Virgin Islands Department of EDUCATION

Grounds Maintenance Primer

Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year 2

US VIRGIN ISLANDS

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Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

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This Grounds Maintenance Primer is one of a number of "modules" being prepared as part of the "Training and Sustainability Program" focused on building local school facility maintenance capacity.

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GROUNDS MAINTENANCE PRIMER

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PURPOSE

The purpose this primer is to provide facility managers with a reference guide of regular school grounds maintenance tasks, the common problems that result from deferring these tasks, as well as preparation and oversight tips.

METHOD

In preparing this guide, the project team expended more than 280 man hours conducting site visits to the majority of schools in each of the four territories to observe existing conditions and compile recommendations to inform the content of this primer as well as future (to be determined) capital projects or other large scale improvements. This primer also includes reference material for local staff to implement and manage grounds maintenance. Recommendations contained in the body of this report include standards from the U.S. Consumer Product Safety Commission's Public Playground Safety Handbook and recommendations from other published sources.

"As the heart of a community, a school is a reflection of the community it serves and its overall perception of educational quality."

-Insular ABCs (Assessment of Buildings and Classrooms)

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Introduction

WHY IS GROUNDS MAINTENANCE IMPORTANT?

A school's exterior appearance – i.e., landscaping and site maintenance – affects the overall perception of educational quality. As the heart of a community, schools are a reflection of the character and potential of its citizens and leaders. School grounds maintenance is therefore vital to the proper functioning, image and achievement of public schools.

"Appropriate operation and maintenance activities ensure that stormwater practices will continue to function properly and yield expected water quality and environmental benefits, protect public safety, meet legal standards, and protect communities' financial investment." (U.S. EPA, 2017)

School grounds must be properly maintained on a routine basis to preserve the quality of the landscaping and ensure effective site drainage to provide a safe and healthy environment for the student to learn and play in. Grounds maintenance personnel, with the proper training to perform with a wide-ranging knowledge base and skill set, are needed to do work that includes physical challenges as well as equipment operation and maintenance.

This primer provides an overview of basic grounds maintenance needed at all school campuses on a revolving schedule throughout each calendar year.

Grounds maintenance alone will not alleviate all concerns; sometimes capital improvement projects are required. Further design and engineering consultation should be sought when modifying existing grading, subsurface and surface drainage, rain gutters or downspouts at various school campuses.

GROUNDS MAINTENANCE SAVES MONEY

Regularly scheduled grounds maintenance can also help reduce overall long-term operating expenses. Deferring maintenance is more costly because replacing school facilities costs more than repair. Facility management best practices have cautioned that public school budgets cannot afford a "run-it-until-it's-broke" approach to maintenance. According to the National Research Council, every $1 in deferred maintenance, costs an estimated $4 to $5 in capital liability. "Thus an accumulation of deferred investments over the long term may be significantly greater than the short-term savings that public-sector decision makers were initially seeking."[1]

For example, inadequately maintained public school storm drainage facilities have been identified throughout the territories. Clogged drain inlets can lead to extensive damage to school buildings, requiring repair expenditures. Proper grounds maintenance can help reduce the extent of clean up costs, flooring replacement, wood frame wall repairs, electrical damage and mold abatement that can result from flooding.

[1] (NRC, 2004)

With the Zika outbreak, ponding water trapped on the ground or in rain gutters is also a serious health concern. A regularly scheduled grounds maintenance program will expand operating costs in the short-term, but will reduce total expenditures long-term by decreasing the frequency of emergency repair and replacement costs.

FURTHER READING

- NRC. (2004). Investments in Federal Facilities: Asset Management Strategies for the 21st Century. National Research Council, Committee on Business Strategies for Public Capital Investment. Retrieved from https://doi.org/10.17226/11012
- U.S. EPA. (2017). The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure. Retrieved from https://www.epa.gov/sites/production/files/2015-04/documents/green_infrastructure-om_report.pdf
- GAO. (2014). Federal Real Property: Improved Transparency Could Help Efforts to Manage Agencies' Maintenance and Repair Backlogs. U.S. Government Accountability Office. Retrieved from http://www.gao.gov/assets/670/660328.pdf

Chapter 1

Site Inspection Reports for USVI

Background

In 2017, the Insular ABCs program civil engineering team conducted site visits to many public school campuses (Appendix A).

Summary of Findings

For the full report, including specific schools visited, see Appendix A. In general, overall site drainage, walkways and parking pavements, playground surfacing, fencing, grass and landscaping need continuous care and maintenance. Example findings include:

1) Overgrown grass, weeds and debris have taken over areas; drain inlets, concrete swales, sidewalk culverts, trench drains and rain gutters are clogged which leads to ponding and flooding where water cannot flow properly.

2) Drain pipes that allow water to flow under sidewalks are buried.

3) Drain inlets and outlets are partially buried.

4) Trees growing too close to buildings and roots uplifting pavement.

5) Perimeter fences are being damaged and overwhelmed with overgrown vegetation.

6) Unpaved roads, driveways and designated parking areas that require filling in pot holes, regrading and compacting.

Observations

The schools visited in 2017 had drainage issues that require improvements to be implemented through funded design and construction projects. The proposed drainage improvements include, but are not limited to:

1) Addition of roof gutters to reroute drainage roof runoff to designated drainage areas.

2) Addition of new drainage collection systems to allow the drainage of ponding and flooded areas.

3) Addition of retention basins to retain and confine onsite runoff and reduce onsite ponding.

4) Addition of concrete and grass swales, gutter and ditches, including sidewalk culverts to route onsite drainage flow to designated flow patterns.

Recommendations

General maintenance should include, but is not limited to:

1) Remove debris (rocks, tree leaves, seeds, fruits and limbs, trash, etc.) by raking and picking up before mowing.

2) Mow, trim and edge grass once every 10 to 14 days. Remove grass clippings.

3) Remove vegetation, dirt and debris from drain inlets and flush drain lines.

4) Prune back tree branches growing over buildings.

5) Tree removal or relocation is recommended if tress are growing too close to buildings, utility lines, drainage systems or walkways.

6) Remove vegetation growing along and on perimeter fence lines that may cause damage to fencing.

7) Routine general maintenance of the drainage system should be continued at a period of every 3-6 months.

8) Clear and regrade retention basins to remove silt and overgrown plant material and restore basins to its original depth to ensure proper basin function.

9) Regrade surrounding areas to match bottom elevation of culverts and flush culverts to ensure proper culvert function.

10) Clean and regrade existing swales and ditches to ensure proper direction of flow and capacity of drainage routes.

11) Repair and maintain unpaved roads, driveways and designated parking areas by filling in pot holes, regrading and compacting as needed.

Coordination between the civil engineer and building architect should be conducted for any building additions or improvements. For example, the addition of new temporary or permanent buildings can impede the existing drainage pattern and have potential drainage impacts that should be analyzed by a civil engineer. Site drainage can also be affected by, but not limited to, changes to building roof downspouts, area drains that are part of the building footprint, and roof runoff collection tanks.

Previous 2013-2015 civil engineering assessments provided estimated costs for site improvements and site plans identifying locations of these proposed projects for each campus (See Further Reading). Those civil engineering site plans can help organize ongoing maintenance needs at each individual campus.

At the territorial level, the facilities manager should be responsible to procure funding for projects that cannot be resolved by grounds maintenance staff. For example, capital improvement project or legislative funds may need to be programmed to provide an emergency access route to the school or for potable water system improvements. Table 1 provides a listing of issues in order of magnitude of costs estimated to correct the problems.

Table 1 - Estimated costs to correct grounds issues identified in 2015 dollars

Civil Subsystem	Estimated costs to correct grounds issues identified in 2015 dollars				
	Am. Samoa ($K)	CNMI ($K)	Guam ($K)	USVI ($K)	Total ($K)
Drainage Swales/Overall Drainage Pattern	$821	$898	$1,308	$774	$3,800
Headwalls, Catch Basins & Drain Inlets	$186	$557	$370	$346	$1,460
Retention/Detention Ponds	$7	$496	$480	$0	$983
Fire Protection Distribution and Storage (Water Supply)	$0	$588	$11	$34	$632
Septic Disposal Systems (Sanitary Sewer)	$108	$68	$0	$16	$192
Potable Water Distribution and Storage (Water Supply)	$45	$75	$26	$36	$182
Piping (Sanitary Sewer)	$8	$11	$13	$47	$79
Fences & Gates (Site Development)	$11	$0	$59	$0	$70
Fire Truck/Emergency Vehicle Access	$0	$46	$0	$0	$46
Pumping Station(s) (Water Supply)	$0	$10	$24	$11	$45
Erosion Control (Earthwork)	$6	$0	$0	$8	$14
Paving & Surfacing (Pedestrian Paving)	$0	$0	$11	$0	$11
Paving & Surfacing (Roadways)	$0	$0	$7	$0	$7
Lift Stations/Emergency Generators (Sanitary Sewer)	$0	$2	$0	$0	$2
Total	**$1,200**	**$2,800**	**$2,400**	**$1,300**	**$7,600**

(Austin Tsutsumi & Associates, 2015)

FURTHER READING

- HHF Planners. (2013-2015). Insular ABCs Initiative: Phase 3 Task 1 - Civil Engineer Assessments:
  - **American Samoa:** http://hhfplanners.com/as.html
  - **CNMI:** http://hhfplanners.com/cnmi.html
  - **Guam:** http://hhfplanners.com/guam.html
  - **USVI:** http://hhfplanners.com/usvi.html

FUTURE CONSIDERATIONS

- Overall site drainage, grass and landscaping need continuous care and maintenance. Is this reflected in your school budget?
- All of the schools visited in 2017 (see full report in Appendix A) had drainage issues that will require additional improvements to be implemented through funded design and construction projects. Are projects that need funding receiving the proper attention?
- If a maintenance situation is urgent, are grounds maintenance staff aware of how to communicate this to school and district administrators for action?
- Is there an adequate mechanism to report, monitor and check that work orders have been resolved in a timely manner?

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Chapter 2
Staffing Levels

The following benchmarks can be used by Facility Managers to serve as a baseline for determining minimum levels of staffing required for grounds maintenance. In this primer, grounds maintenance is focused on addressing stormwater drainage, septic system maintenance, and the general appearance and safety of the outdoor portions of campus. Grounds maintenance does not include janitorial cleaning of building exteriors or interiors, building facility maintenance, campus security or supplies.

Amount of staff required will vary depending on the level of service desired (see Table 2), available equipment and tools, unique conditions of the site (i.e., steep topography, soil conditions, or other accessibility issues that can limit staff's ability to perform work), and supplies available.

Most importantly, grounds maintenance staff need a reliable way to communicate with the Facility Managers and other administrative staff, in order to report emergencies, alert others to deficiencies that are beyond grounds maintenance staff's scope or responsibility (i.e., HVAC or roofing work that should be performed by licensed contractors or large repair projects that should be classified as capital improvements), communicate general concerns, and to initiate and track work orders.

Assuming grounds maintenance crews are provided with proper equipment, protective gear, training, and support, Facility Managers can use campus areas provided in Appendix C with Table 2 to estimate the number of grounds staff needed. These estimates should only serve as a starting point as they fail to consider site-specific topography, existing grounds conditions, or the amount of actual landscaped area. These considerations should be included in work scoping and budget estimate development.

Table 2: Grounds Maintenance Worker Level of Service and Campus Size Benchmarks [2]

Level of Service	Area of Responsibility or Campus Size	Description
High Standard of appearance	1 worker per 3 to 5 acres	• Trim or replace trees as needed • Trim or replace shrubs as needed • Mow grass as needed • Use chemicals as needed • Provide sanitation as needed • Provide extra services
Medium Standard	1 worker per 5 to 15 acres	• Trim trees; selectively replace them every 1 to 3 years • Trim shrubs; selectively replace them every 1 to 3 years • Mow grass as needed • Use chemicals once a year or every two years • Provide sanitation weekly • Limited extra services
Low Standard	1 worker per 15 to 25 acres	• Seldom trim trees with few replacements • Trim shrubs once or twice a year with few replacements • Mow grass as infrequently as possible • Limited use of chemicals (or none) • Monthly sanitation • No extra services

[2] Summarized from Good School Maintenance, Edited by James Fritts, Illinois Assoc of School Boards, 2008.

Grounds maintenance is conducted through different means in each territory, and differently for various tasks (see Table 3). Opportunities to leverage community support, maximize the use of custodian time, and take advantage of contractors services should be evaluated, with obvious consideration of staffing and budget limitations, for all facility management offices.

Table 3 - Grounds Maintenance Strategies Used in Each Territory

Responsible Party	American Samoa	CNMI	Guam	USVI
Central Office		X		X
School Custodians		X		
Mayors	X		X*	

*Guam Mayors outsource grounds maintenance.

FUTURE CONSIDERATIONS

The following questions are intended to guide facility managers' strategic planning.

- Are custodians present at each school, and could they conduct visual surveys and minor clean up each morning?
- Are custodians aware of grounds maintenance issues and able to report concerns to the facility management office?
- Are contractors available for regular simple landscaping services, and would associated costs be cheaper than keeping full time staff and purchasing/maintaining equipment?
- How can village leaders contribute to the care and appearance of schools in their area, and how can they interact with the facility management office in making work or budget requests?
- Who should be responsible for holding workers accountable for the completion of various tasks and how does this oversight impact available staff time?

Table 4: Outdoor and Grounds Care Frequency Chart

DUTIES	Daily	Weekly	Monthly	Annual	As Needed
Pick up trash & debris	X				
Sweep entrances & sidewalks	X				
Inspect play area pavement	X				
Check playground equipment	X				
Rake grounds		X			
Remove leaves		X			
Mow lawn (in season)		X			
Trim around building & walks		X			
Trim along fence lines		X			
Inspect drainage structures and clean storm drains		X			
Pull weeds or apply herbicide			X		
Clean roof drains				X	
Inspect gutters & downspouts				X	
Remove graffiti					X
Trim shrubbery or trees					X
Replace burnt out light bulbs					X

FURTHER READING

- Planning Guide for Maintaining School Facilities. National Forum on Education Statistics and the Association of School Business Officials International (ASBO), sponsored by the National Center for Education Statistics and the National Cooperative Education Statistics System, 2003. https://nces.ed.gov/pubs2003/2003347.pdf
- An Overview of Routine Cleaning and Maintenance for a Healthy School Environment. U.S. Environmental Protection Agency https://www.epa.gov/schools-healthy-buildings/overview-routine-cleaning-and-maintenance-healthy-school-environment

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Chapter 3
Maintaining Drainage Facilities

Generally, the purpose of storm drainage structures is to move rain water away from buildings and prevent site ponding. If water ponds against building foundations, it can cause moisture to seep into the building envelope, damaging walls and in some cases, ponding water causes cracks and foundation settlement. Moisture related problems, such as mold, may also develop. Ponding can limit the use of school grounds, degrade grounds conditions, and may even provide habitat for the propagation of disease-bearing mosquitoes.

The following images show the different types of storm drainage structures on school campuses.

Figure 1: Grass Swale (swales may also be concrete construction)

Figure 2: Trench Drain

Figure 3: Catch Basin

Figure 4: Retention Basin

Figure 5: Drain Pipe Headwall

Figure 6: Sidewalk Culvert

Figure 7: Drainage Channel

FUTURE CONSIDERATIONS

- Some grounds maintenance tasks are best handled by staff in the field. Are grounds maintenance staff consistently performing essential tasks?
- Are staff, parents and other stakeholders satisfied with the general appearance of school grounds? If not, what is the plan to address this?
- Are grounds maintenance staff adequately equipped, trained, and staffed?

TYPICAL STORM DRAINAGE PROBLEMS

Storm drainage structures should be inspected once a month, and especially after a heavy rain. Remove dirt and trash, cut grass, and remove leaves and other debris that can block the flow of water to drain inlets, as well as within the swale or drain.

Removal of vegetation and sediment build-up in trench drains, catch basins, rain gutter, concrete swales, side walk culverts and drain pipes is critical to reduce the ponding and flooding problems on campuses. Maintenance staff will need to use hand tools and wheel barrows to dig out sediment and flush clogged drain pipes. Removal of sediment build-up at the outlet end of drain lines is important to the reduce ponding and flooding upstream.

Blocked Swales

Figure 8: Mud, grass and weeds in concrete and grass swales block the flow of stormwater, causing poor drainage.

Clogged Trench Drains

Figure 9: Trench drains are easily clogged with dirt and vegetation. Periodic inspection and cleaning is needed to prevent flooding.

Re-Grading Needed

Figure 10: These grass swales do not convey water to the drain inlet or away from the sidewalks and need to be re-constructed.

GRASS SWALES

Grass swales are a low-cost and environmentally desirable drainage system that can be easily constructed by simple hand tools such as a pick, shovel and hard hand rake. However, grass swales need periodic maintenance to clear debris or for the re-grading of high points along the swale line that restrict the flow of stormwater to the drain inlet. Grass also needs water (during dry season), fertilizer and periodic mowing.

Grass swales are ideal for areas where water easily percolates into the ground (i.e., not suitable for clay soils) and where the volume and duration of runoff is limited. Grass swales also have environmental benefits: they slow runoff, filter pollutants and allow rainwater to be reabsorbed on-site. This natural form of stormwater management potentially reduces the need for other drainage structures downstream, but some amount of ponding water should be expected. In situations where that is not suitable, a concrete-lined drainage structure may be more appropriate. A concrete drainage structure is often necessary in areas with high foot-traffic or large areas involving a large volume of water or steeply sloped sites. A civil engineer is typically involved in the design.

