FULTON COUNTY MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) NPDES STORMWATER PHASE I, 2014 PERMIT RENEWAL STORMWATER MANAGEMENT PROGRAM

Phase I Large MS4 NPDES Permit #GAS 000117

Revised March 18, 2016

Georgia Department of Natural Resources

Environmental Protection Division • Watershed Protection Branch
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Judson H. Turner, Director

March 23, 2016

Ms. Kun Suwanarpa, Interim Director
Fulton County Department of Water Resources
Fulton County Government Center
141 Pryor Street, SW, Suite 6001
Atlanta, Georgia 30303

RE: Phase I MS4
NPDES Permit No. GAS000117
Storm Water Management Program

Dear Ms. Suwanarpa:

In a February 15, 2016 letter, the Environmental Protection Division (EPD) provided comments on Fulton County's proposed Storm Water Management Program (SWMP). On February 24, 2016, representatives of the County and EPD met to discuss revisions to the document. The County submitted a revised SWMP on March 18, 2016. Based on our review, we have determined that the SWMP is acceptable.

Part 3.3.6 of the NPDES Permit requires the County to develop and implement an Enforcement Response Plan (ERP). As part of the SWMP, the County provided this document. EPD has determined the ERP is acceptable.

Part 3.3.7 of the NPDES Permit requires the County to develop and implement Impaired Waters Monitoring and Implementation Plans. The County submitted a revised Monitoring and Implementation Plan on March 18, 2016 with the revised SWMP. EPD has determined this Plan is acceptable.

Thank you for your cooperation in this matter. If you have any questions, please contact me at 404/651-8546.

Sincerely,

Lisa A. Perrett
Environmental Specialist
Storm Water Unit

cc: Michelle Lawrence, Environmental Compliance Manager
Anderson Mycroft, Stormwater Program Manager

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Fulton County Municipal Separate Storm Sewer System (MS4) Enforcement Response Plan

(Appendices are and attachments are submitted separately in electronic format on compact disk.)

Part 1. Introduction

This document constitutes Fulton County's Stormwater Management Plan (SWMP), and is intended to address the County's obligations under the 2014 – 2019 NPDES MS4 Phase I Permit.

Fulton County SWMP Organization

Fulton County has several organizational units that provide stormwater services to the citizens of Fulton County. The primary functions performed by this structure include administration, maintenance, operations, regulation and enforcement. These services are provided for areas in unincorporated Fulton County only.

The Division of Water Resources, Public Works (DWR) seeks to protect the health, safety, and welfare of Fulton County's citizens through sound management of the County's infrastructure by providing high-quality and cost-efficient services and by complying with federal, state, and county regulatory requirements. The overall coordination of the SWMP, which includes the NPDES MS4 Phase I Permit requirements, is the responsibility of DWR's Environmental Compliance Unit. The Public Education unit addresses public education regarding water quality issues and the protection of water resources.

The Transportation Division of Public Works / General Services has the responsibility for operation and maintenance of the stormwater infrastructure systems within the right-of-way in unincorporated Fulton County.

Planning and Community Services (P&CS) reviews land disturbance plans, issues land disturbance and building permits, and is responsible for building and land development construction inspections associated with permitted construction projects.

Code Enforcement of the Fulton County Police Department enforces erosion control ordinances in unincorporated Fulton County, and works in partnership with the citizens in unincorporated Fulton County to promote and maintain a safe and desirable living and working environment.

Part 2. SWMP Document

This Fulton County SWMP document was prepared in accordance with the "Phase I MS4 Medium and Large Storm Water Management Program Guidance Georgia" document as published by the Georgia Environmental Protection Division (EPD)

The general organization follows the format of Fulton County's 2014 - 2019 Phase I MS4 Permit, and includes Appendix A – Definitions from the Permit.

Part 3. Stormwater Management Program

3.1 Structural and Source Controls

The SWMP implements a program which incorporates structural and source control measures to reduce pollutants from runoff from commercial and residential areas that are discharged from the MS4. The structural and source controls include the following elements:

3.1.1 MS4 Control Structure Inventory and Map

a) An inventory of MS4 control structures (catch basins, detention/retention ponds, and storm drain lines) is maintained by the County. A map showing those structures is included in Appendix B – Stormwater Inventory Map, and a list of structures is included as Appendix C – Stormwater Inventory (Tabular Format).

   Fulton County will add storm drain lines, county maintained detention ponds and ditches to the inventory, and provide the results with the annual report submitted on June 15, 2016.

   The inventory and map will be updated as necessary during each reporting period, and the number or structures added, and the total number of structures will be provided in each annual report.

b) Planning and Community Services (P&CS) will inventory new MS4 control structures and provide information to DWR.

3.1.2 MS4 Inspection and Maintenance Program

a) The Transportation Division is responsible for the inspection and maintenance of MS4 structures (catch basins, ponds, ditches and pipes) in unincorporated Fulton County. The Transportation Division's goal is to inspect 100% of the structures within a 5-year period. This will be accomplished by inspecting 20% of the structures annually. The structures will be maintained in accordance with the table below.

ITEM	CONDITIONS WHEN MAINTENANCE IS NEEDED
Catch Basin	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 20% Sediment(in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin
Detention Pond	Accumulated sediment is 20% of designed basin depth or affects inletting or outletting condition of the facility Trash or debris is plugging openings in the outlet structure
Ditches	Accumulated sediment that exceeds 20% of the design ditch depth. Excessive vegetation that reduces free movement of water through the ditches
Pipes	Accumulated sediment exceeds 20% of the diameter of the pipe

There are 33 detention ponds located in unincorporated South Fulton County that the Transportation Division is responsible for maintaining. Those detention ponds are inspected for proper vegetation maintenance and operation. Grass mowing is accomplished May through October. The County will provide the number and percentage of the total structures inspected during the reporting period in each annual report.

b) As inspection proceeds during each reporting period the maintenance that the inspections indicate is needed will be performed, and the number and percentage of the total structures maintained during the reporting period will be provided in each annual report.

3.1.3 Planning Procedures

The 2030 Fulton County Comprehensive Plan was adopted on December 7, 2011.

The next scheduled update is October 31, 2016. The plan is a management tool to guide the decision making process for land use, housing, environment, and public facilities. The Resource Conservation Section encourages co-location of infrastructure and Development to limit the disturbance of land, preserve environmentally sensitive areas, including steep slopes, wetlands, rock outcropping and other unique topographical features.

The 2016 update will include encouraging LID and GI practices including, bio-retention, infiltration designs, permeable pavement, stormwater planters, rainwater harvesting and improving the pollutant discharge of the existing outfalls.

A copy of the 2016 update to the Fulton County Comprehensive Plan will be included in the 2016 – 2017 annual report, and an inventory of any new GI / LID infrastructure added to County facilities will be included in succeeding reports.

3.1.4 Street Maintenance

The street sweeping program is pending the approval of funding for the purchase of a street sweeper. The street sweeper that was used previously to sweep streets has been surplused. Typically the Transportation Division performs street sweeping in late Fall and Mid-Spring. The streets are prioritized by traffic volume, litter frequency, overhead vegetation and citizen complaints. The priority streets are swept twice a year. The secondary streets are swept on an as needed basis. The goal is to sweep a minimum of 125 miles annually. Debris is disposed in a private landfill.

Inspections of drainage structures are prioritized by the structure being on a major arterial or collector road. Inspected structures are cleaned when the structure is 20% full of sediment or debris has built up in front of the inlet.

During grass cutting season (May- October), crew members will perform litter removal prior to mowing. Litter removal is scheduled according to the established mowing schedule. A goal of mowing a minimum of 55 miles of right-of-way three times annually has been established. There are three grass cutting crews with two crew members for each crew assigned to litter removal.

Litter is removed from County roads by Community Service Workers. The program utilizes Community Service Workers to pick up litter from the County right-of-way. The litter is picked up on a daily basis. The number of workers varies from 4-5 workers on a daily basis removing litter. All litter is disposed of in a private landfill.

Crews patch roadway potholes, deep base repair, alligator sections on roads annually. Additional practices include resurfacing and edge rut maintenance. Inlets are protected during these activities.

Documentation on activities conducted during the reporting period, such as litter removal, street sweeping, deicing material removal, road repair, etc., will be submitted in each annual report, and will include details such as the amount of litter removed, miles of street swept, etc., in each annual report.

3.1.5 Flood Management Projects

a) P&CS will develop a checklist for evaluating the existing detention facilities and begin implementing it by the start of the 2016 reporting period. The checklist will include evaluating the current discharge, determining if a design change is needed for improvement, the urgency of the need, and establishment of a time frame for the needed action.

b) All new development and redevelopment requiring a Land Disturbance Permit per the EPD and GSWCC will follow the County ES & PC Ordinance. This Ordinance requires flood management practices per the Georgia Stormwater Management Manual including detention, overbank protection, non-erosive discharge, more stringent water quality and GI & LID systems as appropriate. The details of any assessments conducted, such as the number of construction plans reviewed that contain flood management projects (e.g. detention ponds), will be provided in each annual report.

c) Water Resources perform a site visit on the 42 County owned HVPS sites to determine if there is a stormwater management facility onsite on any of those sites. The inventory of County owned HVPS sites is attached as Appendix D – Preliminary Existing Flood Management Projects Inventory. Any stormwater management facility found during these inspections will

- Be evaluated for potential to improve hydrologic attenuation and / or improving the quality of the storm water discharged.
- A conceptual design will be performed on any stormwater management facility found to have potential for retrofit.
- Detailed design will be performed based on the conceptual designs to confirm potential for retrofit.
- Construction to retrofit the stormwater facilities found to be suitable for detailed design will be performed.

It is anticipated that not all stormwater management facilities will be suitable for retrofit, based on the conceptual and detailed design processes.

The schedule for site visits, evaluation, conceptual design, detailed design and construction is as follows:

- 2015 – 2016: site visits all county owned HVPS sites and determine if a stormwater management facility is present. Any stormwater management facility found will be evaluated for retrofit potential.
- 2016 – 2017: evaluate all stormwater facilities found in 2015 – 2016 for retrofit potential. An inventory of the sites visited, stormwater management facilities found and a copy of the evaluation(s) will be included in the 2016 – 2017 annual report.
- 2017 – 2018: conceptual design on all stormwater facilities found to have retrofit potential in 2016 – 2017, and detailed design based on conceptual design. The number and status of the conceptual and detailed designs will be included in the 2017 – 2018 annual report.
- 2018 – 2019: retrofit construction based on completed detailed design(s). Fulton County will provide include the status of construction in the 2018 – 2019 annual report.

The detailed designs will be performed in accordance with the requirements of the Georgia Stormwater Management Manual, and the retrofits will be selected from the structural stormwater controls provided in that manual.

3.1.6 Municipal Waste Facilities

Fulton County does not have any open municipal or hazardous waste treatment, disposal, and recovery facilities. However, the County does operate a solid waste transfer station on the site of the closed Merk Miles facility. The transfer is listed on the Municipal Waste Facilities inventory provided below, and will be inspected as part of the HVPS program.

Name	Address
Merk Miles Transfer Facility	3225 Merk Road, Atlanta GA 30331

3.1.7 Municipal Facilities with Potential to Cause Pollution

Fulton County has developed an inventory of municipal facilities with the potential to cause pollution. That inventory is included as “Appendix E - Municipal Facilities with Potential to Cause Pollution.” Fulton County will inspect a minimum of 20% of these facilities each reporting period, and provide the inspection results with the annual MS4 reports. The County will provide an updated inventory in each annual report.

3.1.8 Pesticide, Fertilizer and Herbicide (PFH) Application

a. Fulton County will add the following links to its Stormwater Management page (http://www.fultoncountyga.gov/fcwr-stormwater/7195-stormwater-education-for-pollution-prevention)

- http://www.caes.uga.edu/extension/fulton/
- http://www.caes.uga.edu/departments/ent/upmp/index.html
- http://www.caes.uga.edu/departments/ent/upmp/webinars.html

before the end of the 2014 – 2015 reporting period, and report the location in the 2014 – 2015 Annual MS4 Report.

b. The Transportation Division only uses small amounts of "Round Up" herbicide during the grass cutting season of May-October. Round-Up is applied an average of 3-4 times during this period. Only the amount of herbicide needed for the day is purchased to prevent storing of the herbicide.

3.1.9 Municipal Employee Training

P&CS will have staff trained in NPDES land disturbance inspections (GWSCC certifications), and provide a summary of training conducted during the reporting period.

Employees of the Transportation Division are trained on the proper application and handling of chemicals and how to reduce pollution on a quarterly basis. The training is given by each crew supervisor during mandatory safety meetings. Employees also attend yearly training courses given by Cooperative Extension on the proper handling and usage of herbicides and ways to reduce pollution.

DWR stormwater program management staff will view one of the U.S. Environmental Protection Agency's webcasts (EPA) on EPA's NPDES Training Courses and Workshops website (http://water.epa.gov/polwaste/npdes/NPDES-Training-Courses-and-Workshops.cfm#sw) on an annual basis.

A summary of training conducted during the reporting period will be included with every annual report.

3.2 Illicit Discharge Detection and Elimination Program

3.2.1 Legal Authority

Fulton County will re-evaluate and modify the existing IDDE ordinance when necessary for compliance with this permit, and ensure that the ordinance provides the authority to conduct inspections and monitoring, control illicit discharges and connections, and control illegal dumping and spills into the MS4. The ordinance will include the permittee's authority to take legal action to eliminate illicit discharges or connections. If the ordinance is revised during the reporting period, Fulton County will provide a copy of the revised ordinance with the annual report as it is adopted by the Fulton County Board of Commissioners.

Fulton County adopted the "Prohibitions and Illicit Connections" ordinance on February 2, 2008. The ordinance is included in Appendix F - Fulton County Ordinances.

Generally, the Prohibitions and Illicit Connections ordinance makes it unlawful for anyone or entity to throw, drain, run, or otherwise discharge to the county's stormwater system, including streets, highways, rights-of-way any organic or inorganic matter that causes pollution. In addition the ordinance makes it unlawful to connect anything to the County's stormwater system except conveyance carrying uncontaminated storm water runoff, unless that discharge is identified as part of the County's stormwater management plan. Improper connections must be disconnected and redirected, if necessary, to the county sanitary system or other acceptable outfall upon approval by the director of public works. The ordinance also mandates cooperation with the County in order for the county to comply with the conditions of its NPDES permit, and requires access to records and information for the purpose of examination for compliance with the ordinance. Failure to comply can be subject to penalties including stop work orders and gives the County magistrate and state court jurisdiction to try offenses, and if necessary impose fines of $1,000 per violation or 60 days imprisonment for each violation.

Water line flushing, unpolluted pumped groundwater, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, and water from street washing and discharges or flows from firefighting are exempted.

3.2.2 Outfall Inventory and Map

a) An inventory and a map, based on Fulton County's GIS stormwater inventory, showing the location of all outfalls from the MS4 and the names and location of all waters of the State that receive discharges from those outfalls is provided in Appendix G – MS4 Inventory Outfall Map, and a tabular inventory is provided in Appendix H – MS4 Outfall Inventory (Tabular Format).

b) P&CS will provide DWR with the number and locations of new outfalls during the reporting periods. DWR will update the inventory and provide revised tabular inventory, including the total number of structures in the inventory in each annual report.

Illicit Discharge Detection and Elimination Plan

c) Fulton County's Illicit Discharge Detection and Elimination (IDDE) plan is attached as Appendix I – Fulton County Illicit Discharge Detection and Elimination Plan.

d) The County will provide the number and percentage of inspections conducted during the reporting period, completed inspection reports, information on any illicit discharge detection activities and any enforcement actions taken for illicit discharges.

e) Fulton County's investigative and follow-up procedures include:

   i) Requiring the County's water quality monitoring contractor to remain on site when dry weather flows indicate a possible illicit discharge until County employees arrive on site to begin investigation.
   ii) Utilizing the County's GIS stormwater inventory and personnel to track potential sources of pollution.

f) Fulton County will develop an Enforcement Response Plan and submit it for EPD's review and comment with the 2014 – 2015 Annual MS4 Report.

3.2.3 Spill Response Procedures

In the event that a sanitary sewer spill occurs, the DWR System Maintenance staff responds to the spill. Once at the location the staff takes appropriate measures to contain the spill or remedy the situation, in accordance with the County's standard operating procedures. Spill reporting protocol procedures are in place and available to Fulton County and contract employees that may respond to a spill. The spill occurrences are tracked via GIS and the information contained in a database.

Fulton County Fire and Rescue responds to spills of hazardous or toxic materials in Fulton County. The six member team remains on alert 24 hours a day for emergency response. The primary duty of the team is to stabilize the spill location until action can be taken to remedy the situation. Each crew member has undergone EPA Emergency Response to Hazardous Materials Incidents, 40 hour, OSHA training. The Fire Department holds routine in-house training programs that exceed the eight hour annual continuing education requirement for hazardous material response.

The Fulton County Airport – Brown Field Airport Manager's staff conducts and annual SWPPP implementation for a pollution prevention team members. These members then train their own staffs. The training covers such items as prohibited discharges, inspection, spill response, good housekeeping, implementation of BMP's and reporting and record keeping procedures.

Fulton County will include documentation on all spills in each reporting period in the annual MS4 reports.

3.2.4 Public Reporting Procedures

The public can report illicit discharges on the County website under "Customer Service". Information obtained from the hotline and website is forwarded to the appropriate department for resolution. In addition the public can report complaints that pertain to code enforcement, erosion control, water bans, water quality, scrap tire and other environmental issues in unincorporated Fulton County on the County's Tell Line, 404-612-TELL (8355).

Code Enforcement's inspectors can generate an illicit discharge investigation if they see evidence of an illicit discharge while investigating other code enforcement violations.

All complaints are tracked in an electronic database, and are assigned a case number as they are added to the system. Complainants may track the status of a complaint using the case number.

The first inspection will occur between the day after the initial report and three days after the initial report, depending on the research required to support the inspection. Follow up investigations are performed between three and ten days after the first investigation.

When a Code Enforcement officer determines that a violation has occurred the notice of violation may either by hand delivered at the end of the inspection, or may be mailed at the end of the day the inspection occurs. In all cases the violator has three days to correct the violation before the citation is turned over to the court liaison, who assigns permitted cases to Magistrate Court and non-permitted cases to the Code Enforcement Board

If the magistrate judge or code enforcement board finds that County ordinance has been violated a fine of up to $1,000 per day, per violation can be assessed.

When a major sewer spill occurs, the County

- Provides spill information to the Fulton County Daily Report, the County's official legal organ.
- Posts signs at the point of the spill and points of public access.
- Information is placed on file with the County's Office of Communications in the County Manager's office.
- Forwards a letter providing a brief description of the amount of Sanitary Sewage spilled and actions taken to prevent further spills to EPD.

When a minor sewer spill occurs, the County

- Posts signs at the point of the spill and points of public access.
- Information is forwarded to the Deputy County Manager.
- Notifies EPD in a monthly report

3.2.5 Proper Management and Disposal of Used Oil and Toxic Materials

Transportation utilizes a private contractor for the disposal of used oil and toxic materials.

Public Education maintains a continuous effort to educate the public about pollution and prevention, including such the reduction, reuse and recycling of common household hazardous wastes as paints, solvents, fuels, cleaners, and pesticides. This information is made available on the County's website at http://www.fultoncountyga.gov/fcwr-education/5589-pollution-prevention.

The County will include details of any activities regarding proper management and disposal of used oil and toxic materials performed during the reporting period in the annual reports.

3.2.6 Sanitary Sewer Infiltration Controls

The Fulton County DWR has a robust inflow / infiltration program managed by Systems Maintenance. Systems Maintenance visually inspects 20%, or 2 million feet, of the wastewater system annually. When defects are noted, repairs are scheduled according the severity of the defect. Additionally, Systems Maintenance treats 650,000 feet of the wastewater system for root control annually. There also is an ongoing Capital Improvement Program that has prioritized the repairs to the sewer system based on the findings from the sewer inspections program. The County continues to conduct pipe lining and manhole restoration each year.

The County will include details of any activities regarding sanitary sewer infiltration controls performed during the reporting period in the annual reports.

3.2.7 Municipal Employee Training

a) Employees of the Transportation Division receive basic training from crew supervisors on how to detect and report illicit discharges. The training is given on an annual basis during staff's safety meeting.

   DWR stormwater program management staff attend a quarterly webinar meeting, where materials primarily from EPA's NPDES Training Courses and Workshops website (http://water.epa.gov/polwaste/npdes/NPDES-Training-Courses-and-Workshops.cfm#sw) are presented. In addition DWR stormwater program management staff personnel routinely attend the Georgia Water Professional Association's GAWRA/Stormwater Committee monthly meetings in order to remain abreast of the latest developments in the stormwater field in Georgia and EPA Region IV.

b) A summary of the training conducted during each reporting period will be provided in each annual report.

3.3 Industrial Facility Storm Water Discharge Control

3.3.1. Industrial Facility Inventory

a) Fulton County has developed an inventory of county owned municipal waste facilities, provided in the table below.

Facility Name	Street	City	State	Zip	Type
Camp Creek WRF	7520 Cochran Road	College Park	GA	30349	WRF
Charlie Brown Airport	3952 Aviation Circle, Room 200	Atlanta	GA	30336	Airport
Little Bear WRF	405 Rippling Brook Trace	Palmetto	GA	30213	WRF
Stonewall Tell	5601 Stonewall Tell RD	College Park	GA	30349	Transportation fleet maintenance and storage yard

b) Fulton County will update the privately owned industrial facility inventory on an annual basis, adding industrial facilities:

   i) Listed on EPD's Industrial Storm Water General Permit (IGP) Notice of Intent (NOI) and No Exposure Exclusion (NEE) online listings,
   ii) Any new industrial facilities as they are approved for land disturbance permits by Planning and Community Services, and
   iii) Any new industrial facilities found during the Highly Visible Pollutant Sources inventory update.

   A copy of the privately owned industrial facilities inventory is included as Appendix J – Industrial Facilities Inventory.

c) In order to control runoff from county owned industrial facilities Fulton County will

   i) Review the inventory of county owned industrial facilities, and provide an updated inventory in the annual report if any changes occur to the inventory.
   ii) Ensure that each facility in the inventory has filed a Notice of Intent to discharge storm water in accordance with EPD's General Permit No. GAR GAR050000.
   iii) Ensure that each facility in the inventory has developed a stormwater pollution prevention plan in accordance with the requirements of EPD's General Permit No. GAR GAR050000.
   iv) Inspect each at least 20% of the facilities in the inventory annually to ensure compliance with EPD's General Permit No. GAR GAR050000 and the facility's respective SWPPP.

d) The updated industrial inventory will be provided with each annual report, beginning with the 2014 – 2015 annual report, which will be submitted no later than June 15th, 2015.

3.3.2. Inspection Program

a) At least 20% of the industrial facilities on the County's inventory will be inspected annually, and the results of those inspections reported in the annual MS4 reports, along with a copy of the revised industrial facilities inventory. A copy of the MS4 Facility Inspection Form used for industrial and HVPS inspections is included in Appendix K – Inspection Forms. A copy of forms completed during each reporting period will be included in the annual reports.

b) All industrial facilities on the County's inventory will be required to implement a stormwater monitoring program as provided in Part 6, Monitoring of the Authorization to discharge Under the National Pollutant Discharge Elimination System, Stormwater Discharges Associated with Industrial Activity, General Permit No. GAR 050000.

3.3.3. Enforcement Procedures

Fulton County will follow this protocol when minor problems are noted during industrial facility inspections:

- On-site personnel will be informed of the problem.
- The problem will be described on the inspection form.
- A re-inspection will be scheduled.
- Upon return to the office the inspector will perform research to determine the name and address of the property owner, and write a letter notifying the property owner, describing the problem(s), and inform the property owner the site will be re-inspected to ensure compliance. The notification letter will be sent no later than 5 working days after the inspection, and re-inspection will occur no later than 21 working days after the original inspection.

If the re-inspection does not indicate substantial progress to remediate the problem(s) originally identified, or there is indication that site conditions have deteriorated a site visit will be coordinated with a Code Enforcement officer so that enforcement action can be taken under the County's illicit discharge ordinance.

If Fulton County has reason to believe that any of the site's NPDES permit conditions are being violated Fulton County will copy Georgia EPD with any correspondence sent to the owner.

All enforcement actions will be reported in the County's annual MS4 report.

3.3.4. Educational Activities

Fulton County will develop an Industrial Stormwater education program by the end of the 2014 – 2015 reporting period that will include:

- A web page that will
  - Provide with information about the program and requirements.
  - Provide a link to EPD's NPDES Industrial Storm Water General Permit and related information
- Develop or obtain brochures for distribution during industrial stormwater inspections.
- Fulton County will include details of any educational activities in each annual report.

3.3.5. Municipal Employee Training

a) Fulton County will conduct regular training of employees on proper stormwater pollution prevention practices and protocols, as well as proper safety methods to reduce the potential that materials or equipment will be mishandled or misused. The training will be focused on the reduction of injury, loss of materials, release of contaminants, and the impact that pollutants have on receiving waters. The training sessions will be based on Volume 3, Pollution Prevention Guidebook of the Georgia Stormwater Management Manual. Aside from a general stormwater awareness theme the training sessions will focus on:

   - Pollution prevention/good housekeeping measures
   - Spill Response and Prevention
   - Information about the operation and maintenance of structural best management practices (BMPs)
   - Stormwater pollution prevention plans (SWPPPs) for municipal facilities
   - BMPs recommended for use in the field to prevent contaminated discharges
   - Training to recognize, track, and report illicit discharges.

   In addition the County will:

   - Integrate information sessions on stormwater pollution prevention into other employee training programs.
   - Discuss stormwater pollution prevention at employee meetings.
   - Promote stormwater pollution prevention concepts through posters, brochures, newsletters, etc.
   - Post bulletin boards with updated stormwater pollution prevention procedures, tips and reminders.

b) Fulton County will report the dates, locations and number of employees trained in each annual MS4 report.

3.4 Construction Site Management

Planning and Community Services (P&CS), along with Code Enforcement are primarily responsible for construction site management and enforcement in Fulton County.

3.4.1. Legal Authority

Fulton County has been certified by the Director of EPD as a Local Issuing Authority for the purposes of the Erosion and Sedimentation Act of 1975 as amended. A Memo of Agreement was adopted by the Fulton County Commission and the State Soil and Water Commission on January 20, 2014. The County Board of Commissioners adopted the Fulton County Soil Erosion, Sediment and Pollution Control Ordinance of 2010 On June 2, 2010. This ordinance gives the County Authority to issue Land Disturbance Permits: require BMPs to prevent and minimize erosion and sediment discharge, ES & PC Plan Submission and review prior to commencing construction, conduct inspections and enforcement, including Stop Work Orders, bond forfeiture, and monetary penalties, and require education and certification for persons involved in Land Development, per the Georgia EPD Model Ordinance. If the E&S ordinance is revised during the reporting period, the County will submit a copy of the adopted ordinance in the annual report

3.4.2. Site Plan Review Procedures

P&CS will review the Land Disturbance Plans per the Georgia Stormwater Manual(Blue Book), The Manual for Erosion and Sediment Control in Georgia(Green Book) and the ES & PC checklist of requirements under the State Permit GAR 100001- 3 authorizing discharge under the NPDES associated construction activity. P&CS will provide the number of a list of the site plans received and the number of site plans reviewed, approved, or denied, and the number of Land Disturbance Activity permits issued during the reporting period in each annual report.

3.4.3. Inspection Procedures

a) P&CS will continue to make site inspections to insure that structural and non-structural BMP’s are designed and maintained as required by GASWCC.

b) Certified County Erosion inspectors shall ensure that structural and nonstructural BMPs at construction sites are properly designed and maintained as specified in the CGPs. Certified County erosion inspectors shall inspect each land disturbance activity a minimum of following installation of initial BMPs, during active construction, and after the final site stabilization, and shall include inspections once every seven days, and within 24 hours (except weekends) of every storm that is 0.5 Inches of rainfall or larger. Certified County erosion inspectors will inspect each site a minimum of once per Month until final stabilization is achieved and an NOT has been received by EPD.

c) P&CS will provide the number of active sites and the number of inspections conducted during the previous calendar year in each report.

3.4.4. Enforcement Procedures

Currently Code Enforcement provides construction site inspection for compliance with erosion control and sedimentation code and ordinance, and uses the following procedure and protocol:

a) Sites are inspected based on zone coverage, and deficiencies, if any noted.

b) If a notice of violation is justified the notice is posted on site, and a letter is sent to the responsible party by mail. The violator has 3 days to correct the deficiencies.

c) If the deficiencies are not corrected within 3 days a stop work order is issued, and no further work is allowed on site until the deficiencies are corrected.

Detailed procedures will be provided in the Enforcement Response Plan (ERP) when it is submitted to EPD for review with the 2014-2015 annual report, due June 15, 2015. The ERP will be implemented within six (6) months of EPD approval of the ERP. Fulton County will provide documentation of any enforcement actions taken during the reporting period in each annual report, including the number and type of enforcement.

3.4.5. Educational / Training Activities

a) P&CS inspectors will check that all personnel and entities involved in construction activities comply with the certification requirements of the Georgia Erosion and Sedimentation Act. They will insure that all staff involved in construction subject to Construction General Permits (CGP) are trained and certified by GSWCC.

b) PCS will provide a summary of the training conducted during the reporting period, provide the number and type of current certifications held by County inspection personnel and a summary of all training classes related to erosion control, MS4, and soil and water conservation, in each annual report.

3.5 Highly Visible Pollutant Sources

3.5.1. HVPS Facility Inventory

Fulton County established a Highly Visible Pollutant Sources (HVPS) inventory for the 2009 - 2014 MS Permit, and has updated the inventory annually, and provided an updated inventory based on the County's business license data. Fulton County will continue updating the current HVPS inventory based on an annual review of County business license data and provide the updated inventory with each annual report for the 2014 – 2019 MS4 Permit, beginning with the 2014 – 2015 annual report, due on June 15, 2015. A copy of the 14 – 15 HVPS inventory is included as Appendix L – HVPS Inventory.

3.5.2. Inspection Program

a) Fulton County implemented a HVPS facility inspection program during the 2009 – 2014 MS4 Permit. The current program will be maintained for the 2014 – 2019 MS4 Permit, and includes:
    i) Prioritizing inspections based on conditions in each basin and information from the Georgia Environmental Protection Division, primarily the 305(b)/303(d) list as it is updated biannually
    ii) Using the MS4 Facility Inspection form (included in Appendix K – Inspection Forms) to ensure consistent inspection procedures
    iii) Maintaining a database of inspections completed, based on the updated inventory as the inventory is updated each year
    iv) Reporting the HVPS inspections performed in each annual report

b) The procedure for HVPS inspections will be performed in the sequence provided below.

Office Preparation & Research

1) Determine if commercial facility is in Fulton County's jurisdiction by:
    a) Locating the facility's street address in the most current Aero Atlas map and
    b) Obtaining property tax parcel data as provided in the County's geographical information system (GIS). Only sites within County's MS4 jurisdictional area will be inspected for stormwater issues by County personnel.
2) Review aerial photos of the specific commercial facility for general information such as the size and location of buildings, storage areas and topography using the web link https://www.gis.fc. Determine the overall drainage pattern in the site area, evidence of pollutant discharge, such as oil streaking in paved areas, areas of impacted or dead vegetation, etc. and/or improper disposal of debris or materials.
3) Print or photocopy all appropriate maps such as topographic map, property tax maps, as-builts, site construction plans and aerial photographs. The map(s)

should be scaled so as to show the area(s) of interest on the site, but generally should be no more than 11” x 17”, (The County’s geographic information system (GIS) should be used to the maximum extent practicable.)

4) Using all of the information found from the above steps, estimate where stormwater discharges from the site.
5) Review Georgia’s current 305(b)/303(d) list to see if the site discharges to an impaired segment and if so what the pollutants of concern are.
6) Based on research of the commercial facility’s principal activity and what chemicals and/or materials may be present.
7) Determine the appropriate Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes.
8) Check weather forecast for day of anticipated site visit/inspection. If the forecast indicates that there will be less than 0.1” of rainfall in the 72 hours prior to the site visit, plan to perform a dry weather screen on all outfalls from the site.
9) MS4 Facility Inspection forms:
   a) Create an electronic copy of MS4 Facility Inspection forms.
   b) Fill out the “Facility/Site Information” section of the MS4 Facility Inspection form.
   c) Save the form(s) on the County’s network in the location as designated by the Environmental Compliance Manager to and/or his/her designee(s).
10) Map directions to commercial facility and estimate the travel time along with a fifteen minute early arrival time.
11) Using best available commercial facility contact information, schedule site visit/inspection with appropriate onsite personnel, if possible.

Site Visit

1) Complete a vehicle inspection checklist.
2) Upon arrival at the site, notify appropriate commercial facility official that Fulton County personnel are onsite to perform commercial facility stormwater inspection.
3) Before inspecting the site, verify that the Commercial facility has:
4) Previous HVPS inspection data,
5) Spill Prevention Control Countermeasure (SPCC) Plan,
6) Current Business License.
7) Conduct visual out door inspection of the business if a potential pollutant exposure impacts on the MS4 system.
8) Collect water samples for field or laboratory analyses, when deemed necessary, by using nitrile sampling gloves, an amber 500ml glass sample bottle for light sensitive samples, Polyethylene (P) bottle for grab sample, Polypropylene (PP) bottle 100ml for Fecal grab sample, ice and a cooler to help preserve the water sample. If water samples are taken to an accredited laboratory, arrangements must be made for the relinquishing and receiving of the samples by incorporating a proper chain of custody and sample bottle labels provided by the laboratory designated for analyses.
9) If a stormwater violation is identified, inform onsite commercial facility officials of findings and detail and record any violations.

10) Offer any appropriate educational literature to assist industry to apply best management practices.
11) Leave a copy of site visit findings or obtain Commercial facility's contact's e-mail address to forward inspection results.
12) Schedule a re-inspection if violations were observed and establish a schedule for rectifying violations with responsible personnel.

Post Site Visit

1) Upon completion of MS4 Facility Inspection and return to the office, the inspector will update the inventory and forward the findings in electronic format and submit completed electronic form(s) and findings to Environmental Compliance Manager or his/her designee within forty-eight hours of inspection.
2) If a re-inspection is scheduled, perform the re-inspection and resubmit a revised MS4 Facility Inspection Form to Environmental Compliance Manager or his/her designee within forty-eight of re-inspection,
3) If the site has not been brought into compliance within the agreed upon time, begin appropriate enforcement action including but not limited to issuing Notices of Violations or informing the Georgia Environmental Protection Division and the U.S. Environmental Protection Agency (EPA) of the problems on the site.

Fulton County will perform inspections on a minimum of 20% of the businesses in the HVPS inventory annually. Copies of the completed inspection forms will be included with each annual report, starting with the 2014 – 2015 annual report due on June 15 , 2015, along with a total of the number of inspections performed and a percentage comparing the number of inspections performed to the number of HVPS sites in the inventory.

3.5.3. Enforcement Procedures

a) Fulton County will follow this protocol when problems are noted during HVPS inspections:
   i) On-site personnel will be informed of the problem.
   ii) The problem will be described on the inspection form.
   iii) Upon return to the office the inspector will schedule a re-inspection, to occur within 10 working days of the original inspection, and write a letter to the property owner. The letter will include:
      (1) A description of the problem
      (2) inform the property owner that a re-inspection is scheduled
      (3) offer appropriate educational materials to help the property owner understand the problem and how to rectify it

If upon re-inspection no progress is being made the inspector will schedule a third site visit, to occur within 10 working days of the first re-inspection, and will coordinate this visit with a Code Enforcement officer so that enforcement action can be taken, if necessary.

Step-by-step procedures will be included in the Enforcement Response Plan, and documentation of any enforcement actions taken at HVPS facilities will be included with the annual reports.

3.5.4. Educational Activities

a) Fulton County will develop a HVPS green partner program by the end of the 2014 – 2015 reporting period that will include:

- Developing a checklist of things that a business must do to stay in compliance with all the requirements and extra points for going above and beyond. They would get a sticker to put in their window each year saying they are a Fulton Green Partner.
- Provide a web page on the County's web site with information about the program and requirements.
- Develop or obtain brochures for distribution during HVPS inspections.

The County will provide details on any educational activities (targeting HVPS facilities) performed during the reporting period in each annual report, beginning with the 2014 – 2015 annual report due on June 15, 2015.

3.5.5. Municipal Employee Training

a) Fulton County will conduct regular training of employees on proper stormwater pollution prevention practices and protocols, as well as proper safety methods to reduce the potential that materials or equipment will be mishandled or misused. The training will be focused on the reduction of injury, loss of materials, release of contaminants, and the impact that pollutants have on receiving waters. The training sessions will be based on Volume 3, Pollution Prevention Guidebook of the Georgia Stormwater Management Manual. Aside from a general stormwater awareness theme the training sessions will focus on:

- Pollution prevention/good housekeeping measures
- Spill Response and Prevention
- Information about the operation and maintenance of structural best management practices (BMPs)
- Stormwater pollution prevention plans (SWPPPs) for municipal facilities
- BMPs recommended for use in the field to prevent contaminated discharges
- Training to recognize, track, and report illicit discharges.

In addition the County will:

- Integrate information sessions on stormwater pollution prevention into other employee training programs.
- Discuss stormwater pollution prevention at employee meetings.
- Promote stormwater pollution prevention concepts through posters, brochures, newsletters, etc.
- Post bulletin boards with updated stormwater pollution prevention procedures, tips and reminders.

b) Fulton County will provide a summary of the training conducted during the reporting period in each annual report.

3.6 Enforcement Response Plan

Fulton County will develop an Enforcement Response Plan (ERP) in accordance with the guidance offered in Attachment B, Phase I Medium and Large Storm Water Management Program Guidance, as published by EPD, and will submit the ERP for EPD's approval with the 2014 – 2015 annual report for EPD's review. Fulton County will implement the ERP within six months of EPD's approval, and the ERP will become an addendum to Fulton County's SWMP.

3.7 Monitoring for Discharges to Impaired Waterbodies

In order to meet the monitoring and implementation requirements Fulton County is extending its' existing Watershed Protection Plan and Sampling Quality Assurance Plan to address the impaired waterbodies in the County's MS4 jurisdictional area, including identifying the pollutant(s) of concern, conducting monitoring and implementing best management practices. A complete discussion is included in Appendix M – Monitoring and Implementation Plan.

3.8 Public Education

Fulton County uses a variety of outreach tools to reach our citizens including, but not limited to, websites, literature, school presentations, community events, and presentations to civic organizations. The main focus of these programs is to encourage individual and community stewardship. Our target audience is first and foremost our customers (both residential and commercial), and then the general public. The County reaches our audiences through many avenues, including school groups, library programs, a speakers' bureau for adult groups, senior citizen groups, and many more.

Fulton County's Education and Outreach Program includes Water Quality, Water Conservation, and Pollution Prevention education. These program areas include components that are ongoing throughout the year. Each activity will occur at least quarterly, but in most cases much more frequently. For example, school programs occur on a weekly basis during the school year.

The Water Conservation Program includes:

- Composting
- Rain Barrel Workshops
- Fix-a-Leak Week
- Smart Irrigation Month
- Water Efficient Landscaping education
- Water Use Restrictions
- Rain Gardens

These components of the Water Conservation Program are aimed at protecting water quality through proper landscape maintenance. Composting workshops provide citizens with an efficient and convenient method of disposing of yard debris and lawn clippings while at the same time producing a natural source of nutrients for their landscapes, thereby reducing the use of commercial fertilizers.

Several integrated pest management workshops have been held to educate residents about the proper use of pesticides to protect water quality. A demonstration Rain Garden was installed at a county facility and workshops were conducted to help homeowners learn how to install this type of landscape feature which retains stormwater runoff on site to allow for infiltration into the ground.

Rain barrel make-and-take workshops are held periodically along with fix-a-leak and smart irrigation demonstrations.

The Pollution Prevention program includes a Fats, Roots, Rags, Oils and Grease (FROG) element.

The FROG Program is designed to provide citizens with the tools and knowledge they need to help prevent sewer clogs and backups in homes, businesses, and communities through the proper disposal and cleanup of fats, oils, and grease. Emphasis is also placed on keeping landscaping away from sewer lines to avoid root intrusion. Staff has also developed displays and educational tools to remind our customers not to use their toilets as a trash can. We encourage citizens to not flush disposable cleaning cloths or personal/baby wipes down the toilet.

Public Education also includes

- General watershed education, including special events (Earth Day, Clean Water Week, etc.), children's presentations (school programs, summer camps, after school programs, etc.), and several unique outreach tools (Enviroscape, traveling water library, etc.)
- Fulton County's (http://www.fultoncountyga.gov/fcwr-education) website is kept current with useful information for our customers about special events and opportunities. Social media is utilized by our Communications Department through Twitter and Facebook for breaking news and updates. In addition the Fulton Government Television (FGTV) cable station airs reports and public service announcements about current issues.

The program activities will be documented in the Annual Report with entries for each element, including the number of workshops held, number of attendees at each workshop and an estimate of the number of brochures distributed.

3.9 Public Involvement

Fulton County will conduct a public involvement program that will create opportunities for citizens to participate in the SWMP. The activities include:

- Adopt-A-Stream
- Storm Drain Marking
- Community/Stream Cleanups
- Household Hazardous Waste
- Pharmaceutical Drop-off Program

The Adopt-A-Stream Program is a citizen's volunteer stream monitoring program that assesses the health of local waterways through routine chemical and macroinvertebrate monitoring, and through visual and watershed assessments. Volunteers are trained and certified to monitor waterways for several parameters, including pH, dissolved oxygen, temperature, and macroinvertebrate surveys. Emphasis is placed on nonpoint source education and the collection of quality baseline data for Fulton County's streams. The observations section of the data form corresponds to the basics of IDDE monitoring, including odor, color, clarity, foam, oily sheen, and water flow.

Storm Drain Marking provides a method for informing the public that everything that enters a storm drain flows untreated into a nearby water body. By gluing colorful disks with the message "Keep It Clean – Drains To River" onto the storm drain inlets we can remind neighborhood residents that storm drains are not the place to dispose of trash, yard clippings, motor oil, or any other debris. We conduct stream and river cleanups year round, helping citizens with organization and providing the supplies and support needed to make the events successful.

The Household Hazardous Waste program promotes the reduction, reuse, and recycling of common household products and provides Fulton County residents with advice about environmentally safe, convenient ways to dispose of unwanted household products, such as paint, solvents, fuels, cleaners, and pesticides. The county holds periodic amnesty drop-off days, usually 2 to 4 times per year.

The Fulton County Sherriff's Department has partnered with a non-profit organization to offer free pharmaceutical disposal through 10 drop-off locations around the County. These drop boxes help keep unused medications from falling into the wrong hands or from being flushed down the toilet.

The program activities will be documented in the Annual Report.

3.10 Post-Construction

3.10.1 Legal Authority

a) The County has the authority to require water quality management controls under the Georgia Stormwater Manual, the County Stormwater Design Manual, and the Fulton County Erosion, Sedimentation and Pollution Control Ordinance. The County will address GI/LID practices in revisions to the County ordinances based on evaluations using The Center for Watershed Protection's Code and Ordinance Worksheet. The ordinances will be reviewed during the 2015-2016 reporting period and the status will be included in the report submitted June 15, 2016.

b) The Fulton County Stormwater Management Storm Drainage Design and Criteria Manual, the Center for Watershed's worksheet and the Fulton County Erosion, Sedimentation and Pollution Control Ordinance are located in Appendix N - Fulton County Stormwater Management Manual, CWP Worksheet and ES & P Control of the CD.

c) Fulton County's current stormwater ordinances were evaluated using the Codes & Ordinances Worksheet as published by the Center for Watershed Protection. The completed worksheet resulted in a score of 83 out of 100. The ordinances:
   - Fulton County Comprehensive Storm Water Ordinance
   - Amendment No. 1 to the Fulton County Stormwater Management Storm Drainage and Criteria Manual
   - Zoning Resolutions of Fulton County, Section 4.24 – Floodplain Management
   - Article VI – Conservation Subdivision Ordinance
   - Comprehensive Storm Water Ordinance, Division 6, Chapter 26
   - Fulton County Codes of Law, Article XVI – Litter Control, and
   - Codes & Ordinances Worksheet as published by the Center for Watershed Protection

   are included as part of Appendix N - Fulton County Stormwater Management Manual, CWP Worksheet and ES & P Control.

3.10.2 GI/LID Program

a) P&CS will implement a GI/LID feasibility evaluation and program and submit it with the 2016-2017 annual report.

3.10.3 GI/LID Structure Inventory

a) The County will develop an inventory of both privately owned an public owned water quality related GI/LiD structures constructed after June 11, 2014 that are located within the jurisdiction. The inventory will include the total number of each type of structure (e.g., bio-swales, pervious pavement. Rain gardens, cisterns, and green roofs). The inventory will be submitted with the annual report on June 15, 2017.

b) The County will track the addition of new water quality-related GI/LID Structures through the plan review process and insure that the structures are added to the inventory. The County will provide an updated inventory in each annual report, beginning with the June 15, 2017 annual report.

3.10.4 Inspection program

a) DWR will perform inspections on 20% of the water quality GI/LID structures in the inventory as provided by P&CS annually, and will provide the number of the total structures inspected beginning with the 2017 - 2018 annual report.

b) DWR will conduct maintenance on publicly owned GI/LID structures as needed, beginning in June 2017, and will provide the total number of structures maintained in during each reporting period in each annual report, beginning with the 2017 – 2018 annual report.

c) DWR, in conjunction with P&CS will develop procedures for ensuring privately owned non-residential GI/LID structures are maintained as needed, and will submit the procedures for EPD's review with the 2016 – 2017 annual report. Upon approval by EPD the procedures will be implemented and documentation of inspection and maintenance of privately owned non-residential GI/LID structures will be provided in each annual report, beginning with the 2017 – 2018 annual report.

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1 Introduction and Purpose

The purpose of the Enforcement Response plan is to protect, maintain and enhance the public health, safety, environment and general welfare by establishing minimum requirements and procedures to control the adverse effects of nonpoint source pollutants in stormwater.

Fulton County's stormwater enforcement response program is divided into three sections:

- Illicit Discharge Detection and Elimination (IDDE)
- Industrial Facility Stormwater Discharge Control and Highly Visible Pollutant Sources (HVPS)
- Construction, and Associated Soil Erosion and Sediment Control

The IDDE, Industrial Facility Stormwater Discharge Control and HVPS programs are managed by the Fulton County Stormwater unit. The Construction, and Associated Soil Erosion and Sediment Control program is managed by the Fulton County Planning & Community Services Department.

The Fulton County Stormwater unit utilizes Code Enforcement, a unit of the Fulton County Police Department, for serious and / or repetitive violations. Through the issuance of Notices of Violations (NOV) Code Enforcement can, when necessary route serious and / or repetitive violations of County ordinance to the County's Environmental Court. Environmental Court is held every third and fourth Tuesday in the Fulton County Courthouse. The assigned Court Officer reviews the criminal history records with the Judge to assist in determining fine amounts and or other court ordered requirements.

The ordinances quoted in this document are not included in the printed version, but are included in the electronic copy, available on compact disk.

2 Illicit Discharge Detection and Elimination

2.1 Violations and Enforcement Mechanisms

According to Division 6, Prohibitions and Illicit Connections, Section 26-316 of Fulton County Code of Ordinances "it is unlawful for any person, company, corporation, etc., to throw, drain, run, or otherwise discharge to any component of the county's stormwater system, including streets, highways, rights-of-way; or to cause, permit, or suffer to be thrown, drain, run, or allow to seep or otherwise discharge into such system, any organic or inorganic matter that shall cause or tend to cause pollution to such waters, as provided for in this article."

When poor housekeeping, accumulation of litter or other minor issues that don't rise to the level of a violation of Division 6, Section 26-316 are discovered or reported the County will issue a verbal warning, and track and report verbal warnings along with violations in the Annual MS4 Report.

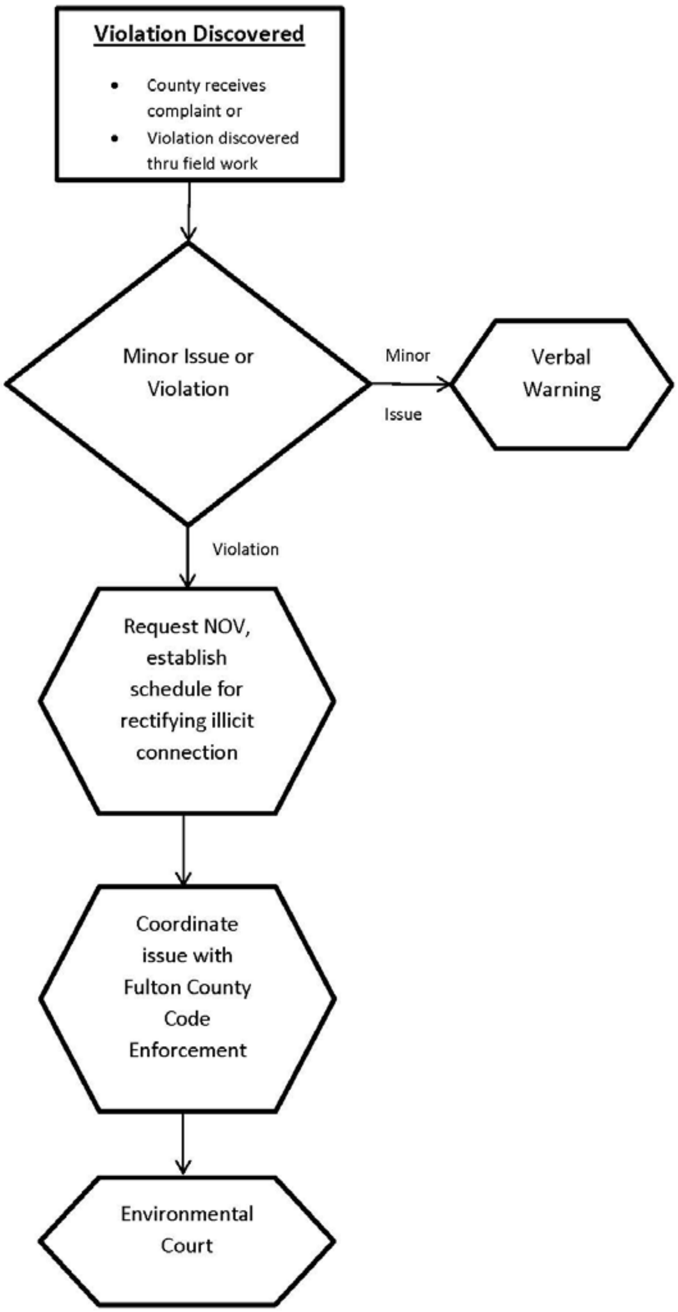
Violations of Division 6, Section 26-316 will result in an issuance of a NOV, and / or trial by the County magistrate or state court.

Each day of violation is considered a separate offense, and is punishable by $1,000 per violation or imprisonment in the county jail for not more than 60 days, or both fine and imprisonment for each offense.

In addition the county attorney on behalf of the county may institute injunctive, or other appropriate action or proceedings at law or equity for the enforcement of this article or to correct violations of this article, and any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.

Enforcement will follow the procedure on the following page.

Section 2


Violation Discovered
County receives complaint or
Violation discovered thru field work
Minor Issue or Violation
Minor
Issue
Verbal Warning
Violation
Request NOV, establish schedule for rectifying illicit connection
Coordinate issue with Fulton County Code Enforcement
Environmental Court

2.2 Tracking

Tracking is initiated when the County finds a dry weather flow at a municipal separate storm sewer system (MS4) outfall, when a potential illicit discharge is reported, or poor housekeeping or other minor issues are discovered. A log will be maintained that includes:

- Dates
  - Dry weather flow, violation or minor issue discovered
  - Inspections and re-inspections
  - Notice of violation issued, if applicable
- Property address and owner(s)
- Type of enforcement action (notice of violation, verbal warning or other action taken by the County)
- Required timeframe to correct violation, if a violation has been determined to have occurred
- Final resolution, including date and verification

The log will be maintained in an Excel spreadsheet, and the results reported in the Annual MS4 Report.

2.3 Summary of Enforcement Measures and Time Frames

Enforcement of the County's Prohibitions and Illicit Connections ordinance will occur in accordance with the table below.

Violation	**Enforcement Measure**	**Time Frame**
Poor housekeeping or other minor issue	Verbal Warning - inform offender that discharge of pollutants is a violation of County ordinance, provide educational materials, log the incident for reporting and future reference.	Same day as discovery
Illegal connection or violation (one time or repetitive dumping)	Inform offender that discharge of pollutants is a violation of County ordinance, establish schedule to rectify the problem, cite the offender under County illicit discharge ordinance if the schedule is not adhered to.	A schedule for rectifying the illicit connection will be developed upon discovery. Failure to conform to the schedule will result in enforcement action, issuance of a Notice of Violation and / or initiation of legal proceedings, as appropriate. Generally 10 business days will be allowed to rectify an illicit connection.

3 Industrial Facility Stormwater Discharge Control and Highly Visible Pollutant Sources

3.1 Introduction, Violations and Enforcement Mechanisms

Fulton County, in accordance with the County (Municipal Separate Storm Sewer System) MS4 Permit and Stormwater Management Plan (SWMP) conducts stormwater related inspections of industrial facilities and highly visible pollutant sources (HVPS) within the County's MS4 jurisdictional areas. Those program activities are fully described in the County's 2014 – 2019 Stormwater Management Plan.

Discharge of pollutants from an industrial or HVPS site, whether discovered as part of the County's inspection program, or due to complaints and / or stream walks is a violation of the County's Prohibitions and Illicit Connections ordinance. Minor violations will result in informal warning and / or education. Major violations and persistent minor violations may result in issuance of a Notice to Comply, reporting to Fulton County Code Enforcement and / or referral to State and or Federal agencies.

Minor violations include, but are not limited to:

- Failure to effectively apply Best Management Practices to minimize potential exposure, poor housekeeping and / or material handling, etc.
- Evidence of discharges (stains, sludge, eroded concrete)
- Observed discharge of wash waters to the storm drain system that have not reached a creek, river or stream
- Illicit connection to storm drainage system, such as a floor drain

Major violations include, but are not limited to:

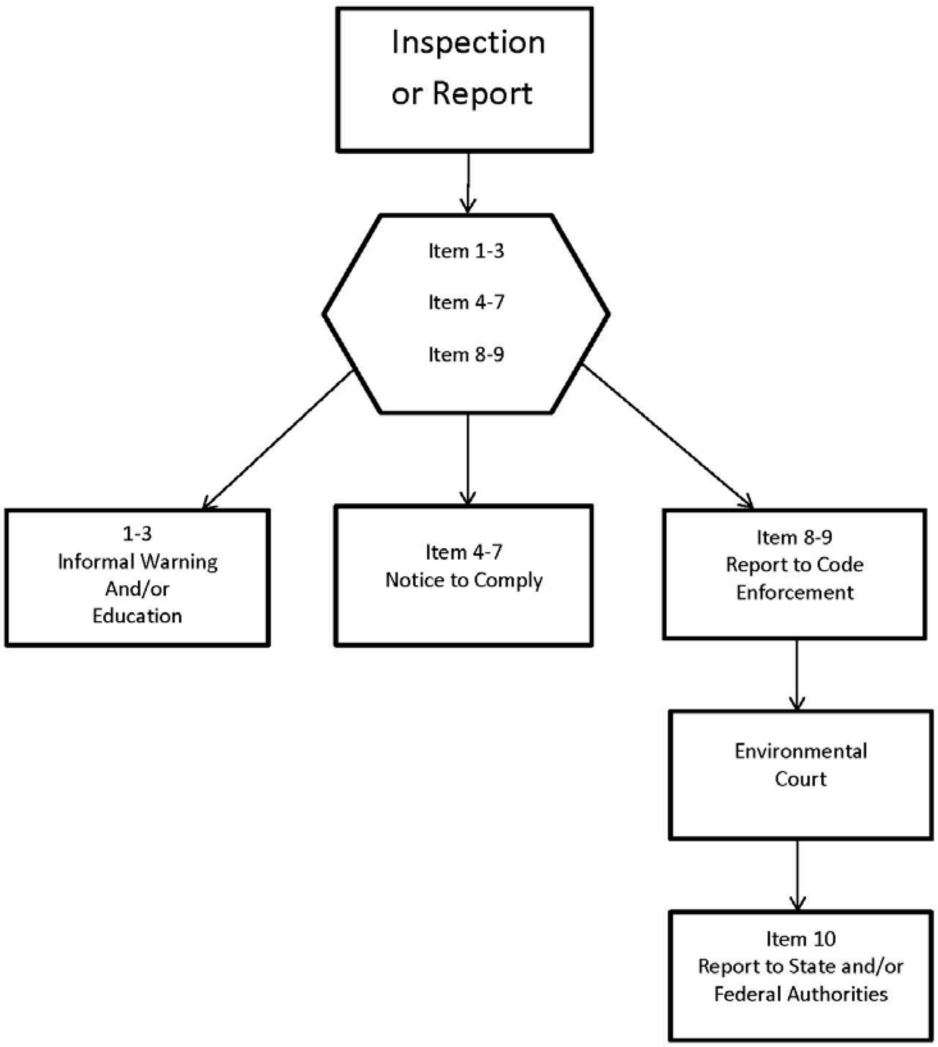
- Discharge of pollutants that have reached a creek, river or stream
- Visible pollutants present in stormwater runoff (during wet weather) such as oil sheen or litter
- Failure to correct previous violations

Enforcement actions can consist of, but are not limited to:

- Informal warning and / or education
- Issuance of a Notice to Comply
- Report to Fulton County Code Enforcement
- Referral to State and / or Federal Agencies

Enforcement will follow the procedure shown below.

Section 3


Inspection
or Report
Item 1-3
Item 4-7
Item 8-9
1-3
Informal Warning
And/or
Education
Item 4-7
Notice to Comply
Item 8-9
Report to Code
Enforcement
Environmental
Court
Item 10
Report to State and/or
Federal Authorities

3.2 Tracking

Tracking is initiated when a potential illicit discharge is reported or found during routine inspections. A log will be maintained that includes:

- Dates
  - Discharge of pollutants, or other potential violation is discovered
  - Inspections and re-inspections
  - Notice of violation issued, if applicable
- Property address and owner(s)
- Type of enforcement action (notice of violation or other action taken by the County)
- Required timeframe to correct violation, if a violation has been determined to have occurred
- Final resolution, including date and verification

The log will be maintained in an Excel spreadsheet, and the results reported in the Annual MS4 Report.

3.3 Time Frame for Enforcement Measures

Minimum enforcement procedures will occur in accordance with the table below.

Violation	I: Informal warning and / or education	II: Notice to Comply	III: Report to Fulton County Code Enforcement	IV: Referral to State and / or Federal Agencies
1. Failure to effectively apply Best Management Practices to minimize potential exposure, poor housekeeping and / or material handling, etc	X			
2. Evidence of discharges (stains, sludge, eroded concrete)	X			
3. Observed discharge of wash waters to the storm drain system	X			
4. Illicit connection to storm drainage system, such as a floor drain		X		
5. Failure to correct violation		X		
6. Discharge of small quantities of pollutants that have reached a creek, river or stream		X		
7. Visible pollutants present in stormwater runoff (during wet weather) such as oil sheen or litter		X		
8. Discharge of large quantities of pollutants that have reached a creek, river or stream			X	
9. Third failure to correct violations 1 -7			X	
10. Failure to correct violations 8 – 9				X

All actions in the above table will occur upon discovery, except Item 5, which will be upon re-inspection.

4 Construction, Associated Soil Erosion and Sediment Control and Stream Buffers

4.1 Preventative Measures

1. Fulton County provides education and materials regarding Best Management Practices and/or prohibitions to educate the Development Community/Contractor.
2. Fulton County recommends a preconstruction site visit on all construction projects to inspect and insure that BMPs are properly installed and functioning and to identify any potential onsite problems, or hazards.
3. All Fulton County Construction and Erosion Inspectors and Storm Water Plan Reviewers are GSWCC certified.
4. Fulton County Construction and Erosion Inspectors perform daily and / or as needed construction site inspections to ensure and promote enforcement.

4.2 Violations and Enforcement Mechanisms

Any construction related activity found to be in violation of any regulation or guideline set forth in the Fulton County Storm Water Management Program shall be subject to a response as outlined in this Construction Enforcement Response Plan (CERP). Fulton County's response to a violation of the Plan may include, but is not limited to the following:

1. Site violations may be issued a Verbal Warning requiring a 24-hour compliance timeline with subsequent reinvestigation.
2. Failure to comply with the Verbal Warning in the 24-hour period results in a written Notice to Comply (NTC). The NTC will identify the source(s) of violation, corrective action(s) to restore the site to an acceptable and lawful condition and a required compliance date.
3. In an emergency situation or failure to comply with the NTC, the Issuance of Stop Work Order (SWO) is utilized. The SWO is a cease and desist order posted onsite until all noncompliant items and corrective measures have been taken. Violations where a Stop Work Order is required immediately, without warning:
   a. Land disturbance without a permit
   b. Excessive sediment leaving the site
   c. Violation of the Stream Buffer Ordinance
   d. Land disturbance with no GSWCC certified personnel on site.
4. Failure to remedy a SWO will result in the Citation to Environmental Court (CTEC)); corrective measures and timeline are specified in the CTEC, no work is allowed onsite unless it is corrective in nature.
5. Judicial enforcement action including injunctive relief and criminal prosecution is to be utilized to achieve compliance should all other efforts fail to address violations. Working with the Environmental Court Solicitor, Fulton County Inspectors, Lead Engineer and Director will formulate a recommendation for fines and mitigation measures.

Ordinances and regulation for this part of the Enforcement Response Plan are provided in:

- Chapter 26, Article II, Erosion, Sedimentation and Pollution Control of 2010.
- Article VII, Fulton County Unified Stream Buffer Protection Ordinance

4.3 Time Frame for Enforcement Measures

1. Enforcement responses to initial construction related storm water violations will be initiated within 5 days of discovery, or at the discretion of Fulton County. In cases where a NTC is issued, immediate action is required.
2. If necessary, follow-up inspections or site visits will occur within 1 day of the compliance date specified in the NTC.
3. Follow-up action for repeat or recurring offenses will occur within 5 days of discovery of the offense, and may include additional enforcement actions including Administrative Orders, Fines, and Judicial Enforcement.
4. In the event of an emergency situation caused by storm water violations and presenting imminent danger to the public health or safety, or danger to County personnel, or the environment, the County may initiate enforcement responses including:
   i. Issuance of Stop Work Order (SWO); or
   ii. A freeze on the issuance all of Land Disturbance Permits to the entity in violation.

4.4 Administrative Fine Schedule

As a result of significant non-compliance, an owner may be assessed an administrative fine with a maximum penalty of $2,500, per day, per violation. Each day during which violation or failure or refusal to comply continues shall be a considered a separate violation.

Minimum administrative penalties shall be as follows:

1. Conducting land disturbance activities without a land disturbance permit or building permit (first offense) - $250.00 for each violation and/or each day on which a violation exists.
2. Conducting land disturbance activities without a land disturbance permit or building permit (second or subsequent offense) - $1,000.00 per violation and/or each day on which a violation exists.
3. Lack of proper installation or maintenance of best management practices - $250.00 per violation.
4. Working under a Stop Work Order (first offense) - $500.00 per violation and/or each day on which a violation exists.
5. Working under a Stop Work Order (second or subsequent offense) - $1,500.00 per violation and/or each day on which a violation exists.

4.5 Reconsideration of Penalties, Administrative Appeal and Judicial Review

Reconsideration Appeal If a property owner wishes to dispute an assessed administrative penalty, the owner must file a written appeal to the Director seeking reconsideration of the County's action. The appeal must clearly define the nature of the disagreement, the specific reference to the code or ordinance referenced in the action and the appellant's arguments supporting their appeal.

Administrative Appeal. The appeal shall entitle the person submitting the plan or holding the permit to a hearing before the Fulton County Board of Commissioners, within 30 days after receipt by the Director of written notice of appeal.

Judicial review. Any person aggrieved by a decision or order of Fulton County, after exhausting his administrative remedies, shall have the right to appeal de novo to the Superior Court of Fulton County.

4.6 Construction Related Stormwater Violation Enforcement Schedule

E & S Violation Enforcement	VW	DTR	NTC	DTR	SWO	DTR	CTEC
Failure to post permit / no permit issued					X	1	X
Violation of stop work order							X
Proper BMP's not in place	X	2	X	1	X	1	X
BMP's not maintained (minor)	X	3	X	1	X	1	X
BMP's not maintained (major)			X	1	X	0	X
Buffer violations					X	0	X
Excessive sediment leaving site					X	0	X
Failure to maintain stormwater ponds (minor)	X	3	X	3	X	0	X
Failure to maintain stormwater ponds (major)			X	2	X	0	X
Failure to have certified staff member on site during land disturbing activity					X	0	X

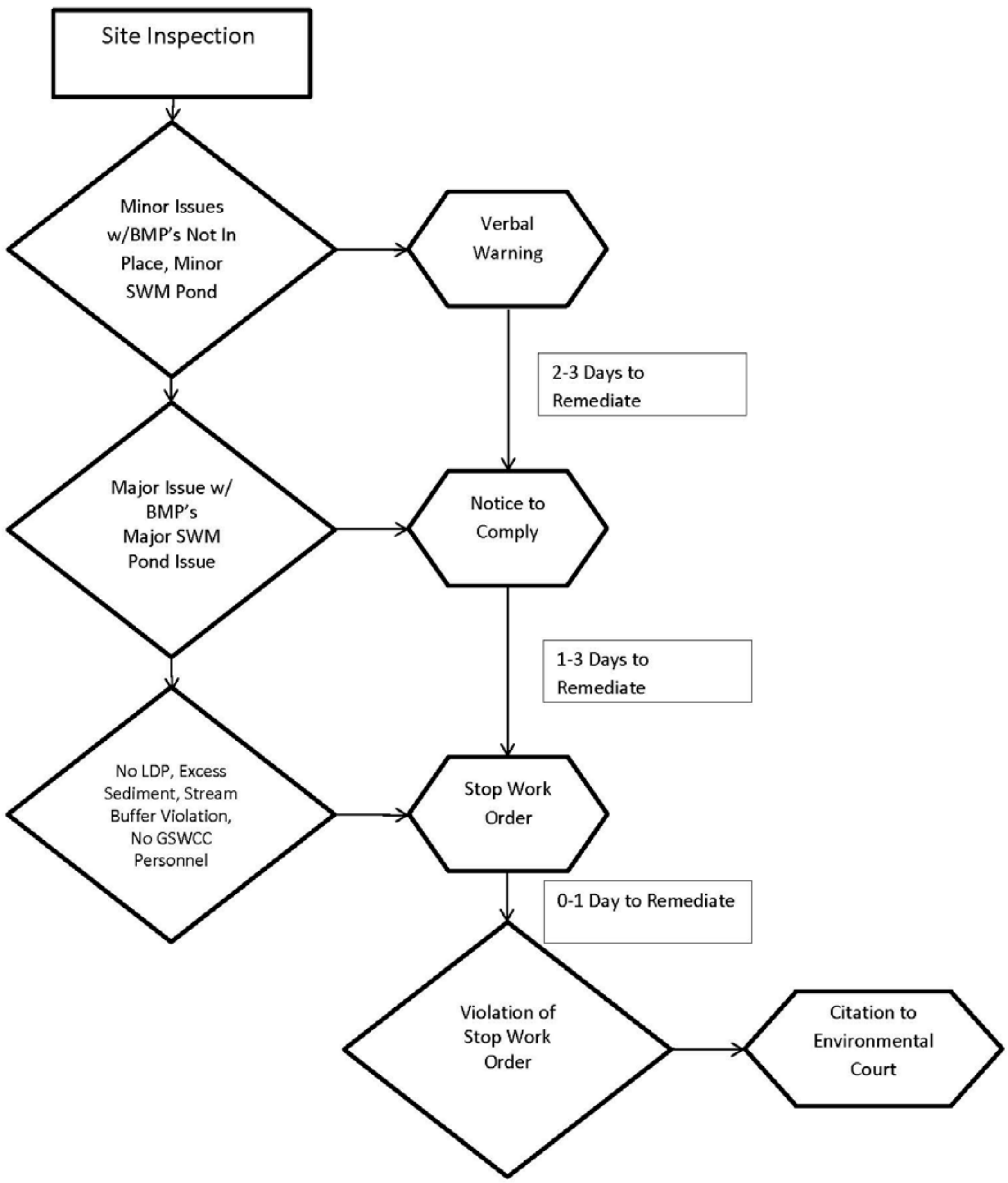
VW: verbal warning
NTC: notice to comply
SWO: stop work order
CTEC: citation to Environmental Court
DTR: Days to remediate

The SWM Pond major violation would be if Public Safety or Water Quality is in danger.
The SWM Pond minor violation would be if BMP's or permanent stabilization lack proper maintenance.

Fulton County keeps a log of all the Erosion, Sedimentation and Pollution Control and Stream Buffer Protection Ordinance violations and gives a summary to the GSWCC District at each Bi-monthly Meeting.

Enforcement will follow the procedure shown on the following page.

Section 4



Site Inspection
Minor Issues w/BMP's Not In Place, Minor SWM Pond
Verbal Warning
2-3 Days to Remediate
Major Issue w/ BMP's Major SWM Pond Issue
Notice to Comply
1-3 Days to Remediate
No LDP, Excess Sediment, Stream Buffer Violation, No GSWCC Personnel
Stop Work Order
0-1 Day to Remediate
Violation of Stop Work Order
Citation to Environmental Court

FULTON COUNTY

STORMWATER MANAGEMENT

STORM DRAINAGE

DESIGN AND CRITERIA

MANUAL

DECEMBER 2000

FULTON COUNTY DEPARTMENT OF PUBLIC WORKS

BOARD OF COMMISSIONERS OF FULTON COUNTY

Mike Kenn – Chairman

Emma Darnell – Vice Chair

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William Edwards

Robert Fulton

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Karen Webster

FULTON COUNTY DEPARTMENT OF PUBLIC WORKS
TIM EQUELS, ACTING DIRECTOR

PRELUDE

The STORMWATER MANAGEMENT DESIGN AND CRITERIA MANUAL (MANUAL) incorporates a new Chapter 15 titled "**WATER QUALITY BEST MANAGEMENT PRACTICES (BMP's)"** as an addition to Fulton County's 1983 Manual on Drainage Design. The addition of practices to address water quality is required for Fulton County to comply with the provisions of Metro Atlanta Area-Wide, Phase One Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit.

The MANUAL encourages the use of the most current applicable stormwater quality and quantity models and hydrograph/hydrology methodologies for the design of post-development BMP's and storage facilities. Culvert design using the Federal Highway Administration (FHWA) Design series No. 5 and No. 10 and other applicable hydraulics programs is also encouraged. The Manual for Erosion and Sediment Control in Georgia is recommended for guidance in the preparation of land development sediment and erosion control plans for use in obtaining a land disturbance permit (LDP) and for establishing erosion and sediment control practices pertaining to NPDES permits for construction sites.

Requests for waivers of specific requirements of this manual may be made in accordance with the Fulton County Comprehensive Stormwater Management Ordinance.

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FORWARD

The Fulton County drainage practice and procedure contained in this manual is intended to assist compliance with the drainage regulations and ordinances approved by the Fulton County Board of Commissioners. This manual was prepared by a thorough revision of the 1976 manual and supercedes all other previous manuals including the 1976 manual.

The purpose of this thorough revision is to assist engineers who are engaged in design of drainage facilities by including more recent and sound engineering methods for runoff computations and detention basin design, design of culverts and road inlets, stable open channels, and energy dissipators. A method for computing soil erosion is also included. The chapter on methods for Erosion and Sediment Control described in the 1976 manual is retained in its original form in this manual.

Excess storm runoff resulting from land developments must be controlled by providing detention basins which regulate the rate of runoff after development. Several methods and examples are included for computing the rate and volume of runoff, and design of detention basin depending on the size of watersheds.

Procedures for the design of pipes, culverts and road inlets are given with examples. Design of open channels of erosion control and estimation of soil erosion are explained with several examples.

An engineer's specification of steps to control erosion and sedimentation from a project will vary in number and type. Topography, size and nature of the project, soil characteristics, amount and kinds of vegetation, land use of adjoining property, climate, and time of year will influence the designer's choice of methods. Included in Chapter 14 are specifications and standards suggested by the U.S. Department of Agriculture, Soil Conservation Service, reproduced as published, and some additional techniques from other sources.

Resources available to the engineer are not limited to the contents of this manual. Any adequate detention basin design based on sound engineering principles and any properly scheduled and thorough scheme of erosion and sediment control will be considered for approval.

We would like to express our special thanks to Dr. Srinivas G. Rao, Assistant Professor of Civil Engineering, Georgia Tech for undertaking the revision of the drainage manual. Mr. James R. Rigby, Civil Engineer, Fulton County Planning and Community Development Department provided excellent administrative help and technical suggestions.

This report was funded by the Fulton County Planning and Community Development Department under Contract AGMT/81 E-20-636 with the Georgia Institute of Technology.

CHAPTER 1 - DESIGN CRITERIA AND POLICIES

1.1 PEAK RUNOFF AND HYDROGRAPHS

(Chapters 2, 3, and 4)

1. The Rational Formula may be used for drainage areas up to 25 acres. The weighted runoff coefficient before development shall not exceed 0.3.

2. Soil Conservation Service (SCS) methods may be used for watersheds up to 2000 acres. For watersheds larger than 2000 acres, flood frequency method, or Corps of Engineers method may be used. The weighted curve number before development shall not exceed the equivalent of 0.3 runoff coefficient.

3. The Burkli – Ziegler Formula or Talbot Formula shall not be used for any watershed size.

4. Hydrographs shall be computed for all drainage areas. Hydrographs can be computed by any of the following methods: Rational method, SCS Tabular method, SCS unit hydrograph method, Colorado unit hydrograph method or Espey unit hydrograph method. Again Rational Method should be limited to small drainage areas. It is suggested to use Espey method or SCS method in preference to Colorado method as the latter involves many parameters. It is also suggested to use two different methods to compute hydrographs to provide a check on the computation.

5. Other methods of runoff determination may be used with the approval of Fulton County. For large watersheds, methods such as TR-20 or HEC-1 may be used.

1.2 PIPES, CULVERT AND ROAD INLETS

(Chapters 5, 6, 7)

1. Pipe Systems and road inlets for public roads shall be designed for the 10-year storm. Inlets shall be spaced so that the spread in the road for the design flow shall not exceed 6-8 feet. (Maximum spacing 600 feet.)

2. Culverts shall be designed for a 100 year frequency. Minimum culvert size shall be 18" and maximum velocity in culvert shall be 15 ft/sec.

3. Energy dissipators shall be provided for the 50-year frequency at the outlet end of pipes and culverts.

4. Storm sewers, catch basins and culverts shall be designed for 25 year frequency in residential and commercial areas, and for 50 year frequency in high value districts.

1.3 <u>DETENTION FACILITIES</u>

(Chapter 8)

1. Drainage facility should be provided to limit the rate of flow and velocities after development to the rate and velocities that existed before development. No increase in the rate and velocity of runoff, as a result of the development, will be permitted greater than one cubic foot per second (cfs) for drainage basins with areas equal to or less than 10 acres in size, 0.1 cfs for each acre greater than 10 acres and less than or equal to 100 acres, and no greater than 10 cfs for areas of any size.

2. For development areas greater than 5 acres, runoff hydrographs should be computed for the flow after development and routed through the detention facility such that the outflow rate and velocity from the facility shall not exceed the rate(s) and velocities mentioned above. For areas greater than 5 acres, use of Bowstring method or any other method without verification by routing is not acceptable.

3. The storage volume of detention basin and the outflow device should be adequate so as not to change the discharge the rate of runoff as mention in (1) for the 2 year, 10 year and 25 year frequency storm and for all storm durations.

4. The detention facility shall be provided with an overflow device or emergency spillway to accommodate the 100 year frequency storm. In cases where emergency spillway is not provided, the outflow device shall be designed for the 100 year frequency.

5. The detention facility, including basin, overflow and outflow device, shall be clearly depicted in plan and cross-section and thoroughly dimensioned on the construction drawings.

1.4 <u>EROSION AND SEDIMENTATION</u>

(Chapter 13, 14)

All grading and/or soil erosion and sediment control associated with land-disturbing activity plans shall comply with the Fulton County Erosion and Sedimentation ordinance. Erosion of soil from sites should be estimated and control of eroded soil from deposition downstream should be identified.

1.5 <u>ORGANIZATION OF THE MANUAL</u>

Computation of peak rate of runoff by the Rational formula is discussed in Chapter 2.
Chapter 3 includes other methods of peak rate computation, such as the SCS TR-55, USGS and Corps of Engineers methods. Hydrographs can be obtained by various methods (Modified Rational method, SCS Tabular method, Colorado unit hydrograph method, SCS unit hydrograph method, SCS unit hydrograph method and Espey unit hydrograph method) given in Chapter 4.
Sizing of pipes, culverts and road inlets are discussed in Chapters 5, 6, and 7. Design of detention facilities is included in Chapter 8.

Design of open channels, stable channels, and energy dissipators is included in Chapters 9, 10, and 12. Some aspects of energy losses in drainage design are given in Chapter 11.
Computation of soil loss, and various erosion and sediment control practices can be found in Chapter 13 and 14. Chapter 15 describes the various post-development Best Management Practices (BMP's) that can be utilized to mitigate surface water quality.

CHAPTER 2 - PEAK RATE OF RUNOFF BY RATIONAL METHOD

The Rational Formula can be written as

$$Q_P = CIA \tag{2.1}$$

Where Q_P = maximum peak rate of runoff from a given drainage area, in cubic feet per second, i.e., cfs.

C = runoff coefficient that represents the ratio of runoff to rainfall.

I = the intensity of rainfall in inches per hour for a duration equal to the time of concentration and for a stated recurrence interval.

A = the drainage area in acres.

The rationale for the method lies in the concept that application of a steady, uniform rainfall intensity will cause runoff to reach its maximum rate when all parts of the watershed are contributing to the outflow at the point of design. That condition is met after the elapsed time, T_C, the time of concentration, which is usually taken as the time for water to flow from the most remote part of the watershed to the point of design. The rational method seems to give satisfactory results when applied to small drainage areas and when correct values of time of concentration and runoff coefficient are used.

Runoff Coefficient (C)

The selection of the appropriate runoff coefficient is the most difficult problem and requires considerable engineering judgment in addition to any measurable facts. The runoff coefficient is related to many factors including antecedent moisture, non-uniform rainfall, soil type and land use pattern, watershed slope and percent imperviousness. Runoff coefficients may vary during the storm and between storms as well as with the return period of recurrence interval. However, as recommended in ASCE Manual No. 37, the use of average coefficients produces generally satisfactory results for smaller frequencies such as 2-10 years but the designer should be aware of these factors affecting the runoff coefficient especially for larger frequencies.

Typical values of runoff coefficients (c) for the Fulton County area are given in Table 2.1. The runoff coefficient is affected by the frequency of rainfall. Table 2.2 presents the multiplying factor of C for several frequencies. For example, the C value for a 50-year storm will be 1.2 times the average C value given in Table 2.1. It should be noted that the overall C should not exceed 1.0 C values should be selected only after inspecting the area in the field and noting the topographic maps and soils information available for the area, and determining the percent imperviousness in the area and different land uses. Composite or weighted runoff coefficients should be computed for various types of land uses by the formula

$$C = (\Sigma C_1 A_1)/\Sigma A_1 \qquad (2.2)$$

where C = the composite runoff coefficient.
C_i = the runoff coefficient for the i^{th} landuse (from Table 2.1)
A_i = the area of the i^{th} landuse (acres)

Rainfall Intensity

The rainfall intensity (I) in Equation 2.1 is a function of both frequency and duration of rainfall. The rainfall intensity-frequency-duration curves to be used for the Fulton County are shown in Chart 2.1. I values can be obtained by entering Chart 2.1 with proper values of frequency and duration. The recommended design frequencies for various drainage facilities in Fulton County are specified in Table 2.3

The storm duration is usually the time of concentration of the watershed, i.e., the time required for water to flow, from the most remote point of the area to the design point. This time of concentration is then the sum of the inlet time (or overland flow time) plus the travel time. Inlet time is the time required for water to flow overland to the nearest pipe, channel or stream. It depends on the length of overland flow, the slope and ground cover. Overland flow velocities can first be computed using Chart 2.2 and then the inlet time is calculated using

$$t = \frac{L}{60V} \qquad (2.3)$$

where t = overland flow time in min.
L = overland flow length in ft.
V = velocity in fps

ASCE has reported that most commonly used values for the overland flow vary 5 to 30 minutes while in flat residential areas with widely spaced inlets a 20-30 minute time is customary.

Alternately the overland flow time can be computed using any of the following formulae.

Izzard Formula

$$t = \frac{41^{C} I^{1/3}}{(CI)^{2/3} S^{1/3}}$$

C_I = retardance coefficient
S = average ground slope of overland flow
C = runoff coefficient
L = average overland flow distance in ft.
t = overland flow time in min
I = intensity of rainfall in inches/hour for a duration equal to t

Typical values of C for IL<500 are given in Table 2.4. Equation 2.4 is to e solved by trial and error since I is also a function of t. A value of I must be assumed from Chart 2.1 and t is calculated using Equation 2.4. T_C is then computed by adding travel time (discussed below) to the calculated t. The assumed rainfall intensity must then be checked against rainfall intensity read from Chart 2.1 for a duration equal to the calculated T_{C}. The trial-error procedure should be continued until the two rainfall intensities match.

Kerby Formula

$$t = 0.827\left(\frac{NL}{\sqrt{S}}\right)0.467$$

N values for L < 1200 ft. are given in Table 2.5. All other quantities in Equation 2.5 have the same meaning as in Equation 2.4.

Federal Aviation Agency Method

Federal Aviation Agency has developed the following equation to compute the overland flow time for urban basins.

$$t = 1.8\,(1.1 - C)\,L^{0.50}\,S^{0.33} \qquad (2.6)$$

where t = overland flow time in minutes

C = runoff coefficient
L = length of overland flow in ft.
S = surface slope in %

Chart 2.3 can be used to determine t, instead of using Equation 2.6.

Travel Time

Travel time is the flow time in pipes, gutters, channels or streams. It is computed by knowing the length of channel, slope, Manning's coefficient, discharge and size (or diameter) of the channel. Chart 2.4 can be used for circular channels to first determine the velocity, and the travel time is then computed using Equation 2.3. Table 2.6 gives typical values of Manning's coefficient for flow in closed conduits and open channels. Values of n for special situations not listed in Table 2.6 can be obtained from Chow (1959) and GDOT (1975).

For noncircular channels such as rectangular or trapezoidal channels, the velocity of flow is computed using Manning's Equation.

$$V = \frac{1.489}{n} R^{2/3} S^{1/2}$$

where V = velocity in fps

n = Manning's coefficient

s = slope in ft/ft

R = hydraulic radius in ft.

$= \frac{\text{water area}}{\text{wetted perimeter}}$

The details of these calculations can be found in Chow (1959). Typical velocities for natural waterways are given in Table 2.7 and can be used as a guide to check the actual calculation.

For small drainage basins with few drainage improvements, Chart 2.5 can be used to check the time of concentration computed by using any of the formulas mentioned above. Chart 2.5 should not be used to solely determine the time of concentration. The time of concentration is computed by entering Chart 2.5 with height (ft) and maximum length of travel (ft). Height is the difference in elevation of the most remote point in the drainage area and the inlet. Maximum length of travel is the greatest distance the water will travel from the most remote point of the drainage area to the inlet. These two items of information can be determined in the field or from contour maps.

The minimum time of concentration may be used for any drainage shall be 5 minutes since the shortest duration for which rainfall values is available is five minutes (see Chart 2.1).

Drainage Area

The drainage area can be accurately determined from a topographic map and field survey. The ridge lines are determined to delineate the watershed and the drainage area is determined using a planimeter.

EXAMPLE 2.1

Using the Rational Formula, compute the peak rate of runoff expected from a 25-year frequency storm from a drainage basin with the following information.

Drainage area = 50 acres
Slope = 10 ft/1000 ft = 1%
Length of overland flow = 200 ft
Slope of overland flow = 10 ft/100 ft = 10%
Ground cover of overland flow = woodland
Length of channel = 2000 ft
Slope of Channel = 3%

Predominant soil type: Clay

Land Uses

Woodland	15 acres
Farmland and pasture	10 acres
Single Family Residential (1 / 2 acre lots)	15 acres
Commercial	10 acres

1. Compute Composite (or weighted) "C" Value Using Table 2.1)

Land use	Area (A_1) Acres	C_1	C_1 A_1
Woodland	15	0.2	3.0
Farmland and pasture	10	0.25	2.5
Single Family Res. (1/2 acre lots)	15	0.5	7.5
Commercial	10	0.85	8.5
	50		21.5

2. Duration

Time of concentration = inlet time + travel time

Inlet Time

Length of travel = 200 ft

Velocity = 0.8ft/sec (from Chart 2.2)

$$Inlet\ time = \frac{200\,ft}{0.8\,ft/\sec} = 250\sec = 4.2\min$$

Travel Time

Length of Channel = 2000 ft
Velocity = 2.05 ft/sec (from Chart 2.2)

$$\text{Travel Time} = \frac{2000}{2.05 \times 60} = 12.3 \text{ min}$$

Time of Concentration = 4.2 + 12.3 = 16.5 min

Check with Chart 2.5

Height of most remote point above outlet = 2000 x 0/3 + 200 x 0.1
= 80 ft

Maximum length of travel = 2200 ft
T_C = 11 min
11 minutes is close enough to 16.5 min to indicate that the 16.5 minutes was reasonable to use.

Rainfall Intensity

I_{25} = 5.9 in/hr (from Chart 2.1)

Peak Rate of Runoff

$Q_P = CIA = 0.43 \times 5.9 \times 50 = 126.85 \cong 127$ cfs

EXAMPLE 2.2

Given the following data, determine the peak discharge resulting from a 25-year storm.
Area = 126 acres
Slope = 10 ft/1000 ft
Time of concentration = 18 min
Length of Area = 4500 ft
Land use : 30% apartments, 70% single family residential

SOLUTION

Composite C

Land use	Area, A_i	C_i	$C_i\ A_i$
Apartments	67.8	0.7	47.5
Residential	58.2	0.5	29.1
	126.0		76.6

$$\text{Composite } C = \frac{76.6}{126} = 0.60$$

Intensity of rainfall

I = 5.4 in/hr (from Chart 2.1)

Peak rate of runoff = CIA = 0.60 x 5.4 x 126 = 408.24 cfs

EXAMPLE 2.3

Determine the overland flow time using Izzard's equation with the following data.

Retardance coefficient (c) = 0.4
Overland flow length (L) = 1450 ft
Average ground slope (s) = 0.049
Runoff coefficient (C) = 0.438

$$t = \frac{41\, CL^{1/3}}{(CI)^{2/3}\, S^{1/3}} \qquad \text{(Eq. 2.4)}$$

$$= \frac{41\,(0.04)\quad (1450)^{1/3}}{(0.438)^{2/3}\ I^{2/3}\quad (0.049)^{1/3}} = \frac{88}{I^{2/3}}$$

This equation is solved by trial – and – error using, say 25-year frequency curve of Chart 2.1

I	$I^{2/3}$	t (from equation)
3.4	2.26	39
3.6	2.35	37
3.8	2.47	36

Of these values of t, t = 37 min gives an I value of 3.6 in/hr from Chart 2.1 which agrees with the assumed value of I in column 1 of the above calculation. Other values of t will not reproduce the I value assumed in column 1. Thus the overland flow time is 37 min.

TABLE 2.1 AVERAGE RUNOFF COEFFICIENTS

Landuse	C value
Commercial	
Downtown	0.7 to 0.95
Neighborhood	0.5 to 0.70
Residential	
Single-Family	0.3 to 0.50
Multi-units, detached	0.4 to 0.60
Multi-units, attached	0.6 to 0.75
Residential (Suburban)	0.25 to 0.70
Apartment	0.5 to 0.70
Industrial	
Light	0.5 to 0.80
Heavy	0.6 to 0.90
Park, Cemeteries	0.1 to 0.25
Playgrounds	0.2 to 0.35
Railroad yard	0.2 to 0.35
Unimproved*	0.1 to 0.30
Pavement	
Asphaltic and concrete	0.7 to 0.95
Brick	0.7 to 0.85
Roofs	0.7 to 0.95
Lawns, Sandy soil	
Flat, 0 to 2% slope	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, greater than 7%	0.15 to 0.20
Lawns, heavy soil	
Flat, 0 to 2%	0.13 to 0.17
Average, 2 to 7%	0.18 to 0.22
Steep, greater than 7%	0.25 to 0.35

*Fulton County ordinance requires that the C value for underdeveloped area not to exceed 0.3.
**The C values are for flat slopes (0 to 2% slope). C values should be increased by 0.05 for average slopes (2 to 7%) and by 0.10 for steep slopes (greater than 7%). Clay soils will have a greater C value than Sandy soils. The difference can be taken to be 0.05 to 0.10.

TABLE 2.2 FREQUENCY FACTORS FOR RUNOFF COEFFICIENTS

Frequency (years)	**Multiples for C**
2-10	1.0
50	1.1
50	1.2
100	1.25

TABLE 2.3 AVERAGE RAINFALL FREQUENCY

Storm Sewers in Residential and Commercial Areas	10-25 year frequency
High Value Districts (Commercial and Residential) and flood protection works	50 year frequency

TABLE 2.4 VALUES OF RETARDANCE COEFFICIENT FOR IZZARD'S FORMULA

Surface	C_I* Value
Smooth asphalt	0.007
Concrete pavement	0.012
Tar and gravel pavement	0.017
Closely slipped soil	0.046
Dense Turf	0.060

*Average value of C = 0.04 should be used.

TABLE 2.5 VALUES OF N FOR KERBY'S FORMULA

Surface	N
Sooth impervious surface	0.02
Smooth bare packed soil	0.10
Poor grass, row crops or moderately	
Rough bare soil	0.20
Pasture or average grass	0.40
Dense grass, forest	0.80

TABLE 2.6   MANNING COEFFICIENTS

Closed Conduits	Good	Poor
Concrete Pipe	0.013	0.015
Corrugated Metal Pipe		
Plain	0.021	0.023
Paved Invert	0.019	
Fully Paved	0.012	
Vitrified Clay Pipe	0.012	0.014
Cast Iron Pipe	0.013	
Steel Pipe	0.009	0.011
Brick	0.014	0.017
Asbestos-Cement Pipe	0.011	0.015
Monolithic Concrete		
Smooth forms	0.012	0.014
Rough forms	0.015	0.017
Plastic Pipes	0.011	0.015
Open Channels		
Lined Channels		
Asphalt	0.013	0.017
Brick	0.012	0.018
Concrete	0.011	0.020
Bubble or Riprap	0.020	0.035
Vegetal	0.030	0.040
Excavated or dredged		
Earth, straight and uniform	0.020	0.040

Earth, winding, fairly uniform	0.025	0.040
Rock	0.030	0.045
Unmaintained	0.050	0.14
Ditches and Swales*		
Good stand any grass	0.09	0.30
Fair stand any grass	0.06	0.25
Natural Channels (minor streams, Top width at flood stage < 100 ft)		
Fairly regular section	0.03	0.07
Irregular section with pools	0.04	0.10
Large streams	0.028	0.033
<u>Flood Plains</u>		
Pasture, no brush	0.030	0.05
Cultivated areas	0.03	0.05
Heavy weeds, scattered brush	0.05	0.07
Light brush and trees	0.05	0.08
medium to dense brush	0.07	0.16
<u>Streets</u>		
Concrete gutter	0.012	
Asphaltic pavement	0.013	0.016
Concrete pavement	0.014	0.016
Concrete gutter with asphaltic	0.013	0.015

*Refer to Chow (1959), GDOT (1975) for additional information.

TABLE 2.7 TYPICAL VELOCITIES IN NATURAL WATERWAYS

Average Slope of waterway (%)	Natural Channel (not well defined)	Shallow Channel	Main Drainage Channel
1-2	1.5 fps	2-3 fps	3-6 fps
2-4	3.0 fps	3-5 fps	5-9 fps
4-6	4.0 fps	4-7 fps	7-10 fps
6-10	5.0 fps	6-8 fps	-----

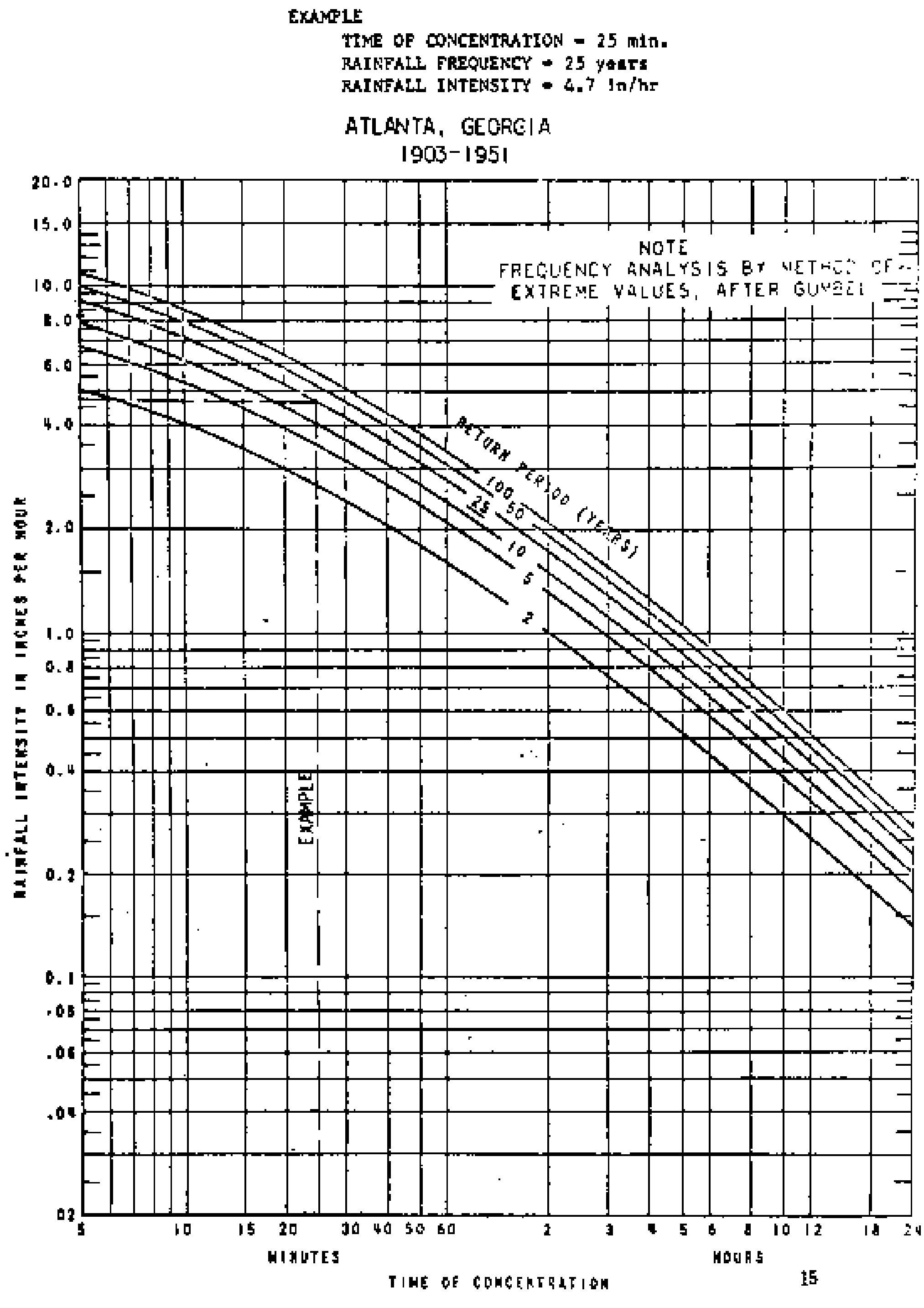


CHART 2.1 Rainfall Values

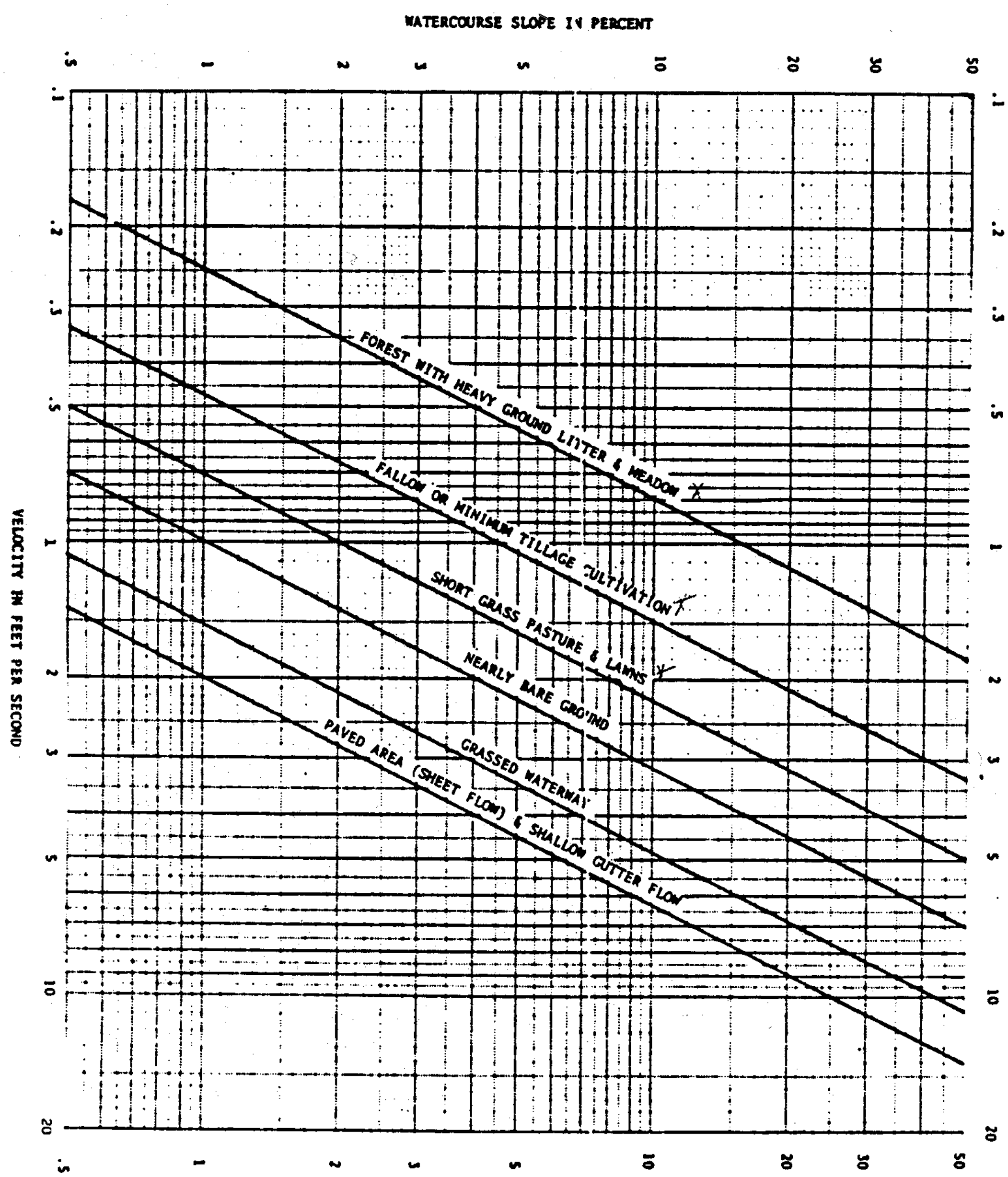


CHART 2.2 Average Velocity of Overland Flow

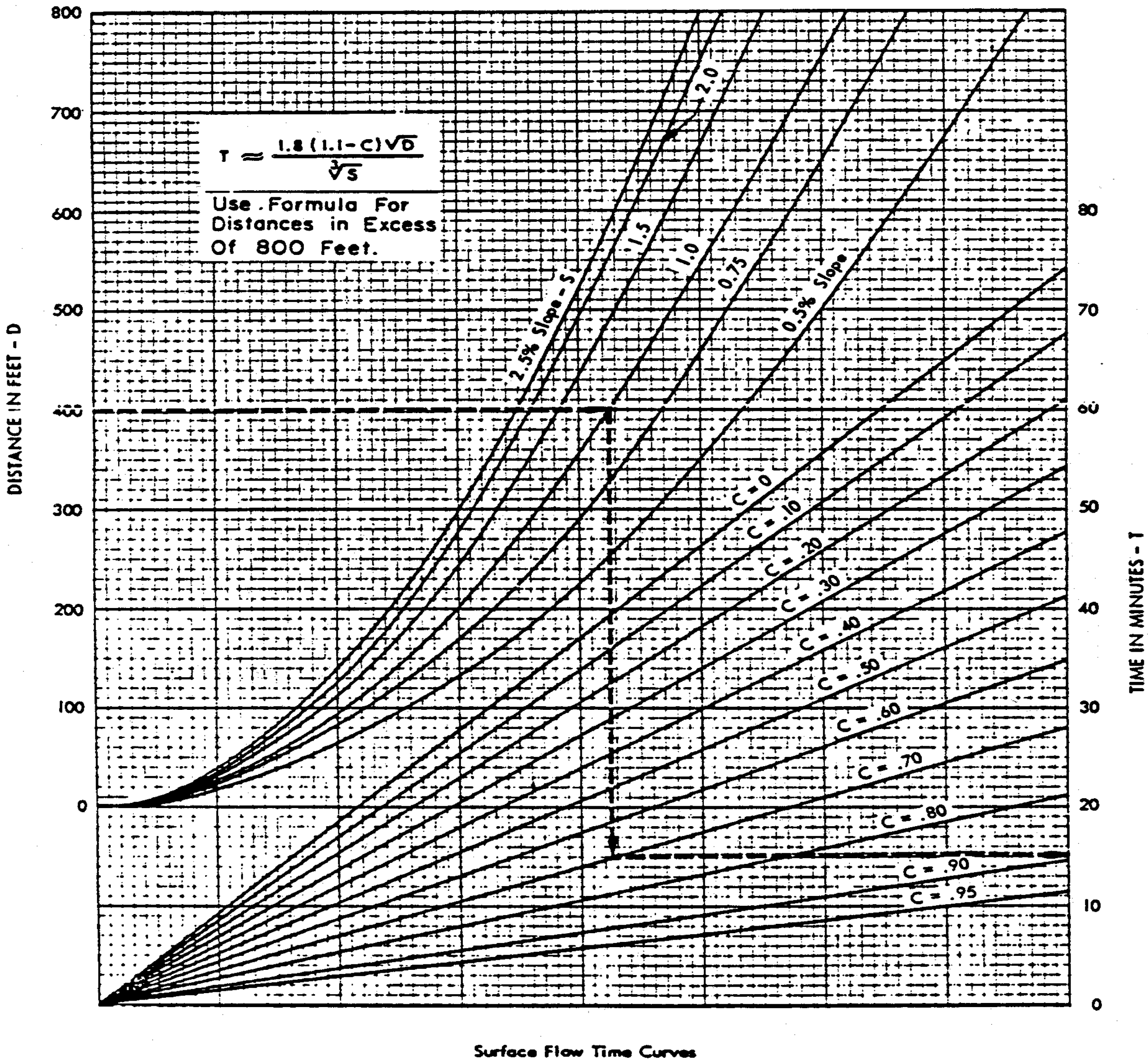


CHART 2.3
Overland Flow Times (Federal Aviation Method)

EXAMPLE

S = 0.0019ft/ft

n = 0.012

Q = 30 cfs

D = 36 in.

V = 4.3 ft/sec.

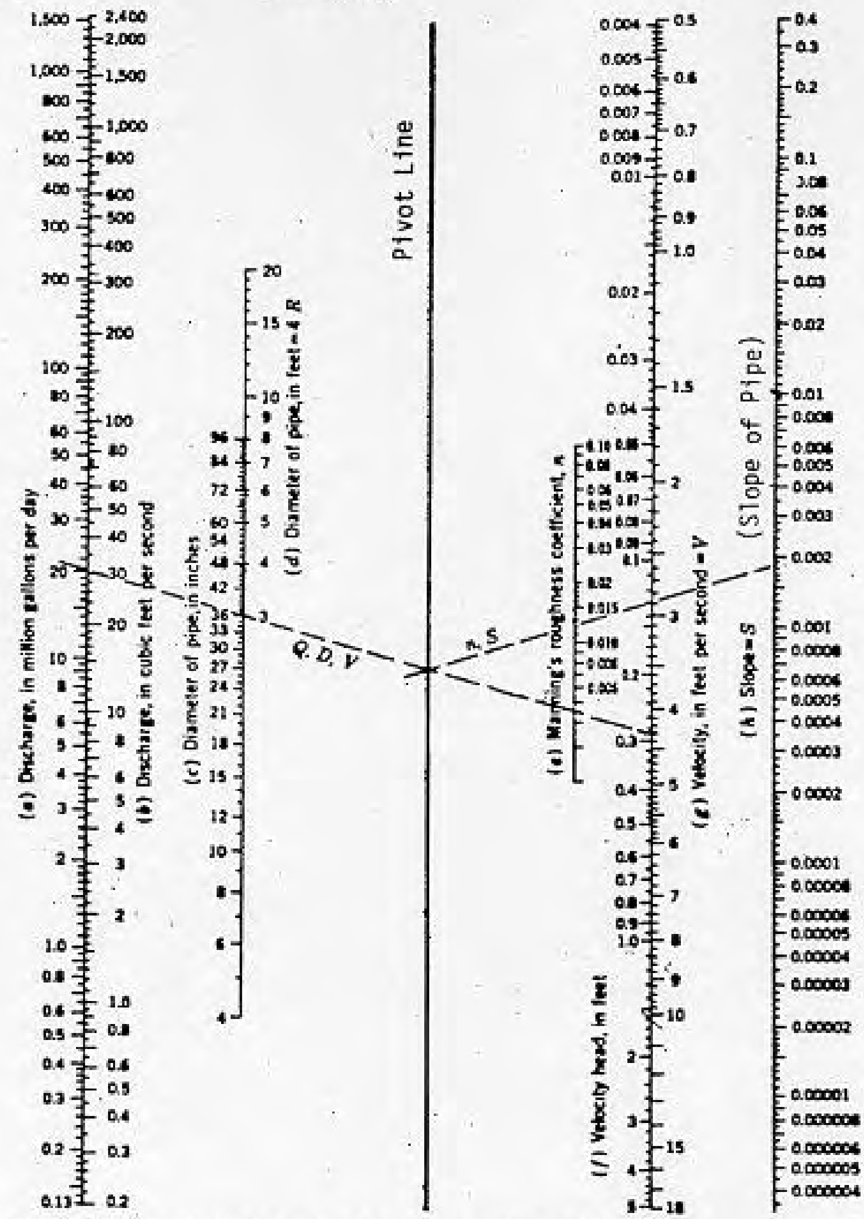
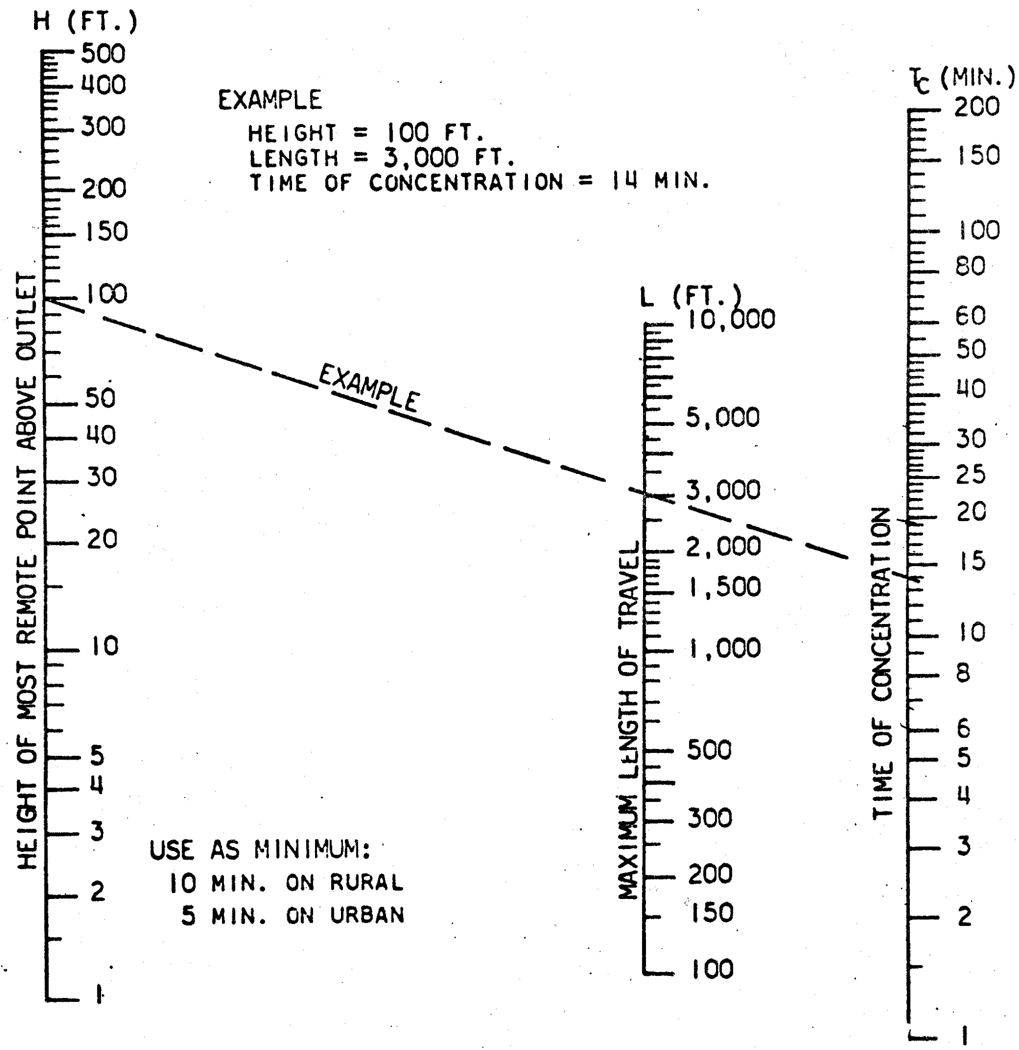


Fig. 4-41. Alignment chart for flow in pipes, for Manning's formula.



TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Based on study by P. Z. Kirpich,
Civil Engineering, Vol.10, No.6, June 1940, p.362

CHART A-1

14

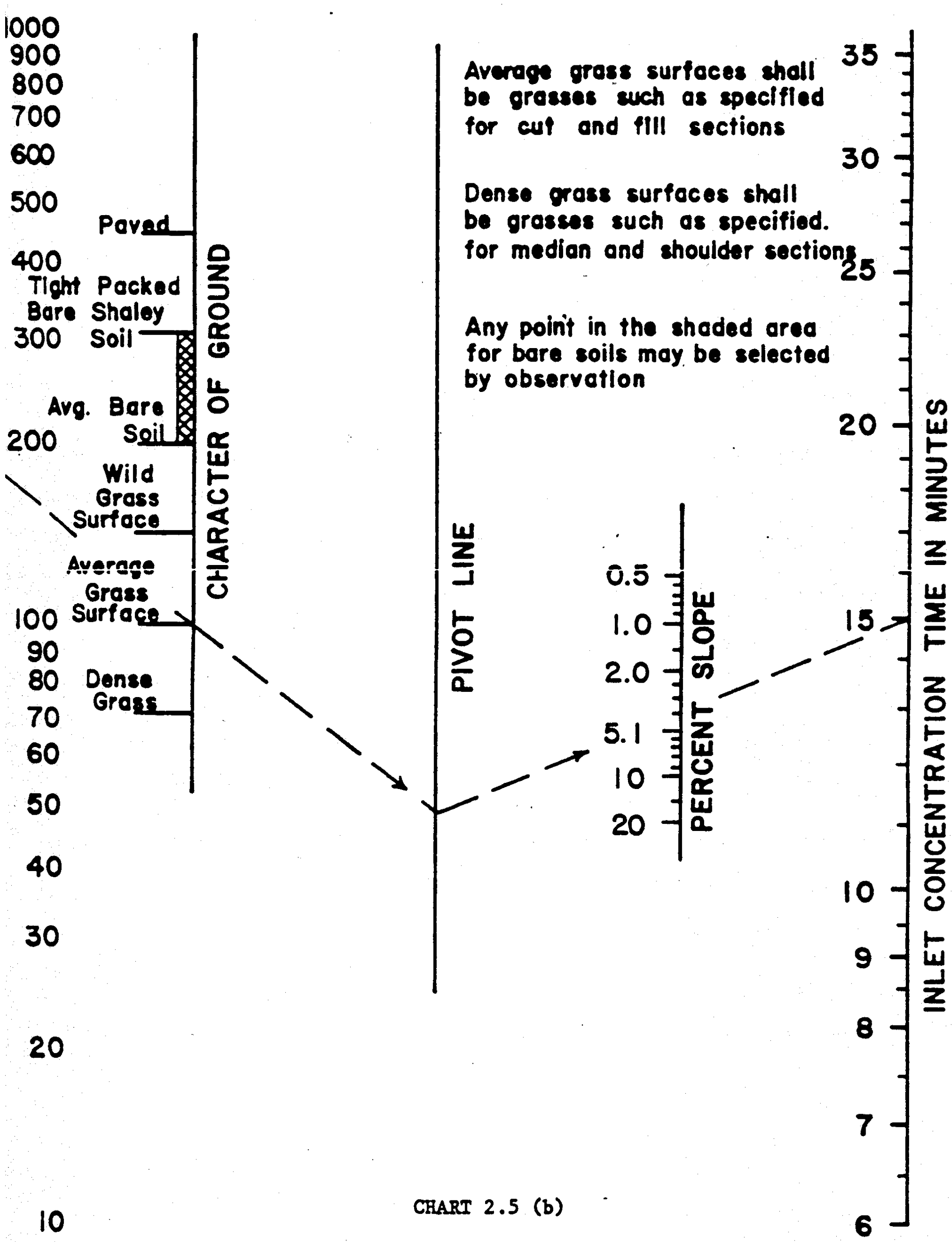


CHART 2.5 (b)

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

CHAPTER 3 - PEAK FLOW COMPUTATIONS BY OTHER METHODS

3.1 SCS TR-55 METHOD

Like the Rational Method discussed in Chapter 2, the Soil Conservation Service (SCS) Method for computing the peak rate of runoff from watersheds has been widely used for a variety of applications including drainage systems. The SCS method is more sophisticated than the Rational Method considering the losses (depression and interception storage, infiltration) which affect the peak rate of surface runoff. However, there are more computations involved in the SCS Method than in the Rational Formula. It is intended that the designer should be aware of alternate methods of peak flow computation such as the SCS Method and check the results of Rational Method with those by the SCS Method. The details of the SCS Method are contained in the SCS National Engineering Handbook, Section 4 and SCS Technical Release No. 55, Urban Hydrology for small watershed. The SCS Method is also called the Curve Number Method wherein the curve number represents the Soil-Cover Complex that affects the runoff.

Runoff Equation

The net rain or runoff is computed using

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S}$$

where Q = surface runoff (in)
P = rainfall for a selected frequency and duration (in)
S = potential maximum retention (in)

The 24-hourgross rainfall values P for various frequencies are given in Table 3.1. These values are obtained for the State of Georgia prepared by the SCS from U.S. Weather Bureau (TP-40). The potential maximum retention, S, is computed by using

$$S = \frac{1000}{CN} - 10 \qquad (3.2)$$

where CN = Curve Number

The solution of Equation 3.1 is shown in Chart 3.1. By entering with values of P and CN, one can determine the value of runoff in inches.

Curve Numbers

Curve Numbers represent the runoff potential of an area. The higher the CN, the higher is the runoff potential. Both soil type and land use determine the CN value. The SCS has classified soils into four hydrologic soil groups based on infiltration rates (SCS TR-55)

Group A -(Low runoff potential) soils having high infiltration rates and consisting primarily of deep well to excessively drained sand and gravels

Group B -Soils having moderate infiltration rates and considering primarily of moderately deep to deep, moderately well to well-drained soils with moderately fine to moderately coarse structure.

Group C -Soils having low infiltration rates and consisting chiefly of soils with a layer that impeded the downward movement of water or soils with moderately fine to fine structure.

Group D -Soils having very slow infiltration rates and high runoff potential. These soils consist primarily of clays with a high swelling potential, soils with a permanent high water table or soils with a clay pan or clay layer at or near the surface.

Runoff Curve Numbers of various land-uses and soil-groups are presented in Table 3.2. A composite CN should be computed when the watershed is composed of different land uses by weighting each curve number according to its area. If, for example, 80% of watershed has CN of 75 and the remaining 20% is impervious (CN = 100), the composite or weighted CN = 0.80 x 75 + 0.20 x 100 = 80.

The antecedent moisture condition is an indication of the rainfall which has recently fallen on the basin. The CN values given in Table 3.2 are applicable to average antecedent moisture conditions (AMC II). Antecedent moisture conditions (AMC) are classified as:

AMC I -a condition when the soils are dry but not to the wilting point and when satisfactory plowing or cultivation takes place.

AMC II -an average of the conditions that have preceded the occurrence of the maximum annual flood.

AMC III -the condition corresponding to heavy rainfall or light rainfall and low temperatures have occurred during the 5 days previous to the given storm and the soil is nearly saturated.

Table 3.3 lists the criteria used by the SCS in the selection of an AMC condition. Curve Numbers of condition I and III can be obtained from CN for condition II using the multiplying factors given in Table 3.4.

SCS Peak Discharge Graph

The SCS report on Urban Hydrology for small watersheds provides a simple method for determining the peak flow rate from homogeneous watersheds resulting from the 24-hour net rain depth (Q) and the time of concentration (T_c). The SCS peak discharge graph (Chart 3.2) is limited to applications where only the peak flow rate is desired for 24 hr. type II storm distributions. A type II storm distribution is typical of the 24-hr. thunderstorm experience in all states except the Pacific Coast States. To apply Chart 3.2 one needs to enter the graph with the time of concentration in hours and read off the peak discharge rate in CSM/in of watershed per inch of net rain during the 24-hr. period. CSM represents cubic feet per second per square mile. The 24-hr. net rain is estimated from the 24-hr. gross rain using the SCS Curve Number approach discussed earlier (Equation 3.1)

The time of concentration (T_c) can be computed as discussed earlier in Chapter 2 or using the SCS procedure as follows. First the time lag (T_L), the time between the centroid of rainfall to peak discharge is computed using

$$T_L' = \frac{L^{0.8}\,(S+1)^{0.7}}{(1900_y)^{0.5}} \qquad (3.3)$$

where L = length of watershed from divide to the point of design in ft.
S = potential maximum retention as given in Equation 3.2
y = average watershed slope in %
T_L' = lag time in hours.

Instead of Equation 3.3, Chart 3.3 can be used to compute T_L'. Further T_L' has to be adjusted for changes in channel modification and/or imperviousness. Charts 3.4 and 3.5 provide the lag factors for these two effects and the adjusted time lag is then computed as

$$T_L = L_C L_i T_L' \qquad (3.4)$$

where L_C and L_I are lag factors corresponding to channel modification and imperviousness.
The time of concentration is related to the time lag by

$$T_L = 0.6\, T_c$$

Table 3.1 24-hour Gross Rainfall for Fulton County

Storm Frequency	Rainfall in Inches
2	3.7
5	4.8
10	5.7
25	6.6
50	7.6
100	7.9

TABLE 3.2

RUNOFF CURVE NUMBERS FOR VARIOUS COVER AND SOIL TYPES

	HYDROLIC SOIL GROUP			
LAND USE DESCRIPTION	A	B	C	D
Cultivated Land: without conservation treatment	72	81	88	91
: with conservation treatment	62	71	78	81
Feature or range land : poor condition	68	79	86	89
: good condition	79	61	74	80
Meadow: good condition	30	58	71	78
Word or Forest Land: thin stand, poor cover, no mulch	45	66	77	83
good cover	25	55	70	77
Open Spaces, lawns, parks, golf courses, Cemeteries, etc.				
good condition: grass cover on 75% more of the area	39	61	74	80
fair condition: grass cover on 50% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious)	81	88	91	93
Land Use Description – cont'd SOIL GROUP:	A	B	C	D

Residential:					
Average lot size	Average % impervious[2]				
1/8 acre or less	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1 /2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
Paved parking lots, roof, driveways, etc.		98	98	98	98
Streets and roads					
Paved with curbs and storm sewers		98	98	98	98
Gavel		76	85	89	91
Dirt		72	82	87	89
Urban areas					
Low density (15 to 18% impervious)		69-71	75-78	82-84	86
Medium density (21 to 27%)		71-73	77-80	84-86	88
High Density (50 to 75%)		73-75	79-82	86-88	90

1. Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

2. The remaining pervious areas (Lawn) are considered to be in good pasture condition for these curve numbers.

Source: Soil Conservation Service (NEH-4)

Table 3.3 AMC Condition Criteria

AMC Condition	5-day Antecedent Rainfall (inches)	
	Dormant Season	Growing Season
I	<0.5	<1.4
II	0.5-1.1	1.4-2.1
III	>1.1	>2.1

Table 3.4 Factors for Converting CN's to AMC I and III

CN for Condition II	Factors for	
	Condition I	Condition III
10	0.40	2.22
20	0.45	1.85
30	0.50	1.67
40	0.55	1.50
50	0.62	1.40
60	0.67	1.30
70	0.73	1.21
80	0.79	1.14
90	0.87	1.07
100	1.00	1.00

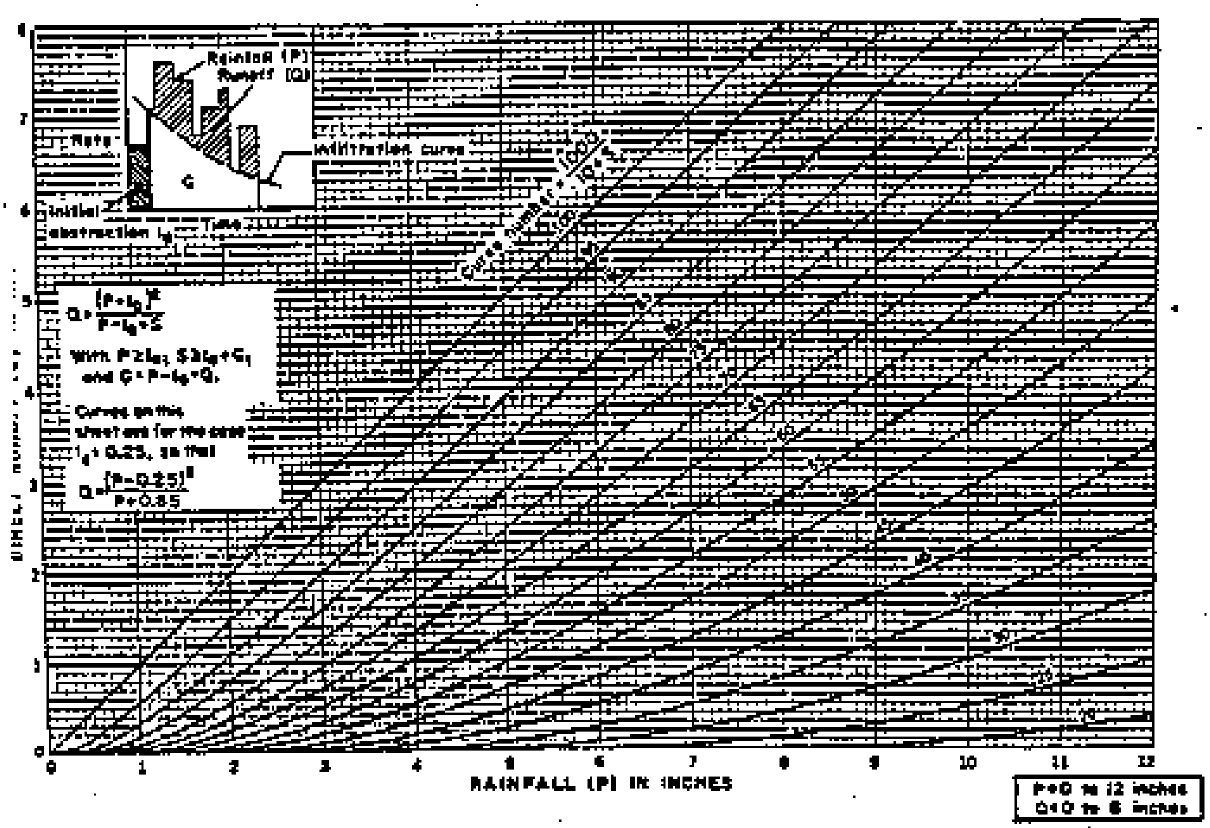


CHART 3.1
SCS Runoff Values

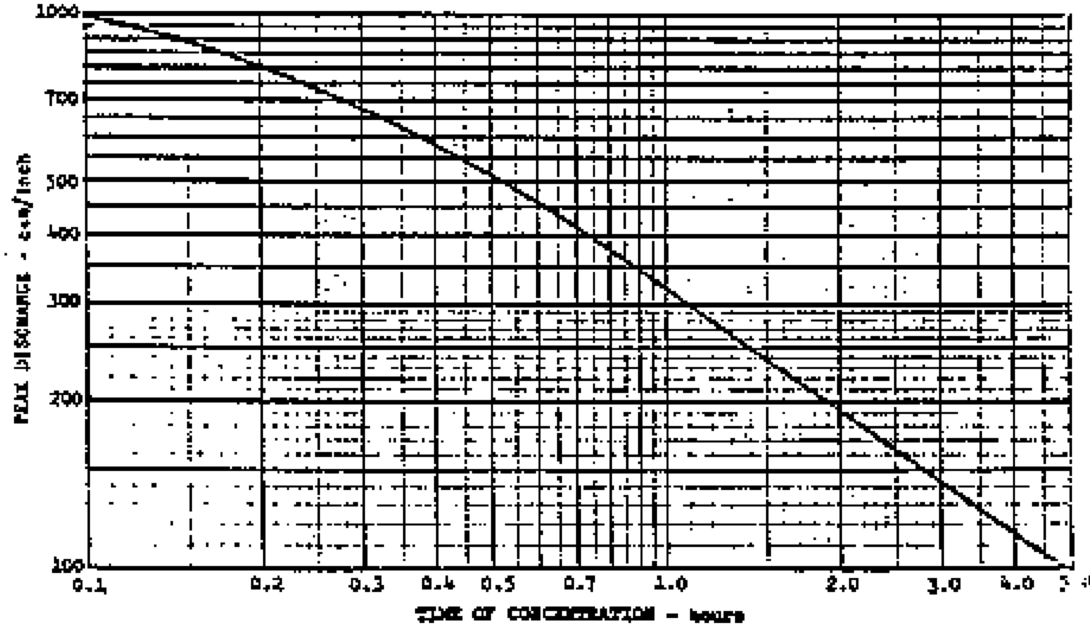


CHART 3.2
SCS Peak Graph

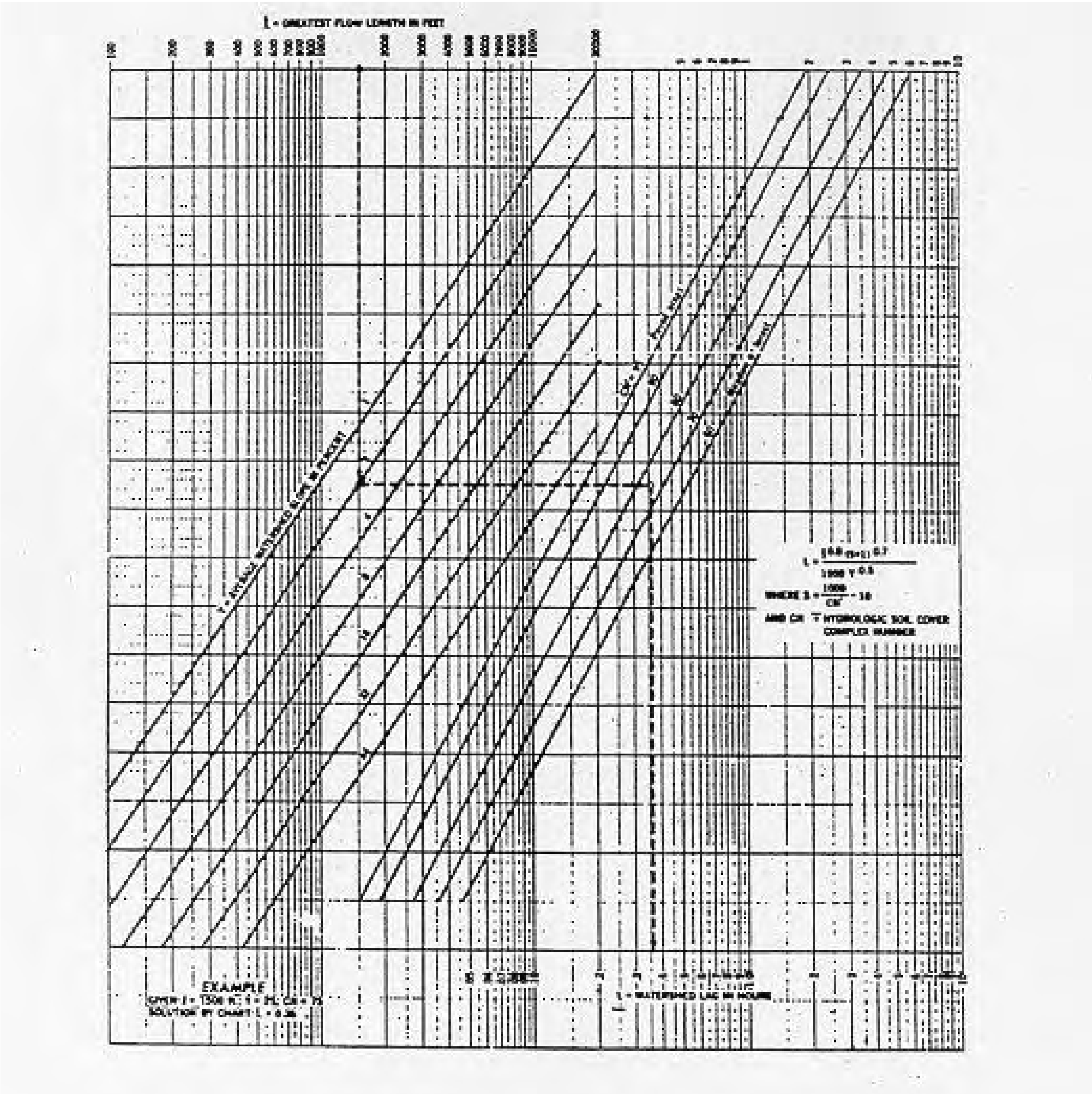


CHART 3.3
Time Lag Computation SCS

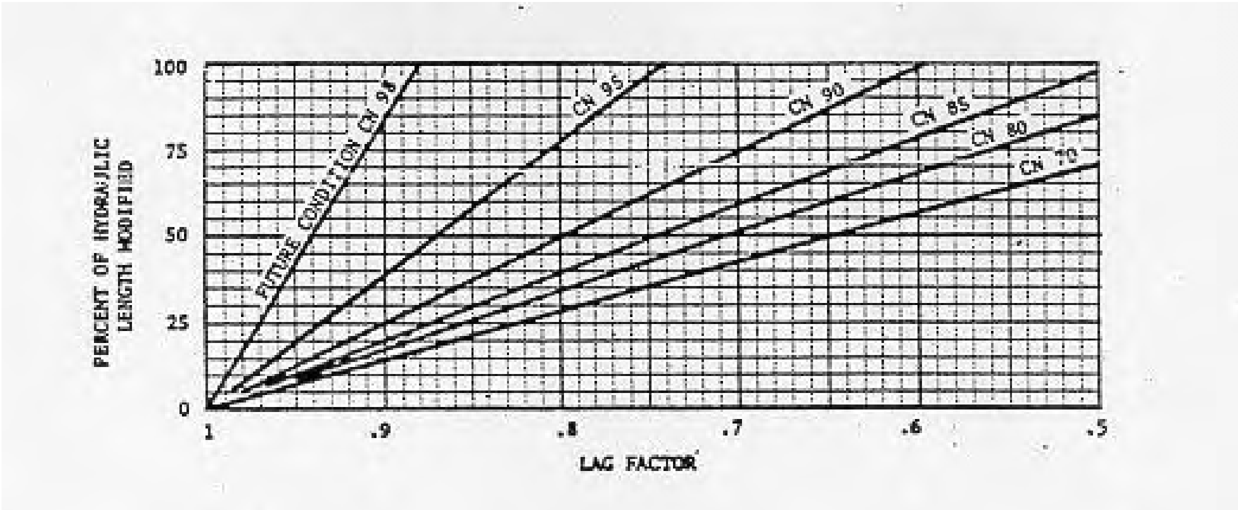


CHART 3.4
Lag Factor for Channel Modification

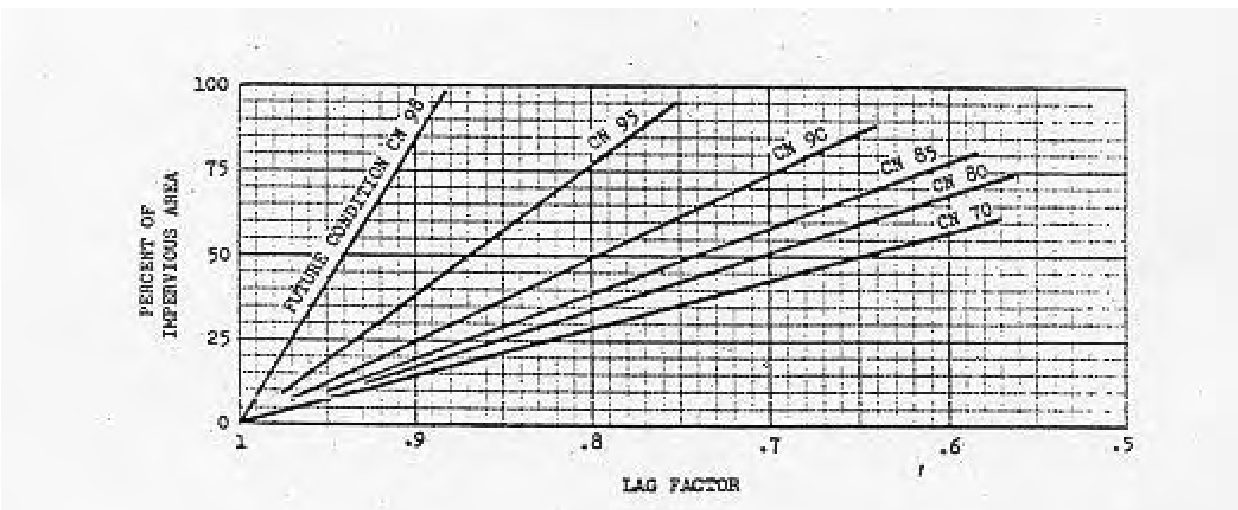


CHART 3.5
Lag Factor for Imperviousness

Example 3.1

Using the SCS TR-55 peak flow graph, compute the peak rate of runoff expected from a 25-year frequency storm. The following information is obtained.

Drainage area = 500 acres, homogeneous watershed

Average slope of watershed = 5%

Greatest flow length = 8000 ft.

Soil type = Gwinnett series

Existing land-uses

Woodland 200 acres

Residential 200 acres

(1 acre lots)

Industrial 100 acres

% imperviousness of watershed = 40%

% Hydraulic length modification = 30%

Solution

Hydrologic soil group is B

$$\text{Composite CN} = \frac{200 \text{ x } 55 + 200 \text{ x } 68 + 100 \text{ x } 88}{500} = 66.8 = 67$$

Rainfall (P)

for 25 year frequency, 24 hour rainfall = 6.6 in (from Table 3.1)
Rainfall Excess (Q)
For P = 6.6, CN = 67, Q = 3.0 inches (from Chart 3.1)

Time of Concentration

Greatest flow length = 8000 ft.

Average slope of watershed = 5%

CN = 67

T_L = 1.1 hours (from Chart 3.3)

Adjustment to T_L

Lag factor for % imperviousness = 0.72 (from Chart 3.5)
Lag factor for hydraulic length modification = 0.79 (from Chart 3.4)
Adjusted Lag = 1.1 x 0.72 x 0.79 = 0.63 hrs.

$$\text{Time of concentration } T_C = \frac{0.63}{0.6} = 1.05 \text{ hours} \quad \text{(Equation 3.5)}$$

Peak Rate of Runoff

For T_C = 1.05 hours, q = 310 cfs/mi^2/in of runoff (from Chart 3.2)

$$\text{Peak rate of runoff} = 310 \text{ x } \frac{500}{640} \text{ x } 3.0 = 726.6 \text{ cfs}$$

3.2 SCS INCREMENTAL PEAK METHOD

A simpler method for computing peak rate of runoff using SCS procedure and proportional peak rates of several incremental effective storm is available for drainage areas up to 2000 acres and watersheds whose average slopes are less than 30 percent. In this method the peak rate is computed without the development of an entire hydrograph. A relationship between incremental storm duration (ΔD) and time to peak (Tp) is assumed and summation of only a single ordinate from each incremental triangular hydrograph with the effective runoff period enables the calculation of peak flow rate is generally taken as 1/5, 1/3, or 1/6 of Tp provided ΔD is less than 0.5 hour. The usual choice is to make ΔD equal to one-third of Tp for which case the effective peak-producing runoff period is 7 ΔD with fifth increment, ΔD_5, being the most intense runoff increment. The peak discharge for each increment (Δq_i) can be computed using

$$\Delta_{q_i} = \frac{484A \quad (\Delta Q)}{Tp} \tag{3.6}$$

where
$$Tp = \frac{\Delta D}{2} + T_L \tag{3.7}$$

and A = drainage area in square miles

Q = incremental rainfall excess in inches.

Δ D = incremental period in hours

Tp = time to peak in hours

T_L = Time lag in hours = 0.6 T_C

The composite peak rate (q_P) is obtained by weighting each incremental peak and summing as follows.

$$q_p = \sum \alpha_i \Delta q_i \tag{3.8}$$

where $\alpha_1 = 0.2, \alpha_2 = 0.4, \alpha_3 = 0.6, \alpha_4 = 0.8, \alpha_5 = 1.0, \alpha_6 = \frac{2}{3}, \quad \alpha_7 = \frac{1}{3}$

Example 3.2

Given a 100-acre watershed with a CN value of 80, average slope of 1%, determine the peak rate for a 10-inch rain in 24-hours.

Solution

Hydraulic length – use the following equation if hydraulic length is not known

$L = 209 A^{0.6}$
$= 209(100)^{0.6} = 3300$ ft.

Watershed Lag.

$T_L = 0.83$ hour (from Chart 3.3)
Compute ΔD assuming $\Delta D = Tp/3$ in equation 3.7
$\Delta D = 0.4 T_L$
$= 0.4(0.83)$

$= 0.33$ hour $\Delta D = \frac{T_p}{3}$ is O.K. since $\Delta D < 0.5$ hr.

Effective peak-producing runoff period for $7\Delta D$.

$7\Delta D = 7(0.33) = 2.31$ hours
$3\Delta D = Tp = 0.99$ hrs.

Prepare a tabulation based on Type II distribution given in Chart 3.6 or Table 3.5. P24 = 10.0 inches and runoff (Q) for CN = 80 is from Chart 3.1.

Time (hrs)	P/p24	Mass P (inches)	Mass Q (inches)
10.0	0.181	1.81	0.44
10.5	0.204	20.4	0.59
11.0	0.235	2.35	0.78
11.5	0.283	2.83	1.12
11.75	0.387	3.87	1.94
12.0	0.663	6.63	4.36
12.5	0.735	7.35	5.02
Time (hrs)	P/p24	Mass P (inches)	Mass Q (inches)
13.0	0.772	7.72	5.36

Prepare a working curve. Plot mass Q versus time. Selected midpoint of maximum increment of runoff (=11.88 hours). This will be the same for most Type II distribution. Mark the curve with $7\Delta D$ beginning at (mid point – $4.5\Delta D$), i.e., 11.83-4.5 (0.33) = 10.39 hours. The working curve is shown on page 47.

Prepare computations for instantaneous peak discharge as shown below. The increment in Col. 1 and the time in Col. 2 correspond with the beginning and end of each incremental period ΔD in the plot.

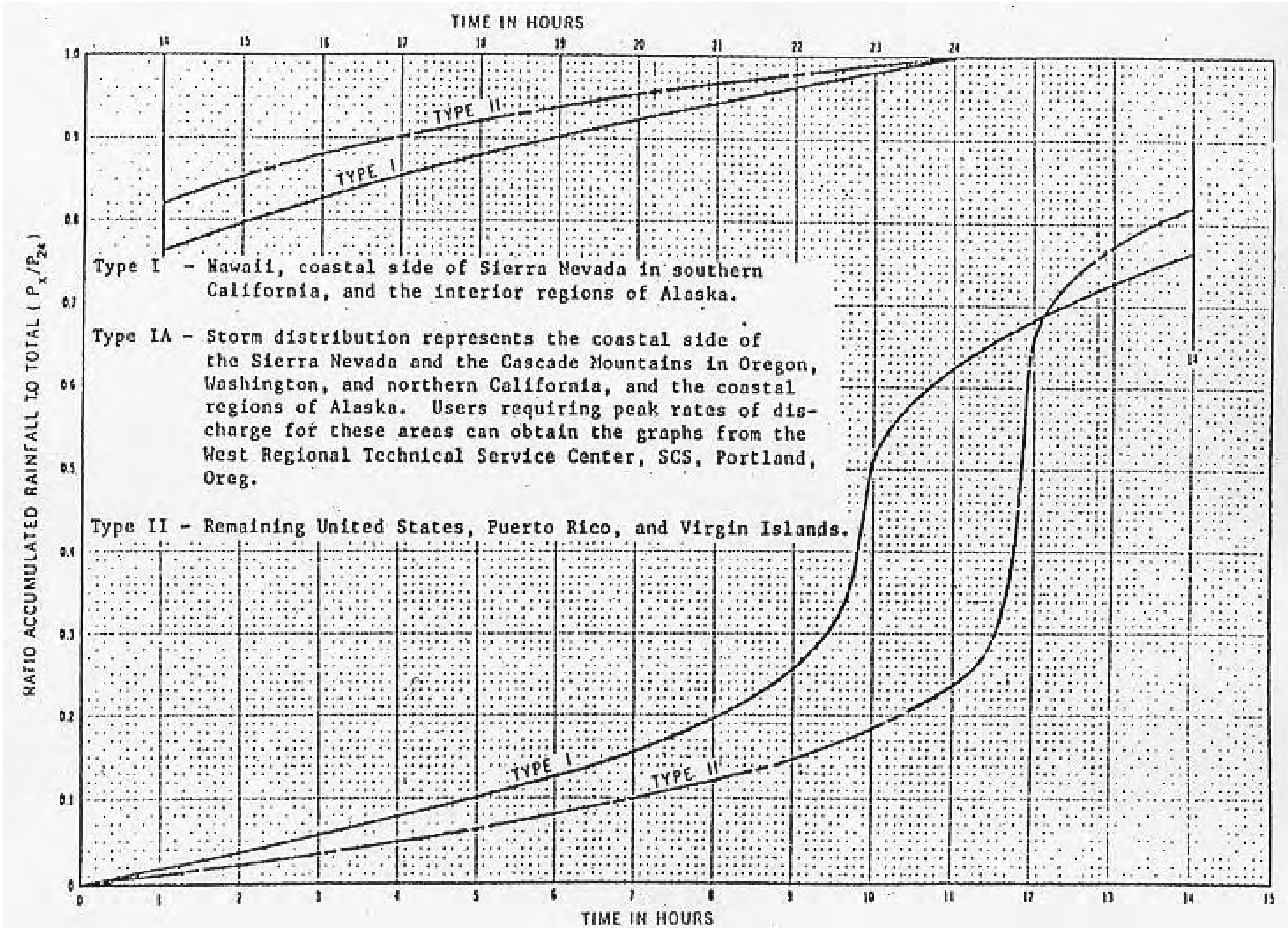
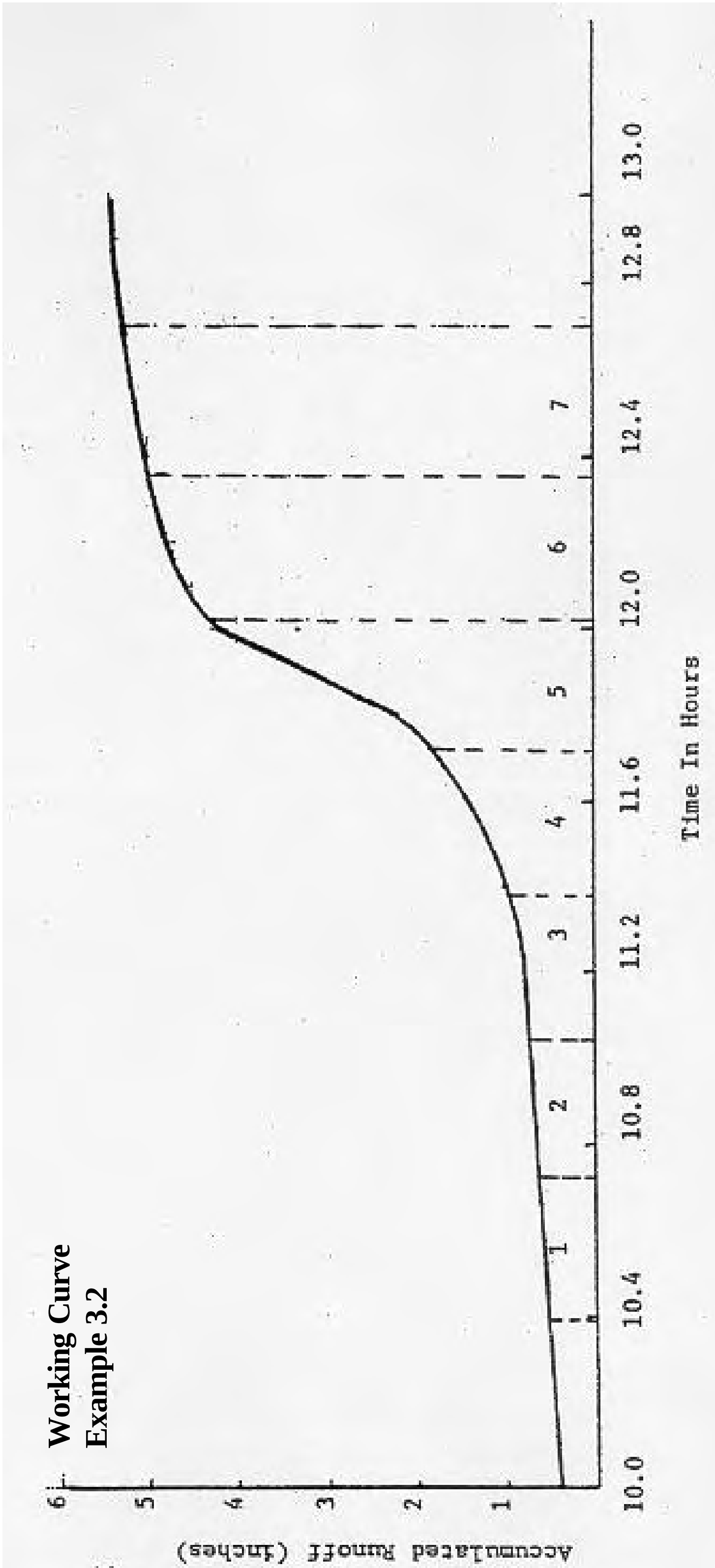


Chart 3-6 – 24-Hour Rainfall distribution (SCS)

Table 3.5 Type II Rainfall Distribution

24- Hour Distribution

Time	fraction of total precip.	time	fraction of total precip.
0.0	0.0	12.5	.735
0.5	.006	13.0	.772
1.0	.011	13.5	.799
1.5	.017	14.0	.820
2.0	.022	14.5	.835
2.5	.029	15.0	.850
3.0	.035	15.5	.865
3.5	.042	16.0	.880
4.0	.048	16.5	.889
4.5	.056	17.0	.898
5.0	.065	17.5	.907
5.5	.072	18.0	.916
6.0	.080	18.5	.925
6.5	.090	19.0	.934
7.0	.100	19.5	.943
7.5	.110	20.0	.952
8.0	.120	20.5	.958
8.5	.134	21.0	.964
9.0	.147	21.5	.970
9.5	.163	22.0	.976
10.0	.181	22.5	.982
10.5	.204	23.0	.988
11.0	.235	23.5	.994
11.5	.283	24.0	1.000
12.0	.663		


Working Curve
Example 3.2
Accumulated Runoff (inches)
Time In Hours
10.0
10.4
10.8
11.2
11.6
12.0
12.4
12.8
13.0
1
2
3
4
5
6
7

(1)	(2)	(3)	(4)	(5)	(6)		(7)
Increments		Time	Runoff(Q)	Δ Q		q_I	Factors $á_i q$
(hours)	(inches)		(inches)	(cfs)	$á_i$		
		10.38	0.55				
ΔD_1				0.12	9.2	0.2	1.8
		10.72	.67				
ΔD_2				.13	9.9	.4	4.0
		11.05	.80				
ΔD_3				.18	13.7	.6	8.2
		11.38	0.98				
ΔD_4				.77	58.8	.8	47.0
		12.71	1.75				
ΔD_5				2.78	211.4	1.0	211.4
		12.04	4.53				
ΔD_6				.42	32.0	2/3	21.3
		12.37	4.95				
ΔD_7				.22	16.8	1/3	5.6
		12.70	5.17			PEAKFLOW	299.3 cfs

The runoff (Q) in column 3 is read from plot. Column 4 is the incremental runoff (Δ Q) for each Δ D. Peak discharge for each Δ Q is computed by Eq. 3.6 and are tabulated in column 5.

$$q_i = \frac{484A}{3D} (\Delta Q)$$

$$= \frac{484\left(\frac{100}{640}\right)}{0.99} \Delta Q = 76.4(\Delta Q)$$

Column 6 lists the proportion of incremental peak discharges are given by equation 3.8. Column 7 is the proportion parts of incremental peak and is equal to column 5 x column 6. Thus the peak discharge is 299 cfs.

Sometimes it may be necessary to choose Δ D equal to 1/6 Tp instead of 1/3 Tp in order to keep Δ D less than 0.5 hour. In this case Δ D will be equal to 0.182 T_L and the effective incremental storm periods will be 15Δ D.

In general the relationship between Δ D and T_L is given by equation 3.7. While the effective incremental storm periods are computed by using 2.6 Tp.

Where the relationship between Δ D and Tp is assumed. The following special cases are useful.

		Weights
$\Delta D = \frac{1}{3} Tp$;	$7\Delta D$'s	0.2, 0.4, 0.6, 0.8, 1.0, 2/3, 1/3
$\Delta D = \frac{1}{6} Tp$;	$15\Delta D$'s	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 5/6, 4/6, 3/6, 2/6, 1/6
$\Delta D = \frac{1}{5} Tp$;	$13\Delta D$'s	0.04, 0.16, 0.28, 0.40, 0.52, 0.64, 0.76, .88, 1.00, 0.80, 0.60, 0.40, 0.20

3.3 FLOOD FREQUENCY METHOD

In the USGS paper "Preliminary Flood-Frequency Relations for Urban Streams Metropolitan Atlanta, Georgia" by H. G. Golden, a flood frequency relationship for Metro Atlanta urban streams is presented (USGS, 1977). It estimates the 2, 5, 10, 25, 50, and 100 year peak flows for drainage basins 0.1 to 100 square miles in size. Its general form is

$$Qx(U) = C_1 \; A^{0.60} (R_L - 1) + C_2 A^e (7 - R_L)$$

where: x is the recurrence interval

Qx(U) is the urban peak flow

C_1 and C_2 are constants that vary with x
A is the drainage area in square miles
R_L is an urban development factor
e is an exponent that varies with x

R_L, the urban development factor, reflects the amount of imperviousness and the extent of the storm sewer system in a drainage basin. It ranges from 1 to completely natural basins to 7 for completely urbanized basins.

Chart 3.7 gives values of R_L

Specific expressions of the flood frequency relationship for the various recurrence intervals are

$$Q_2\ (U) = 195A^{0.60}\ (R_L)$$

$$Q_5\ (U) = 298A^{0.60}\ (R_L - 1) + 56A^{0.59}\ (7 - R_L)$$

$$Q_{10}\ (U) = 341A^{0.60}\ (R_L - 1) + 74A^{0.59}\ (7 - R_L)$$

$$Q_{25}\ (U) = 391A^{0.60}\ (R_L - 1) + 100A^{0.58}\ (7 - R_L)$$

$$Q_{50}\ (U) = 441A^{0.60}\ (R_L - 1) + 121A^{0.58}\ (7 - R_L)$$

$$Q_{100}\ (U) = 482A^{0.60}\ (R_L - 1) + 144A^{0.57}\ (7 - R_L) \qquad (3.10)$$

These equations were developed by the Sauer method, which modifies the flood frequency relationships of natural drainage basins to fit urban drainage basins. Rainfall data from Atlanta and flood frequency equations for natural streams in the Georgia Piedmont, developed by Golden and Price, were used in producing in equations. This method is for estimating the magnitude and frequency of floods on streams in urban areas.

Example 3.

Determine the 25 year frequency peak runoff rate from a watershed in Fulton County which has the following data.

Drainage area (A) = 0.5 mi^2
Imperviousness = 30%
Area served by Storm sewers = 20%

Solution

R_L = 1.85 from Chart 3.7

$$Q_{25} = 391A^{0.6}\ (R_L - 1) + 100A^{0.58}\ (7 - R_L) \quad \text{(From Eq.3.10)}$$

$$Q_{25} = 564 \text{ cfs}$$

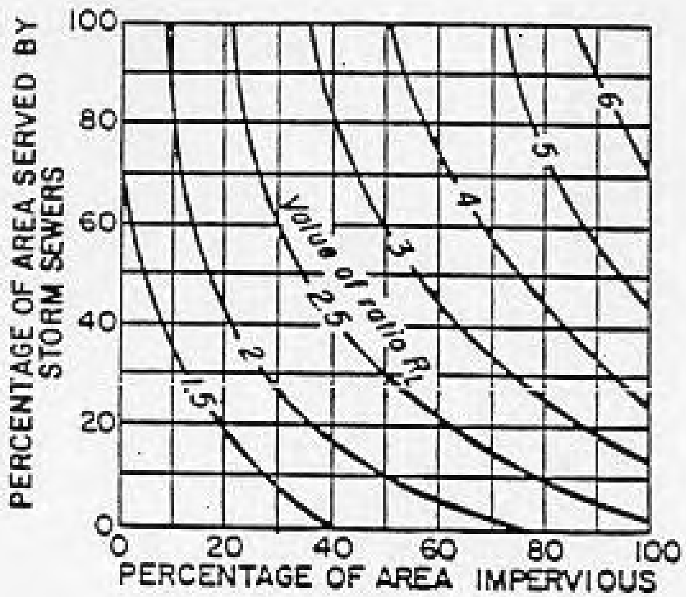


CHART 3.7
Urban Adjustment Ratio R_L for Mean Annual Flood

3.4 CORPS OF ENGINEERS METHOD

Base on stream flow data from Metro Atlanta area and regional frequency analysis the Corps of engineers have developed a simple method for computing the peak discharges. The following equation is used.

$$Q_T = K_T \overline{Q} \tag{3.11}$$

where: Q_T = Peak discharge in cfs for stated frequency of T years.

$\overline{Q}$ = Mean annual flood in cfs for the watershed

$$= 430 A^{0.495} \tag{3.12}$$

where: A = drainage area in square miles

K_T = frequency factor

The following K_T values are recommended

$K_5 = 1.6$	$K_{25} = 2.8$	
$K_{10} = 2.1$	$K_{50} = 3.4$	$K_{100} = 4.2$

Example 3.4

Compute the peak discharge for 25 years frequency from 768 acre watershed.

Solution:

Area (A) = 1.2 sq. mi.

Mean annual flood (Q) = 470 cfs (from Eq. 3.12)

Q_{25} = 2.8 (470) = 1316 cfs

CHAPTER 4 - HYDROGRAPH COMPUTATION

4.1 MODIFIED RATIONAL METHOD

The Rational Method produces only a peak rate of runoff and not a complete hydrograph. An approximate method is presented here for obtaining a flood hydrograph using parameters determined by the Rational Formula. With the values of peak value runoff Qp and time of concentration T_C, we can construct an hydrograph for any rainfall duration D according to one of the figures shown below.

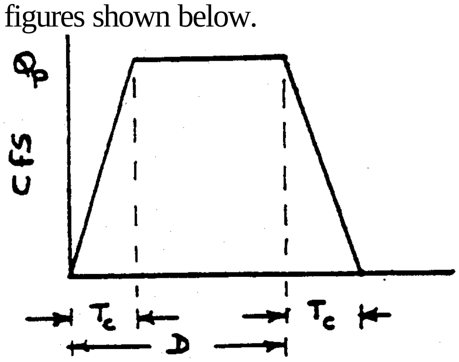


Figure (a)

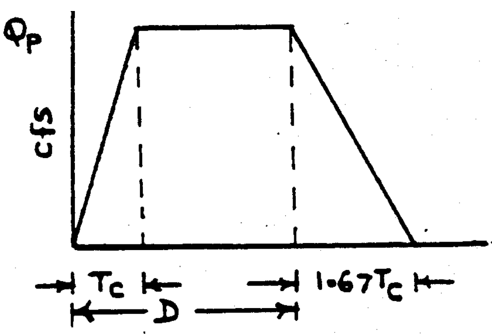


Figure (b)

The rationale for the second method (figure b) is that the recession portion is longer than the rising portion which was practical justification. Soil Conservation Service recommends the use of 1.67 T_C for the recession portion and this can be accepted for drainage designs in many metropolitan sites.

4.2 SCS TABULAR METHOD

The tabular method can be used to develop composite hydrographs at any point within a non-homogeneous watershed by dividing the watershed into several homogeneous sub-areas and computing the time of concentration for each sub-area and the travel time for each reach. It is especially applicable for measuring the effects of changed land use and channel or structural modifications in a part of a watershed. In this method hydrographs are obtained for each sub-area using the drainage area, time of concentration of the sub-area and the travel time to the desired study point. These hydrographs are then added to yield the flood hydrograph at the outlet. The peak rate of runoff is of course the peak of the total hydrograph.

Table 4.1 shows the tabular discharge values for the type II rainfall distribution. Discharges, in terms CSM (cubic feet per second per square mile) per inch of runoff, are given for a range of T_C's from 0.1 to 2 hours and T_t's from 0 to 4 hours. The discharges for other values of T_C and T_t and for other rainfall distributions can be obtained from the SCS. The computed values of T_C

and T_t can be rounded to the nearest value used in Table 4.1 or proper interpolation can be made. The information needed to calculate the peak discharge at a point is:

1. The drainage area of each sub-area
2. T_C for each sub-area
3. T_t for each reach
4. The runoff curve number for each sub-area
5. The 24-hr. rainfall for a selected frequency
6. The runoff in inches for each sub-area

The hydrograph ordinates under time-hours for each sub-area are obtained using the appropriate sheets of Table 4.1 and the following equation.

$$Q_i = q\ A\ Q \tag{4.1}$$

where: Q_i = hydrograph ordinate discharge in cfs
q = hydrograph ordinates in CSM/in, from Table 4.1
A = drainage area in square miles
Q = runoff in inches, from Chart 3.1

Table 4.1 --Tabular discharges for type-II storm distribution (csm/in) Sheet 1 of 5

TIME OF CONCENTRATION = 0.1 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	24	51	299	991	746	477	233	152	132	121	111	85	74	70	68	65	52	48	39	33	29	24	18	14
0.25	20	38	66	140	327	626	686	546	364	236	169	137	117	97	83	75	66	52	41	35	30	24	18	14
0.50	15	27	36	43	67	133	288	482	580	543	429	310	222	168	134	110	81	63	47	38	32	26	19	15
0.75	12	20	25	29	34	42	65	125	245	392	496	515	452	360	273	206	127	80	53	42	35	27	19	15
1.00	9	15	19	21	24	28	32	41	63	115	209	328	427	470	451	389	245	121	64	47	38	29	20	16
1.50	6	10	12	13	14	16	17	19	22	25	29	38	56	92	154	236	410	360	133	66	47	33	21	16
2.00	3	6	7	8	9	10	11	12	13	14	16	18	20	23	27	34	74	244	371	142	68	38	23	17
2.50	2	4	4	5	5	6	7	7	8	9	10	11	12	13	15	16	21	41	243	343	150	48	26	19
3.00	1	2	2	3	3	4	4	4	5	5	6	7	7	8	9	10	12	17	50	239	321	74	29	20
3.50	0	1	1	1	1	2	2	2	3	3	4	4	4	5	6	6	7	10	17	59	304	159	33	21
4.00	0	0	0	0	0	1	1	1	1	2	2	2	2	3	3	4	5	6	10	18	67	290	39	23

TIME OF CONCENTRATION = 0.2 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	23	47	208	509	796	641	424	245	170	138	121	104	85	75	71	68	56	49	40	34	29	24	18	14
0.25	18	34	49	91	196	419	603	627	486	341	235	173	138	114	96	83	70	55	43	36	31	25	18	15
0.50	14	24	32	37	50	87	181	341	490	545	497	397	296	219	167	333	92	67	49	39	33	26	19	15
0.75	11	18	23	26	30	36	49	84	161	284	409	491	481	422	340	363	157	89	56	43	36	27	19	15
1.00	9	14	18	20	22	25	29	35	48	79	143	240	347	426	452	427	299	147	69	49	39	29	20	16
1.50	5	9	11	12	13	14	16	18	20	23	26	32	43	67	110	376	330	399	159	72	50	33	22	17
2.00	3	6	7	7	8	9	10	11	12	13	15	16	18	21	24	29	56	192	363	168	75	40	24	18
2.50	1	3	4	5	5	6	6	7	7	8	9	10	11	12	13	15	19	33	200	337	174	51	26	19
3.00	0	2	2	2	3	3	4	4	5	5	6	6	7	8	8	9	11	15	40	203	316	82	29	20
3.50	0	0	1	1	1	2	2	2	2	3	3	4	4	5	5	6	7	9	16	46	300	180	34	22
4.00	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	3	4	6	9	16	53	286	41	24

TIME OF CONCENTRATION = 0.3 hours
Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	21	43	141	324	586	658	535	372	251	184	148	124	102	86	77	71	61	51	41	34	30	24	18	14
0.25	17	31	43	67	134	279	461	559	530	428	318	234	179	143	116	97	76	59	45	37	32	25	18	15
0.50	13	22	29	34	42	65	124	238	378	479	499	447	363	281	216	168	110	74	51	41	34	26	19	15
0.75	10	17	21	24	27	32	41	63	114	203	316	413	457	443	389	319	198	105	60	45	37	28	20	15
1.00	8	13	16	18	20	23	26	31	40	60	103	176	269	358	415	426	344	182	77	51	41	30	20	16
1.50	5	8	10	11	12	13	15	16	18	21	24	28	36	52	82	132	272	382	192	81	52	34	22	17
2.00	3	5	6	7	8	8	9	10	11	12	14	15	17	19	21	25	44	151	351	198	85	41	24	18
2.50	1	3	4	4	5	5	6	6	7	8	8	9	10	11	12	14	17	28	162	328	200	54	27	19
3.00	0	1	2	2	3	3	3	4	4	5	5	6	6	7	8	9	10	14	33	169	309	94	30	20
3.50	0	0	1	1	1	1	2	2	2	3	3	3	4	4	5	5	6	9	14	38	172	294	35	22
4.00	0	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	4	5	9	15	43	281	42	24

TIME OF CONCENTRATION = 0.4 hours
Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	20	39	103	224	419	558	575	451	331	247	190	155	127	105	90	80	66	53	42	35	30	24	18	14
0.25	15	28	38	54	98	196	343	467	508	464	380	295	228	180	145	119	87	64	47	38	32	26	19	15
0.50	12	20	26	30	37	53	92	172	286	395	462	453	402	332	266	211	137	84	54	42	35	27	19	15
0.75	10	16	19	22	25	29	36	51	85	150	242	338	407	429	406	356	241	128	65	47	38	29	20	16
1.00	8	12	15	17	19	21	24	28	34	49	78	132	208	292	362	403	368	220	88	55	42	30	21	16
1.50	5	8	9	10	11	12	14	15	17	19	22	25	31	43	65	102	220	365	224	93	56	35	22	17
2.00	3	5	6	6	7	8	9	9	10	11	13	14	16	17	20	[illegible]	37	119	338	225	99	43	24	18
2.50	1	3	3	4	4	5	5	6	6	7	8	9	10	11	12	13	16	25	132	317	225	58	27	19
3.00	0	1	2	2	2	3	3	3	4	4	5	5	6	7	7	8	10	13	28	140	300	107	31	21
3.50	0	0	1	1	1	1	1	2	2	2	3	3	3	4	4	5	6	8	13	32	146	286	36	22
4.00	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	5	8	14	36	275	44	24

TIME OF CONCENTRATION = 0.5 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	18	36	80	166	301	433	496	474	395	309	242	194	158	130	109	94	75	57	43	36	31	25	18	15
0.25	15	26	37	52	94	172	277	372	425	424	383	326	270	221	182	150	107	73	49	39	33	26	19	15
0.50	12	20	25	30	38	58	101	169	252	327	374	385	366	329	285	241	169	103	59	44	36	27	19	15
0.75	9	15	19	22	25	30	41	63	103	162	229	292	335	354	348	325	255	157	77	50	39	29	20	16
1.00	7	12	15	17	19	21	25	31	43	66	103	153	210	264	304	327	317	231	109	61	44	31	21	16
1.50	5	8	9	10	11	12	14	15	17	20	24	31	43	63	92	129	214	295	224	115	65	36	23	17
2.00	3	5	6	6	7	8	9	10	11	12	13	14	16	19	23	30	58	143	271	216	120	46	25	18
2.50	1	3	3	4	4	5	5	6	7	7	8	9	10	11	12	14	18	39	150	253	209	71	28	19
3.00	0	1	2	2	2	3	3	4	4	4	5	5	6	7	7	8	10	15	48	154	239	126	32	21
3.50	0	0	1	1	1	1	2	2	2	2	3	3	4	4	5	5	6	8	16	56	155	227	38	23
4.00	0	0	0	0	0	1	1	1	1	1	1	2	2	2	3	3	4	5	9	19	63	217	52	25

TIME OF CONCENTRATION = 0.75 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	15	29	57	98	163	248	329	375	388	369	325	276	232	195	165	142	107	76	51	39	33	26	19	15
0.25	12	21	29	39	61	100	158	227	291	336	355	348	321	285	247	212	156	103	62	44	36	27	19	15
0.50	10	16	21	24	29	41	63	100	150	208	263	305	327	329	314	288	226	147	79	52	40	29	20	16
0.75	8	13	16	18	20	24	30	43	65	98	142	192	239	278	303	311	286	208	107	63	45	31	21	16
1.00	6	10	13	14	15	17	20	24	31	44	65	95	134	177	220	256	294	264	149	81	53	33	21	16
1.50	4	6	8	9	10	11	12	13	14	16	19	23	31	42	60	83	147	269	248	152	85	40	23	17
2.00	2	4	5	5	6	7	7	8	9	10	11	12	14	16	18	23	39	97	251	235	153	56	26	19
2.50	1	2	3	3	4	4	4	5	5	6	7	7	8	9	10	11	15	28	107	218	236	91	29	20
3.00	0	1	1	2	2	2	2	3	3	4	4	5	5	6	6	7	8	12	33	113	225	153	34	22
3.50	0	0	1	1	1	1	1	1	2	2	2	3	3	3	4	4	5	7	13	39	117	215	44	24
4.00	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	3	4	7	15	45	207	63	26

TIME OF CONCENTRATION = 1.0 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	13	24	45	66	107	155	211	258	301	313	316	301	277	247	217	188	146	102	64	46	36	27	19	15
0.25	10	18	24	32	45	68	102	146	193	238	272	293	299	293	215	252	200	139	81	54	41	29	20	16
0.50	8	14	17	20	24	32	46	68	99	136	178	219	251	274	284	283	254	187	105	65	47	31	21	16
0.75	7	11	13	15	17	20	25	33	46	67	94	128	165	202	233	256	273	236	140	82	55	33	21	16
1.00	5	9	11	12	13	15	17	20	25	33	46	65	90	121	154	187	240	262	183	107	66	37	22	17
1.50	3	5	7	7	8	9	10	11	12	14	16	19	24	31	43	58	103	185	244	181	110	48	24	18
2.00	2	3	4	4	5	6	6	7	8	8	9	10	11	13	15	18	29	69	182	230	178	70	27	19
2.50	1	2	2	3	3	3	4	4	5	5	6	6	7	8	9	10	12	21	77	178	219	114	31	21
3.00	0	1	1	1	1	2	2	2	3	3	3	4	4	5	5	6	7	10	25	83	210	172	39	22
3.50	0	0	0	0	1	1	1	1	1	2	2	2	2	3	3	3	4	6	11	29	88	202	52	25
4.00	0	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	4	6	12	33	195	77	28

TIME OF CONCENTRATION = 1.25 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	11	21	37	51	79	107	147	187	219	249	264	271	267	256	241	219	177	128	81	56	42	29	20	16
0.25	9	15	21	27	36	53	74	103	137	172	205	231	249	259	259	253	223	167	102	67	48	31	21	16
0.50	7	12	15	17	21	27	37	51	72	98	128	160	190	216	235	247	251	209	130	82	56	34	21	16
0.75	6	9	12	13	15	17	21	27	36	50	69	93	120	149	177	202	235	242	165	103	67	38	22	17
1.00	4	7	9	10	11	13	14	17	21	27	36	49	66	88	113	139	190	236	200	130	83	43	23	17
1.50	3	5	6	6	7	8	8	9	10	12	14	16	20	25	33	44	76	142	223	195	131	58	26	18
2.00	1	3	3	4	4	5	5	6	6	7	8	9	10	11	13	15	24	52	143	212	189	86	29	20
2.50	1	1	2	2	2	3	3	3	4	4	5	5	6	7	7	8	10	17	58	143	201	132	35	21
3.00	0	1	1	1	1	1	2	2	2	2	3	3	3	4	4	5	6	9	20	64	143	196	45	23
3.50	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2	3	4	5	9	23	68	190	62	26
4.00	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	2	3	5	10	26	184	91	30

TIME OF CONCENTRATION = 1.5 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	10	18	31	42	57	81	105	133	164	192	209	227	235	236	236	225	201	153	99	68	50	32	20	16
0.25	8	13	17	22	30	41	57	76	99	125	153	178	199	215	225	233	224	188	122	82	58	36	21	16
0.50	6	10	13	15	18	22	30	40	54	72	94	118	143	167	188	204	224	214	152	99	68	39	22	17
0.75	5	8	10	11	13	15	18	22	29	39	52	69	89	111	134	157	194	219	182	122	82	44	23	17
1.00	4	6	8	9	10	11	12	14	17	22	29	38	50	66	84	105	148	198	214	150	100	50	24	18
1.50	2	4	5	5	6	7	7	8	9	10	12	14	17	21	26	34	58	109	191	204	149	70	28	19
2.00	1	2	3	3	4	4	4	5	5	6	7	8	8	10	11	13	19	40	112	184	197	102	33	20
2.50	0	1	1	2	2	2	3	3	3	4	4	5	5	6	6	7	9	14	45	114	190	147	40	22
3.00	0	0	1	1	1	1	1	1	2	2	2	3	3	3	4	4	5	7	16	49	115	184	53	25
3.50	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2	3	4	8	18	53	178	74	28
4.00	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	4	8	21	174	105	34

TIME OF CONCENTRATION = 2.0 hours

Hydrograph Time in Hours

T_t	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	7	14	22	30	38	49	64	80	95	114	133	152	165	175	184	192	190	176	129	93	68	41	23	17
0.25	6	10	13	17	22	28	37	47	61	75	91	108	126	143	157	168	185	189	153	109	79	46	24	17
0.50	5	8	10	11	13	17	21	27	35	45	57	71	86	103	119	135	162	186	172	129	92	52	26	18
0.75	4	6	8	8	10	11	13	16	21	26	34	43	55	67	82	97	129	166	183	149	109	59	27	18
1.00	3	5	6	7	7	8	9	11	13	16	20	26	33	42	52	64	92	136	180	167	127	68	29	19
1.50	1	3	3	4	4	5	5	6	7	8	9	10	12	15	18	23	37	68	135	175	163	93	34	21
2.00	1	1	2	2	3	3	3	4	4	5	5	6	6	7	8	10	14	26	71	133	170	127	42	23
2.50	0	1	1	1	1	1	2	2	2	3	3	3	4	4	5	5	7	11	29	74	132	166	53	26
3.00	0	0	0	0	1	1	1	1	1	1	2	2	2	2	3	3	4	5	12	32	76	162	71	30
3.50	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	3	6	13	35	158	95	35
4.00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	3	6	14	80	155	43

The sub-area hydrographs are then added to get the desired flood hydrograph at the study point. The peak discharge is then obtained as the maximum value of Q_1 in the hydrograph.

Example 4.1

Determine the peak discharge for the watershed described in Example 3.1 from a 25-year frequency flood using Tabular method.

Data available

Drainage area = 500 acres

Composite CN = 67

Time of concentration = T_c = 1.05 hrs

Rainfall excess from 25-year storm = Q = 3.0 (from Example 3.1)

Travel time T_t = 0 since watershed is considered as one homogeneous unit.

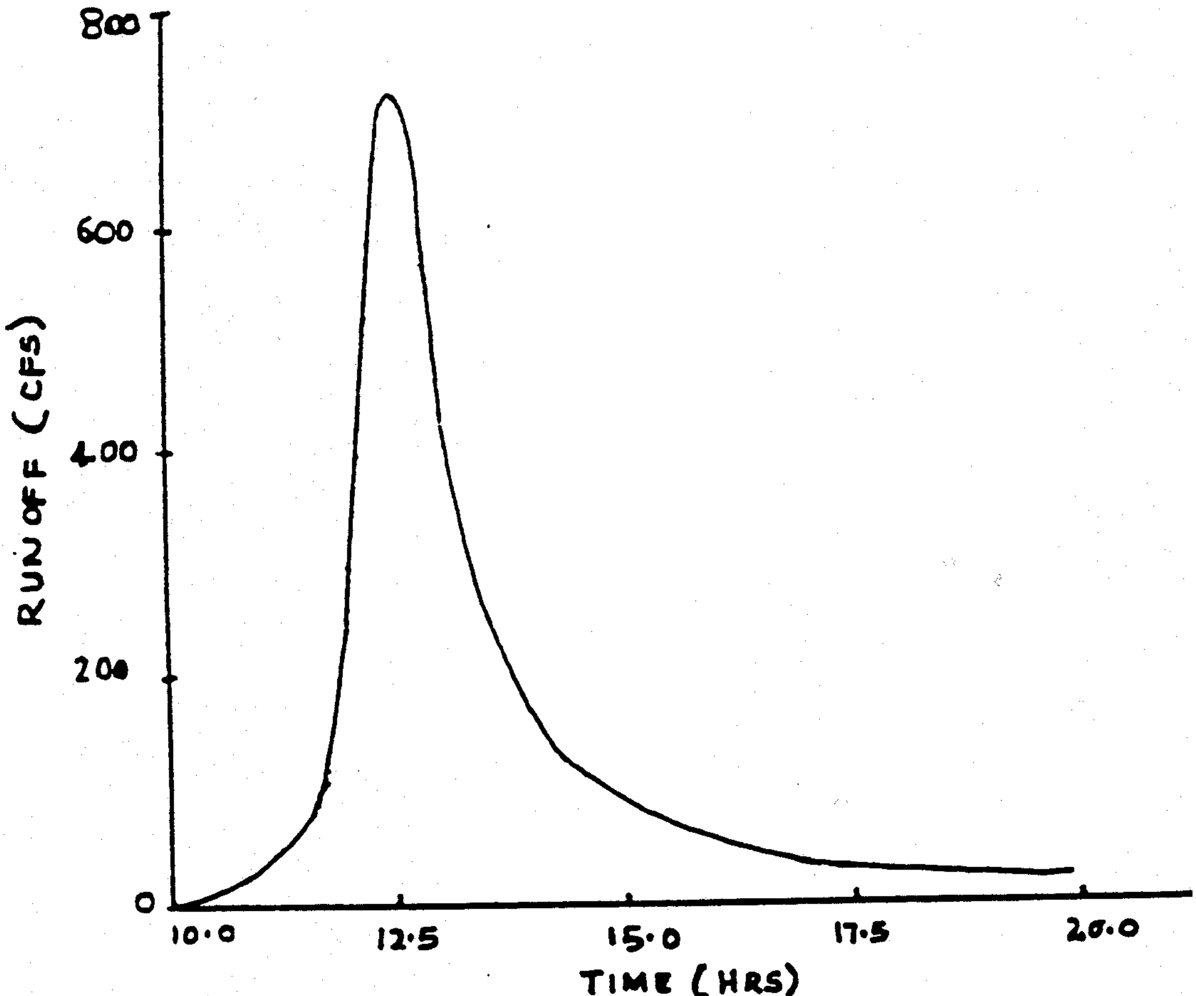
The hydrograph is computed by multiplying the q values given in Table 4.1 corresponding to T_c = 1.05 hrs and T_t = 0 with the constant (A Q = 2.34) as in Equation 4.1.

t	q	Q_{25} (cfs)	t	q	Q_{25}
10.0*	0	0			
11.0	13	30	12.9	217	508
11.7	45	105	13.2	146	342
11.9	107	250	14.0	64	150
12.1	211	494	15.0	36	84
12.3	258	604	18.0	19	44
12.5	313	732	20.0	15	35
12.7	301	704			

*Actually the hydrograph starts at t=0 but the flow is zero or negligible until t = 11 hr. for a type II distribution.

Peak value = 732 cfs

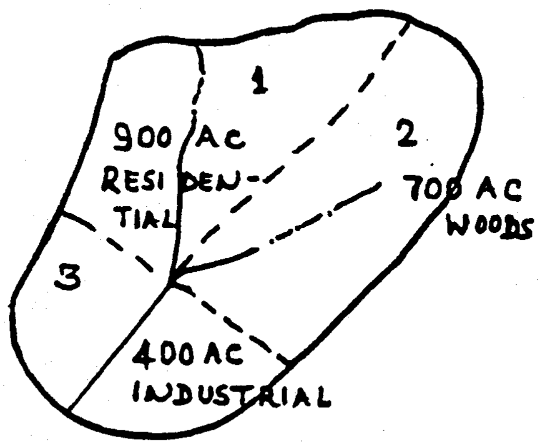
Note that the entire hydrograph was computed in this example but if only the peak value is required one needs to find the maximum q value from the Table 4.1 and multiply it with the constant. Also note that the peak flow rate for the same example problem was 727 cfs by the SCS TR-55 peak flow graph procedure as worked out in Example 3.1. A plot of Q_{25} against t will give the corresponding hydrograph.



Example 4.2

Given a 2000 acre watershed containing Gwinnett Series type soil and composed of 700 acres of woods, 400 acres of industrial area, and 900 acres of residential area (600 acres of 1 acre lots and 300 acres of ¼ acre lots), compute the 100 year peak flow and hydrograph using the SCS Tabular method.

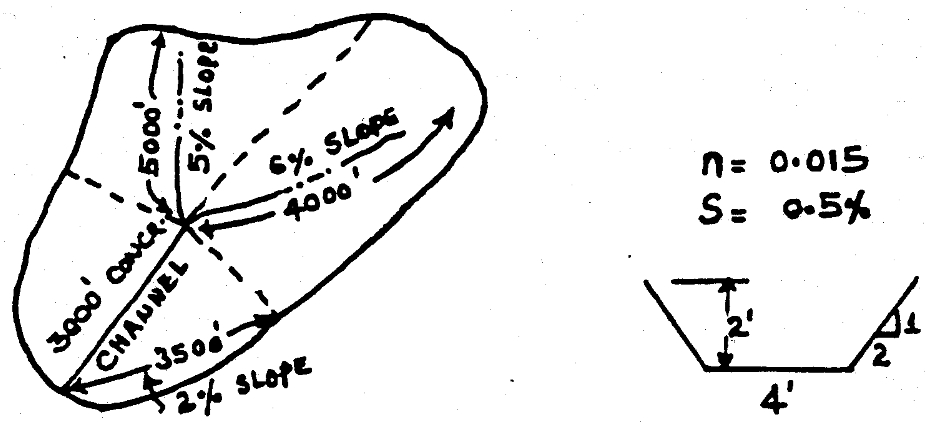
Divide the watershed into sub-areas, each having a common land use and soil type and a definite drainage pattern.



Determine the runoff curve number, CN, for each sub-area. According to SCS soils information, Gwinnett Series type soil is in Hydrologic Soil Group B.

<u>sub-area</u>	<u>landuse</u>		<u>CN</u>
1	residential	(600 ac-1 ac lots (68x67% = 46	71
		(300 ac-1/4 ac lots 75x33% = 25	
2	woods		55
3	industrial		88

Define the drainage system.



Determine the time of concentration (Tc) of each sub-area and the travel time (T_t) of each reach.

<u>sub-area 1</u> (CN=71 and avg slope = 5%)
lag time, L = 0.65 hrs (Chart 3.3)
lag factor (assume 25% drainage modifications) = 0.83 (Chart 3.4)
lag factor (assume 25% imperviousness) = 0.83 (chart 3.5)
adjusted lag = 0.65 x 0.83 = 0.45 hrs.

$$T_c = \frac{T_L}{0.6} = \frac{0.45}{0.6} = 0.75\,\text{hrs.}$$

$$R = \frac{A}{P} = 1.24$$

$$V = \frac{1.49}{n} R^{2/3} S^{1/2} = \frac{1.49}{0.015}(1.24)^{.67}(0.005)^{.5} = 8.1\text{ fps}$$

$$T_t = \frac{5000}{8.1} = 0.2\,\text{hrs. use } 0.25\,\text{hrs.}$$

<u>sub-area 2</u> (CN = 55 and avg slope = 6%)
lag time = 0.7 hrs (Chart 3.3)

$$T_c = \frac{0.7}{0.6} = 1.24\,\text{hrs}$$

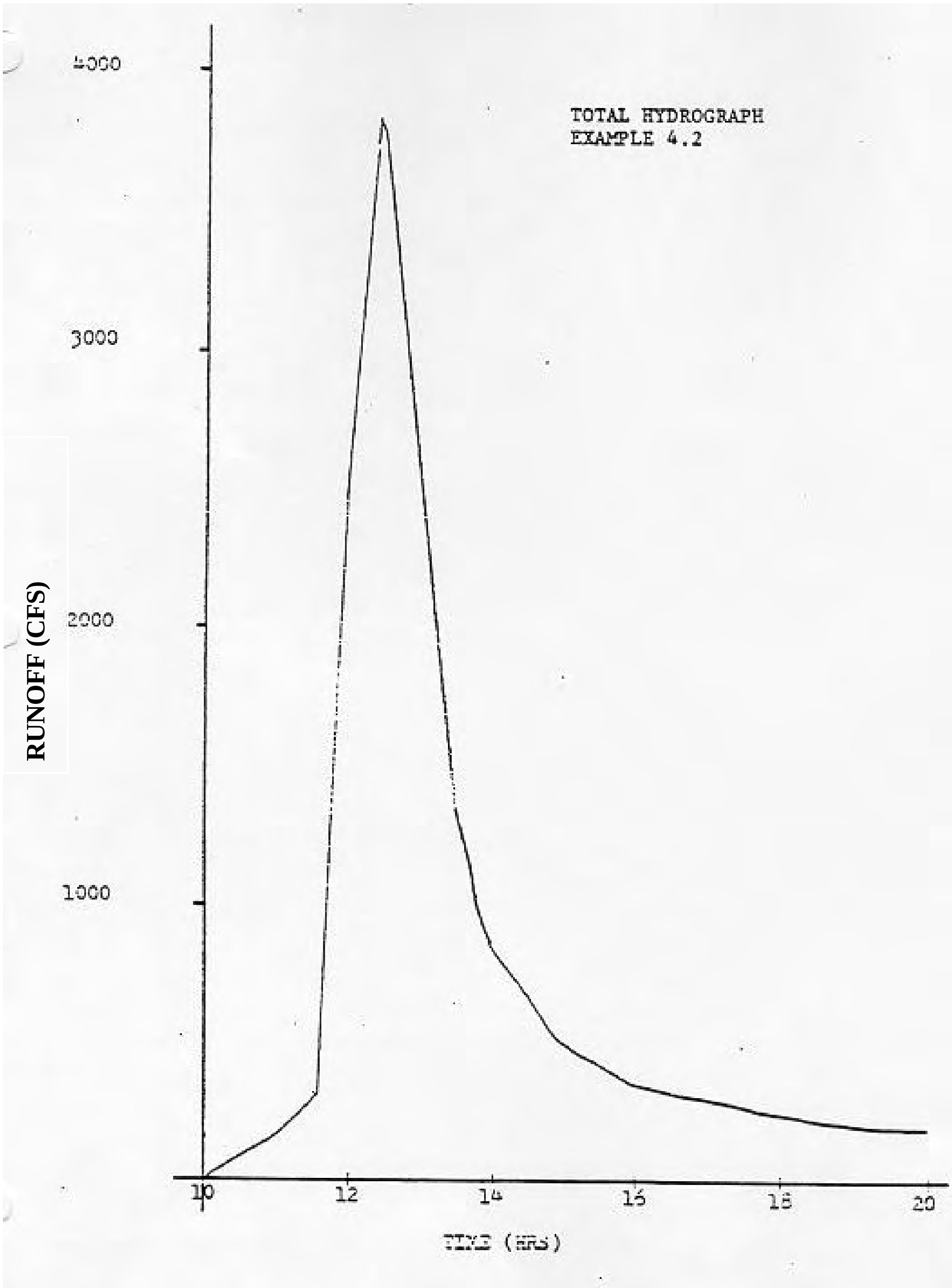
use T_c = 1.25 hrs.
T_r = 0.25 hrs (same as for sub-area 1)

<u>sub-area 3</u> (CN = 88 and avg slope = 2%)
lag time = 0.45 hrs (Chart 3.3)
lag factor (assume 50% imperviousness) = 0.79 (Chart 3.4)
lag factor (assume 40% drainage modifications) = 0.83 (Chart 3.5)
adjusted lag = 0.83 x 0.79x0.45 =0.30

$$T_c = \frac{0.30}{0.6} = 0.5\,\text{hrs}$$

T_t = 0

Sub-areas	1		2		3		Total basin
	T_C=.75,T = .25 DA=1.4, Q=4.5		T_C=1.25,T = .25 DA=1.1, Q=2.7		T_C=0.5,T = 0 DA=0.6, Q=6.5		
t	q	Q_{100}	q	Q_{100}	q	Q_{100}	Q_{100}
10.0	0	0	0	0	0	0	0
11.0	12	76	9	27	18	70	173
11.5	21	132	15	45	36	140	317
11.7	29	183	21	62	80	288	533
11.8	39	246	27	80	166	647	973
11.9	61	384	36	107	301	1174	1665
12.0	100	630	53	157	433	1689	2476
12.1	158	995	74	220	496	1934	3149
12.2	227	1430	103	306	474	1849	3585
12.3	291	1833	137	407	395	1541	3781
12.4	336	2117	172	511	309	1205	3833
12.5	355	2237	205	609	242	944	3790
12.6	348	2192	231	686	194	757	3635
12.7	321	2022	249	740	158	616	3378
12.8	285	1796	259	769	130	507	3072
12.9	247	1556	259	769	109	425	2750
13.0	212	1336	253	751	94	367	2454
13.2	156	983	223	662	75	293	1938
13.5	103	649	167	496	57	222	1367
14.0	62	391	102	303	43	168	862
14.5	44	277	67	199	36	140	616
15.0	36	227	48	143	31	121	491
16.0	27	170	31	92	25	98	360
18.0	19	120	21	62	18	70	252
20.0	15	95	16	48	15	59	202


TOTAL HYDROGRAPH
EXAMPLE 4.2
RUNOFF (CFS)
4000
3000
2000
1000
10
12
14
16
18
20
TIME (HRS)

Determine the runoff from each sub-area. The 24-hour rainfall for the 100-year frequency storm is 7.9 inches.

<u>sub-area 1</u> (CN=71)
Q, the precipitation excess = 4.5 in
<u>sub-area 2</u> (CN = 55)
Q, the precipitation excess = 2.7 in
<u>sub-area 3</u> (CN = 88)
Q, the precipitation excess = 6.5 in

Determine discharges of each sub-area.

Q_{100}, = 100-year discharge = q (DA) Q
Q_{100}, = discharge (cfs)
DA = drainage area (sq. mi.)
Q = runoff (in)
q = cfs/sq. mi./in. runoff (from Table 4.1)
t = time (hrs.)

Determine the total hydrograph by adding the sub-area hydrographs and plot the total hydrograph.

UNIT HYDROGRAPH PROCEDURE

Unit Hydrograph procedure has been extensively used for determining runoff hydrographs resulting from storms of specified duration. The procedure involves:

Computation of unit hydrograph of a duration equal to the time interval over which rainfall is constant. The usual duration of unit hydrographs for urban areas are 5 to 10 minutes.

Determination of rainfall excess pattern in time increments equal to the unit hydrograph duration.

Determination of runoff hydrograph by multiplying the unit hydrograph ordinates each rainfall excess values and properly lagging and summing the resulting hydrographs.

To introduce briefly the concept of unit hydrographs, a D-hour unit hydrograph is defined as the direct runoff hydrographs resulting from a storm having a constant intensity over D-hour period and having 1 inch of rainfall excess (= gross rainfall – losses) over the entire drainage area. In other words the area under the unit hydrograph is equal to 1 inch. The area can be computed using

$$AREA = \frac{SUM \times \Delta T \times 12}{43560 \quad A} \tag{4.1a}$$

Where AREA = area under the unit hydrograph in inches.

SUM = sum of all unit hydrograph ordinates in Cfs.
ΔT = time interval between the ordinates in seconds.
A = drainage area in acres.

The other factors in the above equation are conversion factors to give the area in inches. The direct runoff hydrograph for a storm of constant rainfall intensity over D-hour period and any value of rainfall excess can be computed by multiplying the D-hour unit hydrograph ordinates with the rainfall excess value. In the following we will present three unit hydrograph methods: (1) Colorado method, (2) SCS method and (3) Espey method.

4.3 COLORADO UNIT HYDROGRAPH PROCEDURE

The following steps are used to obtain the design hydrograph in the Colorado hydrograph procedure adopted by Denver Regional Council of Government (Wright – McLaughlin Engineers, 1969).

Determine the synthetic unit hydrograph using hydrograph parameters
Determine the rainfall excess pattern for the storm of stated frequency using depth-duration frequency curve.
Determine the design hydrograph by multiplying the unit hydrograph ordinates by the rainfall excess amounts.

Unit hydrograph

1. Compute the time lag, T_L in hours

$$T_L = C_t \ (L\,L_{ca})^{0.3} \tag{4.2}$$

where: L = hydraulic length of the basin in miles
L_{ca} = distance between centroid of the basin to the study point in miles
C_t = coefficient depending on the percent imperviousness.
C_t can be computed using Equation 4.3

$$C_t = 7.81/(P_a)^{0.78} \tag{4.3}$$

where: P_a = percent imperviousness.

For many basins L_{ca} can be taken to be 0.5L. Values of T_L from Equation 4.2 should be increased by 10 percent for sparsely sewered or very flat basins, and decreased by 10 percent for fully sewered or for steep basins.

2. Compute the time to peak.

The duration (D) of rainfall excess that is generally associated with the unit hydrograph should be 20 to 25 percent of the time to peak or 5 to 10 min whichever is less. The time to peak T_p in hours is given by

$$T_p = T_L \div \frac{D}{2} \tag{4.4}$$

3. Compute the peak discharge

The unit hydrograph peak, q_p in cfs is given by

$$q_p = \frac{640 C_p A}{T_L} \tag{4.5}$$

where:
A = area in mi^2
C_P = coefficient depending on percent imperviousness
T_L = lag time in hours
C_P can be computed using Equation 4.6

$$C_P = 0.89 \ (C_t)^{0.46} \tag{4.6}$$

C_P should be increased or decreased by 10 percent as in the case of C_t discussed earlier.

4. Take the time base of the unit hydrograph as five times the time to peak.

With the values of q_P and T_P determined as above, the shape of the unit hydrograph can be sketched using Chart 4.1 developed by the Corps of Engineers. The Chart 4.1 gives the width of the unit hydrograph at flow rates equal to 0.75 q_P and 0.50 q_P.

These widths are proportioned so that 1/3 of the width occurs prior to the peak discharge. Alternately W_{75} and W_{50} can be computed using

$$W_{75} = \frac{440 \ A^{1.08}}{q_P^{\ 1.08}}$$

$$W_{50} = \frac{770 \ A^{1.08}}{q_P^{\ 1.08}} \tag{4.7}$$

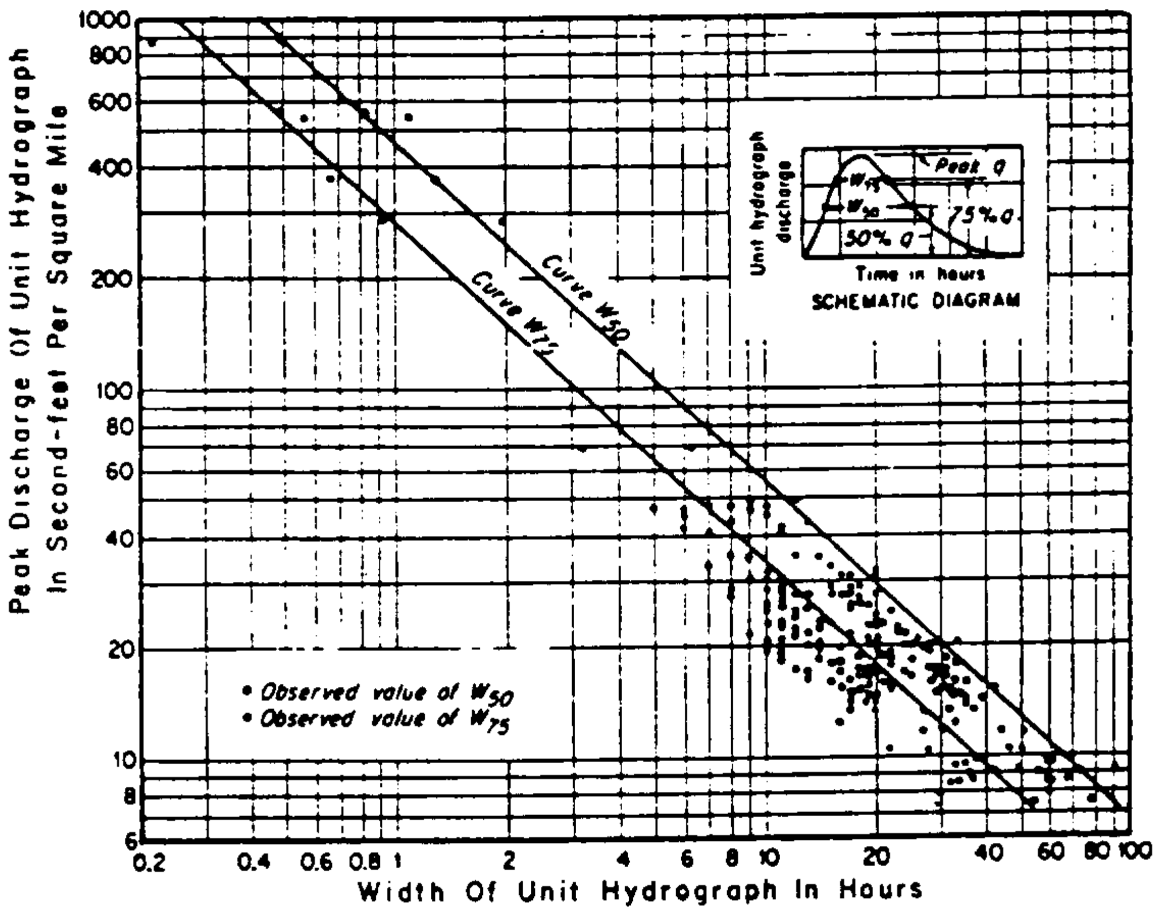


CHART 4.1
Unit Hydrograph Widths at 50 and 75 percent of Peak Flow (Corps of Engineers)

<u>Rainfall excess pattern</u>

The rainfall excess pattern is developed by (1) estimating rainfall from intensity-duration-frequency curve (Chart 2.1), (2) rearranging the increments in a pyramiding fashion with the highest intensity near the center, and (3) deducting initial surface storage and constant infiltrating from the rainfall. Alternately the rainfall excess pattern developed in the SCS hydrograph procedure discussed later can also be used.

EXAMPLE 4.3

Determine the 25-year design runoff hydrograph from a basin with the following data.

Area (A) = 544 acres = 0.85 mi^2

L = 1.21 miles

L_{ca} = 0.85 miles
Impervious area = P_a = 40%
Duration of rainfall excess = D = 10 min = 0.17 hr.

Unit Hydrograph Computation

1. $C_t = \dfrac{781}{P_a^{\ 0.78}} = \dfrac{7.81}{(40)^{0.78}}$ (from Equation 4.3)

2. $T_L = C_t\,(L \quad L_{ca})^{0.3} = 0.44 \quad (1.21 \quad x \quad 0.85)^{0.3}$ (from Equation 4.2)

 T_L = 0.44 hours or 27 min

3. $C_P = 0.89 \quad (C_t)^{0.46} = 0.89 \quad (0.44)^{0.46} = 0.61$ (from Equation 4.6)

4. $q_P = \dfrac{640 C_P A}{T_P} = \dfrac{640 \quad (0.61)(0.85)}{0.44}$ (from Equation 4.5)

 q_P = 754 cfs

5. $T_P = T_L + \dfrac{D}{2} = 27 + \dfrac{10}{2}$ (from Equation 4.4)

 T_P = 32 min or 0.53 hr.

6. $W_{75} = 440\ A^{1.08}/Q_P^{\ 1.08} = \dfrac{440(0.85)^{1.08}}{(754)^{1.08}}$ (from Equation 4.7) or Chart 4.1

 $W_{75} = 0.354 \quad hr\ (= 20.7\ \text{min})$

 $W_{50} = \dfrac{770 A^{1.08}}{Q_P^{\ 1.08}} = \dfrac{770 \quad (0.85)^{1.08}}{(754)^{1.08}}$ (from Equation 4.7 or Chart 4.1)

 $W_{50} = 0.605\ hr\ (= 36.3\ \text{min})$

7. Plot on rectangular coordinates: the peak flow of 754 cfs at time of 32 minutes after the start of the rainfall: at 75% of the peak or at 565.5 cfs plot points at $\left[32 - \frac{1}{3}(20.7)\right]$ or 23.7 minutes and $\left[32 + \frac{2}{3}(20.7)\right]$ or 44.4 minutes; at 50% of the peak or 375 cfs plot points at $\left[32 - \frac{1}{3}(36.3)\right]$ or 17.5 minutes and $\left[32 + \frac{2}{3}(36.3)\right]$ or 53.8 minutes.

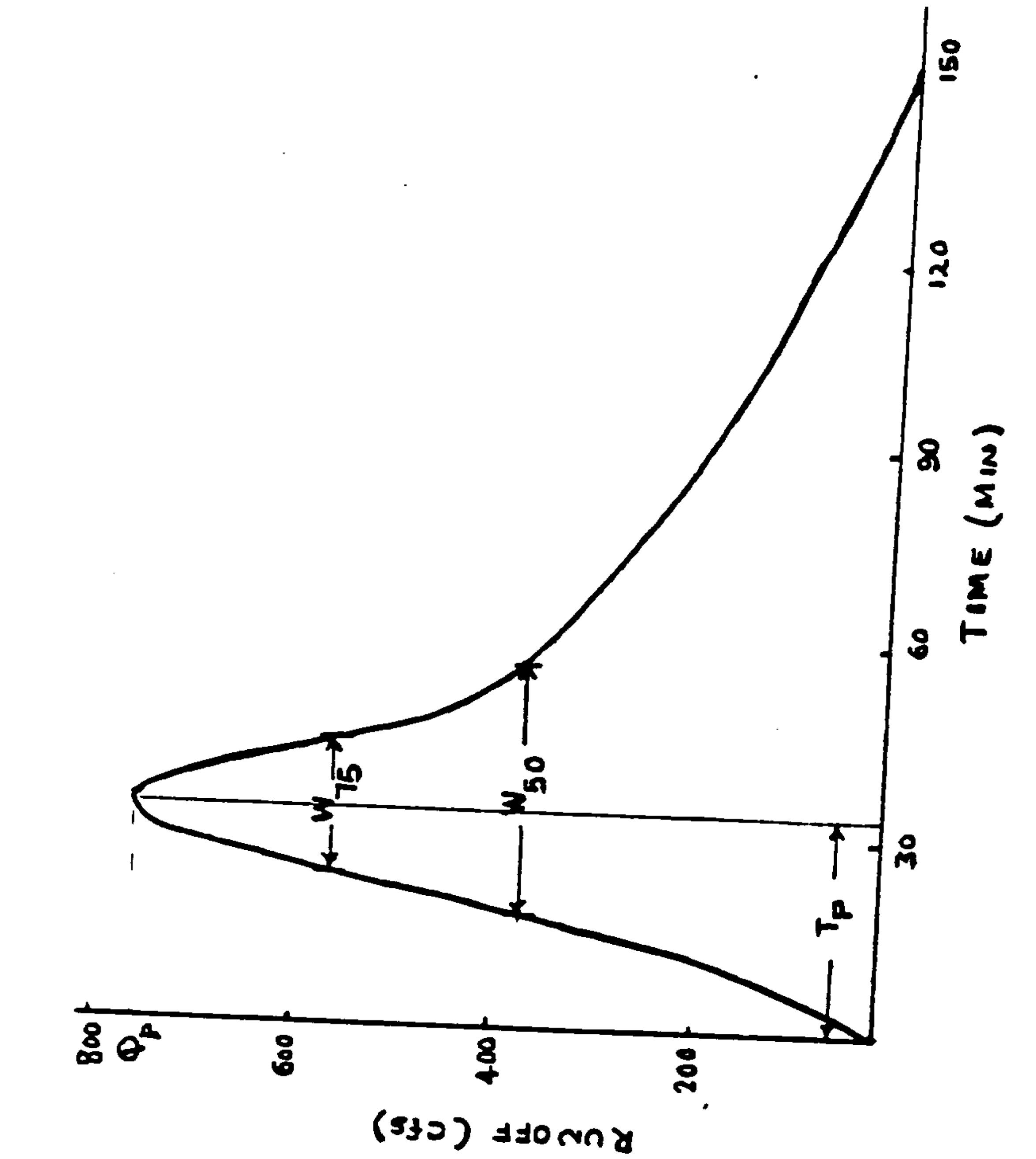
Assume hydrograph will terminate at five times T_P: the elapsed time from the beginning of excess rain to the peak, or 5 x 32 = 160 minutes.

8. Sketch the unit hydrograph as shown on page 72. The unit hydrograph ordinate at 10-minute intervals can be read as 0, 150, 528, 748, 676, 450, 253, 155, 95, 58, 35, 21, 11, 7, 4, 1, 0. The area under the unit hydrograph should be 1.0 inch and this is checked using Eq. 4.1a with ΔT = 10 min = 600 sec, A = 544 acres and SUM = 3192 cfs. The area is

$$\frac{3192 \times 600 \times 12}{43560\,(544)} = 0.97 \text{ inch which is close to 1.0 inch and therefore O.K.}$$

Rainfall Excess Pattern Computation

1. From the intensity-duration-frequency curve for Fulton County, obtain the rainfall values in inches for the 25-year frequency for the 10-, 20-, 30-minute etc. durations and enter in Column 2 of Example 4.3.



Unit Hydrogtaph for Example 4.3

2. In column 3, enter the incremental rainfall for each 10-min period.
3. Rearrange the 10-min rainfall in a pyramidal shape as shown in Col. 4.
4. For the pervious area, enter the infiltration with a maximum of ½ in/hr which is 0.08 for 10-min. Whenever rainfall value is less than his maximum, set the infiltration equal to rainfall.
5. Enter depression storage in col. 6 for the pervious area and Column 9 for the impervious area. Assume total depression storage 0.25 in for pervious area and 0.1 inch for the impervious area. The difference between rainfall (Col. 4) and infiltration (Col. 5) is entered as depression storage until the total depression storage is reached.
6. Enter the rainfall excess in Cols. 7 and 10. The rainfall excess is computed as rainfall – infiltration – depression storage.
7. 60% of rainfall excess and 40% of rainfall excess are entered in Cols. 8 and 11.
8. The total rainfall excess of each time increment is then the sum of Col. 8 and 11 is entered in Col. 12.
9. Check on rainfall excess by the SCS method.

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad \text{(Equation 3.1)}$$

For pervious area *S = 3.38 – 2.17 = 1.21 x 0.60 = 0.73 in.
For impervious area *S = 3.38 – 3.28 = 0.10 x 0.40 = 0.040 in.
Total S = 0.77 in.

$$Q = \frac{(3.38 - 0.2 \times 0.77)^2}{(3.38 + 0.8 \times 0.77)}$$

= 2.6 in. which agrees with 2.61 in. in Col 12

*Recall that S is defined as potential maximum retention, inches.

Determination of Rainfall Excess Example 4.3

Time	Precipitation: Total (in)	Precipitation: Incremental (in)	Precipitation: Rearranged Incremental (in)	Previous Area 60%: Maximum Infiltration (in)	Previous Area 60%: Depression Storage (in)	Previous Area 60%: Rainfall Excess in	Previous Area 60%: 60% of Rainfall Excess (in)	Impervious Area 40%: Depression Storage in	Impervious Area 40%: Rainfall Excess (in)	Impervious Area 40%: 40% Eff. Precip.	Total Rainfall Excess (in)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
0	0	0	0	0	0	0	0	0	0	0	0
10	1.2	1.2	0.08	0.08	0	0	0	0.08	0	0	0
20	1.74	0.54	0.11	0.08	0.03	0	0	0.02	0.09	0.04	0.04
30	2.10	0.36	0.13	0.08	0.05	0	0	0	0.13	0.05	0.05
40	2.33	0.23	0.23	0.08	0.15	0	0	0	0.23	0.09	0.09
50	2.67	0.34	0.34	0.08	0.02	0.24	.14	0	0.34	0.14	0.28
60	2.80	0.13	0.54	0.08	0	0.46	0.28	0	0.54	0.22	0.50
70	2.92	0.12	1.20	0.08	0	1.12	0.67	0	1.2	0.48	1.15
80	3.01	0.11	0.36	0.08	0	0.28	0.17	0	0.36	0.14	0.31
90	3.11	0.10	0.12	0.08	0	0.04	0.02	0	0.02	0.05	0.07
100	3.20	0.09	0.10	0.08	0	0.02	0.01	0	0.10	0.04	0.05
110	3.28	0.08	0.09	0.08	0	0.01	0.0	0	0.09	0.04	0.04
120	3.36	0.08	0.08	0.08	0	0	0	0	0.08	0.03	0.03
		Total	3.38	0.96	0.25	2.17	1.30	0.10	3.28	1.32	2.61

Time	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160										
UH	0	130	528	748	676	450	253	155	95	58.	35	21	11	7	4	1	0										
R.E																											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)										
0.04	0	6	21	30	27	18	10	6	4	2	1	1	0	0	0	0	0										
0.05		0	8	26	37	34	22	13	9	5	3	2	1	0	0	0	0	0									
0.09			0	14	48	67	61	40	23	14	9	5	3	2	1	0	0	0	0								
0.28				0	43	148	309	189	126	71	43	27	16	10	6	3	2	1	0	0							
0.50					0	76	264	374	338	225	126	77	47	29	17	10	5	3	2	0	0						
1.15						0	175	607	860	777	517	291	178	109	67	40	24	13	8	5	1	0					
0.11							0	47	164	232	210	139	78	48	29	18	11	7	3	2	1	0	0				
0.07								0	11	37	52	47	31	18	11	7	4	2	1	1	0	0	0	0			
0.05									0	8	26	37	34	22	13	8	5	3	2	1	0	0	0	0	0		
0.04										0	6	21	30	27	18	10	6	4	2	1	1	0	0	0	0	0	
0.03											0	5	16	22	20	13	8	5	3	2	1	1	0	0	0	0	0
Design Hydrograph	0	6	29	70	155	343	741	1276	(1534) PEAK	1371	993	652	434	287	165	109	65	40	21	12	4	1	0	0	0	0	0

UH = Unit Hydrograph

RE = Rainfall Excess

EXAMPLE 4.3 DESIGN HYDROGRAPH DETERMINATION

Design Hydrograph Computation

The above Table gives the computation involved in developing the hydrograph. In Column 1, place the 10-minute rainfall excess values from previous table. Across the top in rows 1 and 2, place the time intervals and corresponding unit hydrograph ordinates.

Multiplying each 10-min unit hydrograph amount by each rainfall value and record the products I Columns 2-18, starting each row in the next column. Sum the entries in each column to get the desired hydrograph at 10-minute intervals. The hydrograph can now be plotted.

4.4 SCS UNIT HYDROGRAPH PROCEDURE

In this method the design hydrograph for a stated frequency is determined by using the following steps.

Determine the SCS unit hydrograph using the hydrograph parameters and the dimensionless unit hydrograph.
Determine the rainfall excess patter for the stated frequency for selected time increments using the type II 24-hour rainfall distribution curve.
Determine the composite design hydrograph by multiplying the effective rainfall pattern with the unit hydrograph.

Unit Hydrograph

Determine the composite curve number
Determine the adjusted time lag, T_L in hours using Charts 3.3, 3.4, and 3.5.
Find time to peak, T_P in hours

$$T_P = \frac{D}{2} + T_L \qquad (4.8)$$

where: D = duration of rainfall increments in hours

The duration D is generally taken to be 0.2 to 0.25 of T_P, or 0.50 T_L
Note that the time of concentration, T_C is related to the time lag by

$$T_L = 0.6 \; T_C \qquad (4.9)$$

Find the peak discharge of the unit hydrograph, q_P in cfs

$$q_P = \frac{484A}{T_P} \qquad (4.9)$$

where A = drainage area in mi^2
T_P = time to peak in hours

5. Using the values of q_P and T_P , and the dimensionless unit hydrograph given in Chart 4.2 or Table 4.2 determine the unit hydrograph.

Rainfall Excess Pattern

The effective rainfall is determined in increments of D minutes using the SCS Type curve in Chart 3.6. For each time increment the incremental curve value, rainfall depth, cumulative rainfall depth, cumulative rainfall excess and finally the incremental rainfall excess are obtained. Instead of working with the entire 24-hour duration, one usually considers the most intense portion of the curve in Chart 3.6 resulting in a smaller time duration and less computation.

Design Hydrograph

The design hydrograph is obtained by multiplying the unit hydrograph ordinates in step (a) by each of the values of incremental rainfall excess determined in step (b) and properly lagging for each rainfall excess increment.

