STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION, AIRPORTS DIVISION

CONSTRUCTION AND POST-CONSTRUCTION STORM WATER MANAGEMENT PLAN

Prepared For:
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LIST OF ACRONYMS

BMP	Best Management Practice
CCH	City and County of Honolulu
CFR	Code of Federal Regulations
DOH	State of Hawaii, Department of Health
DOTA	State of Hawaii, Department of Transportation, Airports Division
EID	Environmental Identification Number
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
HAR	Hawaii Administrative Rules
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NTP	Notice to Proceed
O&M	Operations and Maintenance Manual
SSCBMP	Site Specific Construction Best Management Practices
SWMPP	Storm Water Management Program Plan
SWPPP	Storm Water Pollution Prevention Plan

1.0 INTRODUCTION

The State of Hawaii, Department of Transportation, Airports Division (DOTA) has developed this Construction and Post-Construction Storm Water Management Plan to address the potential pollutants that are generated as a result of new development and redevelopment that pose a risk to the Small Municipal Separate Storm Sewer System (MS4) and the receiving water bodies through storm water runoff in accordance with applicable National Pollutant Discharge Elimination System (NPDES) permits. The program consists of Best Management Practices (BMP) field manuals; review and approval process; an inspection and enforcement program; post-construction maintenance database; and a training program.

1.1 Applicability

The plan will be implemented for projects on the airport property that meet the DOTA definition of construction. Off-site construction projects discharging or connecting to the MS4 are also subject to the program per the DOTA discharge permit.

1.1.1 Construction Definition

The DOTA definition of construction includes activities which result in the disturbance of the land, including clearing, grading, excavating, and other similar activities. It also includes construction related activities that support the construction projects such as stockpiles, borrow areas, concrete truck washouts, batch plants, fueling areas, material storage areas, and equipment storage areas (EPA 2007). The program applies to both DOTA managed projects and tenant projects occurring at the airport.

A. Exempted Construction Projects

The following activities, provided that they do not impact the storm drainage system, are exempt from any submittal requirements:

- Minor land disturbance activities on a single lot (such as minor landscaping activities). Activities must disturb no more than 10 cubic yards or ¼ acre.
- Post and pole installation (less than 2 cubic yards excavation at any one location).
- Utility repair work (less than 2 cubic yards of excavation at any one location).
- Parking lot and driveway repair (less than ¼ acre disturbed and no sediment leaves the property).
- Repair and maintenance activities.
- Other as approved by the DOTA Environmental Section.

1.1.2 Post-Construction Requirements

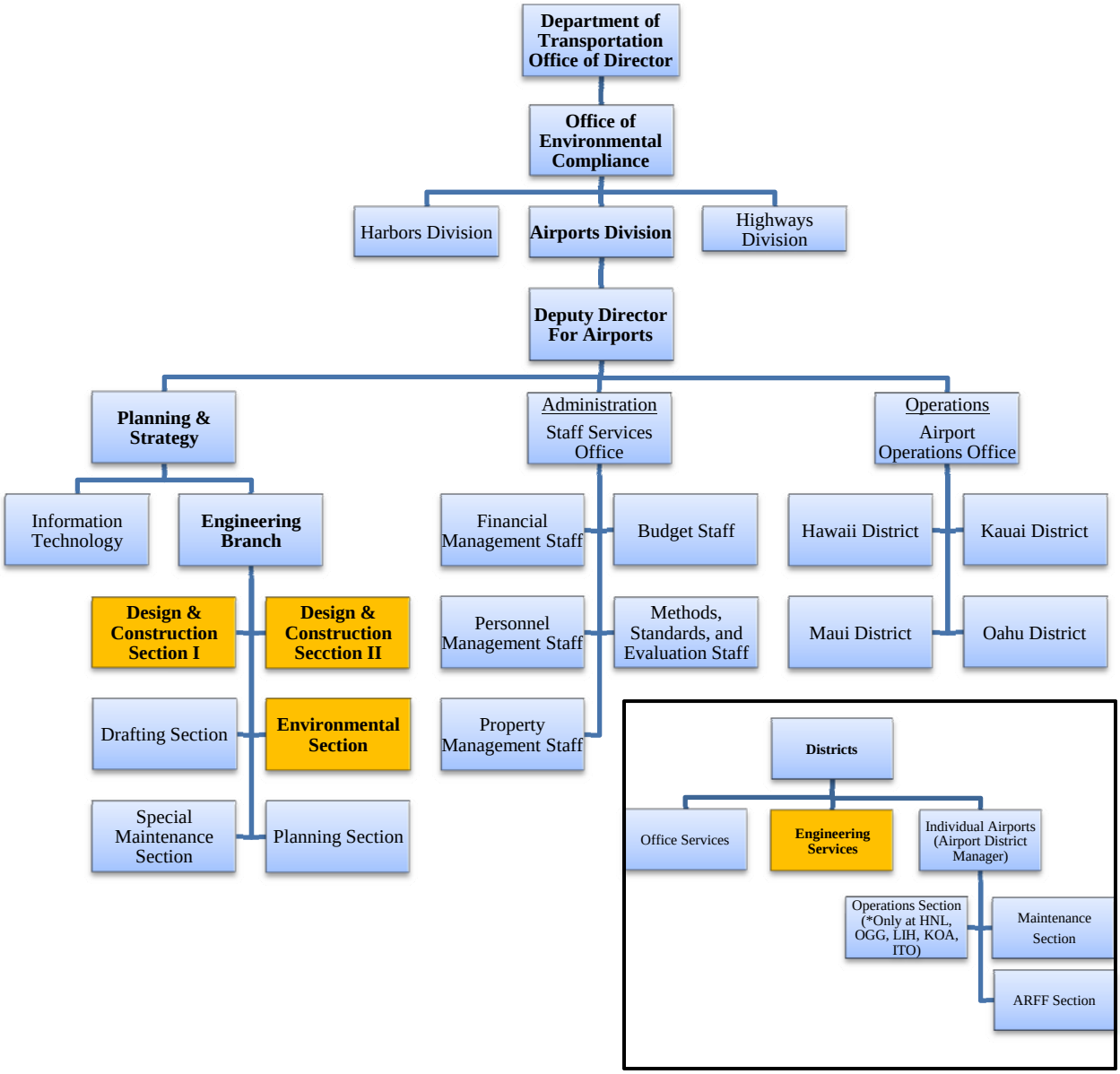
A post-construction BMP (permanent BMP) will remain on the site after construction activities are completed in order to address potential pollutants from future use on the site. Typical permanent BMP strategies include low impact development (LID), source control, and treatment control. Permanent BMPs are required for new development and redevelopment projects that meet the definition of construction, are not exempted, and result in a land disturbance of one acre or more.

A. Post-Construction Exemptions

In addition to the construction project exemptions listed above, Designers may provide justification to the reason that permanent BMPs are not feasible for individual projects; however, these must be approved by the DOTA Environmental Section. Where exemptions are applied, Designers should review the Sustainable High Performance Guidelines to determine if additional pollution prevention measure may be applied.

1.2 Responsibilities

This plan will be implemented under the direction of the DOTA Environmental Section; however, there are several other involved parties with significant roles and responsibilities. Note: the individual responsibilities may be altered for specific projects dependent upon personnel availability.



1.3.1 Designers / Tenants

The designers and/or tenants have the responsibility of ensuring that construction sites are designed in a manner that is protective of the environment, including:

- Preparing construction plans with temporary BMPs and permanent BMPs, where applicable (Section 2.1).
- Submitting paperwork for review to DOTA and properly responding to comments (Section 2.2).
- Applying for necessary permits, including NPDES for construction, NPDES for dewatering, DOTA discharge permit, etc.
- Consulting with the DOTA Environmental Section (Section 2.3).
- Complete the training provided by the DOTA Environmental Section (Section 6.1).

1.3.2 Contractors / Tenants

The contractor and/or tenant have key responsibilities in ensuring day-to-day environmental compliance during construction activities, including:

- Updating or merging Storm Water Pollution Prevention Plans (SWPPP) or Site Specific BMP Plans (SSCBMP) to fit activities conducted on the construction site.
    - This updated SWPPP or SSCBMP will be submitted to the Division or District Engineering Section Project Manager so that the DOTA Environmental Section can review the final document.
- Ensuring that final permits are on-site and conditions have been met. Final versions of the permits should be provided to the Division or District Engineering Section Project Manager and routed to the DOTA Environmental Section.
- Ensuring that BMPs are installed according to the SWPPP or SSCBMP and are properly maintained.
- Conducting BMP inspections at least weekly or as required by the sites NPDES permit (Section 4.1.4).
- Have a representative available during third party inspections so that the necessary paperwork can be presented to the inspector and findings promptly addressed (Section 4.1).
- Communicate corrective actions promptly to the third party inspector.
- Maintain proper documentation on-site (Section 4.2.2.).
- Complete the training provided by the DOTA Environmental Section and provide training on site-specific BMPs to workers on the construction site (Sections 6.1 and 6.2).
- Upon completion of construction, stabilize all exposed areas of soil. Upon satisfactory completion of the final inspection by the third party inspector, remove all temporary BMPs (Section 4.1.3).
- Install permanent BMPs where applicable and provide Operations and Maintenance (O&M) manual, training on device, and initial maintenance on device (Section 2.1.4.D.).

1.3.3 Third Party Inspectors

The third party inspectors provide a different perspective on the construction site and will aid in identifying deficiencies and potential problems before they result in significant impairment to the MS4 or receiving water. Construction Managers may be utilized for DOTA projects and the DOTA Environmental Section will conduct inspections for tenant sites. Their duties include:

- Ensure that they are not involved in day-to-day activities at the construction site.
- Ensure that they are qualified for conducting inspections by completing the classroom training provided by the DOTA Environmental Section and completing three inspections under the supervision of a qualified inspector (Sections 6.1 and 6.3).
- Conduct initial, monthly, and final BMP inspections (Section 4.0) and document on the Inspection Checklist (Appendix E).
- Conduct follow-up activities to ensure that identified deficiencies have been corrected by the contractor and/or tenant.
- Submit reports to the DOTA District or Division Engineering Section Project Manager and the DOTA Environmental Section.

1.3.4 DOTA Environmental Section

The DOTA Environmental Section will ensure that inspections are properly documented tracked, and enforcement actions are applied to correct deficiencies. Their duties include:

- Provide training materials (Section 6.0).
- Coordinate with District and Division Engineers and tenants to ensure that requirements of this plan are met.
- Conducting the construction plan reviews (Section 3.0).
- Providing oversight of third party inspectors to ensure that inspections, documentation, and follow-ups are completed (Section 4.0).
- Maintain recordkeeping in Enviance to include project information, plan reviews, and construction inspections. Utilize data to complete the annual report and/or make changes to the program.
- Initiate documentation for enforcement (Section 5.0).

1.3.5 DOTA Division Engineering Section Project Manager

Division Project Managers are responsible for ensuring that DOTA projects comply with this program and other environmental regulations (e.g. construction NPDES) and their duties include:

- Setting up the scope of the project to include compliance with environmental regulations and this plan (Section 2.3).
- Providing oversight of designers, contractors, and construction managers associated with the project.
- Routing submittals such as construction plan review (Section 3.0) documents and inspection reports (Section 4.0) to the DOTA Environmental Section.
- Providing notice to proceed (NTP) to the contractor (Section 3.7).
- Assisting with enforcement actions where necessary such as withholding payment or stop work orders (Section 5.0).

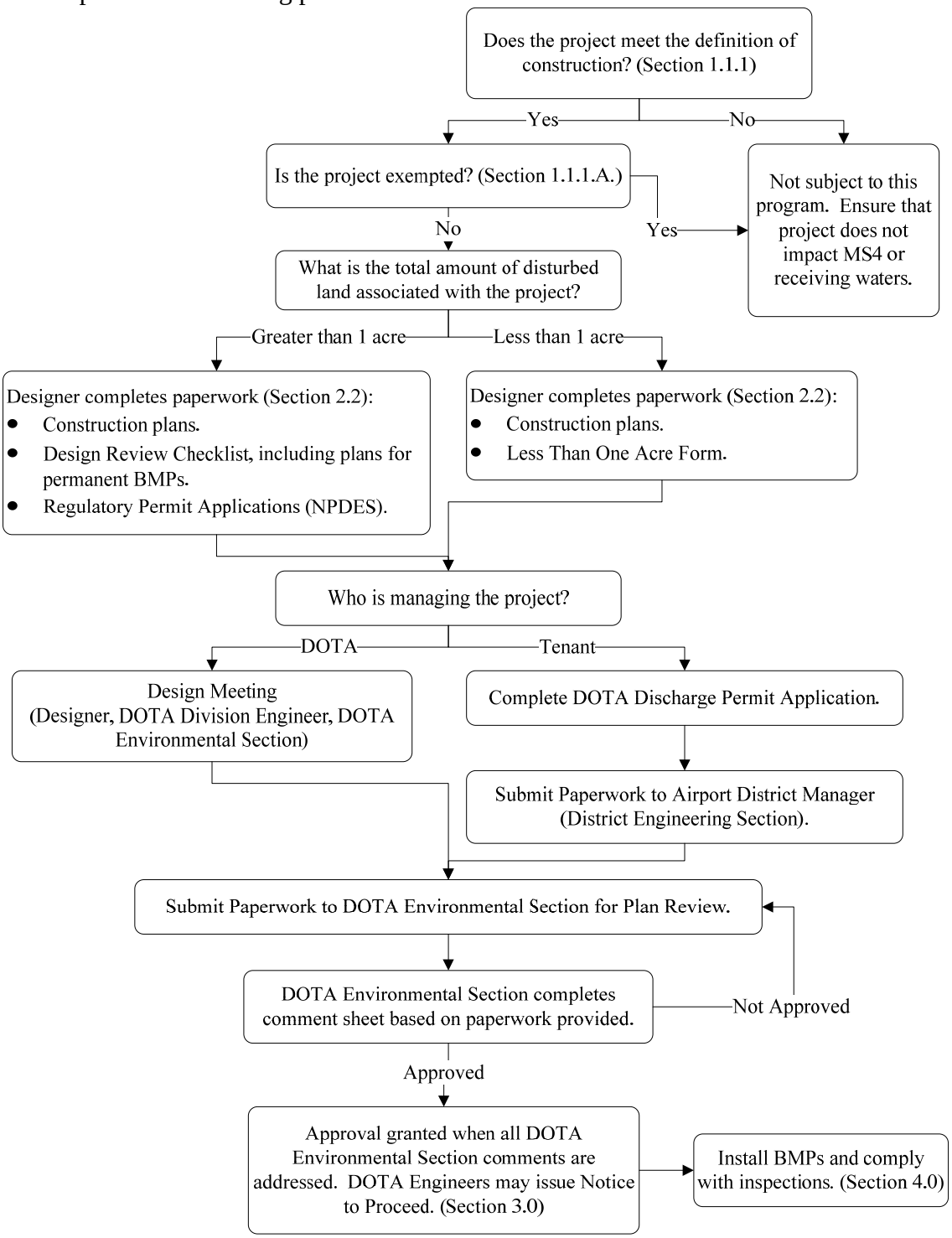
1.3.6 DOTA District Engineering Section Project Manager

District Project Managers are responsible for ensuring that tenant improvement projects comply with this program and their duties include:

- Coordinating with tenant in regards to their planned construction activities.
- Routing construction plan review submittals to the DOTA Environmental Section (Section 3.0).
- Providing NTP to the tenant (Section 3.7).
- Assisting with enforcement actions where necessary such as stop work orders (Section 5.0).

2.0 CONSTRUCTION PROJECT DESIGN

The DOTA Environmental Section conducts a review of DOTA and tenant construction projects to ensure that proposed construction activities are in compliance with applicable regulations and potential impacts are limited to the maximum extent practicable (MEP). The flow chart below depicts the process used during plan review.

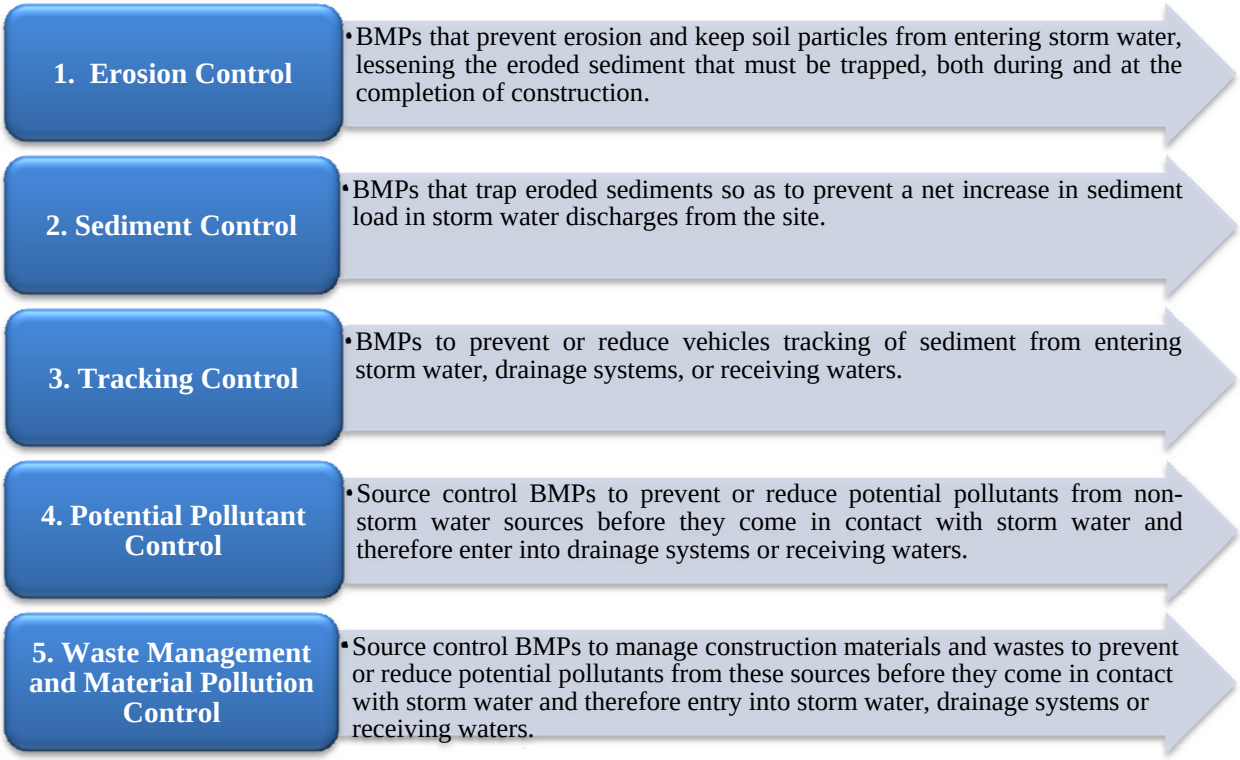


2.1 Construction Design (Designers)

DOTA and tenant new development and redevelopment projects begin with a plan for improvements to be made. Once retained, Designers will create draft construction plans that include applicable temporary BMPs and permanent BMPs.

2.1.1 Construction BMP Field Manual

The Construction BMP Field Manual provides guidance on the selection, installation, and maintenance of temporary BMPs that address construction activities (Appendix F). The Construction BMP Field Manual does not include an exhaustive list of all possible construction site runoff BMPs, but does include commonly used BMPs. The BMPs contained in the Construction BMP Field Manual are divided into five major categories:



2.1.2 Temporary or Construction BMP Selection

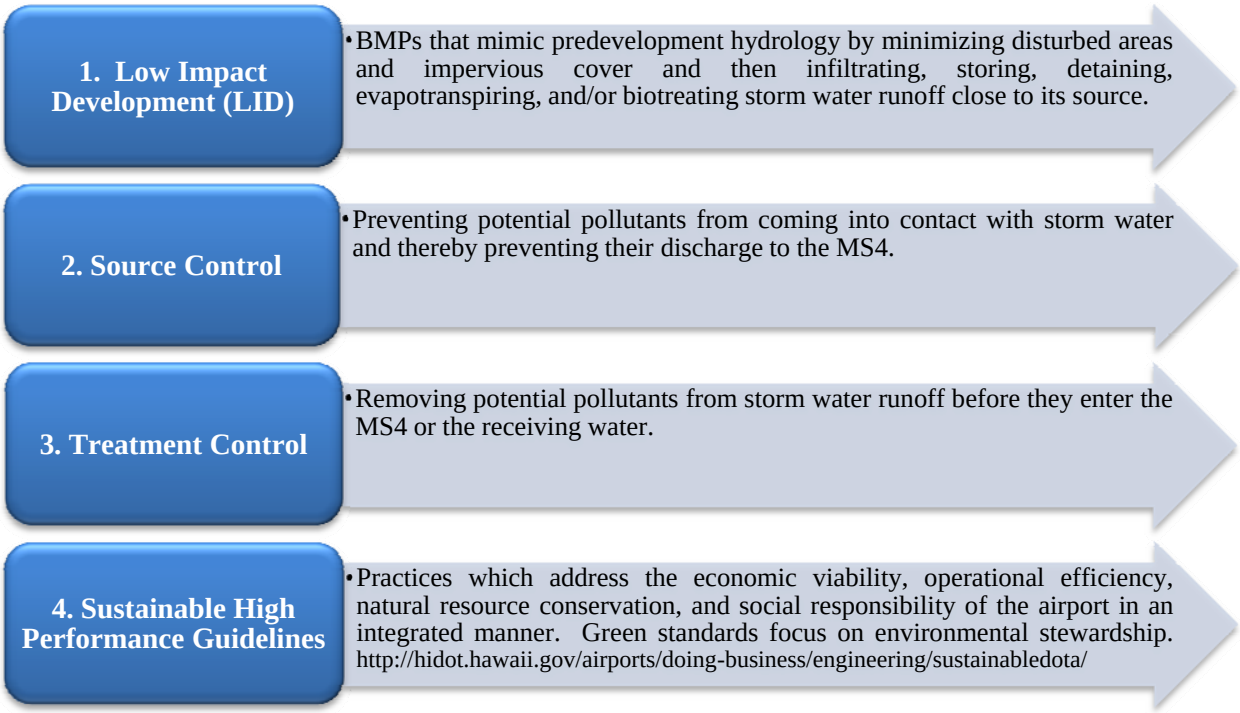
The Designer shall evaluate which BMPs will be required for a particular construction project. The first step in the selection process will be to determine which construction activities may result in potential pollutants. Then select the applicable BMPs and include them in the construction plans. Additionally, the Designer shall refer to the City and County of Honolulu's (CCH) *Rules Relating to Soil Erosion Standards and Guidelines*, which can be downloaded at www.usspecbook.com/files/specs/rules-relating-to-soil-erosion.pdf. Although, projects conducted at the airport are not required to obtain grading permits, the projects may still be classified using the CCH method based on size. Small projects will be considered those that disturb less than one acre of land and will therefore follow Figure 3 of the CCH document, while projects greater than one acre will follow Figure 4 of the CCH document.

2.1.3 Permanent Post-Construction BMP Field Manual

The Permanent Post-Construction BMP Field Manual provides guidance on the selection, installation, and maintenance of permanent BMPs that address potential pollutants that may be generated on the site after construction activities are completed (Appendix G). The Permanent Post-Construction BMP Field Manual does not include an exhaustive list of all possible BMPs, but does include commonly used BMPs.

2.1.4 Permanent BMP Selection

Selection and implementation of proper permanent BMPs requires the designer consider the long term impacts of activities at the site. BMPs incorporated into the concept, planning, and design phase are much more cost-effective than the retrofit of BMPs. The permanent BMP should be considered in terms of the DOTA goals.



A. Potential Pollutants of Concern

The selection of a permanent BMP will commence by evaluating the potential pollutants of concern, including:

- Land use type of the development project and pollutants associated with that land use type;
- Historical pollutants expected to be present on site;
- Changes in storm water discharge flow rates, velocities, durations, and volumes resulting from the development project;
- Sensitivity of receiving waters to changes in storm water discharge flow rates, velocities, durations, and volumes; and
- Receiving water quality.

B. Assess Site Conditions

The Designer will determine what specific site conditions are present. This may include a field reconnaissance to evaluate areas of erosion, existing vegetation, sizing constraints, and the site's hydrology. Further, Designers must also take into consideration the Federal Aviation Administration's (FAA) requirements for minimizing wildlife (i.e. bird) populations in and around the airport to prevent bird strikes with the aircraft. This may eliminate BMPs that require extensive vegetation or standing water.

C. Determine BMP Size/Capacity

The Designer will then evaluate specific permanent BMPs based on the size or capacity required. Specifically, DOTA recommends referencing the City and County of Honolulu (CCH) *Rules Relating to Storm Water Standards*. Volume based BMPs should be designed to hold the first 1 inch of storm water runoff. For flow-based BMPs, the design must be able to accommodate a peak rainfall intensity of 0.4 inches per hour.

D. Plan for BMP Maintenance

BMP maintenance arrangements must be made during the planning phase of development and redevelopment projects. This may include consulting with the DOTA Maintenance Section regarding their capabilities or adding verbiage to a tenant lease to require maintenance. At a minimum, an O&M plan will be prepared by the project proponents to include:

- BMPs
- Employee training program and duties
- Operating schedule
- Maintenance frequency
- Routine service schedule
- Specific maintenance activities
- Other necessary activities

E. DOTA Preferred BMPs

The DOTA has developed a list of preferred permanent BMPs that Designers should consider where applicable:

Goal #1 - Retain storm water on-site:

1. Bioswales.
2. Underground Detention Basin.
3. Pervious Pavement.

Goal #2 – Treat storm water runoff:

* Ensure that maintenance may be performed from accessible manholes with standard equipment (e.g. vacuum trucks, etc.).

1. Hydrodynamic Separators.
2. Oil Water Separators.
3. Storm Drain Inserts.

2.2 Paperwork

Once Designers have developed the concept and selected appropriate BMPs, the proper paperwork must be completed. The DOTA Environmental Section will review the paperwork before the project may proceed. Since projects which disturb greater than one are required to comply with NPDES regulations for construction and consider permanent BMPs, additional paperwork is required.

2.2.1 Projects Less Than One Acre

The following is a summary of submittal requirements for non-exempt projects that disturb less than one (1) acre at the airport:

- Less Than One Acre Notification Form (Appendix B). The Notification Form must be signed and dated by the DOTA PM for DOTA projects or Tenant Owner for tenant projects.
- A narrative description of the BMPs that will be implemented.
- A site plan outlining the anticipated activities and the location of all proposed BMPs. A sample Sediment and Erosion Control BMP Plan Drawing is shown in Appendix B.
    - The site plan is not required to be prepared by an engineer, surveyor, or architect. If an individual with one of these licenses prepares the plan; however, then they must sign and seal the plans.
    - The site plan should include:
        - A site location drawing of the proposed project, indicating the location of the proposed project in relation to roadways, jurisdictional boundaries, canals and coastline;
        - The boundary lines of the site on which the work is to be performed;
        - The location of temporary and/or permanent BMPs;
        - Storm drains or other drainage ways present in the area (for a storm drain map, refer to the DOTA website: http://hidot.hawaii.gov/airports/doing-business/engineering/environmental/); and
        - Direction of storm water flow.

2.2.2 Projects Greater Than One Acre

The following is a summary of submittal requirements for non-exempt projects that will disturb one (1) acre or more at the airport with each design submittal phase:

- Design Review Checklist (Appendix C).
- Construction plans, including:
    - Site location boundaries;
    - Location of temporary and/or permanent BMPs under sheets specifically titled "Site-Specific BMPs" and "Post-Construction BMPs;"
    - BMP design details;
    - Discharge and grading plans;
    - Storm drains or other drainage ways present in the area (for a storm drain map, refer to the DOTA website: http://hidot.hawaii.gov/airports/doing-business/engineering/environmental/); and
    - Direction of storm water flow.
- SWPPP and/or SSCBMP plan.

- Narrative of project.
- Narrative of BMPs to be implemented.
- Project location information;
- Project schedule;
- Contact information to allow the reviewer to obtain additional information if necessary.
- All other information required by Hawaii Administrative Rules (HAR) 11-55, App C.

- NPDES permit application for construction activities. The final permit must be forwarded to the DOTA Environmental Section when available.

To expedite the review process, the DOTA PM and Division Environmental Unit may conduct their reviews concurrently.

2.2.3 DOTA Discharge Permit (Non-DOTA Projects Only)

Tenants or other non-DOTA entities must complete the *Permit To Discharge Into The State Airport Drainage System* (Appendix D) and submit it to the Airport District Manager or DOTA District Engineer with their other plan review paperwork. The DOTA District Engineer will forward the permit application along with the other construction documents to the DOTA Environmental Section. The DOTA Environmental Section will review the documents and if approved assign the project an Environmental Identification Number (EID) from Enviance. That number will be filled in on the top right of the form as the Discharge Permit Number. Then, the DOTA Environmental Section will fill in the issuance date, sign where indicated, and route to the DOTA Division Engineering Program Manager for review and signature. Once signed by all parties, the DOTA Environmental Section will keep a copy of the permit and provide the original to the tenant.

2.3 Design Meetings (DOTA Projects Only)

For DOTA projects, the DOTA Environmental Section or their representative should be present during a pre-planning meeting. This meeting will serve to ensure that before a scope of work has been finalized for an upcoming project, it includes the necessary language for compliance with the MS4 and construction NPDES permits.

Once a Designer has been selected and they have drafted construction plans with BMPs as described in Section 2.1, a pre-design project meeting will be held with the DOTA Environmental Section or their representative. This meeting will serve to ensure that appropriate temporary and permanent BMPs have been considered and/or selected for the project.

3.0 PROJECT PLAN REVIEWS

The DOTA Environmental Section shall conduct a review the project plans and documents to ensure that the environmental impact of the construction activities have been limited to the maximum extent practicable.

3.1 Receipt of Project Review Package

The project review package will consist of all documentation described in Section 2.2. For DOTA projects, the Division Engineering Section Project Manager will route the package to the DOTA Environmental Section for review. For tenant improvement projects, the package shall be routed from the Airport District Manager or District Engineering Section Project Manager to the DOTA Environmental Section. The DOTA Environmental Section may also communicate directly with project designers or tenants to obtain or clarify information. In these cases, the Project Manager will be copied on correspondence.

3.2 Letter Log Number

The DOTA Environmental Section will ensure that each project review package will receive an incoming letter log number per their internal process. The letter log number will be written on the routing sheet and scanned along with the first page of the construction plans in the airport's X:Drive under the *Correspondence Received* folder. The file will be saved using the letter log number and the project name (e.g. 14.001 CONRAC).

Other outgoing and incoming letter log numbers may be assigned to comments and responses generated during the review process.

3.3 Create the Project in Enviance

If the DOTA Environmental Section determines that the project meets the airport definition of a non-exempt construction project (Section 1.1.1), then the project information will be entered into Enviance. First, they will run the report for *Environmental IDs Assigned*, which is located in the *Miscellaneous Reports* folder by right clicking on the report name and select *Run Report*. Then, the next sequential number will be selected from the report based on the District in which the project is occurring (50000s for Oahu; 60000s for Maui; 70000s for Hawaii; and 80000s for Kauai).

Once an EID has been selected, the reviewer will navigate in Enviance to the appropriate airport under the tab for *Construction* and *Construction Sites.* The reviewer will right click on *_Construction Site Template* and select *Copy.* Then, they will right click on *_Construction Sites* and select *Paste.* The reviewer will rename the project using the selected EID number and beginning with a *B* for plan review and a short description of the project (e.g. B.50001 CONRAC). Additionally, if a DOTA Engineering Section project number has been assigned, the reviewer will include that in the name. Note: Project will be renamed with an *A* once construction starts and then a *C* once the project is completed. The reviewer will ensure that the box for *Include Children* is checked and select *Copy.*

To fill in the project information, the reviewer will right click on the construction site just created and select *Properties* and *Edit*. The reviewer will enter the information provided in the fields where indicated. At a minimum, the review must enter the EID, Project Type (i.e. DOTA

or Tenant), and the Location. The reviewer may also include the letter log number assigned in Section 3.2 within the *Description* block.

3.4 Conduct the Review

The DOTA Environmental Section Reviewer will begin the review by ensuring that documentation required in Section 2.2 has been submitted. Once all required documents have been identified, the reviewer will look at the project's size, location, and discharge points. This will aid in determining whether the proper permits have been applied for (e.g. construction NPDES) and the extent of BMPs that may be necessary due to proximity to receiving water and receiving water type. Then, the reviewer will identify potential sources of pollutants and ensure that BMPs have been included to address them. Some examples may include sediment controls for land disturbance, secondary containment for fuel storage, containment for concrete washout, containment for stockpiles, etc. Finally, the reviewer will ensure that permanent BMPs have been included where applicable and that there is a plan for final stabilization of the site. Reviewers will also be familiar with the requirements from applicable regulations, such as HAR 11-55, and ensure that adequate plans have been made to address those requirements.

3.5 Document the Review

The DOTA Environmental Section reviewer will document comments from their review of the construction project package on the comment sheet. The comment sheet header will include the airport name, the project title, the Engineering Section's project number, the Environmental Section's EID number, the date, and the reviewer's name.

Each individual comment will be placed on subsequent lines within the document table. A comment identification number will be assigned to each comment that includes a shortened version of the name of the document reviewed and a sequential number (e.g. 90% CD 001, SWPPP - 002). Then the reviewer will enter their contact information, the date of the review, specific references to the drawing sheet or page number, and their comment.

The completed comment sheet will be routed and/or emailed back to the Division or District Engineering Section Project Manager through the Environmental Section Supervisor. The Project Manager or their designee will review the comments and then respond. They will fill out the columns for respondent contact information, response, concur, non-concur, and FIO. The concur column will be marked if the respondent agrees with the reviewer and makes the necessary change. The non-concur column will be checked if the respondent disagrees with the reviewers assessment, which may facilitate further dialog between the reviewer and respondent. The FIO column stands for "For Information Only" and will be checked when the reviewer requires further clarification.