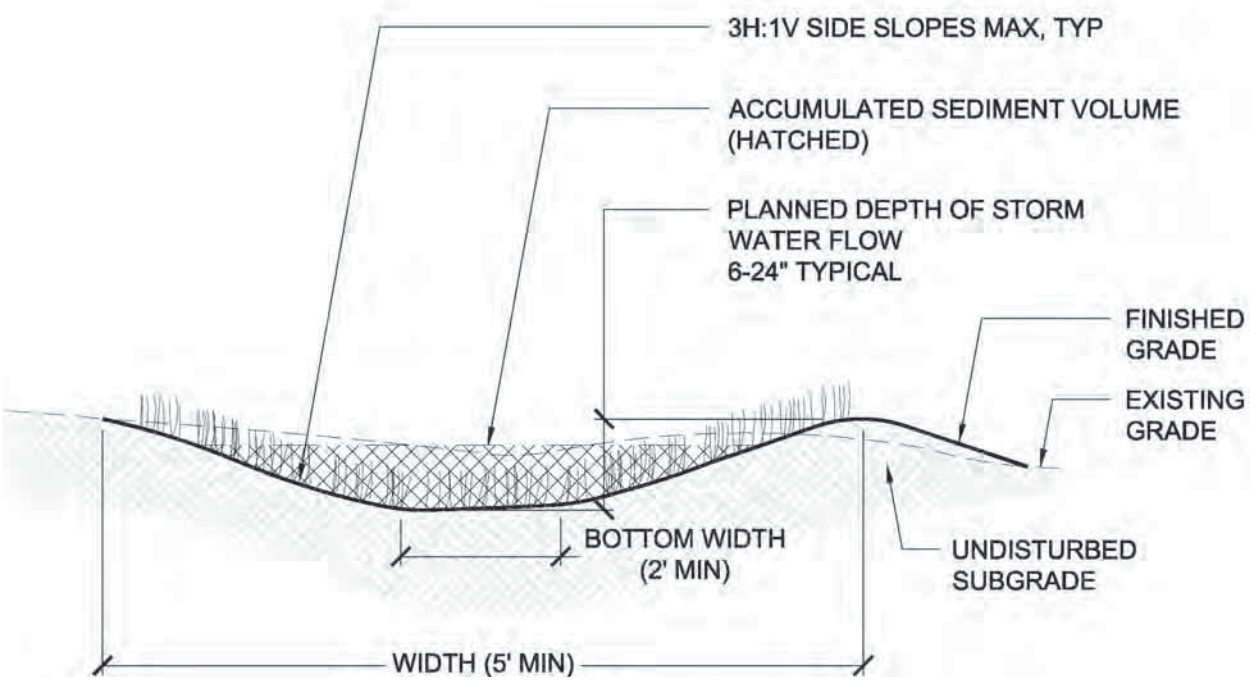

Figure 11: Swale cross section showing planned depth and loss of volume from accumulated sediment. Designed slope is shown as a ratio of horizontal distance (H) to vertical (V).

TIPS FOR CONSTRUCTING A GRASS SWALE

The depth of the grass swale should begin at ground level where standing water occurs, sloping gently lower as one moves further away. The sides of the swale can be graded and smoothed using a hard rake or a flat shovel. No lining material is necessary other than grass to hold soil in place. For considerations on grass selection (i.e., hardiness of species and tolerance to drought) see Appendix G. To plant grass after the swale is ceated:

- Fertilize the seedbed. Apply seeds uniformly across swale surface. Add mulch on top of seeds for protection during establishment.
- Overseed, repair bare spots, and apply additional mulch as necessary.

FURTHER READING

- Storm Water Permanent Best Management Practices Manual, State of Hawai'i Department of Transportation Highways Division, 2007. http://hidot.hawaii.gov/wp-content/uploads/2015/05/Appx-E.1-Permanent-BMP-Manual-Feb-2007.pdf
- National Pollutant Discharge Eliminations System (NPDES) Stormwater Maintenance, Environmental Protection Agency. https://www.epa.gov/npdes/stormwater-maintenance
- Save the Swales, St. Lucie County, Florida, Stormwater/Water Quality Division. http://www.stlucieco.gov/home/showdocument?id=188
- Common Lawn Grasses for Hawai'i, University of Hawai'i College of Tropical Agriculture and Human Resources, 2009. https://www.ctahr.hawaii.edu/oc/freepubs/pdf/TM-12.pdf

FUTURE CONSIDERATIONS

- Which parts of campus have drainage problems? (If you need a map of campus—see links at end of Chapter 1)
- Can the drainage problem be solved by simple routine maintenance (i.e., clearing debris?) or is civil engineering design and other improvements/sources of funding needed?
- How are these needs being communicated to school administrators?

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Chapter 4
Septic System Maintenance

INSPECT AND PUMP FREQUENTLY

The typical septic system should be inspected once a year and pumped every 2 to 3 years or when the total depth of the sludge and scum exceeds one third of the liquid depth of the tank (Figure 12). Contracting a service provider to perform routinely scheduled site visits and inspections is one way to ensure adequate maintenance. Septic service providers will inspect for leaks and check scum and sludge levels in the septic tank.

Maintenance staff at each school should be responsible for keeping records of service performed on each septic system (see attached worksheet, Figure 16). It's important to keep track of when the tanks were pumped and the sludge and scum levels. Document any repairs completed; if repairs are needed, notify the facilities maintenance department or appropriate regional office and document the call on the worksheet shown in Figure 16.

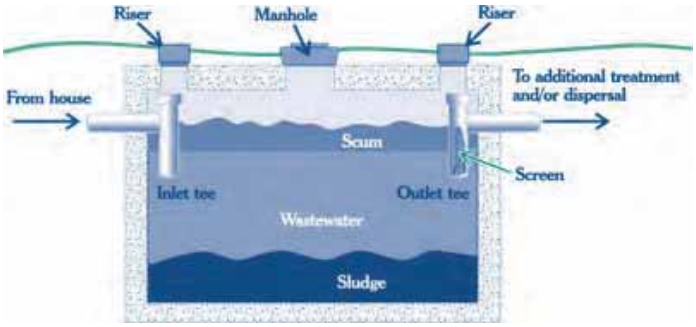

Figure 12: Sludge and scum levels in septic tanks should be routinely monitored.

The Central Office should have as-built drawings or records of every septic system. Ideally, each septic system would be located on a site plan, identifying the location of the septic tank, leach field, sewer lines, and septic tank capacity, manufacturer and model number.

Four major factors affect how frequently a tank must be pumped: number of users, total wastewater generated, volume of solids in the wastewater, and septic tank size. Extreme rainy weather or flooding can also affect the leach field's ability to absorb effluent.

USE WATER EFFICIENTLY

Overburdening the septic system with too much wastewater can cause the system to backup and/or result in more frequent service calls. Reducing the total amount of water use can help reduce the amount of wastewater sent to the septic system. Maintenance staff should routinely be on the lookout for leaking fixtures and immediately fix them.

Figure 13: A leaking toilet wastes 200 gallons of water a day.

High-efficiency plumbing fixtures can also reduce the amount of wastewater generated. In some facilities, older toilets require 3.5 to 5 gallons per flush; newer models use just 1.6 gallons per flush. Adding faucet aerators can also reduce water consumption and cut the volume of water sent to the septic system. Look for Environmental Protection Agency (EPA) labeled WaterSense labeled products when purchasing new fixtures.

Figure 14: The U.S. EPA has partnered with manufacturers to clearly identify low-flow water fixtures (i.e., toilets and sinks)

PROPERLY DISPOSE OF WASTE

To the extent possible, maintenance staff should avoid pouring harsh chemicals such as bleach down any drain connected to a septic system. Figure 17 shows a poster created by the Environmental Protection Agency, to educate users about their septic system. Septic systems used for public schools should be inspected annually and pumped every 2 to 3 years or when the total depth of the sludge and scum exceeds one third of the liquid depth of the tank. Harsh chemicals can kill the collection of living organisms required to digest human waste. Other items that will clog a leach field and should never be flushed:

- Cooking grease or oil
- Flushable wipes
- Photographic solutions
- Feminine hygiene products
- Dental floss
- Diapers
- Cigarette butts
- Coffee grounds
- Paper towels
- Pharmaceuticals
- Chemicals such as gasoline, oil, pesticides, antifreeze, and paint or paint thinners

MAINTAIN YOUR LEACH FIELD

The leach field is the area of underground perforated pipes that allows the earth to slowly absorb wastewater. To properly maintain a functional leach field, avoid the following:

- Parking: unless the leach field is specifically designed for it, never park or drive vehicles over the leach field.

- Plants: avoid planting trees above or near leach fields. The roots will grow into the perforated pipes, which will clog and require replacement. A civil engineer or landscape architect can help determine minimal tree separation distance or specify root barrier material to discourage root intrusion.

- Drainage: to the extent possible, direct site drainage swales, roof downspouts and other site drainage features away from the leach field. Excess water will interfere with the wastewater treatment process.

Figure 15: Avoid planting trees and shrubs above or near leach fields or plumbing lines.

HOW MAINTENANCE SAVES MONEY

Poor maintenance often causes septic systems to fail prematurely. Failing systems are expensive to repair or replace; it is less costly to provide routine inspections and maintenance. Septic systems need to be pumped regularly. Frequency will depend on the size of the system, number of users, weather pattern, as well as health and condition of the system.

PROTECT THE ENVIRONMENT

Another important reason to properly maintain septic systems is that it can help prevent the spread of infection and disease. Fecal matter in septic systems contain disease-causing bacteria and viruses, nitrogen, and phosphorous. Inadequate wastewater treatment can leach into the groundwater and contaminate drinking water (Figure 15).

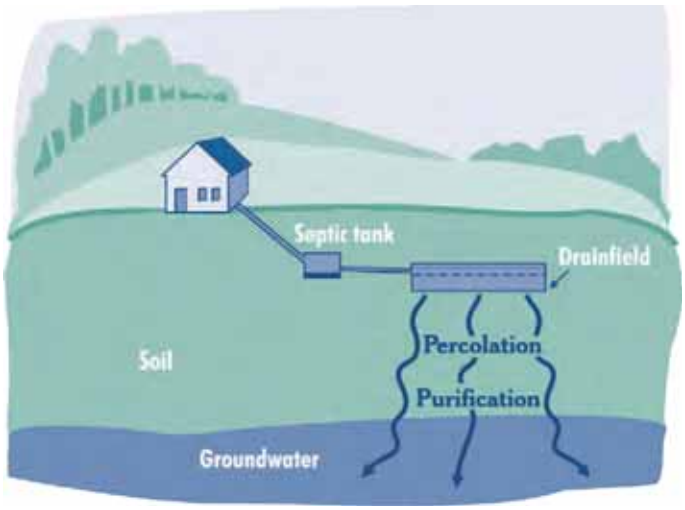

Figure 16: Overloading the leach field can cause contamination of groundwater sources.

FURTHER READING

- Civil Engineering Site plans can be downloaded online, see Chapter 1, Further Reading links.
- U.S. Environmental Protection Agency
  - How to Care for Your Septic System: https://www.epa.gov/septic/how-care-your-septic-system#inspect
  - Your Septic System is Your Responsibility: https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf
  - WaterSense, Water-Saving Products: https://www3.epa.gov/watersense/products/index.html

FUTURE CONSIDERATIONS

- Septic systems that require pumping more often than 2 to 3 times per year, may need a plumber and/or civil engineer to help verify what is wrong and offer suggestions.

School Name:	
(include a Site Plan or describe # and location of septic tank(s), leach fields, and sewer lines)	
Tank Size(s):	
Date of last service:	Description (repairs completed/needed):

Figure 17: Worksheet to be updated by grounds maintenance staff every time the septic system is serviced.

Figure 18: Environmental Protection Agency poster promoting proper septic system maintenance. Public school septic systems should be inspected annually and pumped every 2-3 years or when the total depth of the sludge and scum exceeds one third of the liquid depth of the tank.

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Chapter 5
General Grounds Maintenance

Grounds maintenance workers ensure that the school campus grounds are safe, attractive, orderly, and healthy in order to provide a functional outdoor environment.

Duties consist of keeping school grounds clear of trash, glass, leaves, and other debris; sweeping sidewalks, parking lots, and paved play areas; hosing down sidewalks, steps, and outside entrance areas; maintaining the lawn in a neat and presentable condition by mowing grass, trimming around the buildings, sidewalks, and fence lines; pulling weeds and trimming shrubbery as necessary.

The following general guidelines are provided in response to general observations of school campuses, based on ABCs 2017 site visits. See Appendix A for the full report.

FUTURE CONSIDERATIONS

- Checklists such as Table 4 in Chapter 2, can help ensure maintenance tasks are performed on a consistent basis.
- Such checklists can also serve as the basis for estimating Full-Time-Equivalent staff needed (to adequately provide grounds maintenance services) and key performance indicators to measure staff performance and results.
- If management of grounds maintenance staff is an issue, the district may want to consider outsourcing school grounds maintenance to a private contractor.

1. Keep Campus Clean

General sweeping, raking and picking up leaves, tree litter, foreign debris, trash and garbage, is a daily task to keep the appearance of the campus grounds neat and sanitary. Faculty should remind students to place their trash into a trash container and not on the grounds.

2. Fencing Maintenance

Clear and remove overgrown vegetation along the outside of the perimeter fencing to prevent the chain-link fencing from damage caused by the weight of the vegetation leaning on the fence as well as tree branches falling on the top rail of the fencing. An 8’ to 10' wide clear area on the exterior perimeter of the fence should be maintained on a monthly basis by keeping the vegetation cut down to a manageable height. Keeping the fencing from any obstructions is beneficial for security and maintenance purposes. Fencing repairs will be easier to access and less expensive.

Figure 19: Trash and debris on campus should be cleaned up on a daily basis.

Figure 21: Vegetation has overgrown the existing perimeter chainlink fencing.

Figure 20: Dumping of trash and foreign debris should never be allowed on school grounds.

Figure 22: Fallen trees and overgrown vegetation has damaged section on perimeter chainlink fencing.

3. Remove Nuisance Trees

Removal of plant material that is growing in undesirable locations should be removed as soon as possible. There may be instances where a seed from a tree has germinated and is now growing right next to a building, fencing, drainage swale or sewer leaching field that will cause damage or flooding. Removing vegetation where it should not be growing is essential to reducing this type of maintenance and costly repairs. Do not allow the plant to grow into a tree. It is best to remove it when it is still in its juvenile stage of growth.

Figure 23: Young tree growing along the fence line will eventually damage the fence unless it is removed soon.

Figure 24: Trees growing along the fence also disrupt the drainage swale and should be removed.

4. Limit Vehicle Parking

Cars, trucks and other vehicles should not be allowed to park on or drive along, or cross pedestrian walkways, dedicated fire access lanes and drainage ways. Cars and trucks damage both the walkway pavement as well as adjacent grass and landscape areas. Drainage problems and standing water due to deep tire depressions can also breed mosquitoes. Barricades or posting of "NO CARS AND TRUCKS ALLOWED" or "KEEP VEHICLES OFF THE GRASS" may help in deterring people from driving where they should not be driving.

Figure 25: Vehicles parking on grassed areas damages the turf and creates potholes, which degrades site condition, causes erosion, and may create breeding habitat for mosquitoes.

Figure 26: Vehicles parked within a drainage structure damages the planned function of the swale and causes storm water to backup and flood to other areas of campus. These parked cars are also blocking the fire access lane.

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Chapter 6

Turf (Grass) Maintenance and Safety Guidelines

Why Turf Maintenance is Important

Regular turf maintenance is essential in preventing drainage problems, weeds and pest infestations. Turf left uncut for weeks will block surface rain runoff from flowing into drain inlets. An overgrown retention basin can flood other areas. Good turf maintenance practices will promote healthy growth and will benefit the students that are actively using the playfields on a year round basis. Use proper Personal Protective Equipment (PPE) at all times.

Three important mowing safety guidelines shall be followed to prevent accidents and injuries:

a. Walk the site before mowing.
b. Remove debris (rocks, tree limbs, trash, etc.).
c. Locate any hazards or obstacles (i.e., drain pipes, clean outs, manholes, valve boxes).

Selecting the Right Grass

Many factors affect grass selection. Some considerations are: grass species, desired texture, sun exposure, salt tolerance, growth rate and resistance. For example, “No-Mow” bermuda grass requires less mowing and tolerates drought, saline and alkaline soil, but it can be slow to establish, and is susceptible to insects. Appendix G - Common Lawn Grasses for Hawaii is provided as a reference, however, a local nursery or a landscape architect may have additional site-specific recommendations.

Mowing Turf

Turf shall be mowed at a uniform finished height. Mow turf areas to a minimum average height of 2" when average height of grass becomes 3" to 4". The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Vary the mowing pattern (i.e., avoid mowing in the same direction every time) to prevent the turf from growing in one direction. Mowing in the same direction will cause soil compaction and ruts. Varying the mowing pattern will result in more upright growth.

Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and branches on a turf area shall be

FUTURE CONSIDERATIONS

- Selecting the right grass is important. Certain grasses can help reduce the frequency of lawn trimming because they grow slower. Other species may be more salt tolerant or drought resistant. Consult a local specialist.

picked up and disposed. Adjacent paved areas shall be swept and vacuumed clean. Avoid mowing the turf when conditions are wet which will cause an uneven cut and clippings can mat and block sunlight to the grass.

Mowing shall be done on a regular schedule once every 10 to 14 days. Adjust mowing frequency based on the growth rate to remove approximately 1/3 (height) of the grass blade at each mowing.

Mower blades need to be sharp and should be sharpened at least once a week if the mower is being operated on a daily basis.