EXAMPLE 4.4

Compute the design hydrograph for a 25-year frequency from a basin in Fulton County with the following data using the SCS hydrograph procedure.

Area (A) = 890 acres
Curve number (CN) = 90
Percent imperviousness = 32.3%
Average land slope = 6%
Hydraulic length = 10,500 ft.
Hydraulic length modification = 75%

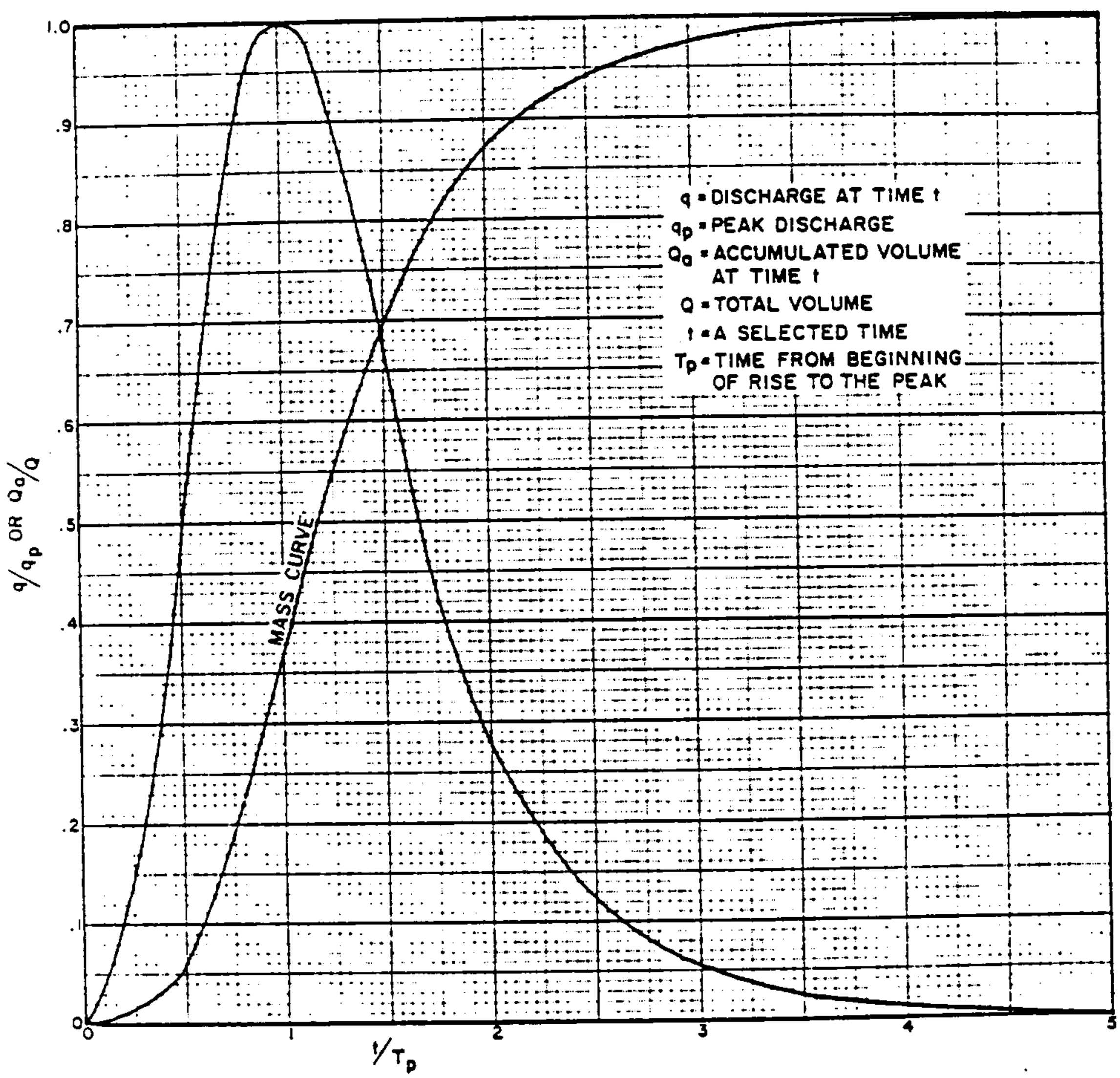


Chart 4.2
Dimensionless unit hydrograph and mass curve

Table 4.2 Ratios for dimensionless unit hydrograph and mass curve

Time Ratios (t/T_P)	Discharge Ratios (q/q_P)	Mass Curve Ratios (Q_a/Q)
0	.000	.000
.1	.030	.001
.2	.100	.006
.3	.190	.012
.4	.310	.035
.5	.470	.065
.6	.660	.107
.7	.820	.163
.8	.930	.228
.9	.990	.300
1.0	1.000	.375
1.1	.990	.450
1.2	.930	.522
1.3	.860	.589
1.4	.780	.650
1.5	.680	.700
1.6	.560	.751
1.7	.460	.790
1.8	.390	.822
1.9	.330	.849
2.0	.280	.871
2.2	.207	.908
2.4	.147	.934
2.6	.107	.953
2.8	.077	.967
3.0	.05	.977
3.2	.040	.984
3.4	.029	.989
3.6	.0.21	.993
3.8	.015	.995
4.0	.011	.997
4.5	.005	.999
5.0	.000	1.000

Solution

a. SCS unit hydrograph

1. $S = \dfrac{100}{CN} - 10 = \dfrac{1000}{90} - 10$ (Equation 3.2)

$= 1.11$ inches

2. $T_L{}' = \dfrac{L^{0.8}(S+1)^{0.7}}{1900y^{0.5}} = \dfrac{(10{,}500)^{0.8}(2.11)^{0.7}}{1900(6)^{0.5}}$ (Equation 3.3)

$= 0.60$ hours

3. $T_L = L_C\ L_i T_L{}'$ (Equation 3.4)

$L_C = 0.70$ (Chart 3.4)

$L_i = 0.87$ (Chart 3.5)

$T_L = 0.70 \times 0.87 \times 0.60 = 0.36$ hours $= 22$ min

4. Use D of 5 minutes, then

$T_P = \dfrac{D}{2} + T_L$ (Equation 4.8)

$= \dfrac{5}{2} + 22 = 24.5$ or 25 min .

5. $q_P = \dfrac{484A}{T_P}$ (Equation 4.10)

6. With the values of T_P and q_P and using the non-dimension unit hydrograph in Chart 4.2 the unit hydrograph as shown below.

Unit Hydrograph Coordinates

(1)	(2)	(3)	(4)
t	t/t_P	q/q_P	q
0	0	0	0
5	.2	.10	162
10	.4	.31	498
15	.6	.66	1059
20	.8	.93	1492
25	1.0	1.00	1615
30	1.2	.93	1492
35	1.4	.78	1252
40	1.6	.56	899
45	1.8	.39	626
50	2.0	.28	449
55	2.2	.21	337
60	2.4	.15	241
65	2.6	.11	177
70	2.8	.08	128
75	3.0	.06	96
80	3.2	.04	64
85	3.4	.03	48
90	3.6	.02	32
95	3.8	.02	32
100	4.0	.01	16
105	4.2	.01	16
110	4.4	.01	16
115	4.6	.00	0
120	4.8	.00	0
125	5.0	.00	0

(1) time in 5-minute increments
(2) column 1 divided by t_P of 25 minutes
(3) from Chart 4.2
(4) column 3 times q_P of 1615 efs

Rainfall Excess Pattern

The rainfall excess is determined in 5-minutes increments using the SCS Type II curve of Chart 3.6 and is shown below. In this table the most intense 2-hour period of Type II storm was selected as going from 11 to 13 hours. This period was broken into 5-minute increments as shown in Co. 1, and the ordinates recorded in Column 2. Col. 3 are the incremental curve ordinates from Column 2. Column 4 is Column 3 times 6.50 giving the rainfall depth in each 5 minute period. 6.50 inches correspond to the 25 year 24-hour rainfall as given in Table 3.1. Column 5 is the accumulated rainfall obtained by summing Column 4. Column 6 results from reading Chart 3.1 for a CN of 90 and rainfall depths from Column 5. Column 7 is the incremental values from Column 6 and represents the rainfall excess in each 5-minute period.

(1) Time	(2 Curve Ordinate	(3) Incr Curve Value	(4) Rain Depth	(5) Accum Rainfall	(6) Acc Runoff	(7) Rain Excess
11.00	0.235		0.00	0.00	0.00	0.00
11.08	0.240	.005	0.03	0.03	0.00	0.00
11.17	0.246	.006	0.04	0.07	0.00	0.00
11.25	0.252	.006	0.04	0.11	0.00	0.00
11.33	0.260	.0080	40.05	0.16	0.00	0.00
11.42	0.275	.015	0.10	0.26	0.00	0.00
11.50	0.294	.019	0.12	0.38	0.02	0.02
11.58	.0312	.018	0.12	0.50	0.08	0.06
11.67	0.340	.028	0.18	0.68	0.15	0.07
11.75	.0410	.070	0.46	1.14	0.42	0.27
11.83	0.490	.080	0.32	1.66	0.82	0.40
11.92	0.610	.120	0.78	2.44	1.48	0.66
12.00	0.660	.50	0.33	2.77	1.77	0.29
12.08	0.679	.019	0.12	2.89	1.89	0.12
12.17	0.690	.011	0.07	2.96	1.96	0.07
12.25	0.708	.018	0.12	3.08	2.07	0.11
12.33	0.720	.012	0.08	3.16	2.15	0.08
12.42	0.728	.008	0.05	3.21	2.19	0.04
12.50	0.735	.007	0.05	3.26	2.24	0.05
12.58	0.743	.008	0.05	3.31	2.28	0.04
12.67	0.750	.007	0.05	3.36	2.33	0.05
12.75	0.755	.005	0.03	3.39	2.35	0.02
12.83	0.762	.007	0.05	3.44	2.40	0.05
12.92	0.767	0.005	0.03	3.47	2.42	0.02
13.00	0.772	0.005	0.03	3.50	2.45	0.03
TOTALS			3.50 inches			2.45 nches

Design Hydrograph

With the unit hydrograph and rainfall excess patterns, the design hydrograph is computed as in Step C of Example 4.3. The hydrograph can now be plotted from the last row of the table shown on the next page.

Calculation of runoff hydrograph from rainfall excess and unit hydrograph

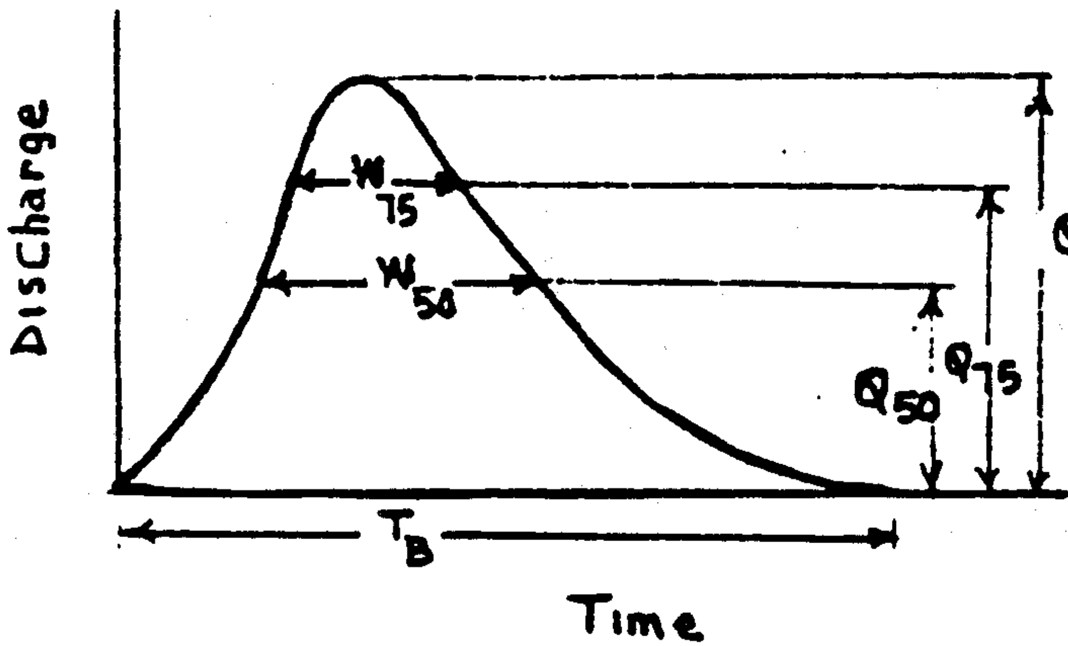
TIME	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
UH	0	162	498	1059	1492	1615	1492	1252	899	626	449	337	241	177	128	96	64	48	32	32	16	16
R.E																						
0.02	0	3	10	21	30	32	30	25	18	13	9	7	5	4	3	2	1	1	1	1	0	0
0.06		0	10	30	64	90	97	90	75	54	38	27	20	14	11	8	6	4	3	2	2	1
0.07			0	11	35	74	104	113	104	88	63	44	31	24	17	12	9	7	4	3	2	2
0.27				0	44	134	286	401	436	403	338	243	169	121	91	65	48	35	26	17	13	9
0.40					0	65	199	424	597	646	597	501	360	250	180	135	96	71	51	38	26	19
0.66						0	107	329	699	985	1066	985	826	593	413	296	222	159	117	84	61	42
0.29							0	47	144	307	433	468	433	363	261	181	130	98	70	51	37	28
0.12								0	19	60	127	179	194	179	150	108	75	54	40	29	21	15
0.07									0	11	35	74	104	113	104	88	63	44	31	26	17	12
0.11										0	18	55	116	164	178	164	138	99	69	49	37	27
0.08											0	13	40	85	119	129	119	100	72	50	36	27
0.06												0	7	20	42	60	65	60	50	36	25	18
0.05													0	8	24	53	75	81	75	64	45	31
0.04														0	7	20	42	60	65	60	50	36
0.05															0	8	24	53	75	81	75	63
0.02																0	3	10	21	30	32	30
0.05																	0	8	24	53	75	81
0.02																		0	3	10	21	30
0.03																			0	5	15	32
RUH	0	3	20	62	173	395	823	1431	2092	2567	2724	2596	2305	1938	1600	1329	1116	944	797	686	592	503

* UH = Unit Hydrograph, R.E = Rainfall excess, RUH = Runoff Hydrograph

Example 4.4

4.5 ***ESPEY UNIT HYDROGRAPH METHOD***

Espey et al (1977) have developed a method for computing a 10-minute unit hydrograph. The procedure involves computation of five parameters and sketching the hydrograph as shown below. These parameters are related to the basin parameters as given by the equation



in Table 4.2. Note that a unit hydrograph for 5-minute duration can be obtained, if necessary by the S-curves method described in Linsley et al, (1974) once the unit hydrograph is constructed it can be multiplied with the rainfall excess pattern to obtain the design hydrograph. The rainfall excess can be developed from the SCS Type II distribution curve or the rainfall-intensity-duration curve as discussed earlier in this Chapter. The following example illustrates the computation of hydrograph using Espey Method. This example also illustrates the S-curve method for converting a unit hydrograph of one duration to a unit hydrograph of another duration.

EXAMPLE 4.5

Determine the storm hydrograph for a basin consisting of two symmetrical sub-basins each draining into an outlet. Consider a 50-year, 60-minute storm. The sub-basins are identical with the following data.

Length of watershed	= 11600 ft
Imperviousness	= 75%
Perviousness	= 25%
Watershed area	= 4.25 acres
Slope of watershed	= 0.5%
Time of concentration	= 5 min

SOLUTION

Determine the unit hydrograph.
The basic 10-minute unit hydrograph is first computed using equations given in Table 4.0 and from the value of Φ chart 4.3. In this case the value of $\Phi = 0.60$. The 10-minute unit hydrograph is shown on page 88. Since the drainage area is small and time of concentration is 5-minutes, the duration of rainfall increments will be assumed to be 5-minutes instead of 10-minutes. Therefore, we need a 5-minute unit hydrograph for this problem. The 5-minute unit hydrograph can be computed using the S-curve method applied to the 10-minute unit hydrograph as indicated in Table on page 89. The 10-minute S-curve is obtained by summing several 10-minute unit hydrographs each offset by 10-minutes. This if the time of the 10-minute unit hydrographs is 10-minutesm 10 $\left(=\frac{100}{10}\right)$ unit hydrographs each offset by 10-minutes need to be added to get the S-curve. The 10-minute S-curve is given in column 3 of this Table. In column 4 the same S-curve is lagged by 5 minutes and the difference between the 10-minute S-curve and lagged S-curve is entered in column 5. The 5-min unit hydrograph is then obtained in column 6 by multiplying column 5 by 2 $\left(=\frac{10\text{ min}}{5\text{ min}}\right)$.

TEN-MINUTE UNIT HYDROGRAPH EQUATIONS

Equations	Total Explained Variation
$T_R = 3.1\,L^{0.23}S^{0.25}I^{-0.18}\Phi^{1.57}$	0.802
$Q = 31.62\text{x}10^3\ A^{0.96}T_R^{-1.07}$	0.936
$T_B = 125.98\text{x}10^3 A\ Q^{-0.95}$	0.844
$W_{50} = 16.22\text{x}10^3 A^{0.93}Q^{-0.92}$	0.943
$W_{75} = 3.42\text{x}10^3 A^{0.79}Q^{-0.78}$	0.834

L — is the total distance (in feet) along the main channel from the point being considered to the upstream watershed boundary.

S — is the main channel slope (in feet per foot) as defined by H/(0.8L), where L is the main channel length as described above and H is the difference in elevation between two points, A and B. A is a point on the channel bottom at a distance of 0.2L downstream from the upstream watershed boundary. B is a point on the channel bottom at the downstream point being considered.

I — is the impervious area within the watershed (as a percentage).

Φ — is the dimensionless watershed conveyance factor given in Chart 4.3.

A — is the watershed drainage area (in square miles).

T_R — is the time of rise of the unit hydrograph (in minutes).

Q — is the peak flow of the unit hydrograph (in cfs).

T_B — is the time base of the unit hydrograph (in minutes).

W_{50} — is the width of the unit hydrograph at 50% of Q (in minutes).

W_{75} — is the width of the unit hydrograph of 75% of Q (in minutes).

TABLE 4.2

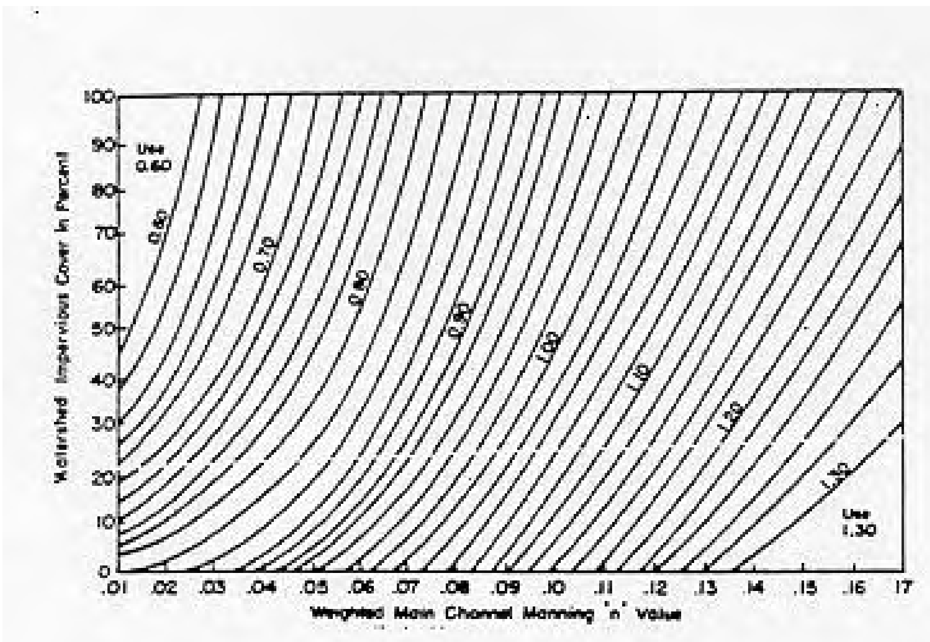
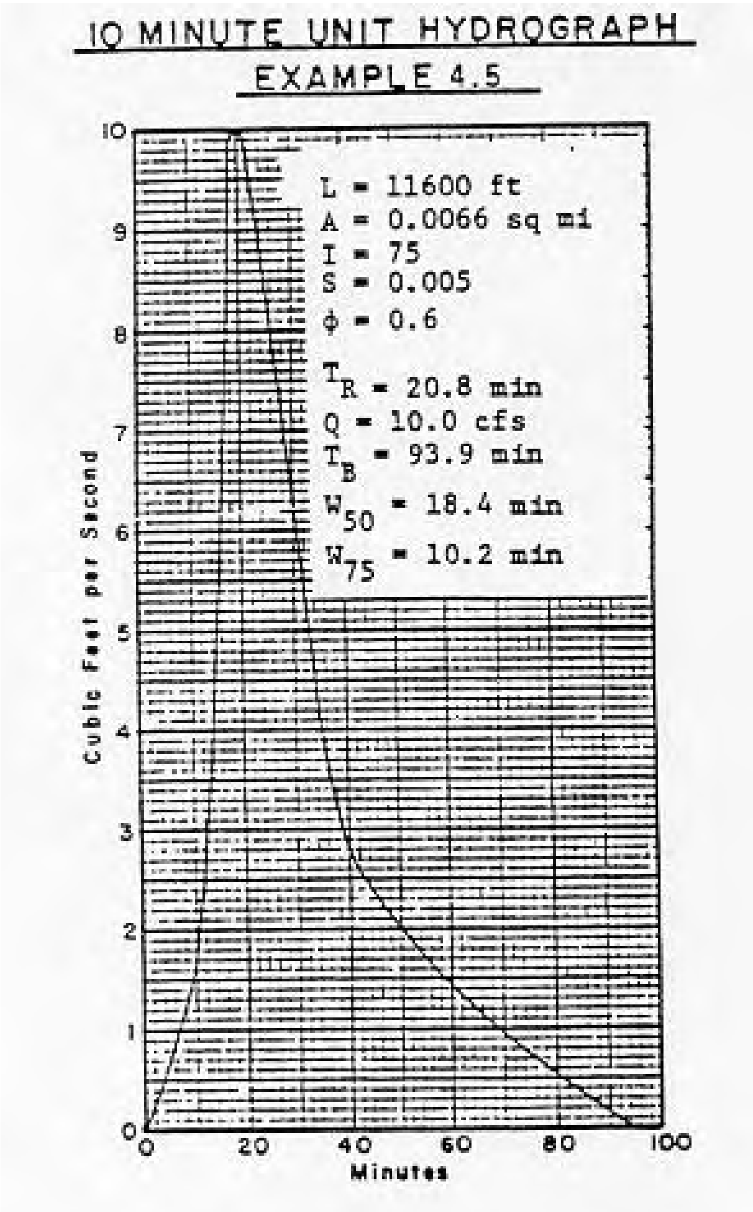


Chart 4.3 Watershed Conveyance Factor ø



10 MINUTE UNIT HYDROGRAPH
EXAMPLE 4.5
L = 11600 ft
A = 0.0066 sq mi
I = 75
S = 0.005
φ = 0.6
T_R = 20.8 min
Q = 10.0 cfs
T_B = 93.9 min
W_50 = 18.4 min
W_75 = 10.2 min
Cubic Feet per Second
Minutes
0
1
2
3
4
5
6
7
8
9
10
0
20
40
60
80
100

DEVELOPMENT OF 5-MINUTE UNIT HYDROGRAPH
FROM 10-MIN. UNIT HYDROGRAPH
EXAMPLE 4.5

MIN.	HOURS	S-CURVE 10-MINUTE	LAGGED S-CURVE	(3) - (4)	5-MIN. UNIT GRAPH
(1)	(2)	(3)	(4)	(5)	(6)*
0	0	0		0	0
5	.08	0.75	0	0.25	.50
10	.17	1.70	0.25	1.45	2.90
15	.25	6.7	1.70	5.00	10.00
16.5	.27				11.00
20	.33	11.69	6.7	5.00	10.00
25	.42	15.6	11.69	3.99	7.98
30	.50	18.05	15.6	2.45	4.90
35	.58	19.6	18.05	1.55	3.30
40	.67	20.85	19.6	1.25	2.50
45	.75	22.0	20.85	1.15	2.03
50	.83	22.83	22.0	0.83	1.66
55	.92	23.6	22.83	0.77	1.54
60	1.00	24.25	23.6	0.65	1.20
65	1.08	24.85	24.25	0.60	0.98
70	1.17	25.20	24.85	0.35	0.77
75	1.25	25.5	25.20	0.30	0.60
80	1.33	25.73	25.5	0.23	0.40
85	1.42	25.8	25.73	0.07	0.25
90	1.50	25.87	25.8	0.07	0.10
93	1.55		25.87		0.0

DETERMINATION OF EFFECTIVE RAINFALL EXCESS - EXAMPLE 4.5

	PRECIPITATION			PERVIOUS AREA 25%				IMPERVIOUS AREA 75%			
TIME (MIN)	50-YR TOTAL IN.	INCREMENTAL IN.	REARRANGED INCREMENTAL IN.	MAXIMUM INFILTRATION IN.	DEPRESSION STORAGE IN.	Rainfall Excess IN.	25% Rainfall Excess IN.	DEPRESSION STORAGE IN.	Rainfall Excess IN.	75% Rainfall Excess IN.	TOTAL AVG. Rainfall Excess IN.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
5	.76	.76	.12	.08	.04	-		.05	.07	.0525	.05
10	1.25	.49	.15	.08	.07	-		.05	.10	.0750	.08
15	1.59	.34	.23	.08	.14	.01	.0125		.23	.1725	.19
20	1.87	.28	.49	.08		.41	.1025		.49	.3670	.47
25	2.10	.23	.76	.08		.68	.1700		.76	.5700	.74
30	2.27	.17	.34	.08		.26	.0650		.34	.2550	.32
35	2.42	.15	.28	.08		.20	.0500		.28	.2100	.26
40	2.55	.13	.17	.08		.09	.0225		.17	.1275	.15
45	2.67	.12	.13	.08		.05	.0125		.13	.0975	.11
50	2.78	.11	.11	.08		.03	.0075		.11	.0825	.09
55	2.88	.10	.10	.08		.02	.0050		.10	.0750	.08
60	2.98	.10	.10	.08		.02	.0050		.10	.0750	.08
			2.98	0.96	0.25	1.77	.4525	.10	2.88	2.1595	2.62

DETERMINATION OF STORM HYDROGRAPH-EXAMPLE 4.5

TIME (MIN)	UNIT HYDROGRAPH (CFS)	EXCESS PRECIPITATION IN INCHES												HYDGR. (CFS)	2x COL. 15
		.05	.08	.19	.47	.74	.32	.26	.15	.11	.09	.08	.08		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
5	.50	.02	0											.02	.04
10	2.90	.15	.04	0										.19	.38
15	10.00	.50	.23	.10	0									.83	1.66
20	10.00	.50	.80	.55	.24	0								3.09	6.18
25	7.98	.40	.80	1.90	1.36	.37	0							4.83	9.66
30	4.90	.24	.64	1.90	4.70	2.14	.16	0						9.78	19.56
35	3.30	.17	.39	1.52	4.70	7.40	.93	.13	0					15.24	30.48
40	2.50	.12	.26	.93	3.74	7.40	3.20	.76	.07	0				16.48	32.96
45	2.03	.10	.20	.63	2.30	5.90	3.20	2.60	.44	.06	0			15.43	30.86
50	1.66	.08	.16	.47	1.55	3.62	2.55	2.60	1.50	.32	.05	0		12.90	25.80
55	1.54	.08	.13	.39	1.17	2.44	1.57	2.07	1.50	1.10	.26	.04	0	10.75	21.50
60	1.20	.06	.12	.31	.95	1.84	1.06	1.27	1.20	1.10	.90	.23	.04	9.08	18.16
65	0.98	.05	.10	.29	.78	1.50	.80	.86	.74	.88	.90	.80	.23	7.93	15.86
70	0.77	.04	.08	.23	.72	1.23	.65	.65	.49	.54	.72	.80	.80	6.95	13.90
75	0.60	.03	.06	.19	.56	1.14	.53	.53	.38	.36	.44	.64	.80	5.66	11.32
80	0.40	.02	.05	.15	.46	.89	.49	.43	.31	.28	.30	.39	.64	4.41	8.82
85	0.25	.01	.03	.11	.36	.72	.39	.40	.25	.22	.22	.26	.39	3.36	6.72
90	0.10	00	.02	.08	.28	.57	.31	.31	.23	.18	.18	.20	.26	2.62	5.24
95			.01	.05	.19	.44	.25	.25	.18	.17	.15	.16	.20	2.05	4.10
100				.02	.12	.30	.19	.20	.15	.13	.14	.13	.16	1.54	3.08
105					.05	.18	.13	.16	.12	.11	.11	.12	.13	1.11	2.22
110						.07	.08	.10	.09	.08	.09	.10	.12	.73	1.46
115							.03	.07	.06	.07	.07	.08	.10	.48	.96
120								.03	.04	.04	.05	.06	.08	.30	.60
125									.02	.03	.04	.05	.06	.20	.40
130										.01	.02	.03	.05	.11	.22
135											.01	.02	.03	.06	.12
140												.01	.02	.03	.06
145													.01	.01	.02

Compute the rainfall pattern

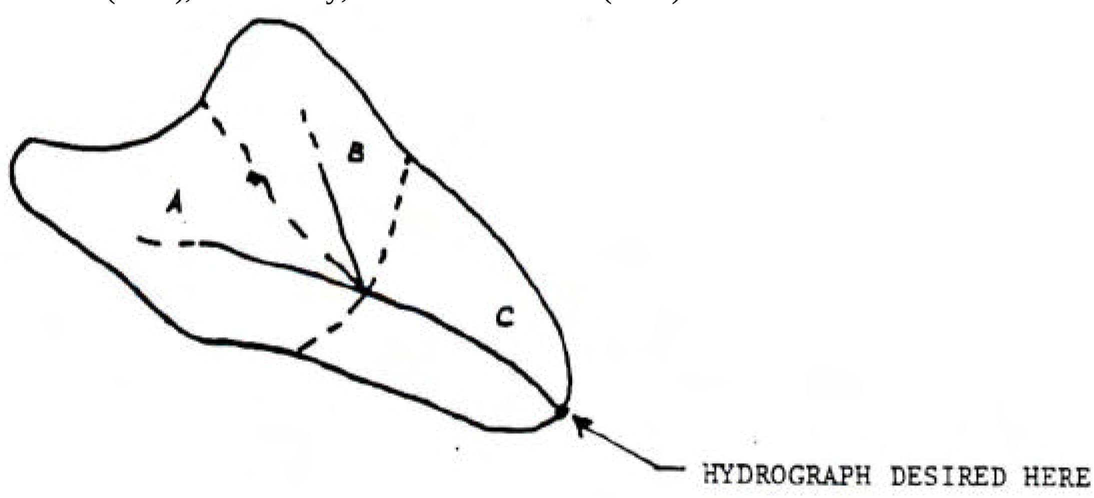
To develop the storm hydrograph, it is necessary to determine the rainfall excess at 5-minute intervals and then multiply the unit hydrograph ordinates by the rainfall excess. These steps are the same as in Colorado Method or SCS Method discussed earlier. Table on page 90 computes the rainfall excess for a 50-year 60-minute rainfall. The intensity-duration-frequency curve is used to calculate the rainfall for various durations and the maximum infiltration rate of 1 in/hour and depression storage of 0.25 in on the pervious areas and 0.10 in on the impervious areas are assumed.

Compute the storm hydrograph

The unit hydrograph ordinates are multiplied by the rainfall excess values for each time increment and the resulting storm hydrograph is computed as shown in Table on page 91. Note that column 16 in this Table gives the total hydrograph from the two symmetrical sub-watersheds. The hydrograph can now be plotted.

4.6 NON-HOMOGENEOUS WATERSHEDS

For a non-homogeneous watershed, the watershed should be subdivided into sub-basins and runoff hydrographs are computed for each sub-basin. The total design hydrograph is then obtained by properly adding and/or routing these sub-basin hydrographs. For example for the watershed composed of three sub-basins A, B, C shown below one obtains runoff hydrographs for A, B, B separately. Hydrographs A and B are added and then routed through the channel in area B. This routed hydrograph is finally added to the hydrograph C to obtain the total hydrograph at the outlet of the entire watershed. An example of this type of computation can be found in Haan (1976), and Linsley, Kohler and Paulhus (1979).



CHAPTER 5

CHAPTER 5 - PIPE SIZE SELECTION

Selection of pipe size shall be based on the peak discharge computed by using the Rational Method. If the pipe has a head of from 0 to 2 pipe diameters, the pipe size can be calculated using Manning's equation (or Chart 2.4).

Manning formula is the most widely used and us recommended here.

$$Q = \frac{1.486}{n} AR^{2/3}S^{1/2} \tag{5.1}$$

in which Q = discharge in cfs

A = cross-sectional area of flow in ft^2

R = hydraulic radius = $\frac{\text{area of section}}{\text{wetted perimeter in ft}}$

S = slope of the invert in ft/ft

n = coefficient of roughness of pipe

The designer should keep in mind that it is important to maintain sufficient velocity within the pipes to prevent deposition of suspended matter washed into the pipes. Past experience has shown that a mean velocity of 2.5-3 fps will normally prevent the depositing of suspended matter in the pipes.

If the head is more than 2 pipe diameters, pipe sizes are to be determined using procedures outlined in Chapter under Culvert design. We will consider three cases of pipe size selection (1) when the velocity of flow is less than the allowable velocity of 18 ft/sec, (2) when the velocity is greater than 18 ft/sec, and (3) when the head loss is appreciable. Each of these cases is given in the following example.

EXAMPLE 5.1

Determine the pipe size to carry the twenty-five year runoff of 684 cfs. The head on pipe is about 2 ft, and the slope is 0.01 ft/ft. Assume Manning's n = 0.013.

SOLUTION

To find pipe diameter, enter Chart 2.4 with the slope (S) = 0.01 ft/ft, the Manning coefficient (n) = 0.013 and the peak runoff rate (Q) = 684 cfs. Connect the values for the slope and Manning coefficient. Make a mark where this line crosses the pivot line. Then connect this point on the pivot line with the runoff value. The pipe diameter will be given on line C and the velocity of flow in the pipe on line f. Thus V = 17 ft/sec., D = 84 inches.

If the velocity is greater than the allowable velocity of 18 ft/sec, pipe size shall be determined as in the following example.

EXAMPLE 5.2

Determine the pipe size with the following data

$$S = 0.05 \text{ ft / ft}$$

$$n = 0.013$$

$$Q = 200 \text{ cfs}$$

SOLUTION

Using Chart 2.4 we get a diameter of 42 inches and the velocity is greater than 18 ft/sec. In this case pipe size is obtained as follows.

$$Q = V_{max} .A \qquad (5.2)$$

where A = Area

$$V_{max} = \text{maximum allowable velocity assumed to be } 18 \text{ ft / sec}$$

$$A = \frac{Q}{V_{max}} = \frac{200}{18} = 11.1 \text{ ft}^2$$

and

$$A = \frac{\pi D^2}{4} \qquad (5.3)$$

$$D = \sqrt{\frac{4A}{\pi}} = 48 \text{ in}$$

This we require a greater diameter pipe but the velocity is within the allowable value.

<u>Pipe Size Selection When Head Loss is Appreciable</u>

Appreciable head loss may occur when there are sharp bends or many smooth bends in the pipe system. In such case the pipe size (D_2) shall be determined using the following equation.

$$40 \quad \Delta Z \quad D_2{}^4 - Q^2 \left[1 + n\left(\frac{L_1}{D_1} + \frac{L_2}{D_2} + \frac{L_c}{D_c} \right) \right] = 0 \qquad (5.4)$$

This equation can be solved by trial-error procedure. When the correct pipe diameter is inserted into this equation, it will balance out roughly to zero. Since pipe sizes vary by 3 or 6 inches, the equation will rarely be satisfied *when a D_2 value is inserted into this equation. If the result upon substituting a selected value of D_2 is negative and the pipe size is small, then the D value is increased in available standard sizes until one gets the positive result for the first time. Use of this equation should be limited to pipe lengths up to 400 feet. The quantities appearing in the above equation are:

Q = runoff rate in cfs computed by the Rational Method

n = Manning coefficient (from Table 2.6)

ΔZ = difference in elevation between the entrance and the exit of the pipe (in ft)

L_1 = length of the pipe from the point where the head loss occurs to the point where the water leaves the pipe system.

L_2 = length of the pipe from the point where the head loss occurs to the point where the water leaves the pipe system.

* or "the left-hand member will rarely equal zero"

L_c = Equivalent length of the pipe which gives a head loss equal to the head loss caused by various valves, bends and fittings, (from (Chart 5.1)

D_1 = diameter of pipe length L_1

D_2 = diameter of pipe length L_2 which is to be determined

D_c = diameter of pipe length L_c (from Chart 5.1)

EXAMPLE 5.3

Find the diameter of the pipe (D_2) considering the head loss using the following data.

Elevation Difference (A) = 2 ft

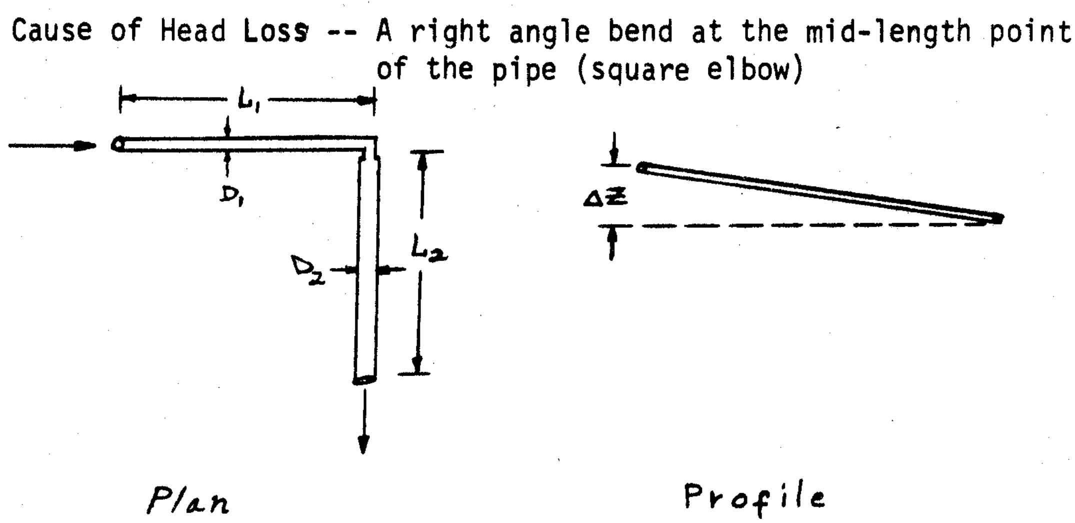
Length of Pipe (L) = 200 ft. (L_1 = 100' ; L_2 = 100')

Manning Coefficient (n) = 0.013

Flow (Q) = 100 cfs.

Pipe --- concrete, good condition

Cause of Head Loss – A right angle bend at the min-length point of the pipe (square elbow)



SOLUTION

By the method presented earlier, a pipe diameter of 42 in. would have carried this flow if there had not been a bend in the pipe. Therefore, the length of pipe downstream from the bend must be made larger due to the head loss created by the bend.

Enter Chart 5.1 with the upstream pipe diameter (D_L = 42”) and the type of bend (square elbow). Thus;

Equivalent length of pipe (L_c) = 240 ft.

Therefore, first try D_2 = 4.0'

$$40 \quad \Delta Z \quad D_2{}^4 - Q^2\left[1 + n\left(\frac{L_1}{D_1} + \frac{L_2}{D_2} + \frac{L_c}{D_c}\right)\right] = 0$$

$$40(2)\quad(4)^4 \quad - \quad (100)^2 \left[1 + 0.013\left(\frac{100}{3.5} + \frac{100}{4} + \frac{240}{3.5}\right)\right] \quad = \quad 0$$

$$20{,}480 - 10{,}000 \quad [1 + 0.013(122.1)] = 0$$

$$20{,}480 - 10{,}000 \quad [1 + 1.5873] \quad = \quad 0$$

$$20{,}480 - 25{,}873 = 0$$

-4,393 is less than zero, therefore D_2 is too small

try $D_2 = 4.5'$

$$40(2)\quad(4.5)^4 \quad - \quad (100)^2 \; [1 + 0.013(119.3)\;] \quad = \quad 0$$

$$32{,}800 - 10{,}000 \;\; [2.5509] \quad = \quad 0$$

7,291 is greater than zero, there it is OK to use.

Use a 54 inch pipe for the last 100 ft.

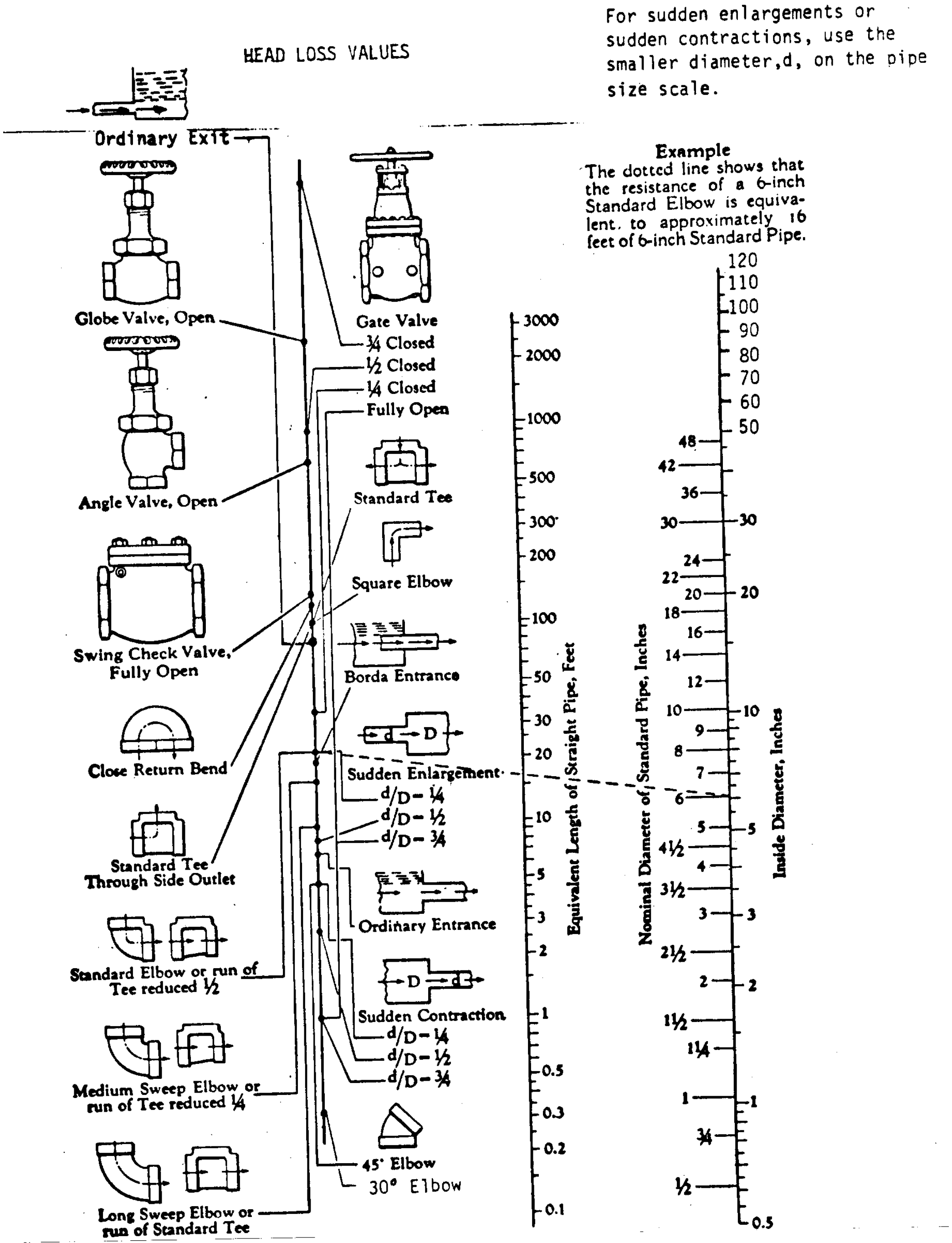

For sudden enlargements or sudden contractions, use the smaller diameter, d, on the pipe size scale.
HEAD LOSS VALUES
Ordinary Exit
Example
The dotted line shows that the resistance of a 6-inch Standard Elbow is equivalent to approximately 16 feet of 6-inch Standard Pipe.
Globe Valve, Open
Gate Valve
¾ Closed
½ Closed
¼ Closed
Fully Open
Angle Valve, Open
Standard Tee
Square Elbow
Swing Check Valve, Fully Open
Borda Entrance
Close Return Bend
Sudden Enlargement
d/D - ¼
d/D - ½
d/D - ¾
Standard Tee Through Side Outlet
Ordinary Entrance
Standard Elbow or run of Tee reduced ½
Sudden Contraction
d/D - ¼
d/D - ½
d/D - ¾
Medium Sweep Elbow or run of Tee reduced ¼
45° Elbow
30° Elbow
Long Sweep Elbow or run of Standard Tee
Equivalent Length of Straight Pipe, Feet
3000
2000
1000
500
300
200
100
50
30
20
10
5
3
2
1
0.5
0.3
0.2
0.1
Nominal Diameter of Standard Pipe, Inches
48
42
36
30
24
22
20
18
16
14
12
10
9
8
7
6
5
4½
4
3½
3
2½
2
1½
1¼
1
¾
½
Inside Diameter, Inches
120
110
100
90
80
70
60
50
30
20
10
5
3
2
1
0.5

CHART 5.1

CHAPTER 6 - DESIGN OF CULVERTS

6.1 SELECTION OF PIPE AND BOX CULVERTS

This section deals with the design procedure for the majority of pipe and box culverts by any structure size not covered by this procedure can be designed by the use of inlet and outlet control nomographs in Sec. 6.2. The following data must be available.

1. Design discharge (Q) in cfs
2. Allowable head water depth (AHW) in ft
3. Approximate length of culvert (L) in ft
4. Slope of culvert barrel (S_o) in ft/ft
5. Shape and kind of culvert, and entrance type

Sharp of culverts my be circular, rectangular, oval, arched; kind of culvert includes concrete, CMP, etc; and entrance may be of groove-edged, square edged, projecting, headwall type. Depth depends on the elevation of the culvert outlet relative to the inlet or, on the value of

$$\frac{L}{100\ S_o}.$$

The culvert barrel will be flowing full when the headwater is substantially above the crown elevation at the entrance. The procedure in using Chart 6.1 are

1. Compute the value of $\frac{L}{100\ S_o}$
2. Select the appropriate chart depending on type of barrel and entrance. Go up on the chart from the given Q value to AHW, move down from this point to the desired solid curve or the next lower solid line depending on whether the actual $\frac{L}{100\ S_o}$ is greater than the next lower solid line value or not. Interpolations are often necessary. Read the corresponding size of barrel and actual headwater. If this intersection point is above the AHW, select the next larger size. An example is shown on Chart 6.1

Georgia DOT Manual gives the design chart for various shapes, kinds and entrance conditions. We will only demonstrate the use of one such chart here as given in Chart 6.1. Georgia DOT Manual should be consulted for the applicable design chart. In these charts the solid line curve gives the maximum discharge for a specified culvert size and headwater depth. For any value of

($L/100S_o$) less than indicated on the solid curve no decrease in headwater can be obtained for a given discharge. At any point on the solid line, the culvert will be in entrance control, i.e., the headwater depth will depend solely on the entrance, and the barrel will not flow full. The dotted (or dashed) curve indicates the headwater discharge relation with outlet control, i.e., the headwater.

6.2 HYDRAULIC DESIGN OF CULVERTS

Hydraulic design of culverts involves the determination of barrel size, type of control and required headwater depth. The size of barrel should be large enough to convey the design peak flow discharge. In transmitting this discharge the culvert must function within the allowable headwater and tail water elevations, length, slope and type of material, types of culvert shapes.
The depth of headwater directly reflects the amount of energy required to overcome various losses and to push the water through the culvert.

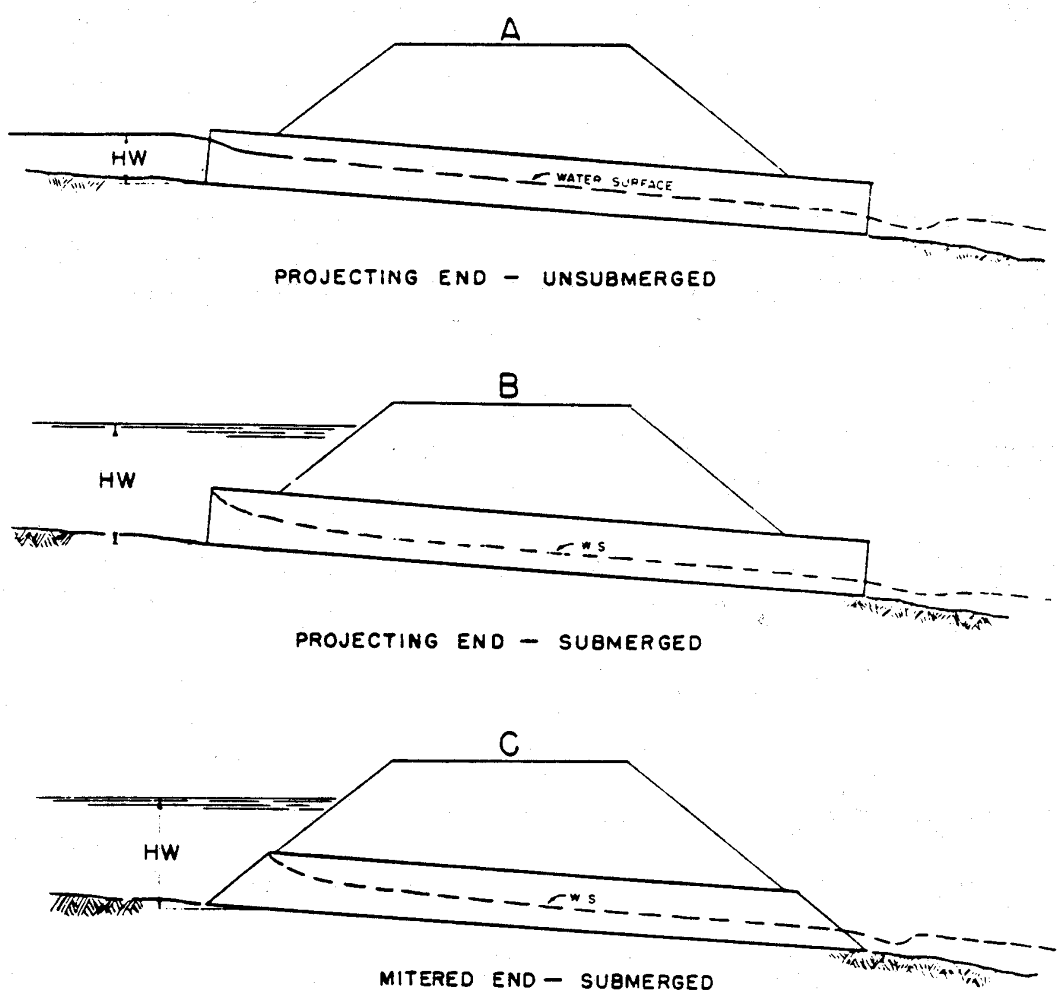
Flow condition may be inlet control or outlet control. In inlet control, the capacity of culvert is controlled at the entrance by such factors as depth of headwater, inlet geometry, barrel geometry but not affected by length, slope, roughness of the barrel or by the tailwater depth. In outlet control the flow is affected by all of the above factors including the factors governing the inlet control. It is possible to determine the type of control by hydraulic computation.

The design of culvert can be a trail-and-error procedure in which a size and type of culvert (box or pipe, etc.) is selected first, and followed by flow property analysis and headwater depth computation. If the calculated headwater depth is greater than the maximum allowable depth based on other requirements such as topography, laws or regulations, a new culvert selection would be made until the allowable condition is met. Flow through culverts in inlet control often results in partially full but improved inlets (beveled-edge, side-taper, slope-taper) which can be employed to increase the flow to e nearly full by reducing the entrance losses in an inlet control. Usually in the design of culverts the headwater depth is computed for both inlet and outlet controls and the larger depth and the corresponding control is used further in hydraulic computations. Culvert outlet velocity is commonly greater than the flow velocity in the channel downstream of culvert and energy dissipators should often be provided to reduce erosion.

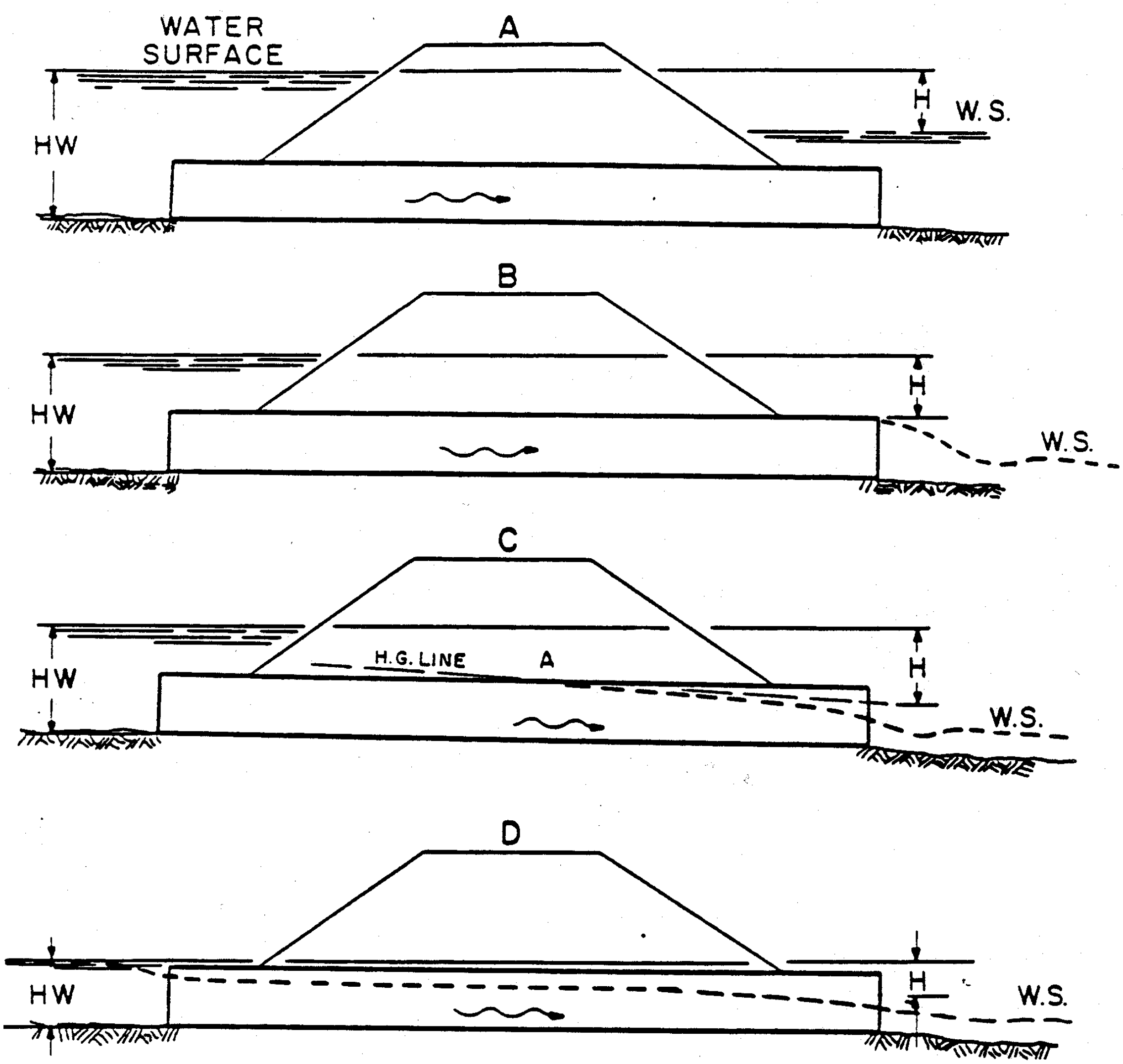
The following factors are important in the design of culverts:

1. Existing or possible tailwater condition (e.g. depth)
2. Accurate determination of allowable headwater depth
3. Outlet velocity.

Culverts are normally sized to pass the peak flow for the selected design storm. It is to be noted that the design peak flow rate should be computed by using the Rational Method or other methods as outlined in Chapter 2. If a detention facility is planned upstream of the culvert, the inflow hydrograph from the watershed must be routed through the detention facility to determine the flow rate for the design of culvert. Additional details on culvert design can be obtained from Georgia DOT Manual and Federal Highway Administration circulars NO. 5 and 13 and 14. In the following procedure for selection o culvert size and the use of inlet and outlet control nomographs are given. The design tabulation sheets that may be used in the design of culverts are also included with example problems.



INLET CONTROL



OUTLET CONTROL

Procedure for Selection of Culvert Size

Step 1: List design data. (See suggested tabulation form)

a. Design discharge Q, in cfs., with average return period. (i.e. Q_{25} or . Q_{50} etc.)

b. Approximate length L of culvert, in feet.

c. Slope of culvert. (If grade is given in percent, convert to slope in ft. per ft.)

d. Allowable headwater depth, the feet, which is the vertical distance from the culvert invert (flow line) at the entrance to the water surface elevation permissible in the headwater pool or approach channel upstream from the culvert.

e. Mean and maximum flood velocities in natural steam.

f. Type of culvert for first trial selection, including barrel material, barrel cross-sectional shape and entrance type.

Since the procedure given is one of trial and error, the initial trial size can be determined in several ways.

Step2: Determine the first trial size culvert.

a. By arbitrary selection.

b. By using an approximating equation such as $\frac{Q}{10} = A$ from which the trial culvert dimensions are determined.

c. By using inlet control nomographs (Charts 6.2-6.8) for the culvert type selected. If this method is used an $\frac{HW}{D}$ must be assumed, say $\frac{HW}{D} = 1.5$, and using the given Q a trial size is determined.

If any trial size is too large in dimension because of limited height of embankment of availability o size, multiple culverts may be used by dividing the discharge equally between the number of barrels used. Raising the embankment height or the use of pipe arch and box culverts with width greater than height should be considered. Final selection should be based on an economic analysis.

Step 3: Find headwater depth of trial size culvert.

a. Assuming INLET CONTROL

(1) Using the trial size from step 2, find the headwater depth HW by use of the appropriate inlet control nomograph (Charts 6.2-6.8). Tailwater condition are neglected, in this determination. $\frac{HW}{D}$ obtained from the nomographs by the height of culvert D.

(2) If HW is greater or less than allowable, try another trial size until HW is acceptable for inlet control before computing HW for outlet control.

b. Assuming OUTLET CONTROL

(1) Approximate the depth of tailwater TW, in feet, above the invert at the outlet for the design flood condition in the outlet channel.

(2) For tailwater TW elevation <u>equal or greater than</u> the top of the culvert at the outlet set h_o equal to TW and find HW by the following equation.

$$HW = H + h_o - LS_o$$

where

HW = vertical distance in feet from culvert invert (flow line) at entrance to the pool surface.

H = head loss in feet as determined from the appropriate nomograph (Charts 6.9-6.15).

h_o = vertical distance in feet from culvert invert at outlet to the hydraulic grade line (In this case h_o equals TW, measured in feet above the culvert invert.)

S_o = slope of barrel in ft./ft.

L = culvert length in ft.

(3) For tailwater TW elevations <u>less than</u> the top of the culvert at the outlet, find headwater HW by equation 3 as in b(2) above except that

$$h_o = \frac{d_c + D}{2} \text{ or TW, whichever is the greater}$$

where:

d_c = critical depth in ft. (Charts 6.16-6.21)

Note: d_c = cannot exceed D
D = height of culvert opening in ft.

Note: Headwater depth determined in b(3) becomes increasingly less accurate as the headwater computed by this method falls below the value

$$D + (1 + k_e)\frac{y^2}{2_g},$$ where k_e = entrance loss coefficient

c. Compare the headwaters found in Step 3a and Step 3b (Inlet Control and Outlet Control). The higher headwater governs and indicates the flow control existing under the given conditions for the trial size selected.

d. If outlet control governs and the HW is higher than is acceptable, select a larger trial size and find HW as instructed under Step 3b. (Inlet control need not be checked, since the smaller size was satisfactory for this control as determined under Step 3a.)

Step 4: Try a culvert of another type or shape and determine size and HW by the above procedure.

Step 5: Compute outlet velocities for size and types to be considered in selection and determine need for channel protection.

a. If outlet control governs in Step 3c above, outlet velocity equals $\frac{Q}{A_o}$, where A_o is the cross-sectional area of flow in the culvert barrel at the outlet. If d_c or TW is less than the height of the culvert barrel use A_o corresponding to d_c or TW depth, whichever gives the greater area of flow. A_o should not exceed the total cross-sectional area A of the culvert barrel.

b. If inlet control governs in step 3c, outlet velocity can be assumed to equal mean velocity in open-channel flow in the barrel as computed by Manning's equation for the rate of flow, barrel size, roughness and slope of culvert selected.

Note: Charts and tables are helpful in computing outlet velocities.

Step 6: Record final selection of culvert with size, type, required headwater, outlet velocity, and economic justification.

For full flow in outlet control the head H required to pass a given quantity of water through a culvert can be computed using

$$H = \left[1 + K_e + \frac{29\, n^2 L}{R^{1.33}}\right] \frac{y^2}{2_g} \tag{6.1}$$

where H = head in feet

K_e = entrance loss coefficient

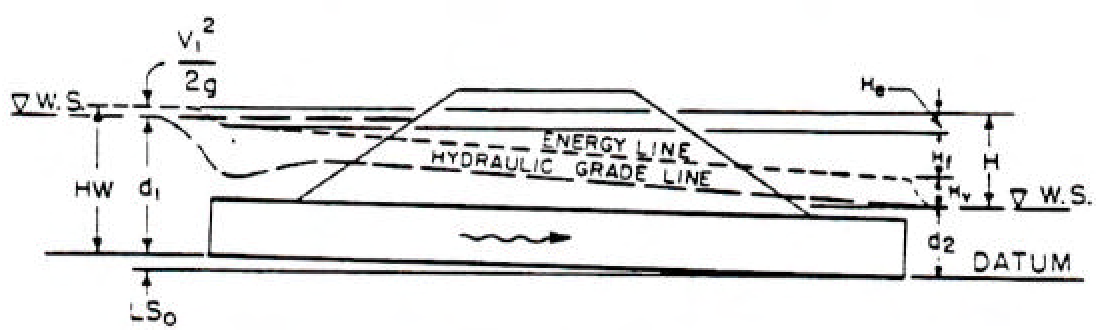
n = Manning's roughness

L = length of barrel in ft

R = hydraulic radius in ft = $\dfrac{waterarea}{wetted\ \ perimeter}$

V = mean velocity of flow in barrel in ft/sec

Although the above procedure pertains to selection of culvert size to pass a given discharge at a given headwater, a better understanding of culvert operation is gained by plotting performance curves through some range of discharge and for different sizes and types of culverts. Performance curves are plots of Headwater depth versus discharge. Also effects of improved inlets (shape, edge, geometry and skew of entrance) in inlet control can be investigated for economic selection of culvert size. Hydraulic design of improved inlets can be found in Federal Highway Administration circular No. 13.



INLET-CONTROL NOMOGRAPHS

Charts 6.2 through 6.8

Instructions For Use

1. To determine headwater (HW) given Q, and size and type of culvert.

a) Connect with straightedge the given culvert diameter or height (D) and the discharge Q, or $\frac{Q}{B}$ for box culverts; mark intersection of straightedge on $\frac{HW}{D}$ scaled marked (1).

b) If $\frac{HW}{D}$ scale market (1) represents entrance type used, read $\frac{HW}{D}$ on scale (1). If another of the three entrance types listed on the nomograph is used, extend the point of intersection in (a) horizontally to scale (2) or (3) and read $\frac{HW}{D}$.

c) Compute HW by multiplying $\frac{HW}{D}$ by D.

2. To determine discharge (Q) per barrel, given HW, and size and type of culvert.

a) Compute $\frac{HW}{D}$ for given conditions.

b) Locate $\frac{HW}{D}$ on scale for appropriate entrance type. If scale (2) or (3) is used, extend $\frac{HW}{D}$ point horizontally to scale (1).

c) Connect point on $\frac{HW}{D}$ scale (1) as found in (b) above and the size of culvert on the left scale. Read Q or $\frac{Q}{B}$ on the discharge scale.

d) If $\frac{Q}{B}$ is read in (c) multiply by B (span of box culvert) to find Q.

3. To determine culvert size, given Q, allowable HW and type of culvert.

a) Using a trial size, compute $\frac{HW}{D}$.

b) Locate $\frac{HW}{D}$ on scale for appropriate entrance type. If scale (2) or (3) is used, extend $\frac{HW}{D}$ point horizontally to scale (1).

c) Connect point on $\frac{HW}{D}$ scale (1) as found in (b) above to given discharge and read diameter, height or size of culvert required for $\frac{HW}{D}$ value.

d) If D is not that originally assumed, repeat procedure with a new D.

<u>OUTLET-CONTROL NOMOGRAPHS</u>
<u>Charts 6.9 through 6.15</u>
<u>Instructions For Use</u>

Outlet control nomographs solve equation 6.1 for head H when the culvert barrel flows full for its entire length. They are also used to determine head H for <u>some</u> part-full flow conditions with outlet control. The nomographs do not give a complete solution for finding headwater, HW, since they only give H in equation 3, HW = $H+h_o-LS_o$.

1. To determine head H for a given culvert and discharge Q.

a) Locate appropriate nomograph for type of culvert selected. Find k_e for entrance type in Table 6.1

b) Begin nomograph solution by locating starting point on length scale. To locate the proper starting point on the length scales follow instructions below:

   1) If the n value of the nomograph corresponds to that of the culvert being used, select the length curve for the proper k_e and locate the starting point at the given culvert length. If a k_e curve is not shown for the selected k_e, see (2) below. If the n value for the culvert selected differs from that of the nomograph, see (3) below.

   2) For the n of the nomograph and a k_e intermediate between the scales given, connect the given length on adjacent scales by a straight line and select a point on this line spaced between the two chart scales in proportion to the k_e values.

   3) For a different roughness coefficient n_1 than that of the chart n, use the length scales shown with an adjusted length L_1 calculated by the formula.

$$L_1 = L\left[\frac{n_1}{n}\right]^2$$ See instruction 2 for n values.

c) Using straightedge, connect point on length scale to size of culvert barrel and mark the point of crossing on the “turning line”. See instruction 3 below for size considerations for rectangular box culvert.

d) Pivot the straightedge on this point on the turning line and connect given discharge rate. Read head in feet on the head (H) scale. For values beyond the limit of the chart scales, find H by solving equation 6.1

2. Values of n for commonly used culvert materials.

	Concrete	
	Pipe	Boxes
	0.012	0.012

	Corrugated Metal		
	Small Corrugations (2 2/3” x ½)	Medium Corrugations (3” x 1”)	Large Corrugations (6” x 2”)
Unpaved	0.024	0.027	Varies*
25% paved	0.021	0.023	0.026
Fully paved	0.012	0.012	0.012

* Variation in n with diameter shown on charts. The various n values have been incorporated into the nomographs and no adjustment for culvert length is required as instructed in 1b(3).

3. To use the box culvert nomograph, Chart 6.9, for full-flow for other than square boxes.

   a) compute cross-sectional area of rectangular box.

   b) Connect proper point (see instruction 1) on length scale of barrel area[3/]

   c) Pivot the straightedge on this point on the turning line and connect given discharge rate. Read head in feet on the head (H) scale.

[3/] The area scale on the nomograph is calculated for barrel cross sections with span B twice the height D; its close correspondence with area of square boxes assures it may be used for all sections intermediate between square and B = 2D or B = ½D. For other box proportions use equation 6.1 for more accurate results.

TABLE 6.1 - ENTRANCE LOSS COEFFICIENTS

Outlet Control, Full or Partly Full

Entrance head loss $H_e = k_e \frac{y^2}{2^g}$

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, socket end (groove end).	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wing walls	
Socket end of pipe (groove end).	0.2
Square-edge	0.5
Round (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall to headwall and wingwalls square edge . . .	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30° or 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10° or 25°	
Square-edge at crown.	0.5
Wingwalls parallel (extension of sides)	
Square-edge at crown	
Side-or slope-tapered inlet	0.2

*Note: "End Section conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers . From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet.

Table 6.2 – Manning's n for Natural Stream Channels [4/]

(Surface Width at flood stage less than 100 ft.)

1.	Fairly regular section:	
	a. Some grass and weeds, little or no brush	0.030--0.035
	b. Dense growth of weeds, depth of flow materially greater than weed height	0.035--0.05
	c. Some weeds, light brush on banks	0.035--0.05
	d. Some weeds, heavy brush on banks	0.05--0.07
	e. Some weeds, dense willows on banks	0.06--0.08
	f. For trees within channel, with branches submerged at high stage, increase all above values by	0.01—0.02
2.	Irregular sections, with pools, slight channel meander; increase values given above about	0.01—0.02
3	Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stage:	
	a. Bottom of gravel, cobbles, and few boulders	0.04--0.05
	b. Bottom of cobbles, with large boulders	0.05--0.07

[4/] From "Design Charts for Open Channel Flow", (see p. 5-14).

PROJECT: 142 B

DESIGNER: L.D.K.

DATE: 2-18-64

HYDROLOGIC AND CHANNEL INFORMATION

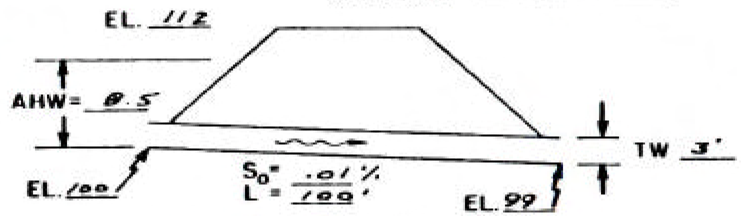
Q_1 = 160 cfs - Q_{50} TW_1 = 5.0'

Q_2 = ______ TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: 321+14



MEAN STREAM VELOCITY = 8'/sec

MAX. STREAM VELOCITY = 10'/sec

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
CMP (cir.) Headwall	160	Assume 54"	1.56	7.0									.			Hw less than 8.5' - Try 48"
"	160	48"	2.25	9.0	.5	8.3	3.7	3.8	3	3.8	1.0	11.1	11.1	13.2'/sec		Hw High Try 54"
"	160	54"	1.56	7.0	.5	4.7	3.6	4.1	3	4.1	1.0	7.8	7.8	11.1'/sec		Velocity at d_c Size o.k.
Concrete (cir) Sq. Edge - Hdwl	160	48"	2.35	9.4	.5	4.7	3.7	3.8	3	3.8	1.0	7.5	9.4	14'/sec		Hw high Try 54"
"	160	54"	1.6	7.2	.5	2.9	3.6	4.1	3	4.1	1.0	6.0	7.2	14.1'/sec		Hw ok. Vel > CMP Try 48 G. Edge
Concrete (cir) Groove end - Hdwl	160	48	1.95	7.8	.2	4.0	3.7	3.8	3	3.8	1.0	6.8	7.8	14.0'/sec		Hw ok Vel high

SUMMARY & RECOMMENDATIONS:

The selection of a 54" CMP with headwall will keep the headwater below the AHW with a minimum outlet velocity. A 48" concrete pipe with groove edged entrance gives equal HW and slightly higher outlet velocity. Protection of outlet channel might be necessary in some locations.

PROJECT: E 14-2 (3)

DESIGNER: F.P.R.

DATE: 2-20-64

HYDROLOGIC AND CHANNEL INFORMATION

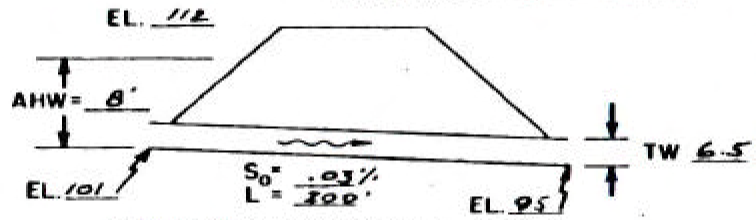
Q_1 = 400 cfs. Q_{50} TW₁ = 6.5'

Q_2 = ______ TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: 8+61



MEAN STREAM VELOCITY = 8'/sec

MAX. STREAM VELOCITY = 12'/sec

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o											
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
Concrete (C.R) Gr. End Proj	400		Assume 1.5			Find	D:	78"						-		HW = 9.1 Too high Try 84"
"	400	84"	1.18	8.3												HW High Try 90"
"	400	90"	1.05	7.9	.2	1.9	5.2	6.3	6.5	6.5	6.0	2.4	7.9	18'/sec I.C. 10'/sec O.C.		If too large Try 2 pipes
Same type 2 pipes	200	54"	1.85	8.3												Too small
"	200	60"	1.38	6.9	.2	3.4	4.0	4.5	6.5	6.5	6.0	3.9	6.9	23'/sec I.C. 10'/sec O.C.		Use See Comments
Cir CMP Bevel B (Chart 7)	200	60"	1.34	6.7	.25	6.2	4.0	4.5	6.5	6.5	6.0	6.7	6.7	14'/sec I.C. 10'/sec O.C.		Use. Bevel A can be used here
		Might try single concrete oval or metal arches														

SUMMARY & RECOMMENDATIONS: PROBLEM TO ILLUSTRATE USE OF DOUBLE PIPES IF ONE PIPE IS TOO HIGH OR NOT AVAILABLE. INLET CONTROL GOVERNS. TW SUBMERGES CULVERT OUTLET FOR ALL DOUBLE BARRELS. VELOCITIES ARE COMPUTED FOR BOTH INLET CONTROL AND FOR FULL FLOW AT OUTLET CAUSED BY TW. TWO 60-INCH CONCRETE PIPES OR TWO 60-INCH CMP WITH INLETS SHOWN SATISFY HEADWATER LIMITATIONS. CONCRETE PIPE WILL GIVE CONSIDERABLY HIGHER OUTLET VELOCITIES IF TAILWATER IS NOT EFFECTIVE IN CAUSING THE CULVERT TO FILL AT THE OUTLET.

PROJECT: ______________ DESIGNER: ______________

DATE: ______________

HYDROLOGIC AND CHANNEL INFORMATION

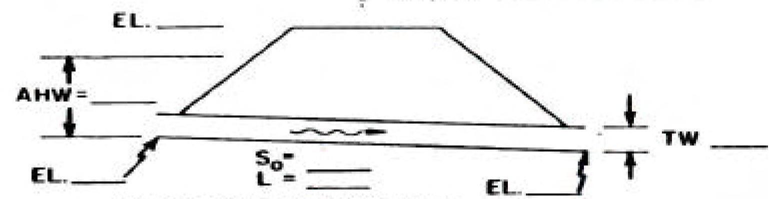
Q_1 = ________ TW_1 = ________

Q_2 = ________ TW_2 = ________

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: ______________

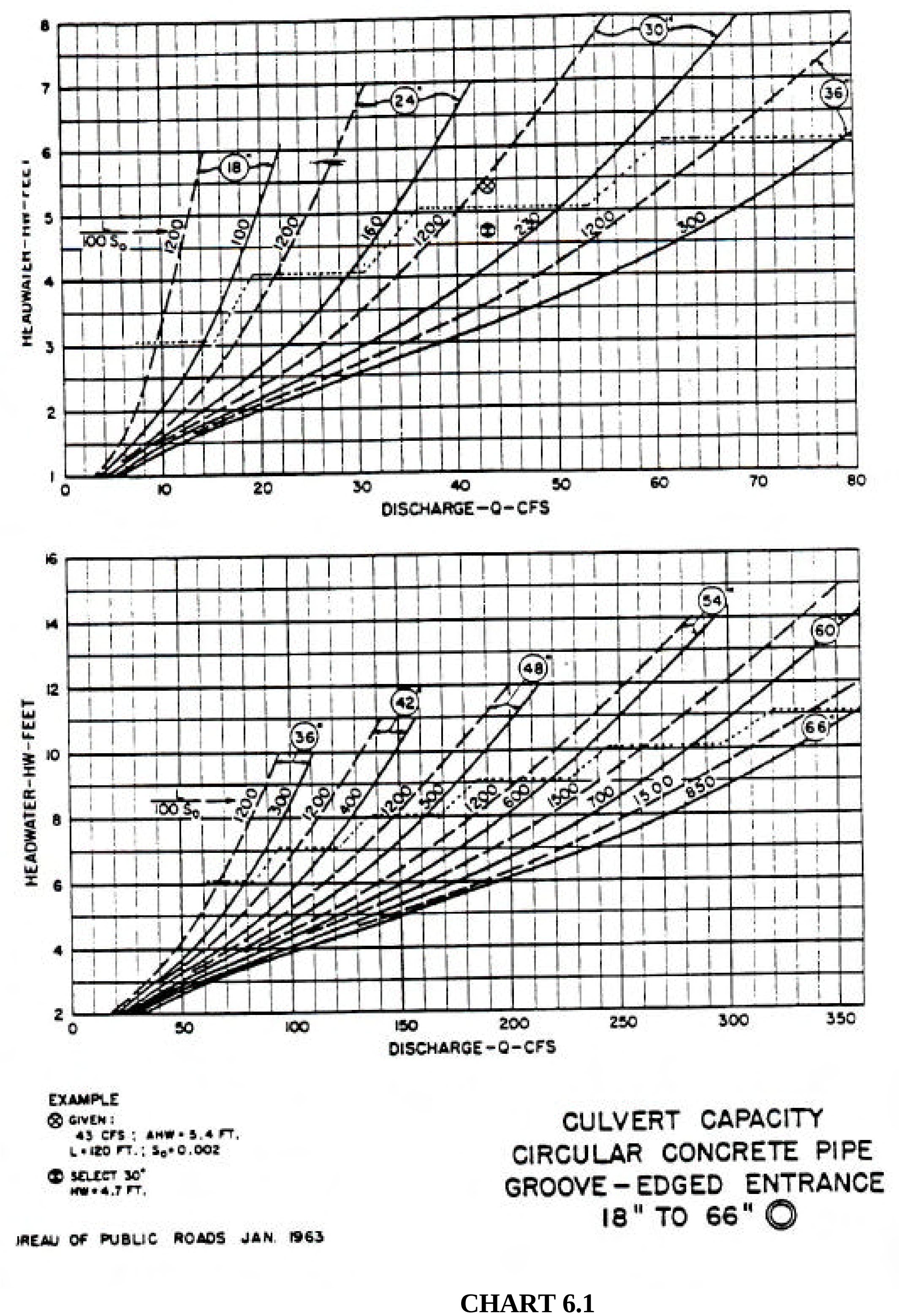


MEAN STREAM VELOCITY = ________

MAX. STREAM VELOCITY = ________

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				

SUMMARY & RECOMMENDATIONS:



HEADWATER-HW-FEET
DISCHARGE-Q-CFS
100 S_o
18"
24"
30"
36"
42"
48"
54"
60"
66"
EXAMPLE
GIVEN:
43 CFS; AHW = 5.4 FT.
L = 120 FT.; S_o = 0.002
SELECT 30"
HW = 4.7 FT.
CULVERT CAPACITY
CIRCULAR CONCRETE PIPE
GROOVE-EDGED ENTRANCE
18" TO 66"
IREAU OF PUBLIC ROADS JAN. 1963

CHART 6.1

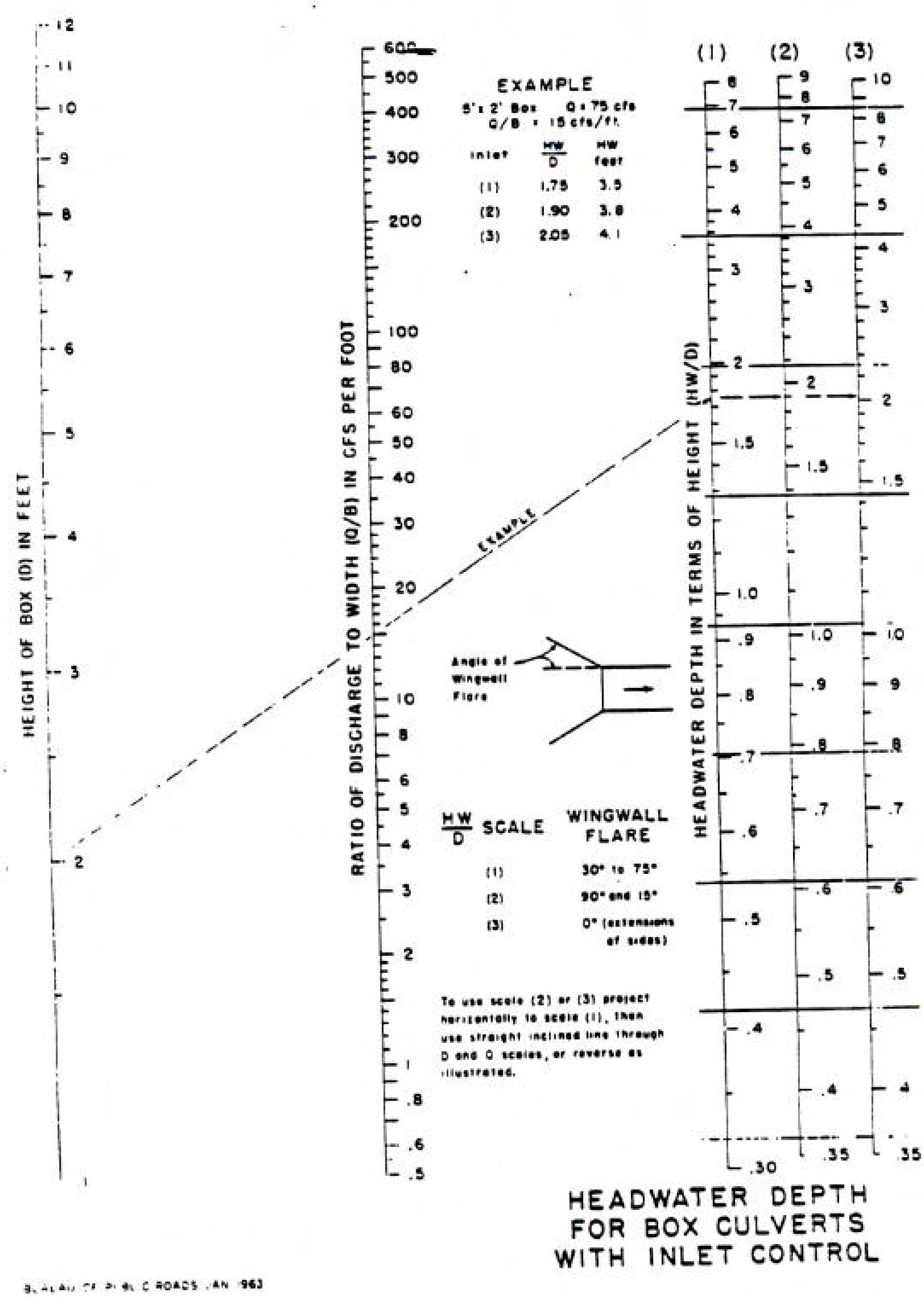
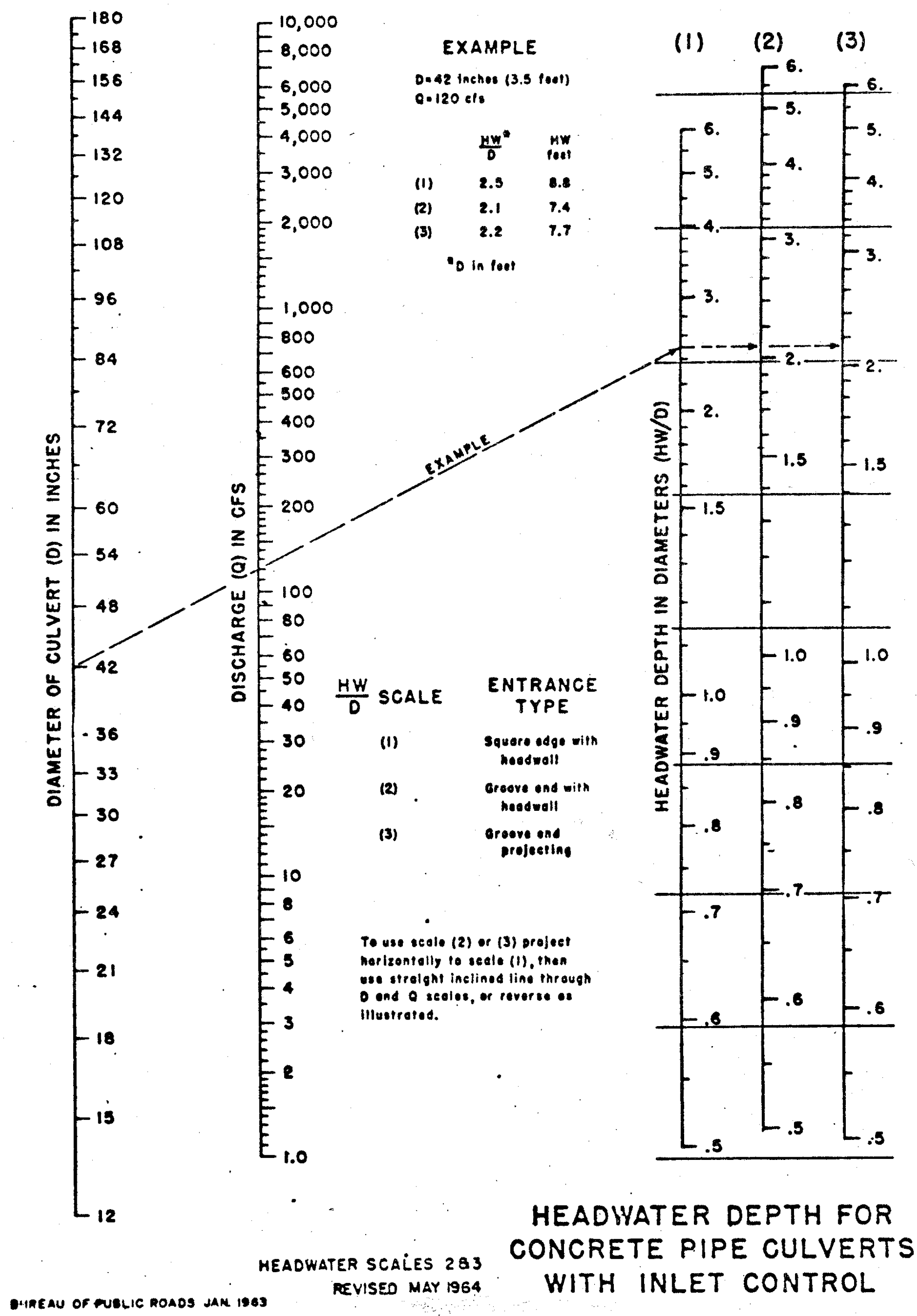

HEIGHT OF BOX (D) IN FEET
RATIO OF DISCHARGE TO WIDTH (Q/B) IN CFS PER FOOT
HEADWATER DEPTH IN TERMS OF HEIGHT (HW/D)
EXAMPLE
5' x 2' Box Q = 75 cfs
Q/B = 15 cfs/ft.
inlet HW/D HW feet
(1) 1.75 3.5
(2) 1.90 3.8
(3) 2.05 4.1
Angle of Wingwall Flare
HW/D SCALE WINGWALL FLARE
(1) 30° to 75°
(2) 90° and 15°
(3) 0° (extensions of sides)
To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.
HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

CHART 6.2



EXAMPLE
D=42 inches (3.5 feet)
Q=120 cfs
HW*/D HW feet
(1) 2.5 8.8
(2) 2.1 7.4
(3) 2.2 7.7
*D in feet
DIAMETER OF CULVERT (D) IN INCHES
DISCHARGE (Q) IN CFS
HEADWATER DEPTH IN DIAMETERS (HW/D)
EXAMPLE
(1) (2) (3)
HW/D SCALE
ENTRANCE TYPE
(1) Square edge with headwall
(2) Groove end with headwall
(3) Groove end projecting
To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL
HEADWATER SCALES 2&3 REVISED MAY 1964
BUREAU OF PUBLIC ROADS JAN. 1963

CHART 6.3

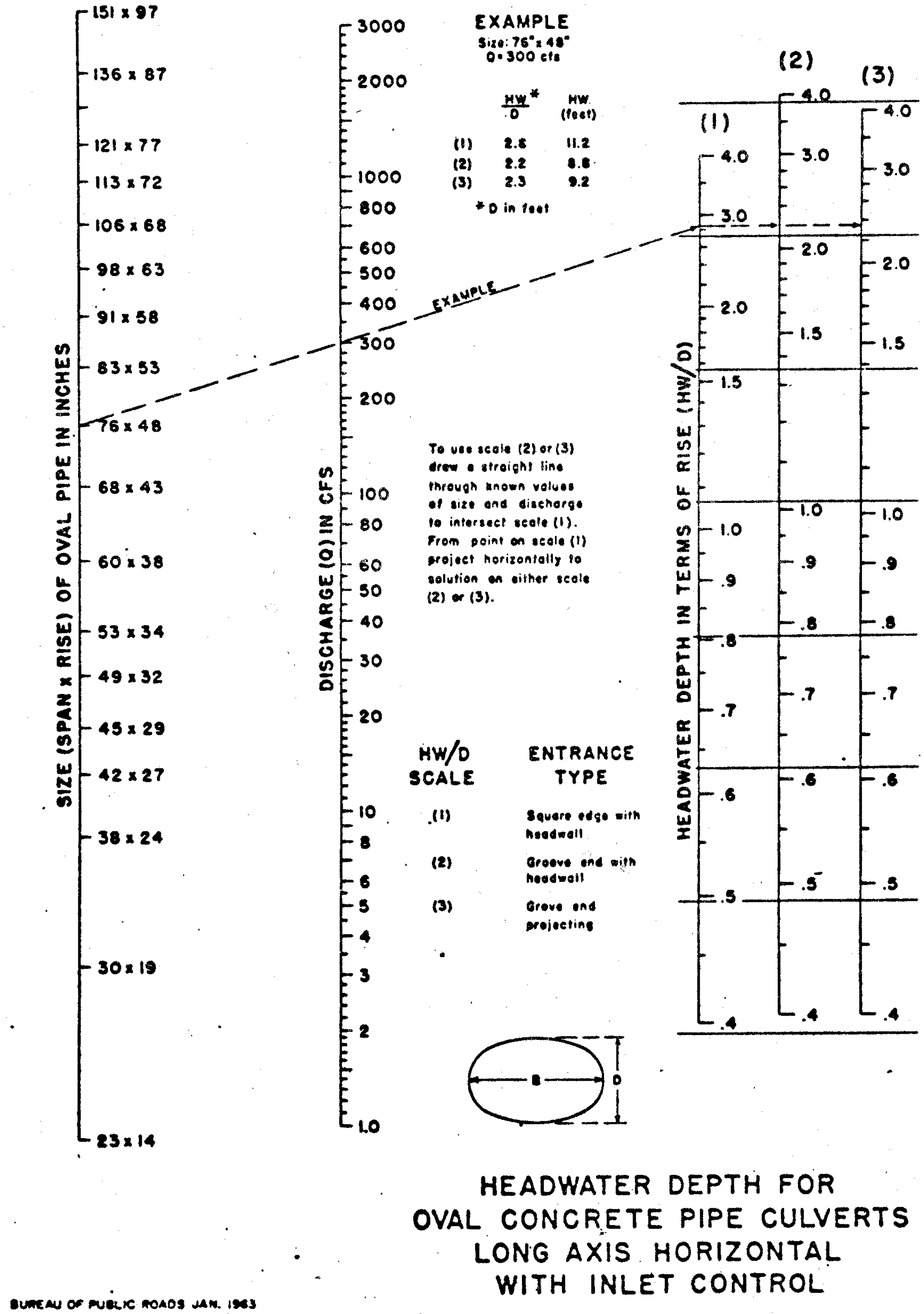
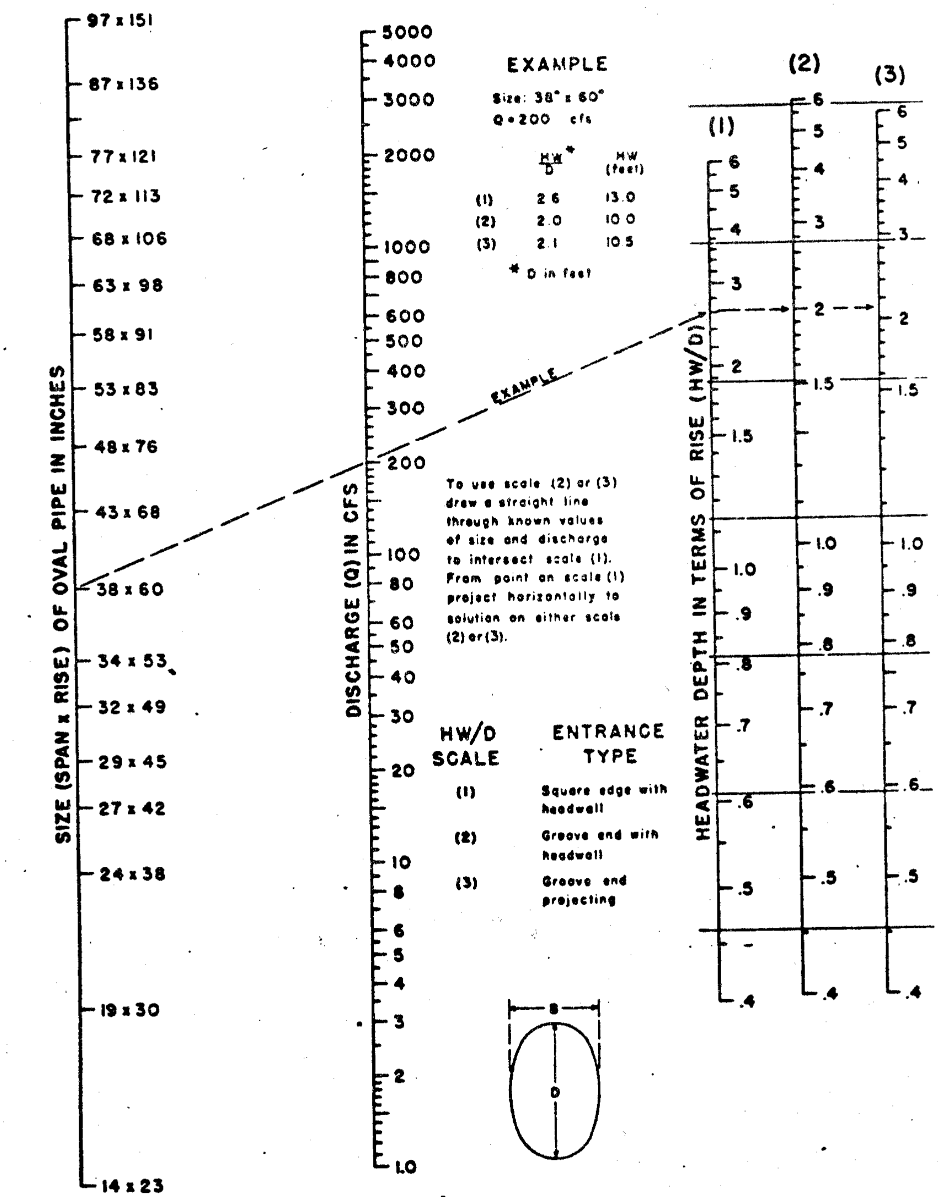

EXAMPLE
Size: 76" x 48"
Q = 300 cfs
HW/D* HW (feet)
(1) 2.8 11.2
(2) 2.2 8.8
(3) 2.3 9.2
* D in feet
To use scale (2) or (3) draw a straight line through known values of size and discharge to intersect scale (1). From point on scale (1) project horizontally to solution on either scale (2) or (3).
HW/D SCALE
ENTRANCE TYPE
(1) Square edge with headwall
(2) Groove end with headwall
(3) Groove end projecting
SIZE (SPAN x RISE) OF OVAL PIPE IN INCHES
DISCHARGE (Q) IN CFS
HEADWATER DEPTH IN TERMS OF RISE (HW/D)
EXAMPLE
HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL WITH INLET CONTROL
BUREAU OF PUBLIC ROADS JAN. 1963

CHART 6.4



HEADWATER DEPTH FOR
OVAL CONCRETE PIPE CULVERTS
LONG AXIS VERTICAL
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

CHART 6.5

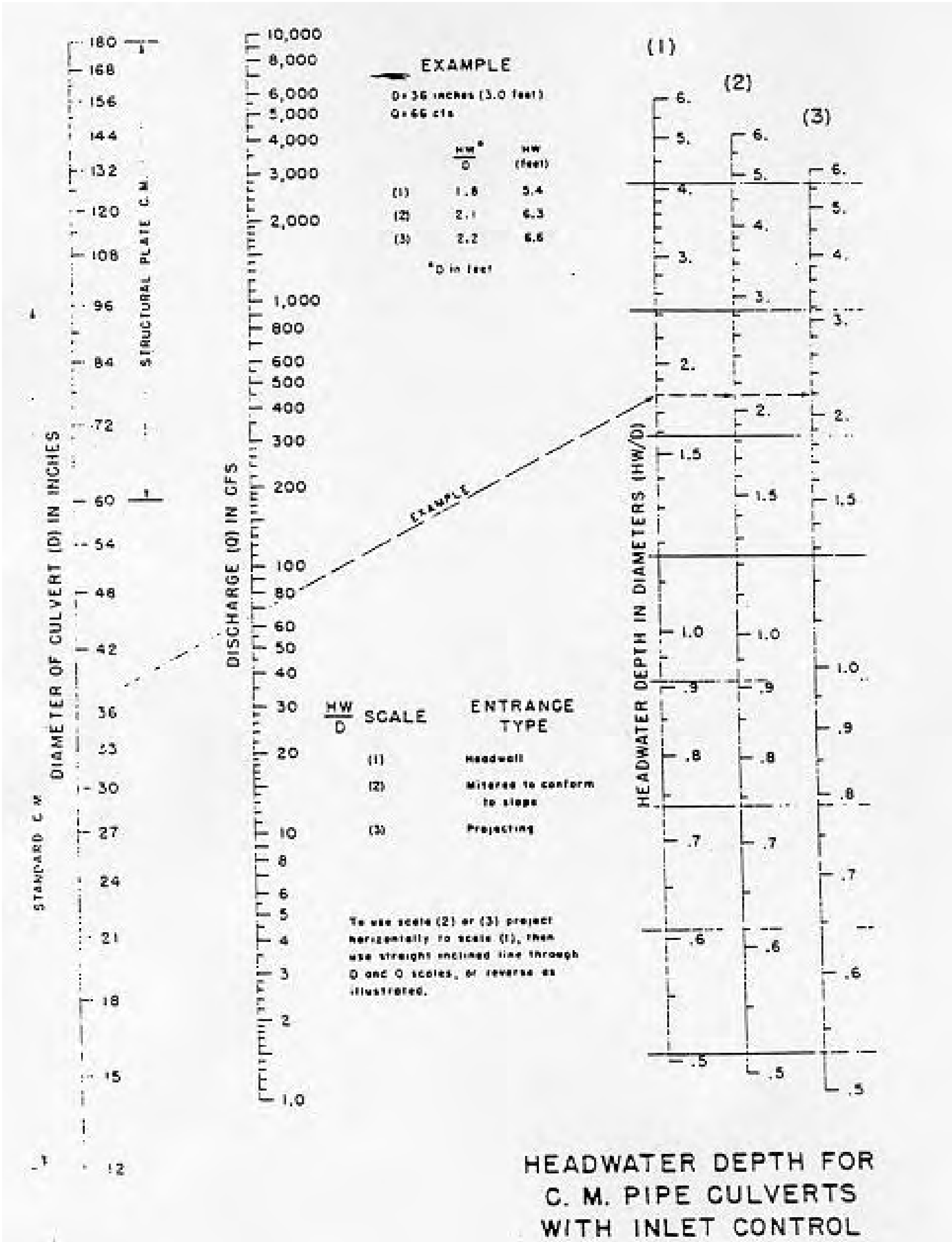
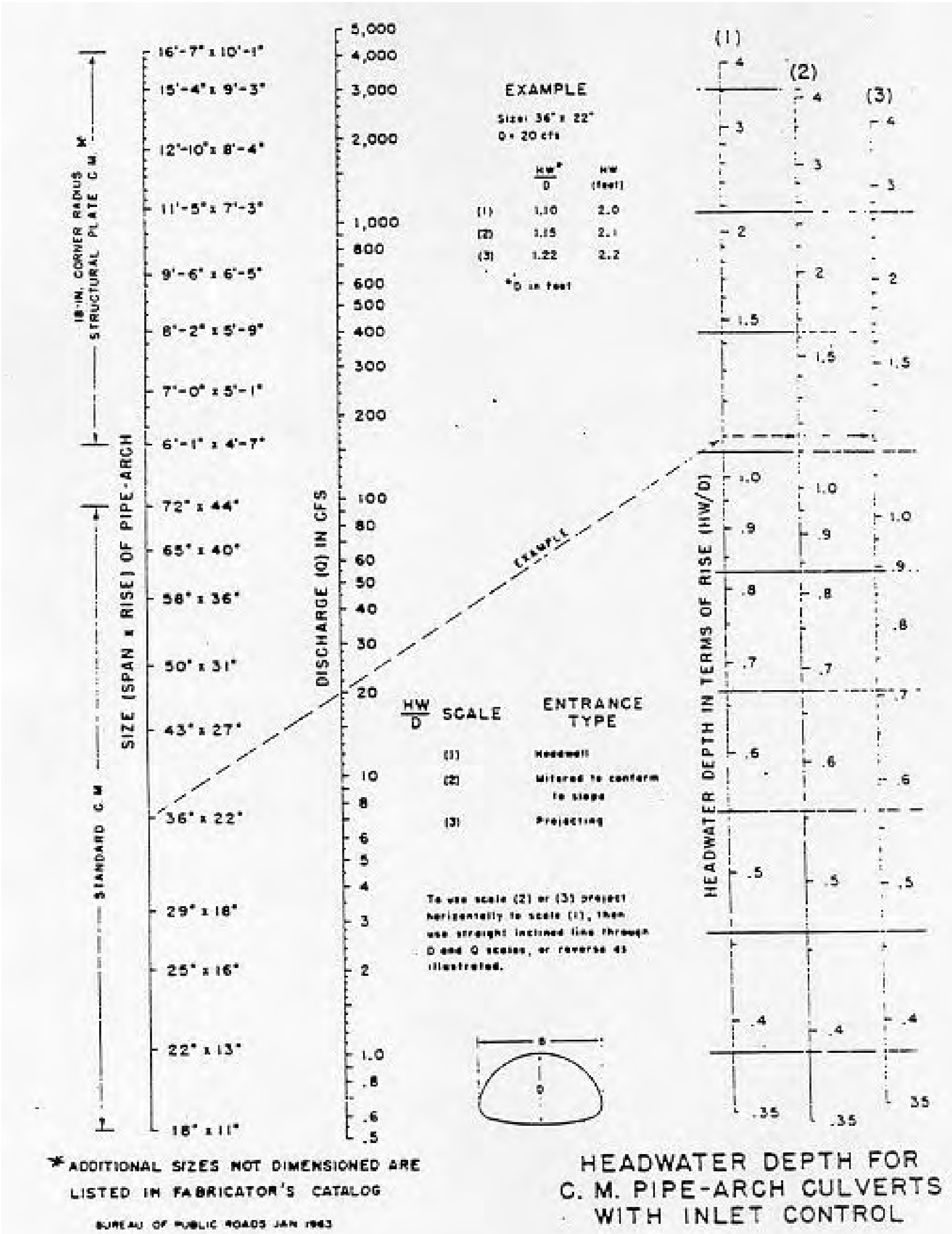
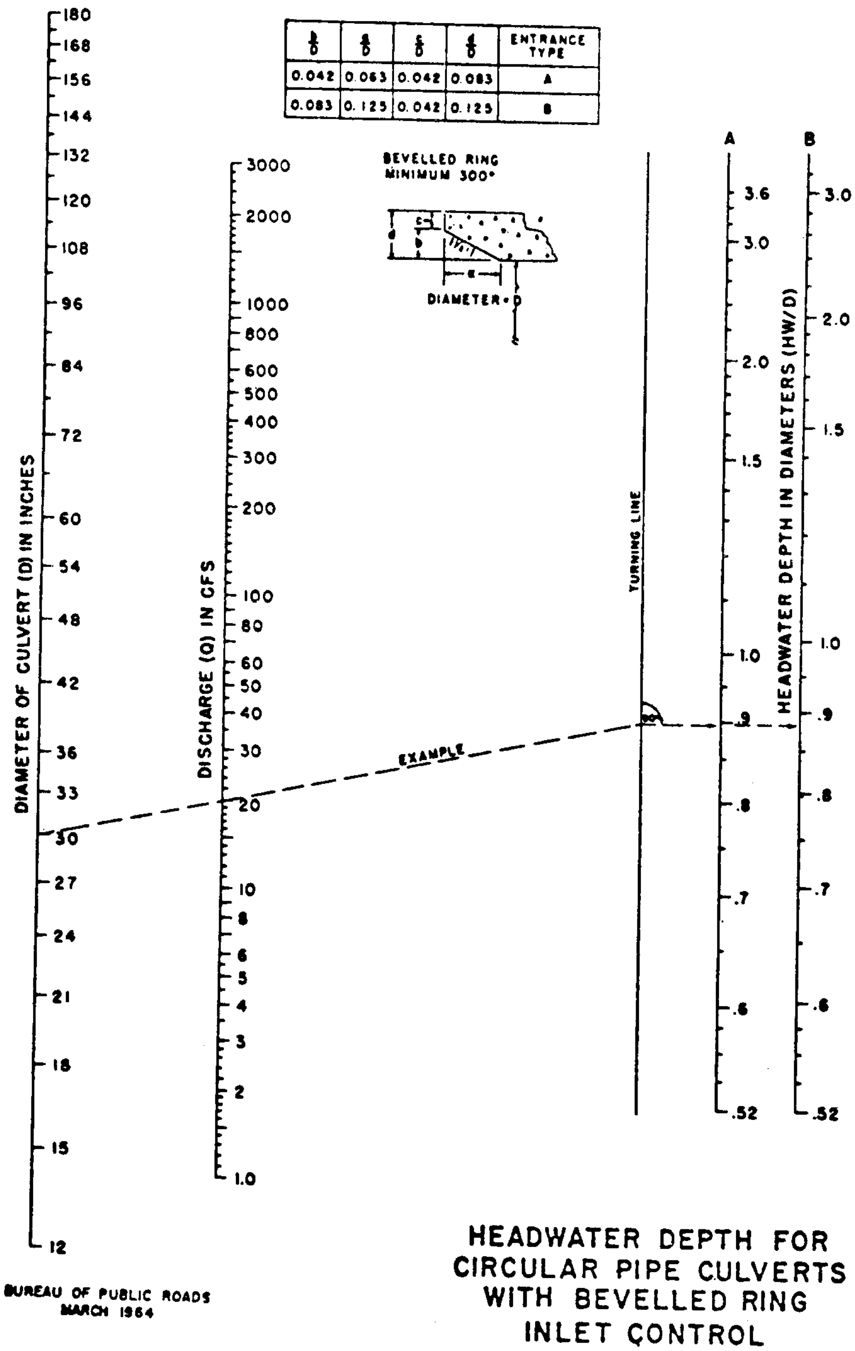

EXAMPLE
D=36 inches (3.0 feet)
Q=66 cfs
HW*/D HW (feet)
(1) 1.8 5.4
(2) 2.1 6.3
(3) 2.2 6.6
*D in feet
STANDARD C.M.
STRUCTURAL PLATE C.M.
DIAMETER OF CULVERT (D) IN INCHES
DISCHARGE (Q) IN CFS
HEADWATER DEPTH IN DIAMETERS (HW/D)
EXAMPLE
(1)
(2)
(3)
HW/D SCALE
ENTRANCE TYPE
(1) Headwall
(2) Mitered to conform to slope
(3) Projecting
To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.
HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

CHART 6.6



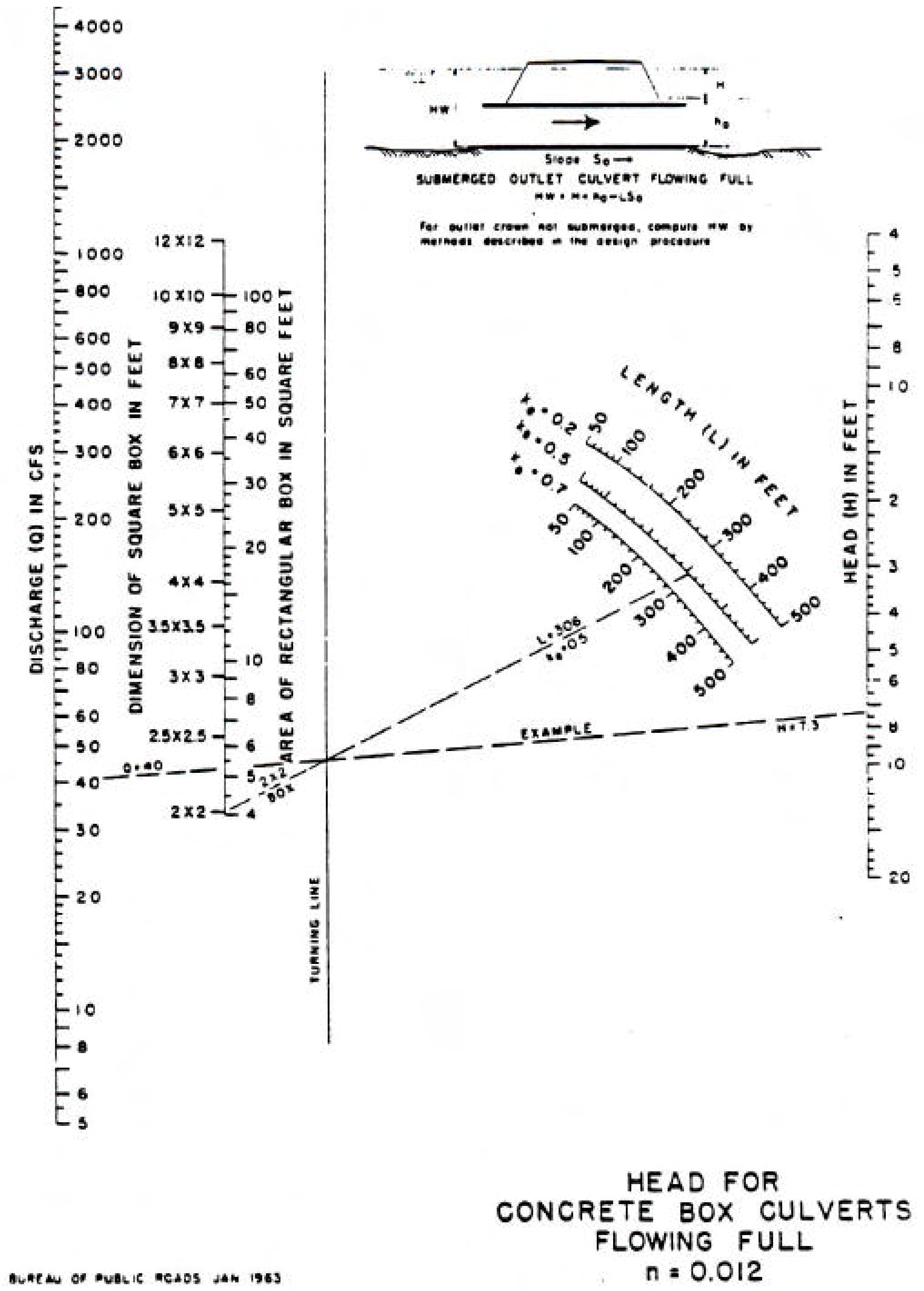
EXAMPLE
Size: 36" x 22"
Q = 20 cfs
HW/D
HW (feet)
(1) 1.10 2.0
(2) 1.15 2.1
(3) 1.22 2.2
*D in feet
HW/D SCALE
ENTRANCE TYPE
(1) Headwall
(2) Mitered to conform to slope
(3) Projecting
To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.
18-IN. CORNER RADIUS STRUCTURAL PLATE C.M.
STANDARD C.M.
SIZE (SPAN x RISE) OF PIPE-ARCH
DISCHARGE (Q) IN CFS
HEADWATER DEPTH IN TERMS OF RISE (HW/D)
EXAMPLE
* ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG
BUREAU OF PUBLIC ROADS JAN 1963
HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

CHART 6.7



b/D
a/D
c/D
d/D
ENTRANCE TYPE
0.042
0.063
0.042
0.083
A
0.083
0.125
0.042
0.125
B
BEVELLED RING
MINIMUM 300°
DIAMETER • D
DIAMETER OF CULVERT (D) IN INCHES
180
168
156
144
132
120
108
96
84
72
60
54
48
42
36
33
30
27
24
21
18
15
12
DISCHARGE (Q) IN CFS
3000
2000
1000
800
600
500
400
300
200
100
80
60
50
40
30
20
10
8
6
5
4
3
2
1.0
EXAMPLE
TURNING LINE
A
B
HEADWATER DEPTH IN DIAMETERS (HW/D)
3.6
3.0
2.0
1.5
1.0
.9
.8
.7
.6
.52
3.0
2.0
1.5
1.0
.9
.8
.7
.6
.52
BUREAU OF PUBLIC ROADS
MARCH 1964
HEADWATER DEPTH FOR
CIRCULAR PIPE CULVERTS
WITH BEVELLED RING
INLET CONTROL

CHART 6.8



HEAD FOR
CONCRETE BOX CULVERTS
FLOWING FULL
n = 0.012

CHART 6.9

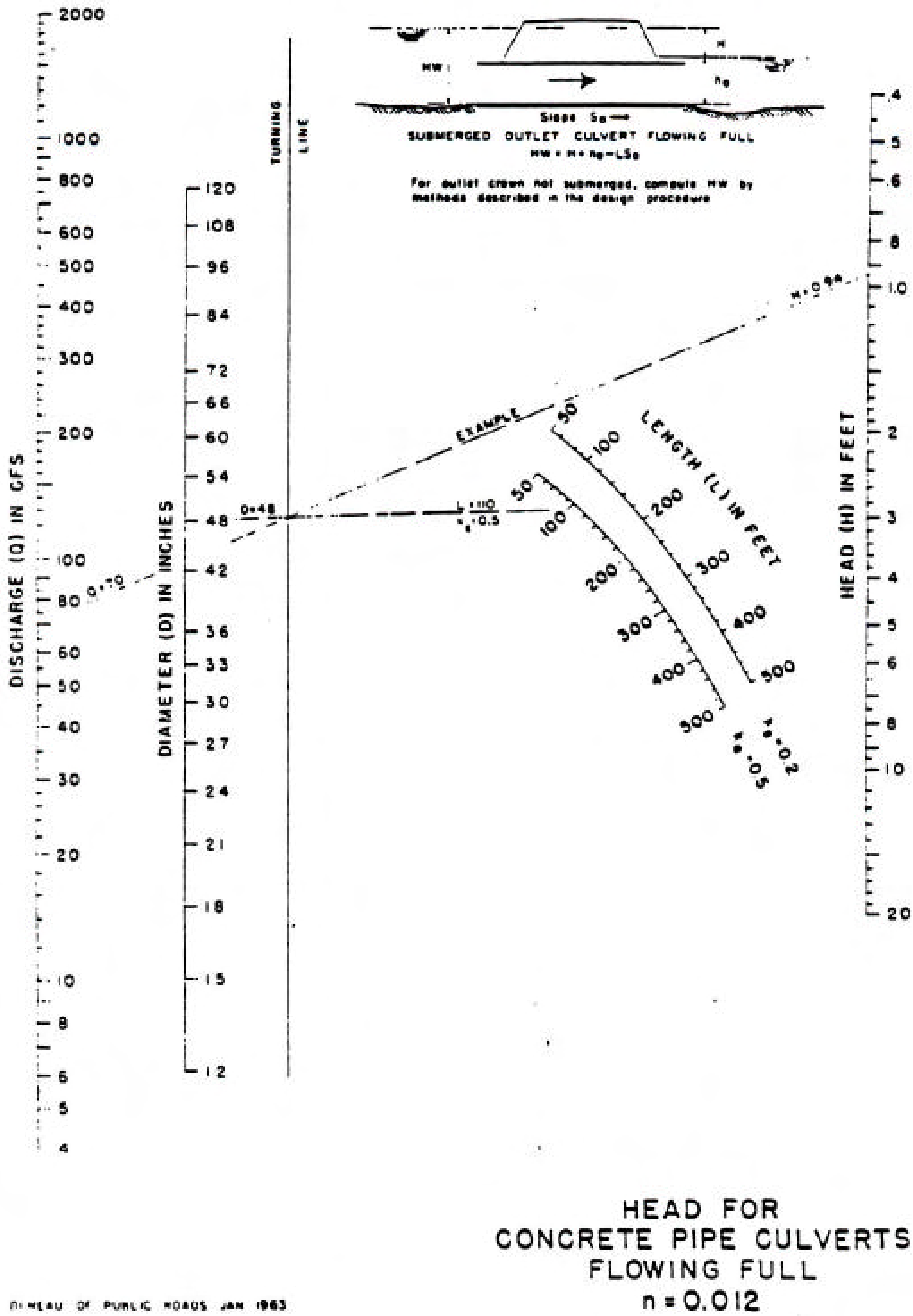
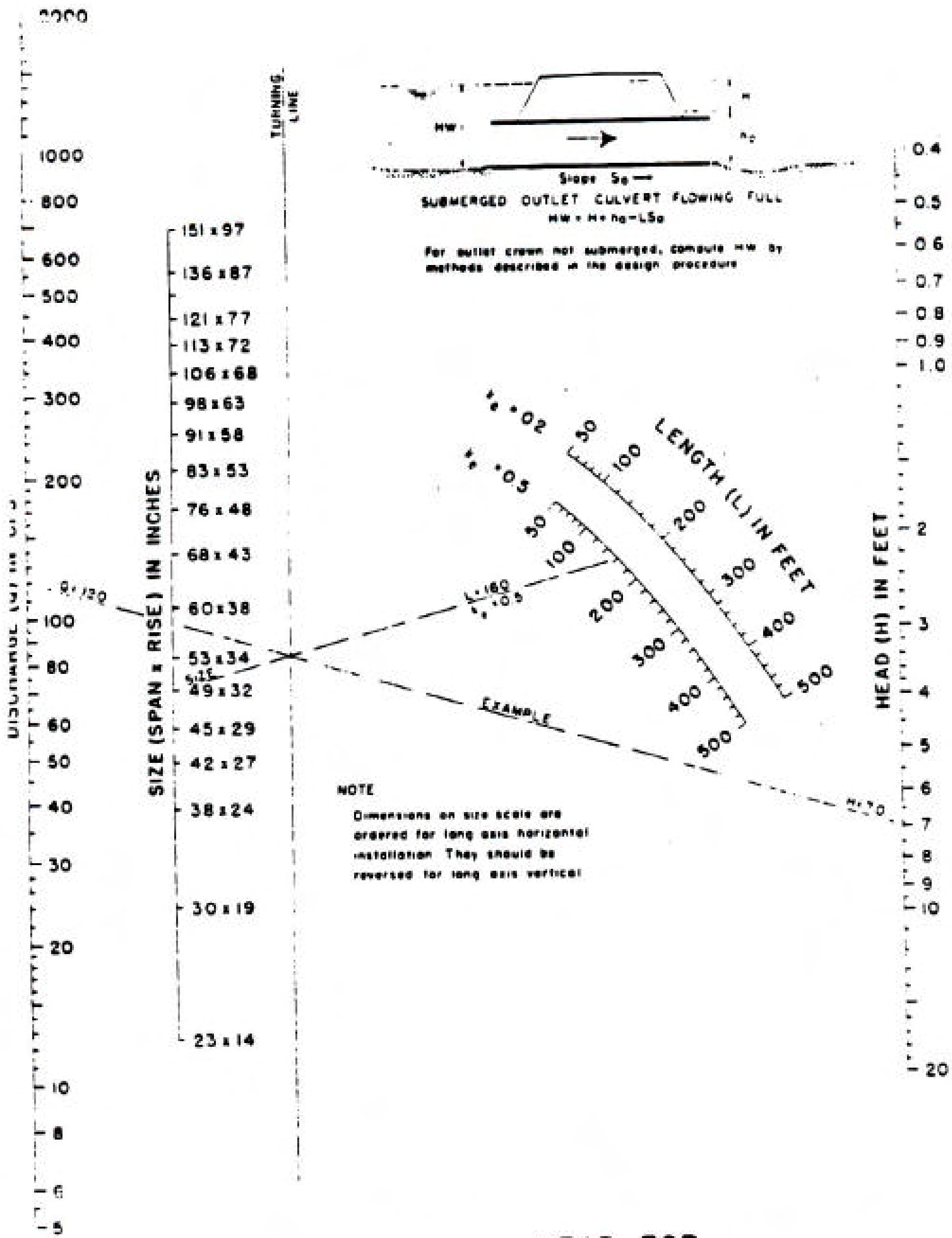

SUBMERGED OUTLET CULVERT FLOWING FULL
HW = H + ho − LSo
For outlet crown not submerged, compute HW by methods described in the design procedure
TURNING LINE
DISCHARGE (Q) IN CFS
DIAMETER (D) IN INCHES
LENGTH (L) IN FEET
HEAD (H) IN FEET
EXAMPLE
HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

CHART 6.10



HEAD FOR
OVAL CONCRETE PIPE CULVERTS
LONG AXIS HORIZONTAL OR VERTICAL
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

CHART 6.11

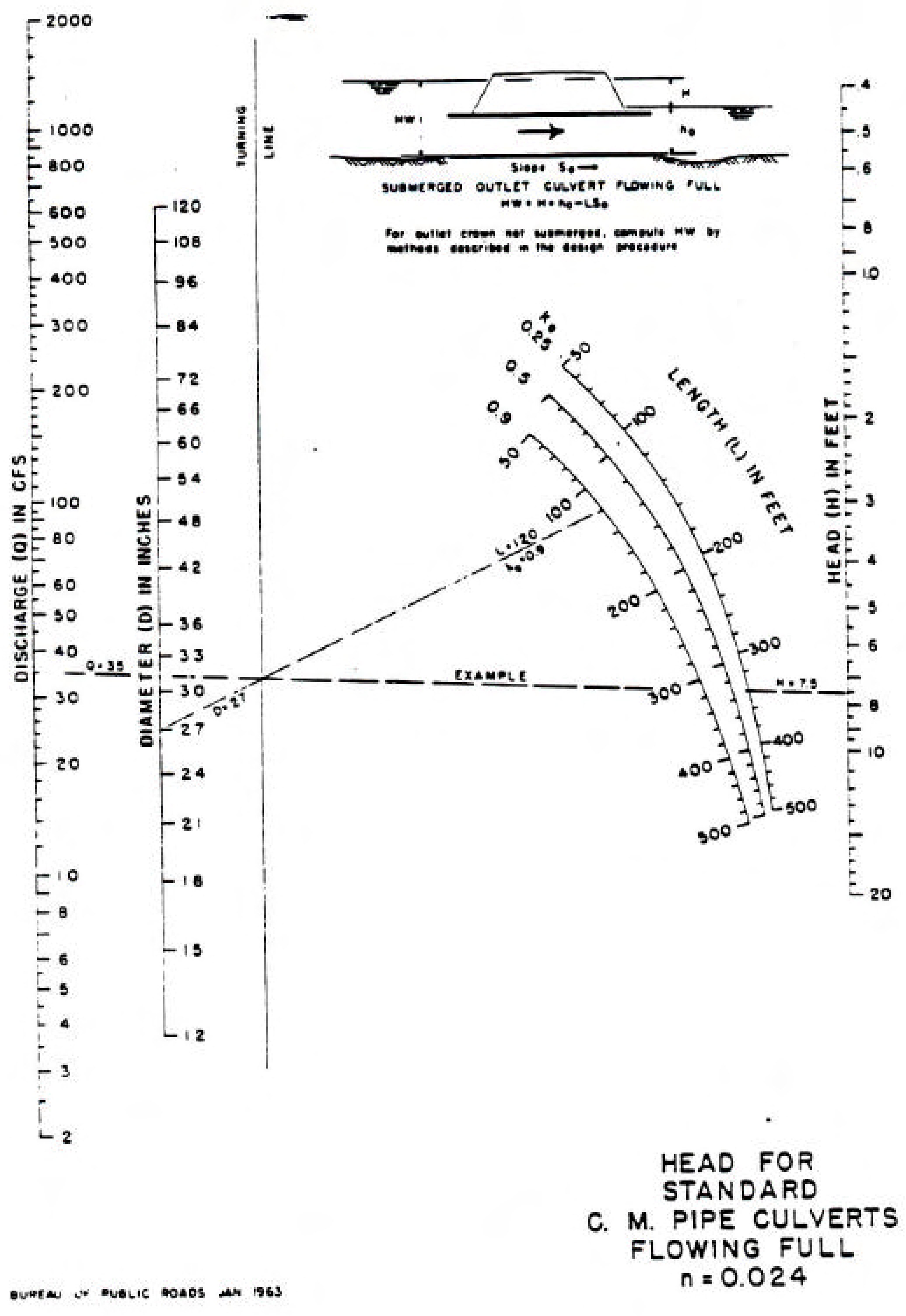
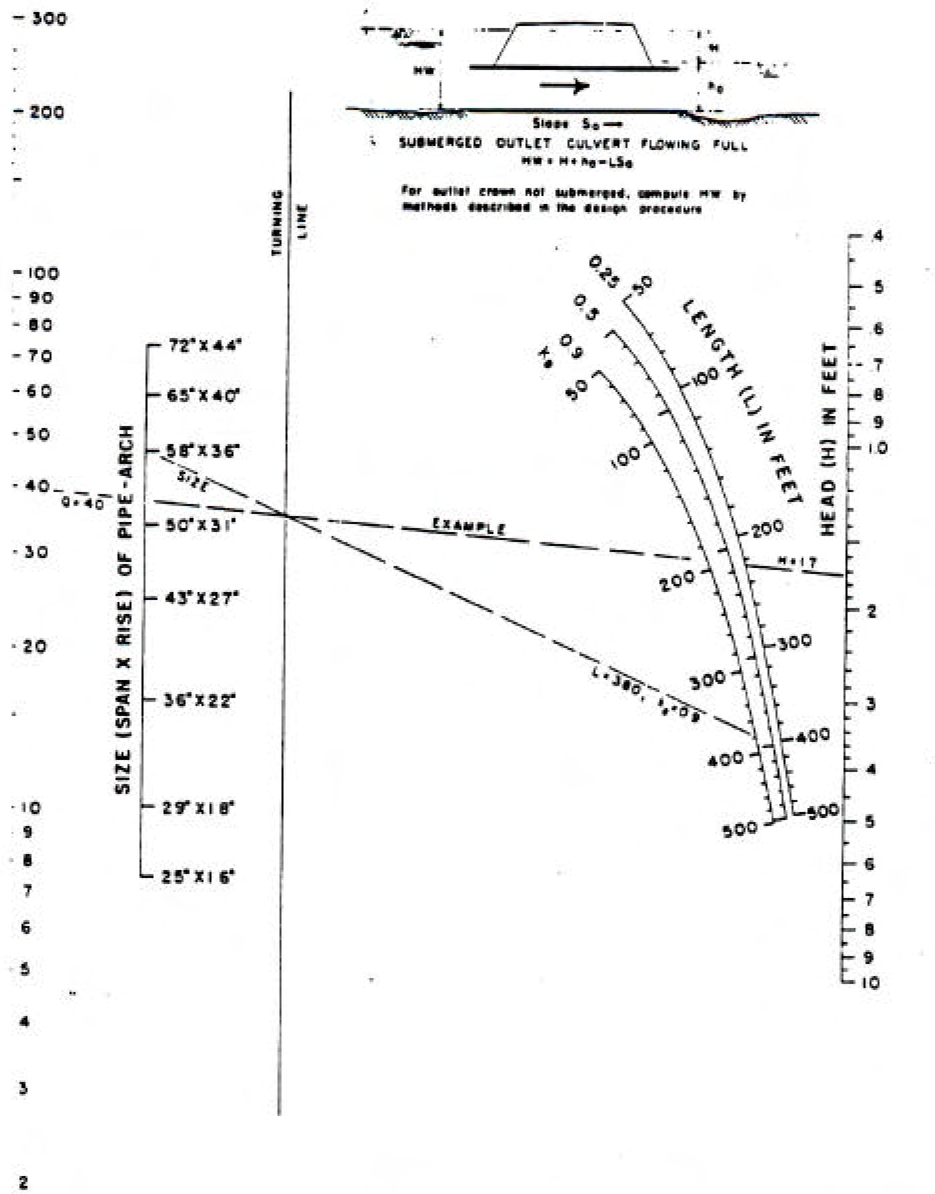

DISCHARGE (Q) IN CFS
DIAMETER (D) IN INCHES
TURNING LINE
SUBMERGED OUTLET CULVERT FLOWING FULL
HW = H + ho − LSo
For outlet crown not submerged, compute HW by methods described in the design procedure
LENGTH (L) IN FEET
HEAD (H) IN FEET
EXAMPLE
HEAD FOR STANDARD C. M. PIPE CULVERTS FLOWING FULL n = 0.024
BUREAU OF PUBLIC ROADS JAN 1963

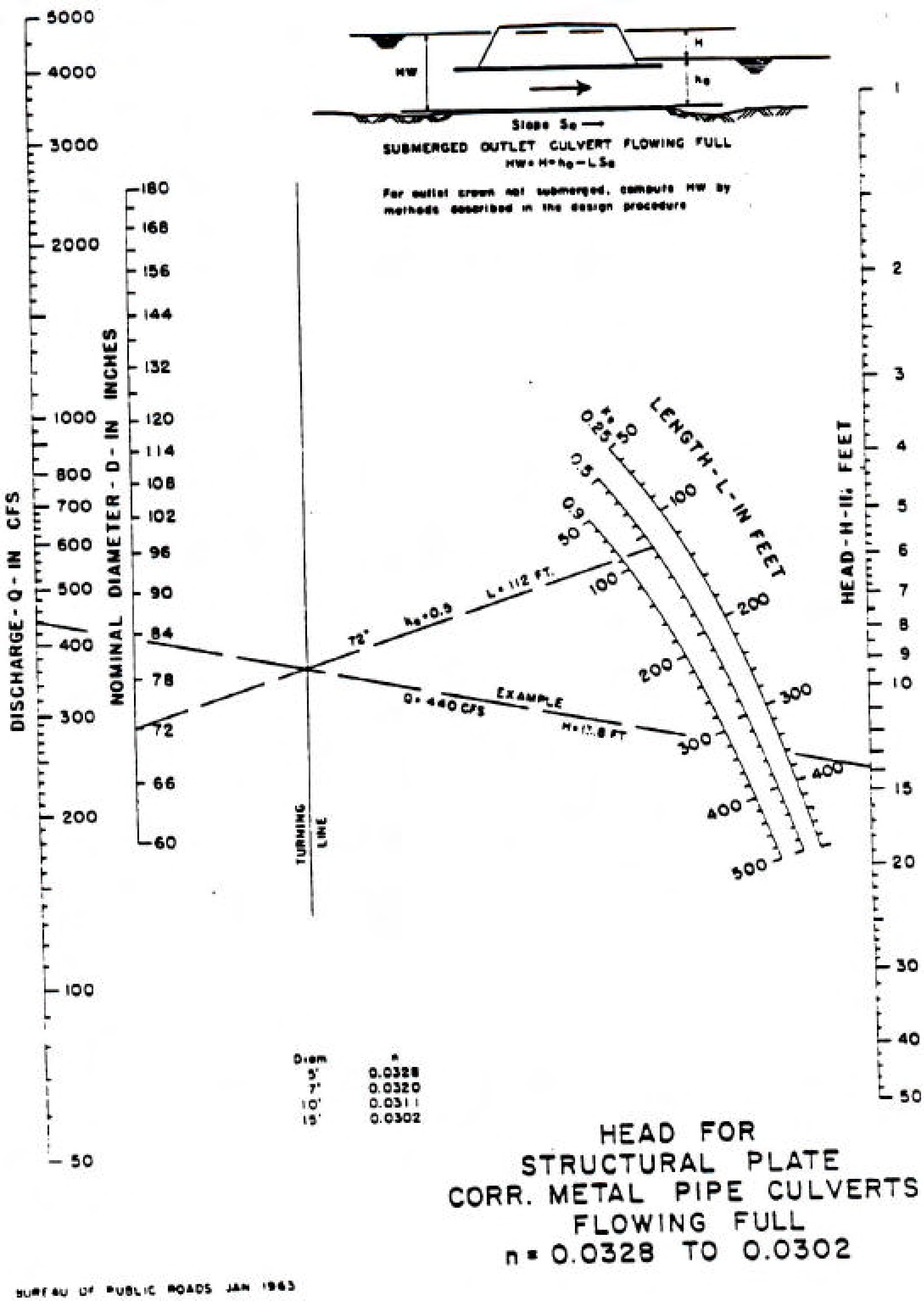
CHART 6.12



HEAD FOR
STANDARD C. M. PIPE-ARCH CULVERTS
FLOWING FULL
n=0.024

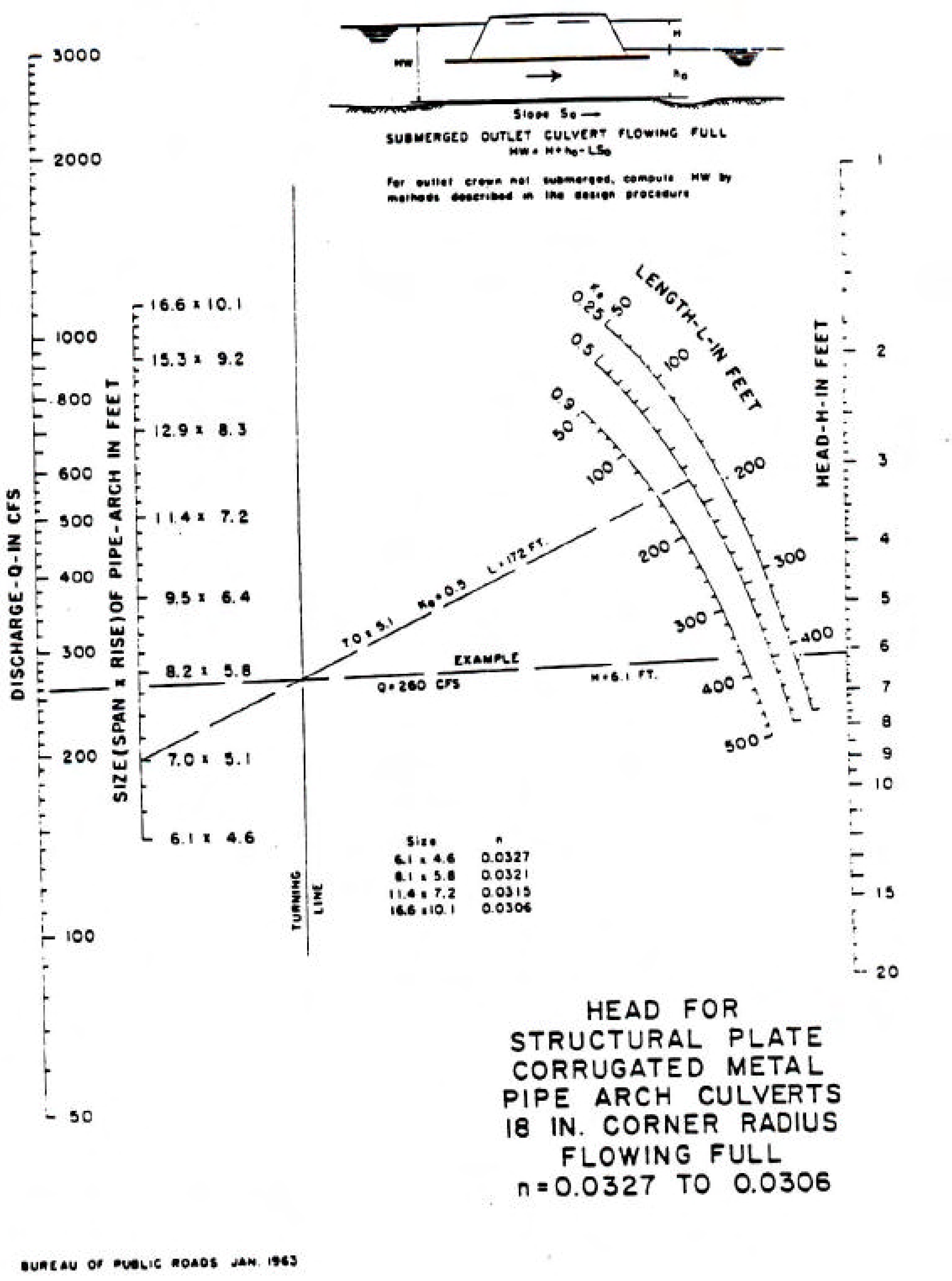
U. OF PUBLIC ROADS JAN. 1963

CHART 6.13



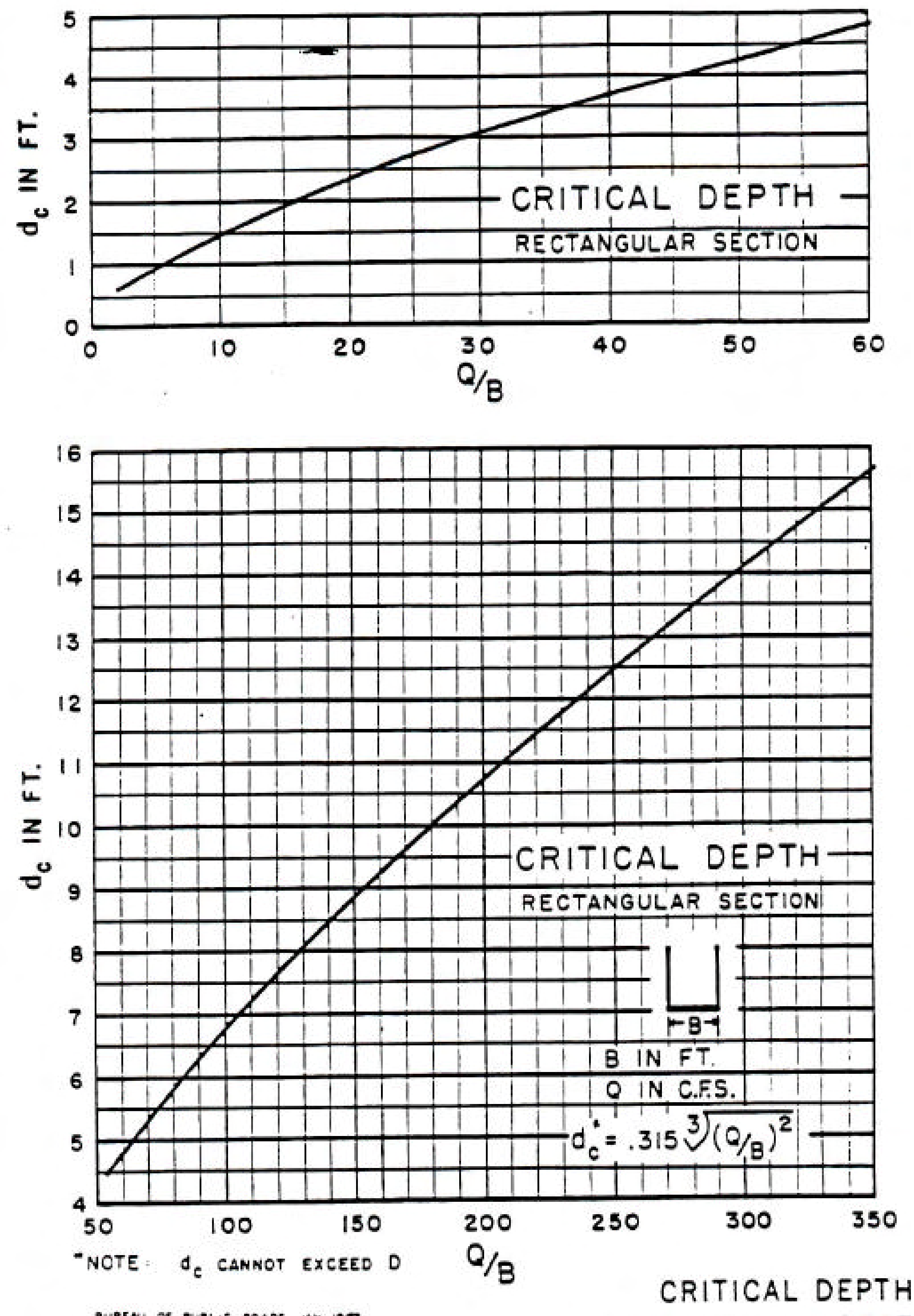
SUBMERGED OUTLET CULVERT FLOWING FULL
HW = H + h₀ − LS₀
For outlet crown not submerged, compute HW by methods described in the design procedure
DISCHARGE - Q - IN CFS
NOMINAL DIAMETER - D - IN INCHES
TURNING LINE
LENGTH - L - IN FEET
HEAD - H - IN FEET
EXAMPLE
Q = 440 CFS
H = 17.8 FT
L = 112 FT.
kₑ = 0.5
72"
Diam n
5' 0.0328
7' 0.0320
10' 0.0311
15' 0.0302
HEAD FOR
STRUCTURAL PLATE
CORR. METAL PIPE CULVERTS
FLOWING FULL
n = 0.0328 TO 0.0302
BUREAU OF PUBLIC ROADS JAN 1963

CHART 6.14



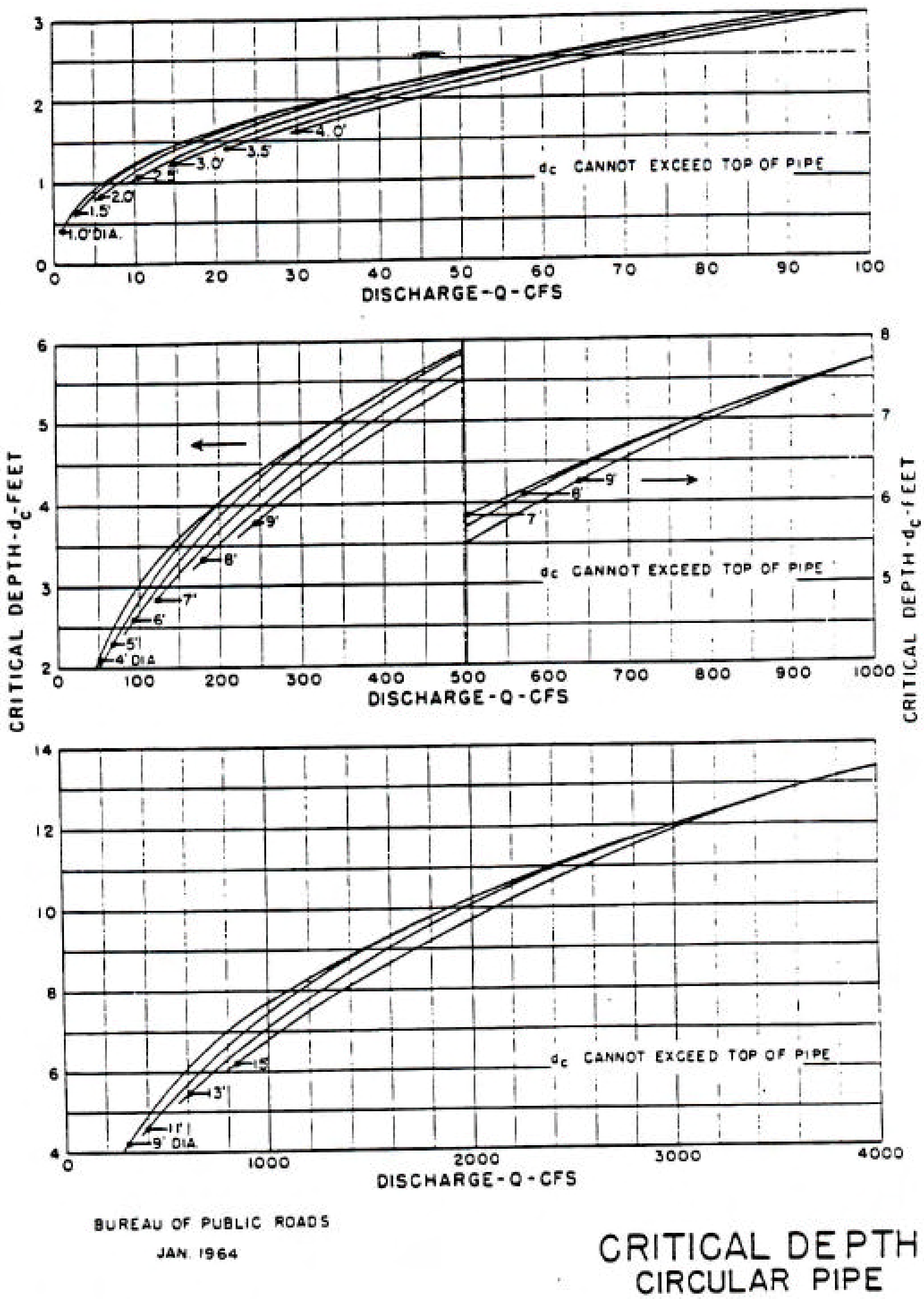
SUBMERGED OUTLET CULVERT FLOWING FULL
HW = H + ho - LSo
For outlet crown not submerged, compute HW by methods described in the design procedure
DISCHARGE-Q-IN CFS
SIZE (SPAN x RISE) OF PIPE-ARCH IN FEET
LENGTH-L-IN FEET
HEAD-H-IN FEET
TURNING LINE
EXAMPLE
Q=260 CFS
H=6.1 FT.
7.0 x 5.1
Ke=0.5
L=172 FT.
Size n
6.1 x 4.6 0.0327
8.1 x 5.8 0.0321
11.4 x 7.2 0.0315
16.6 x 10.1 0.0306
HEAD FOR STRUCTURAL PLATE CORRUGATED METAL PIPE ARCH CULVERTS 18 IN. CORNER RADIUS FLOWING FULL n=0.0327 TO 0.0306
BUREAU OF PUBLIC ROADS JAN. 1963

CHART 6.15



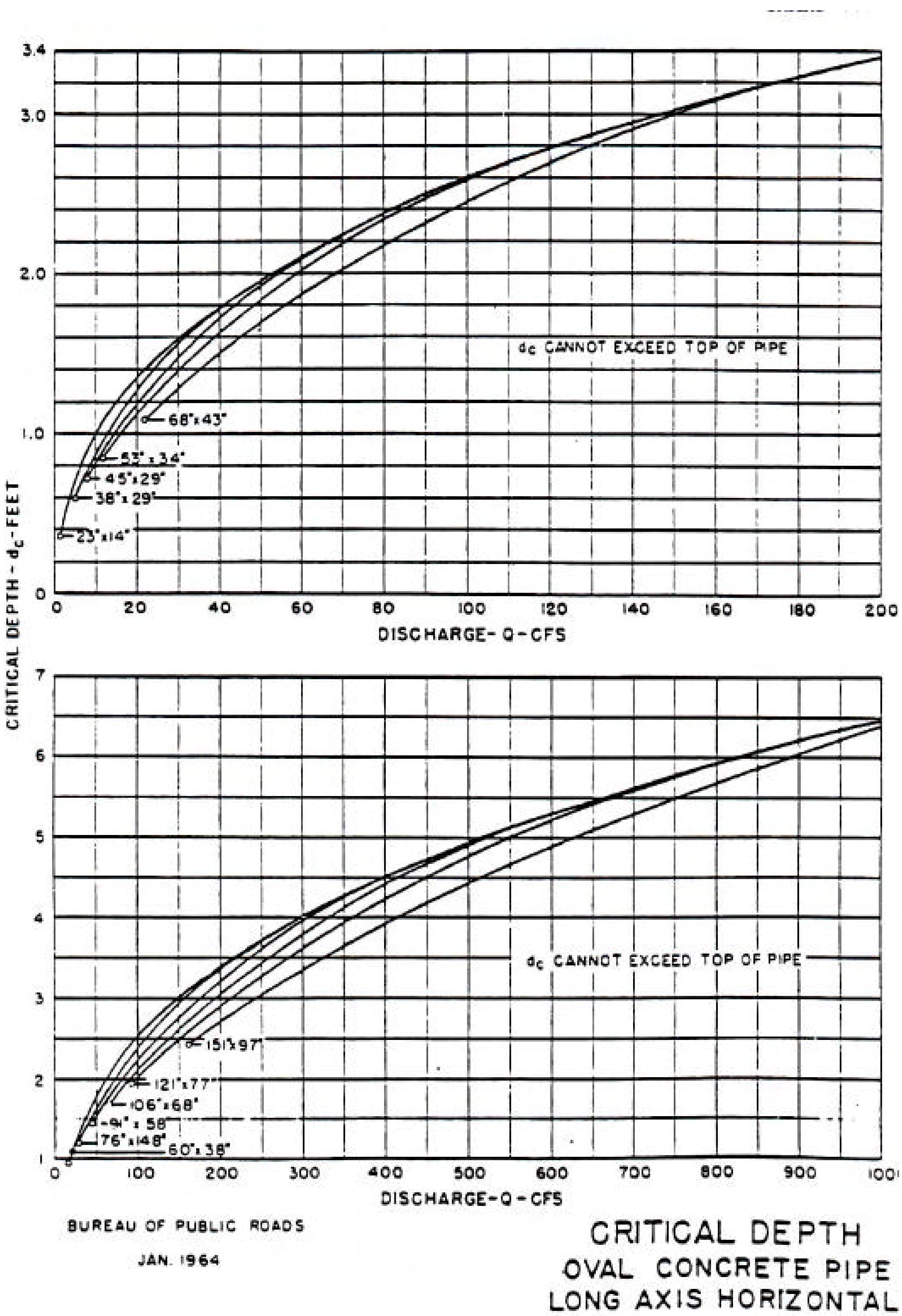
CRITICAL DEPTH
RECTANGULAR SECTION

CHART 6.16



dc CANNOT EXCEED TOP OF PIPE
1.0' DIA.
1.5'
2.0'
2.5'
3.0'
3.5'
4.0'
DISCHARGE - Q - CFS
CRITICAL DEPTH - dc - FEET
4' DIA
5'
6'
7'
8'
9'
9' DIA
11'
13'
15'
BUREAU OF PUBLIC ROADS
JAN. 1964
CRITICAL DEPTH
CIRCULAR PIPE

CHART 6.17



CRITICAL DEPTH - d_c - FEET
DISCHARGE - Q - CFS
d_c CANNOT EXCEED TOP OF PIPE
68"x43"
53"x34"
45"x29"
38"x29"
23"x14"
151"x97"
121"x77"
106"x68"
91"x58"
76"x48"
60"x38"
BUREAU OF PUBLIC ROADS
JAN. 1964
CRITICAL DEPTH
OVAL CONCRETE PIPE
LONG AXIS HORIZONTAL

CHART 6.18

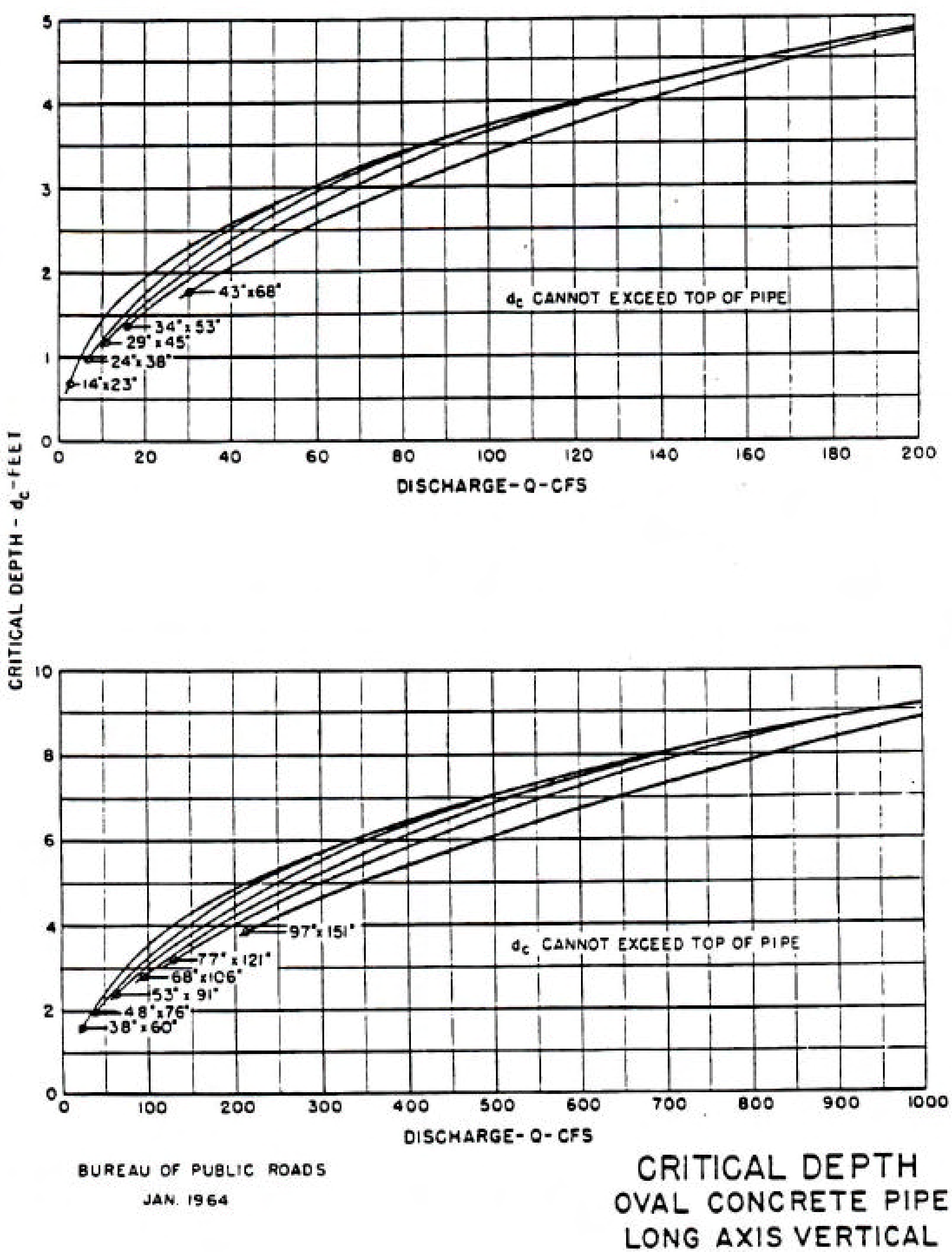

CRITICAL DEPTH - d_c - FEET
43" x 68"
34" x 53"
29" x 45"
24" x 38"
14" x 23"
d_c CANNOT EXCEED TOP OF PIPE
DISCHARGE - Q - CFS
97" x 151"
77" x 121"
68" x 106"
53" x 91"
48" x 76"
38" x 60"
d_c CANNOT EXCEED TOP OF PIPE
DISCHARGE - Q - CFS
BUREAU OF PUBLIC ROADS
JAN. 1964
CRITICAL DEPTH
OVAL CONCRETE PIPE
LONG AXIS VERTICAL

CHART 6.19

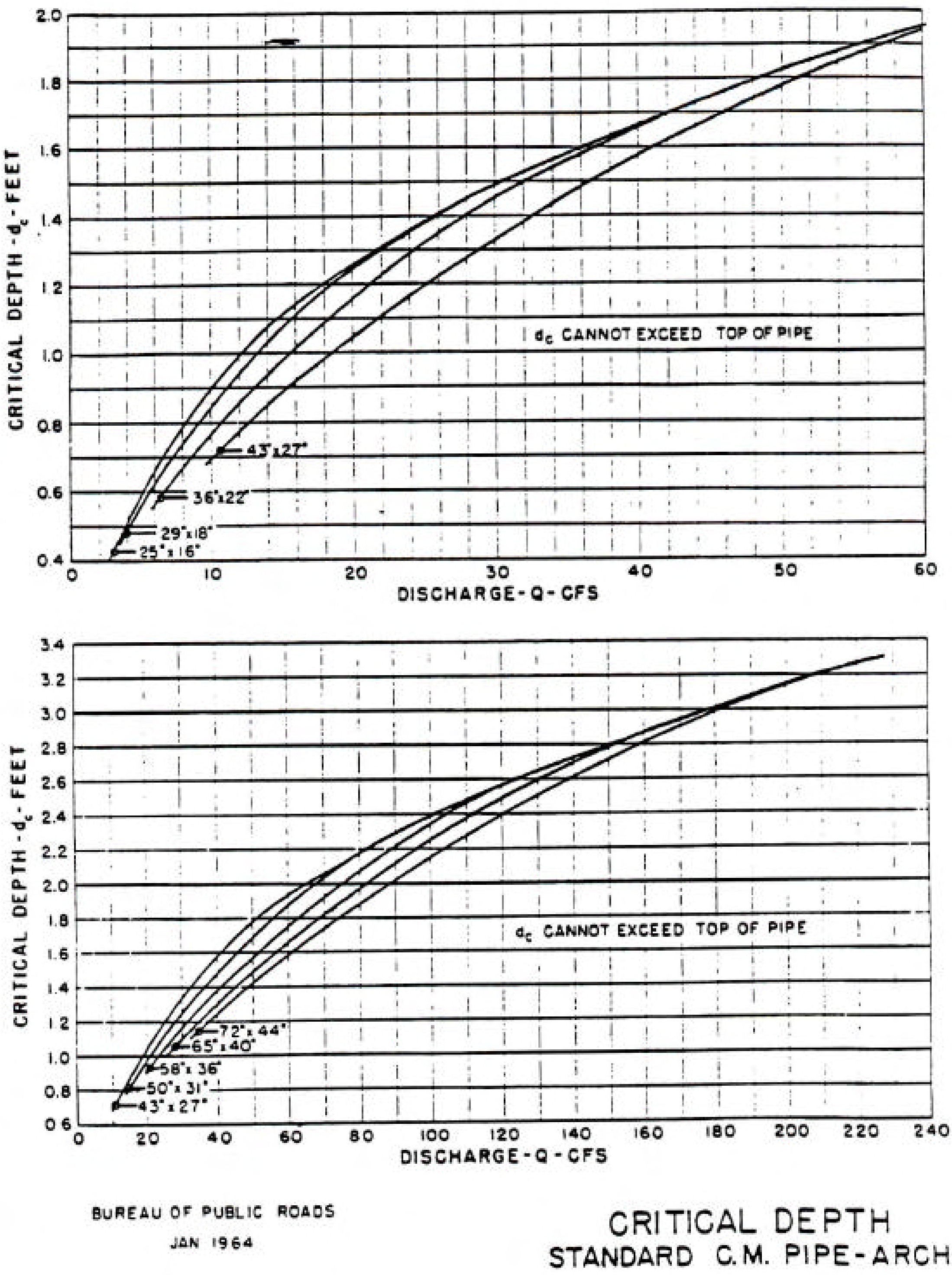

CRITICAL DEPTH - d_c - FEET
DISCHARGE - Q - CFS
d_c CANNOT EXCEED TOP OF PIPE
43"x27"
36"x22"
29"x18"
25"x16"
72"x44"
65"x40"
58"x36"
50"x31"
43"x27"
BUREAU OF PUBLIC ROADS
JAN 1964
CRITICAL DEPTH
STANDARD C.M. PIPE-ARCH

CHART 6.20

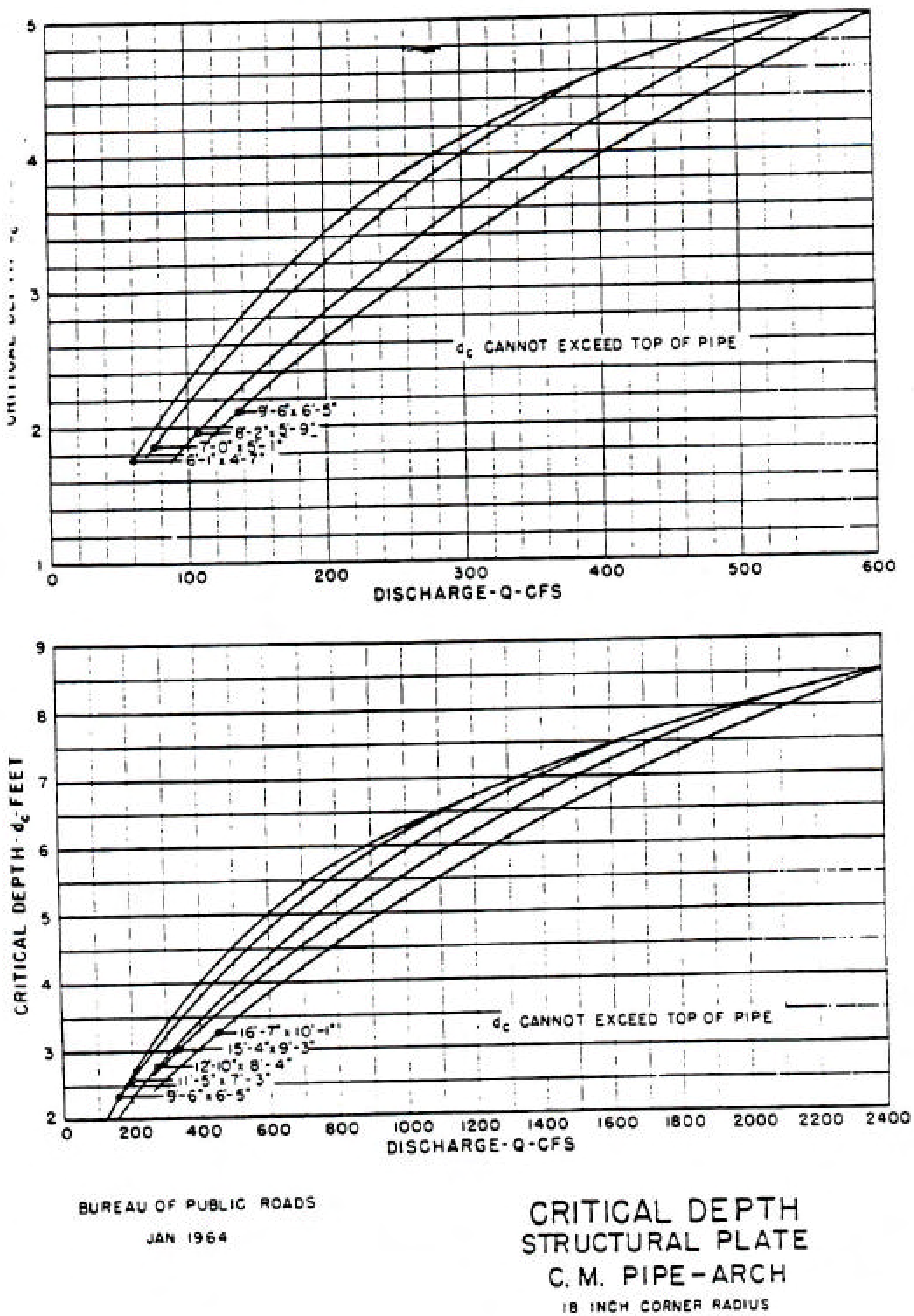
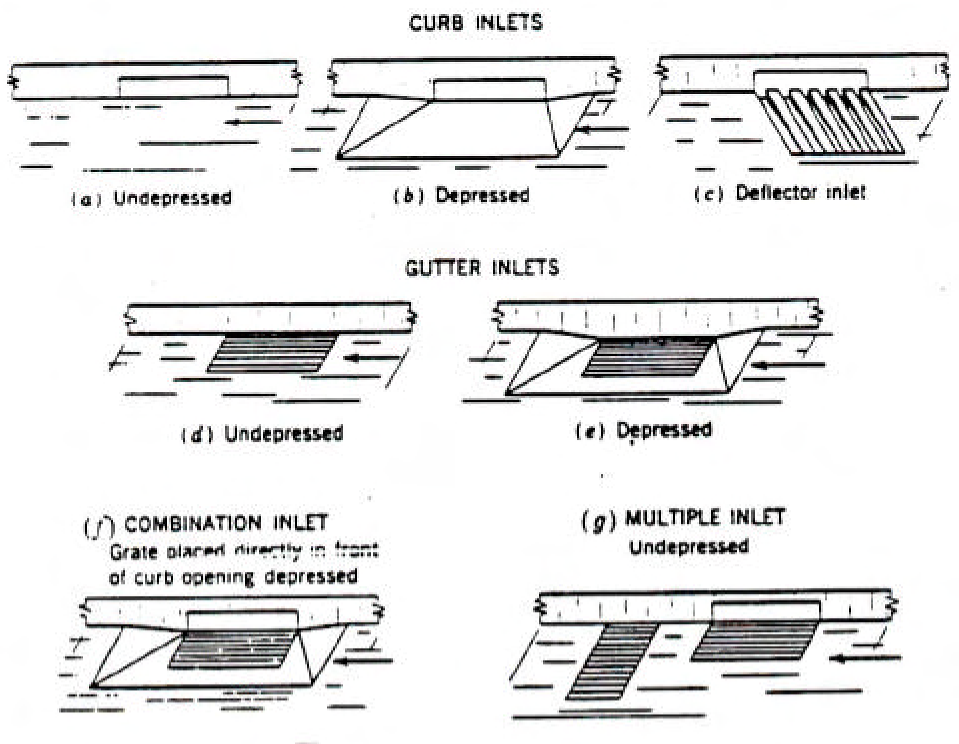

dc CANNOT EXCEED TOP OF PIPE
9'-6" x 6'-5"
8'-2" x 5'-9"
7'-0" x 5'-1"
6'-1" x 4'-7"
DISCHARGE-Q-CFS
CRITICAL DEPTH - dc - FEET
16'-7" x 10'-1"
15'-4" x 9'-3"
12'-10" x 8'-4"
11'-5" x 7'-3"
9'-6" x 6'-5"
BUREAU OF PUBLIC ROADS
JAN 1964
CRITICAL DEPTH
STRUCTURAL PLATE
C. M. PIPE-ARCH
18 INCH CORNER RADIUS

CHART 6.21

CHAPTER 7 - DESIGN OF ROAD INLETS

Inlets can be classified into three major groups: (1) Curb inlets, (2) Grate inlets, (3) Combination inlets. A curb and a grated inlet acting as a unit are known as a combination inlet. A multiple inlet is made up of closely-spaced inlets acting as a unit. Various types of inlets are shown in figure below.



Inlets shall be designed to carry peak rate of runoff from a 10 year frequency storm as calculated using the rational formula. The hydraulic efficiency of stormwater inlets varies with gutter flow, street grade and crown, and with the geometry of the inlet depression. Freedom from clogging or from interference with traffic are also important considerations. The guidelines for the design of inlets established by ASCE are the following.

For all inlets:

a) Use as steep a crown slope as traffic safety and comfort will permit.
b) Design and space inlets so that 5 to 10 percent of the gutter flow reaching each inlet will pass on to the next inlet downstream, provided that this carry-over is not objectionable to pedestrian or vehicular traffic and the inlet is not in a sump.

For inlets where traffic is not expected to travel close to the curb:

a) If clogging is not a problem, use a depressed gutter inlet or a combination inlet with curb and gutter openings contiguous and with a grate having longitude bars.
b) If clogging is a problem and the design flow is small, use a depressed curb inlet. If the design flow is large, use a depressed combination inlet. The combination inlet will be the least subject to clogging and will have the greatest capacity if the curb opening is upstream from the gutter opening and the grate has longitudinal bars.

For inlets in thoroughfares where traffic moves close to the curb:

a) If the street slope is greater than five percent use a deflector inlet if road dirt will not pack in the notches.
b) If the street slope is less than five percent and in all streets in which clogging of the slots between the deflectors may cause difficulty, use an undepressed gutter or combination inlet having a grate with longitudinal bars only.

For inlets in streets having little or no slope for inlets in sumps:

a) On flat streets pitch the gutter slightly from both directions toward the inlets. They will then behave like inlets in sumps.
b) In sumps, use curb, or combination inlets, in order to reduce the flooding which occurs if grates clog.
c) In sumps at the foot of sloping streets, allow ample capacity to admit water that flows past upstream inlets which are flooded or clogged.
d) Inlets in sumps have a tendency to clog; therefore, their design capacities should be reduced accordingly. It is suggested that the design capacities of inlets in sumps should be reduced by the following amounts: 10 percent for curb inlets, 20 percent for combination inlets, and 30 percent for gutter inlets.

The design of roadway inlets has been addressed in ASCE Manual, Georgia DOT Manual and Federal Highway Administration's report on Georgia of Urban Highway Drainage, FHWA-TS-74-225.

7.1 CURB INLETS

Design of curb openings for curb inlets shall be based on the design discharge computed by the Rational Method. The following steps are used.

1. Determine the runoff rate per linear foot of the road that can be expected from the area into the curb from within the roadway.
2. Determine the depth of the curb and gutter capacity using Chart 7.1 and values of gutter spread, cross slope and gutter grade.
3. Determine the spacing between curb inlets and number of inlets by dividing the gutter capacity by the runoff rate per linear foot, and by dividing the length of roadway by the spacing.
4. Determine the percent of design discharge intercepted by each inlet, by selecting the catch basin and entering the corresponding design Charts (Charts 7.2-7.6) with the known values of gutter spread, gutter grade and cross slope. Then determine the percent of discharge by passed by each inlet.
5. Determine the discharge in cubic feet per second intercepted by each inlet by adding the runoff from the paved area and the runoff bypassed by the previous inlet. As before the second inlet will intercept 80% of the runoff reaching it and will bypass 20% to the next inlet.

EXAMPLE 7.1

Find the curb inlet spacing and number of inlets needed with the following data.

Drainage area (A)	=	3 acres
Gutter grade	=	30 ft/1000 ft
Cross slope	=	0.024 ft/1.0 ft
Gutter spread	=	8.0 ft
Length of area	=	3500 ft
Time of Concentration (T_C)	=	16 min
and use	=	90% street – asphalt
	=	10% residential – Single family
Rainfall frequency	=	10 years

SOLUTION

Composite C = 0.85 (0.9) + 0.40(0.10) = 0.81

Rainfall intensity = 5.0 in/hr

1. Compute Runoff (Q_1) per Linear foot

$$
\begin{aligned}
Q_T &= CIA \quad (\text{Rational Formula}) \\
&= 0.81 \times 5.0 \times 3 \\
&= 12.15 \ \text{cfs} \\
Q_1 &= \frac{Q_T}{L} \\
&= \frac{12.15}{3500} \\
&= 0.0035 \ \text{cfs/ft.}
\end{aligned}
$$

2. Determine the depth of curb

   Enter Chart 7.3 with the gutter spread and the cross slope to get the depth at the curb. A check with the design curb depth is made to insure that water will not run over the curb into yards along the road.

depth of curb = 0.38 ft = 4.56 in < 6 in so it is safe

3. Determine the Gutter Capacity
   Now enter the same chart with the gutter grade and the cross slopes. Where these two values meet, go vertically up to get the gutter capacity of the road.
   Q_{max} = 9 cfs

4. Spacing between inlets and number of inlets
   Eight County Standards File No. 4-A catch basins with 36 in. cross drains have been

$$\text{Spacing between curb inlets} = \frac{Q_{max}}{Q_1} = \frac{9}{0.0035} = 2571 \text{ ft}$$

$$\int \text{number of inlets required} = \frac{3500}{2571} = 1.4 \approx 2$$

selected as the type to be used on this road.

5. Determine the percent of the design Q intercepted by the first drain; Enter chart 7.6 with the gutter speed, the gutter grade, and the cross slope. Thus each drain will intercept 80% of the flow reaching it. It is desirable, for reasons of efficiency, to allow some flow to bypass an inlet and to be taken care of by the next inlet downstream. Thus 20% of the flow will be bypassed by each inlet.

6. Calculate the cfs received by each inlet
   The drainage area contributing to runoff to the second inlet is the sum of paved area and the nearby area contributing to runoff. Assume that the runoff past the first inlet consist of rain falling on the pavement and none from nearby area.
   Thus Area A = 0.44 acres.

Compute total runoff to the second inlet as a sum of runoffs from the paved area and nearby area, and runoff bypassed from the previous inlet

Thus Q = CIA + 20% (12.15)
= 0.95 x 5.0 x 0.44 +0.20 (12.15) ; C = 0.95 from paved area
= 2.09 + 2.43
= 4.52 cfs

As before this drain will intercept 80% of the flow reaching it. This 0.9 will bypass this drain (=0.20 x 4.52)

EXAMPLE 7.2

Find the number of inlets and curb inlet spacing with the following data

Area (A) = 25.3 acres

Gutter grade = 50 ft/1000 ft

Cross slope = 0.024 ft/1.0 ft

Gutter spread = 8.0 ft

Time of Concentration (T_C) = 16 min

Land use and Runoff Coefficients (c)

8% street – asphalt 0.85 (from Table 2.1)

92% residential – single family 0.40

Rainfall frequency = 10 years

Rainfall Intensity (I) = 5.0 in/hr (from Chart 2.1)

SOLUTION

Composite C = 0.85 (0.8) + 0.40 (0.92) = 0.44

1. Compute Runoff (Q_1) per Linear foot

$$\begin{aligned}
Q_T &= CIA \quad (\textit{Rational Formula}) \\
&= 0.44 \; x \; 5.0 \; x \; 25.3 \\
&= 55.66 \quad = \quad 56 \; cfs \;\; (Say) \\
Q_1 &= \frac{Q_T}{L} \\
&= \frac{5.6}{3500} \quad = \quad 0.016 \quad cfs/ft
\end{aligned}$$

2. Determine depth of curb

   From Chart 7.1 with the given gutter spread and the cross slope, the depth at the curb = 0.38 ft = 4.56 in < 6 in O.K.

3. Determine the Gutter Capacity (Q_{max})

   On Chart 7.1 move up from the intersection of the given gutter grade and cross slope to read Q_{max}.

   Q_{max} = 9 cfs

1. Spacing between inlets and number of inlets

$$\text{Spacing} = \frac{Q_{max}}{Q_1} = \frac{9}{0.016}$$

$$= 563 \text{ ft}$$

$$\text{Number of inlets} = \frac{3500}{563}$$

Eight County Standards File No. 4-A catch basins with 36 in. cross drains have been selected as the type to be used on this road.

2. Percent design Q intercepted by the first drain can be determined using Chart 7.6 with the gutter spread, gutter grade and cross slope. Each drain will intercept 78% of the flow reaching it. If it is desired to know the number of cfs intercepted by each inlet, then proceed as in Step 6 of Example 7.1.

7.2 GRATE INLETS

For efficient grate inlet, all rectangular bars should be parallel with the flow and the openings should cover at least 50 percent of the width of the grate. The clear length of the opening should be sufficient to allow the water to fall through the openings without striking the far end of the grate. The required clear length of bar (L_b) can be computed by using

Where L_b = length of clear opening of gate, in feet

V = mean approach velocity in the width of the grate opening in ft/sec

$$L_b = \frac{V}{2}(d + d_b)^{1/2}$$

d = depth of flow at the curb, in feet

d_b = depth of the bar, in feet

Chart 7.7 is a graphical solution of the equation for pavement with roughness coefficient, n = 0.015 and depth of bar 3 ½ inches.

As the gutter grade varies so does the length of clear opening required for 100% interception of the water approaching the inlet within the width of the grate. If the length is less than given by Equation 7.1, some of the gutter flow will pass directly over the grate without being intercepted and add to the flow bypassing the gate.

EXAMPLE 7.3
Find the length of clear opening required for an efficient grate with the following data.

Cross slope, S_x = 0.021 ft/ft. Gutter grade, S_o = 10%

2 ft concrete gutter, n = 0.015

allowable spread on pavement = 6 ft

depth of grate bars = 3 ½ inches

SOLUTION

Total width of gutter spread = 2 + 6 = 8 ft

Using Chart 7.7, on upper left diagram for T=8 ft move horizontally to S_x = 0.021 curve, thence downward to S_x 0.021 curve in left center diagram. From this intersection move horizontally to right diagram to S_o = 0.10 curve and read L_d on bottom scale as 3.0 ft.

CAPACITY OF GRATE INLETS ON A CONTINUOUS GRADE

The capacity of an undepressed efficient grate inlet can be determined by computing the flow in the section occupied by the grate width. For straight line sections, the flow intercepted by an undepressed efficient grate can be computed as explained in instruction 3, chart 7.8. Example 7.4 illustrates the procedure. This problem is taken from Georgia DOT Manual.

EXAMPLE 7.4

Partial Interception by Undepressed Grate

Given: Q = 1.5 cfs; pavement cross slope, S_x = 3/8 inch per foot; Gutter Grade 3 percent; gutter, concrete float finish; grate inlet, 30 inches wide by 24 inches long, depth of longitudinal

$Z = \frac{T}{d}$, reciprocal of cross slope; d = depth of gutter flow at the curb

bars 3 inches, no cross bracing, 60 percent clear opening.

Find: Spread on the pavement and the discharge intercepted by the grate inlet.

SOLUTION

1. Determine roughness coefficient; n = 0.014
2. From Table 7.2, Z = 32.000, $\frac{Z}{n}$ = 2,286
3. On Chart 7.8,lay a straightedge on $\frac{Z}{n}$ = 2, 286 and gutter grade = 0.03. Mark intersection of straightedge on the turning line.
4. Lay straightedge on point marked in step 3 and the discharge, 1.5 cfs. Read depth of flow at the curb, 0.15 foot.
5. The spread on the pavement is Zd or 32(0.15) = 4.8 feet.
6. Depth of flow at outward edge of grate (X-distance from curb face = 2.5) is d -

   $\left(\frac{X}{Z}\right)$ or $0.15\left(\frac{2.5}{32.0}\right) = 0.07$ foot.

7. From chart 7.8 (following steps 3 and 4) for d = 0.07 foot, $\frac{Z}{n}$ = 2,286. And S = 0.03;

   Q_b = 0.2 cfs.

8. Then Q_x = 1.5 – 0.2 = 1.3 cfs provided the grate is efficient.

9. The grate has the necessary requirements for efficiency if the clear opening (L_b) is sufficient. The mean velocity in the 2.5 foot section over the grate is 1.3 cfs (step 8) ÷ the area of the section (0.15 foot deep at curb and 0.07 foot deep at the other edge of the grate) or 4.73 feet per second. The clear opening required by equation 7.1 is:

$$L_b = \frac{V}{2}(d + d_b)1/2 = \frac{4.73}{2}(.15 + .25)^{1/2} = 1.5 \text{ feet}$$

The grate opening, 2.0 feet, exceeds that required. Thus the grate is sufficient.

The 2.5 foot grate intercepts 87 percent of the total flow $\left(\frac{1.3}{1.5}\right)$ in Example 7.4. To intercept 100 percent of the flow would require a grate 4.8 feet wide (step 5) almost twice the width required for 87 percent interception.

Ordinarily, the width of grate remains constant and the spacing of inlets is varied to limit the spread on the pavement to the desired quantity. The calculations for determining the discharge for 100 percent interception by a given grate are shown in Example 7.5.

EXAMPLE 7.5

Total interception by Undepressed Grate

<u>Given:</u> The same conditions as in Example 7.4

<u>Find:</u> The gutter flow (Q) that would be totally intercepted by an efficient grate inlet, 30 inches wide.

SOLUTION

1. The spread on the pavement (T = Zd) is limited to the grate width (2.5 feet) for 100 percent interception.

$$d = \frac{2.5}{32.0} = 0.08 \text{ foot}.$$

2. From chart 7.8 (following steps 3 and 4 of Example 7.4), for d = 0.08,

$$\frac{Z}{n} = 2{,}286, \text{ and } S = 0.03, \quad Q = 0.25 \text{ cfs}.$$

Examples 7.4 and 7.5 show the advantage of designing grate inlets for partial interception. For 100 percent interception under the conditions of these examples, the grate width would have to be doubled or about six separate 30-inch grate inlets, each intercepting 0.25 cfs, would be required.

For composite straight-line gutter sections, the flow intercepted by an undepressed efficient grate is computed as explained by instruction 4 on chart 7.8.

7.3 COMBINATION INLETS

A graphical procedure described in ASCE Manual can be used to determine the capacity of single or closely-spaced combination inlets. The assumptions made in this procedure are that the velocity throughout the cross section of the gutter flow is uniform, and the ratio of intercepted width of flow (b_I) to the total width or flow (b_w) determines the percent of capture. Another assumption is that there is no carry over across the grate (s). Charts 7.9 A, B, C, D show flow lines for gutter flows on street grades of various crown slope. Chart 7.10 is a graph showing the relationship between ratio of intercepted width and intercepted flow.

EXAMPLE 7.6

Find the capacity of an undepressed combination inlet with grate 3.67 ft x 1.67 ft in a street with a 4% grade, and 1:18 crown slope. Manning's n = 0.013.

(a) Draw outline of inlet on the appropriate flow diagram (S = 0.04), Chart 7.9B.
(b) Determine by inspection the flow for which the outermost flow line intersects the outer downstream corner of the inlet and note its original distance from the curb. In this example, at a flow of 0.8 cfs, the outer flow line intersects the outer downstream corner of the inlet. The original width of this intercepted flow (b_1) is 2.5 ft.
(c) Also, from Chart 7.9B, determine by inspection flow widths, b_w, for 1, 2, 4, and 6 cfs. These are listed in Col. 2 of Table below.
(d) Compute interception width ratios b_i/b_w. In the example, $b_i/b_w = 2.5 \div$ values in Col 2.
(e) From Chart 7.10 determine interception flow rations, Q_i/Q_w, for corresponding b_i/b_w ratios. These values are listed in Col. 4.
(f) Determine intercepted flows, Q_i, Col. 5 = Col. 1 x Col. 4.
(g) Data from a rating curve derived by the empirical equations are given in Col. 6. Comparison with Col. 5 shows the simplified method yields results well within the usual engineering accuracy.

This method may be used for closely spaced inlets and for inlets placed perpendicular to each other provided that the downstream grate is not overtopped.

CAPACITY OF UNDEPRESSED COMBINATION INLET

Gutter Flow Q_w (cfs) (1)	Flow Width b_w (ft) (2)	Interception Width Ratio, b_i/b_w (3)	Interception Flow Ratio Q_i/Q_w (4)	Intercepted Flow Q_i By Simplified Method (cfs) (5)	Intercepted Flow Q_i By Rating Curve (cfs) (6)
1	2.8	0.89	0.98	0.98	0.99
2	3.5	0.72	0.92	1.84	1.8
4	4.6	0.54	0.79	3.16	3.4
6	5.3	0.47	0.72	4.32	4.5

TABLE 7.1

	Cross Slopes	Gutter Spread
Industrial Area Streets	0.022’:1’	6.0 - 8.0’
Subdivision Streets	0.024’:1’	6.0 – 8.0’

TABLE 7.2

Z AND Z/N VALUES FOR CROSS SLOPES			
S_x	S_x	Z	Z/0.015
1/8	.0104	96.00	6410
3/16	.0156	64.00	4273
¼	.0208	48.00	3205
	.0300	33.33	2222
	.0400	25.00	1667
	.0500	20.00	1333
	.0600	16.67	1111
	.0700	14.28	952
	.0800	12.50	833

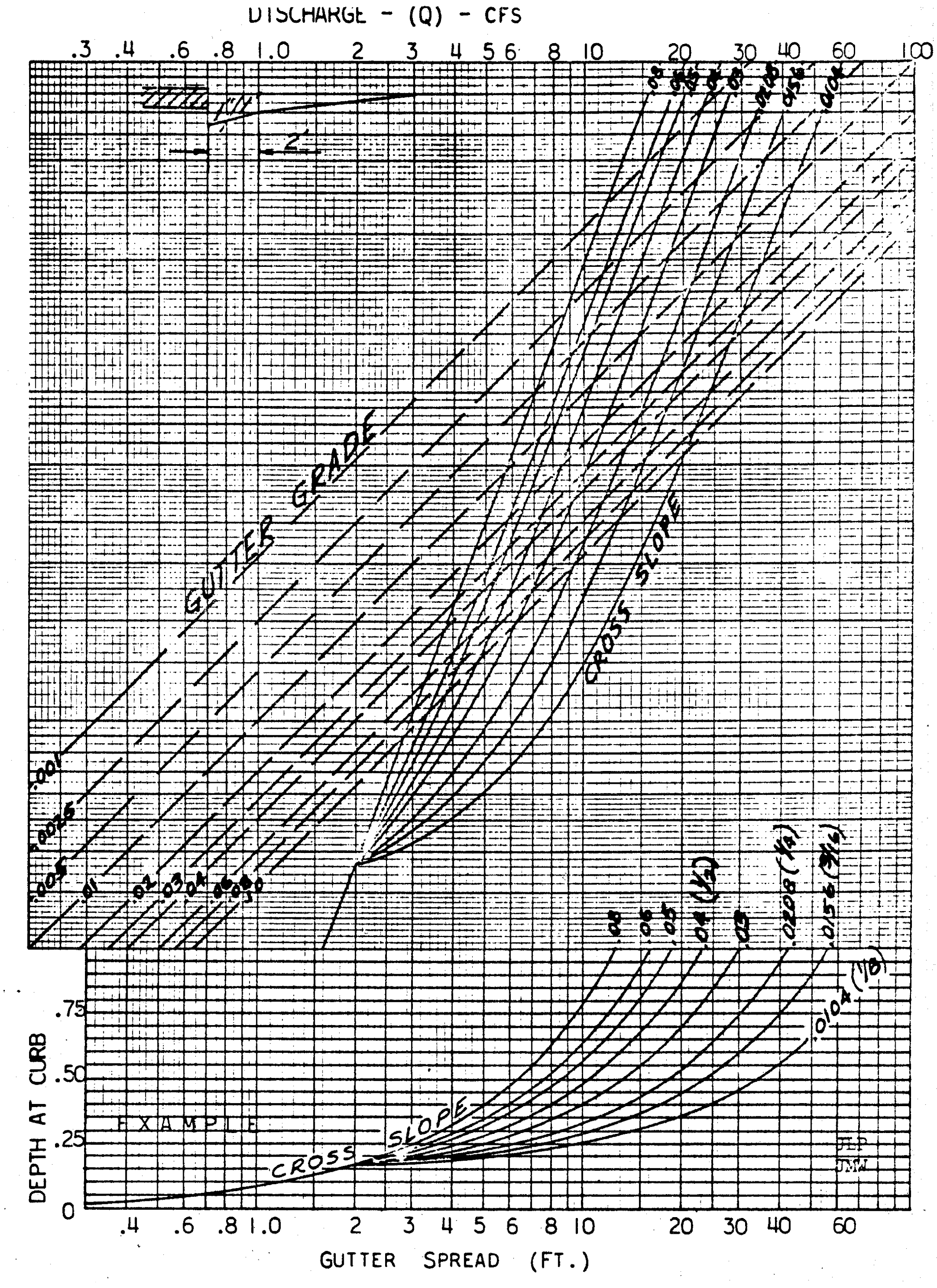
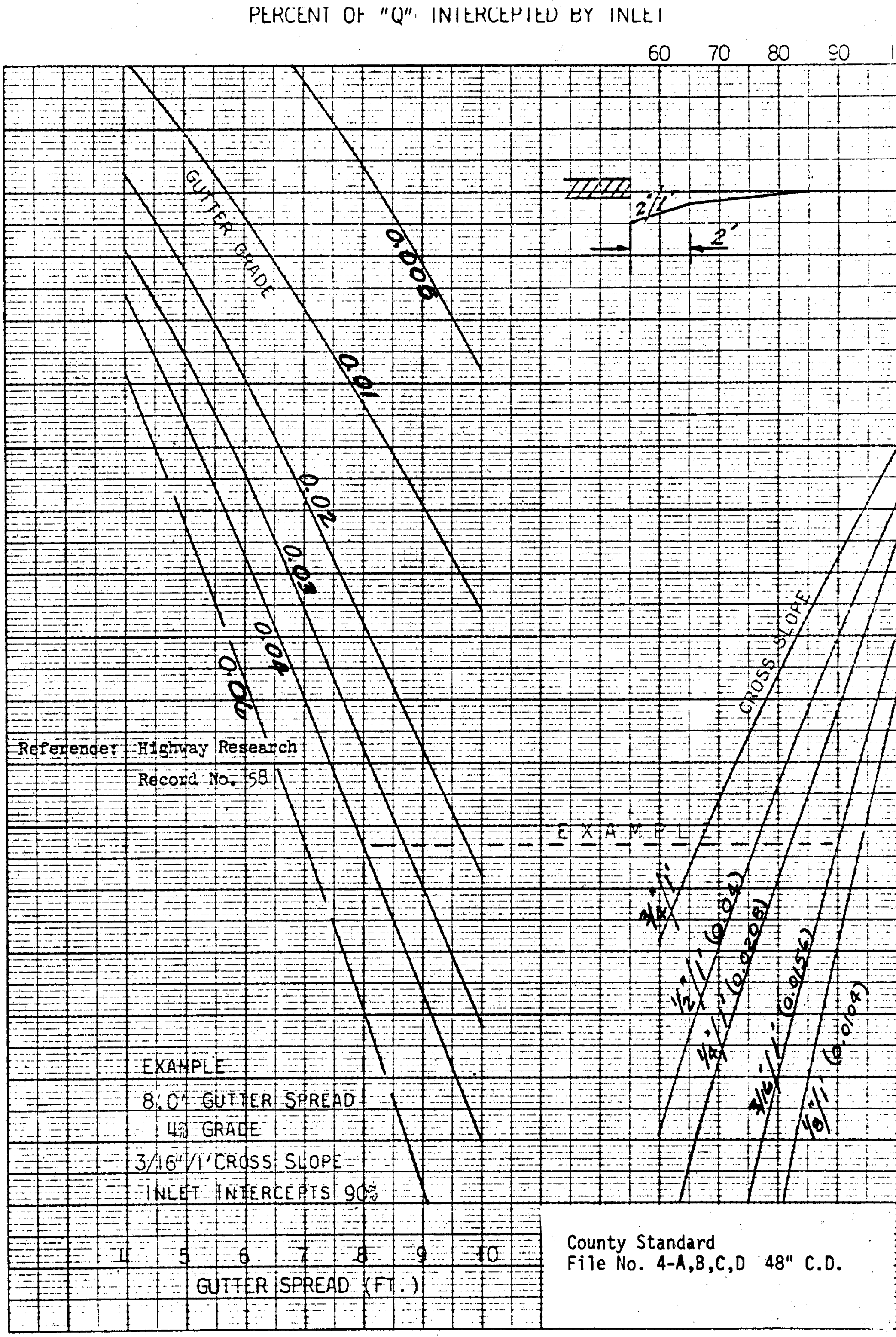


CHART 7.1
GUTTER CAPACITY CHART



PERCENT OF "Q" INTERCEPTED BY INLET
60
70
80
90
100
GUTTER GRADE
0.005
0.01
0.02
0.03
0.04
0.06
CROSS SLOPE
EXAMPLE
Reference: Highway Research Record No. 58
3/8"/1' (0.04)
1/2"/1' (0.0208)
1/4"/1' (0.0156)
3/16"/1' (0.0104)
1/8"/1'
EXAMPLE
8.0' GUTTER SPREAD
4% GRADE
3/16"/1' CROSS SLOPE
INLET INTERCEPTS 90%
4
5
6
7
8
9
10
GUTTER SPREAD (FT.)
County Standard
File No. 4-A,B,C,D 48" C.D.
2'

CHART 7.2

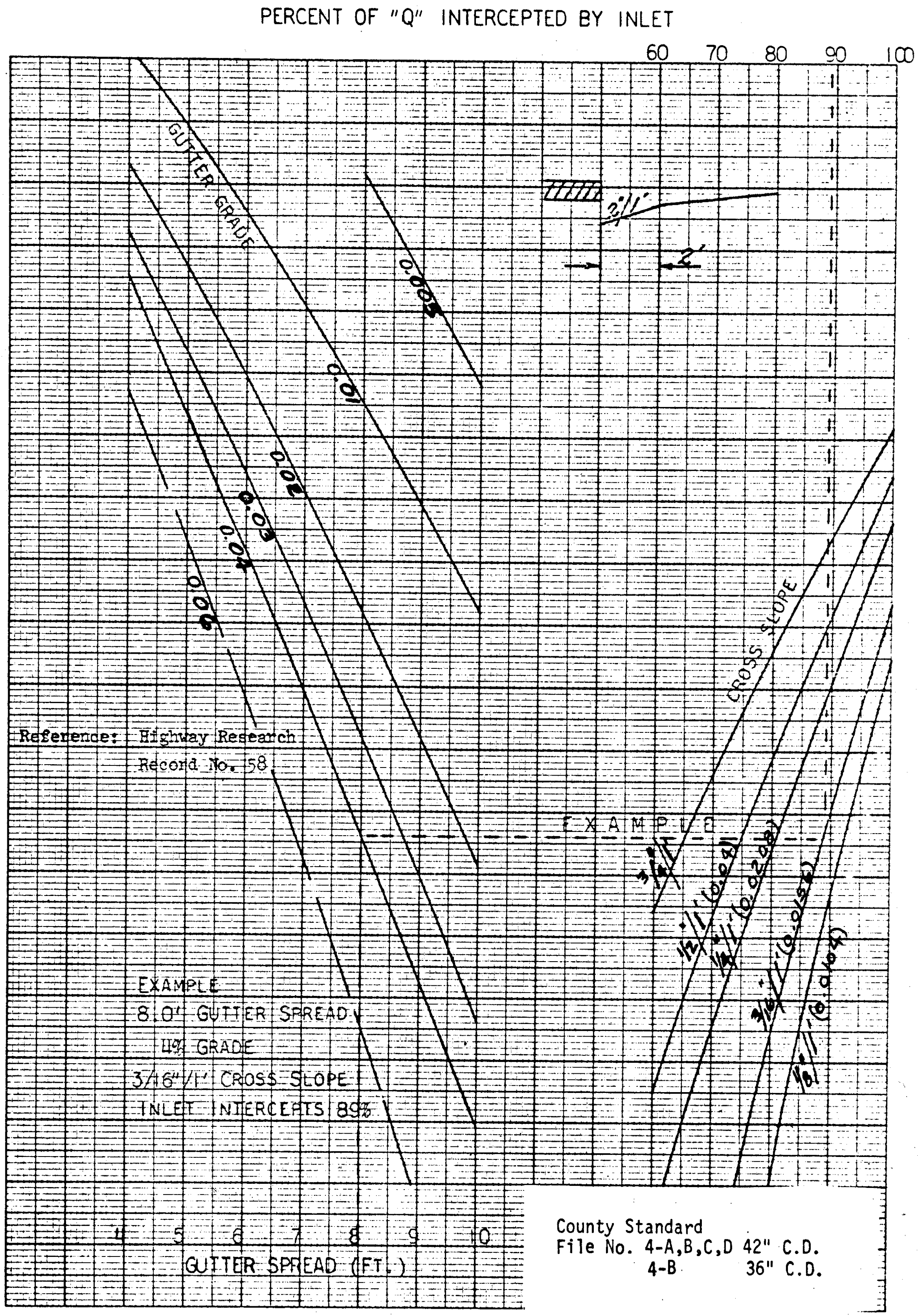

PERCENT OF "Q" INTERCEPTED BY INLET
60
70
80
90
100
GUTTER GRADE
0.005
0.01
0.02
0.03
0.04
0.06
2'
CROSS SLOPE
Reference: Highway Research Record No. 58
EXAMPLE
3/4"/1'
1/2"/1' (0.042)
1/4"/1' (0.0208)
3/16"/1' (0.0156)
1/8"/1' (0.0104)
EXAMPLE
8.0' GUTTER SPREAD
4% GRADE
3/16"/1' CROSS SLOPE
INLET INTERCEPTS 89%
4
5
6
7
8
9
10
GUTTER SPREAD (FT.)
County Standard
File No. 4-A,B,C,D 42" C.D.
4-B 36" C.D.

CHART 7.3

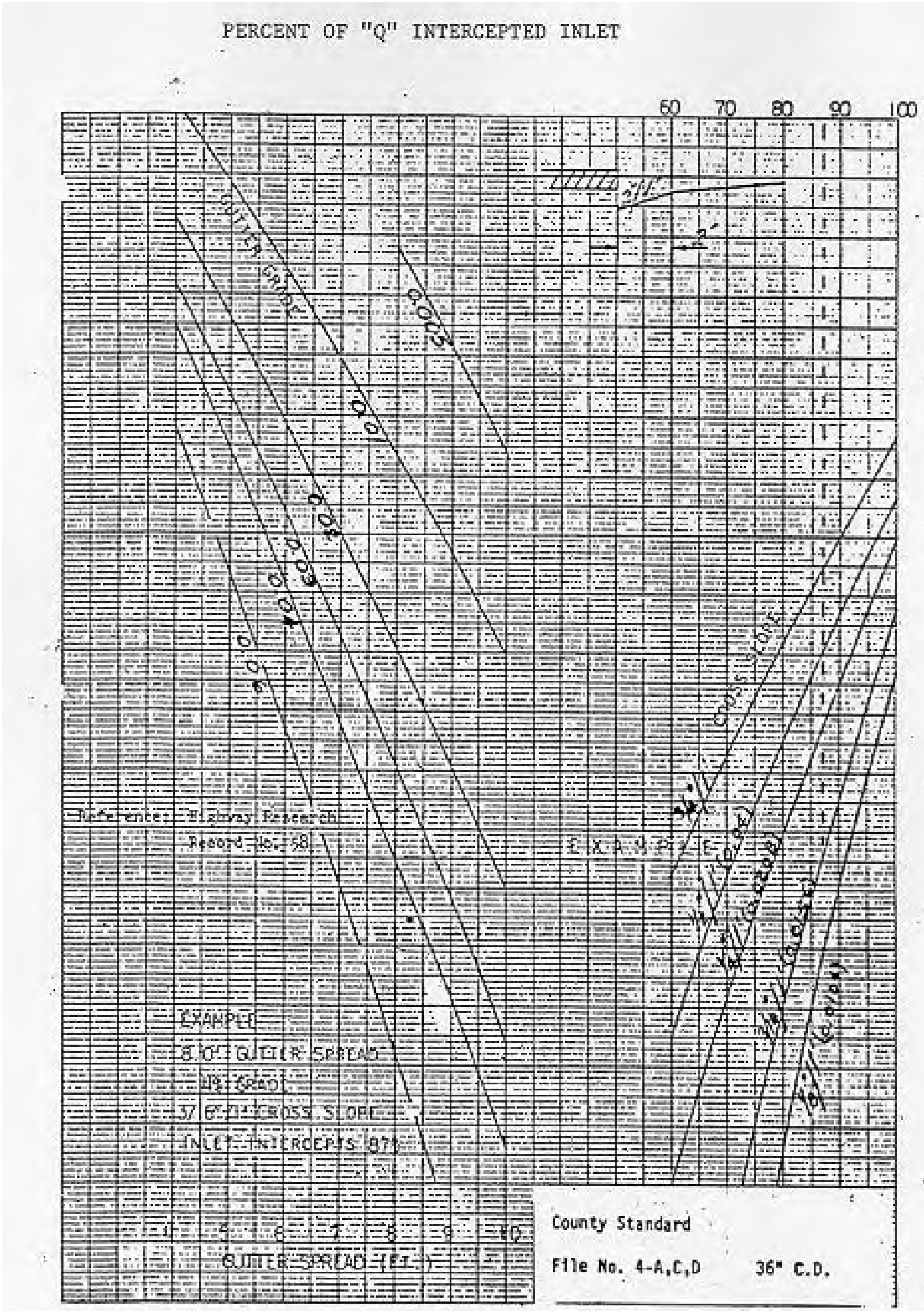

PERCENT OF "Q" INTERCEPTED INLET
60
70
80
90
100
GUTTER GRADE
0.003
0.01
0.02
0.03
0.04
0.06
CROSS SLOPE
Reference: Highway Research
Record No. 58
EXAMPLE
EXAMPLE
8.0' GUTTER SPREAD
4% GRADE
3/8":1' CROSS SLOPE
INLET INTERCEPTS 87%
4
5
6
7
8
9
10
GUTTER SPREAD (FT.)
County Standard
File No. 4-A,C,D
36" C.D.

CHART 7.4

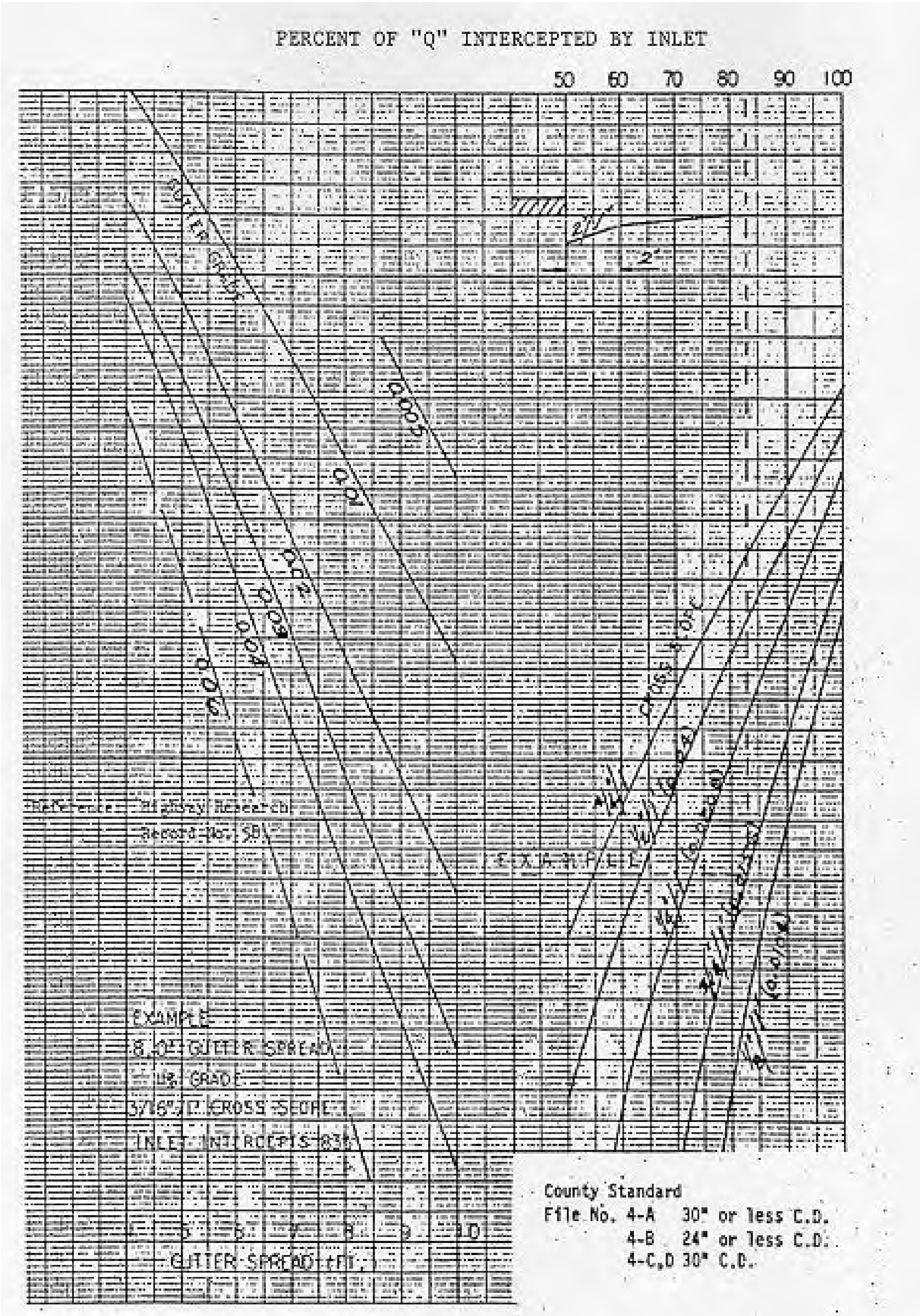

PERCENT OF "Q" INTERCEPTED BY INLET
50 60 70 80 90 100
GUTTER GRADE
0.003
0.01
0.02
0.03
0.04
0.06
EXAMPLE
8.0' GUTTER SPREAD
5 6 7 8 9 10
GUTTER SPREAD (FT.)
County Standard
File No. 4-A 30" or less C.D.
4-B 24" or less C.D.
4-C,D 30" C.D.

CHART 7.5

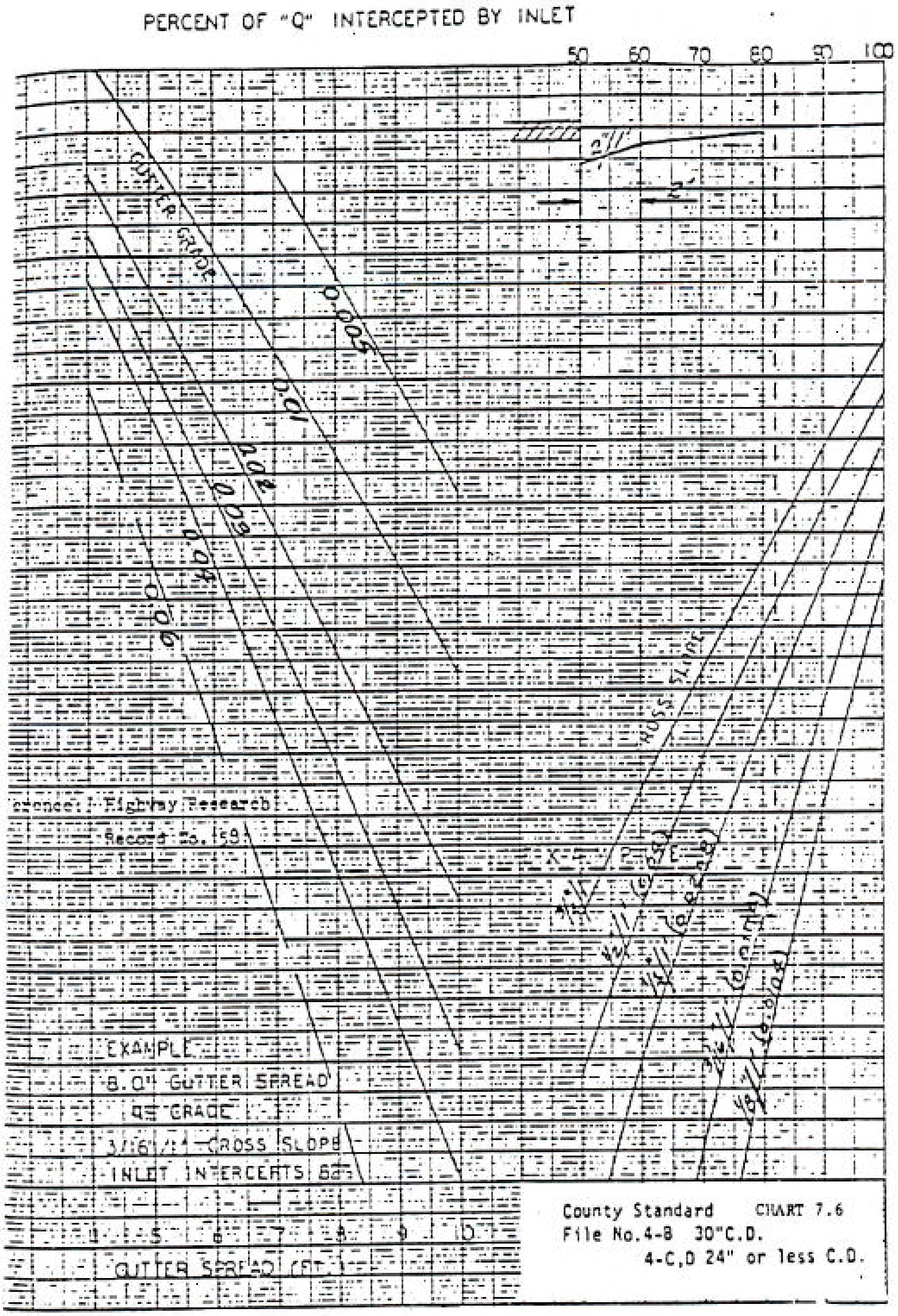

PERCENT OF "Q" INTERCEPTED BY INLET
50 60 70 80 90 100
GUTTER GRADE
0.005
0.01
0.02
0.03
0.04
0.06
CROSS SLOPE
EXAMPLE
8.0" GUTTER SPREAD
GUTTER SPREAD (FT)
County Standard CHART 7.6
File No.4-8 30"C.D.
4-C,D 24" or less C.D.

