. A concrete curb may be provided as a border only when the area receiving the synthetic grass is separated from adjacent areas by a permanent perimeter fence. In these cases the center line of the curb shall coincide with the center-line of the fence posts. In retrofit/renovation projects only, and with prior written approval from M-DCPS, 6” wide x 6” high x 8’-0” long rubber timber curbs may be used as a border element. Under no circumstance shall the perimeter edge of the synthetic grass be installed in direct contact with natural grass areas.

B. Concrete curbs shall be cast-in-place concrete, f’c = 2500, [white] [Coral Gables beige], 12 in. wide x 6 in. deep profile, with 2 – No.3 bars, with top surface having a smooth float or troweled finish, and sloping away from the synthetic grass area. Provide ASTM C1741 joint fillers at each fence post.

C. Rubber Timber Curb: In retrofit/renovation projects only, when there is no permanent perimeter fencing around an area that is receiving synthetic grass, provide 6” wide x 6” high x 8’-0” long rubber timber curb around entire perimeter of the synthetic grass area except where synthetic grass abuts walks. Allow for proper access openings to meet ADA accessibility requirements.

1. Product / producer: Rubberific Timber, by International Mulch Co.
2. Equal product approved by A/E and Board.

D. Do not use treated wood, wood, steel, aluminum, or PVC.

2.2 EDGING

A. Dense, non-degrading recycled plastic nailer boards, suitable for fastening to concrete (or staking into soil only at retrofit projects), and for holding staples to secure synthetic grass edges.

1. Size: Not less than 3/4 in. x 1-1/2 in., as needed to securely fasten to earth or edges of curbs and walks and to receive synthetic grass fasteners.
2. Density: Recycled plastic, at least 60 lb/ft³.
3. Edging shall not soften, embrittle or decay for 8 years when placed under synthetic grass. Do not use treated wood.
4. Product /Producer: TrexTrim, by Trex , or approved equal.
2.3 DRAINAGE COURSE

A. Sand: Salt-free, angular sand, manufactured from recycled concrete.
   1. Gradation: Similar to that of ASTM C144 Sand for Masonry Mortar, but permitting
      100% of particles to pass a 1/4 in. screen. The following is taken from ASTM C144:
      
      | Sieve size | Percent passing |
      |------------|-----------------|
      | No. 4 (0.186 in.) | 100             |
      | No. 16       | 70 to 100       |
      | No. 50       | 10 to 35        |
      | No.200       | 0 to 10         |

2.4 GEOTEXTILE FABRIC

A. Geotextile Fabric: Glass, olefin, nylon or other non-rotting fabric that retains its structure
   in use while passing water, retarding soil, and holding various courses apart.

2.5 SHOCK-ABSORBING COURSE - Provide one of the following:

A. Rubber Mulch: Recycled styrene-butadiene rubber (SBR) tires from which steel belting
   has been removed 100% before reducing to rectangular rubber granules. Nylon, olefin or
   polyester threads from tire belting may remain in granules.
   1. Properties: As will provide a uniform, non-shrinking course thickness and a high
      degree of resilience when compacted to form the shock-absorbing course.
   2. Size: Granule size selected by the installer shall range from granules passing a 3/16
      in. to a 5/8 in. sieve.
   3. Mulch shall not harden or degrade for 8 years when placed under synthetic grass and
      on top of the drainage course.

B. Olefin Foam Pads: Recycled polyethylene or polypropylene foam chips that have been
   fused into a cohering but permeable board, strong enough to withstand adult foot traffic.
   1. Properties: As will provide a uniform, non-shrinking course thickness and a high
      degree of resilience when compacted to form the shock-absorbing course.
   2. Foam Pad size: In largest available size to minimize quantity of joints. Minimum Pad
      size shall be 4 ft x 6 ft.
   3. Foam Pads shall not harden or degrade for 8 years when placed under synthetic
      grass and on top of the drainage course.

2.6 IMPACT MATS

A. Impact Mats shall be provided when rubber mulch is used as the shock-absorbing course.
   Impact mats shall be placed directly beneath the synthetic grass, at locations receiving
   frequent impacts (i.e., slides, and jump-off areas). Top of impact mats shall be placed
   level with the top of the shock-absorbing course. Impact mat design and construction
   shall serve to reduce turf wear and displacement of the shock absorbing course – helping
   to reduce deterioration and displacement as required by CSPC 325 2.4.2.2.2.
   1. Properties: Water-permeable, impact-softening course. Mats shall be neither
      extremely stiff nor extremely resilient.
2. As will provide a uniform, non-shrinking course thickness and a high degree of resilience when compacted.
3. Size: Minimum of 3 ft wide x sufficient length to permit installation, without joints, at each location.
4. Mats shall not significantly degrade for 8 years when placed under synthetic grass.