Once the respondent has addressed all the comments, the comment sheet and any supporting additional information will be routed and/or emailed back to the DOTA Environmental Section reviewer. The reviewer will then indicate on the comment sheet whether the comment has been closed and the date. If there are comments remaining that have not been closed, the reviewer will enter further comment in the "Back Check Comment" column.

Several iterations of this process may be required to ensure that all comments are adequately addressed. Comment sheets will be saved on the airport X:Drive in the folder for *Construction* and *Construction Plan Review* under the EID number assigned in Section 3.3.

3.6 Record Review in Enviance

Once the initial comment sheet has been created, the reviewer will enter the review into Enviance by navigating to the correct project generated in Section 3.3, right clicking, and selecting *Requirements*. The review log will be located by right clicking on the log *Construction Site SW Runoff Plans* and selecting *Data* and *Enter/Edit.* Once in the log, the reviewer will select *Add*, enter the pertinent data, and select *Save.* Once all comments have been addressed, the log will be edited to indicate such.

3.7 Plan Review Approval

Once all comments on the comment sheet have been closed, that indicates that the DOTA Environmental Section has approved the construction plans. Then the Division or District Engineering Section Project Manager may issue a first Notice to Proceed (NTP), which will require the contractor or tenant must complete the following prior to starting construction work:

- Install all temporary construction BMPs within a designated number of calendar days, to be determined by the Project Manager.
- Satisfactorily pass an initial inspection of the BMPs by the DOTA Environmental Section or designee.

4.0 CONSTRUCTION INSPECTIONS

A critical part of the oversight process is the requirement for inspections of the construction site to determine whether the activities comply with this plan as well as applicable environmental regulations such as the construction NPDES permit.

4.1 Inspection Types and Frequencies

Several different types of inspections are conducted to meet the program goal. Initial, monthly, and final inspections will be documented on the Inspection Form (App C).

4.1.1 Initial Inspection

The initial inspection will be conducted by the qualified third party inspector when the project has been issued the first NTP and the contractor has installed all temporary BMPs. The DOTA Division Project Manager or tenant will notify the DOTA Environmental Section when the site is ready for inspection. All deficiencies from this inspection must be addressed prior to the start of construction activities.

4.1.2 Monthly Inspection

Routine inspections will be conducted by a qualified third party inspector on a monthly basis to ensure that BMPs remain effective and are properly maintained. The frequency of the inspections may increase if deficiencies are identified as determined by the inspector. The inspector may suspend monthly inspections if there will be no construction activities conducted on the site for a period of 30 days or more and the disturbed soil has been stabilized.

4.1.3 Final Inspection

The final inspection will be conducted by a qualified third party inspector when the site has been properly stabilized and/or remaining construction activities will have minimal or no adverse impact on storm water runoff (e.g. interior building construction). The site will be considered stabilized when vegetation growth provides 70 percent or more of the density that was present on the site prior to construction activities or other types of non-vegetative controls are in the place (e.g. pavement). The final inspection will also serve as the initial inspection for any permanent BMPs that may be installed on the site. Final inspection closure will not be granted until all deficiencies are addressed, any permanent BMPs have been verified to be installed correctly, and a plan for continued maintenance has been reviewed for permanent BMP operation. Following the closure approval, the contractor may remove temporary BMPs.

4.1.4 Contractor Self-Inspections

Contractors will complete a self-inspection of their construction sites at a minimum weekly or as indicated by their NPDES permit. This may be documented on any form the contractor chooses and will be presented for review during third party inspections.

4.1.5 Permanent BMP Inspection and Maintenance

Once the permanent BMP has been properly installed, it will be inspected on an annual basis and maintenance will be performed as necessary. The District Maintenance Section or a contractor will complete the inspection and maintenance. Then results will be communicated to the DOTA Environmental Section and will be recorded in the Enviance database.

4.2 Conducting the Inspection

Qualified third party inspectors (i.e. not involved in day-to-day construction site operations) will follow these guidelines when conducting inspections at the airport.

4.2.1 Preparation

The qualified third party inspector will prepare for an inspection by contacting the appropriate parties to set up an inspection date and time. Note: the inspection may also be unannounced if appropriate. For DOTA projects, the inspector will notify the Division Engineering Section Project Manager, the Construction Manager, and the contractor. For a tenant improvement project, the inspector with notify the tenant and their contractor.

Then the inspector will review documents for the site obtained from the DOTA Environmental Section, which may include the SWPPP, NPDES permit, construction plans, etc. Additionally, the inspector will review the previous inspection report, as applicable.

The inspector will gather items necessary to complete the inspection, which may include the following:

- Proper Personal Protective Equipment: Hard Hat, Safety Vest, Safety Glasses, Steel Toed Boots, Long Pants.
- Air Operations Area (AOA) badge, where necessary.
- Inspection Form and Pen.
- Camera.
- Flashlight.
- Cell phone.
- Map with locations of MS4 features in the area.

4.2.2 Initial Meeting

The qualified third party inspector will announce their presence to the contractor for safety purposes once they arrive on-site. The inspection will start with a short meeting where the inspector will review applicable paperwork, such as:

- Permits, if applicable (e.g. construction NPDES permit, dewatering NPDES permit, DOTA discharge permit, etc.)
- Training records.
- Self-inspection records.
- Corrective action reports.
- Monthly compliance reports. *Note: for DOTA projects, this may be managed by the Division Project Manager and may not be on-site.
- SWPPP or SSCBMP plan with updated site map.
    - Record of revisions.

4.2.3 Site Inspection

Following the initial meeting, the inspector will walk the site. Specifically, the inspector will view the site entirety of the site perimeter, any drainage structures in the area, and other areas where pollutants may be generated such as the fueling area, maintenance area, or waste management area. The inspector should carry the construction site map to ensure that BMPs on

the map match what is found in the field and that they are properly maintained. Inspectors may refer to the BMP manual (Appendix F) for maintenance requirements. A main concern will be to ensure that illicit discharges are not leaving the site perimeter or entering the MS4. The inspector will take photos of the site, including any potential deficiencies. Before leaving the site, the inspector will verbally describe any observed deficiencies as well as provide educational information.

4.2.4 Construction Inspection Checklist

Either in the field or upon return to the office, the qualified third party inspector will complete the construction inspection checklist (Appendix E). The first section of the checklist includes some general information about the site such as project name, project number, NPDES permit number, inspection date and time, contact information for inspector, contact information for on-site representative, weather conditions, and the type of inspection. Then, the inspector will answer the provided questions.

The second page of the inspection checklist includes a blank table that allows the inspector to fill in BMPs that are present on the site, such as perimeter berm, concrete washout, storm drain inlet protection, etc. Then the inspector will indicate if it has been properly implemented on the site and whether it requires maintenance. Any additional comments or recommendations will be provided at the bottom of the second page.

The third page provides a space to record any deficiencies identified on the site per Section 4.3. The inspector will indicate in this section what will be done for follow-up. For minor deficiencies, the contractor may email photos of the corrective actions. For more significant deficiencies, the inspector will indicate a date for re-inspection. Then, the inspector will check the appropriate box for deficiencies, sign, and date.

Photos with descriptions of deficiencies should be attached to the report. Additionally, for larger sites, a map of the photo location may be included to more easily identify where the deficiency was located.

Once the inspection report has been completed, the report will be distributed to the appropriate parties. For DOTA projects, the report will be sent to the Division Project Manager, Construction Manger, contractor, and DOTA Environmental Section. For tenant projects, the report will be sent to the tenant, contractor, and the DOTA Environmental Section.

4.2.5 Recordkeeping

The DOTA Environmental Section is responsible for recordkeeping and will keep a scanned copy of the Inspection Checklist on the airport X:Drive in the *Construction* folder. Then, the inspection will be entered into Enviance.

The data entry person will navigate in Enviance to the appropriate construction project that was previously set up as a part of the plan review process (Section 3.3). The party will right click on the project name and select *Requirements.* Then, the party will right click on the *Construction Site SW BMP Inspection* and select *Data* and *Enter/Edit.* The inspection will be recorded by clicking on *Add,* entering the pertinent data from the inspection checklist, and selecting *Save*.

If a deficiency was identified during the inspection, it should be entered in the bottom portion of the Enviance log. A general description will be provided in *Description of incidents of non-compliance*; the deficiency type will be entered per Section 4.3; and the enforcement type. Once the contractor has corrected the deficiency, the log may be edited and the closure date and actions will be entered in all inspections logs where the deficiency was identified.

4.3 Types of Deficiencies

There are three types of deficiencies that may be identified during a construction inspection.

4.3.1 Minor Deficiencies

Minor deficiencies are defined as those that do not pose a threat for the discharge of pollutants to the storm drain system, surface waters, or state waters. Minor corrections include, but are not limited to, the following examples:

- BMP Plan does not reflect current operations and an amendment is recommended.
- BMPs are not deficient, but are not consistent with the BMP Plan.
- Linear barriers and/or perimeter controls are installed as required by the BMP Plan, but require minor maintenance. For example, a silt fence which is not anchored properly throughout the entire length or an inlet protection device with some accumulated silt.
- Soil stabilization or sediment controls are installed as required by the BMP Plan, but not properly maintained.
- Site self inspections by project staff are not being conducted at the required frequencies.
- Non-storm water or waste management BMPs that are improperly maintained.
- Oil, fuel, or brake or transmission fluid spills covering less than one square yard and/or are not adjacent to unprotected storm drain inlets, surface waters, or state waters.
- Evidence of active wind erosion on unstabilized slopes/stock piles.
- Minor tracking less than 50 feet from project ingress/egress locations.
- Major deficiencies which are corrected prior to the inspector leaving the site.

4.3.2 Major Deficiencies

Major deficiencies are defined as those that pose significant threats for the discharge of pollutants to the storm drain system, surface waters, or state waters. Major deficiencies include, but are not limited to, the following examples:

- No BMP plan or NPDES permit (if required).
- Linear barriers and/or perimeter controls in areas tributary to a water body or drain inlet that are installed as required by the BMP plan, but are not functional, such as silt fences that are not anchored properly, have collapsed, or been driven over or overwhelmed by accumulated sediment.
- Hazardous materials or waste is stored within a project without containment or implementation of BMPs.
- Oil, fuel, or brake or transmission fluid spills, covering more than one square yard and/or are adjacent to unprotected storm drain inlets, surface waters, or state waters.
- Any discharge of sediment or other deleterious material resulting from dewatering operations conducted without implementation of required BMPs for dewatering.
- Sediment tracking more than 50 feet from project ingress/egress location(s).

- Expansion of the active disturbed soil area limit without written approval.
- Soil stabilization and sediment controls are not installed in accordance with applicable BMP Plan.
- Sediment controls are installed in accordance with the BMP Plan, but there is a large unstabilized disturbed soil area with insufficient controls downgradient to prevent the discharge of untreated storm water to the storm drain system, surface waters, or state waters if a rain event generates runoff.
- Dust from project site visibly blowing off the site and into storm drain conveyances or adjacent surface water bodies.

4.3.3 Critical Deficiencies

Critical deficiencies are defined as those that pose an immediate threat for the discharge of pollutants to the storm drain system, surface waters, or state waters. Critical deficiencies include, but are not limited to, the following examples:

- Any observed discharge, or evidence of discharge, of untreated storm water or non-storm water to the storm drain system, surface waters, or state waters generated by the construction activity.
- Absence of linear barriers and/or perimeter controls required by the BMP Plan.
- There are identified storm drain inlets, surface waters, or state waters within or adjacent to the project site in close proximity to disturbed soil areas without control measures in place that pose an immediate threat of untreated storm water discharges.
- Work in an active stream channel or other surface water body without proper implementation of required BMPs.
- Presence of any spilled oil or hazardous materials near unprotected storm drain inlets, surface waters, or state waters.

5.0 ENFORCEMENT

Enforcement of this program will be initiated by the DOTA Environmental Section and may be supported by Division or District Project Managers. There are several enforcement mechanisms and penalties to ensure compliance with local ordinances, permits, and contract documents.

5.1 Legal Requirements

5.1.1 DOTA Project Specifications

The specifications for DOTA funded projects will be written to include a requirement for compliance with this program. The specifications will also include a description of the enforcement actions that can be taken for non-compliance items. Specifically, the specifications should contain a statement that indicates that any environmental fines levied against the State by the DOH or EPA will be passed onto the offending party.

5.1.2 Tenant Lease Agreement / Revocable Permit

The lease agreements / revocable permits made with tenants on airport property include a clause that requires compliance with environmental laws. Therefore, tenants will be expected to comply with this program when conducting construction activities. Failure to do so may result in the termination of the lease.

5.1.3 DOTA Discharge Permit

The DOTA Discharge Permit (Appendix D) is required for all non-DOTA projects that discharge to the MS4. By signing this permit, the tenant or non-DOTA party agrees to comply with this program or face escalating enforcement.

5.2 Escalating Enforcement

Once a non-compliant item is discovered on a construction site, enforcement will be applied until compliance is achieved on an escalating scale as described in the DOTA's Inspection and Enforcement Manual and as below. An exception to the escalating enforcement scale may be applied if the non-compliant item(s) is an illicit discharge or if the noted item is a repeat violation.

5.2.1 Inspection Checklist

The Inspection Checklist will serve as written warning to the Contractor of items observed during inspection to be in non-compliance. The Contractor will have a time period determined by the inspector to provide photographic evidence of the corrected items or to request additional time to correct the deficiencies.

5.2.2 Warning Letter / Notice of Apparent Violation

If the Contractor has not responded within the designated time period, then the DOTA Environmental Section will issue a formal letter documenting the discrepancies and requiring response within a designated period of time.

5.2.3 Withhold Payment / Stop Work Order

Once the time period allotted by the DOTA Environmental Section has passed, a re-inspection of the site will be conducted by the third party. If the non-compliant items have not been corrected, then the DOTA Environmental Section will work in association with the Division Project Manager to withhold the BMP pay item of the Contractor's payment for DOTA projects. Once the non-compliant item(s) have been corrected, the Contractor will receive the withheld payment.

For tenant projects, the DOTA Environmental Section will work in association with the Airport District Manager to issue a Stop Work Order. Once the non-compliant item(s) have been corrected, the Stop Work Order will be lifted.

5.2.4 Reporting to DOH

In the event that DOTA has exhausted all the enforcement procedures and cannot bring the construction site into compliance or otherwise deems the construction site to pose an immediate and significant threat to water quality, human or environmental health, then the DOTA Environmental Section will notify the Department of Health, Clean Water Branch to assist with enforcement.

6.0 TRAINING PROGRAM

Training is one of the keys to a successful storm water program. The DOTA Environmental Section will provide annual training on this program to all parties with construction storm water responsibilities, including inspectors, engineers, maintenance staff, and plan reviewers. This training will be specific to DOTA activities, policies, and procedures and be provided at varying levels as described below:

6.1 DOTA Provided Training

The DOTA will provide an online training program that is directed toward Project Managers, Construction Managers, Third Party Inspectors, Contractor Managers, and Tenant Owners. (http://hidot.hawaii.gov/airports/doing-business/engineering/environmental/construction-site-runoff-control-program/) The content of the training will include:

- Goals and objectives of the Construction Site Runoff Control Program;
- Regulatory Background;
- Inventory of Construction Sites;
- Plan Review and Approval;
- Proper installation and maintenance of BMPs for Construction Sites; and
- Overview of the Inspection Program and Enforcement Requirements.

Individuals identified for this particular training will be required to present a roster or completed quiz as proof of training completion during inspections.

6.2 Contractor Employee Training

Contractors are required to train employees working on their construction site in regards to site-specific BMPs that are utilized during construction as well as spill response. Information on these items should be documented in the Site Specific BMP Plan. Contractors will be required to present a roster or completed quiz as proof of training completion during inspections.

6.3 Qualified Third Party Inspector Training

Parties intending to conduct construction inspections must complete the classroom training described in Section 6.1 and attend three inspections under the supervision of a qualified inspector.

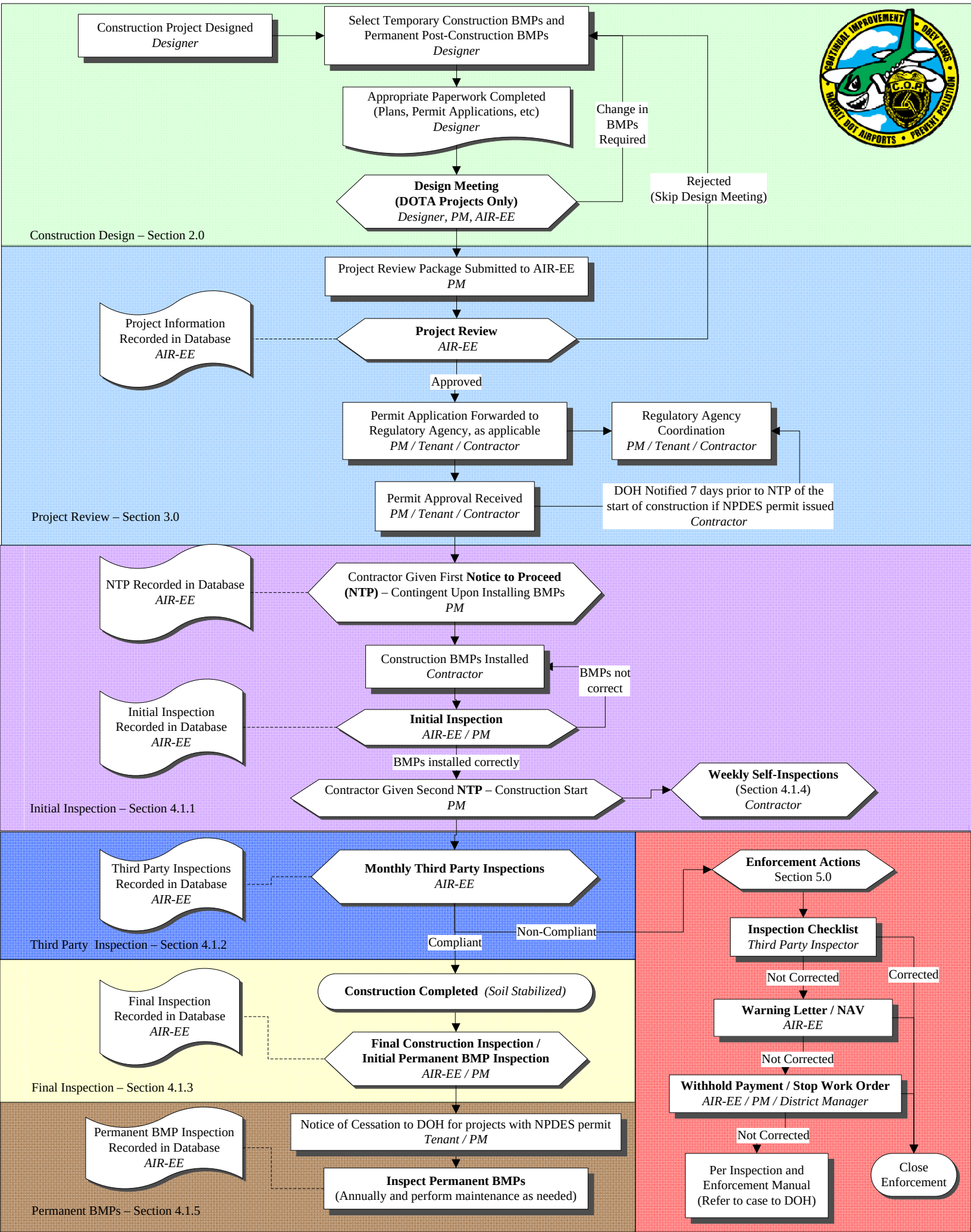
7.0 REFERENCES

- California Stormwater Quality Association. January 2003. *Stormwater Best Management Practice Handbook – Construction.*
- The City & County of Honolulu, Department of Environmental Services. November 2011. *Best Management Practices Manual for Construction Sites in Honolulu*.
- The City & County of Honolulu, Department of Environmental Services. January 2000. *Rules Relating to Storm Drainage Standards*.
- City and County of Honolulu, Department of Planning and Permitting. December 2012. *Storm Water BMP Guide.*
- Environmental Protection Agency. May 2007. *Developing Your Stormwater Pollution Prevention Plan. A Guide for Construction Sites.*
- Environmental Protection Agency, Code of Federal Regulations, Title 40, §122.26, *Storm Water Discharges (applicable to State NPDES Programs).*
- State of Hawaii, Department of Health. December 2013. *Hawaii Administrative Rules, Chapters 11- 54.*
- State of Hawaii, Department of Health. December 2013. *Hawaii Administrative Rules, Chapters 11- 55.*
- State of Hawaii, Department of Transportation, Airports Division. May 2007. *Honolulu International Airport, Small Municipal Separate Storm Sewer System, Storm Water Management Program.*
- State of Hawaii, Department of Transportation, Harbors Division. May 2014. *Construction Site Runoff Control Program.*
- State of Hawaii, Department of Transportation, Highways Division. March 2007. *Oahu Storm Water Management Program Plan, Oahu District*.

Appendix A

Construction Process Flow Chart

DOTA Construction Process



Appendix B

Notification Form for Projects Less Than One Acre

Notification Form
for Sites Disturbing Less Than One Acre
(Not Part of a Larger Common Plan of Development)

PROJECT DESCRIPTION

Date:			
Airport District:			
Project/Site Name:			
Projected Start Date (MM/DD/YYYY):		Projected Completion Date (MM/DD/YYYY):	
Describe project:			

PROJECT INFORMATION

TENANT OWNER / DOTA PROJECT MANAGER	
Name:	
Project Point of Contact:	
Mailing Address:	
Phone:	
Email Address:	
ENGINEERING / DESIGN COMPANY	
Name:	
Point of Contact:	
Mailing Address:	
Phone:	
Email Address:	
CONTRACTOR *Information may be provided at a later date if Contractor has not been selected at the time of plan review.*	
Name:	
Point of Contact:	
Mailing Address:	
Phone:	
Email Address:	

SITE INFORMATION

Construction Site Location: (Street Address, Nearest Intersection, Etc.)			
Latitude:		Longitude:	
Tax Map ID:			
Disturbed Area (to nearest tenth of an acre):		Total Project Area (to nearest tenth of an acre):	
Existing Percentage of Impervious Area:		Percentage of Impervious Area After Project Completion:	

Notification Form
for Sites Disturbing Less Than One Acre
(Not Part of a Larger Common Plan of Development)

WATER BODY INFORMATION			
Nearest Receiving Water Body(s) [RWB]:		Distance to Nearest RWB (feet):	
Any New or Modified Storm Drain Connections:			
Location or ID # of Storm Drains On/Adjacent To Project Area:			
Has the site-specific BMP plan (SSBMP) been attached?			☐ Yes ☐ No ☐ N/A
Do site BMPs control potential pollutants to the maximum extent practicable?			☐ Yes ☐ No ☐ N/A
Does the project include permanent BMPs? (If not, provide justification)			☐ Yes ☐ No ☐ N/A

SIGNATURES AND CERTIFICATIONS

Per my signature below, I hereby certify that this project is disturbing less than one acre of land and is not part of a Larger Common Plan (LCP) for Development. I understand that additional construction activities at this site may require permit coverage and I am responsible for obtaining any federal, state, or local permits that may be required for this project.

I certify that all land-disturbing construction and associated activity pertaining to this site shall be accomplished pursuant to and in keeping with the terms and conditions of all relevant regulations including, but not limited to, the Federal Clean Water Act (33 USC 1251), Hawaii Revised Statutes 342D, Hawaii Administrative Rules (HAR) §11-55 and §11-55, and the Department of Transportation, Airports Division Storm Water Management Program Plan. Failure to do so may result in penalties. I hereby acknowledge that personnel from the Hawaii Department of Transportation's Airports Division or Hawaii Department of Health has the right of access to the site at all times for the purpose of on site inspections during the course of construction and to perform inspections following the project completion. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed Name of Project Designer	Signature of Project Designer	Date
Printed Name of Tenant Owner (if applicable)	Signature of Tenant Owner (if applicable)	Date

Reviewed by: _____ Date: _____

Notes:

1. This form is for the use on projects that will disturb less than 1 acre and are **not** a part of Larger Common Plan (LCP) for development. **If this project is part of a LCP for sale or development this form may not be used.**

2. You must type or print legibly. You must include the original, signed notification form and two (2) copies of a sketched plan outlining the anticipated activities and the location of all proposed sediment and erosion control devices.

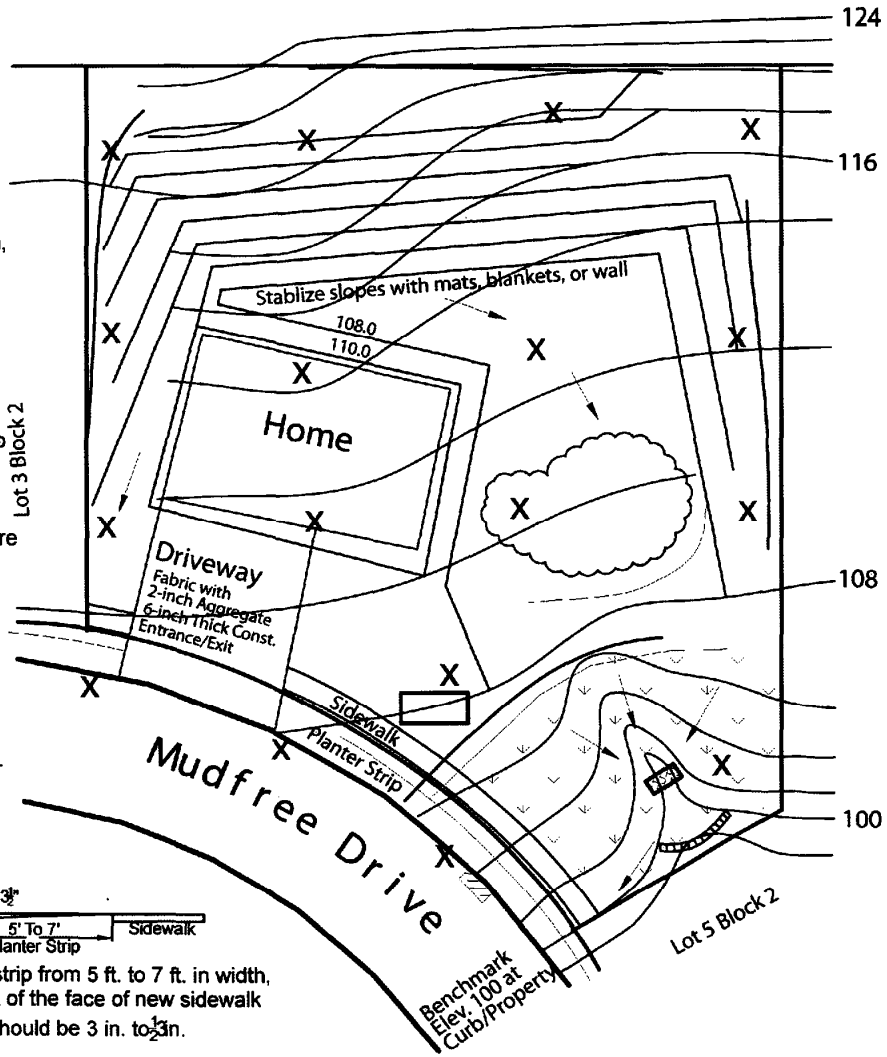
Notification Form
for Sites Disturbing Less Than One Acre
(Not Part of a Larger Common Plan of Development)

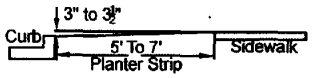
Figure 1: Sample Small Project Erosion and Sediment Control Plan Drawing

N

Scale 1" = 30'

Notes:
To establish a finish floor elevation, collect ground elevations on a grid over the area of the lot.
Finish floor elevation should make a smooth transition to the public sidewalk and planter strip.
Maintain positive drainage away from all structures.
Maximum slope 2 feet horizontal to 1 foot vertical 2:1.
Erosion control matting on slopes greater the 3:1.
Any wall over 4 foot high will require separate permit.
Aggregate entrance/exit should extend from the roadway a min of 50 feet or to the house foundation (which ever is less).
Failure to adiquately maintain erosion and sediment control measures constitute a violation of the issued building or other permit.
Wind erosion control measures shall be in place.





If there is a planter strip from 5 ft. to 7 ft. in width, the standard height of the face of new sidewalk above top of curb should be 3 in. to 3½ in.

- Legend & Symbols -

- Property (Boundary) Line
- Limits of Grading
- Fiber Roll Barrier
- Sediment Barrier
- Natural Contour — 112
- Finished Grade
- Stock Pile
- Natural ground elevation shots — X
- Concrete Washout Area
- Check Dam or Rip Rap
- Final Drainage Path (grade to drain)
- Undisturbed Vegetative Cover
- Storm Water Inlet Protection

- Required Information -

City of Pocatello Erosion and Sediment Control

Certified Person:_____

Certification #_____ Exp. Date:_____

Company:_____

Address:_____

Telephone Number:_____

Signature:_____

Appendix C

Design Review Checklist

DESIGN REVIEW CHECKLIST

Project Name: _____ Date: _____

Designer Name: _____ Airport: _____

Email: _____ Phone: _____

Site Location: _____

Design Submittal (check one):

☐ Conceptual Design ☐ Schematic Design ☐ Design Development ☐ Construction Document

CONSTRUCTION ACTIVITY BMPS

DESIGNER'S CONSTRUCTION REQUIREMENTS	YES	NO	N/A
1. Have construction documents and SWPPP been prepared to meet the requirements of HAR 11-55, DOTA SWMPP, and prevent violations of water quality standards?	☐	☐	☐
2. The following site features should be included on the plans:			
a. Preliminary location, size in square feet, and limits of disturbance.	☐	☐	☐
b. Location of storm drainage features (e.g. drains, ditches, ocean, etc.) and storm water runoff flow paths.	☐	☐	☐
c. Location of construction activity BMPs.	☐	☐	☐
d. Locations of activities that may generate pollutants (e.g. staging area, stockpiles, etc.).	☐	☐	☐
e. Location of other potential storm water pollutants.	☐	☐	☐
3. Have the following permits been applied for (if required):			
a. NPDES Application (Construction ≥ 1 acre)?	☐	☐	☐
b. Other NPDES Application (Dewatering, Hydrotesting, etc.)?	☐	☐	☐
c. DOTA Discharge Permit (for tenant projects)?	☐	☐	☐
d. 401 Water Quality Certification (WQC)?	☐	☐	☐
e. Coastal Zone Management (CZM) Permit?	☐	☐	☐
f. Special Management Area (SMA) Permit?	☐	☐	☐

CONTRACTOR'S CONSTRUCTION REQUIREMENTS	YES	NO	N/A
4. Have construction documents and SWPPP been updated to meet the requirements of HAR 11-55, DOTA SWMPP, and prevent violations of water quality standards?	☐	☐	☐
5. Does schedule include planning elements such as minimizing disturbed areas and working in the dry season?	☐	☐	☐
6. Do plans address the following practices and situations:			
a. Party responsible for inspections identified?	☐	☐	☐
b. Schedule and/or triggers for inspection of BMP measures?	☐	☐	☐

c. Operation and maintenance for BMPs identified?	☐	☐	☐
d. Recordkeeping and incident reporting?	☐	☐	☐

CONSTRUCTION ACTIVITY BMPS NARRATIVE (DESIGNERS AND CONTRACTORS)

Select all applicable BMPs proposed to be incorporated into the project from the Construction Activities BMP Field Manual.

☐ C.1	☐ C.9	☐ C.17	☐ C.25
☐ C.2	☐ C.10	☐ C.18	☐ C.26
☐ C.3	☐ C.11	☐ C.19	☐ C.27
☐ C.4	☐ C.12	☐ C.20	☐ C.28
☐ C.5	☐ C.13	☐ C.21	☐ C.29
☐ C.6	☐ C.14	☐ C.22	☐ C.30
☐ C.7	☐ C.15	☐ C.23	☐ C.31
☐ C.8	☐ C.16	☐ C.24	☐ C.32

Other:

PERMANENT POST-CONSTRUCTION BMPS (DESIGNERS TO COMPLETE)

EXEMPTIONS FROM POST-CONSTRUCTION REQUIREMENTS

If permanent BMPs are not included in the design, provide justification for exemption here:

_____

_____

_____

DOTA Environmental Section Approved? ☐ Yes ☐ No ☐ N/A

POST-CONSTRUCTION PERFORMANCE REQUIREMENTS	YES	NO	N/A
7. Have permanent BMPs been considered in order of DOTA preference (1. LID, 2. Source control, 3. Treatment control)?	☐	☐	☐
8. Have the preferred DOTA BMPs been considered?	☐	☐	☐
9. Are the proposed post-construction BMPs appropriate to limit pollution in runoff from the site to the MEP?	☐	☐	☐
10. Are proposed BMPs appropriate based upon the pollutant potentials that may be present during site operations?	☐	☐	☐
11. Are proposed BMPs appropriate based upon project site factors?	☐	☐	☐
12. Are proposed BMPs appropriate based upon cost (including maintenance)?	☐	☐	☐
13. Is there a plan for ongoing operation and maintenance?	☐	☐	☐

DESIGN REVIEW CHECKLIST

PERMANENT POST-CONSTRUCTION BMP NARRATIVE

Select all applicable post-construction BMPs proposed to be incorporated into the project design from the Permanent Post-Construction BMP Manual.

☐ PC.1	☐ PC.7	☐ PC.13	☐ PC.19
☐ PC.2	☐ PC.8	☐ PC.14	☐ PC.20
☐ PC.3	☐ PC.9	☐ PC.15	☐ PC.21
☐ PC.4	☐ PC.10	☐ PC.16	☐ PC.22
☐ PC.5	☐ PC.11	☐ PC.17	☐ PC.23
☐ PC.6	☐ PC.12	☐ PC.18	☐ PC.24

Other:

Designer / Contractor: I certify that the design is complete, accurate, and addresses applicable environmental requirements to the best of my knowledge.