Turf Edging and Trimming

Clearing and edging grass along paved walkways is an on-going maintenance task. Keeping the walkways and roadways clear and safe is a priority. Use of an edger or weed-eater is recommended as well as a hand pick and shovel. Grass encroaching onto walkways can become a tripping and slipping hazard. The edges of both sides of the walkway shall be visible and shall not drop off suddenly which can cause ankle injuries. General rule of thumb is to maintain the finish grade to be 1/2" from the top of pavement.

Perimeter of turf limits and paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and drain inlets and outlet and to provide a clear cut division line between existing conditions and turf. Edging also is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string-line trimmers is permitted in "soft" areas such as an edge between turf-grass and roadway edges.

Trimming around fences, poles, drain inlets, manholes, cleanouts, valve boxes and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf is mowed.

Chapter 7
Tree, Palm and Shrub Maintenance

OVERVIEW

Tree, palm and shrub maintenance involves proper care to prevent disease and maintain the health of the trees, palms and shrubs which includes watering, pruning, pest control, fertilization and Integrated Pest Management (IPM) practices.

Existing trees and palms shall be inspected every week for dead branches, diseases, weak or heavy limbs and branches that could break and fall to cause injury or death and/or damage building roofs. All school campus trees and palms shall have a tree assessment report conducted by a certified arborist and prune trees according to International Society of Arboriculture (ISA) Pruning Guidelines (ANSI 300 Part 1). Selectively prune trees and palms for health and safety reasons. Removal of large dead trees should be done by a licensed certified arborist.

Figure 27: Example of a large dead tree with branches overhanging a classroom building.

WATERING

Trees, palms and shrubs have specific water requirements. It's best to select plants that are naturally suited to the tropical local conditions of the four U.S Territories to minimize maintenance requirements and use of water.

(a) Do not over-water, which deprives roots of oxygen, stresses the plant and causes roots to become infected. Yellowing of the leaves is also a sign of oxygen starvation and can eventually kill the plant.

(b) Do not under-water the plants. Signs of stress includes wilting and loss of eaves.

(c) Avoid frequent light watering, which will promote the development of shallow surface root systems.

(d) Deep-root watering to a depth of 12 - 18" will help plants develop a deeper root system. Always allow time for the soil to dry partially between waterings.

(e) Water early during the day so the soil will absorb water before it evaporates when the sun is out.

ROOT BARRIER

Root barrier can be used as a retrofit measure when an existing tree has been planted too close to existing buildings or sidewalks (Figure 27). Without a root barrier, the tree's roots may undermine the foundation, resulting in uplift and cracking. When installed properly, root barrier can help manage root expansion by redirecting roots either away from a structure or deeper underground to reduce structural impacts.

Non-chemical root barriers are available as a high density polyethylene (HDPE) roll or panel. The roll root barrier can be draped over utility lines to protect them from root damage. A panel root barrier can be placed along a sidewalk or surrounding a tree well, to minimize uplift and root damage. See the manufacturer's instructions for more information.

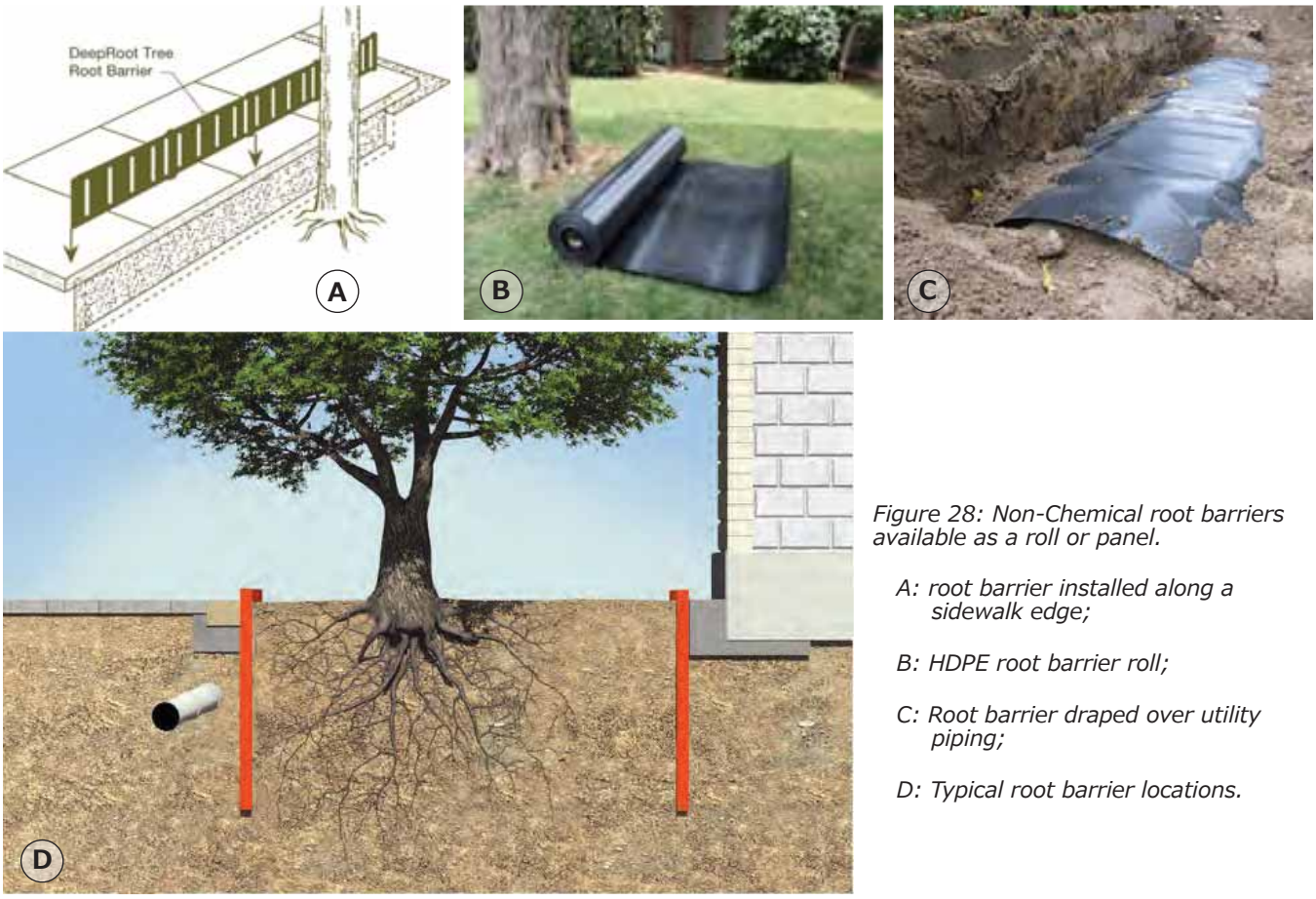

Figure 28: Non-Chemical root barriers available as a roll or panel.

A: root barrier installed along a sidewalk edge;

B: HDPE root barrier roll;

C: Root barrier draped over utility piping;

D: Typical root barrier locations.

PRUNING

Pruning involves the trimming and removal of branches, fronds, and fruits (e.g., coconuts), from trees, palms and shrubs to improve the overall health and appearance and to control or stimulate growth. Pruning is also done to prevent safety hazards, such as falling coconuts.

Tree Pruning: The general rule being "remove no more than 25 to 30 percent of the total crown with each pruning". Removing limbs to balance a tree for appearance sake or to increase time between necessary tree maintenance shall not be done. Most routine pruning such as, removal of weak, diseased or dead limbs can be done any time year round.

There are two primary pruning objectives for trees:

(a) Hazard Reduction Pruning (HRP); the primary objective is to reduce the danger to a specific target caused by visibly defined hazards in a tree such as a dead or damaged branch hanging over utility lines, walkways, roadways or buildings.

(b) Maintenance Pruning (MP); the primary objective is to maintain or improve tree health and structure, and includes hazard reduction pruning.

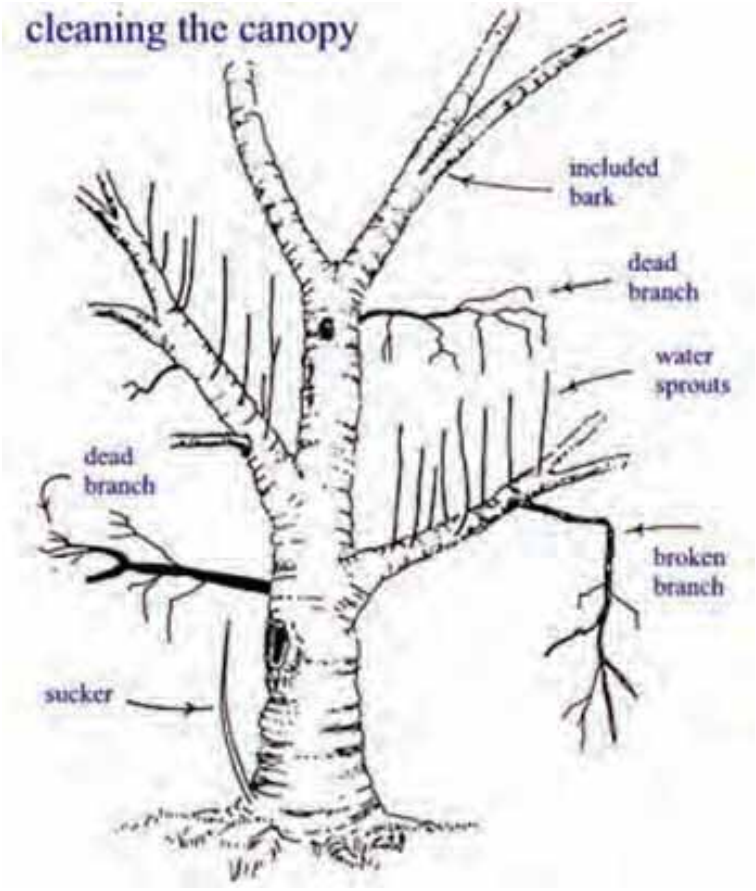

Figure 29: Example of a tree in need of Crown Cleaning.

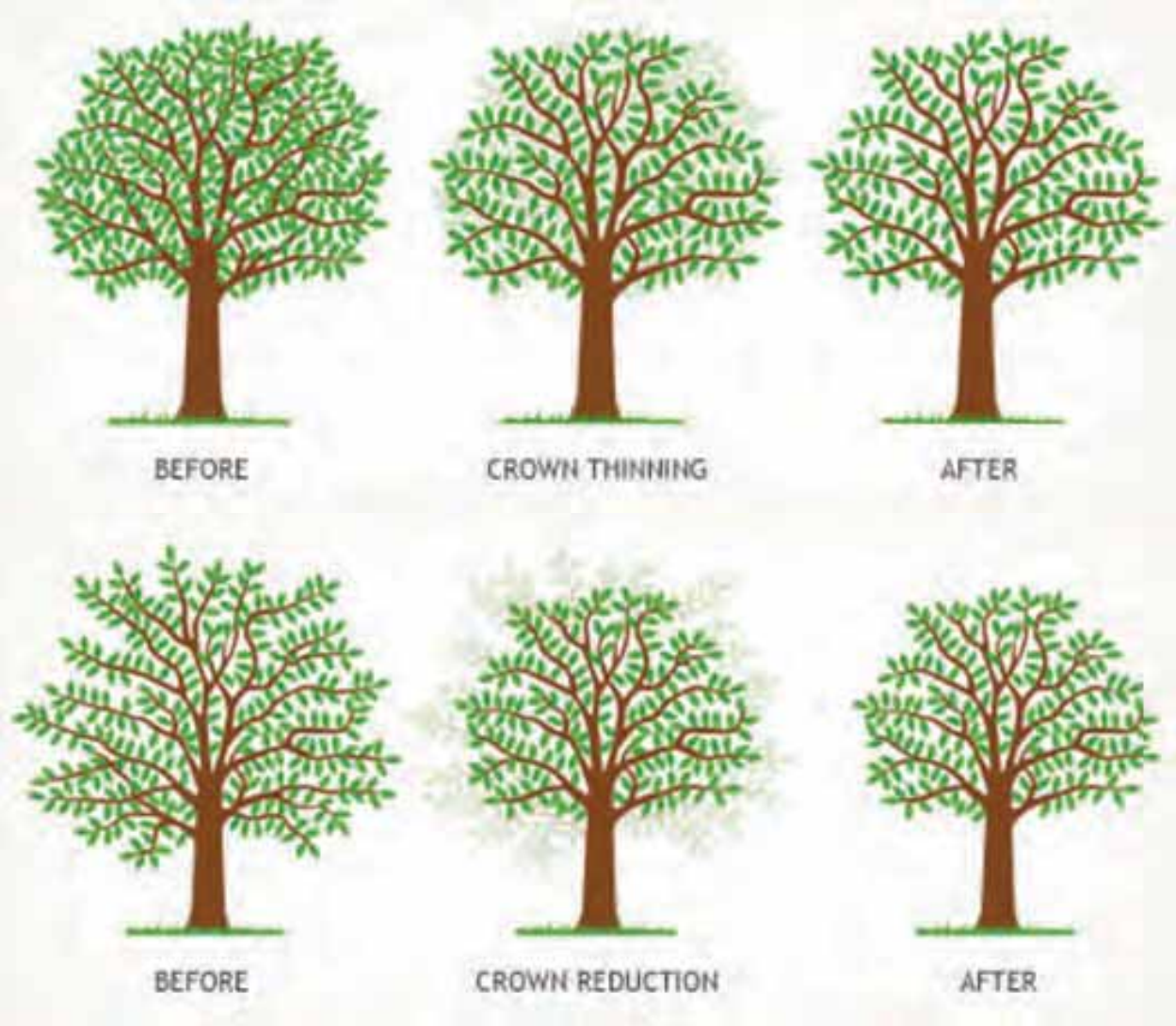

Figure 30: Examples of Crown Thinning and Crown Reduction.

Tree Pruning Types: HRP and MP consist of one or more pruning types.

(a) Crown Cleaning shall consist of the selective removal of one or more of the following items: dead, dying or diseased branches, weak branches, water sprouts and storm damaged growth. ("Water sprouts" are a symptom that too much leaf surface has been removed from a tree; aka, sucker growth)

(b) Crown Thinning shall consist of the selective removal of branches to increase light penetration, air movement and reduce weight. Only perform this pruning type if the health of the tree is declining.

(c) Crown Reduction decreases the height and/or spread of a tree without losing the natural shape/form of the tree.

(d) Crown Restoration improves the structure, form and appearance of trees that have been severely headed or vandalized.

Tree Pruning Guidelines: Follow the guidelines below to prune correctly and safely.

(a) Always cut branches just beyond the branch collar and not flush with the trunk.

(b) Avoid leaving a stub beyond the edge of the branch collar, which can result in decay spreading into the trunk of the tree.

(c) Avoid topping a tree.

(d) Avoid pruning the trunk of a tree, unless the tree is being removed entirely.

(e) Always use sharp tools to make clean cuts.

(f) Always disinfect pruning equipment after pruning, even when moving to other plants in the same area, to prevent the spread of disease organisms.

(g) Always wear appropriate PPE including eyewear, footwear, head protection and gloves.

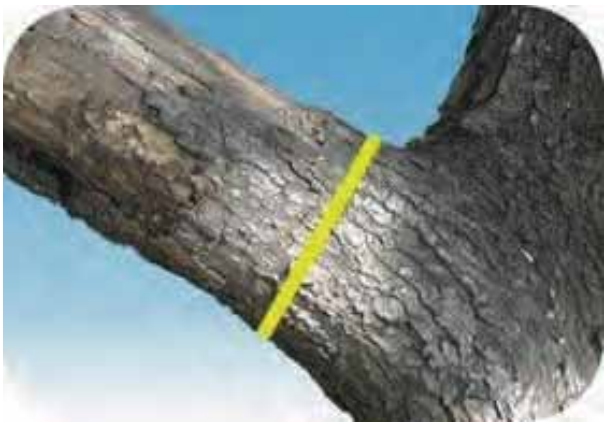

Figure 31: The branch collar is the point where a branch joins the trunk or another branch. This is the area the arborist chooses to make a proper cut.

Figure 32: The wrinkles in the branch collar are the tree's first line of defense against the invasion of micro-organisms. The final cut should be made just outside these wrinkles.

Good

Bad

Figure 33: In good pruning technique, a surgical cut preserves the branch collar, and should be made square to the diameter of the stem. This produces the smallest theoretical wound. If a cut is made on the diagonal, it creates a larger oval sloping cut, which makes it harder for the wound to heal.

Palm Pruning
Prune palms to remove dead, dying, diseased, damaged or unwanted fronds, seed pods and fruit clusters.

Pruning for Coconut Palms
(c) Barricade off area below pruning operation to create a safe pedestrian way.

(d) Remove fronds that are hanging below the horizontal plain.

(e) Remove fruits, seed pods and fruit stalk two times a year or as required to maintain safety of personnel, students and property.

Root Pruning
Have a certified arborist evaluate and perform or oversee tree root pruning. Never cut/remove all of the tree surface roots. Make sure that an arborist is consulted to determine the extent and amount of roots to be removed.

Pruning for Shrubs
(a) Prune shrubs if the branches start to overhang walkways and roadways.

(b) Prune shrubs if the plants are obstructing view of on-coming vehicles and pedestrians.

(c) Cut and remove dead, broken or unhealthy wood back to a healthy part of the plant.

EQUIPMENT

Pruning Equipment
Pruning equipment consists of motorized and hand-operated tools. Select the appropriate tool to the type of pruning and the diameter of the branches being cut. Training and precautions are required for motorized tools and equipment, such as chainsaws and chippers.

Figure 34: Pruning saws are used to cut branches too large for hand pruners or loppers

Figure 35: Use hand pruners to cut branches up to 1/2" in diameter.