CHART 7.6

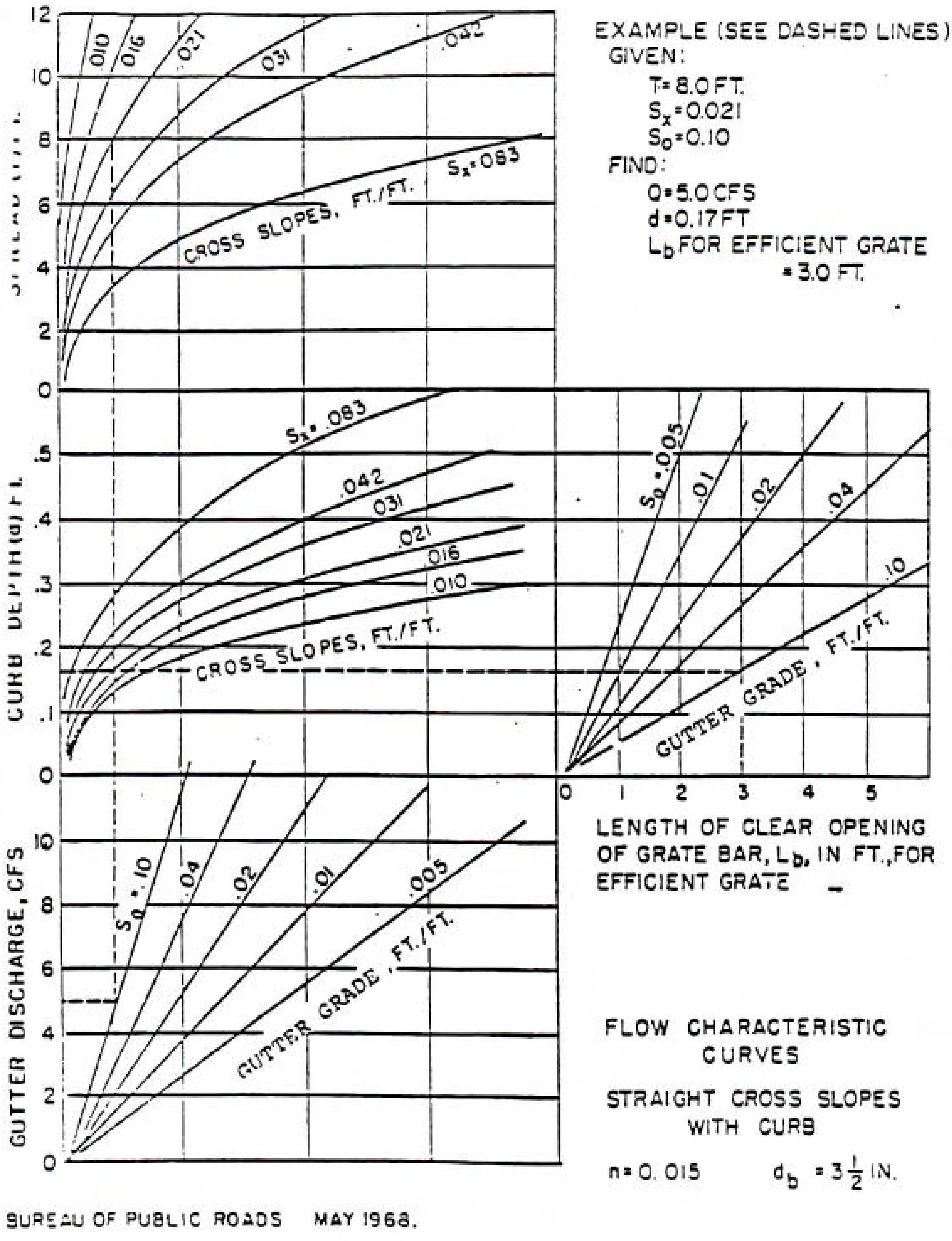
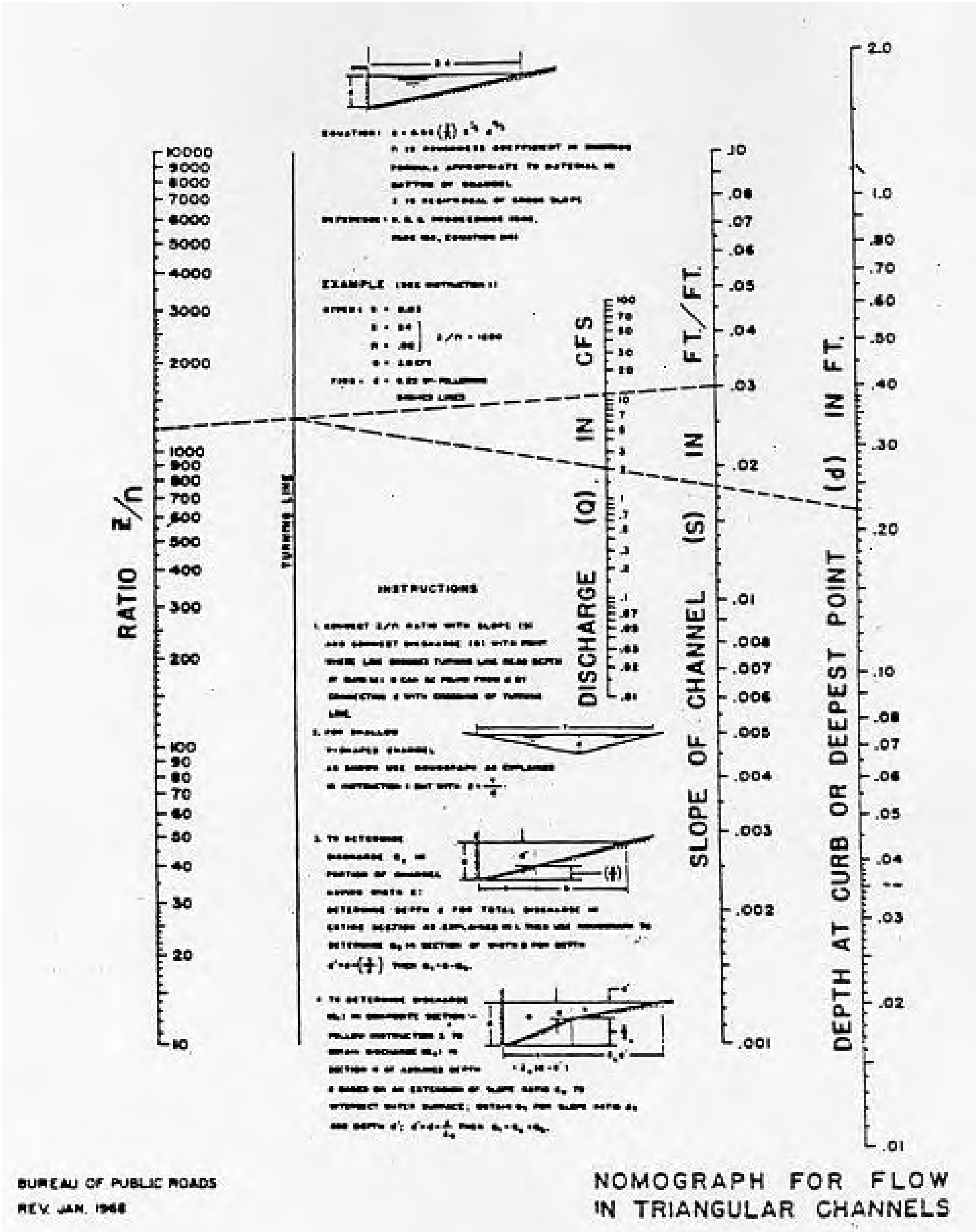
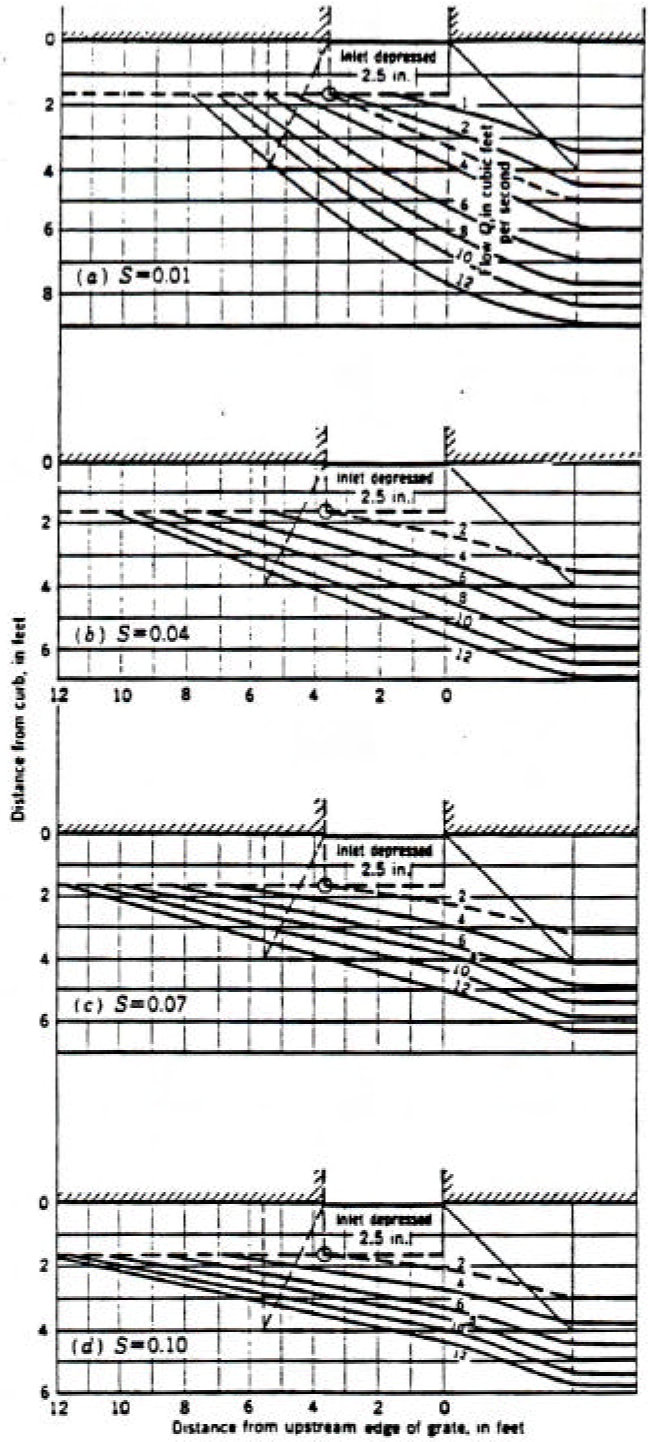

EXAMPLE (SEE DASHED LINES)
GIVEN:
T=8.0 FT.
S_x=0.021
S_0=0.10
FIND:
Q=5.0 CFS
d=0.17 FT
L_b FOR EFFICIENT GRATE =3.0 FT.
CROSS SLOPES, FT./FT.
S_x=.083
.042
.031
.021
.016
.010
CURB DEPTH (d) FT.
GUTTER DISCHARGE, CFS
S_0=.005
.01
.02
.04
.10
GUTTER GRADE, FT./FT.
S_0=.10
LENGTH OF CLEAR OPENING OF GRATE BAR, L_b, IN FT., FOR EFFICIENT GRATE
FLOW CHARACTERISTIC CURVES
STRAIGHT CROSS SLOPES WITH CURB
n=0.015 d_b = $3\frac{1}{2}$ IN.
BUREAU OF PUBLIC ROADS MAY 1968.

CHART 7.7



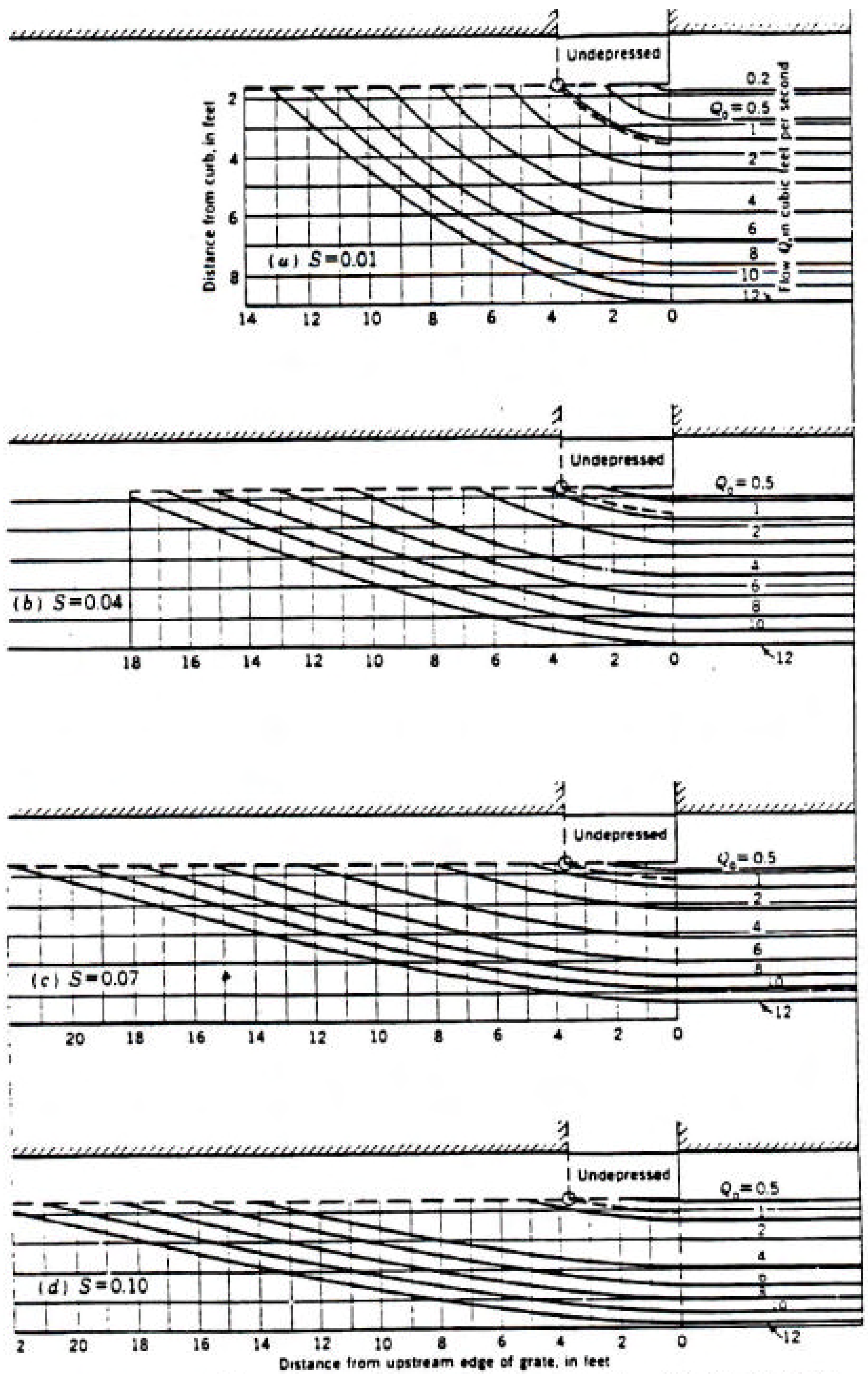
RATIO Z/n
TURNING LINE
EXAMPLE
INSTRUCTIONS
DISCHARGE (Q) IN CFS
SLOPE OF CHANNEL (S) IN FT./FT.
DEPTH AT CURB OR DEEPEST POINT (d) IN FT.
BUREAU OF PUBLIC ROADS
REV. JAN. 1966
NOMOGRAPH FOR FLOW
IN TRIANGULAR CHANNELS

CHART 7.8



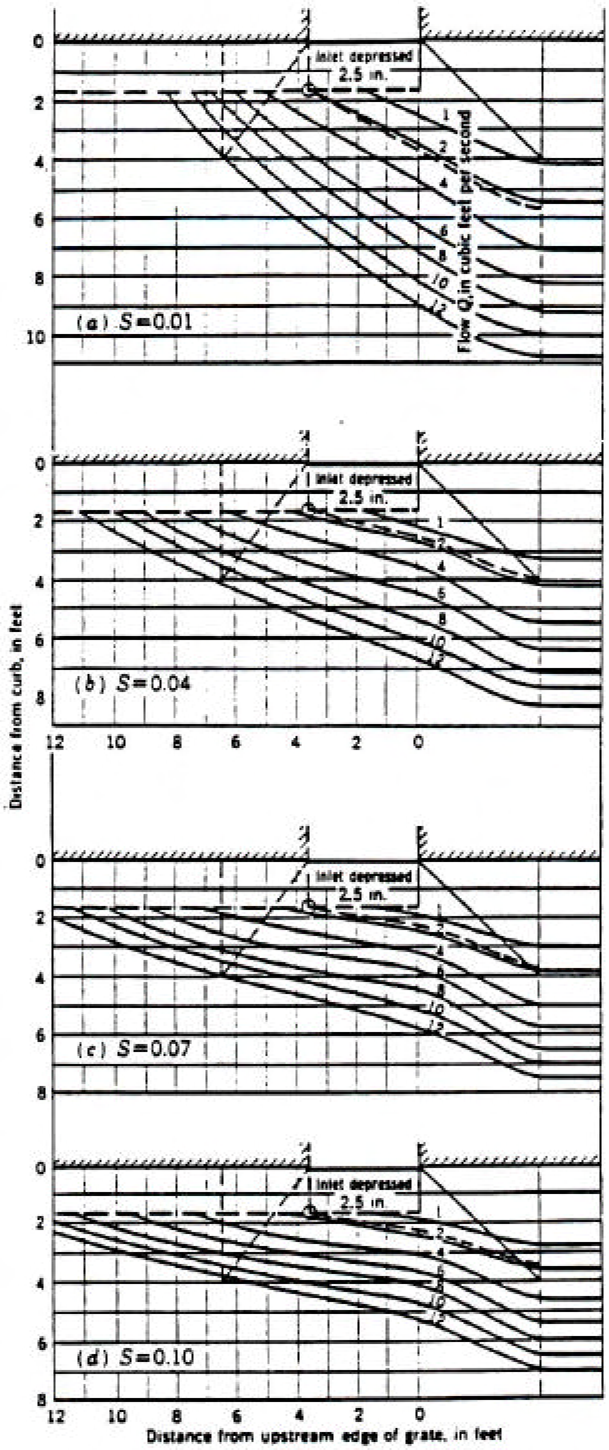
—Flow diagram for simplified method (combination inlets); crown slope, 1:18; n = 0.013; depression, 2.5 in. (6.4 cm) deep and 4 ft wide (1.2 m).

CHART 7.9 A



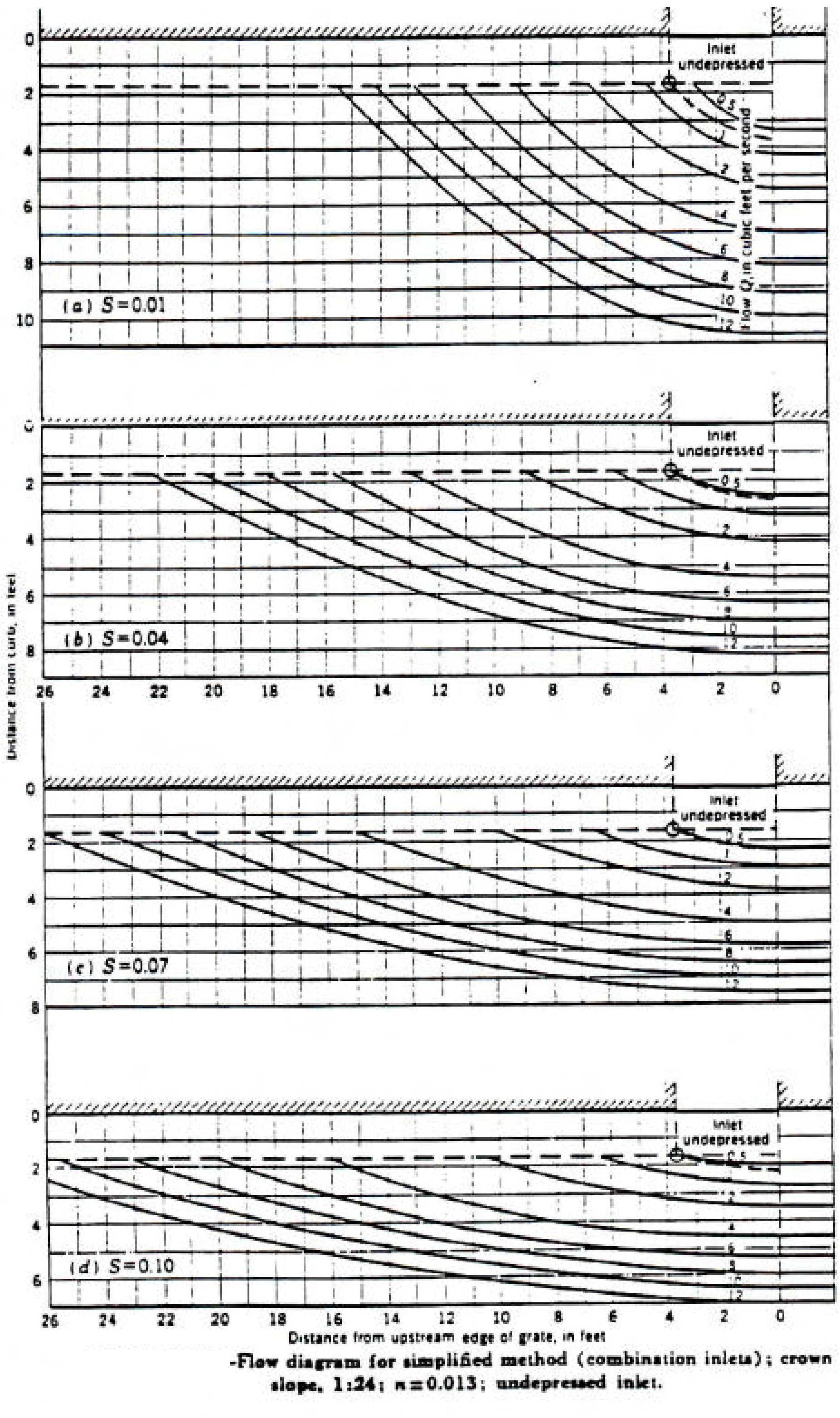
–Flow diagram for simplified method (combination inlets); crown slope, 1:18; n = 0.013; undepressed inlet.

CHART 7.9 B



—Flow diagram for simplified method (combination inlets); crown slope, 1:24; $n = 0.013$; depression, 2.5 in. (6.4 cm) deep and 4 ft wide (1.2 m).

CHART 7.9 C



-**Flow diagram for simplified method (combination inlets); crown slope, 1:24; n=0.013; undepressed inlet.**

CHART 7.9 D

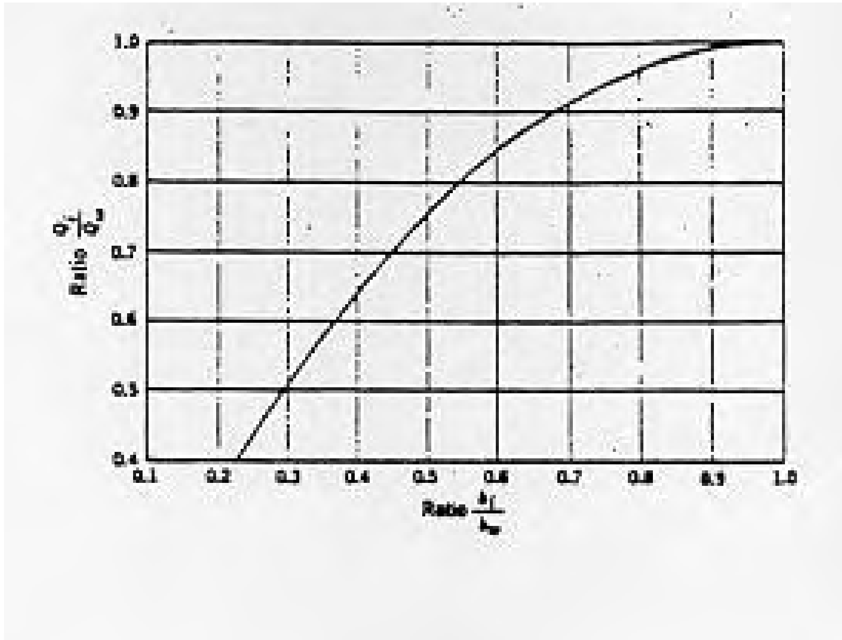


CHART 7.10

CHAPTER 8 - DESIGN OF DETENTION FACILITIES

Urban development activities generally increase volume and rate of runoff from a watershed, and decrease the time of concentration and time lag of the watershed because of increased impervious area in the watershed. These aspects can be seen from typical runoff hydrographs for predevelopment and post development conditions as shown in the figure below. Increased volumes and rates of runoff often intensify flooding problems. To prevent this situation from happening, the developer should provide adequate detention facility that will hold the runoff from the developed area and release water at a rate <u>not</u> in excess of that which prevailed prior to development. Detention facilities act as temporary storage for the excess runoff and release this excess over a period of time after the storm has ceased.

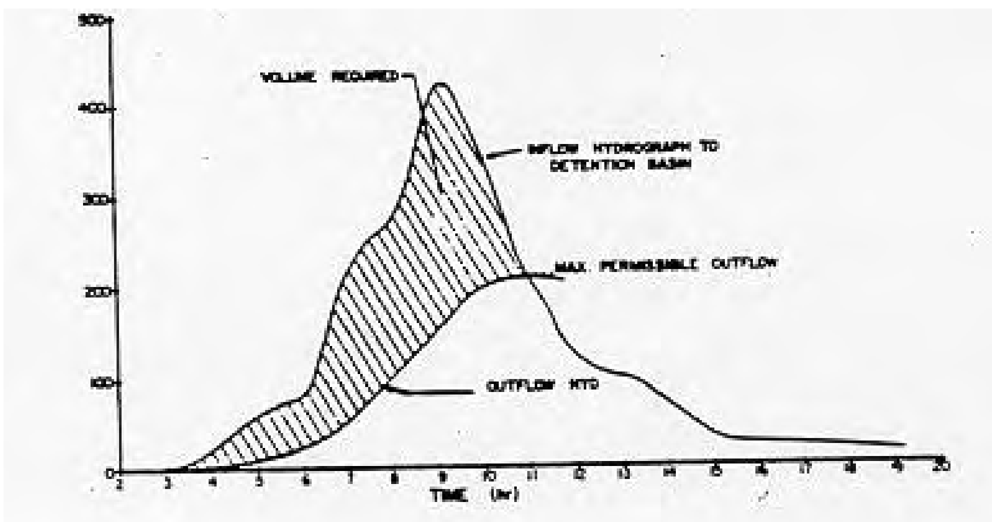


FIGURE 8.1 Required Storage Volume

The size of detention facilities can be determined by measuring the area between the inflow and outflow hydrographs where the inflow hydrograph is the hydrograph for the developed conditions, and the outflow hydrograph corresponds to that for the undeveloped conditions. The area between the two hydrographs gives the required storage volume of the detention pond. In other words, the required storage is computed as the maximum difference between the cumulative inflow and outflow volumes. Knowing the available area of the pond at the site, one can determine the depth of the pond. First it is necessary to see that adequate storage volume is available at the site and this has to be checked with information from topographic maps and actual profile of the pond site. The area and depth for different contour elevations should be determined from this information and a real extent of the pond is the then determined to provide the calculated volume of storage. Second, it is necessary to provide an outlet control device to release runoff at the rate for predevelopment conditions or any other approved allowable release rate. Third, the adequacy of the design of detention facilities and outlet structure facilities should be checked by routing procedure so that the outflow rate shall not exceed the rate which existed from the watershed before development.

The steps involved in the design of detention facilities are:

1. Compute the inflow and outflow hydrographs for the developed and undeveloped conditions for selected rainfall duration and frequency.
2. Determine the storage volume and depth requirements of the facility from the hydrographs.
3. Check if the actual configuration of the detention facility provides the required storage.
4. Decide on the type of outlet controls, and determine their dimensions.
5. Compute depth vs. storage curve for the detention facility and depth vs. discharge curve for the outlet structure.
6. Check the adequacy of the detention facility and the outlet structure by routing the inflow hydrograph. If this outflow hydrograph (or its peak rate) agrees with the hydrograph or its peak rate for the underdeveloped conditions, then the design is adequate. If not select another type of detention facility and outlet control and repeat the routing procedure until the design is adequate.
7. The complete design should be adequate for all storm durations and for all rainfall frequencies of 2, 10 and 25 years; emergency spillways should be provided to carry runoff from a 100 year storm.

Computation of hydrographs can be done using methods given in chapter 4. Selection of the configuration of detention facilities and routing procedure will be given later in this chapter. Some of the commonly used outlet control structures are discussed below.

8.1 <u>OUTLET STRUCTURES</u>

The usual outlet structures for detention facilities include a pipe or culvert, stand-pipes, weir boxes and emergency spillways. Other types of outlet structures will be acceptable if it can be shown that they will adequately regulate the flow from detention facilities.

<u>Pipes or Culverts</u>

Outlet pipes or culverts should be designed as culverts with inlet control instead of
using Manning's equation which assumes uniform flow. The details of the design of culverts in let control can be found in Chapter 6. Pipes smaller than 12" may be analyzed as a submerged orifice if $\frac{HW}{D}$ is greater than 1.5. HD and D are the headwater depth and diameter or pipe. For square-edged entrance condition.

$$Q \;=\; C\,A\sqrt{2_g H} \qquad (8.1)$$

where: Q = discharge in cfs

C = discharge coefficient, usually 0.6

A = area of cross section of pipe in ft^2.

$$= \frac{\pi \quad D^2}{4}$$

D = diameter of pipe in ft

H = head on pipe in feet from the center of pipe to water surface (= HW – 1/2D)

Erosion control practices may be necessary at the downstream and of the outlet pipe depending on the outlet velocity and channel condition.

Standpipes

Perforated vertical pipes or standpipes are used to drain completely a detention facility. The pipes flow into an outflow pipe. The outflow pipe will be of correct size and slope to accommodate the 100-year storm, and sufficient freeboard must be provided above the tope of the standpipe to provide storage. Alternatively, the outflow may be sized to the 25-year storm and a spillway provided for the outflow from the 100-year storm. In any event, control up to the 25-year storm is affected by the elevations and sizes of the holes in the standpipe. Flow rates through these openings can be calculated using Equation 8.1. Assuming C = 0.6, the flow rates calculated using Equation 8.1 are showing in charts 8.1-8.8 from sizes from 6-36 inches in diameter. The size, number, and spacing of holes in the standpipes may be determined by using (Equation 8.1) and knowing the allowable flow rates and basin geometry of the detention facility. Thus the barrel and riser must be sized to insure that the discharge rate is controlled by the orifices in the riser. Where stormwater storage is provided as freeboard storage above an existing lake or pond, the standpipe acts as an overflow. Depending on the depth of storage, the discharge capacity may be determined by analyzing the standpipe as an overflow weir or a submerged orifice. The discharge capacity of submerged orifices can be computed by using Equation 8.1 with h, the head taken as the difference between water surface elevations immediately above and below the orifice.

Weir Flow

Weir boxes (Figure 8.2) made up of concrete or masonry structures are placed at the upstream end of an outlet pipe to control the flow rate. In such a case double protection may be provided by oversizing the outlet pipe to serve as a emergency overflow. The pipe must, however, be designed as a culvert. The discharge capacity of a triangular weir can be calculated using

$$Q = 2.57 \tan \Theta \ H^{5/2} \tag{8.2}$$

where Q = discharge in cfs
H = head in ft
θ = weir half angle

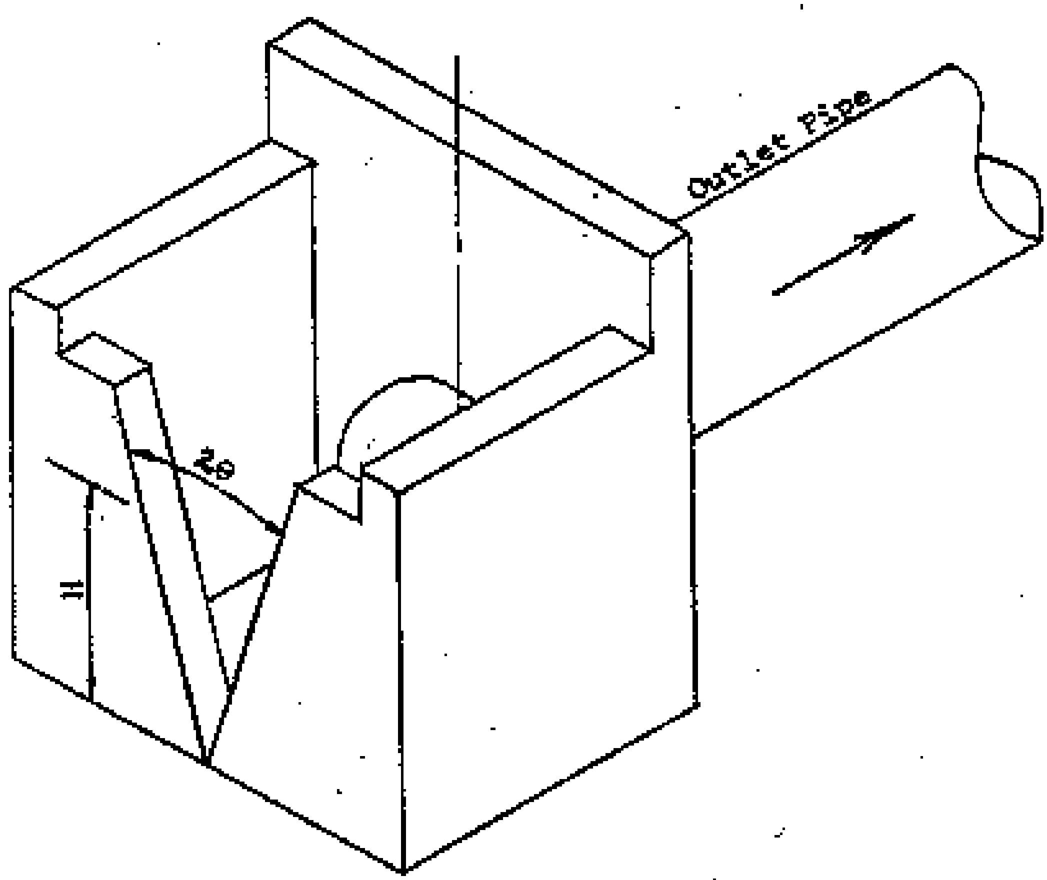


FIGURE 8-2 WEIR BOX

Equation 8.2 can also be used to calculate weir angle (θ), knowing the discharge and head on the weir.

Flow capacity over a sharp crested weir can be calculated using

$$Q = CLR^{3/2} \quad (8.3)$$

where Q = discharge in cfs

C = discharge coefficient, usually taken as 3.3

L = length of weir in ft

H = head above weir in ft

For example the flow over the top edge of the riser is assumed as flow over a sharp crested weir with

$$L = \text{II } D \quad (8.4)$$

where D = diameter of riser in ft

Total flow through the riser is then

$$Q_T = \text{Orifice flow} + \text{Sharp crested weir flow}$$

Flow rate over a broad-crested weir can be calculated using

$$Q = 3.09\, LH^{3/2}$$

where Q = discharge in cfs

L = length of weir

H = head above weir in ft

Emergency Overflow

An emergency overflow shall be provided on all detention facilities to discharge water, should the outlet control structure become clogged or a flood of larger magnitude occur. Emergency overflow can be an overflow channel, an oversized pipe, additional standpipe or a broad-crested weir designed for 100-year storm. Additional details on the design of emergency spillways such as the broad-crested weir are given in Federal Highway Administration's Report FH WA-TS-79.

An emergency spillway can be a broad-crested weir cut through original ground at on end of the embankment with its bottom at an elevation one to two feet above maximum design storage elevation. It is preferable to have a freeboard of 2 feet minimum, but for small detention facilities, an absolute minimum freeboard of 1 foot should be provided. Assuming vertical sidewalls, the discharge through the spillway can be computed using

$$Q = C\ B\ H_p^{\,0.5}$$

where Q = discharge in cfs

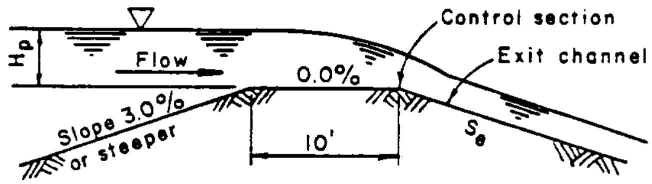
C = discharge coefficient, usually 3.0

B = width of the emergency spillway in feet

Hp = effective head on the spillway in feet.

Critical velocity should be computed to check whether it is within the allowable permissible velocity for the material of the spillway channel (turf or paved). Table 8.1 gives values of discharge, critical velocity and critical slope for various heads.

TABLE 8.1a: EMERGENCY SPILLWAY DESIGN



Side slopes = 2:1
n = 0.04 (Manning's)
Q = Discharge, cfs
V_c = Critical velocity, fps
S_c = Critical slope, %
H_p = Height of pool above emergency spillway control section

One foot is 0.3048m; One cubic foot is 0.0283m^3

Hp, ft.		Spillway Bottom Width, b, feet											
		8	10	12	14	16	18	20	22	24	26	28	30
0.8	Q	14	18	21	24	28	32	35	-	-	-	-	-
	V_c	3.6	3.6	3.6	3.7	3.7	3.7	3.7	-	-	-	-	-
	S_c	3.2	3.2	3.2	3.2	3.1	3.1	3.1					
1.0	Q	22	26	31	36	41	46	51	56	61	66	70	75
	V_c	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.2
	S_c	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
1.2	Q	31	37	44	50	56	63	70	76	82	88	95	101
	V_c	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.6	4.7	4.6	4.6	4.6
	S_c	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6
1.4	Q	40	48	56	65	73	81	90	98	105	113	122	131
	V_c	4.9	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	S_c	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
1.6	Q	51	62	72	82	92	103	113	123	134	145	155	165
	V_c	5.2	5.2	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4
	S_c	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4
1.8	Q	64	76	89	102	115	127	140	152	164	176	188	200
	V_c	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S_c	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3
2.0	Q	78	91	106	122	137	152	167	181	196	211	225	240
	V_c	5.8	5.8	5.8	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	S_c	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

NOTE: For a given H_p, decreasing exit slope from S_c decreases spillway discharge, but increasing exit slope from S_c does not increase discharge.

If a slope (S_e) steeper than S_c is used, velocity (V_e) in the exit channel will increase according to the following relationship:

$$V_e = V_c \left(\frac{S_e}{S_c}\right)^{0.3}$$

8.2 RESERVOIR ROUTING

As mentioned earlier the adequacy of the detention facility and outlet device should be checked by routing the inflow hydrograph (i.e. for post development condition) through the detention facility and its outlet device and verifying whether the routed hydrograph matches the allowable outflow hydrograph (i.e. hydrograph for the undeveloped conditions), particularly in term of peak rate of runoff. The basic routing equation for a reservoir with an unchanging outflow control device is

$$I_1 + I_2 + \left(\frac{2S_1}{t} - O_1\right) = \frac{2S_2}{t} + O_2 \qquad (8.6)$$

where t = a selected increment of time, the routing interval
I_1 = inflow at the beginning of t
O_1 = outflow at the beginning of t
S_1 = storage at the beginning of t
I_2 = inflow at the end of t
O_2 = outflow at the end of t
S_2 = storage at the end of t.

This equation is solved for O at each value of t, knowing the inflow hydrograph (I_1 and I_2) and an additional storage relationship to define S_1 and S_2. This storage relationship depends on the outflow control device. And outflow device is selected and a plot of discharge (O) as a function of depth is prepared. Also a configuration for the detention facility is chosen and a plot of storage (S) as a function of depth is made. From these plots for various depths, a plot is made for $\frac{2S}{t}$ + O vs. O. Further $\frac{2S}{t}$ - O is computed using

$$\frac{2S}{t} - O = \left(\frac{2S}{t} + O\right) - 2\ (O) \qquad (8.7)$$

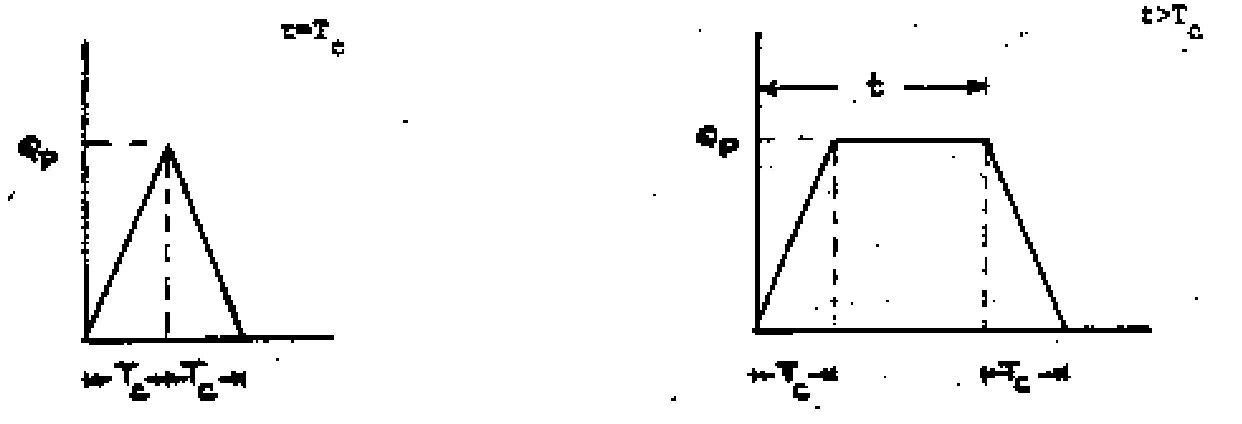
The following tabular computation illustrates the computations involved in the routing of hydrographs. The variables in a particular row of time (t) are taken as variables with subscript 1 and the variables in the previous are taken as variables with subscript 2. At the beginning of computations, the outflow can be assumed to be equal to inflow (I), and $\frac{2S}{t} + O$ is read from the graph corresponding to this value of O. $\left(\frac{2S}{t} - O\right)$ is then computed from Equation 8.7. This finishes the computations for the first value of t. For any other value of t, $(I_1 + I_2)$ is added to $\frac{2S}{t} - O$ from the previous row to get $\frac{2S}{t} + O$. Then O value is entered from $\frac{2S}{t} + O$ vs. O curve. The value of $\frac{2S}{t} - O$ is computed using Equation 8.7 and entered, thus finishing computation for this value of t. These calculations are repeated until the maximum value of O is obtained from this O value and the corresponding $\frac{2S}{t} + O$, the maximum storage (S) can be computed.

The following are the steps involved in reservoir routing:
1. Obtain the inflow hydrograph (I) for the developed conditions and select a routing interval (t)
2. Select the configuration of detention facility and define storage vs. depth (S vs. h) graph
3. Select the outflow control device and define the discharge vs. depth (O vs. h) graph
4. From the S vs. h and O vs. h graphs, define $\frac{2S}{t} + O$ vs. O curve
5. Perform routing calculation as described above.

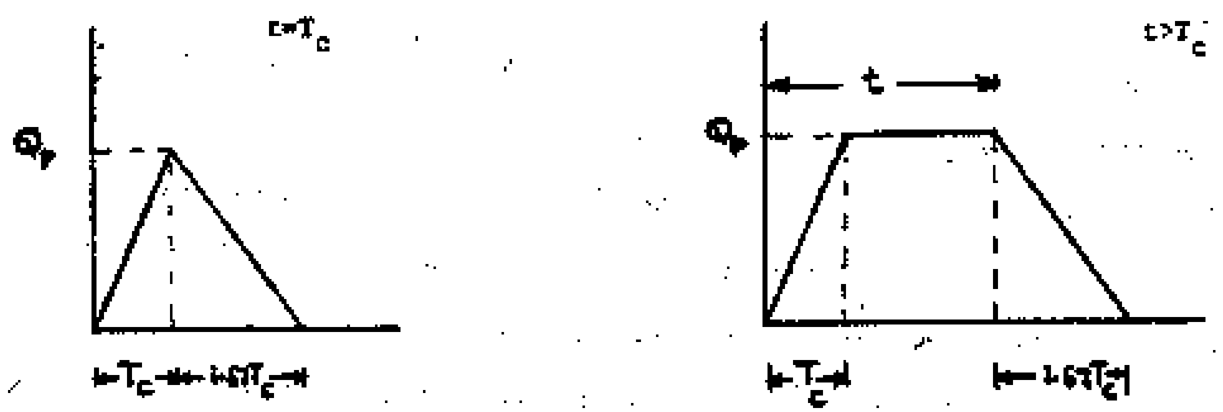
8.2 <u>MODIFIED RATIONAL METHOD</u>

In this method the peak runoff is computed for the underdeveloped and developed conditions using the Rational formula. The storage is computed as the difference between the volume of flow for the two conditions, namely the developed and undeveloped conditions. The volumes of flow can be computed as the area under the corresponding hydrographs. In modified Rational Method approximate hydrographs can be sketched by knowing the peak flow (Q_p), time of concentration (T_c) and storm duration (t). Two possible cases are considered : (1) The rising and recession portions of the hydrographs are both equal to time to peak (T_p) and (2) the rising portion lasts for T_p while the recession portion lasts for 1.67 T_p. The latter assumption is more realistic and has been recommended by the Soil Conservation Service, but it gives larger flow volumes and obviously requires a larger detention basin.

In both cases the time to peak (T_p) is taken as the time of concentration whenever $t \geq T_c$, and taken as t whenever $t < T_c$. Again, depending on the values of t and T_c, the hydrograph can be sketched as a triangle or trapezoid. If $t \leq T_c$, the hydrographs an isosceles triangle with apex equal to the peak flow (Q_p) and a time base equal to 2 T_p, and if $t > T_c$ the hydrograph is a trapezoid with bottom and top widths respectively as $t + T_p$ and $t - T_p$. For the case where the recession period is taken as 1.67 T_p, the time base of triangular hydrograph will be 2.67 T_p, and for the trapezoid it is taken as $t + 1.67\ T_p$. The top width of the trapezoid will be the same as in case 1. With this information the hydrographs can be constructed as shown below.



CASE 1: RECESSION PERIOD = T_c



CASE 2: RECESSION PERIOD = 1.67 T_c

In fact the volume of flow for case 1 will be the same as the flow volume computed in the commonly used Bowstring Method of sizing detention basins. But the Bowstring Method cannot give hydrographs.

Hydrographs are required in sizing the detention basin and outlet devices, especially for watersheds larger than 25 acres in size. Although the sizes of detention basin and outlet devices can be determined by simply computing the storage volume as the difference between the flow volumes for developed and undeveloped conditions, the adequacy of the design has to be examined, if necessary altered, by routing the inflow hydrograph (i.e., hydrograph corresponding to the developed conditions) through the detention facility to obtain the routed outflow hydrograph until the routed hydrographs peak is less than or equal to the peak of the outflow hydrograph (i.e., the hydrograph corresponding to the undeveloped conditions). Routing should be performed for areas greater than 25 acres and the details of routing are given earlier in this chapter. But first, we will give the method for sizing the detention facilities for small areas without the need to perform routing.

The inflow and outflow hydrographs can be constructed for the developed and undeveloped conditions but it is common to use a constant outflow rate from the detention facility, not exceeding the outflow rate for undeveloped conditions. This constant outflow rate is called the allowable maximum release rate (ARR). The procedure can be summarized as follows.

1. Select storm frequency for 25 year and compute peak runoff for the developed and undeveloped conditions using the Rational formula for various storm durations (t)

$$Q_d = C_d \; I \; A$$
$$Q_u = C_u \; I \; A$$

Where: subscripts d and u refer to developed and undeveloped conditions and

Q = peak runoff (cfs)

C_d = runoff coefficient

I = intensity of rainfall in in/hr for the selected frequency and storm duration (t) from Chart 2.1

A = area in acres

2. Sketch the inflow and outflow hydrographs

3. Compute inflow volume

<u>Case 1:</u> <u>recession portion = T_p</u>

$$V_{in} = Q_d t \qquad \text{for all t} \tag{8.10}$$

where V_{in} = inflow volume in ft^3

t = storm duration in seconds

Case 2: recession portion $= 1.67\ T_p$ (8.11)

$$V_{in} = 1.34\ Q_d t \qquad \text{for } t \leq T_c \qquad (8.12)$$
$$V_{in} = Q_d t + 0.34\ Q_p T_c \qquad \text{for } t > T_c$$

where T_c = time of concentration in seconds.

4. Compute outflow volume

$$V_{out} = Q_u t \qquad \text{for all } t \qquad (8.13)$$

5. Determine the storage as the difference between the inflow and outflow volume. Either tabular or graphical method can be used.

6. Repeat steps 2 – 4 for various t values and select the maximum storage. Either tabular or graphical method can be used.

7. Choose the detention facility at the site and determine its area. Also determine the depth of storage by dividing the maximum storage by the area of the detention facility.

8. Design a suitable outlet (pipe, weir, vertical riser, etc.) to carry the allowable release rate (Q_u) at a head equal to the computed depth of storage.

EXAMPLE 8.1

Determine the size of detention basin and outlet control device for a watershed of 200 acre area for a 25 year storm. The following data is available

Length of watershed = 3000 ft. Difference in elevation = 60 ft.

Land use before development		Land use after development	
Woodland	175 acre	Single family residential	180 acre
Cemetery	16 acre	Apartments	10 acre
Derelict buggy Whip factory	6 acre	Streets	10 acre
Abandoned Drive-in movie	3 acre		

SOLUTION

Since the drainage area is greater than 25 acres, we need to use the routing procedure for the design of detention basin. However for the purposes of illustration, we will use the Modified Rational Method without a routing procedure.

$$\text{Average basin slope} = \frac{60 \quad \text{ft}}{3000 \quad \text{ft}} = 0.02 = 2\%$$

Weighted C for undeveloped Conditions c_u =

$$= \frac{175(0.2) + 16(0.25) + 6(0.88) + 3(0.90)}{200} = .233$$

$$\text{Weighted C for developed Conditions} = \frac{180(0.4) + 10(0.6) + 10(0.95)}{200}$$

$$C_d = 0.438$$

From Chart 2.4, T_c = 17 min

Alternatively, assuming a velocity of overland flow to be 2 ft/sec.

$$T_c \quad \frac{3000 \text{ ft}}{2 \text{ ft}/\text{sec}} = 1500 \text{ sec} = 25 \text{ min}$$

But will use the more conservation 17 min.

From Chart 2.1, I = 5.7 in/hr for T_c = 17 min for 25 year storm

Before development:

$$Q_u = C_u \; I \; A$$

$$= (0.233) \; (5.7) \; (200) = 265.62 \text{ cfs}$$

After development

$$Q_d = C_d \; I \; A$$

$$= (0.438) \; (5.7) \; (200) = 499.32 \text{ cfs}$$

Tabulate the volumes of inflow and outflows for various time of concentration. The outflow rate remains constant

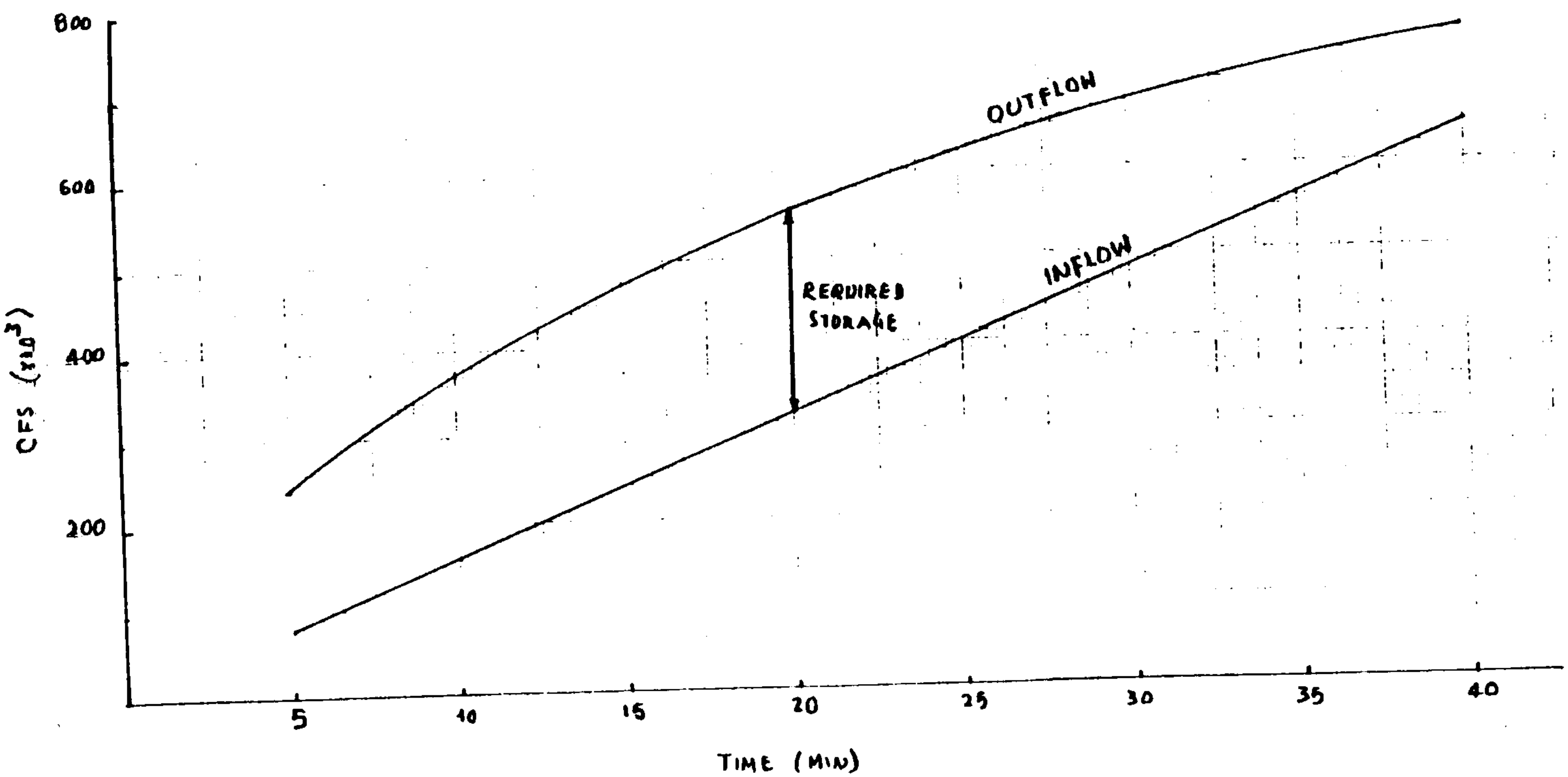
$$C_d = 0.438$$

$T = t_c$ (Min)	T (sec)	I_{25} (in/hr)	$Q_d = C_d I_{25} A$ (cfs)	Inflow Vol. $= Q_d t$ (ft.^{3})	Outflow Vol $= Q_u t$ (ft.^{3})	Storage (ft.^{3})
5	300	9.1	797.16	239148	79686	159462
10	600	7.1	621.96	373176	159372	213804
15	900	6.0	525.6	473040	239058	233982
17	1020	5.7	499.32	509306	270932	238374
20	1200	5.3	464.28	557136	318744	238393
30	1800	4.3	376.68	678024	478116	199908
40	2400	3.6	315.36	756864	637488	119376

From this table or from plot shown on page 179 the required maximum storage is 238892 ft^3 at T_c = 20 min.

A triangular weir box is selected to restrict the outflow to 265.62 cfs for the 25 year storm.

EXAMPLE 8.1



800
600
400
200
CFS ($\times 10^3$)
OUTFLOW
INFLOW
REQUIRED STORAGE
5
10
15
20
25
30
35
40
TIME (MIN)

$$Q_u = 2.57 \tan(\theta) \quad H^{5/2}$$

Assuming $\theta = 45^o$ (half angle of opening)

Given H = 6.4 ft

The configuration of the detention basin should be chosen to ensure that at least the design amount of storage will be achieved at a depth of 6.4 ft. Since the rate of runoff should not be increased under any storm a least the 2-year, 5-year and 10-year storms should be checked. Only the 10-year storm will be verified here to illustrate the procedure.

For the 10-year storm, I = 4.3 in/hr for T_c = 17 min

$$Q_u = C_u \; I \; A = 0.233 \; (4.3) \; (200) = 200.38 \text{ cfs}$$

Again tabulate as below:

$$C_d = 0.438$$

$T = t_c$ (Min)	T (sec)	I_5 (in/hr)	$Q_d = C_d I_{25} A$ (cfs)	Inflow Vol. $= Q_d t$ (ft.^{3})	Outflow Vol $= Q_u t$ (ft.^{3})	Storage (ft.^{3})
5	300	6.7	586.92	17 076	60114	115962
10	600	5.3	464.28	278568	120228	158340
15	900	4.5	394.2	354780	180342	174438
17*	1020	4.3	376.68	384214	204388	179826*
20	1200	3.9	341.64	409968	240456	169512
30	1800	3.2	280.32	504576	360684	143892
60	3600	2.1	183.96	662256	721368	-

From this table or plot the required storage is 179826 ft^3 at T_c = 17 min.
Again the head on the weir is

$$Q_u = 200.38 = 2.57 \tan(\theta) \quad H^{5/2}$$

Gives H = 5.7 ft

Thus for 10-year storm the storage required is 179,826 ft^3 at a depth of 5.7 ft.
These calculations should be repeated for 2- and 5-year storms and the largest storage and corresponding depth should be selected. Finally, the outflow pipe from the weir box should be

large enough to carry the developed runoff from the 100-year storm. For T_c = 17 min, I_{100} = 7.0 in/hr, thus

$$Q_d = C_d I_{100} A = 0.438 \times 7.0 \times 200 = 613 \text{ cfs}$$

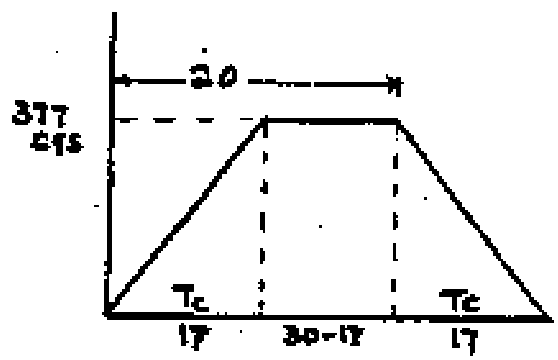
If a concrete pipe with Manning's n = 0.013 at 2% is chosen it's diameter will be 72". A plain corrugated metal pipe at 2% and n = 0.021 should be 84" in diameter (from Chart 2.4).

Computation of Hydrograph

The adequacy of the detention basin and outlet structures can be checked by routing inflow hydrographs. This is particularly required if the drainage area is greater than 25 acres. Reservoir routing procedure discussed in Sec. 8.2 is usually employed.

Case 1: Recession Portion is Equal to T_p

The above analysis of detention basin design pertains to Case 1 as discussed earlier. The inflow hydrograph can be constructed as an isosceles triangle with peak equal to the peak flow for the developed conditions computed using the Rational formula and a time base equal to 2 T_c whenever t $\leq$ T_c and as a trapezoid with peak flow as above and top and bottom widths as (t - T_c) respectively whenever t > T_c. For the above example, for t = 20 minutes, T_c = 17 min, Q_p = 377 cfs we can get the inflow hydrograph as shown below.



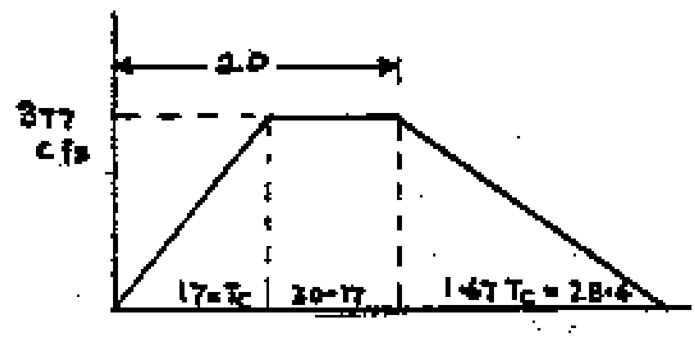
Inflow volumes are computed using Equation 8.10.

The above inflow hydrograph is then routed through the detention facility to check whether the peak of the routed hydrograph is less than or equal to the peak flow for undeveloped conditions. Routing should be performed using hydrographs for various T values, t = 5, t = 10, t = 15, t = 20, t = 40, t = 60 min, etc. Examples on routing are included later in this chapter.

Case 2: Recession Portion is Equal to 1.67 T_p

EXAMPLE 8.2

Another way of constructing the inflow hydrograph is to take the time base as 2.67 T_c for triangular (for $T \leq T_c$) and $T = 1.67\ T_c$ trapezoidal (for $t > T_c$) hydrographs. Such hydrographs assume a rising portion of the hydrographs for T_c minutes and recession portion for 167 T_c . For the above example, for t = 20 min, T_c = 17min, the inflow hydrograph is constructed as below.



The difference between this hydrograph and the previous hydrograph is that the recession portion is T_c in the previous hydrograph and 1.67 T_c in this hydrograph.

The volume of flow is the area under the hydrograph and is computed using equations 8.12.

Applying this procedure for the above problem the storage required for the detention basin can be calculated as follows.

t (Min) (1)	t (sec) (2)	Q_d (cfs) (3)	Vin (ft.^{3}) (4)	Vout (ft.^{3}) (5)	Storage (ft.^{3}) (6)
5	300	797.16	320458	79686	240772
10	600	621.96	499982	159372	340610
15	900	526.60	633874	239058	394816
17*	1020	499.32	682470	270932	411538*
20	1200	464.28	718148	318744	399404
30	1800	376.68	808657	478116	330541
40	2400	315.36	866231	637488	228743

Columns 1, 2, 3, and 5 are the same as in the previous Table. Entries in column 4 are obtained by using equations 8.11 or 8.12 depending on whether $t < T_c$ or $t > T_c$. The required storage is computed in column 6 and is 411538 ft^3 at t = 17 minutes. This volume is 73% greater than the storage obtained by part (a) where the recession portion was assumed to be equal to time to peak. As in Case 1, inflow hydrograph should be constructed for various t values and routed to adequately design the detention facility.

8.4 LAG AND ROUTE METHOD

In this method (Izzard, 1946) the watershed is assumed to have separable lag and storage effects. The lagging effect is considered by using Muskingum routing on the inflow hydrograph determined by a version of Rational Method. The storage effect is considered by reservoir routing the lagged hydrograph obtained from Muskingum routing. This method has been adopted by the Denver Council of Governments. The details of Muskingum and reservoir routing procedure can be found in Lindley, Kohler and Paulhus (1974). An example will be given to illustrate the steps and computations involved in the lag and routing method.

EXAMPLE 8.3

Design a detention facility with outlet control device for a watershed with the following data.

Runoff Coefficient before development (c_u) = 0.233

Runoff Coefficient after development (c_d) = 0.438

Average ground slope of overland flow (S) - 0.04

Average Overland flow distance (L) = 1450 ft

Length of main stream = 3000

Area of the watershed = 200 acres

a. Inflow Hydrograph

Compute the overland flow time (T_e) using Izzard formula

$$t_e = \frac{41\,c\,L^{1/3}}{\left(c_d I\right)^{2/3} S^{1/3}} \qquad \text{(Equation 2.4)}$$

$$= \frac{41\,(0.04)\,(1450)^{1/3}}{(0.438)^{2/3} I^{2/3}\,(0.04)^{1/3}} = \frac{88}{I^{2/3}}$$

This equation is solved by trial and error, using the 25-year storm of Chart 2.1.

I	$I^{2/3}$	t
3.4	2.6	39
3.6	2.35	37
3.8	2.47	36

Then $I = 3.6$ in/hr, $t_e = 37$ min is the correct value. Note the overland flow time can also be computed by using alternative methods given in Chapter 2.

Manning's formula applied to the stream cross-section and slope gives the velocity of steam flow (V) as 3 ft/sec.

Since the length of the stream is 3000 ft., the travel time (t_t) of the stream flow is then

$$t_t = \frac{3000}{3} = 1000 \text{ sec} = 17 \text{ min}$$

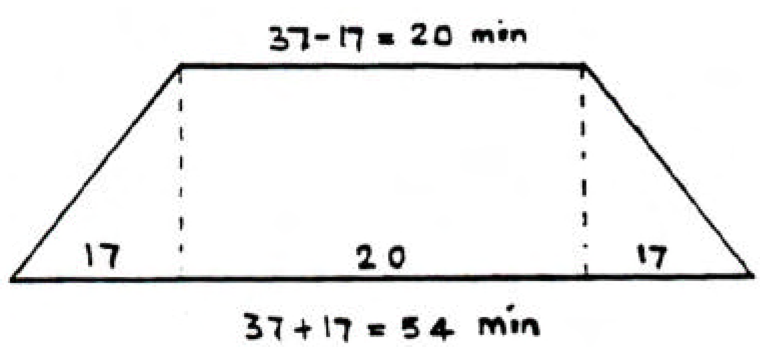
We will now construct a hydrograph as an isosceles triangle of base width t_e if t_t t_e or a trapezoid of base $t_e + t_t$ and top width $t_e - t_t$ whenever $t_t < t_e$. The area under this hydrograph gives the volume of flow.

The peak flow is computed using Rational formula. In this case

$$Q = 0.438 \times 3.6 \frac{\text{in}}{\text{hr}} \times 200 \text{ acres} = \text{acres} = 316 \text{ cfs}$$

$$\text{Volume} = 316 \text{ cfs} \times 37 \times 60 \text{ sec} = 701520 \text{ ft}^3$$

The hydrograph is shown below



b. Lagged Inflow Hydrograph

The lagging effect of the watershed will be considered by Muskingum Method routing with K taken as the lag time and a routing interval (t) of 5 minutes. Thus K = 17 min, t = 5 min. The lagged hydrograph can be found using

$$O2 = C_0 I_1 + C_1 I_2 + C_2 O_1 \qquad (8.14)$$

where $C_o = C_1 = \dfrac{0.5t}{K + 0.5t} = \dfrac{2.5}{19.5} = 0.128$

$$C_2 = \frac{K - 0.5t}{K + 0.5t} = \frac{17 - 2.5}{17 + 2.5} = .744$$

I_1 and I_2 are inflow hydrograph ordinates at the beginning and end of time interval t. The routed hydrograph is computed as shown in the following Table. The values of inflow ordinates (I) are obtained from the inflow hydrograph computed above in Step (a) for various time intervals (Col. 1) and are entered in Column 2.

For example t=5 min, I = $\dfrac{316}{17}$ x 5 = 93 cfs

The values of I and O on any current line are taken as I_2 and O_2 while those on the previous line are taken as I_1 and O_1. Thus for the second line (t = 5), I_2 = 93, I_1 = O, O_1 = 0.0, and O_2 is computed using equation 8.14 as 12. These calculations are repeated until the outflow hydrograph (O) reaches a maximum and starts decreasing. The last column is the lagged inflow hydrograph.

t, min.	I, cfs	C_0I_2	C_1I_1	C_2O_1	O
0	0	0	0	0	0
5	94	12	0	0	12
10	188	24	12	9	45
15	281	36	24	33	93
20	318	41	36	69	146
25	318	41	41	109	191
30	318	41	41	142	224
35	318	41	41	167	249
40	261	34	41	185	260
45	167	21	34	194	249
50	73	9	21	185	215
55	0	0	9	160	169
60	0	0	0	119	119
65	0	0	0	89	89
70	0	0	0	66	66

c. Allowable release rate

Allowable outflow from the basin will be computed using the Rational formula and the same intensity of rainfall as was used in computing the inflow hydrograph.

$O = 0.233 \times 3.6 \times 200 = 167$ cfs

A rough estimate of storage can be found using

$S = 2$ (maximum O_d - maximum O_u) x t_e (in sec)

$= 2\,(260 - 167) \times 37 \times 60 = 413{,}000\ ft^3$

d. Configuration and size of detention facility and outlet structure

If a V - notch weir box is chosen to control the flow, with the V-notch angle $= 2\theta = 30^o$, then

$Q = 2.57 \tan \theta \times H^{5/2} = 0.688\, d^{5/2} = 167$ cfs

$\therefore d = 9.0$ ft

Average dimensions for a rectangular retention basin may be found, taking the length, L as twice the width, w:

$$L = 2w$$

$$413{,}000 = 9 \times 2w \times w$$

$$w = 151$$

and our first try will be a basin measuring 150 ft. by 300 ft. at midway of maximum depth, say at d = 4. Side slopes of 2:1 will make the bottom dimensions 134 ft by 284 ft.

e. Final Outflow Hydrograph By Reservoir Routing

1. For the selected detention facility, obtain depth vs. storage curve.

d, ft.	L, ft.	w, ft.	Area, ft^2 x 10^{-4}	Av Area, ft^2 x 10^{-4}	S, ft^2 x 10^{-4}	S, ft^3 x 10^{-4}
0	284	134	3.81	0	0	
1	288	138	3.97	3.89	3.89	3.89
2	292	142	4.51	4.06	4.06	7.95
3	296	146	4.32	4.24	4.24	12.19
4	300	150	4.50	4.41	4.41	16.60
5	304	154	4.68	4.59	4.59	21.19
6	308	158	4.87	4.78	4.78	25.97
			Area, ft^2	Av Area, ft^2	S, ft^2	S, ft^3

d, ft.	L, ft.	w, ft.	$x\ 10^{-4}$	$x\ 10^{-4}$	$x\ 10^{-4}$	$x\ 10^{-4}$
7	312	162	5.05	4.96	4.96	30.93
8	316	166	5.25	5.15	5.15	36.08
9	320	170	5.44	5.34	5.34	41.42
10	324	174	5.64	5.54	5.54	46.96

2. For the selected outlet control device, obtain depth vs. discharge curve.

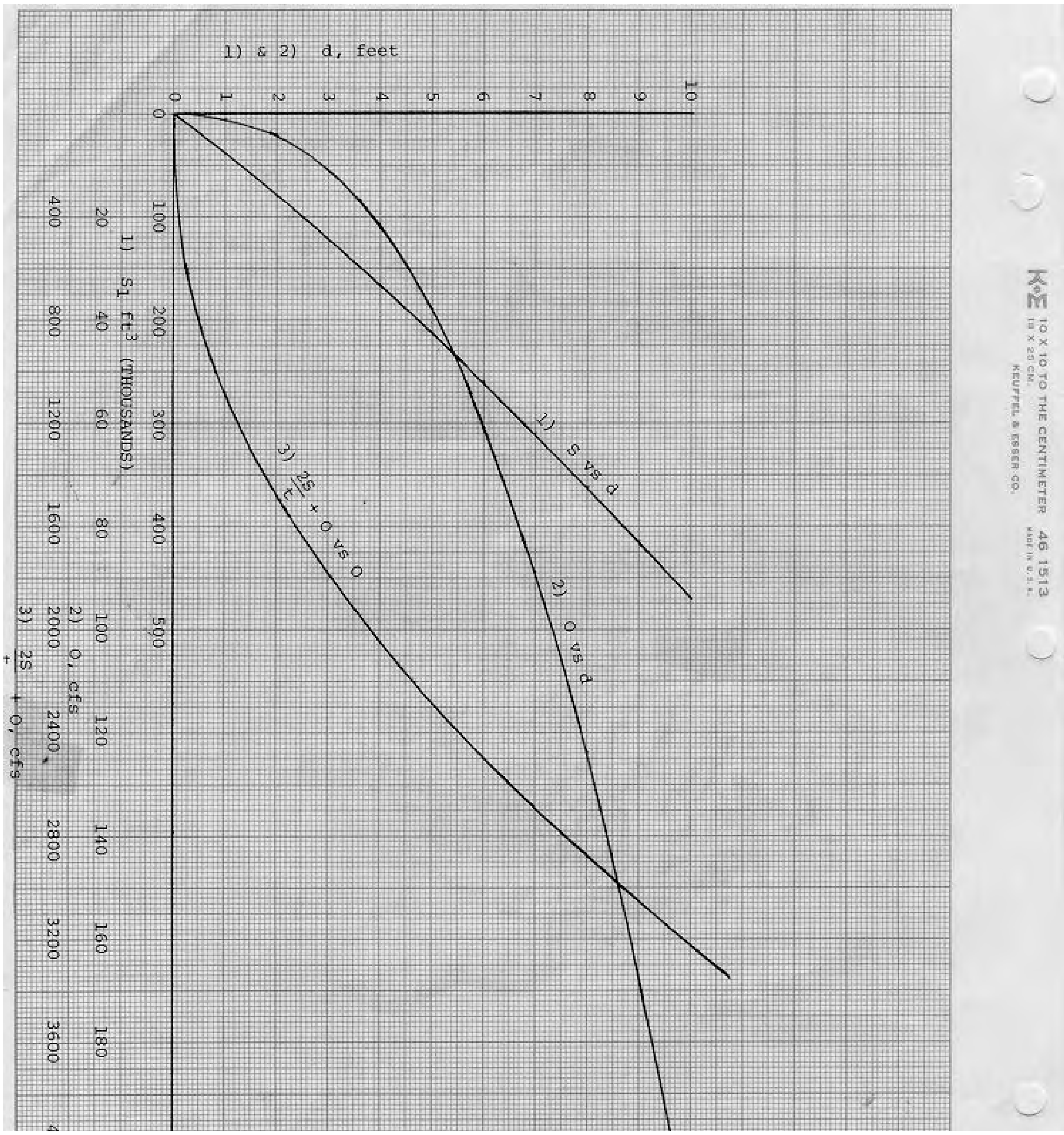
For the V-notch weir, tabulate the flow Q, or O, for various values of d, depth, from the equation $O = .688d^{5/2}$

d, ft.	d 5/2	O, cfs
1	1	.69
2	5.66	3.89
3	15.60	10.72
4	32.00	22.00
5	56.00	38.50
6	88.20	60.00
7	129.60	89.00
8	181.00	124.20
9	243.00	167.00
10	316.00	217.00

Obtain $\frac{2S}{t} + O$ vs. O curve.

O and S are plotted as function of d. From O vs. S curves, or from the tabulations, values of S and O corresponding, in each case, to the same depth are found, and $\frac{2S}{t} + O$ is then calculated, using the selected routing interval, 300 sec. $\frac{2S}{t} + O$ is plotted as a function of O.

d, ft.	$S, ft^3 \times 10^{-4}$	$\frac{2S}{t}$, cfs	O, cfs	$\frac{2S}{t} + O$, cfs
1	3.89	259	1	260
2	7.95	530	4	534
3	12.19	813	11	824
4	16.60	1107	22	1129
5	21.19	1413	38	1451
6	25.97	1731	61	1792
7	30.93	2062	89	2151
8	36.08	2405	124	2529
9	41.42	2761	167	2928
10	46.96	3131	217	3348


1) & 2) d, feet
1) S vs d
2) O vs d
3) 2S/t + O vs O
1) S, ft³ (THOUSANDS)
2) O, cfs
3) 2S/t + O, cfs
K+E 10 X 10 TO THE CENTIMETER 46 1513
KEUFFEL & ESSER CO.

$\frac{2S}{t}$ + O is plotted as a function of O

2. Perform reservoir routing

From this last curve, the routing equation

$I_1 + I_2 + \left(\frac{2S_1}{t} - O_1 \right) + \frac{2S_2}{t} + O_2$ is solved as follows:

At the beginning, there is no inflow, outflow, or storage. Thus, at time zero, all columns are zero. For the second line I_1 = zero, I_2 = 12, $\frac{2S_1}{t} + O_1$ = O, therefore $\frac{2S_2}{t} + O_2$ = 12. From the curve, at $\frac{2S_2}{t} + O_2$ = 12, the value of O_2 is zero. Then $\frac{2S_2}{t} - O_2 = \frac{2S_2}{t} + O_2 - 2(O_2)$ = 12. In advancing a line, all the subscripts are reduced by 1. I1 is now 1_2, I_2 is 45, $\frac{2S_1}{t} - O_1$ is 12.

Adding these, $\frac{2S_2}{t} + O_2$ equals 12+45+12 = 69. Again from the curve, for $\frac{2S_2}{t} + O_2$ equals 69, O_2 is still zero, and $\frac{2S_2}{t} - O_2$ equals 69 minus (2 times zero) = 69. The process continues until zero reaches a maximum and begins to decrease. Not that the first column below is the first column of the tabulation from the Muskingum routing operation for the inflow hydrograph and that the second column is the final column of that tabulation, except that the outflow from the drainage basin has become inflow to detention basin.

t, min.	I, cfs	$\frac{2S}{t}$ - O, cfs	$\frac{2S}{t}$ + O, cfs	O, cfs
0	0	0	0	0
5	12	12	12	0
10	45	69	69	0
15	93	205	207	1
20	146	438	444	3
25	191	755	775	10
30	224	1122	1170	24
35	249	1501	1595	47
40	260	1856	2010	77
45	249	2149	2365	108
50	215	2349	2613	132
55	169	2445	2733	144
60	119	2445	2733	144
65	89		2653	135

The maximum storage may b found at maximum outflow, 0 = 144:

$$\frac{2S}{t} + 0 = 2733 \text{ and also } \frac{2S}{t} = 0 = \frac{2S}{300} + 144$$

$$\frac{2S}{300} + 144 = 2733, \text{ from which } S = 388{,}000 \text{ ft}^3$$

Since the allowable outflow is 167 cfs, it would appear that a smaller basin might be selected, and thus greater economy might be obtained. However, first the chosen basin and outflow device will be tested for the 5-year and 10-year frequency storms. The procedure is identical to the above, and will be followed without comment.

First, the 5-year storm:

$t_e = \frac{88}{I^{2/3}}$, as before, and fitting the possible solutions t the 5-year return period curve of Chart 2.1, we find

I = 2.4 in/hr, at t_e = 49 min.
Allowable outflow O = .233 x 2.4 x 200 = 112 cfs
Peak rate and total volume of developed flow
Peak: Q = .438 x 2.4 x 200 = 211 cfs
Volume: Q = 211cfs * (49 x 60 sec) = 620340 ft^3.

c_0, c_1, and c_2 remain the same: .128, .128, and .744

t .	I	C_0I_2	C_1I_1	C_2O_1	O
5	62	8	0	0	8
10	124	16	8	6	30
15	187	24	16	22	62
20	212	27	24	46	97
25	212	27	27	72	126
30	212	27	27	94	148
35	212	27	27	110	164
40	212	27	27	122	176
45	212	27	27	131	185
50	200	26	27	138	191
55	137	18	26	142	186
60	75	10	18	138	166
65	12	2	10	124	136
70	0	0	2	101	103
75	0	0	0	77	77
80	0	0	0	57	57

Since the retention basin and its weir outflow device have not changed, the same curve of $\frac{2S}{t}$ + 0 vs. 0 may be used to route the developed runoff through the reservoir, and the tabulation proceeds directly. Note again that the 0 which is the right-hand column of the routing to establish the inflow hydrograph becomes I in the second column of the routing operation through the retention basin. That is, the output of the runoff from the site becomes the input to the basin, as before.

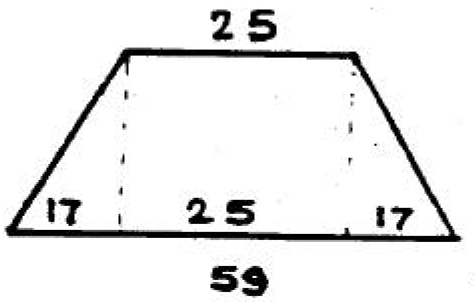
t	I	$\frac{2S}{t}$ - O, cfs	$\frac{2S}{t}$ + O, cfs	O, cfs
0	0	0	0	0
5	8	8	8	0
10	30	46	46	0
15	62	136	138	1
20	97	291	295	2
25	126	506	514	4
30	148	760	780	10
35	164	1032	1072	30
40	176	1304	1372	34
45	185	1563	1665	51
50	191	1795	1939	72
55	186	1992	2172	90
60	166	2132	2344	106
65	136	2206	2434	114
70	103	2217	2445	114
75	77		2397	

Storage S = 150 (2445 – 114) = 350,000 cfs

If + 2% is considered to be an acceptable limit for the outflow, the configuration may be retained. However, the basin should certainly not be made smaller. It remains to check the 10-year flow.

For the 10-Year storm, the equation $t_e = \frac{88}{I^{1/2}}$, solved by trial on the 10-year return period curve leads to values of I = 3.0 in/hr and t_e = 42 min

Allowable outflow 0 = .233 x 3.0 x 200 = 140 cfs
Peak rate and total volume of develop flow
Peak: Q = .438 x 3.0 x 200 = 263 cfs
Volume: Q = .263 x (42 x 60 sec) = 662760 ft3.



t	I	$\frac{2S}{t}$ - O, cfs		$\frac{2S}{t}$ + O, cfs	O, cfs
5	78	10	0	0	10
0	155	20	10	7	37
15	234	30	20	28	78
20	265	34	30	58	122
25	265	34	34	91	159
30	265	34	34	118	186
35	265	34	34	138	206
40	265	34	34	154	222
45	218	28	34	165	227
50	140	18	28	169	215
55	62	8	18	160	186
60	0	0	8	138	146
65	0	0	0	109	109
70	0	0	0	81	81
75	0	0	0	60	60

Referring once again to the $\frac{2S}{t}$ + 0 curve, we perform the final routing operation.

t	I	$\frac{2S}{t}$ - O, cfs	$\frac{2S}{t}$ + O, cfs	O, cfs
0	0	0	0	0
5	10	10	10	0
10	37	57	57	0
15	78	172	172	
20	122	368	372	2
25	159	635	649	7
30	186	948	980	16
35	206	1276	1340	32
40	222	1596	1704	54
45	227	1885	2045	80
50	215	2119	2327	104
55	186	2276	2520	122
60	146	2346	2608	131
65	109	2341	2601	130
70	81	2217	2531	
75	60			

Storage S = 150 (2608 - 131) = 372,000

Thus, because the outflows determined to be allowable are not exceeded beyond permissible amounts, the retention basin as selected is acceptable.

An alternative method of outflow control would be a group of pipes of proper size, slope and elevation above bottom grade of the detention basin to achieve the required outflow rate.

Still another, and simpler, method which will be discussed in some detail is a perforated vertical pipe or standpipe flowing into an outflow pipe. The outflow pipe will be of correct size and slope to accommodate the 100-year storm -- and sufficient free board must be provided above the top of the standpipe to provide storage. Alternatively, the outflow may be sized for the 25-year storm and a spillway provided for the outflow from the 100-year storm.

In any event, control up to the 25-year storm is effected by the elevations and sizes of the holes in the standpipe. If, the equation for discharge, 0, from an orifice,

$$0 = CA \times \sqrt{2gh}$$

the coefficient C is taken to be 0.6, the resulting flows from orifices varying in size from 6 inches to 36 inches in diameter will be shown in the Charts in 8.1 – 8.4.

Then, in the example previously cited, a pipe arrangement which will closely approximate the discharge from the V-notch weir box with $2\theta = 30^o$, may be selected as follows:

Vertical standpipe: 48” dia. (Note: the head required to pass the 100-year flow over a weir π x 48” long should be checked against available free board).

If y is the dimension from bottom of standpipe to centerline of hole, and D is hole diameter, then the hole arrangement may be tabulated:

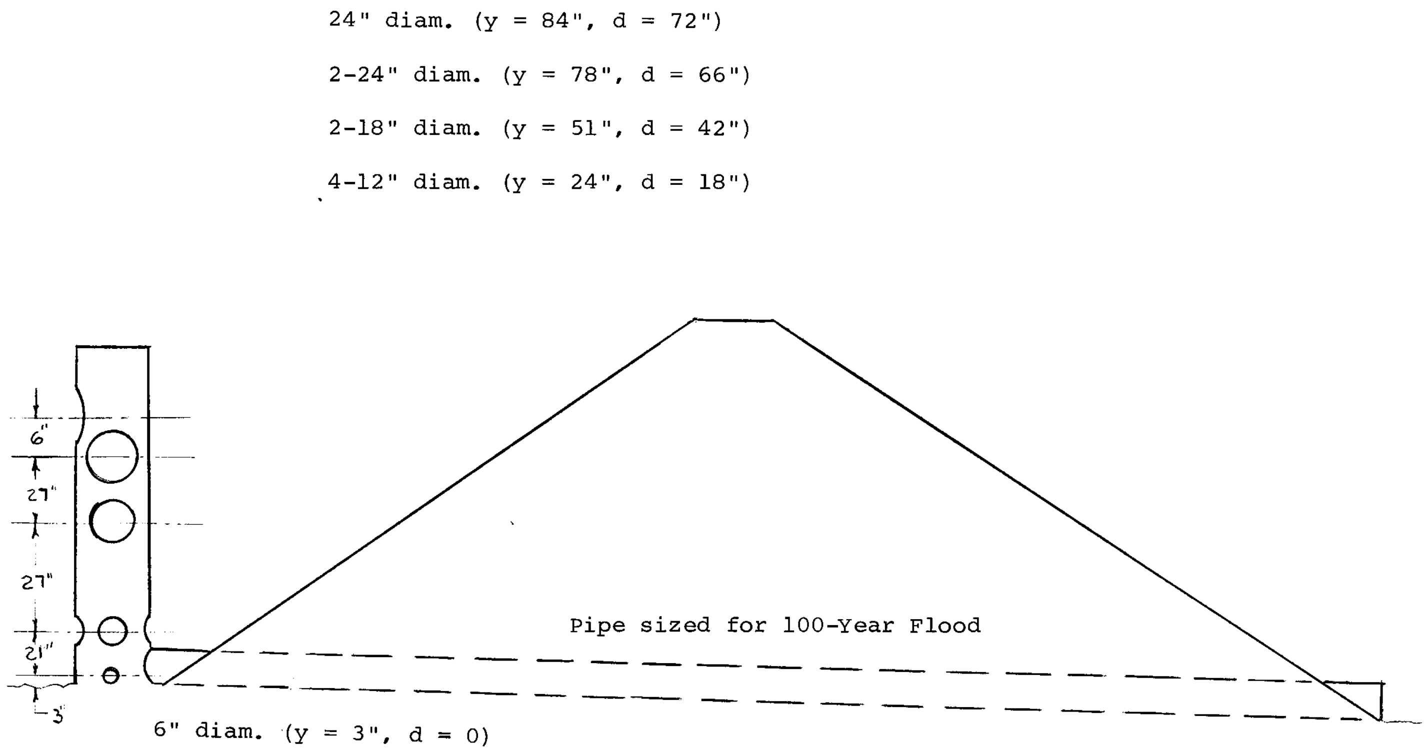
NO. of HOLES	D, INCHES	y, INCHES
1	6	3
4	12	24
2	18	51
2	24	78
1	24	84

If d is water depth, and 0 is discharge, then the flows may be tabulated:

		O, cfs				
d, inches	1-6", y = 3	4-12", y=24	2-18", y=51	2-24", y=78	1-24", y=84	TOTAL
6	.5					.5
12	.8					.8
18	1.1					1.1
24	1.2	3.6				4.8
36	1.6	14.8				16.4
48	1.8	21.6	1.8			25.2
60	2.0	26.0	14.2			42.2
72	2.2	30.0	22.4	3.0		57.6
84	2.4	33.6	28.0	18.0	4.0	86.0
96	2.6	37.0	32.8	38.0	15.0	125.4
108	2.8	40.0	37.0	48.0	43.0	170.3

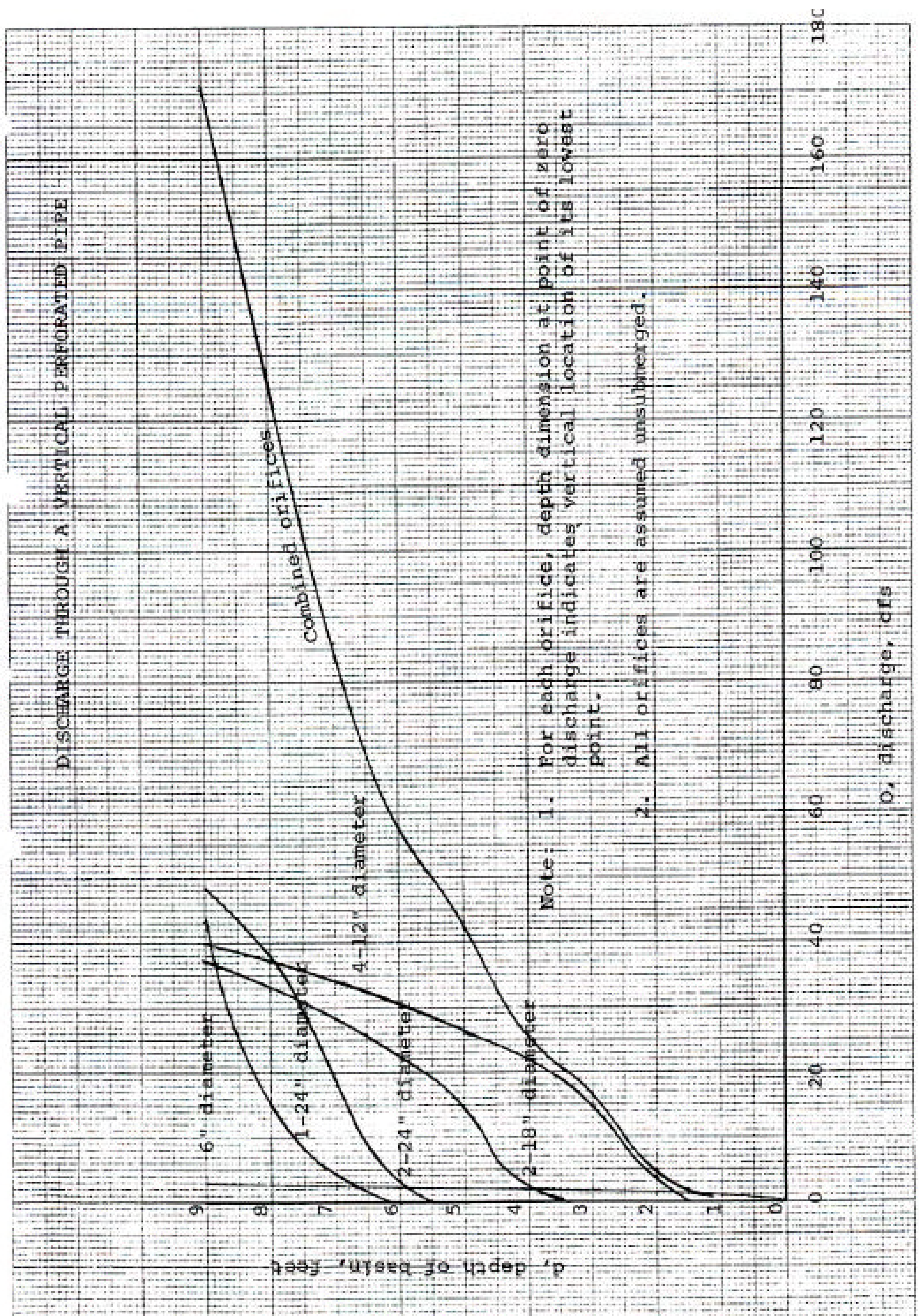
A simplified sketch of the arrangement, not to scale, is shown on page 201, and a graph of the flow to a depth of 9 feet is shown on page 202, for comparison with that from the V-notch weir.

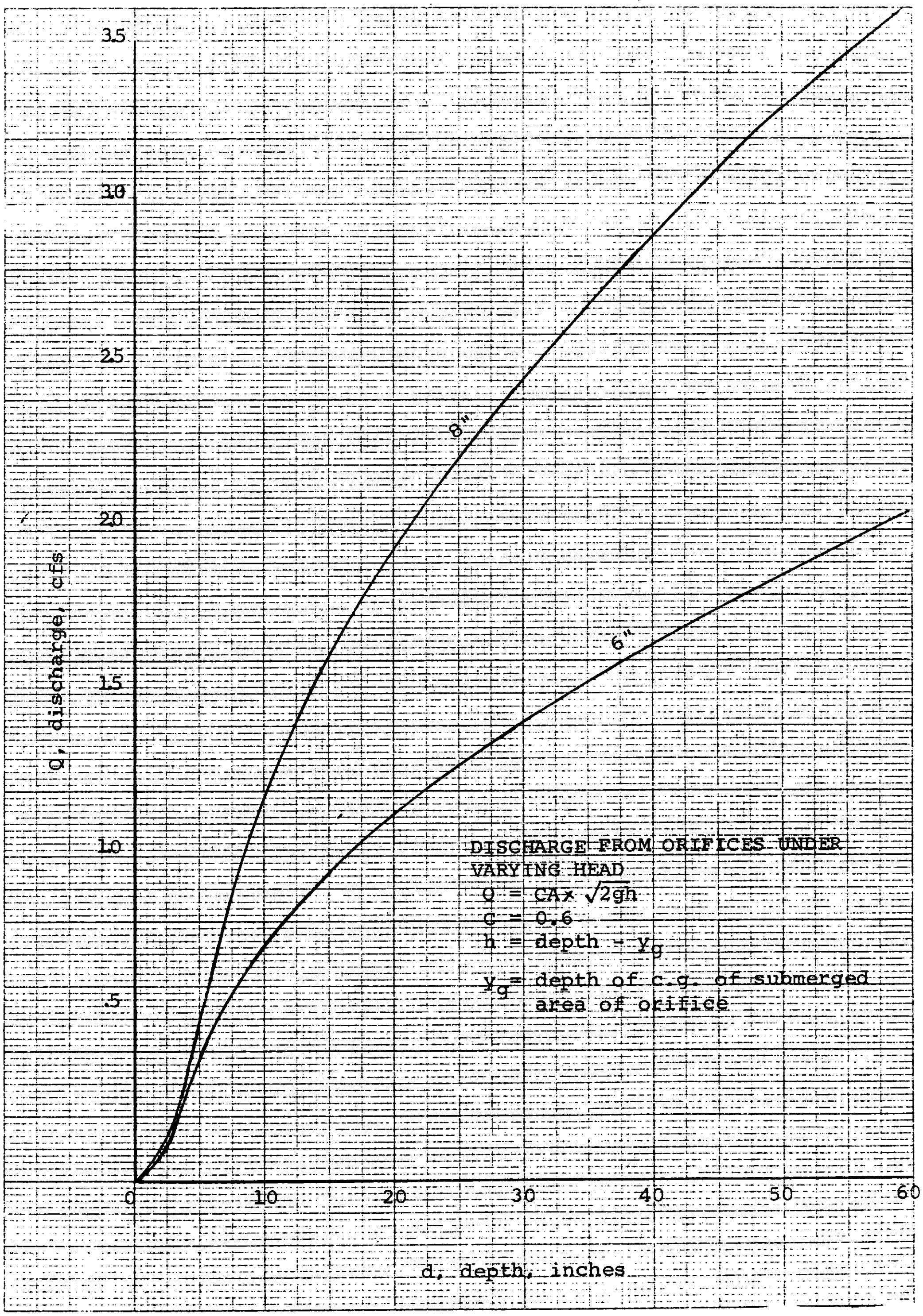
It should be noted that the above design calculations should be repeated for various times of concentration such as 5, 10, 20, 30,…, 60 minutes and for various frequencies. The final design should be adequate for all frequencies and storm durations.



SKETCH OF VERTICAL PERFORATED OUTFLOW PIPE

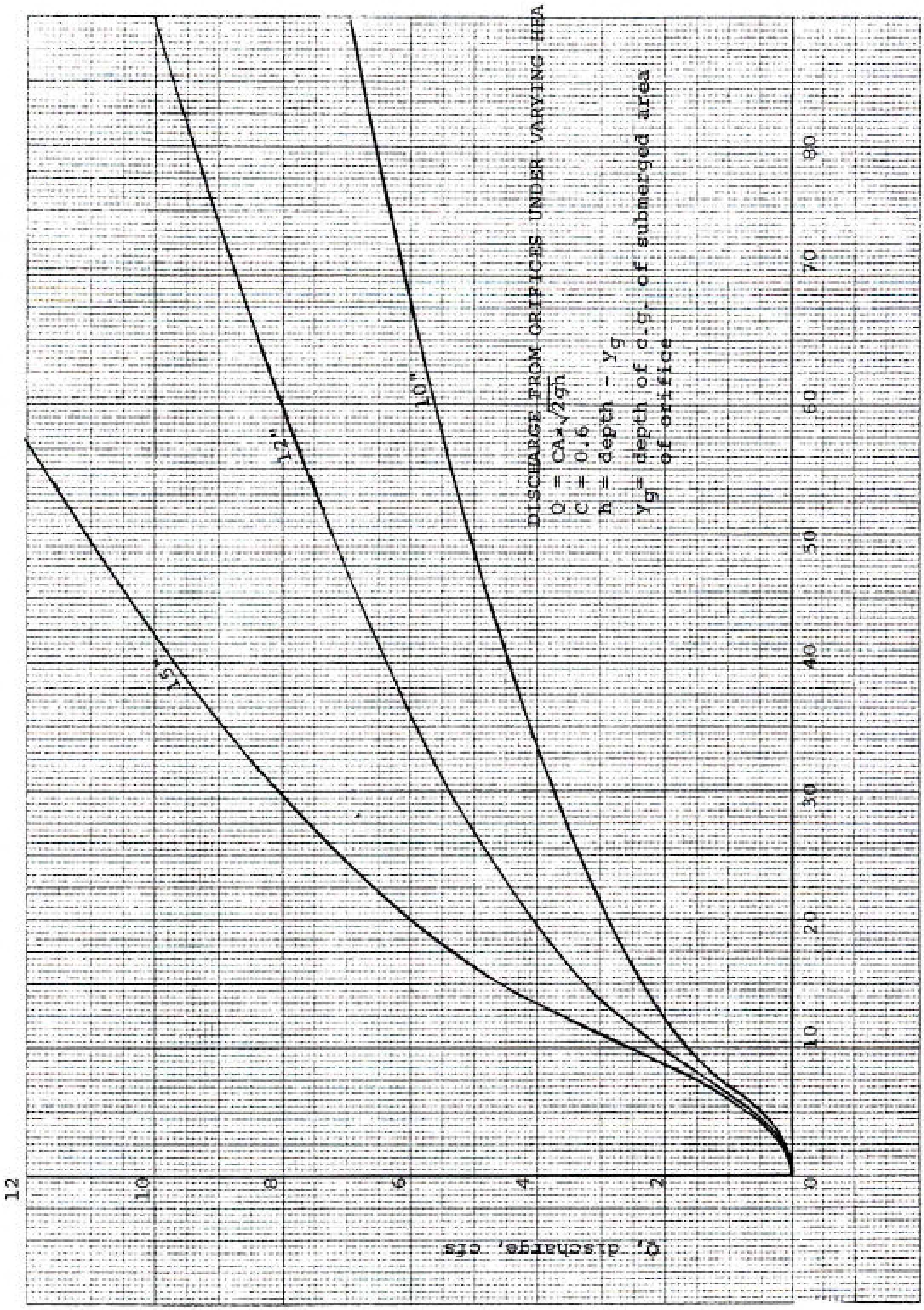
(not to scale)


DISCHARGE THROUGH A VERTICAL PERFORATED PIPE
Combined orifices
4-12" diameter
6" diameter
1-24" diameter
2-24" diameter
2-18" diameter
Note: 1. For each orifice, depth dimension at point of zero discharge indicates vertical location of its lowest point.
2. All orifices are assumed unsubmerged.
d, depth of basin, feet
0 1 2 3 4 5 6 7 8 9
Q, discharge, cfs
0 20 40 60 80 100 120 140 160 180



3.5
3.0
2.5
2.0
1.5
1.0
.5
0
10
20
30
40
50
60
Q, discharge, cfs
d, depth, inches
8"
6"
DISCHARGE FROM ORIFICES UNDER VARYING HEAD
Q = CAx $\sqrt{2gh}$
C = 0.6
h = depth - y_g
y_g = depth of c.g. of submerged area of orifice

CHART 8.1



DISCHARGE FROM ORIFICES UNDER VARYING HEA
Q = CA√2gh
C = 0.6
h = depth - y_g
y_g = depth of c.g. of submerged area of orifice
15"
12"
10"
Q, discharge, cfs
0
2
4
6
8
10
12
10
20
30
40
50
60
70
80

CHART 8.2

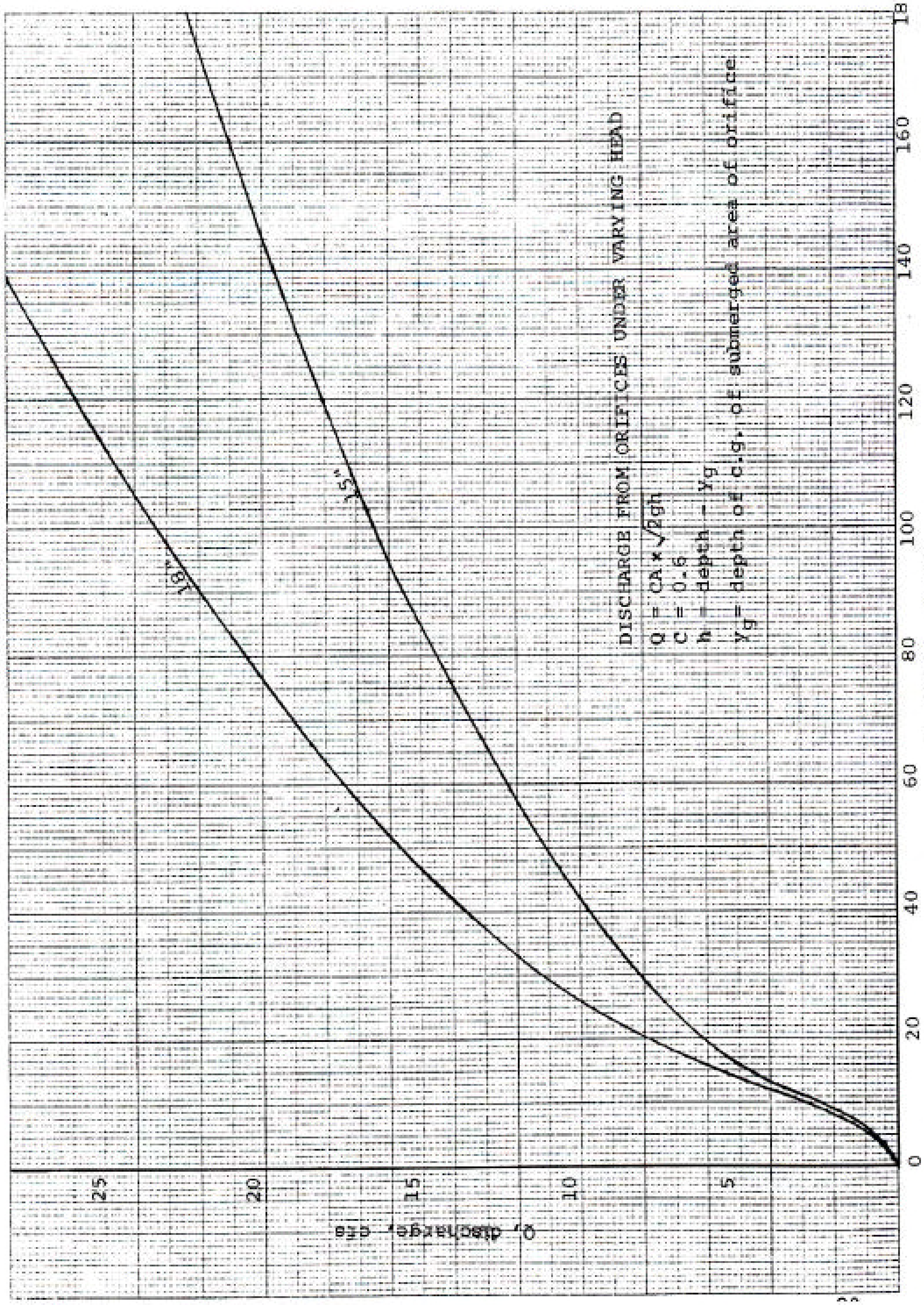
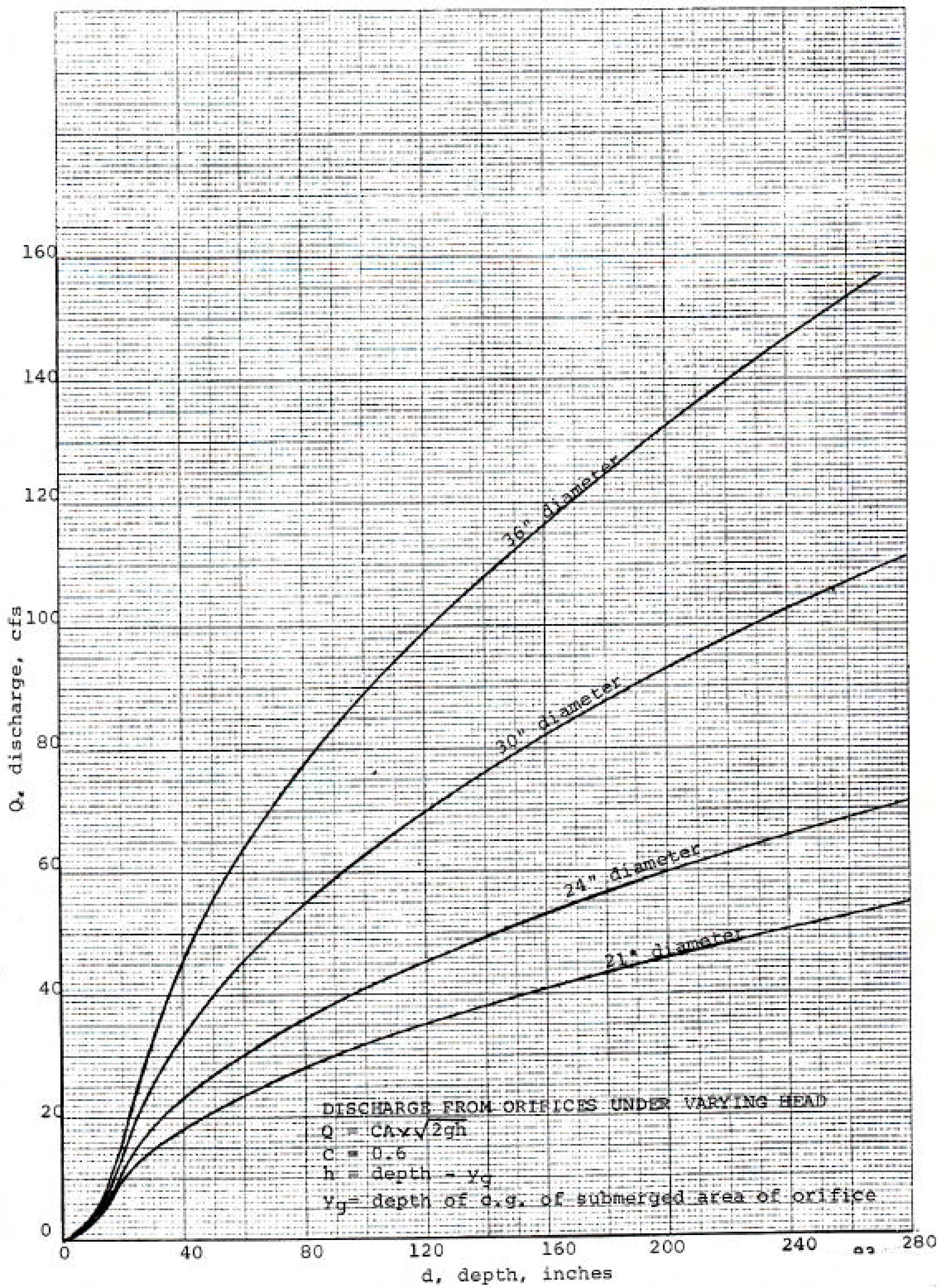

DISCHARGE FROM ORIFICES UNDER VARYING HEAD
Q = CA × √2gh
C = 0.6
h = depth − Yg
Yg = depth of c.g. of submerged area of orifice
18"
15"
Q, discharge, cfs
0
20
40
60
80
100
120
140
160
180
5
10
15
20
25

CHART 8.3



DISCHARGE FROM ORIFICES UNDER VARYING HEAD
Q = CA√2gh
C = 0.6
h = depth - yg
yg= depth of c.g. of submerged area of orifice
36" diameter
30" diameter
24" diameter
21" diameter
Q, discharge, cfs
d, depth, inches
0
20
40
60
80
100
120
140
160
0
40
80
120
160
200
240
280

CHART 8.4

8.5 *COLORADO UNIT HYDROGRAPH METHOD*

EXAMPLE 8.4

Given the following data, design a detention facility with outlet control device and an emergency spillway so that they peak of the outflow hydrograph from a 10-year storm is 220 cfs.

Area (A) = 210 acres = $0.33 mi^2$
Length of watershed (L) = 0.85 mile
Length from centroid of watershed to outlet (L_{ca}) = 0.59 mile
Impervious area = 40%
Pervious area = 60%
Unit duration of hydrograph = 10 min (assumed)

SOLUTION

Step 1: Using the Colorado Unit Hydrograph formulas given in Chapter 4, develop the 10-minute hydrograph

$$C_t = 7.81/40^{.78} = 0.44 \quad \text{(Eq. 4.1)}$$

$$T_L = 0.44(0.85 \text{ x } 0.59)^{.3} = .36 \text{ hour} = 22 \text{ min utes} \quad \text{(Eq. 4.2)}$$

$$C_p = 0.89 \text{ x } .44^{.46} = 0.61 \quad \text{(Eq. 4.6)}$$

$$q_p = \frac{640 \text{ x } 0.61}{.36} = 358 \text{ cfs} \quad \text{(Eq. 4.5)}$$

$$T_p = 22 + 10/2 = 27 \text{ min utes} = 0.45 \text{ hour} \quad \text{(Eq. 4.4)}$$

Step 2: With unit hydrograph q_p assumes as 358 cfs and T_p as 0.45 hour, the SCS dimensionless unit hydrograph results in the inflow hydrograph with 10-minute ordinates as given in column 14 of Table 8.1. Note that the rainfall excess values used for this example are the same as those calculated in Example Problem 4.3.

DETERMINATION OF STORM HYDROGRAPH
(EXAMPLE 8.4)

Time (Min.) (1)	Unit Hydrograph (cfs) (2)	Excess Precipitation in Inches .02 (3)	.05 (4)	.74 (5)	.24 (6)	.17 (7)	06 (8)	03 (9)	03 (10)	02 (11)	02 (12)	02 (13)	Hydrograph (cfs) (14)
0	0												0
10	98	2.0											2.0
20	309	6.2	5.0										11.2
30	350	7.0	15.4	73									95.4
40	250	5.0	17.5	229	23.5								275
50	129	2.6	12.5	259	74	16.7							365
60	72	1.4	6.5	185	84	52	5.9						334.8
70	38.3	0.8	3.6	95	60	60	18.5	2.9					259
80	21.2	0.4	1.9	53	31	43	21.0	9.3	2.9				162
90	11.7	0.2	1.1	28	17.3	22	15.0	10.3	9.3	2.0			95
100	6.4	0.1	0.6	15.6	9.2	12.2	7.7	7.5	10.3	6.2	2.0		71
110	5.1	0.1	0.3	8.7	5.1	6.5	4.3	3.9	7.5	7.0	6.2	2.0	52
120	3.7	0.1	0.3	4.7	2.8	3.6	2.3	2.2	3.9	5.0	7.0	6.2	38
130	0	0	0.2	3.8	1.5	2.0	1.3	1.1	2.2	2.6	5.0	7.0	26
140			0	2.7	1.2	1.1	0.7	0.6	1.1	1.4	2.6	5.0	16
150				0	0.9	0.9	0.4	0.4	0.6	0.8	1.4	2.6	8
160					0	0.6	0.3	0.2	0.4	0.4	0.8	1.4	4
170						0	0.2	0.2	0.2	0.2	0.4	0.8	2
180							0	0.1	0.2	0.1	0.2	0.4	1
190								0	0.1	0.1	0.1	0.2	0.5
200									0	0.1	0.1	0.1	0.3
210										0	0.1	0.1	0.2
220											0	0.1	0.1
230												0	0

TABLE 8.1

Step 3: Select an outlet pipe size and assuming a maximum outflow at 220 cfs with a maximum water depth of 8 to 10 feet (and a culvert length of 70 feet), determine the head-discharge relationship using Charts 8.1 to 8.4. A 60-inch pipe under 8 feet total head above its invert would handle about 220 cfs, so it is decided to develop the head-discharge curve for a 60-inch pipe. Figure 8.3 and column 2 of Table 8.2 give the curve and tabulation of the data.

Step 4: Assume a detention basin with a depth-volume curve such as would result from a rectangular basin with a bottom 170 feet by 340 feet and 2:1 side slopes. Such a curve is given by Fig. 8.3. The surface area of the pond structure at 10-foot depth would be 79,800 square feet or 1.8 acres; at 8-foot depth 75,144 square feet or 1.7 acres; and 70,616 square feet (almost 1.6 acres) at 6-foot depth. Table 8.2 column 3 gives the total storage below each foot of elevation up to a depth of 10 feet. Note that storage is given in cfs-minutes which is the actual cubic feet of storage divided by 60.

Step 5: Complete Table 8.2 by computing the proper values to be inserted in columns 4, 5 and 6. Then plot on Fig. 8.4 the curve $\frac{2S}{\Delta t} + 0$ against 0.

Step 6: Set up and complete storage routing, Table 8.3.
Column 1 – insert cumulative time in 10-minute intervals.
Column 2 – from inflow hydrograph ordinarily as developed in Step 2.

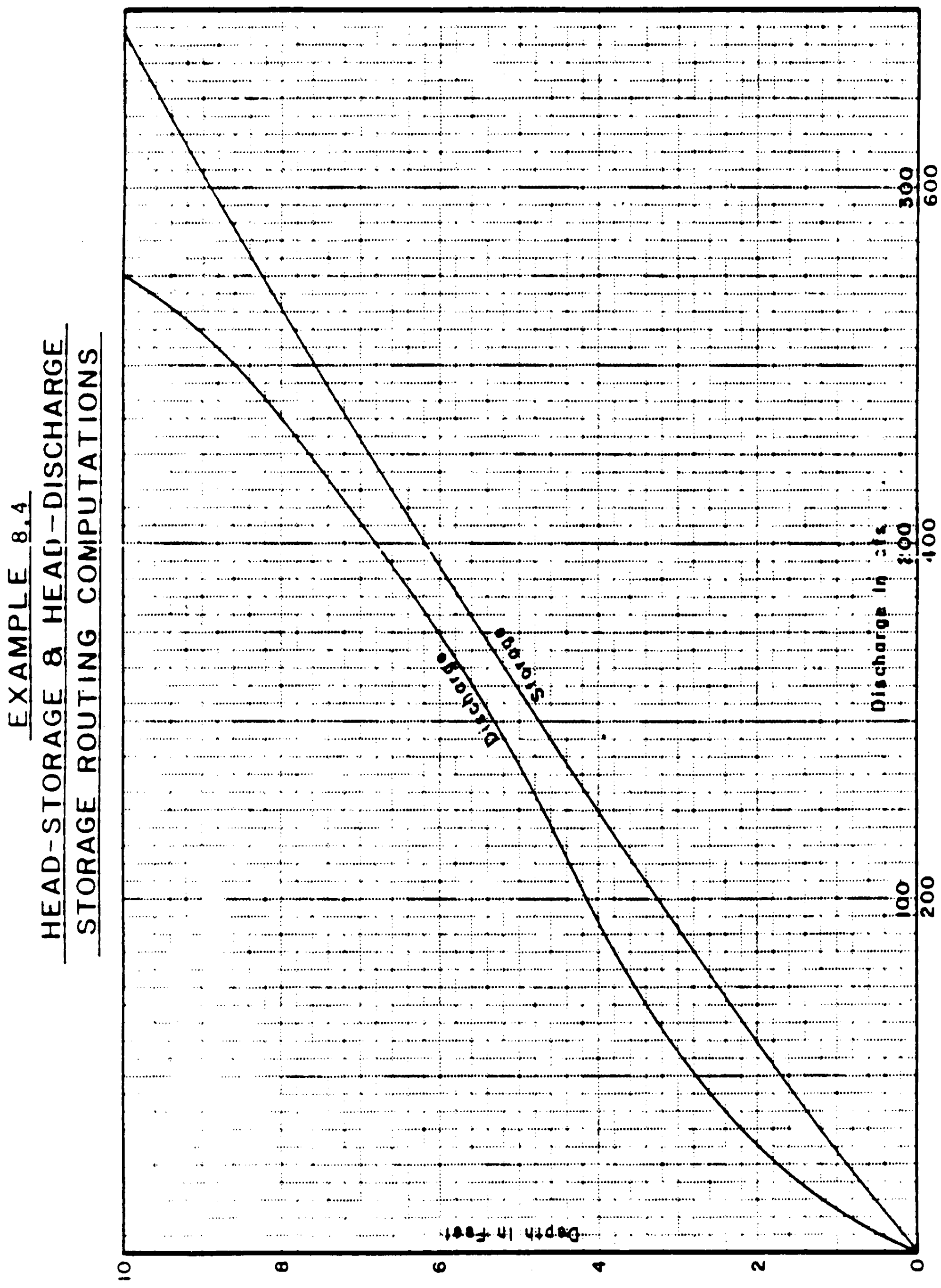
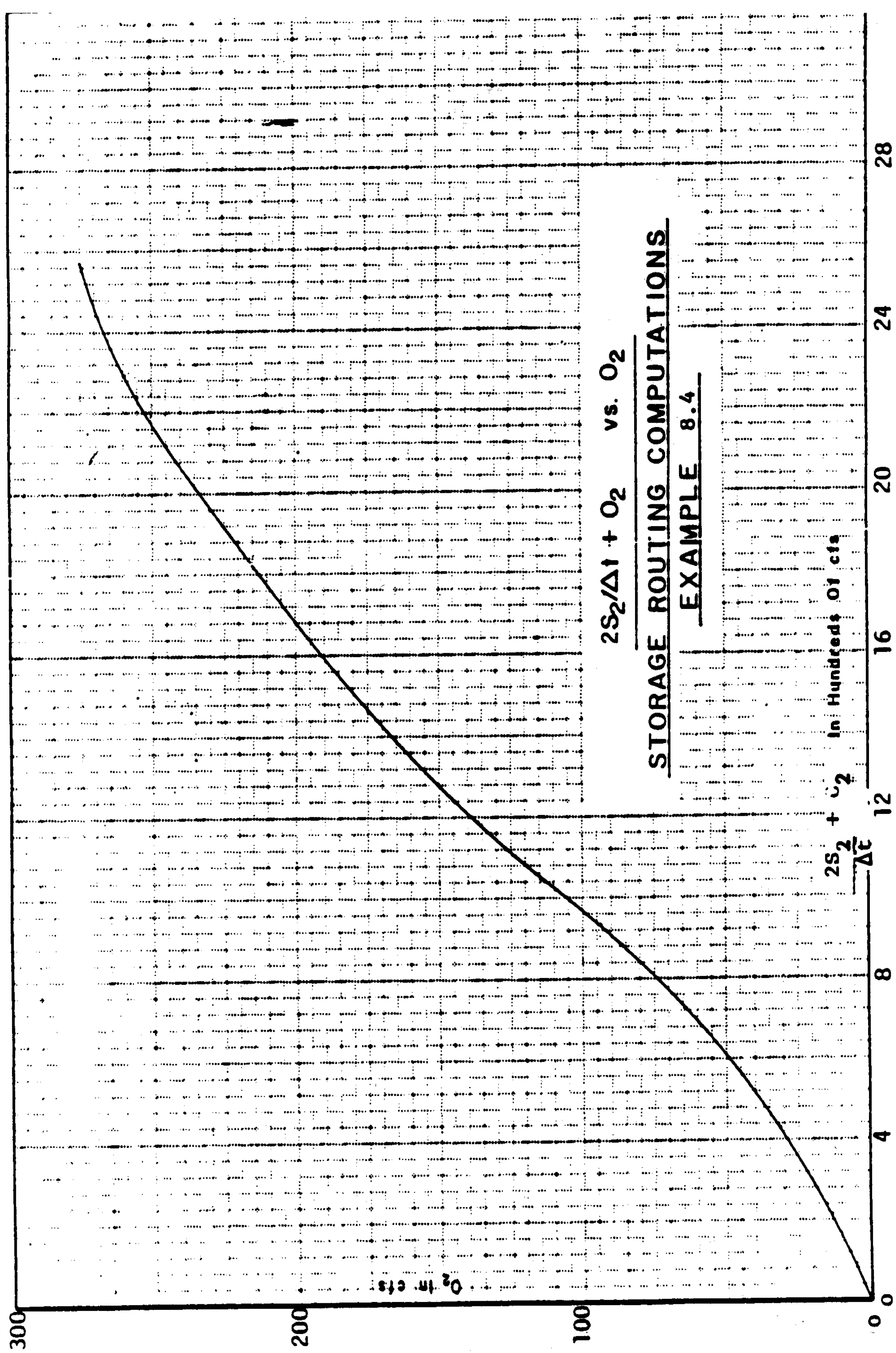

EXAMPLE 8.4
HEAD-STORAGE & HEAD-DISCHARGE
STORAGE ROUTING COMPUTATIONS
Depth In Feet
0
2
4
6
8
10
Storage
Discharge
Discharge In cfs
Storage In Thousands Of Cubic Feet
100
200
200
400
300
600

FIGURE 8.3

TABLE 8.2: STORAGE-INDICATION COMPILATION TABLE

EXAMPLE 8.4

Elevation	Discharge	Storage	$\Delta t = 10$ min
	O_2	S_2	$\frac{2S_2}{\Delta t} + 0_2$
(ft.)	(cfs)	(cfa-min)	(cfs)
(1)	(2)	(3)	(4)
0	0		
1	14	981	210
2	32	1996	216
3	57	3047	666
4	94	4167	927
5	137	5269	1191
6	175	6422	1459
7	205	7622	1729
8	235	8863	2008
9	260	10144	2289
10	275	11467	2568



2S2/Δt + O2 vs. O2
STORAGE ROUTING COMPUTATIONS
EXAMPLE 8.4
O2 in cfs
2S2/Δt + O2 In Hundreds Of cfs
0
4
8
12
16
20
24
28
0
100
200
300

FIGURE 8-4

TABLE 8.3: STORAGE-ROUTING COMPUTATIONS

EXAMPLE 8.4

Time (ft.) (1)	I (cfs) (2)	$\frac{2S}{\Delta t} - 0$ (cfa-min) (3)	$\frac{2S}{\Delta t} + 0$ (cfs) (4)	0 (cfs) (5)
0	0	0	0	0
10	4	2	2	0
20	11	13	15	1
30	95	103	119	8
40	275	406	478	36
50	365	822	1046	112
60	335	1172	1522	175
70	259	1350	1766	208
80	162	1353	1771	209
90	95	1228	1610	191
100	71	1066	1394	164
110	52	917	1189	136
120	38	795	1007	106
130	26	691	859	84
140	16	603	733	65
150	8	523	627	52
160	4	451	535	42
170	2	389	457	34
180	0.5	335.5	391.5	28
190	0.3	286.3	336.3	25
200	0.2	248.8	286.8	19
210	0.1	217.1	249.1	16
220	0	189.1	217.2	14
230	0	165.1	189.1	12
240	0	145.1	165.1	10
250	0	127.5	145.1	8.8
260	0	112.5	127.5	7.5
270	0	99.7	112.5	6.4
280	0	88.3	99.7	5.7
290	0	78.7	88.3	4.8
300	0	---	78.7	4.2

Column 3 - start with 0 in routing interval No. 1. Each subsequent figure in this column is computed using Equation 8.7.

Column 4 - $(I_1 + I_2)$ plus $\left(\frac{2S}{t} - 0\right)$ from previous row; for row No. 1, it is set equal to zero.

Column 5 - For row No. 1 set this to zero. For subsequent Columns, read 0 from the curve.

Step 7: From the discharge-storage and depth-discharge curves of Fig. 8.3 the maximum storage required for the peak outflow rate of 209 cfs will be 466, 000 cubic feet which occurs at a depth of 7.12 feet. This suggests that the emergency overflow spillway could be set at 8 feet.

Step 8: Estimate the probably maximum emergency spillway rate. Precipitation data are to be obtained from the most recent National Weather Service publication (NOAA NWS HYDRO-35, NOAA TP No. 40, NOAA TP No 49) applicable to the area under study. The 1-hour 100-year rainfall will often be the desirable basis of design of the principal or emergency spillway, although where lives or high property values would be endangered by a breached detention basin, the probably maximum precipitation (PMP) (NOA Hydrometeorological Report No. 33) should be used. Runoff determination is based on the Rational Method.

For this example the 60-minute 100-year precipitation of 3.3 inches will be used. A rational method C of 0.95 will be assumed. The peak 100-year 60-minute runoff will then be 0.95 x 3.3 x 210 = 658 cfs.

Should it be desirable to assume the PMP, it would be 0.95 x 21.5 x 210 or 4300 cfs.

The former of these would be reduced somewhat (perhaps 30%) by the assumed storage but the great size of the PMP assures complete flooding of the assumed storage with an outflow rate equal to the inflow rate. Actually, a specific design for so great an outflow would make it essential to carry out thorough detailed studies to have confidence that the spillway provided was satisfactory. The entire dam probably would become an overflow spillway and would need to be constructed accordingly. Assuming the available storage would reduce the 100-year peak to about 70% of 658 cfs. The emergency spillway could then be designed as follows:

Using equation 8.5 with the assumption of C of 3.0 and H_p of 3.0, B is found to be 89 feet. If an H_p of4.0 can be tolerated, the length of the weir could be shortened to 77 feet. Each foot of height of the dam

increases its base width by 4 feet so it becomes a matter of the economic choice of broad-created weir depth as opposed to critical velocity of flow through the weir and cost of dam fill. The 3-

foot deep flow would have a critical velocity (assuming a turf n of 0.04) of 5.5 fps and a critical slope of 2.4%; the 4 foot deep flow would involve a critical velocity of 5.8 fps and 2.3% critical slope. While these velocities are a bit high for turf, the rare 1% frequency of their likelihood makes it feasible to decide upon a dam height of 12 feet assuming the sill of the overflow weir at 8-foot depth plus an overflow depth of 3 feet (and a related 89-foot length of weir along the axis of the dam or related thereto as topography best dictates) with a 1-foot freeboard.

NOTE: The engineer must perform similar calculations for 2, 5, and 25-year storms and then decide the size and configuration of detention facility and outlet structure.

CHAPTER 9 - OPEN CHANNEL FLOW

Open channel flow can be steady or unsteady, uniform or non-uniform, laminar or turbulent, sub-critical or supercritical depending on the shape, slope and roughness of the waterway and the characteristics of incoming flows. Non-uniform flows may be gradually varied or rapidly varied. Normally, open channel flows can be assumed to be steady and uniform, and Manning's equation can be used for flow analysis.

Flood flows are actually unsteady and non-uniform flows. The changing cross sections involved in flood plain analysis render the flow to be non-uniform. Unsteady and non-uniform flows are difficult to analyze and usually steady – gradually varied flow analysis is used to calculate water surface profiles. The calculations begin at a known water surface elevation and proceed upstream for sub-critical flows and downstream for supercritical flows. Since the flow in most natural flood plains is sub-critical, backwater computations proceed upstream from a bridge. The design of bridges usually requires the analysis of non-uniform flows.

The most frequently used shapes of channels are trapezoidal, rectangular; the use of triangular shaped channels is generally limited to small capacity. Whether or not a channel should be provided with a non-erodible lining depends on the maximum permissible velocity and soil stability. The design also must evaluate the hydraulic and economic aspects of freeboards, bends, transitions and junctions.

Channels shall be adequate capacity and of slopes. Mowers cannot normally be used on slopes greater than 2.5:1. But where the soil is non-cohesive and vegetation is likely to be sparse, use of 3 to 1 maximum. Channel dimensions are obtained by using the Manning Formula.

$$Q = AV \tag{9.1}$$

$$V = \frac{1.486}{n} R^{2/3} S^{1/2} \tag{9.2}$$

S = slope of the energy gradient in ft/ft, equal to the slope of the channel bed.

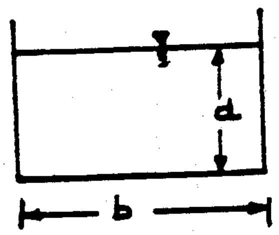
All other quantities are defined in Chapters 2 and 5. The value of Manning's n can be obtained from Table 2.6.

Charts can be developed to solve for channel dimensions using the above equations for various geometries of the channel and these can be found in Chow (1959), SCS (1960) and FHA (1970). Channel dimensions can also be obtained by using the above equations and geometric elements of channels. The geometric elements can be computed using the following equations.

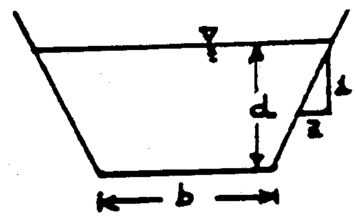
	Rectangular	Trapezoidal	
Water Area (A)	bd	(b + Zd) d	(9.3)

Wetted perimeter (P)	$b + 2d$	$b + 2d\sqrt{1+Z^2}$	(9.4)
Hydraulic Radius $\left(R = \dfrac{A}{P}\right)$;	$\dfrac{bd}{b+2d}$	$\dfrac{(b+Zd)d}{b+2d}\sqrt{1+z^2}$	(9.5)

Where the quantities b, d and z are shown below.



Rectangular



Trapezoidal

Equations for other configurations can be obtained from Chow (1959).

EXAMPLE 9.1

Given Q = 50 cfs and a trapezoidal channel with side slopes of 3 to 1 and bottom width of 10 ft, find the bed slope required to maintain a velocity of 2.5 ft/sec/ Assume n = 0.4

SOLUTION

Q = 50 cfs, z = 3, b = 10 ft, V = 2.5 fps, n = 0.4

Area (A) $\dfrac{O}{V} = \dfrac{50}{2.5} = 20\ ft^2$

Depth (d) of flow = 1.41 ft.	(from Equation 9.3)
R = 1.06 ft.	(from Equation 9.5)
Slope = 0.004 ft/ft	(from Equation 9.2)

Add a free board (of 15 – 20% of d) = 0.3 ft.

Depth of channel (D) = 1.45 + 0.3 = 1.85 ft.

EXAMPLE 9.2

Given an existing channel with side slope of 3:1, bottom width 12 ft, channel depth 3.5 ft, bed slope 0.0008 ft/ft. estimate the capacity of the channel. Assume n = 0.6

SOLUTION

Z = 3, b = 12 ft, D = 3.5 ft, S = 0.0008 ft/ft. n = 0.06

Depth of flow (d) = 3.5 – 0.5 = 3.0 ft;	Free board = 0.5 ft (assumed)
A = 63 ft^2	(from Equation 9.3)
R = 2.05 ft	(from Equation 9.5)
V = 1.15 ft/sec	(from Equation 9.2)

$Q = 61 \times 1.15 = 72.45$ cfs (from Equation 9.1)

EXAMPLE 9.3
Given a trapezoidal section with Q = 300 cfs, n = 0.02, S = 0.0009, bottom width = 15 ft., side slope 2:1, find the depth and velocity

SOLUTION

$$AR^{2/3} = \frac{Qn}{1.486} S^{1/2} = 134.5 \qquad \text{(from Equation 9.2)}$$

By assuming values of d, compute $AR^{2/3}$ for a value higher and lower than 1345

$A = 15\,d + 2d^2$ (from Equation 9.3)

$P = 15 + 4.47d$ (from Equation 9.4)

$R = (15d + 2d^2) / (15 + 4.47d)$ (from Equation 9.5)

Trial	d	A	P	R	$AR^{2/3}$
1	3.0	63.0	28.42	2.21	107.0
2	3.5	77.0	30.65	2.51	142.0
3	3.3	71.3	29.76	2.39	127.5

Plot d vs $AR^{2/3}$ and from the plot determine d for $AR^{2/3} = 134.5$. We can also determine d by interpolation in the above table. This gives d = 3.4 ft as does the plot.

Now $A = 15d + 2\,d^2 = 15(3.4) + 2(3.4)^2 = 74.07^{ft2}$

$$V = \frac{Q}{A} = \frac{300}{74.07} = 4.05 \text{ ft/sec.}$$

Note that this procedure can also be used to compute b if d is specified.

EXAMPLE 9.4
Given a trapezoidal section with Q = 500 cfs, c = 4.0 ft/sec., n = 0.03, S = 0.005, side slopes 2:1 find the bottom width and depth of flow.

SOLUTION

$$R = \left\{\frac{Vn}{1.49} S^{1/2}\right\}^{3/2} = 1.22 \text{ ft} \qquad \text{(from Equation 9.2)}$$

$$A = \frac{Q}{V} = 125 \quad \text{ft}^2$$

The depth (d) is first determined using Equation 9.3 and 9.5 with the elimination of bottom width (b). For trapezoidal section, this elimination gives

$$d = \frac{\frac{X}{R} \pm \sqrt{\left(\frac{X}{R}\right)^2 - 4X}}{2}$$

where:

$$X = \frac{A}{\left\{2\sqrt{Z^2 + 1} - Z\right\}}$$

Substitution of A = 125, Z = 2 gives

X = 50.61
D = 1.25 or 40.25
Select d = 1.25 ft

$$\therefore b = \frac{A}{d} - Z^d = 97.5 \text{ ft}$$ (from Equation 9.3)

CHAPTER 10 - DESIGN OF STABLE CHANNELS

Open Channels can be classified as

a. Non-Erodible Channels
b. Erodible Channels
c. Grassed Channels

10.1 NON ERODIBLE CHANNELS

Non erodible channels built of linings can withstand erosion. The design of channels however, is based on the criteria of minimum velocity to avoid deposition and to avoid growth of vegetation that may reduce the channel capacity Lining include concrete, stone masonry, etc. Minimum velocity generally varies from 2-3 feet per second. The design of non-erodible channels is based on solving Manning equation for normal depth and checking for permissible velocities. Sufficient free board should be provided and generally free boards vary from 5 to 30% of the depth of flow. The determination of section dimensions for non-erodible Channels is illustrated in the following example.

EXAMPLE 10.1

A trapezoidal Channel carrying 400 cfs is to be built with non-erodible bed having a slope (S) of 0.0016 and n=0.025. Find the channel dimensions.

SOLUTION

1. Compute A R $^{2/3}$ using

$$A\,R^{2/3} = \frac{nQ}{1.49}\sqrt{S}$$

$$= \frac{0.025 \quad x \quad 400}{1.49\sqrt{0.0016}} = 167.7 \qquad (10.1)$$

2. For the trapezoidal section

Water area A = (b + Zd) d

Hydraulic radius $\quad R = \dfrac{(b + Zd)d}{(b + 2\sqrt{1+z^2}d)}$

Where b, d and z are bottom width, depth of flow and side slope respectively. Substituting for A and R in equation 12.1.

$$\frac{(b + Zd)d}{(b + 2\sqrt{1+z^2}d)^{2/3}}^{5/3} = 167.7$$

3. Assuming b = 20 ft and z=2, and simplifying

$$7680 + 1720\,d == [d\,(10 + d)\,]^{2.5}$$
$$d = 3.36 \text{ ft}$$

4. Assume other values of b and z, and determine d. Select the one based on practical considerations. Let b = 20 ft, Z = 2 and d = 3.36 ft. is selected.

5. Assign a free board in 2 ft. The depth of channel is 3.36 + 2.0 = 5.36 ft and the top width of the channel (not the width of the water surface) is 41.4 ft.

$$\text{Velocity (v)} = \frac{Q}{A} = \frac{400}{89.8} \qquad \text{(from Equation 8.3)}$$
$$= 4.46 \text{ fps} > \text{minimum velocity of 2-3 fps, O.K.}$$

10.2 ERODIBLE CHANNELS

The design of erodible channels is usually based on the maximum permissible velocity that will not cause erosion of the channel. Table 10.1 give the recommended maximum permissible velocities for various types of channel material. Manning formula is used to determine the dimensions of an erodible channel as illustrated in the following example.

EXAMPLE 10.2

Compute the bottom width (b) and depth (D) of a trapezoidal channel of a slope (S) of 0.0016 to carry a discharge (Q) of 400 cfs. The channel is to be excavated in earth containing non-colloidal coarse gravels and pebbles. Estimated value of n is 0.025. Assume a side slope (Z) of 2:1

SOLUTION

1. Estimated permissible velocity (V) = 4.5 fps (from Table 10.1)

2. Using Manning formula, solve for R $\quad V = \frac{1.49}{n} R^{2/3} S^{1/2}$

$$4.5 = \frac{1.49}{0.025} R^{2/3}\ (0.0016)^{1/2}$$
$$R = 2.6 \text{ ft}$$

3. $$A = \frac{Q}{V} = \frac{400}{4.5} = 88.8 \text{ ft}^2$$

$$P = \frac{A}{R} = \frac{88.8}{2.6} = 34.2 \text{ ft}$$

4. For trapezoidal sections,

$$A = (b + Zd)\ d = (b + 2d)\ d = 88.8$$

$$P = b + 2\sqrt{1+2^2} = b + 2\sqrt{5}\,d = 34.2$$

Solving for b and d simultaneously

b = 18.7 ft

d = 3.46 ft

5. Assume other values of Z and determine b and d. Select the one that is based on practical considerations. Let b = 18.7 ft, d = 3.46 ft and Z = 2 is selected.

6. Free board = 2.0 ft
   Depth of Channel (D) = 3.46 + 2.0 = 5.46 ft

10.3 GRASSED CHANNELS

Presence of Grass or vegetation in channels will result in considerable turbulence, which means loss of energy and retardance of flow. But the grass will also stabilize the channel and reduce erosion an sediment transport. The Manning coefficient of roughness for grassed Channels is specifically known as the retardance coefficient. Retardance varies from very high (A) to very low (E) depending on cover type and condition (Table 10.2). Table 10.3 provides a guide in the selection of the vegetal retardance. The permissible velocity of flow in a grassed channel is the velocity that will prevent erosion and these velocities for different covers, channel slopes and soil conditions are given in Table 10.4. Since Manning's n for just one kind of grass varies over a wide range depending on the depth of flow and the shape and slope of the channel, n versus VR relationships are developed where V is the mean flow velocity and R is the hydraulic radius (Chart 10.1). This relationship is characteristic of the vegetation and practically independent of channel slope and shape.

Design Procedure

The design of grassed channels includes (a) design for stability, i.e., to determine the channel dimension under the condition of a lower degree of retardance, and (b) to review the design for maximum capacity under the condition of a higher degree of retardance.

a. Design for Stability: Given the discharge, Channel slope, and kind of grass, the first stage of design may proceed in the following steps.

   1. Assume a value of n, and determine the corresponding value of VR from the n – VR curve (Chart 10.1, Tables 10.2 and 10.3)

2. Select the permissible velocity from Table (10.4) and compute the value of R

3. Using the Manning formula, compute the value of

$$VR = \frac{1.49\, R^{2/3} S^{1/2}}{n}$$

and check this value against the value of VR obtained in step 1

4. Make other trials until the computed value of VR is equal to the VR value obtained from the V-R curve
5. Compute the water area, or $A = \dfrac{Q}{V}$
6. Once the value of A and R are known, the Channel can be designed.
7.

b. Design for Maximum Capacity

1. Assume the depth d, and compute the water area and the hydraulic radius R.
2. Compute the velocity V by $V = \dfrac{Q}{A}$ and the value of VR
3. From the n-VR Curve of a higher degree retardance, for the selected lining, determine the value of n.

4. Compute the velocity by the Manning formula, and check this value of V against the value obtained in Step 2.

5. Make trial computation until the computed V in Step 4 is equal to the computed V in Step 2.

6. Add proper free board to the computed depth.

EXAMPLE 10.3

Determine the section of a channel lined with grass mixture laid in erosion – resistant soil at a slope of 0.04, and Carrying a discharge of 50 cfs.

SOLUTION

a. Design for Stability

In designing for stability, the grass mixture that offers a low vegetal retardance (i.e. during dormant season) is considered. Thus the permissible velocity (V) is 5 fps (from Chart 10.1)

Trial #	N	VR	$R = \frac{VR}{V}$	$VR = \frac{1.44}{n} R^{5/3} S^{1/2}$
1	0.04	1.80	0.36	0.36
2	0.05	0.90	0.18	0.34
3	0.035	3.50	0.70	4.72
4	0.037	2.50	0.50	2.50

The correct values for the determination of section are R = 0.50 ft and

$$A = \frac{Q}{V} = \frac{50}{5} = 10 \text{ ft}^2$$

Select say trapezoidal section with side slope (Z) = 3:1

Solve for b and d using A = (b +Zd) d

$$R = \frac{(b + Zd)d}{(b + 2\sqrt{1+z^2}d)}$$

b = 17.0 ft, d = 0.53 ft

Top width = 20.18 ft (from Equation 8.6)

b. <u>Design from Maximum Capacity</u>

For this purpose the grass mixture of the growing season which offers a moderate vegetal retardance is considered. The n-VR curve (Chart 10.1) for grass mixture in summer is therefore used. Q = 50 cfs, S = 0.04

For the trapezoidal section with 3:1 side slope and b = 17.0 ft, the trial computation is given below.

Trial #	d	A	R	V	VR	N	$V = \frac{1.49}{n} R^{2/3} S^{1/2}$
1	0.70	13.4	0.63	3.73	2.35	0.051	4.22
2	0.60	11.3	0.54	4.42	2.39	0.050	3.96
3	0.65	12.3	0.58	4.07	2.36	0.051	4.07

The correct depth is 0.65 ft. Adding a free board of 0.2 ft, the total depth is 0.85 ft.

Table 10.1: MAXIMUM PERMISSIBLE VELOCITIES

Material	n	Clear Water V Fps	Water transporting colloidal silts V fps
Fine sand, colloidal	0.020	1.50	2.50
Sand loam, non-collodial	0.020	1.75	2.50
Silt loam, non-collodial	0.020	2.00	3.00
Alluvial silts, non-collodial	0.020	2.00	3.50
Ordinary firm loam	0.020	2.50	3.50
Volcanic ash	0.020	2.50	3.50
Stiff clay, very colloidal	0.025	3.75	5.00
Alluvial silts, colloidal	0.025	3.75	5.00
Shales and hardpans	0.025	6.00	6.00
Fine gravel	0.020	2.50	5.00
Graded loam to cobbles when non-colloidal	0.030	3.75	5.00
Graded silts to cobbles when colloidal	0.030	4.00	5.50
Coarse gravel, non-colloidal	0.025	4.00	6.00
Cobbles and shingles	0.035	5.00	5.50

Table 10.2 CLASSIFICATION OF DEGREE OF RETARDANCE FOR VARIOUS KINDS OF GRASS

Retardance	Cover	Condition
A. Very high	Weeping love grass	Excellent stand, tall (av. 30 in)
	Yellow bluestem ischaemum	Excellent stand, tall (av. 36 in)
B. High	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (av. 12 in.)
	Native grass mixture (little bluestem, blue grama, and other long and short Midwest grasses)	Good stand, unmowed
	Weeping love grass	Good stand, tall (av. 24 in.)
	Lespedeza sericea	Good stand, not woody; tall (av. 19 in.)
	Alfalfa	Good stand, uncut (av. 11 in)
	Weeping love grass	Good stand, mowed (av. 13 in)
	Kudzu	Dense growth, uncut
	Blue grama	Good stand, uncut (av. 13 in)
C. Moderate	Crab grass	Fair stand, uncut (10 to 48 in.)
	Bermuda grass	Good stand, mowed (av. 6 in)
	Common lespedeza	Good stand, uncut (av. 11 in)
	Grass-legume mixture – summer (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (6 to 8 in.)
	Centipede grass	Very dense cover (av. 6 in)
	Kentucky bluegrass	Good stand, headed (6 to12 in.)
D. Low	Bermuda grass	Good stand, cut to 2.5 in height
	Common lespedeza	Excellent stand, uncut (av. 4.5 in.)
	Bufalo grass	Good stand, uncut (3 to 6 in.)
	Grass-legume mixture—fall, spring (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (4 to 5 in.)
	Lespedza sericea	After cutting to 2 in. height very good stand before cutting
E. Very low	Bermuda grass	Good stand, cut 1.5 in height
	Bermuda grass	Burned stubble

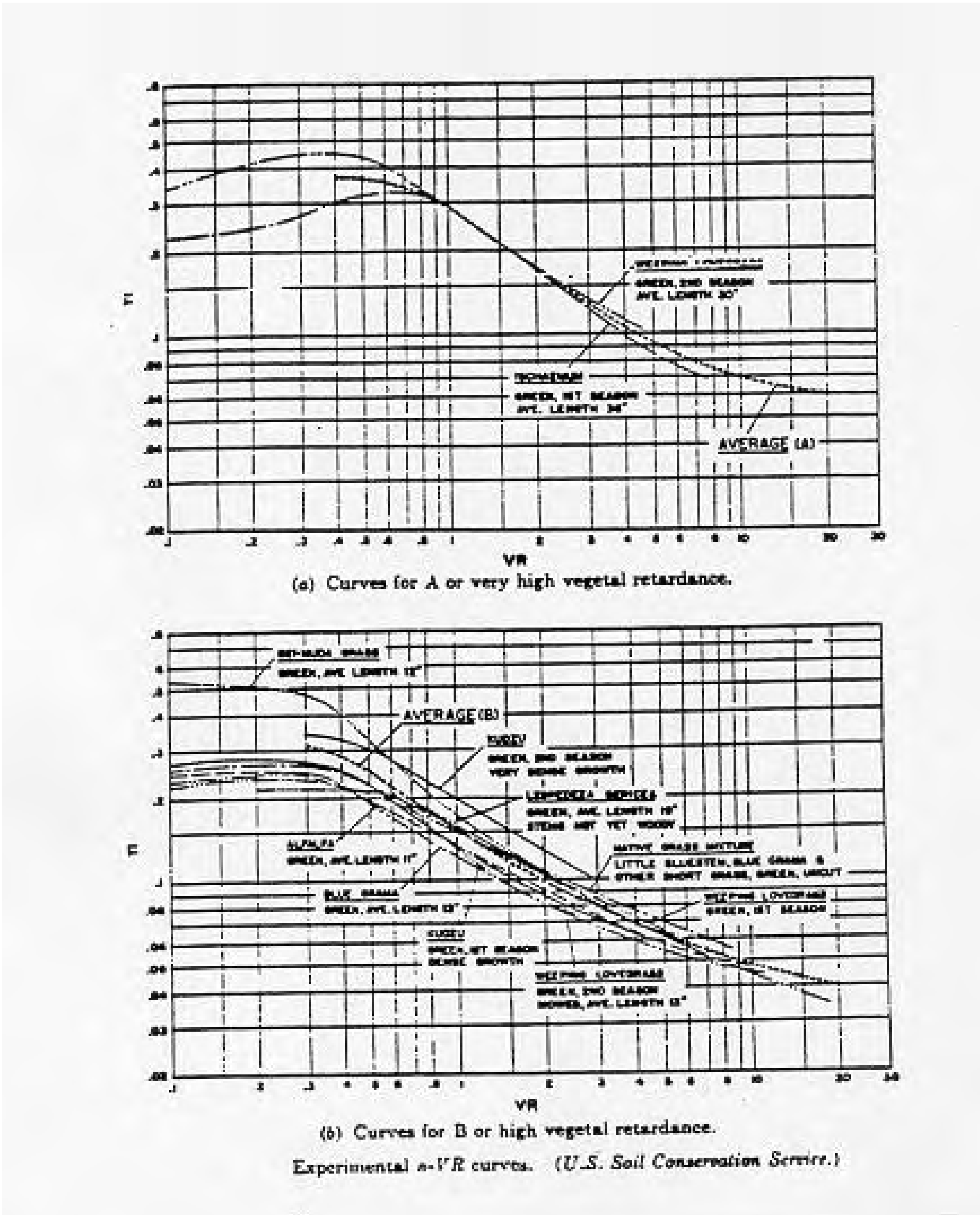
Table 10.3 GUIDE TO SELECTION OF VEGETAL RETADANCE

Stand	Average length of grass, in.	Degree of retardance
Good	>30	A Very high
	11-24	B High
	6-10	C Moderate
	2-6	D Low
	<2	E Very low
Fair	>30	B High
	11-24	C Moderate
	6-10	D Low
	2-6	D Low
	<2	E Very low

Table 10.4 PERMISSIBLE VELOCITIES FOR CHANNELS LINED WITH GRASS

Cover	Slope range, %	Permissible velocity, fps	
		Erosion-resistant Soils	Easily eroded soils
Bermuda grass	0-5	8	6
	5-10	7	5
	>10	6	4
Buffalo grass, Kentucky bluegrass	0-5	7	5
	5-10	6	4
	>10	5	3
Grass mixture	0-5	5	4
	5-10	4	3
	Do not use on slopes steeper than 10%		
Lespedeza sericea, weeping love grass, ischaemum, yellow bluestem, kudzu, alfalfa, crabgrass	0-5	3.5	2.5
	Use on slopes steeper than 5% except for side slopes in combination channel.		
Annuals -used on mild slopes or as temporary protection until permanent covers are established common lespedeza, Sudan grass	0-5	3.5	2.5
	Use on slopes steeper than 5% is not recommended.		

REMARKS. The values apply to average, uniform stands of each type of cover. Use Velocities exceeding 5 fps only where good covers and proper maintenance can be obtained.

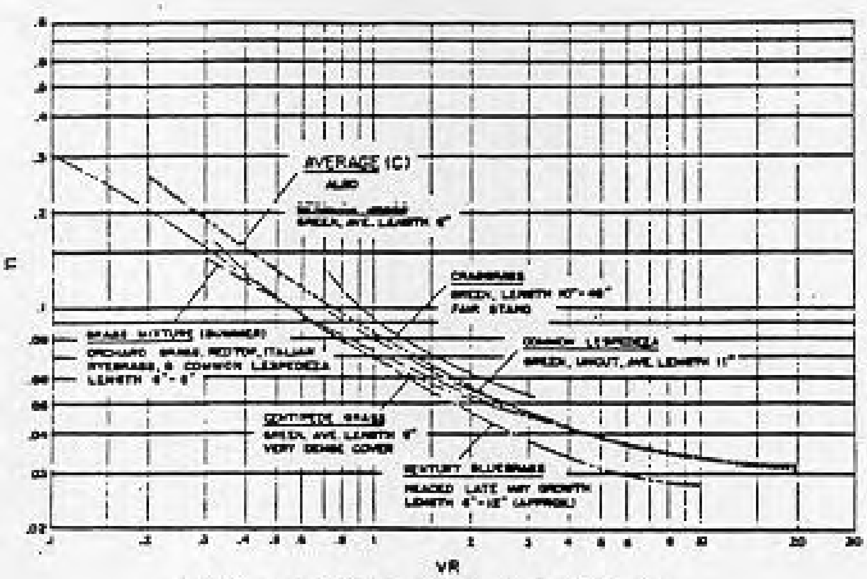


(a) Curves for A or very high vegetal retardance.

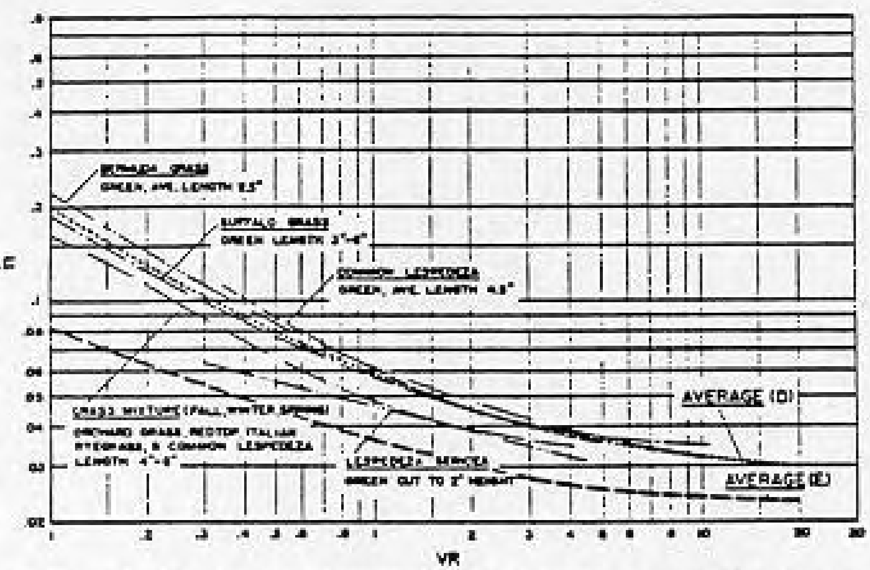
(b) Curves for B or high vegetal retardance.

Experimental n-VR curves. (U.S. Soil Conservation Service.)

CHART 10.1



(c) Curves for C or moderate vegetal retardance.



(d) Curves for D or low vegetal retardance, and an average curve for E or very low vegetal retardance.

CHART 10.1 (continued)

CHAPTER 11 - ENERGY LOSSES

Storm drainage systems commonly consist of road inlets, drop inlets, manholes or junction boxes, storm drain pipes, headwalls and energy dissipators. The size, material type and type of drainage structure must be properly selected to carry the design flow and energy losses from these elements depends on this selection. The selection must ensure that the energy losses are less than the available "fall" in the system. The basis for adequate design is the computation of hydraulic gradient. Assumption of uniform and steady flow condition, although this rarely occurs, is commonly made in these calculations which seem to give adequate results. Energy losses include (1) friction losses in pipes and (2) structure losses. The structural losses include those losses that occur at transitions, junctions, bends, vertical drops, entrance losses, exit losses, etc.

Friction Losses

Friction losses in pipes can be computed using Manning's equation. Manning's coefficient depends on the type of pipe material and should be properly selected as the calculations are sensitive to the roughness coefficient. The hydraulic gradient is computed assuming that the pipe is flowing full if the actual slope of the pipe (S_o) exceeds the friction slopes (S_f). The energy gradient is then equal to the friction slope. This assumption places the hydraulic grade line at the crown of the pipe and avoids the need to calculate water surface profiles in the pipes. But if $S_o < S_f$, however, the pipe will be surcharged and the hydraulic grade line will be parallel to the friction slope.

Structure Losses

Energy losses in structures result from rapid changes in the direction or magnitude of the velocity of flow and elevation of inlet outlet pipes. These losses can be minimized by providing a fully developed invert (semi circular on the bottom and vertical sides from on-half depth to the top of the pipe) through the structure. If the invert is not developed, the expansion loss will approach one-half of velocity head where the velocity head is a function of both upstream and downstream velocities.

Transitions connect pipes of different characteristics of flow area, shape, grade, alignment, material. Transitions may be gradual or sudden. Transition head loss of primarily a function of the velocity head. Even a small transition loss may be important in flat terrain. The loss in head in bends is also a function of the velocity head.

Transition loss in pipes can be expressed in terms of the areas before and after a transition, and either upstream or downstream velocity. Energy loss due to expansion and contraction can be calculated using equations given in ASCE Manual. In open channels the hydraulics of flow are complicated by possible changes in depth but again the energy loss can be expressed as a function of change in velocity head. Additional information for energy loss computation in open channels can be found in Chow (1959) and King and Brater (1963).

The design of a junction is, in effect, the design of two or more transitions, one for each flow path. Allowances should be made for head loss due to curvature of the paths and impact at the converging streams. Considerable judgement is needed to evaluate junction losses. Vertical pipe drops with vitrified clay or cast iron lining are used at junctions where pipe elevations are high, the pipe drops often are constructed with an entrance angle of 30 degrees with the main pipe.

Computation and consideration of energy losses are adequately addressed in ASCE Manual, FHA circular HEC 15, SCS Technical Release 25, and SCS Engineering Handbook, Section 5.

CHAPTER 12 - ENERGY DISSIPATORS

An Energy dissipating device is required to prevent erosion in a waterway (Channel, Swale, Stream, etc.) resulting from excessive flow conditions at the outlet of drainage structures such as pipes, culverts, spillways, etc. Thus an energy dissipator is a structure designed to protect from erosion by reducing the velocity of flow to allowable velocities. Some of the commonly used energy dissipators are impact basins, drop structures, stilling basins, and riprap. Under certain conditions of flow a hydraulic jump is also an effective energy dissipating device. The hydraulic jump used for energy dissipation is usually confined partly or entirely to a channel reach that is known as stilling basin. Reduction of erosion is also accomplished by the use of linings in waterways. Lining may be rigid, such as Portland Cement or asphaltic concrete, or flexible, such as vegetation or riprap. The design of an energy dissipator depends on such factors as the discharge, velocity, depth and turbulence of flow at the end of a hydraulic element and the allowable velocity in the natural waterway. The details of the design of various types of energy dissipators with or without stable linings are available in Federal Highway Administration's circulars HEC 14 and HEC 15, SCS Technical Release No. 25, SCS Engineering Handbook, Section 5.

Energy dissipators can change culvert performance and channel protection requirements. The size of riprap required for a stable channel increases as the exit velocity increases. The length of riprap protection is based on the magnitude of the exit velocity compared with the natural channel velocity. The greater this difference, the longer will be the length of the riprap. The following criteria are to be implemented: (1) The surface of the rip rapped floor is constructed at an elevation h_s below the culvert invert where h_s is the depth of the scour that would occur in a riprap at design discharge conditions. (2) The ration of h_s to d_{50} of the material should be greater than 2 and less than 4. (3) The length of the energy dissipating pool is $10(h_s)$ or $3W_o$ whichever is larger. The overall length of the basin including the apron is $15(h_s)$ or $4W_o$ whichever is larger. Where W_o is the width of the culvert outlet. The thickness of riprap can be taken to be $3(d_{50})$ on the approach and $2(d_{50})$ for the remainder of basin.

The energy dissipator selection process can be summarized as follows:

1. The Input data:
   culvert
   standard outlet
   channel
   allowable scour estimate

2. Scour computation

3. Velocity modification in culvert

4. Energy dissipator design (different types including stilling basins, riprap)

5. Selection of dissipating device (based on right-of-way, basins, cost, efficiency, anticipated scour)

Several examples of such a complete design can be found in HEC No. 14. But we will illustrate the design of riprap for three different conditions in the following examples and addition information for these example problems and other cases can be found in HEC No. 14.

EXAMPLE 12.1

(12.1)

Given: 8 ft by 6 ft box culvert Q=800 cfs, supercritical flow in culvert, normal flow depth = brink depth y_o = 4 ft. Tailwater depth TW=2.8 ft.

Find: Riprap basin dimensions for these conditions:

SOLUTION Definitions of terms in steps 1 through 5 can be found in charts 12.1 and 12.2.

1. $y_o = y_e$ for rectangular section, ye=4 ft.

2. Vo = Q/A = 800/(4) (8) = 25 fps

3. FR = $V_o/[(32.2)\ (y_e)]^{1/2} = 25/[(32.2)\ (4)]^{1/2} = 2.20$

4. $TW/y_e = 2.8/4.0 = 0.7$ $TW/y_e < 0.75$ O.K.

5. Try $d_{50}/y_e = 0.45$, $d_{50} = (0.45)\ (4) = 1.80$ ft.

   From Chart 12.2, $h_s/y_e = 1.6$

   $h_s = (4)\ (1.6) = 6.4$ ft.

   $h_s/d_{50} = 6.4/1.8 = 3.6$ ft $\qquad 2<h_s/d_{50} < 4 \qquad$ O.K.

6. L_s = (10) (6.4 = 64 ft. Ls is the length of energy dissipating Pool

   L_s min = (3) (W_o) = (3) (8) = 24 ft., use L_s = 64 ft.

   L_B = (15) (6.4) = 96 ft. L_B is the overall length of the riprap basin

   L_B min = (4) (W_o) = (4) (8) = 32 ft., use L_B = 96 ft.

7. Thickness of riprap: On the approach $3d_{50}$ = 5.4 ft

Reminder $2d_{50} = 3.6$ ft

Other basin dimensions designed in accordance with details shown in Chart 12.1

EXAMPLE 12.2

Given: 8 ft. by 6 ft. box culvert, $Q = 800$ cfs, supercritical flow in culvert, normal flow depth = brink depth, $y_o = 4$ ft., water depth, $TW = 4.2$ ft., downstream channel can tolerate 7 fps for design charge.

Find: Riprap basin dimensions for these conditions.

SOLUTION

Note-High tailwater depth, $TW/y_o = 1.05 \quad 0.75$

1. Design riprap basin (Example 12.1) use steps 1-7 $d_{50} = 1.8$ ft., $h_s = 6.4$ ft., $L_s = 64$ ft., $L_B = 96$ ft.

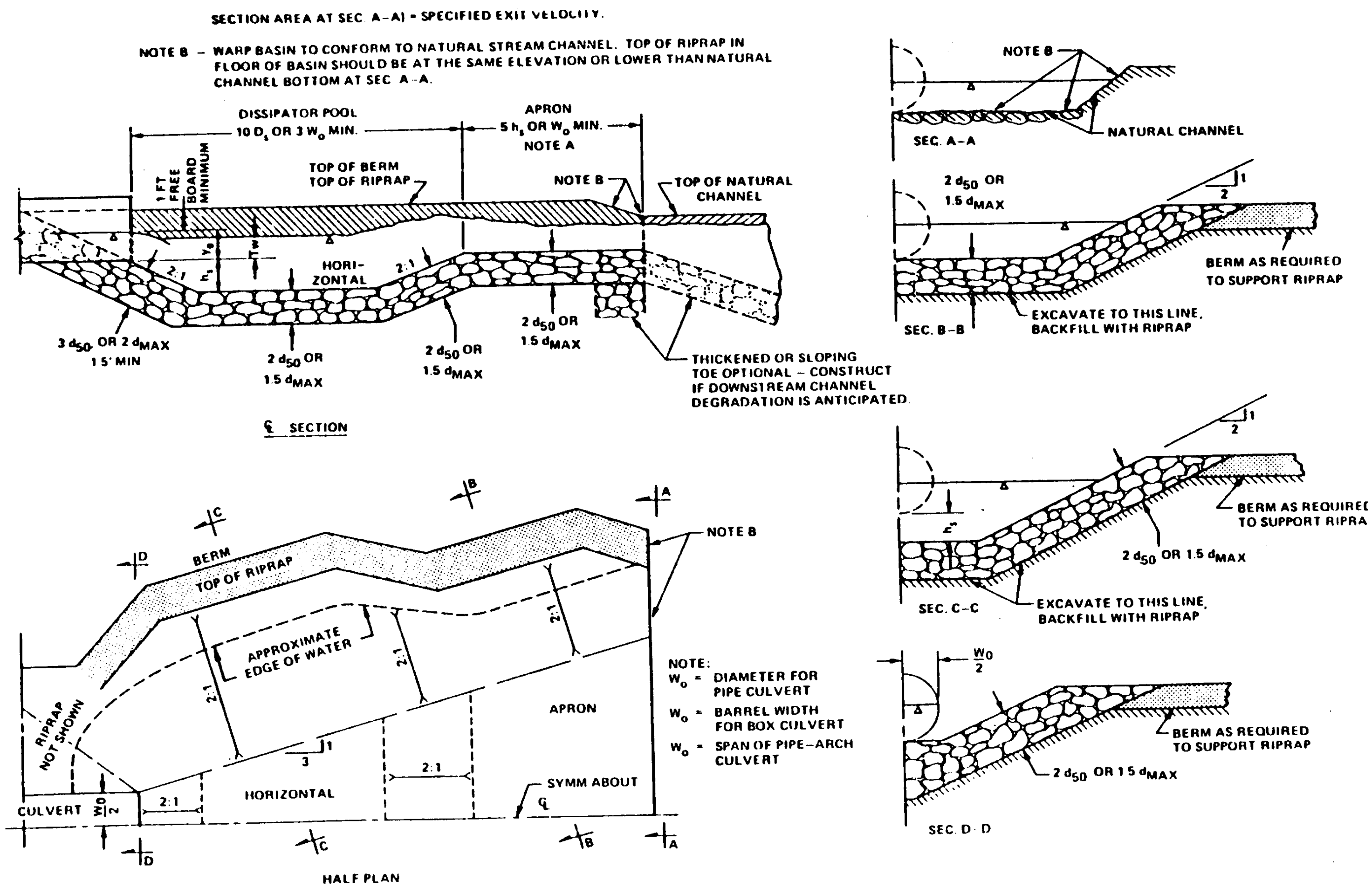
2. Design riprap for downstream channel. Utilize Chart 12.3 for estimating average velocity along the channel. Compute equivalent circular diameter D_e for brink area from:

$$A = \pi\ D_e^{\ 2/4} = (y_o)\ (W_o) = (4)\ (8) = 32\ \text{ft.}^2$$

$$D_e = (32(4)/\ \pi^{\ 1/2}$$

$$D_e = 6.4\ \text{ft.}$$

$$V_o = 25 \text{ fps (Example 12.1)}$$



DETAILS OF RIPRAPPED CULVERT ENERGY BASIN

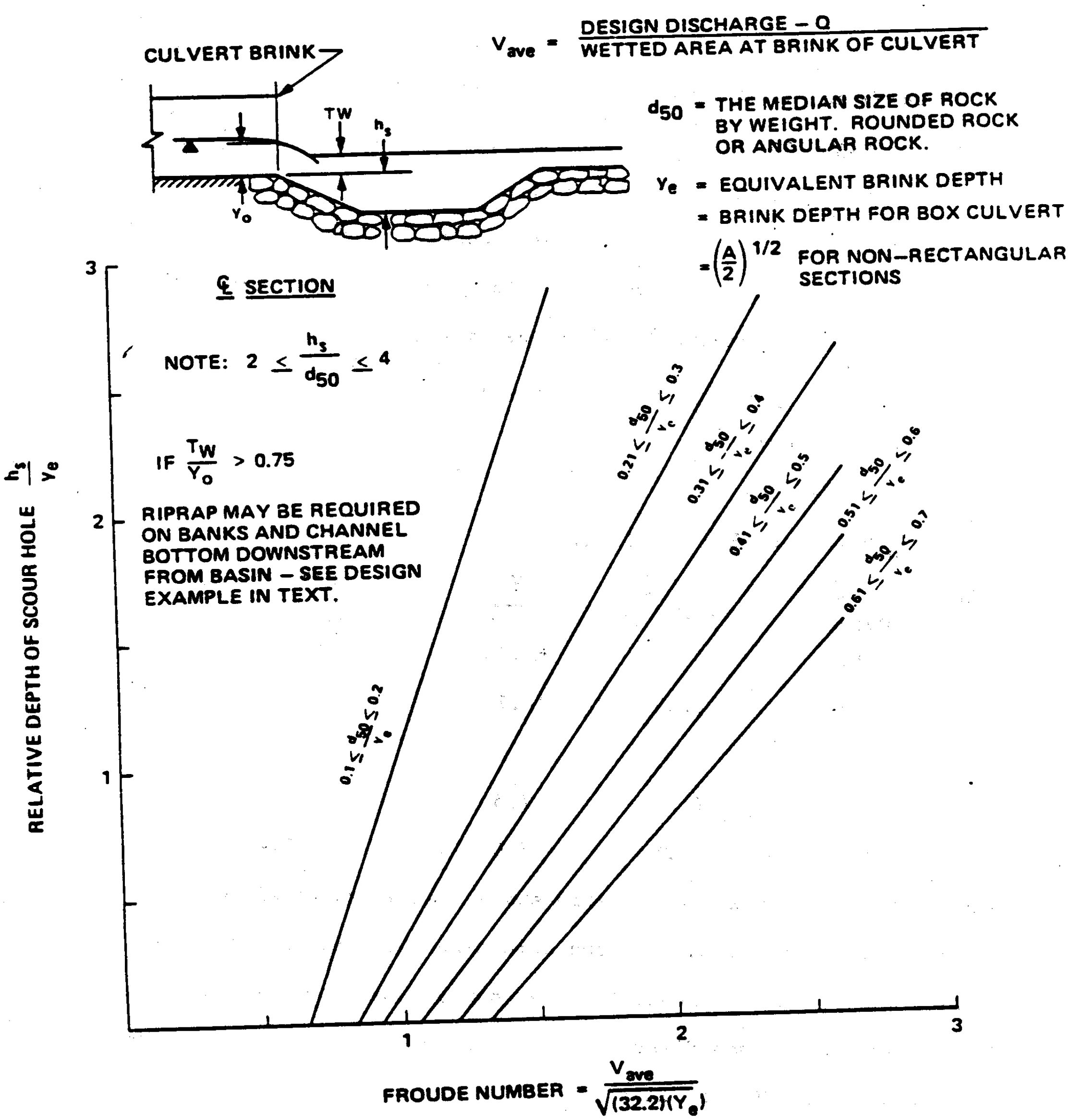


CHART 12.2 RELATIVE DEPTH OF SCOUR HOLE VERSUS FROUDE NUMBER AT BRINK OF CULVERT WITH RELATIVE SIZE OF RIPRAP AS THIRD VARIABLE

L/D_e	L (Compute)	V_L/V_o (Chart 12.3)	V_L ft./sec.	Rock Size D_{50} Chart 12.4 ft.
10	64	0.59	14.7	1.4
15	96	0.36	9.0	0.6
20	128	0.30	7.5	0.4
21	135	0.28	7.0	0.4

Riprap should be at least the size shown. As a practical consideration, the channel can be lined with the same size rock used for the basin. Protection must extend at least 135 feet downstream from the culvert brink. Channel should be shaped and riprap should be installed in accordance with details shown in HEC No. 11.

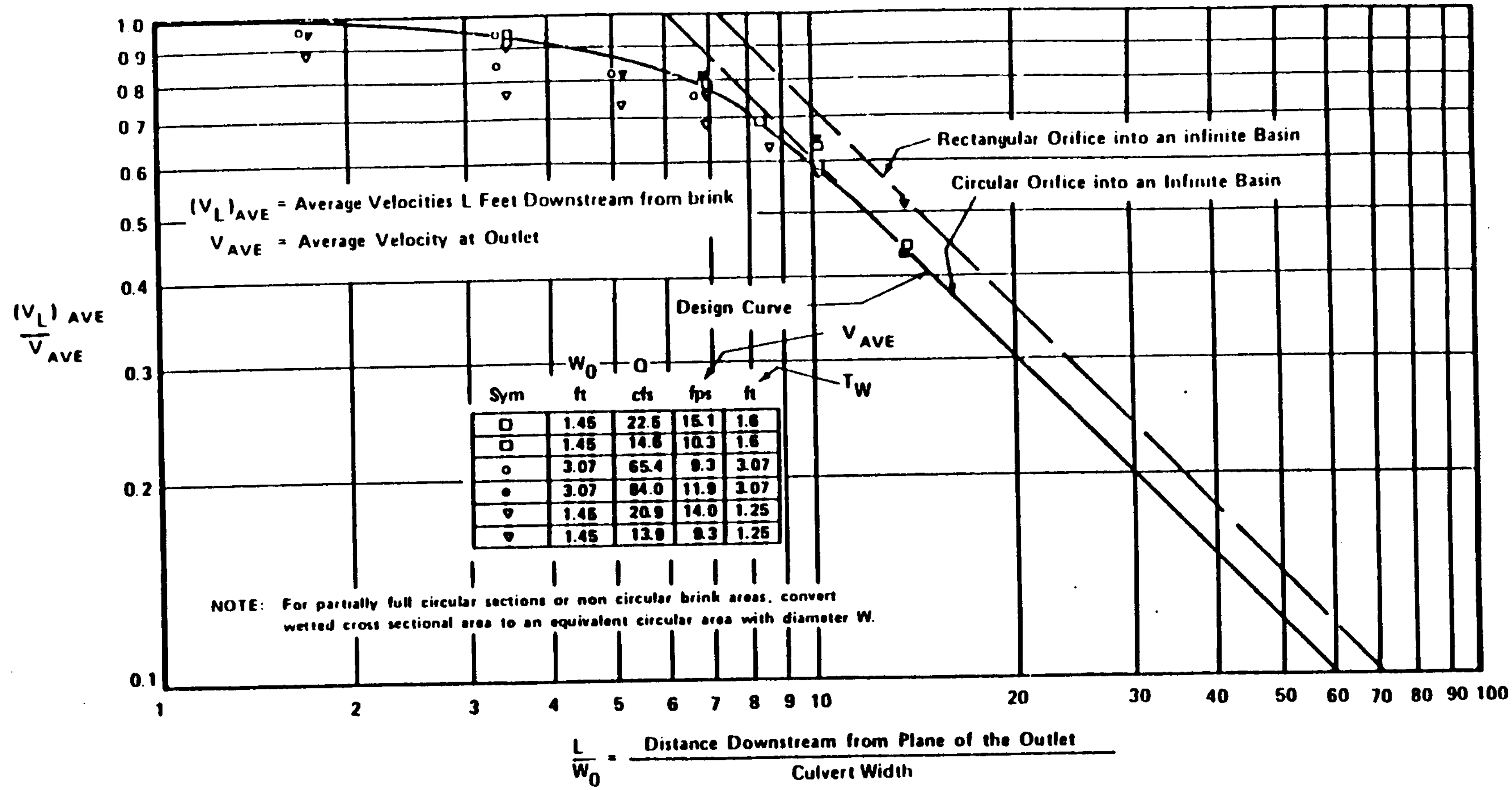
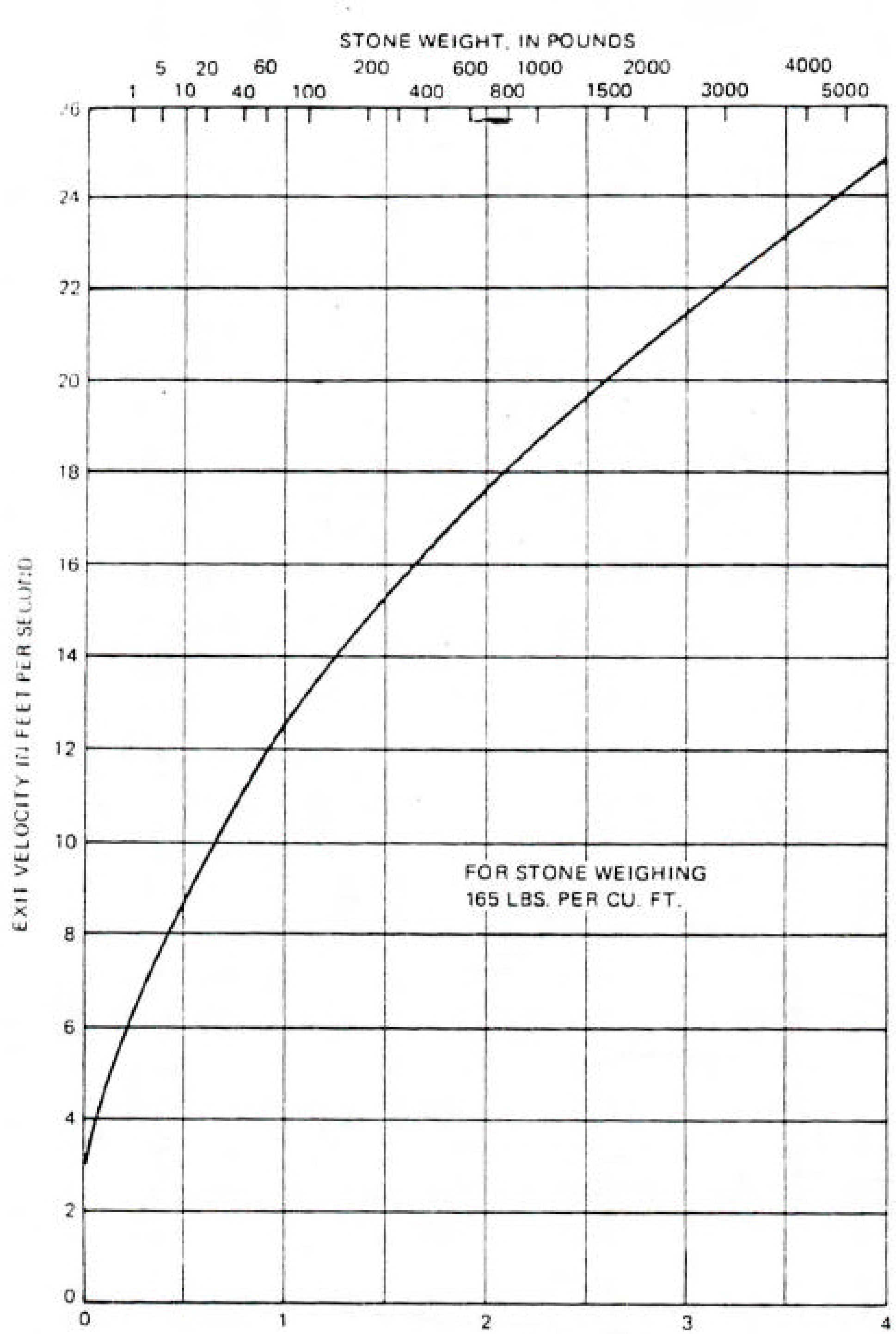


CHART 12.3 Distribution of Centerline Velocity for Flow from Submerged Outlets from Reference XI - 2 to be used for Predicting Channel Velocities Downstream from Culvert Outlet where High Tailwater prevails. Velocities obtained from the use of this Chart can be used with Figure 2 of HEC No. 11 for sizing riprap (DO not use Figure 1 HEC No. 11, use Mean Velocity Values)



EQUIVALENT SPHERICAL DIAMETER OF STONE, IN FEET

CHART 12.4 RIPRAP SIZE FOR USE DOWNSTREAM OF ENERGY DISSIPATORS

EXAMPLE 12.3

Given: 6 feet diameter cmp, $Q = 135$ cfs, $S_o = 0.004$, Mannings $n = 0.024$ normal depth in pipe for $Q = 135$ cfs is 4.5 feet, normal velocity is 5.9 fps, flow is sub-critical, tailwater depth (TW) is 2.0 feet.

Find: Riprap basin dimensions for these conditions:

SOLUTION

1. Determine y_o and V_o:

   $Q/D^{2.5} = 135/(6)^{2.5} = 1.53$

   $TW/D = 2.0/6 = .033$

   From Chart 12.5, $y_o/D = 0.45$

   $y_o = (0.45)\ (6) = 2.7$ ft.

   $TW/y_o = 2.0/2.70 = 0.74 \quad TW/y_o < 0.75$ O.K.

   Brink area (A) for $y_o/D = 0.45$ is

   $A = (0.343)\ (36) = 12.3$ sq. ft.

   (0.343 is from Table 12.1)

   $V_o = Q/A = 135/12.3 = 11.0$ fps

2. $y_e = (A/2)^{½} = (12.3/2)^{1/2} = 2.48$ ft.

3. $Fr = V_o/[(32.2)\ (y_e)]^{1/2} = 11/[(32.2)\ (2.48)]^{1/2} = 1.23$

4. Try $d_{50}/y_e = 0.25$, $d_{50} = (0.25)\ (2.48 = 0.62$ ft.

   From Chart 12.2, $h_s/y_e = 0.75$, $h_s = (0.75)\ (2.48) = 1.86$ ft.

   Check: $h_s/d_{50} = 1.86/0.62 = 3$, $2<h_s/d_{50} < 4$ O.K.

5. $L_s = (10)\ (h_s) = (10)\ (1.86) = 18.6$ ft.

   or $L_s = (3)\ (W_o) = (3)\ (6) = 18$ ft., use $L_s = 18.6$ ft.

   $L_B = (15)\ (h_s) = (15)\ (1.86) = 27.9$ ft. ft.

   or $L_B = (4)\ (W_o) = (4)\ (6) = 24$ ft., use $L_B = 27.9$ ft.

   $d_{50} = 0.60$ ft. use $d_{50} = 8$ in.

Other basin dimensions are designed in accordance with details shown on Chart 12.1

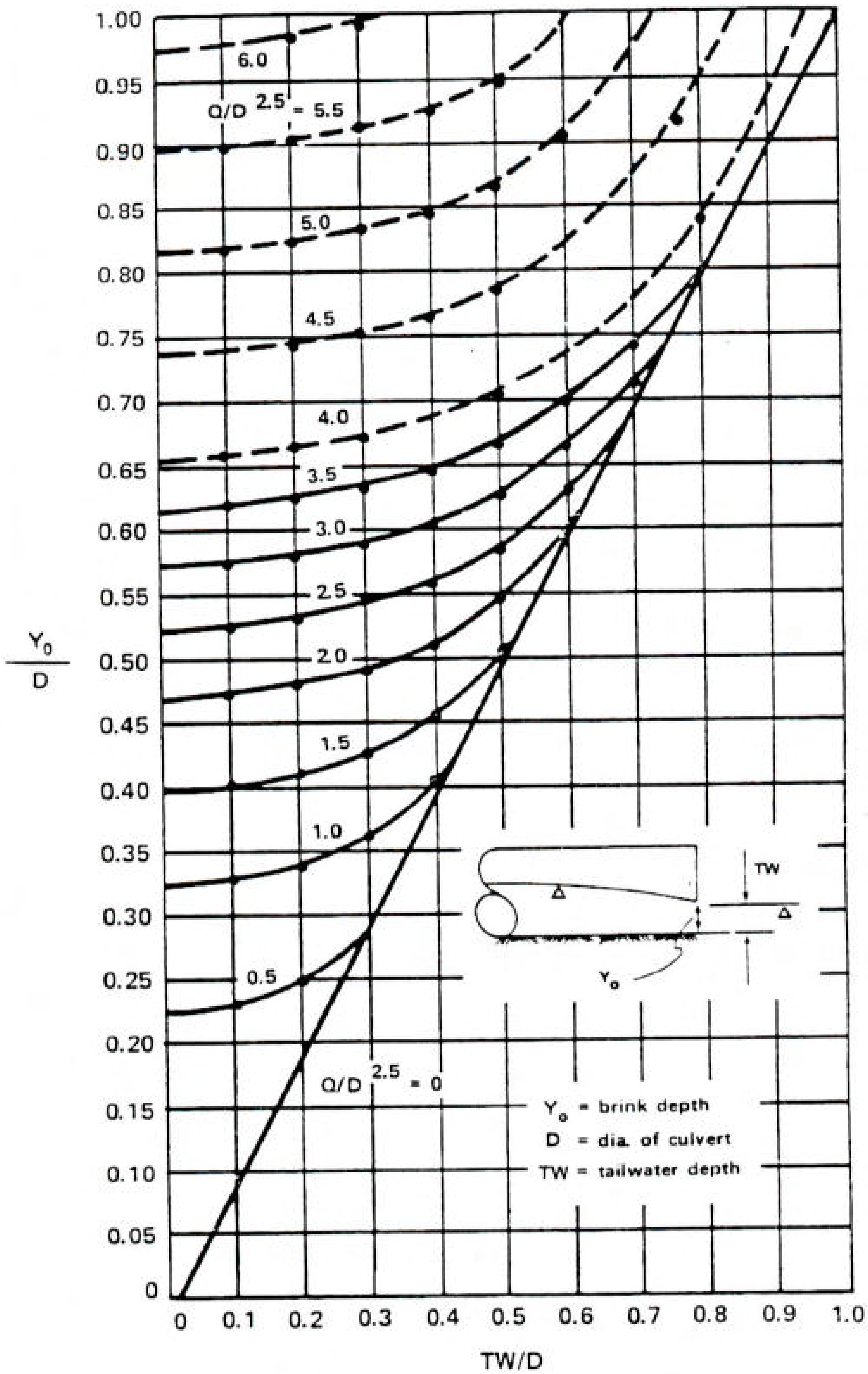


CHART 12.5 Dimensionless Rating Curve for the Outlets of Circular Culverts on Horizontal and Mild Slopes

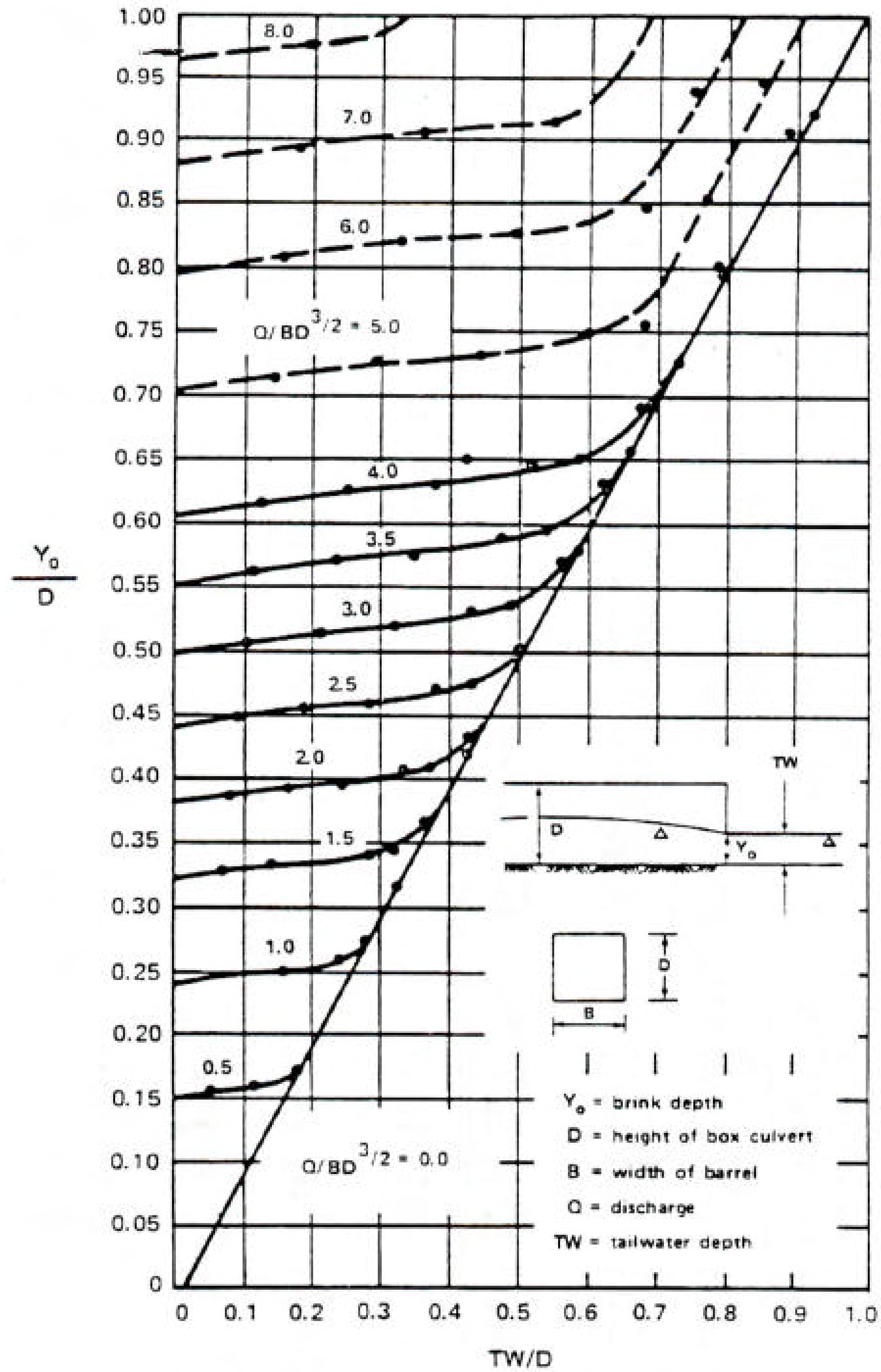


CHART 12.6 Dimensionless Rating Curves for the Outlets of Rectangular Culverts on Horizontal and Mild Slopes

d = depth of flow
D = diameter of pipes
A = area of flow
R = hydraulic radius

Q = discharge in cubic feet per second by Manning's formula
n = Manning coefficient
S = slope of channel bottom and of water surface

$\frac{d}{D}$	$\frac{A}{D^2}$	$\frac{R}{D}$	$\frac{On}{D^{8/3}S^{1/2}}$	$\frac{On}{d^{8/3}S^{1/2}}$	$\frac{d}{D}$	$\frac{A}{D^2}$	$\frac{R}{D}$	$\frac{On}{D^{8/3}S^{1/2}}$	$\frac{On}{d^{8/3}S^{1/2}}$
0.01	0.0013	0.0066	0.00007	15.04	0.51	0.4027	0.2531	0.239	1.442
0.02	0.0037	0.0132	0.00031	1057	0.52	0.4127	0.2562	0.247	1.415
0.03	0.0069	0.0197	0.00074	8.56	0.53	0.4227	0.2592	0.255	1.388
0.04	0.0105	0.0262	0.00138	7.38	0.54	0.4327	0.2621	0.263	1.362
0.05	0.0147	0.0325	0.00222	6.55	0.55	0.4426	0.2649	0.271	1.336
0.06	0.0192	0.0389	0.00328	5.95	0.56	0.4526	0.2676	0.279	1.311
0.07	0.0242	0.0451	0.00455	5.47	0.57	0.4625	0.2703	0.287	1.286
0.08	0.0294	0.0513	0.00604	5.09	0.58	0.4724	0.2728	0.295	1.262
0.09	0.0350	0.0575	0.00775	4.76	0.59	0.4822	0.2753	0.303	1.238
0.10	0.0409	0.0635	0.00967	4.49	0.60	0.4920	0.2776	0.311	1.215
0.11	0.0470	0.0695	0.1181	4.25	0.61	0.5018	0.2799	0.319	1.192
0.12	0.0534	0.0755	0.1417	4.04	0.62	0.5115	0.2821	0.327	1.170
0.13	0.0600	0.0813	0.01674	3.86	0.63	0.5212	0.2842	0.335	1.148
0.14	0.0668	0.0871	0.01952	3.69	0.64	0.5308	0.2862	0.343	1.126
0.15	0.0739	0.0929	0.0225	3.54	0.65	0.5404	0.2882	0.350	1.105
0.16	0.0811	0.0985	0.0257	3.41	0.66	0.5499	0.2900	0.358	1.084
0.17	0.0885	0.1042	0.0291	3.28	0.67	0.5594	0.2917	0.366	1.064
0.18	0.0961	0.1097	0.0327	3.17	0.68	0.5687	0.2933	0.373	1.044
0.19	0.1039	0.1152	0.0365	3.06	0.69	0.5780	0.2948	0.380	1.024
0.20	0.1118	0.1206	0.0406	2.96	0.70	0.5872	0.2962	0.388	1.004
0.21	0.1199	0.1259	0.0448	2.87	0.71	0.5964	0.2975	0.395	0.985
0.22	0.1281	0.1312	0.0492	2.79	0.72	0.6054	0.2987	0.402	0.965
0.23	0.1365	0.1364	0.0537	2.71	0.73	0.6143	0.2998	0.409	0.947
0.24	0.1449	0.1416	0.0585	2.53	0.74	0.6231	0.3008	0.416	0.928
0.25	0.1535	0.1466	0.0634	2.56	0.75	0.6319	0.3017	0.422	0.910
0.26	0.1623	0.1516	0.0686	2.49	0.76	0.6405	0.3024	0.429	0.891
0.27	0.1711	0.1566	0.0739	2.42	0.77	0.6489	0.3031	0.435	0.873
0.28	0.1800	0.1614	0.0793	2.36	0.78	0.6573	0.3036	0.441	0.856
0.29	0.1890	0.1662	0.0849	2.30	0.79	0.6655	0.3039	0.447	0.838
0.30	0.1982	0.1709	0.0907	2.25	0.80	0.6736	0.3042	0.453	0.821
0.31	0.2074	0.1756	0.0966	2.20	0.81	0.6815	0.3043	0.458	0.804
0.32	0.2167	0.1802	0.1027	2.14	0.82	0.6893	0.3043	0.463	0.787
0.33	0.2260	0.1847	0.1089	2.09	0.83	0.6969	0.3041	0.468	0.770
0.34	0.2355	0.1891	0.1153	2.05	0.84	0.7043	0.3038	0.473	0.753
0.35	0.2450	0.1935	0.1218	2.00	0.85	0.7115	0.3033	0.477	0.736
0.36	0.2546	0.1978	0.1284	1.958	0.86	0.7186	0.3026	0.481	0.720
0.37	0.2642	0.2020	0.1351	1.915	0.87	0.7254	0.3018	0.485	0.703
0.38	0.2739	0.2062	0.1420	1.875	0.88	0.7320	0.3007	0.488	0.687
0.39	0.2836	0.2102	0.1490	1.835	0.89	0.7384	0.2995	0.491	0.670
0.40	0.2934	0.2142	0.1561	1.797	0.90	0.7445	0.2980	0.494	0.654
0.41	0.3032	0.2182	0.1633	1.760	0.91	0.7504	0.2963	0.496	0.637
0.42	0.3130	0.2220	0.1705	1.724	0.92	0.7560	0.2944	0.497	0.621
0.43	0.3229	0.2258	0.1779	1.689	0.93	0.7612	0.2921	0.498	0.604
0.44	0.3328	0.2295	0.1854	1.655	0.94	0.7662	0.2895	0.498	0.588
0.45	0.3428	0.2331	0.1929	1.622	0.95	0.7707	0.2865	0.498	0.571
0.46	0.3527	0.2366	0.201	1.590	0.96	0.7749	0.2829	0.496	0.553
0.47	0.3627	0.2401	0.208	1.559	0.97	0.7785	0.2787	0.494	0.535
0.48	0.3727	0.2435	0.216	1.530	0.98	0.7817	0.2735	0.489	0.517
0.49	0.3827	0.2468	0.224	1.500	0.99	0.7841	0.2666	0.483	0496
0.50	0.3927	0.2500	0.232	1.471	1.00	0.7854	0.2500	0.463	0.463

Uniform flow in circular sections flowing partly full   TABLE 12.1

CHAPTER 13 - COMPUTATION OF SOIL EROSION

Erosion and sedimentation of soil construction sites and areas undergoing development can be harmful in that they may pollute the receiving waters, and greatly reduce the capacity of channels and reservoirs in which they ultimately deposit. It is therefore necessary to estimate how much soil may be eroded and deposited, and accordingly, provide control measures to prevent erosion and transportation of soil from construction sites.

The universal soil Loss Equation, developed by the Agricultural Research Service in cooperation with the SCS, estimates soil loss caused by sheet and rill erosion. The equation is

$$E = R\,K\,L\,S\,C\,P \qquad (13.1)$$

where E = average soil loss in tons/acre/year

R = rainfall factor

K = soil erodibility factor

L = length of slope factor

S = slope factor

C = cropping management factor

P = erosion control practice factor

The rainfall factor measures the ability of rainfall water to detach and transport soil. The average <u>annual</u> rainfall factor (R) is shown in Chart 13.1. The corresponding values for <u>storms</u> of various frequencies for the Metro Atlanta area are given in Table 13.1. The soil erodibility (K) depends on soil texture, organic matter content, structure and permeability. Approximate value of K can be obtained from Table 13.2. The length of slope factor (L) and the slope factor (S) are usually combined into one slope-length factor (LS). They are given in Chart 13.2 in terms of slope and slope length of the watershed. The cropping management factor (C) reflects the effects of plant cover and crops on soil erosion. Table 13.4 contain the C factors. Finally the erosion practice factor (P) reflects the effect of management techniques such as contouring and terracing on soil erosion. Table 13.3 gives these factors. Additional details on the Universal Soil Loss Equation can be found in SCS Technical Release No. 51

EXAMPLE 13.1

A five acre site in Fulton County has been cleared and graded for the Construction of a shopping center. The site contains Sandy Clay Loam, with 2% organic matter, is on a 7% slope, and has a slope length of 600 ft. To help control erosion, the contractor has decided to terrace the site and put seed, fertilizer, and straw on it. (a) how much will be the average annual soil loss be reduced by this action? (b) how much will the soil loss be reduced by this action for a 20 year storm?

SOLUTION

a) Average Annual Soil Loss

Before Erosion Control	After Erosion Control
R = 300 (Chart 13.1)	R = 300
K = 0.25 (Table 13.2)	K = 0.25
LS = 2.0 (Chart 13.2)	LS = 2.0
C = 1.0 (Table 13.4)	C = 0.3
P = 1.0 (Table 13.3)	P = 0.40
E = R K L S C P	E = R K L S C P
= 300 (0.25) (2.0) (1.0) (1.0)	= 300 (0.25) (2.0) (1.0) (1.0) (0.4)
= 150 tons/acre/year	= 18 tons/acre/year

Reduction in soil loss = (150-18) x 5 acres

= 660 tons/year.

b) Soil Loss from a 20 year Storm

The only factor that changes is R value. From Table 13.1, for 20 year Storm, R = 134

Soil loss before erosion control

E = 134 x 0.25 x 2.0 x 1.0 x 1.0

E = 134(0.25)(2.0)(1.0)(1.0) = 67 tons/acre

Soil loss after erosion control

E = 134(0.25)(2.0)(1.0)(1.0) = 8 tons/acre

after

Reduction in soil loss = (67-8) x 5 acre = 295 tons

It should be noted that if the watershed or site in study is non-homogeneous in terms of soil properties, the site should be divided into two or more homogeneous sub-acres, and soil loss is computed by summing the soil loss from each sub-area.

To convert soil losses from a weight-basis to a volume basis, the weight is divided by the density of sediment. Typical density of 60 lbs. per cubic foot is usually assumed.

Various control practices to reduce erosion as described in Chapter 14. Sediment basins can be constructed to limit the sediment yield from areas within allowable limits. Usually these allowable limits range from 5 to 15 tons per acre per year. The larger limit is usually for short-term grading operations while the lower limit is for long-term grading operations. The sediment basin traps the sediment from the area in excess of allowable limit.

The volume of sediment expected to be trapped is

$$V_s = (E - E_a)\ \Gamma_s A \qquad (13.2)$$

where E = Volume of sediment expected in tons/acre/yr (from Equation 13.1)

Γ_s = dry intensity of sediment (=1.28 cu yd/ton)

A = drainage area in acres

E_a = maximum allowable sediment from the area in tons/acre/yr

The volume of sediment basin (v) is computed using

$$V = V_b A + 0.5\ V_s \qquad (13.3)$$

where V_b = sediment basin volume in cu yd/ac/yr and can be obtained from Chart 13.3. This provides the trap efficiency to attain the required sediment removal from runoff from the site.

EXAMPLE 13.2

As seen in part (a) of Example 13.1, the average annual sediment yield from the 5 acre area is 150 tons/acre/year. Instead of using terrace type control, the contractor plans to provide a sediment basin to limit the sediment leaving the area to a maximum of 15 tons/acre/year. Assuming a dry density of 1.28 cubic yard/ton, determine the total basin volume.

SOLUTION

E = 150 tons/ac/yr

E_a = 15 tons/ac/yr

Γ_s = 1.28 cu yd/ton

A = 5 acres

using Equation 13.2.

volume of sediment expected to be trapped

$$V_s = (E - E_a)\ \Gamma_s\ A$$

$$= (150 - 15)\ (1.28)\ (5) = 864 \text{ cu yd/yr}$$

$$V_b = 270 \text{ cu yd/ac/yr}$$

Thus the total basin volume is, from Equation 13.3

$$V = V_b A + 0.5\ V_s$$

$$= 270 \times 5 + 0.5 \times 864$$

$$= 1782 \text{ cu yd}$$

TABLE 13.1 RAINFALL FACTORS (R) FOR VARIOUS FREQUENCIES

Frequency (years)	R Value
2	67
5	92
10	112
20	134

Average annual values of the rainfall factor R. (SOURCE: Predicting Rainfall – Erosion Losses from Cropland East of the Rocky Mountains, Agricultural Handbook, No. 282 by Wischmeser and Smith Ref. 53) Published by the Agricultural Research Service, U.S. Department of Agriculture

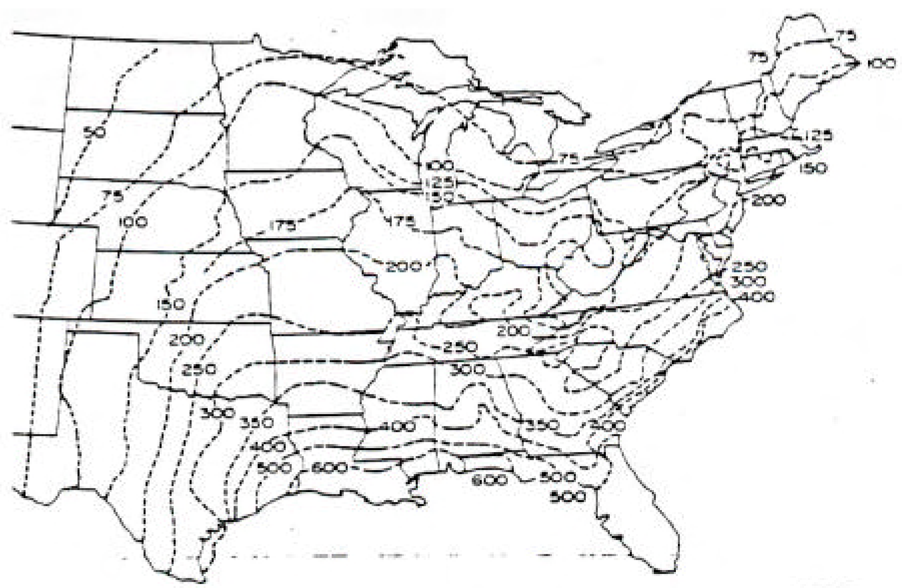


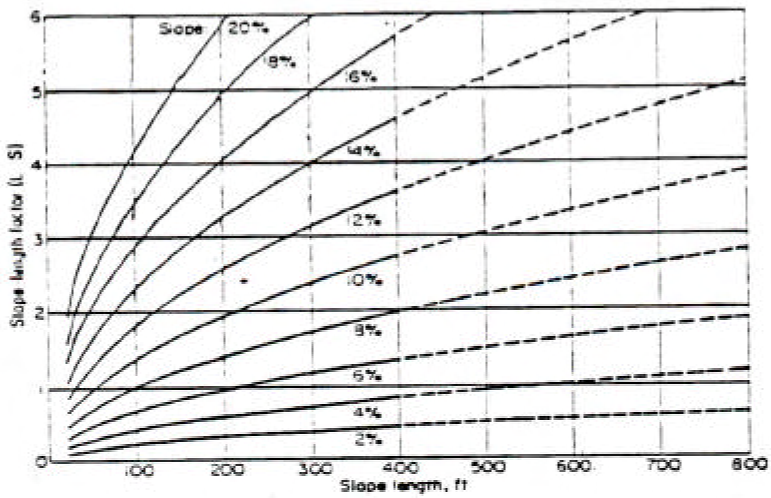
CHART 13.1 AVERAGE ANNUAL VALUES OF THE RAINFALL FACTOR,. R

Soil Erodibility Factor, K

Soil type	Organic matter content		
	<0.5%	2%	4%
Sand	0.05	0.03	0.02
Fine sand	0.16	0.14	0.10
Very fine sand	0.42	0.36	0.28
Loamy sand	0.12	0.10	0.08
Loamy fine sand	0.24	0.20	0.16
Loamy very fine sand	0.44	0.38	0.30
Sandy loam	0.27	0.24	0.19
Fine sandy loam	0.35	0.30	0.24
Very fine sandy loam	0.47	0.41	0.33
Loam	0.38	0.34	0.29
Silt loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy clay loam	0.27	0.25	0.21
Clay loam	0.28	0.25	0.21
Silty clay loam	0.37	0.32	0.26
Sandy clay			
Silty clay	0.14	0.13	0.12
Clay	0.25	0.23	0.19
		0.13-0.29	

TABLE 13.2 SOIL ERODIBILITY FACTOR, K

SOURCE: Control of Water Pollution from Cropland (Rel 39) published by the Agricultural Research Service U.S. Department of Agriculture.



Slope –length factor, L.S.. (SOURCE: Predicting Rainfall – Erosion Losses from Cropland East of the Rocky Mountains, Agricultural Handbook, No. 282 by Wischmeser and Smith Ref. 53) Published by the Agricultural Research Service, U.S. Department of Agriculture

CHART 13.2 SLOPE-LENGTH FACTOR, L.S.

Erosion Control Practice Factors (P)		
Practice	Land Slope %	P
None		1.00
Contouring	1.1-2.0	0.60
Contouring	2.1-7.0	0.50
Contouring	7.1-12.0	0.60
Contouring	12.1-18.0	0.80
Contouring	18.1-24.0	0.90
Contour stripcropping	1.1-20.	0.45
Contour stripcropping	2.1-7.0	0.40
Contour stripcropping	7.1-12.0	0.45
Contour stripcropping	12.1-18.0	0.60
Contour stripcropping	18.1-24.0	0.70
Terracing	11.1-2.0	0.45
Terracing	21.1-7.0	0.40
Terracing	7.1-12.0	0.45
Terracing	12.1-18.0	0.60
Terracing	18.1-24.0	0.70
Straight row farming		1.00

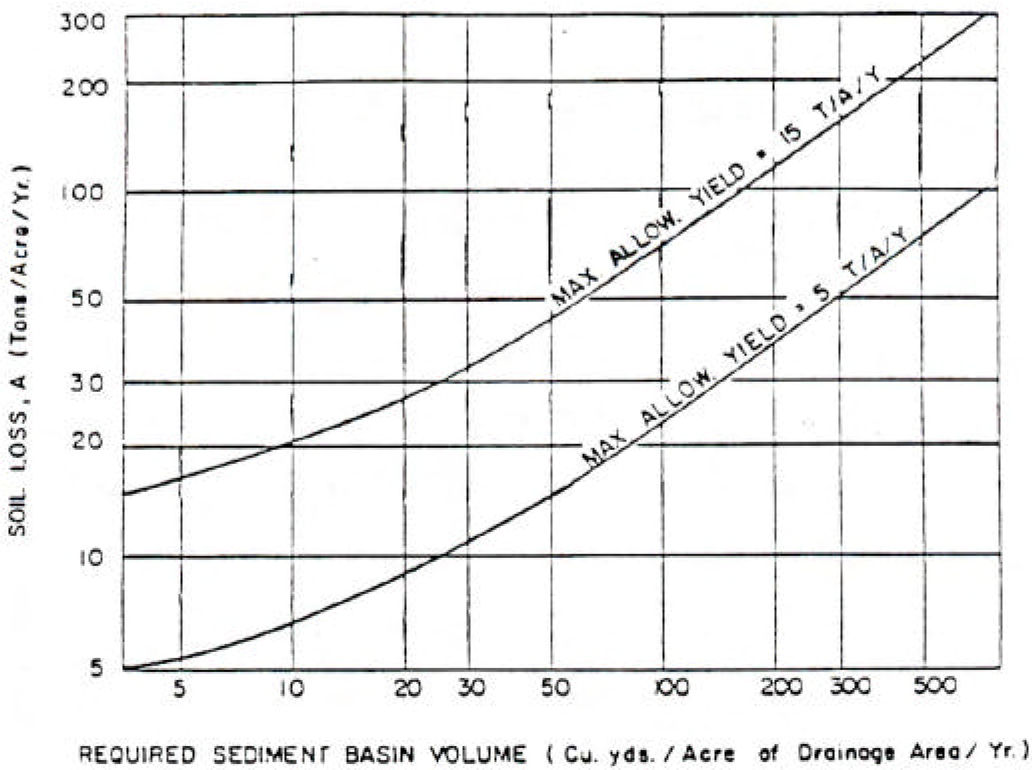
SOURCE. Producing Rainfall Erosion Losses from Cropland East of the Rocky Mountains, Agricultural Handbook No. 282, by W.M. Wishemeser and D. D. Smith, (Ref 53) Published by the Agricultural Research Service U.S. Department of Agriculture.

TABLE 13.3 EROSION CONTROL PRACTICE FACTORS, P

Typical Cropping Factors (C)

Crop	Notes	C	Reference
Bare ground		1.0	56
Grass and legume (hay)	All-year average	0.004-0.01	61
Clover	All-year average	0.015-0.025	61
Lespedeza	All-year average	0.01-0.02	61
Continuous Corn	Rough fallow-residue removal	0.60-0.85	61
Continuous Corn	Seedbed residue removal	0.70-0.90	61
Continuous Corn	Growing crop residue removal	0.25-0.50	61
Continuous Corn	Residue or stubble Residue removal	0.60-0.85	61
Continuous Corn	Rough fallow-residue left	0.20-0.70	61
Continuous Corn	Seedbed residue left	0.45-0.75	61
Continuous Corn	Growing cop residue left	0.25-0.40	61
Continuous Corn	Residue or stubble residue left	0.15-0.65	61
Continuous Cotton	Rough fallow	0.30-0.45	61
Continuous Cotton	Seedbed	0.50-0.80	61
Continuous Cotton	Growing crop	0.45-0.55	61
Continuous Cotton	Residue or stubble	0.20-0.50	61
Grass cover		0.01	56
Land denuded by fire		1.00	56
Seed and fertilizer	18-20 month construction period	0.60	56
Seed fertilizer, and straw mulch	18-20 month construction period	0.30	56

TABLE 13.4 TYPICAL CROPPING FACTORS, C



300
200
100
50
30
20
10
5
SOIL LOSS, A (Tons/Acre/Yr.)
MAX ALLOW. YIELD = 15 T/A/Y
MAX ALLOW. YIELD = 5 T/A/Y
5
10
20
30
50
100
200
300
500
REQUIRED SEDIMENT BASIN VOLUME (Cu. yds. / Acre of Drainage Area / Yr.)

CHART 13.3

CHAPTER 14 - EROSION AND SEDIMENT CONTROL

The U.S. Department of Agriculture Soil Conservation Service, Athens, Georgia, has Published a Manual of Standards and Specifications for Control of Soil Erosion and Sediment in Areas Undergoing Urban Development. Chapter 1 and Chapter 2 of this document, which has been made applicable to the climate, soils, and native vegetation of Georgia, are incorporated into this manual. These are supplemented by additional procedures, from various sources, which may be adapted to the requirements of the project.

DEVELOPING AN EROSION AND SEDIMENT CONTROL PLAN

Importance of Coordination and Installation of Control Measures

Possibly the most important facet of an erosion and sediment control plan is a comprehensive construction and stabilization schedule for implementing changes in land use and topography, and in installing the planned roads, utilities, and basic facilities.

This should be a critical path schedule of construction operations with a primary objective of holding erosion and resulting sediment pollution to a minimum through detailed scheduling of all construction work and efficient construction operations. The schedule should coordinate clearing and grading activities, the installation of temporary and permanent vegetative and structural erosion control measures, and the installation of roads, utilities, and facilities. The end result of the plan should be to reduce the number of acre-days of unprotected earth surfaces to a minimum, to provide for the orderly movement of runoff from the area throughout the construction period, and to provide a means of capturing sediment escaping from the construction area.

Erosion and Sediment Control Measures

There are a number of erosion and sediment control measures that can be applied to both public and private developments with effective results at moderate costs. A brief description of those that are most frequently used follows. The number of them that would be needed on a specific site would be dependent on the severity of the erosion hazard. On some residential developments, for example, temporary protective cover might be the only required measure. On some commercial developments, a half dozen or more measures might be required.

1. Non-critical Area Stabilization - In areas of good soils on moderate slopes, the establishment and maintenance of good vegetative cover utilizing standard plants and establishment techniques recommended by local agencies or landscaping services.

2. Critical Area Stabilization

   a. General - Cutting, filling, and grading soils with heavy equipment results in cuts with exposed sub-soils or fills with mixtures of soil horizons. Conditions such as acidity, low fertility, compaction, and dryness or wetness often prevail which are unfavorable to plant growth. Excessively long slopes and steep grades are often encountered or created. Drainageways are normally subjected to hydraulic forces requiring both special establishment techniques and grasses which have high resistance to scouring. However, plants and techniques are available to provide both temporary and permanent protective cover for all these conditions. Machines that blow a mixture of seed, fertilizer, mulch, and asphalt on soil surfaces are available and are especially suited to seeding steep slopes. Mulch netting is available for use on sites where the erosion hazard is severe.

b. Temporary Protective Cover - Heavy grading or construction of cuts and fills is often carried out in several stages interrupted by lengthy periods during which the land lies idle and is subject to heavy erosion. Similarly, final grading or filling may be completed at a season not favorable for the immediate establishment of permanent vegetative cover. These sites can be temporarily stabilized by seeding fast-growing annuals such as ryegrass or millet which provide quick protection yet can be worked into the soil when the site is prepared for seeding of permanent species.

An alternative method is the application of mulch for immediate protection. Where final grading is not completed, mulch can either be removed or worked into the soil after it has afforded protection while areas lie idle. Areas brought to final grade during midsummer or winter can be mulched immediately, and they may be successfully overseeded at the proper season with a number of permanent grass and legume species.

c. Permanent Vegetation - For both sodding and seeding, there is a fairly wide choice of grasses, legumes, and other plants to use on critical areas. The final choice of species should be determined by weighing such factors as adaptability, use, aesthetic requirements, degree of maintenance required, and other special consideration. Where a "manicured" look is not required, plants with little subsequent management; however, most all plants require periodic mowing and fertilizing. Where a reasonably high level of management can be expected, the choice of plants is broader. Often techniques of seedbed preparation and establishment are as important as the selection of the species.

The selection of the maximum steepness of cut and fill slopes to be permanently vegetated should be of particular concern for any developer. These slopes, when not properly maintained, are generally the largest sediment-producing areas in the completed development. They also are usually the least attractive. By utilizing slopes which will support conventional equipment, maintenance costs for these areas can be greatly reduced. Well-vegetated and maintained slopes will enhance the appearance of any completed project.

3. Structural Measures

a. General - Where temporary and permanent protective cover will not suffice in providing the adequate protection against erosion and sediment damages, other erosion control measures must be carefully selected in the proper combinations to accomplish the most effective job of erosion control. Most of the following measures require little effort to properly install and present few problems for incorporation into the development.

b. Debris (Sediment) Basin - A debris basin is a barrier or dam constructed across a waterway or at another suitable location to retard runoff and trap sediment. These structures may be temporary or permanent. Provisions must be made to periodically remove trapped sediment if the capacity of the basin is inadequate. The spillways must be designed to safely accommodate the normal flow and the maximum flood flow from a storm of selected frequency. If the structure is to be permanent, it should be designed as a water impoundment rather than a debris basin.

c. Diversions - A diversion consists of a graded channel with a supporting ridge on the lower side constructed across a sloping land surface. Its purpose is to intercept and divert runoff before it gains sufficient volume and velocity to create harmful erosion. The number of diversions and their size and spacing are dependent upon the land slope, soil type, and runoff rate. Runoff is collected and conveyed laterally along the diversion at a non-erosive velocity and discharged into a protected area or stable outlet channel.

d. Diversion Dike A diversion dike is a temporary measure consisting of a ridge of earth constructed along the top of a cut or fill slope. Its purpose is to divert runoff away from steep cut or fill slopes until permanent protective measures can be installed.

e. Stream Channel Improvement - This measure consists of straightening or relocating existing stream channels to conform with locations selected in the overall development plan. Design should include sizing the channel to accommodate the runoff to be expected from a storm of selected frequency and insuring the stability of the channel with the use of needed vegetative and structural measures.

f. Streambank Protection - this measure consists of stabilizing and protecting banks of streams or excavated channels against erosion by vegetative or structural means alone or in combination. The intensity of the treatment is dependent on the velocity and the turbulence of the flow and the erosion resistance of the soil comprising the streambank.