Print Name: _____

Signature: _____ Date: _____

Tenant Owner, if applicable:

Print Name: _____

Signature: _____ Date: _____

*Note: Attach supporting documents such as construction plans with sheets titled "Site-Specific BMPs" and "Post-Construction BMPs," SWPPP, and permit applications.

Appendix D

Permit to Discharge
into the
State Airport Drainage System

PERMIT TO DISCHARGE INTO THE STATE AIRPORT DRAINAGE SYSTEM

Per the Department of Transportation, Airports Division (DOTA) Storm Water Management Program Plan (SWMPP), application is hereby made to discharge into the Airport drainage system at the location (s) specified below and at no other place.

1. Name of Airport: _____
2. Name of Tenant: _____
3. Name of Project: _____
4. PMID/TMK: _____
5. Basin ID: _____
6. Location: _____
7. Type of Discharge:

☐ Storm water from industrial site ☐ Construction dewatering
☐ Storm water from construction site ☐ Hydrotesting
☐ Other

Licensee*, the undersigned, hereby agree to the following:

1. That the Licensee shall indemnify and hold the State free and harmless from all suits and actions resulting from the licensee's discharge operations.

2. That the Licensee shall provide appropriate best management practices and/or treatment devices for the removal of soil particles, and/or other pollutant(s) in the discharge, and such discharge shall meet the basic water quality criteria applicable to all waters, as identified in Section 11-54-04, and any other applicable sections in Chapter 11-54, Hawaii Administrative Rules; at the point of discharge into State waters.

3. That the Licensee shall obtain National Pollutant Discharge Elimination System (NPDES) permit/permit coverage as required by the State Department of Health (DOH) and submit a copy to the DOTA.

4. That a copy of any effluent monitoring required by the NPDES permit shall be furnished to DOTA.

5. That the Licensee shall make all restoration to any State Airport or Airport tenant property damaged during the Licensee's discharge operations in accordance with DOTA.

6. That the Licensee shall discontinue the discharge should DOH or DOTA determine that the receiving waters are being polluted, or the discharge does not meet the effluent requirements of the NPDES permit, or the Licensee's operations are not in the best interest of the general public. In addition, the Licensee shall be liable for any and all penalties as a result of discharges from the Licensee's operation.

7. That if DOTA determines that any materials or substances from the Licensee's discharge operations have settled into any storm sewer, the Licensee shall immediately remove and clear any material and substance to the satisfaction of DOTA.

8. That the Licensee will comply with all requirements of the DOTA SWMPP, including construction project plan review and inspections. The Licensee will promptly correct any deficiencies identified by DOH or DOTA.

9. That the Licensee shall notify the DOTA Engineering Branch, Environmental Section (AIR-EE) of dewatering operations at least 24 hours before commencing discharge.

10. The Licensee shall require this permit to be a part of the contract with the contractor.

11. The permit shall expire within 5 years of issuance date.

Signature of Licensee Date

Print Name and Title

Company Name

Company Address

City, State, Zip Code

Telephone Number

Fax Number

Approved:

Engineering Program Manager Date

Environmental Section Supervisor Date

*****Licensee shall be the owner or authorized representative of the tenant's company.
Attach: Drain Connection Plans, if applicable.

DRAIN CONNECTION WORKSHEET

If any item is listed as "no," explain the reason for its exclusion from this submittal

	IS INFO PROVIDED?	
ITEM	**Yes**	**No**
1) Project Location and Project Site Map showing subject discharge points to Airport drainage system.	☐	☐
2) Provide discharge location to each drainage feature in NAD 83 Geographic coordinates (latitude, longitude).	☐	☐
3) Runoff Flow Chart.	☐	☐
4) Quantity of storm water and site process water entering drain system.	☐	☐
5) Site Specific Construction Best Management Practices Plan or detailed summary of Erosion Control BMPs, location map, and construction schedule.	☐	☐
6) NPDES Permit Application, where applicable.	☐	☐

Appendix E

Construction Inspection Checklist

CONSTRUCTION INSPECTION CHECKLIST

Project Name: _____

Date: _____ Start / End Time: _____

Project No.: _____ NPDES Permit # (if any): _____

Name of Inspector's Firm: _____

Name of Inspector: _____ Phone Number: _____

On-site Representative: _____ Phone Number: _____

Weather Conditions: _____

Type of Inspection (check one): ☐ Initial ☐ Weekly ☐ Monthly ☐ Final ☐ Follow-up ☐ Other:

Inspection Items		***Yes***	***No***	***N/A***	***Comments***
1.	Are previously noted deficiencies corrected?	☐	☐	☐	
2.	Is there approval to connect to the MS4 and/or make changes to the storm drain system?	☐	☐	☐	
3.	Are the applicable regulatory permits and updated SWPPP available on-site?	☐	☐	☐	
4.	Are personnel at the site aware of applicable BMPs and the location of the BMP Plan?	☐	☐	☐	
5.	Are contractor self-inspections performed as required in HAR 11-55, App C or at least every 7 days?	☐	☐	☐	
6.	Are spill kits available on-site and spills promptly removed?	☐	☐	☐	
7.	Are all slopes and disturbed areas not actively being worked properly stabilized?	☐	☐	☐	
8.	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	☐	☐	☐	
9.	Are discharge points and receiving waters free of any sediment deposits or other signs of illicit discharge?	☐	☐	☐	
10.	Are storm drain inlets and waterways properly protected?	☐	☐	☐	
11.	Is the construction exit preventing sediment from being tracked into the street?	☐	☐	☐	
12.	Is trash/litter from work areas collected and placed in covered dumpsters?	☐	☐	☐	
13.	Are proper washout facilities (i.e. paint, concrete) available, clearly marked, and maintained?	☐	☐	☐	
14.	Are materials that are potential storm water contaminants stored inside or under cover?	☐	☐	☐	
15.	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or other deleterious material?	☐	☐	☐	
16.	Are non-storm water discharges (i.e. wash water, dewatering) properly controlled?	☐	☐	☐	

CONSTRUCTION INSPECTION CHECKLIST

List BMPs from the SWPPP and whether they are properly implemented and maintained.

BMP		Implemented		Maintained		Comments
		Yes	No	Yes	No	
1.		☐	☐	☐	☐	
2.		☐	☐	☐	☐	
3.		☐	☐	☐	☐	
4.		☐	☐	☐	☐	
5.		☐	☐	☐	☐	
6.		☐	☐	☐	☐	
7.		☐	☐	☐	☐	
8.		☐	☐	☐	☐	
9.		☐	☐	☐	☐	
10.		☐	☐	☐	☐	
11.		☐	☐	☐	☐	
12.		☐	☐	☐	☐	
13.		☐	☐	☐	☐	
14.		☐	☐	☐	☐	
15.		☐	☐	☐	☐	

Additional Comments:

*Use additional paper if the number of BMPs exceeds the space allotted.

CONSTRUCTION INSPECTION CHECKLIST

Description of Potential Non-Compliance:

No.	Description	Photo No.	Deficiency Type	Follow-up Date

NOTE: Descriptions of deficiency types may be found in the *Construction and Post-Construction Storm Water Management Plan*, Section 4.3.

Check box if:

☐ No incidents of potential non-compliance were found, and I certify that this inspection found this site to be in full compliance with both the Storm Water Management Program Plan and applicable permits. All items must be checked "Yes" to be considered in full compliance.

☐ Incidents of potential non-compliance were found and discussed with Site Manager. If any items were checked "No" then this box must be checked. Document any incidences of non-compliance with photograph(s) and description of the non-compliance(s).

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designated to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print Name: _____

Signature: _____ Date: _____

Appendix F

Construction Activities
Best Management Practices Manual

STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION, AIRPORTS DIVISION

CONSTRUCTION ACTIVITIES BEST MANAGEMENT PRACTICES AND FIELD MANUAL

Prepared For:
DEPARTMENT OF TRANSPORTATION, AIRPORTS DIVISION
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

October 2014

Version 1.0

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Construction Activities Best Management Practices
Scheduling

Description
Proper scheduling of construction activities can reduce the area and duration of soil exposure to erosion by wind, rain, runoff, and vehicle tracking.

Limitations
None.

Practice		
☐	C1.1	Avoid rainy periods as much as possible. Schedule major grading operations during dry months (April through October).
☐	C1.2	Monitor the weather forecast for rainfall. Allow sufficient time before rainfall begins to stabilize the soil with vegetation or physical means or to install temporary sediment trapping devices.
☐	C1.3	Minimize area of soil exposed at any one time. Schedule projects to disturb only small portions of the site at a time. Complete grading as soon as possible.
☐	C1.4	Stabilize the finished graded area within seven (7) calendar days or non-active exposed areas within three (3) calendar days from the end of soil-disturbing activities or one (1) calendar day before an anticipated rainfall event.
☐	C1.5	Backfill open trenches as soon as possible. Sequence trenching projects so open portions of the trench are backfilled before excavating the next trench section.

Maintenance and Inspection		
☐	M1.1	Verify that the work is in accordance with the construction schedule. If the work deviates from the schedule, take corrective actions.
☐	M1.2	Update the construction schedule as specified in the contract or as needed for unforeseen changes.

Construction Activities Best Management Practices
Preservation of Existing Vegetation

Description

Carefully planned preservation and protection of existing vegetation at construction sites minimizes the potential of harming or needlessly destroying existing trees, vines, shrubs and/or grasses that stabilize soil and control erosion. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. Vegetation also helps to keep soil from drying out and becoming susceptible to erosional wind sweeps. Identifying the type of vegetation desirable or ideal for the area to preserve can also contribute to the aesthetics of the post-construction site.

Limitations

- Topography, sub-surface geological characteristics, soil quality and a restrictive land development area are just a few site conditions that can make it difficult and expensive to preserve existing vegetation at a development site.
- Federal Aviation Administration rules regarding aircraft clearances and lines of site may require the removal of existing vegetation. Reduced root systems equate to diminished anchoring of soil and a proportional increase in erosion via traffic (foot or vehicular/machinery).

.

Practice		
☐	C2.1	Preservation of existing vegetation shall be practiced in the following locations: • Areas within the project site where construction activities are not required. • Sensitive areas where natural vegetation exists and should be preserved, such as on steep slopes (e.g., steeper than 3:1), areas near watercourses, and wooded areas. • Areas where local, state, or federal governments require preservation, such as delineated wetlands, marshes, shorelines, conservation land, etc.
☐	C2.2	The following criteria may be used for deciding which vegetation will remain on the site: • Aesthetic values: Consideration should be given to foliage, flowering habits, bark and crown characteristics (for trees). • Freedom from disease and rot. • Life span of trees: Short-lived trees need not be preserved. • Environmental values: Habitat; screening; and buffers. • Sudden exposure: Save vegetation that grows in direct sunlight and is able to withstand radiated heat from proposed structures and pavement. • Space needed: Sufficient space must be provided between the vegetation and any structures, electric and telephone lines, water and sewer lines, driveways and roadways.
☐	C2.3	Do not include plant species that compete with the existing vegetation in landscaping plans.
		METHODS FOR PROTECTING EXISTING VEGETATION AND TREES INCLUDE:
☐	C2.4	Protect trees and their root systems during construction by prohibiting soil disturbance within a specified distance identified in the project plans, which also helps prevent soil erosion.
☐	C2.5	Clearly mark, flag or fence areas where vegetation is to be preserved and trees to remain.
☐	C2.6	Stake off root system limits (drip line of tree).
☐	C2.7	Tree wells and retaining walls (permanent) help preserve existing vegetation, but must be large enough to protect the root system.
☐	C2.8	When grading under trees is necessary, excavation and fill is to be limited to one foot within the tree drip lines.

Construction Activities Best Management Practices
Preservation of Existing Vegetation
(continued)

☐	C2.9	Do no locate construction traffic route, spoil stockpile, etc., in areas where significant adverse impact on existing vegetation may occur.
☐	C2.10	Prepare landscaping plans, which preserve as much existing vegetation as possible and ensures the required care for this vegetation to thrive during and after construction.
☐	C2.11	Define and protect with berms, fencing, signs, etc., a setback area from vegetation to be preserved. Setback distance is to be based on the location, species, size, and age of the vegetation to be preserved and on the potential impact of adjacent construction activities or permanent improvement. No disturbance of any kind is to be allowed within the setback area around the vegetation to be preserved.

Maintenance and Inspection		
☐	M2.1	Ensure that the limits of disturbance are clearly marked at all times. If damage to existing vegetation still occurs, consult with an arborist.
☐	M2.2	Provide training for personnel regarding which vegetation will be preserved and the methods of preservation.

Construction Activities Best Management Practices
Location of Potential Sources of Sediment

Description
Proper location of potential sources of sediment can reduce erosion and the discharge of sediment from construction sites.

Limitations
- Prevention of sediment-laden runoff must be supplemented with mulching, planting, and structural controls such as berms, silt fences, and silt basins.
- Contaminated soil may need to managed separately.

Practice		
☐	C3.1	Lay out the work site so that haul roads and stockpiles are buffered with vegetated areas to remove suspended sediment and other pollutants from runoff prior to discharging off site. Vegetation along the perimeter of the site, especially on the downhill side for sloped sites, provides an effective buffer against sediment leaving the construction site.
☐	C3.2	Locate stockpiles away from waterways or low spots.
☐	C3.3	Redirect off-site runoff, where possible, so that it flows through or around the work site without contacting areas where the surface has been disturbed.
☐	C3.4	Properly maintain vegetation at swales and natural drainageways.
☐	C3.5	If available, use naturally level areas for parking and equipment staging during construction.

Maintenance and Inspection		
☐	M3.1	Verify that the work site lay out is in accordance with the project phasing plan. Update the layout per phase of work. An updated lay out plan should be submitted to the Construction Manager prior to the start of work for that phase.
☐	M3.2	Inspect swales and natural drainage ways prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week.
☐	M3.3	Educate personnel about proper locations of potential sources of sediment at the site.

Construction Activities Best Management Practices
Earth Dike

Description
The temporary earth dike is a temporary berm or ridge of compacted soil, used to divert runoff or channel water to a desired location.

Earth dikes are typically used to divert concentrated runoff through disturbed areas into another BMP (e.g. sediment basins), to divert runoff away from disturbed or unstable slopes, to divert runoff from off-site and undisturbed areas around disturbed areas, and as containment for construction materials and wastes.

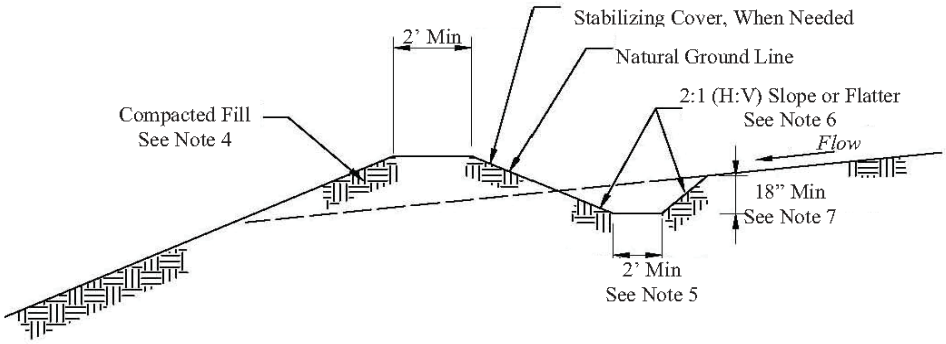
Limitations
Temporary dikes shall not be used for drainage areas greater than 10 acres, or along slopes greater than 10 percent. For larger areas more permanent drainage structures shall be built. Additional limitations include the following:

- Earth dikes may create more disturbed area.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted storm water may cause downstream damage.
- Dikes are not to be constructed of soils that erode easily.
- Regarding the site to remove the dike may add additional cost.

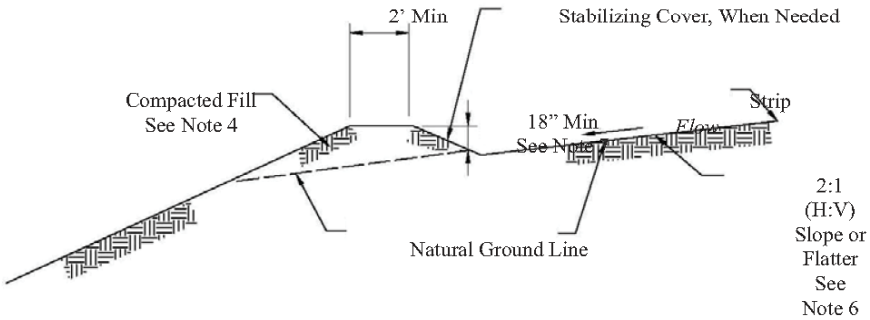
Practice		
☐	C4.1	Dikes are to be well compacted during construction.
☐	C4.2	All dikes are to have positive drainage to a stabilized outlet.
☐	C4.3	Dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 inc. Top width may be wider and side slopes may be flatter at crossing for construction traffic.
☐	C4.4	Dikes are to direct sediment-laden runoff into a sediment-trapping device.
☐	C4.5	Dikes surfaces are to be stabilized with vegetation, chemicals, or physical devices within one (1) calendar day after construction of the dikes have been completed.
☐	C4.6	Dikes are to remain in place until the disturbed areas are permanently stabilized.
☐	C4.7	Dikes must be on-site and must safely convey anticipated flood flows.

Note: Example schematics are included herein for reference.

Maintenance and Inspection		
☐	M4.1	Inspect dikes prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week.
☐	M4.2	Repair damage sustained to the dike within seven (7) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M4.3	Provide training for personnel detailing the location and BMP requirements for any earth dikes the site.



Drainage Swale Section "A"



Earth Dike Section "B"

Notes:

1. Place drainage swales above or below, not on, a cut or fill slope.
2. Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
3. Remove all trees, stumps, obstructions, and other objectionable material from the swale.
4. Fill material along the path of the swale should be compacted to at least 90% compaction.
5. Swale top and bottom width should be at least 2 ft.
6. Side slopes should be 2:1 or flatter.
7. Depth of the swale should be at least 18 in.
8. Construct the drainage swale with a positive grade to a stabilized outlet.
9. Use a lined ditch for high flow velocities.
10. Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%.
11. If rip-rap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. – 12 in. Rock

Drainage Swale and Earth Dike

Source: City and County of Honolulu BMP Manual, November 2011.

Construction Activities Best Management Practices
Temporary Drains and Swales

Description
Temporary drains and swales are used to divert off-site runoff around the construction site, divert runoff from stabilized areas around disturbed areas, and direct runoff into sediment basins or traps.

Limitations
- Temporary drains and swales, or any other diversion of runoff, shall not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local flood plain management requirements.
- A permanent drainage channel must be designed by a licensed, qualified engineer.

Practice		
☐	C5.1	At a minimum, the drain/swale shall conform to predevelopment drainage patterns and capacities.
☐	C5.2	Construct the drain/swale with an uninterrupted, positive grade to a stabilized outlet.
☐	C5.3	Provide erosion protection or energy dissipation measures if the flow out of the drain or swale can reach an erosive velocity.
☐	C5.4	Size temporary drainage swales using local drainage design criteria.
☐	C5.5	Use a lined ditch for high flow velocities.

Note: Refer to schematics provided in the earth dike BMP.

Maintenance and Inspection		
☐	M5.1	Inspect temporary drains and swales prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week.
☐	M5.2	Repair damage sustained to the swales within seven (7) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M5.3	Ensure required personnel are trained on maintenance and operation of temporary drains and swales.

Construction Activities Best Management Practices
Dust Control

Description
Dust control measures are used to stabilize soil from wind erosion, and reduce dust generated by construction activities.

Limitations
- Watering prevents dust only for a short period and must be applied daily (or more often) to be effective.
- Excessive irrigation may cause erosion.
- Oil is not to be used for dust control because the oil may migrate into a drainage way and/or seep into the soil.
- Certain dust suppression chemicals may make soil water repellant, increasing runoff.

Practice		
☐	C6.1	Schedule construction activities to minimize exposed areas.
☐	C6.2	Stabilize exposed soils until permanent BMPs are installed. If stabilizing by water, water continuously throughout the work day, and avoid over saturation to prevent excessive runoff.
☐	C6.3	Identify and stabilize key access points prior to commencement of construction.
☐	C6.4	Minimizing the impact of dust by anticipating the direction of prevailing winds.
☐	C6.5	Direct most construction traffic to stabilized roadways within the project site.
☐	C6.6	Comply with State DOH requirements for dust control.

Maintenance and Inspection		
☐	M6.1	Inspect all areas that have been sprayed to ensure coverage. Ensure that excessive runoff is not generated.
☐	M6.2	Reapply water when soil becomes dry.
☐	M6.3	Provide personnel responsible for dust control with adequate training.

Construction Activities Best Management Practices
Topsoil Management

Description
The salvaging, stockpiling and reapplication of topsoil or other selected material to be used as growth medium in the reclamation of surface disturbances.

Limitations
None.

Practice		
☐	C7.1	Conduct a site-specific survey of the project area as a part of baseline investigations. The soil survey will identify the soils suitable for salvaging and their depth prior to disturbance.
☐	C7.2	All suitable topsoil and suitable material to be utilized in reclamation of the surface disturbance is to be salvaged wherever feasible and stockpiled for reapplication.
☐	C7.3	If conditions permit, topsoil or growth medium is to be applied directly to disturbed areas.
☐	C7.4	Soil replacement depths are determined by several factors including: • Pre-disturbance soil depths, • Vegetation types, and • The physical and chemical properties of the material being covered. Generally speaking, the poorer the physical and chemical properties of the spoil or waste material the greater the required depth of replacement soil.
☐	C7.5	Soil testing (nutrients, pH and toxicity factors), of the replacement soils and the materials to be covered is to be completed prior to reapplication of topsoil.
☐	C7.6	Maintenance and Upkeep: Topsoil stockpiles require periodic maintenance to prevent erosion. Based upon the anticipated length of time the soils will be stockpiled, the piles shall be covered with plastic or another substrate, or revegetated, to protect from wind, rain, and erosion.
		CONSIDERATIONS FOR DEVELOPING A TOPSOIL MANAGEMENT PLAN:
☐	C7.7	The amount and quality of existing topsoil or growth medium.
☐	C7.8	The amount of surface disturbance (area), which will receive topsoil or growth medium and the required depth of application.
☐	C7.9	Methodology to be utilized for topsoil or growth medium salvage.
☐	C7.10	Storage location, the duration of storage of salvaged soils, and the protection of stockpiled soils to prevent erosion.
☐	C7.11	The feasibility of direct replacement of the salvaged soils.
☐	C7.12	Availability of additional growth media to supplement topsoil replacement.

Maintenance and Inspection		
☐	M7.1	Review and Update the topsoil management plan at the beginning of each work week until all grading operations are completed.

Construction Activities Best Management Practices
Geotextiles and Mats

Description
Coverings made of natural or synthetic material are used to temporarily or permanently stabilize soil.

Limitations

- Matting is more costly than other BMP practices, therefore, it may be used in areas where other BMPs are ineffective (e.g., channels, steep slopes).
- Matting is not suitable for rocky sites or areas that will have vegetation that requires mowing (the matting and staple anchors can get caught in the mower).
- May delay seed germination due to reduction in soil temperature.
- Installation requires an experienced maintenance engineer to ensure soil stabilization and erosion protection.

Practice		
☐	C8.1	Applicable use for temporary stabilization of highly erosive soils such as channels, streams, and steep slopes.
☐	C8.2	Apply jute or straw matting to disturbed soils and where existing vegetation has been removed.
☐	C8.3	The following are examples of synthetic soil covers may be used for either temporary or post-construction stabilization, both with and without vegetation: • Excelsior matting • Glass fiber matting • Staples • Mulch netting
☐	C8.4	Anchor to the top of the slope in a 6in deep trench and backfill.
☐	C8.5	Overlap the edges of the blankets approximately 2 to 3 inches and staple every 3 feet. Ensure close contact with the soil.

Maintenance and Inspection		
☐	M8.1	Inspect matting prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week
☐	M8.2	Repair damage sustained to the matting within seven (7) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M8.3	If washout or breakage occurs, reconstruct the slope or channel within seven (7) calendar days after the incident and immediately reinstall the matting.
☐	M8.4	Train required personnel about proper installation and maintenance of geotextile mats as well as the importance of preventing sediment discharge.

Construction Activities Best Management Practices
Seeding and Planting

Description
Seeding of grasses and planting of trees, shrubs, vines, and ground covers provide long-term stabilization of soil. In some areas, with suitable climates, grasses can be planted for temporary stabilization.

Limitations
- Permanent and temporary vegetation may not be appropriate in dry periods without irrigation.
- Fertilizer requirements may have potential to create storm water pollution if improperly applied.
- Federal Aviation Administration (FAA) regulations may prohibit the implementation of vegetation due to concerns over creating bird habitats and possible bird strikes with aircraft in movement areas of the airport. Consult with the Environmental Unit for exemptions in these cases.

Practice		
		GRASSES:
☐	C9.1	Ground preparation: fertilize and mechanically stabilize the soil.
☐	C9.2	Tolerant of short-term temperature extremes and waterlogged soil conditions.
☐	C9.3	Appropriate soil conditions: shallow soil base, good drainage, slope of 2:1 or flatter.
☐	C9.4	Develops quickly from seeds.
☐	C9.5	Mowing, irrigating, and fertilizing are vital for promoting vigorous grass growth.
		TREES AND SHRUBS:
☐	C9.6	Selection Criteria: vigor, species, size, shape, and wildlife food source.
☐	C9.7	Other Factors: wind/exposure and irrigation needs.
		VINES AND GROUND COVERS:
☐	C9.8	Ground preparation: lime and fertilizer preparation.
☐	C9.9	Use proper seeding rates.
☐	C9.10	Appropriate soil conditions: drainage, acidity, and slopes.
☐	C9.11	Generally avoid species requiring irrigation.

Maintenance and Inspection		
☐	M9.1	Inspect seeded areas for failures and re-fertilize and re-seed at not less than half the original application rate.
☐	M9.2	Inspect immediately after any rainfall event to ensure seeds have not washed away.
☐	M9.3	Maintain a log of fertilizer application.

Construction Activities Management Practices
Sand Bag Barrier

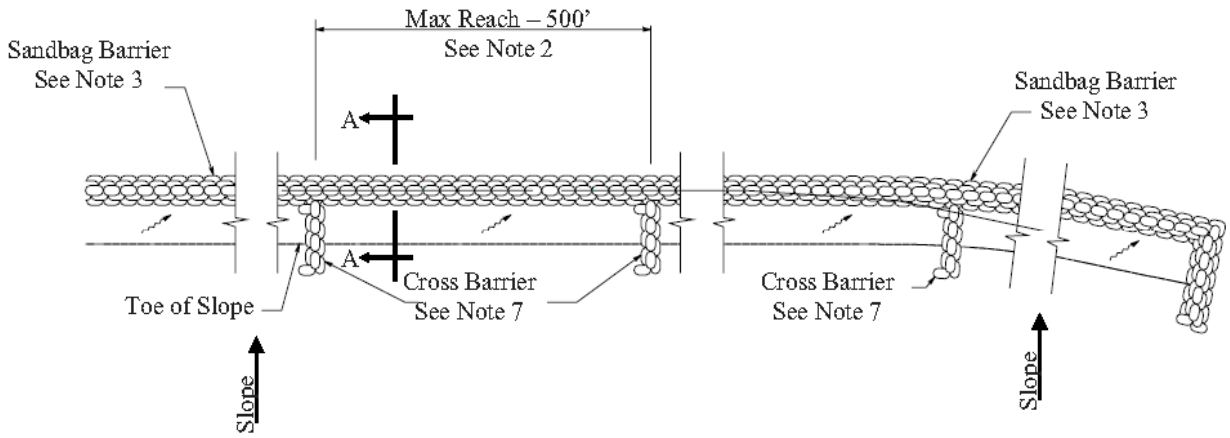
Description
Stacking sand bags along a level contour creates a barrier which detains sediment-laden water, ponding water upstream of the barrier and promoting sedimentation.

Limitations
- Do not install sand bag barrier at locations that could compromise traffic safety.
- Sand bags are more expensive than other barriers, but also more durable.
- Do not use burlap for sand bags.

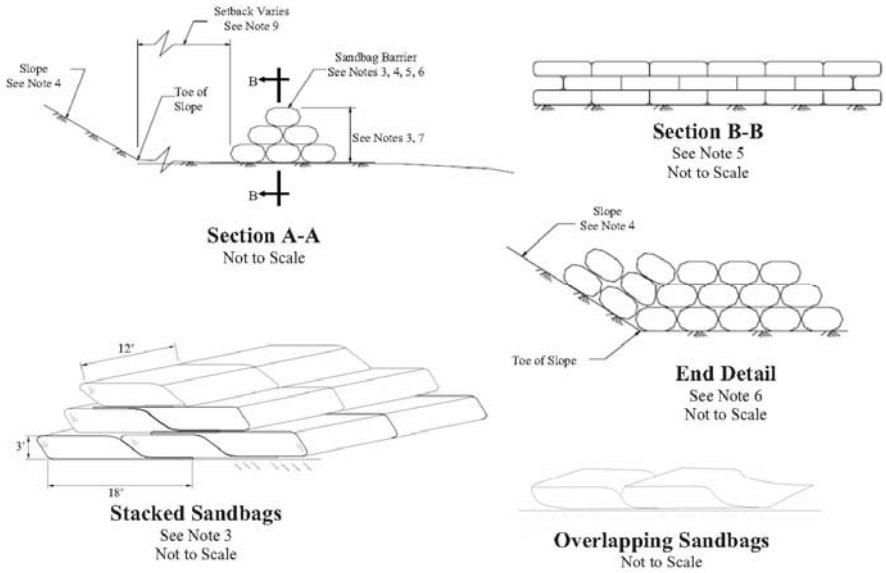
Practice		
☐	C10.1	Sand bag barriers may be used in drainage areas up to 5 acres.
☐	C10.2	Install along a level contour.
☐	C10.3	Base of sand bag barrier shall be at least 48 inches wide.
☐	C10.4	Height of sand bag barrier shall be at least 18 inches.
☐	C10.5	Four-inch PVC pipe may be installed between the top layers of sand bags to drain large flood flows.
☐	C10.6	Provide area behind barrier for runoff to pond and sediment to settle; size barrier according to sediment trap BMP criteria.
☐	C10.7	Place below the toe of a slope.
☐	C10.8	Use sand bags large enough and sturdy enough to withstand major flooding.

Note: Example schematics are included herein for reference.

Maintenance and Inspection		
☐	M10.1	Inspect sand bags prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week.
☐	M10.2	Repair damage sustained to the sand bags within two (2) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M10.3	Remove sediment when accumulation reaches one-third the barrier height.
☐	M10.4	Provide education for required personnel about proper sand bag placement and maintenance. Ensure that the importance of preventing sediment discharge is including in the training curriculum.



Detail "A"
Not to Scale



Notes:
1. Drainage area should not exceed 5 acres.
2. Construct the length of each reach so that the change in base elevation along the reach does not exceed ½ the height of the linear barrier. In no case shall the reach length exceed 500'.
3. Stack sandbags at least three bags high with proper side slopes using a pyramid approach.
4. Locate sandbag barriers on a level contour.
   a. Slopes between 20:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 50 ft. (a closer spacing is more effective), with the first row near the slope toe.
   b. Slopes 2:1 (H:V) or steeper: Sandbags should be placed at a maximum interval of 25 ft. (a closer spacing is more effective), with the first row placed near the slope toe.
5. Overlap butt joints of row beneath with each successive row.
6. The end of the barrier shall be turned up slope.
7. Cross barriers shall be a min of ½ and a max of 2/3 of the height of the linear barrier.
8. Sandbag material must conform to ASTM designation D3786 and ASTM designation D4355.
9. Dimensions may vary to fit field condition.
10. For Sandbag and Fill Material Specifications see SE-8 Sandbag Barrier, Materials.

Source: City and County of Honolulu BMP Manual, November 2011.

Sandbag Barrier

Construction Activities Best Management Practices
Compost Filter Berm

Description
A compost filter berm is a dike or compost product that is placed perpendicular to sheet flow runoff to retain sediment on-site. These are generally placed along the perimeter of a site and work to retain large volumes of water, and retain larger amounts of pollutants as water passes through the berm. The berm may either be vegetated or unvegetated.

Limitations
- Only applicable where flow does not exceed 1 cfs.
- Compost quality shall comply with all local, state, and Federal requirements.

Practice		
☐	C11.1	Select the appropriate sized berm based on rainfall amount and slope.
☐	C11.2	Fill a mesh tube with composted material and tie knots at both ends of the sock. Ensure that the berm is at least 10” in diameter.
☐	C11.3	Place perpendicular to flow along the base or slopes or site perimeter. Ensure that the berm has good contact with the ground. Overlap the ends of berms when placed end-to-end.
☐	C11.4	Place stakes on the downstream side of berms that are located on slopes.
☐	C11.5	When complete, compost may be added to the site as a soil amendment.

Maintenance and Inspection		
☐	M11.1	Inspect berms prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week.
☐	M11.2	Repair damage sustained to the berms, such as ripped mesh, within two (2) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M11.3	Remove sediment when accumulation reaches one-third the barrier height.
☐	M11.4	Provide education for required personnel about proper berm installation and maintenance. Ensure that the importance of preventing sediment discharge is including in the training curriculum.