Figure 36: Loppers are used to cut branches up to 1-1/2 " in diameter.

Figure 37: Chainsaws are used for cutting large limbs; operating a chainsaw requires training.

Figure 38: Use shears and / or motorized hedge trimmers for trimming hedges.

Figure 39: Chippers reduce branches and leaves into a reusable mulch product, but operating the chipper requires training.

Chapter 8

Playground Equipment Maintenance

Playground equipment should be inspected semi-annually—before school begins in the fall and in the early spring. A July safety inspection allows time for repairs to be made before students return for the first day of school. An early spring inspection (early-March) should also be undertaken.

Periodic inspection of playground equipment are important to determine faulty equipment and minimize risk of injury to students and other community users (Figure 40 and 41). The following checklist (Figure 42) should be used for these semi-annual inspections and should be kept with other preventive maintenance records. For playground equipment, the fall height of a child to a cushioned ground surface should never exceed 8 feet. An Outdoor and Grounds Care Frequency Chart is also included (page 15, Chapter 2, Table 4) to provide a guideline for how often grounds keeping tasks should be performed.

Figure 40: Sand or grass is not a safe surfacing for fall protection; a certified resilient play surface is recommended.

Figure 41: Play structure is compromised by extensive wood rot. Exposed nails are a safety hazard and should be removed immediately. Grass is not a safe surfacing for fall protection; a certified resilient play surface is recommended.

Minor repairs should be made at the school level. Repairs beyond the capability of in-school personnel should be brought to the attention of the district facilities manager.

Whether using factory-manufactured or natural elements, public school playgrounds have specific obligations beyond providing a fun, challenging space. Although budgets have a lot to do with choices, parents and the community members expect playground equipment to be safe.

PLAYGROUND EQUIPMENT SAFETY STANDARDS

Relevant standards for playground facilities include the Americans with Disabilities Act, the U.S. Consumer Product Safety Commission Handbook on Public Playground Safety, American Society for Testing Materials International (ASTM) F1292, F1951 and F1487, and in some cases, State Health and Safety Codes, which may have additional, more stringent accessibility requirements. Playgrounds and protective surfacing are dynamic outdoor environments that are intended to provide safe environments for children. Installing equipment that is non-compliant to the standards or to the bare minimums of the standards invites failure, injury, costly replacements or lawsuits.

Today, ASTM F08.63 and F15.29 Subcommittees have developed the following standards dealing with playground surfacing and playground equipment for public use:

1. F1292 Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment -This specification establishes minimum performance requirements for the impact attenuation of playground surfacing materials installed within the use zone of playground equipment. ASTM F1292 section 4.4.2 states, "When an installed playground surface is tested in accordance with this section, if the impact test scores at any tested location in the use zone of a play structure do not meet the performance criterion, bring the surface into compliance with the requirements of this specification or the play structure shall not be permitted to be used until the playground surface complies."

2. F1951 Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment - This specification is a performance standard to determine the suitability of surfacing for persons with disabilities.

3. F2075 Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment - This specification describes the technical requirements for engineered wood fiber. There are a number of tests performed on the subject material for particle size and distribution, heavy metals, and tramp metal, and sieve analysis.

4. F2479 Guide for Specification, Purchase, Installation and Maintenance of Poured-In-Place Playground Surfacing - This guide covers standards for selecting and specifying surface systems under and around playground equipment. This guide describes how to apply existing ASTM standards to evaluate the impact attenuation, accessibility characteristics, and product characteristics when selecting surfacing systems for use under and around playground equipment.

5. F3012 Standard Specification for Loose-Fill Rubber for Use as a Playground Safety Surface under and around Playground Equipment - This standard defines the technical requirements for loose-fill rubber mulch used in and around playground equipment including performance requirements for size, hazardous metal content, tramp metal content, sharp metal content, and lead content.

6. F1487-11 Standard Consumer Safety Performance Specification for Playground Equipment for Public Use - This consumer safety performance specification provides safety and performance standards for various types of public playground equipment. Its purpose is to reduce life-threatening and debilitating injuries.

Playground Inspection Checklist

School _____ Date _____

Inspected by _____

Inspected	Play Equipment	Describe Repairs Needed	What Repairs Were Made
SLIDES			
	Exposed concrete footing		
	Protruding bolts or hardware		
	Head entrapment areas (between 3" and 9")		
	Metal slide bed separating from equipment base at entrance, exit or joints		
	Loose, bent, sharp, or missing parts		
	Unstable equipment		
	Rough or broken slide bed		
	Finger entrapment areas (between 3/8" and 1")		
	Rust or dry rot on frame		
	Peeling paint or graffiti		
	Obstructions in 8' fall zone		
	Rusty/worn hardware		
	Debris littered steps		
CLIMBERS			
	Exposed concrete footing		
	Protruding bolts or hardware		
	Head entrapment areas (between 3" and 9")		
	Loose, bent, sharp, or missing parts		
	Unstable equipment		
	Peeling paint or graffiti		
	Finger entrapment areas (between 3/8" and 1")		
	Rusty-worn hardware		
	Rust or dry rot on frame		
	Loose railings		
	Obstruction in 8' fall zone		
FOOTBALL/SOCCER FIELDS			
	Goals bent or broken		
	Grounds in poor shape		

Figure 42: Playground Inspection Checklist

Inspected	Play Equipment	Describe Repairs Needed	What Repairs Were Made
PLAY EQUIPMENT			
	Glass or rocks scattered on fields		
	Grounds in need of care (i.e., ground uneven, gullied areas, etc.)		
	Glass, bottles, paper or cans need to be cleaned up		
BASEBALL/SOFTBALL DIAMONDS			
	Backstop fencing bent, torn or broken		
SWINGS			
	Loose/worn chain swivels		
	Badly worn chain links		
	Seats cracked or broken		
	Protruding nuts and bolts		
	Loose concrete footings - unstable equipment		
	Loose, bent or missing parts		
	Excessively/dangerously rusted parts		
SEESAWS			
	Rotted or cracked boards		
	Protruding or exposed nuts or bolts		
	Badly worn pivotal joints		
	Cracked boards or handles		
	Loose concrete footing		
BASKETBALL COURTS/ HOOPS			
	Hoops loose/broken		
	Backstop loose		
	Surface (concrete or blacktop) cracked, loose or pitted		
	Surfaces with broken glass or gravel		
CRAWL TUNNELS			
	Peeling paint		
	Finger entrapment areas (between 3/8" and 1")		
	Cracked or broken areas		
	Obstruction in 8’ fall zone		
	Rough/sharp edges		
	Glass or debris present		

Figure 42: Playground Inspection Checklist

Inspected	Play Equipment	Describe Repairs Needed	What Repairs Were Made
PLAY AREA SURFACE AND BORDERS			
	Glass and/or debris present		
	Play pieces are not at least 8’ apart		
	Surfacing border has rough or cracked concrete, rough boards, or protruding bolts or nails		
	The depth of loose surfacing material is less than 6"		
	Surfacing border is not adequately containing the material		
WOODEN CLIMBING EQUIPMENT			
	Split uprights on wooden equipment		
	Exposed footings		
	Uprights worn/loose		
	Platforms, rungs, railings loose or worn		
	Loose bolts		
SPRING RIDING TOYS			
	Concrete footing loose		
	Exposed bolts and nuts		
	Plastic structure broken or cracked		
Please Note: In no case should the fall height of a child to the cushioned ground surface exceed 8 feet.			
Overall comments on playground:			

Figure 42: Playground Inspection Checklist

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Chapter 9

Resources Cited and Recommended Reading

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Graphic Sources

Chapter 3

Figure 1-10: Okahara & Assoc, 2017 Site Visit.

Chapter 4

Figure 11: Okahara & Assoc.

Figure 12: U.S. EPA. (n.d.). Your Septic System is Your Responsibility. Retrieved Mar 16, 2017, from https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf

Figure 13: http://www.dreamstime.com/royalty-free-stock-image-overflowing-toilet-image-image41425426

Figure 14: U.S. EPA. (n.d.). U.S. Environmental Protection Agency. Retrieved Mar 16, 2017, from Watersense/Products: https://www3.epa.gov/watersense/products/index.html

Figure 15: http://www.vacuumtruckexchange.com/roots-in-sewer-lines.html

Figure 16: U.S. EPA. (n.d.). Your Septic System is Your Responsibility. Retrieved Mar 16, 2017, from https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf

Figure 17: HHF Planners

Figure 18: https://www.epa.gov/sites/production/files/2016-08/documents/septicsmart_infographic_v2_081215.eps_508.pdf

Chapter 5

Figure 19-26: Okahara & Assoc, 2017 Site Visit.

Chapter 7

Figure 26: Okahara & Assoc, 2017 Site Visit.

Figure 27A: http://www.deeproot.com/resources/rootBarrier/supporting/Root_Guide_Tech_Sheet.pdf

Figure 27B, 27C, 27D: http://www.greenmax.eu/nl/rootcontrol/

Figure 28: http://hort.ifas.ufl.edu/woody/cleaning.shtml

Figure 29: http://www.arbortectreecare.co.uk/tree-pruning-and-trimming

Figure 30-32: http://treecarepruningandplanting.com/branch-collar.htm

Figure 33: https://www.stihlusa.com/products/hand-tools/hand-pruning-saws/ps60/

Figure 34: https://www.lowes.com/pd/Fiskars-Bypass-Hand-Pruner/3044767

Figure 35: https://www.stihlusa.com/products/hand-tools/loppers/pl10/

Figure 36: https://www.stihlusa.com/products/

Figure 37: http://www.fiskars.ca/Products/Yard-and-Garden/Hedge-Shears and http://www.shindaiwa-usa.com/products/hedge-trimmers.aspx

Figure 38: https://www.vermeer.com/NA/en/N/equipment/brush_chippers/bc900xl

Chapter 8

Figure 39-40: Okahara & Assoc, 2017 Site Visit.

Appendix A
Site Inspection Reports

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

March 3, 2017

CONFIRMATION NOTICE NO. 11

SITE INSPECTION REPORT

Project : Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year Two
Contract number W9128A-11-D-0004
Territory: U.S. Virgin Islands – St. Thomas and St. Croix

Dates of Site Inspections: February 27 and 28, 2017
March 1 and 2, 2017

Inspection Participants: Irvin Higashi, Okahara and Associates (All Days)
Joseph Sibily, USVI / DOE (February 27, and 28)
John Bedminster, HHF Planners (February 27, and 28)
Lionel Jacobs, HHF Planners (March 1 and 2)

DAY 1: February 27, 2017 (St. Thomas):
1. Joseph Sibilly Elementary School
2. Lockhart Elementary School
3. Jane E. Tuitt Elementary School
4. Ulla F. Muller Elementary School
5. Gladys A. Abraham Elementary School
6. Addelita Cancryn Junior High School

DAY 2: February 28, 2017 (St. Thomas):
7. Ivanna Eudora Kean High School
8. Bertha C. Boschulte Middle School
9. Joseph Gomez Elementary School
10. Yvonne Miller Bowsky Elementary School
11. E. Benjamin Oliver Elementary School

DAY 3: March 1, 2017: Fly to St. Croix:
1. Ricardo Richards Elementary School
2. Lew Muckle Elementary School
3. Pearl Larson Elementary School

Day 4: March 2, 2017 (St. Croix):
4. John Woodson Junior High School
5. Eulalie Rivera Elementary School
6. Arthur Richards Junior High School
7. St. Croix Educational Complex High School
8. St. Croix Central High School
9. Positive Connections Alternative
10. Juanita Gardine Elementary School

Day 5: March 3, 2017: FLY BACK TO ST. THOMAS

Between February 27 and March 3, 2017, Okahara and Associates, Inc. conducted and completed grounds site assessments for 20 schools on the islands of St. Thomas and St. Croix of the U.S. Virgin Islands focusing on general condition of the campus grounds maintenance and drainage issues. The following is a summary of our observations with photos and comments at various schools campuses.

ST. Thomas and St. Croix:

1) The existing school campus grounds appears to be deficient in the care and maintenance of the campus exterior grounds in terms of maintaining the overall site drainage system, walkways and parking pavements, playground surfacing, fencing, grass and the landscape.
    a. Overgrown grass, weeds and debris has taken over areas, drain inlets, concrete swales, sidewalk culverts, trench drains and rain gutters are clogged that leads to ponding and flooding where water cannot flow properly.
    b. Drain pipes to allow water to flow under sidewalks are buried.
    c. Drain inlets and outlets are partially buried.
    d. Trees growing too close to buildings and roots uplifting pavement.
    e. Perimeter fencing are being damaged and overwhelmed with overgrown vegetation.
    f. Maintaining unpaved roads, driveways and designated parking areas by filling in pot holes, re-grading and compacting as needed.

2) General maintenance should include, but is not limited to:
    a. Remove debris (rocks, tree leaves, seeds, fruits and limbs, trash, etc.) by racking and picking up before mowing.
    b. Mow, trim and edge grass once every 10 to 14 days. Remove grass clippings.
    c. Removal of vegetation, dirt and debris from the drain inlets and flushing of drain lines.
    d. Tree branches growing over buildings needs to be removed and pruned back.
    e. Tree removal or relocation is recommended if it is growing too close to buildings, utility lines, drainage systems and walkways.
    f. Removal of vegetation growing along and on perimeter fence lines, causing damage to fencing.
    g. Clearing and regrading of retention basins to remove silt and overgrown plant material and restore basins to its original depth to ensure proper basin function.
    h. Regrading of surrounding areas to match bottom elevation of culverts and flushing of culverts to ensure proper culvert function.
    i. Cleaning and regrading of existing swales and ditches to ensure proper direction of flow and capacity of drainage routes.
    j. Maintaining unpaved roads, driveways and designated parking areas by filling in pot holes, re-grading and compacting as needed.

3) All of the schools visited has drainage issues that will require additional improvements to be implemented through funded design and construction projects. The proposed drainage improvements include, but are not limited to:

   a. Addition of roof gutters to reroute drainage roof runoff to designated drainage areas.
   b. Addition of new drainage collection systems to allow the drainage of ponding and flooded areas.
   c. Addition of retention basins to retain and confine onsite runoff and reduce onsite ponding.
   d. Addition of concrete and grass swales, gutter and ditches, including sidewalk culverts to route onsite drainage flow to designated flow patterns.

USVI School Site Visit Report
February 27, 2017 – St. Thomas:

1) JOSEPH SIBILLY ELEMENTARY SCHOOL

a. Replace corroded rain gutters and down spouts to prevent water from splashing onto wooden building structures that is causing dry wood rot and erosion to the ground surface below.

b. The downspout located at the west end of Building No. 5 should be moved to the south end corner to re-direct the surface flow to drain towards the south. The same goes for Building No. 4.

c. Remove the vines that are overgrown to interfere with the communication tower located at the north side of Building No. 4.

d. Remove (by hand shovel and wheel barrels) excess soil build-up along the low concrete walls along Buildings No. 9, 10, & 11 by at least 12 to 18 inches and swale surface runoff towards the north direction in lieu of a diversion ditch as previously noted in the February 2015 site assessment. Remove dead leaves and re-establish shade tolerant groundcover to minimize future runoff from re-occurring.

e. The existing lower play area needs to be condemned for safety reasons. This area needs to be re-designed or removed entirely to prevent injury to people due to the steepness of the existing walkways that terminates at a steep slope. The play apparatus is not suited for children 5 to 12 years old, which is more of an exercise equipment for middle and high school students. There is no safety play surfacing below any of the equipment to protect from fall injuries. Jagged rocks at the surface are visible throughout the area.

f. The lower play area is a natural drainage area and should be reviewed by a civil engineer to determine how to handle the drainage flow pattern during a heavy rainfall.

g. The ficus trees growing along the boulder retaining wall needs to be removed because the roots are pushing the wall outwards and will eventually uplift the existing basketball court. Also, the trees are way too close to the overhead utility lines that need to be pruned often and severely.

2) LOCKHART ELEMENTARY SCHOOL

a. There are a lot of ficus trees that was planted within the raised planters between the classroom buildings that should be removed before the trees start to cause damage to the drainage system by clogging the drain inlets with its fibrous root system and will be difficult to remove later. The ficus trees have aggressive fibrous root system that can intrude under the building floor slabs and cause cracking and uplift damage.

b. The existing fire hydrant riser could not be located between Building No. 12 and 13 within the courtyard planter.

c. The drain openings in each of the courtyard planter islands connect to a center collection drain pipe. The drain pipes need to be cleaned and flushed out thoroughly to prevent the drain opening from clogging which can cause flooding of the adjacent classrooms.

d. The existing fire hydrant riser has corroded off after the shutoff valve and needs to be replaced.

e. The existing play structure and swings should be condemned and removed due to safety issues to the ground surface that is rocky and unsafe. The area has a lot of trash and litter and should be cleaned up.




3) JANE E. TUITT ELEMENTARY SCHOOL

a. Rain gutters needs to be cleaned and remove of build-up debris that is clogging the downspouts.

b. Concrete drainage swale located between Buildings No. 5 and No. 8 need to be kept clear from any obstructions that could cause the flow of water to back-up and cause flooding to Building No. 8 during a heavy downpour.

c. Repair damaged chain-link fencing located at the southeast corner of Building No. 6.


4) ULLA F. MULLER ELEMENTARY SCHOOL

a. Add 2 to 3 more weep holes through the existing CMU wall to increase the flow of surface water to drain. Remove silt/sand build-up on the road pavement.


b. Clean and remove stored debris, dead leaves, overgrown vegetation, and soil buildup against the northwest side of Building No. 3. Regrade the area to allow the surface water to flow to the southwest and in between Building No. 2 and No, 3.


c. Replace corroded rain gutters at Building No. 3 which is contributing the ponding problem below.

d. Re- establish a shade tolerant groundcover planting to prevent future erosion from occurring.

e. Remove stored junk and debris being Building No. 1 and No. 2 to allow surface runoff the flow.

f. The existing large mango tree has been intentionally stripped of its main trunk bark layer and will eventually die. Recommend removing the tree entirely.