There are two general types of bank protection. These are listed and explained below:

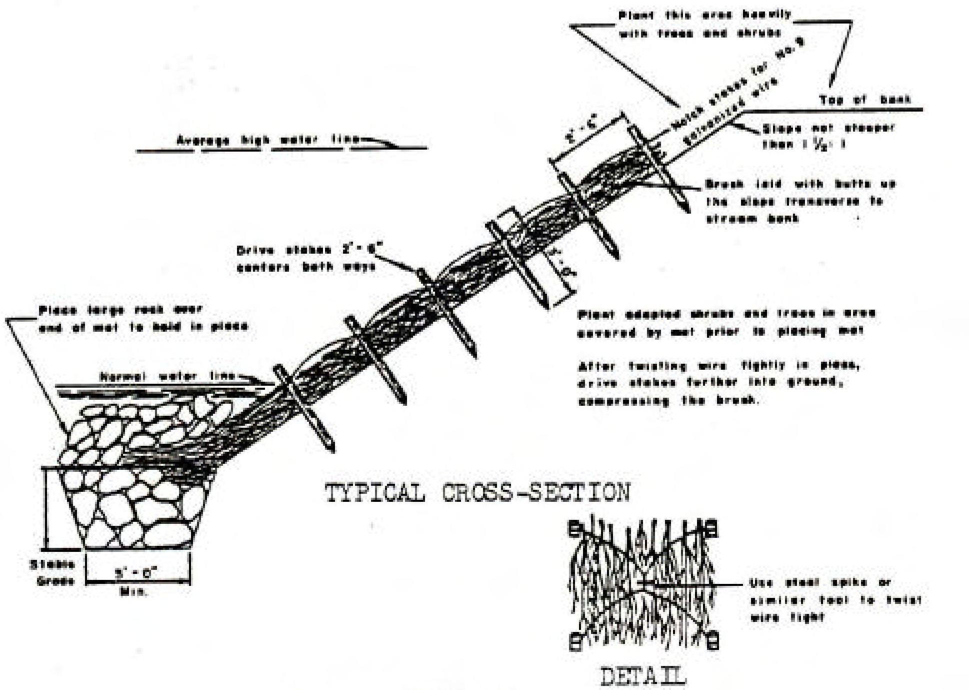
(1) Some form of bank cover that protects the bank from direct erosion.

Cover may consist of living vegetation, brush matting, rock riprap, concrete slabs, or similar materials.

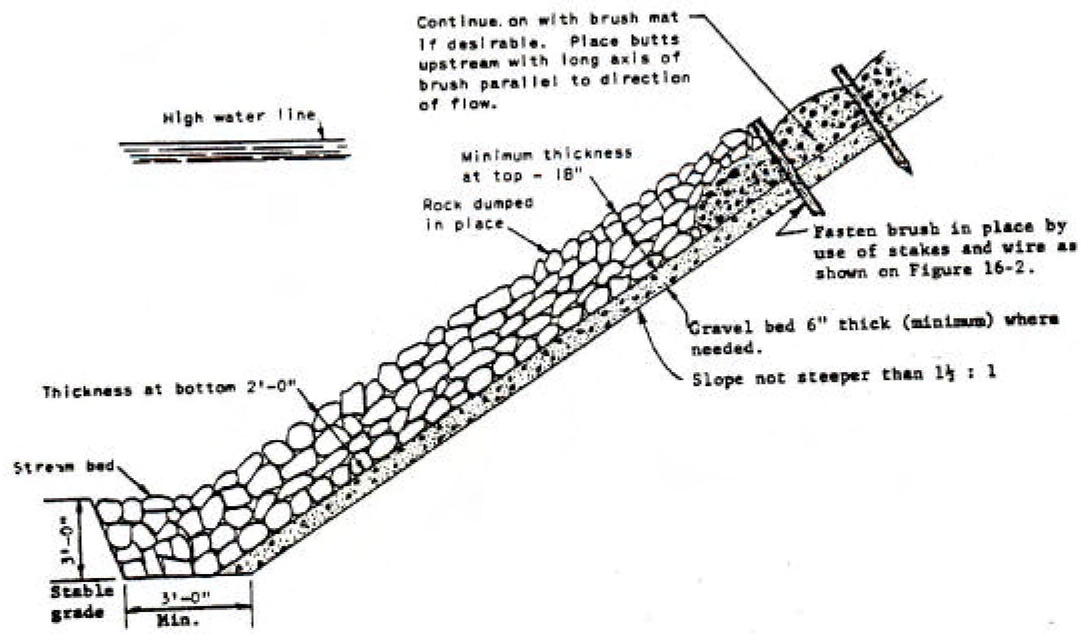
(2) Some types of obstruction that retards flow adjacent to the bank, thereby promoting deposition of sediment.

Piling, tree or brush mat revetments, and rock groins are examples of this type.

Sketches of two of these measure follow



BRUSH MAT REVETMENT

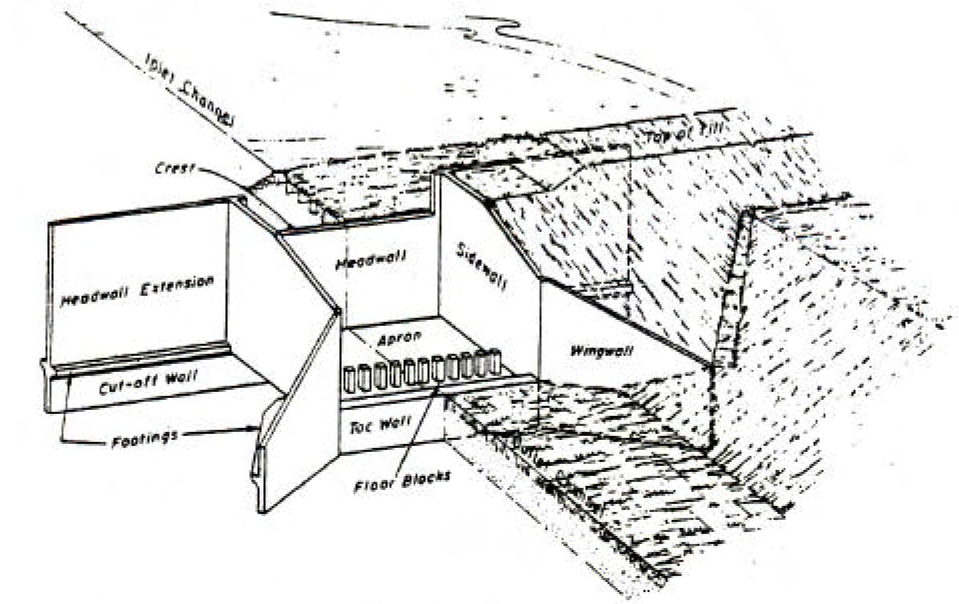


g. Waterways - These are natural drainage depressions or constructed channels used to convey runoff to a stable outlet. They are designed to accommodate the expected runoff from a storm of selected frequency without damage to the channel or its lining. Designs include vegetative and structural measures necessary to control velocities within non-erosive limits.

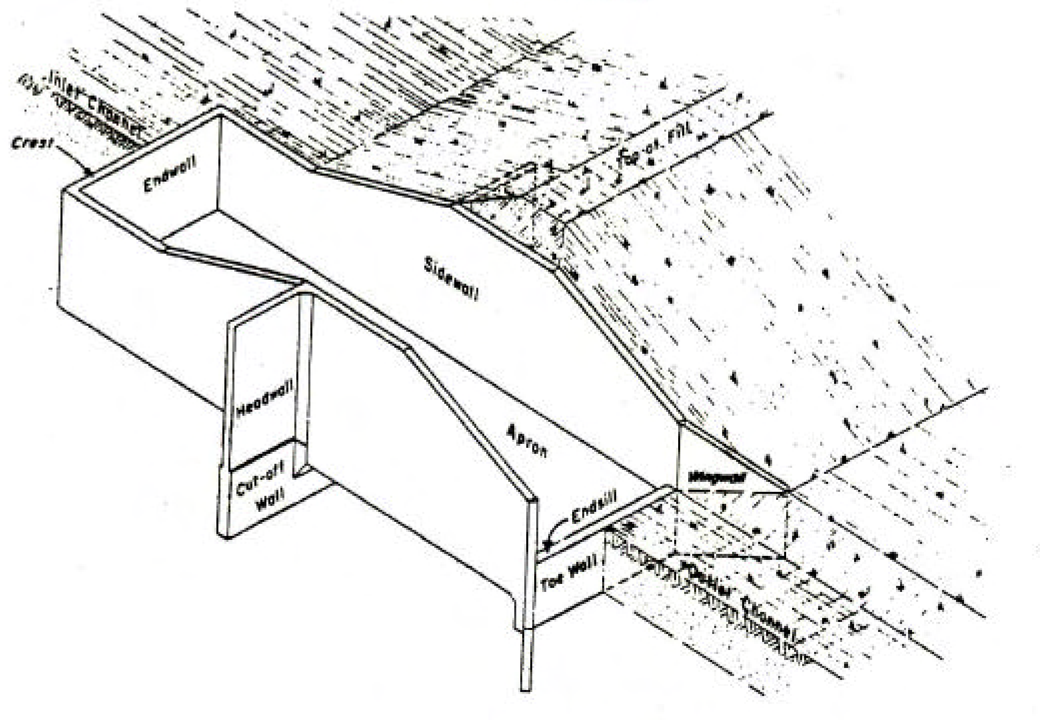
4. Structures

a. General - Structures are used for the following purposes in the control of erosion and sediment pollution in urban developments: grade control, surface water inlets, and sediment entrapment.

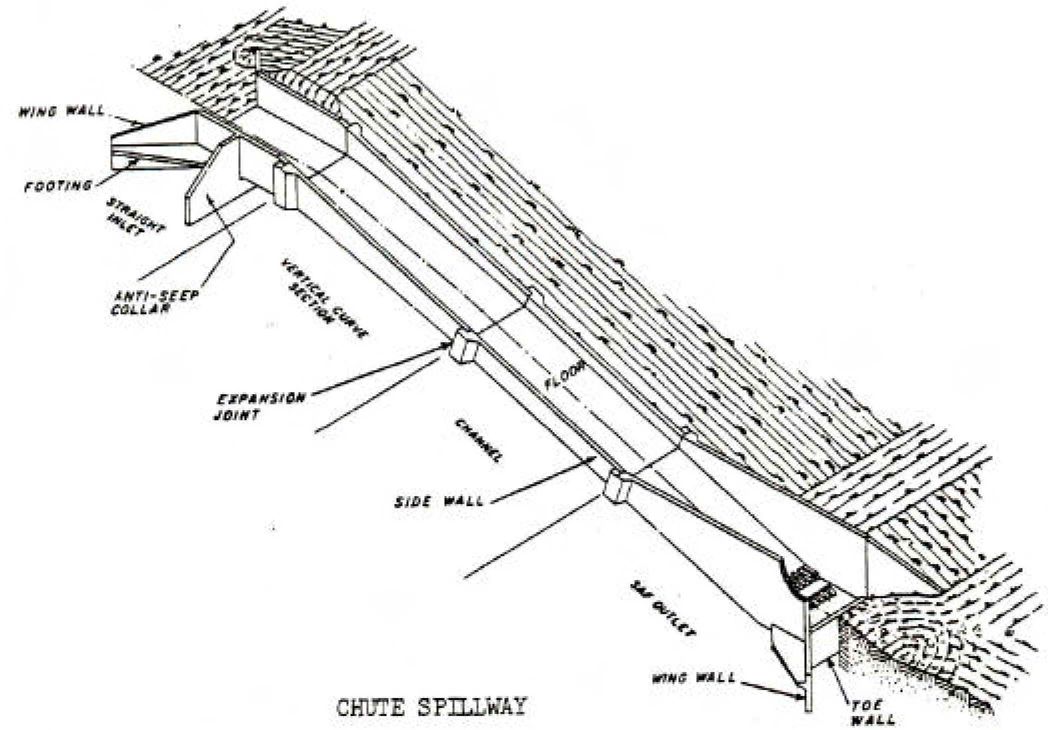
Three principal types of structures used by the Soil Conservation Service for these purposes are known as drop spillways, drop inlet spillways, and chute spillways. The makeup and nomenclature of these structures are shown in the following drawings.



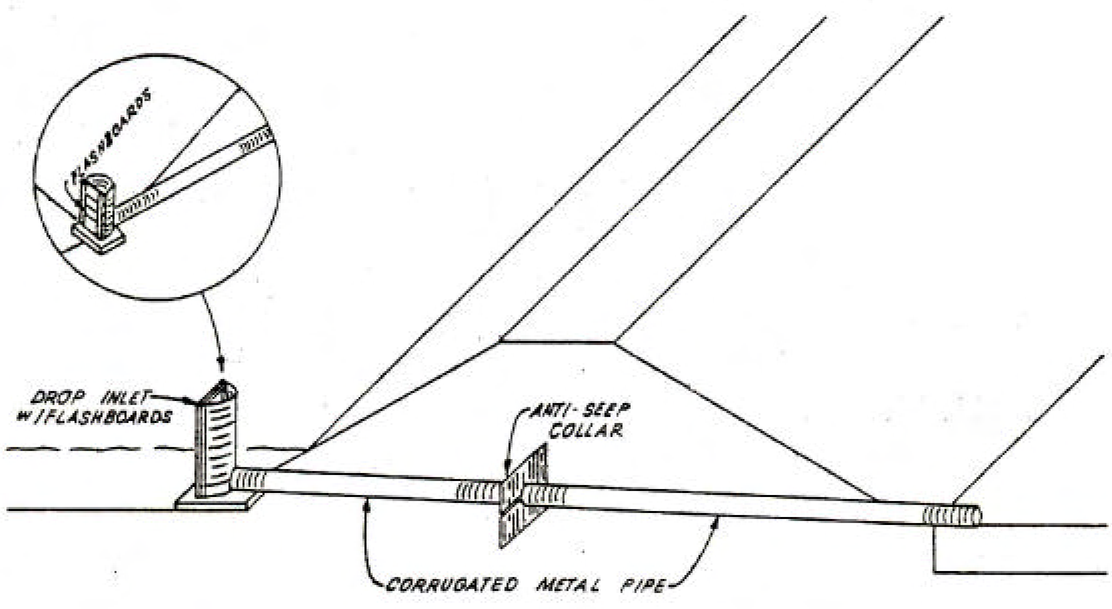
STRAIGHT DROP SPILLWAY



BOX INLET DROP SPILLWAY

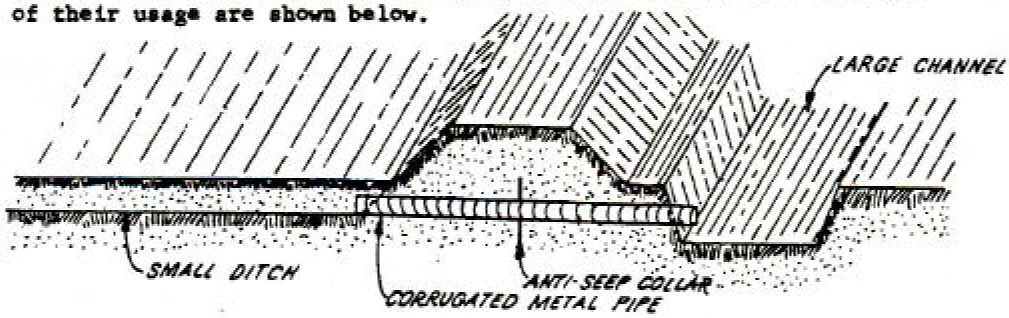


CHUTE SPILLWAY

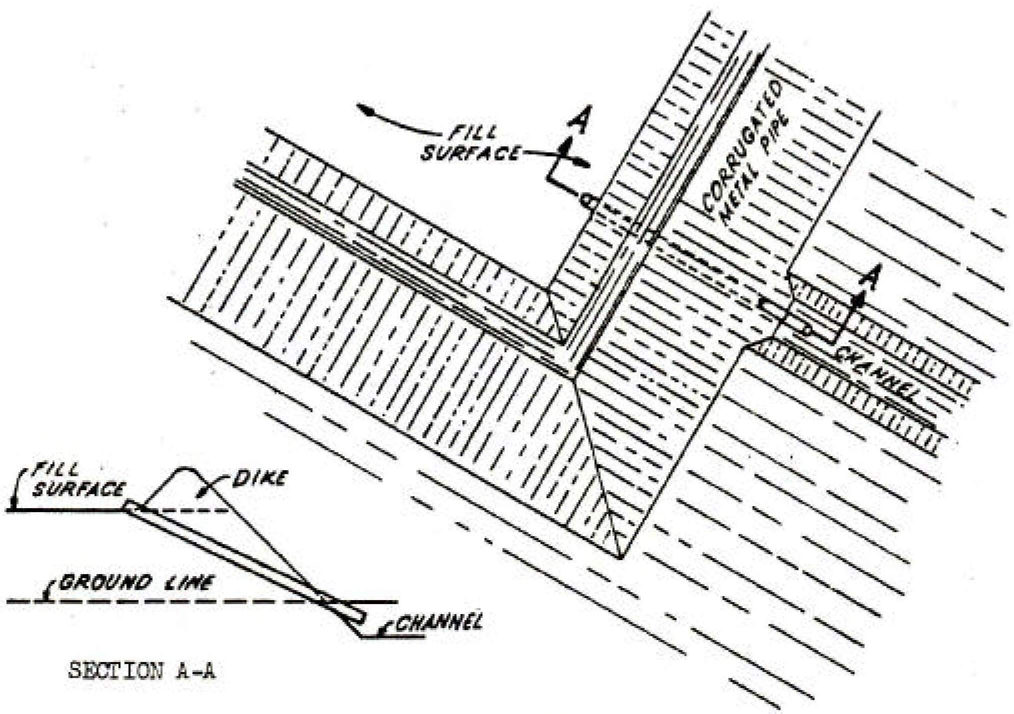


DROP INLET SPILLWAY

Other types of structures that are ideally suited to these types of problems are pipe drops, inclined pipe outlets and flumes. Sketches of their usage are shown below.



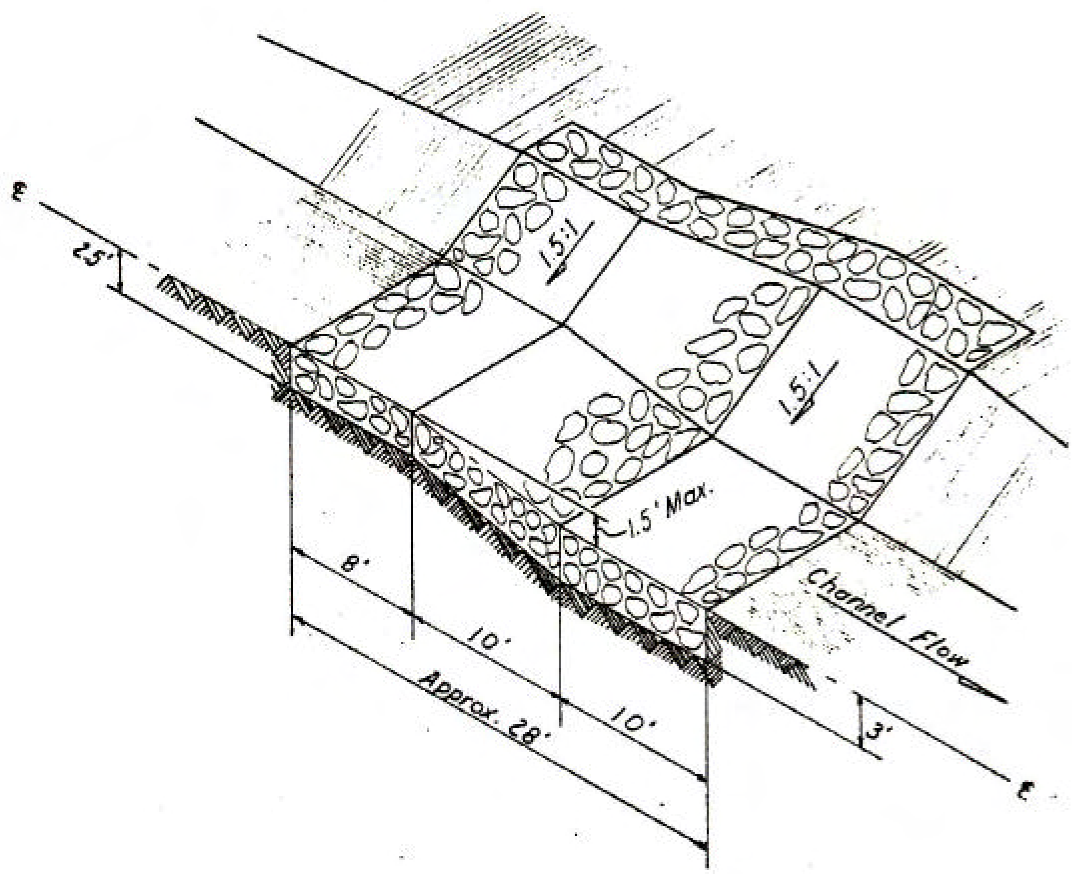
PIPE DROP OUTLET



SECTION A-A

INCLINED PIPE OUTLET

Another type of structure that has been used with considerable success in stabilizing grades of channels is shown below.



LOOSE ROCK GRADE STABILIZATION STRUCTURE

STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL MEASURES

General

The purpose of these standards and specifications is to establish the minimum limit of technical excellence permissible in the planning, design, and installation of these various measures. The many variations in climate, soils, topography, physical features, and planned land use may require that they be strengthened when adapted for installation on a specific site.

Variations of these standards have been in use for many years, having been developed by the SCS in working with land owners through soil and water conservation districts since the late 1930's. However, as progress is made through experience and research, they will require updating periodically.

The construction specifications contained herein are not intended to be complete. Detailed construction specifications should be prepared for each job covering the materials to be furnished, the work to be done, and the manner in which it is to be done or the end result that is to be attained. The specifications should require strict conformance with all applicable ordinances.

Emphasis should be given to the finished appearance of the work, since the locale is urban. Strict finish requirements should be included in the construction specifications.

Design references for site conditions that are too complex to be designed by these standards are available in the form of Soil Conservation Service National Engineering Handbooks and Technical Releases.

U.S. Dept. of Agriculture | Urban Areas
Soil Conservation Service | Georgia

INTERIM

Engineering Standard and Specification

for

LAND GRADING PLAN

Definition

A plan for grading the surface of urban areas to predetermined lines and grades in a manner that will hold erosion and sediment damages to a minimum.

Purpose

The purpose of this standard is to provide instructions for preparing detailed plans for altering the ground surface for the following purposes in a manner that will control erosion during and after construction:

1. Provide more suitable sites for buildings, facilities, and other land uses.

2. Improve surface drainage.

3. Control erosion.

Conditions Where Practice Applies

This standard is applicable where grading to planned lines and grades is practical for the purposes set forth above.

Design Criteria

Grading Plan: The grading plan shall show present topography along with the elevations, lines and grades of the finished earth surfaces. It shall include instructions for the use and compaction of materials to be excavated. Cuts and fills shall be balanced or information provided on location of additional fill material or spoil disposal areas.

Access or haul road location, treatment and maintenance requirements shall be included.

LAND GRADING (Urban Areas)

Surveys and Investigations: The cuts and fills shall be based on adequate surveys and surface and subsurface investigations.

Construction schedule: A construction schedule shall be an integral part of the plan. It shall establish a sequence of construction operations that will facilitate the control of erosion. Among the factors to be considered are: (1) limiting initiation of work to minimum area necessary to prosecute work, leaving soil cover on other areas undisturbed; (2) completing work on individual areas as quickly as possible to permit installation of planned temporary and permanent erosion control measures.

Finish Slopes: Cut and fill slopes that are to be stabilized with vegetation shall be no steeper than 1 ½ horizontal to 1 vertical; and no steeper than 2 ½ horizontal to 1 vertical where maintenance is to be performed with vehicular equipment. Steeper slopes shall be stabilized with mechanical measures such as riprap or retaining walls.

Slope Stability: Excavations and fills shall be planned so they will be stable against forces that might result in slides or gully erosion that would endanger lands and installations at the tops and bottoms of slopes.

Erosion Control: Vegetative and mechanical erosion control measures shall be included in the plan. Temporary measures shall be planned to control erosion throughout the construction period. Permanent measures shall be planned for the finished land surfaces.

Surface Drainage: Provisions shall be made to convey surface runoff at non-erosive velocities to stable outlets and to prevent surface runoff from damaging cut faces and fill slopes. Temporary channels, flumes, inclined pipe outlets and similar structural measures shall be provided as needed during all phases of construction operations. Storm culverts planned to replace natural drainageways shall be designed to accommodate 100-year frequency storms.

Sub-surface Drainage: Sub-surface drainage shall be provided in areas having a high water table to intercept seepage that might affect slope stability, building foundations or create undesirable wetness.

Borrow and Fill Operations: Surfaces of borrow pits and fills should be kept in nearly level planes sloping gently in directions selected to hold erosion from runoff to a minimum. Where soil and site conditions are such that damaging erosion can be expected to occur, diversion dikes shall be maintained along the edges of borrow pit and fill surfaces, and flumes or inclined pipe outlets shall be provided to safely convey runoff to stable outlets.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

DIVERSION

Definition

A channel with supporting ridge on the lower side constructed across the slope.

Purpose

The purpose of this practice is to divert excess water to sites where it can be used or disposed or safety.

Conditions Where Practice Applies

This practice applies to sites where:

1. Runoff from higher-lying areas is damaging lands, streams, roads, structures, buildings, etc.

2. Surface and shallow sub-surface flow is damaging sloping upland.

3. Length of slope should be reduced so that soil loss will not be excessive.

4. Runoff needs to be diverted from one area to another.

5. A temporary diversion dike is not adequate.

Diversions are not applicable below high sediment-producing areas unless measures are installed with or before the diversions to prevent damaging accumulations of sediment in the channel. They usually are not installed on land steeper than 20 percent. Also, they should be used with caution on soils subject to spillage.

DIVERSION (Urban Areas)

Design Criteria

Capacity, Grade and Velocity: Diversions must have the capacity to carry the peak runoff from storms of the following frequencies as a minimum, with freeboard as shown:

Diversion Type	Land or Improvement Protected	Storm Frequency	Freeboard
Temporary	Construction areas Building sites	2 years 5 years	0.3' 0.3'
Permanent	Landscaped, recreation and similar areas.	25 years	0.3'
	Dwellings, schools, commercial bldgs., and similar installations.	50 years	0.5'
	Agricultural Lands	10 years	0.3'

Cross-Section The cross-sectional shape of the diversion shall be such that it can be maintained with modern equipment. The channel may be trapezoidal or parabolic. Side slopes shall be no steeper than 2 to 1, preferably 3 to 1 or flatter.

Outlets: Diversions must have adequate outlets that will convey runoff without causing damaging erosion. Outlets should be stabilized prior to construction of diversions unless special measures (such as mulch pinned with netting) are taken to prevent excessive erosion.

Protection Against Sediment: For temporary diversions no protection is required. For permanent diversions, a filter strip 25 feet wide shall be maintained above the channel except where the site conditions preclude its use. In this event extra capacity shall be designed into the channel to compensate for excessive sedimentation

Construction Specifications

1. The completed diversion shall conform to the line, grade, and cross-section as required to meet the criteria above. The top of the constructed ridge shall not be lower at any point than the designed elevation, including freeboard, plus the settlement factor. The constructed channel shall be generally free draining, and low spots shall not exceed 0.2 foot in depth. All portions of the diversion shall be finished and smoothed as needed for the establishment of vegetative cover.

2. The completed diversion shall be planted to vegetation cover in accordance with the appropriate standard and specification.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

DIVERSION DIKE

Definition

A ridge, with or without a channel on the upper side, constructed of earth at the top of a cut or fill slope.

Purpose

The purpose of this practice is to divert runoff from steep constructed slopes to locations where it can be disposed of safely.

Conditions Where Practice Applies

The practice applies to sites where runoff from areas above or at the top of cut or fill slopes will flow down these slopes, causing damaging erosion.

Design Criteria

The following standard criteria will be used for diversion dikes with drainage areas up to 10 acres of relatively flat land and 5 acres of rolling or steep land. For those with larger drainage areas, designs will conform with all provisions of the standard for diversions.

Cross-Section:

Weight (min.): 1.0 ft. on flat land; 1.5 ft. on sloping land. Top width (min.): 1.5 ft. on flat land; 2.0 ft. on sloping land. Side Slopes: 2 to 1 for temporary dikes; 3 to 1 or flatter for others. Grade: Dependent on topography, but must be positive toward outlet; may require stabilizing measures.

DIVERSION DIKE (Urban Areas)

Outlets: Diversion dikes must have adequate outlets that will convey runoff without causing damaging erosion. Outlets should be established prior to construction of diversion dikes unless special measures (such as mulch pinned with netting) are taken to prevent excessive erosion. Inclined pipe outlets and flumes will be used to convey runoff down steel construction slopes.

Construction Specifications

1. The completed diversion shall conform to the line, grade, and cross-section as required to meet the criteria above. The top of the constructed ridge shall not be lower at any point than the designed elevation, including freeboard, plus the settlement factor. The constructed channel shall be generally free draining, and low spots shall not exceed 0.2 foot in depth. All portions of the diversion shall be finished and smoothed as needed for the establishment of vegetative cover.

2. The completed diversion shall be planted to vegetation cover in accordance with the appropriate standard and specification.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

GRASSED WATERWAY

Definition

A natural or constructed waterway shaped or graded and established in vegetation suitable to safely dispose of runoff.

Purpose

The purpose of grassed waterways is to convey runoff from surrounding land and installations to stable outlets.

Conditions Where Practice Applies

This practice applies to sites where (1) a well-defined watercourse of adequate capacity exists or can be constructed, (2) vegetation protection is required to control erosion, and (3) where such control can be achieved by this practice alone or in combination with others.

Design Criteria

Capacity: The minimum capacity shall be that required to carry the peak runoff expected from a storm of 10-year frequency.

Velocity: Design velocities shall not exceed those shown in the following table:

MAXIMUM PERMISSIBLE VELOCITIES

Vegetative Cover	Erosion Resistant Soils	Easily Eroded Soils
Bermudagrass	5 ft./sec.	4 ft./sec.
Fescue or bahiagrass	4 ft./sec.	3 ft./sec.
Lespedeza sericea	3.5 ft./sec.	2.5 ft./sec.

GRASSED WATERWAY (Urban Areas)

A velocity of five feet per second may be used in any case when good quality vegetation is already established.

Cross-Section: The cross-sectional shape of waterways shall be generally parabolic with the outer edges sloping sharply inward. V-shaped cross-sections shall not be used.

Depth: The minimum depth of a waterway shall be the depth required to keep the design water surface elevation in the waterway at or below the design water surface elevation in a diversion or other tributary channel at their junction when both are flowing at design depth. Design depth shall not be less than one foot.

Drainage: Tile or other suitable sub-surface drainage measures shall be provided for sites having high water table or seepage problems, except where water-tolerant vegetation can be used. Tile drains established as a part of the practice shall conform to all the provisions of the standard for drains.

Construction Specifications

The waterway shall be shaped, when needed, to the specified dimensions and shall be free of overfalls, gullies, or other irregularities.

All earth removed and not needed in shaping of the waterway shall be spread or disposed of so it will not interfere with the functioning of the waterway.

Fills shall be compacted as needed to prevent unequal settlement that would cause damage in the completed waterway.

Protective cover shall be installed in accordance with the appropriate standard as soon as possible after earthwork is complete.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

DEBRIS (SEDIMENT) BASIN

Definition

A barrier or dam constructed across a waterway or at another suitable location to form a silt or sediment basin.

Purpose

To trap sediment eroding from construction sites in order to protect streams, lakes, and improvements from excessive sedimentation.

Scope

This standard applies only to temporary debris basins on sites where:

1. Failure of the structure would not result in loss of life or interruption of use or service of public utilities (failure hazard Class a).

2. The storage capacity below the crest of the emergency spillway does not exceed 13,400 cubic yards.

3. The drainage area does not exceed 200 acres. Permanent structures built wholly or in part as debris basins shall be designed as water impoundment structures. Design criteria shall be commensurate with the complexity of site conditions, including consideration of damages that would be caused by breaching of the embankment by overtopping.

Conditions Where Practice Applies

This practice applies to construction sites where plans to control erosion cannot reasonably be expected to prevent a damaging amount of sediment from leaving the sites.

DEBRIS (SEDIMENT) BASIN (Urban Areas)

Design Criteria

General:

Structure Classification. Limits, and Requirements

Type	Max. W/S Size (ac)	Max Dam 1/ Ht. (ft.)	Design Storm 2/ Frequency	Freeboard 3/ (ft.)
1 4/	20	7	10 yr. 24 hr.	0.5
2	20	10	10 yr. 24 hr.	0.5
3	200	15	25 yr. 24 hr.	1.0

Footnotes:

1/ Height is measures from low point on original cross-section to top of dam.

Soil and cover conditions used should be based on those expected during the construction period.

3/ Vertical distance between basin water surface at maximum design stage and top of dam.

4/ Type 1 basins are to be used only where site conditions prevent the construction of an emergency spillway on residual earth.

Storage: Desirably, the storage capacity of the basin should equal the volume of sediment expected to be trapped in the structure during the development period.

The minimum capacity of a sediment basin shall be 0.5 inch per acre of contributing drainage area. Basin cleanout shall be required when the storage capacity is reduced by 60 percent. (Note: 0.5 acre inch equals 67 cubic yards per acre.)

Principal (Pipe) Spillway Design

Layout: The principal spillway shall consist of a vertical inlet joined at its bottom to a conduit (barrel) which extends through the embankment to a point beyond the downstream top of the embankment. Connections shall be watertight.

Capacity: Capacity of the pipe spillway shall be 0.25 cfs per acre of drainage area. The minimum diameter of the barrel shall be 8 inches. The diameter of the inlet should be 1.5 times greater than that of the barrel to insure full barrel flow.

DEBRIS (SEDIMENT) BASIN (Urban Areas)

Inlet Data: The vertical inlet shall be on of the following:

1. A half round pipe fitted for flashboards.

2. A full round pipe perforated with 1-inch drain holes spaced 8” to 10” vertically and 10” to 12” horizontally.

3. A box-type riser ported or fitted with flashboards.

The crest of the inlet shall be set at least 1 foot below the crest of the emergency spillway.

The inlet shall have a base of sufficient weight to provide a 1.5 to 1 safety factor against flotation.

An approved trash rack shall be installed at the crest of the inlet if the pipe spillway is designed to convey 25 percent or more of the peak discharge from the design storm.

Anti-seep Collars: Anti-seep collars shall be installed around the barrel to increase the line of seepage by 10 percent when any of the following conditions exist:

1. Plastic earthfill is not available to encompass the barrel on all sides three feet thick.

2. Barrel diameter is more than 12 inches.

Outlet: Protection of outlet against scour shall be provided where needed to prevent damaging sediment yield. Measures such as excavated plunge pool and rock riprap are suitable for this purpose.

Emergency Spillways:

Layout: Earth emergency spillways for Type 2 and 2 basins shall be located on undisturbed earth. For Type 1, they shall be located on compacted earth fill selected for erosion resistance qualities. Each shall have a longitudinal level section at least 25 feet long at its crest and a straight outlet section.

Capacity and Design: Spillways shall be trapezoidal in cross-section with minimum bottom widths of 8 feet and side slopes of 3 to 1. The capacity of emergency spillways shall be adequate to pass peak discharges of design storms, less capacities of principal spillways.

Spillways for Type 2 and 3 basins shall be designed to pass designed discharges at non-erosive velocities for the types of protection used.

DEBRIS (SEDIMENT) BASIN (Urban Areas)

Spillways for type 1 basins shall be constructed to slopes of 10 to 1 or flatter, and dikes shall be installed along its sides as needed to contain flow on exit slopes. Design velocity should not exceed 10 feet per second. (For 10 percent slopes and 0.5 foot flow depth, velocity may be assumed to be 10 feet per second.)

<u>Embankment:</u> The minimum top width shall be eight feet. Side slopes shall be no steeper than 2 ½ to 1. Where no slowly permeable material is available for a minimum width core, the downstream side slope shall be increased 4 to 1.

<u>Keyway:</u> A keyway shall be constructed along the centerline of the dam. It shall be at least 8 feet wide and shall extend at least 2 feet below the normal ground surface.

Construction Specifications

<u>Site Preparation:</u> Embankment, impoundment, and borrow areas shall be cleared of all woody growth and debris. Embankment and borrow areas shall be cleared of vegetative growth and grubbed of trees, stumps, and roots over 2 inches in diameter. Debris shall be disposed of in conformance with all applicable ordinances, rules, and regulations.

<u>Borrow areas:</u> Borrow areas will be confined to emergency spillway and impoundment areas where suitable material of adequate quantity is available.

<u>Embankment:</u> Fill material shall be free of woody material, oversized rocks and other objectionable material. Soil moisture must not be too wet or too dry to achieve good compaction. Excavations shall be dewatered before filling. Earthfill shall be constructed in 6” to 8” horizontal lifts.

Compaction shall be achieved by traversing the entire surface of each lift with one track of earth hauling equipment or with the use of a roller or compactor. Heights of earthfill shall be increased by 10 percent to allow for settlement.

<u>Spillway Installation:</u> The principal and emergency spillways shall be installed as designed. Care shall be taken to surround principal spillway barrels with select plastic material and to carefully hand tamp this material.

<u>Protective Cover:</u> Stabilize embankment, emergency spillway, and downstream borrow areas as specified in the appropriate standard.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

INCLINED PIPE OR FLUME OUTLET

Definition

A pipe or flume installed generally parallel to a steep cut, fill, or natural slope.

Purpose

A convey runoff from a relatively level surface or a very small area down a steep slope to a stable outlet.

Conditions Where Practice Applies

This standard applies to all steeply constructed slopes that are subject to damage from runoff from relatively level areas and very small sloping areas.

Design Criteria

The capacity of the pipe or flume shall be adequate to carry the following runoff peaks:

Runoff From	Bare Soil	Good Cover	Paved Areas
Relatively flat surfaces	0.8 cfs/ac.	0.4 cfs/ac.	2.0 cfs/ac.
Steep surfaces	2.0 cfs/ac.	1.0 cfs/ac.	X .

Peaks may be determined accurately by methods contained in Appendix B.

Top of pipe or flume will be maintained at least 12 inches below the top of the diversion dike ridge.

INCLINED PIPE OR FLUME OUTLET (Urban Areas)

The pipe or flume inlet surface shall be bowl-shaped and shall be constructed of metal, concrete, asphalt, or rock riprap.

Pipe and flumes, and their connections shall be watertight. They shall be embedded in the slope or securely anchored throughout their lengths.

The structure shall outlet into a stable outlet.

Construction Specifications

The pipe or flume shall be installed to meet the above design requirements.

Earthfill shall be compacted around the entrance to prevent failure by piping.

When required by job plans, the pipe or flume shall be shortened or lengthened periodically as necessary to maintain the inlet at the proper relative position with respect to the cut or fill surface.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

GRADE STABILIZATION STRUCTURE

Definition

A structure to stabilize the grade or to control head cutting in natural or artificial channels.

Purpose

Grade stabilization structures are installed to stabilize the grade in natural or artificial channels, prevent the formation or advance of gullies, and reduce erosion and sediment pollution.

Conditions Where Practice Applies

This standard applies to sites where structures are needed to stabilize channel grades but does not apply to sites where water is to be impounded.

Design Criteria

Structures: Structures of materials such as concrete, rock, masonry, steel, aluminum and treated wood shall be designed in accordance with sound engineering practice.

Capacity: Structure capacity shall be designed to meet the following requirements.

Overback Flow Damage to	Flood Frequency
Residences, Commercial buildings, recreation buildings, etc.	100-year, 24-hour storm
Recreation and landscapes areas	25-year, 24-hour storm 1/
Agricultural land	10-year, 24-hour storm 1/

GRADE STABILIZATION STRUCTURE (Urban Areas)

30 percent of peak flood flow may be carried around island-type structures provided overbank flow damage from erosion and flooding can be tolerated.

Embankments: Earthfill embankments shall have minimum top widths of feet and slide slopes of 3 to 1 or flatter.

Earthfill material shall be moderately to slowly permeable with the most plastic material being used in the center of the embankment and adjacent to structures. Material shall be compacted to a density approaching 95 percent of standard.

The embankment shall be overbuilt to allow for settlement.

Keyway: A keyway not less than 8 feet wide and 2 feet deep shall be constructed along the centerline of the structure and embankment.

Outlet: All structures except those with cantilevered outlets shall discharge into stable outlets.

Construction Specifications

Earthfill shall be constructed in 6” to 8” thick horizontal lifts. Earthfill moisture shall be such that satisfactory compaction can be obtained.

Excavations shall be dewatered prior to filling.

Structures shall be placed on compacted earthfill.

Embankment surfaces shall be completed to the required lines and grades.

Protective cover shall be applied immediately after completion of the structure.

U.S. Dept. of Agriculture | Urban Areas
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Engineering Standard and Specification for

OPEN CHANNEL

Definition

Constructing or improving a channel in which water flows with a free surface.

Scope

This standard applies to channels with drainage areas less than one square mile. Designs for channels with larger drainage areas shall be based on detailed investigations of site conditions and shall result in channels that are stable under bank full flow conditions immediately after construction has been completed.

Purpose

Open channels are constructed or improved to convey excess surface and subsurface ware without causing damages to adjacent areas from flooding, to the channel from erosion, and to appurtenant structures.

Conditions Where Practice Applies

This standard is applicable to all open channel improvements in urban areas except as noted under "Scope" above. An adequate outlet must be available for he improved channel reach.

The improvement must not cause significant erosion upstream or flooding and/or sediment deposition downstream.

Design Criteria

Open Area Planning: Through open areas the location of the channel shall be selected so as to enhance the natural beauty of the area and fish and wildlife habitat resources. Alignment, if changed, should be continuous, similar to that of a natural channel. As many trees should be left along the channel as is practical.

OPEN CHANNEL (Urban Areas)

Capacity: The capacities are channels shall be adequate to carry the peak runoff rate from the following storm frequencies.

Where Flooding will Affect	Minimum Storm Frequency
Buildings, Parking areas, highways and important streets	100-year
Yards, landscaped Areas, recreation areas, secondary streets	25-year 1/
Agricultural lands	5-year 1/

1/ The flood crest of a 100-year storm shall be contained below improvements that would be damaged significantly by flood water.

Channel Stability and Design Velocities: Channels will be designed to the stable immediately after construction has been completed and to have adequate capacity after they have aged, assuming good maintenance.

Velocities will be computed using Manning's equation. Realistic "n" values will be selected for both conditions. The "as-built" "n" value shall not exceed 0.025.

Maximum "as built" velocities shall not exceed the values given below:

Soil Description	Soil Class	Maximum* Velocity	Remarks
Silty or sandy clay	CL	4.0	For each of the following factors, the
Clayey sands	SC	3.5	Maximum velocity may be increased by
Alluvial silts, Sandy or clayey silts	MH or ML	3.5	0.5 ft/sec/
Silty sands	SM	3.0	1. Strong effort to be made to vegetate channel banks.
Clean sands	SP or SW	2.5	2. Maximum channel bottom grade not in excess of .0015 ft/ft.

*As-built velocities shall be computed for bank full flow.

OPEN CHANNEL (Urban Areas)

Appurtenant Structures: The design of channels shall include the design of all structures required for the functioning of the channel including (1) grade stabilization structures, (2) culverts or bridges, and (3) tributary, surface runoff, and subsurface flow structures. The effects of the improvement on existing structures will be evaluated.

Construction Specifications

1. The channel shall be constructed to the required lines, grades, and cross-sections as required to meet the criteria above.

2. Debris resulting from clearing operations and spoil resulting from excavation operations shall be disposed of in a manner which will:

    a. Be in compliance with all local applicable ordinances.

    b. Provide for the proper functioning of the improvement.

    c. Leave the area in the best feasible condition for the planned use of the owner.

    d. Result in the best aesthetic appearance of the site that is practical.

U.S. Dept. of Agriculture
Soil Conservation Service

Urban Areas
Georgia

INTERIM

Engineering Standard and Specification

for

RIPRAP ON CHANNEL SIDE SLOPES

Definition

A revetment of loose rock or similar material installed on a channel side slope to protect the slope from erosion.

Purpose

The purpose of the riprap is to provide a non-erosive cover for a channel side slope to protect the slope from erosion.

Scope

This standard applies to channels where velocities do not exceed 10 feet per second.

Conditions Where Practice Applies

This practice applies to any channel side slope where soil conditions and water turbulence and velocity are such that it cannot be expected to be stable for bank full flows.

Design Criteria

The toe of the revetment shall be entrenched in stable channel bottoms for a depth of 11/2 to 3 feet, depending on the size of the riprap. If the channel bottom is not stable, the design shall incorporate other requirements needed to stabilize the revetment toe.

The channel side slope shall be no steeper than 1 ½ to 1.

A blanket of filter material shall be placed underneath the riprap except under the following conditions:

RIPRAP ON CHANNEL SIDE SLOPES (Urban Areas)

1. Soil material in the bank has a PI of at least 10 or is a sand-gravel mixture.

2. Stream transports full load of sediment at flood state as evidenced by sand deposits on channel banks.

Riprap shall extend up the bank to an elevation where vegetation will provide adequate protection.

Riprap shall be reasonably well graded within the following limits:

Velocity	Maximum-Minimum Stone Sizes
Up to 6 ft. per sec.	10-50 lbs.
6 to 8 ft. per sec.	20-100 lbs.
8 to 10 ft per sec.	25-250 lbs.

Material shall be hard, durable rock, rubble concrete, or similar material weighing at least 150 lbs. per cubic foot.

Filter material shall be a mixture of hard, durable sand and gravel. Maximum gravel size shall be 1 ½", 3", and 4 ½" respectively for each of the above riprap sizes.

Construction Specifications

The channel side slope and the toe embedment shall be prepared to the required lines and grades.

Filter material and riprap shall be placed in succession to the required thickness and elevations. Riprap shall be hand placed around structures to prevent damage to them.

U.S. Dept. of Agriculture | All Resource Areas
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CRITICAL AREA PLANTING
(Permanent Seedlings)

Definition: Planting vegetation such as trees, shrubs, vines, grasses or legumes on critical areas.

Purposes:

1. To stabilize an area so as to reduce damages from sediment and runoff to downstream areas.

2. To improve and area such as cut and fill slopes for safety and beauty.

Where Applicable: On highly erodible or severely eroded areas where vegetation is difficult to establish with normal seeding or planting methods such as: cut and fill slopes, spillways, borrow areas, channel banks, barns and spoil areas.

Specifications

Grading and Shaping

A. Grading and shaping is not required when hydraulic seeding and fertilizing equipment is used.

B. When conventional seeding and fertilizing is done, grade and shape where feasible and practical so equipment can be used safely and efficiently in preparing the land for establishing and maintaining vegetation. All loose rock, roots and other obstruction that will interfere with establishment and maintenance must be removed from the surface.

Seedbed Preparation

A. When hydraulic seeding and fertilizing equipment is used, no seedbed preparation is required.

B. When conventional seeding and fertilizing is done, seedbed preparation will be done as follows:

1. Broadcast Plantings:

   a. On natural field conditions or slopes that are 3:1 and flatter, a seedbed will be prepared to minimum depth of 4 inches, excluding rock. The soil will be thoroughly broken, wall pulverized, smoothed and firmed as may be accomplished using proper equipment, good methods and workmanship before planting.

   b. On slopes ranging from 2:1—3:1, a seedbed will be prepared by scarifying to a depth of 1 to 4 inches as determined on site. Scarification may be done by use of a chain harrow, grader blade with chisels welded on, or any other suitable equipment including hand tools.

   c. On slopes steeper than 2:1, the surface will be pitted, pock marked or trenched across the slope. Use appropriate hand or machine tools to provide a place 6 to 8 inches apart for seed to lodge and germinate.

2. Planting or Setting Plants: A planting bed will be prepared by one of the three following methods:

   a. Excavating holes (all slopes). For kudzu and honeysuckle, open holes 14" to 16" deep and 8" in diameter. For day lilies, periwinkle (vinca), Bermuda grass sprigs or sod plugs and the like, open holes 8" to 10" deep and 6" in diameter. For nursery stock (trees or shrubs), open holes large enough to accommodate roots without crowding.

   b. Opening furrows (on slopes where feasible), open a furrow 6" to 8" deep for seeding trees, small shrubs, kudzu, honeysuckle, periwinkle, multiflora rose, daylilies, and Bermuda grass sprigs or sod plugs and the like.

Lime and Fertilizer - Rates and Analysis

A. The lime to be used shall be within the specifications of the Georgia Department of Agriculture. It shall be applied at the rate of from 1 to 2 tons per acre or the amount indicated by soil tests.

B. The kinds and amounts of fertilizer to be used for various plants or combination of plants is set forth in Tables 1 or 2.

Lime and Fertilizer - Application

A. When hydraulic seeding and fertilizing equipment is used:

1. The fertilizer, seed, and wood cellulose or cane fiber mulch will be mixed with water and applied in a slurry. The mixture must be spread uniformly over the area to be treated and within one hour after the mixture is made.

2. The lime will be mixed with water and applied in a slurry. This will be spray applied immediately after mulching is completed or a combination with the top dressing when grass plants have grown about 2 to 4 inches tall.

B. Seeds and Plants

The kinds of plants or seeds that may be used for critical area stabilization are listed in the attached Tables 1 or 2.

Seeding and Planting

A. The attached Tables 1 or 2 gives the permissible seeding dates and rates.

B. Methods of Seeding:

1. Hydraulic seeding – Mix the fertilizer, seed, and wood cellulose or cane fiber mulch with water and apply in a slurry. The mixture must be spread uniformly over the area to be treated and within one hour after the mixture is made.

2. Conventional seeding – For broadcast planting, use a cultipacker seeder, drill, rotary seeder, or other mechanical seeder or hand seeding. The seeds or plant materials must be distributed uniformly over the area to be treated and covered lightly with a cultipacker or other suitable equipment. Seeding will be done on a freshly prepared and firmed seedbed.

3. Planting –

   a. Where holes are dug, set plants two inches above fertilizer and finish filling hole with soil without fertilizer. For kudzu, honeysuckle, small shrubs, multiflora rose, periwinkle (vinca) and Bermuda grass, the upper portion of the plant must be at or slightly above the ground surface. For nursery stock (trees or shrubs), set at or slightly deeper than they grew in the nursery.

   b. Where plow furrows are used for kudzu, honeysuckle, small shrubs, multiflora rose, periwinkle (vinca) and Bermuda grass, place plants against the lower wall of the first furrow with the bud or top portion at or just above ground level. Plow at least two return furrows against the first. Day llies will be placed against the lower wall of the first furrow and covered with about 2 inches of soil.

c. For mechanical planters, use any approved mechanical method that will result in the setting of tree seedlings, shrub lespedza, and multiflora rose slightly deeper than they grew in the nursery, or that will result in the setting of kudzu, honeysuckle, periwinkle (vinca) and Bermuda grass so that the bud or top portion of the plant is at or slightly above the ground surface.

d. Dibble planting (all slopes). For all tree seedlings, small shrubs, sprigs, an the like, open holes deep enough to set plants slightly deeper than they grew in the nursery.

Mulching

A. Use mulch on all areas to aid in the establishment of vegetation. The mulching material will consist of:

1. Dry straw or hay of good quality free of seeds of competing plants, and at the rate of two tons per acre; or

2. Wood cellulose of cane fiber mulch at a rate of 1,000 pounds per acre when the lose is 3 /4:1 and steeper; or

3. A combination of good quality, dry straw or hay free of seeds of competing plants at a rate of 2 tons per acre, and wood cellulose or cane fiber mulch at a rate of 500 pounds per acre. This combination will be used when the slope is flatter than 3 /4 :1; or

4. Sericea lespedeza seed-bearing hay at a rate of three tons per acre. This mulch may be applied green or air-dried, but must contain mature seed.

5. Manufactured mulch materials such as soil retention blankets, erosion control netting or others may be required on special areas of high water concentration if unstable soils. When these materials are used, follow the manufacturer's recommendation for installation.

Applying and Anchoring Mulch

A. Straw or hay mulch will be applied uniformly over the area, leaving about 25 percent of the ground surface exposed. It must be spread within 24 hours after seeding and/or planting is done, by:

1. Blower-type mulch-spreading equipment and anchored to the soil by emulsified asphalt sprayed uniformly onto the mulch as it is ejected from the machine. The emulsion shall consist of a homogeneous mixture satisfactory for spraying. The mixture shall consist of 100 gallons of grade AE-5 asphalt emulsion and 100 gallons of water per ton of mulch.

2. Blower-type or other mulch-spreading equipment or by hand, and anchored:

   a. By pressing the mulch into the soil. Anchoring must be done immediately after the mulch is spread. A disk harrow with the disk set straight or a special “packer disk” may be used. The disk may be smooth or serrated and should be 20 inches or more in diameter and 8-12 inches apart. The edges of he disk should be dull enough not to cut the mulch but to press it into the soil, leaving much of it in an erect position.

   b. Fall and winter plantings may include 1 /2 bushel of re or wheat per acre to stabilize the mulch.

B. Wood cellulose fiber or cane fiber mulch will be applied with hydraulic seeding and fertilizing equipment. All slurry ingredients shall be mixed to form a homogeneous slurry and spray-applied within one hour after the mixture is made.

   When wood cellulose fiber or cane fiber mulch is used at the 500 pound per acre rate, straw or hay mulch with asphalt emulsion is applied over this to complete the mulch.

   Wood cellulose or cane fiber mulch at the 1,000 pound per acre rate is used alone where other mulch material will not stick.

   Wood cellulose or cane fiber mulch is self-anchoring
   .

Irrigation

Where irrigation is used, the rate of application will be such that no soil movement will occur.

Fertilizer Maintenance Application

The first and second year fertility requirements for establishment of plants are listed in Tables 1 or 2. Thereafter annual maintenance rates in pounds per acre are recommended as follows:

	H	P205	K20
Grasses and sericea 1/	40	40	40
Grasses alone 1/	70	40	40
Daylilies 2/	40	40	40
Sericea, Crown Vetch or Kudze	0	40	40

1/ Double this amount may be applied every other year.

2/ Apply annually until complete cove is established.

Line Maintenance Application

Apply one ton of limestone every 4-6 years or as need is indicated by soil tests.

Use and Management

Mow sericea or sericea and grass mixture only after frost. Bermuda grass, bahia grass, and fescue may be mowed as desired. Maintain a least six inches of top growth under any use or management.

TABLE 1

SEEDS OR PLANTS FOR SLOPES 2:1 AND STEEPER

Species	Rates/Ac. or Spacing	Planting Dates			Years To Apply Fertilizer	Fertilizer Rates - Pounds Per Acre			
		Mts-L'stone	Piedmont	Coastal		N	P_2O_5	K_2O	N Top-Dressing
Weeping Lovegrass and Sericea Lespedeza	4-6 lbs 40-60 lbs 1/	4/10-6/15	4/1-6/15	2/15-6/15	First Second	60-90 0	120-180 70-100	120-180 70-100	50 --
Sericea Lespedeza Seed-Bearing Hay with Overseeded Weeping Lovegrass	3 tons 2/ 4-6 lbs	10/1-3/15 3/15-5/1	10/1-3/1 3/1-4/15	10/15-2/1 2/15-4/1	In Spring After Mulch 2nd-Spring	60-90 0	120-180 70-100	120-180 70-100	50 --
Hulled Common Bermudagrass and Sericea Lespedeza	5-6 lbs 40-60 lbs 1/	4/10-6/15	4/1-6/15	2/15-6/15	First Second	60-90 0	120-180 70-100	120-180 70-100	50 --
Unhulled Common Bermudagrass and Sericea Lespedeza Seed Hay	8-10 lbs 3 tons 2/	10/1-3/15	10/1-3/1	10/15-2/1	First Second	60-90 0	120-180 70-100	120-180 70-100	50 --
Tall Fescuegrass and Clean Combine Run Sericea Lespedeza	30-40 lbs 60-75 lbs 3/	8/1-10/15	9/1-11/1	9/15-11/15	First Second 4/	60-90 0	120-180 70-100	120-180 70-100	0-50 in Spring --
Hulled Common Bermudagrass	8-10 lbs	4/10-6/15	4/1-6/15	2/15-6/15	First Second	60-90 48	120-180 96	120-180 96	50-100 5/ 50-100 5/
Pensacola Bahiagrass (Better Sites of Lower Piedmont)	40-60 lbs	---	4/1-6/15	10/1-6/15	First Second	60-90 48	120-180 96	120-180 96	50-100 5/ 50-100 5/
Wilmington Bahiagrass (Better Sites of Upper Piedmont)	40-60 lbs	4/10-6/15	4/1-6/15	---	First Second	60-90 48	120-180 96	120-180 96	50-100 5/ 50-100 5/

Species	Rates/Ac. or Spacing	Planting Dates			Years To Apply Fertilizer	Fertiliser Rates - Pounds Per Acre			
		Mts-L'stone	Piedmont	Coastal		N	P_2O_5	K_2O	N Top-Dressing (In Spring)
Tall Fescuegrass (Use on Better Sites)	30-50 lbs	8/1-10/15	9/1-11/1	9/15-11/15	First Second	60-90 60	120-180 120	120-180 120	50-100 5/ ---
Coastal or Common Bermuda-grass Sprigs or Sod Plugs	25-40 cuft 6/ 3' x 3'	---	3/1-8/15	1/1-12/31	First Second	60-90 48	120-180 96	120-180 96	50-100 5/ 50-100 5/
Midland or Common Bermuda-grass Sprigs or Sod Plugs	25-40 cuft 6/ 3' x 3'	3/15-8/1	---	---	First Second	60-90 48	120-180 96	120-180 96	50-100 5/ 50-100 5/
Tawny Daylily	3' x 3'	Anytime	Anytime	Anytime	First Second	120 40	240 40	240 40	50 --
Kudzu	3-7' apart at base of slope	Dormant Season	Dormant Season	Dormant Season	First Second	½-1 lb 6-12-12 per plant 10 lbs 0-14-14 per 100' of row			

1/ Use a minimum of 40 lbs scarified seed. Remainder may be unscarified, clean hulled seed.
2/ Or use any approved mulch and 60-75 pounds clean combine run seed.
3/ May be established by using 3 tons of sericea lespedeza seed-bearing hay mulch.
4/ Beginning of second growing season for sericea lespedeza.
5/ Apply in split applications when high rate is used.
6/ A cubic foot of grass equal approximately 650 sprigs. A bushel equals approximately 800 sprigs.

TABLE 2

SEEDS OR PLANTS FOR SLOPES FLATTER THAN 2:1

Species	Rates/Ac or Spacing	Planting Dates			Years To Apply Fertilizer	Fertilizer Rates - Pounds/Acre			
		Mts-L'stone	Piedmont	Coastal		N	P_2O_5	K_2O	N Top-Dressing
Weeping Lovegrass and Sericea Lespedeza Scarified	3-4 lbs 40-60 lbs 1/	3/15-6/15 5/	3/1-6/15 5/	2/15-6/15 5/	First Second	60-90 0	120-180 70-100	120-180 70-100	50 —
Sericea Lespedeza Seedbearing Hay with Overseeded Weeping Lovegrass	3 tons 2/ 3-4 lbs	10/1-3/15 3/15-5/1	10/1-3/1 3/1-4/15	10/15-2/1 2/15-4/1	First Second	60-90 0	120-180 70-100	120-180 70-100	50 —
Hulled Common Bermudagrass and Sericea Lespedeza Scarified	5-6 lbs 40-60	3/15-6/15 5/	3/1-6/15 5/	2/15-6/15 5/	First Second	60-90 0	120-180 70-100	120-180 70-100	50 —
Unhulled Common Bermudagrass and Sericea Lespedeza Seed Hay	8-10 lbs 3 tons 2/	10/1-3/15	10/1-3/1	10/15-2/1	First Second	60-90 0	120-180 70-100	120-180 70-100	50 —
Tall Fescue Grass and Clean Combine Run Sericea Lespedeza	30-40 lbs 60-75 lbs 4/	8/1-10/15	9/1-11/1	9/15-11/15	First Second 6/	60-90 0	120-180 70-100	120-180 70-100	0-50 in Spring
Hulled Common Bermudagrass Unhulled Common Bermudagrass	8-10 lbs 12-15 lbs	3/15-6/15 5/ 10/1-3/15	3/1-6/15 5/ 10/1-3/1	2/15-6/15 5/ 10/15-2/1	First Second	60-90 36-48	120-180 72-96	120-180 72-96	3/ 50-100 50-100 3/
Pensacola Bahiagrass	40-60 lbs	— —	3/1-6/15 5/	10/1-6/15 5/	First Second	60-90 36-48	120-180 72-96	120-180 72-96	50-100 50-100
Wilmington Bahiagrass	40-60 lbs	3/15-6/15 5/	3/1-6/15 5/	—	First Second	60-90 36-48	120-180 72-96	120-180 72-96	3/ 50-100 50-100 3/

Species	Rates/Ac. or Spacing	Planting Dates Mts-L'stone	Piedmont	Coastal	Apply Fertilizer	N	P_2O_5	K_2O	N Top-Dressing
Coastal or Common Bermuda Sprigs Sod Plugs	25-40 cuft 3' x 3'	—	3/1-8/15 Using freshly dug sprigs planted in moist soil.	1/1-12/31	First Second	60-90 36-48	120-180 72-96	120-180 72-96	50-100 3/ —
Tall Fescuegrass (Use on Better Sites)	30-50 lbs	8/1-10/15	9/1-11/1	9/15-11/15	First Second	60-90 60	120-180 120	120-180 120	(In Spring) 50-100 3/ —
Midland or Common Bermuda Sprigs Sod Plugs	25-40 cuft 3' x 3'	3/15-8/1	—	—	First Second	60-90 36-48	120-180 72-96	120-180 72-96	50-100 3/ —
Tawny Daylily Tubers	3' x 3'	1/1-12/31	1/1-12/31	1/1-12/31	First Second	120 40	240 40	240 40	50 33
Kudzu Plants or Crowns	3-7' apart at base of slope	11/1-5/1	11/15-4/15	11/15-4/1	First Second	½-1 lb per plant 6-12-12 3 lb of 0-14-14 per 100' of row			
Japanese Honey Suckle Plants	3' x 3'	11/1-4/15	11/15-3/15	—	First Second	½-1 lb per plant 6-12-12 3 lb 10-10-10 + 1/3 lb N/100' of row			
Periwinkle (Vinca) Plants	3' x 3'	10/15-4/15	11/1-4/15	11/15-4/15	First Second	½-1 lb per plant 6-12-12 3 lb 10-10-10 + 1/3 lb N/100' of row			
Tree Seedlings	6' x 6'	1/1-5/1	1/1-4/15	1/1-4/1	—	A suitable ground cover should be established prior to or at the same time tree seedlings are planted.			
Shrub Lespedeza Plants	3' x 3'	11/1-4/1	11/1-3/15	11/15-3/1	First Second	10 lbs of 6-12-12 per 100' of row 3 lbs of 0-14-14 per 100' of row			
Multiflora Rose Single Row Double Row	1' apart 1½'x6'-10'	1/1-4/1	1/1-3/15	1/1-3/1	First Second	10 lbs of 6-12-12 per 100' of row 3 lbs of 10-10-10 per 100' of row			

1/ Use a minimum of 40 lbs of scarified seed. Remainder may be unscarified, clean hulled seed.
2/ Or use any approved mulch and 60-75 pounds clean combine run Sericea lespedeza.
3/ Apply in split applications when high rates are used.
4/ May be established by using 3 tons of Sericea lespedeza seed-bearing hay mulch.
5/ May be extended to 7/15 with irrigation.
6/ Beginning of second growing season for Sericea lespedeza.

U.S. Dept. of Agriculture
Soil Conservation Service

All Resource Areas
Georgia

CRITICAL AREA PLANTING
(Temporary Seedlings)

Definition: Planting vegetation such as trees, shrubs, vines, grasses, or legumes on critical areas.

Purpose:

1. To stabilize an area so as to reduce damages from sediment and runoff to downstream areas.

2. To improve an area such as cut and fill slopes for safety and beauty.

Where Applicable: On any bare or denuded area which may be subjected to erosion for up to 12 months, and where a temporary seeing is needed to control erosion and water pollution by sediment prior to the establishment of finished grade or permanent vegetation.

The temporary measures should be coordinated with the permanent erosion control measures planned to assure economical and effective control.

Specifications

Grading and Shaping

A. Excessive water runoff must be controlled by planned and installed needed erosion control practices such as closed drains, ditches, dikes, diversions, contour ripping sediment basins or other erosion control methods.

B. No shaping or grading is required if slopes can be stabilized by vegetation and hand seeding or hydraulic seeding equipment is to be used.

Seedbed Preparation

A. When hydraulic seeder is to be used, no seedbed preparation is required.

B. When conventional or hand seeding is to be done, no preparation is required if the soil material is loose and has not been sealed by rainfall.

C. When soil has been sealed by rainfall or is smooth undisturbed cut slopes, the soil shall be pitted, trenched, or otherwise scarified to provide a place for seed to lodge and germinate.

Lime and Fertilizer

A. No lime is required.

B. On reasonably fertile soils or soil material, no fertilizer is required.

C. On soils of very low fertility, use 500 to 700 pounds of 10-10-10 fertilizer or the equivalent per acre (12-16 lbs./1,000 sq. ft.). If the site will permit, apply before land preparation and disk, rip, or chisel to incorporate.

Seeding

A. Select a grass or grass-legume suitable to the area and season of the year.

B. Apply seed uniformly by hand, cyclone seeder, drill, cultipacker seeder, or hydraulic seder (slurry including seed and fertilizer). Drill or cultipacker seeder normally should place seed 1 /2 to 1 inch deep.

C. Table 1. Seeds to Use for Temporary Seedlings

Species	Rate per 1,000 sq. ft.	Rate Per Acre*	Planting Dates		
			Mts-L'stone	Piedmont	Coastal
Rye	3 lbs.	2-3 bu.	8/1-12/1 3/1-4/1	91/-1/1 3/1-4/1	10/1-3/1
Ryegrass	1 lb.	40-50 lbs.	8/1-12/1	8/15-1/1	8/15-3/1
Wheat	3 lbs.	2-3 bu.	10/1-12/1	10/15-1/1	11/1-1/15
Rye and Annual Lespedeza	1 ½ lb. ½ lb.	1-1 ½ bu. 20-25 lbs	3/1-4/1 3/1-4/1	3/1-4/1 3/1-4/1	2/1-3/1 2/1-3/1
Weeping Love grass	.2 lb.	4-6 lbs.	3/15-8/1	3/1-8/15	2/15-8/15
Sudan grass	1 lb.	35-45 lbs.	4/1-7/1	4/1-7/15	4/1-7/15
Browntop Millet	1 lb.	30-40 lbs.	4/1-7/1	4/1-7/15	4/1-7/15

* Unusual site conditions may require heavier seeding rates.

Mulching

A. Temporary vegetation can in most cases be established without the use of mulch.

B. Mulch without seeding should be considered for short term protection. See Mulching (Code 484) Specifications.

Irrigation

If water is applied, it must be at a rate that will not cause runoff and erosion. Thoroughly wet the soil to a depth that will insure germination of the seed. A second application should be made when needed.

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Soil Conservation Service | Georgia

CRITICAL AREA PLANTING
(Surface Mine Spoil)

Definition: Planting vegetation such as trees, shrubs, vines, grasses or legumes on critical areas.

Purpose:

1. To stabilize an area so as to reduce damages from sediment and runoff to downstream areas.

2. To improve an area such as cut and fill slopes for safety and beauty.

Where Applicable: On spoil resulting from surface mining operations.

Specifications

Grading and Shaping

A. Grade, where practicable and feasible, to permit the use of conventional equipment for seedbed preparation, seeding and mulching.

B. Grading and shaping is desirable but not required when seeding is done with hydraulic seeding equipment.

C. Construct roads, to provide access for hydraulic seeding equipment, with grades that do not cause high surface water concentrations.

Lime and Fertilizer

A. The lime used shall be within the specifications of the Georgia Department of Agriculture. It shall be applied at the rate of one ton per acre. Apply uniformly, immediately before land preparation when site is prepared with conventional equipment. Apply in a slurry in combination with the top dressing when hydraulic seeding equipment is used.

B. Use 1500 pounds per acre of 6-12-12 fertilizer. Apply uniformly, immediately before land preparation when site is prepared with conventional equipment. Apply in a slurry in combination with seed and wood cellulose or cane fiber mulch when hydraulic seeding equipment is used.

Seeding and Planting

A. Seed or plants.

Species	Rates/Acre or Spacing.	Time of Seeding
Weeping Love grass and	3-4 lbs.	Spring
Sericea Lespedeza Scarified	40-60 lbs.	Spring
Sercea Lespedeza Seed Hay and	2 Tons	Fall
Overseeded with Weeping Love grass	3-4 lbs	Spring
Hulled Common Bermuda grass and	5-6 lbs.	Spring
Sericea Lespedeza Scarified	40-60 lbs.	Spring
Unhuled Common Bermuda grass and	8-10 lbs.	Fall
Sericea Lespedeza Seed Hay	3 tons	Fall
Rye and Clean Combine-run	1 bu.	Fall
Sericea Lespedeza	50-75 lbs..	Fall
Loblolly or Virginia Pine	6 x 6	Winter
Sycamore		
Cottonwood	`	

1/ Onsite determination will be made for species in use.

B. Conventional seeding = Use a cultipacker seeder, drill or broadcast uniformly with a rotary seeder; cover lightly and firm soil, using a cultipacker or roller.

C. Hydraulic seeding – Apply in a slurry in combinations with fertilizer and wood cellulose or cane fiber mulch. The mixture must e spread uniformly over the area to be treated within on hour after the mixture is made.

D. Trees – Plant in winter after a suitable ground cover is established. Keep roots moist until set. Set at depth, or slightly deeper than they grew in the nursery. Avoid wading or crumpling roots. Plant seeding with roots straight down and firm the soil around roots.

Mulching

When using conventional seeding equipment, use dry straw or hay of good quality, free of seeds of competing plants and at a rate of 2 1 /2 tons per acre. Apply within 24 hours after seeding. Anchor the mulch by pressing it into the soil or with 250 gals. Per acre of Grade AE-5 or SS-1 asphalt emulsion sprayed onto the mulch as it is ejected from the mulch spreading equipment.

When using hydraulic seeing equipment, use 500 pounds per acre of wood cellulose or cane fiber mulch and apply in the slurry in combination with fertilizer and seed. Within 24 hours after seeding is complete apply 2 ½ tons per acre of dry straw or hay that is free of seeds of competing plants. Anchor 250 gals. Per acre of Grade AE-5 or SS-1 asphalt emulsion sprayed onto the mulch as it is ejected from the mulch spreading equipment.

Top Dressing

Use 50 pounds of available nitrogen. For spring plantings, apply when grass plants are about 2 to 4 inches tall. For fall planting, apply the following March or April.

Second Year Fertilizer

In March or April of sericea's second growing season, apply broadcast 700 pounds per acre of 0-14-14 fertilizer.

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LAND AND RECREATION AREA IMPROVEMENT

Definition: Establishing grasses to improve an area for lawn or recreation use.

Purpose: To increase the attractiveness and usefulness of lawns and recreation areas and to protect the soil and plant resources.

Where Applicable: On any area planned for lawn or recreation use.

Specifications-Grassing

Grading and Shaping

Remove objectionable rocks, stumps and other obstructions and do necessary grading and shaping to form the desired contour of the lands. When grading work is completed, the drainage is to be channeled into protected outlets and generally away form buildings.

Lime and Fertilizer

The lime used must be within the specifications of the Georgia Department of Agriculture. Apply at a rate of 1 ton per acre (45 pounds per 1,000 sq. ft.) for sandy soils or 2 tons per acre (90 pounds per 1,000 sq. ft.) for clayey soils, or use amount indicated by soil tests.

Note: Usually no lime is needed for centipede grass as its optimum pH range is 5.0 to 6.0. Use 1,000 to 1,500 pounds per acre (25 to 40 pounds per 1,000 sq. ft.) of 6-12-12 fertilizer. (For centipede use 400#/A—10#/100 sq. ft. of 12-4-4 fertilizer.) Apply both lime and fertilizer uniformly immediately before land preparation so it can be mixed with the soil.

Land Preparation

If no topsoil exists or is available, 1 to 2 inches of old sawdust or other organic material spread over the surface will be helpful. Thoroughly break the soil 4 to 6 inches deep. It must be well pulverized, smoothed and firmed. Use a ripper, chisel, rotator, or other appropriate tool that will not invert but incorporate applied materials.

A. To Establish by Seeding

Seed	Adaptation	Shade Tolerance	Planting Date	Rate in Pounds 1000 sq. ft.	Acre
Common Bermuda	All Georgia	Poor	3/1-7/1	1	40
Centipede	Central & South	Fair	3/1-7/1	¼	8
Carpet	Central & South	Good	3/1-7/1	3	110
Kentucky Bluegrass	North Georgia	Good	9/1-11/1	3	110
Tall Fescus	North Georgia	Good	9/1-11/1	4	150

`Use a cultipacker seed, drill, rotary seeder, or appropriate seeder to distribute seeds uniformly. Cover seed lightly. Seeding must be done on a freshly prepared and firmed seedbed.

Mulching

Use 2 tons per acre (90 pounds per 1,000 sq. ft.) of good quality straw or hay free of seeds of competing plants. Spread uniformly by hand or with mulch spreader immediately after seeding. Anchor either with emulsified asphalt, by pressing into the soil with disk set in straight position, commercial netting, or frequent wetting with water.

Irrigation

Immediately following mulching, apply water until soil is thoroughly wet (1 to 1½ inches). The rate of application must e such that no soil movement will occur. Repeat applications as needed to keep the soil thoroughly moist until a satisfactory stand of grass has been established.

B. To Establish by Sprigs or Sod Plugs

Use certified plant material (anywhere in Georgia – a hybrid Bermuda grass or one of the zoysias; in central and south Georgia – St. Augustine or centipede grass). Plant fresh, live, well-rooted single sprigs or 1 ½ to 2-inch sod plugs. Space in 12-inch rows, 3 to 6 inches apart. Cover well but leave the tip end or portion with leaves exposed. Firm soil around plant with a roller or by walking on them.

Mulching

Use 1 to 1 ½ tons per acre (45 to 65 pounds per ,000 sq. ft.) of good quality straw or hay free of seeds of competing plants. Spread uniformly by hand or with mulch spreader as planting progresses.

Irrigation

As planting progresses, apply water until the soil is thoroughly wet. Keep soil moist until plants are well established.

C. To Establish by Sodding

Use sod of uniform thickness containing at least a 1-inch layer of soil (excluding top growth). Use only sod that has been lifted within a 36-hour period and kept moist.

Lay sod in strips across the slope starting at the bottom and working up (during periods of high temperature, lightly irrigate the soil immediately prior to laying the sod). Stagger the joints; all joints must be butted tight to prevent voids which could cause drying of the roots or invite erosion.

Roll sod immediately following placement to insure solid contact of root mat and soil surface.

On steep slopes, secure sod to soil surface by covering with heavy jute or plastic netting. Use wire stapes or “T’s” to anchor.

Irrigation

Immediately following anchoring sod, water until moisture penetrates the soil layer beneath sod. Keep soil moist for at least two weeks.

Erosion control matting or netting – such as excelsior, jute, textile and plastic matting and netting.

Cutback asphalt slow curing applied at 1200 gallons per acre (or ½ gallons per sq. yd.).

Polyethylene film may be secured over banks or stockpiled soil material for temporary protection.

Applying and Anchoring Mulch:

A. Apply straw or hay mulch uniformly by hand or mechanically. Anchor as appropriate and feasible. It may be pressed into the soil with a disk harrow with the disk set straight or with a special "packer disk." The disk may be smooth or serrated and should be 20 inches or more in diameter and 8 to 12 inches apart. The edges of the disk should be dull enough not to cut the mulch but to press it into the soil leaving much of it in an erect position.

   Mulch spread with special blower-type equipment may be anchored with emulsified asphalt (Grade AE-5 or SS-1). The asphalt emulsion must be sprayed onto the mulch as it is ejected from the machine. Use 100 gallons of the emulsion and mix with 100 gallons of water per ton of mulch.

B. Spread wood waste uniformly on slopes that are 3:1 and flatter. No anchoring is needed.

C. Commercial matting and netting. Follow manufacturer's specification included with the material.

D. Apply asphalt so area has uniform appearance. (Note: Use in areas of pedestrian traffic could cause problems of "tracking in" or damage to shoes, clothing, etc.)

MULTCHING

Definition: Applying plant residues or other suitable materials not produced on the site to the soil surface.

Purpose: To conserve moisture, prevent surface compaction or crusting, reduce runoff and erosion control undesirable vegetation, modify soil temperature, increase biological activity in the soil.

Where Applicable: On any bare or denuded area which may be subjected to erosion for up to 12 months, and where a mulch is needed to control erosion and water pollution by sediment prior to the establishment of finished grade or permanent vegetation.

The temporary measures should be coordinated with the permanent erosion control measures planned to assure economical and effective control.

Specifications

For temporary protection of critical areas without seeding:

Graded or cleared areas which may be subjected to erosion for 6 months or less, where seedlings may not have a suitable growing season to produce an erosion retardant cover, but which can be established with a mulch cover.

Site Preparation:

A. Grade, as needed and feasible, to permit the use of equipment for applying and anchoring mulch.

B. Install needed erosion control measures as required such as interceptor ditches, berms and terraces, ripping and desilting basins.

C. As needed and feasible, loosen compact soil to a minimum depth of 3 inches.

Mulching Materials:

A. Dry straw or hay spread at a rate of 2 ½ tons per acre.

B. Wood waste – chips, sawdust or bark spread 2 to 3 inches deep (about 6 to 9 tons per acre).
The foregoing measures have been developed by the Soil Conservation Service from
long experience with rural problems of erosion and, more recently, with situations arising from urban and suburban development.

Some additional stratagems follow, which have been used successfully in practical situations.

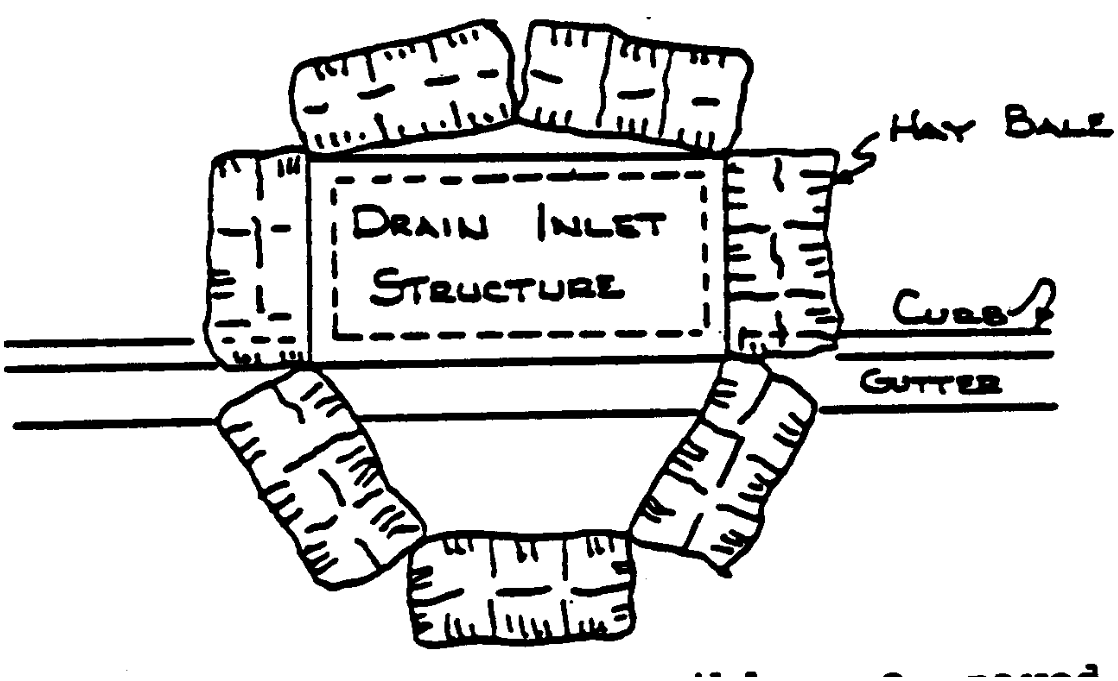
I. HAY BALES

Baled Hay, straw, or pine straw furnishes a temporary silt filtering device of great simplicity and reasonable effectiveness, in several applications.

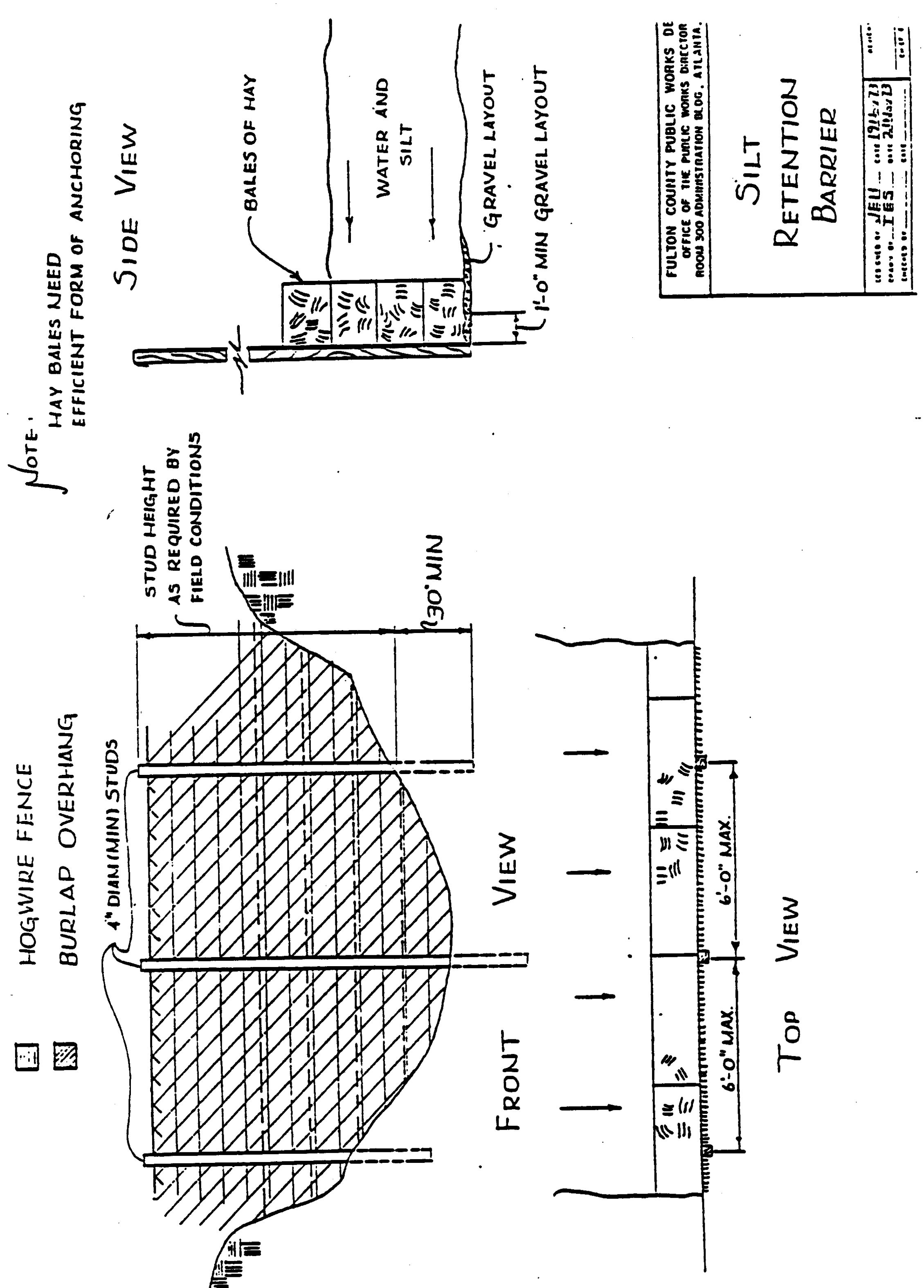
1. Peripheral silt barrier.
   Use: To trap sediment where runoff flows overland on mild slopes toward project boundaries, or at points of concentration at boundaries.

   The standard developed for use in Fulton County appears on page 94.

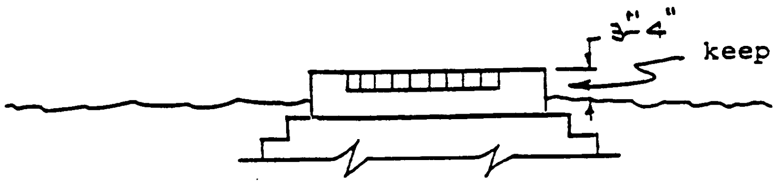
2. Cofferdams for Drainage structures.
   Use:To surround and project drainage structures, such as catch basins and drop inlets, until sedimentation ceases.



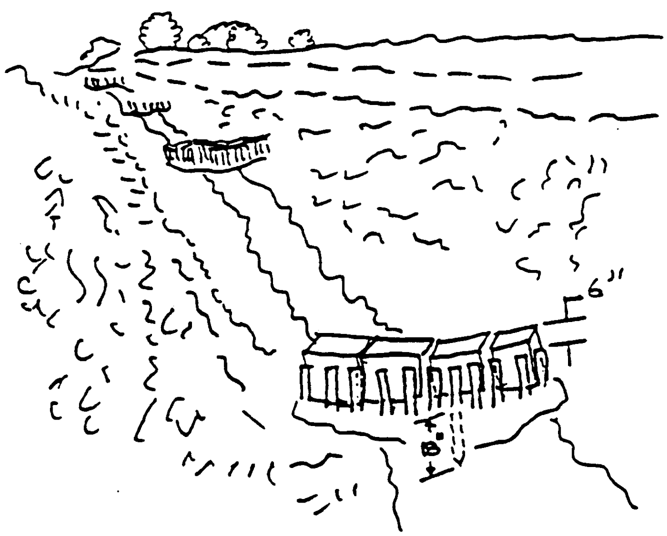
Stake bales where possible. On paved surfaces, tie adjoining bales together


HOGWIRE FENCE
BURLAP OVERHANG
NOTE: HAY BALES NEED EFFICIENT FORM OF ANCHORING
SIDE VIEW
BALES OF HAY
WATER AND SILT
GRAVEL LAYOUT
1'-0" MIN GRAVEL LAYOUT
FULTON COUNTY PUBLIC WORKS DE
OFFICE OF THE PUBLIC WORKS DIRECTOR
ROOM 300 ADMINISTRATION BLDG, ATLANTA.
SILT RETENTION BARRIER
STUD HEIGHT AS REQUIRED BY FIELD CONDITIONS
30" MIN
4" DIAM (MIN) STUDS
FRONT VIEW
6'-0" MAX.
6'-0" MAX.
TOP VIEW

(NOTE: Where grated drop inlets are located in paving, until paving is done, the surrounding area can be used to trap silt.)



3. <u>Ditch Checks.</u>
<u>Use:</u> In roadside or diversion ditches, to trap sediment at intervals, along their own courses.



II. EARTH BERMS

Use: As a peripheral silt barrier, to prevent travel of sediment before it leaves property.

Construct in 6" to 8 in lifts. Compact by traversing with earthmoving equipment or use rollers or other compacting equipment. (NOTE: Without proper compaction, an earth berm is, as a rule, simple erodible material concentrated at a convenient place for erosion.)

III. RETENTION BASINS

Where a permanent retention basis is to be used as a sediment basin during construction, the outlet invert must be undercut so that it shall be above the basin bottom by an amount varying from 6-inches to 24-inches.

CHAPTER 15 - WATER QUALITY BEST MANAGEMENT PRACTICES

15.0 GENERAL INTRODUCTION

Traditionally, stormwater management design efforts focused on the prevention of property damage from flooding (quantity and peak discharge rate); runoff collection systems, such as curbs and gutters; and pipe conveyance systems, which discharged directly into receiving water bodies. It is now becoming increasingly recognized that the historically surface water management approach used for peak discharge rate control is insufficient to address runoff problems effectively. Therefore, all developments that require a Land Disturbance Permit (L.D.P.) and Exemption Plat, shall include provisions to mitigate the site post-development surface water runoff quality and quantity to mimic the undeveloped natural runoff conditions or closely approximate the conditions before development (i.e. time of concentration, travel time/timing, discharge rate and velocity) on site, at the site outlet(s) and downstream of the proposed development. Therefore, the goal is lower the probability of downstream flooding, water quality protection, streambank erosion, sedimentation and provide water for other beneficial uses.

The basic surface water quality runoff measures utilized in stormwater quality management can be separated into two types:

1. non-structural Best Management Practices (BMPs) or Source Control;
2. structural Best Management Practices.

Non-structural practices can be used for pollution prevention or prevent runoff problems; and structural practices (BMPs) help mitigate the problems

Additionally, broadening the County's runoff quality management program requires a better stormwater management approach. Therefore, the developer should utilize a three (3) Phases approach described below to accomplish the surface water management on each site.

PHASES

1. Planning

At the planning phase of each project, the following shall be incorporated into site stormwater runoff management systems:

a) The engineering planning for the runoff of each site should describe how the proposed development will manage the post-development surface water runoff quality and quantity, to include post-development **Best Management Practices (BMP's**).

b) Incorporate into the project planning process the concept that every piece of land is a part of a larger drainage basin/system; therefore, the projects stormwater runoff management system should support the entire sub-drainage basin, basin or system.
c) Analyze the combine runoff/discharge and timing impacts(s) of existing offsite storage facility(ies)and the proposed site storage facility(ies) on offsite, surface water conveyance system(s)

d) Describe in detail the actions necessary to analyze downstream conveyance system capacity to accept the upstream post-developed runoff or discharges without adverse impacts on the system. Examples of downstream impacts may be stream bank erosion, habitat destruction, flooding and the overtopping of existing conveyance system.

2. Concept Plan

A stormwater concept plan of the proposed project shall be developed and submitted to the Department of Public Works for review and approval. This concept plan shall include the following:

a) Site plans depicting the location of all post-development Best Management Practices (BMP's) to be utilized to control surface water runoff quality and quantity to the predevelopment level.

b) Documentation to demonstrate that the plans submitted addressed adequately the Public Work's stormwater concept plan preparation guidelines and criteria.

c) A map depicting all applicable existing or proposed Best Management Practice (BMP) outlet structure flow discharge paths to the appropriate downstream receiving conveyance system.

d) A description of the site existing horizontal floodplain limit, if applicable.

e) Documentation describing the preliminary implementation of 1.b and c, as applicable, with detail engineering design or analysis to be included as a part of the project Land Disturbance Permit (LDP) submittal.

f) Incorporated appropriately into the project plan any impacts the development may have on state waters, stream buffer, such as the piping of tributary. Also indicate possible buffer variance. Examples of the general items to be depicted on plan are: centerline, top of banks, and areas of encroachment etc.

3. Final

The proposed final design and construction documents of the project may include the following:

a) The detailed engineering analysis, design and specification of each proposed BMP and/or stormwater storage facility and conveyance systems.

b) All applicable detailed engineering analysis, (hydrology, hydraulics of the site, existing flood plain describing elevation(s) and horizontal limit) and hydraulic calculations of conveyance systems providing, if necessary, all supporting documentation (with relevant fee(s) to satisfy the County's floodplain management program, including the **Federal Emergency Management Agency (FEMA)**.

c) Construction documents/drawings suitable for issuance of **a Land Disturbance Permit (LDP)**.

15.1 NON-STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

15.1.1 Introduction

Within the treatment train "concept, the non-structural BMPs should be the first line of defense in protecting receiving streams. In most cases, non-structural BMPs are easier and less costly to prevent pollutants from entering the drainage system, than trying to control pollutant with structural BMPs. In addition, non-structural BMPs tend to be less costly, easier to design, implement and easier to maintain than structural BMPs. Therefore, if used properly, non-structural BMPs can be very effective in controlling pollutants and greatly reduce the need for structural BMPs.

Non-structural BMPs normally do not have technical or engineering designs associated with them but are measures that the County, development engineers, other agencies or groups may utilize or implement to assist in the management water quality and the control of pollutants within the County. Following is a brief discussion of some non-structural BMPs that can be used within a stormwater quality management plan for different portions of the drainage system. (See 15.1.2 – 15.1.12) Temporary BMPs used during construction activities are not discussed in this chapter. BMPs may remove or manage the following major pollutants associated with urban runoff:

- organic matter,
- nitrogen,
- phosphorus,
- heavy metals including copper, lead, nickel, cobalt and zinc,
- sediment
- bacteria, and
- temperature.

15.1.2 Public Education/Participation

Public education/participation is not so much a Best Management Practice, as it is a method by which to implement BMPs. Public education/participation is a vital component of many of the individual source control BMPs. A public education and participation plan provides the County with a strategy for educating its employees, the public, and businesses about the importance of protecting stormwater from improper use, storage, and disposal of pollutants. County employees should be trained, especially those that work in departments that may not be directly related to stormwater but whose actions affect stormwater. Residents must become aware that a variety of hazardous products are used in the home and that their improper use and disposal can pollute stormwater and groundwater supplies. Businesses, particularly smaller ones that may not be regulated by Federal, State, or local regulations, must be informed of ways to reduce their potential to pollute stormwater.

15.1.3 Land Use Planning/Management

This BMP presents an important opportunity to reduce the pollutants in stormwater runoff by using a comprehensive planning process to control or prevent certain land use activities in areas where water quality is sensitive to development. It is applicable to all types of land use and represents one of the most effective pollution prevention practices. Subdivision regulations, zoning ordinances, preliminary plan reviews and detailed plan reviews, are tools that may be used to mitigate stormwater contamination in newly developing areas. Also, master planning, cluster development, terracing and buffers are ways to use land use planning as a BMP in the normal design for subdivisions and other urban developments. An impervious cover limitation is one of the more effective land use management tools, since nationwide research has consistently documented increases in pollution loads with increases in impervious cover. In addition to controlling impervious area cover, directly connected impervious areas are kept to a minimum. This is especially important for large impervious areas such as parking lots and highways and it can also be effective for small impervious areas such as roof drainage.

15.1.4 Material Use Controls

There are three major BMPs included in this category:

1. Housekeeping Practices
2. Safer Alternative Products
3. Pesticide/Fertilizer Use

In housekeeping practices, the goal is to promote efficient and safe practices such as storage, use, cleanup, and disposal, when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. In addition, the use of less harmful products can be promoted. Alternatives exist for most product classes including fertilizers, pesticides, cleaning solutions, and automotive and paint products.

Pesticides and fertilizers have become an important component of land use and maintenance for municipalities, commercial land uses and residential land owners. Any usage of pesticides and fertilizers increases the potential for stormwater pollution. BMPs for pesticides and fertilizers include education in their use, control runoff from affected areas, control times when they are used, provide proper disposal areas, etc.

15.1.5 Material Exposure Controls

There are two major BMPs included in this category:

1. Material Storage Control
2. Vehicle Use Reduction

Material storage control is used to prevent or reduce the discharge of pollutants to stormwater from material delivery and storage by minimizing the storage of hazardous materials onsite, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.
Vehicle use reduction is used to reduce the discharge of pollutants to stormwater from vehicle use by high-lighting the stormwater impacts, promoting the benefits to stormwater of alternative transportation, and integrating initiatives with existing or emerging regulations and programs.

15.1.6 Material Disposal and Recycling

There are three major BMPs included in this category:

1. Storm Drain System Signs
2. Household Hazardous Waste Collection
3. Used Oil Collection

Stenciling of the storm drain system (inlets, catch basins, channels, and creeks) with prohibitive language/graphic icons discourages the illegal dumping of unwanted materials. Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets.

Household hazardous wastes are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by the EPA. Household hazardous waste collection programs are a preventative rather than curative measure and may reduce the need for more elaborate treatment controls. Programs can be a combination of permanent collection centers, mobile collection centers, curbside collection, recycling, reuse, and source reduction.

Used oil recycling is a responsible alternative to improper disposal practices such as dumping oil in the sanitary sewer or storm drain system, applying oil to roads for dust control, placing used oil and filters in the trash for disposal to landfill, or simply pouring used oil on the ground. Commonly used oil collection alternatives are a temporary "drop off" site on designated collection days or the use of private collectors such as automobile service stations, quick oil change centers and auto parts stores.

15.1.7 Spill Prevention And Cleanup

There are two major BMPs included in this category:

1. Vehicle Spill Control
2. Aboveground Tank Spill Control

The purpose of a vehicle spill control program is to prevent or reduce the discharge of pollutants to stormwater from vehicle leaks and spills by reducing the chance for spills by preventive maintenance, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees. It is also very important to respond to spills quickly and effectively.

Aboveground tank spill control programs prevent or reduce the discharge of pollutants to stormwater by installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

15.1.8 Dumping Controls

This BMP addresses the implementation of measures to detect, correct, and enforce against illegal dumping of pollutants on streets and into the storm drain system, streams, and creeks. Substances illegally dumped on streets and into the storm drain system and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes.

15.1.9 Connection Controls

There are three major BMPs included in this category:

1. Illicit Connection Prevention
2. Illicit Connection Detection and Removal

3. Leaking Sanitary Sewer Control

Illicit connection protection tries to prevent unwarranted physical connections to the storm drain system from sanitary sewers, floor drains, etc., through regulation, regular inspection, testing, and education. In addition, programs include implementation control procedures for detection and removal of illegal connections from the storm drain conveyance system. Procedures include field screening, follow-up testing, and complaint investigation.

Leaking sanitary sewer control includes implementing control procedures for identifying, repairing, and remediating infiltration, inflow, and wet weather overflows from sanitary sewers into the storm drain conveyance system. Procedures include field screening, testing, and complaint investigation.

15.1.10 Street/Storm Drain Maintenance

There are seven major BMPs included in this category:

1. Roadway Cleaning
2. Catch Basin Cleaning
3. Vegetation Controls
4. Storm Drain Flushing
5. Roadway/Bridge Maintenance
6. Detention/Infiltration Device Maintenance
7. Drainage Channel/Creek Maintenance

Roadway cleaning may help reduce the discharge of pollutants to stormwater from street surfaces by conducting cleaning on a regular basis. However, cleaning often removes the larger sizes of pollutants but not the smaller sizes. Most pollutants are deposited within three feet of the curb which is where the roadway cleaning should be concentrated. Catch basin cleaning on a regular basis also helps reduce pollutants in the storm drain system, reduces high pollutant concentrations during the first flush of storms, prevents clogging of the downstream conveyance system and restores the catch basins' sediment trapping capacity.

Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. Mechanical vegetation control includes leaving existing vegetation, cutting less frequently, hand cutting, planting low maintenance vegetation, mulching, collecting and properly disposing of clippings and cuttings, and educating employees.

Storm drains can be "flushed" with water to suspend and remove deposited materials. Flushing is particularly beneficial for storm drain pipes with grades too flat to be self-cleansing and helps ensure pipes convey design flow and removes pollutants from the storm drain system. However, flushing will only push the pollutants into downstream receiving waters unless the discharge from the flushing is captured and removed from the drainage system. Jet-Vac trucks should be employed to remove debris from this process.

Roadway/bridge maintenance is used to prevent or reduce the discharge of pollutants to storm water by paving as little are as possible, designing bridges to collect and convey stormwater to proper locations, using measure to prevent runoff from entering the drainage system, properly disposing of maintenance wastes, and training employees.

Proper maintenance and siltation removal is required on both a routine and corrective basis to promote effective stormwater pollutant removal efficiency for wet and dry detention ponds and infiltration devices. Also, regularly removing illegally dumped items and material from storm drainage channels and creeks will reduce pollutant levels.

15.1.11 Permanent Erosion Control

There are three major BMPs included in this category:

1. Erosion Control - Permanent Vegetation
2. Erosion Control - Flow Control
3. Erosion Control - Channel Stabilization

Vegetation is a highly effective method for providing long term, cost effective erosion protection for a wide variety of conditions. It is primarily used to protect the soil surface from the impact of rain and the energy of the wind. Vegetation is also effective in reducing the velocity and sediment load in runoff sheet flow.

Channel stabilization addresses the problem of erosion due to concentrated flows. Concentrated flows occur in channels, swales, creeks, rivers and other water courses in which a substantial drainage area drains into a central point. Overland sheet flow begins to collect and concentrate in the form of rills and gullies after overland flow of as little as 100 feet. Erosion due to concentrated flow is typically extensive, causing large soil loss, undermining foundations and decreasing the flow capacity of watercourses.

Proper selection of ground cover is dependent on the type of soil, the time of year of planting, and the anticipated conditions that the ground cover will be subjected. In addition, mulching is a form of erosion protection which is commonly used in conjunction with establishment of vegetation. It typically improves infiltration of water, reduces, runoff, holds seed, fertilizer and lime in place, retains soil moisture, helps maintain temperatures, aids in germination, retards erosion and helps establish plants in disturbed areas.

Once flow is allowed to concentrate, it is more difficult to control erosion problems. Thus every effort should be made to maintain sheet flow conditions for runoff. Where concentrated flows are unavoidable, the following techniques may be used to control erosion that may result in water quality problems:

• Rip Rap	• Gabions	• Check Dams
• Level Spreaders	• Armor Protection	• Diversions

For more information on erosion control consult the publication, Manual for Erosion and Sediment Control in Georgia, available from the Georgia Soil and Water Conservation Commission.

15.2 <u>STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)</u>

15.2.1 Introduction

To provide some guidance in the design and use of different structural BMP's this section gives specifications and performance standards for several BMP's that could find application within the County. However, schematic figures are included for other applicable BMPs

Following are the required specifications, recommended specifications, operation and maintenance recommendations, and performance standards for approximately nine different structural BMP's. For example, designs of the several infiltration facilities included as BMPs in the chapter, and the water quality volume and peak discharge, described in Appendix A. The appropriate BMP design example from other sources can be utilized.

<u>Recommended BMP's</u>

Dry Extended Detention Ponds	Bio-retention Systems
Retention /Wet Extended Detention Ponds	Sand Filters
Constructed Wetlands	Infiltration Trenches
Grassed Swales	Porous Pavement
Vegetated Filter Strips and Flow Spreaders	Oil/Grit Separators
Wet Extended Detention Ponds	

Each structural BMP, performance standard is included to give a general idea of the pollution removal rates for that BMP. The general design criteria for Fulton County is to design BMPs to treat the runoff from the first 1.2 inch of rainfall, from the site, with a detention time of 48 hours. The design criteria for BMPs listed above as developed for the Georgia Stormwater Design Manual (Atlanta Regional Commission, 2000), may be used , after consultation and/or approval of the County Public Works Director or designee.

15.2.2 Extended Detention Ponds

(See Figure 15.1)

STANDARD SPECIFICATIONS FOR EXTENDED DRY DETENTION PONDS

Extended detention ponds shall be designed with a detention time of 48 hours. If the dry extended detention pond is to be designed for only water quality purposes, then the pond should be designed to capture the first 1.2 inches of rainfall from the site or the drainage area above the facility.

Required Specifications

- Capture the runoff from the first 1.2 inches of rainfall from the site (dry extended detention ponds only)
- Side slopes shall be no greater than 3:1 if a fill slope.
- Inlet and outlet located to maximize flow length.
- Design for full development upstream of control.
- Rip-rap protection (or other suitable erosion control means) for the outlet and all inlet structures into the pond.
- One and one-half (1 1/2) foot minimum freeboard above peak stage for top of embankment.
- Emergency spillway designed to pass the 100-year storm event (must be paved in fill areas).
- Maintenance access minimum of 10 feet wide.
- Trash racks, filters or other debris protection on control.
- Anti-vortex plates.
- Insure no outlet leakage and use anti-seep collars.
- Benchmark for sediment removal.

Recommended Specifications

- Two stage design for dry extended detention pond only top stage - dry during the 1.2 inches rainfall event, bottom stage - inundated during storms equal to or less than the 1.2 inches storm event.
- Top stage shall have slopes between 2% and 5% and a depth of 2 to 5 feet.
- Bottom stage maintained as shallow wetland (6 to 12 in.).
- Manage buffer and pond as meadow.
- Minimum 25-foot wide buffer around pool (or as approved).
- On-site disposal areas for two sediment removal cycles.
- Impervious soil boundary.
- Design as off-line pond to bypass larger flows.

- Design as sediment settling basin for pretreatment of the larger particles.
- Pilot channel of paved or concrete material for erosion control (alternately use turf if
- there is little low flow). Size such that any event runoff will overflow the low flow channel into the pond floor..

Operation And Maintenance Recommendations

A stormwater management easement and maintenance agreement shall be required for each facility.

- Extended dry ponds are used where lack of water or other multi-use considerations preclude the use of wet ponds or constructed wetlands.
- Operation and maintenance is the same as for detention.
- Maintenance activities include keeping the outlets unclogged, control of vegetation, removal of sediment deposits, keeping aesthetics of area acceptable.

Performance Standards

- Soluble pollutant removal rates are low for extended dry detention ponds but can be enhanced either with greatly increased detention time, through the use of shallow marshes to increase biological uptake, or through using an infiltration device downstream from the outlet orifice.
- Average annual pollutant removal capability of extended detention ponds is as follows:

Pollutant	1.2 Inch Rain Detained 48 hours	Same as Previous w/ Shallow Marsh
Sediment	80%	80%
Total Phosphorus	40%	60%
Total Nitrogen	20%	40%
BOD	40%	40%
Metals	60%	60%

- Dry extended detention ponds are presumed to be able to remove 80% of the total suspended solids load in typical urban post development runoff.
- Dry detention ponds are presumed to be able to remove 50% of the total suspended solids load in typical urban post-development runoff.

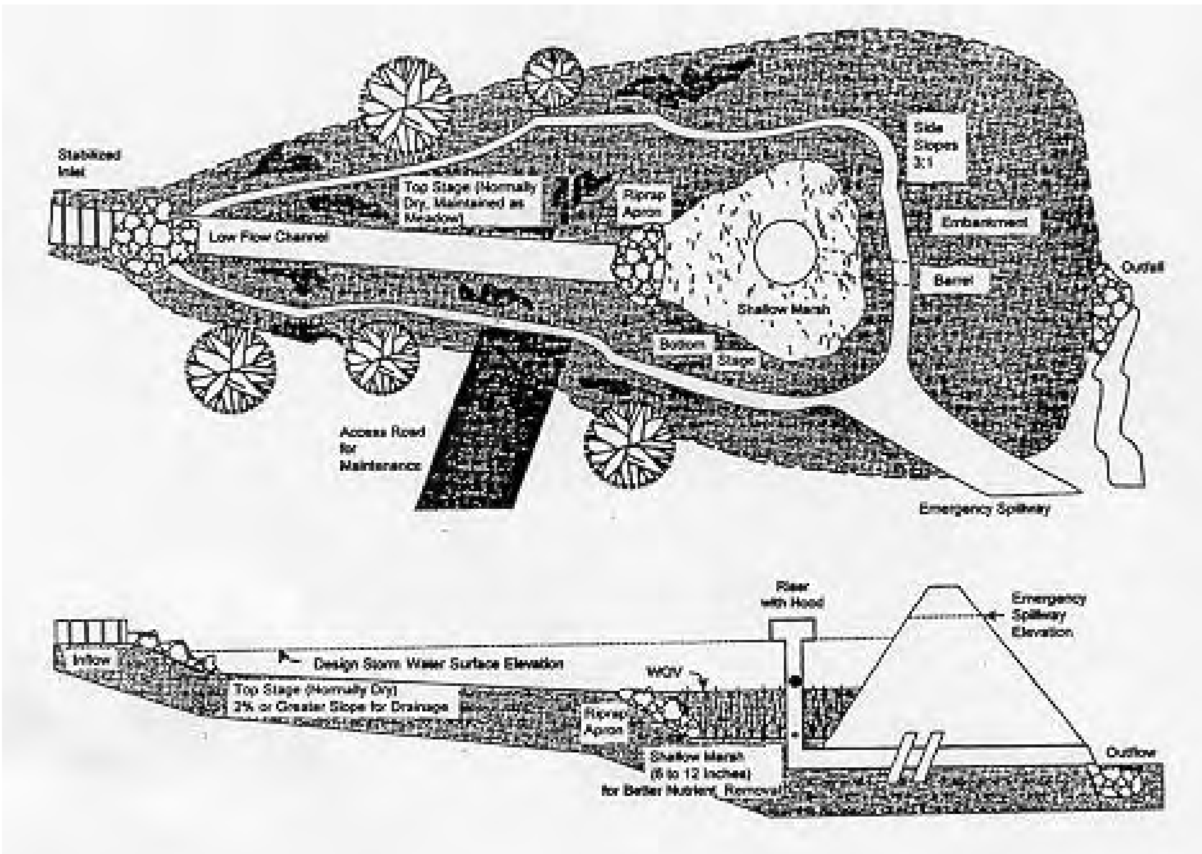


Figure 15-1 Dry Extended Detention Pond Schematic

15.2.3 Retention Ponds

(See Figures 15.2a – 15.2c)

STANDARD SPECIFICATIONS FOR RETENTION/WET EXTENDED DETENTION PONDS

Retention ponds shall be designed with a minimum detention time of 48 hours. If the retention pond is to be designed for only water quality purposes, then the pond should be designed to capture the first 1.2 inch rainfall event for the site drainage area total impervious surface above the facility.

Required Specifications

- Capture the runoff from the first 1.2 inches of rainfall from the site.
- Minimum detention time of 48 hours.
- Minimum length to width ratio of 2:1 (preferably expanding outward toward the outlet). Irregular shorelines for larger ponds provide visual variety.
- Inlet and outlet located to maximize flow length. Use baffles if short-circuiting cannot be prevented with inlet-outlet placement.
- Minimum depth of permanent pool 2 to 3 feet, maximum depth of 9 to 12 feet. Average depth should be 3 to 7 feet.
- Design for full development upstream of control.
- Fill side slopes shall be no greater than 3:1.
- Rip-rap protection (or other suitable erosion control means) for the outlet and all inlet structures into the pond. Individual boulders or baffle plates can work for this.
- One and one-half (1 1/2) foot minimum freeboard above peak stage for top of embankment.
- Emergency drain; i.e. sluice gate, drawdown pipe; capable of draining within 24 hours.
- Emergency spillway designed to pass the 100-year storm event.
- Minimum 25 foot wide buffer around pool (or as approved).
- Trash racks, filters, hoods or other debris control on riser.
- A cleared and graded maintenance access easement that is a minimum of 10 feet wide.
- Maintenance access minimum of 25 feet wide.
- Benchmark for sediment removal.
- Provide forebay designed with 10 percent of the required volume. Forebay should have separate drain for de-watering. Provide grass bio-filters for smaller ponds.
- Provide maintenance access drive with a minimum width of 10 feet.

Recommended Specifications

- Multi-objective use such as amenities or flood control.
- Minimum drainage area may be 20 acres (as applicable).
- Landscaping management of buffer.
- Design for multi-function as flood control and extended detention.
- Minimum length to width ratio of 3:1 to 4:1 (preferably wedge shaped).
- Use reinforced concrete instead of corrugated metal.
- Consider artificial mixing for small sheltered ponds.
- Impervious soil boundary to prevent drawdown.
- Shallow marsh area around fringe 25 to 50 percent of area (including aquatic vegetation).
- A safety bench with minimum width of 10 feet should be provided around the permanent pool.
- On-site disposal areas, for two sediment removal cycles, protected from runoff.
- An oil and grease skimmer for sites with high production of such pollutants.

Operation And Maintenance Recommendations

- Sediment to be removed when 20% of storage volume of the facility is filled (design storage volume must account for volume lost to sediment storage).
- Sediment traps shall be cleaned out when filled.
- No woody vegetation shall be allowed on the embankment without special design provisions.
- Other vegetation over 18 inches high shall be cut unless it is part of planned landscaping.
- Debris shall be removed from blocking inlet and outlet structures and from areas of potential clogging.
- The control shall be kept structurally sound, free from erosion, and functioning as designed.
- Periodic removal of dead vegetation shall be accomplished.
- No standing water is allowed within extended detention pond unless specifically designed for.
- Inspection requirements should be outlined in the maintenance agreement.
- The site should be inspected and debris removed after every major storm.
- All special maintenance responsibilities will be listed in the maintenance agreement.
- Mow embankment and side slopes at least twice a year.
- Consider chemical treatment by alum if algal blooms are a problem.

Performance Standards

- Wet extended ponds are very effective in removal of both the soluble and particulate fractions of pollution.

- Average annual pollutant removal capability of wet ponds is as follows.

Pollutant	0.5 Inch Per Impervious Acre
Sediment	60%
Total Phosphorus	40%
Total Nitrogen	20%
BOD	20%
Metals	20%

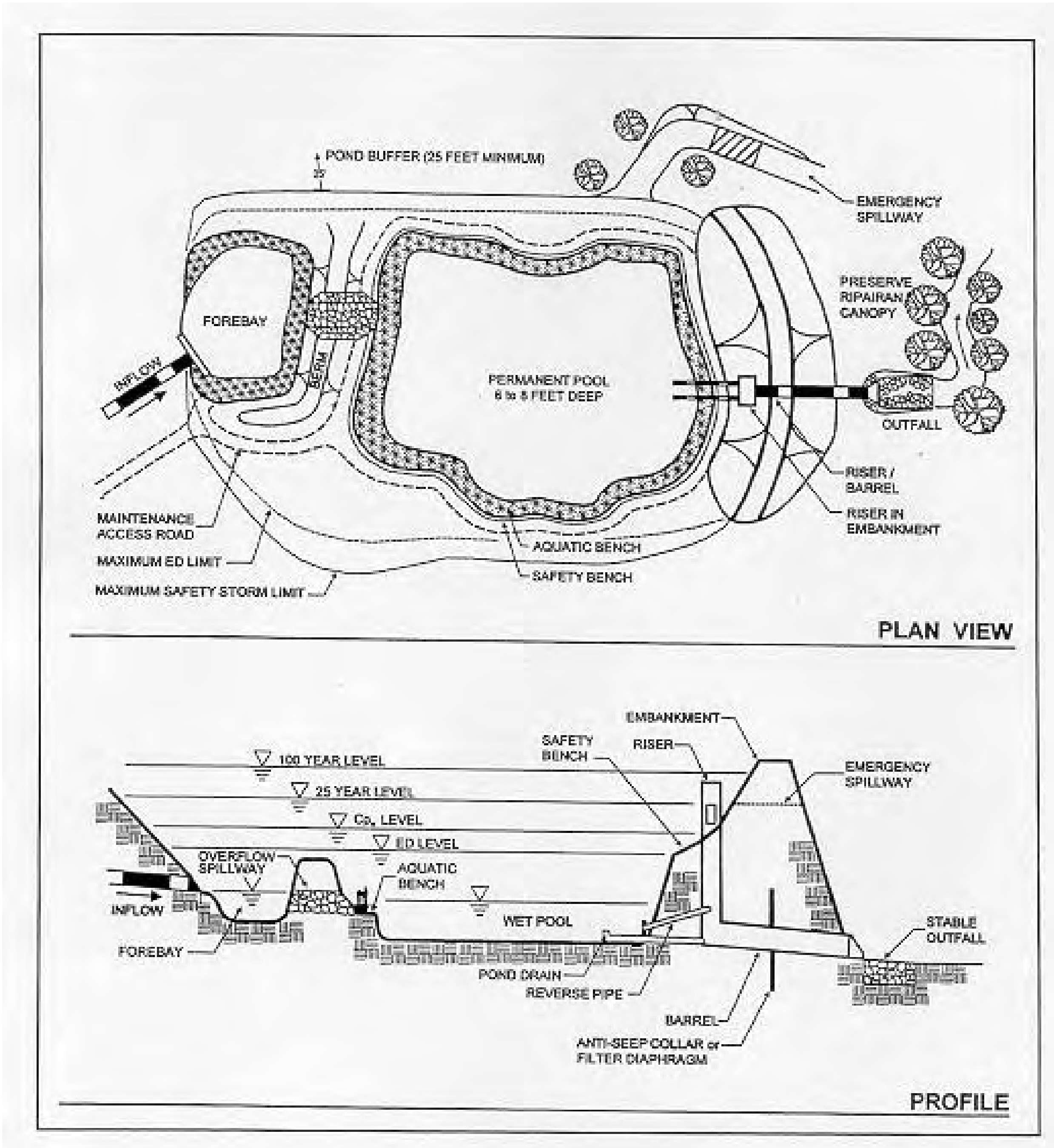


Figure 15.2A Schematic of Wet Extended Detention Pond
(May utilize design example from other sources)
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

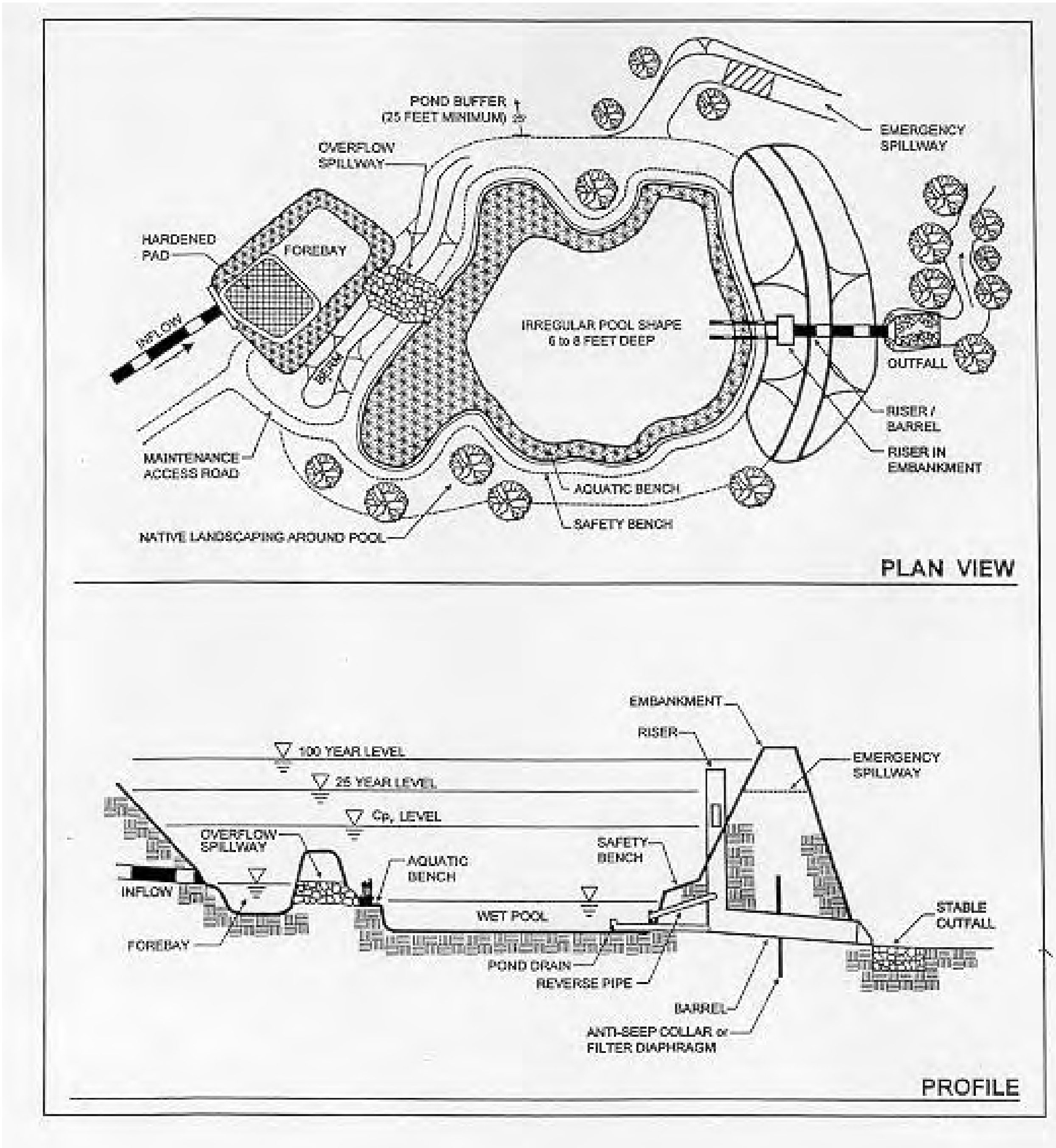


Figure 15.2B Schematic of Wet Pond
(May utilize design example from other sources
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

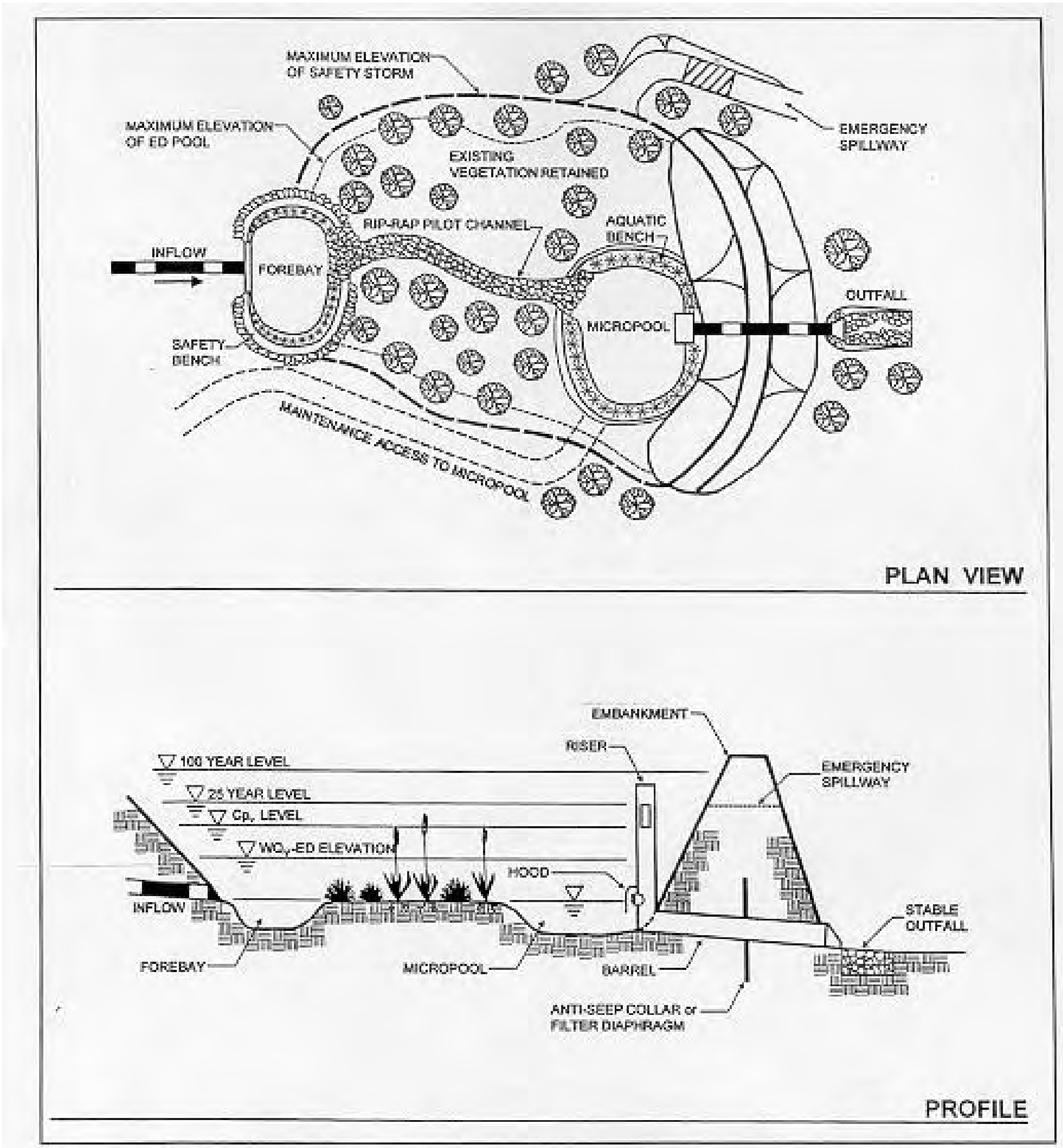


Figure 15.2C Micropool Extended Detention Pond
(May utilize design example from other sources)
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

15.2.4 Sand Filters

(See Figure 15.3 , 15.3A, and 15.3B)

STANDARD SPECIFICATIONS FOR SAND FILTERS

Required Specifications

- Maximum contributing drainage area of 50 acres.
- 1-inch rainfall design storm.
- Designed to completely empty in 48 hours or more.
- Inlet structure shall be designed to spread the flow uniformly across the surface of the filter media.
- Stone riprap or other dissipation devices shall be installed to prevent gouging of the sand media and to promote uniform flow.
- Final sand bed depth shall be at least 18 inches.
- Under- drain pipes shall consist of main collector pipes and perforated lateral branch pipes.
- The under- drain piping shall be reinforced to withstand the weight of the overburden.
- Internal diameters of lateral branch pipes shall be 4 inches or greater and perforations shall be 3/8 inch.
- Maximum spacing between rows of perforations shall not exceed 6 inches.
- All piping shall be schedule 40 polyvinyl chloride or greater strength.
- Minimum grade of piping shall be 1/8 inch per foot (1% slope).
- Access for cleaning all under-drain piping shall be provided.
- A minimum infiltration rate of 0.5 inches per hour should be used for all infiltration designs, including sand filters.
- Provide pre-settling basin.
- Two sand filter configurations are recommended for use:

1) Sand Bed with Gravel Layer;

- Top layer of sand shall be a minimum of 18 inches of 0.02 - 0.04 inch diameter
- sand (smaller sand size is acceptable).
- A layer of one-half to 2-inch diameter gravel under the sand shall be provided for
- a minimum of 2 inches of cover over the top of the under-drain lateral pipes.
- No gravel is required under the lateral pipes.
- The sand and gravel shall be separated by a layer of geotextile fabric.

2) Sand Bed with Trench Design;

- Top layer of sand is to be 12-18 inches of 0.02 - 0.04 inch diameter sand (smaller

- size is acceptable).
- Laterals to be placed in trenches with a covering of one-half to 2-inch gravel and
- geotextile fabric.
- The lateral pipes are to be underlain by a layer of drainage matting.
- A pre-settling basin and/or bio-filtration swale is recommended to pretreat runoff
- discharging to the sand filter.
- A maximum spacing of 10 feet between lateral under-drain pipes is recommended

Operation And Maintenance Recommendations

- A stormwater management easement and maintenance agreement shall be required for each facility. The maintenance covenant shall require the owner of the sand filter to periodically clean the structure.
- Scrape off sediment layer buildup during dry periods with steel rakes or other devices.
- Replace some or all of the sand when permeability of the filter media is reduced to unacceptable levels which should be specified in the design of the facility.

Performance Standards

- Sand Filtration Basins

  - All runoff up to design volume is filtered through sand bed.
  - The storage volume is based on runoff volume of the 1-inch rainfall event.
  - Estimated long-term pollutant removal rates as follow:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	65
	Lead	50
	BOD	60
Other Pollutants	Sediment	85
	Total Nitrogen	50
	Zinc	60
	COD	80
	Bacteria	50-60

- Filtration System Performance Enhancement

  - Sand/peat beds have higher removal effectiveness due to adsorptive properties of
  - peat.
  - Designs incorporating vegetative cover on the filter bed increase nutrient removal.
  - Pretreatment (sedimentation or oil and grease removal) will enhance the
  - performance of the filter and will decrease the maintenance frequency required to maintain effective performance.

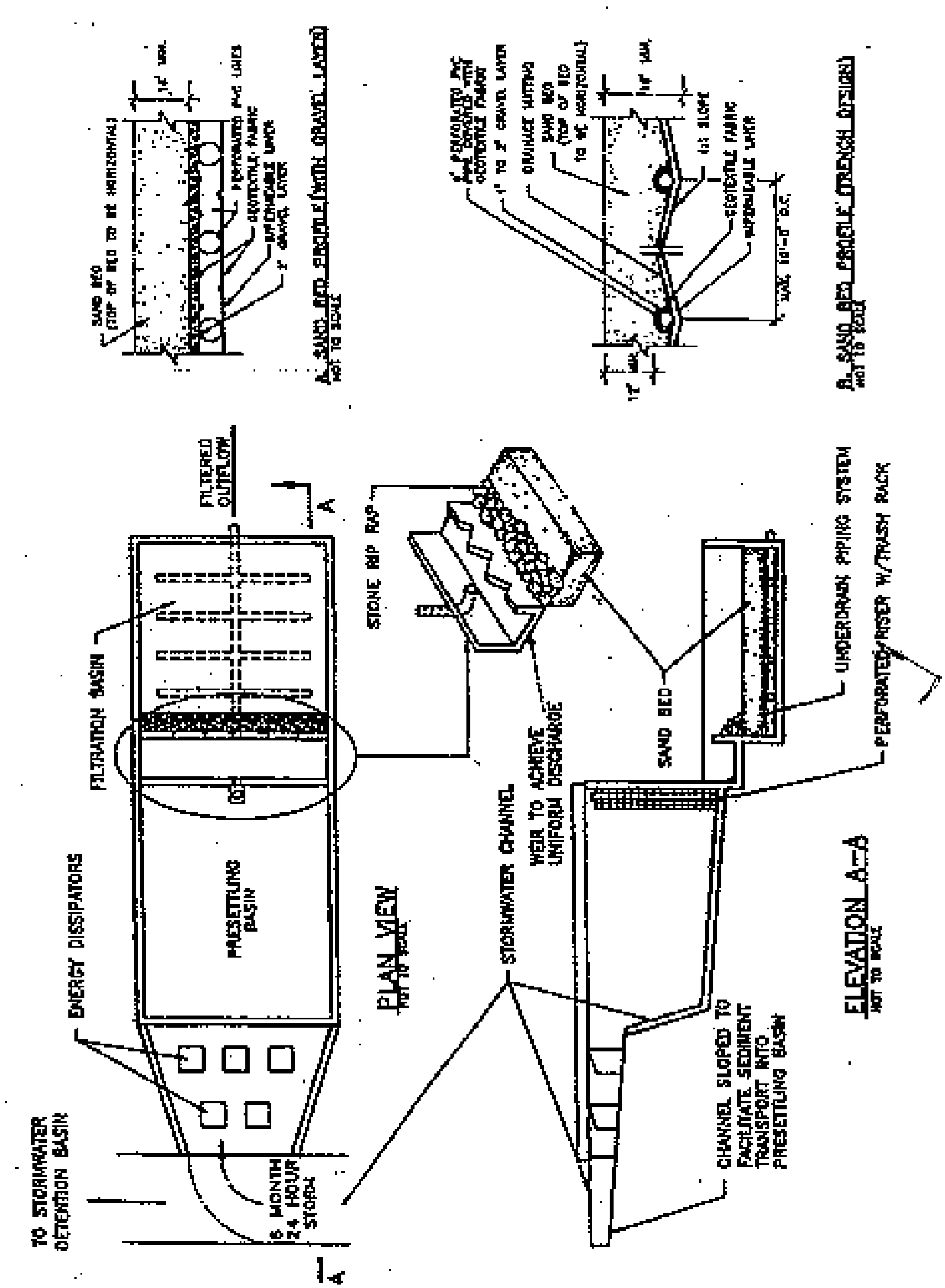


Figure 15.3 Sand Filtration Basin

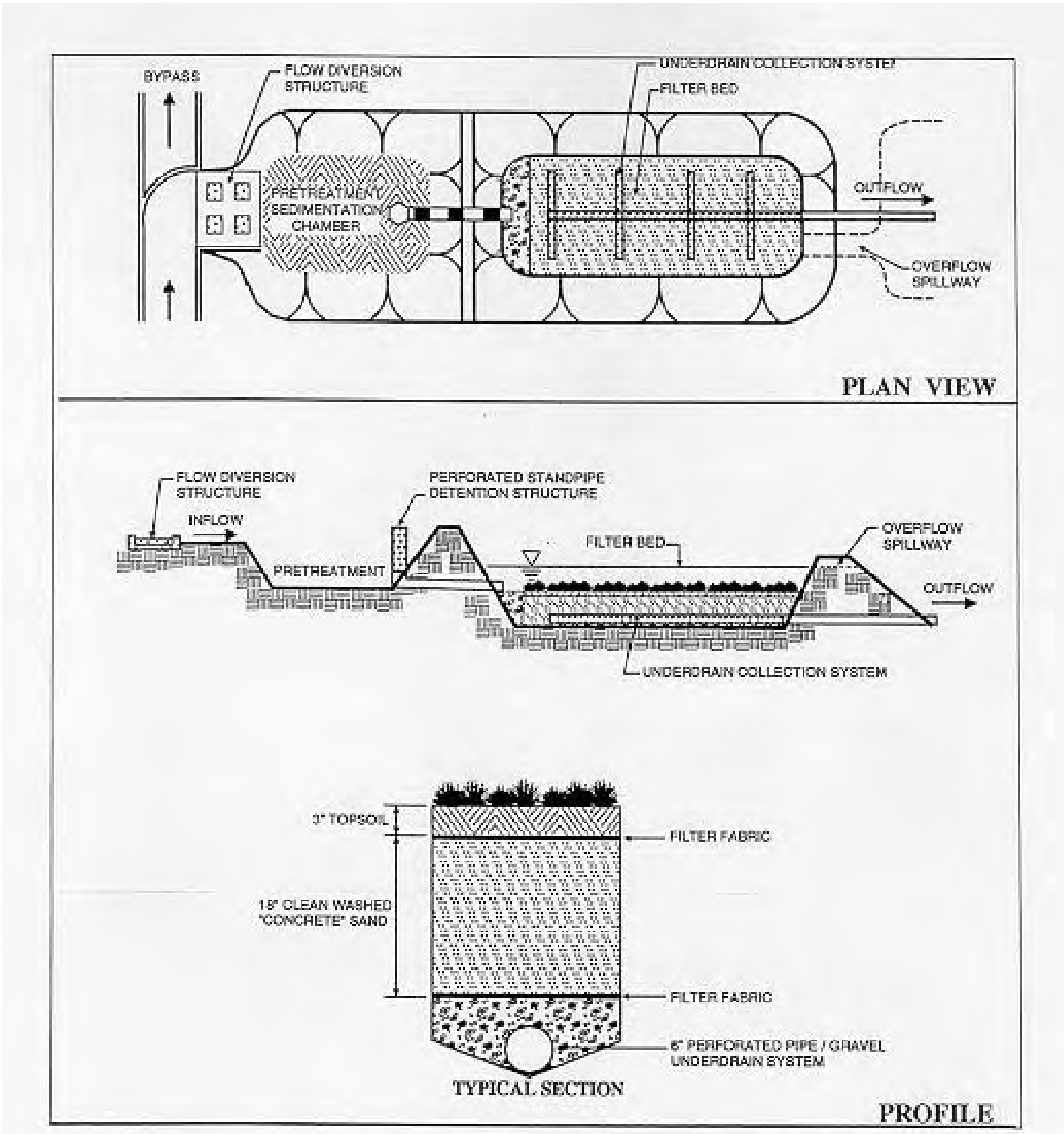


Figure 15.3A Schematic of Surface Sand Filter
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

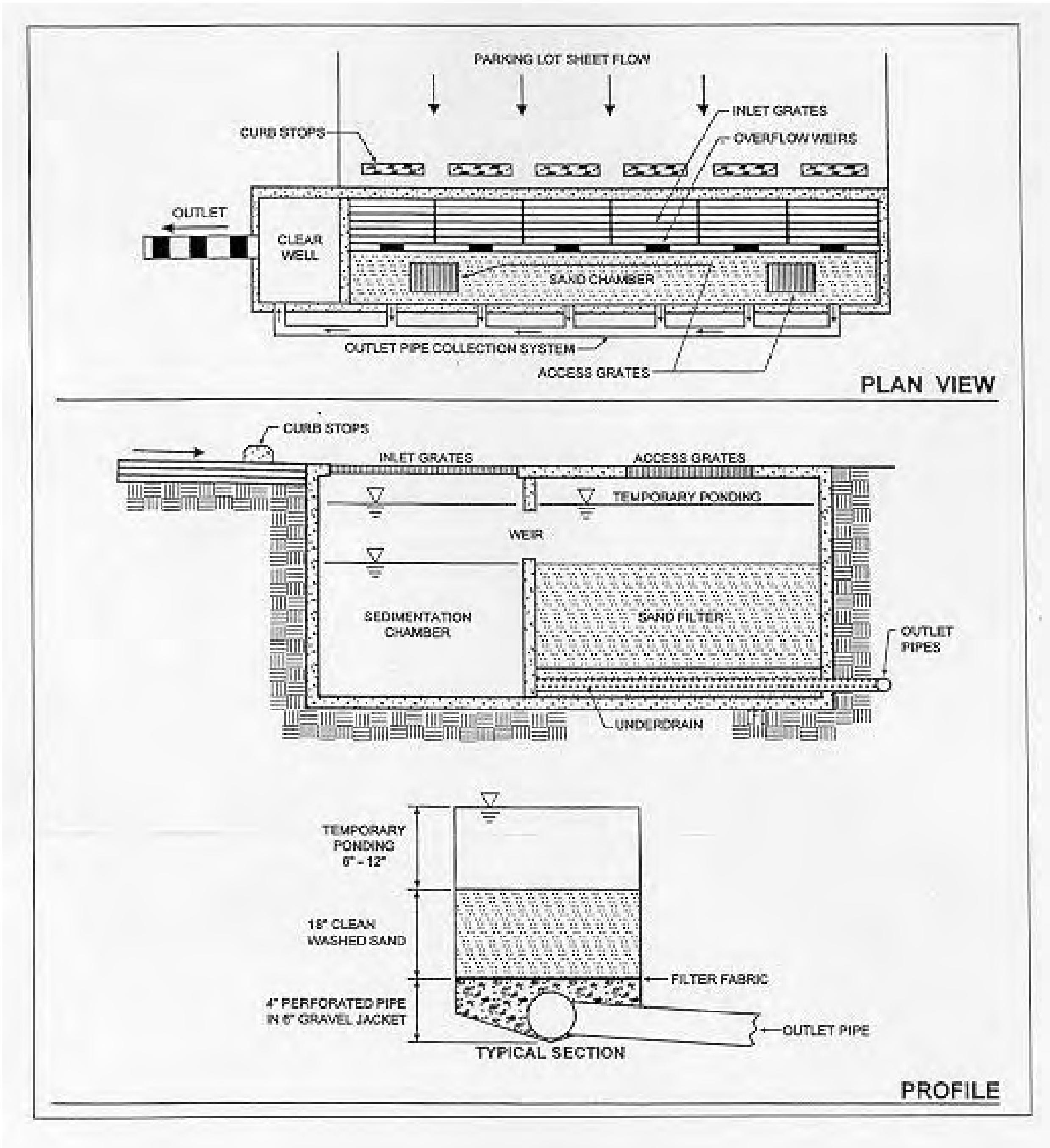


Figure 15.3B Schematic of Perimeter Sand Filter
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

15.2.5 Constructed Wetlands

(See Figure 15.4, 15.4A, 15.4B, 15.4C, and 15.4D)

STANDARD SPECIFICATIONS FOR CONSTRUCTED WETLANDS

Required Specifications

- Inflow of water must be greater than that leaving the basin by infiltration or exfiltration.
- Designed for an extended detention time of 48 hours for the 1.2 inch rainfall event material or other debris that will enter the basin with stormwater runoff. Therefore, some form of protection against blockage shall be installed (such as some type of non-corrodible wire mesh).
- Surface area of the wetland shall account for a minimum of 3 percent of the area of the watershed draining into it.
- The length to width ratio shall be at least 2 to 1.
- A soil depth of at least 4 inches shall be used for shallow wetland basins.
- Approximately 75 percent of the wetland shall have water depths less than 12 inches, and 25 percent of the wetland shall have depths ranging from 2 to 3 feet.
- The deeper area of the wetland shall include the outlet structure so outflow from the basin is not interfered with by sediment buildup.
- A forebay shall be established at the pond inflow points to capture larger sediments and be 4 to 6 feet deep. Direct maintenance access to the forebay shall be provided with access 25 feet wide minimum and 5:1 slope maximum. Sediment depth markers shall be provided.
- If high water velocity is a potential problem, some type of energy dissipation device shall be installed.
- The designer shall maximize use of pre- and post-grading pondscaping design to create both horizontal and vertical diversity and habitat.
- A minimum of 2 aggressive wetland species (primary species – Figure15.4) of vegetation shall be established in quantity on the wetland. (See Appendix C)
- Three additional wetland species (secondary species- Figure 15.4) of vegetation may be planted on the wetland, although in far less numbers than the two primary species.(See Appendix C)
- 30 to 50 percent of the shallow (12 inches or less) area of the basin shall be planted with wetland vegetation.
- Approximately 50 individuals of each secondary species shall be planted per acre; set out in 10 clumps of approximately 5 individuals and planted within 6 feet of the edge of the pond in the shallow area leading up to the ponds edge; spaced as far apart as possible, but no need to segregate species to different areas of the wetland.

- Wetland mulch, if used, shall be spread over the high marsh area and adjacent wet zones (-6 to +6 inches of depth) to depths of 3 to 6 inches.
- A minimum 25 foot buffer, for all but pocket wetlands, shall be established and planted with riparian and upland vegetation (50 foot buffer if wildlife habitat value required in design).
- Surrounding slopes shall be stabilized by planting in order to trap sediments and some pollutants and prevent them from entering the wetland.
- A maintenance plan shall be provided and adequate provision made for ongoing inspection and maintenance, with more intense activity for the first three years after construction.
- The wetland shall be maintained to prevent loss of area of ponding water available for emergent vegetation due to sedimentation and/or accumulation of plant material.

<u>Recommended Specification</u>

- It is recommended that the frequently flooded zone surrounding the wetland be located within approximately 10 to 20 feet from the edge of the permanent pool.
- Soil types conducive to wetland vegetation should be used during construction.
- The wetland should be designed to allow slow percolation of the runoff through the substrate (add a layer of clay for porous substrates).
- The depth of the forebay should be in excess of 3 feet and contain approximately 10 percent of the total volume of the normal pool.
- As much vegetation as possible and as much distance as possible should separate the basin inlet from the outlet.
- Of the 75 percent of the wetland that should be 12 inches deep or less, it is recommended that approximately 25 percent range from 6 inches deep to 12 inches deep, and that the remaining 50 percent be 6 inches or less in depth.
- The water should gradually get shallower about 10 feet from the edge of the pond.
- The planted areas should be made as square as possible within the overall design of the wetland, rather than long and narrow.
- The only site preparation that is necessary for the actual planting (besides flooding the basin) is to ensure that the substrate is soft enough to permit relatively easy insertion of the plants.

<u>Operation And Maintenance Recommendations</u>

- A stormwater management easement and maintenance agreement shall be required for each facility. The maintenance covenant shall require the owner of the wetland to periodically clean the structure. The maintenance agreement shall provide for ongoing inspection and maintenance, with more intense activity for the first three years after construction.

- The wetland shall be maintained to prevent loss of area of ponding water available for emergent vegetation due to sedimentation and/or accumulation of plant material.
- Sediment forebays shall be cleaned every 2 to 5 years except for pocket wetlands without forebays which are cleaned after a six inch accumulation of sediment.
- The ponding water area may be maintained by raising the elevation of the water level in the permanent pond by raising the height of the orifice in the outlet structure, or by removing accumulated solids by excavation.
- Water levels may need to be supplemented or drained periodically until vegetation is fully established.
- It may be desirable to remove contaminated sediment bottoms or to harvest above ground biomas and remove it from the site in order to permanently remove pollutants from the wetland.

Performance Standards

- Performance depends on appropriate plantings for the soils, climate, and types of pollutants or land use (oil and grease, high sediment loads, high nutrient loads) in the drainage area.
- Design performance depends on protecting marsh-type plantings.
- Performance enhancement can be obtained by increasing the size of the marsh area, by incorporating multiple pools into marsh area, or by incorporating a network of shallow channels in the marshy area.
- Estimated long-term pollutant removal rates as follow:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	50
	Lead	75
	BOD	50
Other Pollutants	Sediment	90
	Total Nitrogen	40
	Zinc	75
	COD	55

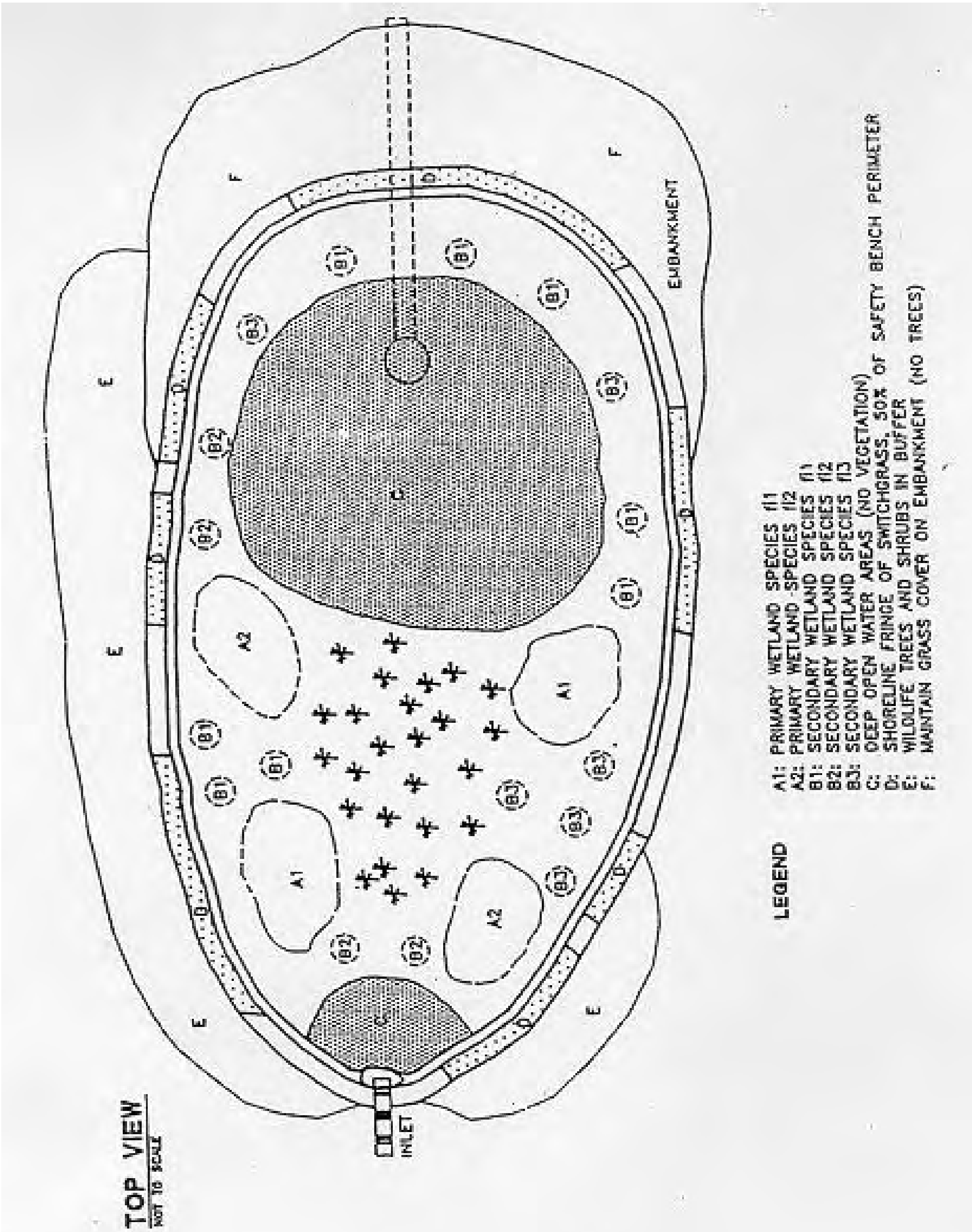


Figure 15.4 Shallow Marsh Planting Strategies

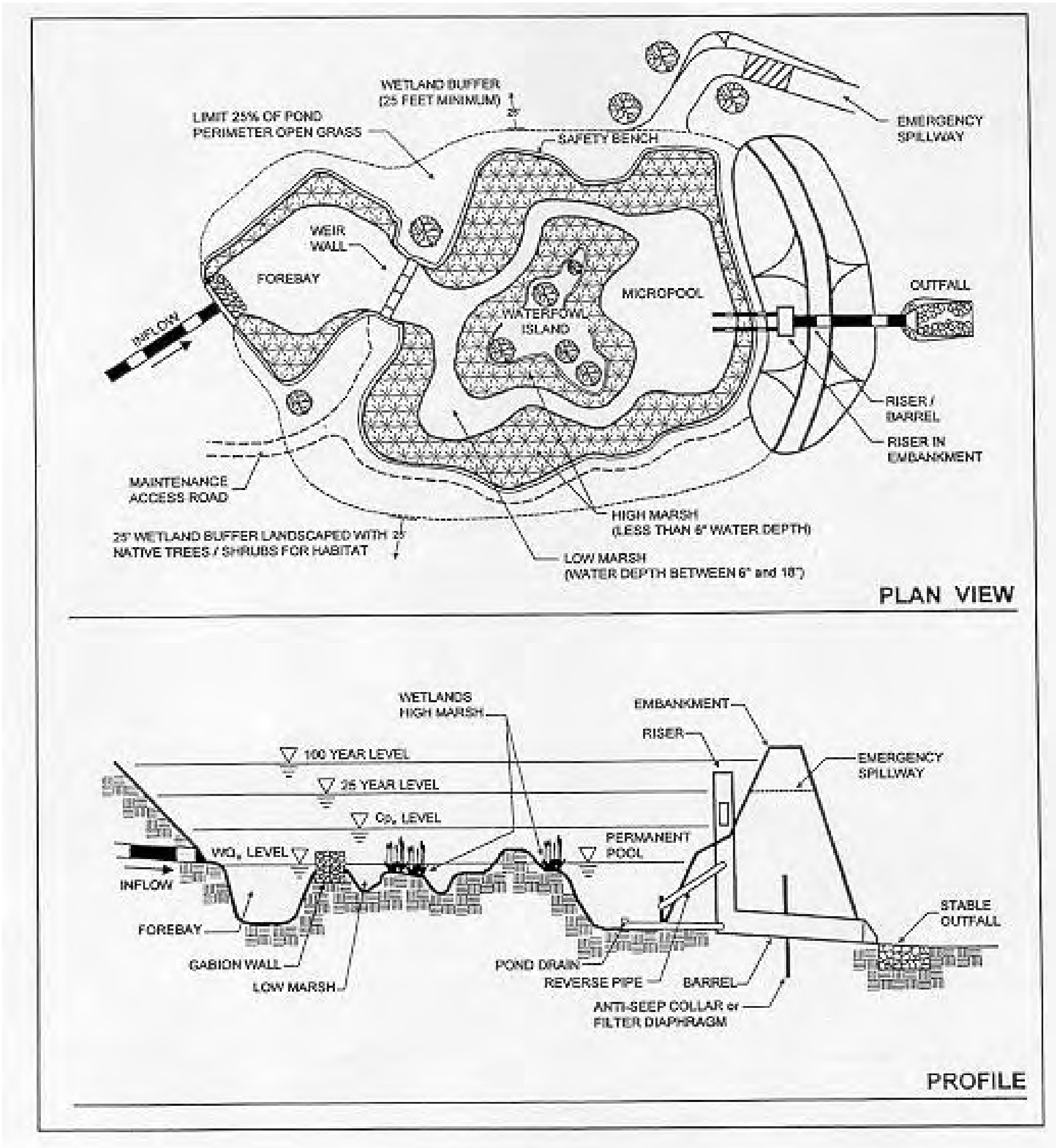


Figure 15.4A Schematic of Shallow Wetland
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

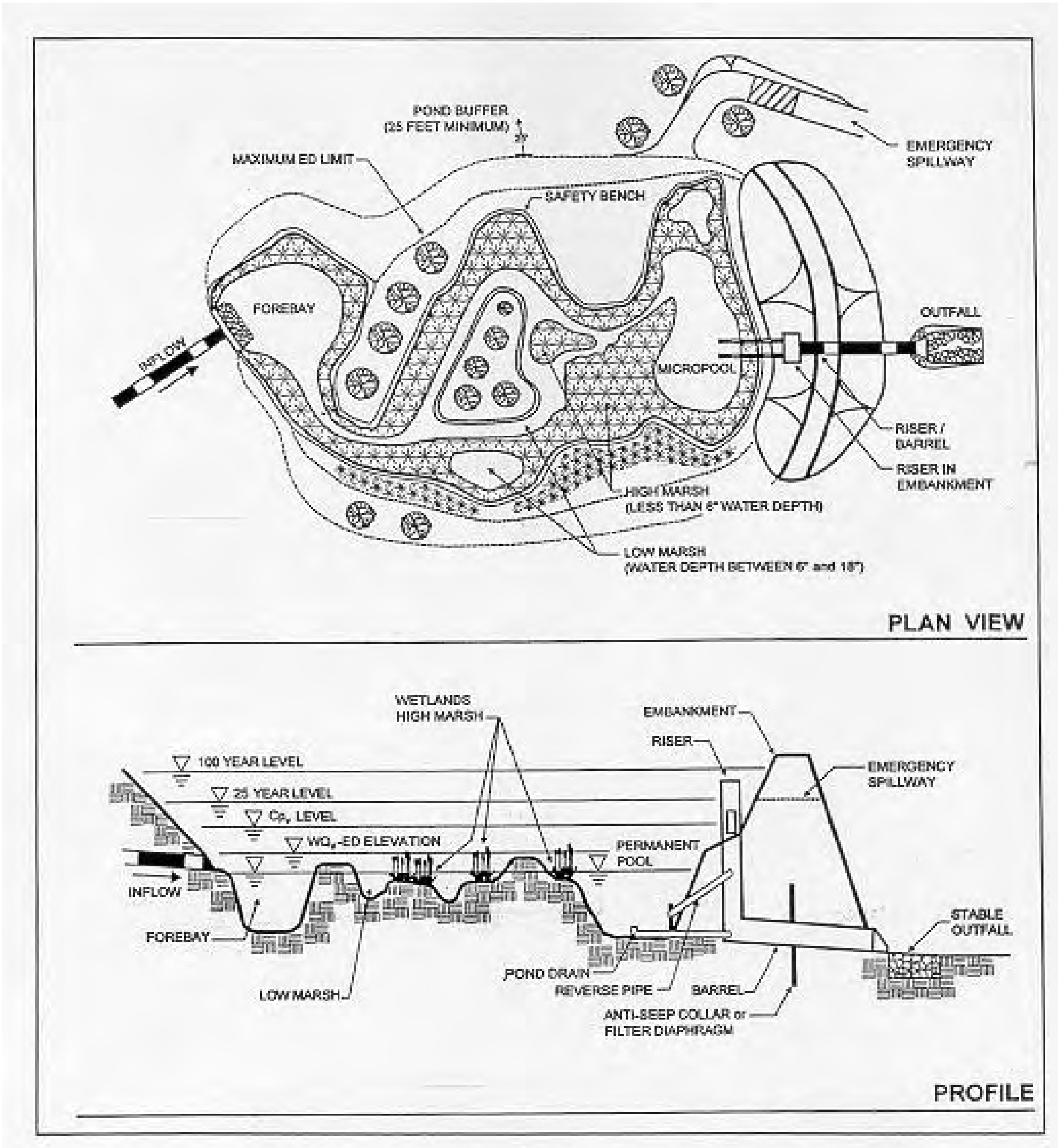


Figure 15.4B Schematic of Extended detention Shallow Wetland
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

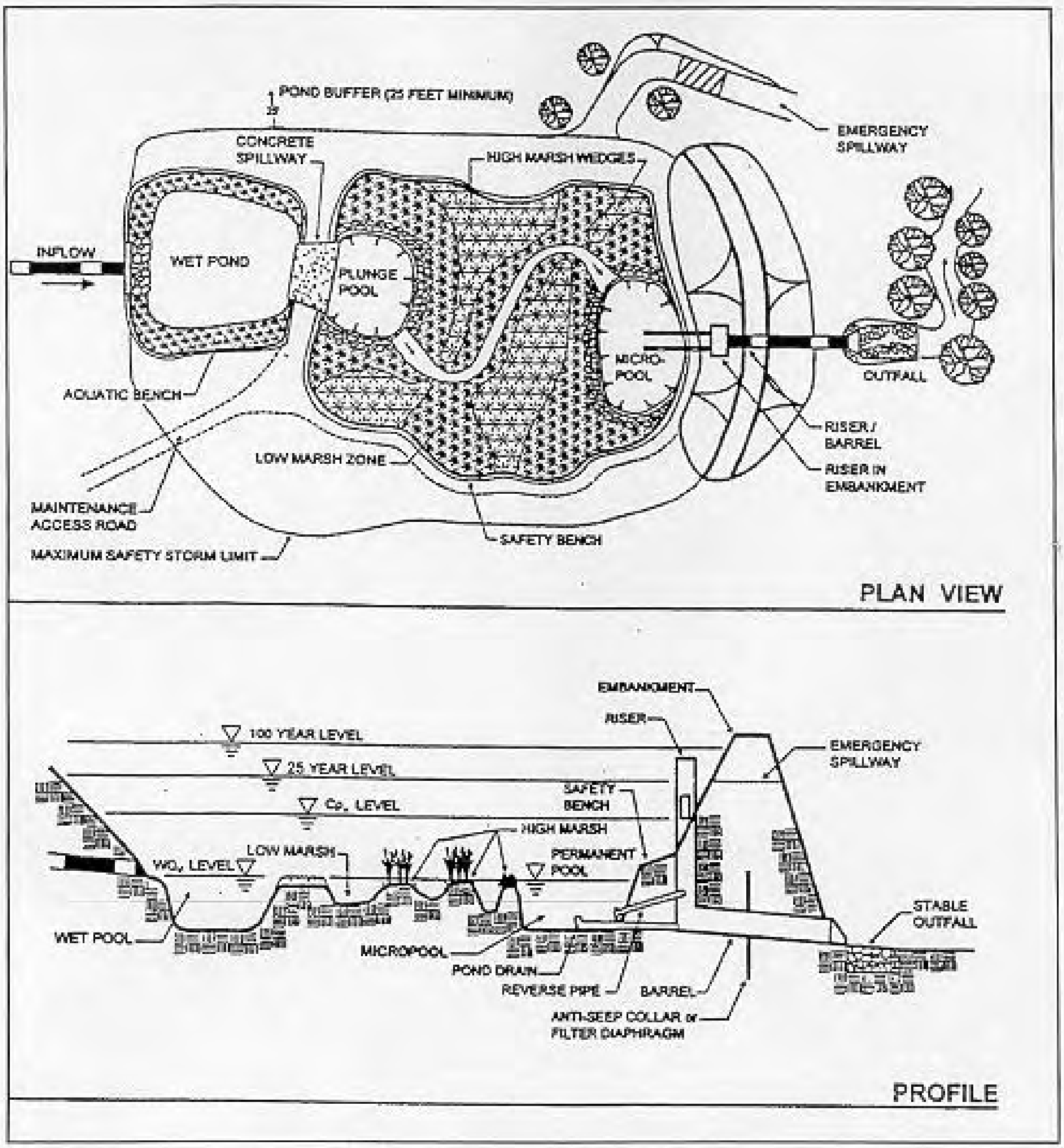


Figure 15.4C Schematic of Pond/Wetland System
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

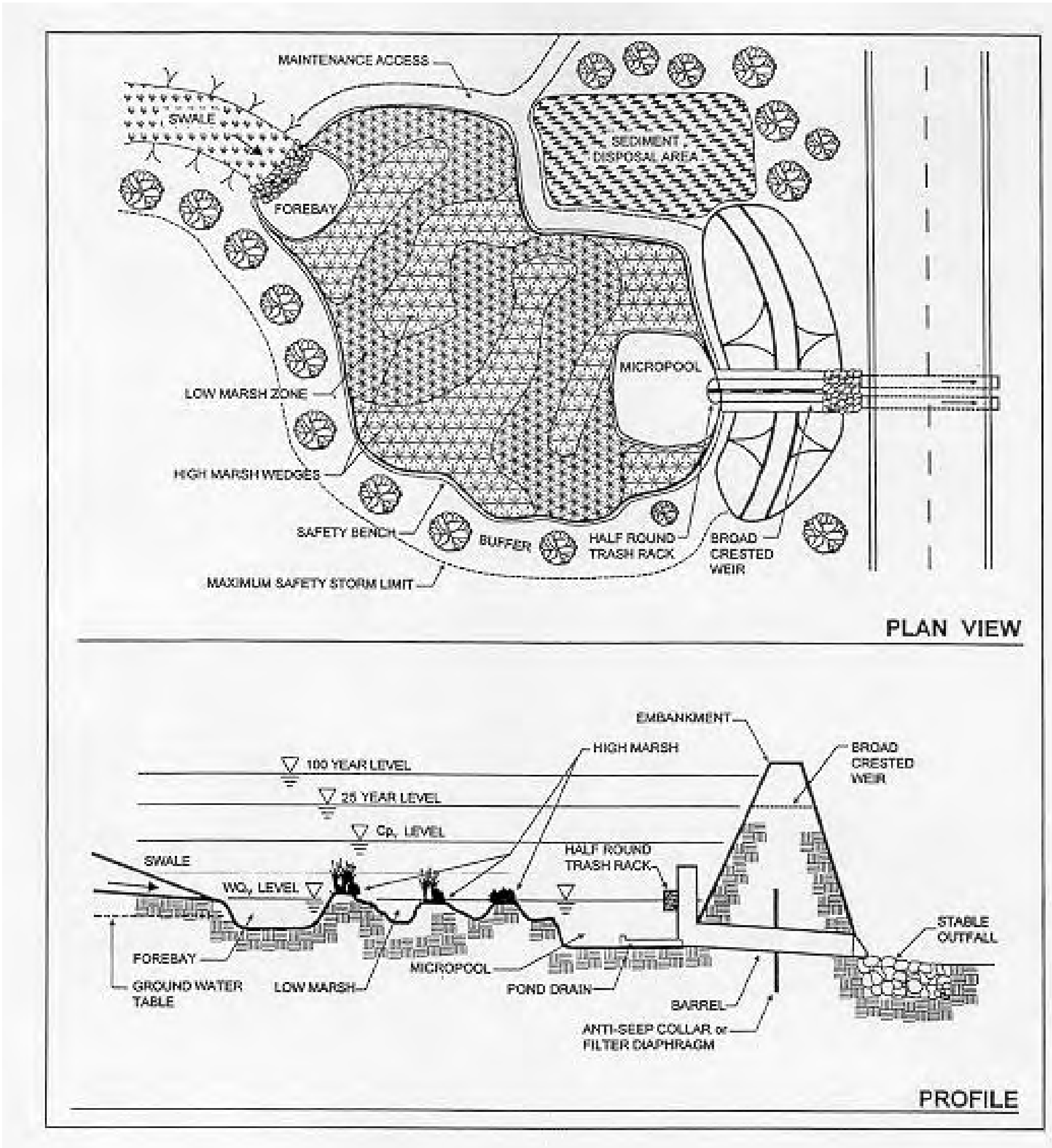


Figure 15.4D Schematic of Pocket Wetland
Source: Georgia Stormwater Management Manual, Volume 2, Technical Handbook

15.2.6 Infiltration Trenches

(See Figure 15.5)

STANDARD SPECIFICATIONS FOR INFILTRATION TRENCHES

Required Specifications

- Used in small drainage areas less than 15 acres.
- Drain the 1.2 inch rainfall storm in 48 hours (or as approved).
- A minimum of one soils boring is required for every 50 feet of trench length, and no less than 2 soils logs for each proposed trench location. Borings should be taken to a depth of at least five feet below the trench depth.
- Each soils boring shall extend a minimum of 3 feet below the bottom of the trench, describe the NRCS series of the soil, the textural class of the soil horizon(s) through the depth of the log, and note any evidence of high ground water level, such as mottling. In addition, the location of impermeable soil layers or dissimilar soil layers should be determined.
- For runoff treatment, the soil infiltration rate should be between 0.5 and 2.4 inches per hour.
- Soil textures with minimum infiltration rates of 0.17 inches per hour or less are not suitable for infiltration trenches.
- Soils that have a 30 percent or greater clay content are not suitable for infiltration trenches.
- Soils that are suitable for infiltration systems are silt loam, loam, sandy loam, loamy sand, and sand.
- The use of infiltration systems on fill is not allowed due to the possibility of creating an unstable sub-grade.
- A minimum of 3 feet difference is required between the bottom of the infiltration trench and the groundwater table and to bedrock.
- Site slope must be less than 20 percent, trench must be horizontal.
- The proximity of building foundations shall be at least 10 feet horizontally.
- A minimum of 100 feet from water supply wells shall be maintained when the runoff is from industrial or commercial areas.
- The design infiltration rate shall be equal to one-half the infiltration rate found from the soil textural analysis.
- Water quality infiltration trenches must be preceded by a pretreatment BMP.
- If the trench is preceded by a pre-settling basin, then the combination of both BMPs must be designed to drain the 1 inch rainfall design storm within 48 hours.

- The aggregate material for the trench shall consist of a clean aggregate with a maximum diameter of 3 inches and a minimum diameter of 1.5 inches.
- Stone aggregate backfill material for the trench shall have a maximum diameter of 3 inches and a minimum diameter of 1.5 inches. For design purposes, void space for these aggregates may be assumed to be in the range of 30 percent to 40 percent.
- The aggregate shall be completely surrounded with an engineering filter fabric. If the trench has an aggregate surface, filter fabric shall surround all aggregate fill material except for the top one foot.
- Runoff must infiltrate through at least 18 inches of soil, which has a minimum cation exchange capacity of 5 milliequivalents per 100 grams of dry soil.
- An observation well shall be installed for every 50 feet of trench length.
- The observation well shall consist of perforated PVC pipe, 4 to 6 inches in diameter, located in the center of the structure, and be constructed flush with the ground elevation of the trench.
- The top of the observation well shall be capped to discourage vandalism and tampering.
- Bypass larger flows.

Recommended Specifications

- Infiltration trenches work well for residential lots, commercial areas, parking lots, and open space areas.
- Can be installed under a swale to increase the storage of the infiltration system.
- Infiltration systems shall not be constructed until all construction areas draining to them are fully stabilized.
- An analysis shall be made to determine any possible adverse effects of seepage zones when there are nearby building foundations, basements, roads, parking lots, or sloping sites.

Operation And Maintenance Recommendations

- A stormwater management easement and maintenance agreement shall be required for each facility. The maintenance covenant shall require the owner of the infiltration trench to periodically clean the structure.
- The trench shall be monitored after every large storm (>1 inch in 24 hours) for the first year after completion of construction and be monitored quarterly thereafter.
- Sediment buildup in the top foot of stone aggregate or the surface inlet shall be monitored on the same schedule as the observation well.

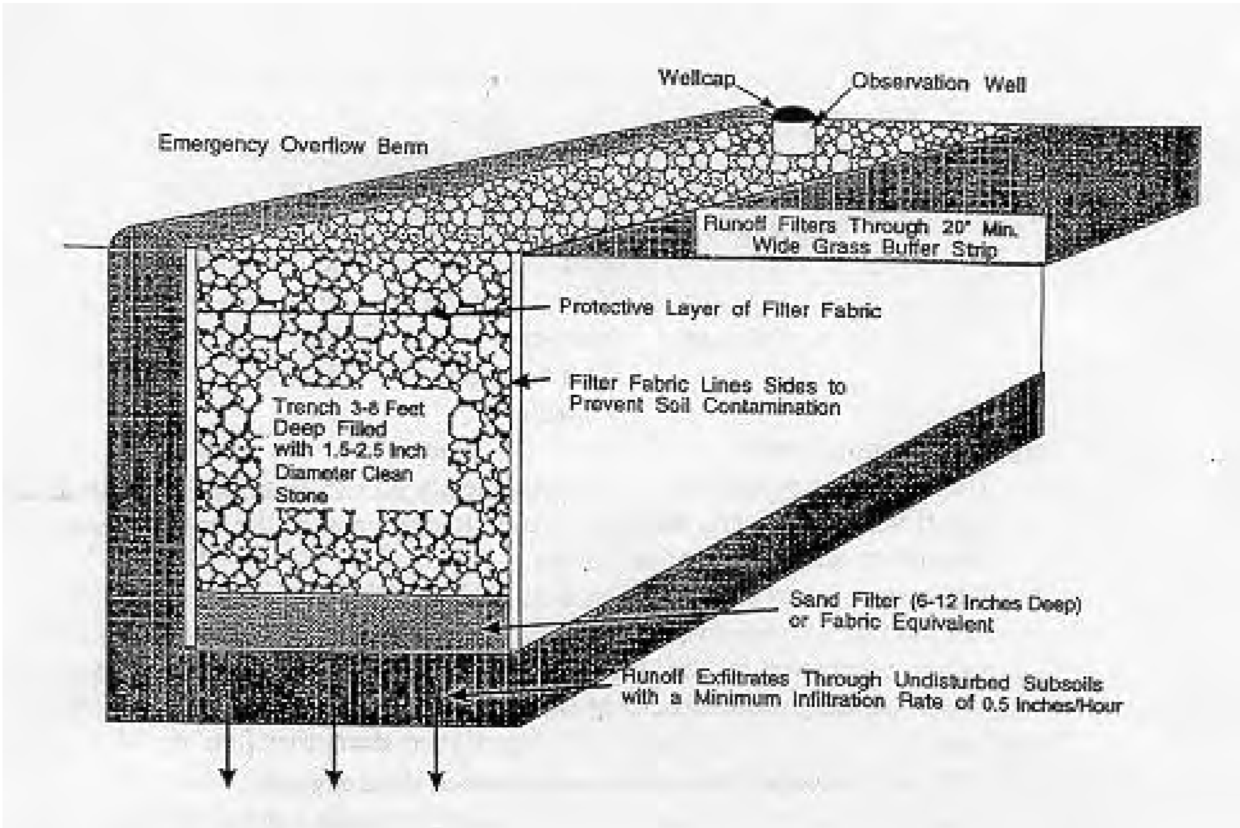


Figure 15.5 Infiltration Trench

Performance Standards

- Full exfiltration trench

  - Runoff can only exit the trench by exfiltrating through the stone into the underlying soils.
  - The storage volume is based on runoff volume of the 1-inch rainfall storm.

Estimated long-term pollutant removal rates as follows:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	65
	Lead	95
	BOD	90
	Pollutant	Removal Rate (%)
Other Pollutants	Sediment	90
	Total Nitrogen	60
	Bacteria	98

- Water quality trench

  - The storage volume is based on first flush volume of 1 inch of runoff from the
  - contributing area.
  - Estimated long-term pollutant removal rates as follow:

	Pollutant	Removal Rate (%)
• Primary Pollutants	Total Phosphorus	60
	Lead	85
	BOD	80
• Other Pollutants	Sediment	90
	Total Nitrogen	55
	Bacteria	90

- Partial exfiltration system

  - The trench is not designed to rely completely on exfiltration to dispose of the
  - captured runoff volume, a perforated pipe is used to drain part of the volume, being placed either beneath or near the top of the trench.
  - The system is not as effective as a full exfiltration system.

- Addition of a layer of very sandy soil over the gravel trench results in removal
- rates as high as 60 percent for the suspended sediment and trace metal loads, 50 percent for oxygen demand, and 40 percent for nutrient loads.

- Pretreatment

  - Pretreatment minimizes trench maintenance requirements.
  - Suspended sediment loads which will clog the trench can be reduced by requiring
  - that the stormwater runoff pass through a 20-foot grassed filter strip prior to entering the trench.
  - Hydrocarbon loadings (oil and grease) that will clog the filter fabric and sand
  - filter underlaying the trench can be reduced by the use of oil and grit chambers (when receiving large parking lot and roadway runoff).

15.2.7 Filter Strips And Flow Spreaders

(See Figure 15.6 and 15.7)

STANDARD SPECIFICATIONS FOR FILTER STRIPS AND FLOW SPREADERS

Required Specifications

The use of filter strips and flow spreaders shall be limited to drainage areas of 10 acres or less with the optimal size being less than 5 acres.

- Capacity of the spreader and/or filter strip length (perpendicular to flow) shall be determined by estimating peak flow from the 25-year storm if the entire storm is routed through the spreader or the 1 inch first flush rainfall storm if this volume of flow is diverted to the spreader for water quality control.
- Drainage area into spreader shall be restricted so that maximum flow will not exceed 30 cfs.
- Channel grade for the last 20 feet of the dike or diversion entering the level spreader shall be less than or equal to 1% and designed to provide a smooth transition into spreader.
- Grade of level spreader shall be 0%.
- Depth of level spreader as measured from the lip shall be at least 6 inches.
- Appropriate length, width, and depth of flow spreader shall be selected from the following table.

Design	Entrance	Depth	End	Length
Flow (cfs)	Width (ft)		(ft)	
		Width (ft)(ft)		
0 - 10	10	0.5	3	10
10 - 20	16	0.6	3	20
20 - 30	24	0.7	3	30

- Level spreader lip shall be constructed on undisturbed soil (not fill material) to uniform height and zero grade over length of the spreader.
- Released runoff to outlet onto undisturbed stabilized areas in sheet flow and not allowed to re-concentrate below the structure.
- Slope of filter strip from level spreader shall not exceed 10 percent.
- All disturbed areas shall be vegetated immediately after construction.
- Filter strip width to be a minimum of 20 feet.
- Top edge of filter strip shall directly abut the contributing impervious area and follow the same elevational contour line.
- Runoff water containing high sediment loads to be treated in a sediment trapping device before release in a flow spreader.
- Spreader lip to be protected with erosion resistant material, such as fiberglass matting or a rigid non-erodible material for higher flows, to prevent erosion and allow vegetation to be established.
- Wooded filter strips are preferred to gravel strips.

Operation And Maintenance Recommendations

- A stormwater management easement and maintenance agreement shall be required for each facility. The maintenance covenant shall require the owner of the filter strip/flow spreader to periodically clean the structure.
- Flow spreader shall be inspected after every rainfall until vegetation is established, and needed repairs made promptly.
- After area is stabilized, inspections shall be made quarterly.
- Vegetation shall be kept in a healthy, vigorous condition.
- Filter strip and flow spreader shall be maintained in a manner to achieve sheet flow.

<u>Performance Standards</u>

- General Performance Information

- Filter strips must accept stormwater runoff as overland sheet flow in order to effectively filter suspended materials out of the overland flow.
- In order to function properly, the strip should be at least as wide as the flow path entering the filter, and flow entering a filter strip must be spread relatively uniformly over the width of the strip.
- The removal of soluble pollutants is low because the degree of infiltration provided is generally very small.
- Removals of nutrients and oxygen demand decrease as the amount of clay in the soil increases.
- Filter strip applications should be limited to drainage areas of 10 acres or less, with the optimal size being less than 5 acres.
- The use of filter strips to treat parking lot runoff or street runoff should incorporate a level spreading device such as a shallow stone filled trench or slotted parking blocks.

• 20-Foot Wide Grassed Filter Strip

- Minimal pollutant removal. This design primarily removes the coarser suspended particles in runoff by the lowering of runoff velocities.
- Pollutant removal enhanced by mild slopes, minimal mowing/ maintenance, sustaining natural cover if possible.
- Long term estimated removal of pollutants is as follows:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	10
	Lead	30
	BOD	10
Other Pollutants	Sediment	30
	Total Nitrogen	10
	COD	10
	Copper	30
	Zinc	30

• 100-Foot Wide Grassed Filter Strip

- Maximal natural pollutant removal. This design removes both fine and coarse suspended particles in runoff by lowering runoff velocities over a significant length of flow path.

- Pollutant removals can be enhanced by mild slopes, minimal mowing/maintenance, sustaining natural cover if possible.

- Long term estimated removal of pollutants is as follows:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	50
	Lead	90
	BOD	70

	Pollutant	Removal Rate (%)
Other Pollutants	Sediment	90
	Total Nitrogen	50
	COD	70
	Copper	90
	Zinc	90

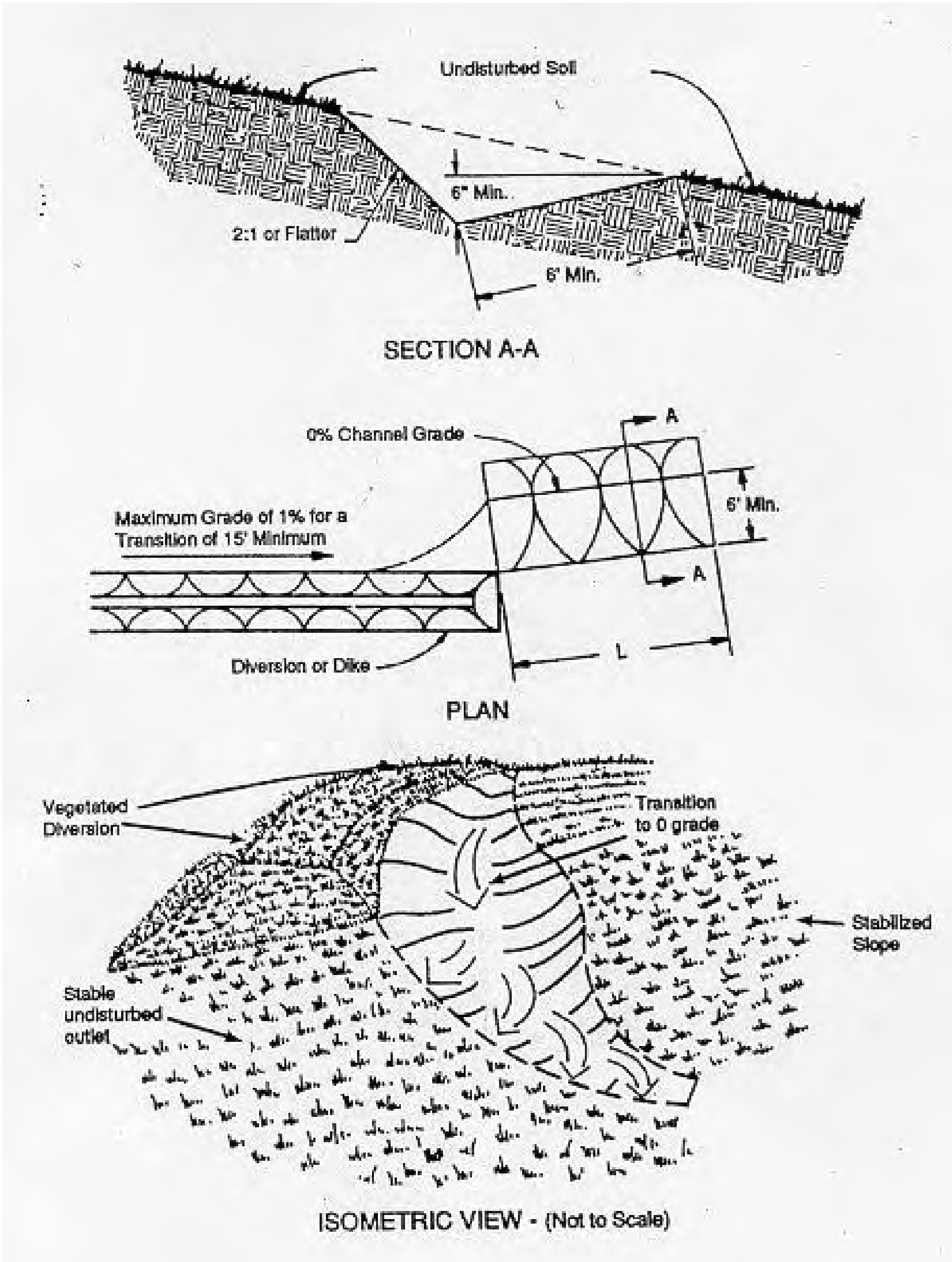


Figure 15.6 Flow Spreader

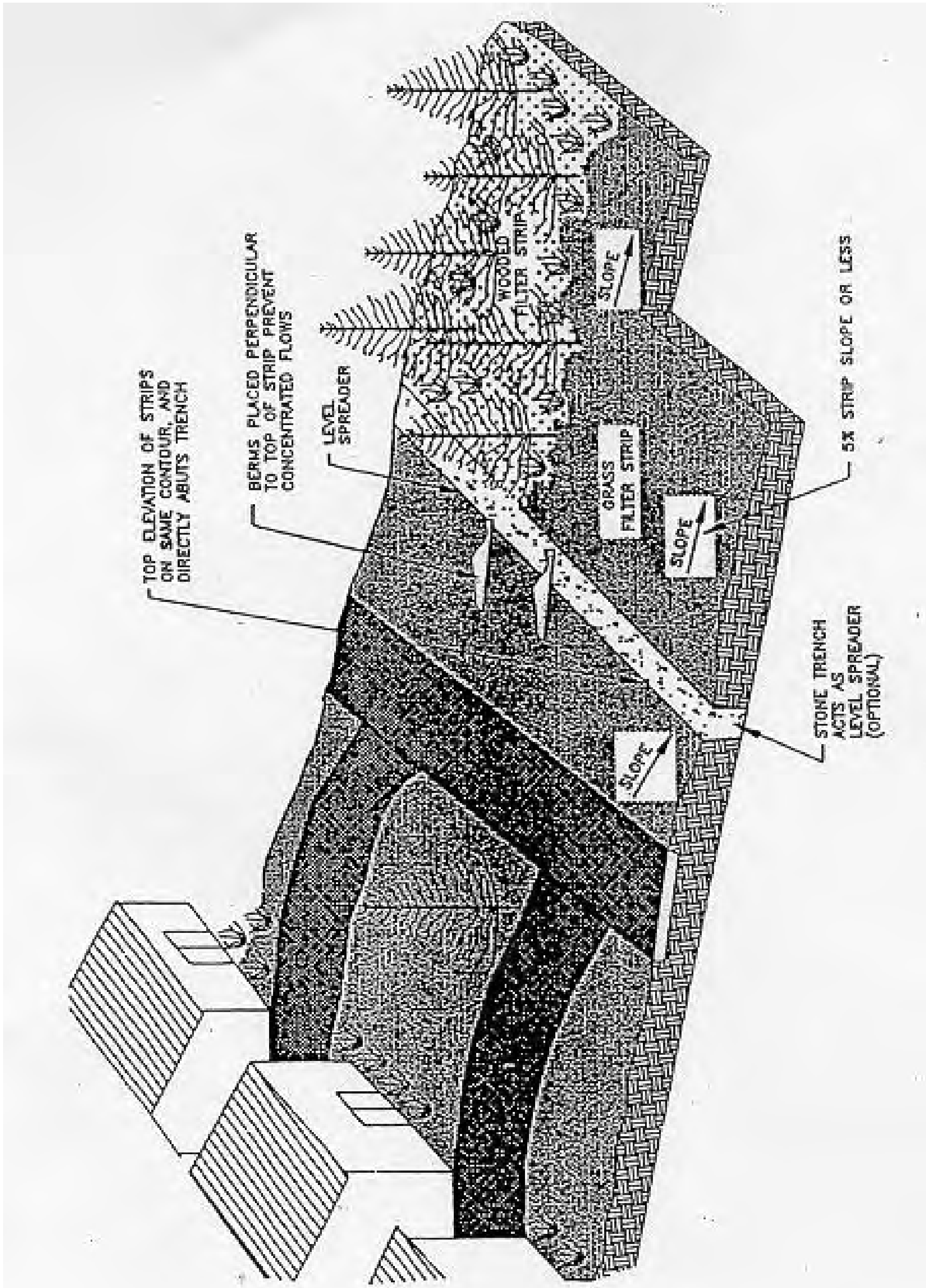


Figure 15.7 Schematic of a Filter Strip

15.2.8 Grassed Swales

(See Figure 15.8 and 15.9)

Standard Specifications For Grassed Swales

Grassed swales are also described as bio-filtration swales with the major difference being that grassed swales often have check dams where bio-filtration swales do not.

Required Specifications

- Grassed swale shall only convey standing or flowing water following a storm.
- As a water quality BMP, grass swales shall be designed for the 1 inch rainfall design storm. If the entire channel design storm is to be accommodated in the swale (e.g., 25-year) then the swale shall be designed for this event.
- Limited to peak discharges generally less than 5 to 10 cfs.
- Limited to runoff velocities less than 2.5 ft/s.
- Maximum design flow depth to be 1 foot.
- Swale slopes shall be graded as close to zero as drainage will permit.
- Swale slope shall not exceed 2%.
- Swale cross-section shall have side slopes of 3:1 (h:v) or flatter.
- Underlying soils shall have a high permeability (fc > 0.5 inches per hour).
- Swale area shall be tilled before grass cover is established.
- Dense cover of a water tolerant, erosion resistant grass shall be established over swale area.
- To obtain credit as a water quality BMP, grassed swales must have a minimum length of 100 feet.
- As a BMP, grassed swales are limited to residential or institutional areas where percentage of impervious area is relatively small.
- Seasonally high water table to be greater than 3 feet below the bottom of the swale.
- Check dams can be installed in swales to promote additional infiltration. Recommended method is to sink a railroad tie halfway into the swale. Riprap stone should be placed on the downstream side to prevent erosion.
- Maximum ponding time behind check dam to be less than 48 hours.

Operation And Maintenance Recommendations

- A stormwater management easement and maintenance agreement shall be required for each facility. The maintenance covenant shall require the owner of the grassed swale to periodically clean the structure.

- Grass swale shall be maintained to keep grass cover dense and vigorous.

- Maintenance shall include periodic mowing, occasional spot reseeding, and weed control.
- Swale grasses shall never be mowed close to the ground.
- Fertilization of grass swale shall be done when needed to maintain the health of the grass, with care not to over-apply the fertilize.

Performance Standards

- General Performance Information

  - Grassed swales provide a water quality benefit by filtering suspended material out
  - of the overland flow. They have little or no value at removing soluble pollutants because the degree of infiltration provided is generally small.
  - In order to function optimally, a grassed swale must be in an area where its
  - longitudinal slope is very slight (2% or less). The table below shows the low removal rates for grassed swales on a 5 percent slope. If discharges or velocities are greater than those recommended (greater than 10 cfs or 2.5 ft/s, respectively), the ability of the swale to perform as a water quality BMP is severely impaired.
  - The use of check dams in the swale helps to lower the discharge velocity and can,
  - in some cases, allow their beneficial use in situations where the swale slope is greater than recommended.
  - Rainfall events of less than 0.25 inches may show increased removals due to the
  - slower velocities in the swales.

- Grassed Swales on a 5% Slope

  - Long term estimated removal of pollutants is as follows:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	10
	Lead	10
	BOD	10
Other Pollutants	Sediment	10
	Total Nitrogen	10
	COD	10
	Copper	10
	Zinc	10

- Grassed Swales on a Slope Less Than 5% With Check Dams
  - Long term estimated removal of pollutants is as follows:

	Pollutant	Removal Rate (%)
Primary Pollutants	Total Phosphorus	30
	Lead	10
	BOD	30
Other Pollutants	Sediment	30
	Total Nitrogen	30
	COD	30
	Copper	10
	Zinc	10

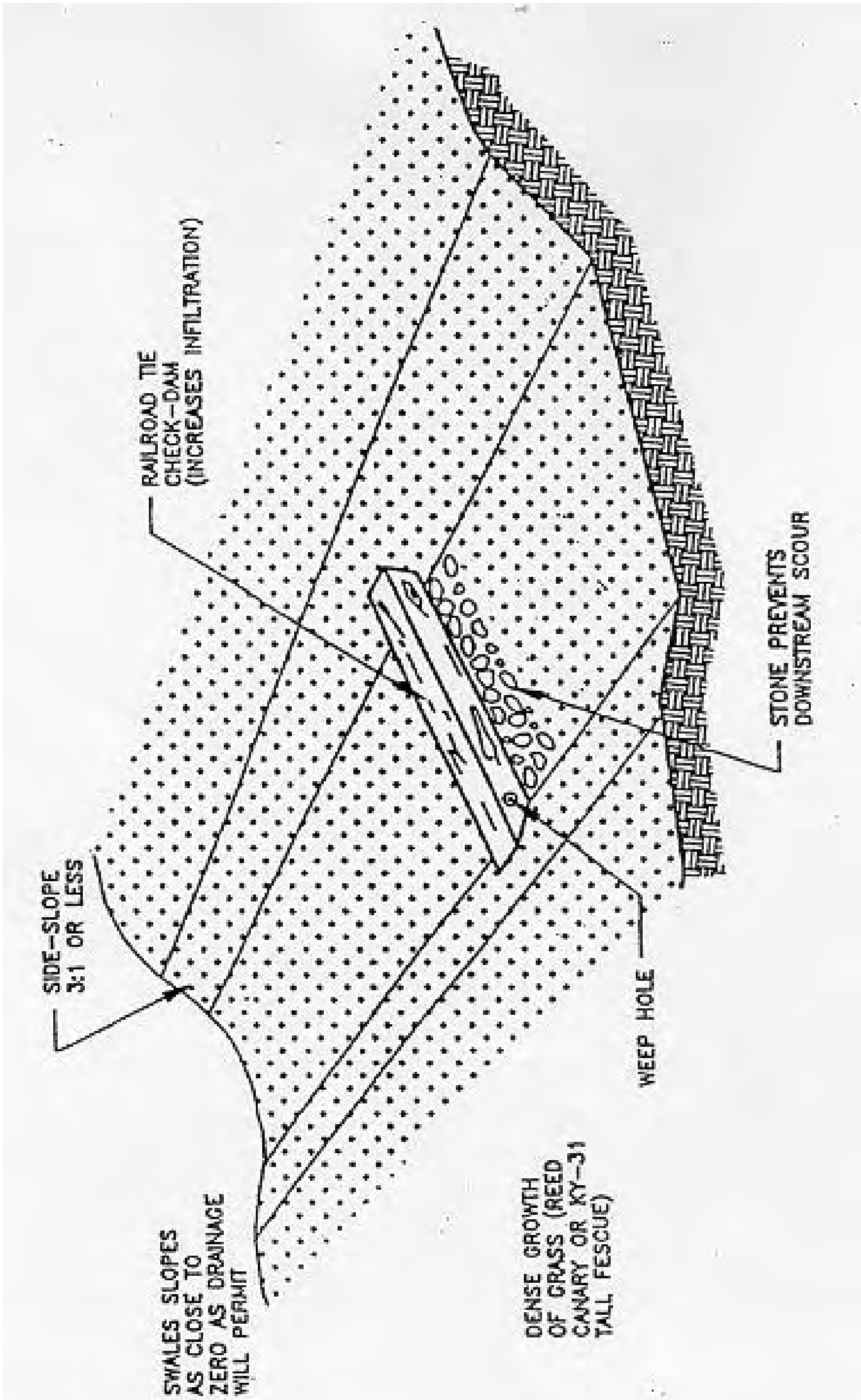


Figure 15.8 Schematic of a Grass Swale

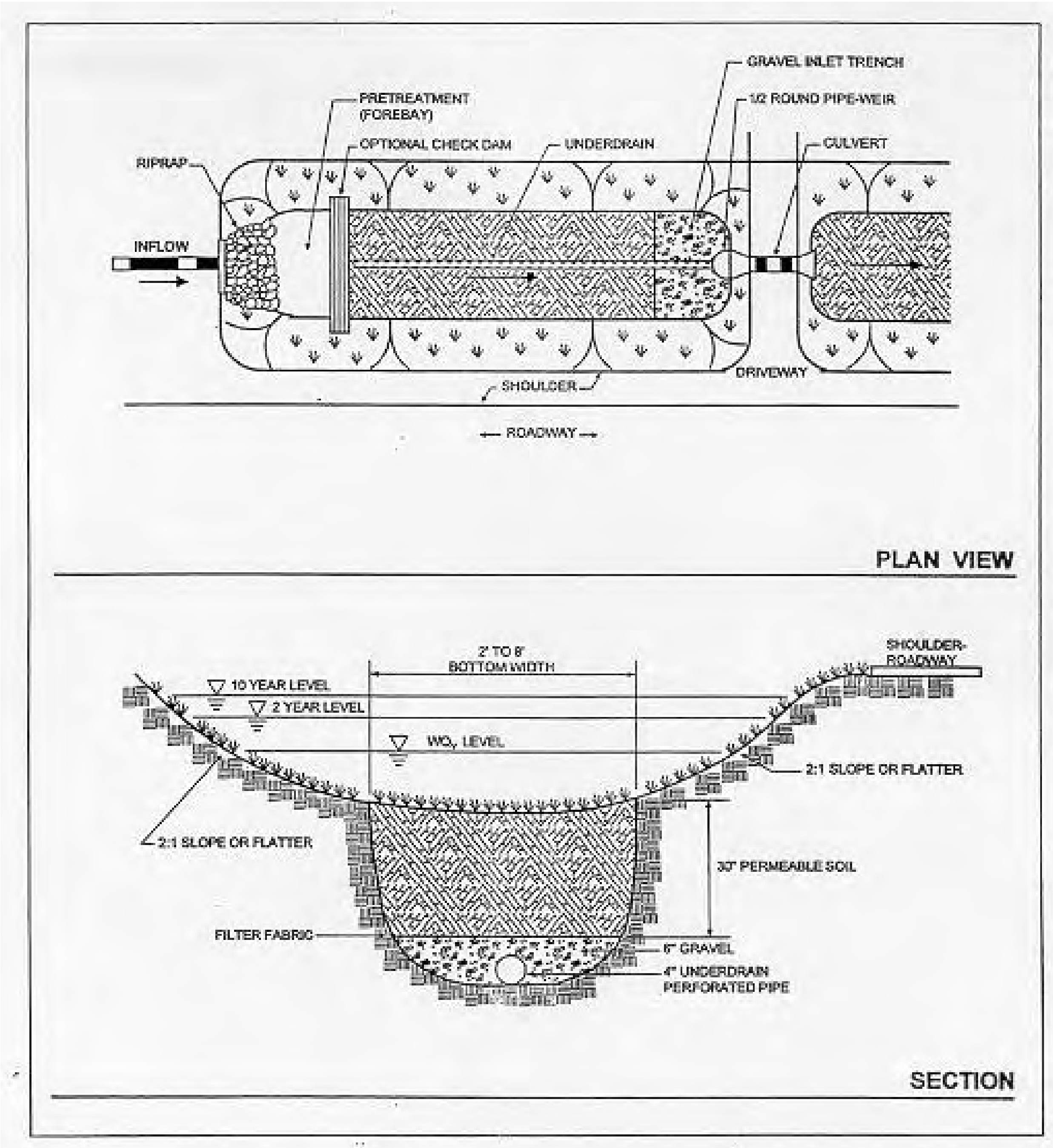


Figure 15.8A Schematic of a Dry Swale

15.2.9 Oil/Grit Separators

(See Figure 15.10)

STANDARD SPECIFICATIONS FOR OIL/GRIT SEPARATORS

Required Specifications

- Separators shall be sized for the 1-inch rainfall design storm. Larger storms shall not be allowed to enter the separator.
- Separator shall be structurally sound and designed for acceptable traffic loadings where subject to traffic loadings.
- Separator shall be designed to be water tight.
- Volume of separator shall be at least 400 cubic feet per acre tributary to the facility (first two chambers).
- Forebay or first chamber shall be designed to collect floatables and larger settleable solids. Its surface area shall not be less than 20 square feet per 10,000 square feet of drainage area.
- Oil absorbent pads, oil skimmers, or other approved methods for removing accumulated oil shall be provided.
- Separator pool shall be at least 4 feet deep.
- Weirs, openings, and pipes shall be sized to pass as a minimum a 25-year storm.
- Manholes shall be provided to each chamber to provide access for cleaning.

Recommended Specifications

- Oil absorbent pads, oil skimmers, or other approved methods for removing accumulated oil shall be provided.
- Separator to be located close to the source before pollutants are conveyed to storm sewers or other BMPs.
- Use only on sites of less than one acre.
- Provide perforated covers as trash racks on orifices leading from first to second chamber.
- Use three chambers for treatment similar to Figure15.10.
- Center chamber may contain a coalescing medium to enhance the gravity separating process.
- Storm drain inlet in third chamber to be located above floor to permit additional settling.
- Stormwater from rooftops and other impervious areas not likely to be polluted with oil shall not discharge to the separator.
- Design to bypass flows above 400 cubic feet per acre.

Operation And Maintenance Recommendations

- A stormwater management easement and maintenance agreement shall be required for each facility. The maintenance covenant shall require the owner of the separator to periodically clean the structure.

- Cleaning quarterly shall be a minimum schedule with more intense land uses such as gas stations requiring cleaning as often as monthly.

- Cleaning shall include pumping out wastewater and grit and having the water processed to remove oils and metals.

Performance Standards

- Oil & Grease Separator Performance

  - These devices are for the most part ineffective as a stand alone treatment of
  - stormwater runoff quality, unless hydrocarbons are the only pollutant of concern.
  - Hydrocarbons in urban runoff can effectively clog the infiltration capacity of
  - under-lying soils because they tend to attach themselves to particles in the water column and settle to the bottom of the BMP.
  - The removal of hydrocarbons will extend the maintenance interval required for
  - downstream BMPs by removing these substances which impair their effectiveness.

- Primary Pollutants - Phosphorus, Lead, BOD

  - Performance standards as related to phosphorus, lead, and BOD are not relevant.

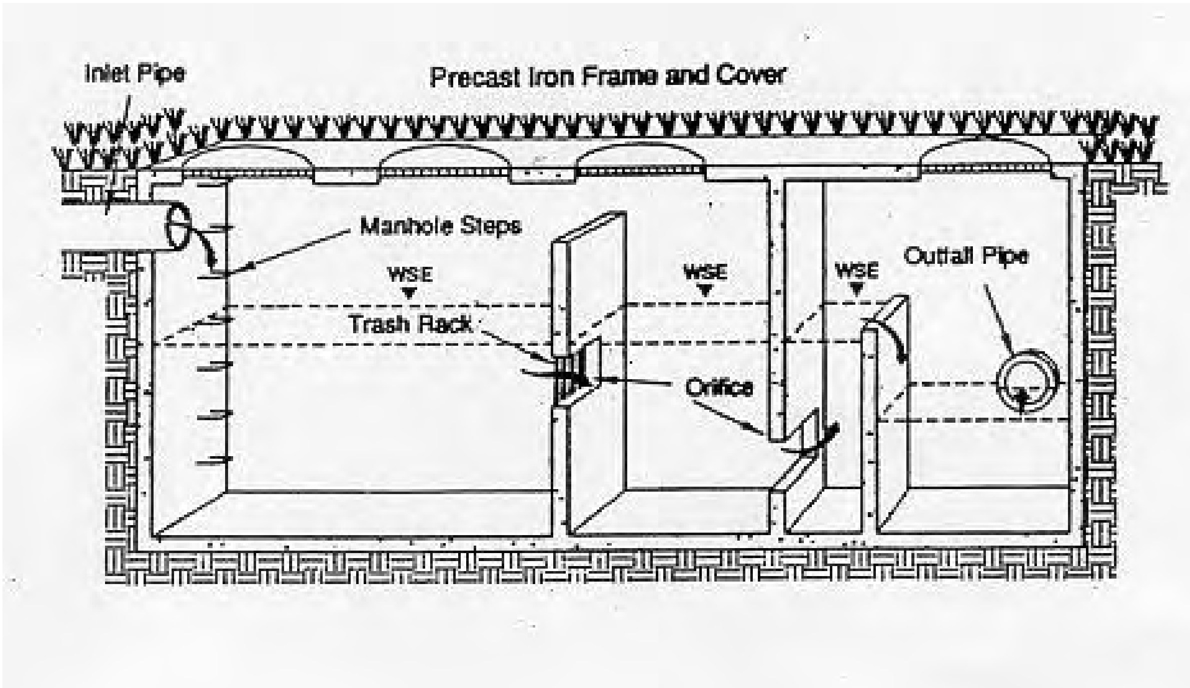


Figure 15.9 Oil/Grit Separator

15.2.10 Alternate Structural BMP's

Prior to the submittal of a development permit with a structural BMP not included in the manual, written approval must be received from the Director of the Department of the Public Works, that the use of the alternate BMP is allowed.

Requests for approval to an alternate BMP must be made in writing and shall include the following information. Developer may be required to pay a fee so that the County can have the design reviewed by an independent expert or panel of experts.

1) Justification for the proposed BMP facility
2) Summary of BMP Submitted for approval
3) Description of design
4) Minimum and maximum flows (drainage area) that BMP can handle
5) Pollutants that are removed by the BMP
6) Pollutant removal efficiency
7) BMP Design Drawings
8) BMP Design calculations
9) Research data supporting water quality efficiencies
10) Monitoring program to document removal efficiencies
11) Maintenance program
12) Safety and aesthetic considerations

A request for approval will be submittal to a review committee. The review committee shall be selected by the County. Members on the committee shall be representatives of the following groups.

1) County
2) Site design engineer consultant
3) Environmental engineer consultant
4) Environmentalist
5) Contractor
6) Developer

The BMP shall be evaluated based on the following criteria.

1) Independent test results/studies
2) Maintenance requirements
3) Design theory
4) Reliability
5) History of use
6) Other factors determined by the review committee

Approval of alternates will require a monitoring program with a period of at least three years with quarterly samples. The program should be in accordance with Fulton County's Municipal NPDES Stormwater permit sampling requirements.

Approval of alternates will require a surety to cover replacement of the alternative with a BMP included in the Design Manual.

The surety will be required during the period of testing. The developer shall provide a plan using BMP's included in the Design Manual and reserve space on the proposed development plan to implement these BMP's should the alternative BMP fail. The County can use the surety to install the BMP's included in the Design Manual if the sampling program is not followed, maintenance requirements are greater than anticipated, if the results do not meet the claims of the approved design, or the Director of the Department of Public Works determines that the BMP is not functioning satisfactorily.

Approval of alternatives will require reporting to include maintenance activities and test results.

The review committee shall recommend approval or denial of the BMP, monitoring requirements, maintenance requirements, and surety requirements. The Director of the Department of Public Utilities shall decide if the BMP should be approved. Appeals of the Director's decision can be made in accordance with the Fulton County appeals process.

The County will maintain a record of alternative BMP designs that have been submitted or are under testing. BMP's that meet design claims will be included in the Design Manual.

15.3 STREAMBANK RESTORATION

Although effective watershed runoff controls are needed to eliminate the root causes of stream degradation, stream health can also benefit from restoration efforts that directly target the stream channel and stream banks. Stream bank erosion needs to be halted, and both in-stream and riparian habitats restored. Such a program requires expertise in areas such as stream forming processes, slope stabilization, plant science, and aquatic biology. Local Soil Conservation Service and Fish and Wildlife Service staff may be able to provide some of this expertise. Stream restoration includes three major activities:

1) Riparian reforestation.
2) Streambank stabilization.
3) Streambed restoration.

Riparian Reforestation

The contribution of trees and woody understory vegetation to the maintenance of stream health cannot be overstated. Streamside forested areas not only provide habitat, shade, and forage for both aquatic and land-based species, but their ability to filter pollutants and rainfall provides a buffer, a last line of defense, from watershed runoff. A program to restore forested streamside areas should receive early consideration, because it can be one of the most cost-effective steps that a community takes in its stream restoration efforts. The objective should be to replicate or mimic the natural ecosystem as much as possible, so mixed-age native plant and tree species are preferred. The cost effectiveness of the program can be increased by encouraging participation by citizen volunteers. Though most revegetation efforts focus on streambanks, the hydrologic characteristics of the watershed can be improved by upland reforestation as well.

Streambank Stabilization

Anyone faced with an eroding or collapsing streambank needs first to determine the cause of the problem. Streambank erosion occurs for a number of reasons, including increased stream velocity, obstacles in the stream, floating debris, wave action, and direct rainfall. Streambank failure occurs when a large section of streambank collapses into the stream channel. Among the causes of streambank failure are changes in channel cross-section through down-cutting of the streambed and undercutting of the bank, increased load on the top of the bank, and internal pressure from uneven water absorption.

Selection of an appropriate bank stabilization method requires careful analysis of each site. No single method requires careful analysis of each site. No single method is appropriate in all situations. Technical advice will often be needed, and is available from sources such as the local Soil Conservation Service and Cooperative Extension Service offices, or from private consultants. One important note: a Corps of Engineers permit may be needed before any material is placed in a stream or adjacent wetlands. The Corps of Engineers Savannah District office should be contacted (1-800-448-2402 or 1-912-652-5347.)

Detailed discussion of the many possible stream and streambank stabilization techniques is beyond the scope of this Manual, but one general approach needs to be mentioned because of growing realization of its contribution to the overall health of streams. The approach has been called to bioengineering or biotechnical approach. Its aim is to replicate or reintroduce natural stream and slope stabilization processes as much as possible. The biotechnical approach to slope protection combines the use of mechanical (or structural) elements with biological elements (plants), functioning together and mutually reinforcing each other (Gray and Leiser, 1982). Biotechnical techniques in which plant materials are the primary structural component have come to be identified by the term "soil bioengineering". Techniques include installing plantings of woody vegetation such as willows, either as individual live cuttings, or in bundles of cuttings. If planted correctly and given time to establish root systems, the cuttings can grow into a dense network of protective vegetation that can bend but not break under stress and that is self-repairing. The vegetation's root matrix provides resistance to the sliding and shear displacement forces involved in slope erosion.

Although "living construction" methods have been systematically studied and used in Europe for more than half a century, technical information on such methods became easily available in the United States only recently. The Pennsylvania Scenic Rivers Program's 1986 guidebook for landowners is an attractive, reader-friendly publication (Pennsylvania Scenic Rivers Program, 1986). The Izaak Walton League of America has published a 21-page survey of stream-bank stabilization methods (Izaak Walton League of America, 1989). The Washington Department of Ecology's draft Stormwater Management Manual for the Puget Sound Basin includes bioengineering methods among the many groups of protection measures that it describes (Washington Department of Ecology, 1992). Also, the Georgia Soil and Water Conservation Commission plans to include a detailed description of the concepts in a new guidebook titled <u>Controlling Streambank Erosion</u> which will soon be available.

Gray and Leiser list four reasons to prefer biotechnical approaches:

1) <u>Their cost effectiveness</u>. Lower cost vegetative treatments can reduce the amount of higher cost structural treatments that may be needed.

2) <u>Their environmental compatibility</u>. Biotechnical systems tend to blend into the landscape and are less visually intrusive. Examples include log or timber cribs gabion and rock breast walls, and reinforced earth. In addition, wherever possible, vegetation is incorporated into the structures, for example by planting in the spaces between structural members.

3) Their use of indigenous, natural materials. Wherever possible, natural locally available materials are used: earth, rock, timber, vegetation - in contrast to man-made materials such as steel and concrete.

4) Their labor- and skill-intensiveness. Well-supervised, skilled labor can often be substituted for high-cost, energy-intensive materials (Gray and Leiser, 1982).

Most importantly, biotechnical methods contribute to the support and protection of the ecology of a stream in ways that purely structural techniques do not.

If possible, a qualified bioengineer should be consulted to evaluate site conditions and determine the appropriated mix of measures that will adequately solve the problem and stand up to the test of time. In some cases, a solely vegetative approach may be all that is needed. In others, conditions such as excessive stream velocities or poor soil conditions may require a combination of vegetative and structural elements. And in still others, space limitations or other conditions may require a solely structural approach such as stone walls or bulkheads. Some of the most common conditions that may preclude the soil bioengineering preference for vegetative measures include inadequate space, heavy pedestrian traffic, the need for an unobstructed view, and too much shade.

Streambed Restoration

Prior to any streambed restoration, upstream conditions should be assessed. Without corrective measures or retrofitting upstream, stormwater flows could quickly destroy any restoration work. If the steam is in equilibrium, or if appropriate corrective measures are in place, streambed restoration can recreate the habitat conditions needed to support aquatic life. Several factors may need to be addressed in streambed restoration:

- Replacement of pools and riffles.
- Velocity control.
- Restoration of the stream gradient and normal flow channel.
- Removal of major stream obstructions.
- Restoration of suitable channel patterns. There are three major channel patterns:
- (1)meandering - which is characterized by repetitive bends, (2) irregular - which is more or less straight; and (3) braided - which separates and rejoins around islands. Which pattern is appropriate depends upon surrounding soil and slope conditions, as well as the original stream patterns (Dunne, 1978).
- Restoration of the substrate (removal of sediment and replacement with gravel and cobbles, as appropriate for the streams).
- Restoration of adjacent wetlands and floodplains.

The number of factors affected by restoration and the extent of the measures taken will depend upon individual stream conditions. Some techniques permit the stream flows themselves to work to restore healthier streambed conditions; others require excavation and physical realignment of the stream channel. Three basic techniques include deflectors, in-stream boulders and drop structures. With many variations, these techniques are used throughout the country.

Deflectors can be easily constructed of common, local material such as cobbles, boulders and logs, and are adaptable to a variety of conditions and stream sizes. They are sited in the channel with the intent of deflecting the current into a more narrow channel. Deflectors can use the stream flow for a variety of purposes, including deepening channels, developing downstream pools, enhancing pool riffle ratios and assisting in the restoration of meander patterns with channelized reaches. There are several deflector designs, such as simple double "wing deflector" that consists of rock structures on each bank deflecting the streamflow to a central channel, single deflectors along one bank, deflectors offset on opposite banks of a stream to imitate meanders, and V-type deflector, which is placed in the middle of the channels with the point of the "V" pointing upstream deflecting water towards both banks. This type of deflector helps re-establish riffles and pools downstream. An underpass deflector is a log placed across a small stream several inches off the bottom. Water is deflected under the log which helps remove sediment deposits and restore pools. (Gore, ed., 1985) (Kumble, 1990).

Drop Structures include a number of variations such as weirs, check dams, sills and plunges. They can serve a variety of functions in streambed restoration depending upon their design, Including: slowing streamflow; deepening existing pools; and creating new pools upstream and downstream. Structures with notches can be used to control heavy stormwater flows and can help re-establish deep pools immediately downstream. Drop structures can be made of concrete, logs or boulders. Log or boulders structures can be used to replicate small falls or rapids. Single log dams across a streambed are simple and effective in restoring plunge pools. The K-dam is a variant of the single log dam, so named by added downstream bracing. In some areas, especially headwater areas, reintroducing beavers has been effective in restoring habitat (Gore, ed., 1985). Their dams function as drop structures in headwaters and on small streams.

Boulder placement is a third in-channel treatment that can assist streambed restoration. Boulders can be used to reduce velocity, restore pools and riffles, restore meanders, provide cover and protect eroded banks by deflecting flow (Gore, ed., 1985). Boulders can be placed randomly or in a pattern. Placing them in a "V" pointed upstream produces eddies that replicate riffles as well as restores downstream pools. Combined with placement of cobbles and gravels, boulder placement can also help restore the stream substrate.