Construction Activities Best Management Practices
Storm Drain Inlet Protection

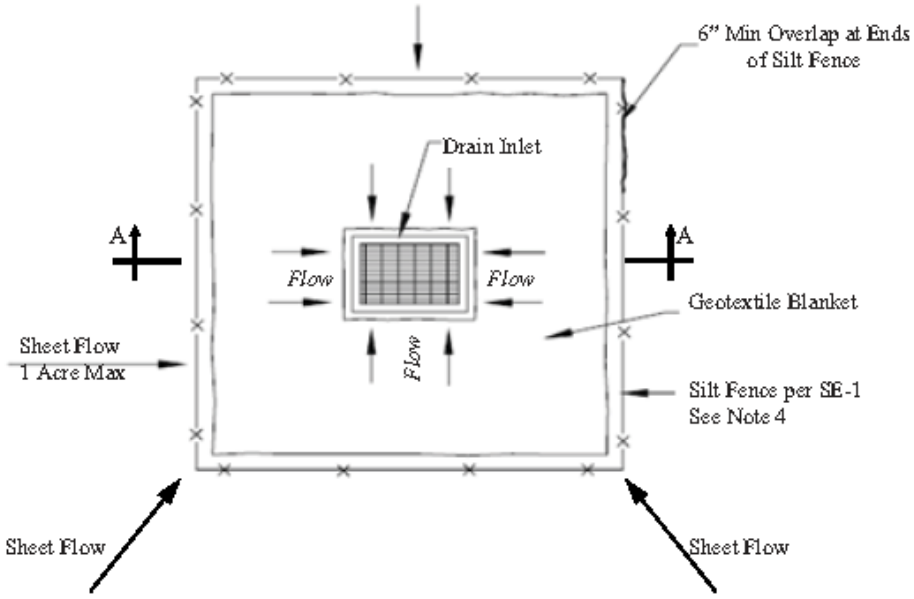
Description
Devices of various designs which detain sediment-laden runoff and allow the sediment to settle out of the water prior to discharge into a storm drain inlet or catch basin.

Limitations
- Inlet protection must not create a potential hazard to traffic.
- Drainage area should not exceed 1 acre.
- Runoff may bypass protected inlets on slopes.
- Ponding will occur at a protected inlet, with possible short term flooding.
- Straw bales are NOT effective for inlet protection.

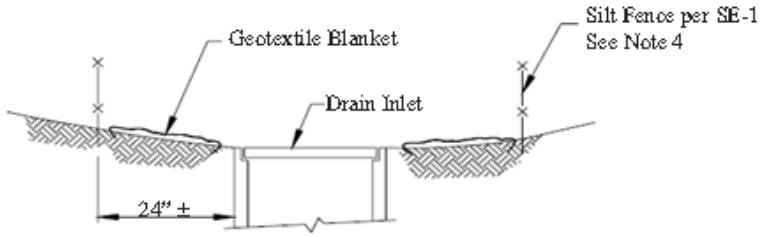
Practice		
☐	C12.1	Every storm drain inlet potentially receiving sediment-laden runoff shall be protected, either by covering the inlet or promoting sedimentation upstream of the inlet.
☐	C12.2	Five types of inlet protection are presented below; however, other effective methods and proprietary devices exist and may be selected: • Filter Fabric Fence: Appropriate for drainage basins less than one acre with less than a 5 percent slope. • Block and Gravel Filter: Appropriate for flows greater than 0.5 cubic feet per second (cfs). • Gravel and Wire Mesh Filter: Used on curb or drop inlets where construction equipment may drive over the inlet. • Sand Bag Barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. • Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment.
☐	C12.3	Select the appropriate type of inlet protection as identified in C12.2 above and design as referred to or as described herein. • Filter Fabric: Must be of sufficient strength and permeability to allow storm water to pass through and retain sediment. Must be anchored such that the fabric will not fall into the drain when the grate is removed for maintenance.
☐	C12.4	Use only for drainage areas smaller than one acre unless a sediment trap first intercepts the runoff.
☐	C12.5	Provide area around the inlet for water to pond without flooding structures and property.

Note: Example schematics for inlet protection are included herein for reference.

Maintenance and Inspection		
☐	M12.1	Inspect inlet protection devices prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week. During extended rainfall events inspect inlet protection devices daily.
☐	M12.2	Repair damage sustained to the inlet protection devices within two (2) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M12.3	Remove sediment after each rainfall event and once the containment device is ½ full of sediment.
☐	M12.4	Provide education for required personnel about storm drain protection from sediment discharge and other construction site contaminants.



Detail "A"
Not to Scale



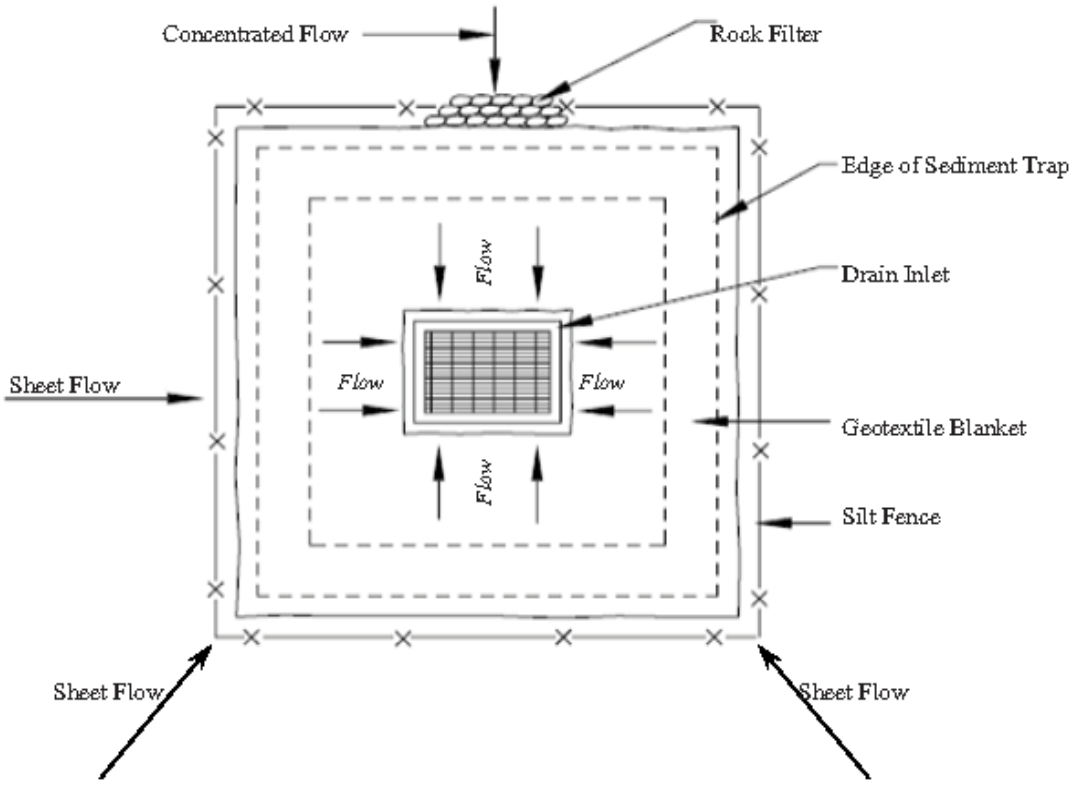
Section A-A
Not to Scale

Notes:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable in concentrated flows.
4. Refer to BMP SE-1, Silt Fence for construction.

Source: City and County of Honolulu BMP Manual, November 2011.

DI Protection Type 1, Filter Fabric Fence



Detail "B"
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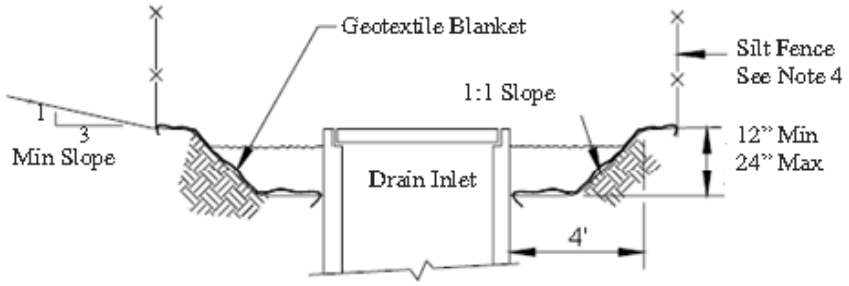
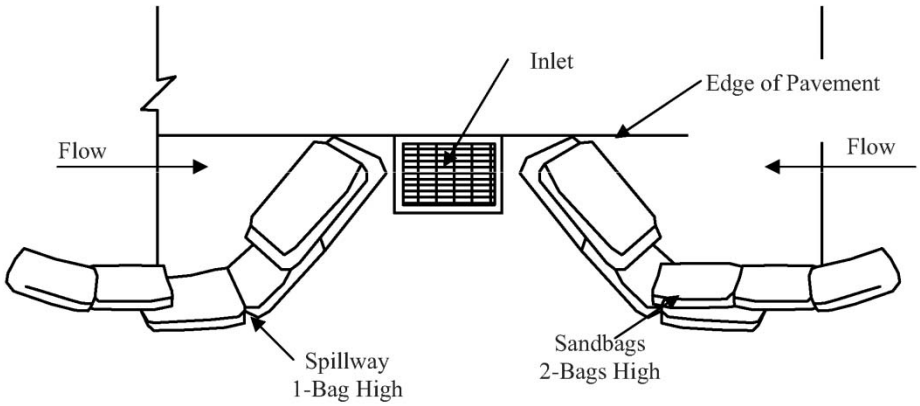


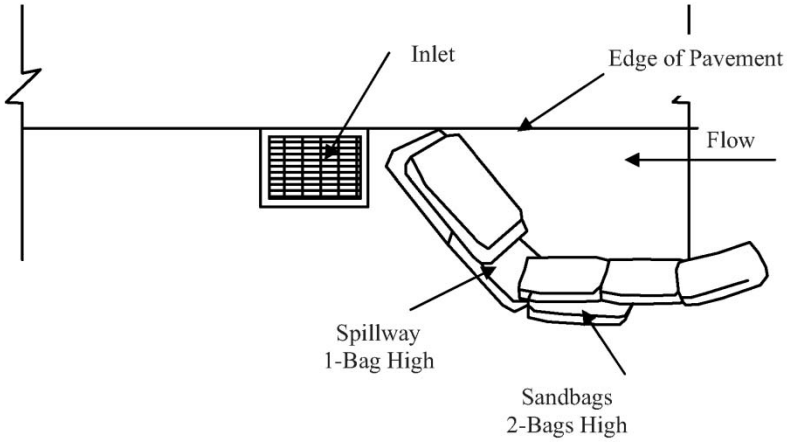
Notes:
1. For use in cleared and grubbed and in graded areas.
2. For concentrated flows, shape basin in 2:1 (L:W) ratio with length oriented towards direction of flow.
3. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area.
4. Refer to BMP SE-1, Silt Fence for construction.

DI Protection Type 2, Excavated Drop Inlet Sediment Trap

Source: City and County of Honolulu BMP Manual, November 2011.



Typical Protection for Inlet on Sump, Detail "C"
Not to Scale

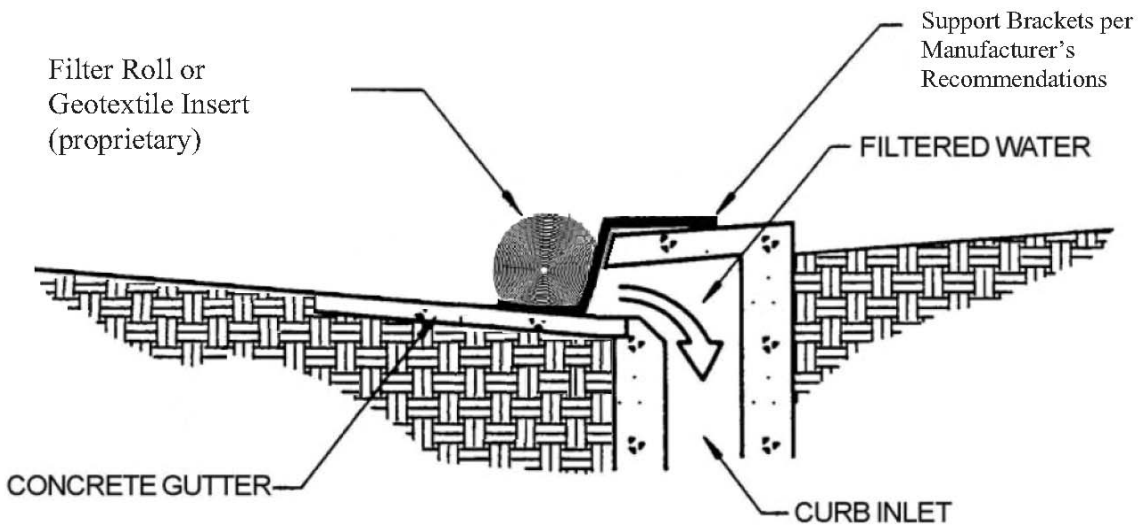


Typical Protection for Inlet on Grade, Detail "D"
Not to Scale

Notes:
1. Intended for short-term use. Not suitable for roads open to traffic.
2. Used to inhibit non-storm water flow.
3. Bags **should** be removed after adjacent operation is completed.
4. Not applicable in areas with high silts and clays without filter fabric.
5. Use sand bag made of geotextile fabric (not burlap) and fill with 0.75 in. rock or 0.25 in. pea gravel.
6. Construct on gently sloping street.
7. Leave room upstream of barrier for water to pond and sediment to settle.
8. Place several layers of sand bags - overlapping the bags and packing them tightly together.
9. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.
10. Do not use sandbags for roadways subject to traffic.
11. For traffic area, insert geotextile filter inserts instead of sandbags.

DI Protection Type 3, Gravel Bag

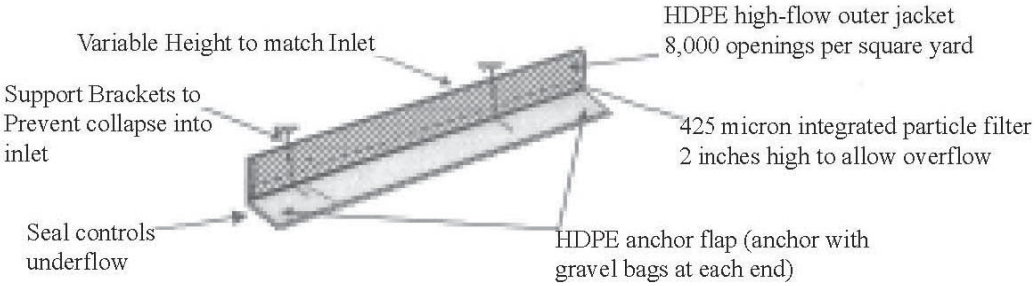
Source: City and County of Honolulu BMP Manual, November 2011.



Detail "F"

Not to Scale and May Use Various Types of Geotextile Inserts

DI Protection Type 5, Filter Roll or Geotextile Insert with Supports for Curb Inlet



Detail "G"

Not to Scale and May Use Various Types and Styles of Geotextile Inserts

DI Protection Type 5, Geotextile Insert with Supports for Curb Inlet

Source: City and County of Honolulu BMP Manual, November 2011.

Construction Activities Best Management Practices
Sediment Trap

Description
A sediment trap is a small, excavated or bermed area where runoff from small drainage areas is detained and sediment can settle.

Limitations
- Only use for drainage areas up to 5 acres.
- Sediment traps only remove coarse sediment (medium silt size and larger) unless sized like a sediment basin.

Practice		
☐	C13.1	Sediment traps are applicable for any disturbed area less than 5 acres.
☐	C13.2	Install along the perimeter of the site at locations where sediment-laden runoff is discharged off site.
☐	C13.3	Install around and/or up slope from the storm drain inlet protection measures.
☐	C13.4	Install at any point within the site where sediment-laden runoff can enter stabilized or natural areas or waterways.
☐	C13.5	Build outside the area to be graded before clearing, grubbing, and grading begin.
☐	C13.6	Locate where the trap is easily cleared of sediment.
☐	C13.7	Trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency.
☐	C13.8	The larger the trap, the less frequently sediment must be removed.
☐	C13.9	The outlet of the trap must be stabilized with rock, vegetation, or another suitable material.
☐	C13.10	A stable emergency spillway must be installed to safely convey major floods.
☐	C13.11	Fencing shall be provided to prevent unauthorized entry.

Maintenance and Inspection		
☐	M13.1	Inspect sediment trap and fencing prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week. During extended rainfall events inspect daily.
☐	M13.2	Dewater sediment trap if infiltration has not completed within 72 hours.
☐	M13.3	Remove sediment when accumulation reaches one-third the sediment trap height and manage according to applicable federal, state, and local regulations.
☐	M13.4	Provide education for required personnel about proper sediment trap installation and maintenance. Ensure that the importance of preventing sediment discharge is including in the training curriculum.

Construction Activities Best Management Practices
Silt Fence

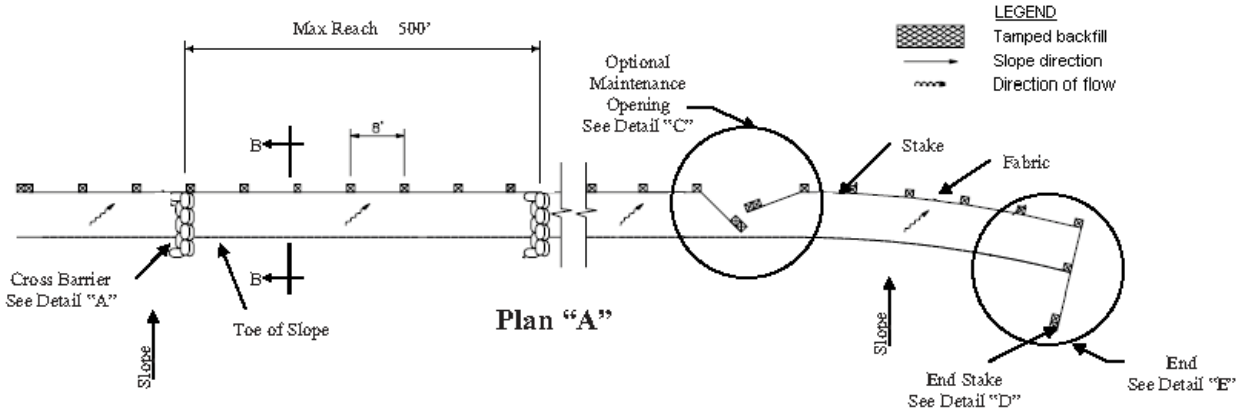
Description
A silt fence is made of a semi-impermeable fabric which has been entrenched, attached to supporting poles, and sometimes backed by a wire fence for support. The silt fence detains sediment laden water, promoting sedimentation behind the fence.

Limitations
- Do not place fence on a slope, or across any contour line.
- Do not use in streams, channels or anywhere flow has concentrated.
- Do not use in locations where ponded water may cause flooding.

Practice		
☐	C14.1	Use principally in areas where sheet flow occurs.
☐	C14.2	Install along a level contour so water does not pond more than 1.5 feet at any point.
☐	C14.3	No more than 1 acre, 100 ft, or 0.5 cfs of concentrated flow should drain to any point along the silt fence.
☐	C14.4	Turn ends of fence uphill.
☐	C14.5	Provide area behind the fence for runoff to pond and sediment to settle (approx. 1200 sq. ft. per acre draining to the silt fence).
☐	C14.6	Select a fabric which retains 85% of the soil, by weight, based on sieve analysis, but is not finer than an equivalent opening size of 70.
☐	C14.7	Install appropriately by stretching silt fence tightly between posts spaced a maximum of 6 feet apart; key into the ground a minimum of 12 inches; overlap section a minimum of 6 inches or wrap sections to create a strong bond.

Note: Example schematics are included herein for reference.

Maintenance and Inspection		
☐	M14.1	Inspect silt fence and posts prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week.
☐	M14.2	Repair damage sustained to the silt fence or posts within two (2) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	M14.3	Remove sediment when accumulation reaches one-third the fence height.
☐	M14.4	Provide education for required personnel about proper silt fence installation and maintenance. Ensure that the importance of preventing sediment discharge is including in the training curriculum.



Notes:

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
3. Sandbag rows and layers shall be offset to eliminate gaps.
4. Setback dimension may vary to fit field condition. Typical 3' setback from top of slope.
5. Stakes shall be spaced at 8' maximum and shall be positioned on downstream side of fence, or as specified by the engineer.
6. Stake dimensions are nominal. Material as specified by engineer.
7. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples or wire.
8. Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
9. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 stables or wire.
10. Minimum 4 staples or wire per stake. Dimensions shown are typical.
11. Joining sections shall not be placed at sump locations.
12. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
13. The last 8' of fence shall be turned up slope to reduce breakthrough of sediment.

Silt Fence

Source: City and County of Honolulu BMP Manual, November 2011.

Construction Activities Best Management Practices
Stabilized Construction Entrance

Description

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located where vehicles and/or equipment leave or enter a construction site to or from a paved surface. The purpose of a stabilized construction entrance is to reduce the amount of sediment tracked off-site. The effectiveness of a stabilized construction entrance is greatly increased if a wash rack is included for removing caked-on sediment from vehicles and equipment before they leave the site.

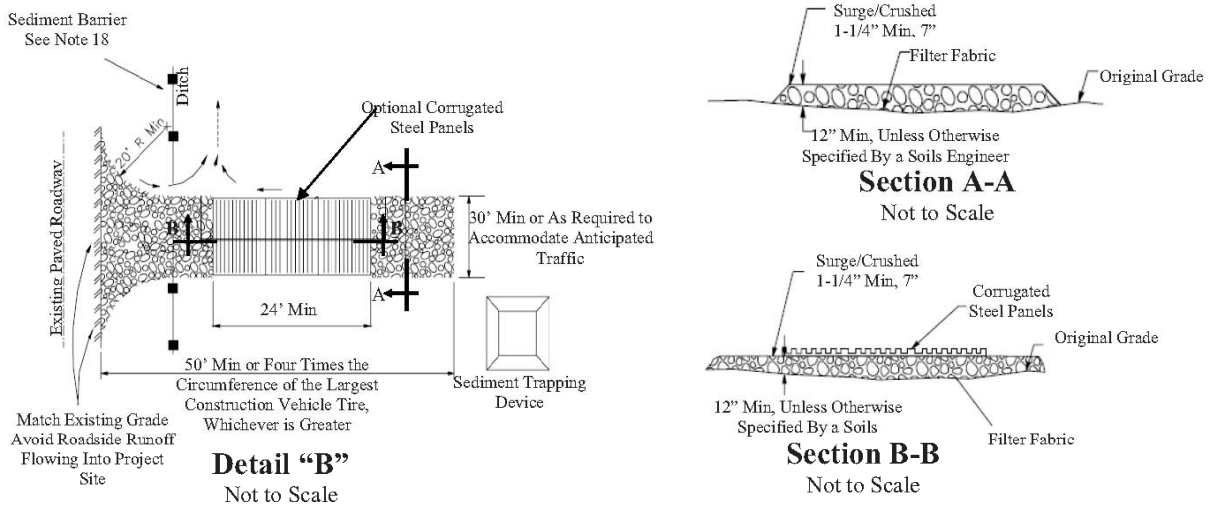
Limitations

- Periodic replenishment of surface aggregate is required.
- Additional street sweeping of adjacent roadways or other paved areas may also be required during the work. Ensure that storm drains and waterways are protected from discharges of street sweeping wastes.
- Stabilized construction entrances are to be constructed on level ground, if possible.
- If a wash rack is included, a sediment trap must be provided to collect wash water runoff.
- A wash rack and sediment trap can significantly increase the cost of a stabilized construction entrance.
- The effectiveness of a stabilized construction entrance is limited by the type and moisture content of construction site soils, by whether or not a wash rack is included, and by the level of care taken to remove sediment from vehicles and equipment if a wash rack is used.

Practice		
☐	C15.1	Construct stabilized construction entrances on level ground where possible.
☐	C15.2	Grade the entrance to prevent runoff from leaving the construction site.
☐	C15.3	Aggregate shall be 3- to 6- inch diameter coarse aggregate.
☐	C15.4	Minimum depth of aggregate is to be 12 inches or as recommended by the soils engineer.
☐	C15.5	Stabilized construction entrances are to be a minimum of 50 feet long and 30 feet wide.
☐	C15.6	Provide ample turning radii as part of the stabilized entrance.
☐	C15.7	If a wash rack is provided, washing is to be done on paved or crushed stone pad that drains into a properly constructed sediment trap or basin.

Note: Example schematics are included herein for reference.

Maintenance and Inspection		
☐	M15.1	Inspect the stabilized construction entrance and wash rack ditches at the end of each work week. If the stabilized construction entrance is clogged with sediment remove the aggregate and separate and dispose of the sediment. Reconstruct the stabilized construction entrance within two (2) calendar days.
☐	M15.2	Inspect roadways and ensure that any tracking is swept and disposed properly. Ensure storm drains and waterways are protected from tracking discharges.
☐	M15.3	Provide education for required personnel about proper stabilized construction entrance installation, use, and maintenance. Ensure that the importance of preventing sediment tracking is including in the training curriculum.



Notes:

1. Construct on level ground where possible.
2. Select 3 to 6 in. diameter stones.
3. Use minimum depth of stones of 12 in. or as recommended by soils engineer.
4. Construct length of 50 ft. minimum, and 30 ft. minimum width.
5. Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
6. Provide ample turning radii as part of the entrance.
7. Limit the points of entrance/exit to the construction site.
8. Limit speed of vehicles to control dust.
9. Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
10. Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
11. Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
12. Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.
13. Place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but not exceeding 6 in. should be used.
14. Designate combination or single purpose entrances and exits to the construction site.
15. Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
16. Implement SE-7, Street Sweeping and Vacuuming, as needed.
17. All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.
18. Construct sediment Barrier and channel runoff to sediment trapping device as appropriate.

Source: City and County of Honolulu BMP Manual, November 2011.

Construction Activities Best Management Practices
Construction Road Stabilization

Description
Access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes should be stabilized immediately after grading and frequently maintained to prevent erosion and control dust. Efficient construction road stabilization not only reduces on-site erosion but can significantly speed on-site work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather.

Limitations
- The roadway must be removed or paved when construction is complete.
- Certain chemical stabilization methods may cause storm water or soil pollution and should not be used (see Dust Control BMP).
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.

Practice		
☐	C16.1	Road should follow topographic contours to reduce erosion of the roadway.
☐	C16.2	The roadway slope should not exceed 15 percent.
☐	C16.3	Gravel roads should be a minimum 4-inch thick, 2-3 inch coarse aggregate base applied immediately after grading, or as recommended by soils engineer.
☐	C16.4	Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust. See Dust Control BMPs in this manual).
☐	C16.5	When evidence of erosion is noted, apply additional aggregate on gravel roads.
☐	C16.6	Water dirt construction roads three or more times per day during the dry season.

Maintenance and Inspection		
☐	M16.1	Inspect the stabilized construction roads at the end of each work week and repair as needed before the start of the next work day.
☐	M16.2	Provide education for required personnel about proper construction road installation and maintenance. Ensure that the importance of preventing sediment discharge is including in the training curriculum.

Construction Activities Best Management Practices
Dewatering Operations

Description
Prevent or reduce the discharge of pollutants to storm water from dewatering operations by using sediment controls and by testing the groundwater for pollution.

There are two general classes of pollutants that may result from dewatering operations: sediment, and toxics and petroleum products. High sediment content in dewatering discharges is common because of the nature of the operation. On the other hand, toxics and petroleum products are not commonly found in dewatering discharges unless the surrounding area has been used for light or heavy industrial activities, or the area has a history of groundwater contamination.

Limitations
The presence of contaminated water may indicate contaminated soil as well.

Practice		
☐	C17.1	Use sediment controls to remove sediment from water generated by dewatering (see Sediment Trap BMP)
☐	C17.2	Use filtration to remove sediment from a sediment trap. Filtration can be achieved by either of the following methods: • Use a sump pit and a perforated or slit standpipe with holes and wrapped in filter fabric. The standpipe is surrounded by stones, which filter the water as it collects in the pit before being pumped out. Wrapping the standpipe in filter fabric may require an increased suction inlet area to avoid clogging and unacceptable pump operation. • Use a floating suction hose to allow cleaner surface water to be pumped out.
☐	C17.3	A weir tank may be used to filter the water through using multiple compartments to allow pollutants to settle out.
☐	C17.4	A gravity filter bag is a square or rectangular bag of geotextile fabric that will remove sediment from the water prior to discharge. Refer to manufacturer's instructions regarding flow rate and frequency of maintenance.
☐	C17.5	In areas suspected of having groundwater pollution, sample the groundwater near the excavation site and have the water tested for known or suspected pollutants. The testing laboratory shall use methods listed in 40 CFR Part 136, and have a quality assurance/quality control measures program. Check with the State Department of Health (DOH) for testing requirements and disposal options.
☐	C17.6	If discharge to a sanitary sewer is considered, check with the DOH and with the owner of the wastewater system for additional testing requirements and disposal options. With permits from the State DOH and the owner of the wastewater system, it may be possible to treat pumped groundwater and discharge the treated effluent to the sanitary sewer.

Maintenance and Inspection		
☐	M17.1	Follow the maintenance and inspection guidelines for the temporary BMPs that have been chosen for the dewatering operations.
☐	M17.2	Check filtering devices frequently to ensure they are unclogged and operating correctly. Adjustments may be needed depending on the amount of sediment in the water being pumped.
☐	M17.3	Systems should be filled in or otherwise removed when permanent dewatering controls are in place and connected to an approved treatment and receiving system.
☐	M17.4	Provide education for required personnel about proper dewatering operations.

Construction Activities Best Management Practices
Paving Operations

Description
Prevent or reduce the discharge of pollutants from paving operations by using measures to prevent storm water pollution, properly disposing of wastes, and providing employee training.

Limitations
None.

Practice		
☐	C18.1	Avoid paving during wet weather.
☐	C18.2	Use asphalt emulsions as prime coat where possible.
☐	C18.3	Store materials away from drainage courses to minimize contact with storm water runoff.
☐	C18.4	Protect drainage course, particularly in sloped areas, by employing BMPs to divert runoff or trap/filter sediment.
☐	C18.5	Leaks and spills from paving equipment can contain toxic levels of heavy metal, oil, and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying.
☐	C18.6	Block/protect catch basins and cover manholes when applying seal coat, tack coat, slurry seal, fog seal, etc.
☐	C18.7	Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry. Slurry residue may be placed in a temporary pit (as described in the concrete waste management BMP) to promote evaporation. Solids must be disposed in accordance with the solid waste management BMP.
☐	C18.8	If paving involves Portland cement concrete, see Concrete Waste Management BMPs in this manual.
☐	C18.9	If paving involves asphaltic concrete, follow these steps: • Sweep excess sand or gravel placed over new asphalt to prevent it from washing into storm drains, channels, or surface waters. Properly dispose of these wastes by referring to the Solid Waste Management BMP in this manual. • Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible. • If paving involves an on-site mixing plant, follow the storm water permitting requirements for industrial activities.

Maintenance and Inspection		
☐	M18.1	Inspect and maintain paving equipment daily to minimize leaks and drips.
☐	M18.2	Provide education for required personnel about proper paving operations.

Construction Activities Best Management Practices
Structure Construction and Painting

Description
Prevent or reduce the discharge of pollutants to storm water from structure repair/ construction and painting by enclosing, covering or providing secondary containment around material storage areas, using good housekeeping practices, using less hazardous alternative products, and training employees.

Limitations
- Less hazardous alternative products may not be available, suitable, or effective in every case.
- A licensed hazardous waste transporter must dispose of hazardous waste that cannot be reused or recycled.
- Be certain that actions to protect storm water quality are consistent with State and Federal safety (OSHA) and air quality regulations.

Practice		
☐	C19.1	Keep the work site clean and orderly.
☐	C19.2	Buy recycled or less hazardous products to the maximum extent practicable.
☐	C19.3	Conduct painting operations consistent with local air quality and OSHA regulations.
☐	C19.4	Properly store paints, epoxy compounds, and solvents.
☐	C19.5	Properly store and dispose waste materials generated from the activity. See Solid Waste Management BMPs in this manual.
☐	C19.6	Enclose or cover painting operations to avoid drift.
☐	C19.7	Use application equipment that minimizes overspray.
☐	C19.8	Clean up spills immediately.
☐	C19.9	Use a drop cloth to collect residue from scraping or sand blasting operations and dispose of the residue properly.
☐	C19.10	Paint chips containing lead or tributyl tin are considered a hazardous waste. See Solid Waste Management BMPs in this manual.
☐	C19.11	Clean painting equipment in a sink that is connected to the sanitary sewer.
☐	C19.12	Mix paints in a covered, contained area whenever possible, in case of a spill
☐	C19.13	Recycle/dispose according to applicable laws and regulations residual paints, solvent, lumber and other materials to the maximum extent practicable.
☐	C19.14	Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.
☐	C19.15	Ensure that employees doing the work are properly trained.
☐	C19.16	Dispose of sand blasted material properly. Chips and dust from marine paints or paints containing lead are to be disposed of as hazardous waste. Paint chips and dust from non-hazardous dry stripping and sand blasting may be swept up and disposed of as trash.

Maintenance and Inspection		
☐	M19.1	At the beginning of each work day inspect and make sure materials are properly stored or covered.
☐	M19.2	Inspect the storm drain system in the immediate work area upon completion of the daily activity, and remove any dirt or debris collected.

Construction Activities Best Management Practices
Vehicle and Equipment Cleaning

Description
Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment cleaning by using off-site facilities, washing in designated and contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and/or training employees.

Limitations
Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.

Practice		
☐	C20.1	Use off-site vehicle wash racks or commercial washing facilities as much as possible. These facilities are more adequately equipped to handle and dispose of the wash waters properly. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute storm water.
☐	C20.2	If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with storm water, streams, rivers, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground. Location of wash area shall be approved by the DOTA Environmental Unit and the Airport Manager.
☐	C20.3	Use as little water as possible to avoid having to install erosion and sediment controls for the wash area.
☐	C20.4	Use phosphate-free, biodegradable soaps.
☐	C20.5	Educate employees on pollution prevention measures.
☐	C20.6	Avoid steam cleaning in uncontained areas. Steam cleaning can generate significant pollutant concentrations.

Maintenance and Inspection		
☐	M20.1	Inspect on-site wash areas at the end of each work week.
☐	M20.2	Monitor employees and subcontractors throughout the duration of the construction project to ensure good housekeeping practices are implemented.

Construction Activities Best Management Practices
Vehicle and Equipment Refueling

Description
Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees.

Limitations
None.