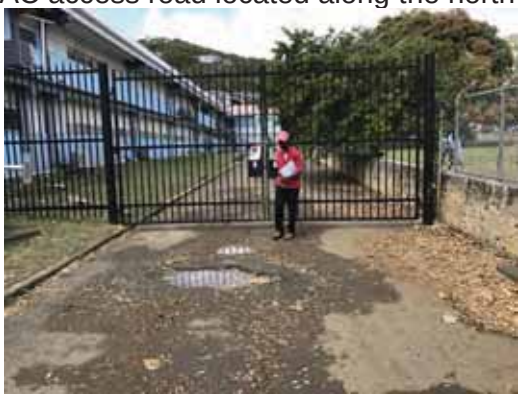
g. Re-establish new grassing within the large courtyard area fronting Buildings No. 1, No. 2, No. 3 and No. 4 to prevent surface run-off.

h. The existing playground equipment needs to be repaired or remove or replace and provide a new safety play surfacing under all play equipment.


i. Exposed rebar used to support a temporary fence for a newly planted tree should be remove or the top portion be covered with a rebar plastic cap.


j. Remove stones and provide new topsoil to re-establish new grassing within the entire playfield area.

k. Repair potholes in the AC access road located along the north side of Building No. 4



5) GLADYS A. ABRAHAM ELEMENTARY SCHOOL

a. Need to bury all of the exposed pvc drain lines to allow surface runoff to flow properly as designed.

b. Clean out sidewalk culverts and remove soil build-up surrounding the culverts to allow the surface runoff to flow freely and reduce the ponding that is occurring along the north side of Building No. 2, No. 4, No. 6 and No. 8.

c. Provide a drainage grass swale located at the west side of Buildings No. 2 and No. 3 to divert the surface runoff toward the off-site drainage ditch.


d. Remove the silt and vegetation build-up in the parking lot located at the north side of Building No. 1 to improve drainage and reduce the ponding.


e. Vehicles should not be parking on the pedestrian walkway and should be using the parking lot.


f. Repair pot holes in the AC pavement or resurface entirely.

g. Re-establish new grassing along the north side of Buildings No. 6, and No. 8 to prevent surface erosion.

6) ADDELITA CANCRYN JUNIOR HIGH SCHOOL

a. The top elevation of the existing catch basins located between the classroom buildings seems high due to the surrounding finish grades are too low due caused by surface erosion occurring over the years. The top section of the side walls of the concrete catch basins has been removed to allow surface runoff to drain into the catch basins.

b. Add new catch basins as noted in the February 2015 site assessment plans located at the north end of the campus property to alleviate the severe ponding problem. This work needs to be designed by a civil engineer. The access road will also need to be regarded and repaved accordingly.


c. Some of the catch basin are filled with debris and should be cleaned out and the drain lines flushed with water to clear any clogged condition.


d. The existing cisterns located at the north ends of the buildings collects the rain water from the roofs and the water that is stored is not being utilized for its intended purpose and consequently the cisterns overflow through the overflow pvc pipes.

e. One of the overhead drain pipes that connect to the cistern located at Building No. 16 has been disconnected and the water spills onto the pavement directly in front of the entrance door to a classroom, causing flooding to the surrounding area. Either the drain line should be repaired and reconnected or be re-directed away from the building.


f. The area along the west side of Building No. 13 is lower in elevation than the AC walkway causing the surface runoff to pond where student benches are located. A new concrete walkway is recommended to raise the finish grade elevation to be above the AC walkway and allow the students to use the benches during a rainfall period.


g. Clean and maintain concrete drainage swales through the campus grounds to insure that surface water flows towards the intended location and not be backed up.


h. Recommend increasing the depth of the retention basin by removing and clearing away earth mounds and debris within the area.


i. Repair pot holes in the AC pavement or resurface entirely.


j. The existing drain outlet at the concrete headwall located at the south end of Buildings No. 12 and No. 15 has been damaged and is clogging the outlet. The damaged end needs to be excavated to expose the corrugated metal pipe section to be removed and reconstructed to original condition.

FEBRUARY 28, 2017 – ST. THOMAS

7) IVANNA EUDORA KEAN HIGH SCHOOL

a. Groundwater is penetrating the interior floor slabs at Building No. 11, No. 13 and No. 25 after long periods of rain due to the exterior elevation is above the interior floor slabs by approximately 3" to 4". Exploratory trenching along the exterior footprint at the north side of Building No. 11 and No.13 should be conducted to determine the extent of the water penetration. Waterproofing and water barriers should be studied further to keep the water from entering the buildings.


b. The downspout located at the southwest corner of Building No. 16 is disconnected and is causing erosion to the ground below and spilling onto the concrete pavement. Need to reconnect the downspout pipe and restore the eroded areas to keep students from walking in this area which is also contributing to the erosion problem.




c. The downspout located at the north east end of Building No. 25 is disconnected and needs to be reconnected.

d. The concrete swale along the north side of Building No. 25 is filled with soil and rocks from above that is restricting the flow of runoff. Need to remove the soil and rocks within the swale.

e. The area between Building No. 25 and the high retaining wall along the north side has a buildup of eroded material and may cause flooding to the building during prolong periods of rainfall. Need to have the buildup material remove to existing elevation that is below the interior floor elevation.

f. A cistern leak may be occurring at the south side of Building No. 21 and should be investigated by exploratory excavation to determine the source of the leak. Water is also continually seeping from the paved parking area below through the extensive cracks in the pavement.


g. Clean out debris from rain gutters and drain pipes.


8) BERTHA C. BOSCHULTE MIDDLE SCHOOL

a. Clean out debris build up in drain inlet located at the north end of Buildings No. 2 and No. 4.

b. Clean and flush out debris in all drains located in the covered courtyard areas located between Buildings No. 2, No. 3, No. 4 and No. 5.


c. Existing fire hydrant is partially buried and located at the same location of the drain inlet north of Buildings No. 2 and No. 4.


d. The building cement plaster is cracking and falling off at Building No. 6. Similar conditions are occurring throughout the campus buildings and need to be addressed for safety concerns of large concrete plaster falling at any given time.


9) E. BENJAMIN OLIVER ELEMENTARY SCHOOL

a. Add new drain inlet located outside the northwest corner of Building No. 7 where ponding occurs. Install a drain pipe directly towards the east direction and daylight beyond the perimeter chain link fencing with a concrete headwall. This needs to be further studied by a civil engineer.


b. Re-grade and repave AC pavement located at the east side of Building No. 1 and slope toward the existing concrete curb break. Relocate the existing trash bins away from the surface drainage way.



c. Recommend paving existing dirt road with a hammer-head turnaround between Building No. 1 and No. 7.



d. Clean out and remove sediment and debris from clogged drain inlets located in the courtyards.



e. Remove eroded debris and vegetation from the concrete stair and walkway leading down to the lower play area. Repair eroded areas along walkway by installing curb walls and concrete swales as necessary.




f. Repair or replace damage fencing along the south and east side property line.



10) JOSEPH GOMEZ ELEMENTARY SCHOOL

a. Replace existing floor drain with a larger 12” x 12” size drain inlet and reconnect to the existing pvc drain line located within the concrete courtyard of Building No. 7.


b. Remove growing ficus plant growing within the roof gutters of Building no. 7.


c. The concrete play area located between Buildings No. 5 and No. 6 does flood during a heavy rainfall. Recommend to re-slope the concrete surface by crowning the surface to slope toward the east and west direction and provide a play court specialty surface.


d. New perimeter security fencing is currently being constructed along the eastern end of the school property.


e. The outdoor basketball court needs resurfacing and the basketball rims, backboards and surrounding chain link fencing needs to be replaced and repaired.


f. The existing playground and ground surface does not meet Federal ASTM safety standards and needs to be condemned or replaced to meet safety standards.




11) YVONNE MILLER BOWSKY ELEMENTARY SCHOOL

a. The existing playground does not have a safety surfacing system and does not meet the Federal ASTM safety standards for playground safety. The existing swing structure is too close to an existing concrete drain inlet.


b. A security fence is recommended to enclose the playground area.

c. The existing concrete drainage way located at the east end of the school property needs to be maintained by cleaning out the runoff vegetated material and debris that is clogging the large drain inlets. Remove overgrown trees and vegetation within the drainage channek to reduce the debris that will clog the drains whenever the next heavy downpour occurs.




d. At the northeast corner of Building No. 8 there is an existing drain inlet that has a concrete curb surrounding the drain inlet on three sides which needs to be removed to allow storm water to enter the drain.


e. Re-grade the slope by constructing a swale away from Building No. 8 at the west end.

f. The concrete retaining wall located at the northwest corner of school property needs to be extended towards the west end to prevent erosion that is currently occurring. The top of the retaining wall may need to be raised higher or remove soil build up behind the retaining wall.

g. The existing play area between the outdoor basketball court and Building 8 is in poor condition and rocky. The exposed rocks and stones need to be raked out and removed and the existing topsoil amended with organic compost. Reseed the entire field with new local grass seeds during the summer months when school is out.

USVI School Site Visit Report
MARCH 1, 2017 – ST. CROIX

1) RICARDO RICHARD ELEMENTARY SCHOOL

a. Clean and maintain roadway culvert and the grass swale beyond to the south.


b. Remove sand and debris from the concrete swale located at the southeast end of the parking lot.


c. Repair extensive potholes within the roadway and parking lot or resurface entirely and restripe parking stalls.


d. Remove excess dead leaves that is piling up along the perimeter fencing located along the west side property line. Allow the existing ponding area to drain towards the adjacent undeveloped property.


e. There is an existing exposed 2” water line that needs to be buried below grade located along the west side perimeter fencing.


f. Replace damaged rain gutters located at the southwest corner of Building No. 1 due to service trucks hitting the gutter when backup up to the loading area for the kitchen.


g. Repair or replace disconnected downspout located at the northwest corner of Building No. 2 which could be contributing to the flooding problem in the area.


h. Clean and remove debris in the concrete gutter located at the northwest corner of Building No. 1.


i. The rubber tire mulch used as the safety play surfacing for the new play structure and swings needs to be maintained on a daily basis to keep the rubber mulch contained within the play boundaries.


2) LEW MUCKLE ELEMENTARY SCHOOL

a. Clean out debris buildup in drain inlet and grate located at the east end of Building No. 3.


b. Remove overgrown vegetation growing through the existing chain link fencing along the north and northeast side of the property and parking lot.


c. Erosion is occurring along the south end of the outdoor basketball court and is undermining the asphalt pavement. Recommend similar repair work to the basketball court that was completed at Yvonne Miller Bowsky Elementary School.


d. Add fill / gravel material to eliminate ponding area.


e. Enlarge drainage swale to allow surface runoff to flow past the concrete walkway and into the AC parking lot.


f. The existing rubber type interlocking tile does not seem to meet the safety standards and needs to be re-evaluated.


g. There is an exposed electrical box that need to be cleaned out and replaced with a new cover to prevent anyone from tampering with it.

3) PEARL LARSON ELEMENTARY SCHOOL

a. The off-site drainage swale has eroded the upper slope just north of the playground equipment area causing rocks and debris to build up at the lower elevation and parking lot area. A diversion concrete type wall and concrete ditch needs to be designed by a civil and/or structural engineer to direct the storm water flow into the existing drain inlet.

b. The existing drainage swale will also need to be expanded and deepened starting near the existing drain inlet and continue along the west side of the property line.


c. The existing large drain inlet located at the bottom of the steep driveway needs to be cleaned and maintained on a continual basis. The steel grate is heavy and lifting equipment is needed to remove the grate.


d. The existing playground rubber tiles are separating from each other and coming apart at the edges. There are tree root intrusions that are lifting the rubber tiles along the west side of the playground. The entire playground rubber tiles needs to be reset or replaced to meet the federal safety standards for the playground.


e. The downhill slope along the steep concrete driveway leading up to the upper playfield is severely eroding and undermining the concrete driveway. There is a wooden pole retaining structure that is also being eroded and will fail in time. A concrete curb along the east edge of \the concrete driveway will help in eliminating the sheet flow of water in this area. A new retaining should be designed to replace the wooden pole retaining structure.


f. Repair or replace corroded and damaged existing drain inlet located at the service drive south of Building No. C.


g. Lower the existing grade around the existing grease trap interceptor to allow the standing water to drain into the existing drain inlet located at the south end of Building No.3 (outside the kitchen). It seems that kitchen grease material is being poured into the adjacent drain inlet and should not be allowed.


h. The existing chain link fence with barbed ends at the top of the fence is too close to the existing swings and needs to be move back to meet the safety fall requirements.


i. Remove and clean up the heavily overgrown and neglected vegetation overtaking the areas located on the southwest, east and northeast corner of Building No. 4 (Gymnasium).




j. The chain link fencing is also being overrun by the vegetation and needs to be removed and the fence repaired or replaced as necessary.


k. The two floor drains in each of the two existing concrete courtyard in Building No. 3 is inadequate to prevent flooding in a heavy rainfall event. The roof downspouts and surface debris in the courtyards needs to be maintained and cleaned on a monthly basis. The floor drains needs to be cleaned and flushed to keep from backing up. Recommend replacing the flush mount drain grate to an atrium type grate to allow water to drain better when debris is built up. Provide backup sump pumps should flooding occur in the future.


MARCH 2, 2017 – ST. CROIX

4) JOHN WOODSON JUNIOR HIGH SCHOOL

a. Remove the landscaping and soil along the courtyard planter wall that is leaking from the bottom of the planter in Building No. 2. Re-waterproof and test the planter before restoring the soil and landscape into the planter. Provide a manageable drainage system for the planter.


b. Lower the finish grades by 6 inches within all of the planters in the courtyards of Buildings No. 2, No. 3, No. 4 and No.5 due to the poor expansive clay-type soil.


c. Remove excess soil build up within the planter area and provide a swale along the edge of the concrete pavement to allow the standing water to drain towards the existing drain inlet located in the courtyard of Building No. 5.


d. Remove the overgrown banana clump and large tree stump in the courtyard of Building No. 5.

e. Lower the existing finish grade along the east side of Building No. 2 which is higher in elevation than the floor slab in the building, which is why water is seeping into the interior floor. Re-design and re-construct the grades and concrete walkways on the exterior to slope away from Building No. 2.

f. The exterior cement plaster on the building walls is also deteriating and needs to be repaired.

g. Lower the existing exterior finish grade by 18” along the east side of Building No. 4 that is contributing to the flooding of Building No. 4 / Rooms B117 and B118.


h. The two major drain outlets with concrete headwalls located at the west side of the school property is buried and assumed clogged. The drain outlets need to be uncovered, cleaned and flushed out.


i. The existing drain pipe is damaged and is leaking near the north entry drive into the school. The drain pipe needs to be cleaned, flushed out and repaired with a new section and lowered below finish grade.


j. Maintain and clean out the standing water and debris under the raised metal grated walkway ramp to allow the surface water to naturally drain towards the existing parking lot swale without obstructions.


5) EULALIE RIVERA ELEMENTARY SCHOOL

a. Civil engineer will need to design a drainage swale and slope away from Building No. 1 (Cafeteria) towards the east.


b. Lower the finish grade to below the floor slab located at the northwest corner of Building No. 11 and slope away from the building.


c. The large gravel parking lot is in good condition, however, recommend an asphalt parking lot with a concave design would alleviate surface runoff towards the south.


d. A few of the square steel columns supporting the covered walkways has corroded and needs to be repaired.


e. Rain gutters and downspouts need to be maintained, repaired or replaced as necessary. Debris is clogging the rain gutters above and overflowing onto the ground below.

f. PVC drain pipes under the sidewalks need to be cleaned and flushed out to allow storm water to flow without any obstructions.


g. Repair broken, clogged or cutoff drain pipes and test for proper flow as necessary.

h. Remove sediment build up in all of the concrete trench drains and clean out drain pipes at the end of the trench drain for proper flow as necessary. Repair or replace broken or damaged trench drain metal grating as necessary.

i. Locate and connect a new drain line at the trench drain pipe outlet located on the edge of the covered walkway between Building No. 5 and No. 4. Connect new drain line into the existing concrete drain box beyond.

j. Civil engineer to design a concrete drainage swale starting from the northeast end of Building No. 11 down to Building No. 10 and out into the open grass area.


k. Repair corroded handicap rail at the bottom of the handicap ramp located between Buildings No. 12 and No. 13.


l. Provide a continuous concrete curb minimum 6 inch high along the concrete walkway edge and connecting to each column base to re-direct the surface runoff from the parking lot located along the north side of Building No. 13 and No. 14. Swale water to drain to the west direction between Buildings No. 12 and No. 11.