2.7 SYNTHETIC GRASS

A. Description: Carpet of synthetic grass blades tufted into primary backing, with secondary backing adhered.
1. Synthetic blades: Monofilament or slitted film olefin (polyethylene and/or polypropylene) with integral lightfast pigment and transparent antibacterial coating.
2. Synthetic grass shall contain a textured polyethylene or nylon monofilament thatch layer with coiled heads, tufted through the primary backing. The height of the upstanding thatch layer shall be no more than half the height of the grass blade.
3. Lead content of pigments: Lead content of synthetic grass shall not exceed limits set by EHPA. Blades containing small amounts of Pb compounds to attain light-fastness in green pigment are allowed if soil, after 10 years beneath synthetic grass, has been tested to contain no more than 400 parts per billion (1/1000) of the maximum amount permitted in soil by EPA, which is 400,000 ppb,
4. Antibacterial protection: Ag-bearing resin, such as AlphaSan, that is UV-resistant and non-leaching.
5. Color and blade width: Color of synthetic turf shall be uniform and shall look as close as possible to natural grass, with the broad-blade characteristic of typical Floratam St. Augustine grass as grows in Miami.
6. Eye safety: Blades shall not stand so upright or be so stiff as to invite eye damage to a person falling face-down on the synthetic grass.
7. Weight:
   a. Face Weight: minimum 40 oz./sq. yd.
   b. Backing Weight: minimum 20 oz./sq. yd.
8. Blade height above backing: minimum 1-1/2 in.
9. Stitch Rate: minimum 9 stitches / 3 in.
11. Primary backing: Woven olefin to provide initial dimensional stability.
12. Secondary backing: Polyurethane coatings or woven or felted stands of olefin, PET, or polyester, added to provide additional tuft bind and structural integrity to the synthetic turf.
13. Roll width: 12 ft. minimum.
15. Tearing of carpet: Not less than than 200 lbf; ASTM D1582 and D5034.
16. Permeability of carpet: As specified in Overall Performance above.
17. Slip resistance of carpet: As specified in Overall Performance above.
18. UV resistance of carpet: As specified in Overall Performance above.

B. Standard. CPSC-compliant impact attenuation figure for each fall height; as calculated based on tests on the type of shock-absorbing course, specified herein; ASTM F1292.
C. Product / Producer:
1. Easy Grass LLC  
   www.easygrass.net
2. ForeverLawn  
   www.foreverlawn.com
3. Synthetic Turf International  
   www.synthetic-turf.com
4. AmeriTurf Synthetic Grass Systems  
   www.ameriturfsystems.com

2.8 SEAMING TAPE OPTIONS

A. Adhesive Fastened: 12 in. wide woven polyester fabric, such as Cordura. Adhesive shall be of composition that does not embrittle in use in Florida climate for 8 years.

B. Micro-Mechanically Fastened: 12 in. wide, woven nylon fabric that bonds to synthetic grass backing by micro-hooking, such as Velcro.

2.9 INFILL

A. Provide infill material across entire surface of the synthetic grass, at a minimum spread rate of 3 lbs per SF. Use a 50/50 combination by weight, of the following infill materials, applied in accordance with the manufacturer’s recommendations:

   1. Rubber Granules:
      a. Clean and metal free recycled styrene butadiene rubber (SBR) granules, or ethylene propylene dien monomer (EPDM) granules.
      b. Granule size: 30/40 mesh.
      c. Life: No hardening or degrading for 8 years when placed beneath synthetic grass.
   2. Synthetic Sand:
      a. Clear or white sanitary silicon dioxide beads.
      b. Size: 12-30 mesh.

2.10 ACCESSORIES

A. Fasteners, edging to concrete: Case hardened screws

B. Fasteners, synthetic grass to edging: Stainless steel staples at least 1/2 in, wide with points at least 5/8 in. long.

C. Seam Adhesive: Adhesive shall provide a strong, hazard-free, and durable bond between adjacent turf panels or sections.