Practice		
☐	C21.1	Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute storm water. For fueling a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly.
☐	C21.2	If fueling must occur on-site, use designated area located way from drainage courses to prevent storm water contamination. Location of fueling area, including a spill prevention and response plan, shall be approved by DOTA Environmental Unit and the Airport Manager.
☐	C21.3	Discourage "topping-off" of fuel tanks.
☐	C21.4	Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks.
☐	C21.5	Place a stockpile of spill cleanup materials where it will be readily accessible.
☐	C21.6	Use absorbent materials on small spills rather than hosing down or burying the spill. Remove and dispose of the adsorbent materials promptly and properly.
☐	C21.7	Comply with all Federal and State requirements regarding stationary above ground storage tanks, including the requirement for secondary containment.
☐	C21.8	Avoid mobile fueling of construction equipment at the site. If possible, transport the equipment to designated fueling areas.
☐	C21.9	Train employees in proper fueling and cleanup procedures.

Maintenance and Inspection		
☐	M21.1	Inspect fueling areas at the end of each work day.
☐	M21.2	Ensure that the spill cleanup materials are fully stocked at the beginning of each work day.
☐	M21.3	Inspect vehicles and equipment for leaks at the beginning and end of each day. Repair leaks immediately.
☐	M21.4	If a spill occurs, clean it up immediately and properly dispose of the contaminated soil and cleanup materials.

Construction Activities Best Management Practices
Vehicle and Equipment Maintenance

Description
Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment maintenance by using off-site facilities, performing work in designated areas only, providing cover for materials stored outside, checking for leaks and spills, containing and cleaning up spills immediately, and training employees.

Limitations
Outdoor vehicle or equipment maintenance is a potentially significant source of water pollution. Activities that can contaminate storm water include vehicle and equipment repair and service, including changing and filling of fluids, and outdoor equipment storage and parking, which can result in dripping of fluids.

Practice		
☐	C22.1	Keep vehicles and equipment clean; don't allow excessive build-up of oil and grease.
☐	C22.2	Use off-site repair shops as much as possible. Maintaining vehicles and equipment outdoors or in areas where vehicle or equipment fluids may spill or leak onto the ground can pollute storm water. Consider using an off-site repair shop to maintain vehicles and equipment. These businesses are better equipped to handle vehicle fluids and spills properly.
☐	C22.3	If maintenance must occur on site, use designated areas, located away from drainage courses, to prevent the contamination of storm water runoff. Maintenance areas shall be bermed or protected to prevent runoff from entering the area. Location of maintenance area, including a plan on how the area will be cleaned up and the materials disposed, shall be approved by DOTA Environmental Unit and the Airport Manager.
☐	C22.4	Always use secondary containment, such as an anchored drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
☐	C22.5	Place a stock of spill cleanup materials where it will be readily accessible.
☐	C22.6	Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
☐	C22.7	Inspect on-site vehicles and equipment daily for leaks, and repair immediately.
☐	C22.8	Regularly inspect incoming vehicles and equipment (including delivery trucks, and employees' vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site.
☐	C22.9	Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.
☐	C22.10	Properly dispose of all wastes from vehicle maintenance activities. Recycle waste materials to the extent practicable.
☐	C22.11	Train employees on proper maintenance and spill cleanup.

Construction Activities Best Management Practices
Vehicle and Equipment Maintenance
(continued)

Maintenance and Inspection		
☐	M22.1	Ensure that the spill cleanup materials are fully stocked at the beginning of each work day.
☐	M22.2	Inspect vehicles and equipment for leaks at the beginning and end of each day. Repair leaks immediately or remove them from the project site.
☐	M22.3	If a spill occurs, clean it up immediately and properly dispose of the contaminated soil and cleanup materials.
☐	M22.4	Spills of a certain size (volume of greater than 25 gal of oil not contained within 72 hrs) per HAR 11-451 must be reported to DOH HEER and the National Response Center.
☐	M22.5	Large spills may require a spill response contractor.
☐	M22.6	Maintain waste fluid containers in leak proof condition in secondary containment and in a covered area.

Construction Activities Management Practices
Material Delivery and Storage

Description
Prevent or reduce the discharge of pollutants to storm water from material delivery and storage by minimizing the storage of hazardous materials on-site, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees.

Limitations
Storage sheds often must meet building and fire code requirements.

Practice		
☐	C23.1	Designate areas of the construction site for material delivery and storage. • Locate storage areas near construction entrances and away from waterways. • Avoid transporting potential pollutants near drainage paths or waterways. • Surround storage areas for potential pollutants with earth berms or other approved containment devices. • Store potential pollutants in a paved area, if available.
☐	C23.2	Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of Honolulu. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA 30.
☐	C23.3	Keep an accurate, up-to-date inventory of materials used at work sites. • Minimize on-site inventory. • Minimize storage of hazardous materials. • During the rainy season, store materials in covered area.
☐	C23.4	Handle hazardous materials as infrequently as possible.
☐	C23.5	Maintain a complete set of material safety data sheets at the work site.
☐	C23.6	Do not store chemicals, drums, or bagged materials directly on the ground. Place dry materials on a pallet and, when possible, in secondary containment. Note that all liquid chemicals and waste must be within secondary containment.
☐	C23.7	If drums must be stored in an uncovered area, store them at a slight angle to reduce ponding of rainwater on the lids and reduce corrosion. Additionally, place in secondary containment.
☐	C23.8	Keep chemicals in their original containers and well labeled.
☐	C23.9	Ensure that employees handling potential pollutants have received adequate training regarding the hazards and proper handling procedures for the materials.
☐	C23.10	Employees trained in emergency spill cleanup procedures are to be present when dangerous materials or liquid chemicals are unloaded.
☐	C23.11	If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Maintenance and Inspection		
☐	M23.1	Keep storage areas clean and well organized. Provide ample cleanup supplies for the various materials being stored.
☐	M23.2	Perimeter controls shall be inspected at the end of each work day. Repair any damages immediately.
☐	M23.3	Inspect storage areas prior to an anticipated rainfall event and after the rainfall event.

Construction Activities Best Management Practices
Material Use

Description
Prevent or reduce the discharge of pollutants to storm water from material use by using alternative products, minimizing hazardous material use on site, and training employees in the proper handling and use of construction materials.

Limitations
Alternative materials may not be available, suitable, or effective in every case.

Practice		
☐	C24.1	Use less hazardous, alternative materials as much as possible.
☐	C24.2	Minimize use of hazardous materials on-site.
☐	C24.3	Use materials only where and when needed to complete the work.
☐	C24.4	Follow manufacturer's instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
☐	C24.5	Personnel who use pesticides are to be trained in their use. The State Department of Agriculture, Pesticides Branch, licenses pesticide dealers, certifies pesticide applicators, and conducts on-site inspections.
☐	C24.6	Do not over-apply fertilizers, herbicides, or pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmental harmful. Except on steep slopes, till fertilizer into the soil rather than surface spreading or spraying it. Apply surface dressings in several smaller applications, as opposed to one large application to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains.
☐	C24.7	Maintain a log of amount, type, and locations where fertilizers, herbicides, or pesticides were applied as well as the BMPs utilized (refer to SWMPP Section E for more detailed chemical usage BMPs). **These logs must be available on-site for review by DOTA inspectors.**
☐	C24.8	Train employees in proper material use.

Maintenance and Inspection		
☐	M24.1	Spot check employees monthly to ensure proper practices are being performed.
☐	M24.2	Ensure that MSDS are maintained for all chemicals used.

Construction Activities Best Management Practices
Protection of Stockpiles

Description
Stockpiles can be a significant source of erosion, sediment, and fugitive dust problems. Measures are to be taken to mitigate the potential for erosion of stockpiles.

Limitations
Stockpiles are for temporary storage of material only. Provisions for permanent removal of stockpiled material must be in place.

Practice		
☐	C25.1	Provide adequate setback from waterways.
☐	C25.2	Avoid sloping ground for locating stockpiles.
☐	C25.3	Minimize stockpile height.
☐	C25.4	Provide earth dikes or other diversion to keep runoff away from stockpiles.
☐	C25.5	Provide silt fences at the toe of the stock pile to mitigate runoff during rain events.
☐	C25.6	Cover, grass, or provide other stabilization measures.
☐	C25.7	Provide adequate setback distance from lot lines.
☐	C25.8	Provide silt basins where required.

Maintenance and Inspection		
☐	M25.1	Maintain and inspect perimeter BMPs according to the type of BMP used.

Construction Activities Best Management Practices
Solid Waste Management - Hazardous Waste

Description
Prevent or reduce the discharge of pollutants to storm water and to the land from hazardous waste through proper material use, waste disposal, and training of employees.

Limitations
A licensed hazardous waste transporter must dispose of hazardous waste that cannot be reused or recycled.

Practice		
☐	C26.1	Determine if a material or item is a potentially hazardous waste: • Check label and shipping papers. • Look for words such as hazardous, danger, caustic, corrosive, flammable, carcinogenic, or toxic. • Check the material safety data sheet (MSDS) from the manufacturer of the product.
		MATERIAL USE:
☐	C26.2	Use the entire product before disposing of the container.
☐	C26.3	Do not remove the original product label; it contains important safety and disposal information.
☐	C26.4	Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Do not apply these chemicals during or just before a rain event. Personnel applying controlled pesticides must be certified in accordance with Federal and State regulations.
☐	C26.5	Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Discharge rinse from water-based paints to the sanitary sewer. Filter and re-use thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
		WASTE RECYCLING/ DISPOSAL:
☐	C26.6	Select designated hazardous waste collection areas on site.
☐	C26.7	Hazardous materials and wastes are to be stored in covered containers and protected from vandalism.
☐	C26.8	Place hazardous waste containers in secondary containment.
☐	C26.9	Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
☐	C26.10	Recycle any useful material such as used oil or water-based paint.
☐	C26.11	Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
☐	C26.12	Arrange for regular waste collection before containers overflow.
☐	C26.13	Make sure that hazardous waste (e.g. excess oil-based paint and sludge) is collected, removed, and disposed of as required by regulations.
		TRAINING:
☐	C26.14	Train employees in proper hazardous waste management.
☐	C26.15	Place warning signs in areas recently treated with chemicals.
☐	C26.16	Keep spill cleanup materials where they are readily accessible.
☐	C26.17	Clean up any spilled material immediately.

Construction Activities Best Management Practices
Solid Waste Management - Hazardous Waste
(continued)

Maintenance and Inspection		
☐	M26.1	Monitor on-site hazardous waste storage and disposal on a daily basis.
☐	M26.2	Keep storage areas clean and well organized. Provide ample cleanup supplies for the various materials being stored.
☐	M26.3	Perimeter controls shall be inspected at the end of each work day. Repair any damages immediately.
☐	M26.4	Inspect storage areas prior to an anticipated rainfall event and after the rainfall event.
☐	M26.5	If a spill occurs, report the incident to the Construction Manager, clean it up immediately and properly dispose of the contaminated soil and cleanup materials according to the material safety data sheet and facility spill response plan. All spills must also be reported to the Airport District Manager, 836-6670.
☐	M26.6	Spills of a certain size (volume of greater than 25 gal of oil not contained within 72 hrs) per HAR 11-451 must be reported to DOH HEER and the National Response Center.
☐	M26.7	Large spills may require a spill response contractor.
☐	M26.8	Supply two copies of the hazardous waste manifest to the Construction Manager.

Construction Activities Best Management Practices
Solid Waste Management - Debris

Description
Prevent or reduce discharge of pollutants to the land, groundwater, and in storm water from solid waste or construction demolition waste by providing designated waste collection areas, separate containers for recyclable waste materials, timing collection of waste and recyclable materials with each stage of the work, and properly training employees.

Limitations
None

Practice		
☐	C27.1	Construction and Demolition (C&D) Waste. Clean up materials contaminated with hazardous substances, friable asbestos, waste paint, solvents, sealers, adhesives, or similar materials are not acceptable at C&D disposal sites.
☐	C27.2	Inert Fill Material. Defined as earth, soil, rock, or rock-like material will not decompose or produce leachate. Place inert fill material such that it will not be subject to erosion from runoff.
☐	C27.3	Recycle or reuse C&D waste whenever practical.
☐	C27.4	Select designated waste collection areas on-site.
☐	C27.5	Inform trash-hauling employees that only watertight dumpsters are to be provided. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
☐	C27.6	Locate containers in a covered area and/or in a secondary containment. Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out and to prevent scattering of wastes by wind.
☐	C27.7	Plan for additional containers and more frequent pickup during the demolition phase of a project.
☐	C27.8	Collect site trash daily, especially during rainy and windy conditions.
☐	C27.9	Erosion and sediment control devices tend to collect litter. Remove this solid waste promptly.
☐	C27.10	Make sure that toxic wastes (used oils, solvent, and paints) and chemicals (acids, pesticides, additives, curing compound) are not disposed of in dumpsters designed for refuse or construction debris.
☐	C27.11	Salvage or recycle any useful material. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas.
☐	C27.12	Do not hose out dumpsters on the construction site. Leave dumpster cleaning to trash hauling employees.
☐	C27.13	Arrange for regular waste collection before containers overflow. Containers shall be of good integrity with no holes. Containers shall come with a lid.
☐	C27.14	If a container does spill, clean up immediately.
☐	C27.15	Make sure that construction waste is collected. Remove and dispose of only at authorized disposal area.
☐	C27.16	Train employees in proper solid waste management.

Maintenance and Inspection		
☐	M27.1	Monitor on-site solid waste storage and disposal and police site for litter and debris on a daily basis.

Construction Activities Best Management Practices
Contaminated Soil Management

Description
Prevent or reduce the discharge of pollutants to storm water and to the land from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

Limitations
- Contaminated soils must be disposed of at DOH-permitted facilities by DOH-approved transporter. Note: If transporting petroleum-contaminated soil (PCS) loads off-site to other than permitted remediation facilities, use transporters approved by the DOH, Office of Solid Waste Management (OSWM). OSWM must be notified 48 hours before any PCS loads are taken to DOH-permitted remediation facilities.
- The presence of contaminated soil may indicate contaminated ground water as well.

Practice		
☐	C28.1	Conduct thorough site planning including pre-construction review of in-house records regarding previous work in the area.
☐	C28.2	Look for contaminated soil as evidence by discoloration, odors, difference in soil properties, abandoned underground tanks or pipes, or buried debris.
☐	C28.3	Prevent leaks and spills to the maximum extent practicable. Contaminated soil can be expensive to treat and/or dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
☐	C28.4	Test suspect soils at certified laboratories.
☐	C28.5	If the soil is contaminated, dispose per all applicable regulations.
☐	C28.6	Secure required State DOH permits.

Maintenance and Inspection		
☐	M28.1	Monitor on-site contaminated soil storage and disposal on a daily basis.
☐	M28.2	Inspect contaminated soil storage areas on a daily basis.

Construction Activities Best Management Practices
Concrete Waste Management

Description
Prevent or reduce the discharge of pollutants to storm water from concrete waste by conducting washout off-site, performing on-site washout in a designated area, and training employees.

Limitations
Off-site washout of concrete wastes may not always be possible.

Practice		
☐	C29.1	Store dry and wet material under cover, away from drainage area.
☐	C29.2	Avoid mixing excess amounts of fresh concrete or cement on-site.
☐	C29.3	Perform washout of concrete trucks off-site or in designated areas only. Location of wash area, including a plan on how the area will be cleaned up and the waste materials disposed, shall be approved by the DOTA Environmental Unit and the Airport Manager.
☐	C29.4	Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
☐	C29.5	Do not allow excess concrete to be dumped on-site, except in designated areas. Location of dump area, including a plan on how the area will be cleaned up and the waste materials disposed, shall be approved by AIR-EE and the Airport Manager.
☐	C29.6	For on-site washout: • Locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste; • The washout should be plastic lined with a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material. The seams of multiple sheets should be thoroughly adhered such that liquid wastes are contained. • Wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed of properly. • Washout facilities should have a minimum freeboard of 4 inches to account for rain events.
☐	C29.7	When sandblasting, avoid creating runoff by draining the water to a bermed or level area.
☐	C29.8	Do not sweep excess exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
☐	C29.9	Train employees in proper concrete waste management.

Maintenance and Inspection		
☐	M29.1	Inspect concrete washout facilities at the end of each work week. Repair any damages before the next time it is used.
☐	M29.2	Cleanout the facility or construct a new one when it reaches 75% capacity.

Construction Activities Best Management Practices
Sanitary/Septic Waste Management

Description
Prevent or reduce the discharge of pollutants to storm water from sanitary/septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Limitations
None.

Practice		
☐	C30.1	Locate sanitary facilities in a convenient location.
☐	C30.2	Untreated raw wastewater is never to be discharged to ground or buried.
☐	C30.3	If using an on-site disposal system (OSDS), such as a septic system, comply with State Department of Health (DOH) requirements.
☐	C30.4	Temporary sanitary facilities that discharge to the sanitary sewer system are to be properly connected to avoid illicit discharges.
☐	C30.5	If discharging to the sanitary sewer, contact the local wastewater treatment plant for their requirements.
☐	C30.6	Sanitary/septic facilities are to be maintained in good working order by a licensed service provider.
☐	C30.7	Arrange for regular waste collection by a licensed transporter before facilities overflow.
☐	C30.8	For DOTA triturator, ensure that triturator training is completed prior to use. Contact the DOTA Environmental Unit for information regarding the training.

Maintenance and Inspection		
☐	M30.1	Inspect sanitary/septic waste storage facility at the end of each work week.
☐	M30.2	Monitor disposal operations for spills.

Construction Activities Best Management Practices
Spill Prevention and Control

Description
Prevent or reduce the discharge of pollutants to storm water from leaks and spills by reducing the chance of spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spilled materials, and training employees.

Report all spills to the Airport Duty Manager. Small spills of oil (less than 25 gallons) which are capable of being cleaned up within 72 hours and which do not threaten ground or surface waters can be cleaned up using adsorbent materials or other acceptable practices. Daily inspections of the facility will identify any small spills, which will be addressed immediately.

In the event of a large or uncontrolled release, the Construction Manager shall act as the Emergency Coordinator (EC) until the Airport Manager or his representative assumes the role of the EC.

Limitations
If necessary, use a private spill cleanup company.

Practice		
☐	C31.1	Hazardous materials and wastes are to be stored in covered containers or in a covered area, in secondary containment and protected from vandalism.
☐	C31.2	Place a stockpile of spill cleanup materials where it will be readily accessible.
☐	C31.3	Train employees in spill prevention and cleanup.
☐	C31.4	Designate responsible individuals.
☐	C31.5	Review spill response requirements at each work site.
☐	C31.6	Clean up leaks and spills immediately.
☐	C31.7	On paved surfaces, clean up the spill with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and adsorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous.
☐	C31.8	Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See Solid Waste Management BMPs in this manual.
☐	C31.9	Report significant spills to the U.S. Coast Guard, Hawaii State Hazard Evaluation & Emergency Response (HEER) Office, and City and County of Honolulu agencies, such as the Fire Department; they can assist in cleanup.
☐	C31.10	Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).
☐	C31.11	If repair or maintenance must occur on-site, see Vehicle and Equipment Maintenance BMPs in this manual.

General Best Management Practices
Spill Prevention and Control
(continued)

☐	C31.12	Place drip pans or adsorbent materials under paving equipment when not in use.
☐	C31.13	Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
☐	C31.14	Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
☐	C31.15	Oil filter disposed of in trash cans or dumpsters can leak oil and pollute storm water. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Recycle oil filters if this service is available.
☐	C31.16	Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if all the acid appears to be drained out. If a battery is dropped, treat it as if it is cracked. Put it into the containment area until it is assured not to be leaking.
☐	C31.17	If fueling must occur on-site, see Vehicle and Equipment Refueling BMPs in this manual.

Maintenance and Inspection		
☐	M31.1	Ensure that the spill cleanup materials are fully stocked at the beginning of each work day.
☐	M31.2	Promptly remove oil products collected in drip pans or other secondary containment devices.
☐	M31.3	Implement mandatory monthly Good Housekeeping / BMP refresher classes for employees.

Construction Activities Best Management Practices
Spill Response Practices

Description
Proper control and cleanup of spilled hazardous materials reduces the discharge of hazardous materials to MS4. This BMP covers hazardous material spills in the DOTA right-of-way by DOTA and contract personnel. The maintenance baseyard and tenant facility storm water pollution control plans (SWPCP) will also contain information about spills in their respective areas.

Report all spills to the Airport Duty Manager. Small spills of oil (less than 25 gallons) which are capable of being cleaned up within 72 hours and which do not threaten ground or surface waters can be cleaned up using adsorbent materials or other acceptable practices. Daily inspections of the facility will identify any small spills, which will be addressed immediately.

In the event of a large or uncontrolled release the Construction Manager shall act as the Emergency Coordinator (EC) until the Airport Manager or his representative assumes the role of the EC.

Limitations
None.

Practice		
☐	C32.1	Stop work.
☐	C32.2	Shut down pumps and equipment and secure valves and work operations.
☐	C32.3	Shut down any nearby propane tanks.
☐	C32.4	Move away from the affected area.
☐	C32.5	Notify and alert others of the incident via: (1) voice; (2) hand-held radios; and/or (3) other effective communication.
☐	C32.6	Keep non-essential employees away from the spill area.
☐	C32.7	Notify the EC.
☐	C32.8	The EC shall evaluate the situation and decide whether to implement a "fight or flight" response by gathering the following information, if it can be done safely: Your name, location, and how you may be reached. Location of the release. Type, quantity, and description of the release. Hazards of the release. Type of media affected (soil, asphalt, concrete, etc.). Rate of the release. Migratory direction of the release. Potential for fire or explosion. Potential for human exposure. Potential for migration to surface water (ocean, storm drains, etc.).
☐	C32.9	Never subject yourself or other personnel to unreasonable risk of illness or injury.
☐	C32.10	Remove all injured persons from the immediate area of danger and render first aid. If injuries are severe, call 911 for emergency medical assistance.
☐	C32.11	If the decision is to "fight," spill response personnel are to don the appropriate personal protective equipment (PPE).
☐	C32.12	Eliminate all possible sources of ignition/detonation such as vehicle engines, welding and grinding operations, and smoking.

General Best Management Practices
Spill Prevention and Response Practices
(continued)

☐	C32.13	Remove or isolate ignitable and incompatible materials from the area of the release.
☐	C32.14	Locate, stop, and contain the source of the release by: (1) closing, checking, repairing, plugging valves; and/or (2) plugging and patching holes.
☐	C32.15	Confine the release to prevent further migration by: 1) Diking and berming using sand, soil, or other inert material; 2) Sealing storm drains with plastic and sandbags; 3) Placing granular sorbent or adsorbent pads and booms; 4) Diverting the chemicals from entering drains, manholes, streams, etc.; or 5) Implementing retention techniques.
☐	C32.16	Implement proper decontamination procedures on vehicles, affected media, PPE, and equipment. This may include placing adsorbent material on oil stained pavement - later sweeping up, removing and disposing of affected media (soil or loose asphalt) that contains contaminant, and/or berming the spill area and scrubbing using detergents – disposing detergent and rinse in accordance with the procedures listed below.
☐	C32.17	All used decontamination solution, disposable PPE and affected media must be properly packaged in U.S. Department of Transportation (U.S. DOT) - specified containers.
☐	C32.18	Labeling, transportation and subsequent disposal of hazardous materials/waste must be in accordance with applicable government regulations.
☐	C32.19	If needed, call the spill response contractor for cleanup and removal of accumulated product resulting from the release. The contractor will remove spilled product and properly dispose of the material in accordance with applicable state and federal regulations.
☐	C32.20	If the release is not readily and easily controlled, evacuation may be necessary.
☐	C32.21	If the EC decides on the "flight" option, the EC is to immediately alert and evacuate all personnel.
☐	C32.22	Call the necessary emergency service providers such as CODE 22, 911 (medical facilities, county police, county fire), U.S. Coast Guard (842-2606), DOH HEER office (586-4249), National Response Center (800-424-8802), Clean Islands Council (536-5814), and/or spill response contractors and vendors. Also notify the DOTA Environmental Section Supervisor (838-8002) in the event of large spills or spills that either enter the storm drain, canal, or ocean.
☐	C32.23	Compliance with the DOH HEER requirements. HEER must be notified as soon as possible and a written report provided within 30 calendar days of a Reportable Quantity (RQ) spill clean-up.
☐	C32.24	Maintenance personnel are to proceed along an evacuation route to the nearest unaffected area.

Maintenance and Inspection		
☐	M32.1	Implement spill response drills on a monthly basis specific to each employee's type of work and materials and equipment used.

Appendix G

Permanent Post-Construction Best Management Practices Manual

STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION, AIRPORTS DIVISION

PERMANENT POST- CONSTRUCTION BEST MANAGEMENT PRACTICES AND FIELD MANUAL

Prepared For:
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Permanent Best Management Practices
PC1: Preservation of Existing Vegetation

Description
Preservation of existing vegetation involves protecting desirable plants and trees in any area subject to land-disturbing activities. The primary function of existing vegetation preservation is to provide an effective form of soil stabilization control, as well as watershed protection, landscape beautification, dust control, pollution control, noise reduction, and shade.

Limitations
Protection of existing vegetation requires planning, and may limit the area available for construction activities. Additionally, if land costs are high, it may not be practical to preserve areas of existing vegetation for a given project unless required by regulation. In this case, it may be appropriate to evaluate the existing vegetation for species type for use in landscaping plans.

Practice		
☐	PC 1.1	Preservation of existing vegetation shall be practiced in the following locations: • Areas on a site where no construction activity is planned or will occur at a later date. • Sensitive areas where natural vegetation exists and should be preserved, such as on steep slopes, watercourses, and building sites in wooded areas. • Within and as a buffer to areas where federal, state, or local government regulations require preservation, such as delineated wetlands, marshes, areas or protected trees, etc.
PLANNING:		
☐	PC 1.2	Preservation of vegetation on a site is to be planned before any site disturbance begins.
☐	PC 1.3	Decisions on which vegetation to save is to be based on the following considerations: • Native Hawaiian or endangered plants • Life expectancy • Health and disease susceptibility • Structural integrity • Aesthetic values • Comfort relative to site temperature variation and wind • Wildlife benefits • Adaptability to the proposed project • Survival needs of the vegetation • Relationship to other vegetation
☐	PC 1.4	All vegetation to be retained is to be delineated and identified (species and size) on the site plan and tagged in the field.
☐	PC 1.5	Critical areas, such as floodplains, steep slopes, and wetlands, are to be left in their initial condition unless disturbance is unavoidable.
☐	PC 1.6	Temporary roadways, utilities, material storage, and crew parking are to be located to minimize damage to shrub and tree stands, following contours to reduce cutting and filling.
☐	PC 1.7	For retention of existing trees in paved areas, at least 5 feet of ungraded ground beyond the drip line is to be retained to help ensure tree survival. Keep equipment away from trees to avoid damage.
☐	PC 1.8	Wind damage can result from exposure of vegetation to increased wind velocities, therefore this must be considered when removing adjacent vegetation.
☐	PC 1.9	Soil stabilization measures are to be located at the limits of clearing to prevent sediment deposition within the area where vegetation is being preserved.

☐	PC 1.10	Plans shall include the maintenance of existing grade around vegetation to be preserved. Obtain recommendations from a qualified, licensed landscape architect or certified arborist prior to altering grades around existing vegetation.
☐	PC 1.11	Plans for tree preservation are to include protection from the following: • Compaction of the soil within the drip line of a tree, which can block off air and water from the roots. • Changes in soil chemistry that can result from spillage of chemicals or improper waste disposal.
TIMING:		
☐	PC 1.12	Preservation of existing vegetation needs to be planned during the design stages by the design engineer before any site disturbance begins.
☐	PC 1.13	No vegetation is to be destroyed or altered until the design of roads, buildings, and utility systems is finalized.
TREE AND VEGETATION MARKING AND PROTECTION:		
☐	PC 1.14	Within 40 feet of a proposed building or excavation, retained trees shall be protected by fencing: • Board fencing: 4-inch posts protruding 4 feet above ground. • Cord fencing: 2-inch posts protruding 4 feet above ground with two rows of cord at least 0.25 inch thick between posts. • Plastic fencing: 3-feet high orange polyethylene webbing secured to metal posts. • Tree buffer zone: Trees must be a maximum of 6 feet apart surrounding clearing limits. • Tree wrapping: Tree to be protected is wrapped with burlap and 2-inch studs wired vertically, no more than 2-inches apart encircling the truck to a height of 5 feet.
☐	PC 1.15	An earth berm may be constructed at the clearing limits for vegetation only if its presence does not conflict with drainage patterns.
☐	PC 1.16	If ground level must be raised around protected trees construct a tree well. Consult a qualified, licensed landscape architect or certified arborist concerning the method of constructing a tree well.
☐	PC 1.17	If the grade is being lowered, trees can be protected by constructing a surrounding tree wall of large stones, bricks, or concrete blocks filled with topsoil.
TRENCHING AND TUNNELING:		
☐	PC 1.18	All requirements of the utility system owner must be met. Root barriers around the tree or concrete jacketing of the utility line may be required.
☐	PC 1.19	The tunnel shall be at least 18 inches below the ground surface, and not below the tree center to minimize impact on the roots.
☐	PC 1.20	Roots shall not be left exposed to air; they shall be covered with soils as soon as possible, protected, and kept moistened with wet burlap or peat moss until the tunnel can be built.
☐	PC 1.21	The ends of damaged or cut roots are to be cut off cleanly and protected by painting them with a tree-wound dressing, as recommended by a certified arborist.
☐	PC 1.22	Trenches and tunnels are to be filled as soon as possible. Careful filling and tamping will eliminate air spaces in the soil.
☐	PC 1.23	To induce and develop root growth, peat moss can be added to the fill material.
☐	PC 1.24	Trees shall be mulched and fertilized to conserve moisture, and to stimulate new root growth.
☐	PC 1.25	Remove any trees intended for retention if those trees are damaged seriously enough to affect their survival. If replacement is desired, the new tree shall be of similar species, and shall be of balled and burlapped nursery stock at least 2 inch caliper.
MAINTENANCE AND INSPECTION:		

☐	PC 1.26	During construction, the limits of disturbance are to remain clearly marked at all times. During the final cleanup and landscaping, fences, and barriers are to be removed last.
☐	PC 1.27	Any damage to the canopy, trunk, or root system of a retained tree during maintenance is to be repaired immediately.
☐	PC 1.28	Soil that has been compacted over a tree's root zone is to be aerated by punching holes 12 inches deep with an iron bar, and moving the bar back and forth until the soil is loosened. Holes are to be placed 18 inches apart throughout the area of compacted soil under the tree canopy.
☐	PC 1.29	Damaged roots are to be immediately cut cleanly. The cuts are to be painted with a tree-wound dressing and moist soil or soil amendments shall be spread over the area. A certified arborist shall be consulted regarding specific methods and materials.
☐	PC 1.30	If bark damage occurs, all loosened bark is to be cut back into the undamaged area, with the cut tapered at the top and bottom, and drainage provided at the base of the wound. Cutting of the undamaged area shall be minimized.
☐	PC 1.31	Serious tree injuries are to be attended to by a certified arborist, forester, or tree specialist.
☐	PC 1.32	Stressed or damaged broadleaf trees are to be fertilized to aid recovery.
☐	PC 1.33	Trees are to be fertilized in the late fall or early spring.
☐	PC 1.34	Fertilizer is to be applied in accordance with label instruction to the soil over the feeder roots, but never closer than 3 feet to the trunk. For conifers, which have extended root systems, the fertilized area is to be increased by one-fourth of the canopy area.

Permanent Best Management Practices
PC2: Permanent Seeding and Planting

Description
Permanent seeding and planting is the process of establishing a perennial vegetative cover on areas that have been disturbed by construction or maintenance activities or are otherwise subject to erosion. Permanent vegetation shall be self-sustaining, need low maintenance, and be compatible with the surrounding environment.

The primary functions of permanent seeding and planting are to:

- Reduce erosion by slowing runoff velocities.
- Protect soil from raindrop impact.
- Enhance infiltration and transpiration.
- Trap sediment and other particulates.
- Improve long-term aesthetics.
- Provide wildlife habitat.

Limitations
If the site is susceptible to erosion, additional control measures may be necessary during seeding and planting in order to establish permanent vegetation.

Practice		
☐	PC 2.1	The site shall first be evaluated to select the appropriate vegetation and planting strategy, considering the following: • Soil type and condition • Site topography • Climate and season • Types of vegetation suited to the site • Maintenance concerns • Aesthetic considerations • Water, fertilizer, and herbicide requirements
☐	PC 2.2	Strip and stockpile topsoil. Use stockpiled materials in the surface preparation prior to seeding operations.
☐	PC 2.3	Apply fertilizer, lime, or other soil amendments as indicated by soil testing.
☐	PC 2.4	Roughen the slope or area to be seeded by plowing, disking, or raking to a depth of 6 inches, with the furrows trending along the contours.
☐	PC 2.5	Plant the seed using broadcast seeding, seed drilling, or hydraulic application of seed, as appropriate.
☐	PC 2.6	Apply a protective mulch to keep the seed in place and control soil moisture and temperature until the seed germinates and grows.
☐	PC 2.7	Irrigate the seed as needed based on rainfall conditions.
☐	PC 2.8	To conform to Hawaii Department of Agriculture's rules and regulations each seed bag is to be delivered to the site seal and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The packaging will be labeled Pure Live Seed (PLS) contained.
☐	PC 2.9	Follow-up applications of see and fertilizer shall be made to cover weak or damaged areas.
☐	PC 2.10	If soil moisture is deficient, new vegetation is to be supplied with supplemental water until firmly established.
☐	PC 2.11	Cutting or mowing grasses will encourage the establishment and spread of the grass.
☐	PC 2.12	All seeded areas are to be inspected for failures and reseeded, fertilized, and mulched as needed, using half the original application rates.