6) ARTHUR RICHARDS JUNIOR HIGH SCHOOL

a. The drain outlets at the headwalls are partially buried and need to be cleaned out to below the invert elevations at both exposed ends located at the east side of Building No. 5 (Gym). Remove built up debris and sediment.


b. Repair or replace damaged CMU headwalls in the same general location noted in item 'a.' above.


c. Replace or remove damage chain link fencing at the top of the CMU wall located at the north end of the track field.

d. Clear and grub a large section of overgrown vegetation growing within the track field at the west side of the track field from north to south.

e. The entire track field needs to be renovated to an all weather track surfacing similar to the St. Croix Educational Complex High School track renovation project, currently under construction.

f. Remove overgrown vegetation around the electrical transformer enclosure, the adjacent power pole and Building No. 7.

g. Remove sediment build up in the east side parking lot and maintain drainage swale east of Building No. 6 to allow the surface storm water to flow towards the south.

h. Remove and clear away the heavily overgrown vegetation growing up against the north side Buildings No. 2 and No. 3.

i. Remove excess soil built up against the east side exterior wall of Building No. 2. The finish grade needs to be lower than the finish floor elevation of both Building No. 2 to prevent flooding the classrooms.

j. Repair and replace missing down spout in the courtyard of Building No. 3.

k. Create a concrete swale along the concrete walkway edge beginning between Buildings No. 2 and No. 3 and continue towards the center courtyard drain inlet.

l. Root pruning of the existing trees is required to allow space for the concrete swale to be constructed.

m. Clean out and flush the drain inlets for all building courtyards.


n. Remove blue painted plywood board that is restricting surface runoff from reaching the drain inlet and is also causing the area to flood Buildings No. 1 and No. 2.


o. Remove overgrown vegetation growing along the outdoor basketball and tennis court fencing.


7) ST. CROIX EDUCATIONAL COMPLEX HIGH SCHOOL

a. Civil engineer to design a new concrete swale located beneath the existing bleachers and slope to the south and install a trench drain across the existing concrete walkway located at the south end and connect into the new 10 inch diameter drain line currently being installed for the track and field renovation project.

b. Add another trench drain across the existing concrete walkway located at the north end of the existing bleachers and slope grade towards the northern direction.

8) ST. CROIX CENTRAL HIGH SCHOOL

a. Resurface AC pavement and raise the road elevation in front of the entry road guardhouse and install two sidewalk culverts to divert surface runoff into the grass area at the north side.


b. Bury existing down spout piping below finish grade and lower the invert elevation to slope into the existing drain inlet.


9) POSITIVE CONNECTIONS ALTERNATIVE

a. Re-grade and install new AC pavement at grass area fronting the north side of Building 7. Reverse the existing slope to slope away from the building. The area is currently being used to park vehicles.


b. Replace and bury existing ½" water line with new ¾" copper water line.

10) JUANITA GARDINE ELEMENTARY SCHOOL

a. Extend the existing trench drain across driveway to intercept surface runoff located north of Building No. 1 and connect to existing drain inlet.

b. Remove existing ficus trees located between Buildings No. 8, No. 9 and No.10. The ficus tree has aggressive root structure that can clogged drain lines and uplift and damage pavements.

c. Clean out heavy sediment build up at the low end of the concrete drainage ditch located at the southwest corner of the school property line.


d. Clean out two separate head walls drain pipes located at the west side/ exterior property wall.

e. Clean out debris and sediment within the trench drain located across the driveway near the west end of Building No. 4.


f. Clean and remove vegetation growing in the existing concrete swales located at the north end of Building No.13.


g. The existing playground does not have a safety surfacing system and does not meet the Federal ASTM safety standards for playground safety.

End of St. Croix Site Visit Report

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

February 27, 2017

CONFIRMATION NOTICE No. 010

SUMMARY REPORT OF IN-BRIEF MEETING

Project : Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year Two, Contract number W9128A-11-D-0004
Territory: U.S. Virgin Islands

The purpose of the In-Brief Meeting was for the consultant to begin the school site visits and to meet the Department of Education (DOE) / Division of Architectural Engineering and HHF staff.

The In-Brief Meeting was held at 8:20 a.m., Monday, February 27, 2017, in the DOE Engineering Office conference table. The attendees were:

USVI - DOE /DOAE	James G. Bernier, P.E., (Territorial Director of Capital Projects & Facilities)
	Joseph A. Sibilly, (Territorial Facilities Manager)
USVI - HHF Planners	Brian Turnbull (Insular ABCs Program Manager, USVI))
	John Bedminster (Insular ABC's Construction Specialist)
Okahara and Associates	Irvin Higashi, Landscape Architect

SUMMARY OF MEETING

1. Introductions and Purpose of Site Visits

1.1 Brian Turnbill started off the meeting by stating the intent and purpose of Okahara's site visit meeting, which is to re-assess the previous site assessment plans for each school campus that was completed and recorded two years ago in February 2015.

1.2 OAI will be developing the grounds maintenance primer that will address deficiencies in drainage, safety, landscape, playgrounds, parking, sewer, and other items that the DOE will be able to utilize and train new maintenance workers to perform specific tasks.

1.3 OAI will note and record any other deficiencies or problems within the grounds and provide recommendations and updates to changes that may have occurred after the previous site assessment reports for each school campus visited. Photographs will be taken and documented to help in identifying each

specific items being addressed. General grounds maintenance items will be noted as well.

2. Discussions:

2.1 Joseph had concerns about certain schools with structural wall problems, parking lots are deteriating, drainage and flooding issues and playground safety. Irvin will look into these concerns as we go through the site inspections.

2.2 James asked whether additional work task could be added to the current list. Brain responded by saying that the government may decide to include it if there is an urgency to correct the deficiencies. Brian also stated that the work plan to correct the deficiencies has been updated and signed by the Commissioner.

2.3 James also asked if OAI will be prioritizing the deficiencies in the report. Irvin stated not necessarily unless the DOE and HHF can prioritize the work task on their own since they are here all the time. eep in mind that work task may re uire license engineers to design while other work task can be done in-house or contracted directly with a contractor to perform.

2.4 James has concerns with e isting school campuses that has septic tank sewer systems. A study was done and 90 of the septic tanks did not work because of the shallow of topsoil depth of 22" which can leach back to the surface. Sewage treatment plants are being looked into.

3. Site Visits Schedule:

3.1 **US I - S T**

AY F

1) Joseph Sibilly Elementary School
2) Lockhart Elementary School
3) Jane E. Tuitt Elementary School
4) Ulla F. Muller Elementary School
5) Gladys A. Abraham Elementary School

AY F

) Ivanna Eudora ean High School
7) Bertha C. Boschulte Middle School
8) Edith L. Williams Elementary School
9) Joseph Gomez Elementary School
10) Yvonne Miller Bowsky Elementary School

AY M

11. E. Benjamin Oliver Elementary School

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3.2 **US I - S C**

1) Lew Muckle Elementary School
2) Ricardo Richards Elementary School

M

3) Pearl Larson Elementary School
4) Juanita Gardine Elementary School
5) John Woodson Junior High School
) St. Croi Central High School
7) Eulalie Rivera Elementary School
8) Positive Connections

M

9) St. Croi Educational Comple High School
10) Arthur Richards Junior High School

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11) Addelita Cancryn JHS timing depends on flight schedule

O M

3.3 The conclusion of the meeting was discussing today site visit scheduling.

4. Ne t Meeting: The out-brief meeting will be held on Friday, March 3, 2017 at 4:00 pm at the DOE /DOAE office.

End of In-Briefing Meeting

Okahara and Associates, Inc.
ENGINEERING CONSULTANTS

March 4, 2017

CONFIRMATION NOTICE No. 12

SUMMARY REPORT OF OUT-BRIEF MEETING

Project : Insular Schools Assessment of Buildings and Classrooms, Phase 3, Year Two, Contract number W9128A-11-D-0004

Territory: U.S. Virgin Islands – St. Thomas and St. Croix

The purpose of the Out-brief Meeting was for the consultant to present a summary of the school site visit findings to the Department of Education (DOE) / Division of Architectural Engineering and HHF staff.

The Out-brief Meeting was held at 4:00 p.m., Friday, March 3, 2017, in the DOE Engineering Office conference table. The attendees were:

USVI - DOE /DOAE	James G. Bernier, P.E., (Territorial Director of Capital Projects & Facilities)
	Peter Seipel, (Territorial Director of Sports and Athletics)
USVI - HHF Planners	Brian Turnbull (Insular ABCs Program Manager, USVI))
Okahara and Associates	Irvin Higashi, (Landscape Architect)

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1. School Site Visits

1.1 Site Visit Schedule: During the In-brief Meeting on Monday morning, February 27, 2017, site visits were planned for 12 schools on the island of St.Thomas and 10 schools on the island of St. Croix. The following is the list of school that was visited this past week.

USVI - St. Thomas

DAY 1: February 27, 2017

1) Joseph Sibilly Elementary School
2) Lockhart Elementary School
3) Jane E. Tuitt Elementary School
4) Ulla F. Muller Elementary School
5) Gladys A. Abraham Elementary School
6) Addelita Cancryn Junior High School

DAY 2: February 28, 2017

7) Ivanna Eudora Kean High School

8) Bertha C. Boschulte Middle School
9) Joseph Gomez Elementary School
10) E. Benjamin Oliver Elementary School
11) Yvonne Miller Bowsky Elementary School

FLY TO ST. CROIX (Lv. STT before noon)

1.2 **USVI - St. Croix**

1) Ricardo Richards Elementary School
2) Lew Muckle Elementary School
3) Pearl Larson Elementary School

Day 4: March 2, 2017

4) John Woodson Junior High School
5) Eulalie Rivera Elementary School
6) Arthur Richards Junior High School
7) St. Croix Educational Complex High School
8) St. Croix Central High School
9) Positive Connections Alternative
10) Juanita Gardine Elementary School

Day 5: March 3, 2017
FLY BACK TO ST. THOMAS (around noon)

1.3 The only school not visited during in St. Thomas as Edith L. Williams Elementary School due to time constraint and there was no issues noted on the previous Feb. 2015 Site Assessment Plan.

2. Summary Briefing of Site Visits to 21 Schools:

2.1 Assessment of Existing Conditions:

a. Based on the site visits to 21 schools, there are significant concerns with, overgrown vegetation, covered drain inlets and trench drains, building rain gutters and downspouts, cisterns, drainage ditches, swales, and culverts, which contributed to flooding and ponding areas.
b. Concerns over inadequate safety play surfacing beneath playgrounds needs to be addressed and improved.
c. Chain-link fencing damaged by over-grown vegetation.
d. Trees needs to be pruned or removed for health and safety reasons.
e. Parking lots needs to be re-paved or repaired.
f. Play areas to be repaired and re-grassed.

2.2 General maintenance should include:

a. Removal of dirt and debris from the drain inlets and flushing of drain lines.
b. Regrading of surrounding areas to match bottom elevation of culverts and flushing of culverts to ensure proper culvert function.

c. Cleaning and re-grading of existing swales, slopes and ditches to ensure proper direction of flow and capacity of drainage routes.

3. Recommendations

3.1 Civil and Structural Engineering

a. The majority of schools visited will require civil engineering design plans to construct new grading for parking lots and driveways, additional drainage features such as fencing, rain gutters, downspouts, drain inlets, concrete swales, trench drains, reconstruction of sidewalks, ramps, and curbs, and proposed retention basins. Topographic surveys will need to be provided.

3.2 A brief site recap showing photos of some of the schools visited during the week identifying a few of the deficiencies. Recommendations will be noted in the site report.

4. Schedule: The draft civil maintenance primer for the four U.S. Territories to be submitted for U.S. Army Corp of Engineers (USACE) for review and comment in early March 2017.

End of Meeting.

USVI (SITE VISITS FROM 02/27/2017 TO 03/3/2017)
Okahara and Associates, Inc.
Attendee: Irvin T. Higashi (Landscape Architect)

1. USVI - St. Thomas

DAY 1: February 27, 2017 (Inbrief Meeting at 8:00 am)

1. Joseph Sibilly Elementary School
2. Lockhart Elementary School
3. Jane E. Tuitt Elementary School
4. Ulla F. Muller Elementary School
5. Gladys A. Abraham Elementary School

DAY 2: February 28, 2017 (Start at 8:00 am)

6. Ivanna Eudora Kean High School
7. Bertha C. Boschulte Middle School Edith L. Williams Alternative Academy
8. Edith L. Williams Elementary School
9. Joseph Gomez Elementary School
10. Yvonne Miller Bowsky Elementary School

DAY 3: March 1, 2017 (Start at 8:00 am)

11. E. Benjamin Oliver Elementary School

FLY TO ST. CROIX (Lv. STT before noon)

2. USVI - St. Croix - (Site Visits to start by 3:00 pm or sooner)

1. Lew Muckle
2. Ricardo Richards Elementary School

Day 4: March 2, 2017 (Start 8:00 am)

3. Pearl Larson Elementary School
4. Juanita Gardine Elementary School
5. John Woodson Junior High School
6. Change to STX. Central HS
7. Eulalie Rivera Elementary School
8. Positive Connections (minor issues; may want to visit after Juanita Gardine)

Day 5: March 3, 2017 (Start at 8:00 am)

9. STX. Edu Complex
10. Arthur Richards Junior High School

FLY TO ST. THOMAS (around noon)

11. Addelita Cancryn JHS [timing depends on flight schedule]

Outbrief Meeting at 4:00 pm

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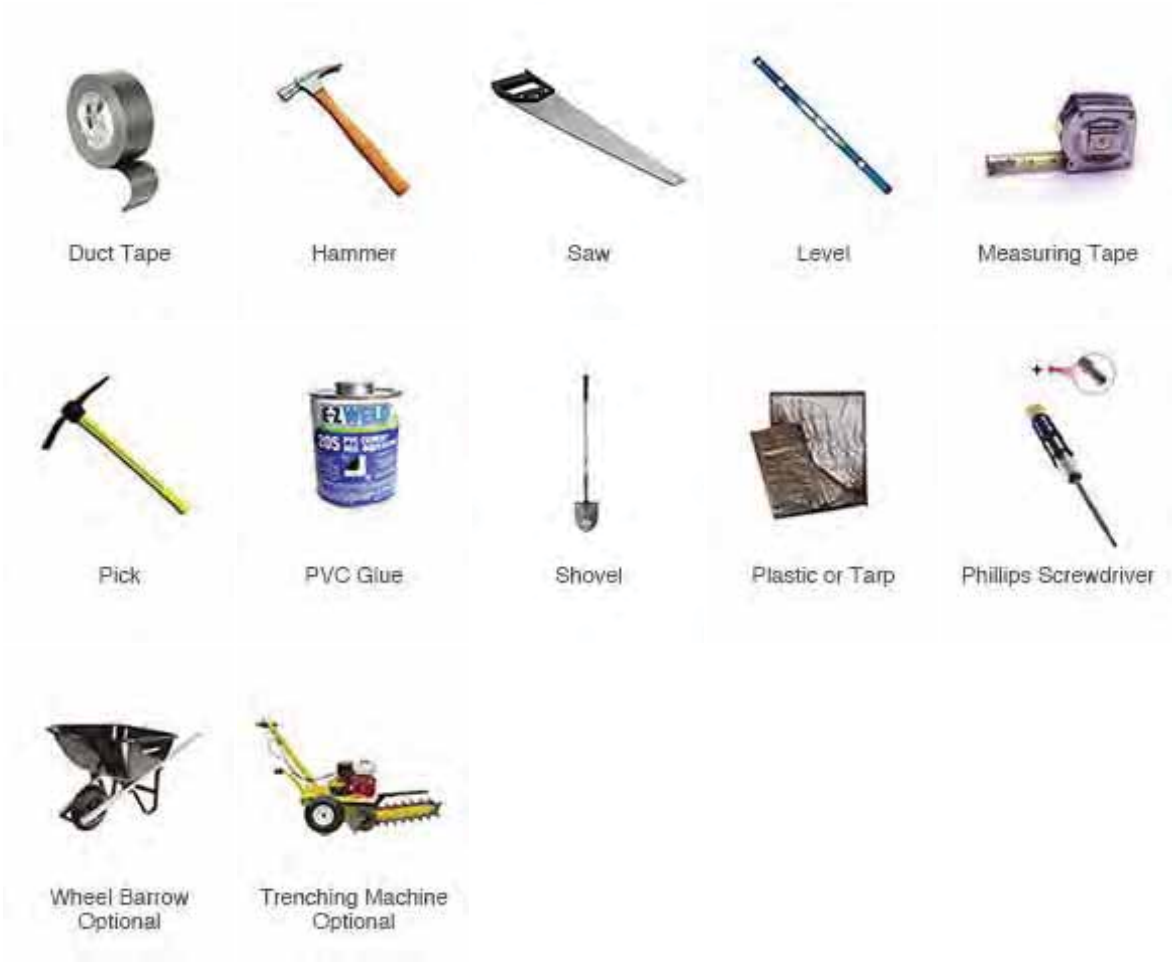
Appendix B

Downspout Water Drainage System

Building roof eaves needs to have rain gutters installed along the roof eaves to prevent eroding the ground below. Downspouts will also need to be installed at the ends of the roof eaves and along the vertical exterior wall of the building. A subsurface corrugated drain pipe shall be connected to the downspout and extend to a location where the rainwater will flow in a direction as to not cause any flooding problems. A pop-up drain emitter to be attached at the end of the corrugated drain line to allow the water to flow out during rain. (See Step 3: Install Pop-Up Emitter))

List of Tools Needed, Shopping List, and Installation Instructions

Tools Needed



Shopping List

Quantity needed of each part will vary based on several factors specific to your project including system length, rainfall intensity, and number of problem areas. Pipe and fittings are offered in two sizes: 3" and 4". Size availability will vary based on region and store. Ensure that component sizes are consistent throughout your drainage system.

NDS (or equivalent) Part Number	Description
321 or 421	3” or 4” Pop-up Emitter with Elbow
3P02 or 4P02	3” or 4” Sewer and Drain Elbow
101	Spee-D Basin (or equivalent)
80	6” Atrium Grate
Generic	3” or 4” Drain Pipe

Installation Instructions

Note Before You Dig
Prior to installation, have your local utility companies locate and mark the location of existing utilities. Lay out your drainage system and mark the location of trenches and individual parts to be installed with marking paint before digging. Carefully remove grass or plants that are located where the trench will be dug so they can be replanted after installation. Trenches should be dug such that they slope a minimum of 1% away from your house. Place all excavated dirt on a tarp so that it can be used later to backfill.