Excavation and fill may also be necessary to restore the stream gradient, the normal flow channel and the stream channel pattern, including meanders and braids, where appropriate. Channel pattern restoration should be combined with streambank restoration and re-vegetation. Streams that have been severely degraded by large amounts of sediment or heavy stormwater flows may require greater restoration work. Sediment may have to be removed mechanically and replaced with gravel and cobbles to replicate the original streambed. Major debris accumulation that is obstructing flows may also need removal.

Restoration of riparian wetlands and floodplains can also be included in re-vegetation project with special consideration given to planting species appropriate to the specific site conditions, including soil types, and degree of saturation. The following can provide further information on streambed restoration:

1) Guidelines for Streambank Restoration. State Soil & Water Conservation Commission, 1994
2) Soil Conservation Service Engineering Field Book, Part 650, 1992
3) The Restoration of Rivers and Streams. James A. Gore, Editor, 1985.
4) Stream Restoration Along the Greenways in Boulder, Colorado. John L. Barnett, 1991
5) The State of the Anacostia 1989 Status Report, Peter A. Kumble, 1990.
6) A Streambank Stabilization and Management Guide for Pennsylvania Landowners. Commonwealth of Pennsylvania, Department of Environmental Resources, 1986.
7) Stream Obstruction Removal Guidelines. Wildlife Society and American Fisheries Society, 1983.

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1. American Association Of State Highway And Transportation Officials, Model Drainage Manual, 1992.

2. Georgia Soil and Water Conservation Commission, Manual For Erosion And Sediment Control In Georgia, Fourth Edition, P.O. Box 8024, Athens, Georgia 30603, 1996.

3. Maestri, B. and others, "Managing Pollution From Highway Stormwater Runoff", Transportation Research Board, National Academy of Science, Transportation Research Record Number 1166, 1988.

4. Metropolitan Washington Council of Governments, A Current Assessment Of Urban Best Management Practices - Techniques for Reducing Non-Point Source Pollution in the Coastal Zone, 777 North Capital Street, Suite 300, Washington, D.C., 1992.

5. State of North Carolina, Erosion And Sediment Control Planning And Design Manual, North Carolina Sedimentation Control Commission, North Carolina Department of Natural Resources And Community Development, 1988.

6. Atlanta Regional Commission (Draft) Georgia Stormwater Management Manual, Volume 2 Technical Handbook, Atlanta, Georgia.

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13. U. S. Soil Conservation Service, Urban Hydrology for Small Watershed, Technical Release No. 55, 1975.

14. U.S. Soil Conservation Service, Hydraulics, Engineering Handbook, Section 5.

APPENDIX A: EXAMPLE DESIGN APPLICATIONS

A.1 Example Design - Infiltration Trenches

All equations used in the following section are fully documented and discussed in Maryland's Department of Natural Resources Standards and Specifications for Infiltration Practices, 1984 (See Reference #2).

Site Layout

The site for an infiltration trench consists of two areas:

1. The portion of the watershed that contributes direct runoff to the infiltration trench, which is denoted as A_u; and

2. The portion of the watershed allocated to the basin (does not contribute runoff to the trench), which is denoted as A_b. The subscript u and b are used to indicate the upland and basin drainage areas, respectively.

Design Procedure

Step 1 Calculate the volume of runoff, in inches, from the first 1.2-inch of rainfall over the total impervious surfaces included within the proposed development, ΔQ_u.

Step 2 Compute the maximum allowable trench depth (d_{max}) from the feasibility equation 15.A.1.

$$d_{max} = Ft_s/V_r \qquad \text{(A.1)}$$

Where: F = minimum infiltration rate, in/hr
t_s = storage time, hr
V_r = void ratio in soil or rock

Step 3 Select the trench design depth (d_t) based on the depth that is at least two feet above the seasonal high groundwater table, or a depth less than or equal to d_{max}, whichever results in the smaller depth.

Step 4 Compute the trench surface area (A_t) from Equation A.2:

$$A_t = (\Delta Q_u A_u)/(V_r d_t - P + Ft_s) \qquad \text{(A.2)}$$

Where: A_t= surface area of trench, ft^2
P = rainfall depth, ft
Other variables previously defined

Step 5 Compute the trench width or length equation A.3.

$$L_t = (\Delta Q_u A_u)/[(V_r d_t - P + Ft_s)W_t] \qquad (A.3)$$

Where: L_t = length of trench, ft
W_t = width of trench, ft
Other variables previously defined

In the event that the sidewalls of the trench must be sloped for stability during construction, the surface dimensions of the trench area should be based on equation A.4:

$$A_t = (L_t - Zd_t)(W_t - Zd_t) \qquad (A.4)$$

Where: Z = trench side slope ratio

The design procedure would begin by selecting a top width (W_t) that is greater than $2Zd_t$, for a specified side ratio (Z). The length (L_t) is then determined as:

$$L_t = Zd_t + (A_t)/(W_t - Zd_t) \qquad (A.5)$$

Example Application

An infiltration trench with surface inlets will be used to control the first 1.2 inches of rainfall from the impervious surfaces within a 6 acre commercial site. Following are the calculations for the surface area of the trench.

Design Data: F = 1.02 in/hr
V_r = 0.4
t_s = 24 hours…….(this example only)
Depth to groundwater = 12 feet
Depth to bedrock = 18 feet

Note: Use t_s = 48 hours for Fulton County

Step 1 Calculate the volume of runoff, in inches, from the first 1.2 inches of rainfall within the proposed development, ΔQ_u.

For the proposed development, 63 percent (0.63) of the total development is covered by impervious surfaces. Thus the volume that must be controlled would be as follows:

$$\Delta Q_u = 1.2 \text{ in } (0.05 + 63^* \, 0.009) = 1.2 \text{ in } (0.617) = 0.74 \text{ in}$$

Step 2 Compute the maximum allowable trench depth (d_{max}) by the feasibility formula:

$$d_{max} = Ft_s/V_r$$
$$d_{max} = (1.02)(24)/0.4 = 61.2 \text{ in} = 5.1 \text{ ft}$$

For this example the depth to the groundwater table is 12 feet and the depth to bedrock is 18 feet.

Step 3 Select a trench design depth less than d_{max} and at least two feet above the groundwater table (subtract 1.5 feet for the overlying soil cover with surface inlets).

Select $d_t = 3.0$ ft

Step 4 Compute the trench surface area (A_t) by the equation:

$$A_t = (\Delta Q_u A_u)/(V_r d_t - P + Ft_s)$$

Where:

$A_u = 6$ acres x 43560 ft^2/acre = 261,360 ft^2
$V_r = 0.40$
$t_s = 24$ hours
$F = 1.02$ in/hr
$d_t = 8.5$ ft
$\Delta Q_u = 0.74$ in $= 0.062$ ft
$P = 1.2$ in $= 0.1$ ft
$A_t = [(0.0062)(261{,}360)]/[(0.40)(3) - 0.1 + (1.02/12 \times 24)]$
$A_t = 5161 \text{ft}^2$

A.2 Example Design - Grassed Swales

Site Layout

The site layout will consist of the portion of the watershed that contributes direct runoff to the swale area or the upland area, which is denoted as A_u; and the portion of the watershed allocated for swale storage, which is denoted as A_s. It is important to note that the upland area (A_u) does not include the area allotted to the swale surface (A_s). Swale locations are usually either on the side or back of the property line or along the side of roadways (not in the road right-of-way). Installation of berms or check dams at certain intervals along the length of the swale will result in storage.

Design Procedure

Step 1 Calculate the volume of runoff, from the first 1.2 inches of rainfall over within the proposed development, ΔQ_u.

Step 2 Compute the maximum allowable swale check dam depth (d_{max}) from the feasibility equation 15.A.6.

$$d_{max} = Ft_s/V_r = FT_p \quad \text{(A.6)}$$

Where: F = minimum infiltration rate, in/hr
t_s = maximum storage time for stone aggregate reservoir, hr
V_r = void ratio in soil or rock
T_p = maximum allowable ponding time for surface storage, hr

Step 3 Select the swale design depth (d_s) based on the depth that is at least two feet above the seasonal high groundwater table, or a depth less than or equal to
d_{max}, whichever results in the smaller depth.

Step 4 The swale surface area dimensions can be determined from Equations A.7 and A.8. The bottom width (W_b) is selected along with the side slope ratio (Z), and depth of check dam (d_s). The swale top width (W) and total hydraulic length (L_T) may be computed as:

$$W = W_b + 2d_sZ \quad \text{(A.7)}$$
$$L_T = [\Delta Q_u A_u]/[(d_s/4)(W+W_b) + W(Ft_s-P)] \quad \text{(A.8)}$$

Where: P = rainfall depth
Other variables defined above.

Step 5 The maximum required spacing between check dams is computed as:

$$L = d_s/S_s \quad \text{.A.9)}$$

Where: S_s = bottom slope of swale, ft/ft

Step 6 The number of check dams needed to impound and store the runoff volume is determined as:

$$N_s = L_T/L \quad \text{(A.10)}$$

Where: L = length of swale behind each check dam, ft

Step 7 If L_t is restricted by the site layout, the level of control provided by the swales is determined by:

$$Q_s = V_w/A_u \quad \text{(A.11)}$$

Where: $V_w = [d_s (W + W_b)L] [N_s]/4$
Q_s = runoff storage depth
V_w = volume of swale storage

Example Application

Low density residential lots of 3/4 acres are to be developed. A total of 4 lots will be created. The site will be designed to be managed with grassed swales with check dams located along the back of the lots. The total area of the development is 3.0 acres with 20% impervious area and 80% pervious area. Following are the calculations for the swale design.

Design Data: F = 2.41 in/hr
$V_r = 0.4$
T_p = 24 hours
Depth to groundwater = 12 feet
Depth to bedrock = 14 feet

Step 1 Calculate the volume of runoff, in inches, from the first 1.2 inches of rainfall within the proposed development, ΔQ_u.

For the proposed development, 20 percent (0.20) of the total development is covered by impervious surfaces. Thus the volume that must be controlled would be as follows:

ΔQ_u = 1.2 in (0.05 + 20*0.009) = 0.276 in
and the required storage volume would be
V = (0.276 in/12) * 3 ac * 43560 = 3006 ft^3

Step 2 Compute the maximum allowable swale depth (d_{max}) from the feasibility equation:

$d_{max} = FT_p$
d_{max} = 2.41(24) = 57.84 in. = 4.82 ft

Step 3 Select the swale check dam design depth (d_s); the depth to the groundwater table and bedrock is greater than d_{max}.

d_s = 1.0 ft

Step 4 Select the swale bottom width (W_b) and the swale side slope ratio (Z), assuming the same side slopes. Determine the top width (W) of the swale check dam from:

$W = W_b + 2d_sZ$

Where: $Z = 5$ (5h/1v)
$W_b = 18$ ft
$W = 18 + 2(1.0)(5) = 28$ ft

The site layout allows for a swale length of 480 feet along the back of all the lots. The total swale length (L_T) is fixed so that the volume of swale storage (V_w) may be determined from the dimensions given:

$$V_w = [d_s (W + W_b) L_T]/4$$

$$V_w = [1.0\ (28 + 18)480]/4 = 5{,}520\ ft^3$$

Step 5 The number of swale check dams (N_s) that needs to be constructed to achieve the volume of storage over the total swale length will vary with the depth of each check dam (d_s), given as:

$$N_s = L_T/L$$

where L is the length of swale behind each check dam, given as:

$$L = d_s/S_s$$

Note: S_s = bottom slope of swale = 0.02 ft/ft

$$L = 1.0/0.02 = 50.0\ ft$$

Step 6 $N_s = 480/83.3 = 9.6$ (use 10 with an adjusted L of 48.0 feet*)

* The adjusted length is determined as $L = L_T/N_s$

Thus, the design storage is 5,520 ft^3 which is greater than the required storage of 5,227 ft^3 (0.48 in x 1ft/12in x 3 acres x 43560 ft^2/acre) so that sufficient storage is provided by the design.

A.3 Water Quality Storm – Volume and Peak Discharge

A.3.1 Overview

The following procedure is a variation of the methodology presented in SCS Technical Release 55(TR-55) to calculate storm runoff volume, peak rate of discharge and hydrographs. This procedure is applicable to small storm events. The following procedures outline the use of this variation of the SCS-TR 55 method. Conventional SCS Methods underestimate the volume and rate of runoff for rainfall events less than 2”. This discrepancy in estimating runoff and discharge rates can lead to situations where a significant amount of runoff by-passes the filtering treatment practice due to an inadequately sized diversion structure or leads to the design of undersized grass channels.

A.3.2 Water Quality Volume

The direct runoff, WQ_R, is calculated using the following:

$$WQ_R = 1.2''*(R_v) \qquad (A.12)$$
$$R_v = 0.05 + (I)*.009 \qquad (A.13)$$

Where: WQ_R = water quality runoff (watershed inches)
R_v = the weighted volumetric runoff coefficient
I = Percent Impervious as a whole number

To calculate the water quality volume (WQ_v) in cubic feet or arce-feet, multiply WQ_R by the contributory area and make the appropriate conversion of units.

$$WQ_V = (WQ_{\underline{R}}\ A)/(12) \qquad (A.14)$$

Where: WQ_R = water quality runoff (watershed inches)
A = on-site area

A.3.3 Water Quality Storm – Peak Discharge

The following procedure relies on the volume of runoff computed using the Small Storm Hydrology Method (Pitt, 1994) and utilizes the NRCS, TR-55 Graphical Peak Discharge Method (USDA, 1986)

The peak discharge equation is:

$$Q_P = q_u*A*WQ_R \qquad (A.15)$$

Where: Q_P= Peak discharge (cfs)
q_u= unit peak discharge (cfs/mi^2/in)
A= drainage area (mi^2)
WQ_R= water quality runoff (in)

The input requirements for this method are as follows:

T_c – hours
Drainage area – acres

Type II rainfall distribution
24-hour design rainfall
CN value

A.3.4 Computations

Computations for the peak discharge method proceed as follows:

1. The 24-hour rainfall depth for the water quality storm event has been determined to be 1.2 inches. The runoff is computed per section A.3.2.

2. The watershed time of concentration (T_c) is computed by summing all the travel time or consecutive components of the drainage conveyance system from the hydraulically most distant point of the watershed to the point of interest within the watershed.

Travel time (T_t) is the time it takes water to travel from one location to another within a watershed. The time of concentration (T_c) is used with the ratio I_a/P to obtain the unit peak discharge, q_u from Figure A.11. If the ratio I_a/P lies outside the range shown in Figure A.11, either the limiting values or other peak discharge method should be used.

The peak runoff rate is computed using equation A.14.

A.3.5 Limitations

The accuracy of the peak discharge method is subject to specific limitations, including the following:

1. The watershed must be hydrologically homogenous and describable by a single CN value.

2. The watershed may have only one main stream, or if more than one, the individual branches must have nearly equal time of concentrations.

3. Hydrologic routing cannot be considered.

4. Accuracy is reduced if the ratio I_a/P is outside the range given in Figure A.11.

5. The weighted CN value must be greater than or equal to 40 and less than or equal to 98.

A.3.6 Example

Assume a 3.0 acre small shopping center having a 1.0 acre flat roof, 1.6 acres of parking and a 0.4 acre open space (sandy soil), for a 1.2 inch rainfall event and no disconnection of impervious surfaces. The time of concentration is 10 minutes.

Part 1 Calculate the weighted volumetric runoff coefficient using equation A.13.

$\%I = 2.6/3(100) = 86.7\%$
$R_V = 0.009(I)+0.05$
$R_V = 0.83$

Calculate the "Water Quality Volume" (WQ_V) using equation A.12

$WQ_R = 1.2(r_V) = 1.00$ in.
$WQ_V = 1.00*(1ft/12in.)*(3.0 ac.)*(43560 ft^3/ac.)$
$WQ_V = 10890 ft^3$

Part 2 The runoff curve number, CN using equation A.15.

For: $WQ_R = 1.00"$
P = 1.2 inches (storm event)
$CN = 1000/[10+5*1.2+10*1.00"-10*((1.00")^2+1.25*1.00*1.2)^{1/2}]$
CN = 98

Part 3 Using the CN value, the value of I_a is determined from Table 15.1and the ratio I_a/P is computed:

$I_a = 0.041$ for CN 98, $Ia/P = 0.041/1.2" = 0.034$

Part 4 The ratio of I_a/P and the time of concentration are used to determin the unit peak discharge from Figure 15.11.

$T_c = 10$ minutes = 0.17 hours
Read $q_u = 850$ csm/in (using the graph for $I_a/P = 0.10$)

Part 5 Calculate the Peak Discharge for "Water Quality Storm" using the equation:

$Q_P = q_u*A*WQ_V$
$A = 3.0 \text{ acres}/640 \text{ ac/mi}^2 = 0.0047 \text{ mi}^2$
$Q_P = (850 \text{ csm/in})*(0.0047 \text{ mi}^2*(1.00")$

$Q_P = 4.0$ cfs

Curve Number	**I_a(in)**	**Curve Number**	**I_a(in)**
40	3.000	70	0.857
41	2.878	71	0.817
42	2.762	72	0.778
43	2.651	73	0.740
44	2.545	74	0.703
45	2.444	75	0.667
46	2.348	76	0.632
47	2.255	77	0.597
48	2.167	78	0.564
49	2.082	79	0.532
50	2.000	80	0.500
51	1.922	81	0.469
52	1.846	82	0.439
53	1.774	83	0.410
54	1.704	84	0.381
55	1.636	85	0.353
56	1.571	86	0.326
57	1.509	87	0.299
58	1.448	88	0.273
59	1.390	89	0.247
60	1.333	90	0.222
61	1.279	91	0.198
62	1.226	92	0.174
63	1.175	93	0.151
64	1.125	94	0.128
65	1.077	95	0.105
66	1.030	96	0.083
67	0.985	97	0.062
68	0.941	98	0.041
69	0.899		

Table A.1
I_a Values for Runoff Curve Numbers

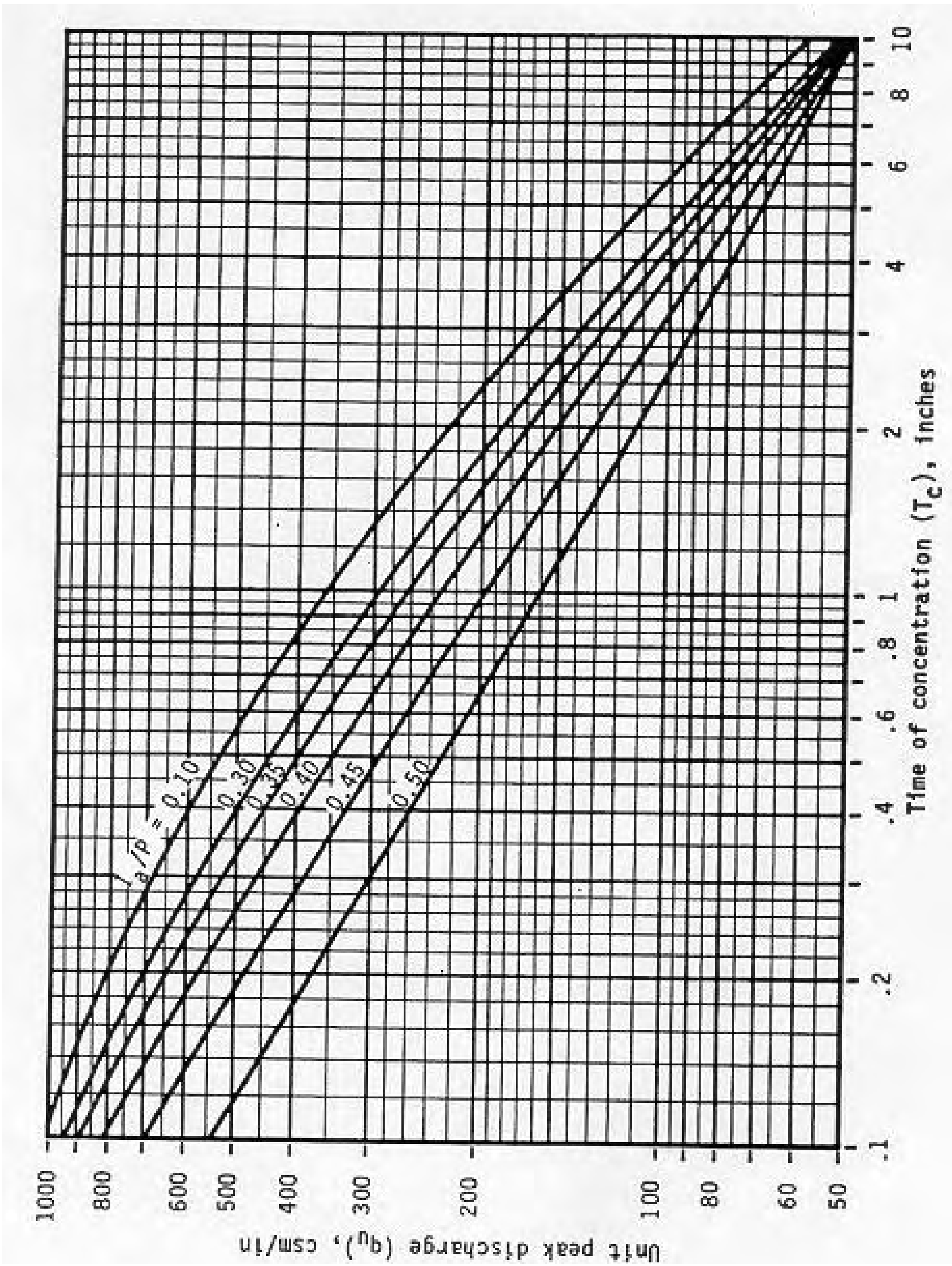

Figure A.11

SCS Type II Unit Peak Discharge

A.4 U.S. Geological Survey Peak Flow and Hydrograph Method

A.4.1 Introduction

For the past 20 years the U.S Geological Survey has been collecting rain and streamflow data at various sites within the Atlanta Metropolitan Area and throughout the State of Georgia. The data from these efforts have been used to calibrate a U.S. Geological Survey rainfall-runoff model for use within the Atlanta Area. The U.S. Geological Survey Model was then used to develop peak discharge regression equations for the 2-,5-,10-,25-,50- and 100-year floods. In addition, the USGS used the statewide data base to develop a dimensionless hydrograph which can be used to simulate flood hydrographs from rural and urban streams within Fulton County.

A.4.2 Peak Discharge Equations

For a complete description of the USGS regression equation presented below, consult the USGS publication "Flood-Frequency Relations For Urban Streams In Georgia – 1994 Update, Water-Resources Investigation Report 95-4017. Following are the USGS regression equations for use in Fulton County. Note that drainage areas in Region 1 flow to the Chattahoochee River while areas in Region 2 flow to the south away from the Chattahoochee River.

Frequency	Equation	
	Region 1	**Region 2**
2-year	$Q_2 = 167A^{0.73}TIA^{0.31}$	$Q_2 = 145A^{0.70}TIA^{0.31}$
5-year	$Q_5 = 301A^{0.71}TIA^{0.26}$	$Q_5 = 258A^{0.69}TIA^{0.26}$
10-year	$Q_{10} = 405A^{0.70}TIA^{0.21}$	$Q_{10} = 351A^{0.70}TIA^{0.21}$
25-year	$Q_{25} = 527A^{0.70}TIA^{0.20}$	$Q_{25} = 452A^{0.70}TIA^{0.20}$
50-year	$Q_{50} = 643A^{0.69}TIA^{0.18}$	$Q_{50} = 548A^{0.70}TIA^{0.18}$
100-year	$Q_{100} = 762A^{0.69}TIA^{0.17}$	$Q_{100} = 644A^{.070}TIA^{0.17}$
200-year	$Q_{200} = 892A^{0.68}TIA^{0.16}$	$Q_{200} = 747A^{0.70}TIA^{0.16}$
500-year	$Q_{500} = 1063A^{0.68}TIA^{0.14}$	$Q_{500} = 888A^{0.70}TIA^{0.14}$

For these equations: A = Drainage Area, mi^2 TIA = Total impervious area, %

A.4.3 Limitations

Following are the limitations of the variables within the peak discharge equations. These equations should not be used on drainage areas which have physical characteristics outside the limits listed below.

Physical Characteristics	Minimum	Maximum	Units
A – Drainage Area	0.04	19.1	mi^2
TIA – Total Impervious Area	1.00	62	percent

A.4.4 Hydrographs

The USGS has developed a dimensionless hydrograph for Georgia streams having drainage areas of less than 500 mi^2. This dimensionless hydrograph can be used to simulate flood hydrographs for rural and urban streams within Fulton County. For a complete description of the USGS dimensionless hydrograph consult the UGSG publication “Lagtime Relationship for Urban Streams in Georgia”, Water-Resources Investigation Report 00-4049. Following are the time and discharge ratios for the dimensionless hydrograph for Fulton County.

Time Ratio (t/T$_L$)	**Discharge Ratio** (Q/Q$_P$)	**Time Ratio** (t/T$_L$)	**Discharge Ratio** (Q/Q$_P$)
0.25	0.12	1.35	0.62
0.30	0.16	1.40	0.56
0.35	0.21	1.45	0.51
0.40	0.26	1.50	0.47
0.45	0.33	1.55	0.43
0.50	0.40	1.60	0.39
0.55	0.49	1.65	0.36
0.60	0.58	1.70	0.33
0.65	0.67	1.75	0.30
0.70	0.76	1.80	0.28
0.75	0.84	1.85	0.26
0.80	0.90	1.90	0.24
0.85	0.95	1.95	0.22
0.90	0.98	2.00	0.20
0.95	1.00	2.05	0.19
1.00	0.99	2.10	0.17
1.05	0.96	2.15	0.16
1.10	0.92	2.20	0.15
1.15	0.86	2.25	0.14
1.20	0.80	2.30	0.13
1.25	0.74	2.35	0.12
1.30	0.68	2.40	0.11

The lagtime equation that should be used in Fulton County to use the dimensionless hydrograph is:

$$T_L = 161A^{.22}S^{.66}IA^{-.67} \qquad \text{(A.16)}$$

Where: T_L = lagtime (hours)
A = drainage area (mi^2)
S = main channel slope (ft/mi)
IA = total impervious area (percent)

Using this lagtime equation and the dimensionless hydrograph, a runoff hydrograph can be determined after the peak discharge is calculated.

A.4.5 Limitations

Following are the limitations of the variables within the lagtime equation (15.A.16). the lagtime equation should not be used for drainage areas which have physical characteristics outside the limits listed below.

Physical Characteristics	Minimum	Maximum	Units
A – Drainage Area	0.2	25	mi^2
S – Main Channel Slope	13	175	feet per mile
IA – Total Impervious Area	14	50	percent

A.4.6 Rural Basins

The USGS has recently revised the equation for estimating peak discharge for rural basins. For a complete discussion of the development of these equations consult the USGS publication "Techniques For Establishing Magnitude And Frequency Of Floods In Rural Basins Of Georgia", Water-Resources Investigations Report 93-4016.

For these rural equations, the USGS has two regions (Region 1 and 2) that will affect the use of the equations within Fulton County. Region 1 includes all those drainage areas that eventually flow into the Chattahoochee River. Following are the equations used to calculate peak discharge for rural basins in Fulton County.

Frequency	**Equations region 1**	**Equation Region 2**
Q^2	$207A^{.654}$	$182A^{.622}$
Q_5	$357A^{.632}$	$311A^{.616}$
Q_{10}	$482A^{.619}$	$411A^{.613}$
Q_{25}	$666A^{.605}$	$552A^{.610}$
Q_{50}	$827A^{.595}$	$669A^{.607}$
Q_{100}	$1010A^{.584}$	$794A^{.605}$
Q_{200}	$1220A^{.575}$	$931A^{.603}$
Q_{500}	$1530A^{.563}$	$1130A^{.601}$

A – Drainage Area in mi^2

A.4.7 Limitations

Following are the limitations associated with the rural basin equations given above.

Physical Characteristics	Minimum	Maximum	Units
Region 1			
A – Drainage Area	0.17	730	mi^2
Region 2			
A – Drainage Area	0.10	3,000	mi^2

A.4.8 Example Problem

For the 100-year flood, calculate the peak discharge for rural and developed conditions for the following drainage area location in Region 1.

Drainage Area = 175 acres = 0.273 mi^2
Total Impervious Area(TIA) = 32%

100-year Rural Peak Discharge

$Q_{100} = 1010A^{.584} = 1010(.273)^{.584} = 473$ cfs

100-year Developed Peak Flow

$Q_{100} = 762A^{.69}TIA^{.17}$
$Q_{100} = 762(.273)^{.69}(32)^{.17} = 561$ cfs

A.5 Example Design Bio-retention Facility (See Figure A.12,A.12a,A.12b,A.12c)

Site Layout

The site layout will consist of a ½ acre residential lot with a house. The entire lot will drain to the bio-retention facility. The area is assumed to have 25 percent impervious area.

Design Procedure

Step 1 Compute the Runoff Control Volumes from the Unified Design Criteria. Calculate the Water Quality Volume (WQ_V).

Step 2 Confirm local design criteria and applicability. Consider any special site-specific design conditions/criteria.

Step 3 Determine the size of bio-retention ponding filter area. The required filter bed area is computed using the following equation:

$$A_f = (WQ_V)(d_f) / [(k)(h_f + d_f)(t_f)] \qquad \text{(A.17)}$$

Where:
A_f = Surface Area of Filter Bed (ft^2)
d_f = Filter Bed Depth (ft)
k = Co-efficient of Permeability of Filter Media (ft/day)
h_f = Average Height of Water Above Filter Bed (ft)
t_f = Design Filter Bed Drain Time (days)

(1.67 days or 40 hours is recommended maximum for sand filters, 48 hours for bio-retention)
Use $k = 0.5$ ft/day

Step 4 Set design elevations and dimensions.

Step 5 Design conveyances to facility

Step 6 Pretreatment Volume: Pretreat with a grass filter strip. The maximum sheet flow velocity for the filter strip and ponding area is 1 foot per second. Any flow velocity higher than this should utilize a stone diaphragm at the between the contributing drainage area and the grass filter strip.

Step 7 Provide 6” perforated pipes, 10’ on center with a minimum of 0.5% slope. 3/8” perforations at 6” centers, 4 holes per row.

Step 8 Emergency storm weir design. Should filter rates become reduced due to facility age or poor maintenance, an overflow weir is provided to pass the 10 year event.

Step 9 Prepare vegetation and landscaping plan. A landscaping plan for the bio-retention area should be pared to indicate how it will be establishes with vegetation.

Example Application

Step 1 Compute the Runoff Control Volumes from the Unified Design Criteria.(See the Geogia Stormwater Design Manual Technical Handbook, Volume 2)
Calculate the Water Quality Volume (WQ_v)

$$WQ_v = [(1.2/12) * (0.5+ (I)*0.009)]*A \qquad \text{(A.18)}$$

Where: I = Percent Impervious
A = On-site Area

$WQ_V = (1.2/12)(0.5+25*0.009)*A$
$WQ_v = (1.2/12)(.275)0.5(43560)$
$WQ_v = 600cfs$

Step 2 Confirm local design criteria and applicability. Consider any special site-specific design conditions/criteria:

Stept 3 Determine the size of bio-retention ponding filter area. The required filter bed area is computed using the following equation:

$$A_f = (WQ_v)(d_f) / [(k)(h_f = d_f)(t_f)] \quad (A.19)$$
$$A_f = (600)(4) / [(0.5)(0.5 = 4)(2)]$$
$$A_f = 533 \text{ ft}^2$$

Where: A_f = Surface Area of Filter Bed (ft^2)
d_f = 4 (ft)
k = 0.5(ft/day)
h_f = 0.5(ft)
t_f = 2(days)

Step 4 Set design elevations and dimensions.

Step 5 Design conveyances to facility.

Step 6 Pretreatment Volume: Pretreat with grass filter strip. The maximum sheet flow velocity for the filter strip and ponding area is 1 foot per second. Any flow velocity higher than this should utilize a stone diaphragm at the between the contributing drainage area and the grass filter strip.

Step 7 Provide 6" perforated pipes, 10' on center with minimum of 0.5% slope. 3/8" perforations at 6" centers, 4 holes per row.

Step 8 Emergency storm weir design. Should filter rates become reduced due to facility age or poor maintenance, an overflow weir is provided to pass the 10 year event.

Step 9 Prepare vegetation and landscaping plan. A landscaping plan for the bio-retention area should be prepared to indicate how it will established with vegetation.

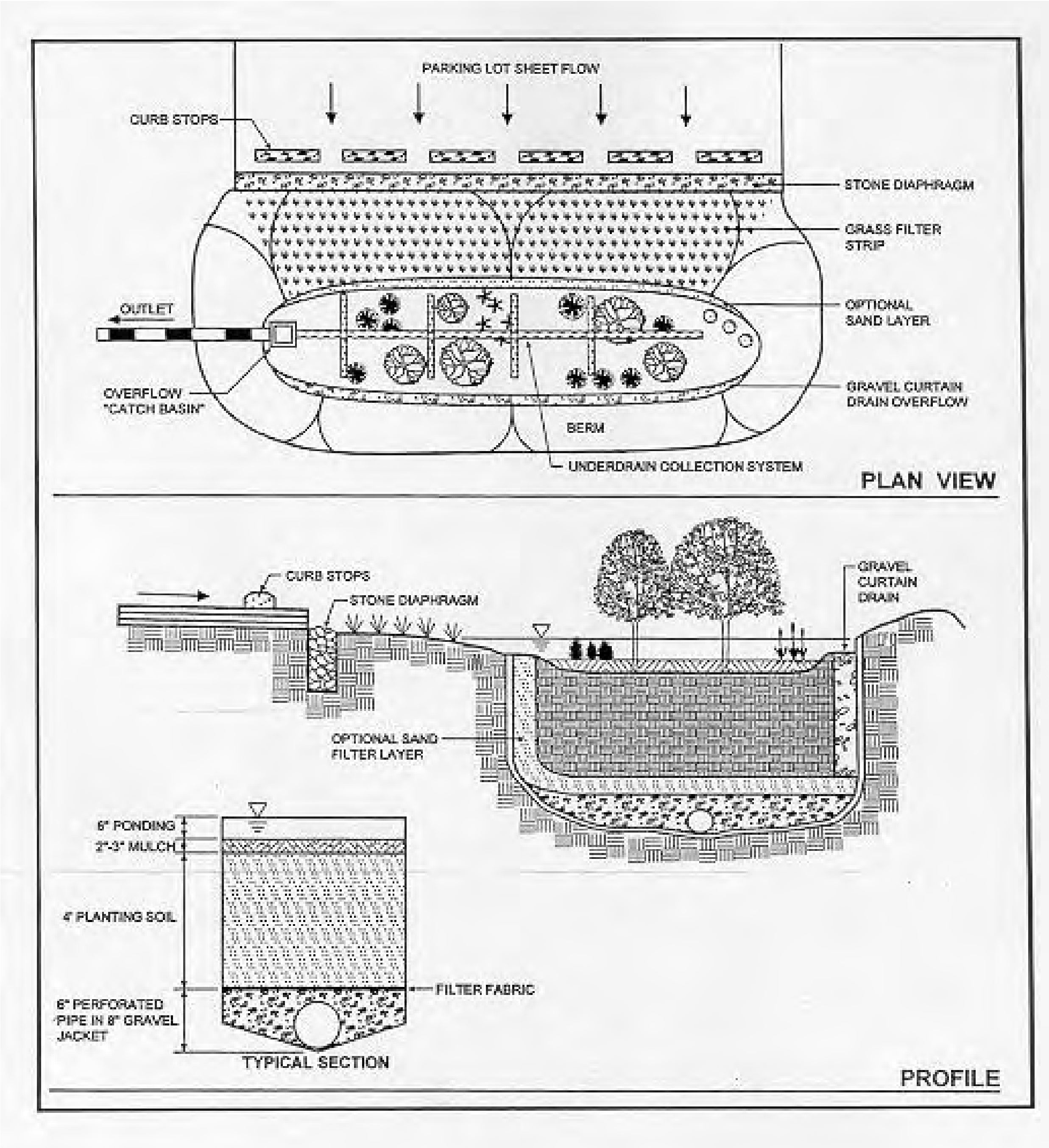

Figure A.12 Schematic of Bio-retention Area
(Recommended in non-residential development or where applicable)

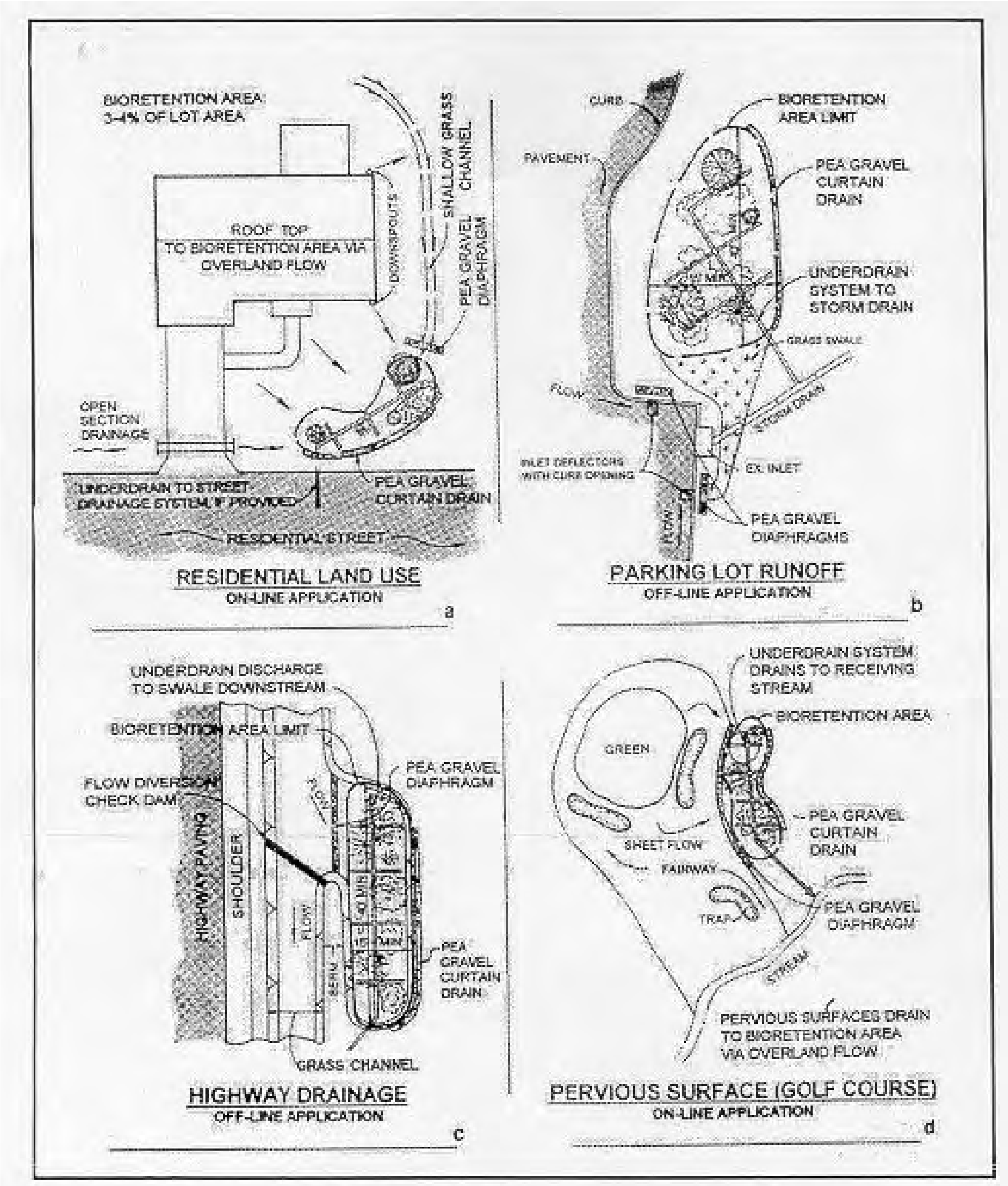

Figure A.12a Bioretention Area Examples

Source: Claytor and Schueler 1996

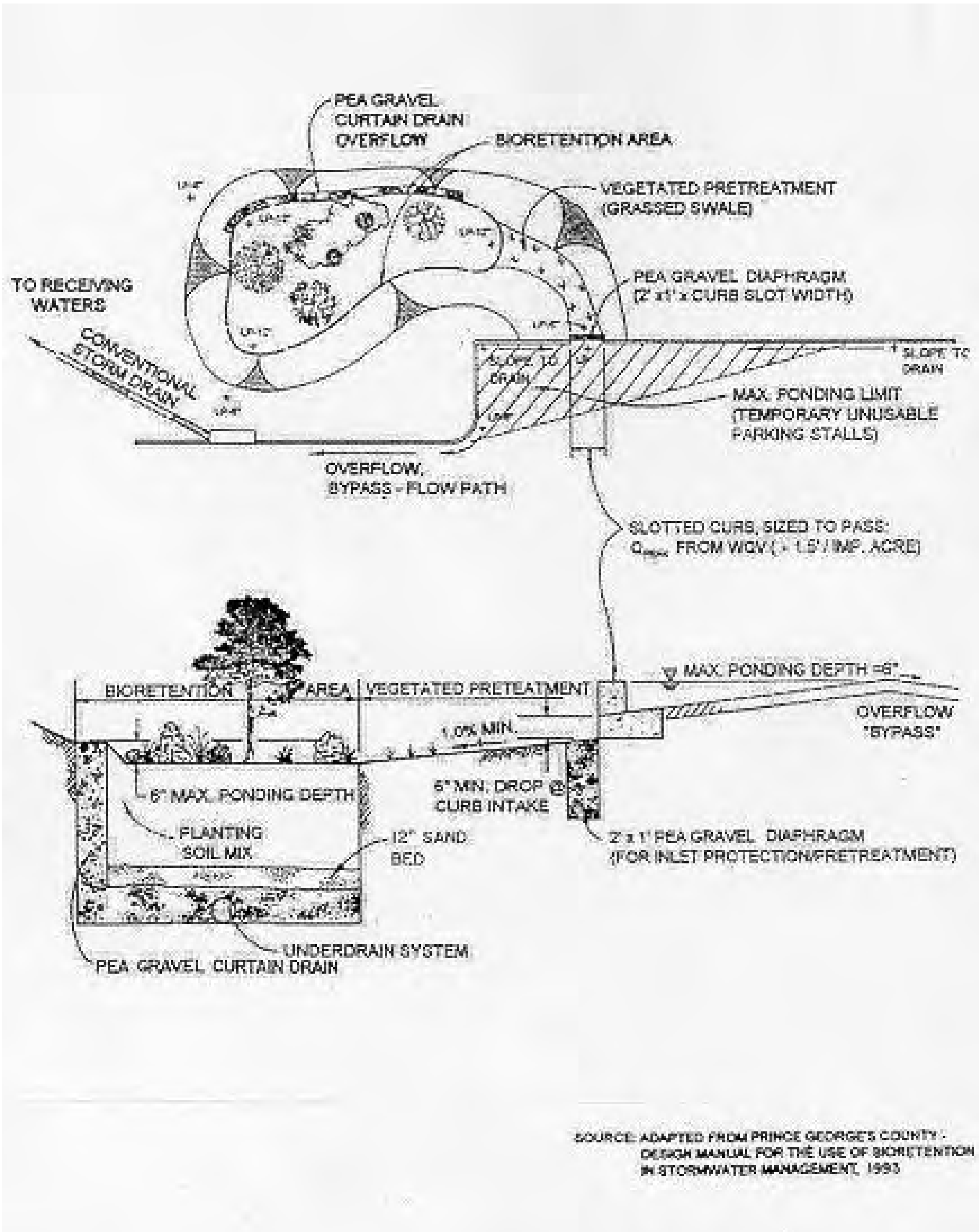

Figure A.12b Schematic Of A Typical Off-Line Bioretention Area
Source: Claytor and Schueler 1996

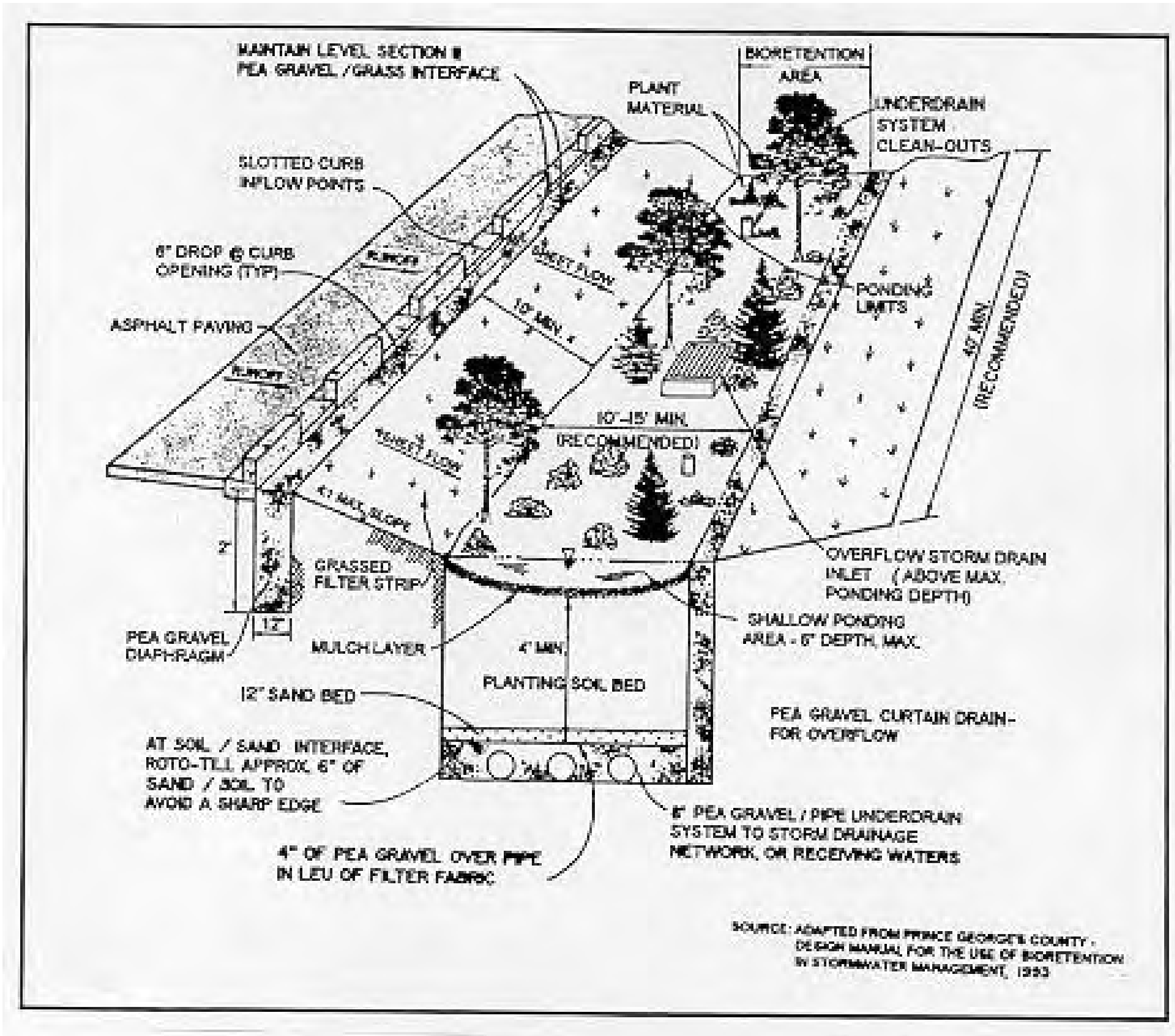

Figure A.12c: Schematic Of A Typical Bioretention Area
Source: Claytor and Schuler 1996

For further information on the sign of infiltration measures the following references are recommended.

References

- Stormwater Infiltration Structure Design. National Stone Association, 1415 Elliot Place, NW, Washington, D.C., 1994. Available from McTrans, University of Florida Gainesville, Florida 32611, (352) 392-0378. Includes a computer model for infiltration design.

- Maryland Department of Natural Resources. Water Resources Administration, Stormwater Management Division, Standards and Specifications for Infiltration Practices, 1984.

Other References

- Federal Highway Administration, 1991 HYDRAIN Documentation.

- U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, 1986. Urban hydrology for small watersheds. Technical Release 55 (TR-55).

- U.S. Department of Transportation, Federal Administration, 1984. Hydrology, Hydraulic Engineering Circular No. 19.

- Overton, D.E. and M.E. Meadows, 1976. Stormwater modeling, Academic Press, New York, N.Y., pp. 58-88.

- Water Resources Council Bulletin 17B, 1981, Guidelines for determining flood flow frequency.

- Wright-McLaughlin Engineers, 1969. Urban storm drainage criteria manual. Volume I and II. Prepared for the Denver Regional Council of governments, Denver, Colorado.

APPENDIX B: GUIDE FOR MAINTENANCE OF BMP FACILITIES

Introduction

Although the actual time that a Best Management Practice (BMP) facility performs its design function is relatively brief (during and immediately following a storm event), it must constantly be ready to do so. This is due to the random nature of rainfall events and the impracticality of inspecting the facility and performing maintenance immediately prior to them. Additionally, pollutant removal efficiencies will decline over time if adequate maintenance is not performed. To maintain maximum pollutant removal, it is important to have BMPs fully operational at all times. To provide this operational level, the BMP facility operator must establish and sustain a comprehensive, regularly scheduled maintenance program.

The positive aspect of a properly functioning BMP facility is that it enhances downstream environments by mitigating the environmental impacts of land development; conversely, BMPs can diminish the positive impact on the environment if they are not properly maintained.

The following criteria provide a guide for maintenance of a BMP facility. These include access and maintenance easements, routine inspection of outlet structures, sediment disposal, maintenance agreements, and other considerations specific to BMP's.

1. Access for Maintenance

Access for inspections, maintenance personnel, and equipment should be provided to all areas of a BMP facility that require observation or maintenance. The location and configuration of easement(s) shall be established during the construction of the facility, and maintained on a regular basis. The area(s) requiring access include the dam embankment, emergency spillway, side slopes, inlets, sediment forebays, riser structures, BMP devices, and pond outlets. In order to provide access for heavy equipment, a suitable 10 ft. wide roadway within a cleared access easement must be provided to the facility. A typical roadway may consist of 6" of stone compacted subgrade (95% Maximum Theoretical Density). On large BMP facilities, additional easements to both upstream and downstream areas should be provided for maintenance access and additional improvements such as all-weather roads, access restrictions, and vandalism deterrents should be considered.

2. Sediment Accumulation and Removal

Sediment accumulation resulting from the normal operation of BMP measures must be recognized. Accommodations should be made for the removal and disposal of sediments. Disposal should be provided either onsite in reserved areas, used as fill or topsoil supplement, or removed from site.

For larger BMPs, access must be provided for equipment to dredge or otherwise remove accumulated silt materials since offsite disposal would likely be more necessary.

3. Maintenance Agreements

An agreement stating maintenance responsibility, schedule, inspection/maintenance records of facility and the operations included in the approved plan submission. Easements for non-county maintained BMPs should include provisions to permit county inspection and emergency maintenance (including reimbursement to the county agency for incurred emergency maintenance costs) if a property owner fails in its inspection and maintenance responsibility and creates a public nuisance. A maintenance agreement is attached.

4. Operation and Maintenance Costs (Sample)

It is clear that the maintenance needs of BMPs are somewhat site specific, and the costs of conducting needed maintenance will vary accordingly. However, it is possible to determine cost estimates using some general BMP facility maintenance parameters. The operation and maintenance of a BMP facility will usually involve routine and non-routing maintenance procedures. Routine maintenance procedures will include inspections, debris and litter control, mechanical components maintenance, vegetation management, and other routine tasks as determined for the specific facility. Non-routine costs are those associated with removing accumulated sediments from the facility and long term structural repairs. Non-routine maintenance costs will vary greatly depending upon the size and depth of the facility, the volume of sediment trapped in the BMP facility, the accessibility of the BMP facility, and whether or not onsite disposal of the dredged sediments is possible.

The average annual operation and maintenance costs of an extended detention dry pond are estimated at 3-5% of the capital cost of the facility. The average annual operation and maintenance costs of a wet pond are estimated at 3% of capital costs. Probable costs for a wet pond less than 100,000 cubic feet is 5% of capital costs, while the probable costs for a wet pond greater than 1,000,000 cubic feet is 1% of capital costs. Initial capital costs will vary considerably depending on the type and size of the BMP facility.

While these cost estimates provide a general guideline to annual operation and maintenance costs, the property owner(s) of the BMP facility should plan ahead to ensure that funds are available when non-routine expenses are necessary. The costs of maintaining a BMP facility over the long run can be considerable, particularly when dredging or performing other non-routine maintenance. To lessen the immediate financial impact of these non-routine costs, it is strongly advised that any party or association responsible for BMP facility maintenance, create a sinking fund for this eventuality. For extended detention dry ponds, which need to have sediment removed at intervals between 2 to 10 years, 10% to 50% of the anticipated dredging costs should be collected per year. For wet ponds, which need to be dredged at intervals between 5 to 15 years, approximately 6% to 20% of the anticipated costs should be accrued per year. Present value of the assessment can include anticipated interest.

5. Maintenance Specific to BMPs

BMP's experience conditions which can lead to degraded efficiency and objectionable conditions. Areas of concern include: excessive weed growth, maintaining adequate vegetative cover, sedimentation, bank erosion, insect control, outlet stoppages, soggy surfaces, algal growth, fence maintenance, unsatisfactory emergency spillway, and dam failures/leakages. The main problem for extended detention dry ponds is a tendency for a soggy bottom, which hinders facility maintenance and the growth of effective vegetative cover.

(A) Inspections

Scheduled, periodic inspections should provide the foundation for a comprehensive maintenance program. Detailed inspections, occurring at least annually, should be conducted by a qualified professional/inspector to ensure that the facility is operating as designed and to provide a chance to schedule any maintenance which the facility may require. The American Public Works Association recommends that the following items be checked as minimum inspection requirements.

Recommended Minimum Inspection Requirements

- Dam settling, woody growth, and signs of piping.
- Signs of seepage on the downstream face of the embankment.
- Condition of grass cover on the embankment, pond floor, and perimeter.
- Riprap displacement or failure.
- Principal and emergency spillway meet design plans for operation.
- Outlet controls, debris racks, and mechanical and electrical equipment.
- Outlet channel conditions.
- Safety features of the BMP facility.
- Access for maintenance equipment.

If possible, inspections should be made during periods of wet weather to ensure that the BMP facility is maintaining desirable retention times. An inspection checklist (BMP Facility Operation and Maintenance Inspection Report for Pond Facilities) is attached. In addition to regularly scheduled inspections, the opportunity should be taken to note deficiencies during any visits by maintenance personnel. After major storm events the facility shall be checked for clogging of the outlet structure.

(B) Sediment Accumulation

Typically BMP's are designed to provide effective pollutant removal capabilities by enhancing sediment deposition. Periodic sediment removal is important to the effectiveness of these facilities; therefore, a schedule of sediment removal should be established.

(C) Vegetative Cover

If allowed to become established, small trees and brush with woody root systems can grow to cause destabilization and seepage in pond embankments which may result in the structural failure of the BMP facility. For this reason the dam embankment, side-slopes, and emergency spillway of a BMP facility should be kept free of woody growth and undesirable vegetation. This will require periodic mowing and a policy of not allowing plantings on these facilities. The frequency of mowing may need to be greater if the BMP facility is located in an area of high visibility. However, if possible, the BMP facility should be managed as an upland meadow with grass no shorter than 6-8 inches. Keeping grass much shorter than this can cause areas of the turf to die off or require a much higher level of maintenance.

Gradual slopes are necessary for establishing vegetative cover and for ease of mowing. Guidelines recommend a maximum of 3h:1v slopes for areas to be maintained by mowing. The pool and bank slopes should be shallow enough to allow for dredging and mowing equipment and the pond bottom should have sufficient slope (maximum 2%) to avoid areas of ponding water. In poorly drained soils, low-flow concrete trenches will be required to help prevent long-term saturated conditions.

Erosion and bare areas noted during site visits should be backfilled with topsoil, compacted, and re-seeded. These problems, if taken care of promptly, can help to avoid more costly repairs made necessary by continued erosion of un-stabilized soils.

No trees, brush, or other woody vegetation should be allowed to grow within 10 feet of the embankment or side slopes. Any old growth, and its root system, should be completely removed. The excavation should then be filled, compacted, re-seeded, and protected until properly vegetated. Any seedlings or planting should be removed at the earliest opportunity and the disturbed areas properly stabilized.

(D) Shorelines

To minimize the maintenance of the area surrounding the shoreline of the BMP facility, the slopes should be relatively flat and bank stabilization materials such as riprap and vegetative growth cover should be incorporated into the design. As a minimum requirement, areas of the shoreline which are adjacent to the embankment of those areas that are most subject to wind erosion must be properly stabilized. The layer of stones should be 12 inches thick and placed on a 10 inch bed of gravel and should extend 3 feet below the normal pool elevation. It may also be necessary to add a slight berm on the upstream face of the dam to support the riprap and prevent it from slipping.

(E) Structural Repairs

The inlet, outlet, and riser structures of the BMP facility should preferably be constructed of pre-cast or reinforced concrete because of its greatly extended service life. Perhaps the largest single expense involved in BMP facility maintenance will be the eventual repair or replacement of these parts of the BMP facility. The use of quality materials with a long service life should be used.

6. BMP Facility Maintenance Responsibility Guidelines

It is the current policy of Fulton County that all stormwater quality management BMPs and all stormwater detention facilities be maintained by the property owner. Maintenance agreements are therefore required in all cases where the owner is other than Fulton County. A maintenance schedule should be part of the BMP facility plan. A maintenance agreement which specifies the frequency of maintenance and which alerts the County of such maintenance activities is required. The County may maintain an inventory of privately maintained BMP facilities, inspections and performance of required maintenance. The County requires at a minimum a yearly inspection report on privately maintained BMP facilities by the owner(s) or a qualified profession representing the owner(s). The County requires stormwater management easements around all BMP/stormwater management facilities.

STATE OF GEORGIA **COUNTY OF FULTON**

Maintenance Agreement
(Sample)

WHEREAS, the Property Owner ____ recognizes that the wet or extended detention facility or facilities (hereinafter referred to as "the facility" or "facilities") must be maintained for the development called, ____________________ ___________________________ , located in Land Lot(s) ________ ,District(s) _______ , of Fulton County, Georgia; and,

WHEREAS, the Property Owner is the owner of real property more particularly described on the attached Exhibit A as recorded by deed in the records of the Clerk of Superior Court of Fulton County in Deed Book ______________ at Page(s)_____________ (hereinafter referred to as "the Property"), and,

WHEREAS, Fulton County (hereinafter referred to as "the County") and the Property Owner, or its administrators, executors, successors, heirs, or assigns, agree that the health, safety and welfare of the citizens of the County require that the facilities be constructed and maintained on the property, and,

WHEREAS, the facility or facilities as shown on the approved development plans and specifications be constructed and maintained by the Property Owner, its administrators, executors, successors, heirs, or assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

SECTION 1.

The facility or facilities shall be constructed by the Property Owner in accordance with the plans and specifications for the development as shown on the approved plans by the County.

SECTION 2.

The Property Owner, its administrators, executors, successors, heirs or assigns shall maintain the facility or facilities in good working condition acceptable to the County and in accordance with the schedule of long term maintenance activities agreed hereto and attached as

Exhibit B.

SECTION 3.

The Property Owner, its administrators, executors, successors, heirs or assigns hereby grants permission to the County, its authorized agents and employees, to enter upon the property and to inspect the facilities whenever the County deems necessary. Whenever possible, the County shall provide notice prior to entry. The Property Owner shall execute an access easement in favor of Fulton County to allow the County to inspect, observe, maintain, and repair the facility as deemed necessary. A fully executed original (example) easement is attached to this Agreement as Exhibit C and by reference made a part hereof.

SECTION 4.

In the event the Property Owner, its administrators, executors, successors, heirs or assigns fails to maintain the facility or facilities as shown on the approved plans and specifications in good working order acceptable to the County and in accordance with the maintenance schedule incorporated in this Agreement, the County, with due notice, may enter the property and take whatever steps it deems necessary to return the facility or facilities to good working order. This provision shall not be construed to allow the County to erect any structure of a permanent nature on the property. It is expressly understood and agreed that the County is under no obligation to maintain or repair the facility or facilities and in no event shall this Agreement be construed to impose any such obligation on the County.

SECTION 5.

In the event the County, pursuant to the Agreement, performs work of any nature, or expends any funds in the performance of said work for labor, use of equipment, supplies, materials, and the like, the Property Owner shall reimburse the County, or shall forfeit any required bond upon demand within thirty (30) days of receipt thereof for all the costs incurred by the County hereunder. If not paid within the prescribed time period, the County shall secure a lien against the real property in the amount of such costs. The actions described in this section are in addition to and not in lieu of any and all legal remedies available to the County as a result of the Property Owner's failure to maintain the facility or facilities.

SECTION 6.

It is the intent of this agreement to insure the proper maintenance of the facility or facilities by the Property Owner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or caused by stormwater runoff.

SECTION 7.

Sediment accumulation resulting from the normal operation of the facility or facilities will be catered for. The Property Owner will make accommodation for the removal and disposal of all accumulated sediments. Disposal will be provided onsite in a reserved area(s) or will be removed from the site. Reserved area(s) shall be sufficient to accommodate for a minimum of two dredging cycles.

SECTION 8.

The Property Owner shall provide the County with a bond or a letter of credit providing for the maintenance of the facility or facilities concerning Maintenance Agreements.

SECTION 9.

The Property Owner shall use the standard BMP Operation and Maintenance Inspection Report attached to this agreement as Exhibit E and by this reference made a part hereof for the purpose of a minimal annual inspection of the facility or facilities by a qualified inspector.

SECTION 10.

The Property Owner, its administrators, executors, successors, heirs and assigns hereby indemnifies and holds harmless Fulton County and its authorized agents and employees for any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the County from the construction, presence, existence or maintenance of the facility or facilities by the Property Owner or the County. In the event a claim is asserted against the County, its authorized agents or employees, the County shall promptly notify the Property Owner and the Property Owner shall defend at its own expense any suit based on such claim. If any judgement or claims against the County, its authorized agents or employees shall be allowed, the Property Owner shall pay for all costs and expenses in connection herewith.

SECTION 11.

This Agreement shall be recorded among the deed records of the Clerk of Superior Court of Fulton County and shall constitute a covenant running with the land and shall be binding on the Property Owner, its administrators, executors, heirs, assigns and any other successors in interest.

SECTION 12.

This Agreement may be enforced by proceedings at law or in equity by or against the parties hereto and their respective successors in interest.

SECTION 13.

Invalidation of any one of the provisions of this Agreement shall in no way effect any other provisions and all other provisions shall remain in full force and effect.

SECTION 14.

This agreement shall be governed in all respects as to validity, construction, capacity, performance or otherwise by the laws of the State of Georgia.

MAINTENANCE AGREEMENT
(Sample)

SO AGREED this ______________ day of __________________ , 19_____ .

PROPERTY OWNER

CORPORATION

____

Name of Corporation: _______________________________, A Georgia Corporation

BY: ______________________ Attest: ____________________________

Title: ______________________ Title: ____________________________
(President or Vice President) (Corporate Secretary or Corporate Secretary Assistant)

(CORPORATE SEAL)

FULTON COUNTY, GEORGIA.

Attest: _____________________
County Clerk

By : ______________________________
Chairman, Fulton County Board of Commissioners

(SEAL)

Attachments:

Exhibit A (Plat and Legal Description)
Exhibit B (Maintenance and Inspection Schedule)
Exhibit C (Access Easement)
Exhibit D (Standard BMP Operation and Maintenance Inspection Report)

MAINTENANCE AGREEMENT
(Sample)

SO AGREED this ______________ day of __________________ , 19_____ .

PROPERTY OWNER

PARTERSHIP

____

Name of Partnership: ________________________________, A Georgia General

Partnership Corporation

BY: ______________________ (Seal) Attest: _____________________________

Witness

Title: _______________________ Title: _________________________(Seal)
General Partner Notary Public

FULTON COUNTY, GEORGIA.

Attest: _____________________ By : _______________________________
County Clerk Chairman, Fulton County, Board of Commissioners

(SEAL)

Attachments:

Exhibit A (Plat and Legal Description)
Exhibit B (Maintenance and Inspection Schedule)
Exhibit C (Access Easement)
Exhibit D (Standard BMP Operation and Maintenance Inspection Report)

MAINTENANCE AGREEMENT
(Sample)

SO AGREED this ______________ day of __________________ , 19_____ .

PROPERTY OWNER

LIMITED LIABILITY CORPORATION

____

Name of LLC: ________________________________,

BY: ______________________ Attest: ____________________________

Witness
Title: _______________________ Title: _________________________(Seal)
Managing Person Notary Public

FULTON COUNTY, GEORGIA.

Attest: _____________________ By : ______________________________
County Clerk Chairman, Fulton County Board of Commissioners

(SEAL)

Attachments:

Exhibit A (Plat and Legal Description)
Exhibit B (Maintenance and Inspection Schedule)
Exhibit C (Access Easement)
Exhibit D (Standard BMP Operation and Maintenance Inspection Report)

FULTON COUNTY
INSPECTION CHECKLIST (SAMPLE)

BMP Facility Operation Maintenance Inspection Report for Pond Facilities
(THIS MAY BE USED AS A TEMPLATE FOR OTHER BMPs)

Project Name ______________________________ Project Number ____________

Inspector's Name ____________________________ Inspection Date ____________

Land Lot(s)/District __________________________ Tax Map ________________

Stormwater Pond ________ Normal Pool __________ Normally Dry ______________

Watershed/Water Resource Management Plan ________________________________

Inspection Frequency Key A = Annual M = Monthly S = After Major Storm

ITEMS INSPECTED	CHECKED YES	CHECKED NO	INSPECTION FREQUENCY	MAINTENANCE PERFORMED YES	MAINTENANCE PERFORMED NO	REMARKS
I. POND FACILITIES A. Pond Dam Enbankment and Emergency Spillways						
1. Vegetation and Ground Cover Adequate						
2. Embankment Erosion						
3. Animal Burrows						
4. Unauthorized Plating						
5. Cracking, Bulging, or Sliding of Dam						
a) Upstream						
b) Downstream						
c) At or Beyond Toe						
Upstream						
Downstream						
d) Emergency Spillway						
6. Pond, Toe & Chimney Drains Clear & Functioning						
7. Seeps/Leaks on Downstream Face						
8. Slope Protection or Riprap Failures						
9. Vertical and Horizontal Alignment of Top of Dam as Per "As-built" Plans						

ITEMS INSPECTED	CHECKED YES	CHECKED NO	INSPECTION FREQUENCY	MAINTENANCE PERFORMED YES	MAINTENANCE PERFORMED NO	REMARKS
9. Outfall Channels Functioning						
10. Other (Specify)						
C. Permanent Pool – Wet Ponds						
1. Undesirable Vegetative Growth						
2. Floating or Floatable Debris Removal Required						
3. Visible Pollution						
4. Shoreline Problems						
5. Other (Specify)						
D. Dry Pool Areas – Dry Pond						
1. Vegetation Adequate						
2. Undesirable Vegetative Growth						
3. Undesirable Woody Growth						
4. Low Flow Channels Clear of Obstructions						
5. Standing Water or Wet Spots						
6. Sediment and/or trash Accumulation						
7. Other (specify)						
E. Condition of Outfalls into Pond Area						
1. Rip Rap Failures						
2. Slope Invert Erosion						
3. Storm Drain Pipes						
4. Endwalls/Headwalls						
5. Other (Specify)						
F. Other						
1. Encroachment on Pond or Easement Area (Be Specific)						
2. Complaints from Local Residents (Describe on Back)						
3. Aesthetics						
a) Grass Mowing Required						

ITEMS INSPECTED	CHECKED YES	NO	INSPECTION FREQUENCY	MAINTENANCE PERFORMED YES	NO	REMARKS
b) Graffiti Removal Required						
c) Other (Specify)						
4. Any Public Hazards (Be Specific)						
5. Maintenance Access						

Inspection Frequency Key *A = Annual* *M = Monthly* *S = After Major Storm*

PERMANENT WATER QUALITY BMP AND ACCESS EASEMENT AGREEMENT

EXHIBIT "A" TO

MAINTENANCE AGREEMENT

SO AGREED this ____________________day of ________________________,year________.

PROPERTY OWNER

INDIVIDIUAL OF PROPERTY OWNED JOINTLY BY SEVERAL INSIVIDUAL

BY:____________________________________	Attest: _________________________
Signature	Signature
____________________________________	_________________________
Printed Name	Printed Name
BY:____________________________________	Attest: _________________________
Signature	Signature
____________________________________	_________________________
Printed Name	Printed Name
BY:____________________________________	Attest: _________________________
Signature	Signature
____________________________________	_________________________
Printed Name	Printed Name

Attachments: Exhibit 1 (Plat and Description of Easement)

APPENDIX C: WETLAND SPECIES

Dominant plant species in Georgia marsh associations

Primary Species

Species	Hydrologic Indicator
Nymphaea odorata(white water lily)	OBL
Nelumbo lutea (yellow lotus)	OBL
Potamogeton spp (pondweed)	OBL
Typha spp. (cattail)	OBL
Pontederia lanceolata (pickerelweed)	OBL
Sagittaria latifolia (arrowhead)	OBL
Carex spp. (sedges)	FACW to OBL
Juncus spp. (rushes)	FAC to OBL
Eleocharis spp. (spikerush)	FACW to OBL
Panicum hemitomon (maidencane)	OBL
Thalia geniculate (file flag)	OBL
Scirpus spp. (bulrush)	FACW to OBL
Rhynchospora spp. (breakrush)	FACW+ to OBL
Spartina bakeri (cordgrass)	FACW+
Dichromena colorata (white-topped sedge)	NL (FACW)
Hypericum fasciculatum (St. John's-wort)	FACW+

Common woody plants in Georgia swamps

Secondary Species

Species	Hydrologic Indicator
Conifers	
Chamaecyparis thyoides (Atlantic white cedar)	OBL
Pinis elliottii (slash pine)	FACW
P. serotina (pond pine)	FACW+
Taxodium distichum (cypress)	OBL

Palms	
Rhapidophyllum hystrix (needle palm)	FAXW
Sabal minor (bluestem; dwarf palmetto)	FACW
S. palmetto (cabbage palm)	FAC+
Hardwoods	
Acer rubrum (southern red maple)	FAC
Alnus serrulata (hazel alder)	FACW
Betula nigra (river birch)	FACW
Carpinus caroliniana (American hornbeam)	FAC
Carya aquatica (water hickory)	OBL
Cornus foemina (stiff cornel)	FACW-
Celtis laevigata (hackberry)	FACW
Fraxinus caroliniana (water ash)	OBL
F. pennsylvanica (green ash, red ash)	FACW
F. profunda (pumpkin ash)	OBL
Gordonia lasianthus (southern magnolia)	FACW
Liquidambar styraciflua (sweet gum)	FAC+
Magnolia grandiflora (southern magnolia)	FAC+
Magnolia virginiana (sweet bay magnolia)	FACW+
Nyssa aquatica (water tupelo)	OBL
N. sylvatica (black gum)	FAC
Platanus occidentalis (American sycamore)	FACW-
Populus deltoides (cottonwood)	FAC+
P. heterophylla (swamp cottonwood)	OBL
Quercus laurifolia (swamp laurel oak)	FACW
Q. michauxii (basket oak)	FACW-
Q. nigra (water oak)	FAC
Salix caroliniana (coastal plain willow)	OBL
S. nigra (black willow)	OBL
Ulmus americana (American elm)	FACW
Shrubs	
Aronia arbutifolia (red chokeberry)	FACW
Cephalanthus occidentalis (buttonbush)	OBL
Clethra alnifolia (sweet pepperbush)	FACW
Cornus amomum (silky dogwood)	FACW+
Crataegus aestivalis (may haw)	OBL
C. marshallii (parsley haw)	OBL
Cyrilla racemiflora (titi)	FACW
Ilex cassine (dahoon holly)	FACW
I. coriacea (large gallberry)	FACW
I. decidua (possum haw)	FACW-
I. glabra (gallberry)	FACW

I. myrtifolia (myrtle-leaf holly)	FACW
Itea virginica (Virginia willow)	FACW+
Leucothoe racemose (fetterbush)	FACW
Lyonia ferruginea (rusty lyonia)	FAC-
L. lucida (fetterbush)	FACW
Myrica cerifera (wax myrtle)	FAC+
M. heterophylla (northern bayberry)	FACW
Rhododendron viscosum (swamp honeysuckle)	OBL
Rubus argutus (blackberry)	FAC
R. betulifolius (blackberry)	NL
Sambucus canadensis (elderberry)	FACW-
Vaccinium corymbosum (highbush blueberry)	FACW
Viburnum nudum (swamp haw)	FACW+
V. obovatum (small viburnum, black haw)	FACW+

Vines

Ampelopsis arborea (pepper vine)	FAC+
Aster carolinianus (climbing aster)	OBL
Gelsemium sempervirens (yellow jassamine)	FAC
Smilax glauca (wild sarsaparilla)	FAC
S. laurifolia (bamboo-vine, carbrier)	FACW
S. walteri (coral greenbrier)	OBL
Vitis aestivalis (summer grape)	FAC-
Vitis rotundifolia (muscadine grape)	FAC

FAC Facultative hydrophyte - equally likely to be found in wetlands and uplands (34%-67% probability)
FACW Facultative wet hydrophyte usually found in wetlands (67%-99% probability)
OBL Obligate hydrophyte almost always found in wetlands
\+ Found more frequently in wetlands
\- Found less frequently in wetlands

*Selection of suitable plant species for constructed wetlands is site-specific, and should be undertaken by a qualified landscape architect or environmental consultant. Additional plant species not included in this list may be appropriate for specific constructed wetlands.

CODE AND ORDINANCE WORKSHEET

About the Adobe Acrobat Form

Note: Acrobat Reader will not save the information entered into a form. Saving changes is only possible with a full version of Acrobat.

- The blue fields indicate that an answer is required.
- The gray fields are for notes and are not required, but highly recommended.
- The green fields will automatically summarize the points – no input is needed here.

To fill out a form:

1. Select the hand tool.
2. Position the pointer inside a form field, and click. The I-beam pointer allows you to type text. If your pointer appears as a pointing finger, you can select an item from a list (i.e., YES or NO).
3. After entering text or making a selection, press Tab to accept the form field change and go to the next or previous field.
4. Once you have filled in the appropriate form fields, do both of the following:
   - Choose File > Export > Form Data to save the form data in a separate FDF file. Type a filename and click save.
   - Print the form so that you have a hard copy for your records.

And Most Importantly…
Send CWP a copy! Let us know how you did!

The Code and Ordinance Worksheet allows an in-depth review of the standards, ordinances, and codes (i.e., the development rules) that shape how development occurs in your community. You are guided through a systematic comparison of your local development rules against the model development principles. Institutional frameworks, regulatory structures and incentive programs are included in this review. The worksheet consists of a series of questions that correspond to each of the model development principles. Points are assigned based on how well the current development rules agree with the site planning benchmarks derived from the model development principles.

The worksheet is intended to guide you through the first two steps of a local site planning roundtable.

Step 1: Find out what the Development Rules are in your community.

Step 2: See how your rules stack up to the Model Development Principles.

The homework done in these first two steps helps to identify which development rules are potential candidates for change.

PREPARING TO COMPLETE THE CODE AND ORDINANCE WORKSHEET

Two tasks need to be performed before you begin in the worksheet. First, you must identify all the development rules that apply in your community. Second, you must identify the local, state, and federal authorities that actually administer or enforce the development rules within your community. Both tasks require a large investment of time. The development process is usually shaped by a complex labyrinth of regulations, criteria, and authorities. A team approach may be helpful. You may wish to enlist the help of a local plan reviewer, land planner, land use attorney, or civil engineer. Their real-world experience with the development process is often very useful in completing the worksheet.

Identify the Development Rules

Gather the key documents that contain the development rules in your community. A list of potential documents to look for is provided in Table 1. Keep in mind that the information you may want on a particular development rule is not always found in code or regulation, and maybe hidden in supporting design manuals, review checklists, guidance document or construction specifications. In most cases, this will require an extensive search. Few communities include all of their rules in a single document. Be prepared to contact state and federal, as well as local agencies to obtain copies of the needed documents.

Table 1: Key Local Documents that will be Needed to Complete the COW
Zoning Ordinance
Subdivision Codes
Street Standards or Road Design Manual
Parking Requirements
Building and Fire Regulations/Standards
Stormwater Management or Drainage Criteria
Buffer or Floodplain Regulations
Environmental Regulations
Tree Protection or Landscaping Ordinance
Erosion and Sediment Control Ordinances
Public Fire Defense Masterplans
Grading Ordinance

Identify Development Authorities

Once the development rules are located, it is relatively easy to determine which local agencies or authorities are actually responsible for administering and enforcing the rules. Completing this step will provide you with a better understanding of the intricacies of the development review process and helps identify key members of a future local roundtable. Table 2 provides a simple framework for identifying the agencies that influence development in your community. As you will see, space is provided not only for local agencies, but for state and federal agencies as well. In some cases, state and federal agencies may also exercise some authority over the local development process (e.g., wetlands, some road design, and stormwater).

USING THE WORKSHEET: HOW DO YOUR RULES STACK UP TO THE MODEL DEVELOPMENT PRINCIPLES?

Completing the Worksheet

Once you have located the documents that outline your development rules and identified the authorities responsible for development in your community, you are ready for the next step. You can now use the worksheet to compare your development rules to the model development principles. The worksheet is presented at the end of this chapter. The worksheet presents seventy-seven site planning benchmarks. The benchmarks are posed as questions. Each benchmark focuses on a specific site design practice, such as the minimum diameter of cul-de-sacs, the minimum width of streets, or the minimum parking ratio for a certain land use. You should refer to the codes, ordinances, and plans identified in the first step to determine the appropriate development rule. The questions require either a yes or no response or specific numeric criteria. If your development rule agrees with the site planning benchmark, you are awarded points.

Calculating Your Score

A place is provided on each page of the worksheet to keep track of your running score. In addition, the worksheet is subdivided into three categories:

- Residential Streets and Parking Lots (Principles No. 1 - 10)
- Lot Development (Principles No. 11 - 16)
- Conservation of Natural Areas (Principles No. 17 - 22).

For each category, you are asked to subtotal your score. This "**Time to Assess**" allows you to consider which development rules are most in line with the site planning benchmarks and what rules are potential candidates for change.

The total number of points possible for all of the site planning benchmarks is 100. Your overall score provides a general indication of your community's ability to support environmentally sensitive development. As a general rule, if your overall score is lower than 80, then it may be advisable to systematically reform your local development rules. A score sheet is provided at end of the Code and Ordinance Worksheet to assist you in determining where your community's score places in respect to the Model Development Principles. Once you have completed the worksheet, go back and review your responses. Determine if there are specific areas that need improvement (e.g., development rules that govern road design) or if your development rules are generally pretty good. This review is key to implementation of better development: assessment of your current development rules and identification of impediments to innovative site design. This review also directly leads into the next step: a site planning roundtable process conducted at the local government level. The primary tasks of a local roundtable are to systematically review existing development rules and then determine if changes can or should be made. By providing a much-needed framework for overcoming barriers to better development, the site planning roundtable can serve as an important tool for local change.

Table 2: Local, State, and Federal Authorities Responsible for Development in Your Community				
Development Responsibility		**State/Federal**	**County**	**Town**
Sets road standards	Agency:	GA DOT	FC DPW	
	Contact Name:	Bryant Poole	Richard Coates	
	Phone No.:	770-986-1001	404-612-7400	
Review/approves subdivision plans	Agency:		FC ECD	
	Contact Name:		Dick Wilcox	
	Phone No.:		404-612-7474	
Establishes zoning ordinances	Agency:	GA DCA	FC ECD	
	Contact Name:	Jon West	Randy Beck	
	Phone No.:	404-679-5279	404-612-8053	
Establishes subdivision ordinances	Agency:	GA DCA	FC ECD	
	Contact Name:	Jon West	Randy Bec	
	Phone No.:	404-679-5279	404-612-8053	
Reviews/establishes stormwater management or drainage criteria	Agency:	GA EPD	FC ECD & PW	
	Contact Name:	Linda MacGregor	Dick Wilcox	
	Phone No.:	404-675-6232	404-612-7474	
Provides fire protection and fire protection code enforcement	Agency:		FC FD	
	Contact Name:		Chief Larry Few	
	Phone No.:		404-612-5720	
Oversees buffer ordinance	Agency:	ARC / EPD	FC ECD	
	Contact Name:	Pat Stevens	Dick Wilcox	
	Phone No.:	404-463-3100	404-612-7474	
Oversees wetland protection	Agency:	ARC / EP	FC ECD	
	Contact Name:	Pat Stevens	Dick Wilcox	
	Phone No.:	404-463-3100	404-612-7474	
Establishes grading requirements or oversees erosion and sediment control program	Agency:	GA EPD	FC ECD	
	Contact Name:	Linda MacGregor	Dick Wilcox	
	Phone No.:	404-675-6232	404-612-7474	
Reviews/approves septic systems	Agency:		FC Health and Wellness	
	Contact Name:		Kevin Jones	
	Phone No.:		404-730-1301	
Review/approves utility plans (e.g., water and sewer)	Agency:		FC ECD	
	Contact Name:		Dick Wilcox	
	Phone No.:		404-612-7474	
Reviews/approves forest conservation/ tree protection plans	Agency:		FC ECD	
	Contact Name:		Gene Gallaway	
	Phone No.:		404-612-7531	

Development Feature	*Your Local Criteria*

1. Street Width

What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 daily trips (ADT)? 20 feet

*If your answer is between **18-22 feet**, give yourself **4** points • •* 4

At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)? YES

*If your answer is **YES**, give yourself **3** points • •* 3

Notes on Street Width (include source documentation such as name of document, section and page #):

FC Driveway Manual Pg. 7, Traffic Regs.

2. Street Length

Do street standards promote the most efficient street layouts that reduce overall street length? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Notes on Street Length (include source documentation such as name of document, section and page #):

Fire Dept Regs.

3. Right-of-Way Width

What is the minimum right of way (ROW) width for a residential street? 43 feet

*If your answer is **less than 45 feet**, give yourself **3** points • •* 3

Does the code allow utilities to be placed under the paved section of the ROW? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Notes on ROW Width (include source documentation such as name of document, section and page #):

FC Driveway Manual Pg. 20

4. Cul-de-Sacs

What is the minimum radius allowed for cul-de-sacs? 32 feet

*If your answer is **less than 35 feet**, give yourself **3** points • •*

*If your answer is **36 feet to 45 feet**, give yourself **1** point • •* 3

Can a landscaped island be created within the cul-de-sac? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Are alternative turnarounds such as "hammerheads" allowed on short streets in low density residential developments? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Notes on Cul-de-Sacs (include source documentation such as name of document, section and page #):

FC Sub-Division Regulations Section 7.5.2

 Subtotal Page 5 **17**

5. Vegetated Open Channels

Are curb and gutters required for most residential street sections? **YES**

*If your answer is **NO**, give yourself **2** points • •* **0**

Are there established design criteria for swales that can provide stormwater quality treatment (i.e., dry swales, biofilters, or grass swales)? **YES**

*If your answer is **YES**, give yourself **2** points • •* **2**

Notes on Vegetated Open Channel (include source documentation such as name of document, section and page #):

Manual for Erosion & Sediment Control in Georgia Pg. 6-57

6. Parking Ratios

What is the minimum parking ratio for a professional office building (per 1000 ft^2 of gross floor area)? **3.0** spaces

*If your answer is **less than 3.0 spaces**, give yourself **1** point • •* **0**

What is the minimum required parking ratio for shopping centers (per 1,000 ft^2 gross floor area)? **5.0** spaces

*If your answer is **4.5 spaces or less**, give yourself **1** point • •* **0**

What is the minimum required parking ratio for single family homes (per home)? **2.0** spaces

*If your answer is **less than or equal to 2.0 spaces**, give yourself **1** point • •* **1**

Are your parking requirements set as maximum or median (rather than minimum) requirements? **NO**

*If your answer is **YES**, give yourself **2** points • •* **0**

Notes on Parking Ratios (include source documentation such as name of document, section and page #):

Zoning Resolution Article 18.2.1

7. Parking Codes

Is the use of shared parking arrangements promoted? **YES**

*If your answer is **YES**, give yourself **1** point • •* **1**

Are model shared parking agreements provided? **YES**

*If your answer is **YES**, give yourself **1** point • •* **1**

Are parking ratios reduced if shared parking arrangements are in place? **YES**

*If your answer is **YES**, give yourself **1** point • •* **1**

If mass transit is provided nearby, is the parking ratio reduced? **YES**

*If your answer is **YES**, give yourself **1** point • •* **1**

Notes on Parking Codes (include source documentation such as name of document, section and page #):

Zoning Resolution Article 18.2.2

Code and Ordinance Worksheet *Subtotal Page 6* **7**

8. Parking Lots

What is the minimum stall width for a standard parking space? 8.5 feet

*If your answer is **9 feet or less**, give yourself **1** point • •* 1

What is the minimum stall length for a standard parking space? 18.0 feet

*If your answer is **18 feet or less**, give yourself **1** point • •* 1

Are at least 30% of the spaces at larger commercial parking lots required to have smaller dimensions for compact cars? NO

*If your answer is **YES**, give yourself **1** point • •* 0

Can pervious materials be used for spillover parking areas? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Notes on Parking Lots (include source documentation such as name of document, section and page #):

FC Zoning Regs. Interpretation Oct. 2006, FC Zoning Reg. 18.4.1

9. Structured Parking

Are there any incentives to developers to provide parking within garages rather than surface parking lots? NO

*If your answer is **YES**, give yourself **1** point • •* 0

Notes on Structured Parking (include source documentation such as name of document, section and page #):

None

10. Parking Lot Runoff

Is a minimum percentage of a parking lot required to be landscaped? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Is the use of bioretention islands and other stormwater practices within landscaped areas or setbacks allowed? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Notes on Parking Lot Runoff (include source documentation such as name of document, section and page #):

If pre-approved by County Arborist

Subtotal Page 7 **8**

Development Feature	Your Local Criteria

• • **Time to Assess:** Principles 1 - 10 focused on the codes, ordinances, and standards that determine the size, shape, and construction of parking lots, roadways, and driveways in the suburban landscape. There were a total of **40** points available for Principles 1 - 10. What was your total score?

Subtotal Page 5 [17] + Subtotal Page 6 [7] + Subtotal Page 7 [8] = **32**

Where were your codes and ordinances most in line with the principles? What codes and ordinances are potential impediments to better development?

In line - All except parking
Impediment - Parking Ratios

11. Open Space Design

Are open space or cluster development designs allowed in the community? YES
*If your answer is **YES**, give yourself **3** points* • • 3
*If your answer is **NO**, skip to question No. 12*

Is land conservation or impervious cover reduction a major goal or objective of the open space design ordinance? YES
*If your answer is **YES**, give yourself **1** point* • • 1

Are the submittal or review requirements for open space design greater than those for conventional development? NO
*If your answer is **NO**, give yourself **1** point* • • 1

Is open space or cluster design a by-right form of development? YES
*If your answer is **YES**, give yourself **1** point* • • 1

Are flexible site design criteria available for developers that utilize open space or cluster design options (e.g., setbacks, road widths, lot sizes) YES
*If your answer is **YES**, give yourself **2** points* • • 2

Notes on Open Space Design (include source documentation such as name of document, section and page #):

Subdivision Regs; Art VI

12. Setbacks and Frontages

Are irregular lot shapes (e.g., pie-shaped, flag lots) allowed in the community?	YES	
If your answer is ***YES****, give yourself* ***1*** *point • •*	1	
What is the minimum requirement for front setbacks for a one half (½) acre residential lot?	50.0	feet
If your answer is ***20 feet or less****, give yourself* ***1*** *point • •*	0	
What is the minimum requirement for rear setbacks for a one half (½) acre residential lot?	35.0	feet
If your answer is ***25 feet or less****, give yourself* ***1*** *point • •*	0	
What is the minimum requirement for side setbacks for a one half (½) acre residential lot?	10.0	feet
If your answer is ***8 feet or less****, give yourself* ***1*** *points • •*	0	
What is the minimum frontage distance for a one half (½) acre residential lot?	35.0	feet
If your answer is ***less than 80 feet****, give yourself* ***2*** *points • •*	2	

Notes on Setback and Frontages (include source documentation such as name of document, section and page #):

Zoning Resolution Article 6.4, Sub Div Regs Article 7.4

13. Sidewalks

What is the minimum sidewalk width allowed in the community?	5.0	feet
If your answer is ***4 feet or less****, give yourself* ***2*** *points • •*	0	
Are sidewalks always required on both sides of residential streets?	NO	
If your answer is ***NO****, give yourself* ***2*** *points • •*	2	
Are sidewalks generally sloped so they drain to the front yard rather than the street?	NO	
If your answer is ***YES****, give yourself* ***1*** *point • •*	0	
Can alternate pedestrian networks be substituted for sidewalks (e.g., trails through common areas)?	YES	
If your answer is ***YES****, give yourself* ***1*** *point • •*	1	

Notes on Sidewalks (include source documentation such as name of document, section and page #):

Subdivision Regulations Art 8.2.4, Sections B&C

14. Driveways

What is the minimum driveway width specified in the community?	14.0	feet
If your answer is ***9 feet or less (one lane) or 18 feet (two lanes)****, give yourself* ***2*** *points • •*	2	

Can pervious materials be used for single family home driveways (e.g., grass, gravel, porous pavers, etc)? — YES

*If your answer is **YES**, give yourself **2** points • •* — 2

Can a "two track" design be used at single family driveways? — NO

*If your answer is **YES**, give yourself **1** point • •* — 0

Are shared driveways permitted in residential developments? — YES

*If your answer is **YES**, give yourself **1** point • •* — 1

Notes on Driveways (include source documentation such as name of document, section and page #):

FC Zoning Reg Interpretation Oct. 2006

15. Open Space Management

Skip to question 16 if open space, cluster, or conservation developments are not allowed in your community.

Does the community have enforceable requirements to establish associations that can effectively manage open space? — YES

*If your answer is **YES**, give yourself **2** points • •* — 2

Are open space areas required to be consolidated into larger units? — YES

*If your answer is **YES**, give yourself **1** point • •* — 1

Does a minimum percentage of open space have to be managed in a natural condition? — YES

*If your answer is **YES**, give yourself **1** point • •* — 1

Are allowable and unallowable uses for open space in residential developments defined? — YES

*If your answer is **YES**, give yourself **1** point • •* — 1

Can open space be managed by a third party using land trusts or conservation easements? — YES

*If your answer is **YES**, give yourself **1** point • •* — 1

Notes on Open Space Management (include source documentation such as name of document, section and page #):

Subdivision Regs Art VI

16. Rooftop Runoff

Can rooftop runoff be discharged to yard areas? — YES

*If your answer is **YES**, give yourself **2** points • •* — 2

Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops? — YES

*If your answer is **YES**, give yourself **2** points • •* — 2

Notes on Rooftop Runoff (include source documentation such as name of document, section and page #):

FC Sub Reg 8.5.3 Sec C

Code and Ordinance Worksheet *Subtotal Page 10* — 13

• • **Time to Assess:** Principles 11 through 16 focused on the regulations which determine lot size, lot shape, housing density, and the overall design and appearance of our neighborhoods. There were a total of **36** points available for Principles 11 - 16. What was your total score?

Subtotal Page 8 [8] + Subtotal Page 9 [8] + Subtotal Page 10 [13] = [29]

Where were your codes and ordinances most in line with the principles? What codes and ordinances are potential impediments to better development?

Impediments: sidewalks, setbacks, frontages & driveways

Note: Have issue with small frontage and setback requirements. Believe strongly these are counter productive for GI/LID.

17. Buffer Systems

Is there a stream buffer ordinance in the community? YES

*If your answer is **YES**, give yourself **2** points • •* 2

If so, what is the minimum buffer width? 75.0 feet

*If your answer is **75 feet or more**, give yourself **1** point • •* 1

Is expansion of the buffer to include freshwater wetlands, steep slopes or the 100-year floodplain required? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Notes on Buffer Systems (include source documentation such as name of document, section and page #):

Art VII, Section 26-439 FC Stream Buffer Protection Ordinance

18. Buffer Maintenance

If you do not have stream buffer requirements in your community, skip to question No. 19

Does the stream buffer ordinance specify that at least part of the stream buffer be maintained with native vegetation? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Does the stream buffer ordinance outline allowable uses? YES

*If your answer is **YES**, give yourself **1** point* 1

Code and Ordinance Worksheet *Subtotal Page 11* 7

Does the ordinance specify enforcement and education mechanisms? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Notes on Buffer Systems (include source documentation such as name of document, section and page #):

Art VII Sec 26-432 FC Stream Buffer Protection Ordinance

19. Clearing and Grading

Is there any ordinance that requires or encourages the preservation of natural vegetation at residential development sites? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Do reserve septic field areas need to be cleared of trees at the time of development? NO

*If your answer is **NO**, give yourself **1** point • •* 1

Notes on Buffer Maintenance (include source documentation such as name of document, section and page #):

20. Tree Conservation

If forests or specimen trees are present at residential development sites, does some of the stand have to be preserved? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Are the limits of disturbance shown on construction plans adequate for preventing clearing of natural vegetative cover during construction? YES

*If your answer is **YES**, give yourself **1** point • •* 1

Notes on Tree Conservation (include source documentation such as name of document, section and page #):

Zoning Resolution 34.4.1.d and the FC Tree Preservation Ordinance

21. Land Conservation Incentives

Are there any incentives to developers or landowners to conserve non-regulated land (open space design, density bonuses, stormwater credits or lower property tax rates)? NO

*If your answer is **YES**, give yourself **2** points • •* 0

Is flexibility to meet regulatory or conservation restrictions (density compensation, buffer averaging, transferable development rights, off-site mitigation) offered to developers? YES

*If your answer is **YES**, give yourself **2** points • •* 2

Notes on Land Cons. Incentives (include source documentation such as name of document, section and page #):

FC Sub Reg Art 6.10

22. Stormwater Outfalls

Is stormwater required to be treated for quality before it is discharged? YES

*If your answer is **YES**, give yourself **2** points* • • 2

Are there effective design criteria for stormwater best management practices (BMPs)? YES

*If your answer is **YES**, give yourself **1** point* • • 1

Can stormwater be directly discharges into a jurisdictional wetland without pretreatment? NO

*If your answer is **NO**, give yourself **1** point* • • 1

Does a floodplain management ordinance that restricts or prohibits development within the 100-year floodplain exist? YES

*If your answer is **YES**, give yourself **2** points* • • 2

Notes on Stormwater Outfalls (include source documentation such as name of document, section and page #):

Georgia Stormwater Management Manual Volume 2 Sections 1.2, 1.3, 3.2 & 3.3, Fulton County

Code and Ordinance Worksheet *Subtotal Page 13* **6**

• • **Time to Assess:** Principles 17 through 22 addressed the codes and ordinances that promote (or impede) protection of existing natural areas and incorporation of open spaces into new development. There were a total of 24 points available for Principles 17 - 22. What was your total score?

Subtotal Page 11 7 + Subtotal Page 12 9 + Subtotal Page 13 6 = **22**

Where were your codes and ordinances most in line with the principles? What codes and ordinances are potential impediments to better development?

In-line - all but developer incentives

To determine final score, add up subtotal from each • **Time to Assess**

Principles 1 - 10 (Page 8)	32
Principles 11 - 16 (Page 11)	29
Principles 17 - 22 (Page 13)	22

TOTAL **83**

SCORING (A total of **100** points are available):	
Your Community's Score	
90- 100	• Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work.
80 - 89	• Your local development rules are pretty good, but could use some tweaking in some areas.
79 - 70	• Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60 - 69	• Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
less than 60	• Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

ARTICLE II. - EROSION, SEDIMENTATION AND POLLUTION CONTROL

FOOTNOTE(S):

--- (**3**) ---

Editor's note— Res. No. 05-0690, adopted June 15, 2005, amended art. II in its entirety to read as herein set out. Formerly, said article pertained to similar subject matter. See the Code Comparative Table for a detailed analysis of amendment.

Sec. 26-35. - Authority and title of article.

This article is adopted by the Fulton County Board of Commissioners pursuant to the authority and mandate of the Georgia Erosion and Sedimentation Act of 1975 (O.C.G.A. § 12-7-1 et seq.), as amended. [A memorandum of agreement authorizes Fulton County as a local issuing authority. As a local issuing authority, Fulton County is certified to provide and maintain an erosion control program which includes, but is not limited to, development plan review, permitting and erosion control enforcement.] This article will be known as "The Fulton County Soil Erosion, Sedimentation and Pollution Control Ordinance of 2010", and repeals the Fulton County Soil Erosion and Sedimentation Control Ordinance of 2005 and any other ordinances or regulations in conflict herewith.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-36. - Intent.

It is the intent of this article to establish soil erosion, sedimentation, and pollution control minimum requirements, standards, and enforcement procedures for land disturbance activities in order to conserve and protect the environment, public health, and the general welfare of the citizens of unincorporated Fulton County.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-38. - Exemptions to article.

This article shall apply to any land disturbing activity undertaken by any person on any land except for the following:

(1) Surface mining, as the same is defined in O.C.G.A. § 12-4-72, "The Georgia Surface Mining Act of 1968".

(2) Granite quarrying and land clearing for such quarrying;

(3) Such minor land disturbing activities as home gardens and individual home landscaping, repairs, maintenance work, fences and other related activities which result in minor soil erosion;

(4) The construction of single-family residences when such construction disturbs less than one acre and is not a part of a larger common plan of development or sale with a planned disturbance of equal to or greater than one acre and not otherwise exempted under this section; provided, however, that construction of any such residence shall conform to the minimum requirements as set forth in O.C.G.A. § 12-7-6 and this paragraph. For single-family residence construction covered by provisions of this, there shall be a buffer zone between the residence and any state waters classified as trout streams pursuant to O.C.G.A. tit. 12, ch. 5, art. 2, the Georgia Water Quality Control Act. In any such buffer, no land-disturbing activity shall be constructed between the residence and the point where vegetation has been wrested by normal stream flow or wave action from the banks of the trout waters. For primary trout waters, the buffer zone shall be at least 50 horizontal feet, and no variance to a smaller buffer shall be granted. For secondary trout waters, the buffer zone shall be at least 50 horizontal feet, but the director, EPD may grant variances to no less than 25 feet. Regardless of whether a trout stream is primary or secondary,

for first order trout waters, which are streams into which no other streams flow except for springs, the buffer shall be at least 25 horizontal feet, and no variance to smaller buffer shall be granted. The minimum requirements of section 26-39 of this article and the buffer zones provided by this section shall be enforced by the issuing authority;

(5) Agricultural operations as defined in O.C.G.A. § 1-3-3 to include raising, harvesting, or storing of products of the field or orchard; feeding, breeding, or managing livestock or poultry; producing or storing feed for use in the production of livestock including, but not limited to, cattle, calves, swine, hogs, goats, sheep, and rabbits or for use in the production of poultry, including but not limited to chicken, hens and turkeys; producing plants, trees, fowl, or animals; the production of aquaculture, horticultural, dairy, livestock, poultry, eggs, and apiarian products; and farm buildings and farm ponds;…..

(6) Forestry land management practices, including harvesting; provided, however, that when such exempt forestry practices cause or result in land-disturbing or other activities otherwise prohibited in a buffer, as established in paragraphs (14) and (15) of section 26-39(c), no other land-disturbing activities, except for normal forest management practices, shall be allowed on the entire property upon which the forestry practices were conducted for a period of three years after completion of such forestry practices;

(7) Any project carried out under the technical supervision of the Natural Resource Conservation Service (NRCS) of the United States Department of Agriculture;

(8) Any project involving less than one acre of disturbed area; provided, however, that this exemption shall not apply to any land disturbing activity within a larger common plan of development or sale with a planned disturbance equal to or greater than one acre or within 200 feet of the bank of any state waters, and for purposes of this paragraph, "state waters" excludes channels and drainage ways which have water in them only during and immediately after rainfall events and intermittent streams which do not have water in them year round; provided, however, that any person responsible for a project which involves one acre or less, which involves land disturbing activity, and which is within 200 feet of any such excluded channel or drainage way, must prevent sediment from moving beyond the boundaries of the property on which such project is located and provided, further, that nothing herein shall prevent the local issuing authority from regulating any such project which is not specifically exempted by paragraphs (1), (2), (3), (4), (5), (6), (7), (9) or (10) of the section;

(9) Construction or maintenance projects, or both, undertaken or financed, in whole or in part, or both, by the Department of Transportation, the Georgia Highway Authority, or the State Road and Tollway Authority; or any road construction or maintenance project, or both, undertaken by any county or municipality; provided, however, that construction or maintenance projects of the department of transportation or state road and tollway authority which disturb one or more contiguous acres of land shall be subject to provisions of O.C.G.A. § 12-7-7.1; except where the department of transportation, the Georgia Highway Authority, or the state road and tollway authority is a secondary permittee for a project located within a larger common plan of development or sale under the state general permit, in which case a copy of a notice of intent under the state general permit shall be submitted to the local issuing authority, the local issuing authority shall enforce compliance with the minimum requirements set forth in O.C.G.A. § 12-7-6 as if a permit had been issued, and violations shall be subject to the same penalties as violations by permit holders;

(10) Any land disturbing activities conducted by any electric membership corporation or municipal electrical system or any public utility under the regulatory jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in O.C.G.A. § 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission, or distribution of power; except where an electric membership corporation or municipal electric system or any public utility under the regulatory jurisdiction of the public service commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in O.C.G.A. § 36-18-1, or any agency or instrumentality of the United States

engaged in the generation, transmission, or distribution of power is a secondary permittee for a project located within a larger common plan of development or sale under the state general permit, in which case the local issuing authority shall enforce compliance with the minimum requirements set forth in O.C.G.A. § 12-7-6 as if a permit had been issued and violations shall be subject to the same penalties as violations by permit holders; and

(11) Any public water system reservoir.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

State law reference— Exemptions, O.C.G.A. § 12-7-17.

Sec. 26-39. - Minimum requirements.

(a) *General provisions.* Excessive soil erosion and resulting sedimentation can take place during land disturbing activities if requirements of the article and the NPDES general permit are not met. Therefore, plans for those land disturbing activities which are not exempted by this article shall contain provisions for application of soil erosion, sedimentation, and pollution control measures and practices. The provisions shall be incorporated into the erosion, sedimentation, and pollution control plans. Soil erosion, sedimentation, and pollution control measures and practices shall conform to the minimum requirements of subsection (b) and (c) of this section. The application of measures and practices shall apply to all features of the site, including street and utility installations, drainage facilities and other temporary and permanent improvements. Measures shall be installed to prevent or control erosion, sedimentation and pollution during all stages of any land disturbing activity in accordance with requirements of this article and the NPDES general permit.

(b) *Minimum requirements/BMPs.*

(1) Best management practices as set forth in subsections (b) and (c) of this section shall be required for all land disturbing activities. Proper design, installation, and maintenance of BMPs shall constitute a complete defense to any action by the director or to any other allegation of noncompliance with subsection (b)(2) of this section or any substantially similar terms contained in a permit for the discharge of stormwater issued pursuant to O.C.G.A. § 12-5-30(f) of the "Georgia Water Quality Control Act". As used in this subsection, the terms "proper design" and "properly designed" mean designed in accordance with the hydraulic design specifications contained in the "Manual for Erosion and Sediment Control in Georgia" specified in O.C.G.A. § 12-7-6(b).

(2) A discharge of stormwater runoff from disturbed areas where BMPs have not been properly designed, installed, and maintained shall constitute a separate violation of any land disturbing permit issued by Fulton County or of any state general permit issued by the division pursuant to O.C.G.A. § 12-5-30(f), the "Georgia Water Quality Control Act" for each day on which such discharge results in the turbidity of receiving waters being increased by more than 25 nephelometric turbidity units for waters supporting warm water fisheries or by more than ten nephelometric turbidity units for waters classified as trout waters. The turbidity of the receiving waters shall be measured in accordance with guidelines issued by the director, EPD. This paragraph shall not apply to any land disturbance associated with the construction of single-family homes which are not part of a larger common plan of development or sale unless the planned disturbance for such construction is equal to or greater than five acres.

(3) Failure to properly design, install, or maintain BMPs shall constitute a violation of any land disturbance permit issued by a local issuing authority or of any state general permit issued by the division pursuant to O.C.G.A. § 12-5-30(f), The "Georgia Water Quality Control Act" for each day on which such failure occurs. When such non-compliance is identified by the director, official notice will be posted on that property.

(4) The director may require, in accordance with regulations adopted by the board, reasonable and prudent monitoring of the turbidity level of receiving waters into which discharges from land disturbing activities occur.

(5) The LIA may set more stringent buffer requirements than stated in subsections (c)(15) and (16) in light of O.C.G.A. § 12-7-6(c).

(c) The rules and regulations, ordinances, or resolutions adopted pursuant to O.C.G.A. § 12-7-1 et seq. for the purpose of governing land-disturbing activities shall require, as a minimum, protections at least as stringent as the state general permit; and BMPs, including sound conservation and engineering practices to prevent and/or minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia," published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land disturbing activity was permitted, as well as the following:

(1) Stripping of vegetation, regrading and other development activities shall be conducted in a manner so as to minimize erosion.

(2) Cut-fill operations must be kept to a minimum.

(3) Development plans must conform to topography and soil type so as to create the lowest practicable erosion potential.

(4) When ever feasible, natural vegetation shall be retained, protected and supplemented.

(5) The disturbed area and the duration of exposure to erosive elements shall be kept to practical minimum;

(6) Disturbed soil shall be stabilized as quick as practicable;

(7) Temporary vegetation or mulching shall be employed to protect exposed critical areas during development;

(8) Permanent vegetation and structural erosion control measures shall be installed as soon as practicable;

(9) To the extent necessary, sediment in runoff water must be trapped by the use of debris basins, sediment basins, silt traps, or similar BMPs as outlined in the erosion and sediment control manual until the disturbed area is stabilized. As used in this paragraph, a disturbed area is stabilized when it is brought to a condition of continuous compliance with the requirements of this section, and O.C.G.A. § 12-7-1 et seq.

(10) Adequate provisions must be provided to minimize damage from surface water to the cut face of excavations or the sloping of fills.

(11) Cuts and fills may not endanger adjoining property;

a. All slopes shall be stabilized immediately and shall remain so for a period of no less than one year from the issuance of the project's final certificate of occupancy and/or the recording of a final plat.

b. All slopes greater than or equal to 3H:1V must be permanently stabilized with structural or vegetative BMPs.

c. A plan must be submitted to demonstrate that all slopes associated with fill/cut sections have been adequately designed to be stabilized structurally (such as retaining walls) or vegetatively (erosion mat/blanket, tree bark mulch, etc). Such analysis, reports, or design shall be prepared and approved by a design professional.

(12) Fills may not encroach upon natural watercourses or constructed channels in a manner so as to adversely affect other property owners;

(13) Grading equipment must cross flowing streams by means of temporary or permanent bridges or culverts except when such methods are not feasible, provided, in any case, those such crossings are kept to a minimum. Migrated soil materials or soil materials displaced by mechanical means from land disturbing sites to adjacent water courses, such as lakes, ponds, streams, and creeks etc. must be remediated. The remedial work shall be conducted as per a remedial plan approved by Fulton County.

(14) Land-disturbing activity plans for erosion, sedimentation and pollution control shall include provisions for treatment or control of any source of sediments and adequate sedimentation control facilities to retain sediments on-site or preclude sedimentation of adjacent waters beyond the levels specified in section 26-39(b)(2).

(15) Except as provided in paragraph (16) of this section, there is established a 25-foot buffer along the banks of all state waters, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, except where the director, EPD determines to allow a variance that is at least as protective of natural resources and the environment, where otherwise allowed by the director, EPD pursuant to O.C.G.A. § 12-2-8, or where a drainage structure or a roadway drainage structure must be constructed, provided that adequate erosion control measures are incorporated in the project plans and specifications are implemented or along any ephemeral stream. As used in this provision, the term 'ephemeral stream' means a stream: that under normal circumstances has water flowing only during and for a short duration after precipitation events; that has the channel located above the ground-water table year round; for which runoff from precipitation is the primary source of water flow, Unless exempted as along an ephemeral stream, the buffers of at least 25 feet established pursuant to part 6 of Article 5, Chapter 5 of Title 12, the "Georgia Water Quality Control Act shall remain in force unless a variance is granted by the director, EPD as provided in this subsection. The following requirements shall apply to any such buffer:

a. No land disturbance activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed state of vegetation until all land-disturbing activities on the construction site are completed, except as otherwise provided by this paragraph.

   Once the final stabilization of the site is achieved, a buffer may be thinned or trimmed of vegetation as long as a protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed; provided, however, that any person constructing a single-family residence, when such residence is constructed by or under contract with the owner for his or her own occupancy, may thin or trim vegetation in a buffer at any time as long as protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed; and

b. The buffer shall not apply to the following land-disturbing activities, provided that they occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream; cause a width of disturbance of not more than 50 feet within the buffer; and adequate erosion control measures are incorporated into the project plans and specifications and are implemented: (i) stream crossings for water lines; or (ii) stream crossings for sewer lines; and

(16) There is established a 50-foot buffer as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, along the banks of any state waters classified as "trout streams" pursuant to Article 2 of Chapter 5 of Title 12, the "Georgia Water Quality Control Act", except where a roadway drainage structure must be constructed; provided, however, that small springs and steams classified as trout streams which discharge an average annual flow of 25 gallons per minute or less shall have a 25-foot buffer or they may be piped, at the discretion of the landowner, pursuant to the terms of a rule providing for a general variance promulgated by the board, so long as any such pipe stops short of the downstream landowner's property and the landowner complies with the buffer requirement for any adjacent trout streams. The director, EPD may grant a variance from such buffer to allow land-disturbing activity,

provided that adequate erosion control measures are incorporated in the project plans and specifications and are implemented. The following requirements shall apply to such buffer:

a. No land-disturbance activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed state of vegetation until all land-disturbing activities on the construction site are completed.

   Once the final stabilization of the site is achieved, a buffer may be thinned or trimmed of vegetation as long as a protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed; provided, however, that any person constructing a single-family residence, when such residence is constructed by or under contract with the owner for his or her own occupancy, may thin or trim vegetation in a buffer at any time as long as protective vegetation cover remains to protect water quality and aquatic habitat and natural canopy is left in sufficient quality to keep shade on the stream bed; and

b. The buffer shall not apply to the following land-disturbing activities, provided that they occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream; cause a width of disturbance of not more than 50 feet within the buffer; and adequate erosion control measures are incorporated into the project plans and specifications and are implemented: (i) stream crossings for water lines; or (ii) stream crossings for sewer lines.

c. Nothing contained in this chapter shall prevent any local issuing authority from adopting rules and regulations, ordinances, or resolutions which contain stream buffer requirements that exceed the minimum requirements in subsections 26-39(b) and (c).

d. The fact that land-disturbing activity for which a permit has been issued results in injury to the property of another shall neither constitute proof of nor create a presumption of a violation of the standards provided for in this article or terms of the permit.

e. Additional requirements. Where the director finds, through inspection, that property owners have been adversely affected due to violations clearly identified by the director, or that the approved current plans do not adequately address the features of the site, the director can require additional BMPs, drawings, and revisions to comply with the minimum requirements as outlined in section 26-39

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-40. - Land disturbance application/permit process.

(a) *General.* The property owner, developer, and designated planners and engineers shall design and review before submittal of the general development plans. They shall review the zoning resolution, stormwater management ordinance, subdivision ordinance, flood damage prevention resolution, this article, and other ordinances which regulate the development of land within the jurisdictional boundaries of unincorporated Fulton County. However, the property owner or operator are the only parties who may obtain a permit.

(b) *Application requirements.*

   (1) Prior to any land disturbing activity, the property in question must be part of an approved and recorded legal lot of record (exemption plat or final plat). Additionally, no land disturbing activity, including grading, excavating, filling, and/or foundation work, shall be conducted within the unincorporated area of Fulton County or in any area where Fulton County has jurisdiction, until a land disturbance permit or a building permit (for those projects not requiring a land disturbance permit under this article) shall have been issued by the director allowing such activity and providing a copy of notice of intent submitted to EPD if applicable. If a project is to be developed in phases, then a separate land disturbance permit or building permit is required for each phase not to exceed 25 acres increments and the development sequence should be followed on all projects issued a land disturbance permit.

(2) No person shall conduct any land disturbing activity within the jurisdictional boundaries of Fulton County without first obtaining a permit from the Fulton County Department of Environment and Community Development or its successor to perform such activity.

(3) The application for a permit shall be submitted to the department of environment and community development and must include the applicant's erosion, sedimentation and pollution control plan with supporting data, as necessary. Said plans shall include, as a minimum, the data specified in subsection (c) of this section. Soil erosion, sedimentation and pollution control plans, together with supporting data, must demonstrate affirmatively that the land disturbing activity proposed will be carried out in such a manner that the provisions of subsections 26-39(b) and (c) will be met. Applications for a permit will not be accepted unless accompanied by nine copies of the applicant's soil erosion, sedimentation and pollution control plans and a physical address of the property owner (Post Office box not acceptable). All applications shall contain a certification stating that the plan preparer or the designee thereof visited the site prior to creation of the plan in accordance with EPD Rule 391-3-7-10.

(4) A minimum fee of $125.00, as set by the board of commissioners of Fulton County, shall be charged for each acre or fraction thereof of the project area.

(5) In addition to Fulton County's permitting fees, fees will also be assessed pursuant to O.C.G.A. § 12-5-23(a)(5), provided that such fees shall not exceed $80.00 per acre of land-disturbing activity, and these fees shall be calculated and paid by the primary permittee as defined in the state general permit for each acre of land-disturbing activity included in the planned development or each phase of development. All applicable fees shall be paid prior to issuance of the land disturbance permit. Half of such fees levied shall be submitted to the division; except that any and all fees due from an entity which is required to give notice pursuant to O.C.G.A. § 12-7-17(9) or (10) shall be submitted in full to the division, regardless of the existence of a local issuing authority in the jurisdiction.

(6) The permit applicant shall be required to post a bond in the form of government security, cash, irrevocable letter of credit, or any combination thereof prior to issuing the permit. The bond amount shall be determined as established by the department. If the applicant does not comply with this article or with the conditions of the permit after issuance, Fulton County may call the bond or any part thereof to be forfeited and may use the proceeds to hire a contractor to stabilize the site of the land disturbing activity and bring it into compliance. These corrective actions may include, but are not limited to, de-silting detention ponds, water bodies, stormwater facilities, roadways, installing fence with locking device, re-establishing damaged buffer, etc. If a permit applicant has had two or more outstanding violations of previous permits, this article, or the Erosion and Sedimentation Act of 1975 (O.C.G.A. § 12-7-1 et seq.), as amended within three years prior to the date of filing of the application under consideration, Fulton County may deny the permit application.

(7) If applicable, immediately upon receipt of an application and plan for a permit, Fulton County shall refer the application and plan to the district for its review and approval or disapproval concerning the adequacy of the erosion and sedimentation control plan. The district shall approve or disapprove a plan within 35 days of receipt. Failure of the district to act within 35 days shall be considered an approval of the pending plan. The results of the district review shall be forwarded to Fulton County. No permit will be issued unless the plan has been approved by the district, and any variances required by section 26-39(c)(14) or (15) and bonding, if required as per subsection (b)(5) of this section, have been obtained. Such review will not be required if Fulton County and the district have entered into an agreement which allows Fulton County to conduct such review and approval of the plan without referring the application and plan to the district. The local issuing authority with plan review authority shall approve or disapprove a revised Plan submittal within 35 days of receipt. Failure of the local issuing authority with plan review authority to act within 35 days shall be considered an approval of the revised plan submittal.

(8) If a permit application has had two or more violations of previous permits, this article, or the Erosion and Sedimentation Act, as amended, within three years prior to the date of filing of the application under consideration, Fulton County may deny the permit application.

(9) The local issuing authority may require the permit applicant to post a bond in the form of government security, cash, irrevocable letter of credit, or any combination thereof up to, but not exceeding, $3,000.00 per acre or fraction thereof of the proposed land-disturbing activity, prior to issuing the permit. If the applicant does not comply with this article or with the conditions of the permit after issuance, the local issuing authority may call the bond or any part thereof to be forfeited and may use the proceeds to hire a contractor to stabilize the site of the land-disturbing activity and bring it into compliance. These provisions shall not apply unless there is in effect an ordinance or statute specifically providing for hearing and judicial review of any determination or order of the local issuing authority with respect to alleged permit violations.

(c) *Plan requirements.*

(1) Plans must be prepared to meet the minimum requirements as contained in section 26-39(b) and (c), or through the use of more stringent, alternate design criteria which conform to sound conservation and engineering practices. The Manual for Erosion and Sediment Control in Georgia is hereby incorporated by reference into this ordinance. The plan for the land disturbing activity shall consider the interrelationship of the soil types, geological and hydrological characteristics, topography, watershed. Vegetation, proposed permanent structures including roadways, constructed waterways, sediment control and stormwater management facilities, local ordinances and state laws. Maps, drawings and supportive computations shall bear the signature and seal of the certified design professional. Persons involved in land development design, review, permitting, construction, monitoring, or inspections or any land disturbing activity shall meet the education and training certification requirements , dependent on his or her level of involvement with the process, as developed by the commission and in consultation with the division and the stakeholder advisory board created pursuant to O.C.G.A. § 12-7-20.

(2) Data required for site plan shall include all the information required from the appropriate erosion, sedimentation and pollution control plan review checklist established by the commission as of January 1 of the year in which the land-disturbing activity was permitted.

(d) *Permits and development activity.*

(1) Permits shall be issued or denied as soon as practicable but in any event not later than 45 days after receipt by Fulton County of a completed application, provided that any necessary variances have been obtained, bonding has been provided, and specifications developed and maintained by the department of public works and permitted by the department of environment and community development have been met, and all applicable fees have been paid prior to permit issuance. The permit shall include conditions under which the activity may be undertaken.

(2) No permit shall be issued by Fulton County unless the erosion, sedimentation and pollution control plan has been approved by the district or Fulton County, and unless Fulton County has affirmatively determined that the plan is in compliance with this article, any variances required by subsections 26-39(c)(14) or (15) are obtained, bonding requirements, if necessary, as per subsection 26-40(b)(5) are met and all ordinances and rules and regulations in effect within the jurisdictional boundaries of unincorporated Fulton County are met. If the permit is denied, the reason for denial shall be furnished to the applicant.

(3) Any land-disturbing activities by a local issuing authority shall be subject to the same requirements of this article, and any other ordinances relating to land development, as are applies to private persons and the division shall enforce such requirements upon the local issuing authority.

(4) If the tract is to be developed in phases, then a separate permit shall be required for each phase to include the development sequence.

(5) The permit may be suspended, revoked, or modified by Fulton County, as to all or any portion of the land affected by the plan, upon finding that the holder or his successor in title is not in compliance with the approved erosion and sedimentation control plan or that the holder or his successor in title is in violation of this article. A holder of a permit shall notify any successor in title to him of the conditions contained in the permit as to all or any portion of the land affected by the approved plan.

(6) Fulton may reject a permit application if the applicant has had two or more violations of previous permits or the Erosion and Sedimentation Act permit requirements within three years prior to the date of the application, in light of O.C.G.A. § 12-7-7-(f)1.

(7) Sedimentation basins shall not be allowed in state waters or other perennially flowing streams.

(8) The permittee shall ensure that engineering and construction on any land within unincorporated Fulton County shall be carried out in such a manner as to protect neighboring persons and property from damage or loss resulting from stormwater runoff, soil erosion, or deposition upon private property or public streets or water-transported silt or debris.

(9) The director or designee during field inspections may require revisions, addendum and modifications that address any and all features to ensure compliance with this article and any permit issued hereunder.

(10) It shall constitute non-compliance with this article to engage in land disturbance activity involving clearing, grading, timber harvesting or grubbing without a permit, which activity may immediately warrant citation(s).

(11) Design and installation of properly functioning detention facilities, including outflow and overflow control devices, shall be the responsibility of the owner. If any erosion control devices are damaged or destroyed during grading or construction, all construction processes shall cease until the devices are restored to their functioning capability. The owner, through application for grading or construction permits, accepts the responsibility of maintenance of the control devices.

(12) The owner and operator shall be responsible for the maintenance of the storm drainage facilities during grading, construction, and for a 15-month period following the final approval of the completed project. Maintenance will be construed to include preserving the enclosing walls or impounding embankment or the detention basin and sedimentation ponds, in good condition; ensuring structural soundness, functional adequacy, and freedom from sediment of all drainage structures; and rectifying any unforeseen erosion problems.

(13) The developer shall provide stabilization by covering the soil with: permanent seeding, sprigging or planting, producing long-term vegetative cover, temporary seeding producing short-term vegetative cover, sodding or covering areas with a turf of perennial sod forming grass; and security fences for safety purposes at detention facilities as prescribed by and prior to approval by Fulton County.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

State law reference— Permits for land disturbing activities, O.C.G.A. §§ 12-7-7, 12-7-9.

Sec. 26-41. - County construction; compliance with article.

All engineering and construction involving land disturbance performed by or on behalf of Fulton County and under the direction of the department of public works or any other Fulton County entity, whether such engineering or construction is being accomplished on existing and proposed public land or on public easement, shall comply with the requirements of sections 26-39 and 26-44.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-42. - Residential construction.

Notwithstanding any other provisions of this article, the construction of single-family detached dwellings shall be subject to the following rules:

(1) *Building permit.* No land disturbing activity or other work (including moving and demolition) shall commence on a project until the owner or the contractor undertaking the work shall have applied for, and been issued, a land disturbance permit or building permit by the director. The owner/contractor shall prominently display on site the building permit, a signed erosion and sedimentation control agreement and approved site plan in full public view, until issuance of certification of occupancy. Demolition projects shall be required to install BMPs where necessary to prevent erosion. Failure to install BMPs shall constitute non compliance with this article.

(2) *Notice to comply.* The director shall issue a notice to comply for failure to either install or maintain BMPs, even though sediments remain contained within the boundaries of the property by the use of debris basins, sediment basins, sediment barriers, and construction exits in accordance with this article. Subsequently, a stop work order shall be issued if compliance with a notice to comply is not achieved by the end of the specified compliance period of five days.

(3) *Stop work order.* The director or representative shall issue an order to cease all work ("stop work order") on a project covered by this section if any work on that project is proceeding without a land disturbance permit or building permit, or, when silt, mud, or other waterborne debris leave the property boundary, or (if such a permit has been issued) it is found by the director or representative that all or any portion of the project remains out of compliance with any requirements of subsections 26-39(b) or (c), any other provision of this article or any other Fulton County ordinance, regulation or requirement after the specified compliance period or a site has been in violation at least two prior occurrences, to include any applicable fines and penalties. All other requirements of subsection 26-45(b) of this article also apply to projects covered by this section.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-43. - Progress report required.

(a) The licensed professional referenced in the administrative guidelines (see subsection 26-40(c)) or his representative as approved by the director shall ensure, inspect and evaluate the installation of the erosion control measures (BMPs) within one week after the initial installation of BMPs. All deficiencies shall be corrected within two business days after inspection, and a summary of corrective measures taken shall be submitted to the director within three days after inspection. A written biweekly report shall be submitted to the director from the beginning to the completion of grading and construction on projects for which a land disturbance permit has been issued. This report shall be the responsibility of the owner or developer and shall be prepared by a professional licensed to practice such activity within Georgia, as stipulated in Fulton County Soil Erosion and Sediment Control Administrative Guidelines. The report shall record the quality and progress of the work required to show full compliance with the provisions of this article, including compliance with or adherence to vegetative practices. In order to ensure full compliance with the approved construction plans, final approval will be withheld until as-built drawings, prepared by a professional licensed to practice such work in Georgia, have been submitted and accepted by the director. The director shall withhold the occupancy permit until full compliance has been achieved.

(b) Additional reporting requirements. Applicants/owners/operators shall provide the Director with a copy of any monitoring results submitted to EPD regarding National Pollutant Discharge Elimination System (NPDES). Reports shall be in a format as prescribed by EPD. A copy of the notice of intent which has been sent to EPD in compliance with the permit requirements must be presented to the site inspector at all pre-construction meetings.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-44. - Inspection and enforcement of article.

(a) The director or designee will periodically inspect the sites of land disturbing activities for which permits have been issued to determine if the activities are being conducted in accordance with the approved plan, permit and this article and to determine if the measures required in the plan are effective in controlling soil erosion and sedimentation. Also, Fulton County shall regulate both primary, secondary and tertiary permittees as such terms are defined in the state general permit. Primary permittees shall be responsible for installation and maintenance of best management practices where the primary permittee is conducting land-disturbing activities. Secondary permittees shall be responsible for installation and maintenance of best management practices where the secondary permittee is conducting land-disturbing activities. Tertiary permittees shall be responsible for installation and maintenance of best management practices where the tertiary permittee is conducting land disturbing activities. If, through inspection, it is deemed that a person engaged in land disturbing activities as defined herein has failed to comply with the approved plan, with permit conditions, or with the provisions of this article, an official notice shall be posted on-site, and as a courtesy a written notice to comply shall also be served upon that person, except for working without a permit or working under a stop work order, which warrant immediate citation(s). The notice shall set forth the measures necessary to achieve compliance and shall state the time within which such measures must be completed. If the person engaged in the land disturbing activity fails to comply with the corrective measures specified in the posted official notice within the time specified, he shall be deemed in violation of this article, and the director may take such additional enforcement actions as he/she deems appropriate.

(b) The local issuing authority must amend its ordinances to the extent appropriate within 12 months of any amendments to the Erosion and Sedimentation Act of 1975.

(c) The director shall have the power to conduct such investigation as the director may deem reasonably necessary to carry out duties as prescribed in this article, and for this purpose shall have the power to enter at reasonable times upon any property, public or private, for the purposes of investigation and inspection of the sites of land disturbance or building activities.

(d) No person shall refuse entry or access to any authorized representative or agent of Fulton County, the commission, the district, or division who requests entry for the purposes of inspection, and who presents appropriate credentials, nor shall any person obstruct, hamper, or interfere with any such representative while in the process of carrying out his official duties including, but not limited to, the review of reports, studies, calculations, drawings, revisions, practices, actions and bonds.

(e) A copy of a current approved plan shall be kept on site until project completion or issuance of certificate of occupancy.

(f) The district or the commission or both shall semi-annually review the actions of counties and municipalities which have been certified as local issuing authorities pursuant to O.C.G.A. § 12-7-8(a). The district or the commission or both may provide technical assistance to any county or municipality for the purpose of improving the effectiveness of the counties or municipality's erosion and sedimentation control program. The districts or the commission shall notify the division and request investigation by the division if any deficient or ineffective legal program is found.

(g) The division may periodically review the actions of counties and municipalities which have been certified as local issuing authorities pursuant to O.C.G.A. § 12-7-8(a). Such review may include, but shall not be limited to, review of the administration and enforcement of a governing authority's ordinance and review of conformance with an agreement, if any, between the district and the governing authority. If such review indicates that the governing authority of any county or municipality certified pursuant to O.C.G.A. § 12-7-8(a) has not administered or enforced its ordinances or has not conducted the program in accordance with any agreement entered into pursuant to O.C.G.A. § 12-7-7(e), the division shall notify the governing authority of the county or municipality in writing. The governing authority of any county or municipality so notified shall have 90 days within which to take the necessary corrective action to retain certification as a local issuing authority. If the county or municipality does not take necessary corrective action within 90 days after notification by the division, the division may revoke the certification of the county or municipality as a local issuing authority.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-45. - Penalties and incentives.

(a) *Failure to obtain a permit for land disturbing activity.* If any person commences any land disturbing activity requiring a land disturbing permit, as prescribed in this article, without first obtaining said permit, the person shall be subject to revocation of his business license, work permit, or other authorization to conduct any business and associated work activities within the jurisdictional boundaries of Fulton County. Failure to comply may result in a citation being issued to appear in state magistrate court which may result in monetary fines.

(b) *Stop work orders and notice to comply.*

(1) On development and residential land disturbance sites for the first and second violations of the provisions of this article, the director or the LIA shall post an official notice to comply and as a courtesy issue a written letter. The violator shall have five days to correct the violation. If the violation is not corrected within five days, the director or the LIA shall issue a stop-work order requiring the land-disturbance activity be stopped until necessary corrective action or mitigation has occurred; provided, however, that, if the violation presents an imminent threat to public health or waters of the state or if the land-disturbing activities are conducted without obtaining the necessary permit, the director shall issue an immediate stop-work order in lieu of notice to comply.

(2) For the third and each subsequent violation, the director or the LIA shall issue an immediate stop-work order; and

(3) All stop-work orders shall be in effect until the necessary corrective action has occurred.

(4) It shall be unlawful for any representative of the owner to remove an official notice to comply or stop work posting. If this action is observed by a county representative, the owner will be responsible for any and all possible fines. Upon issuance of a stop work order, the director or representative shall post official notice at such locations on the project site as deemed appropriate. Such posted official notice(s) shall be prominently displayed on the owner's property until the stop work order is rescinded by the director, at which time said posted notice(s) will be removed by the director or representative.

(5) When a violation in the form of taking action without a permit, failure to maintain a stream buffer, or significant amounts of sediment, as determined by director or his or her designee, have been or are being discharged into state waters and where best management practices have not been properly designed, installed, and maintained, a stop work order shall be issued by the director or his or her designee. All such stop work orders shall be effective immediately upon issuance and shall be in effect until the necessary corrective action or mitigation has occurred. Such stop work orders shall apply to all land-disturbing activity on the site with the exception of the installation and maintenance of temporary or permanent erosion and sediment controls.

(c) *Reinspection fee.* The director shall assess a minimum $50.00 reinspection fee to a project if a reinspection is requested prior to the end of a compliance period and the site is found to remain out of compliance upon that inspection. Such fees (to cover administrative, field inspections, and transportation costs) must be satisfied prior to the issuance of a final erosion inspection or a certificate of occupancy.

(d) *Bond forfeiture.* If, through inspection, it is determined that a person engaged in land disturbing activities has failed to comply with the approved plan and permit, an official notice to comply shall be posted on-site and a letter will be issued as a courtesy. The notice shall set forth the measures necessary to achieve compliance with the plan and shall state the time within which such measures must be completed. If the person engaged in the land disturbing activity fails to comply within the time specified, he shall be deemed in violation of this article and, in addition to other penalties, shall be deemed to have forfeited his performance bond, if required to post one under the provisions of subsection 26-40(b)(6). Fulton County may call the bond or any part thereof to be forfeited and may use the proceeds to hire a contractor to stabilize the site of the land disturbing activity and bring it into compliance.

(e) *Non-compliance.* Non-compliance with this article shall be dealt with as follows:

Any person found to be in non-compliance with any provision of this article shall be served official notice by the department of environment and community development. The offender shall, within the period of time stated in the notice, take all necessary action to gain compliance and shall permanently cease such non-compliance.

(f) *Monetary penalties.* Any person who violates any provisions of this article, or any permit condition or limitation established pursuant to this article or who negligently or intentionally fails or refuses to comply with any final or emergency order of the director issued as provide in this article shall be liable for a civil penalty not to exceed $2,500.00 per day. Notwithstanding any limitation of law as to penalties which can be assessed for violations of county ordinances, any magistrate court or any other court of competent jurisdiction trying cases brought as violations of this article shall be authorized to impose penalties for such violations not to exceed $2,500.00 for each violation. Each day during which violation or failure or refusal to comply continues shall be a separate violation.

(1) The following minimum penalties shall be imposed:

Conducting land disturbance activities without a land disturbance permit or building permit (first offense)—$250.00 for each violation or each day on which a violation exists.

Conducting land disturbance activities without a land disturbance permit or building permit (second or subsequent offense)—$1,000.00.

Lack of proper installation or maintenance of structural/vegetative best management practices—$250.00 per violation.

Working under a stop work order (first offense)—$500.00.

Working under a stop work order (second or subsequent offense)—$1,500.00.

(2) Upon violation of the provisions of this article, Fulton County shall be entitled to take such remedial action as the director deems necessary to ensure compliance, and the violator shall reimburse Fulton County for any cost or expense associated with such compliance efforts and Fulton County shall be entitled to place a lien on the property to secure payment and reimbursement for these expenses.

(3) The department of environment and community development has the primary responsibility for the enforcement of this article.

(4) Persons designated by the director are hereby authorized to issue official notices, citations, and/or summons charging violations under this article, returnable to the state or magistrate courts of Fulton County, or any other court of competent jurisdiction.

(Res. No. 05-0690, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-46. - Education and certification.

(a) Persons involved in land development design, review, permitting, construction, monitoring, or inspection or any land-disturbing activity shall meet the education and training certification requirements, dependent on their level of involvement with the process, as developed by the commission in consultation with the division and the stakeholder advisory board created pursuant to O.C.G.A. § 12-7-20.

(b) For each site on which land disturbing activity occurs, each entity or person acting as either a primary, secondary, or tertiary permittee, as defined in the state general permit, shall have as a minimum one person who is in responsible charge of erosion and sedimentation control activities on behalf of said entity or person and meets the applicable education or training certification requirements developed by the commission present on site whenever land-disturbing activities are conducted on that site. A project site shall herein be defined as any land-disturbance site or multiple sites within a larger common plan of development or sale permitted by an owner or operator for compliance with the state general permit.

(c) Persons or entities involved in projects not requiring a state general permit but otherwise requiring certified personnel on site may contract with certified persons to meet the requirements of this article.

(d) If a state general permittee, who has operational control of land-disturbing activities for a site has met the certification requirements of O.C.G.A § 12-7-19(b)(1), then any person or entity involved in land-disturbing activity at that site and operating in a subcontractor capacity for such permittee shall meet those educational requirements specified in O.C.G.A. § 12-7-19(b)(4) and shall not be required to meet any requirements specified in said paragraph.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-47. - Administrative appeal; judicial review.

(a) *Administrative remedies.* The issuance of a stop work order, as well as the suspension, revocation, modification, or grant with condition of a permit by Fulton County upon finding that the holder is not in compliance with the approved erosion, sediment and pollution control plan; or that the holder is in violation of permit conditions; or that the holder is in violation of this article shall entitle the person submitting the plan or holding the permit to a hearing before the Fulton County Board of Commissioners within 30 days after receipt by the director of written notice of appeal.

(b) *Judicial review.* Any person aggrieved by a decision or order of Fulton County, after exhausting his administrative remedies, shall have the right to appeal de novo to the Superior Court of Fulton County.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-48. - Effectivity, validity and liability.

(a) This article shall become effective on the 15th day of June 2010.

(b) *Validity.* If any section, paragraph, clause, phrase, or provision of this article shall be adjudged invalid or held unconstitutional, such decisions shall not affect the validity of remaining portions of this article.

(c) *Liability.*

(1) Neither the approval of a plan under the provisions of this article, nor the compliance with provisions of this article, shall relieve any person from responsibility for damage to any person or property otherwise imposed by law nor impose any liability upon Fulton County, the district or their officers, employees or agents for damage to any person or property.

(2) The fact that a land disturbing activity for which a permit has been issued results in injury to the property of another shall neither constitute proof of nor create a presumption of a violation of the standards provided for in this article or the terms of the permit.

(3) No provision of this article shall permit any person to violate the Georgia Erosion and Sedimentation Act of 1975, the Georgia Water Quality Control Act or the rules and regulations promulgated and approved thereunder or pollute any waters of the state as defined thereby.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Secs. 26-49—26-75. - Reserved.

Fulton County Comprehensive Storm Water Ordinance

ARTICLE IV. STORMWATER MANAGEMENT

DIVISION 1. GENERALLY

Sec. 26-111. Short title of article.
The provisions of this article shall constitute and be known as the "Stormwater Management Ordinance of Fulton County, Georgia."
(95-0093, art. I, § A(1), 3-15-95)

Sec. 26-112. Definitions.
For the purposes of this article, unless specifically defined below, words or phrases shall be interpreted so as to give them the meaning they have in common usage and to give this article its most effective application. Words in the singular shall include the plural, and words in the plural shall include the singular. Words used in the present tense shall include the future tense. The word "shall" connotes mandatory and not discretionary; the words "should" or "may" are permissive. Unless otherwise specified, or apparent from the context, definitions herein will be the same as those in other Fulton County codes. For the purpose of this article, the following terms, phrases, and words, and their derivatives, shall have the meaning given herein:
Accidental discharge means a discharge of any substance that is nonstormwater related, shall be prohibited by this article into the separate storm sewer that occurs by chance and without planning or consideration prior to occurrence.
Agricultural practices means practices involving the establishment, cultivation, or harvesting of products of the field or orchard; the preparation and planting of pasture land and farm ponds; and the construction of farm buildings, or other related activities per section 5.1 of the Zoning Resolution.
As-built plan or *record drawing* means a set of engineering or site drawings that delineate the specific permitted stormwater management facility as actually constructed.
Best management practices (BMPs) means a wide range of management procedures and structures, activities, prohibitions or practices that have been demonstrated to effectively control the quality and/or quantity of stormwater runoff and which are compatible with the planned land use.
Board means the Fulton County Board of Commissioners.
Clean Water Act means the Federal Water Pollution Control Act, as amended (32 USC 1251 et seq.).
Cooling water means water used exclusively as cooling medium in an appliance, device, or apparatus.
County means unincorporated Fulton County, Georgia.
County commissioner means an elected official of the Fulton County Board of Commissioners.
County/separate storm sewer system means a conveyance or system of conveyances (including roads with drainage systems, highways, rights-of-way, county streets, catchbasins, curbs, gutters, ditches, manmade channels, pipes, culverts, storm drains, detention ponds, other stormwater facilities) which are:

(1) Owned or maintained by Fulton County;
(2) Designed or used for collecting or conveying stormwater;
(3) Not a combined sewer; and
(4) Not a part of publicly owned treatment works (POTW).

Design report means the report that accompanies the stormwater management plan and includes data used for engineering analysis, results of all analysis, design and analysis calculations (including results obtained from computer programs), and other engineering data that would assist the county in evaluating proposed stormwater management facilities.

Detention structure and/or pond means a permanent stormwater management structure whose primary purpose is to temporarily store stormwater runoff and release the stored runoff at controlled rates.

Director of the department of public works or director means the duly designated department head of the public works department or his/her designee.

Discharge means the release of treated or untreated water, fluid or other substance to the county separate storm sewer system.

Erosion and sedimentation control ordinance means the ordinance adopted by the county that controls, reduces, or eliminates soil erosion and its transportation to the county's lakes, rivers, and streams, latest revision.

Existing land use conditions means the ground surface in its original state before grading, excavating, or filling.

Flood means a general and temporary condition of partial or complete inundation of normally dry land areas from:
(1) The overflow of inland waters; or
(2) The unusual and rapid accumulation or runoff of surface waters from any source.

Grading means excavating, filling (including hydraulic fill), or stockpiling of earth material, or any combination thereof, including the land in its excavated or filled condition.

Hardship. The director of public works may grant a hardship to an applicant if, upon application, the director of public works determines that the construction of the proposed improvements will create a safety, traffic, or drainage hazard, are impractical to construct, have an impact to adjacent property owners, or has impact to downstream water quality or quantity.

Illicit connection means any connection to the county's separate stormwater conveyance system (pipe, culvert, road, ditch, channel, draw or watercourse) that is not composed entirely of stormwater runoff or a connection that does not conform to an approved stormwater management plan from the county, other than the NPDES permit for discharging from the county separate storm system.

Issuing department means that department in Fulton County that has been designated as the department with the authority over the issuance, inspection, enforcement, and acceptance of permits for the sole purpose of developing or improving land, or building or constructing structures, utilities, public improvements (including stormwater management facilities), or other facilities located within Fulton County.

Land disturbance permit means a permit issued by the county which must be obtained prior to the beginning of any land disturbing activity.

Land disturbing activity means any use of the land by any person that results in a change in the natural cover or topography that may cause erosion and contribute to sediment and alter the quality and/or quantity of stormwater runoff.
Maintenance means any action necessary to preserve stormwater management facilities in proper working condition, in order to serve the intended purposes set forth in this article or prevent structural failure of such facilities. Maintenance shall not include actions taken solely for the purpose of enhancing the aesthetic aspects associated with stormwater management facilities and BMPs.
National Pollutant Discharge Elimination System (NPDES) permit. The U.S. Environmental Protection Agency (EPA) has issued regulations that require certain jurisdictions to obtain permits to discharge stormwater into waterbodies of the U.S. This report identifies aspects of these (NPDES) permit application regulations for stormwater discharges.
Nonerodible means a material, e.g., natural rock, riprap, concrete, plastic, etc., that will not experience surface wear due to natural forces of wind, water, ice, gravity, or a combination of those forces except over a long period of time.
Nonpoint source pollution means pollution contained in stormwater runoff from ill-defined, diffuse sources.
Permittee means the applicant who has applied for and/or been granted a permit for disturbance of the land by the governing agency.
Person means any and all persons, natural or artificial, and includes any individual, firm, corporation, government agency, business trust, estate trust, partnership, association, two or more persons having a joint or common interest or any other legal entity.
Person responsible for the land disturbing activity means:
(1) The person who has or represents having financial or operational control over the land disturbing activity; and/or
(2) The landowner or person in possession or control of the land who directly or indirectly allowed the land disturbing activity or has benefited from it or who has failed to comply with any provision of this article.
Pollution means the contamination or other alteration of any water's physical, chemical, or biological properties, including changes in the temperature, taste, color, turbidity, or odor of such waters or the discharge of any liquid, gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.
Private means property or facilities owned by individuals, corporations, and other organizations and not by Fulton County government or other governing entity.
Procedure means a procedure adopted by the utility, by and through the director, to implement a regulation or regulations adopted under this article, or to carry out other responsibilities as may be required by this article or other codes, ordinances, or resolutions of Fulton County.
Project means the entire proposed development regardless of the size of the area of land to be disturbed.
Public works department means the department within Fulton County responsible for all stormwater management activities and implementation of the provisions of this article.

Responsible personnel means any foreman, superintendent, or similar individual who is the onsite person in charge of land disturbing activities.

Retention structure and/or pond means a permanent structure whose primary purpose is to permanently store a given volume of stormwater runoff. Release of the given volume is by infiltration and/or evaporation.

Right-of-way means a portion of land over which a local or state government has designated a right of use.

Stormwater concept plan means the overall proposal for a storm drainage system, including stormwater management structures and BMPs and supporting documentation, as specified in the Stormwater Management Design and Criteria Manual. The purpose of the stormwater concept plan is to define on a conceptual level the nature of the proposed development or project and to describe all existing conditions and proposed facilities needed to conform the requirements of the county.

Stormwater management means the collection, conveyance, storage, treatment, and disposal of stormwater runoff in a manner to minimize accelerated channel erosion, increased flood damage, and/or degradation of water quality and in a manner to enhance and ensure the public health, safety, and general welfare, which shall include a system of vegetative or structural measures, or both, that control the increased volume and rate of stormwater runoff caused by manmade changes to the land.

Stormwater Management Design and Criteria Manual means the most recent approved manual of design, performance, and review criteria for stormwater management practices, prepared under the direction of the director of the department of public works or his agent. Copies of this manual can be obtained from the public works department.

Stormwater management districts means any districts established by the board of commissioners where there are special assessments of property owners for the purpose of management and maintenance of stormwater.

Stormwater management facilities means those structures and facilities that are designed for the collection, conveyance, storage, treatment, and disposal of stormwater runoff into and through the drainage system. In most cases, stormwater management facilities will refer to facilities whose primary purpose is related to the quantity of stormwater, and where the BMPs primary purpose will be related to water quality concerns of stormwater.

Stormwater management master plan means the plans for unincorporated Fulton County that govern storm drainage and related facilities, existing and proposed, for all drainage basins and/or watersheds within the county.

Stormwater management plan means the plan and supporting documentation that serves to define and expand the concepts shown as part of the stormwater concept plan, or is sufficient of itself to ensure conformance to the criteria in the Comprehensive Stormwater Management Design and Criteria Manual and this article.

Stormwater management qualitative control means a system of vegetative, structural, or other measures that reduce or eliminate pollutants that might otherwise be carried by stormwater runoff.

Stormwater runoff means the direct response of a watershed to precipitation and includes the surface and subsurface runoff that enters a ditch, stream, storm drain, or other concentrated flow during and following the precipitation.

Variance means the modification of the minimum stormwater management requirements for specific circumstances where strict adherence of the requirements would result in unnecessary hardship and not fulfill the intent of this article.
Waiver means the relinquishment from stormwater management requirements by the director of the issuing department or his agent for a specific land disturbing activity on a case-by-case review basis.
Waste means materials that are discarded, disposed of, or no longer usable.
Water quality means those characteristics of stormwater runoff from a land disturbing activity that relates to the physical, chemical, biological, or radiological integrity of water.
Water quantity means those characteristics of stormwater runoff that relate to the rate and volume of the stormwater runoff to downstream areas resulting from land disturbing activities.
Zoning Resolution of Fulton County (Z.R.F.C.) means the rules and regulations that address zoning and development within the unincorporated areas of the county, latest revision.
(95-0093, art. II, § B, 3-15-95)
Cross references: Definitions generally, § 1-2.

Sec. 26-113. Penalties for violation of article.
(a) Upon determination that a violation of this article has occurred, the person responsible for the land disturbing activity shall be given a written notice of the violations and a time in which to correct the deficiencies.
(b) If construction violations of the approved plan are occurring, an immediate stop work order may be issued by the director of the issuing department or his designee.
(c) All nonconstruction related violations of this article shall be issued a citation by the county.
(d) The Magistrate Court of Fulton County and the State Count of Fulton County shall each have jurisdiction to try offenses alleging violations of this article by any person, firm, corporation, partnership, or other entity. Violations of this article shall be deemed to be a misdemeanor. Each day any violation of this article shall continue shall be considered a separate offense. Upon conviction, any person, firm, corporation, partnership, or other entity shall be subject to a fine of $1,000 per violation or imprisonment in the Fulton County Jail for not more than 60 days, or by both this fine and imprisonment for each offense.
(e) The county attorney on behalf of Fulton County may institute injunctive, or other appropriate action or proceedings at law or equity for the enforcement of this article or to correct violations of this article, and any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.
(95-0093, art. VII, § F, 3-15-95; 99-0644, § II, 5-5-99)
State law references: Maximum punishments which may be imposed for violations of county ordinances, O.C.G.A. § 36-1-20(b).

Sec. 26-114. Authority of article.
(a) This article is established as a new article to and under the authority of this Code.

(b) The authority for this article is based on home rule provisions of Ga. Const. art. IX, § II.
(c) In compliance with the provisions of the Clean Water Act, 33 USC 1251 et seq., as amended, by the Water Quality Act of 1987, PL 100-4.
(95-0093, art. I, § A(2), 3-15-95)

Sec. 26-115. Purpose/objectives of article.
The objectives of this article include the following:
(1) Protect, maintain, and enhance the shortterm and longterm public health, safety, and general welfare. This objective will be achieved by:
a. Establishing minimum requirements and procedures to control the adverse effects of increased stormwater runoff associated with both future land development and existing developed land within Fulton County.
b. Providing proper management of stormwater runoff to minimize damage to public and private property, reduce the effects of development on land and stream channel erosion.
c. Protecting downstream properties from water quality and quantity impacts.
d. Protecting, preserving and enhancing water quality for fish and wildlife habitat within Fulton County.
(2) To satisfy federal (EPA) and state (DNR) regulations that require local programs to control stormwater discharges of pollution.
(3) To keep streets open to emergency vehicle traffic by reducing the flooding of streets.
(4) Establish procedures that minimize damage from flooding caused by development, while recognizing that natural fluctuations in water levels are beneficial.
(5) Require construction of drainage systems which aesthetically and functionally approximate natural systems.
(6) Establish procedures for the planning and implementation of stormwater improvements using a basin-wide approach, considering the total stormwater basin system beyond individual subdivisions and master plans for each basin.
(7) Establish the development and implementation of stormwater management districts.
(95-0093, art. I, § A(3), 3-15-95)

Sec. 26-116. Application and scope of article.
The application of this article and the provisions expressed herein shall be the minimum stormwater management requirements and shall not be deemed a limitation or repeal of any other powers granted by state statute. In addition, if site characteristics indicate that complying with the minimum requirements of this article will not provide adequate designs or protection for local property or residents, the county may impose requirements greater than those set forth in this article. The director of the department of public works or his designee shall be responsible for the coordination and enforcement of the provisions of this article.
(95-0093, art. I, § A(4), 3-15-95)

Sec. 26-117. Conflict with other laws.
Whenever the provisions of this article impose more restrictive standards than are required in or under any other ordinance, the regulations herein contained shall prevail.

Whenever the provisions of any other law require more restrictive standards than are required herein, the requirements of such law shall prevail.
(95-0093, art. VII, § H, 3-15-95)

Sec. 26-118. Severability.
If any term, requirement, or provision of this article or the application thereof shall, to any extent, be invalid or unenforceable, the remainder of this article or the application of such terms, requirements, and provisions shall not be affected thereby and each term, requirement, or provision of this article shall be valid and be enforced to the fullest extent permitted by law.
(95-0093, art. VII, § I, 3-15-95)

Sec. 26-119. Amendments.
This article may be amended in the manner as prescribed by law for its original adoption.
(95-0093, art. VII, § J, 3-15-95)

Sec. 26-120. Liability of county.
Neither the approval of a plan under the provisions of this article nor the compliance with the provisions of this article shall relieve any person from the responsibility for damage to any person or property otherwise imposed by law nor shall it impose any liability upon Fulton County, Georgia, for damage to any person or property.
(95-0093, art. VII, § K, 3-15-95)

Sec. 26-121. Other ordinances.
This article does not negate the following codes, laws, and ordinances or any other applicable ordinance:
(1) Erosion and Sedimentation Control Ordinance of Fulton County.
(2) Zoning Resolution of Fulton County including the floodplain management section.
(3) Rules for dam safety under the Environmental Protection Division by the State of Georgia Safe Dam Act of 1978 (O.C.G.A. § 12-5-370 et seq.). All other impounding structures (dams) criteria not covered by the Safe Dam Act (O.C.G.A. § 12-5-440 et seq.) shall be addressed in the Fulton County Comprehensive Stormwater Manual.
(4) MRPA, Metropolitan River Protection Act (O.C.G.A. § 12-5-440 et seq.).
(5) South Fulton Chattahoochee River Corridor (Georgia River and Mountain Protection Act).
(95-0093, art. VII, § L, 3-15-95)

Sec. 26-122. Effective date.
This article shall take effect 60 calendar days after it becomes law.
(95-0093, art. VII, § M, 3-15-95)

Sec. 26-123. Scope of article; scope of responsibilities.
(a) *Imposition of stormwater management measures.* No person shall develop any land without having provided for stormwater management measures in compliance with this article, unless exempted under the terms of this article, particularly section 26-125.
(b) *Geographic scope of measures.* The provisions of this article shall apply throughout the unincorporated area of Fulton County.

(95-0093, art. I, § C, 3-15-95)

Sec. 26-124. Powers of the department of public works.

(a) The department of public works shall have the power to administer and enforce all regulations and procedures adopted to implement this article, including the right to maintain an action or procedure in any court of competent jurisdiction to compel compliance with or restrain any violation of this article.

(b) The director of the department of public works or his designee shall be responsible for the coordination and enforcement of the provisions of this article. In addition, it shall be the duty of all officers and employees of the county, especially members of the police department, sheriff's department and marshal's office, to assist the director in the course of his/her duties to enforce this article.

(c) The director of the department of public works or his designee shall be responsible for the conservation, management, maintenance (where applicable), extension, and improvement of the county separate storm sewer system, including activities necessary to control stormwater runoff and activities necessary to carry out stormwater management programs included in Fulton County NPDES stormwater permit.

(d) The director of the department of public works or his designee shall develop, or cause to be developed and updated periodically, a stormwater management design manual for the guidance of persons preparing stormwater management plans, and designing or operating stormwater management systems.

(e) The director of the department of public works or his designee shall prepare or cause to be prepared and updated a stormwater management master plan.

(f) The director of public works shall interpret the provisions of this article and may use the opinions of the county attorney and others in arriving at interpretations. Appeals from an interpretation of the director shall be in accordance with the provisions of section 26-131.

(g) The director of public works or his designee shall:

(1) Administer, coordinate, and oversee acquisition, design, construction, and operation and maintenance of municipal/county stormwater facilities and conveyances;

(2) Establish or oversee establishment of development standards and guidelines;

(3) Determine the manner in which stormwater facilities should be operated;

(4) Inspect private systems which discharge to the municipal/county separate storm sewer system;

(5) Advise the other departments on issues related to stormwater;

(6) Protect facilities and properties controlled by Fulton County and prescribe how they are to be used by others;

(7) Require new, increased, or significantly changed stormwater contributions to comply with the terms of this article;

(8) Develop programs or procedures to control the discharge of pollutants into the municipal/county separate storm sewer system;

(9) Adopt and implement the stormwater management program for Fulton County government.

(95-0093, art. I, § D, 3-15-95)

Sec. 26-125. Exemptions from article requirements.

All development, construction or improvements that occur within the boundaries of Fulton County shall be governed by the provisions of this article and the county's Comprehensive Storm Drainage Design and Criteria Manual. The following activities are exempt:

(1) Additions or modifications to existing single-family detached residential structures.

(2) Developments that do not disturb more than 5,000 square feet of land area.

(3) Any maintenance or renovation of an existing structure or system not materially changing or affecting the rate or volume of stormwater runoff, in the sole discretion of the director of the issuing department.

(4) Those exemptions spelled out in section 26-38, provided the activities listed do not contribute pollutants to the county's stormwater conveyance system and the state's waters, or do not increase the turbidity of stormwater runoff from the site due to erosion or land disturbing activity, or the activities listed are governed by other rules and regulations that are more restrictive than this article.

(95-0093, art. I, § E, 3-15-95)

Sec. 26-126. Grandfather clause.

Any applicant or owner of a parcel of land within the jurisdiction of the county who has constructed the required stormwater management facility or BMP or who is in the process of meeting the stormwater management requirements of the law at the time of the effective date of this article, may elect to apply to the director for reconsideration under the provisions of this article.

(95-0093, art. VII, § G, 3-15-95)

Sec. 26-127. Stormwater Management Design and Criteria Manual.

(a) Through the passage of this article, the board of commissioners adopts the Fulton County Comprehensive Storm Drainage Design and Criteria Manual (the manual) and all the rules, regulations, and definitions contained therein. This manual was developed to assist in the design and evaluation of stormwater management facilities and practices. The director of public works shall be responsible for the promulgation of the manual and its contents. The manual shall be updated periodically to reflect the most current and effective practices, rules, and regulations, and shall be made available to the public.

(b) The following topics will be set forth in the Comprehensive Stormwater Management Design and Criteria Manual:

(1) Stormwater concept and management plan approval process;

(2) Stormwater quantity management facilities;

(3) Minimum runoff quality control requirements;

(4) Maintenance agreement for privately owned stormwater facilities; and

(5) All technical criteria and procedures related to stormwater quality and quantity.

(95-0093, art. I, § F, art. VII, § A, 3-15-95)

Sec. 26-128. Variances.

(a) The director of public works may grant a variance from the requirements of this article if there are hardships applicable to the site.

(b) A written request for a variance shall be required and shall state the specific variance sought and the reasons, with supporting data, for their granting.

(c) The director may grant a variance from requirements of this article if the proposed development activity:

(1) Does not change or increase the rate, velocity or volume of runoff significantly; or

(2) Does not have a significant, negative impact on wetland, watercourse, or water body; or

(3) Does not contribute to degradation of downstream water quality or quantity; or

(4) If the construction of proposed improvements will create a safety, traffic or drainage hazard; or

(5) Are impractical to construct; or

(6) The grading, or construction of any of the facilities, related to the development activity that are needed to meet the requirements of this article and will have an adverse impact to an adjacent or downstream property owner.

(95-0093, art. VII, § B, 3-15-95)

Sec. 26-129. Off-site drainage facilities.

Guidelines for consideration of off-site facility/conveyance system use are defined in the Fulton County Comprehensive Stormwater Management Design and Criteria Manual.

(95-0093, art. VII, § C, 3-15-95)

Sec. 26-130. Stormwater management districts.

Upon the recommendation of the director of the department of public works, the board of commissioners shall designate stormwater management districts throughout the unincorporated areas of Fulton County. It shall be the responsibility of the director of the department of public works to determine the boundaries of each stormwater district and shall use the stormwater management master plan as a guide.

(95-0093, art. VII, § D, 3-15-95)

Sec. 26-131. Appeals.

(a) Any person aggrieved by a decision of the director of the issuing department, including any decision with reference to the granting or denial of a variance from the terms of this article, may appeal the same by filing a written notice of appeal with the director within 30 calendar days of the issuance of said decision by the director.

(b) All appeals shall be heard by the director or his designee who is hereby granted specific authority to hear and determine such appeals. The hearing shall be held within 30 days after receipt of notice of appeal or a date mutually agreed upon in writing. The final decision of the director shall be based on published guidelines of appeals established by Fulton County and amended from time to time.

(c) Any appeal of said final decision may be made to the superior court within 30 days from the date of the notice of a final decision. Said notice shall be sent registered mail to the permittee.

(95-0093, art. VII, § E, 3-15-95)

Secs. 26-132--26-165. Reserved.

DIVISION 2. STORMWATER DRAINAGE MANAGEMENT, PLANNING AND DEVELOPMENT REQUIREMENTS

Sec. 26-166. General requirements.

(a) Adequate drainage and control of stormwater are an integral and important part of any development. Proper drainage planning shall be considered an essential element of any stormwater concept plan or stormwater management plan submitted to the county. The design and construction of a site shall also follow the rules and regulations found in article XXXIV of Z.R.F.C. and section 26-39 of this Code.
(b) At the time of the initial submittal to the county with an application for a preliminary plat, every subdivider or developer shall, at his sole expense, be required to submit to the stormwater management section of the department of public works, a stormwater concept plan for review and approval. At the time of the site visit, it shall be determined if drainage studies and reports, design computations, and such other information need to be required to ensure that stormwater originating both from the proposed subdivision or development and lands lying upgradient will be adequately drained and controlled in order to approve the stormwater concept plan. The stormwater concept plan shall be a preliminary drawing of the proposed location of storage facilities, stormwater discharge path of detention/retention pond(s), other downstream and upstream constraints and other matters with potential stormwater implications. Such plans and supplementary information shall be consistent with the requirements of this article, the Z.R.F.C., and the Comprehensive Stormwater Management Design and Criteria Manual.
(c) Upon approval of the stormwater concept plan and prior to the issuance of any building or land disturbance permits, the subdivider shall, at his sole expense, prepare and submit for review and approval by the development services department a stormwater management plan. The stormwater management plan shall consist of drawings and studies, including detailed construction drawings, plans, profiles, and specifications, for the construction and installation of all drainage facilities necessary for the drainage and control of all stormwater within the development, and upgradient, and the conveyance of such water to a safe discharge or outflow point. The stormwater management plan shall conform to the stormwater concept plan for said development. Such plans and supplementary information shall be consistent with the requirements of this article, the Z.R.F.C., and the Comprehensive Stormwater Management Design and Criteria Manual.
(d) A developer and his professionals should discharge the drainage from their site into a storm conveyance system that is publicly owned and maintained. Every subdivider shall provide, at no cost to the county, an easement up to a maximum width as is necessary to accommodate drainage from a 100-year storm for the purpose of constructing and maintaining the drainage system for the transmission, through the subdivider's property, of all stormwater generated upstream from the subdivision. Notwithstanding this requirement, any natural drainageway which traverses any subdivider's property or adjacent properties, shall not be encroached upon or altered so as to render the same less suitable to accept and transport stormwater that has historically flowed through such drainageway. Should a subdivider fail to obtain an off-site easement for the purpose of drainage conveyance, then the design discharge at the outlet facilities of the subdivision shall be limited to the predeveloped conditions for all storm events, including the discharges and velocities, whichever is more restrictive shall apply.
(e) Site visit. Prior to the submittal of a land disturbance permit, or in connection to the stormwater concept plan, the developer/engineer must contact the department of public works stormwater management section to arrange an onsite evaluation visit. By way of example and not limitation, the visit should include an evaluation of the location of storage facilities, stormwater discharge path of detention/retention ponds, other

downstream and upstream constraints and other matters with potential stormwater implications.

(f) It shall be the responsibility of the developer to demonstrate that the development and/or stormwater conveyance facilities will not cause a violation of local, state, and federal laws or regulations to occur at the time of the application for a land disturbance permit. Evidence that the applicant has complied with requirements to obtain other state and federal permits which may be applicable, such as, but not limited to Wetlands (404) Permit, NPDES permit, and Metropolitan River Protection Act, must also be supplied to the county as part of the stormwater management plan and study.

(g) It shall be the responsibility of the developer/engineer to accurately depict the conditions of the site, both onsite and off-site, on the plans submitted to the county that are affected by this article. Any modifications, changes, or construction that occur to the plans or in the field, as a result of having to conform to the county's Storm Drainage Criteria Manual or other criteria found in this article, and the cost to rectify shall be borne entirely by the developer.

(95-0093, art. II, § A, 3-15-95)

Sec. 26-167. Specific requirements.

(a) Prior to the issuance of a land disturbance permit by the development services department the following must be in effect:

(1) Documentation that authorizes the right of entry by the county for emergency maintenance of stormwater management facilities.

(2) Documentation that authorizes the right of entry by the county for the purpose of inspecting the stormwater management facilities.

(3) Any off-site easements necessary to effectuate subsections (a)(1) and (a)(2) of this section (easements must be recorded), or to implement the stormwater management plan.

(4) Written authorization from an adjacent property owner allowing any proposed off-site grading, construction, storage, or other improvements to their property.

(5) An approved stormwater concept plan or stormwater management plan, as adjudged appropriate in the discretion of the director of the department of public works or his designee.

(b) In accordance with section 24.1 of the Z.R.F.C. and with sections 26-40 and 26-42 of this chapter, all applications for building permits, and the accompanying plot plan, shall correspond with the approved grading plan or the approved stormwater management plan on file with the county. The issuing authority may require spot elevations, flow direction arrows, contour lines, or other information that it deems necessary prior to the issuance of the building permit to ensure compliance to the approved grading plan or the approved stormwater management plan.

(c) Prior to the issuance of a certificate of occupancy by the county, all stormwater management facilities required as part of the stormwater management plan shall be completed and approved by the county.

(d) Prior to the issuance of the certificate of occupancy by the appropriate department, the following must be submitted to the county:

(1) Recorded easements for stormwater management facilities.

(2) Receipt by the county of an as-built/record drawing of the stormwater management facilities that is signed and sealed by a registered engineer. Discrepancies between the record drawing and the approved stormwater management plan must be identified to the

county, and the county shall give its approval to any discrepancies prior to the issuance of the certificate of occupancy.

(e) Any and all land disturbance permits may be revoked at any time if the construction of the site or the stormwater management facilities are not in strict accordance with the approved stormwater management plans or other sections of this article.

(f) It shall be the responsibility of the person, firm, corporation, or other entity to maintain the drainage patterns and the stormwater management facilities that are in existence at the time of the issuance of the certificate of occupancy. They, their heirs, or assigns are prohibited from performing any improvements or regrading of the site, that in any way block, alter, or redirect the existing drainage patterns or facilities, except for the occasional maintenance to facilities to keep them operating as originally designed. Conviction by a person, firm, corporation, or other entity for violating this section shall be a misdemeanor and shall be subject to the penalties found in section 26-113.

(95-0093, art. II, § B, 3-15-95)

Sec. 26-168. Watershed management plan.

(a) A watershed management plan (masterplan) shall be developed by the director of public works. Said plan may be submitted for approval to the board of commissioners. Such plan shall be revised when information so warrants, as determined by the director of public works. The purpose of the watershed management plan shall be to:

(1) Establish the boundaries of drainage basins which are either directly located or contribute to stormwater flows within the county;

(2) Offer a means of identifying and alleviating both present and future drainage flooding problems while reasonably maintaining the environment and aesthetic values of drainageways;

(3) Present, in an organized fashion, basic data and information regarding the relationship between rainfall and stormwater flows;

(4) Offer an effective means by which the subdivider and the county may cooperate in controlling stormwater flows;

(5) Provide the county with a process for identifying and scheduling the installation of major facilities, including regional stormwater management and/or flood control facilities; and

(6) Include alternatives for the location of structural, nonstructural, private, and public stormwater management measures and strategies to control the adverse effects of stormwater runoff.

(b) The county may solicit the cooperation of other government entities in providing drainage facilities in drainage basins, or paths thereof, that are within and those that extend outside the county limits for the purpose of carrying out the watershed management plan.

(c) The board of commissioners finds and determines that there are certain areas within the county's limits that are subject to periodic inundation resulting in flood loss to both life and property. To alleviate flood problems and to promote and protect the health, welfare, and safety in order that citizens and property owners can remain under the National Flood Insurance Program, development should be prohibited from encroaching into the flood hazard area.

(d) Should a subdivider or owner wish to develop within a flood hazard area, then the subdivider or owner shall prepare, at his sole expense, an engineering study and supporting information per section 4.24 of the Zoning Resolution of Fulton County and follow all the other criteria, rules and regulations that are indicated therein. Per section 4.24.9F of the Z.R.F.C., any revisions or amendments to the FEMA FIRM maps required shall be completed prior to the county's issuance of a certificate of occupancy.

(e) Watershed management plans shall delineate the special flood hazard areas as shown on the Federal Emergency Management Agency (FEMA) FIRM maps. Where flood hazard areas are not indicated, it shall be the responsibility of the department of public works to delineate the limits on a drainage basin affected by a 100-year storm event. It shall also be the responsibility of the department of public works to develop rules and regulations in the Stormwater Management Design and Criteria Manual that govern development in, adjacent to or around the 100-year storm event limits. Until such rules and regulations are developed, the department of public works shall use as a guide in making a determination the Z.R.F.C., FEMA regulations, and the National Flood Insurance Program.

(95-0093, art. II, § C, 3-15-95)

Sec. 26-169. Drainage system connection.

Permission is required from the county to connect to or discharge into any drainage system, conveyance system, or watercourse within the county. Permission shall be implied as part of an approved stormwater management plan from the county. Deviations from the approved stormwater management plan, that do not have the permission of the county, shall be deemed an illicit connection and in violation of division 6 of this article, and shall prohibit the county from issuing a certificate of occupancy or recording of the final plat, even if the deviations result from mistakes to or omissions from the stormwater management plan or changes that occur in the field.

(95-0093, art. II, § D, 3-15-95)

Sec. 26-170. Permit suspension and revocation.

(a) A land disturbance, building or grading permit, or any type of certificate of occupancy may be suspended or revoked by the issuing department if one or more of the following occurs:

(1) Violations of the conditions of the stormwater management plan approval;

(2) Construction not in accordance with the approved plans;

(3) Noncompliance with correction notices or stop work orders; or

(4) The existence of an immediate danger in the judgment of the director of the department of public works or his designee.

(b) If one or more of these conditions are found, a written notice of violation from the issuing department shall be served upon the owner or authorized representative and an immediate stop work order may be issued. The notice shall set forth the measures necessary to achieve compliance with the plan. Correction of these violations must be initiated within seven days of the notice, or the owner shall be deemed in violation of this article and subject to penalties for the said violation.

(95-0093, art. II, § E, 3-15-95)

Sec. 26-171. Professional registration requirements.

(a) All stormwater concept and stormwater management plans and design reports shall be prepared, certified, and stamped/sealed by a qualified registered Georgia professional engineer, using acceptable engineering standards and practices.
(b) The engineer shall undertake to perform services only in areas of his/her competence, and only when qualified by education and/or experience in the specific technical field. In addition, the engineer must certify that the plans have been designed in accordance with the standards and criteria stated or referred to in this article.
(95-0093, art. II, § F, 3-15-95)
Secs. 26-172--26-205. Reserved.

DIVISION 3. OWNERSHIP AND COUNTY PARTICIPATION

Sec. 26-206. Ownership of stormwater management facilities and BMPs.
(a) All stormwater management facilities and BMP structures shall be privately owned and maintained unless the county accepts the facility for county ownership and/or maintenance, subject to the provisions of division 5 of this article. The owner of all private facilities shall grant and shall be deemed to have granted to the county, a perpetual, nonexclusive easement that allows for public inspection and emergency repair.
(b) All stormwater management measures relying on designated vegetated areas or special site features should be privately owned and maintained as defined on the stormwater management plan.
(c) Regional stormwater management facilities may be publicly owned.
(95-0093, art. III, § A, 3-15-95)

Sec. 26-207. County participation.
A voluntary development agreement between the applicant and Fulton County may provide for additional storage capacity beyond that required by the applicant for onsite stormwater management in order to correct for future development. The county designee shall be authorized to negotiate, subject to ultimate approval by the board of commissioners, within the following guidelines:
(1) Require that the applicant grant any necessary easement over, through, or under the applicant's property to provide access to or drainage for such facility.
(2) Require that the applicant obtain from the owners of property any easements necessary for the construction and maintenance of the same, and the county may assist by purchase, condemnation, dedication, and subject to cost incurred to be paid by applicant.
(95-0093, art. III, § B, 3-15-95)

Sec. 26-208. Agreement between county and municipalities.
(a) Prior to implementation of a stormwater plan, the director may furnish a copy of any stormwater management plan which affects any incorporated city, town, municipality, or other local government, and possessing the power to regulate stormwater management of any stormwater management facility or development.
(b) The county may enter into an intergovernmental agreement with any incorporated city, town, or other municipality concerning any matter related to stormwater management.
(95-0093, art. III, § C, 3-15-95)
Secs. 26-209--26-240. Reserved.

DIVISION 4. FUNDING AND FEES

Secs. 26-241--26-275. Reserved.

DIVISION 5. MAINTENANCE, CONSTRUCTION AND INSPECTION

Sec. 26-276. Maintenance.

(a) Any stormwater management facility or BMP which services a residential, commercial, or industrial development shall be privately owned and privately maintained so that the facilities operate as originally designed. The owner thereof shall grant to the county, a perpetual, nonexclusive easement which allows for public inspection and emergency repair, in accordance with the terms of the maintenance agreement set forth in section 26-277. The county may periodically inspect all privately owned and maintained stormwater management facilities and BMPs for compliance with this article and the county criteria. Failure to maintain such facilities shall be considered a violation and subject the owner to the considerations of this article to rectify the situation or be subject to the penalties in section 26-113.

(b) All regional stormwater management control facilities, identified by the county's storm drainage master plan, shall be publicly maintained.

(c) All other stormwater management control facilities and BMPs shall be privately owned and/or maintained, unless specifically accepted for ownership and maintenance by the county.

(d) Private maintenance requirements shall be a part of the deed to the affected property.

(95-0093, art. V, § A, 3-15-95)

Sec. 26-277. Construction and inspection.

(a) Prior to approval of the stormwater management plan, the permittee shall submit a proposed staged inspection and construction control schedule, which the department of development services shall either approve, disapprove, or modify.

(b) No stage of work, related to the construction of stormwater management facilities or BMPs, shall proceed until the next preceding stage of work is inspected and approved.

(c) Any portion of the work that does not comply with this article or with the stormwater management plan shall be promptly corrected by the permittee.

(d) The permittee shall notify the director of development services department or his designee before commencing any work and upon completion of the work.

(e) After commencing initial stormwater management operations, the permittee shall provide for regular biweekly inspection reports to be certified by a registered professional engineer at construction stages and provided to the department of development services.

(f) The permittee shall provide an as-built/record drawing plan certified by a registered professional to be submitted upon the completion of the stormwater management facilities included in the stormwater management plan. The registered professional shall certify that:

(1) The facilities have been constructed as shown on the as-built plan; and

(2) The facilities meet the approved stormwater management plan and specifications.

(g) A final inspection shall be conducted by the director of development services or his designee upon completion of the work included in the approved stormwater management plan.

(h) The director of development services or his designee shall maintain a file of inspection reports and make available copies of all inspection reports.
(i) The director of development services or his designee will notify the person responsible for the land disturbing activity in writing when violations are observed.
(95-0093, art. V, § B, 3-15-95)

Sec. 26-278. Inspection and maintenance agreement (onsite facilities only).
(a) An inspection and maintenance agreement shall be executed for all private onsite stormwater management facilities prior to the issuance of a grading, land disturbance, or building permit. Such agreement shall be binding on all heirs, successors, or assignees.
(b) The agreement shall provide that preventive maintenance inspections of filtration systems, retention, or detention structures may be made by the department of development services, at its option.
(c) The agreement shall provide that the department of development services shall notify the owners of the facility of any violation, deficiency, or failure to comply with this article. The agreement shall also provide that, upon a failure to correct violations requiring maintenance work, within 30 days after the notice thereof, the county may provide for all necessary work to place the facility in proper working condition. The owners of the facility shall be assessed the costs of the work performed by the county pursuant to this subsection.
(95-0093, art. V, § C, 3-15-95)

Sec. 26-279. Inspection for preventive maintenance (regional facilities only).
Preventive maintenance inspections of infiltration system, retention, or detention structures comprising regional public facilities may be made by the department of public works.
(95-0093, art. V, § D, 3-15-95)

Sec. 26-280. Maintenance of preexisting residential stormwater management facilities.
All dedicated and accepted residential stormwater management facilities in existence in the county on the effective date of this article shall be maintained by the owners (except those constructed prior to 1990) in such a manner as to maintain and enhance the public health, safety, and general welfare to reduce and minimize damage to property; to reduce and minimize the impact of such facilities on land and stream channel erosion; to assist in the attainment and maintenance of water quality standards; to reduce local flooding; and to maintain, as nearly as possible, the preexisting development runoff characteristics of the area. The owners shall be responsible for providing reasonable ingress and egress for maintenance. The county shall not be responsible for aesthetic maintenance.
(95-0093, art. V, § E, 3-15-95)

Sec. 26-281. Maintenance of preexisting commercial/industrial stormwater management facilities.
(a) All commercial/industrial stormwater management facilities in existence in the county on the effective date of this article shall be maintained by the owners thereof in such a manner as to maintain and enhance the public health, safety, and general welfare in order to be assured that such facilities are safe and will not result in injury or harm to persons or property; to reduce and minimize damage to public and private property; to

reduce and minimize the impact of such facilities on land and stream channel erosion; to assist in the attainment and maintenance of water quality standards; to reduce local flooding; and to maintain, as nearly as possible, the preexisting development runoff characteristics of the area. All such maintenance of such facilities shall be at the sole cost and expense of the owners thereof.

(b) The county shall have the authority to take necessary steps to abate any nuisance as that term is defined by applicable law.

(c) If the charges and costs provided for in subsection (b) of this section remain unpaid by the owner for a period of 30 days after notice thereof to the owner or occupant of the property upon which such conditions existed, the county's duly authorized representative shall cause a lien to be issued against the owner of the property for those charges. The execution shall be a lien on the property and, when recorded in the general execution docket of the county, shall be a lien on all property of the defendant in execution from the date of such recording.

(95-0093, art. V, § F, 3-15-95)

Secs. 26-282--26-315. Reserved.

DIVISION 6. PROHIBITIONS AND ILLICIT CONNECTIONS

Sec. 26-316. Prohibitions.

(a) It is unlawful for any person, company, corporation, etc., to throw, drain, run, or otherwise discharge to any component of the county's stormwater system, including streets, highways, rights-of-way; or to cause, permit, or suffer to be thrown, drain, run, or allow to seep or otherwise discharge into such system, any organic or inorganic matter that shall cause or tend to cause pollution to such waters, as provided for in this article.

(b) The director of public works may exempt the following from the prohibition provision above:

(1) Water line flushing performed by a government agency, diverted stream flows, rising groundwaters, and unpolluted groundwater infiltration.

(2) Unpolluted pumped groundwater.

(3) Discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, and water from street washing.

(4) Discharges or flows from firefighting.

(5) Other unpolluted water.

(c) In the event of an accidental discharge or an unavoidable loss to the municipal/county separate storm sewer system of any material of substance other than stormwater runoff, the person responsible shall inform the department of public works within five days of the nature, quantity, and time of the occurrence of the discharge. The person responsible shall take immediate steps to minimize the effects of the discharge on the municipal/county system and receiving streams. The person shall also take immediate steps to ensure no recurrence of the discharge.

(95-0093, art. VI, § A, 3-15-95)

Sec. 26-317. Illicit connections.

(a) It is unlawful for any person, company, corporation, etc., to connect any pipe, open channel, or any other conveyance, structure or system to the county's stormwater conveyance system that discharges anything except stormwater runoff and that are not identified on the stormwater management plan.
(b) Improper connections in violation of this article must be disconnected and redirected, if necessary, to the Fulton County Sanitary System or other acceptable outfall upon approval by the director of public works.
(95-0093, art. VI, § B, 3-15-95)

Sec. 26-318. Cooperation with the county.
(a) It shall be the responsibility of any person, firm, company, corporation, etc., to cooperate with the county in the search for illicit connections or prohibitive activities as described in this division in order for the county to comply with the conditions of its NPDES permit.
(b) Any person, firm, company, corporation, etc., shall answer the questions of the county and share information on business activities as they relate to this article, except those records and activities that are confidential and proprietary. If necessary, the county may obtain access to confidential and proprietary records and activities through a court order, subject to the following conditions:
(1) The county shall have access to records and information for the purpose of examination for compliance with the conditions of this article only during normal business hours;
(2) The county shall not have the right to make copies, excerpts, or transcripts of such records and activities without receiving prior written consent; and
(3) The county shall not disclose or make available to third parties any such records or information obtained unless required to do so by a separate court order.
(c) Failure to comply with the conditions of this division shall be considered a violation and subject to the penalties found in section 26-113.
(95-0093, art. VI, § C, 3-15-95)
Secs. 26-319--26-350. Reserved.

Amendment No. 1 to the Fulton County Stormwater Management Storm Drainage and Critera Manual

STORMWATER MANAGEMENT STORM DRAINAGE DESIGN AND CRITERIA MANUAL DECEMBER 2000 Amendment Number 1 – September 1, 2005
The following conditions shall be considered standard design considerations for all projects requiring a land disturbance permit for all applications received on or after September 1, 2005:

1. Prior to submitting the application for a Land Disturbance Permit, the developer and/or design professional shall submit to the Surface Water Activity Management Program (SWAMP), through the Development Review Division, a project Storm Water Concept Plan. This concept plan shall indicate the preliminary location of the storm water management facilities intended to manage the quality and quantity of storm water. The concept plan shall specifically address the existing downstream off-site drainage conveyance system(s) that the proposed development surface runoff will impact, and the discharge path(s) from the outlet of the storm water management facilities to the off-site drainage system(s) and/or appropriate receiving waters. As part of the Storm Water Concept Plan submittal, a preliminary capacity analysis shall be performed on the off-site drainage system(s) points of constraint. The capacity analysis shall determine the capacity of all existing constraint points, such as pipes, culverts, etc. from the point of storm water discharge at the proposed development site boundary downstream to the lower point of a reach of receiving stream described by two points as follows. The upper point shall be a point downstream of the development on the receiving stream where the drainage area is at least ten times the area of the proposed development. The lower point shall be on the receiving stream downstream of the upper point at the confluence of a tributary that contains a drainage area of a minimum of fifty acres. The critical capacity points shall be selected based upon the design professional's field observation, professional judgment and limited field survey data. The analysis shall identify the downstream properties pre and post-development 100-year water surface elevations, and for any post-development water surface elevation increase exceeding 0.05 feet, the developer shall acquire the applicable offsite drainage easement to accommodate the 100-year storm flow through impacted properties. Where Fulton County has completed a model of the basin, it shall be used by the developer in the analyses.

2. Where storm water currently drains by sheet flow and it is proposed to be collected to and/or discharged at a point, such that the discharge from the storm water management facility outlet crosses a property line, such discharge shall mimic predevelopment sheet flow conditions. A description of the method proposed to achieve post-development sheet flow conditions shall be provided as part of the Storm Water Concept Plan. The proposed sheet flow detail shall be submitted with the LDP application. Should the method to achieve sheet flow across an external property line be unsuccessful, the developer shall acquire an easement(s) sufficient to contain the 25 year storm flow from the point of discharge to a point down gradient at a live dry weather stream or other location as approved by the Director of Public Works. This condition will not apply when the storm

water management facility is designed and approved to discharge directly to a stream or watercourse.

3. A draft of the Inspection and Maintenance Agreement required by Fulton County Code Section 26-278 shall be submitted to the Department of Public Works with the Storm Water Concept Plan.

4. The Inspection and Maintenance Agreement shall provide that all storm water management/detention facility outlet control structures shall be inspected, photographed and cleaned, if necessary, on a monthly basis, by the owner. The Inspection and Maintenance Agreement shall require that the design professional shall prepare an operation and maintenance guidance document, for use by the owner and/or any professionals retained by the owner, to plainly describe the basic operational function of the facility(ies), including a description of a permanent marker post(s) which shall indicate that the level of sediment which, if exceeded, requires sediment removal. The Inspection and Maintenance Agreement shall require an annual operation and maintenance report for all storm water management/detention facilities be prepared by a licensed design professional and submitted to the SWMP. The annual report shall include monthly inspections, photographs, and documentation of the cleaning of storm water management/detention facilities outlet control structure(s) as well as an operational assessment of the facilities indicating that they do, or do not, function as described in the design guidance document (described above), and if they do not, a description of the specific actions to be taken to allow the facilities to function as intended.

5. The required Inspection and Maintenance Agreement shall be recorded with the Clerk of Superior Court prior to issuance of an LDP, Grading Permit or Building Permit associated with the development.

6. The developer/design professional is required to submit, along with the application for an LDP, signed documentation verifying approval of the Storm Water Concept Plan.

7. Where paved parking areas (including access aisles) are proposed to exceed 5,000 square feet, the storm water management facilities shall be designed to reduce pollutants such as oil, grease and other automobile fluids that may leak from vehicles. A general description, or concept, of the storm water management facilities proposed to achieve the removal of such pollutants shall be submitted with the Storm Water Concept Plan. A detailed design of such facilities shall be included in applicable documents for a land disturbance permit.

8. With the application for an LDP, provide documentation (such as channel crosssections, centerline profile, etc.) describing the geometry of those existing natural streams, creeks, or draws within the proposed development boundary which in the design professional's judgment are at risk of erosion due to increased flow, provide a description of the basis utilized in judging areas to be at risk, and provide details on the Storm Water Management Plan of the post-development channel bank protection measures.

9. The developer/design professional shall demonstrate to the County by engineering analysis submitted with the LDP application, that the discharge rate and velocity of the storm water runoff resulting from the development is restricted to seventy-five percent (75%) of the pre-development conditions for the 1-year frequency storm event, up to and including the ten (10)-year frequency storm event. The 1-year channel protection volume shall be calculated in accordance with the Georgia Stormwater Management Manual (Section 2.2.5) and released over a 24 hour period.

10. Plans for any land disturbance permit shall show all proposed drainage patterns for the proposed development after its completion. Drainage from all disturbed areas shall be collected and conveyed to a storm water management facility provided as part of the development. Except for runoff from undisturbed areas within a buffer or other protected easement and/or minimal incidental flows specifically approved by the Director of Public Works, bypass flows will not be permitted. The Storm Water Concept Plan shall identify any proposed areas with incidental and minor release of storm water not conveyed to such facilities.

11. Storm water management facility(ies) volumes shall be designed to achieve water quality treatment, channel protection, over bank flood protection and extreme flood protection, in accordance with the Georgia State Storm water Manual, except that the duration of release for water quality treatment shall be 48 hours.

12. The minimum pre-developed time of concentration shall be ten (10) minutes.

13. Graded cut and fill slopes for building site pads greater than six (6) feet in height shall be limited in steepness to 3 horizontal to 1 vertical.

14. For proposed developments where the existing impervious surface area exceeds 75 percent of the project site, the design predeveloped conditions and /or the required reduction of predeveloped peak flow may, upon approval of the Director of Public Works, be modified./ relaxed following notification (by the developer) of adjacent downstream property owners and demonstrated improvements in drainage conditions..

Zoning Resolutions of Fulton County, Section 4.24 – Floodplain Management

4.24. FLOOD PLAIN MANAGEMENT

4.24.1. PURPOSE.

It is the purpose of this Section to minimize public and private losses due to flood conditions in specific areas by provisions designed to promote the public health, safety and general welfare and to:

A. restrict or prohibit uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

B. require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

C. control the alteration of natural flood plains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters;

D. control filling, grading, dredging and other development which may increase erosion or flood damage, and;

E. prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands;

F. adopt and comply with the requirements of the Flood Disaster Protection Act of 1973 (Pub. L. 93-234, December 31, 1979) and Section 60.2 (h), 60.3 (d) and 65.5 of the National Flood Insurance Program (24 C F R 1909, etc.) thereby assuring that the Unincorporated Areas of Fulton County and its citizens shall continue to participate in the benefits of the program and not be subject to the Prohibitions contained in Section 202 (a) of the 1973 act as amended.

4.24.2. OBJECTIVES.

The objectives of this Section are:

A. to protect human life and health;

B. to minimize expenditure of public money for costly flood control projects;

C. to minimize the need for rescue and relief efforts associated with flooding, generally undertaken at the expense of the general public;

D. to minimize prolonged business interruptions;

E. to minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, street and bridges located in flood plains;

F. to help maintain a stable tax base by providing for the sound use and development of flood prone areas in such a manner as to minimize flood blight areas, and;

G. to insure that potential home buyers are notified that property is in a flood area.

4.24.3. JURISDICTION.

This Section shall apply to all the unincorporated areas of Fulton County which contain special flood hazard or flood prone areas.

4.24.4. FLOOD AREAS ESTABLISHED.

A. Special Flood Hazard Area shall be designated on the "Floodway Boundary and Floodway Maps" (FBFM), the "Flood Insurance Rate Maps" (FIRM), and the "Flood Insurance Study" (FIS) prepared and revised by the Federal Emergency Management Agency (FEMA) effective June 22, 1998 . As defined by FEMA, Special Flood Hazard Areas (SFHA) are classified as numbered or unnumbered zones A, AE, (formerly A1-A30), AO, and AH which are available for review on maps in the Environment and Community Development Department or the Department of Public Works. The accompanying maps and other supporting data and all subsequent amendments and/or revisions are hereby adopted by reference, declared to be a part of this Resolution, and shall have the same force and effect as if fully set forth in this Resolution. SFHA shall be identified as follows:(Amended 11/04/98)

1. Fifty Lots or Five Acres Space or More. When FEMA has not produced water surface elevations data and the proposed development is more than 50 lots or 5 acres, whichever is the lesser, base flood elevation data determined in studies by the U.S. Corps of Engineers or other reputable reports based on competent engineering studies prepared by a current state-registered professional engineer and accepted by the Department of Public Works shall be adopted by reference and declared to be a part of this section.
2. Fewer than Fifty Lots or Five Acres. When FEMA has not produced water surface elevation data and the proposed development is not fewer than 50 lots or 5 acres, whichever is the lesser, then the base flood elevation data may be determined by the best information available.

B. Regulatory Floodway Area shall be designated on the "Flood Boundary and Floodway Map" and the "Flood Insurance Study" as revised by FEMA from time to time. It is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

C. Flood Prone Area shall be designated on the "Flood Insurance Rate Map". Flood Prone Areas shall be those areas classified as areas of moderate and minimal flood hazards, shown thereon as “Zone X” (formerly Zone B). (Amended 06/03/98)

4.24.5. USE REGULATIONS.

(Amended 04/05/06)

Notwithstanding the uses permitted by the zoning district applying to the property, the following shall be prohibited in the Special Flood Hazard Area (100 year IRF): buildings and structures; filling; and compensatory flood storage for placement of either fill or for construction of a structure in the floodplain with exception to exempted uses as specified in Section 4.24.5.A. 1-8:

Floodplain designation shall be based on data generated by FEMA, Fulton County flood studies, or data from engineering flood studies prepared by a state-registered professional engineer and accepted by Fulton County (whichever is most representative of the current floodplain). Flood studies shall be approved contingent upon acceptance by FEMA. Construction (which is consistent with the exemption provisions of this resolution) shall be allowed within floodways only if it is directed towards improving the capacity or flow characteristics of the flood waters or crossing, relocating or altering the floodway channel itself. All such construction must be in conformance with the provisions of the Fulton County Zoning Resolution and the national Flood Insurance Program.

A. Special Flood Hazard-Flood Prone Permitted Uses. The following uses are permitted in Special Flood Hazard and Flood Prone Areas.

1. Agricultural, including forestry and livestock raising, requiring no structure. Agriculture and forestry access roads are permitted provided they are constructed in conformance with the development standards of the regulations.
2. Dams, provided that they are constructed in accordance with the requirement of this section, the Department of Public Works, the U.S.D.A. Soil and Conservation Service and when applicable, meet the specifications of The U.S. Army Corps of Engineers and/or the Georgia Department of Natural Resources.
3. Fences having sufficient open area to permit the free flow of water and/or debris.
4. Identification, regulatory and warning signs.
5. Public and private parks and recreational areas including boat ramps and docks and other functionally dependent uses not including any temporary or permanent buildings, provided; such use is approved by the Department of Environment and Community Development, if applicable, the U.S. Army Corps of Engineers.
6. Parking.
7. Utility lines, pipelines, sewers, roads and stream crossings (if no other means of access is available), and similar facilities, provided they are constructed in such a manner as to permit the free flow of flood waters.

B. Floodway Area Permitted Uses. No construction is allowed within floodways except that which is directed towards improving the capacity or flow characteristics of the flood waters or crossing, relocating or altering the floodway channel itself. All such construction must be in conformance with the provisions of this Resolution and the National Flood Insurance Program.

4.24.6. PERMIT REQUIRED.

A land disturbance permit or grading permit shall be required prior to the commencement of any improvement, including grading and filling, within the Special Flood Hazard or Flood Prone Areas. (Amended 11/03/93)

A. Activities on Lots Within Existing Development. In developments that require only a building permit on a developed lot, portions of which are subject to flooding, the Director of the Environment and Community Development Department shall review the application and issue the Permit as part of the Building Permit. The Flood Elevation Study as required by paragraph 4 (a)(1) above may be waived by the Department of Public Works provided:

1. A licensed surveyor submits base flood elevation data based on the best information available.
2. That the base flood elevation data is to be used only to establish the lowest floor elevation of a structure.

B. Activities Requiring Land Disturbance Permit. In developments that require a Land Disturbance Permit as provided in the "Erosion and Sedimentation Ordinance of 1978", the Environment and Community Development Department shall review the application and issue the Permit as part of the Land Disturbance Permit. (Amended 11/03/93)

C. Other Activities. In all other developments that involve change, modification, or alteration to a flood area, except such activities as plowing, tilling, seeding, planting, or any other agricultural or landscaping pursuit which does not result in change to the cross sectional area of the flood plain nor a significant or hazardous change in the flow characteristics, the developer shall be required to obtain the applicable permit prior to the commencement of any construction within the flood plain.

4.24.7. PERMIT PROCEDURE.
(Amended 11/03/93)

A. Application. Application for a Permit shall be made to the Environment and Community Development Department as indicated under permit required above. If the proposed development requires a land disturbance permit or is of such a nature as to require review and approval by the Environment and Community Development Department, or any other appropriate agencies, the applicant shall be so advised. Such review may require additional data and/or plans to be furnished by the applicant to assure compliance with all applicable regulations.

B. Certification. The Director of the Environment and Community Development Department shall inform an applicant of the requirements that "as-built" lowest floor elevation certificates be obtained prior to approval of a certificate of occupancy for any structure built in or immediately adjacent to a Special Flood Hazard Area. Certificates of elevation:

1. Shall be prepared by a Professional Engineer or Surveyor licensed by the State of Georgia.
2. Shall be maintained in a file in the Offices of the Environment and Community Development Department and the Department of Public Works.

4.24.8. PLANS AND STUDIES REQUIRED.
Wherever it is necessary to determine that the proposed use conforms to the requirements of this Section, the Environment and Community Development Department shall require the applicant to furnish complete and sufficient plans, specifications, hydrological and engineering studies or data. Depending on the size or nature of the proposed use, any or all of the following may be required: (Amended 11/03/93, 06/03/98)

A. Grading, replanting and drainage plans;

B. Proposed temporary and permanent drainage and sedimentation control structures and facilities;

C. Complete hydrologic and hydraulic analysis, prepared by a professional engineer registered in the State of Georgia, establishing the 100 year base flood elevations and horizontal flood plain limits.

D. A determination of the channel cross-section area required to carry the affected stream during the base flood;

E. Complete hydrologic studies to evaluate the total effects a development under review may have upon affected drainage facilities and systems;

F. The Environment and Community Development Department may require the applicant to furnish a written agreement to limit use and development in accord with the approved plan and specifications.

4.24.9. GENERAL DEVELOPMENT PROVISIONS AND STANDARDS.
(Amended 11/03/93)

A. Relocation and Realignment. Within a Special Flood Hazard or Flood Prone Area any relocation or realignment of river and stream channels shall be prohibited if it would reduce the floodway capacity with respect to the base flood elevation, or significantly alter water flow characteristics so as to create a hazard.

B. Nonconforming Uses. Except as restricted or exempted below, existing nonconforming uses within a Special Flood Hazard or Flood Prone Area may be maintained or repaired; modified, altered or repaired to incorporate flood proofing measures; improved to comply with existing state or local health, sanitary or safety code specifications which are solely necessary to assure safe living conditions.

1. Restrictions.

a. The cost of such improvement shall not equal or exceed 50 percent of the market value of the structure either, (i.) before the improvement is started or (ii.) if the structure has been damaged, and is being restored, before the damage occurred.

b. Such non-conforming use shall not be expanded.

2. Exemption.

Any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

C. Structures Elevated Above Flood Hazard or Flood Prone Areas. No new structure shall be approved or constructed so as to extend over a Special Flood Hazard or Flood Prone Area, whether it be a cantilever design or supported by structural elements located within the flood plain.

D. Structures Adjacent to Flood Hazard or Flood Prone Areas. For any proposed new structure adjacent to a Special Flood Hazard or Flood Prone Area the ground surface shall be at least three (3) feet above the base flood elevation. Further, when a filled building site is required, the ground surface at the face of the wall shall be at least ten (10) feet distant from the base flood plain. See paragraph 65.5 of the National Flood Insurance Program as amended.

E. The Lowest Minimum Floor Elevation. The lowest floor elevation, as described in FEMA's elevation certificate on page 5 and 6, shall be at least three (3) feet above the base flood elevation and meet the requirements of 4.24.9 G. (Amended 04/05/95)

F. Removing Flood Hazard or Flood Prone Areas. Lands may be removed from a Special Flood Hazard Area or Flood Prone Area by raising the elevation of such land above the base flood elevation, provided the raising of such land is accomplished in accordance with the requirements of this resolution. Refer to FEMA National Flood Insurance Program Regulation 44 CFR, Part 65 for procedures to amend the FIRM, FHBM, or FIS. The developer/property owner shall prepare all plans and engineering studies and pay any fees necessary to obtain a Letter of Map Revision for their development.(Added 04/05/95)

G. Residential Lots. In districts which permit residential use, development is prohibited in Special Flood Hazard Areas. Fulton County may allow such development provided:(Amended 04/05/95)

1. Not less than 70% of the buildable land area lies above the base flood elevation, a minimum of one (1) foot, and/or

2. Not less than 50% of the minimum lot area, as established by the applicable zoning district, shall be above the base flood elevation.

H. Utilities. The location, design, elevation, and construction of all public utilities and facilities, such as sewer, gas, electrical, on-site waste disposal systems, water systems and streets shall be in such a manner as to minimize or eliminate damage by flooding.

I. Drainage Structures. All drainage structures and facilities located within Special Flood Hazard or Flood Prone Areas shall be constructed in accordance with Fulton County Standards and Specifications. They shall be maintained by the owner in a sanitary, fully functional and operable state so that the flood carrying capacity of the watercourse is preserved.

J. Erosion and Sediment Control. Provision shall be made for the adequate control of erosion and sedimentation.

K. Riverine Considerations. Fulton County shall notify, in riverine situations, adjacent communities and the Georgia State Coordinating Office prior to any alteration or relocation of a watercourse.

L. Watercourse Alteration or Relocation. Fulton County, prior to approval of a permit to alter or relocate a portion of any watercourse shall require an agreement indemnifying Fulton County from all liability arising from the construction pursuant to said permit and providing for the continued maintenance to assure the flood carrying capacity within the altered or relocated water course.

4.24.10. DEVELOPMENT WITHIN FLOOD PRONE AREAS.

A. Development Limitations. Within Flood Prone Areas, no construction including grading and filling shall be allowed that would:

1. Raise the base flood elevation beyond the boundaries of the ownership of the property being developed - Submittal of this certification and the supporting studies by a professional engineer are required.
2. Reduce the flood storage capacity - Fill placed within the flood plain must be compensated. All cut areas must drain by gravity to the main watercourse. Certification by a professional engineer and an "as-built" topographical map superimposed on the original topography are required.
3. Impede the movement of flood waters - Applies to any obstruction placed within the flood plain, i.e., fill, but in particular, roads, driveways, bridges and culverts. All such encroachments shall be designed and submitted by a professional engineer and shall provide:
    a) That there shall be no reduction in the flood carrying capacity of the watercourse.
    b) A certification together with supportive data.
    c) Sufficient opening provided for the passage of the flood waters so as to prevent or greatly reduce the hazard of debris or trash blocking the flood's flow.
4. Changes the flow characteristics of the flood waters as they pass the boundaries of the developed property - Requires certification by a professional engineer along with all supportive studies.
5. Create hazardous or erosion producing velocities Requires certification by a professional engineer along with supportive studies.

B. Stormwater Management Structures. Detention ponds, lakes and similar impoundment structures may be constructed within a Flood Prone Area provided they do not violate the restrictions enumerated under paragraph 10

(a) above. Provided further that any such detention pond, lake or similar impoundment structure shall provide adequate discharge control and sufficient storage capacity to assure that the rate of runoff calculated for the proposed development including that drainage increased or diverted by reason of the development shall not exceed that calculated for the property in its natural state in the event of the 100 year storm.

C. Studies and Plans Required. A hydrologic analysis shall be required to be submitted to the Environment and Community Development Department with each application for a Land Disturbance Permit for property containing a Flood Prone Area. Any or all of the other plans or studies referred to in paragraph 4.24.8 above may be required. Such studies shall take cognizance of existing conditions which affect the flow of water on adjacent properties and also such future conditions as can reasonably be expected to occur in the drainage basin. Such reports shall meet the requirements of the Environment and Community Development Department. (Amended 11/03/93, 06/03/98)

D. Revision Criteria. Each application for a Land Disturbance Permit for property containing a Flood Prone Area shall also submit therewith documented results of hydrology and hydraulic analysis prepared by a registered professional engineer demonstrating that any area defined on the FIRM or FBFM as moderate or minimal flood hazard (Zone X) is not actually a SHFA. Such results and analysis shall demonstrate that none of the following criteria is met in any Flood Prone Area(s) on the site: (Added 06/03/98)

(1) The Flood Prone Area(s) is subject to a one percent (1%) annual chance of flooding with average channel depths greater than one foot or;

(2) The Flood Prone Area(s) has a contributing drainage area greater than one square mile or;

(3) The Flood Prone Area(s) has hazardous velocities in the channel and/or overbank areas greater than 3.5 feet per second. (The County may accept velocities of up to 5 feet per second depending upon the results of a soil study by the engineer).

In the event that any of the above criteria is met, the applicant shall submit to the Environment and Community Development Department the relevant data for a Letter of Map Revision and the appropriate fees required by FEMA. The Fulton County Department of Public Works shall then submit the relevant data, Letter of Map Revision and accompanying fees to FEMA for a determination of whether a map revision is warranted. In the event of such a map revision reclassifying an area as an SHFA, development within the affected area(s) shall comply with Section 4.24.12 of this Article.

4.24.11. DEVELOPMENT WITH UNSTUDIED SPECIAL FLOOD HAZARD AREAS.

4.24.12. DEVELOPMENT WITHIN STUDIED SPECIAL FLOOD HAZARD AREAS.

Development and Revisions Criteria in the unstudied Special Hazard Areas shall be the same as in the Flood Prone Areas, Subsection 4.24.10 (Amended 06/03/98).

A. Development Limitations. No construction shall be allowed within the studied Special Flood Hazard Areas that would:

1. Raise the base flood elevation - Submittal of this certification and the supporting studies by a professional engineer are required.

2. Reduce the flood storage capacity - Fill placed within the flood plain must be compensated. All cut areas must drain by gravity to the main watercourse. Certification by a professional engineer and an "as-built" topography map superimposed on the original topography are required.

3. Impede the movement of flood waters - Applies to any obstruction placed within the flood plain but in particular, roads, bridges, driveways and culverts. All such encroachments shall be designed by a professional engineer and shall provide:

a) That there shall be no reduction in the flood carrying capacity of the watercourse.

b) A certification together with supportive data.

c) Sufficient opening provided for the passage of the flood waters so as to prevent or greatly reduce the hazard of debris or trash blocking the flow of the flood.

4. Change the flow characteristics of the flood waters. Requires certification by a professional engineer along with all supportive studies.

5. Create hazardous or erosion producing velocities. Requires certification by a professional engineer along with supportive studies.

B. Increase Base Flood Elevation. The Department of Public Works may from time to time, request a review and determination from the Floodplain Management Administrator to permit an increase in the base flood elevation. Such increased elevation shall not exceed that depth shown in the Flood Insurance Study, Table 2, Base Flood Water Surface Elevation with Floodway Column. (Amended 04/05/95)

1. This increase may be granted when:

a. The development is a proposed public road, bridge and/or culvert, public utility poles, towers, pipelines, sewers and similar facilities.

b. The development is a private lot, bridge/culvert, private utility poles, towers, pipelines, sewers or other similar facilities.

2. A professional engineer must submit a certification along with supportive documentation that the increase does not extend beyond the boundaries of the property upon which the improvement is proposed and shall not cause any appreciable expansion of flooding, siltation, erosion or inundation hazards. (Amended 11/03/93)

3. A developer shall apply to the Flood Plain Management Administrator of Fulton County for review and approval of an application for a Letter of Map Revision to FEMA. (Added 04/05/95)

4. The Floodplain Management Administrator may apply for a conditional FIRM revision to FEMA prior to permitting encroachment into a Special Flood Hazard Area. Refer to the National Flood Insurance Program Regulations 44 CFR, Part 65.12 for FEMA requirements. (Added 04/05/95)

4.24.13. FLOODWAY ALTERATION.

A. Construction Within Regulatory Floodway. When construction is proposed within the regulatory floodway such as flood control projects, stream channelization, stream relocation, construction of new dams, reservoirs, artificial canals, private levees or flood protection systems which would result in a change in the base flood elevations as shown on the Flood Insurance Rate Maps (FIRM), the following shall be required:

1. Complete plans, data, studies and documentation for the proposed construction shall be submitted to the Department of Public Works.
2. If the Department of Public Works determines that the project is feasible and acceptable, then the Department shall submit the project to FEMA in compliance with the provisions of the National Flood Insurance Program, paragraph 65.5 as amended from time to time.

NOTE: Fulton County may require a fee for review of such proposals.

4.24.14. MOBILE HOMES.

All mobile homes located within the 100-year flood plain must adhere to all applicable regulations stated elsewhere in this Resolution as well as the following:

A. Anchoring. All mobile homes should be anchored to resist flotation, collapse or lateral movement, by providing over-the-top and frame ties to ground anchors. Specific requirements shall be that:

1. Over-the-top ties be provided at each of the four corners of the mobile home, with two additional ties per side at intermediate locations. Mobile homes which are less than 50 feet long must have one additional tie per side;
2. Frame ties be provided at each corner of the home with five additional ties per side at intermediate points. Mobile homes which are less than 50 feet long require four (4) additional ties per side;
3. All components of the anchoring system must be capable of carrying a force of 4800 pounds; and
4. Any additions to the mobile home must be similarly anchored.

B. General Requirements. All mobile homes are required to have:

1. Lots that are elevated on compacted fill in accordance with Paragraph 4.24.9(D).
2. Adequate surface drainage and access for a hauler.

4.24.15. SUBDIVISION PLATS.

Hereinafter, proposed preliminary and final subdivision plats for property located contiguous to or within Flood Prone or Special Flood Hazard Areas shall not be approved except in accordance with the following requirements: (Amended 04/05/95)

A. Each plat shall contain a notation clearly stating the water surface elevation of the Base Flood in relation to mean sea level as approved and accepted by the Department of Public Works. Any lands below this elevation shall be designated on the plat by a heavy line, depicting the Base Flood elevation at that point.

B. No lot shall be approved which has less than the minimum lot area as established by the applicable zoning district regulations and 4.24.9(G) above the base flood elevation.

C. Preliminary and final subdivision plats that were approved prior to the enactment of this section are exempt from the requirements of 4.24.9, D. and 4.24.15, B., above, and building permits shall be issued accordingly.

D. No final subdivision plat shall be approved by the County where development has altered the Special Flood Hazard Area unless the County has first received a Letter of

Map Amendment, Letter of Map Revision or notice of Conditional FIRM Revision from FEMA as stipulated in the National Flood Insurance Program Regulations 44 CFR, Part 65.(Added 04/05/95)

4.24.16. ABROGATION AND GREATER RESTRICTIONS.

This section is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. Where this section and another section of this Resolution conflict or overlap, however, whichever imposes the more stringent restrictions shall prevail.

4.24.17. INTERPRETATION.

In the interpretation and application of this Section, all provisions shall be:

A. Considered as minimum requirements;

B. Liberally construed in favor of the governing body;

C. Deemed neither to limit nor repeal any other powers granted under state statutes.

4.24.18. WARNING AND DISCLAIMER OF LIABILITY.

The degree of flood protection required by this Section is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This Section shall not create liability on the part of Fulton County or by any official or employee thereof for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

4.24.19. COMPLIANCE.

No structure or land shall hereafter be located, extended, converted, or structurally altered without full compliance with the terms of this Section and other applicable regulations.

4.24.20. APPEAL.

(Deleted 3/4/92, See Article 22)

Article VI – Conservation Subdivision Ordinance

ADOPTED BY THE BOARD OF COMMISSIONERS ON APRIL 21, 2004

ARTICLE VI

Conservation Subdivision Ordinance

6.1. **PURPOSE AND INTENT**. It is the purpose and intent of this ordinance to insure preservation of open space within residential developments; provide flexibility to allow for creativity in developments; minimize the environmental and visual impacts of new development on critical natural resources and historically and culturally significant sites and structures; provide an interconnected network of permanent open space; encourage a more efficient form of development that consumes less open land and conforms to existing topography and natural features; reduce erosion and sedimentation by minimizing land disturbance and removal of vegetation; enhance the community character; permit clustering of houses and structures which will reduce the amount of infrastructure, including paved surfaces and utility lines; encourage street design that controls traffic speeds and creates street inter-connectivity; and promote construction of convenient and accessible walking trails and bike paths both within a subdivision and connected to neighboring communities, businesses and facilities to reduce reliance on automobiles.

6.2. **APPLICABILITY OF REGULATIONS.** The Conservation Subdivision option is available for single family detached residential developments in the following districts: AG-1, R-1, R-2, R-2A, R-3, R-3A, R-4, R-4A, R-5 and R-5A in unincorporated Fulton County south of the City of Atlanta (South Fulton). Compliance with all applicable Fulton County ordinances, regulations, or resolutions is required; however, when in conflict, the provisions of this ordinance shall prevail.

6.3 **DEFINITION OF OPEN SPACE**. Open space is the portion of the conservation subdivision that has been set aside for permanent protection. Activities within the open space are restricted in perpetuity through the use of an approved legal instrument.

6.4. **OPEN SPACE REQUIREMENT.** Each conservation subdivision shall provide a minimum of 40% of its total acreage as open space as defined by this ordinance. The open space shall be designated on the conceptual plan and recorded on the final plat. Interconnectivity of all open space within a Conservation Subdivision shall be required.

6.4.1. **OPEN SPACE NETWORKS CONFIGURATION.** The minimum standards for open space networks are as follows:

a. The minimum width of any open space area is 25 feet.

b. All paths shall be a minimum of 20 feet from any property line except where
interparcel access may be provided.

c. All open space networks shall provide connectivity to any common areas within the development and to any adjacent public places/rights-of-way.

d. Paths located in primary conservation areas shall be constructed of pervious materials.

e. Where path networks cross internal subdivision streets or public streets, access points shall be directly across from each other or as approved by the Director.

f. Crossings and access points shall be clearly identified to pedestrians and motorists and may include traffic control devices, bridges and tunnels as approved by the Director.

6.5. **OPEN SPACE AND CONSERVATION AREAS**. Open space shall be designated as either primary conservation areas or secondary conservation areas and shall be configured to create or maintain a network of open space.

6.5.1. **PRIMARY CONSERVATION AREAS.** Primary conservation areas form the core of the open space to be protected. Active recreation areas are prohibited in primary conservation areas unless approved by the Director. Primary conservation areas, as defined by this ordinance, include the following:

a. Cemeteries;

b. Habitats for endangered or threatened species as defined by the Georgia Department of Natural Resources;

c. Wetlands identified by the National Wetlands Inventory maps prepared by the U.S. Fish and Wildlife Service, the County Soil Survey prepared by the United States Department of Agriculture (USDA) Natural Resources Conservation Service, or a certified wetlands delineation using data from the U. S. Army Corps of Engineers;

d. Alluvial soils identified by the Federal Emergency Management Agency (FEMA) and 100-Year floodplain;

e. Lakes (natural and man made), rivers, streams, existing ponds, stormwater management ponds/facilities designed in accordance with the Fulton County Subdivision Regulations, creeks, including but not limited to blue line tributaries and state waters;

f. Riparian zones equal to any required stream buffers and improvement setbacks;

g. Existing slopes greater than 25% on average with a site area greater than 5,000 square feet identified as part of a site analysis conducted by a registered engineer, land surveyor or landscape architect and calculated using topographic maps from the Fulton County GIS system or from a topographic survey prepared by a licensed land surveyor.

6.5.1.1 **VALUE OF PRIMARY CONSERVATION AREAS.** Because primary conservation areas are either protected or sensitive environmental areas, only 50% of the acreage of a primary conservation area may be counted as open space.

6.5.2. **SECONDARY CONSERVATION AREAS**. Secondary conservation areas consist of undeveloped (unconstrained) but buildable land and protected (constrained) lands. Secondary conservation areas, as defined by this ordinance, include the following:

a. Farmlands (fields, pastures, meadows);

b. Woodlands and buffers except riparian buffers;

c. Historic and/or archaeological sites as identified by the Fulton County Historic Resources Survey;

d. Passive recreation areas, public and private, to include pedestrian, bicycle and equestrian trails, picnic areas, community commons or greens, and similar areas;

e. Active recreation areas and facilities, public and private, to include parks as identified by the Parks and Recreation Master Plan, playing fields, and playgrounds. Recreation areas with impervious surfaces (e.g., tennis courts, basketball courts and pools) and golf courses shall be excluded.

6.5.2.1. **VALUE OF SECONDARY CONSERVATION AREAS**. With the exception of active recreation areas and facilities, 100% of secondary conservation areas may be counted as open space. Because active recreation areas are cleared and graded and therefore reduce natural resources and wildlife habitats, only 50% of active recreation areas and facilities may be counted as open space.