Permanent Best Management Practices
PC3: Mulching

Description
Mulching is the process of applying loose bulk materials to the soil surface as a permanent or temporary cover. Common types of mulch are: green material, hydraulic matrices, hydraulic mulches made from recycled paper or wood fiber, stone and aggregate, vegetable fibers (hay or straw), and wood/bark chips. The primary function of mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff. Mulches are also generally used to compliment seeding and vegetation establishment techniques.

Limitations
- Organic mulches are not permanent erosion control measures.
- Vegetable fibers, such as hay or straw, require three-step machinery and are labor intensive during installation. For application with straw blowers, areas for treatment must be within 150 feet of a road.
- Green material is not always commercially available and has poor erosion control.
- Wood/Bark chips have poor erosion control and are not effective on steep slopes. Upon decomposition, the chips draw nitrogen from the soil; therefore, application must be augmented with a high-nitrogen fertilizer.
- Hydraulic Mulches (made from recycled paper) present a potential problem in environmentally sensitive areas due to residual inks and the short fibers limit erosion control.
- Hydraulic Mulches (made from wood fiber) have limited erosion control and do little to moderate moisture and temperature in soils.
- Hydraulic Matrices can be applied to any slope and prevent erosion control. They cannot be applied during, before, or after rain and require at least 24 hours drying time.

Practice		
☐	PC 3.1	Criteria for choosing the appropriate type of mulch: • Cost – material, preparation, and installation cost • Effectiveness – reduction of erosion, flow velocity, and runoff • Acceptability – environmental compatibility, visual impact, institutional acceptability • Vegetation Enhancement – native plant compatibility, germination rate, growth grate, moisture retention, temperature modification, open space/coverage, nutrient uptake. • Installation – durability, longevity, ease of installation, safety • Operation and Maintenance – maintenance frequency, need for fertilization or irrigation
VEGETABLE FIBER MULCHING:		
☐	PC 3.2	Apply seed and fertilizer to the bare soil.
☐	PC 3.3	Apply loose hay or straw over the top of seed/fertilizer at a rate of 2 tons per acre either by machine or by hand distribution.
☐	PC 3.4	The mulch must be evenly distributed on the soil surface so that 80% to 90% of the ground is covered.
☐	PC 3.5	Maximum fiber length shall be maintained and average fiber length shall be greater than 6 inches.
☐	PC 3.6	Anchor the mulch in place by using a tackifier, netting, or "punch" it into the soil mechanically.
☐	PC 3.7	"Punching" straw of hay into the soil can be accomplished with spade or shovel on small areas. On slopes use a "crimper" (a mechanical knife-blade roller). On steep slopes use plastic netting or jute held in place with wire staples, geotextile pins, or wooden stakes.
GREEN MATERIAL MULCHING:		
☐	PC 3.8	Recycle vegetation trimmings as a temporary ground cover with or without seeding.
☐	PC 3.9	The green material is to be evenly distributed on a site to a depth of not more than 4 inches.
☐	PC 3.10	Anchoring green material in place with a tackifier is necessary on steep slopes and in areas where overland sheet flow is anticipated.

WOOD/BARK CHIP MULCHING:		
☐	PC 3.11	Soils must be tested before application and a minimum of 12 pounds nitrogen per ton of mulch must be added to prevent nutrient deficiency in plants.
☐	PC 3.12	Wood/bark chips are not suitable for steep slopes; use shredded wood/bark if necessary.
☐	PC 3.13	The mulch shall be distributed by hand evenly across the soil surface to a depth of 2 to 3 inches.
HYDRAULIC MULCHING:		
☐	PC 3.14	Mix recycled paper or wood fiber in a hydraulic application machine (hydroseeder) and applied as liquid slurry, which contains the recommended rates of seed and fertilizer for the site.
☐	PC 3.15	Must use 100% wood fiber with the following specifications: • Moisture content (total weight basis) not to exceed 12% ± 3%. • Organic matter content (oven dry weight basis) = 99.3% minimum. • Inorganic matter (ash) content (oven dried basis) = 0.7% maximum. • pH = 4.9 ± 10% for a 3% water slurry. • Water holding capacity (oven dried basis) minimum 1.2 gallons per pound of fiber.
HYDRAULIC MATRICES:		
☐	PC 3.16	Use hydraulic slurry composed of wood fiber, paper fiber, or a combination of the two held together by a binder system. A typical mixture applied on a per acre basis is as follows: • 500 pounds per acre wood fiber mulch • 1,000 pounds per acre recycled paper mulch • 55 gallons per acre acrylic copolymer with a minimum of 55% solids content.
BONDED FIBER MATRIX (BFM):		
☐	PC 3.17	The BFM shall be a hydraulic matrix which, when applied and upon drying, adheres to the soil to form a 100% cover which is biodegradable, promotes vegetation, and prevents soil erosion.
☐	PC 3.18	The BFM shall be comprised of long strand, thermally produced wood fibers (>88% of total volume by weight) held together by organic tackifiers (10%) and mineral bonding agents (<2%), which upon drying become insoluble and non-dispersible.
☐	PC 3.19	The matrix shall have a minimum water holding capacity of 1.2 gallons per pound matrix.
☐	PC 3.20	The matrix shall have no germination or growth inhibiting factors and shall not form a water insensitive crust.
☐	PC 3.21	The BFM shall be applied at rates from 3,000 to 4,000 pounds per acre based on the manufacturer's recommendation by an applicator trained and certified by the manufacturer.
☐	PC 3.22	The BFM shall not be applied immediately before, during, or immediately after rainfall, so that the matrix will have an opportunity to dry for 24 hours after installation.
☐	PC 3.23	Replace mulch when bare soil is visible beneath plants in more than 75% of the area. Inspect all such planting areas every 8 to 10 months.

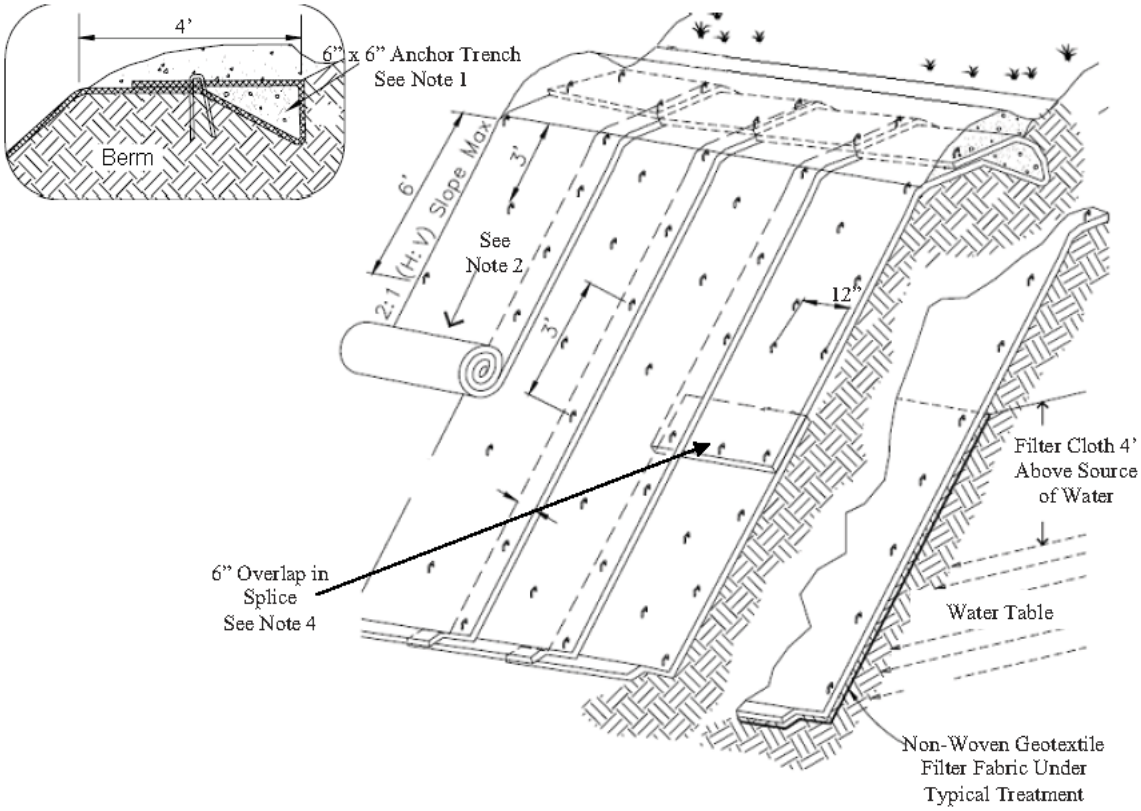
Permanent Best Management Practices
PC4: Geotextiles, Mats, and Erosion Control Blankets

Description
Matting made of natural or synthetic material is used to temporarily or permanently stabilize soil. These products are to be considered at any sites where disturbed soils must be stabilized.

Limitations
Blankets and mats are typically more expensive than other erosion control measures, primarily due to labor costs. Costs usually limit the use of blankets and mats to areas inaccessible by hydraulic equipment, or where other measures are not applicable, such as channels. Blankets and mats are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since stapes and netting can catch in mowers).

Practice		
SITE PREPARATION:		
☐	PC 4.1	Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
☐	PC 4.2	Grade and shape the area of installation.
☐	PC 4.3	Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
☐	PC 4.4	Prepare seedbed by loosening 2 to 3 inches of topsoil.
☐	PC 4.5	Incorporate soil amendments, such as lime and fertilizer, as indicated by soil testing, the seeding plan, and manufacturer's recommendations.
☐	PC 4.6	Seed the area before blanket installation for erosion control and revegetation.
☐	PC 4.7	All mats and blankets should be anchored to the ground with sufficient penetration to resist pullout, generally 6 to 18 inches long. Types of anchors include U-shaped wire staples, metal geotexile stake pins, and triangular wooden stakes.
INSTALLATION ON SLOPES:		
☐	PC 4.8	Begin at the top of the slope and anchor the blanket in the 6 inches deep by 6 inches wide trench. Backfill trench and tamp earth firmly.
☐	PC 4.9	Unroll blanket down slope in the direction of water flow.
☐	PC 4.10	Overlap the edges of adjacent parallel rolls 2 to 3 inches and staple every 3 feet.
☐	PC 4.11	When blankets must be spliced, place blankets end over end (shingle style) with 6-inch overlap. Staple through overlapped area, approximately 12 inches apart.
☐	PC 4.12	Lay blankets loosely and maintain direct contact with the soil. Do no stretch the fabric.
INSTALLATION IN CHANNELS:		
☐	PC 4.13	A schematic for typical installation of blankets or mats in channels is provided, however, always consult the manufacturer's recommendations for installation.
☐	PC 4.14	If manufacturer's recommendation for installation involves soil filling, spread and lightly rake 0.25 to 0.50 inches of fine topsoil into the mat to completely fill mat thickness.
PLASTIC SHEETING:		
☐	PC 4.15	Plastic sheeting shall have a minimum thickness of 6 mils and shall be firmly held in place with sandbags or other weights no more than 10 feet apart. Seems shall overlap 12 to 24 inches and be taped or weighted down their entire length.
MAINTENANCE AND INSPECTION:		
☐	PC 4.16	All blankets and mats shall be inspected after installation and significant rainstorms and repaired/replaced if any failures or washouts occur.

Figure 1. Installation of Geotextiles



Detail "A"

Not to Scale

Notes:

1. Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
2. Unroll blanket down slope in the direction of water flow.
3. Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft.
4. When blankets should be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
5. Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
6. Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples should be placed down the center and staggered with the staples placed along the edges.
7. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1½ staples/yd^2.
8. Install per manufacturer's recommendations.
9. For Limitations, Geotextiles and Plastic Covers Specifications, Types of Erosio: Blankets/Mats, and Site Preparations see EC-7.

Typical Slope Soil Stabilization

Source: City and County of Honolulu BMP Manual, November 2011.

Permanent Best Management Practices
PC5: Vegetated Buffer Strips and Channels

Description

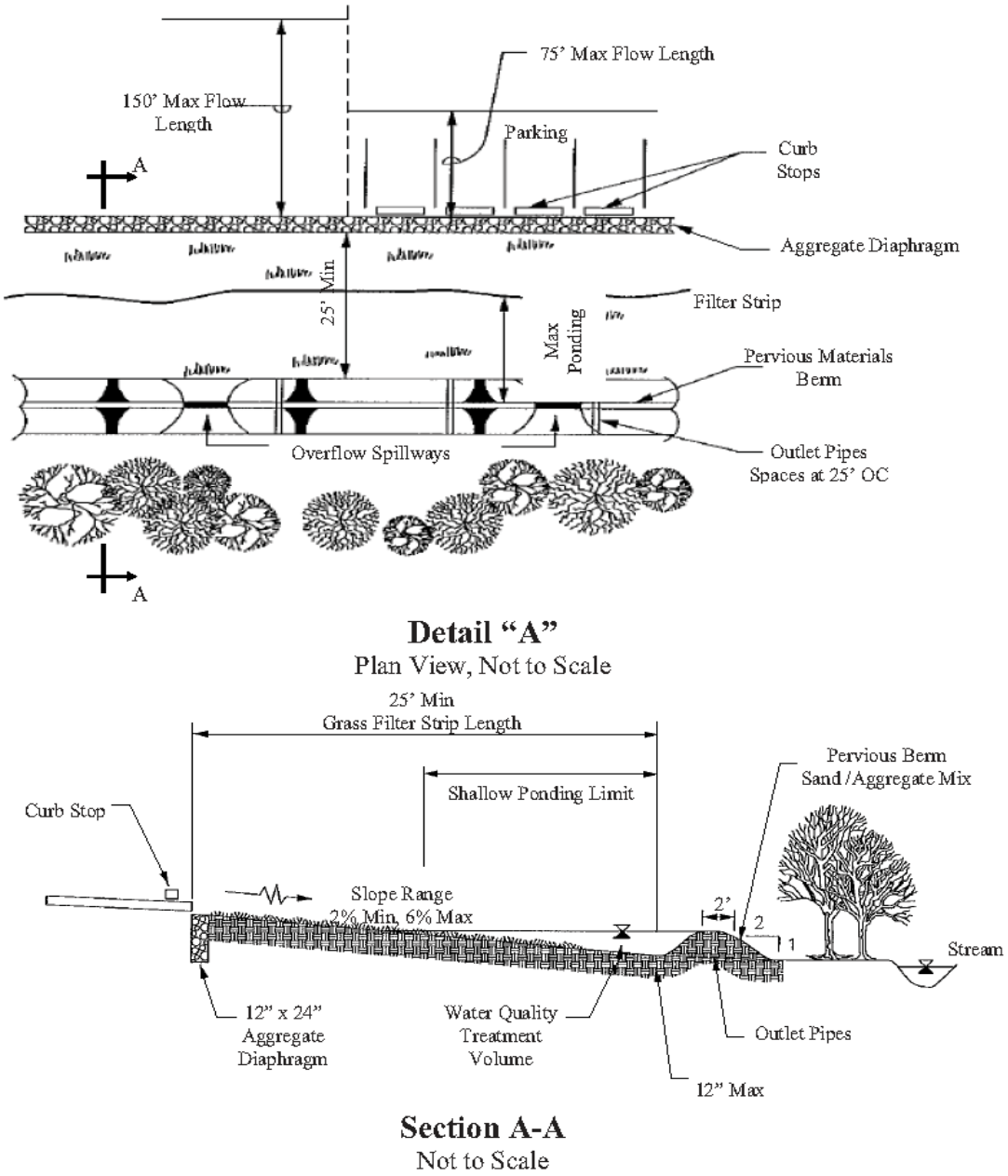
Vegetative buffer strips and channels, also referred to as biofilters in reference to storm water management, can be used to reduce the discharge of pollutants to the storm drain system or to watercourses from a new development or redevelopment. The vegetated surfaces are used to protect soils from erosion and to slow the velocity of runoff to allow the removal of sediment through filtering and settling. A vegetated buffer strip is a strip of land parallel to and adjacent to the edge of the contributing surface. It can be created with either new vegetation as part of a development project or a strip of existing vegetation that is left undisturbed during adjacent development (see BMP Preservation of Existing Vegetation).

Limitations

- Site conditions, including land availability, may limit the use and design of vegetated buffer strips and channels.
- Performance is dependent upon depth of flow and condition of the vegetation.
- Irrigation may be required to maintain the vegetation during dry periods.
- Maintenance requirements can be high to maintain the design condition of the vegetation.
- Vegetated buffer strips are most economical when there is existing vegetation that can be retained to serve as the buffer strip or when a landscaped area to serve as a buffer strip is incorporated into the site design; otherwise, the site design will need to specifically provide buffer strip areas and vegetation will need to be established.
- Vegetated channels require a larger area than lined channels and this area must be provided in the overall site design.
- Vegetated channels require gradual slopes to limit flow velocities. High flow velocities topple the grass and result in flow over the grass rather than through it.

Practice (*Refer to Figure 2)		
☐	PC 5.1	All weeds and debris shall be removed before cultivation of the area and disposed properly.
☐	PC 5.2	Strip and stockpile good topsoil during construction for use in surface preparation prior to planting.
☐	PC 5.3	Plant as soon as possible after the area has been graded.
☐	PC 5.4	After cultivation and installation of irrigation systems (if used) are completed, areas to be planted shall be fine graded and rolled. Topsoil may be needed in areas where soil textures are inadequate.
☐	PC 5.5	Water or irrigate the vegetation as needed to supplement rainfall until established.
☐	PC 5.6	Fertilize in accordance with label instructions and the needs of the soil as indicated by tests.
☐	PC 5.7	Avoid using the buffer strip or vegetated channel for vehicular traffic, as it will damage the vegetation and reduce its effectiveness.
☐	PC 5.8	Application of fertilizers and pesticides, or other soil amendments or chemicals, shall comply with all applicable regulations and label instructions.
☐	PC 5.9	Select a seed mixture appropriate to the site conditions, remembering that dense grasses are the most effective in slowing flow velocities and erosion as well as removing pollutants such as sediment.
☐	PC 5.10	Use planting equipment and methods that provide uniform distribution and placement of seed.
☐	PC 5.11	Sod shall be protected with tarps or other protective covers during delivery and shall not be allowed to dry out between harvesting and placement.
☐	PC 5.12	If irregular or uneven areas appear before or during the plant establishment period, such areas shall be restored to a smooth and even appearance.
☐	PC 5.13	Inspect plantings weekly and after significant storm events, until turf is established, and routinely thereafter. Repair eroded or damaged areas as needed to maintain effectiveness as a buffer strip.
☐	PC 5.14	Maintenance shall consist of mowing, weeding, and ensuring that the irrigation system (if used) is operating properly to sustain growth.

Figure 2. Vegetated Buffer Strips and Channels



Notes:

1. For Implementation see City and County of Honolulu Storm Water Construction BMP Details SE-14 (Vegetated Buffer Strips and Channels).
2. If existing vegetation will be used as a buffer strip, EC-2 (Preservation of Existing Vegetation).

Typical Vegetated Buffer Strip

Source: Prince George's County, Low-Impact Development Design Strategies: An Integrated Environmental Design Approach, 1999

Source: City and County of Honolulu BMP Manual, November 2011.

Permanent Best Management Practices
PC6: Earth Dikes, Drainage Swales, and Lined Ditches

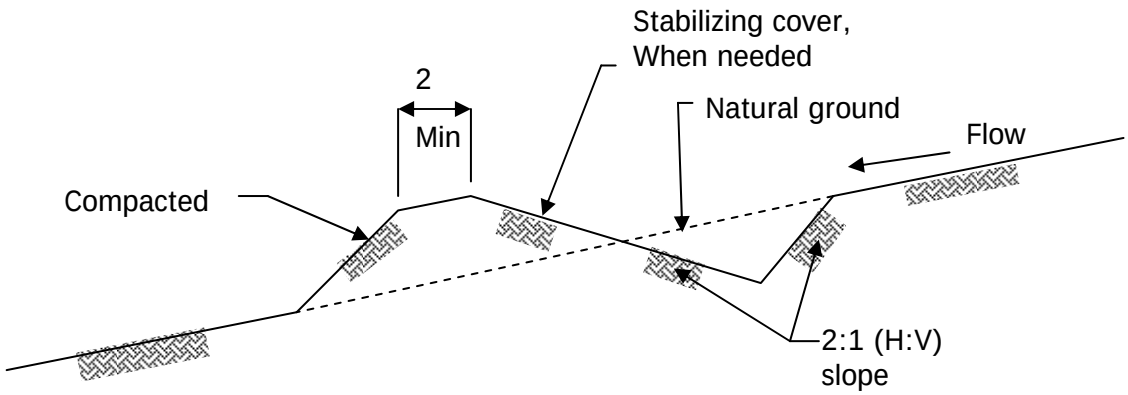
Description
Earth dikes, drainage swales, and lined ditches are structures that intercept, divert, and convey surface runoff. The primary functions of such structures are to prevent erosion and to reduce pollutant loading conveyed to receiving waters. Typical drainage swales and earth dike sections are attached.

Limitations
Earth dikes, drainage swales and lined ditches must be correctly sized and located. Excessively steep, unlined ditches and swales are subject to erosion and gully formation. Unstabilized tributary areas will reduce the effectiveness of these measures, which can cause water to pond in tributary areas will reduce the effectiveness of these measures, which can cause water to pond in active traffic lanes, material storage areas, etc., if not properly sized. Altering existing waterways or clearing existing vegetation may require permits from the Hawaii Department of Health, or the U.S. Army Corps of Engineers.

Practice		
☐	PC 6.1	Select the design flow and safety factor based on evaluation of the risks associated with erosion and over topping, flow backups, or wash out of the structure.
☐	PC 6.2	Examine the site for run-on from off-site sources.
☐	PC 6.3	Select a flow velocity limit based on site-specific soil types and drainage flow patterns.
☐	PC 6.4	Establish a maximum flow velocity for using earth dikes and swales, above which a lined ditch must be used.
☐	PC 6.5	Design an emergency overflow section or bypass area for larger storms that exceed the design storm.
☐	PC 6.6	Install and utilize permanent dikes, swales, and ditches early in the construction process.
☐	PC 6.7	Conveyances must be lined when velocities exceed allowable limits for the soil type. Consider use of riprap, engineering fabric, vegetation, or concrete.
☐	PC 6.8	If sediment-laden water is expected in those conveyances, discharge flows from the conveyance into a sediment-trapping device.
☐	PC 6.9	Temporary conveyances are to be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.
☐	PC 6.10	Inspect permanent conveyances at least once every two years.

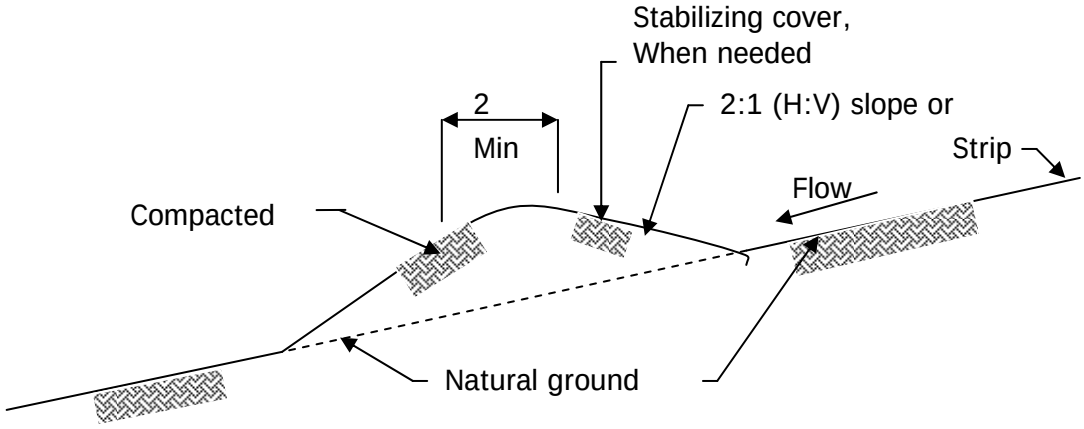
*Example Drainage Swale and Earth Dike attached.

Figure 3. Typical Drainage Swale Design



TYPICAL DRAINAGE SWALE

NOT TO SCALE



TYPICAL EARTH DIKE

NOT TO SCALE

Source: California Stormwater BMP Handbook. January 2003.

Permanent Best Management Practices
PC7: Slope Drains and Subsurface Drains

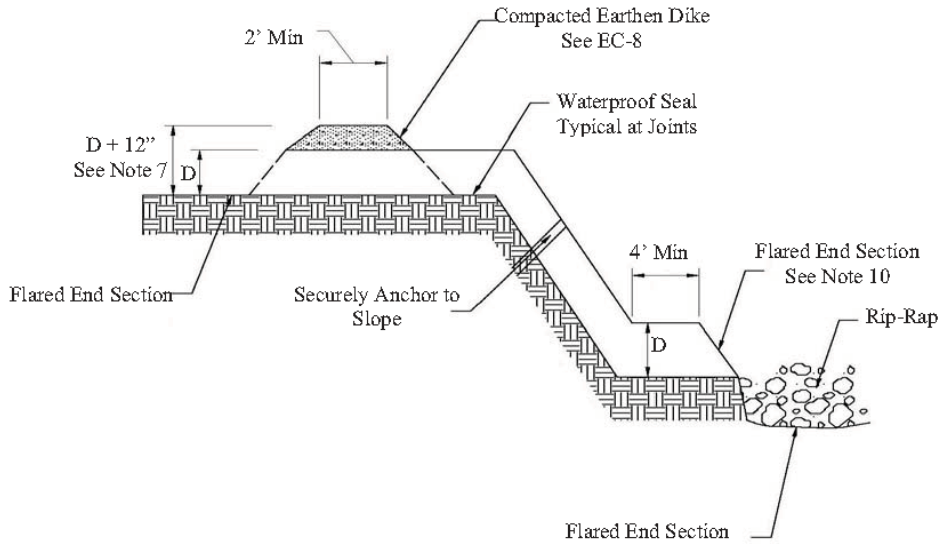
Description
A slope or subsurface drain is a pipe used to intercept and direct surface runoff or ground water into a stabilized watercourse, trapping devic or other stabilized area. The primary function of a slope drain is to convey runoff down cut or fill slopes. A typical slope drain schematic is attached. The primary function of subsurface drains is to drain excessive soil saturation in sloping areas.

Limitations
- Severe erosion may result when slope drains fail by over topping or pipe separation.
- Subsurface drains may remove fine soils, which can result in slope failure.

Practice		
DESIGNING SLOPE DRAINS:		
☐	PC 7.1	Limit drainage area per pipe to 10 acres. For larger areas, use a lined channel or a series of pipes.
☐	PC 7.2	Use interceptor dikes to direct surface runoff into a slope drain.
☐	PC 7.3	Use a standard flared end section or headwall at the entrance to pipe slope drains larger than 12 inches to improve inlet hydraulics.
☐	PC 7.4	Place drainpipes on or bury them underneath the sloped surface.
☐	PC 7.5	Direct flows to a detention basin if the slope drain has the potential to convey sediment-laden water.
INSTALLING SLOPE DRAINS:		
☐	PC 7.6	Install perpendicular to slope contours.
☐	PC 7.7	Maximum slope shall be 2:1 (H:V). If a steeper slope is required, use extra durable outlet protection.
☐	PC 7.8	Protect area around inlet with lining such as vegetation, filter cloth, etc.
☐	PC 7.9	Protect outlets with riprap or some other method of energy dissipation. Where high exit velocities are expected, reinforce riprap with concrete or use reinforced concrete device.
☐	PC 7.10	Compact soil around and under entrance, outlet, and along length of pipe.
☐	PC 7.11	Securely anchor and stabilize pipe and appurtenances into soil.
DESIGNING SUBSURFACE DRAINS:		
☐	PC 7.12	Review relative size of soil and slot/perforation size in the pipe to prevent sediment from entering pipe.
☐	PC 7.13	Install relief drains for groundwater table lowering parallel to the slope, and drain to the side of the slope. Use a gridiron, herringbone, or random pattern.
☐	PC 7.14	Install interceptor drains to prevent excessive soil saturation perpendicular to the slope and divert the discharge to the side of the slope.
☐	PC 7.15	Inspect slope and subsurface drains annually during the rainy season. Follow routine inspection procedures for inlet thereafter.

*Example Slope Drain attached.

Figure 4. Slope Drain Design



Section "A"

Notes:

1. Install slope drains perpendicular to slope contours.
2. Slope drains can be placed on or buried underneath the slope surface.
3. Compact soil around and under entrance, outlet, and along length of pipe.
4. Securely anchor and stabilize pipe and appurtenances into soil.
5. Check to ensure that pipe connections are watertight.
6. Protect area around inlet with filter cloth.
7. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
8. Maximum slope generally limited to 2:1 (H:V).
9. Direct surface runoff to slope drains with interceptor dikes. See BMP EC-00, Earth Dikes and Drainage Swales.
10. Protect outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device. The flared section should slope towards the pipe inlet.
11. The pipe size may be computed using the Rational Method or alternate methods accepted by the City and County of Honolulu.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter, D (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

12. Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.

Typical Slope Drain

Source: City and County of Honolulu BMP Manual, November 2011.

Permanent Best Management Practices
PC8: Top and Toe of Slope Diversion Ditches/Berms

Description
Top and toe of slope diversion ditches/berms are devices used to intercept and direct surface runoff to a slope drain, stabilized watercourse, or stabilized area. The primary function of top and toe of slope diversion ditches/berms is to:

- Minimize sheet flow over slope surfaces.
- Reduce sedimentation by conveying collected runoff to a protected drainage system.

Limitations
Ditches/berms are not sediment trapping devices. If it is anticipated that sediment-laden water will be discharged to the diversion structure, a detention basin or other means to settle and collect soil particles needs to be provided.

Practice		
☐	PC 8.1	Select design flow and safety factors based on evaluation of risks associated with erosion and overtopping, flow backups, or washout of the structure.
☐	PC 8.2	Line or stabilize ditches where high flow velocities will occur.
☐	PC 8.3	At top of slope, direct flow to slope drains.
☐	PC 8.4	When installing diversion ditches and berms protect outlets from erosion.
☐	PC 8.5	Use planned permanent ditches/berms early in the construction phase when practicable.
☐	PC 8.6	Inspect permanent measures prior to the rainy season, after rainfall events, and regularly (approximately once per month) during the rainy season.
☐	PC 8.7	Inspect ditches/berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
☐	PC 8.8	Inspect structures and their inlets and outlets for accumulation of debris and sediment. Remove debris and sediment as needed.

Permanent Best Management Practices
PC9: Outlet Protection / Velocity Dissipation Devices

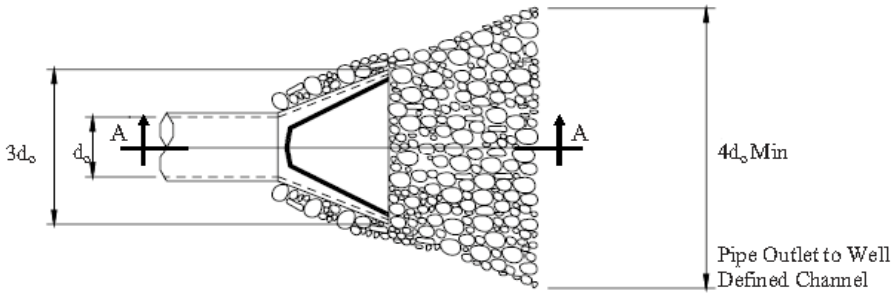
Description
Outlet protection/velocity dissipation devices are physical mechanisms placed at the outlets of pipes and channels. The primary function of such devices is to reduce the velocity and/or energy of existing water, preventing scour and minimizing the potential for downstream erosion. A typical outlet protection design is attached.

Limitations
- Ungrouted riprap may have stones washed away by flows that exceed the design flow.
- Grouted riprap may break up from hydrostatic pressure unless adequate subsurface drainage is provided.

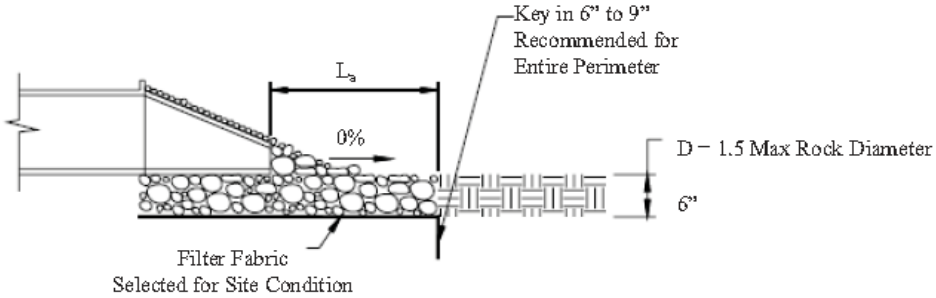
Practice		
☐	PC 9.1	Apron length shall be based on outlet flow rate and tail-water level.
☐	PC 9.2	Align apron with receiving stream and keep the apron straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.
☐	PC 9.3	If the size of apron riprap is 12 inches or longer, protect the underlying filter fabric with 4 inches minimum of gravel blanket.
☐	PC 9.4	Provide additional protection where flow re-concentration and high flow velocities leaving the apron can occur, such as at the top of cut slopes or on slopes steeper than 10 percent.
☐	PC 9.5	Establish a routine inspection schedule for permanent measures so that all structures are inspected at least once every three years.

*Example Outlet Protection attached.

Figure 5. Outlet Protection Design



Plan"A"



Section A-A

Notes:

1. The apron length and rock size gradation are determined using the table above.
2. Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
3. Carefully place riprap to avoid damaging the filter fabric.
   a. Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
   b. Stone 8 in. to 12 in. should be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.
   c. Stone greater than 12 in. should only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D50 rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.
4. Outlets on slopes steeper than 10 percent should have additional protection.
5. Design should comply with city and state regulations.