To speed up installation, a trenching machine can be used to dig all trenches, especially in areas with particularly hard soil. NDS drainage products have been designed to be installed in any soil type. Due to the variety of pipe types and sizes, double check that all pipe connection points are the correct size. Please follow all installation directions included with the individual parts of your drainage system. To create watertight connections between products, apply a bead of waterproof silicone to both parts and connect.

This system requires that the elevation of the Pop-Up Emitter be lower than the elevation of the area drain or the system will not drain.

Step 1: Lay out system, dig trenches and holes

Dig holes and trench for pipe and catch basins. Dry fit (no glue) the entire drainage system from the catch basin to the pop-up emitter. Measure and cut all pipe to necessary lengths. After completing each step, glue parts together. TIP: If installing the drain in an existing concrete area, a wet concrete saw will be required to cut the concrete prior installation.

Step 2: Install Spee-D Basin (or equivalent) beneath downspout

Before beginning your installation, check if your downspout has a downspout elbow connected. If not, connect a downspout elbow to your downspout. The Spee-D Basin (or equivalent) should be installed in the ground directly beneath the downspout elbow to catch all water draining from the downspout. Connect the drain pipe to the Spee-D Basin. The Spee-D Basin can be used to clean out any debris that may enter the system and also serves as an inlet for surface water. Once installation is complete, place the atrium grate on the Spee-D Basin. A 6" SDR-35 drain pipe can be inserted into the Spee-D basin to raise the elevation of the atrium grate. The Atrium grate will also fit into the "bell" or "hub" end of the pipe or on a 6" sewer and drain coupler.

TIP: Dig the hole for the basin an additional 6" deeper than needed. Place 6" of gravel in the bottom of the hole. Drill small holes in the bottom of the basin to prevent standing water in the bottom of the basin.

Step 3: Install Pop-Up Emitter

Using a Corrugated Pipe Adapter, connect the EZ-Drain to an elbow with a weep hole. The elbow should be installed with the weep hole on the horizontal side of the elbow. Slide the Pop-up Emitter onto the elbow. An additional length of pipe can be used to bring Pop-up emitter to the surface.

TIP: To avoid damaging your Pop-Up Emitter with your lawn mower, raise the cutting level of the blades or avoid passing the mower over the Pop-Up Emitter

Step 4: Backfill and Replant

Backfill and replace any grass or plants that were removed.

TIP: DO NOT BACKFILL WITH SOIL WITH HIGH CLAY CONTENT. Water must be able to easily pass through the backfilled soil.

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Appendix C

Approximate Campus Lot Areas

Insular Area	School Name	Campus Area (acres)
USVI	Addelita Cancryn Junior High School	15.9
USVI	Alexander Henderson Elementary School	10
USVI	Alfredo Andrews Elementary School	12.7
USVI	Arthur A. Richards Junior High School	17.8
USVI	Bertha C. Boschulte Middle School	13.6
USVI	Charles Emanuel Elementary School	7.7
USVI	Charlotte Amalie High School	17.4
USVI	Claude O. Markoe Elementary School	9.9
USVI	E. Benjamin Oliver Elementary School	11.8
USVI	Edith L. Williams Alternative Academy	3.3
USVI	Elena Christian Junior High School	9.8
USVI	Eulalie Rivera Elementary School	15.8
USVI	Evelyn M. Williams Elementary School	11.2
USVI	Evelyn Marcelli Elementary School	0.9
USVI	Gladys A. Abraham Elementary School	5.5
USVI	Guy H. Benjamin Elementary School	6.3
USVI	Ivanna Eudora Kean High School	10.8
USVI	J. Antonio Jarvis Primary School	0.6
USVI	Jane E. Tuitt Elementary School	1.9
USVI	John H. Woodson Junior High School	17.1
USVI	Joseph Gomez Elementary School	9.5
USVI	Joseph Sibilly Elementary School	1.6
USVI	Juanita Gardine Elementary School	14.3
USVI	Julius E. Sprauve School	3.2
USVI	Leonard Dober Elementary School	0.9
USVI	Lew Muckle Elementary School	4.6
USVI	Lockhart Elementary School	11.3
USVI	Pearl B. Larsen Elementary School	8.3
USVI	Positive Connections Alternative Education	2.3
USVI	Ricardo Richards Elementary School	8
USVI	St. Croix Central High School	23.7

Insular Area	School Name	Campus Area (acres)
USVI	St. Croix Educational Complex High School	58.7
USVI	Ulla F. Muller Elementary School	3.5
USVI	Yvonne E. Milliner-Bowsky Elementary School	5.5

Appendix D

Safety and First Aid

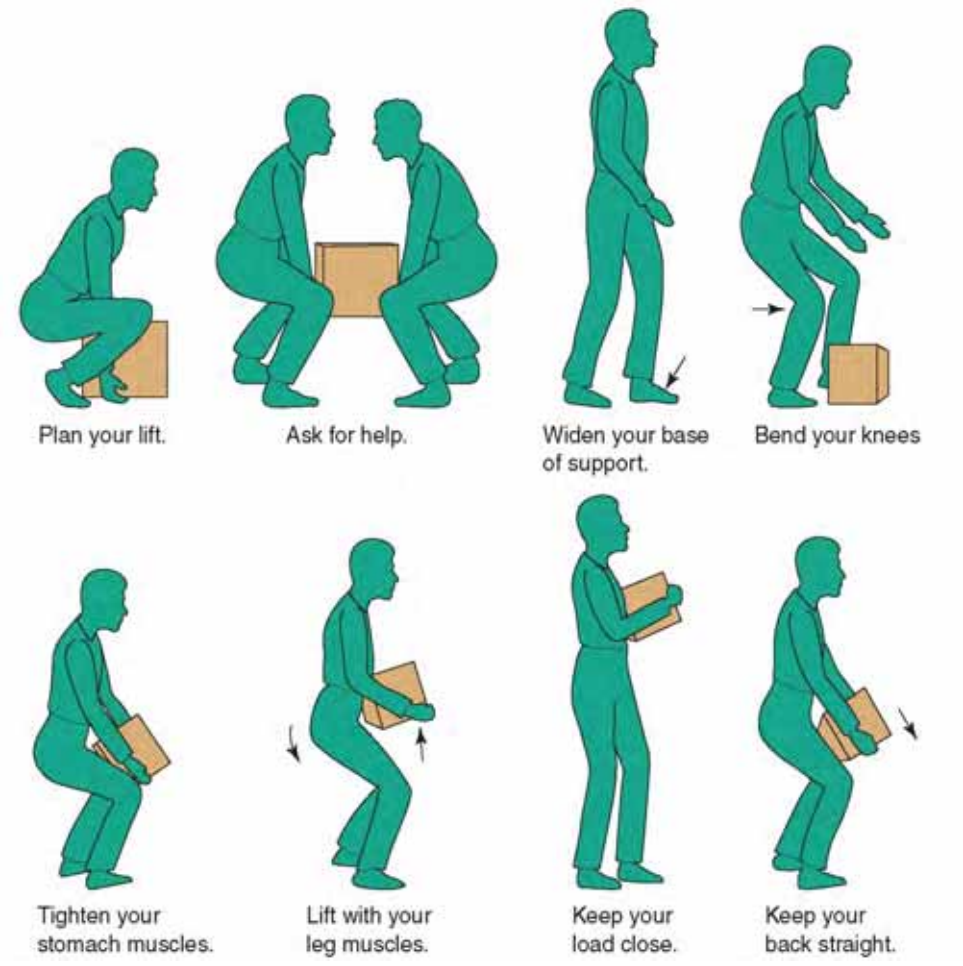
On the job accident prevention is the responsibility of all the employees. It is the further responsibility of each employee to correct or report any unsafe condition or practice that he or she may observe.

Each supervisor is responsible for prevention of accidents to employees working under his/her supervision. It is the supervisor's responsibility to train these employees to enable them to work safely and efficiently.

A. General Safety Rules:

The following are some important general safety rules that each employee is required to follow, regardless of work assignments.

1. Lifting improperly is a major factor of the tremendous number of claims for back injuries. The following procedures should be followed:



a) Size up the load; make sure it is stable and balanced. Test the weight to ensure you can lift it yourself.
b) Plan the job. Ensure that your path of travel is clear and that you have identified the location where you will place the load.
c) Establish a good base of support. Use a wide balanced stance with one foot ahead of the other.
d) Bend your knees and get as close to the object as possible. Lift with your legs and not your back.
e) Get a good grip on the object to be lifted. Make sure you can maintain your hold throughout the lift and won't have to adjust your hands later.
f) Lift gradually, don't jerk, but use a slow steady movement.
g) Keep the load close while carrying; this prevents you from arching your back and adding additional stress to your back.
h) Pivot; don't twist when you need to change directions. Move your feet in the direction of the lift. Twisting is especially harmful for your back.
i) If the load is too heavy either enlist another helper or use a mechanical device.

2. All employees shall keep tools, equipment, and work areas clean and orderly.
3. Keep aisles stairways and exits clear of boxes and other tripping hazards. Do not obstruct exits.
4. Clean spills immediately. Mark the spill if you must leave to retrieve assistance or additional supplies.
5. Each employee should know the location of fire extinguishers in their work area. The area in front of a fire extinguisher should be kept clear for ready access. Employees should not fight fires that are beyond their fire training and limitations of the available fire-fighting equipment. When in doubt, call 911 and evacuate to a safe area.
6. Gasoline will not be used as a washing or cleaning fluid. When cleaning solvent is required, use an approved cleaning solvent.
7. Any employee, while on duty or on district property, who possesses, sells, or receives any illegal drug or who is under the influence of drugs or alcohol, will be discharged and, in appropriate situations, referred to law enforcement authorities.
8. Smoking will not be allowed within any school campus property.
9. Use caution when opening doors which serve two-way pedestrian traffic.
10. Use a stepladder or a step stool for reaching above shoulder height. Never stand on the cap of a ladder.
11. While in a district vehicle, seat belts are required to be worn at all times. Do not disable airbags unless you have written permission from your Supervisor.
12. Material will be stored in a safe and orderly fashion. Flammable liquids should be stored in an approved Flammable Storage Cabinet.
13. Do not operate machinery that you are not familiar with and have not been trained to use.
14. Inspect all tools and equipment prior to use to ensure they are in working order and do not present a hazard.
15. After use put all tools/or equipment back in their proper place.

16. Disconnect all electrical cords by grasping the plug and carefully disengaging; never yank by the cord. If an electrical cord is frayed or wires are exposed remove it from service.
17. Use handrails when using the stairways. Never take more than one stair at a time.
18. Only qualified, designated employees should work on electrical wiring and equipment.
19. Horseplay or practical jokes will not be tolerated.
20. Material Safety Data Sheets must be available, at the point of use, to any person who requests this information.

21. Report all accidents to your supervisor.
22. Report all unsafe or broken tools and equipment to your supervisor. Mark the tool or equipment so that no one else will use.
23. Observe all warning signs, safety bulletins and posters.
24. Do not do any job that appears unsafe; ask your supervisor for guidance.

B. First Aid Training

Appropriate training and equipment shall be made available to employees to respond to an emergency to include first aid, CPR (cardiopulmonary resuscitation), AED (automated external defibrillator) if available, mobile phone, and fully stocked first aid kit.

Arrange for qualified training sessions (The Red Cross) for employees is important for accident prevention and response during emergency situation when accidents or medical conditions occur on or off campus.

C. Preventive Measures

To be incorporated into the program shall include the following:

1. Barricading or securing the work area or hazardous situations as they occur.

2. Proper clothing and personal protective equipment (PPE) for employees. Appropriate PPE for the job being performed shall be required. Protective equipment shall include, proper gloves, hardhat, goggles or safety glasses, earplugs, safety vest, steel toe shoes or boots and respirators. No shorts and slippers shall be acceptable.

3. Driving safely and vehicle safety to and from the work site will reduce chances of getting in an accident. Obey all traffic laws, signs and speed limits. Use of cell phones while driving is not allowed unless a hands-free device is used.

Appendix E

Hand Tools and Truck Safety and Maintenance

A. Hand Tools Safety and Maintenance:

1. Hand tools, such as shovels, rakes, picks, wheel barrows, etc. require maintenance to keep the metal parts free from rust and keep wooden handles from splitting and splintering.
   a) Sharpen tools (shovels, sickles, hand saws, machetes and picks) as they become dull with a flat file.
   b) Always clean and rinse tools to remove dirt and mud and dry before storing to prevent rust from occurring.
   c) Remove rust from metal with a wire brush and machine oil.
   d) Fine sand wooden handles and apply linseed oil to prevent cracking or splintering.
   e) Check tire pressure for the wheel barrow before using.
   f) Store tools in a neat and orderly location.

B. Truck Maintenance and Safety:

1. Trucks are used on a daily basis to transport workers, tools and supplies to the school campuses and they must be maintained regularly and operated with care and skill. Daily truck maintenance shall include checking the following items for proper operation, adjustments or levels:
   a) Head, brake, backup and tail lights
   b) Front and rear turn signals
   c) Hazard lights
   d) Seat belts
   e) Tires (proper inflation and tire wear)
   f) Engine fluids (proper levels)
   g) Hoses and belts
   h) Brakes
   i) Horn
   j) Mirrors
2. The following are ten safe driving practices that can significantly reduce the risks faced by employees that drive on the job.

   a) **Inspect the Vehicle**

   Driver safety begins before turning the ignition key. Employees should be trained to inspect the vehicle before heading out. This includes checking the lights, gauges, tires, and fluid levels and adjusting the steering wheel, seat, and mirrors. The employee should also perform a visual inspection to look for damage. In addition, he or she should ensure that the vehicle has emergency supplies, such as a first-aid kit, flashlight, blankets, emergency phone numbers, and any other items that may be helpful if the employee becomes stranded.

   b) **Secure Cargo**

   Any sudden crash or driving maneuver can cause loose personal items or cargo to slide around or fly off a vehicle, injuring the driver, passengers, or other road users. For that reason, employers should train their employees to secure loads, equipment, and other objects that could become a hazard while being transported.

   It is not uncommon to see tools, building materials or other objects lying alongside the highway. While other drivers don't always secure cargo properly, employers can make a difference with their own employees by training them to do so.

   c) **Use a Seat Belt**

   According to the National Highway Traffic Safety Administration (NHTSA), seat belts are the single most effective means of reducing deaths and serious injuries in traffic crashes. Research has found that the risk of death is cut by 45 percent for those wearing a seat belt while riding in cars. For light-truck occupants, that risk is reduced by 60 percent.

   Yet about 16 percent of Americans fail to buckle up. Anyone not wearing a seat belt during a crash may slam into the steering wheel, windshield, or other parts of the interior, or even be ejected from the vehicle. Total ejection occurs over a quarter of the time for unrestrained occupants.

   In addition to urging employees to use a seat belt at all times when operating or riding in a motor vehicle, employers may also want to develop a seat belt use policy.

d) **Drive Defensively**

Each time employees get behind the wheel, they should have a defensive driving mind-set. That means employers should train employees to incorporate the following habits:

- Check the driving conditions before heading out.
- Avoid driving in severe / bad weather.
- Clear mud and dirt from the vehicle, including all windows and lights.
- Activate the low-beam headlights during the day.
- Keep a safe following distance.
- Don't speed, and slow down in poor driving conditions.
- Use caution at intersections and interchanges.
- Look ahead in traffic for situations requiring quick action.

e) **Avoid Distractions**

According to police-reported crash data, about 17 percent of all crashes involve some form of distraction. Although cell phone use and text messaging have received much attention recently, NHTSA databases include other types of distraction as well, such as talking with occupants; dropping objects; pets and insects; adjusting the radio or controls; eating, drinking, or smoking; watching events on the roadside; and daydreaming.

Countless distractions and pressure to multi-task often tempt drivers to forget that safe driving is their primary responsibility. Employers should remind employees that driving requires their full attention, and they should avoid distractions.

In fact, OSHA says employers should also prohibit texting while driving. The agency explains that employers who require texting while driving or make it necessary are violating the Occupational Safety and Health Act. Moreover, it should be noted that many state and federal laws and regulations prohibit texting or cell phone use while driving. These provisions and their penalty amounts may be worth sharing with employees.

f) **Avoid Impairment**

There's no question that alcohol, certain prescription and over-the-counter medications, and illegal drugs can affect an employee's ability to drive safely. These substances can decrease alertness, concentration, coordination and reaction time. Because a driver makes numerous decisions per mile, it's critical that a driver make the decision to drive alert before getting behind the wheel. Therefore, employers should instruct employees not to drive if they are impaired.

g) **Avoid Drowsy Driving**

Drowsy driving can affect anyone, and many adults surveyed by the National Sleep Foundation have reported falling asleep while driving. Moreover, the government estimates that, nationwide, about 83,000 crashes are caused each year by drowsy drivers, so it's important for employees to be well rested before driving. Employers should train employees who drive to do the following:

- Get a full night of rest before driving.
- Set realistic goals for daily distances.
- Switch drivers if possible.
- Avoid medications that cause drowsiness.

h) **Avoid Aggressive Driving**

Traffic congestion — just saying the phrase may bring frustration to an employee who travels on business. According to the Department of Transportation (DOT), the number of drivers increased by 87.5 percent since 1970, while the roadway system increased only by about 9.5

percent. It's no wonder millions of crashes each year are pinned on aggressive driving. This type of driving includes not only tailgating, rude gestures, and honking the horn but also speeding, failing to signal, passing on the shoulder, and running a red light.