PART 3 EXECUTION  

3.1 INSPECTION, SEQUENCING, AND PRELIMINARY WORK

A. Inspect the location of this work to ensure the following:
   1. That proper drainage of drainage course into surrounding soil or drains can occur.
   2. That adjacent elements such as soil, grass, and walks are at proper elevations and suitable for installation of border, edging, and other protective surfacing components.
B. Dig one or more holes, to bottom elevation of the drainage course depth, to inspect existing conditions. Using the permeability test specified at the end of this section, determine the permeability of existing condition. Report all unsatisfactory conditions and result of all permeability tests to the Contractor, A/E and the Board.

C. Perform excavation to depth needed to install drainage course, and inspect horizontal and vertical surfaces in presence of Contractor and A/E to determine the soil conditions for lateral or vertical draining of drainage course.
   1. Slope bottom of excavation at least 1% in the direction(s) of available drainage.
   2. If sufficient draining into pervious soil can be attained by sloping the excavation to all or part of its perimeter, do so, at no increase in Contract Sum.
   3. If an impervious layer, such as paving or limestone, underlies the protective surfacing area, drill sufficient holes to drain the area and fill drain holes with clean gravel, protected on top by 1/4 in galvanized steel mesh, at no increase in Contract Sum.
   4. If proper drainage can be attained only by pipe laterals, do not continue work until A/E, Board and Contractor agree on a solution.
   5. Sub-grade shall be shaped to an appropriate profile and compacted to achieve a minimum 90% compaction in accordance with ASTM D698 Standard Proctor Method.

D. Do not continue work after excavation until playground equipment has been installed.

3.2 INSTALLATION

A. All components of the Synthetic Grass System shall be installed following the instructions of the producers of each component, except as more stringently specified herein.

B. The perimeter of all synthetic grass areas shall be fastened to an “edging” nailer-board that is secured to a continuous perimeter “border” element surrounding the entire perimeter of the synthetic grass area.
   1. Acceptable border elements shall consist of exterior walls, concrete sidewalks or other “hard” surfaces pre-approved by M-DCPS as acceptable borders.
   2. A concrete curb may be used as a perimeter border only when the area receiving the synthetic grass is separated from adjacent areas by a permanent perimeter fence. In these cases the center line of the curb shall coincide with the center-line of the fence posts.
   3. In retrofit/renovation projects only, and with prior written approval from M-DCPS, a rubber timber curb as described in this document may be used as a “border”. Only in these cases may the synthetic grass be secured to an edging nailer-board that is properly staked into the ground, instead of being secured to a “hard” perimeter border surface.
   4. Under no circumstance shall the edge of the synthetic grass be installed in direct contact with natural grass areas.

C. Concrete sidewalks:
   1. Provide a concrete sidewalk around the entire perimeter of the synthetic grass surface when other types of acceptable “border” elements are not present.
   2. Concrete sidewalks shall be installed in accordance with M-DCPS Design Standards.
3. Top elevation of concrete sidewalk shall meet ADA accessibility requirements for transitioning between the concrete sidewalks and the synthetic grass surface.

D. Concrete Curb:
1. Concrete curbs may be used as a “border” element only if the perimeter of the area receiving the synthetic grass is separated from the adjacent areas by a fence.
2. Place concrete curb with centerline below centerline of fence.
3. Top elevation of the concrete curb shall be placed to permit perimeter edging to be fastened to the concrete curb so that the synthetic grass backing is installed 1-1/2 in. higher than the soil on the opposite side of the curb.
4. Top of concrete curb shall be sloped away from the synthetic grass surface area and all exposed edges shall be rounded.
5. Provide concrete curb joints with joint filler at each fence post.

E. Rubber Timber Curb:
1. Rubber timber curbs may be provided on retrofit/renovation projects only, and then only if there is no perimeter fencing around the area that is receiving synthetic grass.
2. Place rubber timber curb tight against edging of the synthetic grass and on a flat grade to prevent movement or settlement of rubber timber.
3. Anchor each 8 ft. long section of rubber timber curb with a minimum of four 1/2” rebar anchors evenly spaced to ensure that the full length of rubber timber is properly secured. Top of rebar anchors shall be recessed 1-1/2 in. from top of rubber timber curb.