Pipe Diameter, do (inches)	Discharge (ft^3/s)	Apron Length, La (ft)	Rip Rap D50 Diameter Min (inches)
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Licensed Civil Engineer

Source: USDA- SCS

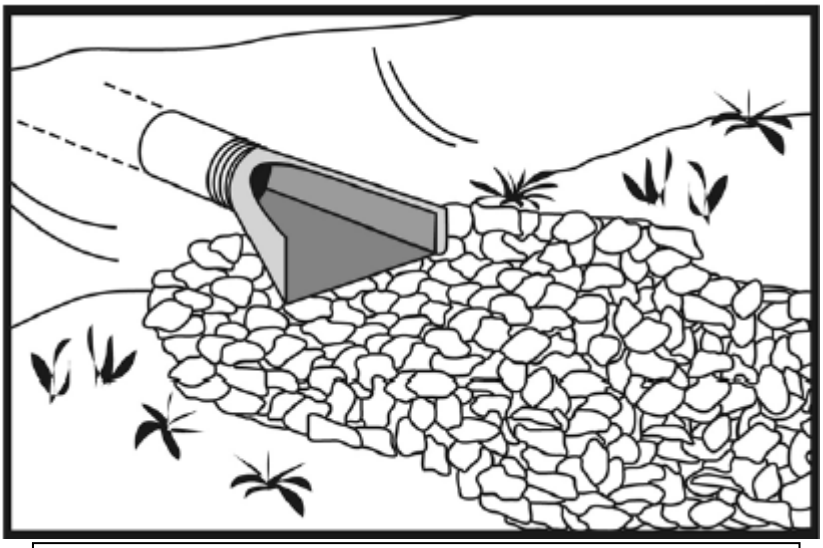
Source: City and County of Honolulu BMP Manual, November 2011.

Permanent Best Management Practices
PC10: Flared Culvert End Sections

Description
Flared culvert end sections are physical devices at the inlets and outlets of pipes and channels. The primary function of flared culvert end sections is to help prevent scour and minimize erosion at inlets and outlets. Such end sections can also improve the hydraulic operation and retain the embankment near pipe conveyances. A general design concept for a flared end section is attached.

Limitations
Flared end sections primarily provide hydraulic efficiency within a drainage system. They also provide limited erosion control benefits.

Practice		
☐	PC 10.1	Construct at zero grade when possible.
☐	PC 10.2	Use in conjunction with other outlet protection.
☐	PC 10.3	At inlets, protect the transition into a flared end section to prevent scouring.
☐	PC 10.4	Inspect flared end sections before the rainy season.



Source: Department of Transportation, Highways Division. Storm Water Permanent BMP Manual. March 2007.

Permanent Best Management Practices
PC11: Slope Roughening / Terracing / Rounding

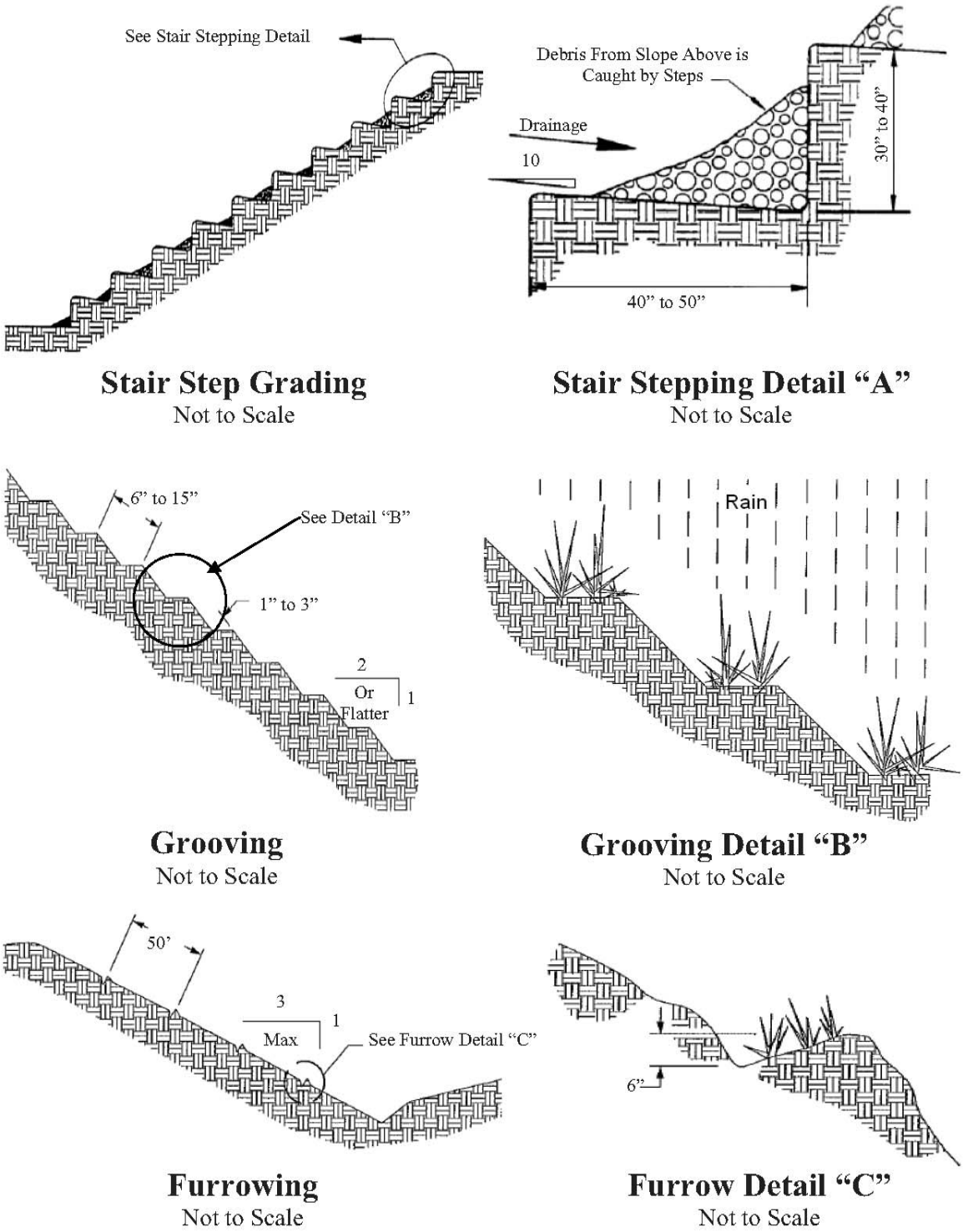
Description
Roughening, terracing, and rounding are techniques used for creating down slope unevenness on bare soil. This is done by constructing furrows or intermediate benches running across a slope or by use of construction equipment to track the soil surface. The primary function of surface roughening or terracing is to reduce erosion potential by decreasing runoff velocities, reducing the length of sheet flow, trapping sediment, and increasing infiltration of water into the soil.

Limitations
- Roughening may increase grading costs and lead to sloughing in certain soil types.
- Stair-step grading may not be practical for sandy, steep, or shallow soils.
- Roughening alone as a temporary erosion control or surface preparation measure is of limited effectiveness in intense rainfall events. If roughening effects are washed away in a heavy storm, the surface will have to be re-roughened and new seed and mulch applied.

Practice		
CUT SLOPE ROUGHENING:		
☐	PC 11.1	Use stair-step grading or furrows (groove cuts) on slopes that are steeper than 3:1 (H:V) and on erodible material that is soft enough to be ripped by a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
☐	PC 11.2	Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in towards the slope.
☐	PC 11.3	Do not make individual vertical cuts more than 24 inches high in soft materials or more than 36 inches high in rocky materials.
☐	PC 11.4	Groove the slope using machinery to create a series of ridges and depressions that run across the slope and on the contour.
FILL SLOPE ROUGHENING:		
☐	PC 11.5	Place fill slopes with gradient steeper than 3:1 (H:V) in lifts not exceeding 8 inches, and assure each lift is properly compacted. The face of the slope shall consist of loose, uncompacted fill 4 to 6 inches deep. Do not blade or scrape the final slope face.
☐	PC 11.6	Use grooving or tracking to roughen the face of the slopes, as necessary.
CUTS, FILLS, AND GRADED AREAS:		
☐	PC 11.7	Slopes that will be maintained by mowing shall be no steeper than 3:1 (H:V).
☐	PC 11.8	To roughen these areas, create shallow grooves by normal tilling, disking, harrowing, or use a cultivator-seeder. Make the final pass of any such tillage on the contour.
☐	PC 11.9	Make grooves formed by such implements close together, less than 10 inches apart and not less than 1 inch deep. Excessive roughness is undesirable where mowing is planned.
ROUGHENING WITH TRACKED MACHINERY:		
☐	PC11.10	Limit roughening with tracked machinery to soils with a sandy texture to avoid undue compaction of the soil surface.
☐	PC11.11	Operate tracked machinery up and down the slope to leave horizontal depressions in the soil.
TERRACING:		
☐	PC11.12	Terraces or benches are to be considered in design of slopes 4:1 (H:V) when slope heights exceed 30 feet. For highly erosive soils, and steeper slopes, slope heights as low as 15 feet are considered.
☐	PC11.13	Runoff from terraces and benches are to be directed to lined diversion ditches, installed where the terrace meets the slope.
☐	PC11.14	All slopes shall be rounded and then seeded and mulched to obtain seed germination and growth.

*Example Slope Terracing attached.

Figure 6. Slope Terracing Designs



Source: City and County of Honolulu BMP Manual, November 2011.

Permanent Best Management Practices
PC12: Level Spreader

Description
A level spreader is an outlet for dikes and diversions that disperses the runoff discharged from the slope. Its primary function is to help reduce erosion by dispersing small volumes of concentrated runoff as sheet flow. A level spreader can be the top of a channel, an earthen berm, or a rigid weir-like structure that distributes flow fairly evenly across its length at non-erosive velocities onto stabilized areas.

Limitations
The maximum flow into a level spreader shall not exceed 30 cubic feet per second. The level spreader lip must have a zero slope for proper operation, allowing the discharged water to flow evenly onto the stabilized area. A level spreader is not a sediment trapping or filtering device. Water flowing into the level spreader should be free of sediment.

Practice		
☐	PC 12.1	Construct a level spreader on undisturbed soil and not on fill material.
☐	PC 12.2	Runoff water containing high sediment loads must be treated in a sediment-trapping device before being released to a level spreader.
☐	PC 12.3	Use a rigid outlet lip design for high discharge flow conditions.
☐	PC 12.4	The outlet area below the level spreader must be uniform and well vegetated having a slope of 10% or less.
☐	PC 12.5	Do not allow discharge flow to re-concentrate below the level spreader outlet.
☐	PC 12.6	Vehicles and heavy equipment are not to be operated in the level spreader, because they can create surface indentations that concentrate flow.
☐	PC 12.7	Inspect for debris and sediment accumulation in the level spreader channel. Remove accumulated debris and sediment within 30 days of inspection.
☐	PC 12.8	Inspect level spreaders prior to the rainy season and after rainfall events exceeding their design storm intensity (25-year recurrence interval, 1-hour duration, unless otherwise directed).

Permanent Best Management Practices
PC13: Infiltration Trench

Description

The infiltration trench provides recharge and water quality volume in one location. Infiltrated storm water shall be filtered through soils prior to entering groundwater. Storm water can also be filtered for pollutants by other suitable media that is accompanied by a certification from a licensed civil engineer, stating that the filter/device will remove 80 percent of total suspended solids from the design flow rate. Infiltration will only be used where soil conditions and slope stability are suitable.

Limitations

- Underlying soils need to have specific infiltration rates, which are tested with geotechnical borings (add specific requirements)
- Soils shall have a clay content of less than 20% and a silt/clay content of less than 40%.
- Infiltration cannot be located on slopes greater than 15% or within fill soils.

Practice		
☐	PC 13.1	Calculate flow to determine capacity: **WQFR = C x 0.4" x A** • WQFR = water quality flow rate in cubic feet per second • C = runoff coefficient (C =0.8 for pervious surface, C= 0.9 for impervious surface). • A = area of the site in acres • 0.4" = hourly rainfall intensity
☐	PC 13.2	The bottom of the trench will be separated by at least 4" vertically for the seasonally high water table or bedrock layer. The trench will be located at least 100 feet away from any water well.
☐	PC 13.3	The trench will have a maximum contributing area of five acres.
☐	PC 13.4	All trenches will be designed to fully de-water the entire water quality volume within 48 hours after the storm event.
☐	PC 13.5	Provide adequate storm water outfalls for the overflow associated with the ten-year design storm event.
☐	PC 13.6	Since the trench will be located "off-line" from the main conveyance system, a flow splitter will be required to divert the water quality volume into the filter.
☐	PC 13.7	Trench construction specifications should state the earliest point in progress when storm drainage may be directed to the trench.
☐	PC 13.8	Final excavation to the final grade should be done after all disturbed areas in the watershed area are stabilized or protected.
☐	PC 13.9	After the completion of final grading, the trench should be well aerated and have a highly porous surface texture.
☐	PC13.10	Trenches may be lined with a 6 to 12 inch layer of filter material, such as coarse sand to help prevent the build-up of impervious deposits. The filter layer can be replaced or cleaned when clogged.
☐	PC13.11	Establish dense vegetation on trench side slopes and floor to prevent erosion and maintain high infiltration rates.
☐	PC13.12	Long-term techniques for infiltration protection are required (2 per trench): • Grass channel • Grass filter strip (minimum 20 feet and only if sheet flow is established and maintained) • Bottom sand layer • Upper sand layer (6" minimum) with filter fabric at sand/gravel interface • Washed bank run gravel used as aggregate

Permanent Post-Construction Best Management Practices
PC14: Retention Basin

Description

A retention basin is a surface depression designed to capture the runoff volume from the water quality design storm for disposal through evaporation and percolation. The primary functions of retention basins are to remove pollutants from storm water runoff where soil conditions are suitable, and to recharge or replenish ground water. In addition, retention basins can significantly reduce total annual surface runoff volume, which can reduce stream bank erosion and other adverse impacts to stream habitats from storm water runoff.

Limitations

- Retention basins can be effectively used only where the soil porosity and evapotranspiration capacity are adequate to dispose of the required quantity of storm water within a reasonable period of time, typically considered to be not more than 5 days. This allows the basin's capacity to be reestablished and reduces the potential for unsanitary conditions, such as mosquito breeding, associated with stagnant water.
- The wet-weather table must be at least 3 feet below the bottom of the retention basin.
- Very porous soils provide low removal of dissolved pollutants, which an increase the risk of ground water contamination.
- Retention basins may not be suitable near drinking water wells, foundations, septic tanks, drain fields, fill sites or steep, unstable slopes.
- Retention basins are not used where there is significant potential for hazardous chemical spills.
- Retention basins usually fail if they receive high sediment loads. Therefore, retention basins are not to be used until upstream drainage area is stabilized.

Practice		
☐	PC 14.1	Calculate flow to determine capacity: **WQFR = C x 0.4" x A** • WQFR = water quality flow rate in cubic feet per second • C = runoff coefficient (C =0.8 for pervious surface, C= 0.9 for impervious surface). • A = area of the site in acres • 0.4" = hourly rainfall intensity
☐	PC 14.2	Special precautions must be applied to the project scheduling, construction techniques, and the equipment used to protect the natural infiltration rate.
☐	PC 14.3	Lightweight equipment and construction procedures that minimize compaction shall be used. The basin area shall be flagged off while heavy equipment is in the area.
☐	PC 14.4	Storm water shall be not allowed to enter the retention basin until all construction is completed and the contributing drainage area to the basin is adequately stabilized. If this prohibition is not feasible in particular situations, do not excavate the facility to the final grade until the contributing drainage area has been stabilized.
☐	PC 14.5	Retention basins are to be inspected annually and following significant storm events.
☐	PC 14.6	Debris and sediment accumulations are to be removed from the retention basin whenever these materials prevent proper functioning of the basin. Generally, this occurs when the sediment layer exceeds 12 inches.
☐	PC 14.7	Retention basin floors shall be tilled as needed to restore the infiltration capacity and to control weed growth on the basin floor. Tilling shall be accomplished using rotary tillers or disc harrows.

Permanent Best Management Practices
PC15: Green Roofs

Description

A green roof, or rooftop garden, is a vegetative layer grown on top of an elevated impervious surface. Green roofs provide shade and reduce the heat within the structure through evapotranspiration, which reduces the temperatures of the roof surface and the surrounding air. In addition to mitigating urban heat islands, green roofs provide enhanced storm water management and water quality treatment. They can reduce and slow storm water runoff from impervious areas. The plants and growing medium of a green roof, in the same manner as other natural surfaces and vegetation, absorb water that would otherwise become runoff. Green roofs can be installed on a wide range of buildings, from industrial facilities to private residences. They can be as simple as a 2-inch covering of hardy groundcover generally termed an "extensive" system, or as complex as a fully accessible park complete with trees, called an "intensive" system.

Limitations

The amount of rainfall retained by a green roof will depend primarily on the depth of the growing medium and may also be affected by the roof slope.

Practice		
☐	PC 15.1	Select succulent, hardy varieties of plants that do not require shade as well as other vegetation general suitable for the environment in Hawaii.
☐	PC 15.2	Ensure that roof structure can support the added weight of both plants and growing media.
☐	PC 15.3	Choose roofs with a slope between 0 to 40 degrees.
☐	PC 15.4	Immediately after planting, inspect green roof frequently to ensure that the vegetation is thriving.
☐	PC 15.5	After the first season, inspect and fertilize green roofs once per year and during draught conditions.
☐	PC 15.6	Intensive green roofs may require the installation of an irrigation system.

Permanent Best Management Practices
PC16: Alternative Wetlands

Description
The Federal Aviation Administration (FAA) requires that wildlife, specifically birds, be limited within the airport due to the safety threat they pose to the aircraft. Therefore, it is not recommended that large wetlands be developed within the airport limits, since they will likely draw local bird populations. However, alternative wetlands can be considered.

Floating Wetlands are constructed of vegetation grown on a raft. The raft is placed in a polluted body of water such as a canal and the plants draw pollutants out of the water. Depending on the type of plant, the pollutant will either be stored in the plant or metabolized.

Modular Wetlands are small wetlands that can be created adjacent to storm drains. These wetlands are usually accompanied by a 4-Stage Treatment Train. They can be used to treat the storm water in the MS4 as well as to reduce the flow rate.

Limitations
Prior approval from DOTA will be required to connect a new drain with the MS4.

Practice		
☐	PC 16.1	Determine the type of alternative wetland needed and the size of the area to be treated.
☐	PC 16.2	Pick hardy plants common to Hawaii in order to limit the watering and landscaping requirements.
Floating Wetlands		
☐	PC 16.3	Construct a raft by either pinning together potted plants or using coir or other compatible substance for the base.
☐	PC 16.4	Pre-plant the vegetation and anchor in the water (culvert or stream).
☐	PC 16.5	Inspect the rafts to ensure that the vegetation remains viable and the raft is intact.
☐	PC 16.6	If using the raft to treat the water, non-viable vegetation may have to be treated as hazardous waste.
Modular Wetlands		
☐	PC 16.7	Design the storm drain so that the water will be directed through the plant bed before entering the MS4.
☐	PC 16.8	Provide a bypass valve for heavy storm water flows.
☐	PC 16.9	Consider included a trap to collect large debris items to prevent the vegetation bed from clogging.
☐	PC16.10	Inspect the drain and remove the filter if applicable, ensure the vegetation is viable, and that water is flowing through the drain.
Other Wetlands		
☐	PC16.12	Follow the manufacturer's instructions for any other type of alternative wetland.

Permanent Best Management Practices
PC17: Green Parking

Description
Green parking refers to several techniques that applied in the right combination can reduce the total impervious groundcover; thereby reducing the quantity of storm water runoff.

Limitations
Green parking may not work in all instances.

Practice		
☐	PC 17.1	Determine the size of the parking lot based on the average parking demand versus the peak demand.
☐	PC 17.2	Minimize the dimensions of parking spaces within the limitations of the local code.
☐	PC 17.3	Use bioretention areas to treat storm water.
☐	PC 17.4	Encourage carpooling.
☐	PC 17.5	Utilize alternative pavers in parking areas.

Permanent Best Management Practices
PC18: Alternative Pavers

Description

Alternative pavers are permeable surfaces that can replace asphalt or concrete and can be used for driveways, parking lots, and walkways. Alternative pavers include gravel, cobbles, wood, mulch, brick, grass pavers, turf blocks, natural stone, pervious concrete, and porous asphalt. This reduces the amount of impervious surface and therefore reduces storm water runoff. Additionally, the pavers can act as a filter for the runoff to remove contaminants. Alternative pavers can be used in conjunction with green parking techniques and bioretention. The following table shows the level of water quality effectiveness achieved by each material and the associated costs.

Material	Water Quality Effectiveness	Installation Cost	Maintenance Cost
Conventional Asphalt/ Concrete	Low	Medium	Low
Brick (in a loose configuration)	Medium	High	Medium
Natural Stone	Medium	High	Medium
Gravel	High	Low	Medium
Wood Mulch	High	Low	Medium
Cobbles	Medium	Low	Medium

Source: Bay Area Stormwater Management Agencies Association (BASMAA). January 1997. *Start at the Source: Residential Site Planning and Design Guidance Manual for Stormwater Quality Protection*. BASMAA, San Francisco, CA.

Limitations

Alternative pavers are not recommended for high traffic volumes. A discharge pipe from the alternative pavement should be connected to the MS4 with approval from DOTA to allow for bypass during large storm events.

Practice		
☐	PC 18.1	Paving blocks are blocks that are laid in a grid to allow space between the blocks.
☐	PC 18.2	Determine the infiltration rate based on the known storm events and soil type. Soils should have an infiltration rate of 0.5 inches per hour.
☐	PC 18.3	Install a discharge pipe from the alternative pavement area to allow bypass during large storm events.
☐	PC 18.4	Frequent sweeping is important to prevent clogging.
☐	PC 18.5	Landscaping upland of the alternative pavers is important to reduce sediment loads in the runoff.
☐	PC 18.6	Inspect the alternative pavers for weathering including paver breakage and cracking as well as potential pollutants, such as oil leaks and sediment build-up.
☐	PC 18.7	Respond to oil leaks with absorbent materials and/or remove the contaminated sediment.

Permanent Best Management Practices
PC19: Bioretention

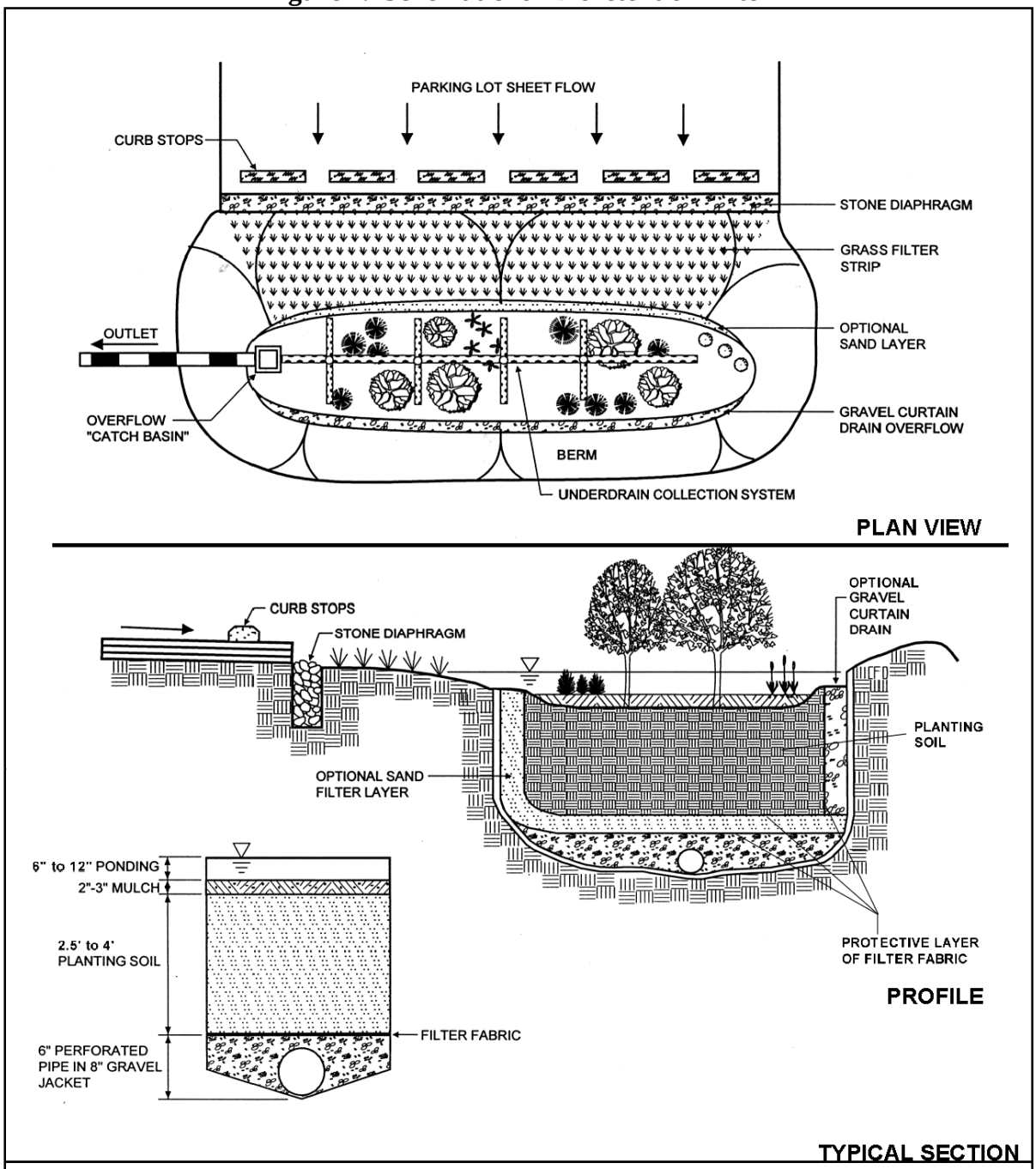
Description
Bioretention combines open space with storm water treatment in vegetated areas where runoff is directed through vegetation and soils for filtration. It captures and temporarily stores the water quality volume and passes it through a filter bed of sand, organic matter, soil, or other media. Filtered runoff may be collected and returned to the conveyance system or allowed to partially infiltrate into the soil.

Limitations
Unless there is adequate infiltration capacity, under drains and overflow drains should be included to collect and discharge filtered runoff to the storm drainage system.

Practice		
☐	PC 19.1	A porosity value "n" (n=Void Volume/Total Volume) of 0.40 should be used in the design of stone reservoirs for infiltration methods.
☐	PC 19.2	Calculate flow to determine capacity: **WQFR = C x 0.4" x A** • WQFR = water quality flow rate in cubic feet per second • C = runoff coefficient (C =0.8 for pervious surface, C= 0.9 for impervious surface). • A = area of the site in acres • 0.4" = hourly rainfall intensity
☐	PC 19.3	Calculate the required filter bed area (Af): **Af = (WQv) x (df)/ [(k) x (hf+df) x (tf)]** • WQv = water quality volume (cu. ft) • df = filter bed depth (ft) • k = coefficient pf permeability of the filter bed (ft/day) • hf = height of water above the filter bed (ft) • tf = design filter bed drain time (days)- 2 days recommended
☐	PC 19.4	Pretreatment includes ensuring a 2 ½ to 4 foot deep planting soil bed, a surface mulch layer, and a 12" deep surface ponding area.
☐	PC 19.5	The ponding depth should be 6 inches or less with a mulch layer of 2 to 3 inches.
☐	PC 19.6	Overflow for the ten-year storm event shall be provided to a non-erosive outlet point and non-erosive velocities shall result.
☐	PC 19.7	A flow regulator shall be provided to divert the water quality volume to the filtering practice.
☐	PC 19.8	The filters shall have a 6 inch perforated under drain pipe in a gravel layer.
☐	PC 19.9	A permeable filter fabric shall be places between the gravel layer and the filter media.
☐	PC19.10	Landscaping is critical to the function and performance of the bioretention areas. A landscaping plan shall be provided for these areas including dense and vigorous vegetation.

*Example Bioretention attached.

Figure 7. Schematic for Bioretention Filter



Bioretention combines open space with stormwater treatment.

Source: Maryland Department of the Environment. 2000.

Permanent Best Management Practices
PC20: Sand Filters

Description

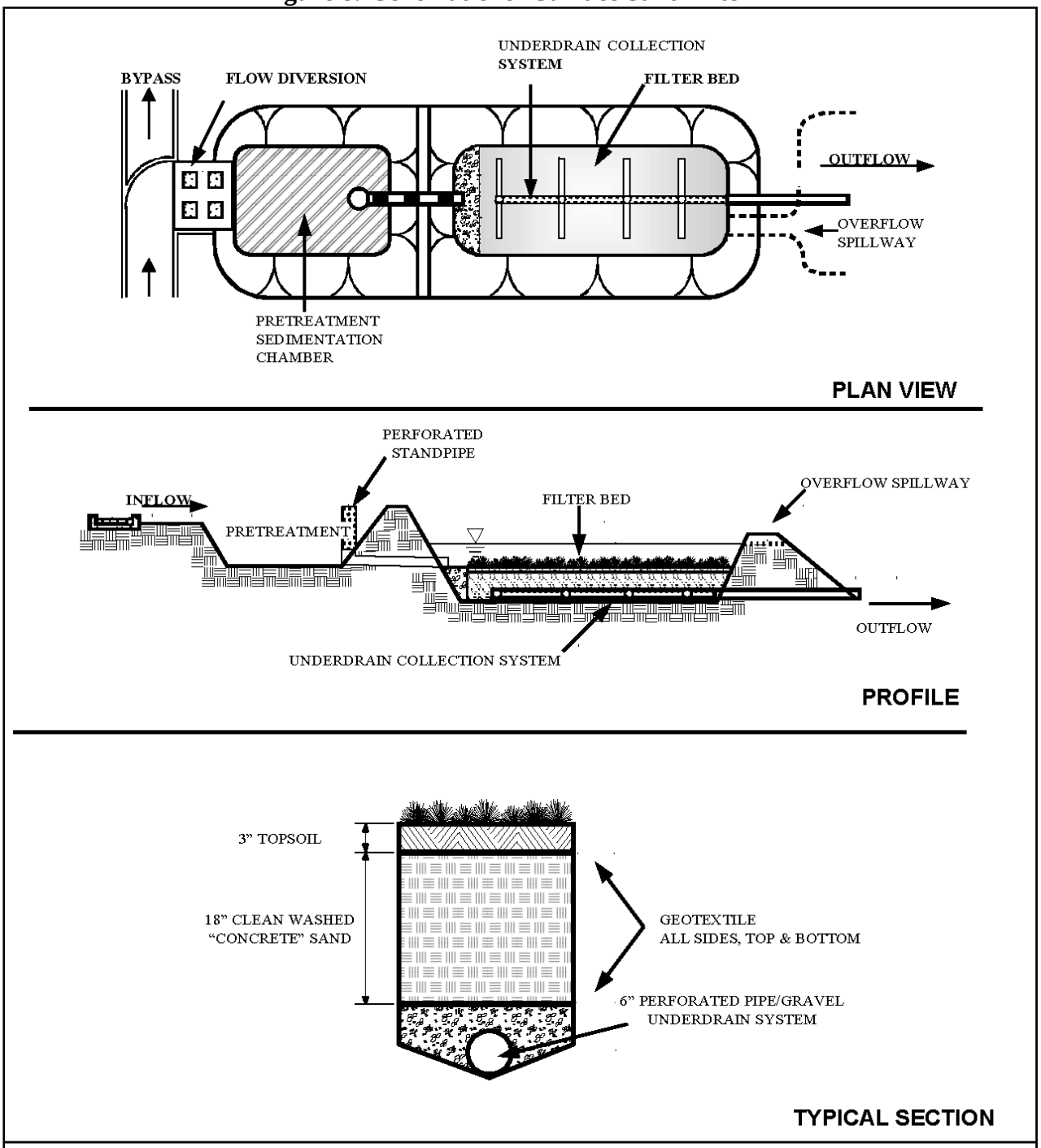
Sand filters are usually designed as two-chambered storm water practices; the first is a settling chamber, and the second is a filter bed filled with sand or another filtering media. As storm water flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as storm water flows through the filtering medium. There are several modifications of the basic sand filter design, including the surface sand filter, underground sand filter, perimeter sand filter, organic media filter, and Multi-Chamber Treatment Train. All of these filtering practices operate on the same basic principle. Modifications to the traditional surface sand filter were made primarily to fit sand filters into more challenging design sites (e.g., underground and perimeter filters) or to improve pollutant removal (e.g., organic media filter).

Limitations

- Sand filters cannot control floods and generally are not designed to protect stream channels from erosion or to recharge the ground water.
- They require frequent maintenance, and underground and perimeter versions of these practices are easily forgotten because they are out of sight.
- They cannot be used to treat large drainage areas.
- Surface sand filters are generally not aesthetically pleasing practices but underground and perimeter sand filters are not visible, and thus do not add or detract from the aesthetic value of a site.