6.6. **OPEN SPACE PROTECTION.** The required open space areas shall be protected in perpetuity from further development or unauthorized use by a conservation easement or permanent restrictive covenant (per O.C.G.A. Section 44-5-60(c)). Fulton County reserves the right to enforce all restrictive covenants and conservation easements.

6.6.1. **REQUIREMENTS FOR CONSERVATION EASEMENTS**. The conservation easement(s) shall:

a. Clearly delineate primary and secondary conservation areas;

b. Describe the features of the subject property that should be permanently protected in accordance with The Georgia Uniform Conservation Easement Act, O.C.G.A. 44-10-1 et seq.;

c. List the parties, that is, the owner(s) of the property, the holder of the easement and Fulton County as a third party beneficiary with rights to enforce the easement if Fulton County is not the holder;

d. Specify how the easement may be transferred as in the case of a homeowners association dissolving;

e. Clearly identify the boundaries of the property by survey and a metes and bounds legal description;

f. Clearly list restrictions;

g. Provide for inspections of the property by the owner, the holder of the easement and Fulton County;

h. Provide for maintenance of the property;

i. Be shown on the final plat and duly recorded with the Clerk of Superior Court prior to the issuance of a Land Disturbance Permit; and

j. Provide for amendments only with the express written permission of the property owner(s), the holder of the easement and Fulton County. Amendments to the easement shall be filed with the Director and shall be recorded in Superior Court.

6.6.2. **REQUIREMENTS FOR PERMANENT RESTRICTIVE COVENANTS**. The permanent restrictive covenant(s) shall:

a. Clearly delineate primary and secondary conservation areas;

b. Describe the features of the subject property that should be permanently protected;

c. Clearly identify the boundaries of the property by survey and a metes and bounds legal description;

d. Clearly list restrictions;

e. Provide for inspections of the property by Fulton County;

f. Provide for maintenance of the property;

g. Be shown on the final plat and duly recorded with the Clerk of Superior Court prior to the issuance of a Land Disturbance Permit; and

h. Provide for amendments only with the express written permission of the property owner(s) and Fulton County. Amendments to the covenant shall be filed with the Director and shall be recorded in Superior Court.

6.7. **MAINTENANCE OF OPEN SPACE**. Open space may be maintained and/or improved through reforestation, pasture management, buffer replantings, stream bank protection and wetlands management or by other means as approved by the Director.

6.8. **OWNERSHIP OF OPEN SPACE**. All open space shall be permanently protected and held in fee simple interest by a qualified conservation organization as defined in The Georgia Uniform Conservation Easement Act, O.C.G.A. 44-10-1 et seq., or a homeowners association established in accordance with the Georgia Property Owners Association Act, O.C.G.A. 44-3-220 et seq., or a land trust, or Fulton County. If accepted by the County, the property must be in accordance with the provisions herein.

6.8.1. **OWNERSHIP OF OPEN SPACE BY A HOMEOWNERS ASSOCIATION**. Open space that is owned by a homeowners association is subject to the following:

a. Prior to the approval of the final plat, the developer of a conservation subdivision shall submit to the Director a description of the homeowners association, including by-laws, and methods for maintaining the open space.

b. Membership of each lot owner in the conservation subdivision shall be mandatory.

c. The homeowners association shall be responsible for maintenance, insurance, and taxes on the open space.

d. The homeowners association shall not be dissolved before providing the appropriate documentation to transfer conservation easements.

e. Any transfer of conservation easements is subject to the approval of the Director.

6.9 **CONSERVATION SUBDIVISION DENSITY.** The maximum number of lots shall be based upon 80% of the net buildable area's density allowed by zoning, with net buildable area defined as the total acreage minus primary conservation areas. Density bonuses are allowed in accordance with section 6.10.

6.10. **CONSERVATION SUBDIVISION DENSITY BONUSES.** The number of lots in a Conservation Subdivision may exceed the number of lots as specified in section 6.9 with one or more of the following bonus options:

a. A density increase is permitted when more than 40% of the total acreage of the project is designated as permanent, protected open space. For each additional whole acre, greater than 40 percent, additional lots or units may be developed as follows:

Current Zoning	**Additional Lots Allowed Per Development for each acre of protected open space greater than 40%**
AG-1	1
R-1	0.5
R-2	1
R-2A	1

R-3 2
R-3A 2
R-4 4
R-4A 3
R-5 5
R-5A 10

b. In lieu of providing additional open space over 40% in the development, the applicant may purchase, in fee simple, additional land in unincorporated Fulton County within one (1) mile of the development comprised of primary and/or secondary conservation areas. The density increase within the development shall be based on the same criteria as in Sec. 6.10.a. As with conservation areas within a development, protected open space, purchased in fee simple outside a development, shall also be protected in perpetuity from further development or unauthorized use by a conservation easement held by Fulton County or other conservation organization, land trust, or homeowners association.

c. Dedication of land for a public use, excluding roads and utility easements, shall entitle an owner to an additional unit per acre of dedicated land as detailed in Section 6.10.a. Prior to the issuance of a Land Disturbance Permit, dedications of land for public use shall be approved by the Fulton County Board of Commissioners or the Fulton County Board of Education if for school purposes, based upon recommendations of existing and future recreation and park plans, comprehensive plans, school board plans and the County's Capital Improvements Program.

d. At no time shall the number of lots exceed 95% of the net buildable area's density allowed by zoning.

6.11. **LOT REQUIREMENTS**. The minimum lot size in any project shall be 4,000 square feet. The total number of lots may not exceed the number of lots that could otherwise be developed under the existing zoning except with the allowable density bonuses described herein.

6.12. **MINIMUM LOT FRONTAGE**. The minimum lot frontage on a right-of-way shall be 20 feet.

6.13. **SETBACKS AND BUILDING SEPARATION REQUIREMENTS**. Setbacks and building separations are subject to the provisions of the Standard Building Code.

6.14. **BUFFER REQUIREMENTS.** A minimum 50-foot wide natural buffer, undisturbed except for approved access and utility crossings and replantings where sparsely vegetated, plus a 10-foot improvement setback, shall be provided along all property lines adjacent to AG-1 zoned properties, residentially zoned or used properties, and existing roads, or as may be approved by the Director.

6.15. **STREET STANDARDS**. Conservation subdivision streets shall be designed based on the following standards:

a. Streets should follow existing contours with a minimum of cut and fill and shall be designed for interparcel access.

b. The maximum length for an interior block is 600 linear feet with the total perimeter length not to exceed 1,680 linear feet. The total area of an interior block shall not exceed 3.30 acres.

c. All newly created lots should derive access from internal subdivision streets.

6.16. **ZONING MODIFICATION REQUIREMENTS**. Proposed conservation subdivisions for properties where zoning is conditional shall require an approved modification to the site plan and other conditions pertinent to use, number of lots and density, as applicable, prior to the approval of a final plat.

6.17. **TAX ASSESSMENT OF OPEN SPACE**. Once a legal instrument for permanent protection has been placed upon the open space, the Fulton County Tax Assessor shall reassess the value of the open space.

DIVISION 6. PROHIBITIONS AND ILLICIT CONNECTIONS

Sec. 26-316. Prohibitions.

(a) It is unlawful for any person, company, corporation, etc., to throw, drain, run, or otherwise discharge to any component of the county's stormwater system, including streets, highways, rights-of-way; or to cause, permit, or suffer to be thrown, drain, run, or allow to seep or otherwise discharge into such system, any organic or inorganic matter that shall cause or tend to cause pollution to such waters, as provided for in this article.

(b) The director of public works may exempt the following from the prohibition provision above:

(1) Water line flushing performed by a government agency, diverted stream flows, rising groundwaters, and unpolluted groundwater infiltration.

(2) Unpolluted pumped groundwater.

(3) Discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, and water from street washing.

(4) Discharges or flows from firefighting.

(5) Other unpolluted water.

(c) In the event of an accidental discharge or an unavoidable loss to the municipal/county separate storm sewer system of any material of substance other than stormwater runoff, the person responsible shall inform the department of public works within five days of the nature, quantity, and time of the occurrence of the discharge. The person responsible shall take immediate steps to minimize the effects of the discharge on the municipal/county system and receiving streams. The person shall also take immediate steps to ensure no recurrence of the discharge.

(95-0093, art. VI, § A, 3-15-95)

Sec. 26-317. Illicit connections.

(a) It is unlawful for any person, company, corporation, etc., to connect any pipe, open channel, or any other conveyance, structure or system to the county's stormwater conveyance system that discharges anything except stormwater runoff and that are not identified on the stormwater management plan.

(b) Improper connections in violation of this article must be disconnected and redirected, if necessary, to the Fulton County Sanitary System or other acceptable outfall upon approval by the director of public works.

(95-0093, art. VI, § B, 3-15-95)

Sec. 26-318. Cooperation with the county.

(a) It shall be the responsibility of any person, firm, company, corporation, etc., to cooperate with the county in the search for illicit connections or prohibitive activities as described in this division in order for the county to comply with the conditions of its NPDES permit.

(b) Any person, firm, company, corporation, etc., shall answer the questions of the county and share information on business activities as they relate to this article, except those records and activities that are confidential and proprietary. If necessary, the county may obtain access to confidential and proprietary records and activities through a court order, subject to the following conditions:

(1) The county shall have access to records and information for the purpose of examination for compliance with the conditions of this article only during normal business hours;

(2) The county shall not have the right to make copies, excerpts, or transcripts of such records and activities without receiving prior written consent; and

(3) The county shall not disclose or make available to third parties any such records or information obtained unless required to do so by a separate court order.

(c) Failure to comply with the conditions of this division shall be considered a violation and subject to the penalties found in section 26-113.

(95-0093, art. VI, § C, 3-15-95)

Secs. 26-319--26-350. Reserved.

Fulton County Codes of Law, Article XVI – Litter Control

ARTICLE XVI. LITTER CONTROL

Sec. 34-726. Enactment authority.
The Board of Commissioners of Fulton County, Georgia under the authority of Article 9, Section 2, Paragraph 1 of the Constitution of the State of Georgia (1983), as amended and O.C.G.A. Title 36-1-20, hereby ordains and enacts into law this article.
(Ord. No. 98-0379, 3-4-98)
State law references: Littering, O.C.G.A. § 16-7-40 et seq.

Sec. 34-727. Purpose.
The governing authority is authorized to adopt ordinances for the governing and policing of unincorporated areas of the county for the purpose of preserving and protecting the public health, safety and welfare. Specifically, the governing authority may provide for the regulation and control of litter (O.C.G.A. § 36-1-20). The board of commissioners hereby enacts the following provisions in an effort to regulate and control litter in the unincorporated areas of Fulton County for the purpose of protecting and preserving the public health, safety, and welfare of the citizens, and to curb thereby the desecration of the beauty of Fulton County caused by persons who litter.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-728. Title.
This article shall be known and may be cited as the "Fulton County Litter Control Ordinance", and as Article XVI of Chapter 34, Health and Sanitation.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-729. Scope of article.
The provisions of this article shall apply only to unincorporated Fulton County or any area within the jurisdiction of the governing authority of Fulton County.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-730. Definitions.
As used in this article, unless the context clearly requires otherwise, the following words or phrases shall have the following meanings:
Bulk waste shall mean dry type wastes such as discarded tires, white goods, furniture, appliances, land clearing material, oversize tree trunks and/or limbs, and/or similar material.
Dispose means to discharge, deposit, inject, burn, dump, place or get rid of any liquid, trash, litter, or garbage into, or on any land, or water so that such liquid, trash, litter, or garbage, or any constituent thereof, may enter into and upon the environment or transfer to the control of another person in a manner inconsistent with this article or any other state or local law, regulation, or ordinance.
Garbage shall mean all household or domestic waste, including waste from the preparation and cooking of food, vegetable, fruit, and meat scraps, ashes, cans and bottles, paper, floor sweepings, cardboard, and other such material to be disposed of from residents, churches, schools, office buildings, business establishments and similar places.

Governing authority means Fulton County ("County"), its board of commissioners, and where delegated [designated] by the board of commissioners, the directors of the Fulton County Department of Public Works, Department of the Environment and Community Development, and Department of Health.

Litter means all discarded sand, liquid, bulk waste, gravel, slag, brickbats, rubbish, waste material, tin cans, refuse, garbage, trash, debris, dead animals or discarded materials of every kind and description.

Litter receptacle shall mean a receptacle designed and constructed to receive, collect, store and contain litter in a lawful, convenient and spill-proof manner.

Owner shall mean any person, firm or corporation owning, leasing, renting, occupying, or managing any premises in unincorporated Fulton County or any area within the jurisdiction of the governing authority.

Person shall mean any individual, trust, firm, association, joint-stock company, corporation (including a government corporation), partnership, organization, municipality, commission, or political subdivision, or any agency, board, department, or bureau of this state or any other state or of the federal government.

Public or *private property* means the right-of-way of any road or highway; any body of water or watercourse or the shores or beaches thereof; any park, playground, building, refuge or conservation or recreation area, and residential or farm properties, timberland or forest.

Refuse means garbage, rubbish, or commercial solid waste.

Rubbish means discarded waste paper, cartons, boxes, wood, tree branches, yard trimmings, furniture, appliances, metals, cans, glass crockery, dunnage and/or similar materials.

Trash means any combustible and noncombustible nonputrescible solid waste, of a size and form which can be easily deposited in, and removed--by Fulton County personnel or lawfully removed by any other entity--from containers provided by the county or any other entity for the disposal and collection of solid waste from residences, and which includes paper, cardboard, small metal items or containers and packaging materials, and similar items normally accumulated in the care and maintenance of residential or commercial property.

Vegetative overgrowth means any and all uncultivated vegetative growth exceeding a height of 12 inches, as measured vertically from the surface of the ground, and covering a portion of any lot, tract or parcel of land which is not occupied by buildings, other structures or trees, but not including riparian vegetation located on any water frontage area.

Weeds means all rank, vegetative growth, including kudzu, poison ivy, plants of obnoxious odors, weeds and grasses causing hay fever or those which serve as a breeding place for mosquitoes and other unhealthy or undesirable insects or as a refuge for snakes, rats or other rodents or as a hiding place for filth, litter or trash or that create a fire or traffic hazard or provide a hiding place for persons.

(Ord. No. 98-0379, 3-4-98)

Sec. 34-731. Dumping, depositing, etc., litter on public property or waters.

(a) It shall be unlawful for any person or persons to dispose, dump, deposit, throw, or leave or to cause or permit the dumping, depositing, placing, throwing, or leaving of litter on any public property or waters within unincorporated Fulton County or other areas within the jurisdiction of the governing authority, unless:

(1) The property is designated by Fulton County or the state or by any of its agencies or political subdivisions or municipalities for the disposal of litter and the person is authorized by the proper public authority to use such property; or

(2) The litter is placed into a litter receptacle or container lawfully installed on such property.

(3) The person is the owner or tenant in lawful possession of such property and the litter is disposed of in a manner consistent with the public welfare and in accordance with this article.

(b) *Restrictions on permission.* It shall be unlawful for the owner of any public property within unincorporated Fulton County or the owner's agent to intentionally and expressly give permission to dump or otherwise place on that property, any garbage, trash or other materials or substances which may catch and retain rain water.

(c) Any person who violates this section shall be punished in accordance with section 34-742 of this article.

(Ord. No. 98-0379, 3-4-98)

State law references: Littering, O.C.G.A. § 16-7-40 et seq.; violation of county ordinances, O.C.G.A. § 36-1-20.

Sec. 34-732. Deposit of refuse on streets and sidewalks.

(a) No person shall deposit in any street or other public place in unincorporated Fulton County or other areas within the jurisdiction of the governing authority, any refuse of any type; provided, however, that earth and rubbish or building debris caused by construction may be allowed to lie in those places subject to law. It shall be lawful to place debris, such as twigs, small branches and similar matter, in the parkway between the sidewalk and the curbstone, provided the debris does not extend over the sidewalk so as to block pedestrian traffic or fall into or extend over the street so as to block pedestrian traffic or fall into or extend over the street so as to hinder vehicular traffic or make it difficult to use any motor-driven, roadway maintenance equipment.

(b) All persons engaged in the business of trimming or removing trees, shrubbery or similar growth shall remove from the property, where the work is being done, all sawdust, branches, stumps and all portions of the byproduct of the trimming or removal service and dispose of such materials in a lawful manner.

(c) All persons engaged in the business of landscaping, nurseries or yard maintenance and who shall contract with a property owner, the owner's agent or the occupant to improve the property, trim or remove shrubbery and trees or maintain yards shall remove from the property all rubbish, including rocks, dirt, glass, trimmings and other byproducts of that service and dispose of such materials in a lawful manner.

(Ord. No. 98-0379, 3-4-98)

Sec. 34-733. Throwing trash upon streets, sidewalks or public places.

It shall be unlawful for any person to throw hulls, peelings, trash or other litter upon the streets, sidewalks or upon the floors of churches, public halls, theaters or other public places.

(Ord. No. 98-0379, 3-4-98)

Sec. 34-734. Placing nails, tacks, glass on streets or sidewalks.
It shall be unlawful for any person to place on the street or sidewalks any loose nails, tacks, spikes, broken glass or any similar substance or thing which would be likely to injure the feet of persons or animals or cut or puncture tires of vehicles.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-735. Cleanliness of sidewalks.
It shall be the duty of all occupants and owners of improved property and owners of vacant property, in front of which the sidewalk area is paved or unpaved, to keep that area clean and to do such sweeping and scraping and cutting of grass or weeds and watering, pruning and maintaining planted material and planters as may be necessary to remove clay, dirt and trash therefrom and to render it passable, comfortable and sightly.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-736. Depositing materials on streets.
(a) *Private construction activity.* No person shall conduct, authorize, or carry out any construction activity on private property so as to cause any debris, dirt, sediment, soil, trash, building material, and other physical materials originating from the private property or construction activity, to deposit upon the surface of a street or highway and create an unsightly condition or a condition which may be injurious or hazardous to any person, animal or vehicle upon or using the street or highway.
(b) *Washing material onto street or highway.* No person shall permit any wood, dirt, mud, sand, rock, rubbish or any other material to wash from such person's property or the property of any person upon which such person is performing repairs, improvements, excavations or grading onto any street or highway within unincorporated Fulton County and/or areas within the jurisdiction of the governing authority of Fulton County so as to cause or permit this material to deposit upon the surface of the street or highway and create an unsightly condition or a condition which may be injurious or hazardous to any person, animal or vehicle upon or using the street or highway.
(c) *Removal required.* Any person who throws, drops or washes or permits to be thrown, dropped or washed onto the street or highway any of the items named or referred to in subsections (a) and (b) of this section shall immediately remove them or cause them to be removed.
(d) *Application to wrecked, damaged vehicles.* Any person removing a wrecked or damaged vehicle from a street or highway shall remove any glass, metal or other material dropped from the damaged vehicle upon the street or highway which may be hazardous to any person, animal or vehicle upon or using the street or highway.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-737. Assessments against private property of the cost of reopening, repairing, or cleaning of street and roads necessitated by construction activity; creation and enforcement of lien.
(a) The governing authority is empowered to assess against any property the cost of reopening or repairing any public way, street, road, right-of-way, or highway, or the cost of cleaning up from any public way, street, road, right-of-way, or highway any debris, dirt, sediment, soil, trash, building material, and other physical materials originating on

such property, as a result of any private construction activity carried on by any developer, contractor, subcontractor, or owner of such property.
(b) Any assessment authorized under subsection (a) of this section, as well as the interest thereon and the expense of collection, shall be a lien against the property so assessed coequal with the lien of other taxes and shall be enforced in the same manner as are state and county ad valorem property taxes by issuance of a fi. Fa. and levy sale as set forth in Title 48, the "Georgia Public Revenue Code."
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 36-1-18; Ga. L. 1981, p. 3259, §§ 1, 2)

Sec. 34-738. Transporting garbage, trash and other waste material in open vehicles.
It shall be unlawful for any person to operate or cause to be operated upon any public street in unincorporated Fulton County or any area under the jurisdiction of the governing authority, any open truck, wagon or other vehicle in and upon which garbage, trash, manure, waste material or other debris is transported, unless the vehicle shall be equipped with a cover that will prevent the garbage, trash, waste material and other debris from falling from the truck onto any street in unincorporated Fulton County and/or areas within the jurisdiction of the governing authority.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-739. Discharging water or other liquids.
No person shall throw or discharge from any lot or building any water, fluid or liquid substance so as to injuriously affect the surface of the street or sidewalk or so to make it unsafe for travel.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-740. Newspapers distributed without charge.
Newspapers may be distributed without charge to private residential premises so long as upon any request from a person to be removed from the company's distribution list, the name is removed. Any person who distributes a newspaper or any entity that causes a newspaper to be distributed after having received notice from a person to be removed from the distribution list shall be in violation of this article.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-741. Spills from vehicles.
(a) *Grading contractors.* A vehicle used by a contractor carrying or grading and hauling dirt in unincorporated Fulton County or any area within the jurisdiction of the governing authority shall be equipped with a cover that prevents dirt from spilling and/or blowing out of the vehicle carrying such dirt. When the contractor shall have finished grading, the contractor shall then clean all dirt off the streets as may have been dropped by the contractor's vehicles. If the work of a contractor has rendered the streets muddy or dusty, all those streets shall be left in as good condition as they were at the time of commencement of the work by the contractor. The cleaning described in this subsection is to be done to the satisfaction of the director of public works or that official's designee.
(b) *Concrete, gravel, sand or asphalt haulers.* Any person engaged in hauling ready-mixed concrete, gravel, sand or asphalt within the jurisdiction of the governing authority of Fulton County shall so fill any vehicle carrying such ready-mixed concrete, gravel,

sand or asphalt so as to not allow spillage from the vehicle on streets or sidewalks within unincorporated Fulton County and/or areas within the jurisdiction of the governing authority. Vehicles hauling sand or gravel shall be provided with suitable covers to prevent materials from blowing from the vehicles. Any person responsible for any spillage from hauling vehicles shall take immediate action to remove the spillage from the streets or sidewalks.
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 36-1-18.

Sec. 34-742. Penalties for littering public property or waters.
Any person who litters public property or waters shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished as follows:
(1) If litter is ten pounds in weight or less or 15 cubic feet in volume or less, by a fine not more than $500.00 or no more than 30 days in jail or both.
(2) If litter is in excess of ten pounds in weight or 15 cubic feet in volume, shall be fined $1,000.00 or no more than 60 days in jail or both for each occurrence; and each occurrence shall be deemed a separate offense.
(3) In addition to the fines set out in subsections (1) and (2) above, the violator shall reimburse Fulton County for the reasonable cost of removing the litter when the litter is removed by Fulton County or its agents; and
(4) In the sound discretion of a court in which a conviction is obtained, the violator may be directed to pick up and remove from any public street or highway or public right-of-way for a distance not to exceed one mile any litter the person has deposited and any and all litter deposited thereon by anyone else; and
(5) In the sound discretion of the judge of a court in which a conviction is obtained, the violator may be directed to pick up and remove from any public property, right-of-way, or such property, upon which it can be established that the violator has deposited litter, any and all litter deposited thereon by anyone; and/or repair or restore property damaged by such littering.
(6) The court may publish the names of persons convicted of a violation under this section.
(Ord. No. 98-0379, 3-4-98)
Cross references: Duty of owner to clean property, § 26-3.
State law references: Chattahoochee River Basin Act, O.C.G.A. § 12-5-400; Metropolitan River Protection Act, O.C.G.A. § 12-5-440; violations of county ordinances, O.C.G.A. § 15-10-60; maximum penalty for violating county ordinances, O.C.G.A. § 36-1-20.

Sec. 34-743. Maintenance of property.
(a) *Required.* Every person owning or occupying public or private property in unincorporated Fulton County shall maintain the property free of any condition which may render the premises or property to be unhealthy, unsanitary, unsightly or unaesthetic to the occupants thereof, the neighborhood or the community at large.
(b) *Conditions in violation.* Because they are deemed to be conducive to breeding or harboring of harmful germs or to the breeding or harboring of insects, snakes, rodents, lizards or similar or undesirable living pests and carriers of harmful germs or poisons or to the harboring of undesirable persons or illicit activities and are in violation of the

general public health, safety, welfare and well-being, the existence of any one of the following conditions on property within unincorporated Fulton County shall be a violation of this section and this article:

(1) Uncontainerized garbage or uncovered garbage containers of all kinds and types.

(2) Trapped litter or any other improperly containerized solid waste.

(3) Exterior storage of junk or other unsightly materials.

(4) The existence of weeds and vegetative overgrowth.

(5) The existence, storage or accumulation of garbage, hazardous, putrescible solid waste or rubbish.

(Ord. No. 98-0379, 3-4-98)

Sec. 34-744. Inspection of property.

(a) *Inspection of premises/right of entry.* The director of the Fulton County Department of Public Works or any duly authorized agent of the department of public works, or any department of Fulton County as directed or authorized by the county manager, may enter on and inspect any and all public and private property in unincorporated Fulton County, at any reasonable time after the presentation of proper credentials, to determine by inspection that those properties are or are not free of any condition which may be in violation of this article. For the purpose of this duty, employees of the department of public works, the department of environment and community development, including, but not limited to code enforcement officers, or subsequent classification titles performing the same duties, or employees of any department as authorized by the county manager, or members of the public duly appointed by the governing authority of Fulton County to perform litter enforcement duties, are clothed with police powers and shall be designated as special officers of Fulton County. Any act of obstructing an inspection hereunder shall constitute a violation of this article and subject the interferer to penalties authorized by section 34-742 or section 34-746 depending on the nature of the property.

(b) *Notice of unsanitary conditions.* Upon the determination--through inspection by the director of the Fulton County Department of Public Works or his agent or designee, or any duly authorized agent or department of Fulton County as directed or authorized by the county manager or the governing authority--that any property within unincorporated Fulton County is in violation of this article, the director of public works or his agent or designee, or any duly authorized agent or department of Fulton County as directed or authorized by the county manager or the governing authority, shall give written notice to the owner or agent of the owner of the property of the condition found. Such notice shall set forth the condition of the property, the specific violation of this article and the remedial action to be taken. The notice to the owner or agent shall include a time certain in which the violation is to be abated, but not more than ten days from date of receipt of the notice by the owner or agent. All notices shall be sent by personal service or sent by registered or certified mail, return receipt requested, to the last known address as listed in the official tax register of the county or records of the secretary of state. Upon failure of the owner or agent to abate the violation cited within the time set forth in the notice, the property owner or agent shall be held accountable for violating this article.

(c) *Citations issued.* Nothing in this section is intended to prevent the immediate issuance of a written citation pursuant to section 34-748 of this article for violation of this article.

(Ord. No. 98-0379, 3-4-98)

Cross references: Nuisance abatement authorized, §§ 26-3, 34-363.

Sec. 34-745. Throwing litter upon private property and waters.
Prohibited. It shall be unlawful for any person to throw hulls, peelings, trash, bottles, cans or other litter upon the private property or waters of another within unincorporated Fulton County.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-746. Penalties for littering private property or waters.
Penalties. Any person who litters private property or waters in unincorporated Fulton County shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished as follows:
(1) Where the volume of trash thrown is less than 30 gallons, the violation of this section shall subject the violator to a fine not more than $500.00 or no more than 30 days in jail or both. Each day a violation continues shall constitute a separate violation.
(2) Where the volume of trash thrown exceeds 30 gallons, the violation of this section shall subject the violator to mandatory penalties as follows:
a. *First offense.* A fine of $1,000.00.
b. *Second offense.* A fine of $1,000.00 and confinement in jail for a period not to exceed 30 days.
c. *Third or more offense.* A fine of $1,000.00 and confinement in jail for a period not to exceed 60 days.
d. Each day a violation continues shall constitute a separate violation.
(3) In addition to the penalties in this subsection, the following penalties may be imposed:
a. *First offense.* The violator may be directed to pick up and remove from any public street or highway or any public right-of-way for a distance not to exceed one-half mile any and all litter deposited thereon by anyone prior to the date of execution of sentence.
b. *Second offense.* The violator may be directed to pick up and remove from any public street or highway or any public right-of-way for a distance not to exceed one mile any and all litter deposited thereon by anyone prior to the date of execution of sentence.
c. *Third or more offense.* The violator may be directed to pick up and remove from any public park, private right-of-way or, with the prior permission of the legal owner or tenant in lawful possession of such property, any private property, upon which it can be established by competent evidence that the violator has deposited or dumped litter, any and all litter deposited or dumped thereon by anyone prior to the date of the execution of sentence.
d. *Publication of names.* The court may publish the names of persons convicted of a violation under this section.
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 16-7-43; O.C.G.A. § 36-1-20.

Sec. 34-747. Prima facie evidence; rebuttable presumptions.
(a) Whenever litter is thrown, deposited, dropped, or dumped from any motor vehicle, boat, airplane, or other conveyance in violation of this article, it shall be prima facie evidence that the operator of the conveyance has violated this article.

(b) Whenever any litter is dumped, deposited, thrown, or left on public or private property in violation of this article is discovered to contain any article or articles, including but not limited to letters, bills, publications, or other writings which display the name of a person thereon in such a manner as to indicate that the article belongs or belonged to such person, it shall be a rebuttable presumption that such person has violated this article.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-748. Enforcement.
(a) Unless otherwise specifically provided by resolution of the Fulton County Board of Commissioners, the enforcement of this article shall be within the jurisdiction of the county's enforcement personnel, including the director of the department of public works or his or her designees or employees and all law and code enforcement personnel who shall have such powers as are reasonably necessary to enforce and give effect to this article. Specifically, but not by way of limitation, any violation of this article may be tried upon citations issued by enforcement personnel pursuant to O.C.G.A. § 15-10-63 and any successor statute. Persons designated by the director of public works or as otherwise designated by the county manager or the governing authority, are hereby authorized to issue citations or summons or both, charging violations under this article, returnable to Magistrate Court, or any court having jurisdiction of a commitment court throughout the entire county, for a hearing.
(b) For purposes of enforcing the provisions of this article, any Fulton County Magistrate Court, including the Environmental Court, shall be entitled to take such action to ensure compliance, and the person convicted shall reimburse Fulton County for any cost or expense associated with such compliance efforts and Fulton County shall be entitled to place a lien on the property or require a bond from the person to secure payment and reimbursement for these expenses.
(c) The provisions of [this] article shall be enforced by the Fulton County Department of Public Works with assistance as needed from the Fulton County Police Department, the Fulton County Department of Health, and the department of the environment and community development and/or as otherwise designated by the county manager or the governing authority.
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 36-1-17; O.C.G.A. § 36-1-18.
Secs. 34-749--34-800. Reserved.

Appendix M – Monitoring and Implementation Plan

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Introduction

This document constitutes Fulton County's Impaired Waterbodies Monitoring and Implementation Plan (Plan). The Plan is based on guidance offered by *Attachment C, Phase I MS4 (Medium and Large) Storm Water Management Program (SWP) Guidance*, as provided by the Georgia Environmental Protection Division's (EPD). The Plan is based on EPD's 2012 305(b)/303(d) list of impaired stream segments, and will be updated as necessary as the 305(b)/303(d) list of impaired stream segments is updated by EPD.

Impaired Waters & Maps

The impaired waters, 12 place hydraulic unit code (HUC 12) and reach violation for stream within Fulton County's municipal separate storm sewer system (MS4) jurisdictional area, based on 2012 Georgia 305(b)/303(d) List of impaired streams are shown in **Table 1** below.

Table 1 - 2012 Georgia 305(b)/303(d) List of Impaired Streams

Reach Name[1]	Reach ID	Reach Violation	TMDL Status
Camp Creek	R031300020332	FC	Evaluation & Implementation Plan
Cater Creek	R031300050104	None	Not available
Deep Creek	R031300020326	Bio F	Draft Evaluation
Morning Creek	R031300050123	FC	Not available
North Utoy Creek	R031300020102	FC	Evaluation & Implementation Plan
Pea Creek	R031300020335	FC, Bio F	Evaluation & Implementation Plan
Sandy Creek (also known as Cooper Sandy Creek)	R031300020104	FC	Evaluation & Implementation Plan
South Utoy Creek	R031300020105	FC	Evaluation & Implementation Plan
Tuggle Creek	R031300020319	None	Not available
Utoy Creek	R031300020106	FC, Zn	Evaluation & Implementation Plan
Whitewater Creek	R031300050213	FC, Bio F	Evaluation & Implementation Plan

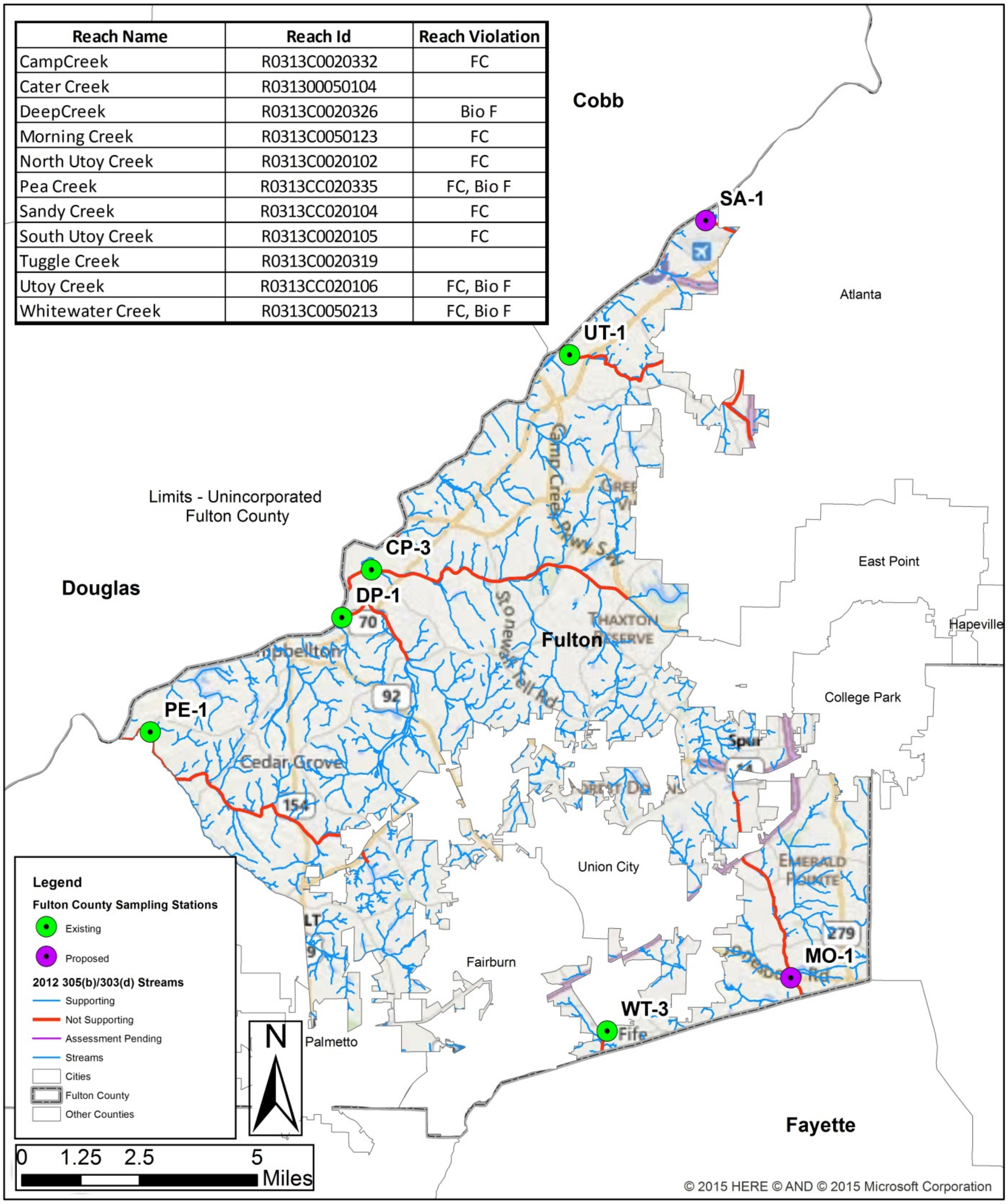
FC – fecal coliform, Bio F – Biota Impacted (Fish Communities), Zn - Zinc

[1] Information in this table is based on a review of the list of TMDL Implementation Plans with TMDLs organized by Basin and HUC10 can be found here, last updated June 2011, available from https://epd.georgia.gov/sites/epd.georgia.gov/files/TMDL_TMDLPlan_List_2011_updated_0.pdf

As shown on the map on the following page, Fulton County currently has water quality monitoring stations on Camp, Deep, Pea, Utoy and Whitewater Creeks (**Figure 1**). These stations are monitored in accordance with the County Watershed Protection Plan (WPP) requirements. The WPP monitoring requirements exceed the Plan requirements, and therefore Fulton County will report results from those stations as part of this Plan. Monitoring results for fecal coliform, bioassessment, and zinc monitored as part of the WPP will be reported annually in the MS4 annual report. Morning and Sandy Creeks are currently listed due to fecal coliforms, and monitoring will be implemented on these basins in accordance with EPD's requirements under the County's MS4 permit.

Currently reach violations have not been defined for Cater and Tuggle Creeks, and therefore Fulton County is not proposing monitoring those creeks or basins. Fulton County will add monitoring to those basins if the reach violations are defined in any future 305(b)/303(d) list of impaired streams.

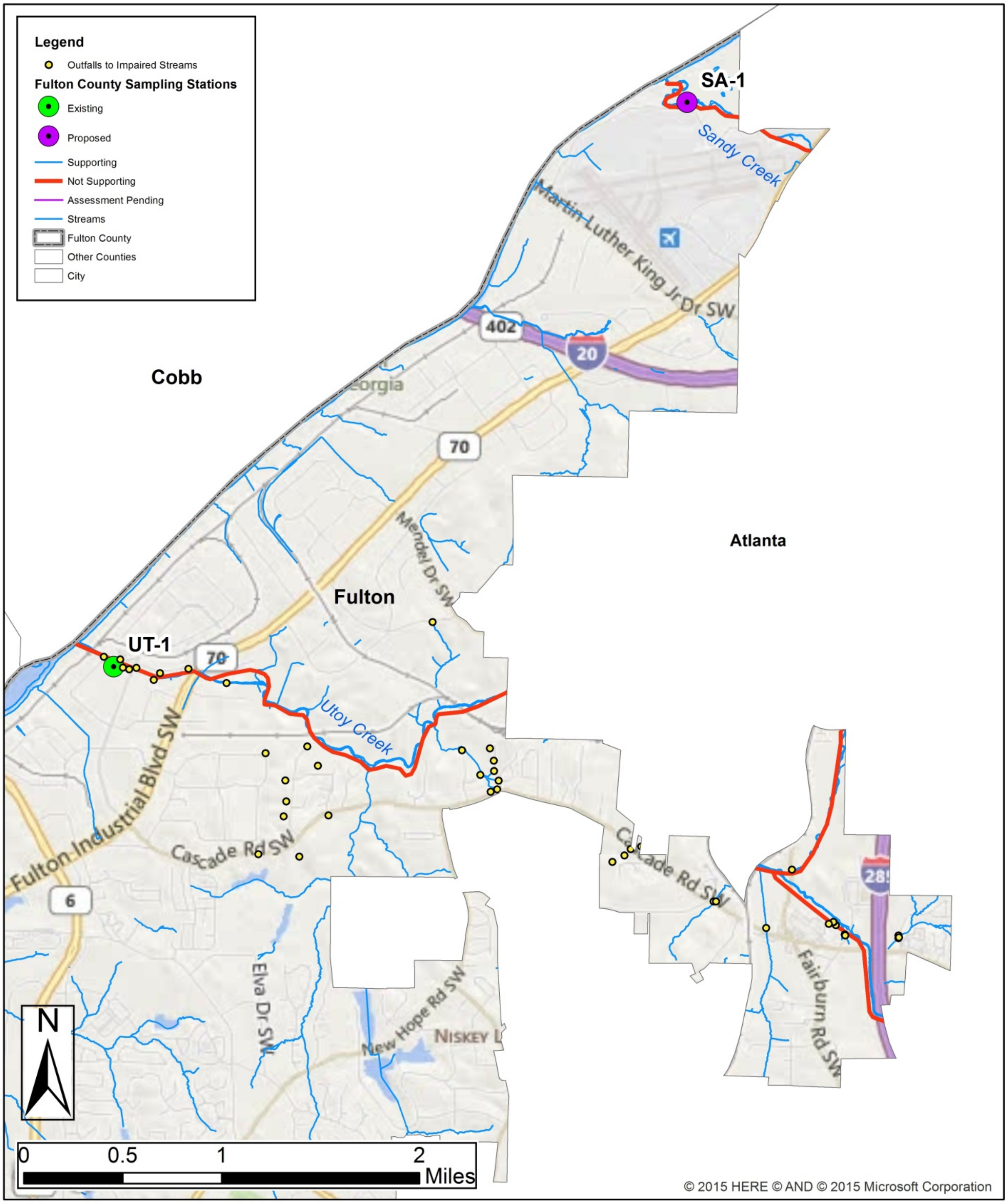
The Permit requires the County to submit maps showing the impaired water and the outfalls on the receiving stream. The following **Figures 2-5** identify outfalls to impaired waters or one mile upstream of impaired waters.



Reach Name	Reach Id	Reach Violation
CampCreek	R0313C0020332	FC
Cater Creek	R031300050104	
DeepCreek	R0313C0020326	Bio F
Morning Creek	R0313C0050123	FC
North Utoy Creek	R0313C0020102	FC
Pea Creek	R0313CC020335	FC, Bio F
Sandy Creek	R0313CC020104	FC
South Utoy Creek	R0313C0020105	FC
Tuggle Creek	R0313C0020319	
Utoy Creek	R0313CC020106	FC, Bio F
Whitewater Creek	R0313C0050213	FC, Bio F

Fulton County
Sampling Location Map

Figure 1 – Fulton County Sampling Location Map



Fulton County
Outfall Location Map

Figure 2 – Sandy Creek and Utoy Creek Outfall Location Map

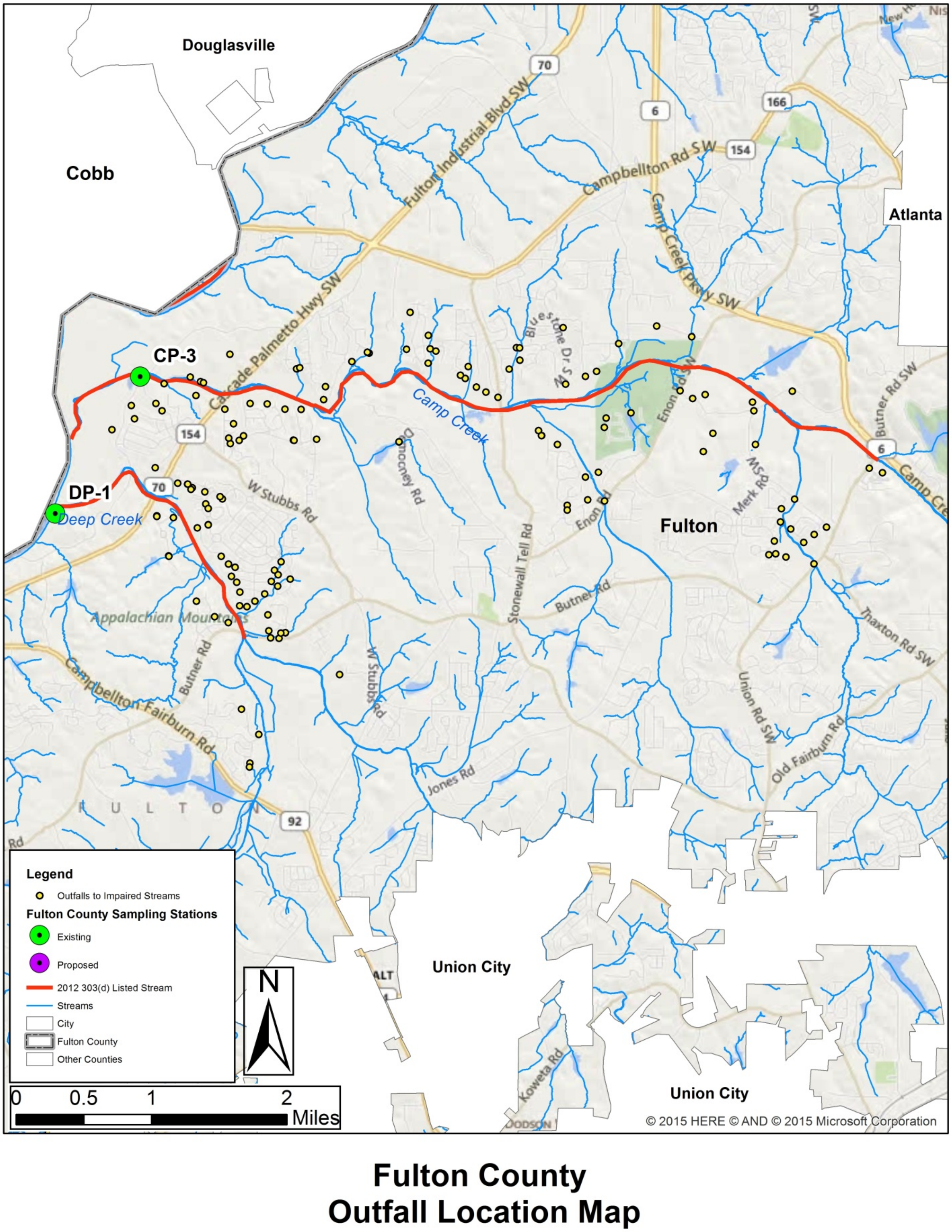
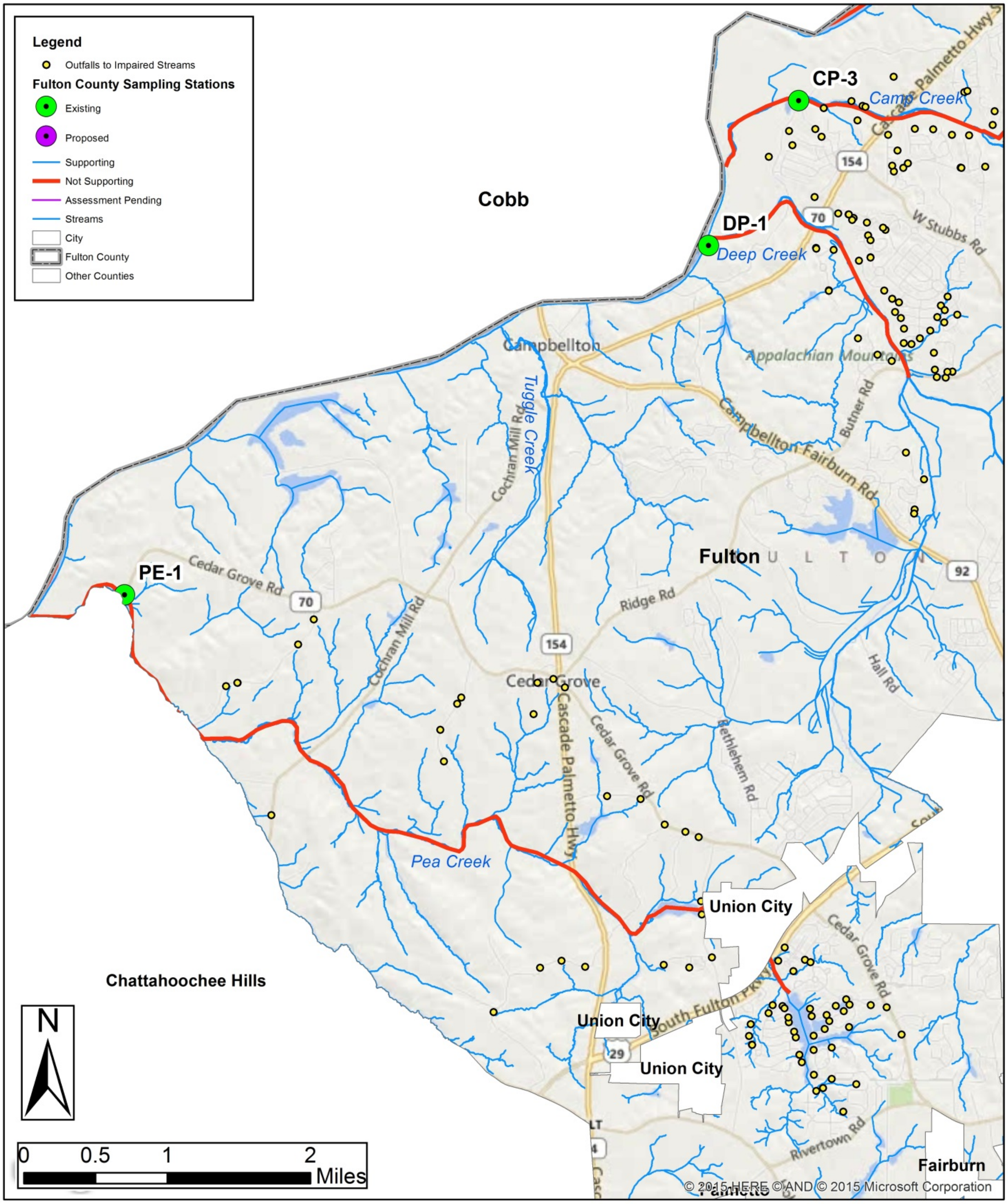
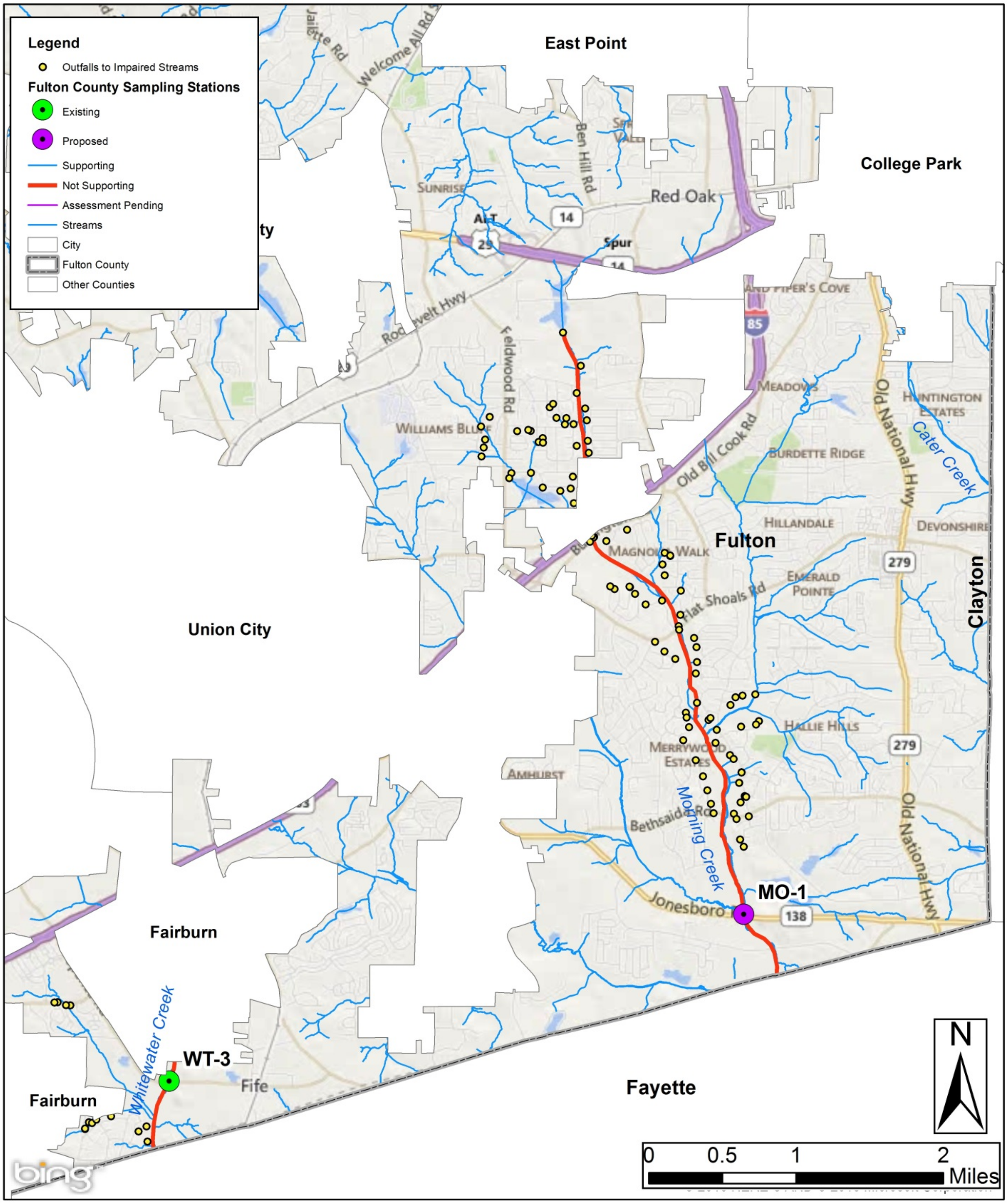


Figure 3 – Camp Creek and Deep Creek Outfall Location Map



Fulton County
Outfall Location Map

Figure 4 – Pea Creek Outfall Location Map



Fulton County
Outfall Location Map

Figure 5 – Whitewater Creek and Morning Creek Outfall Location Map

Monitoring Plan - Camp, Deep, Pea, Utoy and Whitewater Creeks

In general, sampling in Camp, Deep, Pea, Utoy and Whitewater Creeks will be performed as part of the County's watershed protection plan sampling activities, in accordance with the following **Table 2**. A total of 16 samples will be collected annually from each location for fecal coliform (4 samples collected weekly on the same day of the week as possible, within a 30 day period over 4 calendar quarters to calculate 4 geometric means annually). The 30 day sampling period will not overlap the months of April/May and October/November due to changes in the in-stream water quality standards for bacteria.

Table 2 – Existing Monitoring Plan

Reach Name	Reach Violation	Sampling Program
Camp Creek	Fecal coliforms	• 4 grab samples will be acquired within a 30 day period at sampling stations CP-2 and CP-3 every quarter. (16 samples per station annually) • The samples will be analyzed for fecal coliforms. • Geometric means will be calculated.
Deep Creek	Biota, fish	Biological monitoring will be conducted biennially at station DP-1 under methods outlined in the Georgia Macroinvertebrate Bioassessment Standard Operating Procedures (SOP), Metric Spreadsheets and other supporting documents as published by EPD.
Pea Creek	Fecal Coliforms Biota, fish	• 4 grab samples will be acquired within a 30 day period at sampling station PE-1 every quarter. (16 samples per station annually) • The samples will be analyzed for fecal coliforms. • Geometric means will be calculated. • Raw data and the geometric means will be reported. Biological monitoring will be conducted biennially at station PE-1 under methods outlined in the Georgia Macroinvertebrate Bioassessment Standard Operating Procedures (SOP), Metric Spreadsheets and other
Utoy Creek	Fecal coliforms Zinc	• 4 grab samples will be acquired within a 30 day period at sampling station UT-1 every quarter. (16 samples per station annually) • The samples will be analyzed for fecal coliforms. • Geometric means will be calculated. • Raw data and the geometric means will be reported. • 4 grab samples will be acquired at sampling station UT-1 every quarter • The samples will be analyzed for zinc.

Whitewater Creek	Fecal Coliforms	• 4 grab samples will be acquired within a 30 day period at sampling station WT-3 every quarter. (16 samples per station annually) • The samples will be analyzed for fecal coliforms. • Geometric means will be calculated. • Raw data and the geometric means will be reported.
	Biota, fish	Biological monitoring will be conducted biennially at station WT-3 under methods outlined in the Georgia Macroinvertebrate Bioassessment Standard Operating Procedures (SOP), Metric Spreadsheets and other

Note: The 2009 approved Sampling Quality Assurance Plan (SQAP) was developed for the purposes of delisting the streams in Table 2 for bacteria impairment. The sampling schedule and frequency identified in Table 2 conform to the approved SQAP. The SQAP is in the process of being updated to include additional listed streams. Changes will be included in the annual report.

As shown on the map (**Figure 1**), Fulton County currently has water quality monitoring (including biological monitoring) stations on Camp, Deep, Pea, Utoy and Whitewater Creeks. These stations are monitored in accordance with the County Watershed Protection Plan (WPP) requirements. The WPP monitoring requirements exceed the Plan requirements, and therefore Fulton County will report results from those stations as part of this Plan. Monitoring results for fecal coliform, bioassessment, and zinc monitored as part of the WPP will be reported annually in the MS4 annual report. Morning and Sandy Creeks are currently listed due to fecal coliforms, and monitoring will be implemented on these basins in accordance with EPD's requirements under the County's MS4 permit.

Utoy Creek is monitored for zinc in accordance with the County Watershed Protection Plan (WPP) requirements. The WPP monitoring requirement exceeds the Plan requirements and includes collecting TSS and hardness data quarterly to evaluated dissolved metal values to be compared to the State standard. Therefore, Fulton County will report WPP results from Utoy Creek as part of this Plan. Monitoring results for zinc monitored as part of the WPP will be reported annually in the MS4 annual report.

Monitoring Plan – Morning Creek and Sandy Creeks

Fulton County will establish two new monitoring stations on Morning and Sandy Creeks. The station for Morning Creek, MO-1, will be located at 33.548155579° N, 84.483873321° W, as shown on the attached map “Morning Creek.” The station for Sandy Creek, SA-1, will be located at 33.786804106° N, 84.521568177° W, as shown on the attached map “Sandy Creek”. Monitoring of Morning Creek and Sandy Creek will begin in August 2015.

In general, sampling in Morning and Sandy Creeks will be performed as part of the County’s Plan sampling activities, in accordance with the following **Table 3**. A total of 16 samples will be collected annually from each location for fecal coliform (4 samples collected weekly on the same day of the week as possible, within a 30 day period over 4 calendar quarters to calculate 4 geometric means annually). The 30 day sampling period will not overlap the months of April/May and October/November due to changes in the in-stream water quality standards for bacteria.

Table 3 – Proposed Monitoring Plan for Morning Creek and Sandy Creek

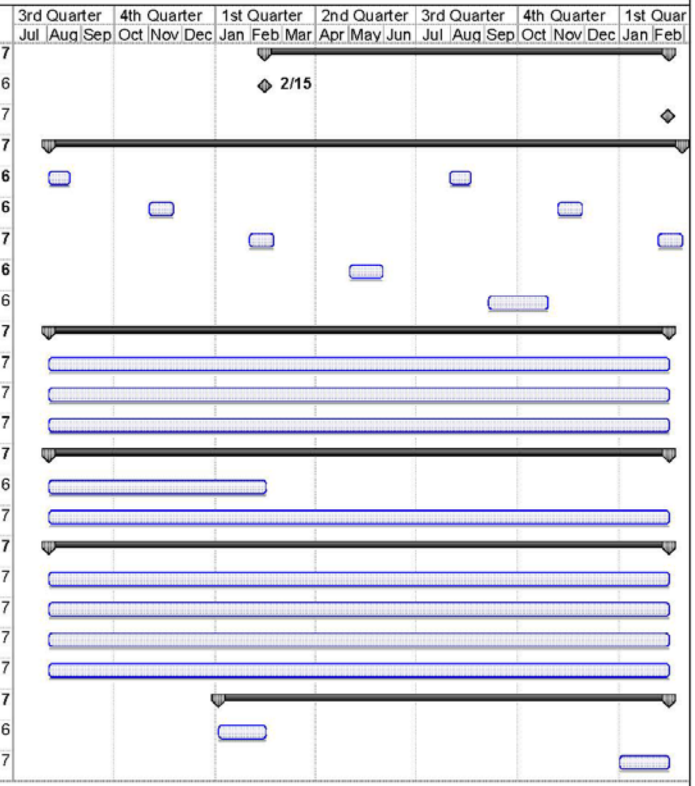
Reach Name	Reach Violation	Sampling Program
Morning Creek	Fecal coliforms	• 4 grab samples will be acquired weekly on the same day of the week as possible, within a 30 day period at sampling station MO-1 every quarter. . (16 samples per station annually) • The samples will be analyzed for fecal
Sandy Creek	Fecal coliforms	• 4 grab samples will be acquired weekly on the same day of the week as possible, within a 30 day period at sampling station SA-1 every quarter. . (16 samples per station annually) • The samples will be analyzed for fecal

Note: A Sampling Quality Assurance Plan (SQAP) is being developed for the purposes of delisting the streams in Table 2 and Table 3 for bacteria impairment. The sampling schedule and frequency identified in Table 2 and Table 3 conform to the proposed draft SQAP. The approved SQAP will be included as part of the annual report.

The schedule for fecal coliform, zinc and biota monitoring is included in **Figure 6**. The schedule also highlights the beginning, and frequency of implementation measures to address the pollutants of concern (POC). In most cases the implementation measures will be performed the duration of the permit with the exception of zinc pollutant source tracking.

Fulton County
Monitoring and BMP Implementation Schedule for MIP

ID	Task Name	Duration	Start	Finish
1	**Project Management**	**263 days**	**Mon 2/15/16**	**Wed 2/15/17**
2	Annual Report	1 day	Mon 2/15/16	Mon 2/15/16
3	Annual Report	1 day	Wed 2/15/17	Wed 2/15/17
4	**Water Quality Monitoring**	**411 days**	**Mon 8/3/15**	**Mon 2/27/17**
5	**Bacteria Monitoring Aug.**	**275 days**	**Mon 8/3/15**	**Fri 8/19/16**
8	**Bacteria Monitoring Nov.**	**281 days**	**Mon 11/2/15**	**Mon 11/28/16**
11	**Bacteria Monitoring Feb.**	**281 days**	**Mon 2/1/16**	**Mon 2/27/17**
14	**Bacteria Monitoring May**	**22 days**	**Mon 5/2/16**	**Tue 5/31/16**
16	Biological Monitoring	40 days	Mon 9/5/16	Fri 10/28/16
17	**Bacteria BMPs**	**403 days**	**Mon 8/3/15**	**Wed 2/15/17**
18	Sewer Capacity Management	403 days	Mon 8/3/15	Wed 2/15/17
19	Septic Tank Education and Sewer Service Availa	403 days	Mon 8/3/15	Wed 2/15/17
20	Highly Visible Pollutant Sources	403 days	Mon 8/3/15	Wed 2/15/17
21	**Zinc BMPs**	**403 days**	**Mon 8/3/15**	**Wed 2/15/17**
22	Zinc Pollutant Source Tracking	141 days	Mon 8/3/15	Mon 2/15/16
23	Industrial Inspections	403 days	Mon 8/3/15	Wed 2/15/17
24	**Sediment BMPs**	**403 days**	**Mon 8/3/15**	**Wed 2/15/17**
25	E&S Ordinance	403 days	Mon 8/3/15	Wed 2/15/17
26	E&S Site Plan Review Procedures	403 days	Mon 8/3/15	Wed 2/15/17
27	E&S Inspection Procedures	403 days	Mon 8/3/15	Wed 2/15/17
28	E&C Enforcement Procedures	403 days	Mon 8/3/15	Wed 2/15/17
29	**Annual Report**	**293 days**	**Mon 1/4/16**	**Wed 2/15/17**
30	Annual Report	31 days	Mon 1/4/16	Mon 2/15/16
31	Annual Report	33 days	Mon 1/2/17	Wed 2/15/17



Project: Schedule
Date: Sun 6/7/15

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Figure 6 – Monitoring and Implementation Schedule

Implementation Plan

In general, the POC in the streams within Fulton County's MS4 jurisdictional area are fecal coliforms, zinc, and total suspended solids (TSS) as indicated by Biota impairment. These pollutants require different strategies to reduce or eliminate pollution sources that cause violations of water quality standards, and will therefore be discussed separately.

Fecal coliforms

Fecal coliform bacteria contamination is a result of human and/or animal sources. Potential sources include sanitary sewer overflows (SSOs), failed sanitary sewers, leaking or overflowing septic tanks, livestock, domestic pets and wildlife. Fulton County's primary focus will be on addressing fecal coliform from human sources, particularly from sanitary sewer system discharges due to blockages or inadequate capacity caused by inflow and infiltration.

Sewer Capacity Management

SSOs and failed sanitary sewers will be addressed by a combination of a capacity management operations and maintenance program (CMOM), flow monitoring and inspecting sanitary sewers where they cross stream or rivers. The CMOM program includes the following elements: proactive system maintenance, capital improvements, public education, collection system modeling, industrial monitoring, commercial pretreatment, safety training, flow monitoring and emergency response plan. The CMOM program is currently ongoing and will continue during the duration of the MS4 permit.

Measurable Goal(s): The effectiveness of the CMOM program can be measured by the reduction in frequency and volume of SSOs. The effectiveness of the CMOM program to reduce fecal coliform in state waters will be tracked by monitoring fecal coliform according to the monitoring program outlined in this Plan.

Septic Tank Education and Sewer Service Availability

Leaking or overflowing septic tanks will be addressed by a combination of educational efforts and providing sewer service to developed areas by 2030. Septic tank maintenance education and maintenance logs are available on the County website. The education brochure includes tips to avoid septic tank issues. The Fulton County Health Department issues permits for septic tanks. The Health Department also provides education for septic tank maintenance. In existing areas where sewer is currently unavailable and failed septic tanks are beginning to show up, homeowners can petition the County to extend sanitary sewer to their homes. Upon receipt of a petition, staff review the area to determine if sanitary sewer can reach the petitioners and will contact the homeowners.

If the conditions are favorable, a preliminary design will be completed for the sewer extension and a package will be submitted to the Fulton County Board of Commissioners for approval of the petition. Upon approval, final design and installation can occur. During the process, a homeowner's meeting is set up to explain the petition process, design impacts and construction process. Any easements that may be required from the petitioners are to be donated as part of the petition process. Septic tank education materials will continue to be available on the County website during the duration of the MS4 permit.

Measurable Goal(s): It is the goal of Fulton County to provide sewer service to developed areas by 2030. The effectiveness of septic tank education and sewer availability to reduce fecal coliform in state waters will be tracked by monitoring fecal coliform according to the monitoring program outlined in this Plan.

Highly Visible Pollutant Sources (HVPS)

Fulton County will screen the 42 County owned HVPS sites to determine if there is a stormwater management facility onsite on any of those sites. Any stormwater management facility found during these inspections will be evaluated for potential to improve hydrologic attenuation and/or improving the quality of the storm water discharged. The procedure and schedule will be as follows:

- 2015 – 2016: site visits to all county owned HVPS sites and determine if a stormwater management facility is present.
- 2016 – 2017: evaluate all stormwater facilities found in 2015 – 2016 for retrofit potential.
- 2017 – 2018: conceptual design on all stormwater facilities found to have retrofit potential in 2016 – 2017, and detailed design based on conceptual design.
- 2018 – 2019: retrofit construction based on completed detailed design(s).

It is anticipated that not all stormwater management facilities will be suitable for retrofit, based on the conceptual and detailed design processes. The detailed designs will be performed in accordance with the requirements of the Georgia Stormwater Management Manual, and the retrofits will be selected from the structural stormwater controls provided in that manual. All the preceding activities for addressing fecal coliforms will be performed continuously throughout the life of the County's MS4 Permit.

Measurable Goal(s): It is the goal of HVPS evaluations to identify County owned facilities to be retrofitted to reduce stormwater contributions. The effectiveness of the HVPS to reduce fecal coliform in state waters will be tracked by monitoring fecal coliform according to the monitoring program outlined in this Plan.

Stream Walk Assessments

Description: Stream walk assessments include in field assessments of impaired streams. A stream assessment will be conducted on impaired streams. The stream walk will begin at the confluence of the impaired streams with the Chattahoochee River or at the most downstream segment within unincorporated Fulton County limits. Stream walks will be used to identify and verify conditions of impaired stream segments. Stream walks will be conducted by staff or qualified contractors. Scientists and engineers will collect field data by walking, measuring, and photographing critical areas in the watershed (i.e. streams, wetlands, conveyance systems, and potential pollutant sources). Stream walk assessments have been conducted on Pea Creek (2011), Deep Creek (2012), Camp Creek, Wilson Creek, and Sandy Creek (2013).

Measurable Goal: The County will evaluate the results of pollutant sources identified from stream walk assessments to determine the effectiveness of this BMP.

Zinc

Zinc Pollutant Source Tracking

Zinc has been a persistent POC in the Utoy Creek basin. In order to gain a better understanding of zinc loading in Utoy Creek, Fulton County performed sediment sampling in the Utoy Creek basin in the 2014 – 2015 reporting period. During the 2015 – 2016 reporting period the County will analyze the results to see if discrete sources or areas are disproportionately contributing to zinc loading. One site, Metalplate Galvanizing, has been identified by EPD as a significant source of zinc. The site is under a consent order and is in the process of developing a stormwater pollution prevention plan (SWPPP).

Measurable Goal(s): The sediment sampling results will be included with the 2014 – 2015 Annual MS4 Report, and the analysis of likely sources of zinc loading will be included with the 2015 – 2016 Annual MS4 Report. Fulton County, through its' industrial stormwater inspections, will ensure strict compliance with the SWPPP, and will immediately notify EPD of any deviations from the SWPPP.

Industrial Inspections

As part of the industrial stormwater inspections, Fulton County will focus the inspections and pollution prevention practices on potential sources of zinc, such as galvanized metal surfaces, motor oil, hydraulic fluid and tire dust. Fulton County will identify all industrial sites in the Utoy Creek basin, and complete a Zinc Source Inventory Worksheet.

Measurable Goal(s): A copy of the worksheet is included in **Appendix J** – Inspection Forms. All activities related to zinc loading, with the exception of sediment sampling and analysis, will be performed continuously throughout the life of the County's MS4 Permit. Zinc levels will be tracked by monitoring zinc in Utoy Creek according to the monitoring program outlined in this Plan.

Bio F

Sediment POC has impacted Biota habitat within the Whitewater Creek, Pea Creek, and Deep Creek basins. The following sediment BMPs will be implemented to reduce further habitat degradation within the impacted watersheds. The following BMPs target reducing sediment transport from constructions sites related to new development and redevelopment.

Erosion and Sedimentation Control Ordinance

Fulton County has been certified by the Director of EPD as a Local Issuing Authority for the purposes of the Erosion and Sedimentation Act of 1975 as amended. A Memo of Agreement was adopted by the Fulton County Commission and the State Soil and Water Commission on January 20, 2014. The County Board of Commissioners adopted the Fulton County Soil Erosion, Sediment and Pollution Control (ES & PC) Ordinance of 2010 on June 2, 2010. This ordinance gives the County Authority to issue Land Disturbance Permits: require BMPs to prevent and minimize erosion and sediment discharge, ES & PC Plan Submission and review prior to commencing construction, conduct inspections and enforcement, including Stop Work Orders, bond forfeiture, and monetary penalties, and require education and certification for persons involved in Land Development, per the Georgia EPD Model Ordinance.

Measurable Goal(s): Ensure proper ordinances and authority is in place to prevent and minimize erosion and sediment discharge. The rate increase of biota impairment will be measured once every two years to evaluate the reduction of sediment in impaired streams.

Site Plan Review Procedures

Planning and Community Services (P&CS) review the Land Disturbance Plans per the Georgia Stormwater Manual(Blue Book), The Manual for Erosion and Sediment Control in Georgia(Green Book) and the ES & PC checklist of requirements under the State Permit GAR 100001- 3 authorizing discharge under the National Pollution Discharge Elimination System (NPDES) Permit associated construction activity.

Measurable Goal(s): Ensure 100% of site plans for projects disturbing over one (1) acre of land will be reviewed by P & CS certified personnel to evaluate the reduction of sediment in impaired streams.

Inspection Procedures

P&CS make site inspections to insure that structural and non-structural BMP's are designed and maintained as required by the Green Book. Certified County erosion inspectors shall ensure that structural and nonstructural BMPs at construction sites are properly designed and maintained as specified in the Construction General Permits (CGPs). Certified County erosion inspectors inspect each land disturbance activity a minimum of once every seven days, and within 24 hours (except weekends) of every storm that is 0.5 inches of rainfall or larger. Certified County erosion inspectors will inspect each site a minimum of once per month until final stabilization is achieved and an NOT has been received by EPD.

Measurable Goal: Active development sites are inspected a minimum of once every seven days, and within 24 hours (except weekends) of every storm that is 0.5 inches of rainfall or larger to evaluate the reduction of sediment in impaired streams. Inspection activities are documented to determine the effectiveness of the BMP.

Enforcement Procedures

Currently Code Enforcement provides construction site inspection for compliance with erosion control and sedimentation code and ordinance, and uses the following procedure and protocol:

a) Sites are inspected based on zone coverage, and deficiencies, if any noted.
b) If a notice of violation is justified, the notice is posted on site, and a letter is sent to the responsible party by mail. The violator has 3 days to correct the deficiencies.
c) If the deficiencies are not corrected within 3 days, a stop work order is issued, and no further work is allowed on site until the deficiencies are corrected.

Measurable Goal: Ensure 100% of identified violations at construction sites will be addressed within 3 days. Code Enforcement will record violations to evaluate the effectiveness of this BMP.

The implementation effectiveness of each BMP is evaluated by the outlined measurable goal and the assessment of the monitoring data. If no improvements can be identified, Fulton County will develop the specific actions of change at the time it is determined that BMPs are not being effective. Potential actions of change based on water quality results and BMP effectiveness will be reported in the MS4 annual report, if necessary.

Additional Measures

In addition, Fulton County will perform detailed analysis to determine if existing detention ponds in the County can be retrofitted for improved hydrologic and water quality performance. The ponds currently under consideration and the POC in their respective basins are shown in **Table 4** below.

Table 4 – Existing Detention Ponds Considered for BMPS

Detention Pond	Basin	Pollutant of Concern
CC1059	Camp Creek	Fecal Coliform
CC1060		
MO1071	Morning Creek	Fecal Coliform
MO1072		
MO1076		
MO1082		
UC1068	Utoy Creek	Fecal Coliform, Zn
UC1069		

Optional Tasks

In addition to the above BMP's the County will:

- Actively look for opportunities to apply for 319(h) grants.
- Evaluate a cost-share program on cleaning out detention ponds.
- Consider enhancing current stormwater programs to look for fecal coliform "hot spots," such as veterinarian clinics and kennels, and educating them on the proper disposal of pet wastes.

Name	Address	City	Zip
2 RAYS MART LLC	3820 STONEWALL TELL RD STE A	COLLEGE PK	30349
ABJCK HERITAGE FOOD SER	512 INTERCHANGE DR	ATLANTA	30336
ADVANCED HANDLING SYS INC	1100 WESTLAKE PKWY	ATLANTA	30336
AFRICAN INTER MARKET	5070 OLD BILL COOK	COLLEGE PK	30349
AHA CONNECTION	6417 POLAR FOX COURT	RIVERDALE	30296
ALBERTO CULVER USA INC	6300 BOAT ROCK BLVD	ATLANTA	30336
AM PM FUELS	3515 CASCADE ROAD	ATLANTA	30331
AMBEMA INC	5225 CAMPBELLTON ROAD	ATLANTA	30331
AMERICAN DELI 98	3695 CASCADE ROAD	ATLANTA	30331
AMERICAN PRODUCT DIST	158 MENDELL DRIVE	ATLANTA	30336
AMERICAN SEALCOAT MFG	525 FREDERICK COURT	ATLANTA	30336
APPLEBEES	3690 CASCADE ROAD	ATLANTA	30331
ARTISTIC PROPERTIES LLC	4680 SHOSHONEE TRAIL	COLLEGE PK	30349
ATHLETIC MARKING CO INC	7270 ONO ROAD	PALMETTO	30268
ATL MAINTENANCE GROUP	4915 WEXFORD TRAIL	ATLANTA	30349
ATLANTA DENT SPECIALIST THE	7756 WATERLACE DRIVE	FAIRBURN	30213
ATLANTA GEAR & AXLE INC	4830 MENDELL COURT	ATLANTA	30336
ATLANTA MASONRY WORKS LLC	525 SEMIRA STREET	ATLANTA	30331
ATLANTA TIRE SPECIALIST LLC	5045 BAKERS FERRY ROAD	ATLANTA	30336
ATM GRANITE AND MARBLE	160 MENDELL DRIVE	ATLANTA	30336
AUTO EMISSIONS EXPRESS LLC	2275 JONESBORO ROAD	FAIRBURN	30213
AUTO PAINT WHILE YOU WAIT	7990 COCHRAN MILL ROAD	PALMETTO	30268
B & T TOWING	5720 WESTBROOK ROAD	COLLEGE PK	30349
BALDHEAD KUSTOMS	425 BROADMORE SQUARE	ATLANTA	30349
BANKABLE BUILDERS INC	3695 CASCADE ROAD	ATLANTA	30331
BASEMENT CREATION LLC	5669 GREENSAGE DRIVE	ATLANTA	30349
BEA & BOY BAKERY	5075 KERRY DRIVE	ATLANTA	30331
BEAS ROADSIDE SERVICE	4231 BUTTERNUT PLACE	COLLEGE PK	30349
BEST AUTO & USED PARTS	8345 GULLATT ROAD	PALMETTO	30268
BEST WAREHOUSING	201 FISH DRIVE	ATLANTA	30336
BMVW INC	8105 GULLATT ROAD	PALMETTO	30268
BP GAS STATION	3805 FLAT SHOALS ROAD	UNION CITY	30291
BRANTLEY DEMARIO	5300 OLD BILL COOK ROAD	COLLEGE PK	30349
BRINKLEY IMPROVEMENT	7485 OLD CHAPEL	ATLANTA	30349
BROCK SMALL ENGINE	9300 CEDAR GROVE ROAD	FAIRBURN	30213
BUFF MASTERS	6555 MARSHAM DRIVE	COLLEGE PK	30349
BULLOCK CONST AND DEV	7635 BISHOP ROAD	FAIRBURN	30213
C3 MOVING & INSTALLATION	4350 COMMERCE CIRCLE	ATLANTA	30336
CHS Plumbing	3244 Blackwood Lane	ATLANTA	30349
CALIFORNIA SHINE	2918 DEMOONEY ROAD	COLLEGE PK	30349
CALIFORNIA SOUNDS	4520 COMMERCE CIRCLE	ATLANTA	30336
CAR PARTS UNLIMITED	8215 GULLATT ROAD	PALMETTO	30268
CARS PLUS AUTO SALES	2145 HIGH POINT TRAIL	ATLANTA	30331
CASCADE FENCE COMPANY INC	1180 FAIRBURN ROAD	ATLANTA	30331
CASCADE FOOD MART	3580	ATLANTA	30331
CASCADE HOME THEATER	2611 BROOKSAGE CT	ATLANTA	30331
CEDAR GROVE BP	8700 CRDAR GORVE ROAD	FAIRBURN	30213

CENTER BROTHERS INC	775 GREAT SW PKWY	ATLANTA	30336
CHINA EXPRESS	1075 FAIRBURN ROAD	ATLANTA	30336
CLAYTON DISTRIBUTING CO INC	4790 MENDELL COURT	ATLANTA	30336
CLUB WAX	4385 COMMERCE DRIVE	ATLANTA	30336
COCA COLA ENTERPRISES INC	5300 BUFFINGTON ROAD	ATLANTA	30349
COME HOME EATERY	3580 CASECADE ROAD	ATLANTA	30311
COMMERCE INTL INC	4465 COMMERCE CIRCLE	ATLANTA	30336
COMPLETE AUTO	7990 COCHRAN MILL ROAD	ATLANTA	30268
CONVEYING SOLUTIONS LLC	5060 BAKERS FERRY ROAD	ATLANTA	30336
COOKING FOR LIFE LLC	3752 CASCADE ROAD	ATLANTA	30331
CORBITTS COLLISION CENTER	5525 HUNTER ROAD	COLLEGE PK	30349
COUNTY LINE SEAFOOD	4520 CAMPBELLTON ROAD	ATLANTA	30331
CREATIVE BUSINESS INVESTOR	320 BOULDER PARK COURT	ATLANTA	30336
CTIGO FOOD MART	5225 CAMPBELLTON ROAD	ATLANTA	30331
CULLBREATH SIGN INSTALL	2360 BURDETT RIDGE DRIVE	COLLEGE PK	30349
CUSTOM ENGINEERED SYS	3700 WENDELL DRIVE	ATLANTA	30336
Cyber Living Inc.	6770 Ann Arbor Drive	ATLANTA	30349
DAVID ROWE CONTRACTING	3465 WEST STUBBS ROAD	ATLANTA	30349
DAVIS HOUSEMOVERS	8475 WILLIAMS ROAD	PALMETTO	30268
DEAN FENCE & LAWN SERVICE	5800 BEARING WAY	COLLEGE PK	30349
DENNIS PHILLIPS & FRED GANTT	3450 CASCADE ROAD	ATLANTA	30311
DENSON DISTRIBUTING INC	5970 CANAAN WOODS DRIVE	ATLANTA	30331
DETAILS CARPENTRY	5040 BAKERS FERRY ROAD	ATLANTA	30336
DO IT RIGHT	4694 DERBY LOOP	FAIRBURN	30349
DRAIN KING MASONRY SYS	220 WESTCLIFFE COURT	COLLEGE PK	30349
DRAKE INSTALLATIONS	430 MENDOTA COURT	COLLEGE PK	30349
DUNKIN DONUTS	7804 SENOIA ROAD	FAIRBURN	30213
E & E TILE AND MARBLE	6550 PLUMMER ROAD	ATLANTA	30331
EDDIE PATTEN JR	7546 PETAL PLACE	FAIRBURN	30213
EFC SPECIAL TOUCH	2464 ORZARK TRAIL	ATLANTA	30331
EJS TIRE SERVICE	3170 STONEWALL TELL ROAD	ATLANTA	30349
EMANUEL COMPLETE MAINT	135 KIMBERLY CREEK PLACE	COLLEGE PK	30349
EMIRTH LLC	5310 HAPPY VALLEY CIRCLE	ATLANTA	30331
ENTERPRISE CONVENIENCE	6015 LYNMARK WAY	FAIRBURN	30213
ENTERPRISE RENT A CAR	3600 NATURALLY FRESH	COLLEGE PK	30349
EVANS MILLWORKS INC	540 WHARTON CIRCLE	ATLANTA	30336
EXCLUSIVE RENOVATIONS	6390 ASHDALE DRIVE	COLLEGE PK	30349
EXPRESS IMPORT EXPORT INT	8324 MILAM LOOP	FAIRBURN	30213
FALCON FOOD MART	3535 ROOSEVELT HWY	COLLEGE PK	30349
FARRIS YARBROUGH	4560 WEDGE DRIVE	ATLANTA	30331
FISH FILLET INC	3752 CASCADE ROAD	ATLANTA	30331
FLEETWASH INC	700 WENDELL COURT	ATLANTA	30336
FOOD MART	3850 FLAT SHOALS ROAD	UNION CITY	30291
FULTON INN	4230 WENDELL DRIVE	ATLANTA	30336
G & K SERVICES	6030 LA GRANGE BLVD, SW	ATLANTA	30336
G & S AUTO SALES	3860 STONEWALL TELL RD STE A	COLLEGE PK	30349
GEORGIA PAVEMENT PROD	535 FREDERICK COURT	ATLANTA	30336
GRAPHIC RESPONSE	4460-A COMMERCE CIRCLE	ATLANTA	30336
G R THOMAS & ASSOC	6350 TAHOE DRIVE	COLLEGE PK	30349
GUT BUSTERS RESTAURANT	5495 CASCADE ROAD	ATLANTA	30331
GOOD LUCK INC	4060 MLK DR	ATLANTA	30336

HARRIS BATTERY CO INC	7785 HOBGOOD ROAD	FAIRBURN	30213
HAWKER BEECHCRAFT CORP	3956 AVIATION CIRCLE	ATLANTA	30336
HEWITT HANDYMAN SERVICE	4400 SHAMROCK DRIVE	ATLANTA	30349
HOLLYWOOD CONSTRUCTION	6980 MERRYWOOD DRIVE	FAIRBURN	30213
HOON CHOL KIM	3840 STONEWALL TELL RD STE D	COLLEGE PK	30349
IHOP RESTAURANT #2061	2510 FLAT SHOALS ROAD	COLLEGE PK	30349
IMPORT TRUCKS OF ATLANTA	925 GREENSBORO DRIVE	ATLANTA	30336
INNOVATIVE CONCEPT INC	2562 WRANGLER DRIVE	ATLANTA	30331
INNOVATIVE TOUCH HOME	5504 BIGHORN PASS	ATLANTA	30349
J R CRICKETS SOCIAL CAFÉ	5495 CASCADE ROAD	ATLANTA	30331
JWT CONSTRUCTION	5870 BLUE BONNET CIRCLE	COLLEGE PK	30349
JACOBS CLEANING SERVICE	5955 BAKERS FERRY ROAD	ATLANTA	30336
JERSEY MIKES SUBS	6035 BAKERS FERRY ROAD	ATLANTA	30336
JOHNNYS NEW YORK PIZZA	5495 CASECADE ROAD	ATLANTA	30331
KEYSTONE AUTOMOTIVE	580 WHARTON CIRCLE	ATLANTA	30336
KEYSTONE AUTOMOTIVE	777 WHARTON CIRCLE	ATLANTA	30336
KFC LICENSES AND PERMITS	3510 CASCADE ROAD	ATLANTA	30331
KIRNLAND FOOD DIST INC	36 ENTERPRISE BLVD	ATLANTA	30336
L T & ASSOCIATES LLC	4011 HERRON PASS	ATLANTA	30349
LA CALLE INC	5370 CAMPBELLTON FAIRBURN	ATLANTA	30349
LARRYS WRECKER SERVICE	4880 WESTBROOK ROAD	ATLANTA	30349
LEON BENTON CONSTRUCTION	1041 FAIRBURN ROAD	ATLANTA	30331
LIANG JIN ZHEHG	6035 BAKERS FERRY ROAD	ATLANTA	30336
LIN WAY TIRE & RUBBER	4530 PATTON DRIVE	ATLANTA	30336
LITHIA POWDER COATING INC	5345 BUCKNELL DRIVE	ATLANTA	30336
LITTLE CEASARS	1075 FAIRBURN ROAD	ATLANTA	30331
LORDS REFINISHING & REST	5960 MALLORY ROAD	COLLEGE PK	30349
LOVESTERS HOME IMPROVE	4995 GREENTREE TRAIL	COLLEGE PK	30349
LUXURY RIDES OF ATLANTA	5737 FAIRBURN ROAD	COLLEGE PK	30349
M D KNOX GLASS & MIRROR	7574 BRAZOS TRAIL	FAIRBURN	30213
MAC & MASSEY LLC	101 GREAT SW PKWY	ATLANTA	30336
MALACHIS CUSTOM WOOD	4876 TRIGER LANE	FAIRBURN	30213
MAR CORPORATION	3724 CASCADE ROAD	ATLANTA	30331
MARK AUTO REPAIR AND BODY	6155 MALLORY ROAD	COLLEGE PK	30349
MARTINEZ GENERAL FLEET SER	3650 LAS OLAS DRIVE	ATLANTA	30349
MATRIX OF FLORIDA LLC	520 WHARTON CIRCLE	ATLANTA	30336
MATTHEWS COLLISON SERVICE	8101 GULLATT ROAD	PALMETTO	30268
MCELROY FINE LINES	2300 SHANCEY LANE	COLLEGE PK	30349
MEM CONCRETE AND CONS LLC	5170 WEST TEAL ROAD	FAIRBURN	30213
METRO SOUTH EMISSIONS LLC	3860 STONEWALL TELL RD STE B	COLLEGE PK	30349
MIDAS TOUCH	3241 TELFORD TERRACE	ATLANTA	30331
MIDAS TOUCH TRANS	8270 EQUINOX LANE	COLLEGE PK	30349
MILLER BROTHERS GAINT TIRE	8330 GULLATT ROAD	PALMETTO	30268
MOBILE AUTOMOTIVE	6940 CAINWOOD DRIVE	COLLEGE PK	30349
MORGAN TIRES PLUS	3735 CASCADE ROAD	ATLANTA	30331
MORGAN TRAILER MFG CO	4800 MENDELL COURT	ATLANTA	30336
MORRIS MOBILE REPAIR SER	3915 DEMOONEY ROAD	COLLEGE PK	30349
MOSES BAR B QUE	4230 STONEWELL TELL ROAD	COLLEGE PK	30349
MPC CONSTRUCTION	7421 MISTYDAWN DRIVE	FAIRBURN	30213
MULAN ASIAN CUISINE	1195 FAIRBURN ROAD	ATLANT	30331
MYERS TIRE SUPPLY	4450 FREDRICK DRIVE	ATLANTA	30336
NATIONAL POWERSPORT AUCT	605 SELIG DRIVE	ATLANTA	30336

NORTHERN PIPELINE CONST	115 LAZER INDUSTRIAL CT	FAIRBURN	30213

OBA CV ABAIR	9295 HUTCHESON FERRY RD	PALMETTO	30268
ONE CALL DOES IT ALL MOBILE	5860 MALLORY ROAD	COLLEGE PK	30349
PA FOWLES	3800 WENDELL DRIVE	ATLANTA	30336
PAPA JOHNS USA INC	3425 CASCADE ROAD	ATLANTA	30311
PARISHABLES FOOD SERVICE	512 INTERCHANGE DR	ATLANTA	30336
PIZZA HUT OF AMERICA INC	3695 CASCADE ROAD	ATLANTA	30331
PORTLAND UTILITIES CONST	6215 CEDAR WOOD DRIVE	COLLEGE PK	30349
PREMIUM PLUS	2613 OLD SPANISH TRAIL	COLLEGE PK	30349
PRESTIGE CAR CARE CENTER	975 CAMP FULTON WAY	ATLANTA	30336
PRESTIGE WRECKER	4106 STACKS ROAD	COLLEGE PK	30349
PUBLIX SUPERMARKET	3695 CASCADE ROAD	ATLANTA	30331
PUBLIX SUPERMARKET	5370 CAMPBELLTON FAIRBURN	ATLANTA	30349
QUALITY AIR TOOL REPAIR INC	300 GREAT SW PKWY	ATLANTA	30336
QUALITY BUILDERS CONTR	3725 PRINCETON LAKES PKWY	ATLANTA	30331
QUALITY TIRES AND ACC INC	2749 FLAT SHOALS ROAD	COLLEGE PK	30349
QUEENY TOWING	7234 MADISON CIRCLE	UNION CITY	30291
QUICK E MART	3450 CASCADE ROAD	ATLANTA	30311
R&B SALES	6070 LAGRANGE BLVD	ATLANTA	30336
RADIATOR WORKS INC	400 WHARTON CIRCLE	ATLANTA	30336
RALPH EXPRESS PAINTING	677 OUTLOOK WAY	COLLEGE PK	30349
RAM TRUCK AND TRAIILER	5945 BAKERS FERRY ROAD	ATLANTA	30336
RAMON WILLIAMS	725 ABERCORN DRIVE	ATLANTA	30331
RASHMIKA ENTERPRISES	5245 WELCOME ALL ROAD	ATLANTA	30349
REDDICK WILEY	6570 BELBURN ROAD	COLLEGE PK	30349
REMY DETAILS	2746 SAND LAKE COURT	COLLEGE PK	30349
REPAIR CENTER	4520 COMMERCE CIRCLE	ATLANTA	30336
RICE JAMES A JR	5068 LOWER ELM STREET	ATLANTA	30349
RIVERTOWN CONSTRUCTION	10395 CEDAR GROVE ROAD	COLLEGE PK	30349
ROLLING FRITO LAY SALES LP	780 WESLEYAN DRIVE	ATLANTA	30336
RONALD B EDENFIELD	5145 WELCOME ALL ROAD	ATLANTA	30349
ROSS & SHIRE TOTAL	1331 ELVA DRIVE	ATLANTA	30331
ROYAL PLUSH AUTO CLINIC	5500 OAKLEY INDUSTRIAL BLVD	FAIRBURN	30213
RUCHDA WINGS	6035 BAKERS FERRY ROAD	ATLANTA	30336
SANTOS INTERIORS	3700 WENDELL DRIVE	ATLANTA	30336
SHARTHYS CREAT & DESIGNS	4200 GLAD MORNING DRIVE	ATLANTA	30349
SIERRA MARY L	8245 GULLATT ROAD	PALMETTO	30268
SIKES TRANSPORTATION SVCS	4821 MENDEL COURT	ATLANTA	30336
SMITH FABRICATION SERVICE	3800 WENDELL DRIVE	ATLANTA	30336
SMITHCO BACKFLOW LLC	6068 HILLANDALE DRIVE	COLLEGE PK	30349
SNIDER TIRE INC	150 JAMES ALDREDGE BLVD	ATLANTA	30336
SO FRESH SO CLEAN	7844 VILLAGE PASS	FAIRBURN	30213
S F LANDSCAPE & NURSURY INC	3415 ENON ROAD	COLLEGE PK	30349
SOUTHEAST PIPER	3948 AVIATION CIRCLE	ATLANTA	30336
SOUTHERN FRIENDS CAR WASH	1185 RESEARCH CENTER	ATLANTA	30331
STARBUCKS	3660 CASCADE ROAD	ATLANTA	30331
STONE MOUNTAIN ACCESS SYS	200 MENDEL DRIVE	ATLANTA	30336
SUSIS TACO GRILL INC	5495 CASECADE ROAD	ATLANTA	30336
T & C FOOD MART	4626 WASHINGTON ROAD	COLLEGE PK	30349
T SHINE MOBILE DETAILING	5186 SEASIDE COURT	COLLEGE PK	30349

TASK HOSPITALITY	4265 SHIRLEY DRIVE	ATLANTA	30336
THE J GROUP INC	1160 FAIRBURN ROAD	ATLANTA	30331
THE KROGER COMPANY	3425 CASCADE ROAD	ATLANTA	30311
THE PAINTER	2470 REYNOLDS ROAD	ATLANTA	30331
TOOMBS MOBILE DETAILING	4010 MELANIE WOODS DRIVE	COLLEGE PK	30349
TOOMBS MOBILE DETAILING	2447 GARNET AVENUE	COLLEGE PK	30349
TOTAL HOME MAINTENANCE	6125 EMERALD POINTE CIRCLE	COLLEGE PK	30349
TRI R SERVICES	4875 ROCK HILL ROAD	COLLEGE PK	30337
TWELVE BASKETS INC	5200 PHILLIP LEE DRIVE	ATLANTA	30336
TWINS IMPORT & COLLISION	8345 GULLATT ROAD	PALMETTO	30268
UNDER THE ROOF DESIGN	4286 HOLIDAY ROAD	COLLEGE PK	30349
UNITED NATURAL FOODS	100 LAKEVIEW COURT	ATLANTA	30336
UTILITY ASSET INC	75 MENDEL DRIVE	ATLANTA	30336
V & R REMODELING	7762 CAMEGIE DRIVE	FAIRBURN	30213
VAN DYKE AUTO DETAILING	3160 CADIZ CIRCLE	COLLEGE PK	30349
VTECH LIGHTING SERVICES	105 ALGERINE COURT	FAIRBURN	30213
WAFFLE HOUSE	6035 BAKERS FERRY ROAD	ATLANTA	30336
WANG KAI MEI	5370 CAMPBELLTON FAIRBURN	ATLANTA	30336
SENSLEY CLARENCE	3830 WILL LEE ROAD	COLLEGE PK	30349
WENDYS	5965 BAKERS FERRY ROAD	ATLANTA	30336
WHOLESOME BLISS LLC	625 MALTESE DRIVE	ATLANTA	30349
WILLIAM R SKINNER	8220 SPENCE ROAD	FAIRBURN	30213
WINGFOOT COMMERCIAL TIRE	180 MENDEL DRIVE	ATLANTA	30336
WYCHE JIMMIE JR	8379 MILAM LOOP	FAIRBURN	30213
YRU SHIMEZ CAR WASH	5342 LAKEROCK	ATLANTA	30331
ZAXBY'S	925 CAMP FULTON WAY	COLLEGE PK	30349
HAROLDS TOWING	2795 GREEN TRAIL DRIVE	COLLEGE PK	30349

ATLANTA MECHANICAL SER	5572 HALSEY TRACE	COLLEGE PK	30349
BIVINS DEVELOPMENT IMPROV	3710 JUDY LYNN COURT	ATLANTA	30349
PROVENANCE CONST SER	119 KIRAM TERRACE	ATLANTA	30349
DAWSON HANDYMAN SERVICE	4085 HAWKINS CROSSING	COLLEGE PK	30349
DEPENDABLE TRANS & TOWING	4150 OLD FAIRBURN ROAD	COLLEGE PK	30349
PROFESSIONAL INSTALLATION	7532 PSRKLAND BEND	COLLEGE PK	30349
DAIRY QUEEN BRAZIER	4090 MARTIN LUTHER KING	COLLEGE PK	30349
WENDYS	3990 MARTIN LUTHER KING	COLLEGE PK	30349
KWIK BUILDING SERVICES	6750 MARLBOROUGH CIR	COLLEGE PK	30349
GA TECHNICAL SER OF GA	5600 MASON ROAD	COLLEGE PK	30349
EILEEN INC	135 MELANIE COURT	COLLEGE PK	30349
IVY PLUMBING CO	5735 OLD BILL COOK ROAD	COLLEGE PK	30349
AMERICAS BEST SIDING	6685 PEPERMILL LANE	COLLEGE PK	30349
SCS SPECILITY CONTRACTING	6171 SABLE FOX DRIVE	COLLEGE PK	30349
STONE CONTRACTORS LLC	2639 SAINT PAUL DRIVE	COLLEGE PK	30349
K&A DETAILING	3920 SHENFIELD DRIVE	COLLEGE PK	30349
PRESTIGE WRECKER TRANS	4106 STACKS ROAD	COLLEGE PK	30349
ROY'S BACKHOE WORK	8220 SPENCE ROAD	ATLANTA	30213
SHELL FOOD MART	7745 SPENCE ROAD	ATLANTA	30213
IT'S IN THE DETAILS MOBILE	673 SPORTSMAN LANE	ATLANTA	30213
KNIGHT TRUCK & TRAILER	4275 SHIRLEY DRIVE	ATLANTA	30336
STONEWALL FISH & WINGS	3840 STONEWALL TELL RD STE C	COLLEGE PK	30349
2 RAYS NEIGHBORHOOD TIRES	3820 STONEWALL TE RD STE B	COLLEGE PK	30349
AB EARLY CONSTRUCTION	4705 JAILETTE TRACE	ATLANTA	30349
MICHELLE'S TREASURE HUT	585 IRONSTONE DRIVE	ATLANTA	30213
DC HOT PIZZA	4245 SHIRLEY DRIVE	ATLANTA	30336
JAZZIE'S CAFÉ & DELI	3220 BUTNER ROAD	ATLANTA	30349
AUTHENTIC PLUMBING SERVICE	1120 CARLO TERRACE	ATLANTA	30331
MILES PRESERVATION SERVICE	5531 BOREAL WAY	ATLANTA	30331
ZAXBY'S	2530 FLAT SHOALS ROAD	ATLANTA	30336
SMILEY'S HOME IMPROVEMENT	3815 VILLAGE DRIVE	ATLANTA	30331
CALCULATED BUILDERS LLC	1505 VERSAILES DRIVE	ATLANTA	30331
BABES PUP & POOL	304 FULTON INDUSTRIAL CIRCLE	ATLANTA	30336
TASTE OF THE SOUTH CAFÉ'	304 FULTON INDUS CIR STE 8	ATLANTA	30336
2012 Municipal Sites			
	Address	**City & State**	**Zip**
Boat Rock Gymnasium	5800 Boat Rock Road	Atlanta, GA	30331
Burdett Concession Stand	2975 Burdett Road	College Pk	30337
Burdett Gymnasium	2945 Burdett Road	College Pk	30337
Burdett Tennis Center	5975 Old Carriage Ln	College Pk	30337
Camp Creek Utility Const	7600 Cochran Road	College Pk	30349
Cedar Grove Community Hse	9285 Cedar Grove Rd.	Fairburn, GA	30213
Cedar Grove Park	7375 Rivertown Road	Fairburn, GA	30213
Clarence Duncan Park Horse	6000 Rivertown Road	Fairburn, GA	30213
Cliftondale Pk Picnic Shelter	4645 Butner Road	College Pk	30349
Cliftondale Park Rec. Center	4399 Butner Road	College Pk	30349
Cochran Mill Restroom	6875 Cochran Mill Road	Palmetto, GA	30268

Creel Park Tennis Courts, 4	2775 Creel Road	College Pk	30349
David Hagins Pistol Range Tr	5301 Aldredge Rd.	Atlanta, GA	30349
Delano Road Park	4701 Delano Road	Red Oak, GA	30272
Farbest Community House	6740 Johnson Road	Fairburn, GA	30213
Fire Administration Office	3977 Aviation Circle	Atlanta, GA	30336
Fire Station #1, Red Oak	5165 Welcome All Rd	Red Oak, GA	30272
Fire Station #11, Fulton Ind	4760 Fulton Indl Blvd	Atlanta, GA	30336
Fire Station #13, Cascade	5890 Plumber Road	Atlanta, GA	30331
Fire Station #17, Cedar Gr	8675 Ridge Road	Cedar Grove	30213
Fire Station #19, C Brown Air	3965 Aero Drive	Atlanta, GA	30336
Fire Station #23, Cascade	4121 Cascade Road	Atlanta	30331
Fire Station #3, Cliftondale	4035 Stonewall Tell Rd	College Pk	30337
Fire Station #5, Pine Ridge	3175 Bethsaida Road	Fairburn	30213
Fire Station #7, Midway	5965 Buffington Road	College Pk	30349
Mason Road Park Rest/con	5665 Mason Road	College Pk	30349
Merk Rd Landfill, Admin Bldg	3150 Merk Rd., SW	Atlanta	30331
Merk Road Transfer Station	3225 Merk Road	Atlanta	30331
Morning Creek	2924 Old Jonesboro Rd	Fairburn	30213
Old National Precinct	5549 Old Nat Hwy, C	College Park	30349
S F Rec Fac At Welcome All	4255 Will Lee Road	College Park	30349
Sandtown Park Gym/office	5600 Campbellton Rd	Atlanta, GA	30331
Sherwin Tucker Park	2400 Pleasant Hill Road	College Park	30349
So Fulton Tennis Ctr	5634 Mason Road Sw	Atlanta, GA	30349
South Annex	5600 Stonewall Tell Rd	College Park	30349
Tax/Tag Office Ingle's	3425 Cascade Rd	College Park	30331
Tom Lowe Shooting Grounds	3025 Merk Rd., SW	Atlanta	30331
Traffic Signal Shop	3929 Aviation Circle	Atlanta	30336
Trammel Crow Park	4980 Cascade Road	Atlanta, GA	30336
Welcome All Park	4225 Will Lee Rd.	College Pk	30337
Wilkerson Mill Park	8095 Wilkerson Mill Rd	Palmetto, GA	30268
Wolfe Creek Trap Skeet Off	3070 Merk Road Sw	Atlanta, GA	30331

Fulton County

MS4 FACILITY INSPECTION REPORT

Inspector Name: ______________________ Date:__ ___ ______ Time: _______ AM/PM

Type of Inspection: ☐ Routine ☐ Follow-up ☐ Complaint ☐ Other: ____________________

CONTACT INFORMATION

Business Name ______________________________

Street Address ____________________ Mailing Address same ______________

____________________ ______________

Responsible Person(s) ______________________________

Title: ______________________________

Business Phone: (___) ______________ ext. ________

Home Based? ☐ Yes ☐ No

Facility personnel present: ______________________________

FACILITY/SITE INFORMATION

Type of Facility: ☐ Industrial HVPS ☐ Municipal ☐ Other ______________

Principal Activity: ____________________ Status Update: ☐ Moved/Out of Business

SIC or NAICs Code: ____________________ ☐ Not Inventoried ☐ Other________

Does facility have a current business license ☐ Yes ☐ No # ____________ Exp. ________

Is facility subject to Statewide General Industrial Stormwater Permit? ☐ Yes ☐ No ☐ UNK

Has facility filed a Notice of Intent (NOI)? ☐ Yes ☐ No ☐ UNK NOI #________

Does facility maintain SWPPP Plan? ☐ Yes ☐ No ☐ UNK

Does facility maintain SPCC Plan? ☐ Yes ☐ No ☐ UNK

INITIAL OBSERVATIONS

Does any stormwater enter the MS4 from this facility? ☐ Yes ☐ No ☐ UNK

Comments

SITE MAP Sketch inspection site showing major site features such as buildings, outdoor storage areas, storm drain inlets, roads, creeks, illicit discharge/connection locations, etc.

Stormwater Structure Inventory:

# of catch basins ____________

# of outfalls ____________

Weather Conditions:

Temperature__________

Precipitation__________

Cloudy ☐ Yes ☐ No

Outfall Conditions:

☐ N/A ☐ Poor

☐ Fair ☐ Good

Flow at Outfalls?

☐ Yes* ☐ No ☐ N/A

*(complete IDDE form if flow is observed)

Additional Comments:

BMP ASSESSMENT

A. Wastes & Recycling	Yes	No	N/A	Comments
Are storm drains located in waste and recycling areas?				
Is the trash/recycling area enclosed and free of litter and debris?				
Are adequate trash containers provided?				
Are lids present on all containers?				
Does the company properly dispose of hazardous waste?				
Is an adequate and functional spill response kit readily available?				

Additional Comments: ____________

B. Outdoor Loading/Unloading of Materials	Yes	No	N/A	Comments
Are storm drains located directly within loading/unloading areas?				
Are loading and unloading areas free of spills and debris?				
Are proper handling procedures used to transport materials?				
Do indoor loading/unloading areas utilize controls to prevent discharges to outdoors (e.g., door skirt)?				

Additional Comments: ____________

C. Outdoor Material Storage	Yes	No	N/A	Comments
Are storm drains located directly within outdoor material storage areas?				
Do outdoor material storage areas have areas with overhead cover?				
Are all drums, cans, containers, tanks, and valves properly labeled?				
Are outdoor material storage areas paved and bermed?				
Do outdoor material storage areas have secondary containment areas?				
Is secondary containment free of spills and rainwater?				
Is an adequate and functional spill response kit readily available?				

Additional Comments? ____________

D. Vehicle & Equipment - Maintenance & Repair	Yes	No	N/A	Comments
Is there a designated vehicle and equipment maintenance area?				
If yes, is it within a building or a covered area?				
Are storm drains located within the vehicle and equipment maintenance area?				
Are materials provided (berm, mat, etc.) to protect storm inlets from spills and leaks?				
Are there designated areas for draining or replacing fluids?				

Additional Comments: ____________

Facility ID ____________

E. Outdoor Vehicle & Equipment Washing	Yes	No	N/A	Comments
Is there a designated wash area?				
Is the wash area properly bermed?				
Are storm drains located within the wash area?				

Additional Comments: ____________

F. Other	Yes	No	N/A	Comments
Are parking areas free of significant spills and leaks?				
Is facility cleaned regularly to prevent accumulations of pollutants?				
Is pressure washing conducted at this facility?				
If yes, is wash water captured?				
How frequently are pressure washing activities conducted?				
Is street sweeping conducted at the facility?				
Are stormwater conveyance systems and structural BMPs regularly inspected and maintained?				
Were any educational materials distributed?				
Are there any other potential stormwater pollution issues or concerns? If yes, explain below.				

Additional Comments: ____________

SUMMARY

Were there any discharges observed? ☐ Yes* ☐ No *(attach completed IDDE form if sampling was performed)

If yes, describe: ____________

RECOMMENDED CORRECTIVE ACTION

Is corrective action needed? ☐ Yes ☐ No

If yes, describe: ____________

VIOLATIONS

- ☐ No violations have been noted at this time.
- ☐ No violations have been noted, but recommend taking corrective action described above.
- ☐ Violations of stormwater ordinance or other applicable regulations were found

Type of Violation:
- ☐ Illegal discharge(s) of pollutants into the storm drain or receiving waters
- ☐ Illegal connection(s) to the storm drain system
- ☐ Improper implementation of required BMPs
- ☐ Other: ____________

Specific action required to correct the violation described above?

Reviewed and received by:

Facility Representative Signature ____________ Date: ____________

Print Name of Facility Representative ____________

Inspector's Signature ____________ Date: ____________

Facility ID ____________________

PHOTOS

Photo #	Date	Time	Taken By	Description of Photo

Additional Comments:

Dry Weather Outfall Screening Form	
Name of City or County: Fulton County	Data Sheet Number:
Date of screening (MM/DD/YY):	Time of screening:
Weather conditions:	
Sampling performed by:	

Outfall Description	
Outfall Location:	Outfall ID:
Outfall Type/Material: ❒ Closed Pipe (circle): RCP CMP PVC HDPE Other: _______________ ❒ Open Channel (circle): Concrete Earthen Grassy Other: _______________	Outfall Diameter/Dimensions:
Receiving stream and watershed name:	
Land use/industries in drainage area:	
GPS Coordinates:	Photo numbers:

Field Observations and Measurements	
Flow from outfall? ❒ Yes ❒ No Flow Description: ❒ Trickle ❒ Moderate ❒ Substantial	
Odor: ❒ None ❒ Sewage ❒ Sulfide (rotten eggs) ❒ Petroleum/gas ❒ Rancid/sour ❒ Other _______________ Relative severity: ❒ 0-None ❒ 1-Faint ❒ 2-Easily Detected ❒ 3-Noticable from a distance	
Color: ❒ Clear ❒ White ❒ Gray ❒ Orange/Rust ❒ Red ❒ Yellow ❒ Green ❒ Brown/Black ❒ Other Relative severity: ❒ 0-None ❒ 1-Faint ❒ 2-Clearly visible in bottle ❒ 3-Clearly visible in flow _______________	
Turbidity: ❒ None ❒ Cloudy ❒ Opaque ❒ Silty ❒ Muddy ❒ Other _______________ Relative severity: ❒ 0-None ❒ 1-Slight cloudiness ❒ 2-Cloudy ❒ 3-Opaque	
Floatables: ❒ None ❒ Sewage ❒ Petroleum (oil sheen) ❒ Suds ❒ Other _______________ Relative severity: ❒ 0-None ❒ 1-Few/slight ❒ 2-Some ❒ 3-Heavy	
Flow Temperature (ºC):	
Flow pH:	pH meter calibrated? ❒ Yes ❒ No
Flow Conductivity (μmho/cm):	Conductivity meter calibrated? ❒ Yes ❒ No

Water Quality Sampling			
Field Test Kit Manufacturer:		Model:	
Fluoride (mg/L):		Fecal Coliform (MPN/100ml):	
Surfactants (mg/L):		Analysis Comments:	
Grab sample for lab? (fluoride/surfactants) ❒ Yes ❒ No		Bacteria Grab sample for lab? (fecal coliform) ❒ Yes ❒ No	
Grab Sample ID:		Bacteria Grab Sample ID:	

Outfall Potential for Illicit Discharge:

❒ Unlikely - or- No Flow ❒ Possible (presence of two or more indicators)

❒ Suspect (one or more indicators with severity of 2 or 3) ❒ Obvious - or- Confirmed

Zinc Source Inventory Worksheet

As a first step you should review your Stormwater Pollution Prevention Plan (SWPPP). Conduct a walk-through inspection to see that your facility is following measures in the SWPPP. The SWPPP facility diagram shows areas of potential sources and measures to contain them. The diagram also shows runoff routing and stormwater conveyances. Record your observations on a worksheet such as the one below.

1. Ground cleanliness

   a. Oily fluid spot/puddles (extent, size of spots/puddles)

   b. Dirt, dust particles: degree and extent of area

   c. Other absorbent materials (saw dust, wood chips, leaves, etc.)

Observations: ____

____

____

____

2. Stormwater conveyance (check for galvanized materials)

   a. Downspouts

   b. Storm sewers

Observations: ____

____

____

____

3. Ground activity

   a. Hydraulic fluid / tire dust (such as forklifts / trucks / heavy equipment)

   b. Motor oil (cars and trucks)

Other sources (manufacture or storage) and observations: ________________________________

____

____

____

____

4. Galvanized materials on grounds (such as process-related materials, storage, scrap piles, parked equipment)

Observations: ____

____

____

____

5. Spill prevention measures (such as covered areas over exposed materials, operations indoors where suitable)

Observations of spill measures in place: ____

____

____

____

6. Chain-link fence

   a. Material
   b. Length
   c. Location within facility or on perimeter, over vegetation or over pavement

Observations: ____

____

____

____

7. Roof (note galvanized surfaces)

   a. Roof material, type of coating, area
   b. Galvanized ductwork, area: HVAC, equipment housings, turbines, etc.
   c. Roof gutters
   d. Galvanized metal strips or wires for moss control
   e. Periodic application of moss control liquids or powders

Observations: ____

____

____

____

8. Buildings

    a. Galvanized materials such as garage doors
    b. Paint containing zinc (see the MSDS for the particular paint)

Observations: ____

____

____

____

9. Other sources / possible sources not noted above ______________________________

____

____

____

AES

ANALYTICAL ENVIRONMENTAL SERVICES, INC
3785 Presidential Parkway, Atlanta GA 30340-3704
TEL.: (770) 457-8177 / TOLL-FREE (800) 972-4889 / FAX: (770) 457-8188

CHAIN OF CUSTODY

Work Order: ______

Date: ______ Page ______ of ______

COMPANY | ADDRESS

PHONE | FAX:

SAMPLED BY | SIGNATURE

ANALYSIS REQUESTED

Visit our website www.aesatlanta.com to check on the status of your results, place bottle orders, etc.

#	SAMPLE ID	SAMPLED DATE	SAMPLED TIME	Grab	Composite	Matrix (See codes)	PRESERVATION (See codes)													REMARKS	No # of Containers
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1		1	
2		2	
3		3	

PROJECT INFORMATION

PROJECT NAME:

PROJECT #:

SITE ADDRESS:

SEND REPORT TO:

INVOICE TO:
(IF DIFFERENT FROM ABOVE)

QUOTE #: ______ PO#: ______

RECEIPT

Total # of Containers

Turnaround Time Request

- Standard 5 Business Days
- 2 Business Day Rush
- Next Business Day Rush
- Same Day Rush **(auth req.)**
- Other ______

STATE PROGRAM (if any): ______

E-mail? Y / N; Fax? Y / N

DATA PACKAGE: I II III IV

SPECIAL INSTRUCTIONS/COMMENTS:

SHIPMENT METHOD

OUT / / VIA:

IN / / VIA:

CLIENT FedEx UPS MAIL COURIER

GREYHOUND OTHER ______

SAMPLES RECEIVED AFTER 3PM OR SATURDAY ARE CONSIDERED AS RECEIVED ON THE NEXT BUSINESS DAY; IF NO TAT IS MARKED ON COC AES WILL PROCEED AS STANDARD TAT.
SAMPLES ARE DISPOSED OF 30 DAYS AFTER COMPLETION OF REPORT UNLESS OTHER ARRANGEMENTS ARE MADE.

MATRIX CODES: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water (Blanks) DW = Drinking Water (Blanks) O = Other (specify)

PRESERVATIVE CODES: H+I = Hydrochloric acid + ice I = Ice only N = Nitric acid S+I = Sulfuric acid + ice S/M+I = Sodium Bisulfate/Methanol + ice O = Other (specify) NA = None

White Copy - Original; Yellow Copy - Client

Appendix J – Industrial Facilities Inventory

Municipal Industrial Facilities

Facility Name	Street	City	State	Zip	Type
Camp Creek WRF	7520 Cochran Road	College Park	GA	30349	WRF
Charlie Brown Airport	3952 Aviation Circle, Room 200	Atlanta	GA	30336	Airport
Little Bear WRF	405 Rippling Brook Trace	Palmetto	GA	30213	WRF
Stonewall Tell	5601 Stonewall Tell RD	College Park	GA	30349	Transportation fleet maintenance and storage yard

Privately Owned Industrial Facilities

Sunny Delight			-
7000 La Grange Blvd, SW	John St. Lewis	404-267-4534	John.St.Lewis@SunnyD.com
Atlanta GA 30336	Site Environmental & Sustainability Leader		
404-267-4530 (Main)			
SVC Manufacturing	Tracy Geisel	404-845-519-7653	-
1650 Westgate Pkwy, SW	ENV Safety Manager		
Atlanta, GA 30336			
404-346-3401 (Main)			
Trimac Transportation South, Inc.			
6800 McLarin Road	Rick Barker	770-969-9177 ext 114	rbarker@trimac.com
Fairburn, GA 30213	Maintenance Manager	404-867-0779 (cell)	-
770-969-9177 (Main)			
			-
Spectra Metal Sales			
6104 Boat Rock Blvd, SW	Gary Kienel	404-344-4305	g.kienel@spectrametals.net
Atlanta, GA 30336	Corporate Regulatory Compliance & Safety Director		-
404-344-4305 (Main)			
Metalplate Galvanizing	Kevin R Grant	404-691-0600	kevin@metalplate.com
505 Selig Dr SW	Plant Manager	Fax: 404-699-2270	
Atlanta, GA 30336			

404-691-0600 (Main)			
Great American Cookie	Tanya Dampier		
4685 Frederick Drive, SW	Productions Supervisor		
Atlanta, GA 30336		770-313-6353	
404-696-1700 (Main)			

Appendix J – Industrial Facilities Inventory

Publix Supermarkets, Inc.			-
5475 Bucknell Dr, SW	Ron Housel	404-344-4500 ext 4009	ron.housel@publix.com
Atlanta, GA 30336	Plant Engineer		
404-344-4500 (Main)			-
Advanced Design & Packaging			
5090 MacDougall Drive, SW	Ed Gallegos	404-699-1952 ext 2725	emg@stronghaveninc.com
Atlanta, GA 30336	Director of Product Sustainability		-
404-699-1952 (Main)			
Parkway Products, Inc.			
5300-B Fulton Industrial Blvd, SW			-
Atlanta, GA 30336			
404-344-2006 (Main)	Chris Bowman, Maintenance Technician	404-344-2006 ext 8443	
			-
	Donald Wagner, Quality Manager	404-344-2006 ext 8252	(Signs Documents)
	Jim Colburn, Manufacturing Manager	404-344-2006 ext 8244	(Signs Documents)
	Eric Opicka, Plant Manager	404-344-2006 ext 8442	(Signs Documents)
The Eggo Company			
5601 Bucknell Drive, SW	Gordon Stiltner, Engineering/Facilities Manager	404-344-6065 ext 230	gordon.stiltner@kellogg.com
Atlanta, GA 30336			
404-344-6065 (Main)		404-344-6065 ext 229	-
			-
Miller Zell, Inc.			
4750 Frederick Dr, SW	Trevi Frazier, Process Manager	404-691-7400 ext 1439	trevi.frazier@millerzell.com
Atlanta, GA 30336			-
404-691-7400 (Main)			

Appendix J – Industrial Facilities Inventory

Owens Corning			
4795 Frederick Drive, SW	Ronald P. Walker, EHS Compliance Technician	404-836-3530	ronald.p.walker@owenscorning.com
Atlanta, GA 30336			-
404-836-3500 (Main)			
			-
RockTenn CP, LLc	Mark Robinson	404-691-6386 ext 12	marobins@rocktenn.com
65 Enterprise Blvd, SW	Environmental Coordinator	770-326-8141	-
Atlanta, GA 30336	Rachel Davis		
404-691-6386 (Main)	Environmental Services Manager		
Atlanta Beverage Base Plant	Alanna Barfield	404-676-8392	abarfield@coca-cola.com
1001 Great Southwest Pkwy		404-387-3165 (cell)	-
Atlanta, GA 30336			-
404-676-2121 (Main)			
Gannett Offset Atlanta			
120 James Aldredge Blvd	Larry Long	404-699-6221	llong@offsetva.gannett.com
Atlanta, GA 30336	Building Manager		
404-699-6200 (Main)			
Kapstone Container Corporation			
5560 Gwaltney Drive	Scott Sumner	404-629-1400	scott.sumner@uscorr.com
Atlanta, GA 30336	Production Manager		
404-629-1400 (Main)			
UPS	William Minter	404-699-4870	cwclark@ups.com
270 Marvin Miller Dr	Plant Engineering Facilities Engineer		-
Atlanta, GA 30336			
404-699-4834 (Main)			

Appendix J – Industrial Facilities Inventory

CKS Packaging Inc.			
5515 Tulane Dr, SW	Jeff Elbon	404-691-8915	jeff@ckspackaging.com
Atlanta GA 30336	Plant Manager		_
404-691-8900 (Main)			
Philips	Timothy D. Lehman	770-969-7886	
8025 Spence Road			_
Fairburn, GA 30213			
Americold Logistics			
1845 Westgate Pkwy, SW	Andy Pittman	404-629-9337	andy.pittman@americoldrealty.com
Atlanta, GA 30336	Facilities Manager		
404-629-2430 (Main)			
Americold Logistics, A, B & C			
1740 Westgate Pkwy, SW	Cary Ralls	404-349-1788	cary.ralls@americold.com
Atlanta, GA 30336	Facilities Manager		
404-349-4704 (Main)			
Americold Logistics			
6500 Tradewater Pkwy, SW	Justin Parrish, Facility Services Manager	404-460-4736	justin.parrish@americoldrealty.com
Atlanta, GA 30336			
404-460-4700 (Main)			
Kapstone Kontainer Corporation			
655-A Selig Dr, SW	Scott Holland	404-691-8158	scott.holland@uscorr.com
Atlanta, GA 30336	Maintenance Manager		
404-691-8158 (Main)			
			_
Vie De France			
4507-R Mills Place, SW	Kevin Ward	404-696-5487 ext 727	kevin.ward@vdfy.com
Atlanta, GA 30336	Maintenance Manager		
404-696-5487			

Appendix J – Industrial Facilities Inventory

(Main)			
Sto Corp			
6175 Riverside Pkwy	Gary Shepherd	678-539-4224	GShepherd@stocorp.com
Atlanta, GA 30331	Maintenance Supervisor	770-823-7309 (Cell)	
404-346-3666 (Main)			
Bronner Brothers			
4200 Wendell Dr, SW	Wes Hayes	404-691-2646 ext 103	wesiii@bronnerbros.com
Atlanta, GA 30336	Plant Manager		
404-691-2646 (Main)			
Lathem Time	Ellery Potash	404691-1400	epotas@lathem.com
200 Selig Drive	Senior Electrical Engineer		_
Atlanta, GA 30336			_
404-601-0400			_
Dessert Innovations			
25-B Enterprise	Rolf Schittli	404-691-1211	Rockylowe
Atlanta, GA	Chief Engineer		
Eurochem Int. Corp.	Kaly Gosh	404-696-9867	kalygosh@eurochem.com
600 Wendell Court	Operations Director		Bnoemis@eurochem.com
Atlanta, GA 30303			
Evergreen Sweeteners	John Capobianco	404-567-4892 516-238-3553 (cell)	jcapobianco@esweeteners.com
5625 Fulton Industrial Blvd	Maintenance Manager	770-634-9626 (cell)	jkroner@esweeteners.com
Atlanta, GA 30336	John Kroner		
404-567-4893 (Main)	Plant Manager		
Intonu	John Marynoski	404-699-9989	
5225 Phillip Lee Drive	Owner		
Atlanta, GA 30336			

Appendix I - Illicit Discharge Detection and Elimination Plan

Inventory & Mapping

Fulton County's illicit discharge detection elimination (IDDE) plan is based on a GIS inventory of the storm drainage system within unincorporated Fulton County. The GIS inventory is used to plan dry weather screening and to facilitate source tracking when dry weather screening indicates the possibility of illicit discharges to the County's municipal separate storm sewer system (MS4).

IDDE Program & Personnel

Fulton County utilizes a combination of County employees and a water quality monitoring contractor to address IDDE requirements.

The County personnel are

- Engineering Administrator (program administration and inter and intra-department coordination)
- Environmental Quality Specialist (technical engineering and support)
- Environmental Quality Specialist (inspections and enforcement)

The water quality contractor is responsible for dry weather screening as described in the "Dry Weather Screening" portion of this document. The water quality contractor provides sufficient trained personnel to achieve the County's goal of screening 20% of the County's MS4 outfalls.

Fulton County's IDDE program consists of the following program elements:

- Dry weather Screening; Fulton County has identified 1,085 MS4 outfalls, and will perform dry weather screening on 20% of those outfalls every reporting period.
- Source Tracking
- Source Elimination

Dry Weather Screening

Fulton County has identified 1,085 MS4 outfalls, and will perform dry weather screening on 20% of those outfalls every reporting period.

Dry weather screening is performed on MS4 outfalls identified as part of the County's GIS stormwater inventory. Screening of stormwater outfalls for illicit discharges is performed during periods of dry weather, which is defined as rainfall of less than 0.1 inch per day for at least 72 hours. Each selected outfall is inspected for flow. When a dry weather flow is observed at an outfall, the following are to be performed on the flow:

- Field observations and measurements – Site descriptions and qualitative observations of physical conditions of the outfall and flow, as well as measurement of several in-situ water quality parameters.
- Water Quality Sampling – Collection of water quality samples for field screening and laboratory analysis when indicated by the field observations and measurements.

The table below lists the recommended equipment for dry weather outfall screening. Before undertaking field work, the field team ensures that all of the necessary equipment is present and in order. Both the pH meter and the conductivity meter are calibrated. In addition, field test kits are be inspected to ensure that they have sufficient reagents and test strips/discs.

Field Equipment	**Function**
Field maps (with outfall locations, drainage areas, and locating outfalls for screening street information)	Locating outfalls for screening
Field measurement equipment (temperature, pH, specific conductivity meters)	Measuring field temperature, pH and specific conductivity of dry weather flows
Field test kits	Measuring fluoride and surfactants
Sample bottles with labels	For collection of grab samples
Sealed, sterile sample bottles with labels	For collection of bacteria grab samples
Grab water sampler (dipper on long pole)	For outfalls/flows that are difficult to reach
Waders and walking stick	For reaching outfalls near a stream or waterbody
Hand-operated vacuum pump sampler	For shallow dry weather flows
Clear tape and applicator	To apply over label
Coolers	For transport of grab samples
Ice / ice packs	To keep samples preserved after collection and during transport from the site
Clipboard or notebook with data collection forms and chain of custody forms / Pens	To document field data and activities
Field logbook	To record notes
Permanent marker (extra fine)	Label sample bottles
Cell phone	Communication in the field
Handheld GPS receiver	Determining or navigating to outfall locations
Digital camera	To document dry weather flow and/or

Field Equipment	Function
	conditions
Flashlight	Recording visual conditions
First Aid Kit	Health & Safety Plan
Disposable gloves, safety shoes and safety glasses	Health & Safety Plan

An example Dry Weather Outfall Screening Form is included in Appendix J – Inspection Forms which, will be used to record the observations and analytical results of the dry weather screening procedures.
Basic descriptive information is recorded at the top part of the Dry Weather Outfall Screening Form:

- Outfall location
- Outfall ID number
- Outfall type, material and size
- Date and time of screening
- Weather observations

Physical observations of the site are recorded on the screening form under Field Observations and Measurements. If no flow is observed during the outfall screening, the "Flow from outfall?" field should be checked "No" and the screening is complete. This result will be counted towards the total number of outfalls screened.

If flow is observed, then "Yes" is checked and the following physical indicators recorded. Each of these observations associated with flowing outfalls may predict the presence of an illicit discharge or illegal connection:

Odor – Description of any odors that emanate from the outfall and an associated severity score. **Color –** The visual assessment of the discharge color. The intensity of color is ranked from one (slightly tinted) to three (clearly visible in the flow). **Turbidity –** The visual estimate of the turbidity of the discharge, which is a measure of the cloudiness or opaqueness of the water. Turbidity is ranked from one (slight cloudiness) to three (opaque). **Floatables –** The presence of any floatable materials in the discharge or the plunge pool below. Sewage, oil sheen or film, and suds are all examples of floatable indicators. [Note that for dry weather screening, trash and debris are not considered indicators of an illicit discharge or illegal connection.

Upon completing the physical observations, the temperature, pH, specific conductivity, fluorides and surfactants of the dry weather flow (either in-situ or using a sample bottle) are measured or obtained with test strips, and the measurements are recorded on the screening form.

Appendix I - Illicit Discharge Detection and Elimination Plan

Water quality sampling of a dry weather flow is performed to look for chemical or bacteriological indicators which may detect, characterize or confirm the presence of an illicit discharge or illegal connection.

Water quality sampling is required for a dry weather flow that meets any of the following criteria:

- Visible sewage or sewage odor
- Physical indicator of potential illicit discharge (color, odor, turbidity or floatables)
- pH lower than 6.0 or higher than 9.0
- Specific conductivity greater than 300 µmho/cm
- Fluorides (< 0.2 mg/L)
- Surfactants / detergents (< 0.2 mg/L)

Sampling may be undertaken either using field test kit equipment or by collecting grab samples for laboratory analysis. All samples forwarded for laboratory analysis will be tested for fecal coliforms.

Field test kits with appropriate reagents, test strips/discs, and sampling equipment are used. The kit manufacturer's procedures for obtaining a test sample and completing the field analysis are followed, and the field analysis results are recorded on the screening form. Grab samples and subsequent laboratory analysis may be performed in lieu of field sampling for one or more of the water quality parameters. Grab samples are analyzed using EPA-approved laboratory analysis methods.

A manual grab sample for a dry weather flow is accomplished by inserting the sample container (either plastic or glass depending on the parameter) under or down current of a discharge with the container opening facing upstream. In many cases, the sample container itself is used to collect the sample. Less accessible outfalls will require the use of poles and buckets to collect the grab sample. A pre-measured cut-off milk jug can be used to capture shallow flows from the outfall. To ensure that the manual grab samples are representative, the following procedures are followed:

- Sample bottle is not opened until sample is to be actually collected.
- Gloves are used at all times when handling sampling bottles.
- The grab sample is taken from the horizontal and vertical center of the outfall.
- The sampler makes sure not to disturb any sediments or benthic growth in the outfall.
- Samples are transferred into proper container (e.g., from bucket to sample container). Fecal coliform grab samples are collected directly into sterile sample containers.

- All of the equipment and containers that comes into contact with the sample are cleaned in order to avoid contamination, and be non-reactive to prevent leaching of pollutants.

The grab sample bottle type, preservation requirements, and holding time requirement for those parameters being tested are listed in following table. Proper preservation and maintenance of the holding times for each parameter is observed so that the integrity of the sampling results is maintained. Fecal coliform samples have a short holding time of six hours and are returned to the lab for analysis within this time.

Parameter	**Container Type**[1]	**Sample Volume (g)**	**Sample Preservation**	**Max Holding Time**
Fecal Coliform[2]	PP, G	100 mL	Cool, 4° C	6 hours

A sample numbering system is used to ensure that each sample is uniquely identified in the field and tracked on field data collection forms. The sample numbering follows the structure labeling system used in the GIS inventory and includes the date and time in military format.

All of the samples collected at the site are placed in the appropriate sample containers for preservation and shipment to the designated laboratory. Each sample is identified with a separate identification label. A waterproof, gummed label is attached to each sampling container. Information to be recorded on the label includes:

- Site name;
- Sample number;
- Analysis to be performed;
- Date and time of collection;
- Preservation used and any other field preparation of the sample; and
- Initials of field crew collecting the sample.

A chain-of-custody (COC) form accompanies all samples, and provides all of the information on the sample label discussed in the preceding section. A COC form is prepared by the sample collector for each set of samples submitted for laboratory analysis. The form is placed in a re-sealable plastic bag and sealed inside each sample cooler. When transferring possession of the samples, the individual relinquishing and receiving samples signs, dates, and notes the time on the COC form. This record documents the transfer of custody from the sampler to another person, to/from a secure storage area, and to the laboratory. Copies of the COC forms are kept for future reference. A copy of the COC can be found in Appendix J – Inspection Forms.

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[1] Polyethylene (P), Polypropylene (PP), Glass (G) – EPA approved sample containers, (40 CFR 136)
[2] In chlorinated waters, dechlorinate the sample with sodium thiosulfate by adding 1 mL of 10% $Na_2S_2O_3$ to the sample.

The samples are packed in coolers with ice (or ice packs) to ensure they maintain the required temperature of less than or equal to 4°C during transport to the designated laboratory, and the laboratory is contacted prior to sampling to assure that the samples will be analyzed within their holding time. Samples may be placed in individual one-gallon resealable bags as a precaution to avoid spilling the sample. All glass bottles are individually bagged and bubble-wrapped to prevent breakage on the way to the lab. Samples may be placed in a large trash bag inside a cooler (to ensure against the sample leaking) with ice completely covering the samples.

Field quality control procedures include calibration procedures, field blanks and field duplicates. The field equipment is calibrated appropriately prior to leaving for the sampling site to ensure proper performance of the equipment. This includes the pH meter, conductivity meter, and the thermometer. The pH meter and conductivity meter is calibrated in accordance with the manufacturer's recommendations.

Quality control blanks are used in the field to determine potential sample contamination during sample collection, handling, shipment, storage, or laboratory handling and analysis. Reagent grade water is used for the quality control blanks. A minimum of one field blank for surfactants (detergents) and fecal coliform is required each day with scheduled field screening. For fluoride, a field blank is used with approximately 10 percent of samples (or as required by the lab). Field duplicates should be collected on approximately 10 percent of the samples to assess the representativeness of sampling procedures in addition to the normal uncertainty associated with the analysis. The laboratories follows Georgia EPD approved methods and routinely performs quality control checks during laboratory analysis, including calibration standards, blanks, laboratory control samples, laboratory control duplicate samples, matrix spikes, and matrix spike duplicates. Spikes and duplicates are performed on a minimum of 10 percent of the samples and should meet data quality objectives.

- Field screening program, including number of outfalls located on the MS4's system, many outfalls are screened, frequency of screening and prioritization:

Fulton County has 1,085 outfalls identified in the current database. A minimum of 20% of these outfalls will be screened each calendar year. Screening is performed throughout the year during dry periods as previously defined.

Screening will be coordinated with the County's Code Enforcement division should legal action as necessary to resolve any problems.

If field screening indicates illicit discharge

- A flow sample is collected for analytical monitoring performed through laboratory analysis.

- The sample is sent to the laboratory analysis for fecal coliform and other pollutants.
- The storm sewer system is then evaluated to determine the potential source. Fulton County staff will walk the storm sewer line to attempt to locate the source, or in some cases, the line is televised to determine the location(s) of the illicit connection, if necessary.

If laboratory analyses determine the presence of potential pollutants an investigation into the potential pollutant source will be performed.
Positive dry weather screenings or complaints precipitate a site visit by County staff to physically verify the potential illicit discharge. Following verification, the appropriate property owner is contacted and notified of the illicit discharge violation. At that time the owner of the property is directed to remedy the problem. A copy of the proposed remediation action by the owner, and a completion schedule is required within 30 days. If the problem which causes the violation is not resolved or completed within the required time period, the property owner is cited and prosecuted, if necessary.

All dry weather screening forms, any laboratory analyses and all documentation related to code enforcement actions will be provided in the Annual MS4 Report.

Source Tracking

Fulton County will immediately begin source tracking on all dry weather flows. The water quality contractor is required to remain on site until the County is notified a potential illicit discharge has been found and the County's Environmental Quality Specialist responsible for inspections and enforcement can arrive at the location of the potential illicit discharge. That County employee will immediately patrol the upstream area to see if a source of the potential illicit discharge can be identified.

If a discrete source can be identified the County will ensure the source of pollutants is eliminated. Steps the County can take include issuing citations based on the County's illicit discharge ordinance, requiring repairs to sanitary sewer systems or replacement of failed septic systems.

If a discrete source of the potential illicit discharge is not identified during the initial patrol

- an automated sampling unit may be deployed
- the immediate area may be scheduled for random patrol

If investigation indicates that the flow found by dry weather screening is groundwater Fulton County will follow the protocol outlined in Attachment D – IDDE Dry Weather Screening and Outfalls with Possible Groundwater Flow as provided in EPD's Phase I MS4 Medium and Large Storm Water Management Program Guidance, available at http://epd.georgia.gov/storm-water.

Appendix I - Illicit Discharge Detection and Elimination Plan

Source Elimination

Once the source of the illicit discharge has been identified Fulton County will take steps to ensure the flow is eliminated. The steps will include notifying the responsible party and/or property owner and setting a timetable for resolving the source of the illicit discharge in accordance with the table below.

Type of problem	**Procedure**	**Time Frame**
One time dump (First offence only)	Inform offender that discharge of pollutants is a violation of County ordinance, provide educational materials, log the incident for reporting and future reference.	Immediately upon discovery
Repetitive dumping	Provide a report and log describing actions taken to date to Code Enforcement, and a request that a citation be issued.	Immediately upon discovery
Illegal connections	Inform offender that discharge of pollutants is a violation of County ordinance, establish schedule to rectify the problem, cite the offender under County illicit discharge ordinance if the schedule is not adhered to.	Illegal connection must be rectified within 60 days of initial notification and establishment of schedule. After 60 days the County will initiate legal proceedings. The first step will be issuance of a notice to comply, with a deadline of 15 days to rectify the illegal connection. After 15 days Code Enforcement will be provided with a report and log describing actions taken to date, and a request that a citation be issued.

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWPEMO19329	PIPE END	CONCRETE
SWPEMO19330	PIPE END	CONCRETE
SWPEMO19331	PIPE END	CONCRETE
SWPEMO19332	PIPE END	CONCRETE
SWHWMO19347	HEADWALL	UNKNOWN
SWHWMO19371	HEADWALL	CONCRETE
SWHWMO19374	HEADWALL	CONCRETE
SWHWMO19377	HEADWALL	UNKNOWN
SWHWMO19383	HEADWALL	CONCRETE
SWHWMO19390	HEADWALL	OTHER
SWHWMO19394	HEADWALL	OTHER
SWHWMO19641	HEADWALL	CONCRETE
SWHWMO19650	HEADWALL	CONCRETE
SWHWMO19652	HEADWALL	CONCRETE
SWPEMO19654	PIPE END	OTHER
SWHWMO19658	HEADWALL	CONCRETE
SWHWMO19405	HEADWALL	UNKNOWN
SWHWMO19410	HEADWALL	OTHER
SWHWMO19411	HEADWALL	CONCRETE
SWPEMO19427	PIPE END	CONCRETE
SWPEMO19472	PIPE END	CONCRETE
SWHWMO19480	HEADWALL	CONCRETE
SWHWMO19482	HEADWALL	CONCRETE
SWPEMO19491	PIPE END	CONCRETE
SWHWMO19520	HEADWALL	CONCRETE
SWHWMO19545	HEADWALL	CONCRETE
SWHWMO19725	HEADWALL	CONCRETE
SWHWMO19734	HEADWALL	CONCRETE
SWHWMO19737	HEADWALL	CONCRETE
SWHWMO19739	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWMO19742	HEADWALL	CONCRETE
SWHWMO19744	HEADWALL	CONCRETE
SWHWMO19747	HEADWALL	CONCRETE
SWHWMO19751	HEADWALL	UNKNOWN
SWHWMO19755	HEADWALL	CONCRETE
SWPEMO19756	PIPE END	CONCRETE
SWDPUC93673	DITCH POINT	NA
SWDPUC93560	DITCH POINT	NA
SWDPUC93506	DITCH POINT	NA
SWHWUC30737	HEADWALL	UNKNOWN
SWHWUC30738	HEADWALL	UNKNOWN
SWHWUC31881	HEADWALL	CONCRETE
SWPEUC31896	PIPE END	CONCRETE
SWPEUC31899	PIPE END	METAL
SWHWUC31905	HEADWALL	UNKNOWN
SWHWUC31916	HEADWALL	CONCRETE
SWHWUC31926	HEADWALL	CONCRETE
SWFEUC31931	FLARED END SECTION	METAL
SWHWUC31838	HEADWALL	CONCRETE
SWHWUC31842	HEADWALL	CONCRETE
SWHWUC31843	HEADWALL	CONCRETE
SWHWUC31844	HEADWALL	CONCRETE
SWHWUC31849	HEADWALL	CONCRETE
SWHWUC31850	HEADWALL	CONCRETE
SWFEUC31867	FLARED END SECTION	CONCRETE
SWHWUC31742	HEADWALL	CONCRETE
SWHWUC31743	HEADWALL	CONCRETE
SWHWUC31744	HEADWALL	CONCRETE
SWHWUC31610	HEADWALL	CONCRETE
SWHWUC31533	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWUC31535	HEADWALL	CONCRETE
SWHWUC31544	HEADWALL	CONCRETE
SWHWUC31547	HEADWALL	CONCRETE
SWPEUC31558	PIPE END	CONCRETE
SWHWUC31570	HEADWALL	CONCRETE
SWHWUC31583	HEADWALL	CONCRETE
SWHWUC31585	HEADWALL	CONCRETE
SWHWUC31591	HEADWALL	CONCRETE
SWHWUC31512	HEADWALL	BRICK
SWHWUC31523	HEADWALL	CONCRETE
SWHWUC31408	HEADWALL	CONCRETE
SWHWUC31427	HEADWALL	CONCRETE
SWHWUC31456	HEADWALL	CONCRETE
SWHWUC31345	HEADWALL	CONCRETE
SWHWUC31372	HEADWALL	CONCRETE
SWHWUC31377	HEADWALL	CONCRETE
SWHWUC31382	HEADWALL	CONCRETE
SWHWUC31387	HEADWALL	CONCRETE
SWHWUC31390	HEADWALL	CONCRETE
SWHWUC31266	HEADWALL	CONCRETE
SWPEUC31203	PIPE END	CONCRETE
SWPEUC31204	PIPE END	METAL
SWHWUC31170	HEADWALL	CONCRETE
SWHWUC31172	HEADWALL	CONCRETE
SWHWUC31173	HEADWALL	CONCRETE
SWHWUC31182	HEADWALL	CONCRETE
SWHWUC31062	HEADWALL	CONCRETE
SWHWUC31068	HEADWALL	CONCRETE
SWHWUC30993	HEADWALL	CONCRETE
SWHWUC30995	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWUC31012	HEADWALL	UNKNOWN
SWHWUC31020	HEADWALL	CONCRETE
SWHWUC31041	HEADWALL	CONCRETE
SWPEUC31044	PIPE END	METAL
SWHWUC31047	HEADWALL	CONCRETE
SWHWUC31055	HEADWALL	CONCRETE
SWHWUC31058	HEADWALL	CONCRETE
SWHWUC30775	HEADWALL	OTHER
SWHWUC30783	HEADWALL	CONCRETE
SWHWUC30982	HEADWALL	CONCRETE
SWHWUC30987	HEADWALL	CONCRETE
SWHWUC30988	HEADWALL	CONCRETE
SWPEUC30888	PIPE END	CONCRETE
SWPEUC30890	PIPE END	CONCRETE
SWPEUC30746	PIPE END	CONCRETE
SWHWUC30755	HEADWALL	CONCRETE
SWHWUC30946	HEADWALL	CONCRETE
SWHWUC30854	HEADWALL	CONCRETE
SWPEUC30862	PIPE END	CONCRETE
SWHWUC30865	HEADWALL	OTHER
SWHWUC30938	HEADWALL	CONCRETE
SWHWUC30942	HEADWALL	CONCRETE
SWPESC32499	PIPE END	CONCRETE
SWPESC32485	PIPE END	CONCRETE
SWPESC32486	PIPE END	METAL
SWPESC32488	PIPE END	METAL
SWHWSC32358	HEADWALL	OTHER
SWHWSC32359	HEADWALL	OTHER
SWHWSC32360	HEADWALL	OTHER
SWHWSC32361	HEADWALL	OTHER

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWSC32317	HEADWALL	CONCRETE
SWHWSC32322	HEADWALL	CONCRETE
SWHWSC32327	HEADWALL	CONCRETE
SWHWSC32331	HEADWALL	CONCRETE
SWPESC32114	PIPE END	METAL
SWCBSC32018	CATCH BASIN	BRICK
SWCBSC32027	CATCH BASIN	CONCRETE
SWMHSC32193	JUNCTION BOX	BRICK
SWCBSC32134	CATCH BASIN	BRICK
SWHWSC32143	HEADWALL	CONCRETE
SWDPCC92690	DITCH POINT	NA
SWDPCC92609	DITCH POINT	NA
SWDPCC92588	DITCH POINT	NA
SWDPCC92601	DITCH POINT	NA
SWHWCC9247	HEADWALL	OTHER
SWHWCC9248	HEADWALL	OTHER
CCCC2516PE	PIPE END	OTHER
SWHWCC25275	HEADWALL	CONCRETE
CCCC8009HW	HEADWALL	OTHER
SWHWCC25270	HEADWALL	CONCRETE
SWHWCC25271	HEADWALL	CONCRETE
CCCC0547HW	HEADWALL	OTHER
SWHWCC25229	HEADWALL	CONCRETE
SWHWCC25230	HEADWALL	CONCRETE
SWHWCC24593	HEADWALL	CONCRETE
SWHWCC24594	HEADWALL	CONCRETE
SWHWCC24595	HEADWALL	CONCRETE
SWHWCC24625	HEADWALL	CONCRETE
SWHWCC24626	HEADWALL	CONCRETE
SWHWCC24478	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWCC24486	HEADWALL	CONCRETE
SWHWCC24314	HEADWALL	CONCRETE
SWXXCC24330	SPECIAL STRUCTURE	CONCRETE
SWHWCC24355	HEADWALL	CONCRETE
SWHWCC24259	HEADWALL	CONCRETE
SWXXCC24287	SPECIAL STRUCTURE	CONCRETE
SWHWCC24223	HEADWALL	CONCRETE
SWHWCC23970	HEADWALL	CONCRETE
SWHWCC23876	HEADWALL	CONCRETE
SWHWCC23933	HEADWALL	CONCRETE
SWHWCC23934	HEADWALL	CONCRETE
SWHWCC23848	HEADWALL	CONCRETE
SWHWCC23849	HEADWALL	CONCRETE
SWHWCC23850	HEADWALL	CONCRETE
SWHWCC23806	HEADWALL	CONCRETE
SWHWCC23681	HEADWALL	CONCRETE
SWHWCC23686	HEADWALL	CONCRETE
SWHWCC23631	HEADWALL	CONCRETE
SWHWCC23649	HEADWALL	CONCRETE
SWHWCC23544	HEADWALL	CONCRETE
SWHWCC23573	HEADWALL	CONCRETE
SWHWCC23582	HEADWALL	CONCRETE
SWHWCC23597	HEADWALL	CONCRETE
SWHWCC23598	HEADWALL	CONCRETE
SWHWCC23493	HEADWALL	CONCRETE
SWHWCC23498	HEADWALL	CONCRETE
SWHWCC23443	HEADWALL	CONCRETE
SWHWCC23450	HEADWALL	CONCRETE
SWHWCC23457	HEADWALL	CONCRETE
SWHWCC23472	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWCC23350	HEADWALL	CONCRETE
SWHWCC23374	HEADWALL	CONCRETE
SWHWCC23392	HEADWALL	CONCRETE
SWHWCC23270	HEADWALL	CONCRETE
SWHWCC23311	HEADWALL	CONCRETE
SWHWCC24655	HEADWALL	CONCRETE
SWHWCC24656	HEADWALL	CONCRETE
SWHWCC24672	HEADWALL	CONCRETE
SWHWCC24674	HEADWALL	CONCRETE
SWPECC25148	PIPE END	METAL
SWPECC25149	PIPE END	METAL
SWHWCC25152	HEADWALL	UNKNOWN
SWHWCC25194	HEADWALL	CONCRETE
SWHWCC25197	HEADWALL	CONCRETE
SWHWCC25248	HEADWALL	CONCRETE
SWHWCC24934	HEADWALL	CONCRETE
SWHWCC24946	HEADWALL	CONCRETE
CCCC0257PE	PIPE END	CONCRETE
SWHWCC24914	HEADWALL	CONCRETE
SWHWCC24923	HEADWALL	CONCRETE
SWHWCC24842	HEADWALL	CONCRETE
SWHWCC24866	HEADWALL	CONCRETE
SWHWCC24749	HEADWALL	CONCRETE
SWHWCC24750	HEADWALL	CONCRETE
SWHWCC24787	HEADWALL	CONCRETE
SWHWCC29916	HEADWALL	CONCRETE
SWHWCC24687	HEADWALL	CONCRETE
SWHWCC24712	HEADWALL	CONCRETE
SWDPCC92856	DITCH POINT	NA
SWDPCC92860	DITCH POINT	NA

Facility ID	Type	Material
SWPECC25051	PIPE END	CONCRETE
SWPECC25226	PIPE END	CONCRETE
SWDPCC92803	DITCH POINT	NA
SWHWCC9043	HEADWALL	CONCRETE
CCCC2652PE	PIPE END	METAL
CCCC2680HW	HEADWALL	CONCRETE
CCCC2690PE	PIPE END	CONCRETE
CCCC2911HW	HEADWALL	OTHER
CCCC3038HW	HEADWALL	OTHER
CCCC2558HW	HEADWALL	CONCRETE
CCCC2606PE	PIPE END	CONCRETE
CCCC2532HW	HEADWALL	CONCRETE
CCCC7008PE	PIPE END	METAL
SWHWCC29851	HEADWALL	CONCRETE
SWHWCC29858	HEADWALL	CONCRETE
SWHWCC29871	HEADWALL	CONCRETE
SWHWCC29873	HEADWALL	CONCRETE
SWHWCC29880	HEADWALL	CONCRETE
SWHWCC29982	HEADWALL	CONCRETE
SWHWCC29796	HEADWALL	CONCRETE
SWHWCC29806	HEADWALL	CONCRETE
SWHWCC29832	HEADWALL	CONCRETE
SWHWCC29718	HEADWALL	CONCRETE
SWHWCC9382	HEADWALL	CONCRETE
SWHWCC29675	HEADWALL	CONCRETE
SWHWCC29683	HEADWALL	UNKNOWN
SWHWCC29701	HEADWALL	CONCRETE
SWHWCC29628	HEADWALL	CONCRETE
SWHWCC29927	HEADWALL	CONCRETE
SWHWCC29933	HEADWALL	CONCRETE

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Facility ID	Type	Material
SWHWCC29941	HEADWALL	CONCRETE
SWHWCC33348	HEADWALL	CONCRETE
SWHWCC33347	HEADWALL	CONCRETE
SWHWCC33346	HEADWALL	CONCRETE
SWHWCC33345	HEADWALL	CONCRETE
SWDPCC93034	DITCH POINT	NA
SWDPCC93076	DITCH POINT	NA
SWDPCC92933	DITCH POINT	NA
SWDPCC92944	DITCH POINT	NA
SWDPCC92948	DITCH POINT	NA
SWPECC33289	PIPE END	UNKNOWN
SWFECC33179	FLARED END SECTION	CONCRETE
SWHWCC32199	HEADWALL	CONCRETE
SWHWCC32211	HEADWALL	CONCRETE
SWHWCC32217	HEADWALL	CONCRETE
SWHWCC32225	HEADWALL	CONCRETE
SWHWCC32238	HEADWALL	CONCRETE
SWHWCC32128	HEADWALL	CONCRETE
SWHWCC32177	HEADWALL	CONCRETE
SWPEDC30631	PIPE END	CONCRETE
SWHWCC30565	HEADWALL	CONCRETE
SWDPCC93398	DITCH POINT	NA
SWHWCC9368	HEADWALL	CONCRETE
SWHWCC9102	HEADWALL	OTHER
SWHWCC9123	HEADWALL	CONCRETE
CCCC8028HW	HEADWALL	CONCRETE
SWHWCC8990	HEADWALL	CONCRETE
SWHWCC8998	HEADWALL	CONCRETE
SWHWCC9001	HEADWALL	UNKNOWN
SWHWCC9287	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWCC9288	HEADWALL	CONCRETE
SWHWCC9289	HEADWALL	OTHER
SWPECC9305	PIPE END	CONCRETE
CCCC4854HW	HEADWALL	CONCRETE
CCCC4861HW	HEADWALL	CONCRETE
CCCC4866HW	HEADWALL	CONCRETE
CCCC4868HW	HEADWALL	CONCRETE
CCCC4876HW	HEADWALL	CONCRETE
CCCC4881HW	HEADWALL	CONCRETE
CCCC4971HW	HEADWALL	METAL
CCCC4984HW	HEADWALL	OTHER
CCCC4987HW	HEADWALL	OTHER
CCCC4990HW	HEADWALL	OTHER
CCCC5004PE	PIPE END	CONCRETE
CCCC4597HW	HEADWALL	OTHER
CCCC4600HW	HEADWALL	OTHER
CCCC4668PE	PIPE END	CONCRETE
CCCC4828HW	HEADWALL	OTHER
CCCC4836HW	HEADWALL	OTHER
CCCC4841PE	PIPE END	METAL
CCCC4210HW	HEADWALL	CONCRETE
CCCC4214HW	HEADWALL	CONCRETE
CCCC4509PE	PIPE END	CONCRETE
CCCC2478HW	HEADWALL	UNKNOWN
CCCC2486PE	PIPE END	METAL
CCCC2491HW	HEADWALL	CONCRETE
CCCC2496PE	PIPE END	METAL
CCCC2507HW	HEADWALL	OTHER
CCCC3133PE	PIPE END	METAL
CCCC2027PE	PIPE END	CONCRETE

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Facility ID	Type	Material
CCCC2031PE	PIPE END	CONCRETE
CCCC2050PE	PIPE END	UNKNOWN
CCCC2053PE	PIPE END	UNKNOWN
CCCC2060PE	PIPE END	CONCRETE
CCCC2063PE	PIPE END	CONCRETE
CCCC2068PE	PIPE END	UNKNOWN
CCCC2086HW	HEADWALL	OTHER
CCCC1333PE	PIPE END	UNKNOWN
CCCC2011PE	PIPE END	METAL
CCCC2014PE	PIPE END	UNKNOWN
CCCC2021PE	PIPE END	CONCRETE
CCCC0968HW	HEADWALL	CONCRETE
SWHWCC30431	HEADWALL	CONCRETE
SWVEDC30569	VE	UNKNOWN
SWPEDC30573	PIPE END	CONCRETE
SWHWDC21871	HEADWALL	CONCRETE
SWHWDC21875	HEADWALL	CONCRETE
SWHWDC21879	HEADWALL	CONCRETE
SWPEDC30564	PIPE END	METAL
SWPEDC30567	PIPE END	METAL
CCDC9610PE	PIPE END	CONCRETE
SWHWDC23109	HEADWALL	CONCRETE
SWHWDC27165	HEADWALL	CONCRETE
SWHWDC27176	HEADWALL	CONCRETE
SWHWDC27186	HEADWALL	CONCRETE
CCDC9629PE	PIPE END	CONCRETE
CCDC9611PE	PIPE END	CONCRETE
SWHWDC27125	HEADWALL	CONCRETE
SWHWDC27010	HEADWALL	CONCRETE
SWHWDC27021	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWDC27035	HEADWALL	CONCRETE
SWHWDC26721	HEADWALL	CONCRETE
SWHWDC25701	HEADWALL	CONCRETE
SWHWDC25702	HEADWALL	CONCRETE
SWHWDC26694	HEADWALL	CONCRETE
SWHWDC26695	HEADWALL	CONCRETE
SWHWDC26704	HEADWALL	CONCRETE
SWHWDC25568	HEADWALL	CONCRETE
SWHWDC25573	HEADWALL	CONCRETE
SWHWDC25576	HEADWALL	CONCRETE
SWHWDC25577	HEADWALL	CONCRETE
SWHWDC25582	HEADWALL	CONCRETE
SWHWDC25590	HEADWALL	CONCRETE
SWHWDC25597	HEADWALL	CONCRETE
SWHWDC25610	HEADWALL	CONCRETE
SWHWDC26613	HEADWALL	CONCRETE
SWHWDC26620	HEADWALL	CONCRETE
SWHWDC26621	HEADWALL	CONCRETE
SWHWDC26630	HEADWALL	CONCRETE
SWHWDC26644	HEADWALL	CONCRETE
SWHWDC26645	HEADWALL	CONCRETE
SWHWDC26551	HEADWALL	CONCRETE
SWHWDC26600	HEADWALL	CONCRETE
SWHWDC26501	HEADWALL	CONCRETE
SWHWDC26503	HEADWALL	CONCRETE
SWHWDC26506	HEADWALL	CONCRETE
SWHWDC26508	HEADWALL	CONCRETE
SWHWDC26514	HEADWALL	CONCRETE
SWPEDC26517	PIPE END	METAL
SWHWDC26320	HEADWALL	CONCRETE

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Facility ID	Type	Material
SWHWDC26330	HEADWALL	CONCRETE
SWHWDC26336	HEADWALL	CONCRETE
SWHWDC26337	HEADWALL	CONCRETE
SWHWDC26348	HEADWALL	CONCRETE
SWHWDC25888	HEADWALL	CONCRETE
SWHWDC25900	HEADWALL	CONCRETE
SWHWDC25903	HEADWALL	CONCRETE
SWHWDC25905	HEADWALL	CONCRETE
SWHWDC25911	HEADWALL	CONCRETE
SWHWDC26278	HEADWALL	CONCRETE
SWHWDC25844	HEADWALL	CONCRETE
SWHWDC25858	HEADWALL	CONCRETE
SWHWDC25778	HEADWALL	CONCRETE
SWHWDC25792	HEADWALL	CONCRETE
SWHWDC25806	HEADWALL	CONCRETE
SWPEDC26873	PIPE END	CONCRETE
SWHWDC26885	HEADWALL	CONCRETE
SWPEDC26890	PIPE END	METAL
SWHWDC26794	HEADWALL	CONCRETE
SWHWDC26837	HEADWALL	CONCRETE
SWHWDC26249	HEADWALL	CONCRETE
SWHWDC26773	HEADWALL	CONCRETE
SWHWDC26230	HEADWALL	CONCRETE
SWHWDC26118	HEADWALL	CONCRETE
SWHWDC26121	HEADWALL	CONCRETE
SWHWDC26143	HEADWALL	CONCRETE
SWHWDC26063	HEADWALL	CONCRETE
SWHWDC26073	HEADWALL	CONCRETE
SWHWDC26079	HEADWALL	CONCRETE
SWHWDC26010	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWDC25556	HEADWALL	CONCRETE
SWHWDC25560	HEADWALL	CONCRETE
SWHWDC26030	HEADWALL	CONCRETE
SWHWDC25962	HEADWALL	CONCRETE
SWHWDC25967	HEADWALL	CONCRETE
SWHWDC25969	HEADWALL	CONCRETE
SWHWDC25976	HEADWALL	CONCRETE
SWHWDC25977	HEADWALL	CONCRETE
SWHWDC25981	HEADWALL	CONCRETE
SWHWDC27249	HEADWALL	CONCRETE
SWHWDC26006	HEADWALL	CONCRETE
SWHWDC25916	HEADWALL	CONCRETE
SWHWDC25918	HEADWALL	UNKNOWN
SWHWDC25924	HEADWALL	CONCRETE
SWHWDC25926	HEADWALL	CONCRETE
SWHWDC25931	HEADWALL	CONCRETE
SWHWDC25940	HEADWALL	CONCRETE
SWHWWC23982	HEADWALL	CONCRETE
SWPEWC25263	PIPE END	CONCRETE
SWDPWC92365	DITCH POINT	NA
SWDPWC92395	DITCH POINT	NA
SWHWWC29373	HEADWALL	UNKNOWN
SWHWWC29193	HEADWALL	CONCRETE
SWHWWC29103	HEADWALL	CONCRETE
SWPEWC29113	PIPE END	CONCRETE
SWHWWC29132	HEADWALL	CONCRETE
SWHWWC29139	HEADWALL	CONCRETE
SWCBWC29157	CATCH BASIN	CONCRETE
SWPEWC29161	PIPE END	CONCRETE
SWHWWC29176	HEADWALL	OTHER

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Facility ID	Type	Material
SWHWWC29177	HEADWALL	OTHER
SWHWWC29185	HEADWALL	OTHER
SWHWWC29052	HEADWALL	CONCRETE
SWHWWC29057	HEADWALL	CONCRETE
SWHWWC29069	HEADWALL	OTHER
SWHWWC29025	HEADWALL	CONCRETE
SWPEWC29026	PIPE END	CONCRETE
SWPEWC29027	PIPE END	CONCRETE
SWCBWC28959	CATCH BASIN	BRICK
SWHWWC28848	HEADWALL	CONCRETE
SWPEWC28853	PIPE END	UNKNOWN
SWPEWC28857	PIPE END	UNKNOWN
SWHWWC28864	HEADWALL	CONCRETE
SWCBWC28894	CATCH BASIN	CONCRETE
SWHWWC28774	HEADWALL	CONCRETE
SWHWWC28838	HEADWALL	CONCRETE
SWPEWC28767	PIPE END	METAL
SWHWWC28768	HEADWALL	CONCRETE
SWHWWC28769	HEADWALL	CONCRETE
SWHWWC28650	HEADWALL	CONCRETE
SWPEWC28653	PIPE END	CONCRETE
SWPEWC28654	PIPE END	CONCRETE
SWHWWC28597	HEADWALL	CONCRETE
SWPEWC28435	PIPE END	CONCRETE
SWPEWC28380	PIPE END	CONCRETE
SWPEWC28381	PIPE END	CONCRETE
SWHWWC28294	HEADWALL	UNKNOWN
SWHWWC28303	HEADWALL	UNKNOWN
SWHWWC28291	HEADWALL	CONCRETE
SWHWWC28188	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWWC28219	HEADWALL	CONCRETE
SWHWWC28156	HEADWALL	CONCRETE
SWHWWC27932	HEADWALL	CONCRETE
SWHWWC27996	HEADWALL	CONCRETE
SWHWWC28014	HEADWALL	CONCRETE
CCDC9621HW	HEADWALL	CONCRETE
SWHWDC22199	HEADWALL	CONCRETE
SWHWDC22169	HEADWALL	CONCRETE
SWPEDC22666	PIPE END	METAL
CCDC9605PE	PIPE END	METAL
CCDC9606PE	PIPE END	CONCRETE
SWHWDC27639	HEADWALL	CONCRETE
SWHWDC27587	HEADWALL	CONCRETE
SWHWDC27594	HEADWALL	CONCRETE
SWHWDC27598	HEADWALL	CONCRETE
SWHWDC27602	HEADWALL	CONCRETE
SWPEDC27611	PIPE END	CONCRETE
SWPEDC27612	PIPE END	CONCRETE
SWHWDC27628	HEADWALL	CONCRETE
SWHWDC27629	HEADWALL	CONCRETE
SWHWDC27636	HEADWALL	CONCRETE
SWHWDC27513	HEADWALL	CONCRETE
SWHWDC27514	HEADWALL	CONCRETE
SWHWDC27528	HEADWALL	CONCRETE
SWHWDC27535	HEADWALL	CONCRETE
SWHWDC27568	HEADWALL	CONCRETE
SWHWDC27569	HEADWALL	CONCRETE
SWHWDC27570	HEADWALL	CONCRETE
SWHWDC27473	HEADWALL	CONCRETE
SWHWDC27478	HEADWALL	CONCRETE

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Facility ID	Type	Material
SWHWDC27488	HEADWALL	CONCRETE
SWHWDC27489	HEADWALL	CONCRETE
SWHWDC27501	HEADWALL	CONCRETE
SWHWDC27505	HEADWALL	CONCRETE
SWHWDC27329	HEADWALL	UNKNOWN
SWHWDC27440	HEADWALL	CONCRETE
SWHWDC27441	HEADWALL	CONCRETE
SWPEDC22668	PIPE END	CONCRETE
SWHWDC27317	HEADWALL	CONCRETE
SWHWDC21580	HEADWALL	CONCRETE
SWHWDC21581	HEADWALL	CONCRETE
SWHWDC21675	HEADWALL	OTHER
SWHWDC21699	HEADWALL	CONCRETE
SWHWDC21611	HEADWALL	CONCRETE
SWHWDC21656	HEADWALL	CONCRETE
SWHWDC22300	HEADWALL	CONCRETE
SWHWDC22306	HEADWALL	CONCRETE
SWHWDC22308	HEADWALL	CONCRETE
SWHWDC22315	HEADWALL	CONCRETE
SWHWDC22322	HEADWALL	CONCRETE
CCDC9651PE	PIPE END	CONCRETE
SWPEDC22359	PIPE END	CONCRETE
SWHWDC22230	HEADWALL	CONCRETE
SWHWDC22273	HEADWALL	CONCRETE
SWHWDC22111	HEADWALL	CONCRETE
SWHWDC22145	HEADWALL	CONCRETE
SWHWDC22085	HEADWALL	CONCRETE
SWHWDC22089	HEADWALL	CONCRETE
SWHWDC21985	HEADWALL	CONCRETE
SWFEDC21917	FLARED END SECTION	CONCRETE

Facility ID	Type	Material
SWHWDC21919	HEADWALL	CONCRETE
SWHWDC21924	HEADWALL	CONCRETE
SWHWDC21925	HEADWALL	CONCRETE
SWHWDC21931	HEADWALL	CONCRETE
SWHWDC21955	HEADWALL	CONCRETE
SWHWDC21970	HEADWALL	CONCRETE
SWHWDC21804	HEADWALL	CONCRETE
SWHWDC21807	HEADWALL	CONCRETE
SWHWTC21130	HEADWALL	CONCRETE
SWHWTC21133	HEADWALL	CONCRETE
SWHWTC21136	HEADWALL	CONCRETE
SWHWTC21139	HEADWALL	CONCRETE
SWHWDC21755	HEADWALL	CONCRETE
SWHWDC21775	HEADWALL	CONCRETE
SWHWTC22811	HEADWALL	CONCRETE
SWPETC23075	PIPE END	CONCRETE
SWHWTC23078	HEADWALL	CONCRETE
SWHWTC23081	HEADWALL	CONCRETE
SWHWTC23093	HEADWALL	CONCRETE
SWHWTC23095	HEADWALL	CONCRETE
SWHWTC23097	HEADWALL	CONCRETE
SWHWTC22808	HEADWALL	CONCRETE
SWPETC22997	PIPE END	CONCRETE
SWPETC23001	PIPE END	CONCRETE
SWPETC23003	PIPE END	CONCRETE
SWPETC23005	PIPE END	CONCRETE
SWPETC23009	PIPE END	CONCRETE
SWPETC23011	PIPE END	CONCRETE
SWPETC23020	PIPE END	CONCRETE
SWPETC23022	PIPE END	CONCRETE

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Facility ID	Type	Material
SWPETC23034	PIPE END	CONCRETE
SWPETC23036	PIPE END	CONCRETE
SWPETC23039	PIPE END	CONCRETE
SWPETC23044	PIPE END	CONCRETE
SWPETC23048	PIPE END	CONCRETE
SWPETC23049	PIPE END	CONCRETE
SWPETC23051	PIPE END	CONCRETE
SWPETC23053	PIPE END	CONCRETE
SWHWTC22937	HEADWALL	CONCRETE
SWHWTC22947	HEADWALL	CONCRETE
SWHWTC22952	HEADWALL	CONCRETE
SWHWTC22957	HEADWALL	CONCRETE
SWHWTC22962	HEADWALL	CONCRETE
SWHWTC22991	HEADWALL	CONCRETE
SWHWTC22884	HEADWALL	CONCRETE
SWHWTC22896	HEADWALL	CONCRETE
SWHWTC22897	HEADWALL	CONCRETE
SWHWTC22913	HEADWALL	CONCRETE
SWHWTC22914	HEADWALL	CONCRETE
SWHWTC22845	HEADWALL	CONCRETE
SWHWTC22854	HEADWALL	CONCRETE
SWPEPC21178	PIPE END	UNKNOWN
SWPEPC21179	PIPE END	CONCRETE
SWHWPC21183	HEADWALL	OTHER
SWPEPC21185	PIPE END	METAL
SWPEPC21190	PIPE END	CONCRETE
SWPEPC21192	PIPE END	CONCRETE
SWPEPC21194	PIPE END	METAL
SWHWPC21197	HEADWALL	BRICK
SWPEPC21199	PIPE END	CONCRETE

Facility ID	Type	Material
SWPEPC21061	PIPE END	CONCRETE
SWPEPC21065	PIPE END	CONCRETE
SWHWPC21067	HEADWALL	CONCRETE
SWPEPC21069	PIPE END	CONCRETE
SWHWPC21077	HEADWALL	BRICK
SWPEPC21079	PIPE END	CONCRETE
SWHWPC21082	HEADWALL	CONCRETE
SWHWPC21084	HEADWALL	BRICK
SWPEPC21089	PIPE END	UNKNOWN
SWFEPC21110	FLARED END SECTION	CONCRETE
SWHWPC21112	HEADWALL	CONCRETE
SWFEPC21116	FLARED END SECTION	CONCRETE
SWFEPC21117	FLARED END SECTION	CONCRETE
SWHWPC21119	HEADWALL	CONCRETE
SWHWPC21123	HEADWALL	BRICK
SWHWPC21126	HEADWALL	CONCRETE
SWHWPC21141	HEADWALL	CONCRETE
SWHWPC21144	HEADWALL	BRICK
SWHWPC21155	HEADWALL	BRICK
SWHWPC20994	HEADWALL	CONCRETE
SWHWPC21007	HEADWALL	CONCRETE
SWHWPC21021	HEADWALL	CONCRETE
SWHWPC21041	HEADWALL	OTHER
SWPEPC21043	PIPE END	CONCRETE
SWPEPC21045	PIPE END	CONCRETE
SWHWPC21048	HEADWALL	CONCRETE
SWPEPC21050	PIPE END	CONCRETE
SWPEPC21057	PIPE END	CONCRETE
SWPEPC21059	PIPE END	CONCRETE
SWHWPC20941	HEADWALL	CONCRETE

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Facility ID	Type	Material
SWHWPC20963	HEADWALL	CONCRETE
SWHWPC20978	HEADWALL	CONCRETE
SWPEPC20982	PIPE END	CONCRETE
SWHWPC20865	HEADWALL	CONCRETE
SWHWPC20915	HEADWALL	CONCRETE
SWHWPC20840	HEADWALL	CONCRETE
SWHWPC20726	HEADWALL	CONCRETE
SWHWPC20733	HEADWALL	CONCRETE
SWHWPC20737	HEADWALL	CONCRETE
SWHWPC20740	HEADWALL	CONCRETE
SWHWPC20762	HEADWALL	CONCRETE
SWHWPC20770	HEADWALL	CONCRETE
SWHWPC20661	HEADWALL	NA
SWHWPC20671	HEADWALL	CONCRETE
SWHWPC20686	HEADWALL	CONCRETE
SWHWPC20698	HEADWALL	CONCRETE
SWHWPC20702	HEADWALL	CONCRETE
SWHWPC20708	HEADWALL	CONCRETE
SWHWPC20710	HEADWALL	CONCRETE
SWHWPC20715	HEADWALL	CONCRETE
SWHWPC20720	HEADWALL	CONCRETE
SWHWPC20609	HEADWALL	CONCRETE
SWHWPC20610	HEADWALL	CONCRETE
SWHWPC20635	HEADWALL	CONCRETE
SWHWPC20637	HEADWALL	CONCRETE
SWHWPC20647	HEADWALL	CONCRETE
SWHWPC20534	HEADWALL	CONCRETE
SWHWPC20539	HEADWALL	CONCRETE
SWHWPC20580	HEADWALL	CONCRETE
SWHWPC20581	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWPC20471	HEADWALL	CONCRETE
SWPEPC20476	PIPE END	METAL
SWHWPC20479	HEADWALL	METAL
SWHWPC20518	HEADWALL	CONCRETE
SWHWPC20520	HEADWALL	CONCRETE
SWPEPC20343	PIPE END	METAL
SWPEPC20359	PIPE END	METAL
SWHWPC20402	HEADWALL	CONCRETE
SWHWPC20323	HEADWALL	CONCRETE
SWPEPC20337	PIPE END	METAL
SWHWBR25327	HEADWALL	CONCRETE
SWPEBR25257	PIPE END	CONCRETE
SWHWBR25260	HEADWALL	CONCRETE
SWHWBR25274	HEADWALL	CONCRETE
SWPEBR25277	PIPE END	CONCRETE
SWPEBR25278	PIPE END	CONCRETE
SWPEBR25286	PIPE END	CONCRETE
SWPEBR25301	PIPE END	CONCRETE
SWPEBR25304	PIPE END	CONCRETE
SWPEBR25318	PIPE END	CONCRETE
SWHWBR25195	HEADWALL	CONCRETE
SWHWBR25201	HEADWALL	CONCRETE
SWHWBR25204	HEADWALL	CONCRETE
SWHWBR25220	HEADWALL	CONCRETE
SWHWBR25223	HEADWALL	CONCRETE
SWHWBR25233	HEADWALL	CONCRETE
SWPEBR25249	PIPE END	CONCRETE
SWPEBR25251	PIPE END	CONCRETE
SWPEBR25254	PIPE END	CONCRETE
SWHWBR25079	HEADWALL	CONCRETE

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Facility ID	Type	Material
SWHWBR25170	HEADWALL	CONCRETE
SWHWBR25065	HEADWALL	BRICK
SWHWBR25067	HEADWALL	BRICK
SWPEBR25108	PIPE END	METAL
SWPEBR25111	PIPE END	METAL
SWPEBR25116	PIPE END	CONCRETE
SWPEBR25118	PIPE END	CONCRETE
SWPEBR25121	PIPE END	UNKNOWN
SWPEBR25122	PIPE END	CONCRETE
SWPEBR25129	PIPE END	CONCRETE
SWPEBR25131	PIPE END	CONCRETE
SWPEBR25139	PIPE END	UNKNOWN
SWPEBR25141	PIPE END	METAL
SWPEBR25143	PIPE END	CONCRETE
SWPEBR25146	PIPE END	UNKNOWN
SWPEBR25147	PIPE END	CONCRETE
SWPEBR25153	PIPE END	CONCRETE
SWPEBR25155	PIPE END	CONCRETE
SWHWBR25158	HEADWALL	CONCRETE
SWHWBR25017	HEADWALL	CONCRETE
SWHWBR25019	HEADWALL	CONCRETE
SWHWBR25029	HEADWALL	CONCRETE
SWHWBR25033	HEADWALL	CONCRETE
SWHWBR25045	HEADWALL	CONCRETE
SWFEWW20073	FLARED END SECTION	CONCRETE
SWHWWW20074	HEADWALL	OTHER
SWHWWW20015	HEADWALL	CONCRETE
SWHWWW20023	HEADWALL	CONCRETE
SWHWWW20043	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWWW20047	HEADWALL	CONCRETE
SWFEWW20065	FLARED END SECTION	CONCRETE
SWHWWW20069	HEADWALL	CONCRETE
SWHWWW19966	HEADWALL	CONCRETE
SWHWWW19967	HEADWALL	CONCRETE
SWHWWW19971	HEADWALL	CONCRETE
SWHWWW19977	HEADWALL	CONCRETE
SWHWWW19980	HEADWALL	CONCRETE
SWPEMO15217	PIPE END	METAL
SWPEMO15216	PIPE END	CONCRETE
SWPELC19910	PIPE END	CONCRETE
SWPELC19912	PIPE END	CONCRETE
SWPELC19913	PIPE END	CONCRETE
SWPELC19917	PIPE END	CONCRETE
SWPELC19919	PIPE END	CONCRETE
SWPELC19926	PIPE END	CONCRETE
SWPELC19930	PIPE END	CONCRETE
SWDPMO90146	DITCH POINT	NA
SWDPMO90159	DITCH POINT	NA
SWHWMO15564	HEADWALL	CONCRETE
SWHWMO15578	HEADWALL	CONCRETE
SWHWMO15581	HEADWALL	CONCRETE
SWHWMO15499	HEADWALL	CONCRETE
SWHWMO15502	HEADWALL	CONCRETE
SWHWMO15504	HEADWALL	CONCRETE
SWHWMO15512	HEADWALL	BRICK
SWPEMO15533	PIPE END	CONCRETE
SWHWMO15545	HEADWALL	CONCRETE
SWHWMO15548	HEADWALL	CONCRETE
SWHWMO15447	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWMO15468	HEADWALL	CONCRETE
SWHWMO15471	HEADWALL	CONCRETE
SWHWMO15376	HEADWALL	CONCRETE
SWPEMO15388	PIPE END	CONCRETE
SWPEMO15400	PIPE END	CONCRETE
SWPEMO15408	PIPE END	METAL
SWHWMO15311	HEADWALL	CONCRETE
SWPEMO15316	PIPE END	METAL
SWHWMO15332	HEADWALL	CONCRETE
SWHWMO15335	HEADWALL	CONCRETE
SWPEMO15341	PIPE END	CONCRETE
SWHWMO15342	HEADWALL	CONCRETE
SWHWMO15344	HEADWALL	CONCRETE
SWHWMO15350	HEADWALL	CONCRETE
SWPEMO15235	PIPE END	METAL
SWHWMO15241	HEADWALL	CONCRETE
SWHWMO15247	HEADWALL	CONCRETE
SWPEMO15259	PIPE END	CONCRETE
SWPEMO15274	PIPE END	CONCRETE
SWPEMO15276	PIPE END	METAL
SWHWMO15283	HEADWALL	CONCRETE
SWHWMO15161	HEADWALL	CONCRETE
SWPEMO15176	PIPE END	CONCRETE
SWHWMO15185	HEADWALL	CONCRETE
SWHWMO15209	HEADWALL	CONCRETE
SWHWMO15210	HEADWALL	CONCRETE
SWHWMO15213	HEADWALL	CONCRETE
SWHWMO15223	HEADWALL	CONCRETE
SWHWMO15136	HEADWALL	CONCRETE
SWHWMO15144	HEADWALL	CONCRETE

Facility ID	Type	Material
SWHWMO15149	HEADWALL	CONCRETE
SWHWMO15600	HEADWALL	UNKNOWN
SWHWMO15588	HEADWALL	CONCRETE
SWHWMO15048	HEADWALL	CONCRETE
SWHWMO15052	HEADWALL	CONCRETE
SWHWMO15059	HEADWALL	CONCRETE
SWHWMO15071	HEADWALL	CONCRETE
SWFEMO15076	FLARED END SECTION	METAL
SWHWMO15083	HEADWALL	CONCRETE
SWPEMO10503	PIPE END	CONCRETE
SWPEMO10779	PIPE END	METAL
SWHWMO10813	HEADWALL	OTHER
SWHWMO10814	HEADWALL	OTHER
SWHWMO10822	HEADWALL	CONCRETE
SWHWMO10823	HEADWALL	CONCRETE
SWHWMO10826	HEADWALL	CONCRETE
SWHWMO10834	HEADWALL	CONCRETE
SWHWMO10835	HEADWALL	CONCRETE
SWHWMO10838	HEADWALL	CONCRETE
SWHWMO10841	HEADWALL	CONCRETE
SWPEMO10751	PIPE END	CONCRETE
SWDPMO90003	DITCH POINT	NA
SWHWMO10647	HEADWALL	CONCRETE
SWPEMO15607	PIPE END	CONCRETE
SWHWMO10655	HEADWALL	OTHER
SWHWMO10661	HEADWALL	OTHER
SWHWMO10663	HEADWALL	OTHER
SWHWMO10671	HEADWALL	OTHER
SWHWMO10676	HEADWALL	OTHER
SWHWMO10607	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWMO10617	HEADWALL	CONCRETE
SWHWMO10629	HEADWALL	CONCRETE
SWHWMO10447	HEADWALL	CONCRETE
SWHWMO10320	HEADWALL	CONCRETE
SWHWMO10360	HEADWALL	CONCRETE
SWHWMO10362	HEADWALL	CONCRETE
SWHWMO10068	HEADWALL	CONCRETE
SWHWMO10132	HEADWALL	CONCRETE
SWHWMO10201	HEADWALL	CONCRETE
SWHWCT16550	HEADWALL	CONCRETE
SWHWCT16551	HEADWALL	CONCRETE
SWHWCT16461	HEADWALL	CONCRETE
SWHWCT16513	HEADWALL	CONCRETE
SWHWCT16424	HEADWALL	CONCRETE
SWHWCT16426	HEADWALL	CONCRETE
SWHWCT16429	HEADWALL	CONCRETE
SWHWCT16433	HEADWALL	CONCRETE
SWHWCT16435	HEADWALL	CONCRETE
SWHWCT16438	HEADWALL	CONCRETE
SWHWCT16441	HEADWALL	CONCRETE
SWHWCT16333	HEADWALL	CONCRETE
SWHWCT16349	HEADWALL	CONCRETE
SWHWCT16374	HEADWALL	CONCRETE
SWHWCT16380	HEADWALL	CONCRETE
SWHWCT16381	HEADWALL	CONCRETE
SWHWCT16385	HEADWALL	CONCRETE
SWPECT16220	PIPE END	CONCRETE
SWHWCT16118	HEADWALL	CONCRETE
SWHWCT16120	HEADWALL	CONCRETE
SWHWCT16190	HEADWALL	UNKNOWN

Facility ID	Type	Material
SWHWCT16193	HEADWALL	UNKNOWN
SWHWCT16035	HEADWALL	CONCRETE
SWPECT16093	PIPE END	UNKNOWN
SWHWCT11338	HEADWALL	OTHER
SWHWCT11345	HEADWALL	BRICK
SWHWCT11346	HEADWALL	BRICK
SWHWCT11349	HEADWALL	OTHER
SWHWCT16005	HEADWALL	CONCRETE
SWHWCT16016	HEADWALL	CONCRETE
SWHWCT16031	HEADWALL	CONCRETE
SWHWCT16034	HEADWALL	CONCRETE
SWHWCT11266	HEADWALL	OTHER
SWHWCT11289	HEADWALL	CONCRETE
SWHWCT11294	HEADWALL	CONCRETE
SWHWCT11295	HEADWALL	BRICK
SWHWCT11296	HEADWALL	BRICK
SWPECT11297	PIPE END	METAL
SWHWCT11304	HEADWALL	UNKNOWN
SWHWCT11226	HEADWALL	CONCRETE
SWHWCT11236	HEADWALL	CONCRETE
SWHWCT11237	HEADWALL	CONCRETE
SWHWCT16124	HEADWALL	CONCRETE
SWHWCT16130	HEADWALL	CONCRETE
SWHWCT16133	HEADWALL	UNKNOWN
SWHWCT16146	HEADWALL	CONCRETE
SWHWCT16152	HEADWALL	CONCRETE
SWHWCT16516	HEADWALL	CONCRETE
SWHWCT11155	HEADWALL	UNKNOWN
SWPECT11172	PIPE END	METAL
SWHWCT11190	HEADWALL	BRICK

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWCT11210	HEADWALL	CONCRETE
SWPECT11215	PIPE END	METAL
SWHWCT11044	HEADWALL	CONCRETE
SWHWCT11046	HEADWALL	CONCRETE
SWHWCT11063	HEADWALL	CONCRETE
SWHWCT11074	HEADWALL	CONCRETE
SWHWCT11076	HEADWALL	CONCRETE
SWPECT11116	PIPE END	METAL
SWPECT11118	PIPE END	METAL
SWPECT11120	PIPE END	METAL
SWHWCT11122	HEADWALL	CONCRETE
SWHWCT11123	HEADWALL	CONCRETE
SWPECT11124	PIPE END	METAL
SWPECT11125	PIPE END	METAL
SWHWCT11133	HEADWALL	OTHER
SWHWCT11134	HEADWALL	OTHER
SWHWMO12586	HEADWALL	CONCRETE
SWHWMO12597	HEADWALL	CONCRETE
SWWIMO12602	WI	CONCRETE
SWHWMO12482	HEADWALL	CONCRETE
SWHWMO12418	HEADWALL	CONCRETE
SWHWMO12394	HEADWALL	CONCRETE
SWHWMO12335	HEADWALL	CONCRETE
SWHWMO12228	HEADWALL	CONCRETE
SWHWMO12088	HEADWALL	CONCRETE
SWHWMO12070	HEADWALL	CONCRETE
SWHWMO17535	HEADWALL	UNKNOWN
SWHWMO17538	HEADWALL	UNKNOWN
SWHWMO17539	HEADWALL	UNKNOWN
SWPEMO17549	PIPE END	METAL

Facility ID	Type	Material
SWHWMO17552	HEADWALL	CONCRETE
SWVEMO17561	VE	UNKNOWN
SWFEMO17566	FLARED END SECTION	CONCRETE
SWVEMO17571	VE	UNKNOWN
SWPEMO17575	PIPE END	CONCRETE
SWPEMO17576	PIPE END	CONCRETE
SWPEMO17581	PIPE END	CONCRETE
SWHWMO17509	HEADWALL	CONCRETE
SWHWMO17510	HEADWALL	CONCRETE
SWHWMO17511	HEADWALL	CONCRETE
SWHWMO17355	HEADWALL	CONCRETE
SWHWMO17374	HEADWALL	CONCRETE
SWHWMO17202	HEADWALL	CONCRETE
SWHWMO17209	HEADWALL	CONCRETE
SWHWMO17225	HEADWALL	CONCRETE
SWHWMO17125	HEADWALL	CONCRETE
SWHWMO17148	HEADWALL	CONCRETE
SWHWMO12987	HEADWALL	CONCRETE
SWHWMO17106	HEADWALL	CONCRETE
SWHWMO17113	HEADWALL	CONCRETE
SWHWMO17122	HEADWALL	CONCRETE
SWHWMO17045	HEADWALL	CONCRETE
SWHWMO17291	HEADWALL	CONCRETE
SWHWMO17293	HEADWALL	CONCRETE
SWHWMO17518	HEADWALL	CONCRETE
SWHWMO17313	HEADWALL	CONCRETE
SWHWMO17006	HEADWALL	CONCRETE
SWHWMO17007	HEADWALL	CONCRETE
SWHWMO12965	HEADWALL	CONCRETE
SWHWMO12970	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWMO12976	HEADWALL	CONCRETE
SWHWMO12981	HEADWALL	CONCRETE
SWHWMO12990	HEADWALL	CONCRETE
SWHWMO12996	HEADWALL	CONCRETE
SWPEMO18113	PIPE END	CONCRETE
SWHWMO18129	HEADWALL	CONCRETE
SWHWMO12870	HEADWALL	CONCRETE
SWHWMO12875	HEADWALL	CONCRETE
SWHWMO13050	HEADWALL	OTHER
SWHWMO13056	HEADWALL	CONCRETE
SWHWMO13060	HEADWALL	CONCRETE
SWHWMO13068	HEADWALL	OTHER
SWHWMO12836	HEADWALL	CONCRETE
SWHWMO12839	HEADWALL	CONCRETE
SWHWMO12842	HEADWALL	CONCRETE
SWHWMO12863	HEADWALL	CONCRETE
SWHWMO12812	HEADWALL	CONCRETE
SWHWMO12829	HEADWALL	CONCRETE
SWPEMO13004	PIPE END	OTHER
SWHWMO13005	HEADWALL	OTHER
SWHWMO13008	HEADWALL	CONCRETE
SWHWMO13009	HEADWALL	CONCRETE
SWHWMO13033	HEADWALL	CONCRETE
SWHWMO13034	HEADWALL	CONCRETE
SWHWMO13037	HEADWALL	UNKNOWN
SWFEMO13039	FLARED END SECTION	CONCRETE
SWHWMO13041	HEADWALL	CONCRETE
SWHWMO12905	HEADWALL	CONCRETE
SWHWMO12911	HEADWALL	CONCRETE
SWPEMO12928	PIPE END	CONCRETE

Facility ID	Type	Material
SWHWMO12930	HEADWALL	CONCRETE
SWHWMO12934	HEADWALL	CONCRETE
SWPEMO12939	PIPE END	CONCRETE
SWHWMO12941	HEADWALL	CONCRETE
SWHWMO12943	HEADWALL	CONCRETE
SWHWMO12947	HEADWALL	CONCRETE
SWHWMO13096	HEADWALL	UNKNOWN
SWPEMO13121	PIPE END	METAL
SWHWMO13122	HEADWALL	CONCRETE
SWHWMO13123	HEADWALL	CONCRETE
SWPEMO13127	PIPE END	CONCRETE
SWHWMO18007	HEADWALL	CONCRETE
SWHWMO17923	HEADWALL	CONCRETE
SWHWMO17956	HEADWALL	CONCRETE
SWHWMO17957	HEADWALL	CONCRETE
SWHWMO17903	HEADWALL	CONCRETE
SWHWMO17908	HEADWALL	CONCRETE
SWHWMO17910	HEADWALL	CONCRETE
SWPEMO18204	PIPE END	CONCRETE
SWPEMO17824	PIPE END	METAL
SWHWMO18191	HEADWALL	CONCRETE
SWPEMO18199	PIPE END	CONCRETE
SWHWMO18212	HEADWALL	OTHER
SWHWMO18214	HEADWALL	OTHER
SWHWMO18226	HEADWALL	OTHER
SWHWMO18227	HEADWALL	OTHER
SWHWMO14066	HEADWALL	CONCRETE
SWHWMO14064	HEADWALL	CONCRETE
SWHWMO14062	HEADWALL	UNKNOWN
SWPEMO18205	PIPE END	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWMO18209	HEADWALL	CONCRETE
SWHWMO14037	HEADWALL	UNKNOWN
SWHWMO14048	HEADWALL	CONCRETE
SWHWMO14058	HEADWALL	CONCRETE
SWHWMO13968	HEADWALL	OTHER
SWHWMO13971	HEADWALL	OTHER
SWHWMO13974	HEADWALL	OTHER
SWHWMO13977	HEADWALL	OTHER
SWHWMO13993	HEADWALL	CONCRETE
SWHWMO13996	HEADWALL	CONCRETE
SWHWMO14009	HEADWALL	CONCRETE
SWHWMO14017	HEADWALL	CONCRETE
SWHWMO14020	HEADWALL	CONCRETE
SWHWMO14028	HEADWALL	CONCRETE
SWHWMO14032	HEADWALL	UNKNOWN
SWPEMO13935	PIPE END	METAL
SWHWMO13939	HEADWALL	OTHER
SWHWMO13948	HEADWALL	CONCRETE
SWHWMO13849	HEADWALL	CONCRETE
SWHWMO13870	HEADWALL	CONCRETE
SWHWMO13881	HEADWALL	CONCRETE
SWHWMO13888	HEADWALL	CONCRETE
SWHWMO13889	HEADWALL	CONCRETE
SWHWMO13891	HEADWALL	CONCRETE
SWHWMO13892	HEADWALL	CONCRETE
SWPEMO13799	PIPE END	OTHER
SWPEMO13803	PIPE END	OTHER
SWPEMO13810	PIPE END	OTHER
SWPEMO13716	PIPE END	CONCRETE
SWPEMO13724	PIPE END	METAL

Facility ID	Type	Material
SWHWMO13725	HEADWALL	CONCRETE
SWPEMO13731	PIPE END	CONCRETE
SWPEMO13732	PIPE END	CONCRETE
SWHWMO13737	HEADWALL	CONCRETE
SWHWMO13740	HEADWALL	CONCRETE
SWHWMO18961	HEADWALL	UNKNOWN
SWHWMO18965	HEADWALL	CONCRETE
SWHWMO18976	HEADWALL	CONCRETE
SWHWMO18979	HEADWALL	UNKNOWN
SWHWMO18987	HEADWALL	CONCRETE
SWHWMO18992	HEADWALL	CONCRETE
SWHWMO18998	HEADWALL	CONCRETE
SWHWMO19000	HEADWALL	CONCRETE
SWHWMO18893	HEADWALL	CONCRETE
SWHWMO18926	HEADWALL	CONCRETE
SWHWMO18932	HEADWALL	CONCRETE
SWHWMO18937	HEADWALL	CONCRETE
SWHWMO18942	HEADWALL	CONCRETE
SWHWMO18944	HEADWALL	CONCRETE
SWHWMO18946	HEADWALL	CONCRETE
SWHWMO18826	HEADWALL	CONCRETE
SWHWMO18828	HEADWALL	CONCRETE
SWHWMO18831	HEADWALL	CONCRETE
SWHWMO18841	HEADWALL	CONCRETE
SWPEMO18846	PIPE END	METAL
SWHWMO18865	HEADWALL	CONCRETE
SWHWMO18869	HEADWALL	CONCRETE
SWHWMO18873	HEADWALL	CONCRETE
SWHWMO18880	HEADWALL	CONCRETE
SWHWMO18884	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWHWMO18677	HEADWALL	CONCRETE
SWHWMO18683	HEADWALL	CONCRETE
SWHWMO18689	HEADWALL	CONCRETE
SWHWMO18788	HEADWALL	CONCRETE
SWHWMO18790	HEADWALL	CONCRETE
SWHWMO18793	HEADWALL	CONCRETE
SWHWMO18796	HEADWALL	UNKNOWN
SWHWMO18803	HEADWALL	CONCRETE
SWHWMO18811	HEADWALL	CONCRETE
SWHWMO18821	HEADWALL	CONCRETE
SWHWMO18823	HEADWALL	CONCRETE
SWHWMO18718	HEADWALL	CONCRETE
SWHWMO18727	HEADWALL	CONCRETE
SWHWMO18743	HEADWALL	CONCRETE
SWHWMO18747	HEADWALL	CONCRETE
SWHWMO18749	HEADWALL	CONCRETE
SWHWMO18762	HEADWALL	OTHER
SWHWMO18766	HEADWALL	OTHER
SWHWMO18661	HEADWALL	CONCRETE
SWHWMO18647	HEADWALL	UNKNOWN
SWHWMO18692	HEADWALL	CONCRETE
SWHWMO18696	HEADWALL	CONCRETE
SWHWMO18702	HEADWALL	CONCRETE
SWPEMO18772	PIPE END	METAL
SWHWMO18776	HEADWALL	UNKNOWN
SWHWMO18778	HEADWALL	CONCRETE
SWHWMO14790	HEADWALL	CONCRETE
SWHWMO14793	HEADWALL	CONCRETE
SWHWMO19310	HEADWALL	CONCRETE
SWHWMO19683	HEADWALL	CONCRETE

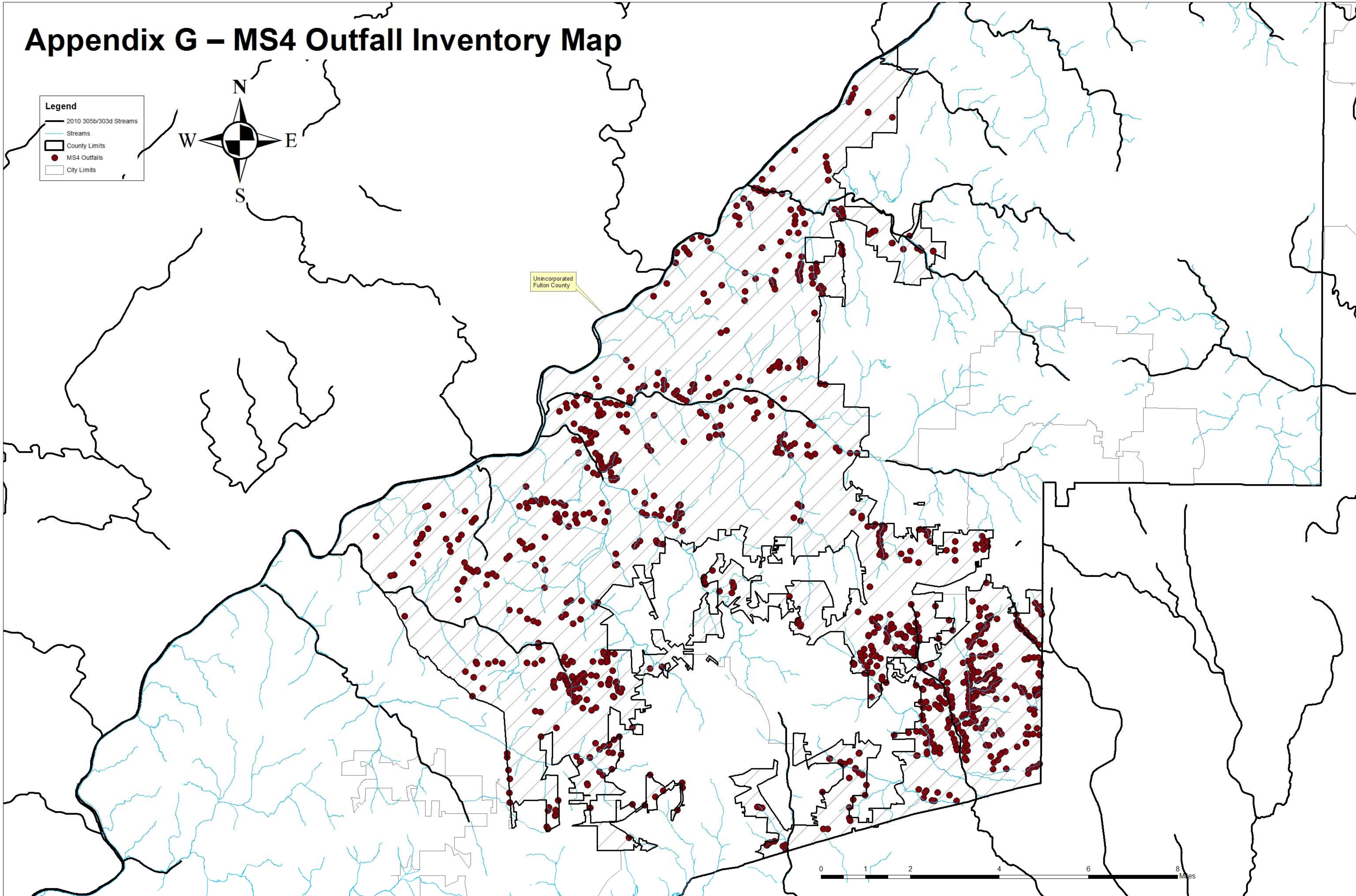
Facility ID	Type	Material
SWHWMO19717	HEADWALL	OTHER
SWHWMO19721	HEADWALL	CONCRETE
SWHWMO14445	HEADWALL	CONCRETE
SWHWMO14452	HEADWALL	CONCRETE
SWHWMO14744	HEADWALL	OTHER
SWHWMO14670	HEADWALL	CONCRETE
SWPEMO14675	PIPE END	CONCRETE
SWPEMO14707	PIPE END	CONCRETE
SWHWMO14715	HEADWALL	CONCRETE
SWPEMO14720	PIPE END	METAL
SWPEMO14721	PIPE END	METAL
SWPEMO14604	PIPE END	METAL
SWPEMO14605	PIPE END	METAL
SWHWMO14626	HEADWALL	OTHER
SWHWMO14648	HEADWALL	CONCRETE
SWHWMO14652	HEADWALL	CONCRETE
SWHWMO14653	HEADWALL	CONCRETE
SWHWMO14656	HEADWALL	CONCRETE
SWPEMO14551	PIPE END	METAL
SWPEMO14552	PIPE END	METAL
SWPEMO14553	PIPE END	METAL
SWHWMO14496	HEADWALL	CONCRETE
SWHWMO14497	HEADWALL	CONCRETE
SWPEMO14501	PIPE END	CONCRETE
SWHWMO14427	HEADWALL	CONCRETE
SWHWMO14428	HEADWALL	CONCRETE
SWPEMO14467	PIPE END	CONCRETE
SWPEMO14469	PIPE END	CONCRETE
SWHWMO14336	HEADWALL	CONCRETE
SWHWMO14342	HEADWALL	CONCRETE

Appendix H – MS4 Outfall Inventory

Facility ID	Type	Material
SWPEMO14345	PIPE END	METAL
SWHWMO14366	HEADWALL	OTHER
SWHWMO14372	HEADWALL	CONCRETE
SWPEMO14378	PIPE END	METAL
SWHWMO14379	HEADWALL	CONCRETE

Total: 1,085 MS4 outfalls

Appendix G – MS4 Outfall Inventory Map



Appendix F – Fulton County Ordinances

Fulton County Comprehensive Storm Water Ordinance

ARTICLE IV. STORMWATER MANAGEMENT

DIVISION 1. GENERALLY

Sec. 26-111. Short title of article.
The provisions of this article shall constitute and be known as the "Stormwater Management Ordinance of Fulton County, Georgia."
(95-0093, art. I, § A(1), 3-15-95)

Sec. 26-112. Definitions.
For the purposes of this article, unless specifically defined below, words or phrases shall be interpreted so as to give them the meaning they have in common usage and to give this article its most effective application. Words in the singular shall include the plural, and words in the plural shall include the singular. Words used in the present tense shall include the future tense. The word "shall" connotes mandatory and not discretionary; the words "should" or "may" are permissive. Unless otherwise specified, or apparent from the context, definitions herein will be the same as those in other Fulton County codes. For the purpose of this article, the following terms, phrases, and words, and their derivatives, shall have the meaning given herein:
Accidental discharge means a discharge of any substance that is nonstormwater related, shall be prohibited by this article into the separate storm sewer that occurs by chance and without planning or consideration prior to occurrence.
Agricultural practices means practices involving the establishment, cultivation, or harvesting of products of the field or orchard; the preparation and planting of pasture land and farm ponds; and the construction of farm buildings, or other related activities per section 5.1 of the Zoning Resolution.
As-built plan or record drawing means a set of engineering or site drawings that delineate the specific permitted stormwater management facility as actually constructed.
Best management practices (BMPs) means a wide range of management procedures and structures, activities, prohibitions or practices that have been demonstrated to effectively control the quality and/or quantity of stormwater runoff and which are compatible with the planned land use.
Board means the Fulton County Board of Commissioners.
Clean Water Act means the Federal Water Pollution Control Act, as amended (32 USC 1251 et seq.).
Cooling water means water used exclusively as cooling medium in an appliance, device, or apparatus.
County means unincorporated Fulton County, Georgia.
County commissioner means an elected official of the Fulton County Board of Commissioners.

County/separate storm sewer system means a conveyance or system of conveyances (including roads with drainage systems, highways, rights-of-way, county streets, catch basins, curbs, gutters, ditches, manmade channels, pipes, culverts, storm drains, detention ponds, other stormwater facilities) which are:

(1) Owned or maintained by Fulton County;
(2) Designed or used for collecting or conveying stormwater;
(3) Not a combined sewer; and
(4) Not a part of publicly owned treatment works (POTW).

Design report means the report that accompanies the stormwater management plan and includes data used for engineering analysis, results of all analysis, design and analysis calculations (including results obtained from computer programs), and other engineering data that would assist the county in evaluating proposed stormwater management facilities.

Detention structure and/or pond means a permanent stormwater management structure whose primary purpose is to temporarily store stormwater runoff and release the stored runoff at controlled rates.

Director of the department of public works or director means the duly designated department head of the public works department or his/her designee.

Discharge means the release of treated or untreated water, fluid or other substance to the county separate storm sewer system.

Erosion and sedimentation control ordinance means the ordinance adopted by the county that controls, reduces, or eliminates soil erosion and its transportation to the county's lakes, rivers, and streams, latest revision.

Existing land use conditions means the ground surface in its original state before grading, excavating, or filling.

Flood means a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) The overflow of inland waters; or
(2) The unusual and rapid accumulation or runoff of surface waters from any source.

Grading means excavating, filling (including hydraulic fill), or stockpiling of earth material, or any combination thereof, including the land in its excavated or filled condition.

Hardship. The director of public works may grant a hardship to an applicant if, upon application, the director of public works determines that the construction of the proposed improvements will create a safety, traffic, or drainage hazard, are impractical to construct, have an impact to adjacent property owners, or has impact to downstream water quality or quantity.

Illicit connection means any connection to the county's separate stormwater conveyance system (pipe, culvert, road, ditch, channel, draw or watercourse) that is not composed entirely of stormwater runoff or a connection that does not conform to an approved stormwater management plan from the county, other than the NPDES permit for discharging from the county separate storm system.

Issuing department means that department in Fulton County that has been designated as the department with the authority over the issuance, inspection, enforcement, and acceptance of permits for the sole purpose of developing or improving land, or building or constructing structures, utilities, public improvements (including stormwater management facilities), or other facilities located within Fulton County.

Land disturbance permit means a permit issued by the county which must be obtained prior to the beginning of any land disturbing activity.

Land disturbing activity means any use of the land by any person that results in a change in the natural cover or topography that may cause erosion and contribute to sediment and alter the quality and/or quantity of stormwater runoff.

Maintenance means any action necessary to preserve stormwater management facilities in proper working condition, in order to serve the intended purposes set forth in this article or prevent structural failure of such facilities. Maintenance shall not include actions taken solely for the purpose of enhancing the aesthetic aspects associated with stormwater management facilities and BMPs.

National Pollutant Discharge Elimination System (NPDES) permit. The U.S. Environmental Protection Agency (EPA) has issued regulations that require certain jurisdictions to obtain permits to discharge stormwater into waterbodies of the U.S. This report identifies aspects of these (NPDES) permit application regulations for stormwater discharges.

Nonerodible means a material, e.g., natural rock, riprap, concrete, plastic, etc., that will not experience surface wear due to natural forces of wind, water, ice, gravity, or a combination of those forces except over a long period of time.

Nonpoint source pollution means pollution contained in stormwater runoff from ill-defined, diffuse sources.

Permittee means the applicant who has applied for and/or been granted a permit for disturbance of the land by the governing agency.

Person means any and all persons, natural or artificial, and includes any individual, firm, corporation, government agency, business trust, estate trust, partnership, association, two or more persons having a joint or common interest or any other legal entity.

Person responsible for the land disturbing activity means:

(1) The person who has or represents having financial or operational control over the land disturbing activity; and/or

(2) The landowner or person in possession or control of the land who directly or indirectly allowed the land disturbing activity or has benefited from it or who has failed to comply with any provision of this article.

Pollution means the contamination or other alteration of any water's physical, chemical, or biological properties, including changes in the temperature, taste, color, turbidity, or odor of such waters or the discharge of any liquid, gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.

Private means property or facilities owned by individuals, corporations, and other organizations and not by Fulton County government or other governing entity.

Procedure means a procedure adopted by the utility, by and through the director, to implement a regulation or regulations adopted under this article, or to carry out other responsibilities as may be required by this article or other codes, ordinances, or resolutions of Fulton County.

Project means the entire proposed development regardless of the size of the area of land to be disturbed.

Public works department means the department within Fulton County responsible for all stormwater management activities and implementation of the provisions of this article.

Responsible personnel means any foreman, superintendent, or similar individual who is the onsite person in charge of land disturbing activities.

Retention structure and/or pond means a permanent structure whose primary purpose is to permanently store a given volume of stormwater runoff. Release of the given volume is by infiltration and/or evaporation.

Right-of-way means a portion of land over which a local or state government has designated a right of use.

Stormwater concept plan means the overall proposal for a storm drainage system, including stormwater management structures and BMPs and supporting documentation, as specified in the Stormwater Management Design and Criteria Manual. The purpose of the stormwater concept plan is to define on a conceptual level the nature of the proposed development or project and to describe all existing conditions and proposed facilities needed to conform the requirements of the county.

Stormwater management means the collection, conveyance, storage, treatment, and disposal of stormwater runoff in a manner to minimize accelerated channel erosion, increased flood damage, and/or degradation of water quality and in a manner to enhance and ensure the public health, safety, and general welfare, which shall include a system of vegetative or structural measures, or both, that control the increased volume and rate of stormwater runoff caused by manmade changes to the land.

Stormwater Management Design and Criteria Manual means the most recent approved manual of design, performance, and review criteria for stormwater management practices, prepared under the direction of the director of the department of public works or his agent. Copies of this manual can be obtained from the public works department.

Stormwater management districts means any districts established by the board of commissioners where there are special assessments of property owners for the purpose of management and maintenance of stormwater.

Stormwater management facilities means those structures and facilities that are designed for the collection, conveyance, storage, treatment, and disposal of stormwater runoff into and through the drainage system. In most cases, stormwater management facilities will refer to facilities whose primary purpose is related to the quantity of stormwater, and where the BMPs primary purpose will be related to water quality concerns of stormwater.

Stormwater management master plan means the plans for unincorporated Fulton County that govern storm drainage and related facilities, existing and proposed, for all drainage basins and/or watersheds within the county.

Stormwater management plan means the plan and supporting documentation that serves to define and expand the concepts shown as part of the stormwater concept plan, or is sufficient of itself to ensure conformance to the criteria in the Comprehensive Stormwater Management Design and Criteria Manual and this article.

Stormwater management qualitative control means a system of vegetative, structural, or other measures that reduce or eliminate pollutants that might otherwise be carried by stormwater runoff.

Stormwater runoff means the direct response of a watershed to precipitation and includes the surface and subsurface runoff that enters a ditch, stream, storm drain, or other concentrated flow during and following the precipitation.

Variance means the modification of the minimum stormwater management requirements for specific circumstances where strict adherence of the requirements would result in unnecessary hardship and not fulfill the intent of this article.
Waiver means the relinquishment from stormwater management requirements by the director of the issuing department or his agent for a specific land disturbing activity on a case-by-case review basis.
Waste means materials that are discarded, disposed of, or no longer usable.
Water quality means those characteristics of stormwater runoff from a land disturbing activity that relates to the physical, chemical, biological, or radiological integrity of water.
Water quantity means those characteristics of stormwater runoff that relate to the rate and volume of the stormwater runoff to downstream areas resulting from land disturbing activities.
Zoning Resolution of Fulton County (Z.R.F.C.) means the rules and regulations that address zoning and development within the unincorporated areas of the county, latest revision.
(95-0093, art. II, § B, 3-15-95)
Cross references: Definitions generally, § 1-2.

Sec. 26-113. Penalties for violation of article.
(a) Upon determination that a violation of this article has occurred, the person responsible for the land disturbing activity shall be given a written notice of the violations and a time in which to correct the deficiencies.
(b) If construction violations of the approved plan are occurring, an immediate stop work order may be issued by the director of the issuing department or his designee.
(c) All nonconstruction related violations of this article shall be issued a citation by the county.
(d) The Magistrate Court of Fulton County and the State Count of Fulton County shall each have jurisdiction to try offenses alleging violations of this article by any person, firm, corporation, partnership, or other entity. Violations of this article shall be deemed to be a misdemeanor. Each day any violation of this article shall continue shall be considered a separate offense. Upon conviction, any person, firm, corporation, partnership, or other entity shall be subject to a fine of $1,000 per violation or imprisonment in the Fulton County Jail for not more than 60 days, or by both this fine and imprisonment for each offense.
(e) The county attorney on behalf of Fulton County may institute injunctive, or other appropriate action or proceedings at law or equity for the enforcement of this article or to correct violations of this article, and any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.
(95-0093, art. VII, § F, 3-15-95; 99-0644, § II, 5-5-99)
State law references: Maximum punishments which may be imposed for violations of county ordinances, O.C.G.A. § 36-1-20(b).

Sec. 26-114. Authority of article.
(a) This article is established as a new article to and under the authority of this Code.

(b) The authority for this article is based on home rule provisions of Ga. Const. art. IX, § II.
(c) In compliance with the provisions of the Clean Water Act, 33 USC 1251 et seq., as amended, by the Water Quality Act of 1987, PL 100-4.
(95-0093, art. I, § A(2), 3-15-95)

Sec. 26-115. Purpose/objectives of article.
The objectives of this article include the following:
(1) Protect, maintain, and enhance the shortterm and longterm public health, safety, and general welfare. This objective will be achieved by:
a. Establishing minimum requirements and procedures to control the adverse effects of increased stormwater runoff associated with both future land development and existing developed land within Fulton County.
b. Providing proper management of stormwater runoff to minimize damage to public and private property, reduce the effects of development on land and stream channel erosion.
c. Protecting downstream properties from water quality and quantity impacts.
d. Protecting, preserving and enhancing water quality for fish and wildlife habitat within Fulton County.
(2) To satisfy federal (EPA) and state (DNR) regulations that require local programs to control stormwater discharges of pollution.
(3) To keep streets open to emergency vehicle traffic by reducing the flooding of streets.
(4) Establish procedures that minimize damage from flooding caused by development, while recognizing that natural fluctuations in water levels are beneficial.
(5) Require construction of drainage systems which aesthetically and functionally approximate natural systems.
(6) Establish procedures for the planning and implementation of stormwater improvements using a basin-wide approach, considering the total stormwater basin system beyond individual subdivisions and master plans for each basin.
(7) Establish the development and implementation of stormwater management districts.
(95-0093, art. I, § A(3), 3-15-95)

Sec. 26-116. Application and scope of article.
The application of this article and the provisions expressed herein shall be the minimum stormwater management requirements and shall not be deemed a limitation or repeal of any other powers granted by state statute. In addition, if site characteristics indicate that complying with the minimum requirements of this article will not provide adequate designs or protection for local property or residents, the county may impose requirements greater than those set forth in this article. The director of the department of public works or his designee shall be responsible for the coordination and enforcement of the provisions of this article.
(95-0093, art. I, § A(4), 3-15-95)

Sec. 26-117. Conflict with other laws.
Whenever the provisions of this article impose more restrictive standards than are required in or under any other ordinance, the regulations herein contained shall prevail.