F. Drainage Course:
1. Install minimum of 4 in. thick to produce a level top base course.
2. Drainage course shall be thoroughly compacted to prevent differential settlement across the play area. Minimum compaction levels shall be 90% density as measured by a standard proctor test.
3. Finish grade of the drainage course shall not exceed 1/4 in. in any direction when measured beneath a 10-foot long straight edge.

G. Geotextile Fabric: Provide a Geotextile fabric over the entire area of the drainage course material. The Geotextile fabric may be provided integral with the synthetic grass or as a separate lining installed over the drainage course and turned up and fastened to the edging.

H. Shock-Absorbing Course:
1. Rubber Mulch:
   a. Install in thickness to meet the critical fall height requirements for each item of playground equipment as determined by ASTM F1292 impact attenuation tests for each critical height of the highest play surface on that piece of equipment.
   b. Rubber mulch shall be compacted until it settles no further under adult foot traffic.
2. Olefin Foam Board:
   a. Install in thickness to meet the critical fall height requirements for each item of playground equipment as determined by ASTM F1292 impact attenuation tests for each critical height of the highest play surface on that piece of equipment.
I. Impact Mats: Impact mats shall be used whenever rubber mulch is used as the shock-absorbing course.
   1. Place impact mats at locations receiving frequent impact such as at ends of slides, and at playground equipment jump-off areas.
   2. Mats shall be placed beneath the synthetic grass so that the top of the mat is level with the top of the shock-absorbing course.

J. Edging: Install around the full perimeter of the synthetic grass surface and fasten to walls, concrete walks or curbs, with the specified case-hardened screws at 24 in. o.c. minimum.
   1. Set top of edging at a level that causes the synthetic grass backing to lie not more than 1/2 in. below the top surface of the border or walks, as required by ADA.

K. Synthetic Grass Layout: Install in the widest roll widths available, with all rolls pointing in one direction, and with all blades inclined in same direction.
   1. Edge lifting and trip avoidance. Lay out rolls so that seams are not over impact mats or in other heavy-use locations where seam lifting would bring on a major tripping hazard.
   2. Installation shall minimize the appearance of seams and resist wind up-lift forces. Seam shall be staggered.
   3. Method of installation shall permit easy replacement in part or totally.

L. Synthetic Grass Seaming:
   1. Apply seaming material with adhesive or micro-mechanical fastening material to back of joints in such a way that rolls abut tightly.
   2. Do not use stitching to join rolls.
   3. Apply a bead of non-embrittling sealant within joint as each roll is laid and taped behind seam.

M. Synthetic Grass Fastening: Staple synthetic grass to edging 1 in. to 2 in. oc as needed to reduce creep and limit lifting under high winds.

N. Infill for Synthetic Grass: To aid blades in staying erect and reduce matting and likelihood of wind uplift, apply uniformly at rate recommended by producer. The equipment used for application of the infill shall erect the fiber, place the infill materials, and incorporate a metering method to provide consistent distribution.

O. Cleaning: Leave the area clean, with surface neatly broomed to uniform appearance.

P. Training: Provide a minimum of 1-hour training to M-DCPS Maintenance personnel and School custodial staff, on the proper maintenance and cleaning of the synthetic grass surface.

Q. Maintenance Grooming: Six (6) months after the Substantial Completion date of the project, provide at no additional cost to the Board, a complete maintenance grooming of the entire synthetic grass surface. Grooming shall be performed using power broom and sweepers recommended by the manufacturer.
3.3 FIELD QUALITY CONTROL

A. Permeability Tests: Test permeability of the work-in-progress 3 times and provide letter to A/E reporting results and any recommendations for enhancing the quality in the work.
   1. Completion of excavation (compacted sub-grade) for protective surfacing assembly.
   2. Completion of shock-absorbing course (over drainage course, Geotextile fabric, and soil).
   3. Completion of entire protective surfacing installation,

B. Test Procedures: Construct a 2 ft³ (15 gal) bottomless 3/4 in. plywood or steel box, 12 in x 12 in. interior dimensions x 24 in. high, with sponge rubber seal at bottom and provision for adding up to 60 lb of weights (symmetrically) to its outside.
   1. Set in place over surface and stabilize with weights to compress material being tested to limit lateral leaking. Fill quickly to top with cool (45°-75° F) water.
   2. With a stopwatch, measure downward flow time – the time it takes the water to run through, leaving no water ponded on surface.
   3. Compute rate of flow (seconds for 15 gal to drain) and submit report.  ///