Employers should encourage their employees to limit the dangers of aggressive driving with these tips:

- Be patient with other drivers.
- Plan routes to avoid congestion and construction zones.
- Allow plenty of time to reach the destination.
- Accept lateness, especially when it is beyond the driver's control.
- Avoid aggressive behaviors.
- Move out of an aggressive driver's way.

i) **Take Security Measures**

In-transit security is also important to ensure the physical safety of the driver and to reduce and prevent vehicle and cargo theft and damage. Employers may wish to cover the following simple precautions with their drivers to lower the risks:

- Locking vehicle doors and keeping windows rolled up
- Avoiding secluded, poorly lit parking lots
- Staying alert when walking to the vehicle
- Applying cargo seals or locks
- Carrying vehicle information at all times

j) **Properly Handle Hazardous Materials**

Any material that is "capable of posing an unreasonable risk to health, safety, and property when transported in commerce" must be properly packaged, labeled, placarded, and marked as required by the DOT Hazardous Materials (Hazmat) Regulations. These regulated materials even include common solvents, adhesives, paint, and fuel, with some exceptions. Paperwork may also need to accompany the material to identify it as hazardous and outline what to do in the event of a spill.

If an employee will be transporting hazardous materials, training will be required in accordance with DOT regulations. However, some basic hazmat safety training topics might include always securing the package so it won't shift, never smoking in or near the vehicle, protecting a package from extreme heat, and inspecting a package for damage and tampering.

Appendix F

Turf Equipment Safety and Maintenance

A. Turf Equipment Safety:

1. Turf maintenance equipment are classified into the following three general categories:
   a) Motorized hand-operated equipment

   b) Equipment powered by gas engines

   c) Equipment powered by electric motors

2 Wear proper personal protective equipment (PPE) to protect your skin by using sunscreen, your eyes with safety glasses or goggles, head by wearing a construction hard hat, hearing by wearing earplugs, hands and feet with appropriate work gloves and boots (steel-toed).

3. Safety Guidelines for Motorized Turf Equipment:
   a) Always read the operator's manual for all equipment and be familiar with safe operation and maintenance procedures as specified by the manufacturer.

   b) Dress appropriately for the equipment you are using. Wear snug fitting clothes to prevent getting caught while operating equipment.

   c) Wear appropriate personnel protective equipment.

   d) Know how to stop the engine quickly.

   e) Shut of hand-held equipment when changing locations.

   f) Be sure students and other bystanders are a safe distance from the work area.

   g) Turn off equipment when making adjustments or performing maintenance.

   h) Turn off equipment when leaving it unattended.

   i) Avoid putting hands or feet near rotating parts, cutters, belts, pulleys and gears.

4. Safety Guidelines for Gas Engines:
   a) Disconnect spark plug before performing any maintenance.

   b) Turn off the engine and let cool before refueling.

   c) Fuel equipment in a ventilated area and on a hard surface.

d) Avoid spilling gasoline on a hot engine, which can start a fire.

e) Properly clean up any fuel spills that may occur.

f) No smoking while operating or fueling.

g) Avoid refueling or performing equipment maintenance in a grass or landscape area.

h) Operate engines only in well-ventilated areas.

5. Safety Guidelines for Electric Motors:
   a) Check power cord regularly for nicks and cuts. Replace if the insulation is worn or damaged.

   b) Extension cords must be UL approved and appropriate to carry the power load of the equipment being used.

   c) Keep power cords away from sharp objects, intense heat, oil and solvents, all of which can damage the insulation.

   d) Always know where the cord is when operating an electric device. If the cord become severed, shock or electrocution can result.

   e) Avoid using electric equipment in wet areas unless manufacturer states such use is permitted.

6) Safety Guidelines for Battery-Operated (Cordless) Tools:
   a) Use only the kind of battery that the tool manufacturer specifies for the battery-powered tool you are using.

   b) Recharge a battery-powered tool only with a charger that is specifically intended for the battery in the tool.

   c) Ensure that the tool is switched off or removed the battery from the tool before changing accessories, making adjustments, or storing the tool.

   d) Store the battery pack safely so that no metal parts, nail, screws, wrenches, etc. can come in contact with the battery terminals. This could cause shorting of the battery and possibly sparks, fires or burns.

   e) Dispose of batteries only as recommended by the manufacturer.

B. Types of Motorized Lawn Maintenance Equipment:

1. Mowers:
   a) Walk-behind self propelled rotary mowers are the most popular type.

b) Standing mowers are similar to walk-behind mowers except that the operator stands on a platform to operate the equipment.

c) Riding mowers have a seat and steering mechanism, which allows the operator to ride on top of the mower.

2. String *Trimmers* are used for trimming grass, weeds and light brush.


3. Edgers are used to create a clean edge where lawn meet curbs, driveways or walkways. Operate edgers with special care as they can damage concrete, brick, asphalt and wood.


4. *Blowers* are used to clean up leaves, grass clippings and other debris by moving these materials with forced air.


C. Guidelines for Turf Equipment Operation:

1. Guidelines for Mower Operation:
   a) Always read the operator's manual before operating the mower.

   b) Before mowing, walk the site to pick up trash and other debris. Avoid mowing over debris. Flying debris is dangerous and can leave an unattractive mess. Debris can also cause mower and/or property damage, as well as injuries from flying objects.

   c) Turn off mower to remove foreign objects in front or next to it.

   d) Turn off engine before removing or attaching the clippings bag.

   e) Avoid operating a mower in wet grass. Slippery conditions can be dangerous and wet grass can clog the discharge chute of the mower.

   f) The operator should be the only person on a riding mower.

   g) Work from side to side on sloping terrain, rather than up and down, to avoid rollover. On steeper slopes, an intermediate walk-behind mower may be safer than a riding mower.

   h) Do not operate a mower without a deflector or a clippings bag.

   i) Maintain solid and firm footing while operating a walk-behind mower.

2. Guidelines for string trimmer operation:
   a) Always read the operator's manual before operating the string trimmer.

   b) Wear eye and ear protection, long pants and government recommended safety standards footwear.

   c) Inspect string shield and shut-off switches before starting. Check the surrounding area to be sure there are no people or vehicles nearby.

   d) Keep hands, face and feet clear of rotating trimming lines at all times.

   e) Place yourself in a proper starting position with stable footing and the trimmer on the ground before pulling the starting rope.

   f) Grip trimmer firmly by both handles while operating. Avoid over-reaching and maintain good balance at all times.

   g) Immediately turn trimmer off and check for damage if it strikes a foreign object or becomes entangled. Make repairs before restarting.

   h) Stop operating when the hub or spool is broken.

   i) Avoid extending trimming line beyond the length stated in the operator's manual as this can cause injury or damage to the engine.

3. Guidelines for edger operation:
   a) Always read the operator's manual before operating the edger.

   b) Wear eye and ear protection, long pants and government recommended safety standards footwear.

   c) Always operate an edger with guards and other safety devices intact and keep it on the ground while starting.

   d) Remove rocks or other debris from the work area to reduce the potential for damage to vehicles, buildings, etc. or injury to pedestrians.

4. Guidelines for blower operation:
   a) Wear eye and ear protection, long pants and government recommended safety standards footwear.

   b) Make sure debris is blown into an appropriate area. Avoid blowing into drain inlets, streets, neighboring properties, vehicles, windows or towards people.

   c) Keep the air stream close to the ground by extending the nozzle.

   d) Be aware of creating a dusty situation in dry conditions.

Appendix G

Cooperative Extension Service
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Turf Management
Mar. 2009
TM-12*

Common Lawn Grasses for Hawaii

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Notes

Mowing height: Reel mowers are preferred for cutting turfgrasses at heights less than 1 inch. Rotary mowers are preferred for heights greater than 1 inch.

Propagation: 2-inch square plugs planted 12 inches on center require 30 ft^2 of sod per 1000 ft^2 of lawn area planted. 2-inch square plugs planted 6 inches on center require 110 ft^2 of sod per 1000 ft^2 of lawn area planted.

Nitrogen fertilizer: Amounts given in table refer to quick-release N, such as urea, ammonium sulfate, and some mixed formulations, unless otherwise noted. In windward locations during winter months, reduce fertilizer amounts or omit applications because the grass grows slowly and cannot use the nutrients.

Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft^2)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft^2)
Common bermudagrass (*Cynodon dactylon*)	Gray-green; medium texture; long internodes.	Resists wear; has deep root system, low moisture requirement; tolerates saline, alkaline, and moderately acid soils; tolerates many herbicides.	Vigorous, often invading where not wanted; frequent seed head formation; susceptible to some lawn insects; builds thatch;	Sun	Seed (hulled): 1–2 lb Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–1	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'No-Mow' bermudagrass ('Green Velvet') (*Cynodon dactylon*)	Dark blue-green; medium texture; creeping growth; usually not more than 3 inches high.	Resists some wear; tolerates saline and alkaline soil, some compaction, and drought; requires less mowing.	Susceptible to several insects and diseases; builds thatch; slow to establish.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–1	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'Tifgreen' bermudagrass (Tifton 328) (*C. dactylon x transvaalensis*)	Dark green; fine texture with prostrate growth; shorter internodes than common bermudagrass; soft leaves.	Resists wear; tolerates saline and alkaline soils; stands moderate acidity; produces few seed heads. Under proper management can be a beautiful lawn.	Vigorous grower; very susceptible to some lawn insects; builds thatch; injured by some herbicides. A very high-maintenance grass.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.

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Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft²)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft²)
'Tifway' bermudagrass (Tifton 419) (*C. dactylon x transvaalensis*)	Dark green; fine texture; dense sod; stiff leaves.	Resists wear; tolerates saline and alkaline soils; very rapid recovery; good weed resistance; high quality turf; produces few seed heads. Moderate maintenance	Susceptible to insects; builds heavy thatch.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'Tifdwarf' bermudagrass (*C. dactylon x transvaalensis*)	Dark green; dense mat; fine texture; shorter blades and internodes than 'Tifgreen'.	Resists wear; tolerates saline, moderately acid, and alkaline soils; produces few seed heads. Denser sod than 'Tifgreen'; requires less frequent mowing.	Susceptible to grass webworms and also to other insects and diseases; builds thatch; slow to cover. A very high-maintenance grass.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1– 2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
'Sunturf' bermudagrass (*C. magennisii*)	Dark green; fine texture; low-growing.	Resists wear; tolerates saline and alkaline soils; drought resistant; rapid recovery from scalping; produces few seed heads.	Vigorous grower; slightly slow to establish, but rapid growth thereafter; susceptible to insect injury; builds thatch.	Sun	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	1/2–3/4	1 lb per month or 2–3 lb of slow-release N every 60–90 days. Reduce applications in winter months in windward locations.
Manilagrass (*Zoysia matrella*)	Deep green; medium texture; blades flat and shorter than templegrass; blades stiff; fewer mounds than templegrass	Resists wear; shade tolerant; tolerates salinity, drought, and mild soil acidity; dense growth resists weeds when established; tolerates most herbicides.	Attacked by billbugs and rust fungus; builds thatch; slow to establish; forms some mounds; requires good drainage; requires heavy-duty mower.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
Templegrass; koreangrass; velvetgrass (*Zoysia tenuifolia*)	Medium green; fine texture; blades stiff with sharp points; pronounced mounds or humps.	Resists wear; shade tolerant; may be left unmowed as a groundcover; seldom flowers; tolerates many herbicides.	Badly attacked by billbugs and some other insects and diseases; builds thatch. Slowest of the zoysias to establish; forms mounds that are difficult to mow; requires reel mower; requires good drainage; high water user.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	As desired or 3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
'Emerald' zoysiagrass (*Z. japonica x tenuifolia* 'Emerald')	Deep green; medium texture; blades shorter than manilagrass; blades not stiff; not as mounding as templegrass.	Resists wear; shade tolerant; tolerates salinity, drought, and mild soil acidity; spreads faster than manilagrass; keeps out weeds when well established; tolerates most herbicides.	Attacked by billbugs and possibly by rust fungus; builds thatch; forms some mounds; requires reel mower; requires good drainage; leaves stiff; many seed heads.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.

Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft²)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft²)
'Meyer Z-52' zoysiagrass (*Zoysia japonica* 'Meyer')	Light green; medium texture; leaves stiff, prickly, and longer than 'Emerald'.	Resists wear; shade tolerant; tolerates salinity and mild soil acidity; produces no mounds; keeps weeds out when well established; tolerates most herbicides.	Attacked by some insects and diseases; builds thatch; requires heavy-duty mower; needs good drainage; leaves stiff; produces seed heads.	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	3/4–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
'El Toro' zoysiagrass (*Zoysia japonica* 'El Toro')	Light green; fine to medium texture; stiff leaves.	Resists normal wear; tolerates shade, drought, and salinity; deep root system. Produces a quality turf with proper management.	Does not tolerate excessive traffic; recovers slowly. Does not like poorly drained soils.	Sun or light shade	Plugs: 6–12" apart Stolons: 5–10 bu Sprigs: 1–2 bu	1/2–2	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
'Z-3' zoysiagrass (*Zoysia matrella x japonica*)	Medium green; medium-fine texture; short, soft leaves; inconspicuous seed heads.	Establishes more quickly than most zoysias. Forms a dense stand; tolerates drought; resists wear; recovers well. Produces a quality turf with proper management.	Can invade other plantings; forms some thatch. Should be mowed to low heights to keep it attractive. Verticut once a year and/or lightly topdress.	Sun or light shade	Plugs: 6–12" apart Stolons: 5–10 bu Sprigs: 1–2 bu	1/2–1	1/2 lb per month or 1–2 lb of slow-release N every 60–90 days.
St. Augustinegrass (*Stenotaphrum secundatum*)	Light green; coarse texture; stiff, wide blades and stems; no underground stems; leaves upright; shallow-rooted.	Resists moderate wear; very shade tolerant; tolerates a range of soils and climates but prefers well-drained, fertile soil; low maintenance; easy to establish. There are variegated varieties for ornamental purposes and dwarf lawn cultivars.	Attacked by grass webworms, chinch bugs and other insects and diseases; produces thick thatch; requires heavy-duty mower; susceptible to certain herbicides. Does not tolerate drought well. Difficult to start with stolons.	Sun or shade	Stolons: 3–5 bu Plugs: 6–12" apart	2–3	1 lb preferably slow-release N every 60–90 days or as determined by color. Iron may be necessary to improve color in soils with low iron or alkaline pH.
Centipedegrass (hunangrass) (*Eremochloa ophiuroides*)	Medium green; medium texture; leaves long and narrow; many stolons; shallow-rooted.	Tolerates some shade; does well in coarse, heavy, low-fertility, or acid soils; makes dense, weed-free sod; best for moist areas; few insect or disease problems; very low maintenance requirement. 'Au Centennial' is a dwarf selection.	Becomes chlorotic under alkaline soil conditions; does not tolerate heavy traffic or poorly drained soil; susceptible to certain herbicides and salt spray. Not drought tolerant.	Sun or light shade	Seed: 2–4 lb Plugs: 6–12" apart Sprigs: 1–2 bu	1–2	1–6 lb per year (slow-release N preferred) depending on desired quality and maintenance levels. Do not apply more than 2 lb quick-release N per application. Iron may be needed on alkaline soils.

Lawn grass	Appearance	Desirable characteristics	Undesirable characteristics	Location	Propagation (per 1000 ft²)	Preferred mowing height (inches)	Nitrogen fertilizer requirement for best quality (actual N per 1000 ft²)
Carpetgrass, Australian carpetgrass (*Axonopus affinis* or *A. compressus*)	Light green; coarse texture; creeping growth habit; blunt, rounded leaf tips; produces seed heads primarily in summer.	Produces a dense stand; tolerates wet and shady conditions, poorly drained soils; prefers acid soils; low maintenance. Somewhat resembles centipedegrass. Commonly used in pastures and for erosion control.	Not drought or salt tolerant; not suitable for a quality lawn; poor traffic tolerance; shallow root system; must be irrigated frequently in drought conditions; may be chlorotic under alkaline conditions.	Sun or shade	Seed: 5 lb Sprigs: 1–2 bu	1–2	Does not need or like a lot of N. Apply $^1/_2$–1 lb every 6 months.
Seashore paspalum (*Paspalum vaginatum*)	Medium to dark green; fine textured; very soft leaves; Y-shaped seed heads.	Tolerates saline conditions; seen growing directly into brackish ponds and streams; tolerates brackish irrigation. Tolerates drought and wear. Will show moisture stress but recovers quickly.	Affected by armyworms, webworms. Scalping can be a problem in shade. Produces very heavy thatch; few herbicides available; requires regular maintenance to maintain quality	Sun or light shade	Stolons: 5–10 bu Plugs: 6–12" apart Sprigs: 1–2 bu	$^3/_4$–1$^1/_2$ Best mowed at 1" or less.	$^1/_2$ lb per month or 1–2 lb of slow-release N every 60–90 days.
Hilograss (*Paspalum conjugatum*)	Medium to dark green; coarse texture; wide, pointed blade tip; Y-shaped seed heads.	Easily takes over lawn or bare ground. Tolerates acidic, wet, and low-fertility soils; establishes easily and grows fast. Does well in high rainfall areas. Makes a satisfactory lawn grass with some maintenance.	An invader in most cases. May cause an allergic rash to sensitive skin. Does not tolerate drought and heat well. Needs to be mowed frequently to control unsightly seed heads and upright growth.	Sun or light shade	May not be commercially available. Seed: 4–6 lb Stolons: 5–10 bu Plugs 6–12" apart Sprigs: 1–2 bu	1–2	Does well with little or no fertilizer. Apply $^1/_2$–1 lb every 6 months.

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