Practice		
☐	PC 20.1	Sand filters are best applied on relatively small sites (up to 10 acres for surface sand filters and closer to 2 acres for perimeter or underground filters.
☐	PC 20.2	They require an elevation drop, or head (about 5 to 8 feet), to allow flow through the system.
☐	PC 20.3	Provide at least 2 feet of separation between the bottom of the filter and the seasonally high ground water table to prevent damage to the filter and ground water contamination.
☐	PC 20.4	Pretreatment is achieved in the sedimentation chamber that precedes the filter bed. In this chamber, the coarsest particles settle out; this prevents clogging as the particles do not reach the filter bed.
☐	PC 20.5	Provide at least 25 percent of the water quality volume in a dry or wet sedimentation chamber as pretreatment to the filter system.
☐	PC 20.6	The water quality volume is the amount of runoff that will be treated for pollutant removal in the practice. Typical water quality volumes are the runoff from a 1-inch storm or ½ inch of runoff over the entire drainage area to the practice.
☐	PC 20.7	To determine the amount of runoff that will be treated for pollutant removal, calculate flow to determine water quality flow rate (cfs): **WQFR = C x 0.4" x A** • WQFR = water quality flow rate in cubic feet per second • C = runoff coefficient (C =0.8 for pervious surface, C= 0.9 for impervious surface). • A = area of the site in acres • 0.4" = hourly rainfall intensity
☐	PC 20.8	Calculate the required filter bed area (Af): **Af = (WQv) x (df)/ [(k) x (hf+df) x (tf)]** • WQv = water quality volume (cu. ft) • df = filter bed depth (ft) • k = coefficient pf permeability of the filter bed (ft/day) • hf = height of water above the filter bed (ft) • tf = design filter bed drain time (days)- 2 days recommended
☐	PC 20.9	Provide at least 75 percent of the water quality volume in the practice including both the sand chamber and the sediment chamber.
☐	PC20.11	Construct an under drain, which is a perforated pipe system in a gravel bed that is installed on the bottom of filtering practices and used to collect and remove filtered runoff.
☐	PC20.12	Use a flow splitter, which is a structure that bypasses larger flows to the storm drain system or to a stabilized channel during larger storms

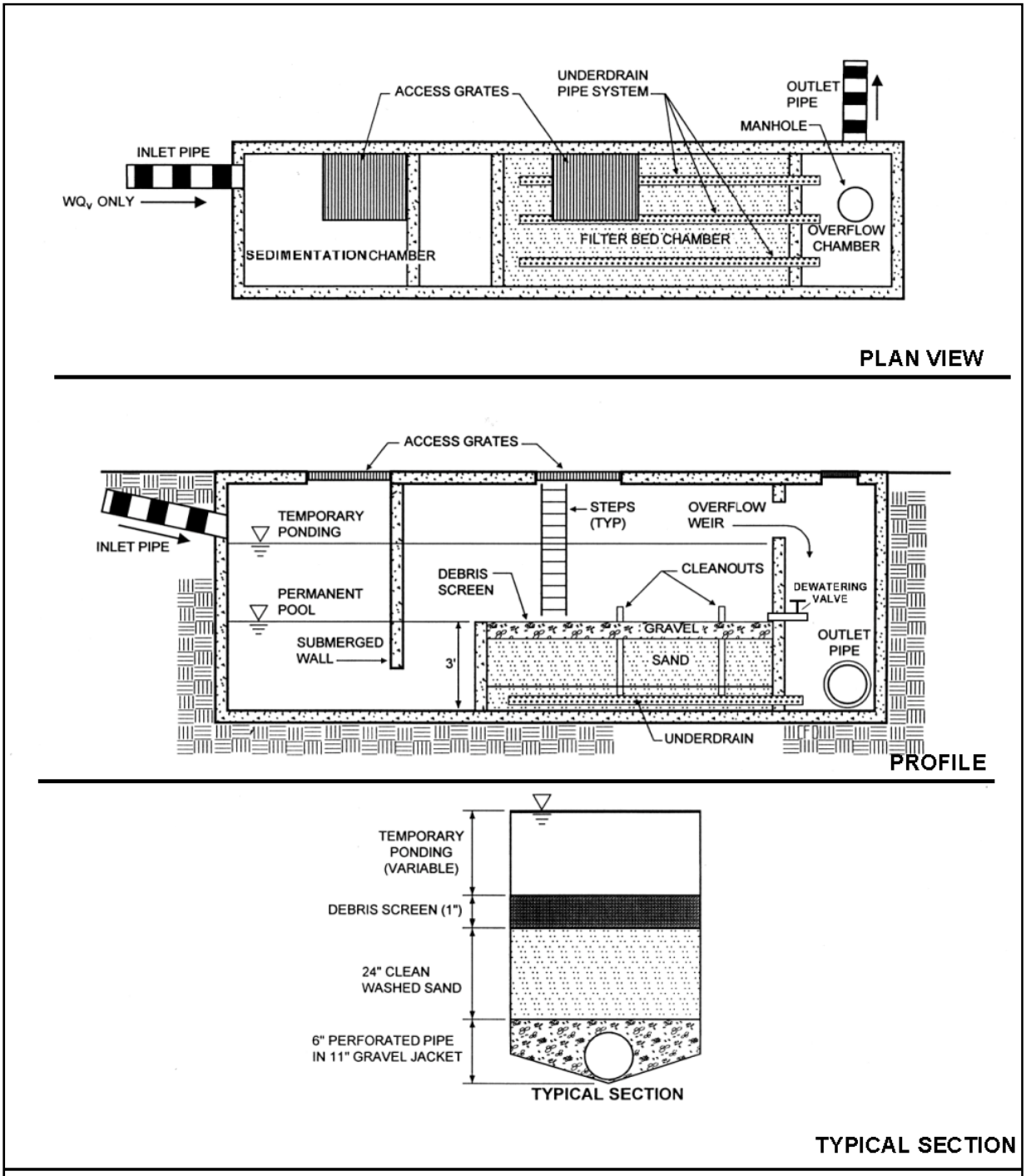
Figure 8. Schematic for Surface Sand Filter



Surface sand filters can treat the largest drainage area of all the filtering systems.

Source: Maryland Department of the Environment. 2000.

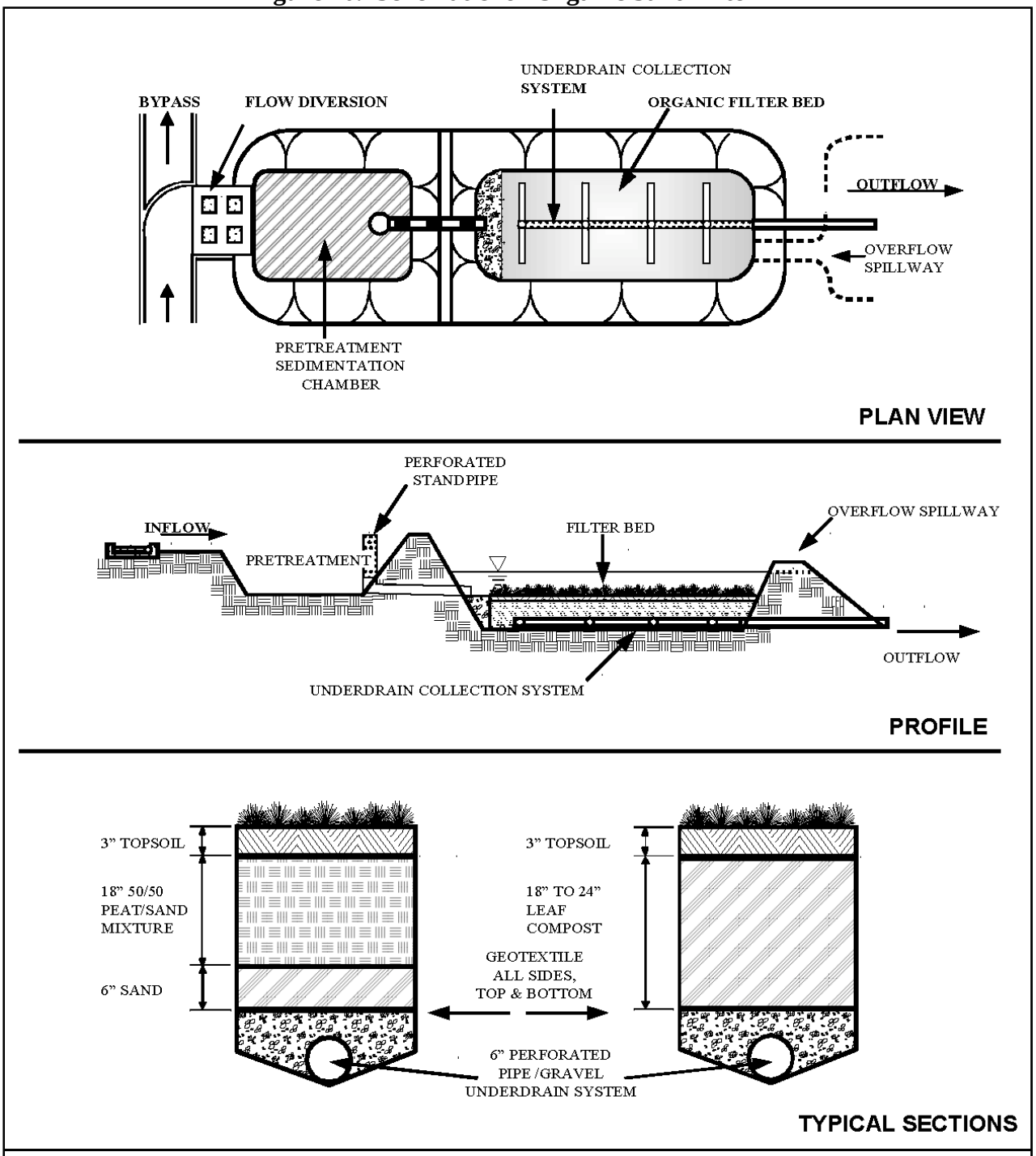
Figure 9. Schematic for Underground Sand Filter



The underground sand filter is an option for providing WQ_v where space is limited.

Source: Maryland Department of the Environment. 2000.

Figure 10. Schematic for Organic Sand Filter



The organic filter is used when maximum nutrient or trace metal removals are desired.

Source: Maryland Department of the Environment. 2000.

Permanent Best Management Practices
PC21: Oil Water Separator

Description

Oil water separators are permanent treatment control devices designed to remove contaminants. The conventional separator and the coalescing plate interceptor (CPI) are two commonly used oil water separators. The primary function of oil water separators is to specifically remove petroleum compounds, other floatable debris, and settleable solids. Conventional separators are capable of removing oil droplets with diameters greater than 150 microns. CPI separators are used when droplets smaller than 150 microns must be removed.

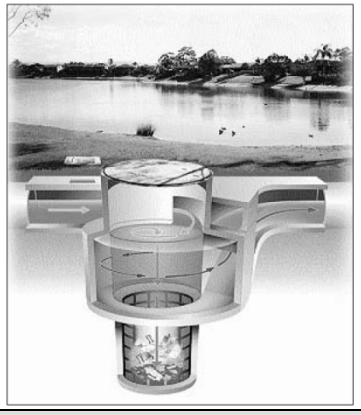
Limitations

- The design loading rate for oil water separators is low, therefore, they can only be cost-effectively sized to detail and treat nuisance and low flows (small storm or first flush events). Sizing to accommodate an average to larger storm results in a large sized facility and is not economical.
- The typically low concentrations of oil in most storm water results in considerable performance uncertainty.
- Oil water separators require frequent inspection and routine maintenance for the life of the structure.

Practice		
☐	PC 21.1	Determine the size of separators based on rate of runoff, rise-rate velocity of the oil droplets, and the settling rate of solids to be removed.
☐	PC 21.2	Oil water separators shall be sized to treat first flush of runoff, which larger storms diverted around the separator.
☐	PC 21.3	Determine type of separator, CPI or conventional. CPI separator contains closely spaced plates that enhance the removal efficiency.
☐	PC 21.4	Oil water separators shall be inspected at least semi-annually and following significant storm events.

Permanent Best Management Practices
PC22: Continuous Deflective Separation (CDS)

Description
Continuous Deflective Separation (CDS) technologies direct solid pollutants into the lower catchment chamber and the floatables to the surface of the upper chamber using a non-mechanical, non-blocking screen technology. It is most often used for grow pollutant removal. The system utilizes the natural motion of water to separate and trap sediments by direct infiltration. As storm water flows through the system, a very fine screen deflects the pollutants, which are captured in a litter sump in the center of the system.



Limitations
The system does not rely on secondary flow currents induced by vortex action.

Practice		
☐	PC 22.1	To determine the amount of runoff that will be treated for pollutant removal, calculate flow to determine water quality flow rate (cfs): **WQFR = C x 0.4" x A** • WQFR = water quality flow rate in cubic feet per second • C = runoff coefficient (C =0.8 for pervious surface, C= 0.9 for impervious surface). • A = area of the site in acres • 0.4" = hourly rainfall intensity
☐	PC 22.2	A porosity value "n" (n=Vv/Vt) of 0.40 should be used in the design of stone reservoirs for infiltration methods.
☐	PC 22.3	Processing capabilities vary from 3 to 300 cubic feet per second.
☐	PC 22.4	Pre-cast modules are available for flows up to 62 cubic feet per second, while higher flow processing requires cast-in-place construction.
☐	PC 22.5	Every unit requires a detailed hydraulic analysis before installation to ensure optimum solids separation is achieved.
☐	PC 22.6	There are no specific landscaping requirements. Areas around CDS units should be clear at the surface and accessible for maintenance and inspection purposes.
☐	PC 22.7	Aggressive maintenance plans are required to reduce the risk of re-suspension of sediment during large storm events.
☐	PC 22.8	Manholes should be included for each chamber for cleaning access.
☐	PC 22.9	Inlets should be inspected and cleaned after every major storm event and inspected monthly.
☐	PC22.10	Oil water separators may be used in conjunction with CDS units to remove oils.
☐	PC22.11	CDS units should be inspected every 6 months and cleaned where necessary.
☐	PC22.12	Catch basin cleaning equipment can be used, but manual sediment removal may be required as well.
☐	PC22.13	Amount of material removed from each chamber should be documented. Disposal of waste should be done according to material contents and disposal requirements.

Construction Activities Best Management Practices
PC23: Storm Drain Inlet Protection

Description
Devices of various designs which detain sediment-laden runoff and allow the sediment to settle out of the water prior to discharge into a storm drain inlet or catch basin.

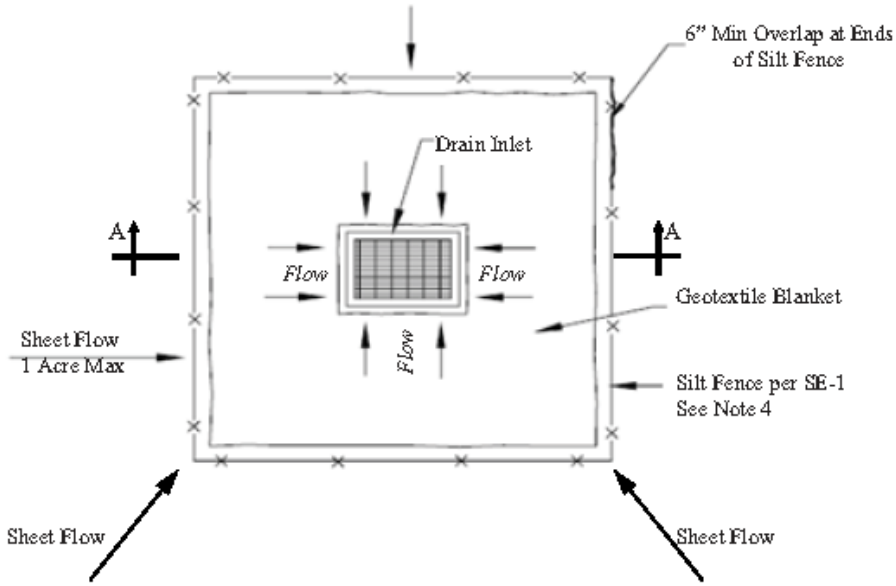
Limitations
- Inlet protection must not create a potential hazard to traffic.
- Drainage area should not exceed 1 acre.
- Runoff may bypass protected inlets on slopes.
- Ponding will occur at a protected inlet, with possible short term flooding.
- Straw bales are NOT effective for inlet protection.

Practice		
☐	PC23.1	Every storm drain inlet potentially receiving sediment-laden runoff shall be protected, either by covering the inlet or promoting sedimentation upstream of the inlet.
☐	PC23.2	Five types of inlet protection are presented below; however, other effective methods and proprietary devices exist and may be selected: • Filter Fabric Fence: Appropriate for drainage basins less than one acre with less than a 5 percent slope. • Block and Gravel Filter: Appropriate for flows greater than 0.5 cubic feet per second (cfs). • Gravel and Wire Mesh Filter: Used on curb or drop inlets where construction equipment may drive over the inlet. • Sand Bag Barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. • Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment.
☐	PC23.3	Inlet protection must be of sufficient strength and permeability to allow storm water to pass through and retain sediment. Must be anchored such that the material will not fall into the drain when the grate is removed for maintenance.
☐	PC23.4	Use only for drainage areas smaller than one acre unless a sediment trap first intercepts the runoff.
☐	PC23.5	Provide area around the inlet for water to pond without flooding structures and property.

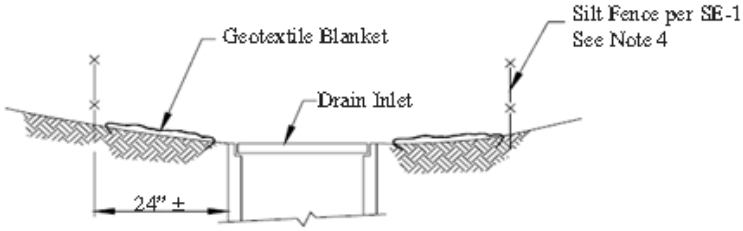
Note: Example schematics for inlet protection are included herein for reference.

Maintenance and Inspection		
☐	PC23.1	Inspect inlet protection devices prior to an anticipated rainfall event, after the rainfall event, and regularly at the end of each work week. During extended rainfall events inspect inlet protection devices daily.
☐	PC23.2	Repair damage sustained to the inlet protection devices within two (2) calendar days after the incident or before the next anticipated rainfall event, whichever comes first.
☐	PC23.3	Remove sediment after each rainfall event and once the containment device is ½ full of sediment.
☐	PC23.4	Provide education for required personnel about storm drain protection from sediment discharge and other construction site contaminants.

Figure 11. Storm Drain Inlet Protection - Filter Fabric Fence



Detail "A"
Not to Scale



Section A-A
Not to Scale

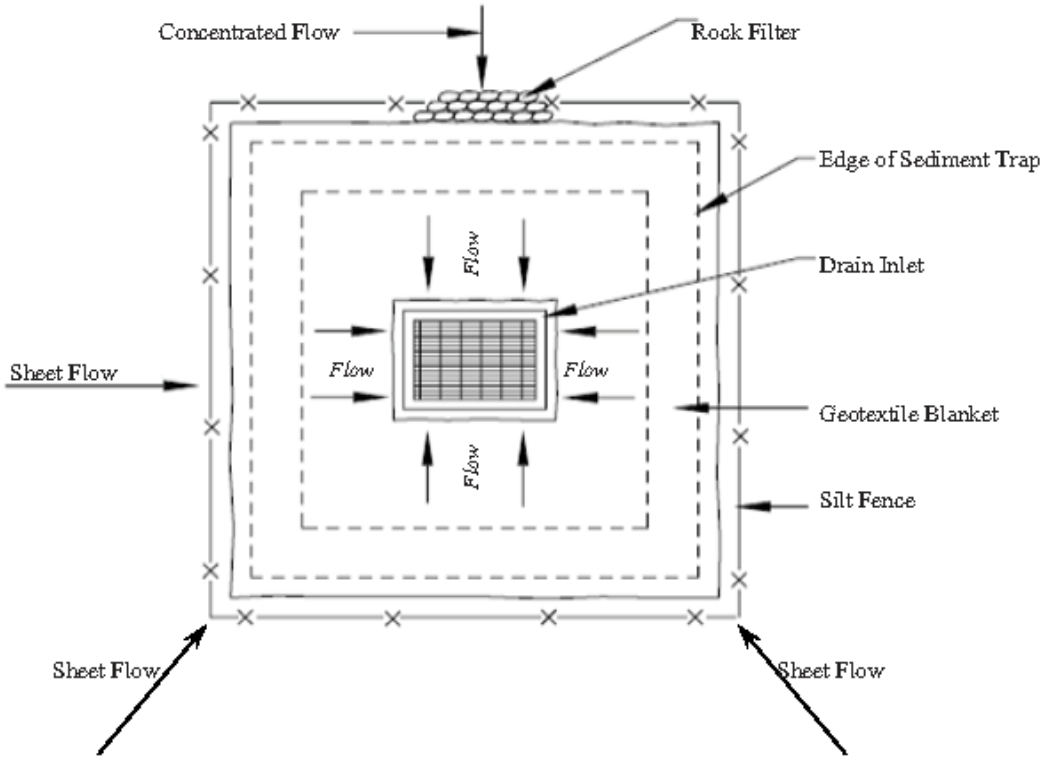
Notes:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable in concentrated flows.
4. Refer to BMP SE-1, Silt Fence for construction.

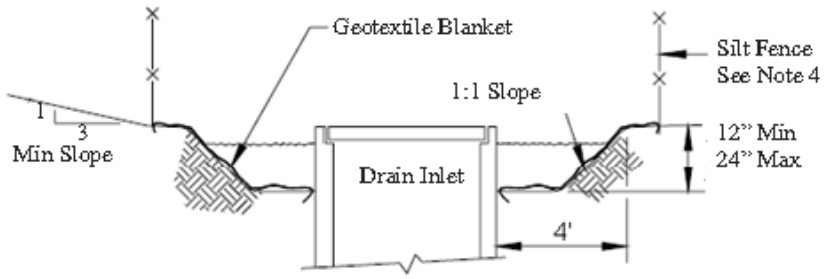
Source: City and County of Honolulu BMP Manual, November 2011.

DI Protection Type 1, Filter Fabric Fence

Figure 12. Storm Drain Inlet Protection – Sediment Trap



Detail "B"
Not to Scale

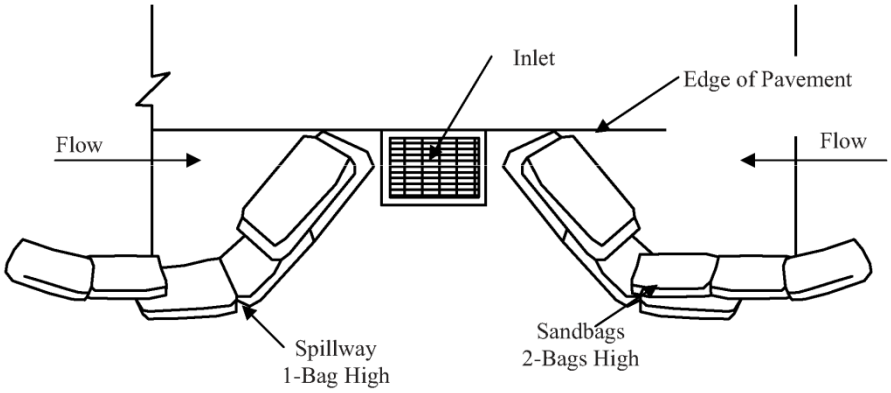


Notes:
1. For use in cleared and grubbed and in graded areas.
2. For concentrated flows, shape basin in 2:1 (L:W) ratio with length oriented towards direction of flow.
3. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area.
4. Refer to BMP SE-1, Silt Fence for construction.

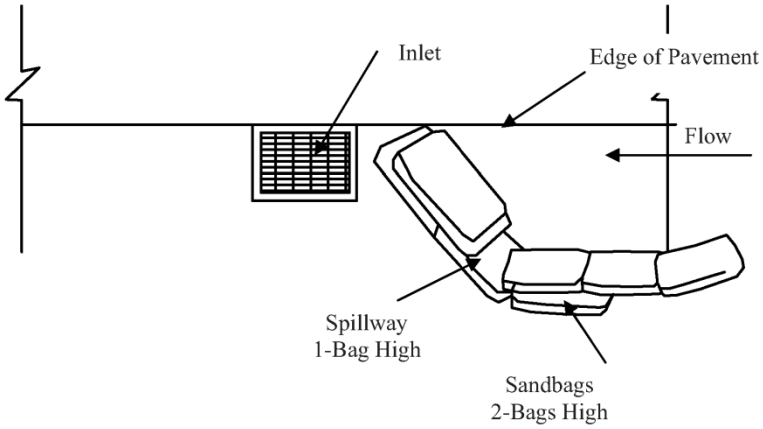
DI Protection Type 2, Excavated Drop Inlet Sediment Trap

Source: City and County of Honolulu BMP Manual, November 2011.

Figure 13. Storm Drain Inlet Protection – Gravel Bag



Typical Protection for Inlet on Sump, Detail "C"
Not to Scale



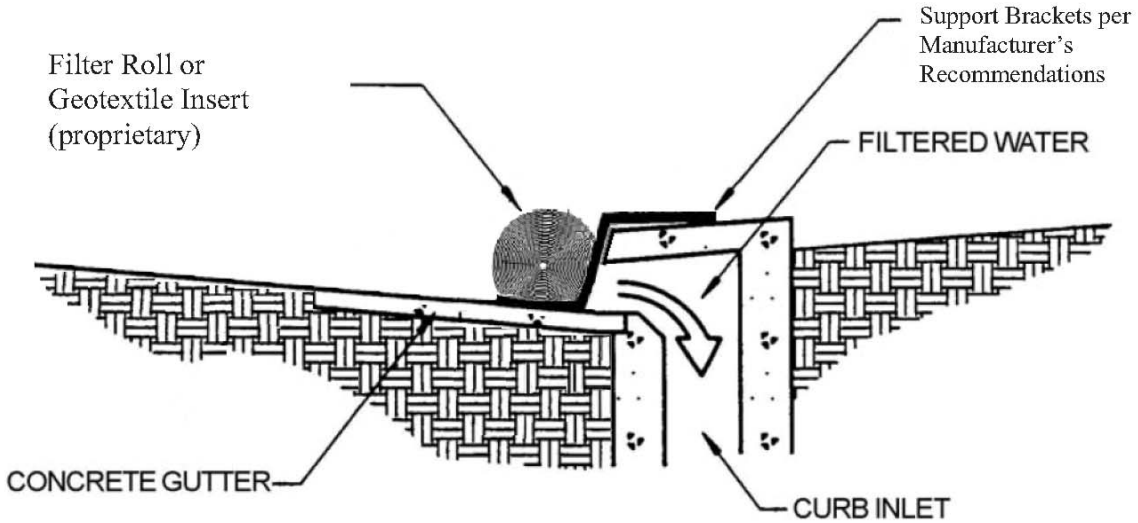
Typical Protection for Inlet on Grade, Detail "D"
Not to Scale

Notes:
1. Intended for short-term use. Not suitable for roads open to traffic.
2. Used to inhibit non-storm water flow.
3. Bags **should** be removed after adjacent operation is completed.
4. Not applicable in areas with high silts and clays without filter fabric.
5. Use sand bag made of geotextile fabric (not burlap) and fill with 0.75 in. rock or 0.25 in. pea gravel.
6. Construct on gently sloping street.
7. Leave room upstream of barrier for water to pond and sediment to settle.
8. Place several layers of sand bags - overlapping the bags and packing them tightly together.
9. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.
10. Do not use sandbags for roadways subject to traffic.
11. For traffic area, insert geotextile filter inserts instead of sandbags.

DI Protection Type 3, Gravel Bag

Source: City and County of Honolulu BMP Manual, November 2011.

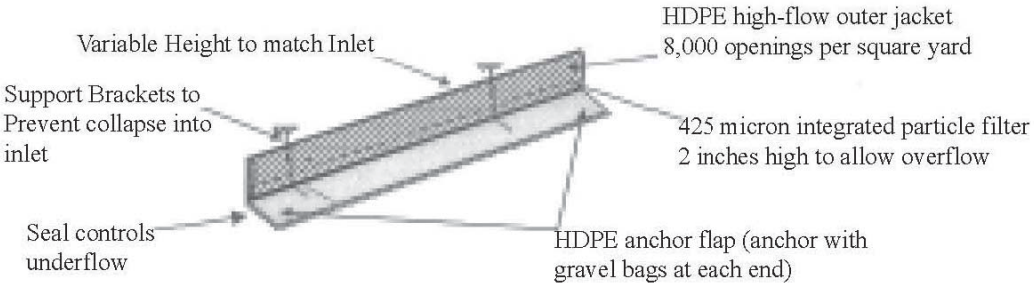
Figure 14. Storm Drain Inlet Protection - Geotextile



Detail "F"

Not to Scale and May Use Various Types of Geotextile Inserts

DI Protection Type 5, Filter Roll or Geotextile Insert with Supports for Curb Inlet



Detail "G"

Not to Scale and May Use Various Types and Styles of Geotextile Inserts

DI Protection Type 5, Geotextile Insert with Supports for Curb Inlet

Source: City and County of Honolulu BMP Manual, November 2011.

Construction Activities Best Management Practices
PC24: Underground Detention Basin

Description

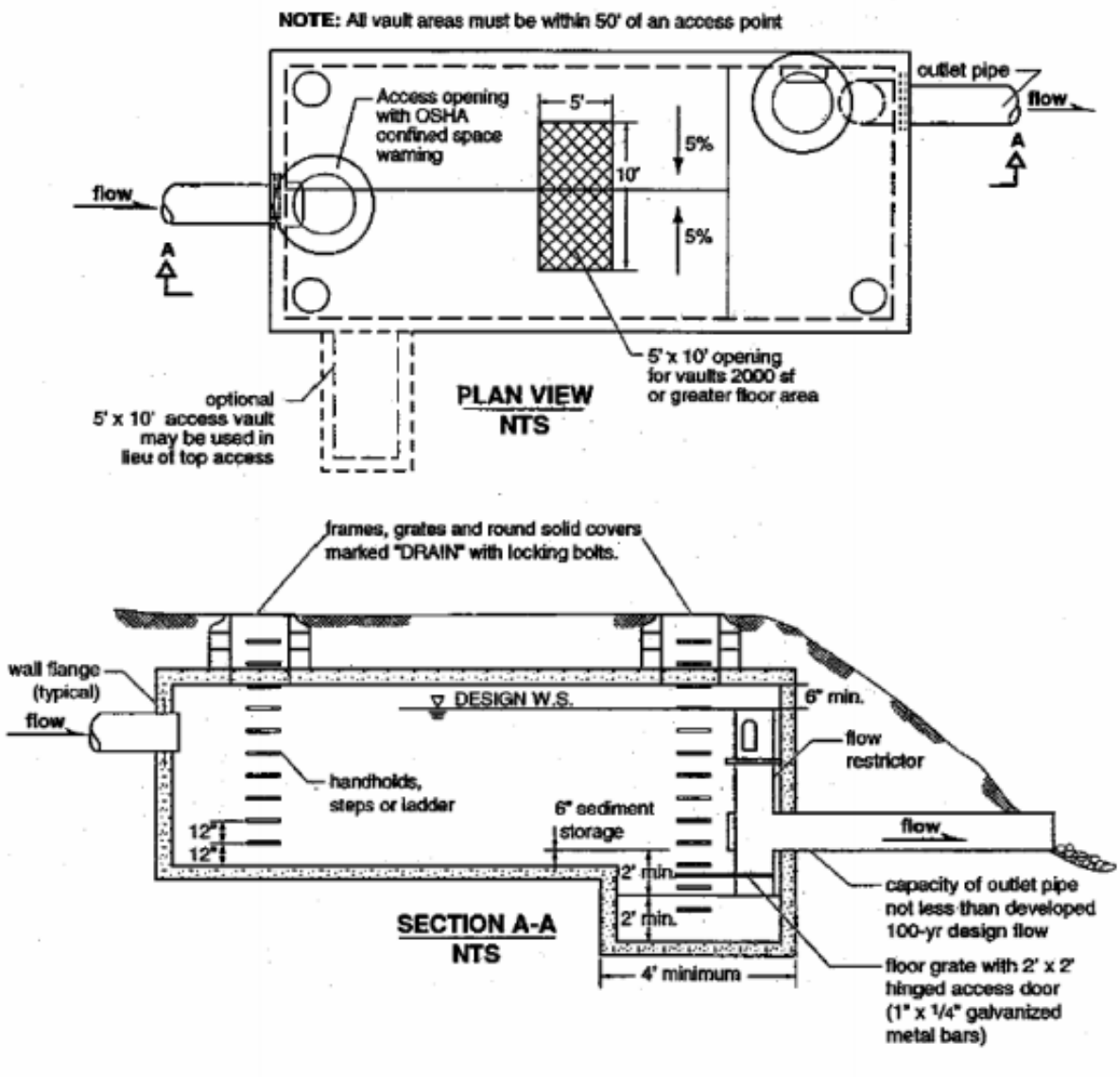
Detention basins can provide storm water volume control and are normally used for sites where developable surface area is at a minimum. There are several designs for underground detention facilities, and all methods serve as alternatives to surface dry detention for storm water quantity control. Furthermore detention basins contain flow and retain the water until it can be released slowly over the course of a period of time. This method decreases peak flows and reduces flooding problems.

Limitations

- These systems may require more excavation than surface ponds or wetlands.
- Frequent maintenance is required.

Practices		
☐	PC24.1	The maximum contributing drainage area to be served by a single underground detention vault or tank is 25 acres.
☐	PC24.2	The general design shall consist of the following elements: • An outlet structure; • An emergency spillway; and • Maintenance access.
☐	PC24.3	Routing calculations must be used to demonstrate that the storage volume is adequate.
☐	PC24.4	Underground vaults and tanks must meet structural requirements for overburden support and traffic loading.
☐	PC24.5	Flood protection controls for peak discharge control, should be designed as final controls for on-site storm water. Underground detention will typically be located downstream of structural storm water BMPs that are designed to provide treatment of the water quality volume and channel protection volume.
☐	PC24.6	The drainage easement shall be located 15 feet from the outside limits of the underground detention structure. The first floor elevation for any structure adjacent to the underground detention shall have an elevation no lower than 1 foot above the emergency spillway elevation.
☐	PC24.7	Water shall not be discharged from underground detention in an erosive manner. Riprap, plunge pools or pads, or other energy dissipaters are to be placed at the end of the outlet to prevent scouring and erosion.
☐	PC24.8	A high flow bypass shall be included in the underground detention design to address instances of significant rainfall, outlet structure blockage, or mechanical failure. The bypass shall be located so that downstream structures will not be impacted by emergency discharges.
☐	PC24.9	Adequate maintenance access must be provided for all underground detention systems. Access must be provided over the inlet pipe and outflow structure. Access openings can consist of a standard frame, grate and solid cover, or a removable panel.

Figure 16. Underground Detention Basin



Source: Knox County Tennessee Stormwater Management Manual, Volume 2, January 2008.