Whenever the provisions of any other law require more restrictive standards than are required herein, the requirements of such law shall prevail.
(95-0093, art. VII, § H, 3-15-95)

Sec. 26-118. Severability.
If any term, requirement, or provision of this article or the application thereof shall, to any extent, be invalid or unenforceable, the remainder of this article or the application of such terms, requirements, and provisions shall not be affected thereby and each term, requirement, or provision of this article shall be valid and be enforced to the fullest extent permitted by law.
(95-0093, art. VII, § I, 3-15-95)

Sec. 26-119. Amendments.
This article may be amended in the manner as prescribed by law for its original adoption.
(95-0093, art. VII, § J, 3-15-95)

Sec. 26-120. Liability of county.
Neither the approval of a plan under the provisions of this article nor the compliance with the provisions of this article shall relieve any person from the responsibility for damage to any person or property otherwise imposed by law nor shall it impose any liability upon Fulton County, Georgia, for damage to any person or property.
(95-0093, art. VII, § K, 3-15-95)

Sec. 26-121. Other ordinances.
This article does not negate the following codes, laws, and ordinances or any other applicable ordinance:
(1) Erosion and Sedimentation Control Ordinance of Fulton County.
(2) Zoning Resolution of Fulton County including the floodplain management section.
(3) Rules for dam safety under the Environmental Protection Division by the State of Georgia Safe Dam Act of 1978 (O.C.G.A. § 12-5-370 et seq.). All other impounding structures (dams) criteria not covered by the Safe Dam Act (O.C.G.A. § 12-5-440 et seq.) shall be addressed in the Fulton County Comprehensive Stormwater Manual.
(4) MRPA, Metropolitan River Protection Act (O.C.G.A. § 12-5-440 et seq.).
(5) South Fulton Chattahoochee River Corridor (Georgia River and Mountain Protection Act).
(95-0093, art. VII, § L, 3-15-95)

Sec. 26-122. Effective date.
This article shall take effect 60 calendar days after it becomes law.
(95-0093, art. VII, § M, 3-15-95)

Sec. 26-123. Scope of article; scope of responsibilities.
(a) *Imposition of stormwater management measures.* No person shall develop any land without having provided for stormwater management measures in compliance with this article, unless exempted under the terms of this article, particularly section 26-125.
(b) *Geographic scope of measures.* The provisions of this article shall apply throughout the unincorporated area of Fulton County.

(95-0093, art. I, § C, 3-15-95)

Sec. 26-124. Powers of the department of public works.

(a) The department of public works shall have the power to administer and enforce all regulations and procedures adopted to implement this article, including the right to maintain an action or procedure in any court of competent jurisdiction to compel compliance with or restrain any violation of this article.

(b) The director of the department of public works or his designee shall be responsible for the coordination and enforcement of the provisions of this article. In addition, it shall be the duty of all officers and employees of the county, especially members of the police department, sheriff's department and marshal's office, to assist the director in the course of his/her duties to enforce this article.

(c) The director of the department of public works or his designee shall be responsible for the conservation, management, maintenance (where applicable), extension, and improvement of the county separate storm sewer system, including activities necessary to control stormwater runoff and activities necessary to carry out stormwater management programs included in Fulton County NPDES stormwater permit.

(d) The director of the department of public works or his designee shall develop, or cause to be developed and updated periodically, a stormwater management design manual for the guidance of persons preparing stormwater management plans, and designing or operating stormwater management systems.

(e) The director of the department of public works or his designee shall prepare or cause to be prepared and updated a stormwater management master plan.

(f) The director of public works shall interpret the provisions of this article and may use the opinions of the county attorney and others in arriving at interpretations. Appeals from an interpretation of the director shall be in accordance with the provisions of section 26-131.

(g) The director of public works or his designee shall:

(1) Administer, coordinate, and oversee acquisition, design, construction, and operation and maintenance of municipal/county stormwater facilities and conveyances;

(2) Establish or oversee establishment of development standards and guidelines;

(3) Determine the manner in which stormwater facilities should be operated;

(4) Inspect private systems which discharge to the municipal/county separate storm sewer system;

(5) Advise the other departments on issues related to stormwater;

(6) Protect facilities and properties controlled by Fulton County and prescribe how they are to be used by others;

(7) Require new, increased, or significantly changed stormwater contributions to comply with the terms of this article;

(8) Develop programs or procedures to control the discharge of pollutants into the municipal/county separate storm sewer system;

(9) Adopt and implement the stormwater management program for Fulton County government.

(95-0093, art. I, § D, 3-15-95)

Sec. 26-125. Exemptions from article requirements.

All development, construction or improvements that occur within the boundaries of Fulton County shall be governed by the provisions of this article and the county's Comprehensive Storm Drainage Design and Criteria Manual. The following activities are exempt:

(1) Additions or modifications to existing single-family detached residential structures.

(2) Developments that do not disturb more than 5,000 square feet of land area.

(3) Any maintenance or renovation of an existing structure or system not materially changing or affecting the rate or volume of stormwater runoff, in the sole discretion of the director of the issuing department.

(4) Those exemptions spelled out in section 26-38, provided the activities listed do not contribute pollutants to the county's stormwater conveyance system and the state's waters, or do not increase the turbidity of stormwater runoff from the site due to erosion or land disturbing activity, or the activities listed are governed by other rules and regulations that are more restrictive than this article.

(95-0093, art. I, § E, 3-15-95)

Sec. 26-126. Grandfather clause.

Any applicant or owner of a parcel of land within the jurisdiction of the county who has constructed the required stormwater management facility or BMP or who is in the process of meeting the stormwater management requirements of the law at the time of the effective date of this article, may elect to apply to the director for reconsideration under the provisions of this article.

(95-0093, art. VII, § G, 3-15-95)

Sec. 26-127. Stormwater Management Design and Criteria Manual.

(a) Through the passage of this article, the board of commissioners adopts the Fulton County Comprehensive Storm Drainage Design and Criteria Manual (the manual) and all the rules, regulations, and definitions contained therein. This manual was developed to assist in the design and evaluation of stormwater management facilities and practices. The director of public works shall be responsible for the promulgation of the manual and its contents. The manual shall be updated periodically to reflect the most current and effective practices, rules, and regulations, and shall be made available to the public.

(b) The following topics will be set forth in the Comprehensive Stormwater Management Design and Criteria Manual:

(1) Stormwater concept and management plan approval process;

(2) Stormwater quantity management facilities;

(3) Minimum runoff quality control requirements;

(4) Maintenance agreement for privately owned stormwater facilities; and

(5) All technical criteria and procedures related to stormwater quality and quantity.

(95-0093, art. I, § F, art. VII, § A, 3-15-95)

Sec. 26-128. Variances.

(a) The director of public works may grant a variance from the requirements of this article if there are hardships applicable to the site.

(b) A written request for a variance shall be required and shall state the specific variance sought and the reasons, with supporting data, for their granting.

(c) The director may grant a variance from requirements of this article if the proposed development activity:

(1) Does not change or increase the rate, velocity or volume of runoff significantly; or

(2) Does not have a significant, negative impact on wetland, watercourse, or water body; or

(3) Does not contribute to degradation of downstream water quality or quantity; or

(4) If the construction of proposed improvements will create a safety, traffic or drainage hazard; or

(5) Are impractical to construct; or

(6) The grading, or construction of any of the facilities, related to the development activity that are needed to meet the requirements of this article and will have an adverse impact to an adjacent or downstream property owner.

(95-0093, art. VII, § B, 3-15-95)

Sec. 26-129. Off-site drainage facilities.

Guidelines for consideration of off-site facility/conveyance system use are defined in the Fulton County Comprehensive Stormwater Management Design and Criteria Manual.

(95-0093, art. VII, § C, 3-15-95)

Sec. 26-130. Stormwater management districts.

Upon the recommendation of the director of the department of public works, the board of commissioners shall designate stormwater management districts throughout the unincorporated areas of Fulton County. It shall be the responsibility of the director of the department of public works to determine the boundaries of each stormwater district and shall use the stormwater management master plan as a guide.

(95-0093, art. VII, § D, 3-15-95)

Sec. 26-131. Appeals.

(a) Any person aggrieved by a decision of the director of the issuing department, including any decision with reference to the granting or denial of a variance from the terms of this article, may appeal the same by filing a written notice of appeal with the director within 30 calendar days of the issuance of said decision by the director.

(b) All appeals shall be heard by the director or his designee who is hereby granted specific authority to hear and determine such appeals. The hearing shall be held within 30 days after receipt of notice of appeal or a date mutually agreed upon in writing. The final decision of the director shall be based on published guidelines of appeals established by Fulton County and amended from time to time.

(c) Any appeal of said final decision may be made to the superior court within 30 days from the date of the notice of a final decision. Said notice shall be sent registered mail to the permittee.

(95-0093, art. VII, § E, 3-15-95)

Secs. 26-132--26-165. Reserved.

DIVISION 2. STORMWATER DRAINAGE MANAGEMENT, PLANNING AND DEVELOPMENT REQUIREMENTS

Sec. 26-166. General requirements.

(a) Adequate drainage and control of stormwater are an integral and important part of any development. Proper drainage planning shall be considered an essential element of any stormwater concept plan or stormwater management plan submitted to the county. The design and construction of a site shall also follow the rules and regulations found in article XXXIV of Z.R.F.C. and section 26-39 of this Code.

(b) At the time of the initial submittal to the county with an application for a preliminary plat, every subdivider or developer shall, at his sole expense, be required to submit to the stormwater management section of the department of public works, a stormwater concept plan for review and approval. At the time of the site visit, it shall be determined if drainage studies and reports, design computations, and such other information need to be required to ensure that stormwater originating both from the proposed subdivision or development and lands lying upgradient will be adequately drained and controlled in order to approve the stormwater concept plan. The stormwater concept plan shall be a preliminary drawing of the proposed location of storage facilities, stormwater discharge path of detention/retention pond(s), other downstream and upstream constraints and other matters with potential stormwater implications. Such plans and supplementary information shall be consistent with the requirements of this article, the Z.R.F.C., and the Comprehensive Stormwater Management Design and Criteria Manual.

(c) Upon approval of the stormwater concept plan and prior to the issuance of any building or land disturbance permits, the subdivider shall, at his sole expense, prepare and submit for review and approval by the development services department a stormwater management plan. The stormwater management plan shall consist of drawings and studies, including detailed construction drawings, plans, profiles, and specifications, for the construction and installation of all drainage facilities necessary for the drainage and control of all stormwater within the development, and upgradient, and the conveyance of such water to a safe discharge or outflow point. The stormwater management plan shall conform to the stormwater concept plan for said development. Such plans and supplementary information shall be consistent with the requirements of this article, the Z.R.F.C., and the Comprehensive Stormwater Management Design and Criteria Manual.

(d) A developer and his professionals should discharge the drainage from their site into a storm conveyance system that is publicly owned and maintained. Every subdivider shall provide, at no cost to the county, an easement up to a maximum width as is necessary to accommodate drainage from a 100-year storm for the purpose of constructing and maintaining the drainage system for the transmission, through the subdivider's property, of all stormwater generated upstream from the subdivision. Notwithstanding this requirement, any natural drainageway which traverses any subdivider's property or adjacent properties, shall not be encroached upon or altered so as to render the same less suitable to accept and transport stormwater that has historically flowed through such drainageway. Should a subdivider fail to obtain an off-site easement for the purpose of drainage conveyance, then the design discharge at the outlet facilities of the subdivision shall be limited to the predeveloped conditions for all storm events, including the discharges and velocities, whichever is more restrictive shall apply.

(e) Site visit. Prior to the submittal of a land disturbance permit, or in connection to the stormwater concept plan, the developer/engineer must contact the department of public works stormwater management section to arrange an onsite evaluation visit. By way of example and not limitation, the visit should include an evaluation of the location of storage facilities, stormwater discharge path of detention/retention ponds, other downstream and upstream constraints and other matters with potential stormwater implications.

(f) It shall be the responsibility of the developer to demonstrate that the development and/or stormwater conveyance facilities will not cause a violation of local, state, and federal laws or regulations to occur at the time of the application for a land disturbance permit. Evidence that the applicant has complied with requirements to obtain other state and federal permits which may be applicable, such as, but not limited to Wetlands (404) Permit, NPDES permit, and Metropolitan River Protection Act, must also be supplied to the county as part of the stormwater management plan and study.

(g) It shall be the responsibility of the developer/engineer to accurately depict the conditions of the site, both onsite and off-site, on the plans submitted to the county that are affected by this article. Any modifications, changes, or construction that occur to the plans or in the field, as a result of having to conform to the county's Storm Drainage Criteria Manual or other criteria found in this article, and the cost to rectify shall be borne entirely by the developer.

(95-0093, art. II, § A, 3-15-95)

Sec. 26-167. Specific requirements.

(a) Prior to the issuance of a land disturbance permit by the development services department the following must be in effect:

(1) Documentation that authorizes the right of entry by the county for emergency maintenance of stormwater management facilities.

(2) Documentation that authorizes the right of entry by the county for the purpose of inspecting the stormwater management facilities.

(3) Any off-site easements necessary to effectuate subsections (a)(1) and (a)(2) of this section (easements must be recorded), or to implement the stormwater management plan.

(4) Written authorization from an adjacent property owner allowing any proposed off-site grading, construction, storage, or other improvements to their property.

(5) An approved stormwater concept plan or stormwater management plan, as adjudged appropriate in the discretion of the director of the department of public works or his designee.

(b) In accordance with section 24.1 of the Z.R.F.C. and with sections 26-40 and 26-42 of this chapter, all applications for building permits, and the accompanying plot plan, shall correspond with the approved grading plan or the approved stormwater management plan on file with the county. The issuing authority may require spot elevations, flow direction arrows, contour lines, or other information that it deems necessary prior to the issuance of the building permit to ensure compliance to the approved grading plan or the approved stormwater management plan.

(c) Prior to the issuance of a certificate of occupancy by the county, all stormwater management facilities required as part of the stormwater management plan shall be completed and approved by the county.

(d) Prior to the issuance of the certificate of occupancy by the appropriate department, the following must be submitted to the county:

(1) Recorded easements for stormwater management facilities.

(2) Receipt by the county of an as-built/record drawing of the stormwater management facilities that is signed and sealed by a registered engineer. Discrepancies between the record drawing and the approved stormwater management plan must be identified to the

county, and the county shall give its approval to any discrepancies prior to the issuance of the certificate of occupancy.

(e) Any and all land disturbance permits may be revoked at any time if the construction of the site or the stormwater management facilities are not in strict accordance with the approved stormwater management plans or other sections of this article.

(f) It shall be the responsibility of the person, firm, corporation, or other entity to maintain the drainage patterns and the stormwater management facilities that are in existence at the time of the issuance of the certificate of occupancy. They, their heirs, or assigns are prohibited from performing any improvements or regrading of the site, that in any way block, alter, or redirect the existing drainage patterns or facilities, except for the occasional maintenance to facilities to keep them operating as originally designed. Conviction by a person, firm, corporation, or other entity for violating this section shall be a misdemeanor and shall be subject to the penalties found in section 26-113.

(95-0093, art. II, § B, 3-15-95)

Sec. 26-168. Watershed management plan.

(a) A watershed management plan (masterplan) shall be developed by the director of public works. Said plan may be submitted for approval to the board of commissioners. Such plan shall be revised when information so warrants, as determined by the director of public works. The purpose of the watershed management plan shall be to:

(1) Establish the boundaries of drainage basins which are either directly located or contribute to stormwater flows within the county;

(2) Offer a means of identifying and alleviating both present and future drainage flooding problems while reasonably maintaining the environment and aesthetic values of drainageways;

(3) Present, in an organized fashion, basic data and information regarding the relationship between rainfall and stormwater flows;

(4) Offer an effective means by which the subdivider and the county may cooperate in controlling stormwater flows;

(5) Provide the county with a process for identifying and scheduling the installation of major facilities, including regional stormwater management and/or flood control facilities; and

(6) Include alternatives for the location of structural, nonstructural, private, and public stormwater management measures and strategies to control the adverse effects of stormwater runoff.

(b) The county may solicit the cooperation of other government entities in providing drainage facilities in drainage basins, or paths thereof, that are within and those that extend outside the county limits for the purpose of carrying out the watershed management plan.

(c) The board of commissioners finds and determines that there are certain areas within the county's limits that are subject to periodic inundation resulting in flood loss to both life and property. To alleviate flood problems and to promote and protect the health, welfare, and safety in order that citizens and property owners can remain under the National Flood Insurance Program, development should be prohibited from encroaching into the flood hazard area.

(d) Should a subdivider or owner wish to develop within a flood hazard area, then the subdivider or owner shall prepare, at his sole expense, an engineering study and supporting information per section 4.24 of the Zoning Resolution of Fulton County and follow all the other criteria, rules and regulations that are indicated therein. Per section 4.24.9F of the Z.R.F.C., any revisions or amendments to the FEMA FIRM maps required shall be completed prior to the county's issuance of a certificate of occupancy.

(e) Watershed management plans shall delineate the special flood hazard areas as shown on the Federal Emergency Management Agency (FEMA) FIRM maps. Where flood hazard areas are not indicated, it shall be the responsibility of the department of public works to delineate the limits on a drainage basin affected by a 100-year storm event. It shall also be the responsibility of the department of public works to develop rules and regulations in the Stormwater Management Design and Criteria Manual that govern development in, adjacent to or around the 100-year storm event limits. Until such rules and regulations are developed, the department of public works shall use as a guide in making a determination the Z.R.F.C., FEMA regulations, and the National Flood Insurance Program.

(95-0093, art. II, § C, 3-15-95)

Sec. 26-169. Drainage system connection.

Permission is required from the county to connect to or discharge into any drainage system, conveyance system, or watercourse within the county. Permission shall be implied as part of an approved stormwater management plan from the county. Deviations from the approved stormwater management plan, that do not have the permission of the county, shall be deemed an illicit connection and in violation of division 6 of this article, and shall prohibit the county from issuing a certificate of occupancy or recording of the final plat, even if the deviations result from mistakes to or omissions from the stormwater management plan or changes that occur in the field.

(95-0093, art. II, § D, 3-15-95)

Sec. 26-170. Permit suspension and revocation.

(a) A land disturbance, building or grading permit, or any type of certificate of occupancy may be suspended or revoked by the issuing department if one or more of the following occurs:

(1) Violations of the conditions of the stormwater management plan approval;

(2) Construction not in accordance with the approved plans;

(3) Noncompliance with correction notices or stop work orders; or

(4) The existence of an immediate danger in the judgment of the director of the department of public works or his designee.

(b) If one or more of these conditions are found, a written notice of violation from the issuing department shall be served upon the owner or authorized representative and an immediate stop work order may be issued. The notice shall set forth the measures necessary to achieve compliance with the plan. Correction of these violations must be initiated within seven days of the notice, or the owner shall be deemed in violation of this article and subject to penalties for the said violation.

(95-0093, art. II, § E, 3-15-95)

Sec. 26-171. Professional registration requirements.

(a) All stormwater concept and stormwater management plans and design reports shall be prepared, certified, and stamped/sealed by a qualified registered Georgia professional engineer, using acceptable engineering standards and practices.
(b) The engineer shall undertake to perform services only in areas of his/her competence, and only when qualified by education and/or experience in the specific technical field. In addition, the engineer must certify that the plans have been designed in accordance with the standards and criteria stated or referred to in this article.
(95-0093, art. II, § F, 3-15-95)
Secs. 26-172--26-205. Reserved.

DIVISION 3. OWNERSHIP AND COUNTY PARTICIPATION

Sec. 26-206. Ownership of stormwater management facilities and BMPs.
(a) All stormwater management facilities and BMP structures shall be privately owned and maintained unless the county accepts the facility for county ownership and/or maintenance, subject to the provisions of division 5 of this article. The owner of all private facilities shall grant and shall be deemed to have granted to the county, a perpetual, nonexclusive easement that allows for public inspection and emergency repair.
(b) All stormwater management measures relying on designated vegetated areas or special site features should be privately owned and maintained as defined on the stormwater management plan.
(c) Regional stormwater management facilities may be publicly owned.
(95-0093, art. III, § A, 3-15-95)

Sec. 26-207. County participation.
A voluntary development agreement between the applicant and Fulton County may provide for additional storage capacity beyond that required by the applicant for onsite stormwater management in order to correct for future development. The county designee shall be authorized to negotiate, subject to ultimate approval by the board of commissioners, within the following guidelines:
(1) Require that the applicant grant any necessary easement over, through, or under the applicant's property to provide access to or drainage for such facility.
(2) Require that the applicant obtain from the owners of property any easements necessary for the construction and maintenance of the same, and the county may assist by purchase, condemnation, dedication, and subject to cost incurred to be paid by applicant.
(95-0093, art. III, § B, 3-15-95)

Sec. 26-208. Agreement between county and municipalities.
(a) Prior to implementation of a stormwater plan, the director may furnish a copy of any stormwater management plan which affects any incorporated city, town, municipality, or other local government, and possessing the power to regulate stormwater management of any stormwater management facility or development.
(b) The county may enter into an intergovernmental agreement with any incorporated city, town, or other municipality concerning any matter related to stormwater management.
(95-0093, art. III, § C, 3-15-95)
Secs. 26-209--26-240. Reserved.

DIVISION 4. FUNDING AND FEES

Secs. 26-241--26-275. Reserved.

DIVISION 5. MAINTENANCE, CONSTRUCTION AND INSPECTION

Sec. 26-276. Maintenance.

(a) Any stormwater management facility or BMP which services a residential, commercial, or industrial development shall be privately owned and privately maintained so that the facilities operate as originally designed. The owner thereof shall grant to the county, a perpetual, nonexclusive easement which allows for public inspection and emergency repair, in accordance with the terms of the maintenance agreement set forth in section 26-277. The county may periodically inspect all privately owned and maintained stormwater management facilities and BMPs for compliance with this article and the county criteria. Failure to maintain such facilities shall be considered a violation and subject the owner to the considerations of this article to rectify the situation or be subject to the penalties in section 26-113.

(b) All regional stormwater management control facilities, identified by the county's storm drainage master plan, shall be publicly maintained.

(c) All other stormwater management control facilities and BMPs shall be privately owned and/or maintained, unless specifically accepted for ownership and maintenance by the county.

(d) Private maintenance requirements shall be a part of the deed to the affected property.

(95-0093, art. V, § A, 3-15-95)

Sec. 26-277. Construction and inspection.

(a) Prior to approval of the stormwater management plan, the permittee shall submit a proposed staged inspection and construction control schedule, which the department of development services shall either approve, disapprove, or modify.

(b) No stage of work, related to the construction of stormwater management facilities or BMPs, shall proceed until the next preceding stage of work is inspected and approved.

(c) Any portion of the work that does not comply with this article or with the stormwater management plan shall be promptly corrected by the permittee.

(d) The permittee shall notify the director of development services department or his designee before commencing any work and upon completion of the work.

(e) After commencing initial stormwater management operations, the permittee shall provide for regular biweekly inspection reports to be certified by a registered professional engineer at construction stages and provided to the department of development services.

(f) The permittee shall provide an as-built/record drawing plan certified by a registered professional to be submitted upon the completion of the stormwater management facilities included in the stormwater management plan. The registered professional shall certify that:

(1) The facilities have been constructed as shown on the as-built plan; and

(2) The facilities meet the approved stormwater management plan and specifications.

(g) A final inspection shall be conducted by the director of development services or his designee upon completion of the work included in the approved stormwater management plan.

(h) The director of development services or his designee shall maintain a file of inspection reports and make available copies of all inspection reports.

(i) The director of development services or his designee will notify the person responsible for the land disturbing activity in writing when violations are observed.

(95-0093, art. V, § B, 3-15-95)

Sec. 26-278. Inspection and maintenance agreement (onsite facilities only).

(a) An inspection and maintenance agreement shall be executed for all private onsite stormwater management facilities prior to the issuance of a grading, land disturbance, or building permit. Such agreement shall be binding on all heirs, successors, or assignees.

(b) The agreement shall provide that preventive maintenance inspections of filtration systems, retention, or detention structures may be made by the department of development services, at its option.

(c) The agreement shall provide that the department of development services shall notify the owners of the facility of any violation, deficiency, or failure to comply with this article. The agreement shall also provide that, upon a failure to correct violations requiring maintenance work, within 30 days after the notice thereof, the county may provide for all necessary work to place the facility in proper working condition. The owners of the facility shall be assessed the costs of the work performed by the county pursuant to this subsection.

(95-0093, art. V, § C, 3-15-95)

Sec. 26-279. Inspection for preventive maintenance (regional facilities only). Preventive maintenance inspections of infiltration system, retention, or detention structures comprising regional public facilities may be made by the department of public works.

(95-0093, art. V, § D, 3-15-95)

Sec. 26-280. Maintenance of preexisting residential stormwater management facilities. All dedicated and accepted residential stormwater management facilities in existence in the county on the effective date of this article shall be maintained by the owners (except those constructed prior to 1990) in such a manner as to maintain and enhance the public health, safety, and general welfare to reduce and minimize damage to property; to reduce and minimize the impact of such facilities on land and stream channel erosion; to assist in the attainment and maintenance of water quality standards; to reduce local flooding; and to maintain, as nearly as possible, the preexisting development runoff characteristics of the area. The owners shall be responsible for providing reasonable ingress and egress for maintenance. The county shall not be responsible for aesthetic maintenance.

(95-0093, art. V, § E, 3-15-95)

Sec. 26-281. Maintenance of preexisting commercial/industrial stormwater management facilities.

(a) All commercial/industrial stormwater management facilities in existence in the county on the effective date of this article shall be maintained by the owners thereof in such a manner as to maintain and enhance the public health, safety, and general welfare in order to be assured that such facilities are safe and will not result in injury or harm to persons or property; to reduce and minimize damage to public and private property; to reduce and minimize the impact of such facilities on land and stream channel erosion; to assist in the attainment and maintenance of water quality standards; to reduce local flooding; and to maintain, as nearly as possible, the preexisting development runoff characteristics of the area. All such maintenance of such facilities shall be at the sole cost and expense of the owners thereof.

(b) The county shall have the authority to take necessary steps to abate any nuisance as that term is defined by applicable law.

(c) If the charges and costs provided for in subsection (b) of this section remain unpaid by the owner for a period of 30 days after notice thereof to the owner or occupant of the property upon which such conditions existed, the county's duly authorized representative shall cause a lien to be issued against the owner of the property for those charges. The execution shall be a lien on the property and, when recorded in the general execution docket of the county, shall be a lien on all property of the defendant in execution from the date of such recording.

(95-0093, art. V, § F, 3-15-95)

Secs. 26-282--26-315. Reserved.

DIVISION 6. PROHIBITIONS AND ILLICIT CONNECTIONS

Sec. 26-316. Prohibitions.

(a) It is unlawful for any person, company, corporation, etc., to throw, drain, run, or otherwise discharge to any component of the county's stormwater system, including streets, highways, rights-of-way; or to cause, permit, or suffer to be thrown, drain, run, or allow to seep or otherwise discharge into such system, any organic or inorganic matter that shall cause or tend to cause pollution to such waters, as provided for in this article.

(b) The director of public works may exempt the following from the prohibition provision above:

(1) Water line flushing performed by a government agency, diverted stream flows, rising groundwaters, and unpolluted groundwater infiltration.

(2) Unpolluted pumped groundwater.

(3) Discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, and water from street washing.

(4) Discharges or flows from firefighting.

(5) Other unpolluted water.

(c) In the event of an accidental discharge or an unavoidable loss to the municipal/county separate storm sewer system of any material of substance other than stormwater runoff, the person responsible shall inform the department of public works within five days of the nature, quantity, and time of the occurrence of the discharge. The person responsible shall take immediate steps to minimize the effects of the discharge on the municipal/county system and receiving streams. The person shall also take immediate steps to ensure no recurrence of the discharge.

(95-0093, art. VI, § A, 3-15-95)

Sec. 26-317. Illicit connections.

(a) It is unlawful for any person, company, corporation, etc., to connect any pipe, open channel, or any other conveyance, structure or system to the county's stormwater conveyance system that discharges anything except stormwater runoff and that are not identified on the stormwater management plan.
(b) Improper connections in violation of this article must be disconnected and redirected, if necessary, to the Fulton County Sanitary System or other acceptable outfall upon approval by the director of public works.
(95-0093, art. VI, § B, 3-15-95)

Sec. 26-318. Cooperation with the county.
(a) It shall be the responsibility of any person, firm, company, corporation, etc., to cooperate with the county in the search for illicit connections or prohibitive activities as described in this division in order for the county to comply with the conditions of its NPDES permit.
(b) Any person, firm, company, corporation, etc., shall answer the questions of the county and share information on business activities as they relate to this article, except those records and activities that are confidential and proprietary. If necessary, the county may obtain access to confidential and proprietary records and activities through a court order, subject to the following conditions:
(1) The county shall have access to records and information for the purpose of examination for compliance with the conditions of this article only during normal business hours;
(2) The county shall not have the right to make copies, excerpts, or transcripts of such records and activities without receiving prior written consent; and
(3) The county shall not disclose or make available to third parties any such records or information obtained unless required to do so by a separate court order.
(c) Failure to comply with the conditions of this division shall be considered a violation and subject to the penalties found in section 26-113.
(95-0093, art. VI, § C, 3-15-95)
Secs. 26-319--26-350. Reserved.

Amendment No. 1 to the Fulton County Stormwater Management Storm Drainage and Critera Manual

STORMWATER MANAGEMENT STORM DRAINAGE DESIGN AND CRITERIA MANUAL DECEMBER 2000 Amendment Number 1 – September 1, 2005

The following conditions shall be considered standard design considerations for all projects requiring a land disturbance permit for all applications received on or after September 1, 2005:

1. Prior to submitting the application for a Land Disturbance Permit, the developer and/or design professional shall submit to the Surface Water Activity Management Program (SWAMP), through the Development Review Division, a project Storm Water Concept Plan. This concept plan shall indicate the preliminary location of the storm water management facilities intended to manage the quality and quantity of storm water. The concept plan shall specifically address the existing downstream off-site drainage conveyance system(s) that the proposed development surface runoff will impact, and the discharge path(s) from the outlet of the storm water management facilities to the off-site drainage system(s) and/or appropriate receiving waters. As part of the Storm Water Concept Plan submittal, a preliminary capacity analysis shall be performed on the off-site drainage system(s) points of constraint. The capacity analysis shall determine the capacity of all existing constraint points, such as pipes, culverts, etc. from the point of storm water discharge at the proposed development site boundary downstream to the lower point of a reach of receiving stream described by two points as follows. The upper point shall be a point downstream of the development on the receiving stream where the drainage area is at least ten times the area of the proposed development. The lower point shall be on the receiving stream downstream of the upper point at the confluence of a tributary that contains a drainage area of a minimum of fifty acres. The critical capacity points shall be selected based upon the design professional's field observation, professional judgment and limited field survey data. The analysis shall identify the downstream properties pre and post-development 100-year water surface elevations, and for any post-development water surface elevation increase exceeding 0.05 feet, the developer shall acquire the applicable offsite drainage easement to accommodate the 100-year storm flow through impacted properties. Where Fulton County has completed a model of the basin, it shall be used by the developer in the analyses.

2. Where storm water currently drains by sheet flow and it is proposed to be collected to and/or discharged at a point, such that the discharge from the storm water management facility outlet crosses a property line, such discharge shall mimic predevelopment sheet flow conditions. A description of the method proposed to achieve post-development sheet flow conditions shall be provided as part of the Storm Water Concept Plan. The proposed sheet flow detail shall be submitted with the LDP application. Should the method to achieve sheet flow across an external property line be unsuccessful, the developer shall acquire an easement(s) sufficient to contain the 25 year storm flow from the point of discharge to a point down gradient at a live dry weather stream or other location as approved by the Director of Public Works. This condition will not apply when the storm

water management facility is designed and approved to discharge directly to a stream or watercourse.

3. A draft of the Inspection and Maintenance Agreement required by Fulton County Code Section 26-278 shall be submitted to the Department of Public Works with the Storm Water Concept Plan.

4. The Inspection and Maintenance Agreement shall provide that all storm water management/detention facility outlet control structures shall be inspected, photographed and cleaned, if necessary, on a monthly basis, by the owner. The Inspection and Maintenance Agreement shall require that the design professional shall prepare an operation and maintenance guidance document, for use by the owner and/or any professionals retained by the owner, to plainly describe the basic operational function of the facility(ies), including a description of a permanent marker post(s) which shall indicate that the level of sediment which, if exceeded, requires sediment removal. The Inspection and Maintenance Agreement shall require an annual operation and maintenance report for all storm water management/detention facilities be prepared by a licensed design professional and submitted to the SWMP. The annual report shall include monthly inspections, photographs, and documentation of the cleaning of storm water management/detention facilities outlet control structure(s) as well as an operational assessment of the facilities indicating that they do, or do not, function as described in the design guidance document (described above), and if they do not, a description of the specific actions to be taken to allow the facilities to function as intended.

5. The required Inspection and Maintenance Agreement shall be recorded with the Clerk of Superior Court prior to issuance of an LDP, Grading Permit or Building Permit associated with the development.

6. The developer/design professional is required to submit, along with the application for an LDP, signed documentation verifying approval of the Storm Water Concept Plan.

7. Where paved parking areas (including access aisles) are proposed to exceed 5,000 square feet, the storm water management facilities shall be designed to reduce pollutants such as oil, grease and other automobile fluids that may leak from vehicles. A general description, or concept, of the storm water management facilities proposed to achieve the removal of such pollutants shall be submitted with the Storm Water Concept Plan. A detailed design of such facilities shall be included in applicable documents for a land disturbance permit.

8. With the application for an LDP, provide documentation (such as channel crosssections, centerline profile, etc.) describing the geometry of those existing natural streams, creeks, or draws within the proposed development boundary which in the design professional’s judgment are at risk of erosion due to increased flow, provide a description of the basis utilized in judging areas to be at risk, and provide details on the Storm Water Management Plan of the post-development channel bank protection measures.

9. The developer/design professional shall demonstrate to the County by engineering analysis submitted with the LDP application, that the discharge rate and velocity of the storm water runoff resulting from the development is restricted to seventy-five percent (75%) of the pre-development conditions for the 1-year frequency storm event, up to and including the ten (10)-year frequency storm event. The 1-year channel protection volume shall be calculated in accordance with the Georgia Stormwater Management Manual (Section 2.2.5) and released over a 24 hour period.

10. Plans for any land disturbance permit shall show all proposed drainage patterns for the proposed development after its completion. Drainage from all disturbed areas shall be collected and conveyed to a storm water management facility provided as part of the development. Except for runoff from undisturbed areas within a buffer or other protected easement and/or minimal incidental flows specifically approved by the Director of Public Works, bypass flows will not be permitted. The Storm Water Concept Plan shall identify any proposed areas with incidental and minor release of storm water not conveyed to such facilities.

11. Storm water management facility(ies) volumes shall be designed to achieve water quality treatment, channel protection, over bank flood protection and extreme flood protection, in accordance with the Georgia State Storm water Manual, except that the duration of release for water quality treatment shall be 48 hours.

12. The minimum pre-developed time of concentration shall be ten (10) minutes.

13. Graded cut and fill slopes for building site pads greater than six (6) feet in height shall be limited in steepness to 3 horizontal to 1 vertical.

14. For proposed developments where the existing impervious surface area exceeds 75 percent of the project site, the design predeveloped conditions and /or the required reduction of predeveloped peak flow may, upon approval of the Director of Public Works, be modified./ relaxed following notification (by the developer) of adjacent downstream property owners and demonstrated improvements in drainage conditions..

Zoning Resolutions of Fulton County, Section 4.24 – Floodplain Management

4.24. FLOOD PLAIN MANAGEMENT

4.24.1. PURPOSE.

It is the purpose of this Section to minimize public and private losses due to flood conditions in specific areas by provisions designed to promote the public health, safety and general welfare and to:

A. restrict or prohibit uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

B. require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

C. control the alteration of natural flood plains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters;

D. control filling, grading, dredging and other development which may increase erosion or flood damage, and;

E. prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands;

F. adopt and comply with the requirements of the Flood Disaster Protection Act of 1973 (Pub. L. 93-234, December 31, 1979) and Section 60.2 (h), 60.3 (d) and 65.5 of the National Flood Insurance Program (24 C F R 1909, etc.) thereby assuring that the Unincorporated Areas of Fulton County and its citizens shall continue to participate in the benefits of the program and not be subject to the Prohibitions contained in Section 202 (a) of the 1973 act as amended.

4.24.2. OBJECTIVES.

The objectives of this Section are:

A. to protect human life and health;

B. to minimize expenditure of public money for costly flood control projects;

C. to minimize the need for rescue and relief efforts associated with flooding, generally undertaken at the expense of the general public;

D. to minimize prolonged business interruptions;

E. to minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, street and bridges located in flood plains;

F. to help maintain a stable tax base by providing for the sound use and development of flood prone areas in such a manner as to minimize flood blight areas, and;

G. to insure that potential home buyers are notified that property is in a flood area.

4.24.3. JURISDICTION.

This Section shall apply to all the unincorporated areas of Fulton County which contain special flood hazard or flood prone areas.

4.24.4. FLOOD AREAS ESTABLISHED.

A. Special Flood Hazard Area shall be designated on the "Floodway Boundary and Floodway Maps" (FBFM), the "Flood Insurance Rate Maps" (FIRM), and the "Flood Insurance Study" (FIS) prepared and revised by the Federal Emergency Management Agency (FEMA) effective June 22, 1998 . As defined by FEMA, Special Flood Hazard Areas (SFHA) are classified as numbered or unnumbered zones A, AE, (formerly A1-A30), AO, and AH which are available for review on maps in the Environment and Community Development Department or the Department of Public Works. The accompanying maps and other supporting data and all subsequent amendments and/or revisions are hereby adopted by reference, declared to be a part of this Resolution, and shall have the same force and effect as if fully set forth in this Resolution. SFHA shall be identified as follows:(Amended 11/04/98)

1. Fifty Lots or Five Acres Space or More. When FEMA has not produced water surface elevations data and the proposed development is more than 50 lots or 5 acres, whichever is the lesser, base flood elevation data determined in studies by the U.S. Corps of Engineers or other reputable reports based on competent engineering studies prepared by a current state-registered professional engineer and accepted by the Department of Public Works shall be adopted by reference and declared to be a part of this section.
2. Fewer than Fifty Lots or Five Acres. When FEMA has not produced water surface elevation data and the proposed development is not fewer than 50 lots or 5 acres, whichever is the lesser, then the base flood elevation data may be determined by the best information available.

B. Regulatory Floodway Area shall be designated on the "Flood Boundary and Floodway Map" and the "Flood Insurance Study" as revised by FEMA from time to time. It is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

C. Flood Prone Area shall be designated on the "Flood Insurance Rate Map". Flood Prone Areas shall be those areas classified as areas of moderate and minimal flood hazards, shown thereon as “Zone X” (formerly Zone B). (Amended 06/03/98)

4.24.5. USE REGULATIONS.

(Amended 04/05/06)

Notwithstanding the uses permitted by the zoning district applying to the property, the following shall be prohibited in the Special Flood Hazard Area (100 year IRF): buildings and structures; filling; and compensatory flood storage for placement of either fill or for construction of a structure in the floodplain with exception to exempted uses as specified in Section 4.24.5.A. 1-8:

Floodplain designation shall be based on data generated by FEMA, Fulton County flood studies, or data from engineering flood studies prepared by a state-registered professional engineer and accepted by Fulton County (whichever is most representative of the current floodplain). Flood studies shall be approved contingent upon acceptance by FEMA.

Construction (which is consistent with the exemption provisions of this resolution) shall be allowed within floodways only if it is directed towards improving the capacity or flow characteristics of the flood waters or crossing, relocating or altering the floodway channel itself. All such construction must be in conformance with the provisions of the Fulton County Zoning Resolution and the national Flood Insurance Program.

A. Special Flood Hazard-Flood Prone Permitted Uses. The following uses are permitted in Special Flood Hazard and Flood Prone Areas.

1. Agricultural, including forestry and livestock raising, requiring no structure. Agriculture and forestry access roads are permitted provided they are constructed in conformance with the development standards of the regulations.
2. Dams, provided that they are constructed in accordance with the requirement of this section, the Department of Public Works, the U.S.D.A. Soil and Conservation Service and when applicable, meet the specifications of The U.S. Army Corps of Engineers and/or the Georgia Department of Natural Resources.
3. Fences having sufficient open area to permit the free flow of water and/or debris.
4. Identification, regulatory and warning signs.
5. Public and private parks and recreational areas including boat ramps and docks and other functionally dependent uses not including any temporary or permanent buildings, provided; such use is approved by the Department of Environment and Community Development, if applicable, the U.S. Army Corps of Engineers.
6. Parking.
7. Utility lines, pipelines, sewers, roads and stream crossings (if no other means of access is available), and similar facilities, provided they are constructed in such a manner as to permit the free flow of flood waters.

B. Floodway Area Permitted Uses. No construction is allowed within floodways except that which is directed towards improving the capacity or flow characteristics of the flood waters or crossing, relocating or altering the floodway channel itself. All such construction must be in conformance with the provisions of this Resolution and the National Flood Insurance Program.

4.24.6. PERMIT REQUIRED.

A land disturbance permit or grading permit shall be required prior to the commencement of any improvement, including grading and filling, within the Special Flood Hazard or Flood Prone Areas. (Amended 11/03/93)

A. Activities on Lots Within Existing Development. In developments that require only a building permit on a developed lot, portions of which are subject to flooding, the Director of the Environment and Community Development Department shall review the application and issue the Permit as part of the Building Permit. The Flood Elevation Study as required by paragraph 4 (a)(1) above may be waived by the Department of Public Works provided:

1. A licensed surveyor submits base flood elevation data based on the best information available.
2. That the base flood elevation data is to be used only to establish the lowest floor elevation of a structure.

B. Activities Requiring Land Disturbance Permit. In developments that require a Land Disturbance Permit as provided in the "Erosion and Sedimentation Ordinance of 1978", the Environment and Community Development Department shall review the application and issue the Permit as part of the Land Disturbance Permit. (Amended 11/03/93)

C. Other Activities. In all other developments that involve change, modification, or alteration to a flood area, except such activities as plowing, tilling, seeding, planting, or any other agricultural or landscaping pursuit which does not result in change to the cross sectional area of the flood plain nor a significant or hazardous change in the flow characteristics, the developer shall be required to obtain the applicable permit prior to the commencement of any construction within the flood plain.

4.24.7. PERMIT PROCEDURE.

(Amended 11/03/93)

A. Application. Application for a Permit shall be made to the Environment and Community Development Department as indicated under permit required above. If the proposed development requires a land disturbance permit or is of such a nature as to require review and approval by the Environment and Community Development Department, or any other appropriate agencies, the applicant shall be so advised. Such review may require additional data and/or plans to be furnished by the applicant to assure compliance with all applicable regulations.

B. Certification. The Director of the Environment and Community Development Department shall inform an applicant of the requirements that "as-built" lowest floor elevation certificates be obtained prior to approval of a certificate of occupancy for any structure built in or immediately adjacent to a Special Flood Hazard Area. Certificates of elevation:

1. Shall be prepared by a Professional Engineer or Surveyor licensed by the State of Georgia.
2. Shall be maintained in a file in the Offices of the Environment and Community Development Department and the Department of Public Works.

4.24.8. PLANS AND STUDIES REQUIRED.

Wherever it is necessary to determine that the proposed use conforms to the requirements of this Section, the Environment and Community Development Department shall require the applicant to furnish complete and sufficient plans, specifications, hydrological and engineering studies or data. Depending on the size or nature of the proposed use, any or all of the following may be required: (Amended 11/03/93, 06/03/98)

A. Grading, replanting and drainage plans;

B. Proposed temporary and permanent drainage and sedimentation control structures and facilities;

C. Complete hydrologic and hydraulic analysis, prepared by a professional engineer registered in the State of Georgia, establishing the 100 year base flood elevations and horizontal flood plain limits.

D. A determination of the channel cross-section area required to carry the affected stream during the base flood;

E. Complete hydrologic studies to evaluate the total effects a development under review may have upon affected drainage facilities and systems;

F. The Environment and Community Development Department may require the applicant to furnish a written agreement to limit use and development in accord with the approved plan and specifications.

4.24.9. GENERAL DEVELOPMENT PROVISIONS AND STANDARDS.

(Amended 11/03/93)

A. Relocation and Realignment. Within a Special Flood Hazard or Flood Prone Area any relocation or realignment of river and stream channels shall be prohibited if it would reduce the floodway capacity with respect to the base flood elevation, or significantly alter water flow characteristics so as to create a hazard.

B. Nonconforming Uses. Except as restricted or exempted below, existing nonconforming uses within a Special Flood Hazard or Flood Prone Area may be maintained or repaired; modified, altered or repaired to incorporate flood proofing measures; improved to comply with existing state or local health, sanitary or safety code specifications which are solely necessary to assure safe living conditions.

1. Restrictions.

a. The cost of such improvement shall not equal or exceed 50 percent of the market value of the structure either, (i.) before the improvement is started or (ii.) if the structure has been damaged, and is being restored, before the damage occurred.

b. Such non-conforming use shall not be expanded.

2. Exemption.

Any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

C. Structures Elevated Above Flood Hazard or Flood Prone Areas. No new structure shall be approved or constructed so as to extend over a Special Flood Hazard or Flood Prone Area, whether it be a cantilever design or supported by structural elements located within the flood plain.

D. Structures Adjacent to Flood Hazard or Flood Prone Areas. For any proposed new structure adjacent to a Special Flood Hazard or Flood Prone Area the ground surface shall be at least three (3) feet above the base flood elevation. Further, when a filled building site is required, the ground surface at the face of the wall shall be at least ten (10) feet distant from the base flood plain. See paragraph 65.5 of the National Flood Insurance Program as amended.

E. The Lowest Minimum Floor Elevation. The lowest floor elevation, as described in FEMA's elevation certificate on page 5 and 6, shall be at least three (3) feet above the base flood elevation and meet the requirements of 4.24.9 G. (Amended 04/05/95)

F. Removing Flood Hazard or Flood Prone Areas. Lands may be removed from a Special Flood Hazard Area or Flood Prone Area by raising the elevation of such land above the base flood elevation, provided the raising of such land is accomplished in accordance with the requirements of this resolution. Refer to FEMA National Flood Insurance Program Regulation 44 CFR, Part 65 for procedures to amend the FIRM, FHBM, or FIS. The developer/property owner shall prepare all plans and engineering studies and pay any fees necessary to obtain a Letter of Map Revision for their development.(Added 04/05/95)

G. Residential Lots. In districts which permit residential use, development is prohibited in Special Flood Hazard Areas. Fulton County may allow such development provided:(Amended 04/05/95)

1. Not less than 70% of the buildable land area lies above the base flood elevation, a minimum of one (1) foot, and/or

2. Not less than 50% of the minimum lot area, as established by the applicable zoning district, shall be above the base flood elevation.

H. Utilities. The location, design, elevation, and construction of all public utilities and facilities, such as sewer, gas, electrical, on-site waste disposal systems, water systems and streets shall be in such a manner as to minimize or eliminate damage by flooding.

I. Drainage Structures. All drainage structures and facilities located within Special Flood Hazard or Flood Prone Areas shall be constructed in accordance with Fulton County Standards and Specifications. They shall be maintained by the owner in a sanitary, fully functional and operable state so that the flood carrying capacity of the watercourse is preserved.

J. Erosion and Sediment Control. Provision shall be made for the adequate control of erosion and sedimentation.

K. Riverine Considerations. Fulton County shall notify, in riverine situations, adjacent communities and the Georgia State Coordinating Office prior to any alteration or relocation of a watercourse.

L. Watercourse Alteration or Relocation. Fulton County, prior to approval of a permit to alter or relocate a portion of any watercourse shall require an agreement indemnifying Fulton County from all liability arising from the construction pursuant to said permit and providing for the continued maintenance to assure the flood carrying capacity within the altered or relocated water course.

4.24.10. DEVELOPMENT WITHIN FLOOD PRONE AREAS.

A. Development Limitations. Within Flood Prone Areas, no construction including grading and filling shall be allowed that would:

1. Raise the base flood elevation beyond the boundaries of the ownership of the property being developed - Submittal of this certification and the supporting studies by a professional engineer are required.
2. Reduce the flood storage capacity - Fill placed within the flood plain must be compensated. All cut areas must drain by gravity to the main watercourse. Certification by a professional engineer and an "as-built" topographical map superimposed on the original topography are required.
3. Impede the movement of flood waters - Applies to any obstruction placed within the flood plain, i.e., fill, but in particular, roads, driveways, bridges and culverts. All such encroachments shall be designed and submitted by a professional engineer and shall provide:
    a) That there shall be no reduction in the flood carrying capacity of the watercourse.
    b) A certification together with supportive data.
    c) Sufficient opening provided for the passage of the flood waters so as to prevent or greatly reduce the hazard of debris or trash blocking the flood's flow.
4. Changes the flow characteristics of the flood waters as they pass the boundaries of the developed property - Requires certification by a professional engineer along with all supportive studies.
5. Create hazardous or erosion producing velocities Requires certification by a professional engineer along with supportive studies.

B. Stormwater Management Structures. Detention ponds, lakes and similar impoundment structures may be constructed within a Flood Prone Area provided they do not violate the restrictions enumerated under paragraph 10

(a) above. Provided further that any such detention pond, lake or similar impoundment structure shall provide adequate discharge control and sufficient storage capacity to assure that the rate of runoff calculated for the proposed development including that drainage increased or diverted by reason of the development shall not exceed that calculated for the property in its natural state in the event of the 100 year storm.

C. Studies and Plans Required. A hydrologic analysis shall be required to be submitted to the Environment and Community Development Department with each application for a Land Disturbance Permit for property containing a Flood Prone Area. Any or all of the other plans or studies referred to in paragraph 4.24.8 above may be required. Such studies shall take cognizance of existing conditions which affect the flow of water on adjacent properties and also such future conditions as can reasonably be expected to occur in the drainage basin. Such reports shall meet the requirements of the Environment and Community Development Department. (Amended 11/03/93, 06/03/98)

D. Revision Criteria. Each application for a Land Disturbance Permit for property containing a Flood Prone Area shall also submit therewith documented results of hydrology and hydraulic analysis prepared by a registered professional engineer demonstrating that any area defined on the FIRM or FBFM as moderate or minimal flood hazard (Zone X) is not actually a SHFA. Such results and analysis shall demonstrate that none of the following criteria is met in any Flood Prone Area(s) on the site: (Added 06/03/98)

(1) The Flood Prone Area(s) is subject to a one percent (1%) annual chance of flooding with average channel depths greater than one foot or;

(2) The Flood Prone Area(s) has a contributing drainage area greater than one square mile or;

(3) The Flood Prone Area(s) has hazardous velocities in the channel and/or overbank areas greater than 3.5 feet per second. (The County may accept velocities of up to 5 feet per second depending upon the results of a soil study by the engineer).

In the event that any of the above criteria is met, the applicant shall submit to the Environment and Community Development Department the relevant data for a Letter of Map Revision and the appropriate fees required by FEMA. The Fulton County Department of Public Works shall then submit the relevant data, Letter of Map Revision and accompanying fees to FEMA for a determination of whether a map revision is warranted. In the event of such a map revision reclassifying an area as an SHFA, development within the affected area(s) shall comply with Section 4.24.12 of this Article.

4.24.11. DEVELOPMENT WITH UNSTUDIED SPECIAL FLOOD HAZARD AREAS.

4.24.12. DEVELOPMENT WITHIN STUDIED SPECIAL FLOOD HAZARD AREAS.

Development and Revisions Criteria in the unstudied Special Hazard Areas shall be the same as in the Flood Prone Areas, Subsection 4.24.10 (Amended 06/03/98).

A. Development Limitations. No construction shall be allowed within the studied Special Flood Hazard Areas that would:

1. Raise the base flood elevation - Submittal of this certification and the supporting studies by a professional engineer are required.

2. Reduce the flood storage capacity - Fill placed within the flood plain must be compensated. All cut areas must drain by gravity to the main watercourse. Certification by a professional engineer and an "as-built" topography map superimposed on the original topography are required.

3. Impede the movement of flood waters - Applies to any obstruction placed within the flood plain but in particular, roads, bridges, driveways and culverts. All such encroachments shall be designed by a professional engineer and shall provide:

a) That there shall be no reduction in the flood carrying capacity of the watercourse.

b) A certification together with supportive data.

c) Sufficient opening provided for the passage of the flood waters so as to prevent or greatly reduce the hazard of debris or trash blocking the flow of the flood.

4. Change the flow characteristics of the flood waters. Requires certification by a professional engineer along with all supportive studies.

5. Create hazardous or erosion producing velocities. Requires certification by a professional engineer along with supportive studies.

B. Increase Base Flood Elevation. The Department of Public Works may from time to time, request a review and determination from the Floodplain Management Administrator to permit an increase in the base flood elevation. Such increased elevation shall not exceed that depth shown in the Flood Insurance Study, Table 2, Base Flood Water Surface Elevation with Floodway Column. (Amended 04/05/95)

1. This increase may be granted when:

a. The development is a proposed public road, bridge and/or culvert, public utility poles, towers, pipelines, sewers and similar facilities.

b. The development is a private lot, bridge/culvert, private utility poles, towers, pipelines, sewers or other similar facilities.

2. A professional engineer must submit a certification along with supportive documentation that the increase does not extend beyond the boundaries of the property upon which the improvement is proposed and shall not cause any appreciable expansion of flooding, siltation, erosion or inundation hazards. (Amended 11/03/93)

3. A developer shall apply to the Flood Plain Management Administrator of Fulton County for review and approval of an application for a Letter of Map Revision to FEMA. (Added 04/05/95)

4. The Floodplain Management Administrator may apply for a conditional FIRM revision to FEMA prior to permitting encroachment into a Special Flood Hazard Area. Refer to the National Flood Insurance Program Regulations 44 CFR, Part 65.12 for FEMA requirements. (Added 04/05/95)

4.24.13. FLOODWAY ALTERATION.

A. Construction Within Regulatory Floodway. When construction is proposed within the regulatory floodway such as flood control projects, stream channelization, stream relocation, construction of new dams, reservoirs, artificial canals, private levees or flood protection systems which would result in a change in the base flood elevations as shown on the Flood Insurance Rate Maps (FIRM), the following shall be required:

1. Complete plans, data, studies and documentation for the proposed construction shall be submitted to the Department of Public Works.
2. If the Department of Public Works determines that the project is feasible and acceptable, then the Department shall submit the project to FEMA in compliance with the provisions of the National Flood Insurance Program, paragraph 65.5 as amended from time to time.

NOTE: Fulton County may require a fee for review of such proposals.

4.24.14. MOBILE HOMES.

All mobile homes located within the 100-year flood plain must adhere to all applicable regulations stated elsewhere in this Resolution as well as the following:

A. Anchoring. All mobile homes should be anchored to resist flotation, collapse or lateral movement, by providing over-the-top and frame ties to ground anchors. Specific requirements shall be that:

1. Over-the-top ties be provided at each of the four corners of the mobile home, with two additional ties per side at intermediate locations. Mobile homes which are less than 50 feet long must have one additional tie per side;
2. Frame ties be provided at each corner of the home with five additional ties per side at intermediate points. Mobile homes which are less than 50 feet long require four (4) additional ties per side;
3. All components of the anchoring system must be capable of carrying a force of 4800 pounds; and
4. Any additions to the mobile home must be similarly anchored.

B. General Requirements. All mobile homes are required to have:

1. Lots that are elevated on compacted fill in accordance with Paragraph 4.24.9(D).
2. Adequate surface drainage and access for a hauler.

4.24.15. SUBDIVISION PLATS.

Hereinafter, proposed preliminary and final subdivision plats for property located contiguous to or within Flood Prone or Special Flood Hazard Areas shall not be approved except in accordance with the following requirements: (Amended 04/05/95)

A. Each plat shall contain a notation clearly stating the water surface elevation of the Base Flood in relation to mean sea level as approved and accepted by the Department of Public Works. Any lands below this elevation shall be designated on the plat by a heavy line, depicting the Base Flood elevation at that point.

B. No lot shall be approved which has less than the minimum lot area as established by the applicable zoning district regulations and 4.24.9(G) above the base flood elevation.

C. Preliminary and final subdivision plats that were approved prior to the enactment of this section are exempt from the requirements of 4.24.9, D. and 4.24.15, B., above, and building permits shall be issued accordingly.

D. No final subdivision plat shall be approved by the County where development has altered the Special Flood Hazard Area unless the County has first received a Letter of

Map Amendment, Letter of Map Revision or notice of Conditional FIRM Revision from FEMA as stipulated in the National Flood Insurance Program Regulations 44 CFR, Part 65.(Added 04/05/95)

4.24.16. ABROGATION AND GREATER RESTRICTIONS.

This section is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. Where this section and another section of this Resolution conflict or overlap, however, whichever imposes the more stringent restrictions shall prevail.

4.24.17. INTERPRETATION.

In the interpretation and application of this Section, all provisions shall be:

A. Considered as minimum requirements;

B. Liberally construed in favor of the governing body;

C. Deemed neither to limit nor repeal any other powers granted under state statutes.

4.24.18. WARNING AND DISCLAIMER OF LIABILITY.

The degree of flood protection required by this Section is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This Section shall not create liability on the part of Fulton County or by any official or employee thereof for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

4.24.19. COMPLIANCE.

No structure or land shall hereafter be located, extended, converted, or structurally altered without full compliance with the terms of this Section and other applicable regulations.

4.24.20. APPEAL.

(Deleted 3/4/92, See Article 22)

Article VI – Conservation Subdivision Ordinance

ADOPTED BY THE BOARD OF COMMISSIONERS ON APRIL 21, 2004

ARTICLE VI

Conservation Subdivision Ordinance

6.1. **PURPOSE AND INTENT**. It is the purpose and intent of this ordinance to insure preservation of open space within residential developments; provide flexibility to allow for creativity in developments; minimize the environmental and visual impacts of new development on critical natural resources and historically and culturally significant sites and structures; provide an interconnected network of permanent open space; encourage a more efficient form of development that consumes less open land and conforms to existing topography and natural features; reduce erosion and sedimentation by minimizing land disturbance and removal of vegetation; enhance the community character; permit clustering of houses and structures which will reduce the amount of infrastructure, including paved surfaces and utility lines; encourage street design that controls traffic speeds and creates street inter-connectivity; and promote construction of convenient and accessible walking trails and bike paths both within a subdivision and connected to neighboring communities, businesses and facilities to reduce reliance on automobiles.

6.2. **APPLICABILITY OF REGULATIONS.** The Conservation Subdivision option is available for single family detached residential developments in the following districts: AG-1, R-1, R-2, R-2A, R-3, R-3A, R-4, R-4A, R-5 and R-5A in unincorporated Fulton County south of the City of Atlanta (South Fulton). Compliance with all applicable Fulton County ordinances, regulations, or resolutions is required; however, when in conflict, the provisions of this ordinance shall prevail.

6.3 **DEFINITION OF OPEN SPACE**. Open space is the portion of the conservation subdivision that has been set aside for permanent protection. Activities within the open space are restricted in perpetuity through the use of an approved legal instrument.

6.4. **OPEN SPACE REQUIREMENT.** Each conservation subdivision shall provide a minimum of 40% of its total acreage as open space as defined by this ordinance. The open space shall be designated on the conceptual plan and recorded on the final plat. Interconnectivity of all open space within a Conservation Subdivision shall be required.

6.4.1. **OPEN SPACE NETWORKS CONFIGURATION.** The minimum standards for open space networks are as follows:

a. The minimum width of any open space area is 25 feet.

b. All paths shall be a minimum of 20 feet from any property line except where interparcel access may be provided.

c. All open space networks shall provide connectivity to any common areas within the development and to any adjacent public places/rights-of-way.

d. Paths located in primary conservation areas shall be constructed of pervious materials.

e. Where path networks cross internal subdivision streets or public streets, access points shall be directly across from each other or as approved by the Director.

f. Crossings and access points shall be clearly identified to pedestrians and motorists and may include traffic control devices, bridges and tunnels as approved by the Director.

6.5. **OPEN SPACE AND CONSERVATION AREAS**. Open space shall be designated as either primary conservation areas or secondary conservation areas and shall be configured to create or maintain a network of open space.

6.5.1. **PRIMARY CONSERVATION AREAS.** Primary conservation areas form the core of the open space to be protected. Active recreation areas are prohibited in primary conservation areas unless approved by the Director. Primary conservation areas, as defined by this ordinance, include the following:

a. Cemeteries;

b. Habitats for endangered or threatened species as defined by the Georgia Department of Natural Resources;

c. Wetlands identified by the National Wetlands Inventory maps prepared by the U.S. Fish and Wildlife Service, the County Soil Survey prepared by the United States Department of Agriculture (USDA) Natural Resources Conservation Service, or a certified wetlands delineation using data from the U. S. Army Corps of Engineers;

d. Alluvial soils identified by the Federal Emergency Management Agency (FEMA) and 100-Year floodplain;

e. Lakes (natural and man made), rivers, streams, existing ponds, stormwater management ponds/facilities designed in accordance with the Fulton County Subdivision Regulations, creeks, including but not limited to blue line tributaries and state waters;

f. Riparian zones equal to any required stream buffers and improvement setbacks;

g. Existing slopes greater than 25% on average with a site area greater than 5,000 square feet identified as part of a site analysis conducted by a registered engineer, land surveyor or landscape architect and calculated using topographic maps from the Fulton County GIS system or from a topographic survey prepared by a licensed land surveyor.

6.5.1.1 **VALUE OF PRIMARY CONSERVATION AREAS.** Because primary conservation areas are either protected or sensitive environmental areas, only 50% of the acreage of a primary conservation area may be counted as open space.

6.5.2. **SECONDARY CONSERVATION AREAS**. Secondary conservation areas consist of undeveloped (unconstrained) but buildable land and protected (constrained) lands. Secondary conservation areas, as defined by this ordinance, include the following:

a. Farmlands (fields, pastures, meadows);

b. Woodlands and buffers except riparian buffers;

c. Historic and/or archaeological sites as identified by the Fulton County Historic Resources Survey;

d. Passive recreation areas, public and private, to include pedestrian, bicycle and equestrian trails, picnic areas, community commons or greens, and similar areas;

e. Active recreation areas and facilities, public and private, to include parks as identified by the Parks and Recreation Master Plan, playing fields, and playgrounds. Recreation areas with impervious surfaces (e.g., tennis courts, basketball courts and pools) and golf courses shall be excluded.

6.5.2.1. **VALUE OF SECONDARY CONSERVATION AREAS**. With the exception of active recreation areas and facilities, 100% of secondary conservation areas may be counted as open space. Because active recreation areas are cleared and graded and therefore reduce natural resources and wildlife habitats, only 50% of active recreation areas and facilities may be counted as open space.

6.6. **OPEN SPACE PROTECTION.** The required open space areas shall be protected in perpetuity from further development or unauthorized use by a conservation easement or permanent restrictive covenant (per O.C.G.A. Section 44-5-60(c)). Fulton County reserves the right to enforce all restrictive covenants and conservation easements.

6.6.1. **REQUIREMENTS FOR CONSERVATION EASEMENTS**. The conservation easement(s) shall:

a. Clearly delineate primary and secondary conservation areas;

b. Describe the features of the subject property that should be permanently protected in accordance with The Georgia Uniform Conservation Easement Act, O.C.G.A. 44-10-1 et seq.;

c. List the parties, that is, the owner(s) of the property, the holder of the easement and Fulton County as a third party beneficiary with rights to enforce the easement if Fulton County is not the holder;

d. Specify how the easement may be transferred as in the case of a homeowners association dissolving;

e. Clearly identify the boundaries of the property by survey and a metes and bounds legal description;

f. Clearly list restrictions;

g. Provide for inspections of the property by the owner, the holder of the easement and Fulton County;

h. Provide for maintenance of the property;

i. Be shown on the final plat and duly recorded with the Clerk of Superior Court prior to the issuance of a Land Disturbance Permit; and

j. Provide for amendments only with the express written permission of the property owner(s), the holder of the easement and Fulton County. Amendments to the easement shall be filed with the Director and shall be recorded in Superior Court.

6.6.2. **REQUIREMENTS FOR PERMANENT RESTRICTIVE COVENANTS**. The permanent restrictive covenant(s) shall:

a. Clearly delineate primary and secondary conservation areas;

b. Describe the features of the subject property that should be permanently protected;

c. Clearly identify the boundaries of the property by survey and a metes and bounds legal description;

d. Clearly list restrictions;

e. Provide for inspections of the property by Fulton County;

f. Provide for maintenance of the property;

g. Be shown on the final plat and duly recorded with the Clerk of Superior Court prior to the issuance of a Land Disturbance Permit; and

h. Provide for amendments only with the express written permission of the property owner(s) and Fulton County. Amendments to the covenant shall be filed with the Director and shall be recorded in Superior Court.

6.7. **MAINTENANCE OF OPEN SPACE**. Open space may be maintained and/or improved through reforestation, pasture management, buffer replantings, stream bank protection and wetlands management or by other means as approved by the Director.

6.8. **OWNERSHIP OF OPEN SPACE**. All open space shall be permanently protected and held in fee simple interest by a qualified conservation organization as defined in The Georgia Uniform Conservation Easement Act, O.C.G.A. 44-10-1 et seq., or a homeowners association established in accordance with the Georgia Property Owners Association Act, O.C.G.A. 44-3-220 et seq., or a land trust, or Fulton County. If accepted by the County, the property must be in accordance with the provisions herein.

6.8.1. **OWNERSHIP OF OPEN SPACE BY A HOMEOWNERS ASSOCIATION**. Open space that is owned by a homeowners association is subject to the following:

a. Prior to the approval of the final plat, the developer of a conservation subdivision shall submit to the Director a description of the homeowners association, including by-laws, and methods for maintaining the open space.

b. Membership of each lot owner in the conservation subdivision shall be mandatory.

c. The homeowners association shall be responsible for maintenance, insurance, and taxes on the open space.

d. The homeowners association shall not be dissolved before providing the appropriate documentation to transfer conservation easements.

e. Any transfer of conservation easements is subject to the approval of the Director.

6.9 **CONSERVATION SUBDIVISION DENSITY.** The maximum number of lots shall be based upon 80% of the net buildable area's density allowed by zoning, with net buildable area defined as the total acreage minus primary conservation areas. Density bonuses are allowed in accordance with section 6.10.

6.10. **CONSERVATION SUBDIVISION DENSITY BONUSES.** The number of lots in a Conservation Subdivision may exceed the number of lots as specified in section 6.9 with one or more of the following bonus options:

a. A density increase is permitted when more than 40% of the total acreage of the project is designated as permanent, protected open space. For each additional whole acre, greater than 40 percent, additional lots or units may be developed as follows:

Current Zoning	Additional Lots Allowed Per Development for each acre of protected open space greater than 40%
AG-1	1
R-1	0.5
R-2	1
R-2A	1

R-3 2
R-3A 2
R-4 4
R-4A 3
R-5 5
R-5A 10

b. In lieu of providing additional open space over 40% in the development, the applicant may purchase, in fee simple, additional land in unincorporated Fulton County within one (1) mile of the development comprised of primary and/or secondary conservation areas. The density increase within the development shall be based on the same criteria as in Sec. 6.10.a. As with conservation areas within a development, protected open space, purchased in fee simple outside a development, shall also be protected in perpetuity from further development or unauthorized use by a conservation easement held by Fulton County or other conservation organization, land trust, or homeowners association.

c. Dedication of land for a public use, excluding roads and utility easements, shall entitle an owner to an additional unit per acre of dedicated land as detailed in Section 6.10.a. Prior to the issuance of a Land Disturbance Permit, dedications of land for public use shall be approved by the Fulton County Board of Commissioners or the Fulton County Board of Education if for school purposes, based upon recommendations of existing and future recreation and park plans, comprehensive plans, school board plans and the County's Capital Improvements Program.

d. At no time shall the number of lots exceed 95% of the net buildable area's density allowed by zoning.

6.11. **LOT REQUIREMENTS**. The minimum lot size in any project shall be 4,000 square feet. The total number of lots may not exceed the number of lots that could otherwise be developed under the existing zoning except with the allowable density bonuses described herein.

6.12. **MINIMUM LOT FRONTAGE**. The minimum lot frontage on a right-of-way shall be 20 feet.

6.13. **SETBACKS AND BUILDING SEPARATION REQUIREMENTS**. Setbacks and building separations are subject to the provisions of the Standard Building Code.

6.14. **BUFFER REQUIREMENTS.** A minimum 50-foot wide natural buffer, undisturbed except for approved access and utility crossings and replantings where sparsely vegetated, plus a 10-foot improvement setback, shall be provided along all property lines adjacent to AG-1 zoned properties, residentially zoned or used properties, and existing roads, or as may be approved by the Director.

6.15. **STREET STANDARDS**. Conservation subdivision streets shall be designed based on the following standards:

a. Streets should follow existing contours with a minimum of cut and fill and shall be designed for interparcel access.

b. The maximum length for an interior block is 600 linear feet with the total perimeter length not to exceed 1,680 linear feet. The total area of an interior block shall not exceed 3.30 acres.

c. All newly created lots should derive access from internal subdivision streets.

6.16. **ZONING MODIFICATION REQUIREMENTS**. Proposed conservation subdivisions for properties where zoning is conditional shall require an approved modification to the site plan and other conditions pertinent to use, number of lots and density, as applicable, prior to the approval of a final plat.

6.17. **TAX ASSESSMENT OF OPEN SPACE**. Once a legal instrument for permanent protection has been placed upon the open space, the Fulton County Tax Assessor shall reassess the value of the open space.

Comprehensive Storm Water Ordinance, Division 6, Chapter 26

DIVISION 6. PROHIBITIONS AND ILLICIT CONNECTIONS

Sec. 26-316. Prohibitions.

(a) It is unlawful for any person, company, corporation, etc., to throw, drain, run, or otherwise discharge to any component of the county's stormwater system, including streets, highways, rights-of-way; or to cause, permit, or suffer to be thrown, drain, run, or allow to seep or otherwise discharge into such system, any organic or inorganic matter that shall cause or tend to cause pollution to such waters, as provided for in this article.

(b) The director of public works may exempt the following from the prohibition provision above:

(1) Water line flushing performed by a government agency, diverted stream flows, rising groundwaters, and unpolluted groundwater infiltration.

(2) Unpolluted pumped groundwater.

(3) Discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, and water from street washing.

(4) Discharges or flows from firefighting.

(5) Other unpolluted water.

(c) In the event of an accidental discharge or an unavoidable loss to the municipal/county separate storm sewer system of any material of substance other than stormwater runoff, the person responsible shall inform the department of public works within five days of the nature, quantity, and time of the occurrence of the discharge. The person responsible shall take immediate steps to minimize the effects of the discharge on the municipal/county system and receiving streams. The person shall also take immediate steps to ensure no recurrence of the discharge.

(95-0093, art. VI, § A, 3-15-95)

Sec. 26-317. Illicit connections.

(a) It is unlawful for any person, company, corporation, etc., to connect any pipe, open channel, or any other conveyance, structure or system to the county's stormwater conveyance system that discharges anything except stormwater runoff and that are not identified on the stormwater management plan.

(b) Improper connections in violation of this article must be disconnected and redirected, if necessary, to the Fulton County Sanitary System or other acceptable outfall upon approval by the director of public works.

(95-0093, art. VI, § B, 3-15-95)

Sec. 26-318. Cooperation with the county.

(a) It shall be the responsibility of any person, firm, company, corporation, etc., to cooperate with the county in the search for illicit connections or prohibitive activities as described in this division in order for the county to comply with the conditions of its NPDES permit.

(b) Any person, firm, company, corporation, etc., shall answer the questions of the county and share information on business activities as they relate to this article, except those records and activities that are confidential and proprietary. If necessary, the county may obtain access to confidential and proprietary records and activities through a court order, subject to the following conditions:

(1) The county shall have access to records and information for the purpose of examination for compliance with the conditions of this article only during normal business hours;

(2) The county shall not have the right to make copies, excerpts, or transcripts of such records and activities without receiving prior written consent; and

(3) The county shall not disclose or make available to third parties any such records or information obtained unless required to do so by a separate court order.

(c) Failure to comply with the conditions of this division shall be considered a violation and subject to the penalties found in section 26-113.

(95-0093, art. VI, § C, 3-15-95)

Secs. 26-319--26-350. Reserved.

Fulton County Codes of Law, Article XVI – Litter Control

ARTICLE XVI. LITTER CONTROL

Sec. 34-726. Enactment authority.
The Board of Commissioners of Fulton County, Georgia under the authority of Article 9, Section 2, Paragraph 1 of the Constitution of the State of Georgia (1983), as amended and O.C.G.A. Title 36-1-20, hereby ordains and enacts into law this article.
(Ord. No. 98-0379, 3-4-98)
State law references: Littering, O.C.G.A. § 16-7-40 et seq.

Sec. 34-727. Purpose.
The governing authority is authorized to adopt ordinances for the governing and policing of unincorporated areas of the county for the purpose of preserving and protecting the public health, safety and welfare. Specifically, the governing authority may provide for the regulation and control of litter (O.C.G.A. § 36-1-20). The board of commissioners hereby enacts the following provisions in an effort to regulate and control litter in the unincorporated areas of Fulton County for the purpose of protecting and preserving the public health, safety, and welfare of the citizens, and to curb thereby the desecration of the beauty of Fulton County caused by persons who litter.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-728. Title.
This article shall be known and may be cited as the "Fulton County Litter Control Ordinance", and as Article XVI of Chapter 34, Health and Sanitation.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-729. Scope of article.
The provisions of this article shall apply only to unincorporated Fulton County or any area within the jurisdiction of the governing authority of Fulton County.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-730. Definitions.
As used in this article, unless the context clearly requires otherwise, the following words or phrases shall have the following meanings:
Bulk waste shall mean dry type wastes such as discarded tires, white goods, furniture, appliances, land clearing material, oversize tree trunks and/or limbs, and/or similar material.
Dispose means to discharge, deposit, inject, burn, dump, place or get rid of any liquid, trash, litter, or garbage into, or on any land, or water so that such liquid, trash, litter, or garbage, or any constituent thereof, may enter into and upon the environment or transfer to the control of another person in a manner inconsistent with this article or any other state or local law, regulation, or ordinance.
Garbage shall mean all household or domestic waste, including waste from the preparation and cooking of food, vegetable, fruit, and meat scraps, ashes, cans and bottles, paper, floor sweepings, cardboard, and other such material to be disposed of from residents, churches, schools, office buildings, business establishments and similar places.

Governing authority means Fulton County ("County"), its board of commissioners, and where delegated [designated] by the board of commissioners, the directors of the Fulton County Department of Public Works, Department of the Environment and Community Development, and Department of Health.
Litter means all discarded sand, liquid, bulk waste, gravel, slag, brickbats, rubbish, waste material, tin cans, refuse, garbage, trash, debris, dead animals or discarded materials of every kind and description.
Litter receptacle shall mean a receptacle designed and constructed to receive, collect, store and contain litter in a lawful, convenient and spill-proof manner.
Owner shall mean any person, firm or corporation owning, leasing, renting, occupying, or managing any premises in unincorporated Fulton County or any area within the jurisdiction of the governing authority.
Person shall mean any individual, trust, firm, association, joint-stock company, corporation (including a government corporation), partnership, organization, municipality, commission, or political subdivision, or any agency, board, department, or bureau of this state or any other state or of the federal government.
Public or *private property* means the right-of-way of any road or highway; any body of water or watercourse or the shores or beaches thereof; any park, playground, building, refuge or conservation or recreation area, and residential or farm properties, timberland or forest.
Refuse means garbage, rubbish, or commercial solid waste.
Rubbish means discarded waste paper, cartons, boxes, wood, tree branches, yard trimmings, furniture, appliances, metals, cans, glass crockery, dunnage and/or similar materials.
Trash means any combustible and noncombustible nonputrescible solid waste, of a size and form which can be easily deposited in, and removed--by Fulton County personnel or lawfully removed by any other entity--from containers provided by the county or any other entity for the disposal and collection of solid waste from residences, and which includes paper, cardboard, small metal items or containers and packaging materials, and similar items normally accumulated in the care and maintenance of residential or commercial property.
Vegetative overgrowth means any and all uncultivated vegetative growth exceeding a height of 12 inches, as measured vertically from the surface of the ground, and covering a portion of any lot, tract or parcel of land which is not occupied by buildings, other structures or trees, but not including riparian vegetation located on any water frontage area.
Weeds means all rank, vegetative growth, including kudzu, poison ivy, plants of obnoxious odors, weeds and grasses causing hay fever or those which serve as a breeding place for mosquitoes and other unhealthy or undesirable insects or as a refuge for snakes, rats or other rodents or as a hiding place for filth, litter or trash or that create a fire or traffic hazard or provide a hiding place for persons.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-731. Dumping, depositing, etc., litter on public property or waters.
(a) It shall be unlawful for any person or persons to dispose, dump, deposit, throw, or leave or to cause or permit the dumping, depositing, placing, throwing, or leaving of litter

on any public property or waters within unincorporated Fulton County or other areas within the jurisdiction of the governing authority, unless:

(1) The property is designated by Fulton County or the state or by any of its agencies or political subdivisions or municipalities for the disposal of litter and the person is authorized by the proper public authority to use such property; or

(2) The litter is placed into a litter receptacle or container lawfully installed on such property.

(3) The person is the owner or tenant in lawful possession of such property and the litter is disposed of in a manner consistent with the public welfare and in accordance with this article.

(b) *Restrictions on permission.* It shall be unlawful for the owner of any public property within unincorporated Fulton County or the owner's agent to intentionally and expressly give permission to dump or otherwise place on that property, any garbage, trash or other materials or substances which may catch and retain rain water.

(c) Any person who violates this section shall be punished in accordance with section 34-742 of this article.

(Ord. No. 98-0379, 3-4-98)

State law references: Littering, O.C.G.A. § 16-7-40 et seq.; violation of county ordinances, O.C.G.A. § 36-1-20.

Sec. 34-732. Deposit of refuse on streets and sidewalks.

(a) No person shall deposit in any street or other public place in unincorporated Fulton County or other areas within the jurisdiction of the governing authority, any refuse of any type; provided, however, that earth and rubbish or building debris caused by construction may be allowed to lie in those places subject to law. It shall be lawful to place debris, such as twigs, small branches and similar matter, in the parkway between the sidewalk and the curbstone, provided the debris does not extend over the sidewalk so as to block pedestrian traffic or fall into or extend over the street so as to block pedestrian traffic or fall into or extend over the street so as to hinder vehicular traffic or make it difficult to use any motor-driven, roadway maintenance equipment.

(b) All persons engaged in the business of trimming or removing trees, shrubbery or similar growth shall remove from the property, where the work is being done, all sawdust, branches, stumps and all portions of the byproduct of the trimming or removal service and dispose of such materials in a lawful manner.

(c) All persons engaged in the business of landscaping, nurseries or yard maintenance and who shall contract with a property owner, the owner's agent or the occupant to improve the property, trim or remove shrubbery and trees or maintain yards shall remove from the property all rubbish, including rocks, dirt, glass, trimmings and other byproducts of that service and dispose of such materials in a lawful manner.

(Ord. No. 98-0379, 3-4-98)

Sec. 34-733. Throwing trash upon streets, sidewalks or public places.

It shall be unlawful for any person to throw hulls, peelings, trash or other litter upon the streets, sidewalks or upon the floors of churches, public halls, theaters or other public places.

(Ord. No. 98-0379, 3-4-98)

Sec. 34-734. Placing nails, tacks, glass on streets or sidewalks.
It shall be unlawful for any person to place on the street or sidewalks any loose nails, tacks, spikes, broken glass or any similar substance or thing which would be likely to injure the feet of persons or animals or cut or puncture tires of vehicles.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-735. Cleanliness of sidewalks.
It shall be the duty of all occupants and owners of improved property and owners of vacant property, in front of which the sidewalk area is paved or unpaved, to keep that area clean and to do such sweeping and scraping and cutting of grass or weeds and watering, pruning and maintaining planted material and planters as may be necessary to remove clay, dirt and trash therefrom and to render it passable, comfortable and sightly.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-736. Depositing materials on streets.
(a) *Private construction activity.* No person shall conduct, authorize, or carry out any construction activity on private property so as to cause any debris, dirt, sediment, soil, trash, building material, and other physical materials originating from the private property or construction activity, to deposit upon the surface of a street or highway and create an unsightly condition or a condition which may be injurious or hazardous to any person, animal or vehicle upon or using the street or highway.
(b) *Washing material onto street or highway.* No person shall permit any wood, dirt, mud, sand, rock, rubbish or any other material to wash from such person's property or the property of any person upon which such person is performing repairs, improvements, excavations or grading onto any street or highway within unincorporated Fulton County and/or areas within the jurisdiction of the governing authority of Fulton County so as to cause or permit this material to deposit upon the surface of the street or highway and create an unsightly condition or a condition which may be injurious or hazardous to any person, animal or vehicle upon or using the street or highway.
(c) *Removal required.* Any person who throws, drops or washes or permits to be thrown, dropped or washed onto the street or highway any of the items named or referred to in subsections (a) and (b) of this section shall immediately remove them or cause them to be removed.
(d) *Application to wrecked, damaged vehicles.* Any person removing a wrecked or damaged vehicle from a street or highway shall remove any glass, metal or other material dropped from the damaged vehicle upon the street or highway which may be hazardous to any person, animal or vehicle upon or using the street or highway.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-737. Assessments against private property of the cost of reopening, repairing, or cleaning of street and roads necessitated by construction activity; creation and enforcement of lien.
(a) The governing authority is empowered to assess against any property the cost of reopening or repairing any public way, street, road, right-of-way, or highway, or the cost of cleaning up from any public way, street, road, right-of-way, or highway any debris, dirt, sediment, soil, trash, building material, and other physical materials originating on

such property, as a result of any private construction activity carried on by any developer, contractor, subcontractor, or owner of such property.
(b) Any assessment authorized under subsection (a) of this section, as well as the interest thereon and the expense of collection, shall be a lien against the property so assessed coequal with the lien of other taxes and shall be enforced in the same manner as are state and county ad valorem property taxes by issuance of a fi. Fa. and levy sale as set forth in Title 48, the "Georgia Public Revenue Code."
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 36-1-18; Ga. L. 1981, p. 3259, §§ 1, 2)

Sec. 34-738. Transporting garbage, trash and other waste material in open vehicles.
It shall be unlawful for any person to operate or cause to be operated upon any public street in unincorporated Fulton County or any area under the jurisdiction of the governing authority, any open truck, wagon or other vehicle in and upon which garbage, trash, manure, waste material or other debris is transported, unless the vehicle shall be equipped with a cover that will prevent the garbage, trash, waste material and other debris from falling from the truck onto any street in unincorporated Fulton County and/or areas within the jurisdiction of the governing authority.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-739. Discharging water or other liquids.
No person shall throw or discharge from any lot or building any water, fluid or liquid substance so as to injuriously affect the surface of the street or sidewalk or so to make it unsafe for travel.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-740. Newspapers distributed without charge.
Newspapers may be distributed without charge to private residential premises so long as upon any request from a person to be removed from the company's distribution list, the name is removed. Any person who distributes a newspaper or any entity that causes a newspaper to be distributed after having received notice from a person to be removed from the distribution list shall be in violation of this article.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-741. Spills from vehicles.
(a) *Grading contractors.* A vehicle used by a contractor carrying or grading and hauling dirt in unincorporated Fulton County or any area within the jurisdiction of the governing authority shall be equipped with a cover that prevents dirt from spilling and/or blowing out of the vehicle carrying such dirt. When the contractor shall have finished grading, the contractor shall then clean all dirt off the streets as may have been dropped by the contractor's vehicles. If the work of a contractor has rendered the streets muddy or dusty, all those streets shall be left in as good condition as they were at the time of commencement of the work by the contractor. The cleaning described in this subsection is to be done to the satisfaction of the director of public works or that official's designee.
(b) *Concrete, gravel, sand or asphalt haulers.* Any person engaged in hauling ready-mixed concrete, gravel, sand or asphalt within the jurisdiction of the governing authority of Fulton County shall so fill any vehicle carrying such ready-mixed concrete, gravel,

sand or asphalt so as to not allow spillage from the vehicle on streets or sidewalks within unincorporated Fulton County and/or areas within the jurisdiction of the governing authority. Vehicles hauling sand or gravel shall be provided with suitable covers to prevent materials from blowing from the vehicles. Any person responsible for any spillage from hauling vehicles shall take immediate action to remove the spillage from the streets or sidewalks.
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 36-1-18.

Sec. 34-742. Penalties for littering public property or waters.
Any person who litters public property or waters shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished as follows:
(1) If litter is ten pounds in weight or less or 15 cubic feet in volume or less, by a fine not more than $500.00 or no more than 30 days in jail or both.
(2) If litter is in excess of ten pounds in weight or 15 cubic feet in volume, shall be fined $1,000.00 or no more than 60 days in jail or both for each occurrence; and each occurrence shall be deemed a separate offense.
(3) In addition to the fines set out in subsections (1) and (2) above, the violator shall reimburse Fulton County for the reasonable cost of removing the litter when the litter is removed by Fulton County or its agents; and
(4) In the sound discretion of a court in which a conviction is obtained, the violator may be directed to pick up and remove from any public street or highway or public right-of-way for a distance not to exceed one mile any litter the person has deposited and any and all litter deposited thereon by anyone else; and
(5) In the sound discretion of the judge of a court in which a conviction is obtained, the violator may be directed to pick up and remove from any public property, right-of-way, or such property, upon which it can be established that the violator has deposited litter, any and all litter deposited thereon by anyone; and/or repair or restore property damaged by such littering.
(6) The court may publish the names of persons convicted of a violation under this section.
(Ord. No. 98-0379, 3-4-98)
Cross references: Duty of owner to clean property, § 26-3.
State law references: Chattahoochee River Basin Act, O.C.G.A. § 12-5-400; Metropolitan River Protection Act, O.C.G.A. § 12-5-440; violations of county ordinances, O.C.G.A. § 15-10-60; maximum penalty for violating county ordinances, O.C.G.A. § 36-1-20.

Sec. 34-743. Maintenance of property.
(a) *Required.* Every person owning or occupying public or private property in unincorporated Fulton County shall maintain the property free of any condition which may render the premises or property to be unhealthy, unsanitary, unsightly or unaesthetic to the occupants thereof, the neighborhood or the community at large.
(b) *Conditions in violation.* Because they are deemed to be conducive to breeding or harboring of harmful germs or to the breeding or harboring of insects, snakes, rodents, lizards or similar or undesirable living pests and carriers of harmful germs or poisons or to the harboring of undesirable persons or illicit activities and are in violation of the

general public health, safety, welfare and well-being, the existence of any one of the following conditions on property within unincorporated Fulton County shall be a violation of this section and this article:
(1) Uncontainerized garbage or uncovered garbage containers of all kinds and types.
(2) Trapped litter or any other improperly containerized solid waste.
(3) Exterior storage of junk or other unsightly materials.
(4) The existence of weeds and vegetative overgrowth.
(5) The existence, storage or accumulation of garbage, hazardous, putrescible solid waste or rubbish.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-744. Inspection of property.
(a) *Inspection of premises/right of entry.* The director of the Fulton County Department of Public Works or any duly authorized agent of the department of public works, or any department of Fulton County as directed or authorized by the county manager, may enter on and inspect any and all public and private property in unincorporated Fulton County, at any reasonable time after the presentation of proper credentials, to determine by inspection that those properties are or are not free of any condition which may be in violation of this article. For the purpose of this duty, employees of the department of public works, the department of environment and community development, including, but not limited to code enforcement officers, or subsequent classification titles performing the same duties, or employees of any department as authorized by the county manager, or members of the public duly appointed by the governing authority of Fulton County to perform litter enforcement duties, are clothed with police powers and shall be designated as special officers of Fulton County. Any act of obstructing an inspection hereunder shall constitute a violation of this article and subject the interferer to penalties authorized by section 34-742 or section 34-746 depending on the nature of the property.
(b) *Notice of unsanitary conditions.* Upon the determination--through inspection by the director of the Fulton County Department of Public Works or his agent or designee, or any duly authorized agent or department of Fulton County as directed or authorized by the county manager or the governing authority--that any property within unincorporated Fulton County is in violation of this article, the director of public works or his agent or designee, or any duly authorized agent or department of Fulton County as directed or authorized by the county manager or the governing authority, shall give written notice to the owner or agent of the owner of the property of the condition found. Such notice shall set forth the condition of the property, the specific violation of this article and the remedial action to be taken. The notice to the owner or agent shall include a time certain in which the violation is to be abated, but not more than ten days from date of receipt of the notice by the owner or agent. All notices shall be sent by personal service or sent by registered or certified mail, return receipt requested, to the last known address as listed in the official tax register of the county or records of the secretary of state. Upon failure of the owner or agent to abate the violation cited within the time set forth in the notice, the property owner or agent shall be held accountable for violating this article.
(c) *Citations issued.* Nothing in this section is intended to prevent the immediate issuance of a written citation pursuant to section 34-748 of this article for violation of this article.
(Ord. No. 98-0379, 3-4-98)

Cross references: Nuisance abatement authorized, §§ 26-3, 34-363.

Sec. 34-745. Throwing litter upon private property and waters.
Prohibited. It shall be unlawful for any person to throw hulls, peelings, trash, bottles, cans or other litter upon the private property or waters of another within unincorporated Fulton County.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-746. Penalties for littering private property or waters.
Penalties. Any person who litters private property or waters in unincorporated Fulton County shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished as follows:
(1) Where the volume of trash thrown is less than 30 gallons, the violation of this section shall subject the violator to a fine not more than $500.00 or no more than 30 days in jail or both. Each day a violation continues shall constitute a separate violation.
(2) Where the volume of trash thrown exceeds 30 gallons, the violation of this section shall subject the violator to mandatory penalties as follows:
a. *First offense.* A fine of $1,000.00.
b. *Second offense.* A fine of $1,000.00 and confinement in jail for a period not to exceed 30 days.
c. *Third or more offense.* A fine of $1,000.00 and confinement in jail for a period not to exceed 60 days.
d. Each day a violation continues shall constitute a separate violation.
(3) In addition to the penalties in this subsection, the following penalties may be imposed:
a. *First offense.* The violator may be directed to pick up and remove from any public street or highway or any public right-of-way for a distance not to exceed one-half mile any and all litter deposited thereon by anyone prior to the date of execution of sentence.
b. *Second offense.* The violator may be directed to pick up and remove from any public street or highway or any public right-of-way for a distance not to exceed one mile any and all litter deposited thereon by anyone prior to the date of execution of sentence.
c. *Third or more offense.* The violator may be directed to pick up and remove from any public park, private right-of-way or, with the prior permission of the legal owner or tenant in lawful possession of such property, any private property, upon which it can be established by competent evidence that the violator has deposited or dumped litter, any and all litter deposited or dumped thereon by anyone prior to the date of the execution of sentence.
d. *Publication of names.* The court may publish the names of persons convicted of a violation under this section.
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 16-7-43; O.C.G.A. § 36-1-20.

Sec. 34-747. Prima facie evidence; rebuttable presumptions.
(a) Whenever litter is thrown, deposited, dropped, or dumped from any motor vehicle, boat, airplane, or other conveyance in violation of this article, it shall be prima facie evidence that the operator of the conveyance has violated this article.

(b) Whenever any litter is dumped, deposited, thrown, or left on public or private property in violation of this article is discovered to contain any article or articles, including but not limited to letters, bills, publications, or other writings which display the name of a person thereon in such a manner as to indicate that the article belongs or belonged to such person, it shall be a rebuttable presumption that such person has violated this article.
(Ord. No. 98-0379, 3-4-98)

Sec. 34-748. Enforcement.
(a) Unless otherwise specifically provided by resolution of the Fulton County Board of Commissioners, the enforcement of this article shall be within the jurisdiction of the county's enforcement personnel, including the director of the department of public works or his or her designees or employees and all law and code enforcement personnel who shall have such powers as are reasonably necessary to enforce and give effect to this article. Specifically, but not by way of limitation, any violation of this article may be tried upon citations issued by enforcement personnel pursuant to O.C.G.A. § 15-10-63 and any successor statute. Persons designated by the director of public works or as otherwise designated by the county manager or the governing authority, are hereby authorized to issue citations or summons or both, charging violations under this article, returnable to Magistrate Court, or any court having jurisdiction of a commitment court throughout the entire county, for a hearing.
(b) For purposes of enforcing the provisions of this article, any Fulton County Magistrate Court, including the Environmental Court, shall be entitled to take such action to ensure compliance, and the person convicted shall reimburse Fulton County for any cost or expense associated with such compliance efforts and Fulton County shall be entitled to place a lien on the property or require a bond from the person to secure payment and reimbursement for these expenses.
(c) The provisions of [this] article shall be enforced by the Fulton County Department of Public Works with assistance as needed from the Fulton County Police Department, the Fulton County Department of Health, and the department of the environment and community development and/or as otherwise designated by the county manager or the governing authority.
(Ord. No. 98-0379, 3-4-98)
State law references: O.C.G.A. § 36-1-17; O.C.G.A. § 36-1-18.
Secs. 34-749--34-800. Reserved.

ARTICLE II. - EROSION, SEDIMENTATION AND POLLUTION CONTROL[3]

Footnotes:

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Editor's note—Res. No. 05-0690, adopted June 15, 2005, amended art. II in its entirety to read as herein set out. Formerly, said article pertained to similar subject matter. See the Code Comparative Table for a detailed analysis of amendment.

Sec. 26-35. - Authority and title of article.

This article is adopted by the Fulton County Board of Commissioners pursuant to the authority and mandate of the Georgia Erosion and Sedimentation Act of 1975 (O.C.G.A. § 12-7-1 et seq.), as amended. [A memorandum of agreement authorizes Fulton County as a local issuing authority. As a local issuing authority, Fulton County is certified to provide and maintain an erosion control program which includes, but is not limited to, development plan review, permitting and erosion control enforcement.] This article will be known as "The Fulton County Soil Erosion, Sedimentation and Pollution Control Ordinance of 2010", and repeals the Fulton County Soil Erosion and Sedimentation Control Ordinance of 2005 and any other ordinances or regulations in conflict herewith.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-36. - Intent.

It is the intent of this article to establish soil erosion, sedimentation, and pollution control minimum requirements, standards, and enforcement procedures for land disturbance activities in order to conserve and protect the environment, public health, and the general welfare of the citizens of unincorporated Fulton County.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-37. - Definitions.

The following definitions shall apply in the interpretation and enforcement of this article, unless otherwise specifically stated:

Best management practices (BMPs). These include sound conservation minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control" published by the commission as of January of the year in which the land-disturbing activity was permitted.

Board. The Georgia Board of Natural Resources.

Board of zoning appeals. Board appointed by the Fulton County Board of Commissioners which hears appeals of stop work orders.

Buffer. The area of land immediately adjacent to the banks of state waters in its natural state of vegetation, which facilitates the protection of water quality and aquatic habitat.

Commission. The State of Georgia Soil and Water Conservation Commission. (GSWCC)

CPESC. Certified professional in erosion and sediment control with certification by Certified Profession in Erosion and Sediment Control Inc., a Corporation Registered in North Carolina, which is also referred to as CPESC or CPESC, Inc.

Cut. A portion of land surface or area from which earth has been removed or will be removed by excavation; the depth below the original ground surface to the excavated surface, also known as excavation.

Department. Fulton County Department of Environment and Community Development.

Design professional. A professional licensed by the State of Georgia in the field of: engineering, architecture, landscape architecture, forestry, geology, or land surveying; or a person that is a certified professional in erosion and sediment control (CPESC) with a current certification by Certified Professional in Erosion and Sediment Control, Inc.

Development. The alteration of property for any purpose involving building, subdividing, and/or the preparation of land for any of the above purposes. Development includes, but is not limited to, providing utilities, access, parking, storm water management, sewage disposal systems, and/or construction of a structure.

Development sequence. The sequence of activities to be completed, in order, during the development of a land disturbance project as per approved construction plans.

Director. The director (or his/her designee(s)) of the Fulton County Department of Environment and Community Development.

Director, DPW. The director of the Fulton County Department of Public Works or his/her designee.

Director, EPD. The director of the Environmental Protection Division of the Georgia Department of Natural Resources.

Division. The Environmental Protection Division of the Department of Natural Resources.

District. The Fulton County Soil and Water Conservation District.

Drainage structure. A device composed of a virtually non-erodible material such as concrete, steel, plastic, or other such material that conveys water from one place to another by intercepting the flow and carrying it to a release point for stormwater management, drainage control, or flood control purposes.

EPD. The Environmental Protection Division of the Georgia Department of Natural Resources.

Erosion. The process by which land surface is worn away by the action of wind, water, ice, or gravity.

Erosion and Sedimentation Control Manual. A field manual produced by the Georgia Soil and Water Conservation Commission that illustrates vegetative and structural best management practices (BMPs), and their use for land-disturbing activities.

Erosion, sediment, and pollution control plan. A plan required by the Erosion and Sedimentation Act, O.C.G.A. ch. 12-7, that includes, as a minimum protection at least as stringent as the state general permit, best management practices, and requirements in section 26-39(c).

Fill. A portion of land surface to which soil or other solid material has been added; the depth above the original ground surface or elevation.

Final Stabilization. All soil disturbing activities at the site have been completed, and that for unpaved areas and areas not covered by permanent structures and areas located outside the waste disposal limits of a landfill cell that has been certified by EPD for waste disposal, 100 percent of the soil surface is uniformly covered in permanent vegetation with a density of 70 percent or greater, or equivalent permanent stabilization measures (such as the use of rip rap, gabions, permanent mulches or geotextiles) have been used. Permanent vegetation shall consist of planted trees, shrubs, perennial vines: a crop of perennial vegetation appropriate for the time of year and region: or a crop of annual vegetation and a seeding of target crop perennials appropriate for the region. Final stabilization applies to each phase of construction.

Finished grade. The final elevation and contour of the ground after cutting or filling and conforming to the proposed design.

Grading. Altering the shape of ground surfaces. This includes stripping, cutting, filling, stockpiling, and shaping or any combination thereof, and shall include the land in its cut or filled condition.

Ground elevation. The elevation of the ground surface as measured from sea level prior to cutting or filling.

Land disturbing activity. Any activity which may result in soil erosion from water or wind and the movement of sediments into state waters or onto lands within the state, including, but not limited to, clearing, dredging, grading, excavating, transporting, and filling of land but not including agricultural practices as described in subsection 26-38(5).

Larger common plan of development or sale. A contiguous area where multiple separate and distinct construction activities are occurring under one plan of development or sale. For the purpose of this paragraph, "plan" means an announcement; piece of documentation such as a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, or computer design; or physical demarcation such as boundary signs, lot stakes, or survey markings, indicating that construction activities may occur on a specific plot.

Local issuing authority. The governing authority of any county or municipality which is certified pursuant to O.C.G.A. § 12-7-8(a).

Metropolitan River Protection Act (MRPA). A state law referenced as O.C.G.A. § 12-5-440 et seq., which addresses environmental and developmental matters in certain metropolitan river corridors and their drainage basins.

Natural ground surface. Original site topography/ground surface prior to land disturbance activities.

Nephelometric turbidity units (NTU). Numerical units of measure based upon photometric analytical techniques for measuring the light scattered by finely divided particles of a substance in suspension. This technique is used to estimate the extent of turbidity in water in which colloidally dispersed or suspended particles are present.

Notice to comply. Enforcement action based on noncompliance through failure to either properly install or maintain BMPs, where sediments remain within the boundaries of the property. This enforcement action provides the violator five days to achieve compliance.

NOI. A notice of intent form provided by EPD for coverage under the state general permit.

NOT. A notice of termination form provided by EPD to terminate coverage under the state general permit.

Official notice. A posting of a notice to comply or a stop work order on a property that is non-compliant or in violation.

Operator. The party or parties that have: (A) operational control of construction project plans and specifications, including the ability to make modifications to those plans and specifications; or (B) day-to-day operational control of those activities that there are necessary to ensure compliance with an erosion, sedimentation and pollution control plan for the site or other permit conditions, such as a person authorized to direct workers at a site to carry out activities required by the erosion, sedimentation and pollution control plan or to comply with other permit conditions.

100-year flood plain. Land in the flood plain subject to a one percent or greater statistical occurrence probability of flooding in any given year.

Outfall. The location where storm water is discernible, confined and discrete conveyance leaves a facility or site or, if there is a receiving water on site, becomes a point source discharging into the receiving water.

Permit. The authorization necessary to conduct a land disturbing activity under the provisions of this article.

Person. Any individual, owner, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, state agency, municipality, or other political subdivision of this state, any interstate body, or any other legal entity.

Phase or phased. Sub-parts or segments of construction projects where the sub-part or segment is constructed and stabilized prior to completing construction activities on the entire construction site.

Project. The entire proposed development project, regardless of the size of the area of land to be disturbed.

Properly designed. Designed in accordance with the design requirements and specifications contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual published by the Georgia Soil and Water

Commission as of January 1 of the year in which the land-disturbing activity was permitted and amendments to the manual as approved by the commission up until the date of NOI submittal).

Reinspection fee. A fee assessed to the developer/owner/operator or responsible party for reinspecting the project if requested by the developer/owner/operator or responsible party prior to the end of the compliance period, provided that upon that reinspection the project remains out of compliance.

Roadway drainage structure. A device such as a bridge, catch basin, culvert, or ditch, composed of a virtually non-erodible material such as concrete, steel, plastic, or other such material that conveys water under a roadway by intercepting the flow on one side of a traveled way (public or private) consisting of one or more defined lanes, with or without shoulder areas, and carrying water to a release point on the other side.

Sediment. Solid material, both organic and inorganic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, ice, or gravity as a product of erosion.

Sedimentation. The process by which eroded material is transported and deposited by the action of water, wind, ice, or gravity.

Soil and water conservation district approved plan. An erosion and sedimentation control plan approved in writing by the Fulton County Soil and Water Conservation District.

Stabilization. The process of establishing an enduring soil cover by the installation of temporary or permanent structures or vegetation for the purpose of reducing to a minimum the erosion process and the resultant transport of sediment by wind, water, ice, or gravity.

State general permit. The National Pollution Discharge Elimination System general permit or permits for storm-water runoff from construction activities as is now in effect or as may be amended or reissued in the future pursuant to the state's authority to implement the same through federal delegation under the Federal Water Pollution Control Act, as amended, 33 U.S.C. Section 1251, et seq., and O.C.G.A. § 12-5-30(f).

State waters. Any and all rivers, streams, creeks, branches, lakes, ditches, reservoirs, ponds, drainage systems, springs, wells, and other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the state which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

Stop work order. Enforcement action that ceases all work onsite or a portion of the site.

Structural erosion and sedimentation control measures. Practices for the stabilizing of erodible or sediment-producing areas by utilizing the mechanical properties of matter for the purpose of either changing the surface of the land or storing, regulating, or disposing of runoff to prevent sediment loss. Examples of structural erosion and sediment control measures are: riprap, sediment basins, dikes, level spreaders, waterways, outlets, diversions, grade stabilization structures, sediment traps, and sediment barriers, etc. Such measures as defined in the publication "Manual for Erosion and Sediment Control in Georgia."

Trout streams. All streams or portions of streams within the watershed as designated by the Wildlife Resources Division of the Georgia Department of Natural Resources under the provisions of the Georgia Water Quality Control Act, O.C.G.A. § 12-5-20, in the rules and regulations for Water Quality Control, Chapter 391-3 at www.gaepd.org. Streams designated as primary trout waters are defined as water supporting a self-sustaining population of rainbow, brown, or brook trout. Streams designated as secondary trout waters are those in which there is no evidence of natural trout reproduction, but are capable of supporting trout throughout the year. First order trout waters are streams into which no other streams flow except springs.

Turbidity. A measure of clarity of a water sample.

Underbrush. Any small shrubs, ground cover, or similar plants growing beneath the canopy of mature trees.

Vegetative erosion and sedimentation control measures. Measures for the stabilization of erodible or sediment-producing areas by covering the soil with:

(1) Permanent seeding, sprigging, or planting, producing long-term vegetative cover;

(2) Temporary seeding, producing short-term vegetative cover; or

(3) Sodding, covering areas with a turf of perennial sod-forming grass. Such practices can be found in the publication "Manual for Erosion and Sediment Control in Georgia".

Watercourse. Any natural or artificial watercourse, stream, river, creek, channel, ditch, canal, conduit, culvert, drain, waterway, gully, ravine, or wash in which water flows either continuously or intermittently and which has a definite channel, bed, and banks, and including any area adjacent thereto subject to inundation by reason of overflow or flood water.

Wetlands. Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Cross reference— Definitions generally, § 1-2.

State Law reference— Similar provisions, O.C.G.A. § 12-7-3.

Sec. 26-38. - Exemptions to article.

This article shall apply to any land disturbing activity undertaken by any person on any land except for the following:

(1) Surface mining, as the same is defined in O.C.G.A. § 12-4-72, "The Georgia Surface Mining Act of 1968".

(2) Granite quarrying and land clearing for such quarrying;

(3) Such minor land disturbing activities as home gardens and individual home landscaping, repairs, maintenance work, fences and other related activities which result in minor soil erosion;

(4) The construction of single-family residences when such construction disturbs less than one acre and is not a part of a larger common plan of development or sale with a planned disturbance of equal to or greater than one acre and not otherwise exempted under this section; provided, however, that construction of any such residence shall conform to the minimum requirements as set forth in O.C.G.A. § 12-7-6 and this paragraph. For single-family residence construction covered by provisions of this, there shall be a buffer zone between the residence and any state waters classified as trout streams pursuant to O.C.G.A. tit. 12, ch. 5, art. 2, the Georgia Water Quality Control Act. In any such buffer, no land-disturbing activity shall be constructed between the residence and the point where vegetation has been wrested by normal stream flow or wave action from the banks of the trout waters. For primary trout waters, the buffer zone shall be at least 50 horizontal feet, and no variance to a smaller buffer shall be granted. For secondary trout waters, the buffer zone shall be at least 50 horizontal feet, but the director, EPD may grant variances to no less than 25 feet. Regardless of whether a trout stream is primary or secondary, for first order trout waters, which are streams into which no other streams flow except for springs, the buffer shall be at least 25 horizontal feet, and no variance to smaller buffer shall be granted. The minimum requirements of section 26-39 of this article and the buffer zones provided by this section shall be enforced by the issuing authority;

(5) Agricultural operations as defined in O.C.G.A. § 1-3-3 to include raising, harvesting, or storing of products of the field or orchard; feeding, breeding, or managing livestock or poultry; producing or storing feed for use in the production of livestock including, but not limited to, cattle, calves, swine, hogs, goats, sheep, and rabbits or for use in the production of poultry, including but not limited to chicken, hens and turkeys; producing plants, trees, fowl, or animals; the production of aquaculture, horticultural, dairy, livestock, poultry, eggs, and apiarian products; and farm buildings and farm ponds;…..

(6) Forestry land management practices, including harvesting; provided, however, that when such exempt forestry practices cause or result in land-disturbing or other activities otherwise prohibited in a buffer, as established in paragraphs (14) and (15) of section 26-39(c), no other land-disturbing activities, except for normal forest management practices, shall be allowed on the entire property

upon which the forestry practices were conducted for a period of three years after completion of such forestry practices;

(7) Any project carried out under the technical supervision of the Natural Resource Conservation Service (NRCS) of the United States Department of Agriculture;

(8) Any project involving less than one acre of disturbed area; provided, however, that this exemption shall not apply to any land disturbing activity within a larger common plan of development or sale with a planned disturbance equal to or greater than one acre or within 200 feet of the bank of any state waters, and for purposes of this paragraph, "state waters" excludes channels and drainage ways which have water in them only during and immediately after rainfall events and intermittent streams which do not have water in them year round; provided, however, that any person responsible for a project which involves one acre or less, which involves land disturbing activity, and which is within 200 feet of any such excluded channel or drainage way, must prevent sediment from moving beyond the boundaries of the property on which such project is located and provided, further, that nothing herein shall prevent the local issuing authority from regulating any such project which is not specifically exempted by paragraphs (1), (2), (3), (4), (5), (6), (7), (9) or (10) of the section;

(9) Construction or maintenance projects, or both, undertaken or financed, in whole or in part, or both, by the Department of Transportation, the Georgia Highway Authority, or the State Road and Tollway Authority; or any road construction or maintenance project, or both, undertaken by any county or municipality; provided, however, that construction or maintenance projects of the department of transportation or state road and tollway authority which disturb one or more contiguous acres of land shall be subject to provisions of O.C.G.A. § 12-7-7.1; except where the department of transportation, the Georgia Highway Authority, or the state road and tollway authority is a secondary permittee for a project located within a larger common plan of development or sale under the state general permit, in which case a copy of a notice of intent under the state general permit shall be submitted to the local issuing authority, the local issuing authority shall enforce compliance with the minimum requirements set forth in O.C.G.A. § 12-7-6 as if a permit had been issued, and violations shall be subject to the same penalties as violations by permit holders;

(10) Any land disturbing activities conducted by any electric membership corporation or municipal electrical system or any public utility under the regulatory jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in O.C.G.A. § 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission, or distribution of power; except where an electric membership corporation or municipal electric system or any public utility under the regulatory jurisdiction of the public service commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in O.C.G.A. § 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission, or distribution of power is a secondary permittee for a project located within a larger common plan of development or sale under the state general permit, in which case the local issuing authority shall enforce compliance with the minimum requirements set forth in O.C.G.A. § 12-7-6 as if a permit had been issued and violations shall be subject to the same penalties as violations by permit holders; and

(11) Any public water system reservoir.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

State Law reference— Exemptions, O.C.G.A. § 12-7-17.

Sec. 26-39. - Minimum requirements.

(a) General provisions. Excessive soil erosion and resulting sedimentation can take place during land disturbing activities if requirements of the article and the NPDES general permit are not met. Therefore, plans for those land disturbing activities which are not exempted by this article shall contain provisions for application of soil erosion, sedimentation, and pollution control measures and practices. The provisions shall be incorporated into the erosion, sedimentation, and pollution control plans. Soil erosion, sedimentation, and pollution control measures and practices shall conform to the minimum requirements of subsection (b) and (c) of this section. The application of measures and practices shall apply to all features of the site, including street and utility installations, drainage facilities and other temporary and permanent improvements. Measures shall be installed to prevent or control erosion, sedimentation and pollution during all stages of any land disturbing activity in accordance with requirements of this article and the NPDES general permit.

(b) Minimum requirements/BMPs.

(1) Best management practices as set forth in subsections (b) and (c) of this section shall be required for all land disturbing activities. Proper design, installation, and maintenance of BMPs shall constitute a complete defense to any action by the director or to any other allegation of noncompliance with subsection (b)(2) of this section or any substantially similar terms contained in a permit for the discharge of stormwater issued pursuant to O.C.G.A. § 12-5-30(f) of the "Georgia Water Quality Control Act". As used in this subsection, the terms "proper design" and "properly designed" mean designed in accordance with the hydraulic design specifications contained in the "Manual for Erosion and Sediment Control in Georgia" specified in O.C.G.A. § 12-7-6(b).

(2) A discharge of stormwater runoff from disturbed areas where BMPs have not been properly designed, installed, and maintained shall constitute a separate violation of any land disturbing permit issued by Fulton County or of any state general permit issued by the division pursuant to O.C.G.A. § 12-5-30(f), the "Georgia Water Quality Control Act" for each day on which such discharge results in the turbidity of receiving waters being increased by more than 25 nephelometric turbidity units for waters supporting warm water fisheries or by more than ten nephelometric turbidity units for waters classified as trout waters. The turbidity of the receiving waters shall be measured in accordance with guidelines issued by the director, EPD. This paragraph shall not apply to any land disturbance associated with the construction of single-family homes which are not part of a larger common plan of development or sale unless the planned disturbance for such construction is equal to or greater than five acres.

(3) Failure to properly design, install, or maintain BMPs shall constitute a violation of any land disturbance permit issued by a local issuing authority or of any state general permit issued by the division pursuant to O.C.G.A. § 12-5-30(f), The "Georgia Water Quality Control Act" for each day on which such failure occurs. When such non-compliance is identified by the director, official notice will be posted on that property.

(4) The director may require, in accordance with regulations adopted by the board, reasonable and prudent monitoring of the turbidity level of receiving waters into which discharges from land disturbing activities occur.

(5) The LIA may set more stringent buffer requirements than stated in subsections (c)(15) and (16) in light of O.C.G.A. § 12-7-6(c).

(c) The rules and regulations, ordinances, or resolutions adopted pursuant to O.C.G.A. § 12-7-1 et seq. for the purpose of governing land-disturbing activities shall require, as a minimum, protections at least as stringent as the state general permit; and BMPs, including sound conservation and engineering practices to prevent and/or minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia," published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land disturbing activity was permitted, as well as the following:

(1) Stripping of vegetation, regrading and other development activities shall be conducted in a manner so as to minimize erosion.

(2) Cut-fill operations must be kept to a minimum.

(3) Development plans must conform to topography and soil type so as to create the lowest practicable erosion potential.

(4) When ever feasible, natural vegetation shall be retained, protected and supplemented.

(5) The disturbed area and the duration of exposure to erosive elements shall be kept to practical minimum;

(6) Disturbed soil shall be stabilized as quick as practicable;

(7) Temporary vegetation or mulching shall be employed to protect exposed critical areas during development;

(8) Permanent vegetation and structural erosion control measures shall be installed as soon as practicable;

(9) To the extent necessary, sediment in runoff water must be trapped by the use of debris basins, sediment basins, silt traps, or similar BMPs as outlined in the erosion and sediment control manual until the disturbed area is stabilized. As used in this paragraph, a disturbed area is stabilized when it is brought to a condition of continuous compliance with the requirements of this section, and O.C.G.A. § 12-7-1 et seq.

(10) Adequate provisions must be provided to minimize damage from surface water to the cut face of excavations or the sloping of fills.

(11) Cuts and fills may not endanger adjoining property;

a. All slopes shall be stabilized immediately and shall remain so for a period of no less than one year from the issuance of the project's final certificate of occupancy and/or the recording of a final plat.

b. All slopes greater than or equal to 3H:1V must be permanently stabilized with structural or vegetative BMPs.

c. A plan must be submitted to demonstrate that all slopes associated with fill/cut sections have been adequately designed to be stabilized structurally (such as retaining walls) or vegetatively (erosion mat/blanket, tree bark mulch, etc). Such analysis, reports, or design shall be prepared and approved by a design professional.

(12) Fills may not encroach upon natural watercourses or constructed channels in a manner so as to adversely affect other property owners;

(13) Grading equipment must cross flowing streams by means of temporary or permanent bridges or culverts except when such methods are not feasible, provided, in any case, those such crossings are kept to a minimum. Migrated soil materials or soil materials displaced by mechanical means from land disturbing sites to adjacent water courses, such as lakes, ponds, streams, and creeks etc. must be remediated. The remedial work shall be conducted as per a remedial plan approved by Fulton County.

(14) Land-disturbing activity plans for erosion, sedimentation and pollution control shall include provisions for treatment or control of any source of sediments and adequate sedimentation control facilities to retain sediments on-site or preclude sedimentation of adjacent waters beyond the levels specified in section 26-39(b)(2).

(15) Except as provided in paragraph (16) of this section, there is established a 25-foot buffer along the banks of all state waters, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, except where the director, EPD determines to allow a variance that is at least as protective of natural resources and the environment, where otherwise allowed by the director, EPD pursuant to O.C.G.A. § 12-2-8, or where a drainage structure or a roadway drainage structure must be constructed, provided that adequate erosion control measures are incorporated in the project plans and specifications are implemented or along any ephemeral stream. As used in this provision, the term 'ephemeral stream' means a stream: that under normal circumstances has water flowing only during and for a short duration after precipitation events; that has the channel located above the ground-water table year round; for which runoff from precipitation is the primary source of water flow, Unless exempted as along an ephemeral stream, the buffers of at least 25 feet established pursuant to part 6 of Article 5, Chapter 5 of Title 12, the "Georgia Water Quality Control Act shall remain in force unless a variance is granted by the director, EPD as provided in this subsection. The following requirements shall apply to any such buffer:

a. No land disturbance activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed state of vegetation until all land-disturbing activities on the construction site are completed, except as otherwise provided by this paragraph.

Once the final stabilization of the site is achieved, a buffer may be thinned or trimmed of vegetation as long as a protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed; provided, however, that any person constructing a single-family residence, when such residence is constructed by or under contract with the owner for his or her own occupancy, may thin or trim vegetation in a buffer at any time as long as protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed; and

b. The buffer shall not apply to the following land-disturbing activities, provided that they occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream; cause a width of disturbance of not more than 50 feet within the buffer; and adequate erosion control measures are incorporated into the project plans and specifications and are implemented: (i) stream crossings for water lines; or (ii) stream crossings for sewer lines; and

(16) There is established a 50-foot buffer as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, along the banks of any state waters classified as "trout streams" pursuant to Article 2 of Chapter 5 of Title 12, the "Georgia Water Quality Control Act", except where a roadway drainage structure must be constructed; provided, however, that small springs and steams classified as trout streams which discharge an average annual flow of 25 gallons per minute or less shall have a 25-foot buffer or they may be piped, at the discretion of the landowner, pursuant to the terms of a rule providing for a general variance promulgated by the board, so long as any such pipe stops short of the downstream landowner's property and the landowner complies with the buffer requirement for any adjacent trout streams. The director, EPD may grant a variance from such buffer to allow land-disturbing activity, provided that adequate erosion control measures are incorporated in the project plans and specifications and are implemented. The following requirements shall apply to such buffer:

a. No land-disturbance activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed state of vegetation until all land-disturbing activities on the construction site are completed.

Once the final stabilization of the site is achieved, a buffer may be thinned or trimmed of vegetation as long as a protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed; provided, however, that any person constructing a single-family residence, when such residence is constructed by or under contract with the owner for his or her own occupancy, may thin or trim vegetation in a buffer at any time as long as protective vegetation cover remains to protect water quality and aquatic habitat and natural canopy is left in sufficient quality to keep shade on the stream bed; and

b. The buffer shall not apply to the following land-disturbing activities, provided that they occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream; cause a width of disturbance of not more than 50 feet within the buffer; and adequate erosion control measures are incorporated into the project plans and specifications and are implemented: (i) stream crossings for water lines; or (ii) stream crossings for sewer lines.

c. Nothing contained in this chapter shall prevent any local issuing authority from adopting rules and regulations, ordinances, or resolutions which contain stream buffer requirements that exceed the minimum requirements in subsections 26-39(b) and (c).

d. The fact that land-disturbing activity for which a permit has been issued results in injury to the property of another shall neither constitute proof of nor create a presumption of a violation of the standards provided for in this article or terms of the permit.

e. Additional requirements. Where the director finds, through inspection, that property owners have been adversely affected due to violations clearly identified by the director, or that the approved current plans do not adequately address the features of the site, the director can require additional BMPs, drawings, and revisions to comply with the minimum requirements as outlined in section 26-39.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-40. - Land disturbance application/permit process.

(a) General. The property owner, developer, and designated planners and engineers shall design and review before submittal of the general development plans. They shall review the zoning resolution, stormwater management ordinance, subdivision ordinance, flood damage prevention resolution, this article, and other ordinances which regulate the development of land within the jurisdictional boundaries of unincorporated Fulton County. However, the property owner or operator are the only parties who may obtain a permit.

(b) Application requirements.

(1) Prior to any land disturbing activity, the property in question must be part of an approved and recorded legal lot of record (exemption plat or final plat). Additionally, no land disturbing activity, including grading, excavating, filling, and/or foundation work, shall be conducted within the unincorporated area of Fulton County or in any area where Fulton County has jurisdiction, until a land disturbance permit or a building permit (for those projects not requiring a land disturbance permit under this article) shall have been issued by the director allowing such activity and providing a copy of notice of intent submitted to EPD if applicable. If a project is to be developed in phases, then a separate land disturbance permit or building permit is required for each phase not to exceed 25 acres increments and the development sequence should be followed on all projects issued a land disturbance permit.

(2) No person shall conduct any land disturbing activity within the jurisdictional boundaries of Fulton County without first obtaining a permit from the Fulton County Department of Environment and Community Development or its successor to perform such activity.

(3) The application for a permit shall be submitted to the department of environment and community development and must include the applicant's erosion, sedimentation and pollution control plan with supporting data, as necessary. Said plans shall include, as a minimum, the data specified in subsection (c) of this section. Soil erosion, sedimentation and pollution control plans, together with supporting data, must demonstrate affirmatively that the land disturbing activity proposed will be carried out in such a manner that the provisions of subsections 26-39(b) and (c) will be met. Applications for a permit will not be accepted unless accompanied by nine copies of the applicant's soil erosion, sedimentation and pollution control plans and a physical address of the property owner (Post Office box not acceptable). All applications shall contain a certification stating that the plan preparer or the designee thereof visited the site prior to creation of the plan in accordance with EPD Rule 391-3-7-10.

(4) A minimum fee of $125.00, as set by the board of commissioners of Fulton County, shall be charged for each acre or fraction thereof of the project area.

(5) In addition to Fulton County's permitting fees, fees will also be assessed pursuant to O.C.G.A. § 12-5-23(a)(5), provided that such fees shall not exceed $80.00 per acre of land-disturbing activity, and these fees shall be calculated and paid by the primary permittee as defined in the state general permit for each acre of land-disturbing activity included in the planned development or each phase of development. All applicable fees shall be paid prior to issuance of the land disturbance permit. Half of such fees levied shall be submitted to the division; except that any and all fees due from an entity which is required to give notice pursuant to O.C.G.A. § 12-7-17(9) or (10) shall be submitted in full to the division, regardless of the existence of a local issuing authority in the jurisdiction.

(6) The permit applicant shall be required to post a bond in the form of government security, cash, irrevocable letter of credit, or any combination thereof prior to issuing the permit. The bond amount shall be determined as established by the department. If the applicant does not comply with this article or with the conditions of the permit after issuance, Fulton County may call the bond or any part thereof to be forfeited and may use the proceeds to hire a contractor to stabilize the site of the land disturbing activity and bring it into compliance. These corrective actions may include, but are

not limited to, de-silting detention ponds, water bodies, stormwater facilities, roadways, installing fence with locking device, re-establishing damaged buffer, etc. If a permit applicant has had two or more outstanding violations of previous permits, this article, or the Erosion and Sedimentation Act of 1975 (O.C.G.A. § 12-7-1 et seq.), as amended within three years prior to the date of filing of the application under consideration, Fulton County may deny the permit application.

(7) If applicable, immediately upon receipt of an application and plan for a permit, Fulton County shall refer the application and plan to the district for its review and approval or disapproval concerning the adequacy of the erosion and sedimentation control plan. The district shall approve or disapprove a plan within 35 days of receipt. Failure of the district to act within 35 days shall be considered an approval of the pending plan. The results of the district review shall be forwarded to Fulton County. No permit will be issued unless the plan has been approved by the district, and any variances required by section 26-39(c)(14) or (15) and bonding, if required as per subsection (b)(5) of this section, have been obtained. Such review will not be required if Fulton County and the district have entered into an agreement which allows Fulton County to conduct such review and approval of the plan without referring the application and plan to the district. The local issuing authority with plan review authority shall approve or disapprove a revised Plan submittal within 35 days of receipt. Failure of the local issuing authority with plan review authority to act within 35 days shall be considered an approval of the revised plan submittal.

(8) If a permit application has had two or more violations of previous permits, this article, or the Erosion and Sedimentation Act, as amended, within three years prior to the date of filing of the application under consideration, Fulton County may deny the permit application.

(9) The local issuing authority may require the permit applicant to post a bond in the form of government security, cash, irrevocable letter of credit, or any combination thereof up to, but not exceeding, $3,000.00 per acre or fraction thereof of the proposed land-disturbing activity, prior to issuing the permit. If the applicant does not comply with this article or with the conditions of the permit after issuance, the local issuing authority may call the bond or any part thereof to be forfeited and may use the proceeds to hire a contractor to stabilize the site of the land-disturbing activity and bring it into compliance. These provisions shall not apply unless there is in effect an ordinance or statute specifically providing for hearing and judicial review of any determination or order of the local issuing authority with respect to alleged permit violations.

(c) Plan requirements.

(1) Plans must be prepared to meet the minimum requirements as contained in section 26-39(b) and (c), or through the use of more stringent, alternate design criteria which conform to sound conservation and engineering practices. The Manual for Erosion and Sediment Control in Georgia is hereby incorporated by reference into this ordinance. The plan for the land disturbing activity shall consider the interrelationship of the soil types, geological and hydrological characteristics, topography, watershed. Vegetation, proposed permanent structures including roadways, constructed waterways, sediment control and stormwater management facilities, local ordinances and state laws. Maps, drawings and supportive computations shall bear the signature and seal of the certified design professional. Persons involved in land development design, review, permitting, construction, monitoring, or inspections or any land disturbing activity shall meet the education and training certification requirements , dependent on his or her level of involvement with the process, as developed by the commission and in consultation with the division and the stakeholder advisory board created pursuant to O.C.G.A. § 12-7-20.

(2) Data required for site plan shall include all the information required from the appropriate erosion, sedimentation and pollution control plan review checklist established by the commission as of January 1 of the year in which the land-disturbing activity was permitted.

(d) Permits and development activity.

(1) Permits shall be issued or denied as soon as practicable but in any event not later than 45 days after receipt by Fulton County of a completed application, provided that any necessary variances have been obtained, bonding has been provided, and specifications developed and maintained by the department of public works and permitted by the department of environment and community development have been met, and all applicable fees have been paid prior to permit issuance. The permit shall include conditions under which the activity may be undertaken.

(2) No permit shall be issued by Fulton County unless the erosion, sedimentation and pollution control plan has been approved by the district or Fulton County, and unless Fulton County has affirmatively determined that the plan is in compliance with this article, any variances required by subsections 26-39(c)(14) or (15) are obtained, bonding requirements, if necessary, as per subsection 26-40(b)(5) are met and all ordinances and rules and regulations in effect within the jurisdictional boundaries of unincorporated Fulton County are met. If the permit is denied, the reason for denial shall be furnished to the applicant.

(3) Any land-disturbing activities by a local issuing authority shall be subject to the same requirements of this article, and any other ordinances relating to land development, as are applies to private persons and the division shall enforce such requirements upon the local issuing authority.

(4) If the tract is to be developed in phases, then a separate permit shall be required for each phase to include the development sequence.

(5) The permit may be suspended, revoked, or modified by Fulton County, as to all or any portion of the land affected by the plan, upon finding that the holder or his successor in title is not in compliance with the approved erosion and sedimentation control plan or that the holder or his successor in title is in violation of this article. A holder of a permit shall notify any successor in title to him of the conditions contained in the permit as to all or any portion of the land affected by the approved plan.

(6) Fulton may reject a permit application if the applicant has had two or more violations of previous permits or the Erosion and Sedimentation Act permit requirements within three years prior to the date of the application, in light of O.C.G.A. § 12-7-7-(f)1.

(7) Sedimentation basins shall not be allowed in state waters or other perennially flowing streams.

(8) The permittee shall ensure that engineering and construction on any land within unincorporated Fulton County shall be carried out in such a manner as to protect neighboring persons and property from damage or loss resulting from stormwater runoff, soil erosion, or deposition upon private property or public streets or water-transported silt or debris.

(9) The director or designee during field inspections may require revisions, addendum and modifications that address any and all features to ensure compliance with this article and any permit issued hereunder.

(10) It shall constitute non-compliance with this article to engage in land disturbance activity involving clearing, grading, timber harvesting or grubbing without a permit, which activity may immediately warrant citation(s).

(11) Design and installation of properly functioning detention facilities, including outflow and overflow control devices, shall be the responsibility of the owner. If any erosion control devices are damaged or destroyed during grading or construction, all construction processes shall cease until the devices are restored to their functioning capability. The owner, through application for grading or construction permits, accepts the responsibility of maintenance of the control devices.

(12) The owner and operator shall be responsible for the maintenance of the storm drainage facilities during grading, construction, and for a 15-month period following the final approval of the completed project. Maintenance will be construed to include preserving the enclosing walls or impounding embankment or the detention basin and sedimentation ponds, in good condition; ensuring structural soundness, functional adequacy, and freedom from sediment of all drainage structures; and rectifying any unforeseen erosion problems.

(13) The developer shall provide stabilization by covering the soil with: permanent seeding, sprigging or planting, producing long-term vegetative cover, temporary seeding producing short-term vegetative cover, sodding or covering areas with a turf of perennial sod forming grass; and security fences for safety purposes at detention facilities as prescribed by and prior to approval by Fulton County.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

State Law reference— Permits for land disturbing activities, O.C.G.A. §§ 12-7-7, 12-7-9.

Sec. 26-41. - County construction; compliance with article.

All engineering and construction involving land disturbance performed by or on behalf of Fulton County and under the direction of the department of public works or any other Fulton County entity, whether such engineering or construction is being accomplished on existing and proposed public land or on public easement, shall comply with the requirements of sections 26-39 and 26-44.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-42. - Residential construction.

Notwithstanding any other provisions of this article, the construction of single-family detached dwellings shall be subject to the following rules:

(1) Building permit. No land disturbing activity or other work (including moving and demolition) shall commence on a project until the owner or the contractor undertaking the work shall have applied for, and been issued, a land disturbance permit or building permit by the director. The owner/contractor shall prominently display on site the building permit, a signed erosion and sedimentation control agreement and approved site plan in full public view, until issuance of certification of occupancy. Demolition projects shall be required to install BMPs where necessary to prevent erosion. Failure to install BMPs shall constitute non compliance with this article.

(2) Notice to comply. The director shall issue a notice to comply for failure to either install or maintain BMPs, even though sediments remain contained within the boundaries of the property by the use of debris basins, sediment basins, sediment barriers, and construction exits in accordance with this article. Subsequently, a stop work order shall be issued if compliance with a notice to comply is not achieved by the end of the specified compliance period of five days.

(3) Stop work order. The director or representative shall issue an order to cease all work ("stop work order") on a project covered by this section if any work on that project is proceeding without a land disturbance permit or building permit, or, when silt, mud, or other waterborne debris leave the property boundary, or (if such a permit has been issued) it is found by the director or representative that all or any portion of the project remains out of compliance with any requirements of subsections 26-39(b) or (c), any other provision of this article or any other Fulton County ordinance, regulation or requirement after the specified compliance period or a site has been in violation at least two prior occurrences, to include any applicable fines and penalties. All other requirements of subsection 26-45(b) of this article also apply to projects covered by this section.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-43. - Progress report required.

(a) The licensed professional referenced in the administrative guidelines (see subsection 26-40(c)) or his representative as approved by the director shall ensure, inspect and evaluate the installation of the erosion control measures (BMPs) within one week after the initial installation of BMPs. All deficiencies shall be corrected within two business days after inspection, and a summary of corrective measures taken shall be submitted to the director within three days after inspection. A written biweekly report shall be submitted to the director from the beginning to the completion of grading and construction on projects for which a land disturbance permit has been issued. This report shall be the responsibility of the owner or developer and shall be prepared by a professional licensed to practice such activity within Georgia, as stipulated in Fulton County Soil Erosion and Sediment Control Administrative Guidelines. The report shall record the quality and progress of the work required to show full compliance with the provisions of this article, including compliance with or adherence to vegetative practices. In order to ensure full compliance with the approved construction plans, final approval will be withheld until as-built drawings, prepared by a professional licensed to practice such work in Georgia, have been submitted and accepted by the director. The director shall withhold the occupancy permit until full compliance has been achieved.

(b) Additional reporting requirements. Applicants/owners/operators shall provide the Director with a copy of any monitoring results submitted to EPD regarding National Pollutant Discharge Elimination System (NPDES). Reports shall be in a format as prescribed by EPD. A copy of the notice of intent which has been sent to EPD in compliance with the permit requirements must be presented to the site inspector at all pre-construction meetings.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-44. - Inspection and enforcement of article.

(a) The director or designee will periodically inspect the sites of land disturbing activities for which permits have been issued to determine if the activities are being conducted in accordance with the approved plan, permit and this article and to determine if the measures required in the plan are effective in controlling soil erosion and sedimentation. Also, Fulton County shall regulate both primary, secondary and tertiary permittees as such terms are defined in the state general permit. Primary permittees shall be responsible for installation and maintenance of best management practices where the primary permittee is conducting land-disturbing activities. Secondary permittees shall be responsible for installation and maintenance of best management practices where the secondary permittee is conducting land-disturbing activities. Tertiary permittees shall be responsible for installation and maintenance of best management practices where the tertiary permittee is conducting land disturbing activities. If, through inspection, it is deemed that a person engaged in land disturbing activities as defined herein has failed to comply with the approved plan, with permit conditions, or with the provisions of this article, an official notice shall be posted on-site, and as a courtesy a written notice to comply shall also be served upon that person, except for working without a permit or working under a stop work order, which warrant immediate citation(s). The notice shall set forth the measures necessary to achieve compliance and shall state the time within which such measures must be completed. If the person engaged in the land disturbing activity fails to comply with the corrective measures specified in the posted official notice within the time specified, he shall be deemed in violation of this article, and the director may take such additional enforcement actions as he/she deems appropriate.

(b) The local issuing authority must amend its ordinances to the extent appropriate within 12 months of any amendments to the Erosion and Sedimentation Act of 1975.

(c) The director shall have the power to conduct such investigation as the director may deem reasonably necessary to carry out duties as prescribed in this article, and for this purpose shall have the power to enter at reasonable times upon any property, public or private, for the purposes of investigation and inspection of the sites of land disturbance or building activities.

(d) No person shall refuse entry or access to any authorized representative or agent of Fulton County, the commission, the district, or division who requests entry for the purposes of inspection, and who presents appropriate credentials, nor shall any person obstruct, hamper, or interfere with any such representative while in the process of carrying out his official duties including, but not limited to, the review of reports, studies, calculations, drawings, revisions, practices, actions and bonds.

(e) A copy of a current approved plan shall be kept on site until project completion or issuance of certificate of occupancy.

(f) The district or the commission or both shall semi-annually review the actions of counties and municipalities which have been certified as local issuing authorities pursuant to O.C.G.A. § 12-7-8(a). The district or the commission or both may provide technical assistance to any county or municipality for the purpose of improving the effectiveness of the counties or municipality's erosion and sedimentation control program. The districts or the commission shall notify the division and request investigation by the division if any deficient or ineffective legal program is found.

(g) The division may periodically review the actions of counties and municipalities which have been certified as local issuing authorities pursuant to O.C.G.A. § 12-7-8(a). Such review may include, but shall not be limited to, review of the administration and enforcement of a governing authority's ordinance and review of conformance with an agreement, if any, between the district and the governing authority. If such review indicates that the governing authority of any county or municipality certified pursuant to O.C.G.A. § 12-7-8(a) has not administered or enforced its ordinances or has not conducted the program in accordance with any agreement entered into pursuant to O.C.G.A. § 12-7-7(e), the division shall notify the governing authority of the county or municipality in writing. The governing authority of any county or municipality so notified shall have 90 days within which to take the necessary corrective action to retain certification as a local issuing authority. If the county or municipality does not take necessary corrective action within 90 days after notification by the division, the division may revoke the certification of the county or municipality as a local issuing authority.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-45. - Penalties and incentives.

(a) Failure to obtain a permit for land disturbing activity. If any person commences any land disturbing activity requiring a land disturbing permit, as prescribed in this article, without first obtaining said permit, the person shall be subject to revocation of his business license, work permit, or other authorization to conduct any business and associated work activities within the jurisdictional boundaries of Fulton County. Failure to comply may result in a citation being issued to appear in state magistrate court which may result in monetary fines.

(b) Stop work orders and notice to comply.

(1) On development and residential land disturbance sites for the first and second violations of the provisions of this article, the director or the LIA shall post an official notice to comply and as a courtesy issue a written letter. The violator shall have five days to correct the violation. If the violation is not corrected within five days, the director or the LIA shall issue a stop-work order requiring the land-disturbance activity be stopped until necessary corrective action or mitigation has occurred; provided, however, that, if the violation presents an imminent threat to public health or waters of the state or if the land-disturbing activities are conducted without obtaining the necessary permit, the director shall issue an immediate stop-work order in lieu of notice to comply.

(2) For the third and each subsequent violation, the director or the LIA shall issue an immediate stop-work order; and

(3) All stop-work orders shall be in effect until the necessary corrective action has occurred.

(4) It shall be unlawful for any representative of the owner to remove an official notice to comply or stop work posting. If this action is observed by a county representative, the owner will be responsible for any and all possible fines. Upon issuance of a stop work order, the director or representative shall post official notice at such locations on the project site as deemed appropriate. Such posted official notice(s) shall be prominently displayed on the owner's property until the stop work order is rescinded by the director, at which time said posted notice(s) will be removed by the director or representative.

(5) When a violation in the form of taking action without a permit, failure to maintain a stream buffer, or significant amounts of sediment, as determined by director or his or her designee, have been or are being discharged into state waters and where best management practices have not been properly designed, installed, and maintained, a stop work order shall be issued by the director or his or her designee. All such stop work orders shall be effective immediately upon issuance and shall be in effect until the necessary corrective action or mitigation has occurred. Such stop work orders shall apply to all land-disturbing activity on the site with the exception of the installation and maintenance of temporary or permanent erosion and sediment controls.

(c) Reinspection fee. The director shall assess a minimum $50.00 reinspection fee to a project if a reinspection is requested prior to the end of a compliance period and the site is found to remain out of compliance upon that inspection. Such fees (to cover administrative, field inspections, and transportation costs) must be satisfied prior to the issuance of a final erosion inspection or a certificate of occupancy.

(d) Bond forfeiture. If, through inspection, it is determined that a person engaged in land disturbing activities has failed to comply with the approved plan and permit, an official notice to comply shall be posted on-site and a letter will be issued as a courtesy. The notice shall set forth the measures necessary to achieve compliance with the plan and shall state the time within which such measures must be completed. If the person engaged in the land disturbing activity fails to comply within the time specified, he shall be deemed in violation of this article and, in addition to other penalties, shall be deemed to have forfeited his performance bond, if required to post one under the provisions of subsection 26-40(b)(6). Fulton County may call the bond or any part thereof to be forfeited and may use the proceeds to hire a contractor to stabilize the site of the land disturbing activity and bring it into compliance.

(e) Non-compliance. Non-compliance with this article shall be dealt with as follows:

Any person found to be in non-compliance with any provision of this article shall be served official notice by the department of environment and community development. The offender shall, within the period of time stated in the notice, take all necessary action to gain compliance and shall permanently cease such non-compliance.

(f) Monetary penalties. Any person who violates any provisions of this article, or any permit condition or limitation established pursuant to this article or who negligently or intentionally fails or refuses to comply with any final or emergency order of the director issued as provide in this article shall be liable for a civil penalty not to exceed $2,500.00 per day. Notwithstanding any limitation of law as to penalties which can be assessed for violations of county ordinances, any magistrate court or any other court of competent jurisdiction trying cases brought as violations of this article shall be authorized to impose penalties for such violations not to exceed $2,500.00 for each violation. Each day during which violation or failure or refusal to comply continues shall be a separate violation.

(1) The following minimum penalties shall be imposed:

Conducting land disturbance activities without a land disturbance permit or building permit (first offense)—$250.00 for each violation or each day on which a violation exists.

Conducting land disturbance activities without a land disturbance permit or building permit (second or subsequent offense)—$1,000.00.

Lack of proper installation or maintenance of structural/vegetative best management practices—$250.00 per violation.

Working under a stop work order (first offense)—$500.00.

Working under a stop work order (second or subsequent offense)—$1,500.00.

(2) Upon violation of the provisions of this article, Fulton County shall be entitled to take such remedial action as the director deems necessary to ensure compliance, and the violator shall reimburse Fulton County for any cost or expense associated with such compliance efforts and Fulton County shall be entitled to place a lien on the property to secure payment and reimbursement for these expenses.

(3) The department of environment and community development has the primary responsibility for the enforcement of this article.

(4) Persons designated by the director are hereby authorized to issue official notices, citations, and/or summons charging violations under this article, returnable to the state or magistrate courts of Fulton County, or any other court of competent jurisdiction.

(Res. No. 05-0690, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-46. - Education and certification.

(a) Persons involved in land development design, review, permitting, construction, monitoring, or inspection or any land-disturbing activity shall meet the education and training certification requirements, dependent on their level of involvement with the process, as developed by the commission in consultation with the division and the stakeholder advisory board created pursuant to O.C.G.A. § 12-7-20.

(b) For each site on which land disturbing activity occurs, each entity or person acting as either a primary, secondary, or tertiary permittee, as defined in the state general permit, shall have as a minimum one person who is in responsible charge of erosion and sedimentation control activities on behalf of said entity or person and meets the applicable education or training certification requirements developed by the commission present on site whenever land-disturbing activities are conducted on that site. A project site shall herein be defined as any land-disturbance site or multiple sites within a larger common plan of development or sale permitted by an owner or operator for compliance with the state general permit.

(c) Persons or entities involved in projects not requiring a state general permit but otherwise requiring certified personnel on site may contract with certified persons to meet the requirements of this article.

(d) If a state general permittee, who has operational control of land-disturbing activities for a site has met the certification requirements of O.C.G.A § 12-7-19(b)(1), then any person or entity involved in land-disturbing activity at that site and operating in a subcontractor capacity for such permittee shall meet those educational requirements specified in O.C.G.A. § 12-7-19(b)(4) and shall not be required to meet any requirements specified in said paragraph.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-47. - Administrative appeal; judicial review.

(a) Administrative remedies. The issuance of a stop work order, as well as the suspension, revocation, modification, or grant with condition of a permit by Fulton County upon finding that the holder is not in compliance with the approved erosion, sediment and pollution control plan; or that the holder is in violation of permit conditions; or that the holder is in violation of this article shall entitle the person submitting the plan or holding the permit to a hearing before the Fulton County Board of Commissioners within 30 days after receipt by the director of written notice of appeal.

(b) Judicial review. Any person aggrieved by a decision or order of Fulton County, after exhausting his administrative remedies, shall have the right to appeal de novo to the Superior Court of Fulton County.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Sec. 26-48. - Effectivity, validity and liability.

(a) This article shall become effective on the 15th day of June 2010.

(b) Validity. If any section, paragraph, clause, phrase, or provision of this article shall be adjudged invalid or held unconstitutional, such decisions shall not affect the validity of remaining portions of this article.

(c) Liability.

    (1) Neither the approval of a plan under the provisions of this article, nor the compliance with provisions of this article, shall relieve any person from responsibility for damage to any person or property otherwise imposed by law nor impose any liability upon Fulton County, the district or their officers, employees or agents for damage to any person or property.

    (2) The fact that a land disturbing activity for which a permit has been issued results in injury to the property of another shall neither constitute proof of nor create a presumption of a violation of the standards provided for in this article or the terms of the permit.

    (3) No provision of this article shall permit any person to violate the Georgia Erosion and Sedimentation Act of 1975, the Georgia Water Quality Control Act or the rules and regulations promulgated and approved thereunder or pollute any waters of the state as defined thereby.

(Res. No. 05-0690, Exh. A, 6-15-05; Ord. No. 10-0576, 6-2-10)

Secs. 26-49—26-75. - Reserved.

Site Name	Address	City & State	Zip
Boat Rock Gymnasium	5800 Boat Rock Road	Atlanta, GA	30331
Burdett Concession Stand	2975 Burdett Road	College Pk	30337
Burdett Gymnasium	2945 Burdett Road	College Pk	30337
Burdett Tennis Center	5975 Old Carriage Ln	College Pk	30337
Camp Creek Utility Const	7600 Cochran Road	College Pk	30349
Cedar Grove Community Hse	9285 Cedar Grove Rd.	Fairburn, GA	30213
Cedar Grove Park	7375 Rivertown Road	Fairburn, GA	30213
Clarence Duncan Park Horse	6000 Rivertown Road	Fairburn, GA	30213
Cliftondale Pk Picnic Shelter	4645 Butner Road	College Pk	30349
Cliftondale Park Rec. Center	4399 Butner Road	College Pk	30349
Cochran Mill Restroom	6875 Cochran Mill Road	Palmetto, GA	30268
Creel Park Tennis Courts, 4	2775 Creel Road	College Pk	30349
David Hagins Pistol Range Tr	5301 Aldredge Rd.	Atlanta, GA	30349
Delano Road Park	4701 Delano Road	Red Oak, GA	30272
Farbest Community House	6740 Johnson Road	Fairburn, GA	30213
Fire Administration Office	3977 Aviation Circle	Atlanta, GA	30336
Fire Station #1, Red Oak	5165 Welcome All Rd	Red Oak, GA	30272
Fire Station #11, Fulton Ind	4760 Fulton Indl Blvd	Atlanta, GA	30336
Fire Station #13, Cascade	5890 Plumber Road	Atlanta, GA	30331
Fire Station #17, Cedar Gr	8675 Ridge Road	Cedar Grove	30213
Fire Station #19, C Brown Air	3965 Aero Drive	Atlanta, GA	30336
Fire Station #23, Cascade	4121 Cascade Road	Atlanta	30331
Fire Station #3, Cliftondale	4035 Stonewall Tell Rd	College Pk	30337
Fire Station #5, Pine Ridge	3175 Bethsaida Road	Fairburn	30213
Fire Station #7, Midway	5965 Buffington Road	College Pk	30349
Mason Road Park Rest/con	5665 Mason Road	College Pk	30349
Morning Creek	2924 Old Jonesboro Rd	Fairburn	30213
Old National Precinct	5549 Old Nat Hwy, C	College Park	30349
S F Rec Fac At Welcome All	4255 Will Lee Road	College Park	30349
Sandtown Park Gym/office	5600 Campbellton Rd	Atlanta, GA	30331
Sherwin Tucker Park	2400 Pleasant Hill Road	College Park	30349
So Fulton Tennis Ctr	5634 Mason Road Sw	Atlanta, GA	30349
South Annex	5600 Stonewall Tell Rd	College Park	30349
Tax/Tag Office Ingle's	3425 Cascade Rd	College Park	30331
Tom Lowe Shooting Grounds	3025 Merk Rd., SW	Atlanta	30331
Traffic Signal Shop	3929 Aviation Circle	Atlanta	30336
Trammel Crow Park	4980 Cascade Road	Atlanta, GA	30336
Welcome All Park	4225 Will Lee Rd.	College Pk	30337
Wilkerson Mill Park	8095 Wilkerson Mill Rd	Palmetto, GA	30268
Wolfe Creek Trap Skeet Off	3070 Merk Road Sw	Atlanta, GA	30331

Name	Address	City	Zip
Boat Rock Gymnasium	5800 Boat Rock Road	Atlanta, GA	30331
Burdett Concession Stand	2975 Burdett Road	College Pk	30337
Burdett Gymnasium	2945 Burdett Road	College Pk	30337
Burdett Tennis Center	5975 Old Carriage Ln	College Pk	30337
Camp Creek Utility Const	7600 Cochran Road	College Pk	30349
Cedar Grove Community Hse	9285 Cedar Grove Rd.	Fairburn, GA	30213
Cedar Grove Park	7375 Rivertown Road	Fairburn, GA	30213
Clarence Duncan Park Horse	6000 Rivertown Road	Fairburn, GA	30213
Cliftondale Pk Picnic Shelter	4645 Butner Road	College Pk	30349
Cliftondale Park Rec. Center	4399 Butner Road	College Pk	30349
Cochran Mill Restroom	6875 Cochran Mill Road	Palmetto, GA	30268
Creel Park Tennis Courts, 4	2775 Creel Road	College Pk	30349
David Hagins Pistol Range Tr	5301 Aldredge Rd.	Atlanta, GA	30349
Delano Road Park	4701 Delano Road	Red Oak, GA	30272
Farbest Community House	6740 Johnson Road	Fairburn, GA	30213
Fire Administration Office	3977 Aviation Circle	Atlanta, GA	30336
Fire Station #1, Red Oak	5165 Welcome All Rd	Red Oak, GA	30272
Fire Station #11, Fulton Ind	4760 Fulton Indl Blvd	Atlanta, GA	30336
Fire Station #13, Cascade	5890 Plumber Road	Atlanta, GA	30331
Fire Station #17, Cedar Gr	8675 Ridge Road	Cedar Grove	30213
Fire Station #19, C Brown Air	3965 Aero Drive	Atlanta, GA	30336
Fire Station #23, Cascade	4121 Cascade Road	Atlanta	30331
Fire Station #3, Cliftondale	4035 Stonewall Tell Rd	College Pk	30337
Fire Station #5, Pine Ridge	3175 Bethsaida Road	Fairburn	30213
Fire Station #7, Midway	5965 Buffington Road	College Pk	30349
Mason Road Park Rest/con	5665 Mason Road	College Pk	30349
Merk Rd Landfill, Admin Bldg	3150 Merk Rd., SW	Atlanta	30331
Merk Road Transfer Station	3225 Merk Road	Atlanta	30331
Morning Creek	2924 Old Jonesboro Rd	Fairburn	30213
Old National Precinct	5549 Old Nat Hwy, C	College Park	30349
S F Rec Fac At Welcome All	4255 Will Lee Road	College Park	30349
Sandtown Park Gym/office	5600 Campbellton Rd	Atlanta, GA	30331
Sherwin Tucker Park	2400 Pleasant Hill Road	College Park	30349
So Fulton Tennis Ctr	5634 Mason Road Sw	Atlanta, GA	30349
South Annex	5600 Stonewall Tell Rd	College Park	30349
Tax/Tag Office Ingle's	3425 Cascade Rd	College Park	30331
Tom Lowe Shooting Grounds	3025 Merk Rd., SW	Atlanta	30331
Traffic Signal Shop	3929 Aviation Circle	Atlanta	30336
Trammel Crow Park	4980 Cascade Road	Atlanta, GA	30336
Welcome All Park	4225 Will Lee Rd.	College Pk	30337
Wilkerson Mill Park	8095 Wilkerson Mill Rd	Palmetto, GA	30268
Wolfe Creek Trap Skeet Off	3070 Merk Road Sw	Atlanta, GA	30331

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO19333	Catch Basin	Brick
SWCBMO19334	Catch Basin	Brick
SWCBMO19370	Catch Basin	Brick
SWCBMO19372	Catch Basin	Concrete
SWCBMO19373	Catch Basin	Concrete
SWCBMO19375	Catch Basin	Concrete
SWCBMO19376	Catch Basin	Concrete
SWCBMO19378	Catch Basin	Concrete
SWCBMO19379	Catch Basin	Concrete
SWCBMO19380	Catch Basin	Concrete
SWCBMO19381	Catch Basin	Concrete
SWCBMO19388	Catch Basin	Brick
SWCBMO19389	Catch Basin	Brick
SWCBMO19398	Catch Basin	Unknown
SWCBMO19399	Catch Basin	Unknown
SWCBMO19401	Catch Basin	Brick
SWCBMO19581	Catch Basin	Concrete
SWCBMO19582	Catch Basin	Concrete
SWCBMO19584	Catch Basin	Concrete
SWCBMO19585	Catch Basin	Concrete
SWCBMO19586	Catch Basin	Concrete
SWCBMO19587	Catch Basin	Concrete
SWCBMO19588	Catch Basin	Concrete
SWCBMO19592	Catch Basin	Concrete
SWCBMO19593	Catch Basin	Unknown
SWCBMO19594	Catch Basin	Unknown
SWCBMO19595	Catch Basin	Concrete
SWCBMO19596	Catch Basin	Concrete
SWCBMO19602	Catch Basin	Concrete
SWCBMO19607	Catch Basin	Concrete
SWCBMO19609	Catch Basin	Concrete
SWCBMO19610	Catch Basin	Concrete
SWCBMO19611	Catch Basin	Concrete
SWCBMO19616	Catch Basin	Concrete
SWCBMO19617	Catch Basin	Concrete
SWCBMO19626	Catch Basin	Concrete
SWCBMO19627	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO19628	Catch Basin	Concrete
SWCBMO19636	Catch Basin	Concrete
SWCBMO19637	Catch Basin	Concrete
SWCBMO19638	Catch Basin	Concrete
SWCBMO19639	Catch Basin	Concrete
SWCBMO19642	Catch Basin	Concrete
SWCBMO19643	Catch Basin	Concrete
SWCBMO19645	Catch Basin	Concrete
SWCBMO19646	Catch Basin	Concrete
SWCBMO19648	Catch Basin	Concrete
SWCBMO19649	Catch Basin	Concrete
SWCBMO19651	Catch Basin	Concrete
SWCBMO19655	Catch Basin	Concrete
SWCBMO19656	Catch Basin	Concrete
SWCBMO19402	Catch Basin	Brick
SWCBMO19404	Catch Basin	Concrete
SWCBMO19406	Catch Basin	Brick
SWCBMO19407	Catch Basin	Brick
SWCBMO19408	Catch Basin	Concrete
SWCBMO19409	Catch Basin	Concrete
SWCBMO19412	Catch Basin	Brick
SWCBMO19413	Catch Basin	Brick
SWCBMO19414	Catch Basin	Brick
SWCBMO19416	Catch Basin	Concrete
SWCBMO19419	Catch Basin	Unknown
SWCBMO19420	Catch Basin	Unknown
SWCBMO19422	Catch Basin	Concrete
SWCBMO19423	Catch Basin	Unknown
SWCBMO19425	Catch Basin	Brick
SWCBMO19426	Catch Basin	Brick
SWCBMO19436	Catch Basin	Concrete
SWCBMO19437	Catch Basin	Concrete
SWCBMO19441	Catch Basin	Concrete
SWCBMO19442	Catch Basin	Concrete
SWCBMO19444	Catch Basin	Concrete
SWCBMO19445	Catch Basin	Concrete
SWCBMO19446	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO19448	Catch Basin	Concrete
SWCBMO19449	Catch Basin	Concrete
SWCBMO19454	Catch Basin	Concrete
SWCBMO19455	Catch Basin	Concrete
SWCBMO19456	Catch Basin	Concrete
SWCBMO19457	Catch Basin	Concrete
SWCBMO19458	Catch Basin	Concrete
SWCBMO19459	Catch Basin	Concrete
SWCBMO19464	Catch Basin	Concrete
SWCBMO19465	Catch Basin	Concrete
SWCBMO19466	Catch Basin	Concrete
SWCBMO19467	Catch Basin	Concrete
SWCBMO19469	Catch Basin	Concrete
SWCBMO19474	Catch Basin	Concrete
SWCBMO19475	Catch Basin	Concrete
SWCBMO19476	Catch Basin	Concrete
SWCBMO19477	Catch Basin	Concrete
SWCBMO19478	Catch Basin	Concrete
SWCBMO19479	Catch Basin	Concrete
SWCBMO19483	Catch Basin	Concrete
SWCBMO19484	Catch Basin	Concrete
SWCBMO19485	Catch Basin	Concrete
SWCBMO19486	Catch Basin	Concrete
SWCBMO19487	Catch Basin	Concrete
SWCBMO19490	Catch Basin	Unknown
SWCBMO19492	Catch Basin	Concrete
SWCBMO19493	Catch Basin	Concrete
SWCBMO19494	Catch Basin	Concrete
SWCBMO19496	Catch Basin	Concrete
SWCBMO19497	Catch Basin	Concrete
SWCBMO19499	Catch Basin	Concrete
SWCBMO19500	Catch Basin	Concrete
SWCBMO19504	Catch Basin	Concrete
SWCBMO19505	Catch Basin	Concrete
SWCBMO19507	Catch Basin	Concrete
SWCBMO19508	Catch Basin	Concrete
SWCBMO19509	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO19511	Catch Basin	Concrete
SWCBMO19512	Catch Basin	Concrete
SWCBMO19513	Catch Basin	Concrete
SWCBMO19514	Catch Basin	Concrete
SWCBMO19515	Catch Basin	Concrete
SWCBMO19521	Catch Basin	Concrete
SWCBMO19522	Catch Basin	Concrete
SWCBMO19523	Catch Basin	Concrete
SWCBMO19524	Catch Basin	Concrete
SWCBMO19525	Catch Basin	Concrete
SWCBMO19526	Catch Basin	Concrete
SWCBMO19528	Catch Basin	Concrete
SWCBMO19530	Catch Basin	Concrete
SWCBMO19531	Catch Basin	Concrete
SWCBMO19532	Catch Basin	Concrete
SWCBMO19533	Catch Basin	Concrete
SWCBMO19535	Catch Basin	Concrete
SWCBMO19537	Catch Basin	Concrete
SWCBMO19542	Catch Basin	Concrete
SWCBMO19547	Catch Basin	Concrete
SWCBMO19548	Catch Basin	Concrete
SWCBMO19549	Catch Basin	Concrete
SWCBMO19550	Catch Basin	Concrete
SWCBMO19552	Catch Basin	Concrete
SWCBMO19553	Catch Basin	Concrete
SWCBMO19554	Catch Basin	Concrete
SWCBMO19555	Catch Basin	Concrete
SWCBMO19558	Catch Basin	Concrete
SWCBMO19559	Catch Basin	Concrete
SWCBMO19561	Catch Basin	Concrete
SWCBMO19562	Catch Basin	Concrete
SWCBMO19567	Catch Basin	Concrete
SWCBMO19569	Catch Basin	Concrete
SWCBMO19570	Catch Basin	Concrete
SWCBMO19571	Catch Basin	Concrete
SWCBMO19572	Catch Basin	Concrete
SWCBMO19573	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO19574	Catch Basin	Concrete
SWCBMO19575	Catch Basin	Concrete
SWCBMO19576	Catch Basin	Concrete
SWCBMO19724	Catch Basin	Concrete
SWCBMO19729	Catch Basin	Concrete
SWCBMO19730	Catch Basin	Concrete
SWCBMO19731	Catch Basin	Concrete
SWCBMO19736	Catch Basin	Concrete
SWCBMO19738	Catch Basin	Concrete
SWCBMO19740	Catch Basin	Concrete
SWCBMO19741	Catch Basin	Concrete
SWCBMO19743	Catch Basin	Concrete
SWCBMO19745	Catch Basin	Concrete
SWCBMO19746	Catch Basin	Concrete
SWCBMO19749	Catch Basin	Concrete
SWCBMO19750	Catch Basin	Unknown
SWCBMO19752	Catch Basin	Concrete
SWCBMO19753	Catch Basin	Concrete
SWCBMO19754	Catch Basin	Concrete
SWCBMO19757	Catch Basin	Unknown
SWCBMO14304	Catch Basin	Brick
SWCBMO14305	Catch Basin	Brick
SWCBMO14307	Catch Basin	Concrete
SWCBMO14308	Catch Basin	Concrete
SWCBMO14309	Catch Basin	Concrete
SWCBMO14311	Catch Basin	Concrete
SWCBMO14312	Catch Basin	Concrete
SWCBMO14315	Catch Basin	Concrete
SWCBMO14316	Catch Basin	Concrete
SWCBMO14321	Catch Basin	Brick
SWCBMO14322	Catch Basin	Brick
SWCBMO14326	Catch Basin	Concrete
SWCBMO14327	Catch Basin	Concrete
SWCBMO14329	Catch Basin	Concrete
SWCBMO14330	Catch Basin	Concrete
SWCBMO14333	Catch Basin	Brick
SWCBMO14334	Catch Basin	Brick

Structure ID	Type	Material
SWCBMO14340	Catch Basin	Brick
SWCBMO14341	Catch Basin	Brick
SWCBMO14367	Catch Basin	Concrete
SWCBMO14370	Catch Basin	Concrete
SWCBMO14375	Catch Basin	Concrete
SWCBMO14376	Catch Basin	Concrete
SWCBMO14383	Catch Basin	Concrete
SWCBMO14384	Catch Basin	Concrete
SWCBMO14387	Catch Basin	Concrete
SWCBMO14388	Catch Basin	Concrete
SWCBMO14391	Catch Basin	Concrete
SWCBMO14393	Catch Basin	Concrete
SWCBMO14396	Catch Basin	Concrete
SWCBMO14397	Catch Basin	Concrete
SWCBMO14399	Catch Basin	Concrete
SWCBMO14404	Catch Basin	Concrete
SWCBMO14405	Catch Basin	Concrete
SWCBMO14411	Catch Basin	Concrete
SWCBMO14412	Catch Basin	Concrete
SWCBMO14417	Catch Basin	Concrete
SWCBMO14418	Catch Basin	Concrete
SWCBMO14424	Catch Basin	Concrete
SWCBMO14425	Catch Basin	Concrete
SWCBMO14430	Catch Basin	Concrete
SWCBMO14431	Catch Basin	Concrete
SWCBMO14432	Catch Basin	Concrete
SWCBMO14433	Catch Basin	Concrete
SWCBMO14434	Catch Basin	Concrete
SWCBMO14436	Catch Basin	Concrete
SWCBMO14437	Catch Basin	Concrete
SWCBMO14438	Catch Basin	Concrete
SWCBMO14439	Catch Basin	Brick
SWCBMO14440	Catch Basin	Concrete
SWCBMO14441	Catch Basin	Concrete
SWCBMO14442	Catch Basin	Concrete
SWCBMO14466	Catch Basin	Brick
SWCBMO14468	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO14470	Catch Basin	Concrete
SWCBMO14471	Catch Basin	Concrete
SWCBMO14475	Catch Basin	Concrete
SWCBMO14476	Catch Basin	Concrete
SWCBMO14477	Catch Basin	Concrete
SWCBMO14478	Catch Basin	Concrete
SWCBMO14479	Catch Basin	Concrete
SWCBMO14480	Catch Basin	Concrete
SWCBMO14483	Catch Basin	Concrete
SWCBMO14484	Catch Basin	Concrete
SWCBMO14485	Catch Basin	Concrete
SWCBMO14489	Catch Basin	Concrete
SWCBMO14492	Catch Basin	Concrete
SWCBMO14494	Catch Basin	Concrete
SWCBMO14518	Catch Basin	Concrete
SWCBMO14519	Catch Basin	Concrete
SWCBMO14520	Catch Basin	Concrete
SWCBMO14521	Catch Basin	Concrete
SWCBMO14522	Catch Basin	Concrete
SWCBMO14523	Catch Basin	Concrete
SWCBMO14524	Catch Basin	Concrete
SWCBMO14525	Catch Basin	Concrete
SWCBMO14529	Catch Basin	Concrete
SWCBMO14532	Catch Basin	Concrete
SWCBMO14535	Catch Basin	Concrete
SWCBMO14538	Catch Basin	Concrete
SWCBMO14539	Catch Basin	Concrete
SWCBMO14540	Catch Basin	Concrete
SWCBMO14541	Catch Basin	Concrete
SWCBMO14543	Catch Basin	Concrete
SWCBMO14544	Catch Basin	Concrete
SWCBMO14547	Catch Basin	Concrete
SWCBMO14557	Catch Basin	Concrete
SWCBMO14558	Catch Basin	Concrete
SWCBMO14559	Catch Basin	Concrete
SWCBMO14561	Catch Basin	Concrete
SWCBMO14562	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO14563	Catch Basin	Concrete
SWCBMO14564	Catch Basin	Concrete
SWCBMO14565	Catch Basin	Concrete
SWCBMO14566	Catch Basin	Concrete
SWCBMO14568	Catch Basin	Concrete
SWCBMO14569	Catch Basin	Concrete
SWCBMO14571	Catch Basin	Concrete
SWCBMO14573	Catch Basin	Concrete
SWCBMO14574	Catch Basin	Concrete
SWCBMO14576	Catch Basin	Concrete
SWCBMO14577	Catch Basin	Concrete
SWCBMO14578	Catch Basin	Concrete
SWCBMO14579	Catch Basin	Concrete
SWCBMO14580	Catch Basin	Concrete
SWCBMO14582	Catch Basin	Concrete
SWCBMO14583	Catch Basin	Concrete
SWCBMO14584	Catch Basin	Concrete
SWCBMO14585	Catch Basin	Concrete
SWCBMO14588	Catch Basin	Concrete
SWCBMO14589	Catch Basin	Concrete
SWCBMO14590	Catch Basin	Concrete
SWCBMO14591	Catch Basin	Concrete
SWCBMO14594	Catch Basin	Concrete
SWCBMO14595	Catch Basin	Concrete
SWCBMO14628	Catch Basin	Concrete
SWCBMO14629	Catch Basin	Concrete
SWCBMO14630	Catch Basin	Concrete
SWCBMO14635	Catch Basin	Concrete
SWCBMO14636	Catch Basin	Concrete
SWCBMO14637	Catch Basin	Concrete
SWCBMO14647	Catch Basin	Unknown
SWCBMO14649	Catch Basin	Concrete
SWCBMO14661	Catch Basin	Concrete
SWCBMO14662	Catch Basin	Concrete
SWCBMO14666	Catch Basin	Concrete
SWCBMO14672	Catch Basin	Concrete
SWCBMO14673	Catch Basin	Brick

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Structure ID	Type	Material
SWCBMO14674	Catch Basin	Brick
SWCBMO14678	Catch Basin	Brick
SWCBMO14679	Catch Basin	Brick
SWCBMO14681	Catch Basin	Brick
SWCBMO14682	Catch Basin	Concrete
SWCBMO14693	Catch Basin	Concrete
SWCBMO14697	Catch Basin	Brick
SWCBMO14702	Catch Basin	Concrete
SWCBMO14703	Catch Basin	Concrete
SWCBMO14704	Catch Basin	Brick
SWCBMO14716	Catch Basin	Brick
SWCBMO14717	Catch Basin	Brick
SWCBMO14718	Catch Basin	Brick
SWCBMO14726	Catch Basin	Brick
SWCBMO14727	Catch Basin	Brick
SWCBMO14728	Catch Basin	Brick
SWCBMO14730	Catch Basin	Brick
SWCBMO14731	Catch Basin	Concrete
SWCBMO14737	Catch Basin	Brick
SWCBMO14738	Catch Basin	Brick
SWCBMO14739	Catch Basin	Brick
SWCBMO14741	Catch Basin	Brick
SWCBMO14742	Catch Basin	Brick
SWCBMO14745	Catch Basin	Brick
SWCBMO14746	Catch Basin	Brick
SWCBMO14747	Catch Basin	Brick
SWCBMO14750	Catch Basin	Brick
SWCBMO14752	Catch Basin	Brick
SWCBMO14755	Catch Basin	Brick
SWCBMO14756	Catch Basin	Brick
SWCBMO14761	Catch Basin	Brick
SWCBMO14762	Catch Basin	Brick
SWCBMO14763	Catch Basin	Brick
SWCBMO14764	Catch Basin	Brick
SWCBMO14768	Catch Basin	Brick
SWCBMO14769	Catch Basin	Brick
SWCBMO14777	Catch Basin	Brick

Structure ID	Type	Material
SWCBMO19673	Catch Basin	Brick
SWCBMO19674	Catch Basin	Brick
SWCBMO19675	Catch Basin	Unknown
SWCBMO19677	Catch Basin	Brick
SWCBMO19681	Catch Basin	Brick
SWCBMO19682	Catch Basin	Brick
SWCBMO19684	Catch Basin	Concrete
SWCBMO19685	Catch Basin	Concrete
SWCBMO19688	Catch Basin	Brick
SWCBMO19689	Catch Basin	Brick
SWCBMO19714	Catch Basin	Brick
SWCBMO19715	Catch Basin	Brick
SWCBMO19723	Catch Basin	Concrete
SWCBMO14446	Catch Basin	Concrete
SWCBMO14449	Catch Basin	Concrete
SWCBMO14450	Catch Basin	Concrete
SWCBMO14454	Catch Basin	Brick
SWCBMO14455	Catch Basin	Brick
SWCBMO14456	Catch Basin	Concrete
SWCBMO14458	Catch Basin	Concrete
SWCBMO14459	Catch Basin	Concrete
SWCBMO14460	Catch Basin	Concrete
SWCBMO14461	Catch Basin	Concrete
SWCBMO14799	Catch Basin	Unknown
SWCBMO14800	Catch Basin	Unknown
SWCBMO14801	Catch Basin	Brick
SWCBMO14802	Catch Basin	Brick
SWCBMO19304	Catch Basin	Unknown
SWCBMO19305	Catch Basin	Unknown
SWCBMO19306	Catch Basin	Unknown
SWCBMO19307	Catch Basin	Concrete
SWCBMO19311	Catch Basin	Concrete
SWCBMO19312	Catch Basin	Unknown
SWCBMO18768	Catch Basin	Brick
SWCBMO18770	Catch Basin	Brick
SWCBMO18771	Catch Basin	Brick
SWCBMO18774	Catch Basin	Brick

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Structure ID	Type	Material
SWCBMO18775	Catch Basin	Brick
SWCBMO18777	Catch Basin	Brick
SWCBMO18780	Catch Basin	Brick
SWCBMO18781	Catch Basin	Brick
SWCBMO18783	Catch Basin	Brick
SWCBMO18785	Catch Basin	Brick
SWCBMO18787	Catch Basin	Brick
SWCBMO18604	Catch Basin	Concrete
SWCBMO18608	Catch Basin	Brick
SWCBMO18610	Catch Basin	Concrete
SWCBMO18611	Catch Basin	Concrete
SWCBMO18613	Catch Basin	Concrete
SWCBMO18614	Catch Basin	Concrete
SWCBMO18615	Catch Basin	Concrete
SWCBMO18616	Catch Basin	Concrete
SWCBMO18617	Catch Basin	Concrete
SWCBMO18618	Catch Basin	Concrete
SWCBMO18619	Catch Basin	Concrete
SWCBMO18620	Catch Basin	Concrete
SWCBMO18621	Catch Basin	Concrete
SWCBMO18623	Catch Basin	Concrete
SWCBMO18624	Catch Basin	Concrete
SWCBMO18626	Catch Basin	Concrete
SWCBMO18627	Catch Basin	Concrete
SWCBMO18628	Catch Basin	Concrete
SWCBMO18629	Catch Basin	Concrete
SWCBMO18630	Catch Basin	Concrete
SWCBMO18631	Catch Basin	Concrete
SWCBMO18635	Catch Basin	Concrete
SWCBMO18636	Catch Basin	Concrete
SWCBMO18637	Catch Basin	Concrete
SWCBMO18638	Catch Basin	Concrete
SWCBMO18639	Catch Basin	Concrete
SWCBMO18640	Catch Basin	Concrete
SWCBMO18645	Catch Basin	Brick
SWCBMO18646	Catch Basin	Brick
SWCBMO18648	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO18649	Catch Basin	Concrete
SWCBMO18650	Catch Basin	Concrete
SWCBMO18691	Catch Basin	Brick
SWCBMO18700	Catch Basin	Concrete
SWCBMO18701	Catch Basin	Unknown
SWCBMO18703	Catch Basin	Brick
SWCBMO18707	Catch Basin	Brick
SWCBMO18708	Catch Basin	Brick
SWCBMO18709	Catch Basin	Brick
SWCBMO18710	Catch Basin	Brick
SWCBMO18711	Catch Basin	Brick
SWCBMO18714	Catch Basin	Concrete
SWCBMO18717	Catch Basin	Concrete
SWCBMO18719	Catch Basin	Brick
SWCBMO18720	Catch Basin	Brick
SWCBMO18724	Catch Basin	Brick
SWCBMO18725	Catch Basin	Brick
SWCBMO18726	Catch Basin	Unknown
SWCBMO18728	Catch Basin	Unknown
SWCBMO18729	Catch Basin	Unknown
SWCBMO18732	Catch Basin	Brick
SWCBMO18733	Catch Basin	Brick
SWCBMO18736	Catch Basin	Brick
SWCBMO18737	Catch Basin	Brick
SWCBMO18738	Catch Basin	Brick
SWCBMO18739	Catch Basin	Brick
SWCBMO18740	Catch Basin	Brick
SWCBMO18741	Catch Basin	Brick
SWCBMO18742	Catch Basin	Brick
SWCBMO18745	Catch Basin	Brick
SWCBMO18746	Catch Basin	Brick
SWCBMO18748	Catch Basin	Brick
SWCBMO18750	Catch Basin	Brick
SWCBMO18751	Catch Basin	Brick
SWCBMO18753	Catch Basin	Brick
SWCBMO18755	Catch Basin	Brick
SWCBMO18757	Catch Basin	Brick

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Structure ID	Type	Material
SWCBMO18758	Catch Basin	Brick
SWCBMO18760	Catch Basin	Concrete
SWCBMO18761	Catch Basin	Concrete
SWCBMO18764	Catch Basin	Concrete
SWCBMO18765	Catch Basin	Concrete
SWCBMO18767	Catch Basin	Brick
SWCBMO18652	Catch Basin	Concrete
SWCBMO18654	Catch Basin	Concrete
SWCBMO18656	Catch Basin	Concrete
SWCBMO18658	Catch Basin	Concrete
SWCBMO18659	Catch Basin	Concrete
SWCBMO18663	Catch Basin	Concrete
SWCBMO18664	Catch Basin	Concrete
SWCBMO18665	Catch Basin	Concrete
SWCBMO18666	Catch Basin	Concrete
SWCBMO18667	Catch Basin	Concrete
SWCBMO18668	Catch Basin	Unknown
SWCBMO18669	Catch Basin	Concrete
SWCBMO18670	Catch Basin	Concrete
SWCBMO18674	Catch Basin	Brick
SWCBMO18675	Catch Basin	Brick
SWCBMO18679	Catch Basin	Brick
SWCBMO18680	Catch Basin	Brick
SWCBMO18687	Catch Basin	Brick
SWCBMO18688	Catch Basin	Brick
SWCBMO18690	Catch Basin	Unknown
SWCBMO18789	Catch Basin	Brick
SWCBMO18791	Catch Basin	Brick
SWCBMO18792	Catch Basin	Brick
SWCBMO18794	Catch Basin	Brick
SWCBMO18795	Catch Basin	Brick
SWCBMO18797	Catch Basin	Brick
SWCBMO18798	Catch Basin	Brick
SWCBMO18801	Catch Basin	Brick
SWCBMO18802	Catch Basin	Brick
SWCBMO18804	Catch Basin	Brick
SWCBMO18805	Catch Basin	Brick

Structure ID	Type	Material
SWCBMO18808	Catch Basin	Unknown
SWCBMO18809	Catch Basin	Brick
SWCBMO18812	Catch Basin	Brick
SWCBMO18814	Catch Basin	Brick
SWCBMO18815	Catch Basin	Brick
SWCBMO18816	Catch Basin	Brick
SWCBMO18817	Catch Basin	Brick
SWCBMO18820	Catch Basin	Brick
SWCBMO18822	Catch Basin	Brick
SWCBMO18824	Catch Basin	Brick
SWCBMO18827	Catch Basin	Concrete
SWCBMO18829	Catch Basin	Concrete
SWCBMO18830	Catch Basin	Concrete
SWCBMO18832	Catch Basin	Concrete
SWCBMO18833	Catch Basin	Unknown
SWCBMO18834	Catch Basin	Concrete
SWCBMO18835	Catch Basin	Unknown
SWCBMO18839	Catch Basin	Concrete
SWCBMO18840	Catch Basin	Concrete
SWCBMO18842	Catch Basin	Concrete
SWCBMO18843	Catch Basin	Concrete
SWCBMO18845	Catch Basin	Concrete
SWCBMO18847	Catch Basin	Concrete
SWCBMO18848	Catch Basin	Concrete
SWCBMO18850	Catch Basin	Concrete
SWCBMO18851	Catch Basin	Concrete
SWCBMO18853	Catch Basin	Brick
SWCBMO18854	Catch Basin	Concrete
SWCBMO18856	Catch Basin	Concrete
SWCBMO18857	Catch Basin	Concrete
SWCBMO18859	Catch Basin	Concrete
SWCBMO18860	Catch Basin	Brick
SWCBMO18862	Catch Basin	Concrete
SWCBMO18863	Catch Basin	Concrete
SWCBMO18864	Catch Basin	Concrete
SWCBMO18866	Catch Basin	Concrete
SWCBMO18867	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO18868	Catch Basin	Concrete
SWCBMO18870	Catch Basin	Brick
SWCBMO18871	Catch Basin	Brick
SWCBMO18874	Catch Basin	Concrete
SWCBMO18875	Catch Basin	Concrete
SWCBMO18877	Catch Basin	Brick
SWCBMO18878	Catch Basin	Brick
SWCBMO18881	Catch Basin	Concrete
SWCBMO18882	Catch Basin	Concrete
SWCBMO18885	Catch Basin	Concrete
SWCBMO18886	Catch Basin	Concrete
SWCBMO18888	Catch Basin	Concrete
SWCBMO18889	Catch Basin	Concrete
SWCBMO18891	Catch Basin	Concrete
SWCBMO18892	Catch Basin	Concrete
SWCBMO18896	Catch Basin	Concrete
SWCBMO18897	Catch Basin	Concrete
SWCBMO18899	Catch Basin	Concrete
SWCBMO18901	Catch Basin	Concrete
SWCBMO18902	Catch Basin	Concrete
SWCBMO18903	Catch Basin	Concrete
SWCBMO18904	Catch Basin	Concrete
SWCBMO18908	Catch Basin	Brick
SWCBMO18909	Catch Basin	Brick
SWCBMO18910	Catch Basin	Brick
SWCBMO18916	Catch Basin	Unknown
SWCBMO18917	Catch Basin	Brick
SWCBMO18919	Catch Basin	Brick
SWCBMO18920	Catch Basin	Brick
SWCBMO18921	Catch Basin	Brick
SWCBMO18922	Catch Basin	Brick
SWCBMO18927	Catch Basin	Unknown
SWCBMO18928	Catch Basin	Brick
SWCBMO18930	Catch Basin	Brick
SWCBMO18933	Catch Basin	Brick
SWCBMO18934	Catch Basin	Brick
SWCBMO18936	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO18938	Catch Basin	Concrete
SWCBMO18939	Catch Basin	Concrete
SWCBMO18940	Catch Basin	Concrete
SWCBMO18941	Catch Basin	Concrete
SWCBMO18945	Catch Basin	Concrete
SWCBMO18947	Catch Basin	Concrete
SWCBMO18948	Catch Basin	Concrete
SWCBMO18949	Catch Basin	Unknown
SWCBMO18950	Catch Basin	Unknown
SWCBMO18951	Catch Basin	Brick
SWCBMO18952	Catch Basin	Unknown
SWCBMO18957	Catch Basin	Unknown
SWCBMO18959	Catch Basin	Brick
SWCBMO18960	Catch Basin	Brick
SWCBMO18962	Catch Basin	Brick
SWCBMO18963	Catch Basin	Brick
SWCBMO18967	Catch Basin	Concrete
SWCBMO18968	Catch Basin	Concrete
SWCBMO18969	Catch Basin	Concrete
SWCBMO18970	Catch Basin	Concrete
SWCBMO18971	Catch Basin	Concrete
SWCBMO18973	Catch Basin	Concrete
SWCBMO18974	Catch Basin	Concrete
SWCBMO18977	Catch Basin	Concrete
SWCBMO18978	Catch Basin	Concrete
SWCBMO18982	Catch Basin	Concrete
SWCBMO18983	Catch Basin	Concrete
SWCBMO18986	Catch Basin	Concrete
SWCBMO18989	Catch Basin	Concrete
SWCBMO18990	Catch Basin	Brick
SWCBMO18991	Catch Basin	Concrete
SWCBMO18993	Catch Basin	Brick
SWCBMO18994	Catch Basin	Concrete
SWCBMO18995	Catch Basin	Concrete
SWCBMO18996	Catch Basin	Brick
SWCBMO18603	Catch Basin	Concrete
SWCBMO19001	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO19002	Catch Basin	Concrete
SWCBMO19003	Catch Basin	Concrete
SWCBMO19004	Catch Basin	Concrete
SWCBMO19005	Catch Basin	Concrete
SWCBMO19007	Catch Basin	Concrete
SWCBMO19008	Catch Basin	Concrete
SWCBMO19010	Catch Basin	Concrete
SWCBMO19011	Catch Basin	Concrete
SWCBMO19012	Catch Basin	Concrete
SWCBMO19013	Catch Basin	Concrete
SWCBMO19015	Catch Basin	Concrete
SWCBMO19016	Catch Basin	Concrete
SWCBMO19018	Catch Basin	Concrete
SWCBMO19019	Catch Basin	Concrete
SWCBMO19023	Catch Basin	Concrete
SWCBMO19024	Catch Basin	Concrete
SWCBMO19026	Catch Basin	Concrete
SWCBMO19027	Catch Basin	Concrete
SWCBMO19029	Catch Basin	Concrete
SWCBMO19030	Catch Basin	Concrete
SWCBMO13603	Catch Basin	Concrete
SWCBMO13604	Catch Basin	Concrete
SWCBMO13605	Catch Basin	Concrete
SWCBMO13606	Catch Basin	Concrete
SWCBMO13610	Catch Basin	Concrete
SWCBMO13611	Catch Basin	Concrete
SWCBMO13613	Catch Basin	Concrete
SWCBMO13614	Catch Basin	Concrete
SWCBMO13615	Catch Basin	Concrete
SWCBMO13616	Catch Basin	Concrete
SWCBMO13617	Catch Basin	Concrete
SWCBMO13618	Catch Basin	Concrete
SWCBMO13619	Catch Basin	Concrete
SWCBMO13620	Catch Basin	Concrete
SWCBMO13623	Catch Basin	Concrete
SWCBMO13624	Catch Basin	Concrete
SWCBMO13625	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO13626	Catch Basin	Concrete
SWCBMO13627	Catch Basin	Concrete
SWCBMO13628	Catch Basin	Concrete
SWCBMO13632	Catch Basin	Concrete
SWCBMO13633	Catch Basin	Concrete
SWCBMO13634	Catch Basin	Concrete
SWCBMO13635	Catch Basin	Concrete
SWCBMO13645	Catch Basin	Concrete
SWCBMO13647	Catch Basin	Concrete
SWCBMO13648	Catch Basin	Concrete
SWCBMO13649	Catch Basin	Concrete
SWCBMO13650	Catch Basin	Concrete
SWCBMO13651	Catch Basin	Concrete
SWCBMO13653	Catch Basin	Concrete
SWCBMO13655	Catch Basin	Concrete
SWCBMO13656	Catch Basin	Concrete
SWCBMO13657	Catch Basin	Concrete
SWCBMO13658	Catch Basin	Concrete
SWCBMO13660	Catch Basin	Concrete
SWCBMO13661	Catch Basin	Concrete
SWCBMO13664	Catch Basin	Concrete
SWCBMO13665	Catch Basin	Concrete
SWCBMO13666	Catch Basin	Concrete
SWCBMO13667	Catch Basin	Concrete
SWCBMO13668	Catch Basin	Concrete
SWCBMO13669	Catch Basin	Concrete
SWCBMO13670	Catch Basin	Concrete
SWCBMO13671	Catch Basin	Concrete
SWCBMO13672	Catch Basin	Concrete
SWCBMO13673	Catch Basin	Concrete
SWCBMO13674	Catch Basin	Concrete
SWCBMO13675	Catch Basin	Concrete
SWCBMO13676	Catch Basin	Concrete
SWCBMO13678	Catch Basin	Concrete
SWCBMO13679	Catch Basin	Concrete
SWCBMO13681	Catch Basin	Concrete
SWCBMO13682	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO13684	Catch Basin	Concrete
SWCBMO13685	Catch Basin	Concrete
SWCBMO13688	Catch Basin	Concrete
SWCBMO13689	Catch Basin	Concrete
SWCBMO13690	Catch Basin	Concrete
SWCBMO13691	Catch Basin	Concrete
SWCBMO13697	Catch Basin	Concrete
SWCBMO13698	Catch Basin	Concrete
SWCBMO13699	Catch Basin	Concrete
SWCBMO13702	Catch Basin	Brick
SWCBMO13703	Catch Basin	Unknown
SWCBMO13705	Catch Basin	Brick
SWCBMO13706	Catch Basin	Unknown
SWCBMO13708	Catch Basin	Unknown
SWCBMO13709	Catch Basin	Brick
SWCBMO13710	Catch Basin	Unknown
SWCBMO13713	Catch Basin	Brick
SWCBMO13714	Catch Basin	Concrete
SWCBMO13715	Catch Basin	Unknown
SWCBMO13723	Catch Basin	Unknown
SWCBMO13726	Catch Basin	Unknown
SWCBMO13727	Catch Basin	Unknown
SWCBMO13728	Catch Basin	Unknown
SWCBMO13729	Catch Basin	Unknown
SWCBMO13733	Catch Basin	Concrete
SWCBMO13734	Catch Basin	Concrete
SWCBMO13735	Catch Basin	Brick
SWCBMO13736	Catch Basin	Brick
SWCBMO13739	Catch Basin	Concrete
SWCBMO13741	Catch Basin	Concrete
SWCBMO13742	Catch Basin	Concrete
SWCBMO13743	Catch Basin	Concrete
SWCBMO13745	Catch Basin	Brick
SWCBMO13746	Catch Basin	Brick
SWCBMO13747	Catch Basin	Concrete
SWCBMO13748	Catch Basin	Concrete
SWCBMO13751	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO13752	Catch Basin	Concrete
SWCBMO13753	Catch Basin	Concrete
SWCBMO13754	Catch Basin	Concrete
SWCBMO13755	Catch Basin	Concrete
SWCBMO13756	Catch Basin	Concrete
SWCBMO13757	Catch Basin	Concrete
SWCBMO13758	Catch Basin	Concrete
SWCBMO13761	Catch Basin	Concrete
SWCBMO13763	Catch Basin	Concrete
SWCBMO13764	Catch Basin	Concrete
SWCBMO13765	Catch Basin	Concrete
SWCBMO13766	Catch Basin	Concrete
SWCBMO13769	Catch Basin	Brick
SWCBMO13770	Catch Basin	Brick
SWCBMO13771	Catch Basin	Concrete
SWCBMO13773	Catch Basin	Brick
SWCBMO13774	Catch Basin	Concrete
SWCBMO13776	Catch Basin	Brick
SWCBMO13777	Catch Basin	Brick
SWCBMO13778	Catch Basin	Brick
SWCBMO13779	Catch Basin	Brick
SWCBMO13780	Catch Basin	Concrete
SWCBMO13785	Catch Basin	Concrete
SWCBMO13787	Catch Basin	Concrete
SWCBMO13791	Catch Basin	Brick
SWCBMO13794	Catch Basin	Brick
SWCBMO13795	Catch Basin	Brick
SWCBMO13797	Catch Basin	Brick
SWCBMO13798	Catch Basin	Brick
SWCBMO13807	Catch Basin	Brick
SWCBMO13808	Catch Basin	Brick
SWCBMO13809	Catch Basin	Brick
SWCBMO13811	Catch Basin	Brick
SWCBMO13812	Catch Basin	Concrete
SWCBMO13813	Catch Basin	Concrete
SWCBMO13814	Catch Basin	Concrete
SWCBMO13815	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO13817	Catch Basin	Concrete
SWCBMO13818	Catch Basin	Concrete
SWCBMO13820	Catch Basin	Concrete
SWCBMO13821	Catch Basin	Concrete
SWCBMO13827	Catch Basin	Concrete
SWCBMO13828	Catch Basin	Concrete
SWCBMO13829	Catch Basin	Concrete
SWCBMO13830	Catch Basin	Concrete
SWCBMO13831	Catch Basin	Concrete
SWCBMO13832	Catch Basin	Concrete
SWCBMO13833	Catch Basin	Concrete
SWCBMO13834	Catch Basin	Concrete
SWCBMO13835	Catch Basin	Concrete
SWCBMO13836	Catch Basin	Concrete
SWCBMO13839	Catch Basin	Concrete
SWCBMO13840	Catch Basin	Concrete
SWCBMO13841	Catch Basin	Concrete
SWCBMO13842	Catch Basin	Concrete
SWCBMO13843	Catch Basin	Concrete
SWCBMO13844	Catch Basin	Concrete
SWCBMO13845	Catch Basin	Concrete
SWCBMO13850	Catch Basin	Concrete
SWCBMO13851	Catch Basin	Concrete
SWCBMO13852	Catch Basin	Concrete
SWCBMO13853	Catch Basin	Concrete
SWCBMO13854	Catch Basin	Concrete
SWCBMO13855	Catch Basin	Concrete
SWCBMO13856	Catch Basin	Concrete
SWCBMO13857	Catch Basin	Concrete
SWCBMO13858	Catch Basin	Concrete
SWCBMO13859	Catch Basin	Concrete
SWCBMO13860	Catch Basin	Concrete
SWCBMO13861	Catch Basin	Concrete
SWCBMO13862	Catch Basin	Concrete
SWCBMO13863	Catch Basin	Concrete
SWCBMO13864	Catch Basin	Concrete
SWCBMO13865	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO13893	Catch Basin	Concrete
SWCBMO13898	Catch Basin	Concrete
SWCBMO13899	Catch Basin	Concrete
SWCBMO13902	Catch Basin	Concrete
SWCBMO13903	Catch Basin	Concrete
SWCBMO13906	Catch Basin	Brick
SWCBMO13908	Catch Basin	Brick
SWCBMO13909	Catch Basin	Brick
SWCBMO13911	Catch Basin	Brick
SWCBMO13912	Catch Basin	Brick
SWCBMO13913	Catch Basin	Brick
SWCBMO13914	Catch Basin	Brick
SWCBMO13915	Catch Basin	Brick
SWCBMO13916	Catch Basin	Brick
SWCBMO13921	Catch Basin	Brick
SWCBMO13922	Catch Basin	Brick
SWCBMO13925	Catch Basin	Brick
SWCBMO13926	Catch Basin	Brick
SWCBMO13933	Catch Basin	Brick
SWCBMO13934	Catch Basin	Brick
SWCBMO13937	Catch Basin	Brick
SWCBMO13938	Catch Basin	Brick
SWCBMO13942	Catch Basin	Brick
SWCBMO13943	Catch Basin	Brick
SWCBMO13945	Catch Basin	Concrete
SWCBMO13946	Catch Basin	Concrete
SWCBMO13951	Catch Basin	Brick
SWCBMO13953	Catch Basin	Brick
SWCBMO13954	Catch Basin	Brick
SWCBMO13956	Catch Basin	Brick
SWCBMO13957	Catch Basin	Brick
SWCBMO13958	Catch Basin	Brick
SWCBMO13959	Catch Basin	Brick
SWCBMO13960	Catch Basin	Brick
SWCBMO13961	Catch Basin	Brick
SWCBMO13962	Catch Basin	Brick
SWCBMO13963	Catch Basin	Brick

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Structure ID	Type	Material
SWCBMO13964	Catch Basin	Brick
SWCBMO13966	Catch Basin	Brick
SWCBMO13967	Catch Basin	Brick
SWCBMO13969	Catch Basin	Brick
SWCBMO13970	Catch Basin	Brick
SWCBMO13972	Catch Basin	Brick
SWCBMO13973	Catch Basin	Brick
SWCBMO13975	Catch Basin	Brick
SWCBMO13976	Catch Basin	Brick
SWCBMO13978	Catch Basin	Brick
SWCBMO13979	Catch Basin	Brick
SWCBMO13985	Catch Basin	Concrete
SWCBMO13986	Catch Basin	Concrete
SWCBMO13989	Catch Basin	Concrete
SWCBMO13990	Catch Basin	Concrete
SWCBMO13994	Catch Basin	Concrete
SWCBMO13995	Catch Basin	Concrete
SWCBMO14002	Catch Basin	Concrete
SWCBMO14003	Catch Basin	Unknown
SWCBMO14004	Catch Basin	Concrete
SWCBMO14005	Catch Basin	Unknown
SWCBMO14010	Catch Basin	Unknown
SWCBMO14011	Catch Basin	Unknown
SWCBMO14014	Catch Basin	Brick
SWCBMO14015	Catch Basin	Concrete
SWCBMO14016	Catch Basin	Unknown
SWCBMO14018	Catch Basin	Concrete
SWCBMO14019	Catch Basin	Unknown
SWCBMO14021	Catch Basin	Unknown
SWCBMO14022	Catch Basin	Concrete
SWCBMO14023	Catch Basin	Unknown
SWCBMO14025	Catch Basin	Unknown
SWCBMO14026	Catch Basin	Unknown
SWCBMO14027	Catch Basin	Unknown
SWCBMO14030	Catch Basin	Unknown
SWCBMO14031	Catch Basin	Unknown
SWCBMO14033	Catch Basin	Brick

Structure ID	Type	Material
SWCBMO14034	Catch Basin	Brick
SWCBMO14038	Catch Basin	Concrete
SWCBMO14039	Catch Basin	Concrete
SWCBMO14040	Catch Basin	Concrete
SWCBMO14043	Catch Basin	Concrete
SWCBMO14044	Catch Basin	Concrete
SWCBMO14046	Catch Basin	Concrete
SWCBMO14049	Catch Basin	Unknown
SWCBMO14051	Catch Basin	Concrete
SWCBMO14056	Catch Basin	Brick
SWCBMO14057	Catch Basin	Brick
SWCBMO18206	Catch Basin	Concrete
SWCBMO18207	Catch Basin	Concrete
SWCBMO18208	Catch Basin	Concrete
SWCBMO18210	Catch Basin	Brick
SWCBMO18211	Catch Basin	Brick
SWCBMO18216	Catch Basin	Brick
SWCBMO18217	Catch Basin	Concrete
SWCBMO18218	Catch Basin	Brick
SWCBMO18219	Catch Basin	Brick
SWCBMO18222	Catch Basin	Brick
SWCBMO18223	Catch Basin	Brick
SWCBMO18228	Catch Basin	Brick
SWCBMO18229	Catch Basin	Brick
SWCBMO18231	Catch Basin	Brick
SWCBMO18232	Catch Basin	Brick
SWCBMO18235	Catch Basin	Brick
SWCBMO18239	Catch Basin	Brick
SWCBMO18242	Catch Basin	Brick
SWCBMO18243	Catch Basin	Brick
SWCBMO18245	Catch Basin	Concrete
SWCBMO18247	Catch Basin	Concrete
SWCBMO18248	Catch Basin	Unknown
SWCBMO18249	Catch Basin	Brick
SWCBMO18250	Catch Basin	Brick
SWCBMO18252	Catch Basin	Brick
SWCBMO18253	Catch Basin	Brick

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Structure ID	Type	Material
SWCBMO18256	Catch Basin	Brick
SWCBMO18257	Catch Basin	Brick
SWCBMO18258	Catch Basin	Concrete
SWCBMO18259	Catch Basin	Concrete
SWCBMO18265	Catch Basin	Brick
SWCBMO18266	Catch Basin	Brick
SWCBMO18268	Catch Basin	Brick
SWCBMO18269	Catch Basin	Brick
SWCBMO18273	Catch Basin	Brick
SWCBMO18274	Catch Basin	Concrete
SWCBMO18275	Catch Basin	Brick
SWCBMO18276	Catch Basin	Brick
SWCBMO18277	Catch Basin	Concrete
SWCBMO18278	Catch Basin	Concrete
SWCBMO18280	Catch Basin	Brick
SWCBMO18281	Catch Basin	Brick
SWCBMO18284	Catch Basin	Concrete
SWCBMO18286	Catch Basin	Concrete
SWCBMO18287	Catch Basin	Concrete
SWCBMO18289	Catch Basin	Brick
SWCBMO18151	Catch Basin	Brick
SWCBMO18154	Catch Basin	Concrete
SWCBMO18155	Catch Basin	Concrete
SWCBMO18156	Catch Basin	Concrete
SWCBMO18157	Catch Basin	Brick
SWCBMO18161	Catch Basin	Concrete
SWCBMO18162	Catch Basin	Concrete
SWCBMO18163	Catch Basin	Concrete
SWCBMO18164	Catch Basin	Concrete
SWCBMO18170	Catch Basin	Concrete
SWCBMO18171	Catch Basin	Concrete
SWCBMO18172	Catch Basin	Concrete
SWCBMO18173	Catch Basin	Concrete
SWCBMO18174	Catch Basin	Concrete
SWCBMO18175	Catch Basin	Concrete
SWCBMO18176	Catch Basin	Concrete
SWCBMO18177	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO18178	Catch Basin	Concrete
SWCBMO18179	Catch Basin	Concrete
SWCBMO18180	Catch Basin	Concrete
SWCBMO18181	Catch Basin	Concrete
SWCBMO18182	Catch Basin	Concrete
SWCBMO18183	Catch Basin	Concrete
SWCBMO18187	Catch Basin	Concrete
SWCBMO18188	Catch Basin	Concrete
SWCBMO18189	Catch Basin	Brick
SWCBMO18190	Catch Basin	Brick
SWCBMO18196	Catch Basin	Brick
SWCBMO18197	Catch Basin	Unknown
SWCBMO18202	Catch Basin	Concrete
SWCBMO18203	Catch Basin	Concrete
SWCBMO18290	Catch Basin	Brick
SWCBMO17803	Catch Basin	Concrete
SWCBMO17804	Catch Basin	Concrete
SWCBMO17805	Catch Basin	Concrete
SWCBMO17806	Catch Basin	Concrete
SWCBMO17808	Catch Basin	Concrete
SWCBMO17809	Catch Basin	Concrete
SWCBMO17810	Catch Basin	Concrete
SWCBMO17811	Catch Basin	Concrete
SWCBMO17812	Catch Basin	Concrete
SWCBMO17813	Catch Basin	Concrete
SWCBMO17815	Catch Basin	Concrete
SWCBMO17816	Catch Basin	Concrete
SWCBMO17818	Catch Basin	Concrete
SWCBMO17819	Catch Basin	Concrete
SWCBMO17820	Catch Basin	Concrete
SWCBMO17821	Catch Basin	Concrete
SWCBMO17825	Catch Basin	Concrete
SWCBMO17826	Catch Basin	Concrete
SWCBMO17827	Catch Basin	Concrete
SWCBMO17828	Catch Basin	Concrete
SWCBMO17829	Catch Basin	Concrete
SWCBMO17830	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO17831	Catch Basin	Concrete
SWCBMO17833	Catch Basin	Concrete
SWCBMO17834	Catch Basin	Concrete
SWCBMO17835	Catch Basin	Concrete
SWCBMO17836	Catch Basin	Concrete
SWCBMO17837	Catch Basin	Concrete
SWCBMO17838	Catch Basin	Concrete
SWCBMO17839	Catch Basin	Concrete
SWCBMO17840	Catch Basin	Concrete
SWCBMO17841	Catch Basin	Concrete
SWCBMO17842	Catch Basin	Concrete
SWCBMO17843	Catch Basin	Concrete
SWCBMO17844	Catch Basin	Concrete
SWCBMO17845	Catch Basin	Concrete
SWCBMO17846	Catch Basin	Concrete
SWCBMO17847	Catch Basin	Concrete
SWCBMO17848	Catch Basin	Concrete
SWCBMO17849	Catch Basin	Concrete
SWCBMO17850	Catch Basin	Concrete
SWCBMO17851	Catch Basin	Concrete
SWCBMO17852	Catch Basin	Concrete
SWCBMO17853	Catch Basin	Concrete
SWCBMO17854	Catch Basin	Concrete
SWCBMO17855	Catch Basin	Concrete
SWCBMO17859	Catch Basin	Concrete
SWCBMO17860	Catch Basin	Concrete
SWCBMO17861	Catch Basin	Concrete
SWCBMO17862	Catch Basin	Concrete
SWCBMO17864	Catch Basin	Concrete
SWCBMO17865	Catch Basin	Concrete
SWCBMO17868	Catch Basin	Concrete
SWCBMO17869	Catch Basin	Concrete
SWCBMO17872	Catch Basin	Concrete
SWCBMO17873	Catch Basin	Concrete
SWCBMO17874	Catch Basin	Concrete
SWCBMO17875	Catch Basin	Concrete
SWCBMO17876	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO17877	Catch Basin	Concrete
SWCBMO17878	Catch Basin	Concrete
SWCBMO17879	Catch Basin	Concrete
SWCBMO17880	Catch Basin	Concrete
SWCBMO17881	Catch Basin	Concrete
SWCBMO17884	Catch Basin	Concrete
SWCBMO17887	Catch Basin	Concrete
SWCBMO17888	Catch Basin	Concrete
SWCBMO17889	Catch Basin	Concrete
SWCBMO17890	Catch Basin	Concrete
SWCBMO17891	Catch Basin	Concrete
SWCBMO17892	Catch Basin	Concrete
SWCBMO17895	Catch Basin	Concrete
SWCBMO17897	Catch Basin	Concrete
SWCBMO17898	Catch Basin	Concrete
SWCBMO17899	Catch Basin	Concrete
SWCBMO17900	Catch Basin	Concrete
SWCBMO17905	Catch Basin	Concrete
SWCBMO17906	Catch Basin	Concrete
SWCBMO17911	Catch Basin	Concrete
SWCBMO17912	Catch Basin	Concrete
SWCBMO17913	Catch Basin	Concrete
SWCBMO17914	Catch Basin	Concrete
SWCBMO17915	Catch Basin	Concrete
SWCBMO17916	Catch Basin	Concrete
SWCBMO17917	Catch Basin	Concrete
SWCBMO17918	Catch Basin	Concrete
SWCBMO17919	Catch Basin	Concrete
SWCBMO17925	Catch Basin	Concrete
SWCBMO17927	Catch Basin	Concrete
SWCBMO17928	Catch Basin	Concrete
SWCBMO17929	Catch Basin	Concrete
SWCBMO17931	Catch Basin	Concrete
SWCBMO17932	Catch Basin	Concrete
SWCBMO17934	Catch Basin	Concrete
SWCBMO17935	Catch Basin	Concrete
SWCBMO17937	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO17938	Catch Basin	Concrete
SWCBMO17944	Catch Basin	Concrete
SWCBMO17947	Catch Basin	Concrete
SWCBMO17948	Catch Basin	Concrete
SWCBMO17949	Catch Basin	Concrete
SWCBMO17950	Catch Basin	Concrete
SWCBMO17951	Catch Basin	Concrete
SWCBMO17963	Catch Basin	Concrete
SWCBMO17964	Catch Basin	Concrete
SWCBMO17967	Catch Basin	Concrete
SWCBMO17968	Catch Basin	Concrete
SWCBMO17969	Catch Basin	Concrete
SWCBMO17970	Catch Basin	Concrete
SWCBMO17971	Catch Basin	Concrete
SWCBMO17972	Catch Basin	Concrete
SWCBMO17973	Catch Basin	Concrete
SWCBMO17974	Catch Basin	Concrete
SWCBMO17975	Catch Basin	Concrete
SWCBMO17978	Catch Basin	Concrete
SWCBMO17979	Catch Basin	Concrete
SWCBMO17980	Catch Basin	Concrete
SWCBMO17986	Catch Basin	Concrete
SWCBMO17987	Catch Basin	Concrete
SWCBMO17990	Catch Basin	Concrete
SWCBMO17991	Catch Basin	Concrete
SWCBMO17993	Catch Basin	Concrete
SWCBMO17995	Catch Basin	Concrete
SWCBMO17996	Catch Basin	Concrete
SWCBMO17999	Catch Basin	Concrete
SWCBMO18000	Catch Basin	Concrete
SWCBMO18014	Catch Basin	Concrete
SWCBMO18015	Catch Basin	Concrete
SWCBMO18016	Catch Basin	Concrete
SWCBMO18018	Catch Basin	Concrete
SWCBMO18021	Catch Basin	Concrete
SWCBMO18022	Catch Basin	Concrete
SWCBMO18023	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO18024	Catch Basin	Concrete
SWCBMO18026	Catch Basin	Concrete
SWCBMO18027	Catch Basin	Concrete
SWCBMO18028	Catch Basin	Concrete
SWCBMO18029	Catch Basin	Concrete
SWCBMO18030	Catch Basin	Concrete
SWCBMO18031	Catch Basin	Concrete
SWCBMO18034	Catch Basin	Concrete
SWCBMO18035	Catch Basin	Concrete
SWCBMO18036	Catch Basin	Concrete
SWCBMO18037	Catch Basin	Concrete
SWCBMO18038	Catch Basin	Concrete
SWCBMO18039	Catch Basin	Concrete
SWCBMO18041	Catch Basin	Concrete
SWCBMO13074	Catch Basin	Brick
SWCBMO13075	Catch Basin	Brick
SWCBMO13076	Catch Basin	Brick
SWCBMO13080	Catch Basin	Brick
SWCBMO13082	Catch Basin	Unknown
SWCBMO13083	Catch Basin	Brick
SWCBMO13084	Catch Basin	Brick
SWCBMO13086	Catch Basin	Unknown
SWCBMO13087	Catch Basin	Brick
SWCBMO13091	Catch Basin	Brick
SWCBMO13097	Catch Basin	Concrete
SWCBMO13100	Catch Basin	Concrete
SWCBMO13101	Catch Basin	Concrete
SWCBMO13103	Catch Basin	Unknown
SWCBMO13104	Catch Basin	Brick
SWCBMO13106	Catch Basin	Brick
SWCBMO13107	Catch Basin	Brick
SWCBMO13111	Catch Basin	Brick
SWCBMO13113	Catch Basin	Brick
SWCBMO13114	Catch Basin	Brick
SWCBMO13117	Catch Basin	Brick
SWCBMO13118	Catch Basin	Brick
SWCBMO13125	Catch Basin	Unknown

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Structure ID	Type	Material
SWCBMO13126	Catch Basin	Brick
SWCBMO13129	Catch Basin	Unknown
SWCBMO13130	Catch Basin	Concrete
SWCBMO12877	Catch Basin	Concrete
SWCBMO12878	Catch Basin	Concrete
SWCBMO12879	Catch Basin	Concrete
SWCBMO12880	Catch Basin	Concrete
SWCBMO12881	Catch Basin	Concrete
SWCBMO12882	Catch Basin	Concrete
SWCBMO12883	Catch Basin	Concrete
SWCBMO12884	Catch Basin	Concrete
SWCBMO12885	Catch Basin	Concrete
SWCBMO12888	Catch Basin	Concrete
SWCBMO12889	Catch Basin	Concrete
SWCBMO12891	Catch Basin	Unknown
SWCBMO12892	Catch Basin	Brick
SWCBMO12893	Catch Basin	Unknown
SWCBMO12894	Catch Basin	Concrete
SWCBMO12895	Catch Basin	Concrete
SWCBMO12901	Catch Basin	Concrete
SWCBMO12902	Catch Basin	Concrete
SWCBMO12903	Catch Basin	Concrete
SWCBMO12906	Catch Basin	Concrete
SWCBMO12907	Catch Basin	Concrete
SWCBMO12912	Catch Basin	Concrete
SWCBMO12913	Catch Basin	Concrete
SWCBMO12914	Catch Basin	Concrete
SWCBMO12915	Catch Basin	Concrete
SWCBMO12922	Catch Basin	Concrete
SWCBMO12923	Catch Basin	Concrete
SWCBMO12926	Catch Basin	Concrete
SWCBMO12927	Catch Basin	Concrete
SWCBMO12929	Catch Basin	Concrete
SWCBMO12932	Catch Basin	Concrete
SWCBMO12936	Catch Basin	Unknown
SWCBMO12937	Catch Basin	Concrete
SWCBMO12940	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO12942	Catch Basin	Concrete
SWCBMO12944	Catch Basin	Concrete
SWCBMO12946	Catch Basin	Concrete
SWCBMO12950	Catch Basin	Concrete
SWCBMO12803	Catch Basin	Concrete
SWCBMO12804	Catch Basin	Concrete
SWCBMO12805	Catch Basin	Concrete
SWCBMO12806	Catch Basin	Concrete
SWCBMO12815	Catch Basin	Brick
SWCBMO12818	Catch Basin	Unknown
SWCBMO12819	Catch Basin	Brick
SWCBMO12821	Catch Basin	Concrete
SWCBMO12822	Catch Basin	Brick
SWCBMO12823	Catch Basin	Brick
SWCBMO12824	Catch Basin	Concrete
SWCBMO12826	Catch Basin	Brick
SWCBMO12828	Catch Basin	Brick
SWCBMO12830	Catch Basin	Brick
SWCBMO13002	Catch Basin	Brick
SWCBMO13003	Catch Basin	Brick
SWCBMO13006	Catch Basin	Brick
SWCBMO13012	Catch Basin	Concrete
SWCBMO13014	Catch Basin	Brick
SWCBMO13015	Catch Basin	Brick
SWCBMO13016	Catch Basin	Brick
SWCBMO13018	Catch Basin	Brick
SWCBMO13020	Catch Basin	Brick
SWCBMO13021	Catch Basin	Concrete
SWCBMO13022	Catch Basin	Concrete
SWCBMO13025	Catch Basin	Brick
SWCBMO13027	Catch Basin	Brick
SWCBMO13028	Catch Basin	Brick
SWCBMO13029	Catch Basin	Brick
SWCBMO13030	Catch Basin	Unknown
SWCBMO13035	Catch Basin	Brick
SWCBMO13036	Catch Basin	Brick
SWCBMO13040	Catch Basin	Brick

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Structure ID	Type	Material
SWCBMO13042	Catch Basin	Brick
SWCBMO13046	Catch Basin	Brick
SWCBMO13047	Catch Basin	Brick
SWCBMO13048	Catch Basin	Brick
SWCBMO13049	Catch Basin	Brick
SWCBMO13054	Catch Basin	Brick
SWCBMO13055	Catch Basin	Brick
SWCBMO13059	Catch Basin	Brick
SWCBMO13061	Catch Basin	Brick
SWCBMO13062	Catch Basin	Brick
SWCBMO13064	Catch Basin	Unknown
SWCBMO13065	Catch Basin	Unknown
SWCBMO13069	Catch Basin	Brick
SWCBMO13070	Catch Basin	Brick
SWCBMO13072	Catch Basin	Unknown
SWCBMO13073	Catch Basin	Unknown
SWCBMO12831	Catch Basin	Brick
SWCBMO12833	Catch Basin	Brick
SWCBMO12837	Catch Basin	Brick
SWCBMO12838	Catch Basin	Brick
SWCBMO12840	Catch Basin	Brick
SWCBMO12841	Catch Basin	Brick
SWCBMO12843	Catch Basin	Brick
SWCBMO12844	Catch Basin	Brick
SWCBMO12845	Catch Basin	Brick
SWCBMO12846	Catch Basin	Brick
SWCBMO12847	Catch Basin	Brick
SWCBMO12848	Catch Basin	Brick
SWCBMO12849	Catch Basin	Brick
SWCBMO12852	Catch Basin	Brick
SWCBMO12856	Catch Basin	Brick
SWCBMO12857	Catch Basin	Concrete
SWCBMO12862	Catch Basin	Concrete
SWCBMO12868	Catch Basin	Brick
SWCBMO12869	Catch Basin	Brick
SWCBMO12876	Catch Basin	Concrete
SWCBMO18131	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO18134	Catch Basin	Concrete
SWCBMO18135	Catch Basin	Concrete
SWCBMO18136	Catch Basin	Concrete
SWCBMO18137	Catch Basin	Concrete
SWCBMO18139	Catch Basin	Concrete
SWCBMO18141	Catch Basin	Concrete
SWCBMO18150	Catch Basin	Concrete
SWCBMO18047	Catch Basin	Concrete
SWCBMO18048	Catch Basin	Concrete
SWCBMO18049	Catch Basin	Concrete
SWCBMO18051	Catch Basin	Concrete
SWCBMO18052	Catch Basin	Concrete
SWCBMO18054	Catch Basin	Concrete
SWCBMO18055	Catch Basin	Concrete
SWCBMO18058	Catch Basin	Concrete
SWCBMO18060	Catch Basin	Concrete
SWCBMO18061	Catch Basin	Concrete
SWCBMO18063	Catch Basin	Concrete
SWCBMO18064	Catch Basin	Concrete
SWCBMO18065	Catch Basin	Concrete
SWCBMO18066	Catch Basin	Concrete
SWCBMO18067	Catch Basin	Concrete
SWCBMO18068	Catch Basin	Concrete
SWCBMO18075	Catch Basin	Concrete
SWCBMO18076	Catch Basin	Concrete
SWCBMO18077	Catch Basin	Concrete
SWCBMO18079	Catch Basin	Concrete
SWCBMO18082	Catch Basin	Concrete
SWCBMO18083	Catch Basin	Unknown
SWCBMO18084	Catch Basin	Concrete
SWCBMO18087	Catch Basin	Concrete
SWCBMO18089	Catch Basin	Concrete
SWCBMO18090	Catch Basin	Concrete
SWCBMO18091	Catch Basin	Concrete
SWCBMO18092	Catch Basin	Concrete
SWCBMO18094	Catch Basin	Concrete
SWCBMO18102	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO18103	Catch Basin	Concrete
SWCBMO18105	Catch Basin	Concrete
SWCBMO18110	Catch Basin	Concrete
SWCBMO18114	Catch Basin	Concrete
SWCBMO18115	Catch Basin	Concrete
SWCBMO18118	Catch Basin	Concrete
SWCBMO18120	Catch Basin	Unknown
SWCBMO18126	Catch Basin	Concrete
SWCBMO18127	Catch Basin	Concrete
SWCBMO18128	Catch Basin	Concrete
SWCBMO18130	Catch Basin	Concrete
SWCBMO12952	Catch Basin	Unknown
SWCBMO12956	Catch Basin	Concrete
SWCBMO12957	Catch Basin	Concrete
SWCBMO12961	Catch Basin	Concrete
SWCBMO12962	Catch Basin	Concrete
SWCBMO12963	Catch Basin	Concrete
SWCBMO12964	Catch Basin	Concrete
SWCBMO12967	Catch Basin	Concrete
SWCBMO12968	Catch Basin	Concrete
SWCBMO12974	Catch Basin	Concrete
SWCBMO12975	Catch Basin	Concrete
SWCBMO12979	Catch Basin	Concrete
SWCBMO12980	Catch Basin	Concrete
SWCBMO12982	Catch Basin	Concrete
SWCBMO12983	Catch Basin	Concrete
SWCBMO12988	Catch Basin	Brick
SWCBMO12989	Catch Basin	Brick
SWCBMO12992	Catch Basin	Brick
SWCBMO12993	Catch Basin	Brick
SWCBMO12994	Catch Basin	Brick
SWCBMO12995	Catch Basin	Brick
SWCBMO12998	Catch Basin	Brick
SWCBMO12999	Catch Basin	Brick
SWCBMO13133	Catch Basin	Brick
SWCBMO13135	Catch Basin	Brick
SWCBMO17004	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO17005	Catch Basin	Concrete
SWCBMO17011	Catch Basin	Brick
SWCBMO17012	Catch Basin	Concrete
SWCBMO17013	Catch Basin	Concrete
SWCBMO17014	Catch Basin	Concrete
SWCBMO17016	Catch Basin	Brick
SWCBMO17017	Catch Basin	Concrete
SWCBMO17023	Catch Basin	Concrete
SWCBMO17269	Catch Basin	Concrete
SWCBMO17270	Catch Basin	Concrete
SWCBMO17272	Catch Basin	Concrete
SWCBMO17273	Catch Basin	Concrete
SWCBMO17276	Catch Basin	Concrete
SWCBMO17277	Catch Basin	Concrete
SWCBMO17279	Catch Basin	Concrete
SWCBMO17280	Catch Basin	Concrete
SWCBMO17281	Catch Basin	Concrete
SWCBMO17282	Catch Basin	Concrete
SWCBMO17284	Catch Basin	Concrete
SWCBMO17285	Catch Basin	Concrete
SWCBMO17286	Catch Basin	Concrete
SWCBMO17287	Catch Basin	Concrete
SWCBMO17296	Catch Basin	Concrete
SWCBMO17297	Catch Basin	Concrete
SWCBMO17299	Catch Basin	Concrete
SWCBMO17301	Catch Basin	Concrete
SWCBMO17302	Catch Basin	Brick
SWCBMO17304	Catch Basin	Brick
SWCBMO17305	Catch Basin	Concrete
SWCBMO17307	Catch Basin	Concrete
SWCBMO17308	Catch Basin	Concrete
SWCBMO17309	Catch Basin	Concrete
SWCBMO17316	Catch Basin	Concrete
SWCBMO17317	Catch Basin	Concrete
SWCBMO17320	Catch Basin	Concrete
SWCBMO17321	Catch Basin	Concrete
SWCBMO17322	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO17323	Catch Basin	Concrete
SWCBMO17324	Catch Basin	Concrete
SWCBMO17326	Catch Basin	Concrete
SWCBMO17327	Catch Basin	Concrete
SWCBMO17328	Catch Basin	Concrete
SWCBMO17329	Catch Basin	Concrete
SWCBMO17330	Catch Basin	Concrete
SWCBMO17332	Catch Basin	Unknown
SWCBMO17333	Catch Basin	Concrete
SWCBMO17335	Catch Basin	Concrete
SWCBMO17337	Catch Basin	Concrete
SWCBMO17340	Catch Basin	Concrete
SWCBMO17342	Catch Basin	Concrete
SWCBMO17343	Catch Basin	Concrete
SWCBMO17345	Catch Basin	Concrete
SWCBMO17024	Catch Basin	Concrete
SWCBMO17025	Catch Basin	Concrete
SWCBMO17027	Catch Basin	Concrete
SWCBMO17028	Catch Basin	Concrete
SWCBMO17029	Catch Basin	Concrete
SWCBMO17036	Catch Basin	Concrete
SWCBMO17037	Catch Basin	Concrete
SWCBMO17038	Catch Basin	Concrete
SWCBMO17039	Catch Basin	Concrete
SWCBMO17041	Catch Basin	Concrete
SWCBMO17042	Catch Basin	Concrete
SWCBMO17046	Catch Basin	Brick
SWCBMO17047	Catch Basin	Brick
SWCBMO17048	Catch Basin	Brick
SWCBMO17049	Catch Basin	Concrete
SWCBMO17052	Catch Basin	Brick
SWCBMO17053	Catch Basin	Brick
SWCBMO17054	Catch Basin	Brick
SWCBMO17055	Catch Basin	Brick
SWCBMO17057	Catch Basin	Brick
SWCBMO17058	Catch Basin	Brick
SWCBMO17061	Catch Basin	Brick

Structure ID	Type	Material
SWCBMO17062	Catch Basin	Brick
SWCBMO17065	Catch Basin	Brick
SWCBMO17066	Catch Basin	Brick
SWCBMO17068	Catch Basin	Brick
SWCBMO17069	Catch Basin	Brick
SWCBMO17070	Catch Basin	Brick
SWCBMO17071	Catch Basin	Concrete
SWCBMO17074	Catch Basin	Concrete
SWCBMO17075	Catch Basin	Brick
SWCBMO17077	Catch Basin	Concrete
SWCBMO17079	Catch Basin	Brick
SWCBMO17080	Catch Basin	Concrete
SWCBMO17082	Catch Basin	Concrete
SWCBMO17083	Catch Basin	Concrete
SWCBMO17086	Catch Basin	Concrete
SWCBMO17088	Catch Basin	Concrete
SWCBMO17089	Catch Basin	Concrete
SWCBMO17092	Catch Basin	Concrete
SWCBMO17097	Catch Basin	Concrete
SWCBMO17099	Catch Basin	Concrete
SWCBMO17100	Catch Basin	Concrete
SWCBMO17103	Catch Basin	Concrete
SWCBMO17104	Catch Basin	Concrete
SWCBMO17111	Catch Basin	Concrete
SWCBMO17110	Catch Basin	Concrete
SWCBMO17114	Catch Basin	Concrete
SWCBMO17115	Catch Basin	Concrete
SWCBMO17117	Catch Basin	Concrete
SWCBMO17118	Catch Basin	Concrete
SWCBMO17123	Catch Basin	Concrete
SWCBMO17124	Catch Basin	Concrete
SWCBMO17126	Catch Basin	Concrete
SWCBMO17127	Catch Basin	Concrete
SWCBMO17132	Catch Basin	Concrete
SWCBMO17133	Catch Basin	Concrete
SWCBMO17136	Catch Basin	Concrete
SWCBMO17137	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO17139	Catch Basin	Concrete
SWCBMO17140	Catch Basin	Concrete
SWCBMO17141	Catch Basin	Concrete
SWCBMO17142	Catch Basin	Concrete
SWCBMO17144	Catch Basin	Concrete
SWCBMO17145	Catch Basin	Concrete
SWCBMO17151	Catch Basin	Concrete
SWCBMO17153	Catch Basin	Concrete
SWCBMO17154	Catch Basin	Concrete
SWCBMO17157	Catch Basin	Concrete
SWCBMO17158	Catch Basin	Concrete
SWCBMO17160	Catch Basin	Concrete
SWCBMO17161	Catch Basin	Concrete
SWCBMO17162	Catch Basin	Concrete
SWCBMO17163	Catch Basin	Concrete
SWCBMO17165	Catch Basin	Concrete
SWCBMO17166	Catch Basin	Concrete
SWCBMO17167	Catch Basin	Concrete
SWCBMO17168	Catch Basin	Concrete
SWCBMO17169	Catch Basin	Concrete
SWCBMO17170	Catch Basin	Concrete
SWCBMO17172	Catch Basin	Concrete
SWCBMO17173	Catch Basin	Concrete
SWCBMO17176	Catch Basin	Concrete
SWCBMO17177	Catch Basin	Concrete
SWCBMO17179	Catch Basin	Concrete
SWCBMO17180	Catch Basin	Concrete
SWCBMO17181	Catch Basin	Concrete
SWCBMO17186	Catch Basin	Concrete
SWCBMO17187	Catch Basin	Concrete
SWCBMO17188	Catch Basin	Concrete
SWCBMO17190	Catch Basin	Concrete
SWCBMO17195	Catch Basin	Concrete
SWCBMO17198	Catch Basin	Concrete
SWCBMO17200	Catch Basin	Concrete
SWCBMO17205	Catch Basin	Concrete
SWCBMO17206	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO17207	Catch Basin	Concrete
SWCBMO17208	Catch Basin	Concrete
SWCBMO17210	Catch Basin	Concrete
SWCBMO17211	Catch Basin	Concrete
SWCBMO17212	Catch Basin	Concrete
SWCBMO17213	Catch Basin	Concrete
SWCBMO17214	Catch Basin	Concrete
SWCBMO17215	Catch Basin	Concrete
SWCBMO17217	Catch Basin	Concrete
SWCBMO17218	Catch Basin	Concrete
SWCBMO17219	Catch Basin	Concrete
SWCBMO17220	Catch Basin	Concrete
SWCBMO17226	Catch Basin	Concrete
SWCBMO17227	Catch Basin	Concrete
SWCBMO17228	Catch Basin	Concrete
SWCBMO17231	Catch Basin	Concrete
SWCBMO17232	Catch Basin	Concrete
SWCBMO17234	Catch Basin	Concrete
SWCBMO17235	Catch Basin	Concrete
SWCBMO17236	Catch Basin	Concrete
SWCBMO17237	Catch Basin	Concrete
SWCBMO17239	Catch Basin	Concrete
SWCBMO17240	Catch Basin	Concrete
SWCBMO17241	Catch Basin	Concrete
SWCBMO17242	Catch Basin	Concrete
SWCBMO17245	Catch Basin	Concrete
SWCBMO17246	Catch Basin	Concrete
SWCBMO17247	Catch Basin	Concrete
SWCBMO17248	Catch Basin	Concrete
SWCBMO17249	Catch Basin	Concrete
SWCBMO17250	Catch Basin	Concrete
SWCBMO17253	Catch Basin	Concrete
SWCBMO17255	Catch Basin	Concrete
SWCBMO17257	Catch Basin	Concrete
SWCBMO17258	Catch Basin	Concrete
SWCBMO17259	Catch Basin	Concrete
SWCBMO17260	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO17261	Catch Basin	Concrete
SWCBMO17262	Catch Basin	Concrete
SWCBMO17263	Catch Basin	Concrete
SWCBMO17264	Catch Basin	Concrete
SWCBMO17348	Catch Basin	Concrete
SWCBMO17349	Catch Basin	Concrete
SWCBMO17350	Catch Basin	Concrete
SWCBMO17351	Catch Basin	Concrete
SWCBMO17356	Catch Basin	Concrete
SWCBMO17357	Catch Basin	Concrete
SWCBMO17358	Catch Basin	Concrete
SWCBMO17359	Catch Basin	Concrete
SWCBMO17364	Catch Basin	Concrete
SWCBMO17365	Catch Basin	Concrete
SWCBMO17368	Catch Basin	Concrete
SWCBMO17370	Catch Basin	Concrete
SWCBMO17371	Catch Basin	Concrete
SWCBMO17377	Catch Basin	Concrete
SWCBMO17378	Catch Basin	Concrete
SWCBMO17380	Catch Basin	Concrete
SWCBMO17381	Catch Basin	Concrete
SWCBMO17384	Catch Basin	Concrete
SWCBMO17385	Catch Basin	Concrete
SWCBMO17386	Catch Basin	Concrete
SWCBMO17387	Catch Basin	Concrete
SWCBMO17388	Catch Basin	Concrete
SWCBMO17389	Catch Basin	Concrete
SWCBMO17391	Catch Basin	Concrete
SWCBMO17392	Catch Basin	Concrete
SWCBMO17393	Catch Basin	Concrete
SWCBMO17394	Catch Basin	Concrete
SWCBMO17395	Catch Basin	Concrete
SWCBMO17408	Catch Basin	Concrete
SWCBMO17412	Catch Basin	Concrete
SWCBMO17413	Catch Basin	Concrete
SWCBMO17414	Catch Basin	Concrete
SWCBMO17415	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO17416	Catch Basin	Concrete
SWCBMO17417	Catch Basin	Concrete
SWCBMO17418	Catch Basin	Concrete
SWCBMO17419	Catch Basin	Concrete
SWCBMO17420	Catch Basin	Concrete
SWCBMO17421	Catch Basin	Concrete
SWCBMO17422	Catch Basin	Concrete
SWCBMO17423	Catch Basin	Concrete
SWCBMO17424	Catch Basin	Concrete
SWCBMO17425	Catch Basin	Concrete
SWCBMO17426	Catch Basin	Concrete
SWCBMO17427	Catch Basin	Concrete
SWCBMO17434	Catch Basin	Concrete
SWCBMO17435	Catch Basin	Concrete
SWCBMO17436	Catch Basin	Concrete
SWCBMO17437	Catch Basin	Concrete
SWCBMO17438	Catch Basin	Concrete
SWCBMO17440	Catch Basin	Concrete
SWCBMO17441	Catch Basin	Concrete
SWCBMO17442	Catch Basin	Concrete
SWCBMO17446	Catch Basin	Concrete
SWCBMO17447	Catch Basin	Concrete
SWCBMO17448	Catch Basin	Concrete
SWCBMO17449	Catch Basin	Concrete
SWCBMO17450	Catch Basin	Concrete
SWCBMO17451	Catch Basin	Concrete
SWCBMO17453	Catch Basin	Concrete
SWCBMO17454	Catch Basin	Concrete
SWCBMO17455	Catch Basin	Concrete
SWCBMO17456	Catch Basin	Concrete
SWCBMO17457	Catch Basin	Concrete
SWCBMO17458	Catch Basin	Concrete
SWCBMO17459	Catch Basin	Concrete
SWCBMO17460	Catch Basin	Concrete
SWCBMO17461	Catch Basin	Concrete
SWCBMO17465	Catch Basin	Concrete
SWCBMO17466	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO17474	Catch Basin	Concrete
SWCBMO17478	Catch Basin	Concrete
SWCBMO17479	Catch Basin	Concrete
SWCBMO17480	Catch Basin	Concrete
SWCBMO17481	Catch Basin	Concrete
SWCBMO17482	Catch Basin	Concrete
SWCBMO17483	Catch Basin	Concrete
SWCBMO17484	Catch Basin	Concrete
SWCBMO17485	Catch Basin	Concrete
SWCBMO17486	Catch Basin	Concrete
SWCBMO17487	Catch Basin	Concrete
SWCBMO17488	Catch Basin	Concrete
SWCBMO17489	Catch Basin	Concrete
SWCBMO17490	Catch Basin	Concrete
SWCBMO17499	Catch Basin	Concrete
SWCBMO17507	Catch Basin	Concrete
SWCBMO17508	Catch Basin	Concrete
SWCBMO17520	Catch Basin	Brick
SWCBMO17523	Catch Basin	Brick
SWCBMO17525	Catch Basin	Brick
SWCBMO17526	Catch Basin	Brick
SWCBMO17529	Catch Basin	Brick
SWCBMO17530	Catch Basin	Brick
SWCBMO17533	Catch Basin	Unknown
SWCBMO17534	Catch Basin	Brick
SWCBMO17540	Catch Basin	Brick
SWCBMO17541	Catch Basin	Brick
SWCBMO17542	Catch Basin	Unknown
SWCBMO17543	Catch Basin	Unknown
SWCBMO17547	Catch Basin	Brick
SWCBMO17548	Catch Basin	Unknown
SWCBMO17555	Catch Basin	Brick
SWCBMO17556	Catch Basin	Brick
SWCBMO17577	Catch Basin	Brick
SWCBMO17578	Catch Basin	Concrete
SWCBMO17582	Catch Basin	Brick
SWCBMO17583	Catch Basin	Brick

Structure ID	Type	Material
SWCBMO17591	Catch Basin	Concrete
SWCBMO17592	Catch Basin	Concrete
SWCBMO12010	Catch Basin	Concrete
SWCBMO12011	Catch Basin	Concrete
SWCBMO12012	Catch Basin	Concrete
SWCBMO12013	Catch Basin	Concrete
SWCBMO12014	Catch Basin	Concrete
SWCBMO12015	Catch Basin	Concrete
SWCBMO12016	Catch Basin	Concrete
SWCBMO12017	Catch Basin	Concrete
SWCBMO12018	Catch Basin	Concrete
SWCBMO12019	Catch Basin	Concrete
SWCBMO12020	Catch Basin	Concrete
SWCBMO12021	Catch Basin	Concrete
SWCBMO12023	Catch Basin	Concrete
SWCBMO12024	Catch Basin	Concrete
SWCBMO12025	Catch Basin	Concrete
SWCBMO12026	Catch Basin	Concrete
SWCBMO12028	Catch Basin	Concrete
SWCBMO12029	Catch Basin	Concrete
SWCBMO12032	Catch Basin	Concrete
SWCBMO12033	Catch Basin	Concrete
SWCBMO12034	Catch Basin	Concrete
SWCBMO12035	Catch Basin	Concrete
SWCBMO12037	Catch Basin	Concrete
SWCBMO12038	Catch Basin	Concrete
SWCBMO12040	Catch Basin	Concrete
SWCBMO12041	Catch Basin	Concrete
SWCBMO12042	Catch Basin	Concrete
SWCBMO12043	Catch Basin	Concrete
SWCBMO12044	Catch Basin	Concrete
SWCBMO12045	Catch Basin	Concrete
SWCBMO12046	Catch Basin	Concrete
SWCBMO12050	Catch Basin	Concrete
SWCBMO12051	Catch Basin	Concrete
SWCBMO12052	Catch Basin	Concrete
SWCBMO12054	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO12055	Catch Basin	Concrete
SWCBMO12056	Catch Basin	Concrete
SWCBMO12057	Catch Basin	Concrete
SWCBMO12058	Catch Basin	Concrete
SWCBMO12060	Catch Basin	Concrete
SWCBMO12061	Catch Basin	Concrete
SWCBMO12062	Catch Basin	Concrete
SWCBMO12063	Catch Basin	Concrete
SWCBMO12064	Catch Basin	Concrete
SWCBMO12066	Catch Basin	Concrete
SWCBMO12067	Catch Basin	Concrete
SWCBMO12068	Catch Basin	Concrete
SWCBMO12069	Catch Basin	Concrete
SWCBMO12071	Catch Basin	Concrete
SWCBMO12072	Catch Basin	Concrete
SWCBMO12074	Catch Basin	Concrete
SWCBMO12075	Catch Basin	Concrete
SWCBMO12076	Catch Basin	Concrete
SWCBMO12077	Catch Basin	Concrete
SWCBMO12078	Catch Basin	Concrete
SWCBMO12079	Catch Basin	Concrete
SWCBMO12080	Catch Basin	Concrete
SWCBMO12081	Catch Basin	Concrete
SWCBMO12083	Catch Basin	Concrete
SWCBMO12084	Catch Basin	Concrete
SWCBMO12085	Catch Basin	Concrete
SWCBMO12086	Catch Basin	Concrete
SWCBMO12087	Catch Basin	Concrete
SWCBMO12089	Catch Basin	Concrete
SWCBMO12090	Catch Basin	Concrete
SWCBMO12091	Catch Basin	Concrete
SWCBMO12092	Catch Basin	Concrete
SWCBMO12093	Catch Basin	Concrete
SWCBMO12094	Catch Basin	Concrete
SWCBMO12096	Catch Basin	Concrete
SWCBMO12097	Catch Basin	Concrete
SWCBMO12098	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO12099	Catch Basin	Concrete
SWCBMO12101	Catch Basin	Concrete
SWCBMO12102	Catch Basin	Concrete
SWCBMO12104	Catch Basin	Concrete
SWCBMO12105	Catch Basin	Concrete
SWCBMO12106	Catch Basin	Concrete
SWCBMO12107	Catch Basin	Concrete
SWCBMO12108	Catch Basin	Concrete
SWCBMO12109	Catch Basin	Concrete
SWCBMO12111	Catch Basin	Concrete
SWCBMO12112	Catch Basin	Concrete
SWCBMO12116	Catch Basin	Concrete
SWCBMO12117	Catch Basin	Concrete
SWCBMO12118	Catch Basin	Concrete
SWCBMO12119	Catch Basin	Concrete
SWCBMO12120	Catch Basin	Concrete
SWCBMO12121	Catch Basin	Concrete
SWCBMO12127	Catch Basin	Concrete
SWCBMO12128	Catch Basin	Concrete
SWCBMO12129	Catch Basin	Concrete
SWCBMO12130	Catch Basin	Concrete
SWCBMO12131	Catch Basin	Concrete
SWCBMO12133	Catch Basin	Concrete
SWCBMO12134	Catch Basin	Concrete
SWCBMO12135	Catch Basin	Concrete
SWCBMO12138	Catch Basin	Concrete
SWCBMO12139	Catch Basin	Concrete
SWCBMO12140	Catch Basin	Concrete
SWCBMO12141	Catch Basin	Concrete
SWCBMO12142	Catch Basin	Concrete
SWCBMO12143	Catch Basin	Concrete
SWCBMO12144	Catch Basin	Concrete
SWCBMO12152	Catch Basin	Concrete
SWCBMO12153	Catch Basin	Concrete
SWCBMO12155	Catch Basin	Concrete
SWCBMO12156	Catch Basin	Concrete
SWCBMO12157	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO12158	Catch Basin	Concrete
SWCBMO12159	Catch Basin	Concrete
SWCBMO12160	Catch Basin	Concrete
SWCBMO12161	Catch Basin	Concrete
SWCBMO12162	Catch Basin	Concrete
SWCBMO12163	Catch Basin	Concrete
SWCBMO12164	Catch Basin	Concrete
SWCBMO12165	Catch Basin	Concrete
SWCBMO12166	Catch Basin	Concrete
SWCBMO12169	Catch Basin	Concrete
SWCBMO12170	Catch Basin	Concrete
SWCBMO12171	Catch Basin	Concrete
SWCBMO12172	Catch Basin	Concrete
SWCBMO12173	Catch Basin	Concrete
SWCBMO12174	Catch Basin	Concrete
SWCBMO12175	Catch Basin	Concrete
SWCBMO12178	Catch Basin	Concrete
SWCBMO12179	Catch Basin	Concrete
SWCBMO12184	Catch Basin	Concrete
SWCBMO12185	Catch Basin	Concrete
SWCBMO12186	Catch Basin	Concrete
SWCBMO12187	Catch Basin	Concrete
SWCBMO12188	Catch Basin	Concrete
SWCBMO12189	Catch Basin	Concrete
SWCBMO12190	Catch Basin	Concrete
SWCBMO12191	Catch Basin	Concrete
SWCBMO12192	Catch Basin	Concrete
SWCBMO12193	Catch Basin	Concrete
SWCBMO12194	Catch Basin	Concrete
SWCBMO12195	Catch Basin	Concrete
SWCBMO12196	Catch Basin	Concrete
SWCBMO12197	Catch Basin	Concrete
SWCBMO12199	Catch Basin	Concrete
SWCBMO12200	Catch Basin	Concrete
SWCBMO12201	Catch Basin	Concrete
SWCBMO12202	Catch Basin	Concrete
SWCBMO12203	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO12204	Catch Basin	Concrete
SWCBMO12205	Catch Basin	Concrete
SWCBMO12206	Catch Basin	Concrete
SWCBMO12207	Catch Basin	Concrete
SWCBMO12208	Catch Basin	Concrete
SWCBMO12209	Catch Basin	Concrete
SWCBMO12210	Catch Basin	Concrete
SWCBMO12211	Catch Basin	Concrete
SWCBMO12212	Catch Basin	Concrete
SWCBMO12213	Catch Basin	Concrete
SWCBMO12214	Catch Basin	Concrete
SWCBMO12215	Catch Basin	Concrete
SWCBMO12216	Catch Basin	Concrete
SWCBMO12217	Catch Basin	Concrete
SWCBMO12218	Catch Basin	Concrete
SWCBMO12219	Catch Basin	Concrete
SWCBMO12220	Catch Basin	Concrete
SWCBMO12221	Catch Basin	Concrete
SWCBMO12222	Catch Basin	Concrete
SWCBMO12223	Catch Basin	Concrete
SWCBMO12224	Catch Basin	Concrete
SWCBMO12225	Catch Basin	Concrete
SWCBMO12233	Catch Basin	Concrete
SWCBMO12234	Catch Basin	Concrete
SWCBMO12235	Catch Basin	Concrete
SWCBMO12236	Catch Basin	Concrete
SWCBMO12237	Catch Basin	Concrete
SWCBMO12238	Catch Basin	Concrete
SWCBMO12239	Catch Basin	Concrete
SWCBMO12241	Catch Basin	Concrete
SWCBMO12244	Catch Basin	Concrete
SWCBMO12245	Catch Basin	Concrete
SWCBMO12246	Catch Basin	Concrete
SWCBMO12247	Catch Basin	Concrete
SWCBMO12248	Catch Basin	Concrete
SWCBMO12249	Catch Basin	Concrete
SWCBMO12250	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO12251	Catch Basin	Concrete
SWCBMO12254	Catch Basin	Concrete
SWCBMO12256	Catch Basin	Concrete
SWCBMO12257	Catch Basin	Concrete
SWCBMO12266	Catch Basin	Concrete
SWCBMO12267	Catch Basin	Concrete
SWCBMO12268	Catch Basin	Concrete
SWCBMO12269	Catch Basin	Concrete
SWCBMO12270	Catch Basin	Concrete
SWCBMO12271	Catch Basin	Concrete
SWCBMO12272	Catch Basin	Concrete
SWCBMO12273	Catch Basin	Concrete
SWCBMO12274	Catch Basin	Concrete
SWCBMO12275	Catch Basin	Concrete
SWCBMO12276	Catch Basin	Concrete
SWCBMO12277	Catch Basin	Concrete
SWCBMO12278	Catch Basin	Concrete
SWCBMO12279	Catch Basin	Concrete
SWCBMO12280	Catch Basin	Concrete
SWCBMO12281	Catch Basin	Concrete
SWCBMO12282	Catch Basin	Concrete
SWCBMO12283	Catch Basin	Concrete
SWCBMO12284	Catch Basin	Concrete
SWCBMO12285	Catch Basin	Concrete
SWCBMO12286	Catch Basin	Concrete
SWCBMO12287	Catch Basin	Concrete
SWCBMO12289	Catch Basin	Concrete
SWCBMO12290	Catch Basin	Concrete
SWCBMO12291	Catch Basin	Concrete
SWCBMO12292	Catch Basin	Concrete
SWCBMO12293	Catch Basin	Concrete
SWCBMO12294	Catch Basin	Concrete
SWCBMO12296	Catch Basin	Concrete
SWCBMO12299	Catch Basin	Concrete
SWCBMO12300	Catch Basin	Concrete
SWCBMO12302	Catch Basin	Concrete
SWCBMO12303	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO12304	Catch Basin	Concrete
SWCBMO12305	Catch Basin	Concrete
SWCBMO12306	Catch Basin	Concrete
SWCBMO12307	Catch Basin	Concrete
SWCBMO12308	Catch Basin	Concrete
SWCBMO12309	Catch Basin	Concrete
SWCBMO12310	Catch Basin	Concrete
SWCBMO12311	Catch Basin	Concrete
SWCBMO12313	Catch Basin	Concrete
SWCBMO12314	Catch Basin	Concrete
SWCBMO12316	Catch Basin	Concrete
SWCBMO12318	Catch Basin	Concrete
SWCBMO12319	Catch Basin	Concrete
SWCBMO12320	Catch Basin	Concrete
SWCBMO12321	Catch Basin	Concrete
SWCBMO12322	Catch Basin	Concrete
SWCBMO12323	Catch Basin	Concrete
SWCBMO12325	Catch Basin	Concrete
SWCBMO12326	Catch Basin	Concrete
SWCBMO12327	Catch Basin	Concrete
SWCBMO12328	Catch Basin	Concrete
SWCBMO12330	Catch Basin	Concrete
SWCBMO12331	Catch Basin	Concrete
SWCBMO12332	Catch Basin	Concrete
SWCBMO12336	Catch Basin	Concrete
SWCBMO12337	Catch Basin	Concrete
SWCBMO12352	Catch Basin	Concrete
SWCBMO12353	Catch Basin	Concrete
SWCBMO12354	Catch Basin	Concrete
SWCBMO12355	Catch Basin	Concrete
SWCBMO12356	Catch Basin	Concrete
SWCBMO12357	Catch Basin	Concrete
SWCBMO12358	Catch Basin	Concrete
SWCBMO12359	Catch Basin	Concrete
SWCBMO12360	Catch Basin	Concrete
SWCBMO12365	Catch Basin	Concrete
SWCBMO12366	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO12370	Catch Basin	Concrete
SWCBMO12371	Catch Basin	Concrete
SWCBMO12372	Catch Basin	Concrete
SWCBMO12373	Catch Basin	Concrete
SWCBMO12374	Catch Basin	Concrete
SWCBMO12376	Catch Basin	Concrete
SWCBMO12377	Catch Basin	Concrete
SWCBMO12378	Catch Basin	Concrete
SWCBMO12379	Catch Basin	Concrete
SWCBMO12380	Catch Basin	Concrete
SWCBMO12381	Catch Basin	Concrete
SWCBMO12382	Catch Basin	Concrete
SWCBMO12383	Catch Basin	Concrete
SWCBMO12384	Catch Basin	Concrete
SWCBMO12385	Catch Basin	Concrete
SWCBMO12386	Catch Basin	Concrete
SWCBMO12387	Catch Basin	Concrete
SWCBMO12388	Catch Basin	Concrete
SWCBMO12389	Catch Basin	Concrete
SWCBMO12390	Catch Basin	Concrete
SWCBMO12396	Catch Basin	Concrete
SWCBMO12397	Catch Basin	Concrete
SWCBMO12398	Catch Basin	Concrete
SWCBMO12399	Catch Basin	Concrete
SWCBMO12400	Catch Basin	Concrete
SWCBMO12401	Catch Basin	Concrete
SWCBMO12402	Catch Basin	Concrete
SWCBMO12403	Catch Basin	Concrete
SWCBMO12404	Catch Basin	Concrete
SWCBMO12405	Catch Basin	Concrete
SWCBMO12406	Catch Basin	Concrete
SWCBMO12407	Catch Basin	Concrete
SWCBMO12408	Catch Basin	Concrete
SWCBMO12409	Catch Basin	Concrete
SWCBMO12410	Catch Basin	Concrete
SWCBMO12411	Catch Basin	Concrete
SWCBMO12412	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO12414	Catch Basin	Concrete
SWCBMO12415	Catch Basin	Concrete
SWCBMO12419	Catch Basin	Concrete
SWCBMO12420	Catch Basin	Concrete
SWCBMO12426	Catch Basin	Concrete
SWCBMO12427	Catch Basin	Concrete
SWCBMO12428	Catch Basin	Concrete
SWCBMO12429	Catch Basin	Concrete
SWCBMO12430	Catch Basin	Concrete
SWCBMO12436	Catch Basin	Concrete
SWCBMO12437	Catch Basin	Concrete
SWCBMO12438	Catch Basin	Concrete
SWCBMO12439	Catch Basin	Concrete
SWCBMO12440	Catch Basin	Concrete
SWCBMO12441	Catch Basin	Concrete
SWCBMO12442	Catch Basin	Concrete
SWCBMO12443	Catch Basin	Concrete
SWCBMO12444	Catch Basin	Concrete
SWCBMO12446	Catch Basin	Concrete
SWCBMO12447	Catch Basin	Concrete
SWCBMO12452	Catch Basin	Concrete
SWCBMO12453	Catch Basin	Concrete
SWCBMO12454	Catch Basin	Concrete
SWCBMO12455	Catch Basin	Concrete
SWCBMO12457	Catch Basin	Concrete
SWCBMO12458	Catch Basin	Concrete
SWCBMO12459	Catch Basin	Concrete
SWCBMO12460	Catch Basin	Concrete
SWCBMO12461	Catch Basin	Concrete
SWCBMO12462	Catch Basin	Concrete
SWCBMO12464	Catch Basin	Concrete
SWCBMO12465	Catch Basin	Concrete
SWCBMO12466	Catch Basin	Concrete
SWCBMO12467	Catch Basin	Concrete
SWCBMO12468	Catch Basin	Concrete
SWCBMO12469	Catch Basin	Concrete
SWCBMO12470	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO12471	Catch Basin	Concrete
SWCBMO12472	Catch Basin	Concrete
SWCBMO12473	Catch Basin	Concrete
SWCBMO12474	Catch Basin	Concrete
SWCBMO12475	Catch Basin	Concrete
SWCBMO12476	Catch Basin	Concrete
SWCBMO12483	Catch Basin	Concrete
SWCBMO12484	Catch Basin	Concrete
SWCBMO12485	Catch Basin	Concrete
SWCBMO12486	Catch Basin	Concrete
SWCBMO12487	Catch Basin	Concrete
SWCBMO12489	Catch Basin	Concrete
SWCBMO12490	Catch Basin	Concrete
SWCBMO12499	Catch Basin	Concrete
SWCBMO12500	Catch Basin	Concrete
SWCBMO12501	Catch Basin	Concrete
SWCBMO12502	Catch Basin	Concrete
SWCBMO12507	Catch Basin	Concrete
SWCBMO12508	Catch Basin	Concrete
SWCBMO12509	Catch Basin	Concrete
SWCBMO12510	Catch Basin	Concrete
SWCBMO12511	Catch Basin	Concrete
SWCBMO12512	Catch Basin	Concrete
SWCBMO12513	Catch Basin	Concrete
SWCBMO12515	Catch Basin	Concrete
SWCBMO12516	Catch Basin	Concrete
SWCBMO12517	Catch Basin	Concrete
SWCBMO12518	Catch Basin	Concrete
SWCBMO12521	Catch Basin	Concrete
SWCBMO12522	Catch Basin	Concrete
SWCBMO12530	Catch Basin	Concrete
SWCBMO12531	Catch Basin	Concrete
SWCBMO12532	Catch Basin	Concrete
SWCBMO12533	Catch Basin	Concrete
SWCBMO12543	Catch Basin	Concrete
SWCBMO12544	Catch Basin	Concrete
SWCBMO12545	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO12546	Catch Basin	Concrete
SWCBMO12547	Catch Basin	Concrete
SWCBMO12548	Catch Basin	Concrete
SWCBMO12549	Catch Basin	Concrete
SWCBMO12550	Catch Basin	Concrete
SWCBMO12551	Catch Basin	Concrete
SWCBMO12558	Catch Basin	Concrete
SWCBMO12559	Catch Basin	Concrete
SWCBMO12560	Catch Basin	Concrete
SWCBMO12561	Catch Basin	Concrete
SWCBMO12562	Catch Basin	Concrete
SWCBMO12563	Catch Basin	Concrete
SWCBMO12564	Catch Basin	Concrete
SWCBMO12582	Catch Basin	Concrete
SWCBMO12584	Catch Basin	Concrete
SWCBMO12585	Catch Basin	Concrete
SWCBMO12603	Catch Basin	Concrete
SWCBCT11086	Catch Basin	Concrete
SWCBCT11087	Catch Basin	Concrete
SWCBCT11088	Catch Basin	Concrete
SWCBCT11089	Catch Basin	Unknown
SWCBCT11090	Catch Basin	Brick
SWCBCT11091	Catch Basin	Brick
SWCBCT11092	Catch Basin	Brick
SWCBCT11093	Catch Basin	Brick
SWCBCT11094	Catch Basin	Brick
SWCBCT11095	Catch Basin	Brick
SWCBCT11096	Catch Basin	Brick
SWCBCT11097	Catch Basin	Brick
SWCBCT11109	Catch Basin	Concrete
SWCBCT11115	Catch Basin	Concrete
SWCBCT11117	Catch Basin	Concrete
SWCBCT11119	Catch Basin	Concrete
SWCBCT11121	Catch Basin	Concrete
SWCBCT11146	Catch Basin	Concrete
SWCBCT11016	Catch Basin	Brick
SWCBCT11039	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBCT11041	Catch Basin	Concrete
SWCBCT11042	Catch Basin	Concrete
SWCBCT11049	Catch Basin	Concrete
SWCBCT11051	Catch Basin	Concrete
SWCBCT11052	Catch Basin	Concrete
SWCBCT11053	Catch Basin	Concrete
SWCBCT11054	Catch Basin	Concrete
SWCBCT11055	Catch Basin	Concrete
SWCBCT11056	Catch Basin	Concrete
SWCBCT11057	Catch Basin	Concrete
SWCBCT11058	Catch Basin	Concrete
SWCBCT11059	Catch Basin	Concrete
SWCBCT11060	Catch Basin	Concrete
SWCBCT11067	Catch Basin	Concrete
SWCBCT11068	Catch Basin	Concrete
SWCBCT11069	Catch Basin	Concrete
SWCBCT11070	Catch Basin	Concrete
SWCBCT11071	Catch Basin	Concrete
SWCBCT11073	Catch Basin	Concrete
SWCBCT11075	Catch Basin	Concrete
SWCBCT11077	Catch Basin	Concrete
SWCBCT11078	Catch Basin	Concrete
SWCBCT11079	Catch Basin	Concrete
SWCBCT11080	Catch Basin	Concrete
SWCBCT11082	Catch Basin	Concrete
SWCBCT11083	Catch Basin	Concrete
SWCBCT11084	Catch Basin	Concrete
SWCBCT11085	Catch Basin	Concrete
SWCBCT11157	Catch Basin	Brick
SWCBCT11158	Catch Basin	Brick
SWCBCT11159	Catch Basin	Concrete
SWCBCT11160	Catch Basin	Concrete
SWCBCT11168	Catch Basin	Brick
SWCBCT11169	Catch Basin	Brick
SWCBCT11194	Catch Basin	Concrete
SWCBCT11195	Catch Basin	Concrete
SWCBCT11196	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCT11197	Catch Basin	Brick
SWCBCT11202	Catch Basin	Unknown
SWCBCT11203	Catch Basin	Brick
SWCBCT11204	Catch Basin	Concrete
SWCBCT11205	Catch Basin	Concrete
SWCBCT11206	Catch Basin	Brick
SWCBCT11207	Catch Basin	Brick
SWCBCT11208	Catch Basin	Brick
SWCBCT11209	Catch Basin	Brick
SWCBCT11211	Catch Basin	Brick
SWCBCT11212	Catch Basin	Brick
SWCBCT11213	Catch Basin	Brick
SWCBCT11214	Catch Basin	Brick
SWCBCT11216	Catch Basin	Brick
SWCBCT11217	Catch Basin	Brick
SWCBCT11218	Catch Basin	Brick
SWCBCT11219	Catch Basin	Unknown
SWCBCT11220	Catch Basin	Brick
SWCBCT11221	Catch Basin	Brick
SWCBCT11177	Catch Basin	Brick
SWCBCT11178	Catch Basin	Brick
SWCBCT11179	Catch Basin	Brick
SWCBCT11181	Catch Basin	Brick
SWCBCT11185	Catch Basin	Concrete
SWCBCT11186	Catch Basin	Concrete
SWCBCT16122	Catch Basin	Brick
SWCBCT16125	Catch Basin	Brick
SWCBCT16126	Catch Basin	Brick
SWCBCT16127	Catch Basin	Brick
SWCBCT16128	Catch Basin	Brick
SWCBCT16131	Catch Basin	Brick
SWCBCT16132	Catch Basin	Brick
SWCBCT16134	Catch Basin	Concrete
SWCBCT16135	Catch Basin	Concrete
SWCBCT16139	Catch Basin	Concrete
SWCBCT16140	Catch Basin	Concrete
SWCBCT16141	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBCT16142	Catch Basin	Unknown
SWCBCT16144	Catch Basin	Concrete
SWCBCT16145	Catch Basin	Unknown
SWCBCT16147	Catch Basin	Concrete
SWCBCT16149	Catch Basin	Concrete
SWCBCT16150	Catch Basin	Concrete
SWCBCT16517	Catch Basin	Concrete
SWCBCT16518	Catch Basin	Concrete
SWCBCT16522	Catch Basin	Brick
SWCBCT16523	Catch Basin	Brick
SWCBCT16525	Catch Basin	Concrete
SWCBCT16528	Catch Basin	Brick
SWCBCT16529	Catch Basin	Brick
SWCBCT16532	Catch Basin	Brick
SWCBCT16533	Catch Basin	Brick
SWCBCT16535	Catch Basin	Brick
SWCBCT16536	Catch Basin	Brick
SWCBCT16537	Catch Basin	Brick
SWCBCT16538	Catch Basin	Brick
SWCBCT16539	Catch Basin	Brick
SWCBCT16540	Catch Basin	Brick
SWCBCT11222	Catch Basin	Brick
SWCBCT11223	Catch Basin	Brick
SWCBCT11241	Catch Basin	Brick
SWCBCT11242	Catch Basin	Brick
SWCBCT11243	Catch Basin	Brick
SWCBCT11244	Catch Basin	Brick
SWCBCT11247	Catch Basin	Brick
SWCBCT11248	Catch Basin	Brick
SWCBCT11249	Catch Basin	Brick
SWCBCT11250	Catch Basin	Brick
SWCBCT11281	Catch Basin	Unknown
SWCBCT11282	Catch Basin	Unknown
SWCBCT11283	Catch Basin	Unknown
SWCBCT11284	Catch Basin	Concrete
SWCBCT11285	Catch Basin	Unknown
SWCBCT11286	Catch Basin	Unknown

Structure ID	Type	Material
SWCBCT11292	Catch Basin	Unknown
SWCBCT11293	Catch Basin	Unknown
SWCBCT11310	Catch Basin	Brick
SWCBCT11311	Catch Basin	Brick
SWCBCT11324	Catch Basin	Brick
SWCBCT11325	Catch Basin	Brick
SWCBCT11329	Catch Basin	Unknown
SWCBCT11331	Catch Basin	Brick
SWCBCT11332	Catch Basin	Brick
SWCBCT11333	Catch Basin	Brick
SWCBCT11334	Catch Basin	Brick
SWCBCT11335	Catch Basin	Brick
SWCBCT11336	Catch Basin	Brick
SWCBCT11337	Catch Basin	Brick
SWCBCT11339	Catch Basin	Brick
SWCBCT11340	Catch Basin	Brick
SWCBCT11341	Catch Basin	Brick
SWCBCT11342	Catch Basin	Brick
SWCBCT11343	Catch Basin	Brick
SWCBCT11344	Catch Basin	Brick
SWCBCT16006	Catch Basin	Concrete
SWCBCT16007	Catch Basin	Concrete
SWCBCT16009	Catch Basin	Concrete
SWCBCT16010	Catch Basin	Concrete
SWCBCT16011	Catch Basin	Concrete
SWCBCT16012	Catch Basin	Concrete
SWCBCT16013	Catch Basin	Concrete
SWCBCT16014	Catch Basin	Concrete
SWCBCT16019	Catch Basin	Concrete
SWCBCT16020	Catch Basin	Concrete
SWCBCT16021	Catch Basin	Concrete
SWCBCT16022	Catch Basin	Concrete
SWCBCT16023	Catch Basin	Concrete
SWCBCT16024	Catch Basin	Concrete
SWCBCT16028	Catch Basin	Concrete
SWCBCT16029	Catch Basin	Concrete
SWCBCT16032	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBCT16033	Catch Basin	Concrete
SWCBCT16036	Catch Basin	Concrete
SWCBCT16037	Catch Basin	Concrete
SWCBCT16038	Catch Basin	Concrete
SWCBCT16039	Catch Basin	Concrete
SWCBCT16040	Catch Basin	Concrete
SWCBCT16044	Catch Basin	Concrete
SWCBCT16045	Catch Basin	Concrete
SWCBCT16046	Catch Basin	Concrete
SWCBCT16047	Catch Basin	Concrete
SWCBCT16048	Catch Basin	Concrete
SWCBCT16049	Catch Basin	Concrete
SWCBCT16051	Catch Basin	Concrete
SWCBCT16052	Catch Basin	Concrete
SWCBCT16053	Catch Basin	Concrete
SWCBCT16054	Catch Basin	Concrete
SWCBCT16056	Catch Basin	Concrete
SWCBCT16059	Catch Basin	Concrete
SWCBCT16060	Catch Basin	Concrete
SWCBCT16062	Catch Basin	Concrete
SWCBCT16063	Catch Basin	Concrete
SWCBCT16065	Catch Basin	Concrete
SWCBCT16067	Catch Basin	Concrete
SWCBCT16068	Catch Basin	Concrete
SWCBCT16069	Catch Basin	Concrete
SWCBCT16072	Catch Basin	Concrete
SWCBCT16073	Catch Basin	Concrete
SWCBCT16074	Catch Basin	Concrete
SWCBCT16075	Catch Basin	Concrete
SWCBCT16115	Catch Basin	Concrete
SWCBCT16116	Catch Basin	Concrete
SWCBCT16119	Catch Basin	Concrete
SWCBCT16121	Catch Basin	Brick
SWCBCT16172	Catch Basin	Concrete
SWCBCT16173	Catch Basin	Concrete
SWCBCT16175	Catch Basin	Concrete
SWCBCT16177	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCT16178	Catch Basin	Concrete
SWCBCT16179	Catch Basin	Concrete
SWCBCT16180	Catch Basin	Concrete
SWCBCT16181	Catch Basin	Concrete
SWCBCT16184	Catch Basin	Concrete
SWCBCT16223	Catch Basin	Concrete
SWCBCT16237	Catch Basin	Concrete
SWCBCT16242	Catch Basin	Concrete
SWCBCT16247	Catch Basin	Concrete
SWCBCT16248	Catch Basin	Concrete
SWCBCT16249	Catch Basin	Concrete
SWCBCT16250	Catch Basin	Concrete
SWCBCT16257	Catch Basin	Concrete
SWCBCT16258	Catch Basin	Concrete
SWCBCT16261	Catch Basin	Concrete
SWCBCT16262	Catch Basin	Concrete
SWCBCT16264	Catch Basin	Concrete
SWCBCT16265	Catch Basin	Concrete
SWCBCT16266	Catch Basin	Concrete
SWCBCT16267	Catch Basin	Concrete
SWCBCT16275	Catch Basin	Concrete
SWCBCT16276	Catch Basin	Concrete
SWCBCT16277	Catch Basin	Concrete
SWCBCT16279	Catch Basin	Concrete
SWCBCT16280	Catch Basin	Concrete
SWCBCT16281	Catch Basin	Concrete
SWCBCT16282	Catch Basin	Concrete
SWCBCT16284	Catch Basin	Concrete
SWCBCT16286	Catch Basin	Concrete
SWCBCT16287	Catch Basin	Concrete
SWCBCT16288	Catch Basin	Concrete
SWCBCT16289	Catch Basin	Concrete
SWCBCT16290	Catch Basin	Concrete
SWCBCT16293	Catch Basin	Concrete
SWCBCT16294	Catch Basin	Concrete
SWCBCT16298	Catch Basin	Concrete
SWCBCT16299	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCT16300	Catch Basin	Concrete
SWCBCT16301	Catch Basin	Concrete
SWCBCT16302	Catch Basin	Concrete
SWCBCT16305	Catch Basin	Concrete
SWCBCT16306	Catch Basin	Concrete
SWCBCT16307	Catch Basin	Concrete
SWCBCT16312	Catch Basin	Concrete
SWCBCT16313	Catch Basin	Concrete
SWCBCT16317	Catch Basin	Concrete
SWCBCT16318	Catch Basin	Concrete
SWCBCT16320	Catch Basin	Concrete
SWCBCT16321	Catch Basin	Concrete
SWCBCT16325	Catch Basin	Concrete
SWCBCT16326	Catch Basin	Concrete
SWCBCT16327	Catch Basin	Concrete
SWCBCT16331	Catch Basin	Concrete
SWCBCT16332	Catch Basin	Concrete
SWCBCT16336	Catch Basin	Concrete
SWCBCT16337	Catch Basin	Concrete
SWCBCT16338	Catch Basin	Concrete
SWCBCT16339	Catch Basin	Concrete
SWCBCT16343	Catch Basin	Concrete
SWCBCT16344	Catch Basin	Concrete
SWCBCT16350	Catch Basin	Concrete
SWCBCT16351	Catch Basin	Concrete
SWCBCT16352	Catch Basin	Concrete
SWCBCT16353	Catch Basin	Concrete
SWCBCT16355	Catch Basin	Concrete
SWCBCT16356	Catch Basin	Concrete
SWCBCT16358	Catch Basin	Concrete
SWCBCT16359	Catch Basin	Concrete
SWCBCT16360	Catch Basin	Concrete
SWCBCT16361	Catch Basin	Concrete
SWCBCT16362	Catch Basin	Concrete
SWCBCT16364	Catch Basin	Concrete
SWCBCT16366	Catch Basin	Concrete
SWCBCT16367	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCT16368	Catch Basin	Concrete
SWCBCT16370	Catch Basin	Concrete
SWCBCT16371	Catch Basin	Concrete
SWCBCT16377	Catch Basin	Concrete
SWCBCT16378	Catch Basin	Concrete
SWCBCT16379	Catch Basin	Concrete
SWCBCT16383	Catch Basin	Concrete
SWCBCT16384	Catch Basin	Concrete
SWCBCT16391	Catch Basin	Concrete
SWCBCT16392	Catch Basin	Concrete
SWCBCT16393	Catch Basin	Concrete
SWCBCT16395	Catch Basin	Concrete
SWCBCT16396	Catch Basin	Concrete
SWCBCT16397	Catch Basin	Concrete
SWCBCT16398	Catch Basin	Concrete
SWCBCT16402	Catch Basin	Concrete
SWCBCT16403	Catch Basin	Concrete
SWCBCT16404	Catch Basin	Concrete
SWCBCT16405	Catch Basin	Concrete
SWCBCT16406	Catch Basin	Concrete
SWCBCT16408	Catch Basin	Concrete
SWCBCT16409	Catch Basin	Concrete
SWCBCT16410	Catch Basin	Concrete
SWCBCT16411	Catch Basin	Concrete
SWCBCT16413	Catch Basin	Concrete
SWCBCT16414	Catch Basin	Concrete
SWCBCT16415	Catch Basin	Concrete
SWCBCT16417	Catch Basin	Concrete
SWCBCT16418	Catch Basin	Concrete
SWCBCT16419	Catch Basin	Concrete
SWCBCT16420	Catch Basin	Concrete
SWCBCT16421	Catch Basin	Concrete
SWCBCT16423	Catch Basin	Concrete
SWCBCT16425	Catch Basin	Concrete
SWCBCT16431	Catch Basin	Concrete
SWCBCT16432	Catch Basin	Concrete
SWCBCT16434	Catch Basin	Brick

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Structure ID	Type	Material
SWCBCT16436	Catch Basin	Brick
SWCBCT16437	Catch Basin	Brick
SWCBCT16439	Catch Basin	Brick
SWCBCT16440	Catch Basin	Unknown
SWCBCT16442	Catch Basin	Brick
SWCBCT16443	Catch Basin	Brick
SWCBCT16447	Catch Basin	Brick
SWCBCT16448	Catch Basin	Brick
SWCBCT16451	Catch Basin	Brick
SWCBCT16452	Catch Basin	Brick
SWCBCT16459	Catch Basin	Brick
SWCBCT16460	Catch Basin	Brick
SWCBCT16465	Catch Basin	Concrete
SWCBCT16466	Catch Basin	Concrete
SWCBCT16468	Catch Basin	Concrete
SWCBCT16470	Catch Basin	Concrete
SWCBCT16471	Catch Basin	Concrete
SWCBCT16473	Catch Basin	Concrete
SWCBCT16474	Catch Basin	Concrete
SWCBCT16475	Catch Basin	Unknown
SWCBCT16476	Catch Basin	Unknown
SWCBCT16477	Catch Basin	Concrete
SWCBCT16478	Catch Basin	Unknown
SWCBCT16479	Catch Basin	Concrete
SWCBCT16480	Catch Basin	Concrete
SWCBCT16481	Catch Basin	Concrete
SWCBCT16482	Catch Basin	Concrete
SWCBCT16488	Catch Basin	Concrete
SWCBCT16494	Catch Basin	Concrete
SWCBCT16495	Catch Basin	Concrete
SWCBCT16496	Catch Basin	Concrete
SWCBCT16498	Catch Basin	Concrete
SWCBCT16499	Catch Basin	Concrete
SWCBCT16503	Catch Basin	Brick
SWCBCT16504	Catch Basin	Brick
SWCBCT16506	Catch Basin	Brick
SWCBCT16508	Catch Basin	Unknown

Structure ID	Type	Material
SWCBCT16509	Catch Basin	Brick
SWCBCT16510	Catch Basin	Brick
SWCBCT11366	Catch Basin	Concrete
SWCBCT11368	Catch Basin	Brick
SWCBCT11369	Catch Basin	Brick
SWCBMO10079	Catch Basin	Concrete
SWCBMO10080	Catch Basin	Concrete
SWCBMO10081	Catch Basin	Concrete
SWCBMO10082	Catch Basin	Concrete
SWCBMO10083	Catch Basin	Concrete
SWCBMO10085	Catch Basin	Concrete
SWCBMO10086	Catch Basin	Concrete
SWCBMO10087	Catch Basin	Concrete
SWCBMO10088	Catch Basin	Concrete
SWCBMO10089	Catch Basin	Concrete
SWCBMO10090	Catch Basin	Concrete
SWCBMO10091	Catch Basin	Concrete
SWCBMO10092	Catch Basin	Concrete
SWCBMO10093	Catch Basin	Concrete
SWCBMO10096	Catch Basin	Concrete
SWCBMO10097	Catch Basin	Concrete
SWCBMO10099	Catch Basin	Concrete
SWCBMO10100	Catch Basin	Concrete
SWCBMO10101	Catch Basin	Concrete
SWCBMO10105	Catch Basin	Concrete
SWCBMO10106	Catch Basin	Concrete
SWCBMO10107	Catch Basin	Concrete
SWCBMO10109	Catch Basin	Concrete
SWCBMO10448	Catch Basin	Concrete
SWCBMO10110	Catch Basin	Concrete
SWCBMO10111	Catch Basin	Concrete
SWCBMO10112	Catch Basin	Concrete
SWCBMO10113	Catch Basin	Concrete
SWCBMO10116	Catch Basin	Concrete
SWCBMO10118	Catch Basin	Concrete
SWCBMO10119	Catch Basin	Concrete
SWCBMO10120	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO10122	Catch Basin	Concrete
SWCBMO10128	Catch Basin	Concrete
SWCBMO10135	Catch Basin	Concrete
SWCBMO10139	Catch Basin	Concrete
SWCBMO10140	Catch Basin	Concrete
SWCBMO10165	Catch Basin	Concrete
SWCBMO10169	Catch Basin	Concrete
SWCBMO10170	Catch Basin	Concrete
SWCBMO10172	Catch Basin	Concrete
SWCBMO10173	Catch Basin	Concrete
SWCBMO10196	Catch Basin	Concrete
SWCBMO10197	Catch Basin	Concrete
SWCBMO10204	Catch Basin	Concrete
SWCBMO10205	Catch Basin	Concrete
SWCBMO10206	Catch Basin	Concrete
SWCBMO10207	Catch Basin	Concrete
SWCBMO10209	Catch Basin	Concrete
SWCBMO10210	Catch Basin	Concrete
SWCBMO10211	Catch Basin	Concrete
SWCBMO10212	Catch Basin	Concrete
SWCBMO10214	Catch Basin	Concrete
SWCBMO10215	Catch Basin	Concrete
SWCBMO10216	Catch Basin	Concrete
SWCBMO10218	Catch Basin	Concrete
SWCBMO10220	Catch Basin	Concrete
SWCBMO10221	Catch Basin	Concrete
SWCBMO10145	Catch Basin	Concrete
SWCBMO10146	Catch Basin	Concrete
SWCBMO10147	Catch Basin	Concrete
SWCBMO10148	Catch Basin	Concrete
SWCBMO10149	Catch Basin	Concrete
SWCBMO10150	Catch Basin	Concrete
SWCBMO10151	Catch Basin	Concrete
SWCBMO10152	Catch Basin	Concrete
SWCBMO10153	Catch Basin	Concrete
SWCBMO10155	Catch Basin	Concrete
SWCBMO10156	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO10161	Catch Basin	Concrete
SWCBMO10162	Catch Basin	Concrete
SWCBMO10069	Catch Basin	Concrete
SWCBMO10071	Catch Basin	Concrete
SWCBMO10073	Catch Basin	Concrete
SWCBMO10074	Catch Basin	Concrete
SWCBMO10075	Catch Basin	Concrete
SWCBMO10076	Catch Basin	Concrete
SWCBMO10077	Catch Basin	Concrete
SWCBMO10222	Catch Basin	Concrete
SWCBMO10224	Catch Basin	Concrete
SWCBMO10225	Catch Basin	Concrete
SWCBMO10227	Catch Basin	Concrete
SWCBMO10232	Catch Basin	Concrete
SWCBMO10234	Catch Basin	Concrete
SWCBMO10235	Catch Basin	Concrete
SWCBMO10237	Catch Basin	Concrete
SWCBMO10240	Catch Basin	Concrete
SWCBMO10241	Catch Basin	Concrete
SWCBMO10242	Catch Basin	Concrete
SWCBMO10245	Catch Basin	Concrete
SWCBMO10246	Catch Basin	Concrete
SWCBMO10247	Catch Basin	Concrete
SWCBMO10250	Catch Basin	Concrete
SWCBMO10251	Catch Basin	Concrete
SWCBMO10290	Catch Basin	Concrete
SWCBMO10252	Catch Basin	Concrete
SWCBMO10253	Catch Basin	Concrete
SWCBMO10254	Catch Basin	Concrete
SWCBMO10257	Catch Basin	Concrete
SWCBMO10263	Catch Basin	Concrete
SWCBMO10264	Catch Basin	Concrete
SWCBMO10265	Catch Basin	Concrete
SWCBMO10266	Catch Basin	Concrete
SWCBMO10270	Catch Basin	Concrete
SWCBMO10279	Catch Basin	Concrete
SWCBMO10281	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBMO10282	Catch Basin	Concrete
SWCBMO10283	Catch Basin	Concrete
SWCBMO10289	Catch Basin	Concrete
SWCBMO10292	Catch Basin	Concrete
SWCBMO10293	Catch Basin	Concrete
SWCBMO10294	Catch Basin	Concrete
SWCBMO10295	Catch Basin	Concrete
SWCBMO10296	Catch Basin	Concrete
SWCBMO10299	Catch Basin	Concrete
SWCBMO10301	Catch Basin	Concrete
SWCBMO10302	Catch Basin	Concrete
SWCBMO10303	Catch Basin	Concrete
SWCBMO10304	Catch Basin	Concrete
SWCBMO10305	Catch Basin	Concrete
SWCBMO10308	Catch Basin	Concrete
SWCBMO10310	Catch Basin	Concrete
SWCBMO10313	Catch Basin	Concrete
SWCBMO10314	Catch Basin	Concrete
SWCBMO10316	Catch Basin	Concrete
SWCBMO10317	Catch Basin	Concrete
SWCBMO10318	Catch Basin	Concrete
SWCBMO10321	Catch Basin	Concrete
SWCBMO10322	Catch Basin	Concrete
SWCBMO10323	Catch Basin	Concrete
SWCBMO10324	Catch Basin	Concrete
SWCBMO10325	Catch Basin	Concrete
SWCBMO10326	Catch Basin	Concrete
SWCBMO10419	Catch Basin	Concrete
SWCBMO10363	Catch Basin	Concrete
SWCBMO10365	Catch Basin	Concrete
SWCBMO10366	Catch Basin	Concrete
SWCBMO10367	Catch Basin	Concrete
SWCBMO10368	Catch Basin	Concrete
SWCBMO10369	Catch Basin	Concrete
SWCBMO10370	Catch Basin	Concrete
SWCBMO10373	Catch Basin	Concrete
SWCBMO10374	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO10375	Catch Basin	Concrete
SWCBMO10376	Catch Basin	Concrete
SWCBMO10377	Catch Basin	Concrete
SWCBMO10378	Catch Basin	Concrete
SWCBMO10379	Catch Basin	Concrete
SWCBMO10420	Catch Basin	Concrete
SWCBMO10421	Catch Basin	Concrete
SWCBMO15589	Catch Basin	Concrete
SWCBMO15590	Catch Basin	Concrete
SWCBMO15591	Catch Basin	Concrete
SWCBMO15592	Catch Basin	Concrete
SWCBMO10426	Catch Basin	Concrete
SWCBMO10427	Catch Basin	Concrete
SWCBMO10428	Catch Basin	Concrete
SWCBMO10429	Catch Basin	Concrete
SWCBMO10432	Catch Basin	Concrete
SWCBMO10433	Catch Basin	Concrete
SWCBMO10434	Catch Basin	Concrete
SWCBMO10435	Catch Basin	Concrete
SWCBMO10438	Catch Basin	Concrete
SWCBMO10439	Catch Basin	Concrete
SWCBMO10440	Catch Basin	Concrete
SWCBMO10441	Catch Basin	Concrete
SWCBMO10449	Catch Basin	Concrete
SWCBMO10562	Catch Basin	Concrete
SWCBMO10564	Catch Basin	Concrete
SWCBMO10566	Catch Basin	Concrete
SWCBMO10568	Catch Basin	Concrete
SWCBMO10570	Catch Basin	Concrete
SWCBMO10572	Catch Basin	Concrete
SWCBMO10581	Catch Basin	Concrete
SWCBMO10582	Catch Basin	Concrete
SWCBMO10587	Catch Basin	Concrete
SWCBMO10589	Catch Basin	Concrete
SWCBMO10591	Catch Basin	Concrete
SWCBMO10592	Catch Basin	Concrete
SWCBMO10593	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO10594	Catch Basin	Concrete
SWCBMO10596	Catch Basin	Concrete
SWCBMO10597	Catch Basin	Concrete
SWCBMO10598	Catch Basin	Concrete
SWCBMO10599	Catch Basin	Concrete
SWCBMO10602	Catch Basin	Concrete
SWCBMO10603	Catch Basin	Concrete
SWCBMO10612	Catch Basin	Brick
SWCBMO10613	Catch Basin	Brick
SWCBMO10614	Catch Basin	Brick
SWCBMO10623	Catch Basin	Concrete
SWCBMO10625	Catch Basin	Concrete
SWCBMO10626	Catch Basin	Concrete
SWCBMO10635	Catch Basin	Concrete
SWCBMO10637	Catch Basin	Concrete
SWCBMO10641	Catch Basin	Concrete
SWCBMO10643	Catch Basin	Concrete
SWCBMO10648	Catch Basin	Concrete
SWCBMO10649	Catch Basin	Concrete
SWCBMO10653	Catch Basin	Concrete
SWCBMO10654	Catch Basin	Concrete
SWCBMO10656	Catch Basin	Concrete
SWCBMO10657	Catch Basin	Concrete
SWCBMO10662	Catch Basin	Concrete
SWCBMO10669	Catch Basin	Concrete
SWCBMO10670	Catch Basin	Concrete
SWCBMO10672	Catch Basin	Brick
SWCBMO10673	Catch Basin	Brick
SWCBMO10687	Catch Basin	Concrete
SWCBMO15601	Catch Basin	Brick
SWCBMO10764	Catch Basin	Brick
SWCBMO10693	Catch Basin	Concrete
SWCBMO10697	Catch Basin	Brick
SWCBMO10704	Catch Basin	Brick
SWCBMO10708	Catch Basin	Concrete
SWCBMO10716	Catch Basin	Brick
SWCBMO10721	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO10725	Catch Basin	Brick
SWCBMO10727	Catch Basin	Concrete
SWCBMO10747	Catch Basin	Concrete
SWCBMO10750	Catch Basin	Unknown
SWCBMO10753	Catch Basin	Brick
SWCBMO10754	Catch Basin	Brick
SWCBMO10755	Catch Basin	Concrete
SWCBMO10756	Catch Basin	Concrete
SWCBMO10758	Catch Basin	Concrete
SWCBMO10759	Catch Basin	Concrete
SWCBMO10773	Catch Basin	Brick
SWCBMO10774	Catch Basin	Brick
SWCBMO10778	Catch Basin	Concrete
SWCBMO10780	Catch Basin	Brick
SWCBMO10788	Catch Basin	Brick
SWCBMO10800	Catch Basin	Concrete
SWCBMO10801	Catch Basin	Concrete
SWCBMO10802	Catch Basin	Concrete
SWCBMO10803	Catch Basin	Concrete
SWCBMO10804	Catch Basin	Concrete
SWCBMO10805	Catch Basin	Concrete
SWCBMO10806	Catch Basin	Concrete
SWCBMO10807	Catch Basin	Concrete
SWCBMO10808	Catch Basin	Concrete
SWCBMO10809	Catch Basin	Brick
SWCBMO10810	Catch Basin	Brick
SWCBMO10824	Catch Basin	Concrete
SWCBMO10825	Catch Basin	Concrete
SWCBMO10829	Catch Basin	Concrete
SWCBMO10830	Catch Basin	Concrete
SWCBMO10836	Catch Basin	Concrete
SWCBMO10837	Catch Basin	Concrete
SWCBMO10839	Catch Basin	Brick
SWCBMO10840	Catch Basin	Brick
SWCBMO10327	Catch Basin	Concrete
SWCBMO10328	Catch Basin	Concrete
SWCBMO10329	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO10331	Catch Basin	Concrete
SWCBMO10332	Catch Basin	Concrete
SWCBMO10334	Catch Basin	Concrete
SWCBMO10335	Catch Basin	Concrete
SWCBMO10336	Catch Basin	Concrete
SWCBMO10337	Catch Basin	Concrete
SWCBMO10338	Catch Basin	Concrete
SWCBMO10349	Catch Basin	Concrete
SWCBMO10453	Catch Basin	Concrete
SWCBMO10454	Catch Basin	Concrete
SWCBMO10460	Catch Basin	Concrete
SWCBMO10461	Catch Basin	Concrete
SWCBMO10464	Catch Basin	Concrete
SWCBMO10465	Catch Basin	Concrete
SWCBMO10466	Catch Basin	Concrete
SWCBMO10467	Catch Basin	Concrete
SWCBMO10470	Catch Basin	Concrete
SWCBMO10471	Catch Basin	Concrete
SWCBMO10472	Catch Basin	Concrete
SWCBMO10473	Catch Basin	Concrete
SWCBMO10474	Catch Basin	Concrete
SWCBMO10475	Catch Basin	Concrete
SWCBMO10476	Catch Basin	Concrete
SWCBMO10479	Catch Basin	Concrete
SWCBMO10480	Catch Basin	Concrete
SWCBMO10481	Catch Basin	Concrete
SWCBMO10482	Catch Basin	Concrete
SWCBMO10488	Catch Basin	Concrete
SWCBMO10489	Catch Basin	Concrete
SWCBMO10491	Catch Basin	Concrete
SWCBMO10495	Catch Basin	Concrete
SWCBMO10496	Catch Basin	Concrete
SWCBMO10497	Catch Basin	Concrete
SWCBMO10498	Catch Basin	Concrete
SWCBMO10512	Catch Basin	Concrete
SWCBMO10513	Catch Basin	Concrete
SWCBMO10517	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO10518	Catch Basin	Concrete
SWCBMO10525	Catch Basin	Concrete
SWCBMO10526	Catch Basin	Concrete
SWCBMO10528	Catch Basin	Concrete
SWCBMO10529	Catch Basin	Concrete
SWCBMO10551	Catch Basin	Concrete
SWCBMO10552	Catch Basin	Concrete
SWCBMO10555	Catch Basin	Brick
SWCBMO10556	Catch Basin	Concrete
SWCBMO15019	Catch Basin	Concrete
SWCBMO15023	Catch Basin	Brick
SWCBMO15025	Catch Basin	Concrete
SWCBMO15593	Catch Basin	Concrete
SWCBMO15028	Catch Basin	Brick
SWCBMO15029	Catch Basin	Concrete
SWCBMO15035	Catch Basin	Concrete
SWCBMO15036	Catch Basin	Concrete
SWCBMO15041	Catch Basin	Concrete
SWCBMO15043	Catch Basin	Concrete
SWCBMO15044	Catch Basin	Concrete
SWCBMO15045	Catch Basin	Concrete
SWCBMO15046	Catch Basin	Concrete
SWCBMO15047	Catch Basin	Concrete
SWCBMO15050	Catch Basin	Concrete
SWCBMO15053	Catch Basin	Concrete
SWCBMO15054	Catch Basin	Concrete
SWCBMO15055	Catch Basin	Concrete
SWCBMO15056	Catch Basin	Concrete
SWCBMO15058	Catch Basin	Concrete
SWCBMO15060	Catch Basin	Concrete
SWCBMO15061	Catch Basin	Concrete
SWCBMO15062	Catch Basin	Concrete
SWCBMO15063	Catch Basin	Concrete
SWCBMO15064	Catch Basin	Concrete
SWCBMO15065	Catch Basin	Concrete
SWCBMO15067	Catch Basin	Concrete
SWCBMO15068	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO15078	Catch Basin	Concrete
SWCBMO15079	Catch Basin	Concrete
SWCBMO15081	Catch Basin	Concrete
SWCBMO15082	Catch Basin	Concrete
SWCBMO15084	Catch Basin	Concrete
SWCBMO15085	Catch Basin	Concrete
SWCBMO15086	Catch Basin	Concrete
SWCBMO15087	Catch Basin	Concrete
SWCBMO15088	Catch Basin	Concrete
SWCBMO15089	Catch Basin	Concrete
SWCBMO15090	Catch Basin	Concrete
SWCBMO15091	Catch Basin	Concrete
SWCBMO15092	Catch Basin	Concrete
SWCBMO15093	Catch Basin	Concrete
SWCBMO15094	Catch Basin	Concrete
SWCBMO15095	Catch Basin	Concrete
SWCBMO15096	Catch Basin	Concrete
SWCBMO15097	Catch Basin	Concrete
SWCBMO15098	Catch Basin	Concrete
SWCBMO15102	Catch Basin	Concrete
SWCBMO15103	Catch Basin	Concrete
SWCBMO15104	Catch Basin	Concrete
SWCBMO15105	Catch Basin	Concrete
SWCBMO15106	Catch Basin	Concrete
SWCBMO15107	Catch Basin	Concrete
SWCBMO15108	Catch Basin	Concrete
SWCBMO15110	Catch Basin	Concrete
SWCBMO15111	Catch Basin	Concrete
SWCBMO15114	Catch Basin	Concrete
SWCBMO15115	Catch Basin	Concrete
SWCBMO15116	Catch Basin	Concrete
SWCBMO15117	Catch Basin	Concrete
SWCBMO15118	Catch Basin	Concrete
SWCBMO15120	Catch Basin	Concrete
SWCBMO15121	Catch Basin	Concrete
SWCBMO15122	Catch Basin	Concrete
SWCBMO15123	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO15124	Catch Basin	Concrete
SWCBMO15129	Catch Basin	Concrete
SWCBMO15130	Catch Basin	Concrete
SWCBMO15131	Catch Basin	Concrete
SWCBMO15132	Catch Basin	Concrete
SWCBMO15137	Catch Basin	Concrete
SWCBMO15138	Catch Basin	Concrete
SWCBMO15139	Catch Basin	Concrete
SWCBMO15140	Catch Basin	Concrete
SWCBMO15141	Catch Basin	Concrete
SWCBMO15142	Catch Basin	Concrete
SWCBMO15145	Catch Basin	Concrete
SWCBMO15146	Catch Basin	Concrete
SWCBMO15151	Catch Basin	Concrete
SWCBMO15152	Catch Basin	Concrete
SWCBMO15163	Catch Basin	Concrete
SWCBMO15164	Catch Basin	Concrete
SWCBMO15167	Catch Basin	Concrete
SWCBMO15174	Catch Basin	Brick
SWCBMO15175	Catch Basin	Brick
SWCBMO15178	Catch Basin	Brick
SWCBMO15179	Catch Basin	Brick
SWCBMO15180	Catch Basin	Brick
SWCBMO15181	Catch Basin	Brick
SWCBMO15182	Catch Basin	Concrete
SWCBMO15186	Catch Basin	Concrete
SWCBMO15187	Catch Basin	Concrete
SWCBMO15191	Catch Basin	Concrete
SWCBMO15192	Catch Basin	Concrete
SWCBMO15200	Catch Basin	Concrete
SWCBMO15202	Catch Basin	Concrete
SWCBMO15204	Catch Basin	Concrete
SWCBMO15206	Catch Basin	Concrete
SWCBMO15207	Catch Basin	Concrete
SWCBMO15214	Catch Basin	Concrete
SWCBMO15215	Catch Basin	Concrete
SWCBMO15218	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO15219	Catch Basin	Concrete
SWCBMO15224	Catch Basin	Concrete
SWCBMO15225	Catch Basin	Brick
SWCBMO15226	Catch Basin	Brick
SWCBMO15227	Catch Basin	Concrete
SWCBMO15228	Catch Basin	Brick
SWCBMO15230	Catch Basin	OTHER
SWCBMO15231	Catch Basin	Brick
SWCBMO15232	Catch Basin	Brick
SWCBMO15233	Catch Basin	Brick
SWCBMO15237	Catch Basin	Brick
SWCBMO15238	Catch Basin	Brick
SWCBMO15239	Catch Basin	Brick
SWCBMO15240	Catch Basin	Brick
SWCBMO15242	Catch Basin	Brick
SWCBMO15243	Catch Basin	Brick
SWCBMO15245	Catch Basin	Brick
SWCBMO15246	Catch Basin	Brick
SWCBMO15248	Catch Basin	Brick
SWCBMO15262	Catch Basin	Brick
SWCBMO15263	Catch Basin	Brick
SWCBMO15266	Catch Basin	Brick
SWCBMO15267	Catch Basin	Unknown
SWCBMO15269	Catch Basin	Brick
SWCBMO15270	Catch Basin	Brick
SWCBMO15309	Catch Basin	Brick
SWCBMO15310	Catch Basin	Brick
SWCBMO15313	Catch Basin	Brick
SWCBMO15314	Catch Basin	Brick
SWCBMO15317	Catch Basin	Brick
SWCBMO15323	Catch Basin	Brick
SWCBMO15324	Catch Basin	Brick
SWCBMO15326	Catch Basin	Brick
SWCBMO15327	Catch Basin	Brick
SWCBMO15329	Catch Basin	Concrete
SWCBMO15330	Catch Basin	Concrete
SWCBMO15333	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO15334	Catch Basin	Concrete
SWCBMO15347	Catch Basin	Concrete
SWCBMO15348	Catch Basin	Concrete
SWCBMO15353	Catch Basin	Concrete
SWCBMO15354	Catch Basin	Concrete
SWCBMO15355	Catch Basin	Concrete
SWCBMO15356	Catch Basin	Concrete
SWCBMO15357	Catch Basin	Concrete
SWCBMO15358	Catch Basin	Concrete
SWCBMO15360	Catch Basin	Concrete
SWCBMO15367	Catch Basin	Concrete
SWCBMO15368	Catch Basin	Concrete
SWCBMO15369	Catch Basin	Concrete
SWCBMO15370	Catch Basin	Concrete
SWCBMO15373	Catch Basin	Concrete
SWCBMO15379	Catch Basin	Brick
SWCBMO15412	Catch Basin	Concrete
SWCBMO15414	Catch Basin	Concrete
SWCBMO15416	Catch Basin	Concrete
SWCBMO15418	Catch Basin	Concrete
SWCBMO15419	Catch Basin	Concrete
SWCBMO15420	Catch Basin	Concrete
SWCBMO15422	Catch Basin	Concrete
SWCBMO15423	Catch Basin	Concrete
SWCBMO15424	Catch Basin	Concrete
SWCBMO15425	Catch Basin	Concrete
SWCBMO15426	Catch Basin	Concrete
SWCBMO15427	Catch Basin	Concrete
SWCBMO15428	Catch Basin	Concrete
SWCBMO15429	Catch Basin	Concrete
SWCBMO15430	Catch Basin	Concrete
SWCBMO15431	Catch Basin	Concrete
SWCBMO15432	Catch Basin	Concrete
SWCBMO15433	Catch Basin	Concrete
SWCBMO15434	Catch Basin	Concrete
SWCBMO15435	Catch Basin	Brick
SWCBMO15436	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBMO15438	Catch Basin	Brick
SWCBMO15439	Catch Basin	Concrete
SWCBMO15440	Catch Basin	Concrete
SWCBMO15441	Catch Basin	Concrete
SWCBMO15442	Catch Basin	Concrete
SWCBMO15444	Catch Basin	Concrete
SWCBMO15449	Catch Basin	Concrete
SWCBMO15450	Catch Basin	Concrete
SWCBMO15451	Catch Basin	Concrete
SWCBMO15452	Catch Basin	Concrete
SWCBMO15453	Catch Basin	Concrete
SWCBMO15454	Catch Basin	Concrete
SWCBMO15455	Catch Basin	Brick
SWCBMO15459	Catch Basin	Concrete
SWCBMO15466	Catch Basin	Concrete
SWCBMO15467	Catch Basin	Concrete
SWCBMO15474	Catch Basin	Concrete
SWCBMO15475	Catch Basin	Concrete
SWCBMO15476	Catch Basin	Concrete
SWCBMO15477	Catch Basin	Concrete
SWCBMO15479	Catch Basin	Concrete
SWCBMO15480	Catch Basin	Concrete
SWCBMO15481	Catch Basin	Concrete
SWCBMO15482	Catch Basin	Concrete
SWCBMO15487	Catch Basin	Concrete
SWCBMO15488	Catch Basin	Concrete
SWCBMO15489	Catch Basin	Concrete
SWCBMO15490	Catch Basin	Concrete
SWCBMO15491	Catch Basin	Concrete
SWCBMO15493	Catch Basin	Concrete
SWCBMO15496	Catch Basin	Concrete
SWCBMO15497	Catch Basin	Concrete
SWCBMO15500	Catch Basin	Concrete
SWCBMO15501	Catch Basin	Concrete
SWCBMO15503	Catch Basin	Concrete
SWCBMO15509	Catch Basin	Concrete
SWCBMO15510	Catch Basin	Concrete

Structure ID	Type	Material
SWCBMO15518	Catch Basin	Brick
SWCBMO15519	Catch Basin	Brick
SWCBMO15521	Catch Basin	Brick
SWCBMO15523	Catch Basin	Brick
SWCBMO15526	Catch Basin	Brick
SWCBMO15527	Catch Basin	Brick
SWCBMO15530	Catch Basin	Brick
SWCBMO15531	Catch Basin	Brick
SWCBMO15534	Catch Basin	Concrete
SWCBMO15537	Catch Basin	Brick
SWCBMO15539	Catch Basin	Brick
SWCBMO15541	Catch Basin	Brick
SWCBMO15542	Catch Basin	Brick
SWCBMO15544	Catch Basin	Concrete
SWCBMO15546	Catch Basin	Concrete
SWCBMO15547	Catch Basin	Concrete
SWCBMO15551	Catch Basin	Concrete
SWCBMO15552	Catch Basin	Concrete
SWCBMO15555	Catch Basin	Concrete
SWCBMO15556	Catch Basin	Concrete
SWCBMO15557	Catch Basin	Concrete
SWCBMO15558	Catch Basin	Concrete
SWCBMO15561	Catch Basin	Brick
SWCBMO15562	Catch Basin	Brick
SWCBMO15566	Catch Basin	Brick
SWCBMO15567	Catch Basin	Concrete
SWCBMO15568	Catch Basin	Concrete
SWCBMO15569	Catch Basin	Concrete
SWCBMO15571	Catch Basin	Concrete
SWCBMO15575	Catch Basin	Concrete
SWCBMO15576	Catch Basin	Concrete
SWCBMO15579	Catch Basin	Concrete
SWCBMO15580	Catch Basin	Concrete
SWCBMO15582	Catch Basin	Concrete
SWCBLC19934	Catch Basin	Brick
SWCBLC19935	Catch Basin	Concrete
SWCBLC19936	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWW19954	Catch Basin	Concrete
SWCBWW19955	Catch Basin	Concrete
SWCBWW19956	Catch Basin	Concrete
SWCBWW19957	Catch Basin	Concrete
SWCBWW19958	Catch Basin	Concrete
SWCBWW19959	Catch Basin	Concrete
SWCBWW19960	Catch Basin	Concrete
SWCBWW19961	Catch Basin	Concrete
SWCBWW19962	Catch Basin	Concrete
SWCBWW19963	Catch Basin	Concrete
SWCBWW19965	Catch Basin	Concrete
SWCBWW19969	Catch Basin	Concrete
SWCBWW19970	Catch Basin	Concrete
SWCBWW19972	Catch Basin	Concrete
SWCBWW19973	Catch Basin	Concrete
SWCBWW19974	Catch Basin	Concrete
SWCBWW19975	Catch Basin	Concrete
SWCBWW19976	Catch Basin	Concrete
SWCBWW19978	Catch Basin	Concrete
SWCBWW19979	Catch Basin	Concrete
SWCBWW19983	Catch Basin	Concrete
SWCBWW19984	Catch Basin	Concrete
SWCBWW19986	Catch Basin	Brick
SWCBWW19989	Catch Basin	Concrete
SWCBWW19990	Catch Basin	Concrete
SWCBWW19996	Catch Basin	Concrete
SWCBWW19998	Catch Basin	Concrete
SWCBWW19999	Catch Basin	Concrete
SWCBWW20002	Catch Basin	Concrete
SWCBWW20003	Catch Basin	Concrete
SWCBWW20006	Catch Basin	Concrete
SWCBWW20007	Catch Basin	Concrete
SWCBWW20110	Catch Basin	Brick
SWCBWW20109	Catch Basin	Concrete
SWCBWW20108	Catch Basin	Brick
SWCBWW20017	Catch Basin	Concrete
SWCBWW20019	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWW20020	Catch Basin	Concrete
SWCBWW20029	Catch Basin	Concrete
SWCBWW20030	Catch Basin	Brick
SWCBWW20031	Catch Basin	Concrete
SWCBWW20033	Catch Basin	Concrete
SWCBWW20034	Catch Basin	Brick
SWCBWW20035	Catch Basin	Concrete
SWCBWW20036	Catch Basin	Concrete
SWCBWW20039	Catch Basin	Concrete
SWCBWW20045	Catch Basin	Brick
SWCBWW20046	Catch Basin	Concrete
SWCBWW20106	Catch Basin	Brick
SWCBWW20060	Catch Basin	Brick
SWCBWW20061	Catch Basin	Brick
SWCBWW20062	Catch Basin	Brick
SWCBWW20063	Catch Basin	Brick
SWCBWW20064	Catch Basin	Concrete
SWCBWW20066	Catch Basin	Brick
SWCBWW20067	Catch Basin	Brick
SWCBWW20071	Catch Basin	Brick
SWCBWW20072	Catch Basin	Brick
SWCBWW20076	Catch Basin	Brick
SWCBWW20077	Catch Basin	Brick
SWCBWW20082	Catch Basin	Brick
SWCBWW20083	Catch Basin	Brick
SWCBWW20085	Catch Basin	Brick
SWCBWW19953	Catch Basin	Concrete
SWCBWW20086	Catch Basin	Brick
SWCBWW20090	Catch Basin	Brick
SWCBWW20091	Catch Basin	Brick
SWCBWW20096	Catch Basin	Concrete
SWCBWW20097	Catch Basin	Concrete
SWCBWW20101	Catch Basin	Concrete
SWCBWW20102	Catch Basin	Concrete
SWCBBR25004	Catch Basin	Concrete
SWCBBR25008	Catch Basin	Concrete
SWCBBR25009	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBBR25011	Catch Basin	Concrete
SWCBBR25012	Catch Basin	Concrete
SWCBBR25014	Catch Basin	Concrete
SWCBBR25020	Catch Basin	Concrete
SWCBBR25021	Catch Basin	Concrete
SWCBBR25023	Catch Basin	Concrete
SWCBBR25024	Catch Basin	Concrete
SWCBBR25031	Catch Basin	Concrete
SWCBBR25032	Catch Basin	Concrete
SWCBBR25035	Catch Basin	Concrete
SWCBBR25036	Catch Basin	Concrete
SWCBBR25037	Catch Basin	Concrete
SWCBBR25039	Catch Basin	Concrete
SWCBBR25047	Catch Basin	Concrete
SWCBBR25048	Catch Basin	Concrete
SWCBBR25049	Catch Basin	Concrete
SWCBBR25050	Catch Basin	Concrete
SWCBBR25051	Catch Basin	Concrete
SWCBBR25058	Catch Basin	Unknown
SWCBBR25059	Catch Basin	Brick
SWCBBR25142	Catch Basin	Brick
SWCBBR25145	Catch Basin	Brick
SWCBBR25148	Catch Basin	Brick
SWCBBR25156	Catch Basin	Brick
SWCBBR25157	Catch Basin	Concrete
SWCBBR25160	Catch Basin	Concrete
SWCBBR25162	Catch Basin	Concrete
SWCBBR25164	Catch Basin	Concrete
SWCBBR25166	Catch Basin	Concrete
SWCBBR25003	Catch Basin	Concrete
SWCBBR25069	Catch Basin	Unknown
SWCBBR25070	Catch Basin	Brick
SWCBBR25080	Catch Basin	Concrete
SWCBBR25081	Catch Basin	Brick
SWCBBR25083	Catch Basin	Concrete
SWCBBR25084	Catch Basin	Concrete
SWCBBR25087	Catch Basin	Concrete

Structure ID	Type	Material
SWCBBR25088	Catch Basin	Concrete
SWCBBR25089	Catch Basin	Concrete
SWCBBR25090	Catch Basin	Concrete
SWCBBR25091	Catch Basin	Concrete
SWCBBR25092	Catch Basin	Concrete
SWCBBR25093	Catch Basin	Concrete
SWCBBR25094	Catch Basin	Concrete
SWCBBR25099	Catch Basin	Concrete
SWCBBR25100	Catch Basin	Concrete
SWCBBR25176	Catch Basin	Concrete
SWCBBR25180	Catch Basin	Concrete
SWCBBR25181	Catch Basin	Concrete
SWCBBR25182	Catch Basin	Concrete
SWCBBR25183	Catch Basin	Concrete
SWCBBR25187	Catch Basin	Concrete
SWCBBR25188	Catch Basin	Concrete
SWCBBR25189	Catch Basin	Concrete
SWCBBR25191	Catch Basin	Concrete
SWCBBR25196	Catch Basin	Concrete
SWCBBR25197	Catch Basin	Concrete
SWCBBR25199	Catch Basin	Concrete
SWCBBR25202	Catch Basin	Concrete
SWCBBR25205	Catch Basin	Concrete
SWCBBR25206	Catch Basin	Concrete
SWCBBR25207	Catch Basin	Concrete
SWCBBR25208	Catch Basin	Concrete
SWCBBR25213	Catch Basin	Concrete
SWCBBR25214	Catch Basin	Concrete
SWCBBR25215	Catch Basin	Concrete
SWCBBR25224	Catch Basin	Concrete
SWCBBR25225	Catch Basin	Concrete
SWCBBR25226	Catch Basin	Concrete
SWCBBR25227	Catch Basin	Concrete
SWCBBR25234	Catch Basin	Concrete
SWCBBR25235	Catch Basin	Concrete
SWCBBR25237	Catch Basin	Concrete
SWCBBR25238	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBBR25241	Catch Basin	Concrete
SWCBBR25242	Catch Basin	Concrete
SWCBBR25243	Catch Basin	Concrete
SWCBBR25244	Catch Basin	Concrete
SWCBBR25245	Catch Basin	Concrete
SWCBBR25246	Catch Basin	Concrete
SWCBBR25247	Catch Basin	Concrete
SWCBBR25264	Catch Basin	Concrete
SWCBBR25267	Catch Basin	Concrete
SWCBBR25268	Catch Basin	Concrete
SWCBBR25269	Catch Basin	Concrete
SWCBBR25295	Catch Basin	Concrete
SWCBBR25297	Catch Basin	Concrete
SWCBBR25312	Catch Basin	Brick
SWCBBR25313	Catch Basin	Brick
SWCBBR25319	Catch Basin	Concrete
SWCBBR25320	Catch Basin	Concrete
SWCBBR25321	Catch Basin	Concrete
SWCBBR25323	Catch Basin	Concrete
SWCBBR25326	Catch Basin	Concrete
SWCBPC20304	Catch Basin	Concrete
SWCBPC20305	Catch Basin	Concrete
SWCBPC20306	Catch Basin	Concrete
SWCBPC20307	Catch Basin	Concrete
SWCBPC20308	Catch Basin	Concrete
SWCBPC20310	Catch Basin	Concrete
SWCBPC20312	Catch Basin	Concrete
SWCBPC20313	Catch Basin	Concrete
SWCBPC20314	Catch Basin	Concrete
SWCBPC20315	Catch Basin	Concrete
SWCBPC20316	Catch Basin	Concrete
SWCBPC20317	Catch Basin	Concrete
SWCBPC20318	Catch Basin	Concrete
SWCBPC20319	Catch Basin	Concrete
SWCBPC20321	Catch Basin	Concrete
SWCBPC20322	Catch Basin	Concrete
SWCBPC20324	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC20325	Catch Basin	Concrete
SWCBPC20326	Catch Basin	Concrete
SWCBPC20327	Catch Basin	Concrete
SWCBPC20328	Catch Basin	Concrete
SWCBPC20329	Catch Basin	Concrete
SWCBPC20331	Catch Basin	Concrete
SWCBPC20332	Catch Basin	Concrete
SWCBPC20333	Catch Basin	Concrete
SWCBPC20339	Catch Basin	Concrete
SWCBPC20344	Catch Basin	Concrete
SWCBPC20345	Catch Basin	Concrete
SWCBPC20347	Catch Basin	Concrete
SWCBPC20348	Catch Basin	Concrete
SWCBPC20349	Catch Basin	Concrete
SWCBPC20350	Catch Basin	Concrete
SWCBPC20351	Catch Basin	Concrete
SWCBPC20352	Catch Basin	Concrete
SWCBPC20353	Catch Basin	Concrete
SWCBPC20354	Catch Basin	Concrete
SWCBPC20355	Catch Basin	Concrete
SWCBPC20356	Catch Basin	Concrete
SWCBPC20360	Catch Basin	Concrete
SWCBPC20361	Catch Basin	Concrete
SWCBPC20362	Catch Basin	Concrete
SWCBPC20363	Catch Basin	Concrete
SWCBPC20364	Catch Basin	Concrete
SWCBPC20369	Catch Basin	Concrete
SWCBPC20370	Catch Basin	Concrete
SWCBPC20371	Catch Basin	Concrete
SWCBPC20372	Catch Basin	Concrete
SWCBPC20373	Catch Basin	Concrete
SWCBPC20374	Catch Basin	Concrete
SWCBPC20375	Catch Basin	Concrete
SWCBPC20376	Catch Basin	Concrete
SWCBPC20377	Catch Basin	Concrete
SWCBPC20380	Catch Basin	Concrete
SWCBPC20381	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBPC20383	Catch Basin	Concrete
SWCBPC20384	Catch Basin	Concrete
SWCBPC20385	Catch Basin	Concrete
SWCBPC20386	Catch Basin	Concrete
SWCBPC20387	Catch Basin	Concrete
SWCBPC20388	Catch Basin	Concrete
SWCBPC20389	Catch Basin	Concrete
SWCBPC20393	Catch Basin	Concrete
SWCBPC20395	Catch Basin	Concrete
SWCBPC20397	Catch Basin	Concrete
SWCBPC20398	Catch Basin	Concrete
SWCBPC20403	Catch Basin	Concrete
SWCBPC20405	Catch Basin	Concrete
SWCBPC20406	Catch Basin	Concrete
SWCBPC20407	Catch Basin	Concrete
SWCBPC20408	Catch Basin	Concrete
SWCBPC20409	Catch Basin	Concrete
SWCBPC20410	Catch Basin	Concrete
SWCBPC20414	Catch Basin	Concrete
SWCBPC20415	Catch Basin	Concrete
SWCBPC20416	Catch Basin	Concrete
SWCBPC20420	Catch Basin	Concrete
SWCBPC20421	Catch Basin	Concrete
SWCBPC20424	Catch Basin	Concrete
SWCBPC20425	Catch Basin	Concrete
SWCBPC20303	Catch Basin	Concrete
SWCBPC20432	Catch Basin	Concrete
SWCBPC20433	Catch Basin	Concrete
SWCBPC20434	Catch Basin	Concrete
SWCBPC20435	Catch Basin	Concrete
SWCBPC20436	Catch Basin	Concrete
SWCBPC20437	Catch Basin	Concrete
SWCBPC20438	Catch Basin	Concrete
SWCBPC20439	Catch Basin	Concrete
SWCBPC20440	Catch Basin	Concrete
SWCBPC20441	Catch Basin	Concrete
SWCBPC20446	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC20449	Catch Basin	Concrete
SWCBPC20452	Catch Basin	Concrete
SWCBPC20453	Catch Basin	Concrete
SWCBPC20454	Catch Basin	Concrete
SWCBPC20455	Catch Basin	Concrete
SWCBPC20459	Catch Basin	Concrete
SWCBPC20460	Catch Basin	Concrete
SWCBPC20463	Catch Basin	Concrete
SWCBPC20464	Catch Basin	Concrete
SWCBPC20467	Catch Basin	Concrete
SWCBPC20468	Catch Basin	Concrete
SWCBPC20469	Catch Basin	Concrete
SWCBPC20470	Catch Basin	Concrete
SWCBPC20474	Catch Basin	Concrete
SWCBPC20475	Catch Basin	Concrete
SWCBPC20480	Catch Basin	Concrete
SWCBPC20481	Catch Basin	Concrete
SWCBPC20483	Catch Basin	Concrete
SWCBPC20484	Catch Basin	Concrete
SWCBPC20485	Catch Basin	Concrete
SWCBPC20486	Catch Basin	Concrete
SWCBPC20487	Catch Basin	Concrete
SWCBPC20488	Catch Basin	Concrete
SWCBPC20489	Catch Basin	Concrete
SWCBPC20490	Catch Basin	Concrete
SWCBPC20491	Catch Basin	Concrete
SWCBPC20493	Catch Basin	Concrete
SWCBPC20494	Catch Basin	Concrete
SWCBPC20495	Catch Basin	Concrete
SWCBPC20496	Catch Basin	Concrete
SWCBPC20497	Catch Basin	Concrete
SWCBPC20498	Catch Basin	Concrete
SWCBPC20499	Catch Basin	Concrete
SWCBPC20501	Catch Basin	Concrete
SWCBPC20502	Catch Basin	Concrete
SWCBPC20503	Catch Basin	Concrete
SWCBPC20504	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBPC20505	Catch Basin	Concrete
SWCBPC20507	Catch Basin	Concrete
SWCBPC20508	Catch Basin	Concrete
SWCBPC20510	Catch Basin	Concrete
SWCBPC20514	Catch Basin	Concrete
SWCBPC20515	Catch Basin	Concrete
SWCBPC20516	Catch Basin	Concrete
SWCBPC20517	Catch Basin	Concrete
SWCBPC20524	Catch Basin	Concrete
SWCBPC20527	Catch Basin	Concrete
SWCBPC20532	Catch Basin	Concrete
SWCBPC20533	Catch Basin	Concrete
SWCBPC20535	Catch Basin	Concrete
SWCBPC20536	Catch Basin	Concrete
SWCBPC20537	Catch Basin	Concrete
SWCBPC20541	Catch Basin	Concrete
SWCBPC20542	Catch Basin	Concrete
SWCBPC20544	Catch Basin	Concrete
SWCBPC20545	Catch Basin	Concrete
SWCBPC20547	Catch Basin	Concrete
SWCBPC20548	Catch Basin	Concrete
SWCBPC20550	Catch Basin	Concrete
SWCBPC20551	Catch Basin	Concrete
SWCBPC20552	Catch Basin	Concrete
SWCBPC20553	Catch Basin	Concrete
SWCBPC20554	Catch Basin	Concrete
SWCBPC20555	Catch Basin	Concrete
SWCBPC20556	Catch Basin	Concrete
SWCBPC20557	Catch Basin	Concrete
SWCBPC20558	Catch Basin	Concrete
SWCBPC20563	Catch Basin	Concrete
SWCBPC20564	Catch Basin	Concrete
SWCBPC20565	Catch Basin	Concrete
SWCBPC20566	Catch Basin	Concrete
SWCBPC20567	Catch Basin	Concrete
SWCBPC20570	Catch Basin	Concrete
SWCBPC20571	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC20573	Catch Basin	Concrete
SWCBPC20574	Catch Basin	Concrete
SWCBPC20576	Catch Basin	Concrete
SWCBPC20577	Catch Basin	Concrete
SWCBPC20582	Catch Basin	Concrete
SWCBPC20583	Catch Basin	Concrete
SWCBPC20584	Catch Basin	Concrete
SWCBPC20585	Catch Basin	Concrete
SWCBPC20586	Catch Basin	Concrete
SWCBPC20587	Catch Basin	Concrete
SWCBPC20588	Catch Basin	Concrete
SWCBPC20589	Catch Basin	Concrete
SWCBPC20592	Catch Basin	Concrete
SWCBPC20593	Catch Basin	Concrete
SWCBPC20594	Catch Basin	Concrete
SWCBPC20595	Catch Basin	Concrete
SWCBPC20596	Catch Basin	Concrete
SWCBPC20597	Catch Basin	Concrete
SWCBPC20598	Catch Basin	Concrete
SWCBPC20599	Catch Basin	Concrete
SWCBPC20600	Catch Basin	Concrete
SWCBPC20601	Catch Basin	Concrete
SWCBPC20602	Catch Basin	Concrete
SWCBPC20604	Catch Basin	Concrete
SWCBPC20605	Catch Basin	Concrete
SWCBPC20606	Catch Basin	Concrete
SWCBPC20607	Catch Basin	Concrete
SWCBPC20608	Catch Basin	Concrete
SWCBPC20611	Catch Basin	Concrete
SWCBPC20612	Catch Basin	Concrete
SWCBPC20613	Catch Basin	Concrete
SWCBPC20614	Catch Basin	Concrete
SWCBPC20615	Catch Basin	Concrete
SWCBPC20616	Catch Basin	Concrete
SWCBPC20617	Catch Basin	Concrete
SWCBPC20618	Catch Basin	Concrete
SWCBPC20619	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBPC20620	Catch Basin	Concrete
SWCBPC20621	Catch Basin	Concrete
SWCBPC20622	Catch Basin	Concrete
SWCBPC20623	Catch Basin	Concrete
SWCBPC20624	Catch Basin	Concrete
SWCBPC20625	Catch Basin	Concrete
SWCBPC20626	Catch Basin	Concrete
SWCBPC20628	Catch Basin	Concrete
SWCBPC20629	Catch Basin	Concrete
SWCBPC20631	Catch Basin	Concrete
SWCBPC20632	Catch Basin	Concrete
SWCBPC20633	Catch Basin	Concrete
SWCBPC20634	Catch Basin	Concrete
SWCBPC20638	Catch Basin	Concrete
SWCBPC20639	Catch Basin	Concrete
SWCBPC20640	Catch Basin	Concrete
SWCBPC20641	Catch Basin	Concrete
SWCBPC20642	Catch Basin	Concrete
SWCBPC20643	Catch Basin	Concrete
SWCBPC20645	Catch Basin	Concrete
SWCBPC20646	Catch Basin	Concrete
SWCBPC20649	Catch Basin	Concrete
SWCBPC20650	Catch Basin	Concrete
SWCBPC20652	Catch Basin	Concrete
SWCBPC20653	Catch Basin	Concrete
SWCBPC20654	Catch Basin	Concrete
SWCBPC20655	Catch Basin	Concrete
SWCBPC20656	Catch Basin	Concrete
SWCBPC20657	Catch Basin	Concrete
SWCBPC20658	Catch Basin	Concrete
SWCBPC20659	Catch Basin	Concrete
SWCBPC20660	Catch Basin	Concrete
SWCBPC20662	Catch Basin	Concrete
SWCBPC20663	Catch Basin	Concrete
SWCBPC20665	Catch Basin	Concrete
SWCBPC20666	Catch Basin	Concrete
SWCBPC20667	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC20668	Catch Basin	Concrete
SWCBPC20669	Catch Basin	Concrete
SWCBPC20670	Catch Basin	Concrete
SWCBPC20672	Catch Basin	Concrete
SWCBPC20673	Catch Basin	Concrete
SWCBPC20674	Catch Basin	Concrete
SWCBPC20676	Catch Basin	Concrete
SWCBPC20682	Catch Basin	Concrete
SWCBPC20683	Catch Basin	Concrete
SWCBPC20684	Catch Basin	Concrete
SWCBPC20685	Catch Basin	Concrete
SWCBPC20687	Catch Basin	Concrete
SWCBPC20688	Catch Basin	Concrete
SWCBPC20690	Catch Basin	Concrete
SWCBPC20691	Catch Basin	Concrete
SWCBPC20694	Catch Basin	Concrete
SWCBPC20696	Catch Basin	Concrete
SWCBPC20697	Catch Basin	Concrete
SWCBPC20699	Catch Basin	Concrete
SWCBPC20703	Catch Basin	Concrete
SWCBPC20704	Catch Basin	Concrete
SWCBPC20705	Catch Basin	Concrete
SWCBPC20706	Catch Basin	Concrete
SWCBPC20707	Catch Basin	Concrete
SWCBPC20709	Catch Basin	Concrete
SWCBPC20711	Catch Basin	Concrete
SWCBPC20712	Catch Basin	Concrete
SWCBPC20716	Catch Basin	Concrete
SWCBPC20717	Catch Basin	Concrete
SWCBPC20718	Catch Basin	Concrete
SWCBPC20719	Catch Basin	Concrete
SWCBPC20721	Catch Basin	Concrete
SWCBPC20723	Catch Basin	Concrete
SWCBPC20724	Catch Basin	Concrete
SWCBPC20725	Catch Basin	Concrete
SWCBPC20727	Catch Basin	Concrete
SWCBPC20728	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBPC20729	Catch Basin	Concrete
SWCBPC20730	Catch Basin	Concrete
SWCBPC20731	Catch Basin	Concrete
SWCBPC20734	Catch Basin	Concrete
SWCBPC20735	Catch Basin	Concrete
SWCBPC20736	Catch Basin	Concrete
SWCBPC20738	Catch Basin	Concrete
SWCBPC20739	Catch Basin	Concrete
SWCBPC20747	Catch Basin	Concrete
SWCBPC20748	Catch Basin	Concrete
SWCBPC20749	Catch Basin	Concrete
SWCBPC20751	Catch Basin	Concrete
SWCBPC20752	Catch Basin	Concrete
SWCBPC20753	Catch Basin	Concrete
SWCBPC20754	Catch Basin	Concrete
SWCBPC20755	Catch Basin	Concrete
SWCBPC20756	Catch Basin	Concrete
SWCBPC20757	Catch Basin	Concrete
SWCBPC20758	Catch Basin	Concrete
SWCBPC20759	Catch Basin	Concrete
SWCBPC20760	Catch Basin	Concrete
SWCBPC20761	Catch Basin	Concrete
SWCBPC20763	Catch Basin	Concrete
SWCBPC20764	Catch Basin	Concrete
SWCBPC20768	Catch Basin	Concrete
SWCBPC20769	Catch Basin	Concrete
SWCBPC20771	Catch Basin	Concrete
SWCBPC20772	Catch Basin	Concrete
SWCBPC20773	Catch Basin	Concrete
SWCBPC20774	Catch Basin	Concrete
SWCBPC20776	Catch Basin	Concrete
SWCBPC20777	Catch Basin	Concrete
SWCBPC20778	Catch Basin	Concrete
SWCBPC20781	Catch Basin	Concrete
SWCBPC20782	Catch Basin	Concrete
SWCBPC20787	Catch Basin	Concrete
SWCBPC20788	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC20789	Catch Basin	Concrete
SWCBPC20790	Catch Basin	Concrete
SWCBPC20791	Catch Basin	Concrete
SWCBPC20794	Catch Basin	Concrete
SWCBPC20795	Catch Basin	Concrete
SWCBPC20796	Catch Basin	Concrete
SWCBPC20797	Catch Basin	Concrete
SWCBPC20800	Catch Basin	Concrete
SWCBPC20801	Catch Basin	Concrete
SWCBPC20802	Catch Basin	Concrete
SWCBPC20803	Catch Basin	Concrete
SWCBPC20806	Catch Basin	Concrete
SWCBPC20807	Catch Basin	Concrete
SWCBPC20808	Catch Basin	Concrete
SWCBPC20809	Catch Basin	Concrete
SWCBPC20811	Catch Basin	Concrete
SWCBPC20812	Catch Basin	Concrete
SWCBPC20815	Catch Basin	Concrete
SWCBPC20816	Catch Basin	Concrete
SWCBPC20823	Catch Basin	Concrete
SWCBPC20824	Catch Basin	Concrete
SWCBPC20825	Catch Basin	Concrete
SWCBPC20826	Catch Basin	Concrete
SWCBPC20828	Catch Basin	Concrete
SWCBPC20829	Catch Basin	Concrete
SWCBPC20830	Catch Basin	Concrete
SWCBPC20831	Catch Basin	Concrete
SWCBPC20832	Catch Basin	Concrete
SWCBPC20833	Catch Basin	Concrete
SWCBPC20836	Catch Basin	Concrete
SWCBPC20837	Catch Basin	Concrete
SWCBPC20841	Catch Basin	Concrete
SWCBPC20843	Catch Basin	Concrete
SWCBPC20844	Catch Basin	Concrete
SWCBPC20845	Catch Basin	Concrete
SWCBPC20846	Catch Basin	Concrete
SWCBPC20852	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBPC20853	Catch Basin	Concrete
SWCBPC20854	Catch Basin	Concrete
SWCBPC20855	Catch Basin	Concrete
SWCBPC20856	Catch Basin	Concrete
SWCBPC20857	Catch Basin	Concrete
SWCBPC20858	Catch Basin	Concrete
SWCBPC20859	Catch Basin	Concrete
SWCBPC20860	Catch Basin	Concrete
SWCBPC20867	Catch Basin	Concrete
SWCBPC20868	Catch Basin	Concrete
SWCBPC20875	Catch Basin	Concrete
SWCBPC20876	Catch Basin	Concrete
SWCBPC20877	Catch Basin	Concrete
SWCBPC20878	Catch Basin	Concrete
SWCBPC20879	Catch Basin	Concrete
SWCBPC20880	Catch Basin	Concrete
SWCBPC20881	Catch Basin	Concrete
SWCBPC20882	Catch Basin	Concrete
SWCBPC20883	Catch Basin	Concrete
SWCBPC20884	Catch Basin	Concrete
SWCBPC20885	Catch Basin	Concrete
SWCBPC20886	Catch Basin	Concrete
SWCBPC20887	Catch Basin	Concrete
SWCBPC20888	Catch Basin	Concrete
SWCBPC20889	Catch Basin	Concrete
SWCBPC20890	Catch Basin	Concrete
SWCBPC20891	Catch Basin	Concrete
SWCBPC20892	Catch Basin	Concrete
SWCBPC20893	Catch Basin	Concrete
SWCBPC20894	Catch Basin	Concrete
SWCBPC20895	Catch Basin	Concrete
SWCBPC20896	Catch Basin	Concrete
SWCBPC20897	Catch Basin	Concrete
SWCBPC20898	Catch Basin	Concrete
SWCBPC20899	Catch Basin	Concrete
SWCBPC20900	Catch Basin	Concrete
SWCBPC20901	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC20902	Catch Basin	Concrete
SWCBPC20903	Catch Basin	Concrete
SWCBPC20904	Catch Basin	Concrete
SWCBPC20905	Catch Basin	Concrete
SWCBPC20906	Catch Basin	Concrete
SWCBPC20907	Catch Basin	Concrete
SWCBPC20909	Catch Basin	Concrete
SWCBPC20910	Catch Basin	Concrete
SWCBPC20916	Catch Basin	Concrete
SWCBPC20917	Catch Basin	Concrete
SWCBPC20918	Catch Basin	Concrete
SWCBPC20919	Catch Basin	Concrete
SWCBPC20920	Catch Basin	Concrete
SWCBPC20921	Catch Basin	Concrete
SWCBPC20922	Catch Basin	Concrete
SWCBPC20923	Catch Basin	Concrete
SWCBPC20924	Catch Basin	Concrete
SWCBPC20925	Catch Basin	Concrete
SWCBPC20926	Catch Basin	Concrete
SWCBPC20927	Catch Basin	Concrete
SWCBPC20928	Catch Basin	Concrete
SWCBPC20929	Catch Basin	Concrete
SWCBPC20930	Catch Basin	Concrete
SWCBPC20931	Catch Basin	Concrete
SWCBPC20932	Catch Basin	Concrete
SWCBPC20933	Catch Basin	Concrete
SWCBPC20934	Catch Basin	Concrete
SWCBPC20935	Catch Basin	Concrete
SWCBPC20936	Catch Basin	Concrete
SWCBPC20944	Catch Basin	Concrete
SWCBPC20945	Catch Basin	Concrete
SWCBPC20946	Catch Basin	Concrete
SWCBPC20947	Catch Basin	Concrete
SWCBPC20948	Catch Basin	Concrete
SWCBPC20949	Catch Basin	Concrete
SWCBPC20950	Catch Basin	Concrete
SWCBPC20951	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBPC20952	Catch Basin	Concrete
SWCBPC20953	Catch Basin	Concrete
SWCBPC20954	Catch Basin	Concrete
SWCBPC20955	Catch Basin	Concrete
SWCBPC20956	Catch Basin	Concrete
SWCBPC20957	Catch Basin	Concrete
SWCBPC20958	Catch Basin	Concrete
SWCBPC20959	Catch Basin	Concrete
SWCBPC20960	Catch Basin	Concrete
SWCBPC20961	Catch Basin	Concrete
SWCBPC20964	Catch Basin	Concrete
SWCBPC20965	Catch Basin	Concrete
SWCBPC20969	Catch Basin	Concrete
SWCBPC20970	Catch Basin	Concrete
SWCBPC20972	Catch Basin	Concrete
SWCBPC20974	Catch Basin	Concrete
SWCBPC20983	Catch Basin	Concrete
SWCBPC20984	Catch Basin	Concrete
SWCBPC20985	Catch Basin	Concrete
SWCBPC20986	Catch Basin	Concrete
SWCBPC20987	Catch Basin	Concrete
SWCBPC20995	Catch Basin	Concrete
SWCBPC20997	Catch Basin	Concrete
SWCBPC20998	Catch Basin	Concrete
SWCBPC20999	Catch Basin	Concrete
SWCBPC21000	Catch Basin	Concrete
SWCBPC21001	Catch Basin	Concrete
SWCBPC21002	Catch Basin	Concrete
SWCBPC21003	Catch Basin	Concrete
SWCBPC21004	Catch Basin	Concrete
SWCBPC21009	Catch Basin	Concrete
SWCBPC21010	Catch Basin	Concrete
SWCBPC21013	Catch Basin	Brick
SWCBPC21017	Catch Basin	Brick
SWCBPC21025	Catch Basin	Concrete
SWCBPC21096	Catch Basin	Concrete
SWCBPC21098	Catch Basin	Concrete

Structure ID	Type	Material
SWCBPC21143	Catch Basin	Concrete
SWCBPC21161	Catch Basin	Concrete
SWCBPC21162	Catch Basin	Concrete
SWCBPC21166	Catch Basin	Concrete
SWCBPC21167	Catch Basin	Concrete
SWCBPC21168	Catch Basin	Concrete
SWCBPC21169	Catch Basin	Concrete
SWCBTC22823	Catch Basin	Concrete
SWCBTC22824	Catch Basin	Concrete
SWCBTC22825	Catch Basin	Concrete
SWCBTC22827	Catch Basin	Concrete
SWCBTC22828	Catch Basin	Concrete
SWCBTC22829	Catch Basin	Concrete
SWCBTC22830	Catch Basin	Concrete
SWCBTC22831	Catch Basin	Concrete
SWCBTC22832	Catch Basin	Concrete
SWCBTC22833	Catch Basin	Concrete
SWCBTC22834	Catch Basin	Concrete
SWCBTC22835	Catch Basin	Concrete
SWCBTC22843	Catch Basin	Concrete
SWCBTC22844	Catch Basin	Concrete
SWCBTC22846	Catch Basin	Concrete
SWCBTC22847	Catch Basin	Concrete
SWCBTC22848	Catch Basin	Concrete
SWCBTC22849	Catch Basin	Concrete
SWCBTC22852	Catch Basin	Concrete
SWCBTC22853	Catch Basin	Concrete
SWCBTC22855	Catch Basin	Concrete
SWCBTC22856	Catch Basin	Concrete
SWCBTC22857	Catch Basin	Concrete
SWCBTC22858	Catch Basin	Concrete
SWCBTC22859	Catch Basin	Concrete
SWCBTC22860	Catch Basin	Concrete
SWCBTC22861	Catch Basin	Concrete
SWCBTC22862	Catch Basin	Concrete
SWCBTC22863	Catch Basin	Concrete
SWCBTC22864	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBTC22865	Catch Basin	Concrete
SWCBTC22867	Catch Basin	Concrete
SWCBTC22868	Catch Basin	Concrete
SWCBTC22869	Catch Basin	Concrete
SWCBTC22870	Catch Basin	Concrete
SWCBTC22871	Catch Basin	Concrete
SWCBTC22872	Catch Basin	Concrete
SWCBTC22873	Catch Basin	Concrete
SWCBTC22874	Catch Basin	Concrete
SWCBTC22875	Catch Basin	Concrete
SWCBTC22876	Catch Basin	Concrete
SWCBTC22877	Catch Basin	Concrete
SWCBTC22878	Catch Basin	Concrete
SWCBTC22879	Catch Basin	Concrete
SWCBTC22880	Catch Basin	Concrete
SWCBTC22881	Catch Basin	Concrete
SWCBTC22882	Catch Basin	Concrete
SWCBTC22883	Catch Basin	Concrete
SWCBTC22885	Catch Basin	Concrete
SWCBTC22888	Catch Basin	Concrete
SWCBTC22889	Catch Basin	Concrete
SWCBTC22890	Catch Basin	Concrete
SWCBTC22892	Catch Basin	Concrete
SWCBTC22893	Catch Basin	Concrete
SWCBTC22894	Catch Basin	Concrete
SWCBTC22895	Catch Basin	Concrete
SWCBTC22899	Catch Basin	Concrete
SWCBTC22900	Catch Basin	Concrete
SWCBTC22901	Catch Basin	Concrete
SWCBTC22902	Catch Basin	Concrete
SWCBTC22903	Catch Basin	Concrete
SWCBTC22904	Catch Basin	Concrete
SWCBTC22905	Catch Basin	Concrete
SWCBTC22906	Catch Basin	Concrete
SWCBTC22908	Catch Basin	Concrete
SWCBTC22909	Catch Basin	Concrete
SWCBTC22911	Catch Basin	Concrete

Structure ID	Type	Material
SWCBTC22912	Catch Basin	Concrete
SWCBTC22917	Catch Basin	Concrete
SWCBTC22918	Catch Basin	Concrete
SWCBTC22919	Catch Basin	Concrete
SWCBTC22920	Catch Basin	Concrete
SWCBTC22921	Catch Basin	Concrete
SWCBTC22922	Catch Basin	Concrete
SWCBTC22923	Catch Basin	Concrete
SWCBTC22924	Catch Basin	Concrete
SWCBTC22925	Catch Basin	Concrete
SWCBTC22926	Catch Basin	Concrete
SWCBTC22927	Catch Basin	Concrete
SWCBTC22928	Catch Basin	Concrete
SWCBTC22929	Catch Basin	Concrete
SWCBTC22930	Catch Basin	Concrete
SWCBTC22931	Catch Basin	Concrete
SWCBTC22932	Catch Basin	Concrete
SWCBTC22933	Catch Basin	Concrete
SWCBTC22934	Catch Basin	Concrete
SWCBTC22935	Catch Basin	Concrete
SWCBTC22936	Catch Basin	Concrete
SWCBTC22938	Catch Basin	Concrete
SWCBTC22939	Catch Basin	Concrete
SWCBTC22940	Catch Basin	Concrete
SWCBTC22941	Catch Basin	Concrete
SWCBTC22942	Catch Basin	Concrete
SWCBTC22943	Catch Basin	Concrete
SWCBTC22944	Catch Basin	Concrete
SWCBTC22945	Catch Basin	Concrete
SWCBTC22946	Catch Basin	Concrete
SWCBTC22948	Catch Basin	Concrete
SWCBTC22949	Catch Basin	Concrete
SWCBTC22950	Catch Basin	Concrete
SWCBTC22953	Catch Basin	Concrete
SWCBTC22954	Catch Basin	Concrete
SWCBTC22958	Catch Basin	Concrete
SWCBTC22959	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBTC22960	Catch Basin	Concrete
SWCBTC22961	Catch Basin	Concrete
SWCBTC22963	Catch Basin	Concrete
SWCBTC22966	Catch Basin	Concrete
SWCBTC22967	Catch Basin	Concrete
SWCBTC22968	Catch Basin	Concrete
SWCBTC22969	Catch Basin	Concrete
SWCBTC22970	Catch Basin	Concrete
SWCBTC22971	Catch Basin	Concrete
SWCBTC22972	Catch Basin	Concrete
SWCBTC22975	Catch Basin	Concrete
SWCBTC22976	Catch Basin	Concrete
SWCBTC22978	Catch Basin	Concrete
SWCBTC22980	Catch Basin	Concrete
SWCBTC22981	Catch Basin	Concrete
SWCBTC22982	Catch Basin	Concrete
SWCBTC22983	Catch Basin	Concrete
SWCBTC22985	Catch Basin	Concrete
SWCBTC22986	Catch Basin	Concrete
SWCBTC22987	Catch Basin	Concrete
SWCBTC22988	Catch Basin	Concrete
SWCBTC22989	Catch Basin	Concrete
SWCBTC22990	Catch Basin	Concrete
SWCBTC22993	Catch Basin	Concrete
SWCBTC22994	Catch Basin	Concrete
SWCBTC22995	Catch Basin	Concrete
SWCBTC23058	Catch Basin	Concrete
SWCBTC23076	Catch Basin	Concrete
SWCBTC23077	Catch Basin	Concrete
SWCBTC23079	Catch Basin	Concrete
SWCBTC23080	Catch Basin	Concrete
SWCBTC23082	Catch Basin	Concrete
SWCBTC23083	Catch Basin	Concrete
SWCBTC23084	Catch Basin	Concrete
SWCBTC23085	Catch Basin	Concrete
SWCBTC23086	Catch Basin	Concrete
SWCBTC23087	Catch Basin	Concrete

Structure ID	Type	Material
SWCBTC22803	Catch Basin	Concrete
SWCBTC22804	Catch Basin	Concrete
SWCBTC22805	Catch Basin	Concrete
SWCBTC22806	Catch Basin	Concrete
SWCBTC22807	Catch Basin	Concrete
SWCBTC22809	Catch Basin	Concrete
SWCBTC22810	Catch Basin	Concrete
SWCBTC22816	Catch Basin	Concrete
SWCBTC22817	Catch Basin	Concrete
SWCBTC22818	Catch Basin	Concrete
SWCBTC22819	Catch Basin	Concrete
SWCBTC22820	Catch Basin	Concrete
SWCBTC22821	Catch Basin	Concrete
SWCBTC22822	Catch Basin	Concrete
SWCBTC21099	Catch Basin	Concrete
SWCBTC21100	Catch Basin	Concrete
SWCBTC21101	Catch Basin	Concrete
SWCBTC21107	Catch Basin	Concrete
SWCBTC21129	Catch Basin	Concrete
SWCBTC21132	Catch Basin	Concrete
SWCBTC21135	Catch Basin	Concrete
SWCBTC21137	Catch Basin	Concrete
SWCBTC21138	Catch Basin	Concrete
SWCBDC21751	Catch Basin	Concrete
SWCBDC21752	Catch Basin	Concrete
SWCBDC21757	Catch Basin	Concrete
SWCBDC21758	Catch Basin	Concrete
SWCBDC21759	Catch Basin	Concrete
SWCBDC21760	Catch Basin	Concrete
SWCBDC21764	Catch Basin	Concrete
SWCBDC21765	Catch Basin	Concrete
SWCBDC21766	Catch Basin	Concrete
SWCBDC21767	Catch Basin	Concrete
SWCBDC21769	Catch Basin	Concrete
SWCBDC21771	Catch Basin	Concrete
SWCBDC21776	Catch Basin	Concrete
SWCBDC21778	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC21779	Catch Basin	Concrete
SWCBDC21781	Catch Basin	Concrete
SWCBDC21782	Catch Basin	Concrete
SWCBDC21783	Catch Basin	Concrete
SWCBDC21784	Catch Basin	Concrete
SWCBDC21785	Catch Basin	Concrete
SWCBDC21786	Catch Basin	Concrete
SWCBDC21789	Catch Basin	Concrete
SWCBDC21790	Catch Basin	Concrete
SWCBDC21791	Catch Basin	Concrete
SWCBDC21793	Catch Basin	Concrete
SWCBDC21794	Catch Basin	Concrete
SWCBDC21796	Catch Basin	Concrete
SWCBDC21797	Catch Basin	Concrete
SWCBDC21798	Catch Basin	Concrete
SWCBDC21799	Catch Basin	Concrete
SWCBDC21800	Catch Basin	Concrete
SWCBDC21801	Catch Basin	Concrete
SWCBDC21810	Catch Basin	Concrete
SWCBDC21811	Catch Basin	Concrete
SWCBDC21812	Catch Basin	Concrete
SWCBDC21813	Catch Basin	Concrete
SWCBDC21819	Catch Basin	Concrete
SWCBDC21820	Catch Basin	Concrete
SWCBDC21821	Catch Basin	Concrete
SWCBDC21517	Catch Basin	Concrete
SWCBDC21518	Catch Basin	Concrete
SWCBDC21519	Catch Basin	Concrete
SWCBDC21523	Catch Basin	Concrete
SWCBDC21524	Catch Basin	Concrete
SWCBDC21525	Catch Basin	Concrete
SWCBDC21526	Catch Basin	Concrete
SWCBDC21527	Catch Basin	Concrete
SWCBDC21528	Catch Basin	Concrete
SWCBDC21534	Catch Basin	Concrete
SWCBDC21535	Catch Basin	Concrete
SWCBDC21536	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC21537	Catch Basin	Concrete
SWCBDC21734	Catch Basin	Concrete
SWCBDC21735	Catch Basin	Concrete
SWCBDC21739	Catch Basin	Concrete
SWCBDC21740	Catch Basin	Concrete
SWCBDC21741	Catch Basin	Concrete
SWCBDC21742	Catch Basin	Concrete
SWCBDC21743	Catch Basin	Concrete
SWCBDC21744	Catch Basin	Concrete
SWCBDC21748	Catch Basin	Concrete
SWCBDC21822	Catch Basin	Concrete
SWCBDC21823	Catch Basin	Concrete
SWCBDC21824	Catch Basin	Concrete
SWCBDC21826	Catch Basin	Concrete
SWCBDC21827	Catch Basin	Concrete
SWCBDC21828	Catch Basin	Concrete
SWCBDC21829	Catch Basin	Concrete
SWCBDC21830	Catch Basin	Concrete
SWCBDC21831	Catch Basin	Concrete
SWCBDC21832	Catch Basin	Concrete
SWCBDC21833	Catch Basin	Concrete
SWCBDC21834	Catch Basin	Concrete
SWCBDC21835	Catch Basin	Concrete
SWCBDC21836	Catch Basin	Concrete
SWCBDC21837	Catch Basin	Concrete
SWCBDC21838	Catch Basin	Concrete
SWCBDC21839	Catch Basin	Concrete
SWCBDC21840	Catch Basin	Concrete
SWCBDC21841	Catch Basin	Concrete
SWCBDC21842	Catch Basin	Concrete
SWCBDC21843	Catch Basin	Concrete
SWCBDC21844	Catch Basin	Concrete
SWCBDC21848	Catch Basin	Concrete
SWCBDC21849	Catch Basin	Concrete
SWCBDC21851	Catch Basin	Concrete
SWCBDC21857	Catch Basin	Concrete
SWCBDC21903	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC21904	Catch Basin	Concrete
SWCBDC21914	Catch Basin	Concrete
SWCBDC21915	Catch Basin	Concrete
SWCBDC21918	Catch Basin	Concrete
SWCBDC21922	Catch Basin	Concrete
SWCBDC21923	Catch Basin	Concrete
SWCBDC21928	Catch Basin	Concrete
SWCBDC21929	Catch Basin	Concrete
SWCBDC21935	Catch Basin	Concrete
SWCBDC21938	Catch Basin	Concrete
SWCBDC21939	Catch Basin	Concrete
SWCBDC21940	Catch Basin	Concrete
SWCBDC21941	Catch Basin	Concrete
SWCBDC21942	Catch Basin	Concrete
SWCBDC21943	Catch Basin	Concrete
SWCBDC21944	Catch Basin	Concrete
SWCBDC21945	Catch Basin	Concrete
SWCBDC21947	Catch Basin	Concrete
SWCBDC21948	Catch Basin	Concrete
SWCBDC21950	Catch Basin	Concrete
SWCBDC21952	Catch Basin	Concrete
SWCBDC21956	Catch Basin	Concrete
SWCBDC21957	Catch Basin	Concrete
SWCBDC21959	Catch Basin	Concrete
SWCBDC21960	Catch Basin	Concrete
SWCBDC21962	Catch Basin	Concrete
SWCBDC21963	Catch Basin	Concrete
SWCBDC21965	Catch Basin	Concrete
SWCBDC21966	Catch Basin	Concrete
SWCBDC21971	Catch Basin	Concrete
SWCBDC21972	Catch Basin	Concrete
SWCBDC21973	Catch Basin	Concrete
SWCBDC21974	Catch Basin	Concrete
SWCBDC21975	Catch Basin	Concrete
SWCBDC21976	Catch Basin	Concrete
SWCBDC21978	Catch Basin	Concrete
SWCBDC21981	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC21988	Catch Basin	Concrete
SWCBDC21989	Catch Basin	Concrete
SWCBDC21995	Catch Basin	Concrete
SWCBDC21997	Catch Basin	Concrete
SWCBDC21998	Catch Basin	Concrete
SWCBDC21999	Catch Basin	Concrete
SWCBDC22001	Catch Basin	Concrete
SWCBDC22003	Catch Basin	Concrete
SWCBDC22004	Catch Basin	Concrete
SWCBDC22005	Catch Basin	Concrete
SWCBDC22006	Catch Basin	Concrete
SWCBDC22007	Catch Basin	Concrete
SWCBDC22012	Catch Basin	Concrete
SWCBDC22013	Catch Basin	Concrete
SWCBDC22019	Catch Basin	Concrete
SWCBDC22020	Catch Basin	Concrete
SWCBDC22024	Catch Basin	Concrete
SWCBDC22025	Catch Basin	Concrete
SWCBDC22026	Catch Basin	Concrete
SWCBDC22029	Catch Basin	Concrete
SWCBDC22030	Catch Basin	Concrete
SWCBDC22031	Catch Basin	Concrete
SWCBDC22032	Catch Basin	Concrete
SWCBDC22036	Catch Basin	Concrete
SWCBDC22037	Catch Basin	Concrete
SWCBDC22039	Catch Basin	Concrete
SWCBDC22040	Catch Basin	Concrete
SWCBDC22041	Catch Basin	Concrete
SWCBDC22043	Catch Basin	Concrete
SWCBDC22044	Catch Basin	Concrete
SWCBDC22045	Catch Basin	Concrete
SWCBDC22046	Catch Basin	Concrete
SWCBDC22047	Catch Basin	Concrete
SWCBDC22048	Catch Basin	Concrete
SWCBDC22049	Catch Basin	Concrete
SWCBDC22050	Catch Basin	Concrete
SWCBDC22052	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC22053	Catch Basin	Concrete
SWCBDC22054	Catch Basin	Concrete
SWCBDC22055	Catch Basin	Concrete
SWCBDC22056	Catch Basin	Concrete
SWCBDC22057	Catch Basin	Concrete
SWCBDC22059	Catch Basin	Concrete
SWCBDC22060	Catch Basin	Concrete
SWCBDC22061	Catch Basin	Concrete
SWCBDC22062	Catch Basin	Concrete
SWCBDC22065	Catch Basin	Concrete
SWCBDC22066	Catch Basin	Concrete
SWCBDC22068	Catch Basin	Concrete
SWCBDC22069	Catch Basin	Concrete
SWCBDC22070	Catch Basin	Concrete
SWCBDC22071	Catch Basin	Concrete
SWCBDC22072	Catch Basin	Concrete
SWCBDC22073	Catch Basin	Concrete
SWCBDC22074	Catch Basin	Concrete
SWCBDC22075	Catch Basin	Concrete
SWCBDC22076	Catch Basin	Concrete
SWCBDC22077	Catch Basin	Concrete
SWCBDC22079	Catch Basin	Concrete
SWCBDC22082	Catch Basin	Concrete
SWCBDC22083	Catch Basin	Concrete
SWCBDC22090	Catch Basin	Concrete
SWCBDC22091	Catch Basin	Concrete
SWCBDC22092	Catch Basin	Concrete
SWCBDC22093	Catch Basin	Concrete
SWCBDC22097	Catch Basin	Concrete
SWCBDC22098	Catch Basin	Concrete
SWCBDC22099	Catch Basin	Concrete
SWCBDC22100	Catch Basin	Concrete
SWCBDC22101	Catch Basin	Concrete
SWCBDC22103	Catch Basin	Concrete
SWCBDC22105	Catch Basin	Concrete
SWCBDC22106	Catch Basin	Concrete
SWCBDC22107	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC22108	Catch Basin	Concrete
SWCBDC22115	Catch Basin	Concrete
SWCBDC22116	Catch Basin	Concrete
SWCBDC22118	Catch Basin	Concrete
SWCBDC22119	Catch Basin	Concrete
SWCBDC22120	Catch Basin	Concrete
SWCBDC22121	Catch Basin	Concrete
SWCBDC22122	Catch Basin	Concrete
SWCBDC22123	Catch Basin	Concrete
SWCBDC22124	Catch Basin	Concrete
SWCBDC22125	Catch Basin	Concrete
SWCBDC22127	Catch Basin	Concrete
SWCBDC22129	Catch Basin	Concrete
SWCBDC22130	Catch Basin	Concrete
SWCBDC22131	Catch Basin	Concrete
SWCBDC22133	Catch Basin	Concrete
SWCBDC22134	Catch Basin	Concrete
SWCBDC22135	Catch Basin	Concrete
SWCBDC22136	Catch Basin	Concrete
SWCBDC22137	Catch Basin	Concrete
SWCBDC22138	Catch Basin	Concrete
SWCBDC22139	Catch Basin	Concrete
SWCBDC22140	Catch Basin	Concrete
SWCBDC22141	Catch Basin	Concrete
SWCBDC22142	Catch Basin	Concrete
SWCBDC22200	Catch Basin	Concrete
SWCBDC22201	Catch Basin	Concrete
SWCBDC22203	Catch Basin	Concrete
SWCBDC22204	Catch Basin	Concrete
SWCBDC22205	Catch Basin	Concrete
SWCBDC22206	Catch Basin	Concrete
SWCBDC22208	Catch Basin	Concrete
SWCBDC22209	Catch Basin	Concrete
SWCBDC22210	Catch Basin	Concrete
SWCBDC22212	Catch Basin	Concrete
SWCBDC22213	Catch Basin	Concrete
SWCBDC22214	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC22215	Catch Basin	Concrete
SWCBDC22216	Catch Basin	Concrete
SWCBDC22217	Catch Basin	Concrete
SWCBDC22218	Catch Basin	Concrete
SWCBDC22219	Catch Basin	Concrete
SWCBDC22220	Catch Basin	Concrete
SWCBDC22221	Catch Basin	Concrete
SWCBDC22222	Catch Basin	Concrete
SWCBDC22223	Catch Basin	Concrete
SWCBDC22224	Catch Basin	Concrete
SWCBDC22225	Catch Basin	Concrete
SWCBDC22226	Catch Basin	Concrete
SWCBDC22231	Catch Basin	Concrete
SWCBDC22232	Catch Basin	Concrete
SWCBDC22233	Catch Basin	Concrete
SWCBDC22234	Catch Basin	Concrete
SWCBDC22235	Catch Basin	Concrete
SWCBDC22237	Catch Basin	Concrete
SWCBDC22238	Catch Basin	Concrete
SWCBDC22239	Catch Basin	Concrete
SWCBDC22240	Catch Basin	Concrete
SWCBDC22241	Catch Basin	Concrete
SWCBDC22242	Catch Basin	Concrete
SWCBDC22243	Catch Basin	Concrete
SWCBDC22244	Catch Basin	Concrete
SWCBDC22245	Catch Basin	Concrete
SWCBDC22246	Catch Basin	Concrete
SWCBDC22247	Catch Basin	Concrete
SWCBDC22248	Catch Basin	Concrete
SWCBDC22250	Catch Basin	Concrete
SWCBDC22251	Catch Basin	Concrete
SWCBDC22252	Catch Basin	Concrete
SWCBDC22253	Catch Basin	Concrete
SWCBDC22254	Catch Basin	Concrete
SWCBDC22255	Catch Basin	Concrete
SWCBDC22256	Catch Basin	Concrete
SWCBDC22257	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC22258	Catch Basin	Concrete
SWCBDC22259	Catch Basin	Concrete
SWCBDC22260	Catch Basin	Concrete
SWCBDC22261	Catch Basin	Concrete
SWCBDC22262	Catch Basin	Concrete
SWCBDC22263	Catch Basin	Concrete
SWCBDC22264	Catch Basin	Concrete
SWCBDC22265	Catch Basin	Concrete
SWCBDC22267	Catch Basin	Concrete
SWCBDC22268	Catch Basin	Concrete
SWCBDC22269	Catch Basin	Concrete
SWCBDC22274	Catch Basin	Concrete
SWCBDC22275	Catch Basin	Concrete
SWCBDC22276	Catch Basin	Concrete
SWCBDC22278	Catch Basin	Concrete
SWCBDC22279	Catch Basin	Concrete
SWCBDC22280	Catch Basin	Concrete
SWCBDC22281	Catch Basin	Concrete
SWCBDC22282	Catch Basin	Concrete
SWCBDC22285	Catch Basin	Concrete
SWCBDC22286	Catch Basin	Concrete
SWCBDC22291	Catch Basin	Concrete
SWCBDC22292	Catch Basin	Concrete
SWCBDC22295	Catch Basin	Concrete
SWCBDC22296	Catch Basin	Concrete
SWCBDC22301	Catch Basin	Concrete
SWCBDC22302	Catch Basin	Concrete
SWCBDC22303	Catch Basin	Concrete
SWCBDC22304	Catch Basin	Concrete
SWCBDC22305	Catch Basin	Concrete
SWCBDC22311	Catch Basin	Concrete
SWCBDC22312	Catch Basin	Concrete
SWCBDC22316	Catch Basin	Concrete
SWCBDC22317	Catch Basin	Concrete
SWCBDC22318	Catch Basin	Concrete
SWCBDC22319	Catch Basin	Concrete
SWCBDC22320	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC22321	Catch Basin	Concrete
SWCBDC22324	Catch Basin	Concrete
SWCBDC22325	Catch Basin	Concrete
SWCBDC22326	Catch Basin	Concrete
SWCBDC22328	Catch Basin	Concrete
SWCBDC22329	Catch Basin	Concrete
SWCBDC22410	Catch Basin	Concrete
SWCBDC22412	Catch Basin	Concrete
SWCBDC22413	Catch Basin	Concrete
SWCBDC22414	Catch Basin	Concrete
SWCBDC22416	Catch Basin	Concrete
SWCBDC22491	Catch Basin	Concrete
SWCBDC22492	Catch Basin	Concrete
SWCBDC22493	Catch Basin	Concrete
SWCBDC22494	Catch Basin	Concrete
SWCBDC22496	Catch Basin	Concrete
SWCBDC22497	Catch Basin	Concrete
SWCBDC22500	Catch Basin	Concrete
SWCBDC22501	Catch Basin	Unknown
SWCBDC22503	Catch Basin	Concrete
SWCBDC22504	Catch Basin	Concrete
SWCBDC22505	Catch Basin	Concrete
SWCBDC22506	Catch Basin	Concrete
SWCBDC22508	Catch Basin	Concrete
SWCBDC22509	Catch Basin	Concrete
SWCBDC22510	Catch Basin	Concrete
SWCBDC22511	Catch Basin	Concrete
SWCBDC22512	Catch Basin	Concrete
SWCBDC22514	Catch Basin	Concrete
SWCBDC22515	Catch Basin	Concrete
SWCBDC22516	Catch Basin	Concrete
SWCBDC22517	Catch Basin	Concrete
SWCBDC22518	Catch Basin	Concrete
SWCBDC22562	Catch Basin	Concrete
SWCBDC22563	Catch Basin	Concrete
SWCBDC22564	Catch Basin	Concrete
SWCBDC22565	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC22568	Catch Basin	Concrete
SWCBDC22571	Catch Basin	Concrete
SWCBDC22573	Catch Basin	Concrete
SWCBDC22574	Catch Basin	Concrete
SWCBDC22576	Catch Basin	Concrete
SWCBDC22577	Catch Basin	Concrete
SWCBDC22580	Catch Basin	Concrete
SWCBDC22581	Catch Basin	Concrete
SWCBDC22584	Catch Basin	Concrete
SWCBDC22585	Catch Basin	Concrete
SWCBDC22587	Catch Basin	Concrete
SWCBDC22588	Catch Basin	Concrete
SWCBDC22593	Catch Basin	Concrete
SWCBDC22594	Catch Basin	Concrete
SWCBDC22596	Catch Basin	Concrete
SWCBDC22597	Catch Basin	Concrete
SWCBDC22601	Catch Basin	Concrete
SWCBDC22602	Catch Basin	Concrete
SWCBDC22603	Catch Basin	Concrete
SWCBDC22604	Catch Basin	Concrete
SWCBDC22608	Catch Basin	Concrete
SWCBDC22609	Catch Basin	Concrete
SWCBDC22613	Catch Basin	Concrete
SWCBDC22614	Catch Basin	Concrete
SWCBDC22616	Catch Basin	Concrete
SWCBDC22617	Catch Basin	Concrete
SWCBDC22620	Catch Basin	Concrete
SWCBDC22621	Catch Basin	Concrete
SWCBDC22622	Catch Basin	Concrete
SWCBDC22623	Catch Basin	Concrete
SWCBDC22624	Catch Basin	Concrete
SWCBDC22625	Catch Basin	Concrete
SWCBDC22627	Catch Basin	Concrete
SWCBDC22628	Catch Basin	Concrete
SWCBDC22629	Catch Basin	Concrete
SWCBDC22630	Catch Basin	Concrete
SWCBDC22632	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC22633	Catch Basin	Concrete
SWCBDC22635	Catch Basin	Concrete
SWCBDC22636	Catch Basin	Concrete
SWCBDC22638	Catch Basin	Concrete
SWCBDC22639	Catch Basin	Concrete
SWCBDC22647	Catch Basin	Concrete
SWCBDC22648	Catch Basin	Concrete
SWCBDC22650	Catch Basin	Concrete
SWCBDC22651	Catch Basin	Concrete
SWCBDC21586	Catch Basin	Concrete
SWCBDC21587	Catch Basin	Concrete
SWCBDC21588	Catch Basin	Concrete
SWCBDC21589	Catch Basin	Concrete
SWCBDC21590	Catch Basin	Concrete
SWCBDC21591	Catch Basin	Concrete
SWCBDC21592	Catch Basin	Concrete
SWCBDC21594	Catch Basin	Concrete
SWCBDC21595	Catch Basin	Concrete
SWCBDC21599	Catch Basin	Concrete
SWCBDC21600	Catch Basin	Concrete
SWCBDC21601	Catch Basin	Concrete
SWCBDC21602	Catch Basin	Concrete
SWCBDC21604	Catch Basin	Concrete
SWCBDC21605	Catch Basin	Concrete
SWCBDC21606	Catch Basin	Concrete
SWCBDC21607	Catch Basin	Concrete
SWCBDC21608	Catch Basin	Concrete
SWCBDC21609	Catch Basin	Concrete
SWCBDC21610	Catch Basin	Concrete
SWCBDC21615	Catch Basin	Concrete
SWCBDC21616	Catch Basin	Concrete
SWCBDC21619	Catch Basin	Concrete
SWCBDC21620	Catch Basin	Concrete
SWCBDC21621	Catch Basin	Concrete
SWCBDC21622	Catch Basin	Concrete
SWCBDC21623	Catch Basin	Concrete
SWCBDC21624	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC21625	Catch Basin	Concrete
SWCBDC21626	Catch Basin	Concrete
SWCBDC21627	Catch Basin	Concrete
SWCBDC21628	Catch Basin	Concrete
SWCBDC21629	Catch Basin	Concrete
SWCBDC21630	Catch Basin	Concrete
SWCBDC21634	Catch Basin	Concrete
SWCBDC21635	Catch Basin	Concrete
SWCBDC21636	Catch Basin	Concrete
SWCBDC21637	Catch Basin	Concrete
SWCBDC21638	Catch Basin	Concrete
SWCBDC21640	Catch Basin	Concrete
SWCBDC21641	Catch Basin	Concrete
SWCBDC21642	Catch Basin	Concrete
SWCBDC21643	Catch Basin	Concrete
SWCBDC21644	Catch Basin	Concrete
SWCBDC21645	Catch Basin	Concrete
SWCBDC21646	Catch Basin	Concrete
SWCBDC21647	Catch Basin	Concrete
SWCBDC21648	Catch Basin	Concrete
SWCBDC21649	Catch Basin	Concrete
SWCBDC21650	Catch Basin	Concrete
SWCBDC21651	Catch Basin	Concrete
SWCBDC21652	Catch Basin	Concrete
SWCBDC21653	Catch Basin	Concrete
SWCBDC21654	Catch Basin	Concrete
SWCBDC21655	Catch Basin	Concrete
SWCBDC21657	Catch Basin	Concrete
SWCBDC21658	Catch Basin	Concrete
SWCBDC21661	Catch Basin	Concrete
SWCBDC21662	Catch Basin	Concrete
SWCBDC21665	Catch Basin	Concrete
SWCBDC21666	Catch Basin	Concrete
SWCBDC21667	Catch Basin	Concrete
SWCBDC21668	Catch Basin	Concrete
SWCBDC21669	Catch Basin	Concrete
SWCBDC21670	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC21671	Catch Basin	Concrete
SWCBDC21672	Catch Basin	Concrete
SWCBDC21673	Catch Basin	Concrete
SWCBDC21674	Catch Basin	Concrete
SWCBDC21678	Catch Basin	Concrete
SWCBDC21681	Catch Basin	Concrete
SWCBDC21682	Catch Basin	Concrete
SWCBDC21683	Catch Basin	Concrete
SWCBDC21684	Catch Basin	Concrete
SWCBDC21685	Catch Basin	Concrete
SWCBDC21687	Catch Basin	Concrete
SWCBDC21688	Catch Basin	Concrete
SWCBDC21695	Catch Basin	Concrete
SWCBDC21701	Catch Basin	Concrete
SWCBDC21702	Catch Basin	Concrete
SWCBDC21703	Catch Basin	Concrete
SWCBDC21704	Catch Basin	Concrete
SWCBDC21705	Catch Basin	Concrete
SWCBDC21706	Catch Basin	Concrete
SWCBDC21707	Catch Basin	Concrete
SWCBDC21708	Catch Basin	Concrete
SWCBDC21709	Catch Basin	Concrete
SWCBDC21540	Catch Basin	Concrete
SWCBDC21541	Catch Basin	Concrete
SWCBDC21547	Catch Basin	Concrete
SWCBDC21548	Catch Basin	Concrete
SWCBDC21563	Catch Basin	Concrete
SWCBDC21713	Catch Basin	Concrete
SWCBDC21714	Catch Basin	Concrete
SWCBDC21715	Catch Basin	Concrete
SWCBDC21716	Catch Basin	Concrete
SWCBDC21718	Catch Basin	Concrete
SWCBDC21719	Catch Basin	Concrete
SWCBDC21720	Catch Basin	Concrete
SWCBDC21721	Catch Basin	Concrete
SWCBDC21722	Catch Basin	Concrete
SWCBDC21723	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC21724	Catch Basin	Concrete
SWCBDC21728	Catch Basin	Concrete
SWCBDC21729	Catch Basin	Concrete
SWCBDC21730	Catch Basin	Concrete
SWCBDC21731	Catch Basin	Concrete
SWCBDC21732	Catch Basin	Concrete
SWCBDC21733	Catch Basin	Concrete
SWCBDC21564	Catch Basin	Concrete
SWCBDC21565	Catch Basin	Concrete
SWCBDC21567	Catch Basin	Concrete
SWCBDC21568	Catch Basin	Concrete
SWCBDC21569	Catch Basin	Concrete
SWCBDC21570	Catch Basin	Concrete
SWCBDC21571	Catch Basin	Concrete
SWCBDC21572	Catch Basin	Concrete
SWCBDC21573	Catch Basin	Concrete
SWCBDC21574	Catch Basin	Concrete
SWCBDC21575	Catch Basin	Concrete
SWCBDC21576	Catch Basin	Concrete
SWCBDC21582	Catch Basin	Concrete
SWCBDC21583	Catch Basin	Concrete
SWCBDC27303	Catch Basin	Concrete
SWCBDC27304	Catch Basin	Concrete
SWCBDC27305	Catch Basin	Concrete
SWCBDC27306	Catch Basin	Concrete
SWCBDC27307	Catch Basin	Concrete
SWCBDC27308	Catch Basin	Concrete
SWCBDC27309	Catch Basin	Concrete
SWCBDC27310	Catch Basin	Concrete
SWCBDC27318	Catch Basin	Brick
SWCBDC27319	Catch Basin	Brick
SWCBDC27320	Catch Basin	Concrete
SWCBDC27321	Catch Basin	Concrete
SWCBDC27326	Catch Basin	Concrete
SWCBDC27327	Catch Basin	Concrete
SWCBDC27328	Catch Basin	Concrete
SWCBDC27403	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC27405	Catch Basin	Concrete
SWCBDC27406	Catch Basin	Concrete
SWCBDC27408	Catch Basin	Concrete
SWCBDC27409	Catch Basin	Concrete
SWCBDC27411	Catch Basin	Concrete
SWCBDC27412	Catch Basin	Concrete
SWCBDC27413	Catch Basin	Concrete
SWCBDC27414	Catch Basin	Concrete
SWCBDC27415	Catch Basin	Concrete
SWCBDC27416	Catch Basin	Concrete
SWCBDC27420	Catch Basin	Concrete
SWCBDC27421	Catch Basin	Concrete
SWCBDC27422	Catch Basin	Concrete
SWCBDC27423	Catch Basin	Concrete
SWCBDC27424	Catch Basin	Concrete
SWCBDC27425	Catch Basin	Concrete
SWCBDC27432	Catch Basin	Concrete
SWCBDC27433	Catch Basin	Concrete
SWCBDC27434	Catch Basin	Concrete
SWCBDC27435	Catch Basin	Concrete
SWCBDC27436	Catch Basin	Concrete
SWCBDC27437	Catch Basin	Concrete
SWCBDC27438	Catch Basin	Concrete
SWCBDC27439	Catch Basin	Concrete
SWCBDC27442	Catch Basin	Concrete
SWCBDC27443	Catch Basin	Concrete
SWCBDC27444	Catch Basin	Concrete
SWCBDC27446	Catch Basin	Concrete
SWCBDC27447	Catch Basin	Concrete
SWCBDC27449	Catch Basin	Concrete
SWCBDC27450	Catch Basin	Concrete
SWCBDC27452	Catch Basin	Concrete
SWCBDC27453	Catch Basin	Concrete
SWCBDC27454	Catch Basin	Concrete
SWCBDC27455	Catch Basin	Concrete
SWCBDC27458	Catch Basin	Concrete
SWCBDC27459	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC27460	Catch Basin	Concrete
SWCBDC27461	Catch Basin	Concrete
SWCBDC27462	Catch Basin	Concrete
SWCBDC27463	Catch Basin	Brick
SWCBDC27464	Catch Basin	Brick
SWCBDC27466	Catch Basin	Concrete
SWCBDC27467	Catch Basin	Brick
SWCBDC27469	Catch Basin	Concrete
SWCBDC27470	Catch Basin	Concrete
SWCBDC27474	Catch Basin	Concrete
SWCBDC27475	Catch Basin	Concrete
SWCBDC27479	Catch Basin	Concrete
SWCBDC27480	Catch Basin	Concrete
SWCBDC27482	Catch Basin	Concrete
SWCBDC27483	Catch Basin	Concrete
SWCBDC27485	Catch Basin	Concrete
SWCBDC27486	Catch Basin	Concrete
SWCBDC27490	Catch Basin	Concrete
SWCBDC27491	Catch Basin	Concrete
SWCBDC27495	Catch Basin	Concrete
SWCBDC27496	Catch Basin	Concrete
SWCBDC27497	Catch Basin	Concrete
SWCBDC27498	Catch Basin	Concrete
SWCBDC27499	Catch Basin	Concrete
SWCBDC27502	Catch Basin	Concrete
SWCBDC27503	Catch Basin	Concrete
SWCBDC27504	Catch Basin	Concrete
SWCBDC27510	Catch Basin	Concrete
SWCBDC27511	Catch Basin	Concrete
SWCBDC27515	Catch Basin	Concrete
SWCBDC27516	Catch Basin	Concrete
SWCBDC27517	Catch Basin	Concrete
SWCBDC27518	Catch Basin	Concrete
SWCBDC27519	Catch Basin	Concrete
SWCBDC27521	Catch Basin	Concrete
SWCBDC27522	Catch Basin	Concrete
SWCBDC27523	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC27524	Catch Basin	Concrete
SWCBDC27525	Catch Basin	Concrete
SWCBDC27526	Catch Basin	Concrete
SWCBDC27527	Catch Basin	Concrete
SWCBDC27529	Catch Basin	Concrete
SWCBDC27530	Catch Basin	Concrete
SWCBDC27531	Catch Basin	Concrete
SWCBDC27532	Catch Basin	Concrete
SWCBDC27533	Catch Basin	Concrete
SWCBDC27534	Catch Basin	Concrete
SWCBDC27536	Catch Basin	Concrete
SWCBDC27537	Catch Basin	Concrete
SWCBDC27538	Catch Basin	Concrete
SWCBDC27539	Catch Basin	Brick
SWCBDC27540	Catch Basin	Concrete
SWCBDC27541	Catch Basin	Concrete
SWCBDC27545	Catch Basin	Concrete
SWCBDC27546	Catch Basin	Concrete
SWCBDC27551	Catch Basin	Concrete
SWCBDC27552	Catch Basin	Concrete
SWCBDC27555	Catch Basin	Concrete
SWCBDC27560	Catch Basin	Concrete
SWCBDC27561	Catch Basin	Concrete
SWCBDC27562	Catch Basin	Concrete
SWCBDC27563	Catch Basin	Concrete
SWCBDC27571	Catch Basin	Concrete
SWCBDC27572	Catch Basin	Concrete
SWCBDC27573	Catch Basin	Concrete
SWCBDC27574	Catch Basin	Concrete
SWCBDC27575	Catch Basin	Concrete
SWCBDC27576	Catch Basin	Concrete
SWCBDC27577	Catch Basin	Concrete
SWCBDC27578	Catch Basin	Concrete
SWCBDC27580	Catch Basin	Concrete
SWCBDC27581	Catch Basin	Concrete
SWCBDC27582	Catch Basin	Concrete
SWCBDC27583	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC27584	Catch Basin	Concrete
SWCBDC27585	Catch Basin	Concrete
SWCBDC27586	Catch Basin	Concrete
SWCBDC27591	Catch Basin	Concrete
SWCBDC27592	Catch Basin	Concrete
SWCBDC27595	Catch Basin	Concrete
SWCBDC27596	Catch Basin	Concrete
SWCBDC27597	Catch Basin	Concrete
SWCBDC27599	Catch Basin	Concrete
SWCBDC27600	Catch Basin	Concrete
SWCBDC27601	Catch Basin	Concrete
SWCBDC27617	Catch Basin	Concrete
SWCBDC27618	Catch Basin	Brick
SWCBDC27620	Catch Basin	Concrete
SWCBDC27621	Catch Basin	Concrete
SWCBDC27623	Catch Basin	Concrete
SWCBDC27624	Catch Basin	Concrete
SWCBDC27627	Catch Basin	Concrete
SWCBDC27630	Catch Basin	Concrete
SWCBDC27632	Catch Basin	Concrete
SWCBDC27633	Catch Basin	Concrete
SWCBDC27634	Catch Basin	Concrete
SWCBDC27635	Catch Basin	Concrete
SWCBDC27640	Catch Basin	Concrete
SWCBDC27641	Catch Basin	Concrete
SWCBDC27642	Catch Basin	Concrete
SWCBDC27643	Catch Basin	Concrete
SWCBDC27644	Catch Basin	Concrete
SWCBDC27645	Catch Basin	Concrete
SWCBDC27647	Catch Basin	Concrete
SWCBDC27648	Catch Basin	Concrete
SWCBDC27649	Catch Basin	Concrete
SWCBDC27650	Catch Basin	Concrete
SWCBDC27651	Catch Basin	Concrete
SWCBDC21030	Catch Basin	Concrete
SWCBDC22195	Catch Basin	Concrete
SWCBDC22196	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC22172	Catch Basin	Concrete
SWCBDC22181	Catch Basin	Concrete
SWCBDC22182	Catch Basin	Concrete
SWCBDC22183	Catch Basin	Concrete
SWCBDC22184	Catch Basin	Concrete
SWCBDC22185	Catch Basin	Concrete
SWCBDC22186	Catch Basin	Concrete
SWCBDC22187	Catch Basin	Concrete
SWCBDC22188	Catch Basin	Concrete
SWCBDC22189	Catch Basin	Concrete
SWCBDC22190	Catch Basin	Concrete
SWCBDC22191	Catch Basin	Concrete
SWCBDC22192	Catch Basin	Concrete
SWCBDC22193	Catch Basin	Concrete
SWCBDC22194	Catch Basin	Concrete
SWCBDC22174	Catch Basin	Concrete
SWCBDC22177	Catch Basin	Concrete
SWCBDC22178	Catch Basin	Concrete
SWCBDC22179	Catch Basin	Concrete
SWCBDC22180	Catch Basin	Concrete
SWCBDC22170	Catch Basin	Concrete
SWCBDC22171	Catch Basin	Concrete
SWCBDC22152	Catch Basin	Concrete
SWCBDC22153	Catch Basin	Concrete
SWCBDC22154	Catch Basin	Concrete
SWCBDC22156	Catch Basin	Concrete
SWCBDC22157	Catch Basin	Concrete
SWCBDC22158	Catch Basin	Concrete
SWCBDC22160	Catch Basin	Concrete
SWCBDC22161	Catch Basin	Concrete
SWCBDC22162	Catch Basin	Concrete
SWCBDC22155	Catch Basin	Concrete
SWCBDC22163	Catch Basin	Concrete
SWCBDC22164	Catch Basin	Concrete
SWCBDC22165	Catch Basin	Concrete
SWCBDC22377	Catch Basin	Concrete
SWCBDC22378	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC22379	Catch Basin	Concrete
SWCBDC22383	Catch Basin	Concrete
SWCBDC22384	Catch Basin	Concrete
SWCBDC22385	Catch Basin	Concrete
SWCBDC22386	Catch Basin	Unknown
SWCBDC22391	Catch Basin	Concrete
SWCBDC22394	Catch Basin	Concrete
SWCBDC22397	Catch Basin	Concrete
SWCBDC22436	Catch Basin	Concrete
SWCBDC22446	Catch Basin	Concrete
SWCBDC22447	Catch Basin	Concrete
SWCBDC22448	Catch Basin	Concrete
SWCBDC22449	Catch Basin	Concrete
SWCBDC22450	Catch Basin	Concrete
SWCBDC22451	Catch Basin	Concrete
SWCBDC22452	Catch Basin	Concrete
SWCBWC27987	Catch Basin	Brick
SWCBWC27998	Catch Basin	Concrete
SWCBWC27999	Catch Basin	Brick
SWCBWC28001	Catch Basin	Unknown
SWCBWC28002	Catch Basin	Brick
SWCBWC28004	Catch Basin	Brick
SWCBWC28005	Catch Basin	Brick
SWCBWC28006	Catch Basin	Brick
SWCBWC28008	Catch Basin	Brick
SWCBWC28009	Catch Basin	Brick
SWCBWC28015	Catch Basin	Brick
SWCBWC28016	Catch Basin	Brick
SWCBWC27904	Catch Basin	Concrete
SWCBWC27905	Catch Basin	Concrete
SWCBWC27934	Catch Basin	Concrete
SWCBWC27935	Catch Basin	Concrete
SWCBWC27943	Catch Basin	Concrete
SWCBWC27950	Catch Basin	Concrete
SWCBWC27951	Catch Basin	Concrete
SWCBWC27952	Catch Basin	Concrete
SWCBWC27953	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC27956	Catch Basin	Concrete
SWCBWC27957	Catch Basin	Brick
SWCBWC27958	Catch Basin	Brick
SWCBWC27960	Catch Basin	Brick
SWCBWC27963	Catch Basin	Brick
SWCBWC27965	Catch Basin	Brick
SWCBWC27967	Catch Basin	Brick
SWCBWC27969	Catch Basin	Brick
SWCBWC27970	Catch Basin	Brick
SWCBWC27972	Catch Basin	Brick
SWCBWC27974	Catch Basin	Brick
SWCBWC27977	Catch Basin	Brick
SWCBWC27979	Catch Basin	Brick
SWCBWC27981	Catch Basin	Brick
SWCBWC27983	Catch Basin	Brick
SWCBWC27984	Catch Basin	Brick
SWCBWC28017	Catch Basin	Brick
SWCBWC28018	Catch Basin	Brick
SWCBWC28020	Catch Basin	Brick
SWCBWC28022	Catch Basin	Brick
SWCBWC28023	Catch Basin	Brick
SWCBWC28024	Catch Basin	Brick
SWCBWC28031	Catch Basin	Brick
SWCBWC28032	Catch Basin	Brick
SWCBWC28033	Catch Basin	Brick
SWCBWC28034	Catch Basin	Brick
SWCBWC28036	Catch Basin	Brick
SWCBWC28037	Catch Basin	Brick
SWCBWC28039	Catch Basin	Brick
SWCBWC28040	Catch Basin	Brick
SWCBWC28042	Catch Basin	Concrete
SWCBWC28043	Catch Basin	Brick
SWCBWC28046	Catch Basin	Concrete
SWCBWC28047	Catch Basin	Brick
SWCBWC28049	Catch Basin	Brick
SWCBWC28051	Catch Basin	Brick
SWCBWC28052	Catch Basin	Brick

Structure ID	Type	Material
SWCBWC28053	Catch Basin	Brick
SWCBWC28055	Catch Basin	Brick
SWCBWC28058	Catch Basin	Brick
SWCBWC28059	Catch Basin	Brick
SWCBWC28064	Catch Basin	Brick
SWCBWC28066	Catch Basin	Brick
SWCBWC28067	Catch Basin	Brick
SWCBWC28068	Catch Basin	Brick
SWCBWC28075	Catch Basin	Concrete
SWCBWC28076	Catch Basin	Concrete
SWCBWC28077	Catch Basin	Brick
SWCBWC28078	Catch Basin	Concrete
SWCBWC28079	Catch Basin	Concrete
SWCBWC28081	Catch Basin	Concrete
SWCBWC28082	Catch Basin	Concrete
SWCBWC28087	Catch Basin	Concrete
SWCBWC28088	Catch Basin	Concrete
SWCBWC28090	Catch Basin	Concrete
SWCBWC28091	Catch Basin	Concrete
SWCBWC28092	Catch Basin	Concrete
SWCBWC28093	Catch Basin	Concrete
SWCBWC28094	Catch Basin	Concrete
SWCBWC28095	Catch Basin	Concrete
SWCBWC28097	Catch Basin	Concrete
SWCBWC28099	Catch Basin	Concrete
SWCBWC28100	Catch Basin	Concrete
SWCBWC28104	Catch Basin	Concrete
SWCBWC28114	Catch Basin	Concrete
SWCBWC28122	Catch Basin	Concrete
SWCBWC28123	Catch Basin	Concrete
SWCBWC28125	Catch Basin	Concrete
SWCBWC28126	Catch Basin	Concrete
SWCBWC28130	Catch Basin	Brick
SWCBWC28135	Catch Basin	Unknown
SWCBWC28136	Catch Basin	Brick
SWCBWC28137	Catch Basin	Brick
SWCBWC28148	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC28149	Catch Basin	Concrete
SWCBWC28152	Catch Basin	Concrete
SWCBWC28153	Catch Basin	Concrete
SWCBWC28159	Catch Basin	Concrete
SWCBWC28160	Catch Basin	Concrete
SWCBWC28162	Catch Basin	Concrete
SWCBWC28163	Catch Basin	Concrete
SWCBWC28164	Catch Basin	Concrete
SWCBWC28165	Catch Basin	Concrete
SWCBWC28166	Catch Basin	Concrete
SWCBWC28167	Catch Basin	Concrete
SWCBWC28168	Catch Basin	Concrete
SWCBWC28169	Catch Basin	Concrete
SWCBWC28170	Catch Basin	Concrete
SWCBWC28172	Catch Basin	Concrete
SWCBWC28173	Catch Basin	Concrete
SWCBWC28174	Catch Basin	Concrete
SWCBWC28175	Catch Basin	Concrete
SWCBWC28177	Catch Basin	Concrete
SWCBWC28178	Catch Basin	Concrete
SWCBWC28190	Catch Basin	Concrete
SWCBWC28191	Catch Basin	Concrete
SWCBWC28192	Catch Basin	Concrete
SWCBWC28194	Catch Basin	Concrete
SWCBWC28195	Catch Basin	Concrete
SWCBWC28196	Catch Basin	Concrete
SWCBWC28197	Catch Basin	Concrete
SWCBWC28198	Catch Basin	Concrete
SWCBWC28199	Catch Basin	Concrete
SWCBWC28200	Catch Basin	Concrete
SWCBWC28201	Catch Basin	Concrete
SWCBWC28203	Catch Basin	Concrete
SWCBWC28204	Catch Basin	Concrete
SWCBWC28205	Catch Basin	Concrete
SWCBWC28206	Catch Basin	Concrete
SWCBWC28207	Catch Basin	Concrete
SWCBWC28210	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWC28211	Catch Basin	Concrete
SWCBWC28213	Catch Basin	Concrete
SWCBWC28214	Catch Basin	Concrete
SWCBWC28216	Catch Basin	Concrete
SWCBWC28224	Catch Basin	Concrete
SWCBWC28225	Catch Basin	Concrete
SWCBWC28226	Catch Basin	Concrete
SWCBWC28227	Catch Basin	Concrete
SWCBWC28228	Catch Basin	Concrete
SWCBWC28231	Catch Basin	Concrete
SWCBWC28232	Catch Basin	Concrete
SWCBWC28233	Catch Basin	Concrete
SWCBWC28234	Catch Basin	Concrete
SWCBWC28242	Catch Basin	Concrete
SWCBWC28243	Catch Basin	Concrete
SWCBWC28246	Catch Basin	Concrete
SWCBWC28247	Catch Basin	Concrete
SWCBWC28248	Catch Basin	Concrete
SWCBWC28249	Catch Basin	Concrete
SWCBWC28250	Catch Basin	Concrete
SWCBWC28251	Catch Basin	Concrete
SWCBWC28258	Catch Basin	Concrete
SWCBWC28259	Catch Basin	Concrete
SWCBWC28262	Catch Basin	Concrete
SWCBWC28263	Catch Basin	Concrete
SWCBWC28265	Catch Basin	Concrete
SWCBWC28266	Catch Basin	Concrete
SWCBWC28267	Catch Basin	Concrete
SWCBWC28268	Catch Basin	Concrete
SWCBWC28269	Catch Basin	Concrete
SWCBWC28270	Catch Basin	Concrete
SWCBWC28271	Catch Basin	Concrete
SWCBWC28278	Catch Basin	Concrete
SWCBWC28279	Catch Basin	Concrete
SWCBWC28281	Catch Basin	Concrete
SWCBWC28282	Catch Basin	Concrete
SWCBWC28283	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC28284	Catch Basin	Concrete
SWCBWC28286	Catch Basin	Concrete
SWCBWC28287	Catch Basin	Concrete
SWCBWC28288	Catch Basin	Concrete
SWCBWC28289	Catch Basin	Concrete
SWCBWC28292	Catch Basin	Concrete
SWCBWC28296	Catch Basin	Concrete
SWCBWC28297	Catch Basin	Concrete
SWCBWC28300	Catch Basin	Concrete
SWCBWC28301	Catch Basin	Concrete
SWCBWC28304	Catch Basin	Concrete
SWCBWC28305	Catch Basin	Concrete
SWCBWC28307	Catch Basin	Concrete
SWCBWC28308	Catch Basin	Concrete
SWCBWC28310	Catch Basin	Concrete
SWCBWC28311	Catch Basin	Concrete
SWCBWC28317	Catch Basin	Concrete
SWCBWC28318	Catch Basin	Concrete
SWCBWC28319	Catch Basin	Concrete
SWCBWC28320	Catch Basin	Concrete
SWCBWC28321	Catch Basin	Concrete
SWCBWC28322	Catch Basin	Concrete
SWCBWC28323	Catch Basin	Concrete
SWCBWC28324	Catch Basin	Concrete
SWCBWC28325	Catch Basin	Concrete
SWCBWC28326	Catch Basin	Concrete
SWCBWC28327	Catch Basin	Concrete
SWCBWC28328	Catch Basin	Concrete
SWCBWC28329	Catch Basin	Concrete
SWCBWC28330	Catch Basin	Concrete
SWCBWC28331	Catch Basin	Concrete
SWCBWC28332	Catch Basin	Concrete
SWCBWC28333	Catch Basin	Concrete
SWCBWC28334	Catch Basin	Concrete
SWCBWC28335	Catch Basin	Concrete
SWCBWC28336	Catch Basin	Concrete
SWCBWC28337	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWC28343	Catch Basin	Concrete
SWCBWC28344	Catch Basin	Concrete
SWCBWC28349	Catch Basin	Concrete
SWCBWC28350	Catch Basin	Concrete
SWCBWC28351	Catch Basin	Concrete
SWCBWC28355	Catch Basin	Concrete
SWCBWC28357	Catch Basin	Brick
SWCBWC28359	Catch Basin	Concrete
SWCBWC28360	Catch Basin	Concrete
SWCBWC28363	Catch Basin	Concrete
SWCBWC28364	Catch Basin	Concrete
SWCBWC28367	Catch Basin	Concrete
SWCBWC28368	Catch Basin	Concrete
SWCBWC28370	Catch Basin	Unknown
SWCBWC28371	Catch Basin	Concrete
SWCBWC28385	Catch Basin	Concrete
SWCBWC28386	Catch Basin	Concrete
SWCBWC28387	Catch Basin	Concrete
SWCBWC28709	Catch Basin	Concrete
SWCBWC28710	Catch Basin	Concrete
SWCBWC28711	Catch Basin	Concrete
SWCBWC28712	Catch Basin	Concrete
SWCBWC28714	Catch Basin	Concrete
SWCBWC28715	Catch Basin	Concrete
SWCBWC28716	Catch Basin	Concrete
SWCBWC28717	Catch Basin	Concrete
SWCBWC28725	Catch Basin	Concrete
SWCBWC28726	Catch Basin	Concrete
SWCBWC28391	Catch Basin	Concrete
SWCBWC28392	Catch Basin	Concrete
SWCBWC28394	Catch Basin	Concrete
SWCBWC28396	Catch Basin	Brick
SWCBWC28398	Catch Basin	Brick
SWCBWC28400	Catch Basin	Concrete
SWCBWC28402	Catch Basin	Concrete
SWCBWC28404	Catch Basin	Concrete
SWCBWC28405	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC28406	Catch Basin	Concrete
SWCBWC28409	Catch Basin	Concrete
SWCBWC28411	Catch Basin	Concrete
SWCBWC28419	Catch Basin	Concrete
SWCBWC28420	Catch Basin	Concrete
SWCBWC28422	Catch Basin	Brick
SWCBWC28424	Catch Basin	Concrete
SWCBWC28425	Catch Basin	Concrete
SWCBWC28427	Catch Basin	Brick
SWCBWC28430	Catch Basin	Concrete
SWCBWC28432	Catch Basin	Concrete
SWCBWC28436	Catch Basin	Brick
SWCBWC28439	Catch Basin	Brick
SWCBWC28440	Catch Basin	Brick
SWCBWC28441	Catch Basin	Concrete
SWCBWC28443	Catch Basin	Concrete
SWCBWC28445	Catch Basin	Concrete
SWCBWC28446	Catch Basin	Brick
SWCBWC28447	Catch Basin	Brick
SWCBWC28449	Catch Basin	Brick
SWCBWC28451	Catch Basin	Concrete
SWCBWC28455	Catch Basin	Concrete
SWCBWC28457	Catch Basin	Concrete
SWCBWC28459	Catch Basin	Brick
SWCBWC28461	Catch Basin	Brick
SWCBWC28465	Catch Basin	Concrete
SWCBWC28467	Catch Basin	Unknown
SWCBWC28468	Catch Basin	Concrete
SWCBWC28470	Catch Basin	Unknown
SWCBWC28474	Catch Basin	Brick
SWCBWC28475	Catch Basin	Brick
SWCBWC28487	Catch Basin	Concrete
SWCBWC28490	Catch Basin	Concrete
SWCBWC28491	Catch Basin	Concrete
SWCBWC28493	Catch Basin	Brick
SWCBWC28495	Catch Basin	Concrete
SWCBWC28496	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWC28501	Catch Basin	Concrete
SWCBWC28502	Catch Basin	Concrete
SWCBWC28510	Catch Basin	Concrete
SWCBWC28511	Catch Basin	Concrete
SWCBWC28512	Catch Basin	Concrete
SWCBWC28513	Catch Basin	Concrete
SWCBWC28515	Catch Basin	Brick
SWCBWC28516	Catch Basin	Brick
SWCBWC28520	Catch Basin	Concrete
SWCBWC28521	Catch Basin	Concrete
SWCBWC28522	Catch Basin	Concrete
SWCBWC28524	Catch Basin	Concrete
SWCBWC28525	Catch Basin	Brick
SWCBWC28526	Catch Basin	Concrete
SWCBWC28527	Catch Basin	Concrete
SWCBWC28528	Catch Basin	Concrete
SWCBWC28529	Catch Basin	Concrete
SWCBWC28531	Catch Basin	Concrete
SWCBWC28532	Catch Basin	Concrete
SWCBWC28538	Catch Basin	Concrete
SWCBWC28539	Catch Basin	Concrete
SWCBWC28540	Catch Basin	Concrete
SWCBWC28541	Catch Basin	Concrete
SWCBWC28542	Catch Basin	Concrete
SWCBWC28543	Catch Basin	Concrete
SWCBWC28544	Catch Basin	Concrete
SWCBWC28545	Catch Basin	Concrete
SWCBWC28546	Catch Basin	Concrete
SWCBWC28547	Catch Basin	Concrete
SWCBWC28548	Catch Basin	Concrete
SWCBWC28549	Catch Basin	Concrete
SWCBWC28551	Catch Basin	Concrete
SWCBWC28552	Catch Basin	Concrete
SWCBWC28553	Catch Basin	Concrete
SWCBWC28554	Catch Basin	Concrete
SWCBWC28555	Catch Basin	Concrete
SWCBWC28556	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC28557	Catch Basin	Concrete
SWCBWC28558	Catch Basin	Concrete
SWCBWC28559	Catch Basin	Concrete
SWCBWC28560	Catch Basin	Concrete
SWCBWC28561	Catch Basin	Concrete
SWCBWC28567	Catch Basin	Concrete
SWCBWC28568	Catch Basin	Concrete
SWCBWC28569	Catch Basin	Concrete
SWCBWC28570	Catch Basin	Concrete
SWCBWC28571	Catch Basin	Concrete
SWCBWC28572	Catch Basin	Concrete
SWCBWC28573	Catch Basin	Concrete
SWCBWC28574	Catch Basin	Concrete
SWCBWC28575	Catch Basin	Concrete
SWCBWC28576	Catch Basin	Concrete
SWCBWC28577	Catch Basin	Concrete
SWCBWC28578	Catch Basin	Concrete
SWCBWC28580	Catch Basin	Concrete
SWCBWC28581	Catch Basin	Concrete
SWCBWC28582	Catch Basin	Concrete
SWCBWC28584	Catch Basin	Concrete
SWCBWC28585	Catch Basin	Concrete
SWCBWC28590	Catch Basin	Concrete
SWCBWC28591	Catch Basin	Concrete
SWCBWC28598	Catch Basin	Concrete
SWCBWC28599	Catch Basin	Concrete
SWCBWC28600	Catch Basin	Concrete
SWCBWC28601	Catch Basin	Concrete
SWCBWC28602	Catch Basin	Concrete
SWCBWC28603	Catch Basin	Concrete
SWCBWC28604	Catch Basin	Concrete
SWCBWC28608	Catch Basin	Concrete
SWCBWC28609	Catch Basin	Concrete
SWCBWC28613	Catch Basin	Concrete
SWCBWC28614	Catch Basin	Concrete
SWCBWC28616	Catch Basin	Brick
SWCBWC28617	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWC28618	Catch Basin	Brick
SWCBWC28619	Catch Basin	Brick
SWCBWC28621	Catch Basin	Brick
SWCBWC28623	Catch Basin	Unknown
SWCBWC28624	Catch Basin	Brick
SWCBWC28626	Catch Basin	Concrete
SWCBWC28627	Catch Basin	Brick
SWCBWC28628	Catch Basin	Concrete
SWCBWC28630	Catch Basin	Concrete
SWCBWC28632	Catch Basin	Brick
SWCBWC28633	Catch Basin	Concrete
SWCBWC28635	Catch Basin	Concrete
SWCBWC28637	Catch Basin	Concrete
SWCBWC28639	Catch Basin	Concrete
SWCBWC28642	Catch Basin	Brick
SWCBWC28644	Catch Basin	Concrete
SWCBWC28645	Catch Basin	Brick
SWCBWC28647	Catch Basin	Concrete
SWCBWC28659	Catch Basin	Brick
SWCBWC28662	Catch Basin	Unknown
SWCBWC28663	Catch Basin	Unknown
SWCBWC28664	Catch Basin	Brick
SWCBWC28668	Catch Basin	Unknown
SWCBWC28669	Catch Basin	Brick
SWCBWC28671	Catch Basin	Brick
SWCBWC28672	Catch Basin	Unknown
SWCBWC28673	Catch Basin	Unknown
SWCBWC28674	Catch Basin	Brick
SWCBWC28676	Catch Basin	Unknown
SWCBWC28677	Catch Basin	Brick
SWCBWC28738	Catch Basin	Concrete
SWCBWC28739	Catch Basin	Concrete
SWCBWC28742	Catch Basin	Concrete
SWCBWC28745	Catch Basin	Concrete
SWCBWC28746	Catch Basin	Concrete
SWCBWC28750	Catch Basin	Concrete
SWCBWC28758	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC28759	Catch Basin	Concrete
SWCBWC28760	Catch Basin	Concrete
SWCBWC28761	Catch Basin	Concrete
SWCBWC28762	Catch Basin	Concrete
SWCBWC28772	Catch Basin	Concrete
SWCBWC28773	Catch Basin	Concrete
SWCBWC28777	Catch Basin	Concrete
SWCBWC28778	Catch Basin	Concrete
SWCBWC28779	Catch Basin	Concrete
SWCBWC28780	Catch Basin	Concrete
SWCBWC28782	Catch Basin	Concrete
SWCBWC28783	Catch Basin	Concrete
SWCBWC28784	Catch Basin	Concrete
SWCBWC28785	Catch Basin	Concrete
SWCBWC28786	Catch Basin	Concrete
SWCBWC28787	Catch Basin	Concrete
SWCBWC28788	Catch Basin	Concrete
SWCBWC28789	Catch Basin	Concrete
SWCBWC28795	Catch Basin	Concrete
SWCBWC28796	Catch Basin	Concrete
SWCBWC28797	Catch Basin	Concrete
SWCBWC28798	Catch Basin	Concrete
SWCBWC28799	Catch Basin	Concrete
SWCBWC28800	Catch Basin	Concrete
SWCBWC28801	Catch Basin	Concrete
SWCBWC28802	Catch Basin	Concrete
SWCBWC28803	Catch Basin	Concrete
SWCBWC28808	Catch Basin	Concrete
SWCBWC28815	Catch Basin	Concrete
SWCBWC28816	Catch Basin	Concrete
SWCBWC28821	Catch Basin	Concrete
SWCBWC28823	Catch Basin	Concrete
SWCBWC28824	Catch Basin	Concrete
SWCBWC28825	Catch Basin	Concrete
SWCBWC28826	Catch Basin	Concrete
SWCBWC28827	Catch Basin	Concrete
SWCBWC28830	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWC28831	Catch Basin	Concrete
SWCBWC28833	Catch Basin	Concrete
SWCBWC28834	Catch Basin	Concrete
SWCBWC28841	Catch Basin	Concrete
SWCBWC28843	Catch Basin	Unknown
SWCBWC28844	Catch Basin	Concrete
SWCBWC28845	Catch Basin	Concrete
SWCBWC28849	Catch Basin	Concrete
SWCBWC28850	Catch Basin	Concrete
SWCBWC28858	Catch Basin	Brick
SWCBWC28859	Catch Basin	Brick
SWCBWC28861	Catch Basin	Brick
SWCBWC28862	Catch Basin	Brick
SWCBWC28870	Catch Basin	Brick
SWCBWC28871	Catch Basin	Brick
SWCBWC28874	Catch Basin	Unknown
SWCBWC28875	Catch Basin	Concrete
SWCBWC28876	Catch Basin	Brick
SWCBWC28877	Catch Basin	Brick
SWCBWC28878	Catch Basin	Unknown
SWCBWC28879	Catch Basin	Unknown
SWCBWC28884	Catch Basin	Brick
SWCBWC28885	Catch Basin	Brick
SWCBWC28886	Catch Basin	Brick
SWCBWC28887	Catch Basin	Brick
SWCBWC28889	Catch Basin	Unknown
SWCBWC28890	Catch Basin	Unknown
SWCBWC28894	Catch Basin	Concrete
SWCBWC28896	Catch Basin	Brick
SWCBWC28898	Catch Basin	Brick
SWCBWC28899	Catch Basin	Brick
SWCBWC28901	Catch Basin	Concrete
SWCBWC28902	Catch Basin	Brick
SWCBWC28903	Catch Basin	Brick
SWCBWC28904	Catch Basin	Brick
SWCBWC28907	Catch Basin	Concrete
SWCBWC28908	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC28909	Catch Basin	Concrete
SWCBWC28910	Catch Basin	Concrete
SWCBWC28911	Catch Basin	Concrete
SWCBWC28914	Catch Basin	Concrete
SWCBWC28915	Catch Basin	Concrete
SWCBWC28916	Catch Basin	Concrete
SWCBWC28918	Catch Basin	Concrete
SWCBWC28919	Catch Basin	Concrete
SWCBWC28920	Catch Basin	Concrete
SWCBWC28921	Catch Basin	Concrete
SWCBWC28924	Catch Basin	Concrete
SWCBWC28928	Catch Basin	Concrete
SWCBWC28934	Catch Basin	Concrete
SWCBWC28935	Catch Basin	Concrete
SWCBWC28939	Catch Basin	Concrete
SWCBWC28940	Catch Basin	Concrete
SWCBWC28944	Catch Basin	Concrete
SWCBWC28945	Catch Basin	Concrete
SWCBWC28948	Catch Basin	Concrete
SWCBWC28949	Catch Basin	Concrete
SWCBWC28958	Catch Basin	Concrete
SWCBWC28959	Catch Basin	Brick
SWCBWC28963	Catch Basin	Brick
SWCBWC28964	Catch Basin	Brick
SWCBWC28967	Catch Basin	Brick
SWCBWC28970	Catch Basin	Concrete
SWCBWC28972	Catch Basin	Concrete
SWCBWC28973	Catch Basin	Concrete
SWCBWC28974	Catch Basin	Concrete
SWCBWC28975	Catch Basin	Concrete
SWCBWC28977	Catch Basin	Concrete
SWCBWC28983	Catch Basin	Concrete
SWCBWC28984	Catch Basin	Concrete
SWCBWC28985	Catch Basin	Concrete
SWCBWC28992	Catch Basin	Brick
SWCBWC28993	Catch Basin	Brick
SWCBWC28995	Catch Basin	Concrete

Structure ID	Type	Material
SWCBWC28999	Catch Basin	Brick
SWCBWC29000	Catch Basin	Brick
SWCBWC29001	Catch Basin	Brick
SWCBWC29003	Catch Basin	Concrete
SWCBWC29004	Catch Basin	Concrete
SWCBWC29005	Catch Basin	Concrete
SWCBWC29006	Catch Basin	Concrete
SWCBWC29009	Catch Basin	Concrete
SWCBWC29010	Catch Basin	Concrete
SWCBWC29011	Catch Basin	Brick
SWCBWC29012	Catch Basin	Concrete
SWCBWC29013	Catch Basin	Concrete
SWCBWC29014	Catch Basin	Concrete
SWCBWC29018	Catch Basin	Concrete
SWCBWC29020	Catch Basin	Concrete
SWCBWC29023	Catch Basin	Concrete
SWCBWC29030	Catch Basin	Brick
SWCBWC29031	Catch Basin	Concrete
SWCBWC29032	Catch Basin	Concrete
SWCBWC29033	Catch Basin	Concrete
SWCBWC29034	Catch Basin	Brick
SWCBWC29035	Catch Basin	Concrete
SWCBWC29036	Catch Basin	Unknown
SWCBWC29037	Catch Basin	Unknown
SWCBWC29038	Catch Basin	Concrete
SWCBWC29039	Catch Basin	Concrete
SWCBWC29043	Catch Basin	Concrete
SWCBWC29044	Catch Basin	Concrete
SWCBWC29046	Catch Basin	Concrete
SWCBWC29047	Catch Basin	Concrete
SWCBWC29049	Catch Basin	Unknown
SWCBWC29051	Catch Basin	Concrete
SWCBWC29058	Catch Basin	Unknown
SWCBWC29059	Catch Basin	Concrete
SWCBWC29062	Catch Basin	Brick
SWCBWC29063	Catch Basin	Brick
SWCBWC29068	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBWC29070	Catch Basin	Brick
SWCBWC29071	Catch Basin	Brick
SWCBWC29072	Catch Basin	Brick
SWCBWC29073	Catch Basin	Brick
SWCBWC29074	Catch Basin	Brick
SWCBWC29076	Catch Basin	Brick
SWCBWC29078	Catch Basin	Brick
SWCBWC29079	Catch Basin	Concrete
SWCBWC29086	Catch Basin	Concrete
SWCBWC29087	Catch Basin	Concrete
SWCBWC29089	Catch Basin	Concrete
SWCBWC29090	Catch Basin	Concrete
SWCBWC29091	Catch Basin	Concrete
SWCBWC29096	Catch Basin	Concrete
SWCBWC29099	Catch Basin	Concrete
SWCBWC29100	Catch Basin	Unknown
SWCBWC29101	Catch Basin	Brick
SWCBWC29102	Catch Basin	Concrete
SWCBWC29104	Catch Basin	Concrete
SWCBWC29105	Catch Basin	Concrete
SWCBWC29106	Catch Basin	Brick
SWCBWC29107	Catch Basin	Concrete
SWCBWC29108	Catch Basin	Brick
SWCBWC29109	Catch Basin	Concrete
SWCBWC29110	Catch Basin	Unknown
SWCBWC29111	Catch Basin	Unknown
SWCBWC29115	Catch Basin	Brick
SWCBWC29118	Catch Basin	Concrete
SWCBWC29119	Catch Basin	Brick
SWCBWC29121	Catch Basin	Brick
SWCBWC29133	Catch Basin	Concrete
SWCBWC29134	Catch Basin	Concrete
SWCBWC29137	Catch Basin	Concrete
SWCBWC29138	Catch Basin	Concrete
SWCBWC29156	Catch Basin	Concrete
SWCBWC29157	Catch Basin	Concrete
SWCBWC29158	Catch Basin	Concrete
SWCBWC29163	Catch Basin	Concrete
SWCBWC29164	Catch Basin	Concrete
SWCBWC29172	Catch Basin	Concrete
SWCBWC29179	Catch Basin	Brick
SWCBWC29180	Catch Basin	Brick
SWCBWC29181	Catch Basin	Concrete
SWCBWC29184	Catch Basin	Concrete
SWCBWC29189	Catch Basin	Brick
SWCBWC29192	Catch Basin	Brick
SWCBWC29197	Catch Basin	Concrete
SWCBWC29200	Catch Basin	Concrete
SWCBWC29201	Catch Basin	Concrete
SWCBWC29203	Catch Basin	Concrete
SWCBWC29204	Catch Basin	Concrete
SWCBWC29206	Catch Basin	Concrete
SWCBWC29207	Catch Basin	Concrete
SWCBWC29209	Catch Basin	Concrete
SWCBWC29210	Catch Basin	Concrete
SWCBWC29211	Catch Basin	Concrete
SWCBWC29213	Catch Basin	Concrete
SWCBWC29216	Catch Basin	Brick
SWCBWC29221	Catch Basin	Concrete
SWCBWC29223	Catch Basin	Concrete
SWCBWC29246	Catch Basin	Brick
SWCBWC29247	Catch Basin	Brick
SWCBWC29248	Catch Basin	Brick
SWCBWC29249	Catch Basin	Concrete
SWCBWC29250	Catch Basin	Brick
SWCBWC29251	Catch Basin	Brick
SWCBWC29255	Catch Basin	Brick
SWCBWC29256	Catch Basin	Concrete
SWCBWC29257	Catch Basin	Concrete
SWCBWC29259	Catch Basin	Concrete
SWCBWC29260	Catch Basin	Concrete
SWCBWC29261	Catch Basin	Concrete
SWCBWC29268	Catch Basin	Concrete
SWCBWC29269	Catch Basin	Brick

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Structure ID	Type	Material
SWCBWC29273	Catch Basin	Concrete
SWCBWC29275	Catch Basin	Concrete
SWCBWC29282	Catch Basin	Concrete
SWCBWC29300	Catch Basin	Concrete
SWCBWC29301	Catch Basin	Concrete
SWCBWC29303	Catch Basin	Concrete
SWCBWC29315	Catch Basin	Concrete
SWCBWC29316	Catch Basin	Concrete
SWCBWC29317	Catch Basin	Concrete
SWCBWC29321	Catch Basin	Concrete
SWCBWC29325	Catch Basin	Concrete
SWCBWC29328	Catch Basin	Concrete
SWCBWC29332	Catch Basin	Concrete
SWCBWC29334	Catch Basin	Concrete
SWCBWC29335	Catch Basin	Concrete
SWCBWC29341	Catch Basin	Concrete
SWCBWC29342	Catch Basin	Concrete
SWCBWC29348	Catch Basin	Concrete
SWCBWC29349	Catch Basin	Concrete
SWCBWC29350	Catch Basin	Concrete
SWCBWC29351	Catch Basin	Concrete
SWCBWC29352	Catch Basin	Concrete
SWCBWC29357	Catch Basin	Concrete
SWCBWC29358	Catch Basin	Concrete
SWCBWC29359	Catch Basin	Concrete
SWCBWC29360	Catch Basin	Concrete
SWCBWC29361	Catch Basin	Concrete
SWCBWC29362	Catch Basin	Concrete
SWCBWC29363	Catch Basin	Concrete
SWCBWC29366	Catch Basin	Concrete
SWCBWC29367	Catch Basin	Concrete
SWCBWC29368	Catch Basin	Concrete
SWCBDC25505	Catch Basin	Concrete
SWCBDC25506	Catch Basin	Concrete
SWCBDC25507	Catch Basin	Concrete
SWCBDC25508	Catch Basin	Concrete
SWCBDC25509	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC25510	Catch Basin	Concrete
SWCBDC25511	Catch Basin	Concrete
SWCBDC25512	Catch Basin	Concrete
SWCBDC25513	Catch Basin	Concrete
SWCBDC25515	Catch Basin	Concrete
SWCBDC25518	Catch Basin	Concrete
SWCBDC25519	Catch Basin	Concrete
SWCBDC25520	Catch Basin	Concrete
SWCBDC25521	Catch Basin	Concrete
SWCBDC25522	Catch Basin	Concrete
SWCBDC25914	Catch Basin	Concrete
SWCBDC25915	Catch Basin	Concrete
SWCBDC25917	Catch Basin	Concrete
SWCBDC25919	Catch Basin	Concrete
SWCBDC25920	Catch Basin	Concrete
SWCBDC25921	Catch Basin	Concrete
SWCBDC25922	Catch Basin	Concrete
SWCBDC25923	Catch Basin	Concrete
SWCBDC25925	Catch Basin	Concrete
SWCBDC25927	Catch Basin	Concrete
SWCBDC25928	Catch Basin	Concrete
SWCBDC25930	Catch Basin	Concrete
SWCBDC25526	Catch Basin	Concrete
SWCBDC25527	Catch Basin	Concrete
SWCBDC25528	Catch Basin	Concrete
SWCBDC25529	Catch Basin	Concrete
SWCBDC25530	Catch Basin	Concrete
SWCBDC25531	Catch Basin	Concrete
SWCBDC25532	Catch Basin	Concrete
SWCBDC25533	Catch Basin	Concrete
SWCBDC25536	Catch Basin	Concrete
SWCBDC25540	Catch Basin	Concrete
SWCBDC25541	Catch Basin	Concrete
SWCBDC25934	Catch Basin	Concrete
SWCBDC25935	Catch Basin	Concrete
SWCBDC25936	Catch Basin	Concrete
SWCBDC25937	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC25939	Catch Basin	Concrete
SWCBDC25942	Catch Basin	Concrete
SWCBDC25943	Catch Basin	Concrete
SWCBDC25944	Catch Basin	Concrete
SWCBDC25945	Catch Basin	Concrete
SWCBDC25947	Catch Basin	Concrete
SWCBDC25948	Catch Basin	Concrete
SWCBDC25949	Catch Basin	Concrete
SWCBDC25951	Catch Basin	Concrete
SWCBDC25952	Catch Basin	Concrete
SWCBDC25953	Catch Basin	Concrete
SWCBDC25957	Catch Basin	Concrete
SWCBDC25958	Catch Basin	Concrete
SWCBDC25960	Catch Basin	Concrete
SWCBDC25963	Catch Basin	Concrete
SWCBDC25966	Catch Basin	Concrete
SWCBDC25968	Catch Basin	Concrete
SWCBDC25970	Catch Basin	Concrete
SWCBDC25971	Catch Basin	Concrete
SWCBDC25972	Catch Basin	Concrete
SWCBDC25973	Catch Basin	Concrete
SWCBDC25984	Catch Basin	Concrete
SWCBDC25985	Catch Basin	Concrete
SWCBDC25994	Catch Basin	Concrete
SWCBDC25995	Catch Basin	Concrete
SWCBDC25997	Catch Basin	Concrete
SWCBDC25998	Catch Basin	Concrete
SWCBDC26000	Catch Basin	Concrete
SWCBDC26001	Catch Basin	Concrete
SWCBDC26004	Catch Basin	Concrete
SWCBDC26011	Catch Basin	Concrete
SWCBDC26012	Catch Basin	Concrete
SWCBDC26013	Catch Basin	Concrete
SWCBDC26014	Catch Basin	Concrete
SWCBDC26015	Catch Basin	Concrete
SWCBDC25544	Catch Basin	Concrete
SWCBDC25548	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC25549	Catch Basin	Concrete
SWCBDC25550	Catch Basin	Concrete
SWCBDC25551	Catch Basin	Concrete
SWCBDC25552	Catch Basin	Concrete
SWCBDC25553	Catch Basin	Concrete
SWCBDC25554	Catch Basin	Concrete
SWCBDC25558	Catch Basin	Concrete
SWCBDC25559	Catch Basin	Concrete
SWCBDC25561	Catch Basin	Concrete
SWCBDC25562	Catch Basin	Concrete
SWCBDC26016	Catch Basin	Concrete
SWCBDC26017	Catch Basin	Concrete
SWCBDC26019	Catch Basin	Concrete
SWCBDC26021	Catch Basin	Concrete
SWCBDC26022	Catch Basin	Concrete
SWCBDC26025	Catch Basin	Concrete
SWCBDC26026	Catch Basin	Concrete
SWCBDC26027	Catch Basin	Concrete
SWCBDC26028	Catch Basin	Concrete
SWCBDC26033	Catch Basin	Concrete
SWCBDC26034	Catch Basin	Concrete
SWCBDC26037	Catch Basin	Concrete
SWCBDC26038	Catch Basin	Concrete
SWCBDC26042	Catch Basin	Concrete
SWCBDC26043	Catch Basin	Concrete
SWCBDC26044	Catch Basin	Concrete
SWCBDC26045	Catch Basin	Concrete
SWCBDC26046	Catch Basin	Concrete
SWCBDC26047	Catch Basin	Concrete
SWCBDC26049	Catch Basin	Concrete
SWCBDC26054	Catch Basin	Concrete
SWCBDC26058	Catch Basin	Concrete
SWCBDC26059	Catch Basin	Concrete
SWCBDC26060	Catch Basin	Concrete
SWCBDC26061	Catch Basin	Concrete
SWCBDC26066	Catch Basin	Concrete
SWCBDC26067	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC26069	Catch Basin	Concrete
SWCBDC26077	Catch Basin	Concrete
SWCBDC26080	Catch Basin	Concrete
SWCBDC26081	Catch Basin	Concrete
SWCBDC26084	Catch Basin	Concrete
SWCBDC26085	Catch Basin	Concrete
SWCBDC26086	Catch Basin	Concrete
SWCBDC26087	Catch Basin	Concrete
SWCBDC26090	Catch Basin	Concrete
SWCBDC26091	Catch Basin	Concrete
SWCBDC26092	Catch Basin	Concrete
SWCBDC26093	Catch Basin	Concrete
SWCBDC26094	Catch Basin	Concrete
SWCBDC26095	Catch Basin	Concrete
SWCBDC26096	Catch Basin	Concrete
SWCBDC26097	Catch Basin	Concrete
SWCBDC26098	Catch Basin	Concrete
SWCBDC26104	Catch Basin	Concrete
SWCBDC26105	Catch Basin	Concrete
SWCBDC26106	Catch Basin	Concrete
SWCBDC26107	Catch Basin	Concrete
SWCBDC26108	Catch Basin	Concrete
SWCBDC26109	Catch Basin	Concrete
SWCBDC26110	Catch Basin	Concrete
SWCBDC26111	Catch Basin	Concrete
SWCBDC26112	Catch Basin	Concrete
SWCBDC26113	Catch Basin	Concrete
SWCBDC26114	Catch Basin	Concrete
SWCBDC26124	Catch Basin	Concrete
SWCBDC26125	Catch Basin	Concrete
SWCBDC26128	Catch Basin	Concrete
SWCBDC26129	Catch Basin	Concrete
SWCBDC26130	Catch Basin	Concrete
SWCBDC26136	Catch Basin	Concrete
SWCBDC26138	Catch Basin	Concrete
SWCBDC26139	Catch Basin	Concrete
SWCBDC26140	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC26141	Catch Basin	Concrete
SWCBDC26142	Catch Basin	Concrete
SWCBDC26144	Catch Basin	Concrete
SWCBDC26145	Catch Basin	Concrete
SWCBDC26147	Catch Basin	Concrete
SWCBDC26148	Catch Basin	Concrete
SWCBDC26152	Catch Basin	Concrete
SWCBDC26153	Catch Basin	Concrete
SWCBDC26154	Catch Basin	Concrete
SWCBDC26155	Catch Basin	Concrete
SWCBDC26157	Catch Basin	Concrete
SWCBDC26159	Catch Basin	Concrete
SWCBDC26160	Catch Basin	Concrete
SWCBDC26161	Catch Basin	Concrete
SWCBDC26162	Catch Basin	Concrete
SWCBDC26163	Catch Basin	Concrete
SWCBDC26164	Catch Basin	Concrete
SWCBDC26167	Catch Basin	Concrete
SWCBDC26168	Catch Basin	Concrete
SWCBDC26170	Catch Basin	Concrete
SWCBDC26171	Catch Basin	Concrete
SWCBDC26172	Catch Basin	Concrete
SWCBDC26173	Catch Basin	Concrete
SWCBDC26174	Catch Basin	Concrete
SWCBDC26175	Catch Basin	Concrete
SWCBDC26177	Catch Basin	Concrete
SWCBDC26178	Catch Basin	Concrete
SWCBDC26179	Catch Basin	Concrete
SWCBDC26180	Catch Basin	Concrete
SWCBDC26184	Catch Basin	Concrete
SWCBDC26185	Catch Basin	Concrete
SWCBDC26191	Catch Basin	Concrete
SWCBDC26192	Catch Basin	Concrete
SWCBDC26195	Catch Basin	Concrete
SWCBDC26196	Catch Basin	Concrete
SWCBDC26198	Catch Basin	Concrete
SWCBDC26199	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBDC26200	Catch Basin	Concrete
SWCBDC26201	Catch Basin	Concrete
SWCBDC26204	Catch Basin	Concrete
SWCBDC26205	Catch Basin	Concrete
SWCBDC26206	Catch Basin	Concrete
SWCBDC26207	Catch Basin	Concrete
SWCBDC26209	Catch Basin	Concrete
SWCBDC26210	Catch Basin	Concrete
SWCBDC26213	Catch Basin	Concrete
SWCBDC26214	Catch Basin	Concrete
SWCBDC26217	Catch Basin	Concrete
SWCBDC26218	Catch Basin	Concrete
SWCBDC26220	Catch Basin	Concrete
SWCBDC26221	Catch Basin	Concrete
SWCBDC26231	Catch Basin	Concrete
SWCBDC26233	Catch Basin	Concrete
SWCBDC26234	Catch Basin	Concrete
SWCBDC26235	Catch Basin	Concrete
SWCBDC26243	Catch Basin	Concrete
SWCBDC26244	Catch Basin	Concrete
SWCBDC26246	Catch Basin	Concrete
SWCBDC26247	Catch Basin	Concrete
SWCBDC26250	Catch Basin	Concrete
SWCBDC26251	Catch Basin	Concrete
SWCBDC26725	Catch Basin	Concrete
SWCBDC26726	Catch Basin	Concrete
SWCBDC26727	Catch Basin	Concrete
SWCBDC26728	Catch Basin	Concrete
SWCBDC26730	Catch Basin	Concrete
SWCBDC26735	Catch Basin	Concrete
SWCBDC26741	Catch Basin	Concrete
SWCBDC26742	Catch Basin	Concrete
SWCBDC26743	Catch Basin	Concrete
SWCBDC26745	Catch Basin	Concrete
SWCBDC26746	Catch Basin	Concrete
SWCBDC26747	Catch Basin	Concrete
SWCBDC26748	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC26749	Catch Basin	Concrete
SWCBDC26754	Catch Basin	Concrete
SWCBDC26755	Catch Basin	Concrete
SWCBDC26762	Catch Basin	Concrete
SWCBDC26763	Catch Basin	Concrete
SWCBDC26779	Catch Basin	Concrete
SWCBDC26780	Catch Basin	Concrete
SWCBDC26784	Catch Basin	Concrete
SWCBDC26785	Catch Basin	Concrete
SWCBDC26787	Catch Basin	Concrete
SWCBDC26789	Catch Basin	Concrete
SWCBDC26790	Catch Basin	Concrete
SWCBDC26792	Catch Basin	Concrete
SWCBDC26795	Catch Basin	Concrete
SWCBDC26796	Catch Basin	Concrete
SWCBDC26798	Catch Basin	Concrete
SWCBDC26799	Catch Basin	Concrete
SWCBDC26800	Catch Basin	Concrete
SWCBDC26801	Catch Basin	Concrete
SWCBDC26804	Catch Basin	Concrete
SWCBDC26805	Catch Basin	Concrete
SWCBDC26806	Catch Basin	Concrete
SWCBDC26810	Catch Basin	Brick
SWCBDC26815	Catch Basin	Brick
SWCBDC26816	Catch Basin	Brick
SWCBDC26822	Catch Basin	Concrete
SWCBDC26823	Catch Basin	Concrete
SWCBDC26825	Catch Basin	Concrete
SWCBDC26826	Catch Basin	Concrete
SWCBDC26827	Catch Basin	Concrete
SWCBDC26828	Catch Basin	Concrete
SWCBDC26830	Catch Basin	Concrete
SWCBDC26831	Catch Basin	Concrete
SWCBDC26832	Catch Basin	Concrete
SWCBDC26876	Catch Basin	Concrete
SWCBDC26878	Catch Basin	Brick
SWCBDC26886	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC26888	Catch Basin	Concrete
SWCBDC26891	Catch Basin	Concrete
SWCBDC26892	Catch Basin	Concrete
SWCBDC26898	Catch Basin	Concrete
SWCBDC26899	Catch Basin	Concrete
SWCBDC25715	Catch Basin	Concrete
SWCBDC25716	Catch Basin	Concrete
SWCBDC25717	Catch Basin	Concrete
SWCBDC25718	Catch Basin	Concrete
SWCBDC25719	Catch Basin	Concrete
SWCBDC25720	Catch Basin	Concrete
SWCBDC25722	Catch Basin	Concrete
SWCBDC25723	Catch Basin	Concrete
SWCBDC25724	Catch Basin	Concrete
SWCBDC25725	Catch Basin	Concrete
SWCBDC25731	Catch Basin	Concrete
SWCBDC25732	Catch Basin	Concrete
SWCBDC25735	Catch Basin	Concrete
SWCBDC25737	Catch Basin	Concrete
SWCBDC25739	Catch Basin	Concrete
SWCBDC25740	Catch Basin	Concrete
SWCBDC25743	Catch Basin	Concrete
SWCBDC25744	Catch Basin	Concrete
SWCBDC25745	Catch Basin	Concrete
SWCBDC25747	Catch Basin	Concrete
SWCBDC25748	Catch Basin	Concrete
SWCBDC25749	Catch Basin	Concrete
SWCBDC25750	Catch Basin	Concrete
SWCBDC25751	Catch Basin	Concrete
SWCBDC25752	Catch Basin	Concrete
SWCBDC25753	Catch Basin	Concrete
SWCBDC25754	Catch Basin	Concrete
SWCBDC25758	Catch Basin	Concrete
SWCBDC25759	Catch Basin	Concrete
SWCBDC25760	Catch Basin	Concrete
SWCBDC25761	Catch Basin	Concrete
SWCBDC25765	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC25766	Catch Basin	Concrete
SWCBDC25770	Catch Basin	Concrete
SWCBDC25771	Catch Basin	Concrete
SWCBDC25773	Catch Basin	Concrete
SWCBDC25777	Catch Basin	Concrete
SWCBDC25779	Catch Basin	Concrete
SWCBDC25780	Catch Basin	Concrete
SWCBDC25781	Catch Basin	Concrete
SWCBDC25782	Catch Basin	Concrete
SWCBDC25784	Catch Basin	Concrete
SWCBDC25785	Catch Basin	Concrete
SWCBDC25787	Catch Basin	Concrete
SWCBDC25788	Catch Basin	Concrete
SWCBDC25789	Catch Basin	Concrete
SWCBDC25790	Catch Basin	Concrete
SWCBDC25794	Catch Basin	Concrete
SWCBDC25795	Catch Basin	Concrete
SWCBDC25796	Catch Basin	Concrete
SWCBDC25797	Catch Basin	Concrete
SWCBDC25798	Catch Basin	Concrete
SWCBDC25799	Catch Basin	Concrete
SWCBDC25800	Catch Basin	Concrete
SWCBDC25803	Catch Basin	Concrete
SWCBDC25804	Catch Basin	Concrete
SWCBDC25805	Catch Basin	Concrete
SWCBDC25807	Catch Basin	Concrete
SWCBDC25808	Catch Basin	Concrete
SWCBDC25811	Catch Basin	Concrete
SWCBDC25813	Catch Basin	Concrete
SWCBDC25814	Catch Basin	Concrete
SWCBDC25818	Catch Basin	Concrete
SWCBDC25819	Catch Basin	Concrete
SWCBDC25820	Catch Basin	Concrete
SWCBDC25821	Catch Basin	Concrete
SWCBDC25822	Catch Basin	Concrete
SWCBDC25825	Catch Basin	Concrete
SWCBDC25826	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC25829	Catch Basin	Concrete
SWCBDC25830	Catch Basin	Concrete
SWCBDC25832	Catch Basin	Concrete
SWCBDC25833	Catch Basin	Concrete
SWCBDC25834	Catch Basin	Concrete
SWCBDC25835	Catch Basin	Concrete
SWCBDC25836	Catch Basin	Concrete
SWCBDC25837	Catch Basin	Concrete
SWCBDC25841	Catch Basin	Concrete
SWCBDC25842	Catch Basin	Concrete
SWCBDC25846	Catch Basin	Concrete
SWCBDC25847	Catch Basin	Concrete
SWCBDC25850	Catch Basin	Concrete
SWCBDC25851	Catch Basin	Concrete
SWCBDC25852	Catch Basin	Concrete
SWCBDC25853	Catch Basin	Concrete
SWCBDC25856	Catch Basin	Concrete
SWCBDC25857	Catch Basin	Concrete
SWCBDC25859	Catch Basin	Concrete
SWCBDC25860	Catch Basin	Concrete
SWCBDC25865	Catch Basin	Concrete
SWCBDC25866	Catch Basin	Concrete
SWCBDC25869	Catch Basin	Concrete
SWCBDC25870	Catch Basin	Concrete
SWCBDC25872	Catch Basin	Concrete
SWCBDC25873	Catch Basin	Concrete
SWCBDC25879	Catch Basin	Concrete
SWCBDC25880	Catch Basin	Concrete
SWCBDC25881	Catch Basin	Concrete
SWCBDC25884	Catch Basin	Concrete
SWCBDC25885	Catch Basin	Concrete
SWCBDC25886	Catch Basin	Concrete
SWCBDC25887	Catch Basin	Brick
SWCBDC25889	Catch Basin	Concrete
SWCBDC25891	Catch Basin	Concrete
SWCBDC25892	Catch Basin	Concrete
SWCBDC25894	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC25895	Catch Basin	Concrete
SWCBDC25898	Catch Basin	Concrete
SWCBDC25899	Catch Basin	Concrete
SWCBDC25901	Catch Basin	Concrete
SWCBDC25904	Catch Basin	Concrete
SWCBDC25906	Catch Basin	Concrete
SWCBDC25907	Catch Basin	Concrete
SWCBDC25910	Catch Basin	Concrete
SWCBDC25912	Catch Basin	Concrete
SWCBDC26256	Catch Basin	Concrete
SWCBDC26257	Catch Basin	Concrete
SWCBDC26258	Catch Basin	Concrete
SWCBDC26260	Catch Basin	Concrete
SWCBDC26261	Catch Basin	Concrete
SWCBDC26262	Catch Basin	Concrete
SWCBDC26263	Catch Basin	Concrete
SWCBDC26266	Catch Basin	Concrete
SWCBDC26268	Catch Basin	Concrete
SWCBDC26269	Catch Basin	Concrete
SWCBDC26270	Catch Basin	Concrete
SWCBDC26271	Catch Basin	Concrete
SWCBDC26272	Catch Basin	Concrete
SWCBDC26273	Catch Basin	Concrete
SWCBDC26274	Catch Basin	Concrete
SWCBDC26279	Catch Basin	Concrete
SWCBDC26280	Catch Basin	Concrete
SWCBDC26281	Catch Basin	Concrete
SWCBDC26282	Catch Basin	Concrete
SWCBDC26284	Catch Basin	Concrete
SWCBDC26285	Catch Basin	Concrete
SWCBDC26287	Catch Basin	Concrete
SWCBDC26288	Catch Basin	Concrete
SWCBDC26294	Catch Basin	Concrete
SWCBDC26295	Catch Basin	Concrete
SWCBDC26296	Catch Basin	Concrete
SWCBDC26297	Catch Basin	Concrete
SWCBDC26299	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC26300	Catch Basin	Concrete
SWCBDC26306	Catch Basin	Concrete
SWCBDC26307	Catch Basin	Concrete
SWCBDC26308	Catch Basin	Concrete
SWCBDC26309	Catch Basin	Concrete
SWCBDC26310	Catch Basin	Concrete
SWCBDC26311	Catch Basin	Concrete
SWCBDC26312	Catch Basin	Concrete
SWCBDC26313	Catch Basin	Concrete
SWCBDC26314	Catch Basin	Concrete
SWCBDC26316	Catch Basin	Concrete
SWCBDC26322	Catch Basin	Concrete
SWCBDC26323	Catch Basin	Concrete
SWCBDC26324	Catch Basin	Concrete
SWCBDC26325	Catch Basin	Concrete
SWCBDC26331	Catch Basin	Concrete
SWCBDC26332	Catch Basin	Concrete
SWCBDC26334	Catch Basin	Concrete
SWCBDC26335	Catch Basin	Concrete
SWCBDC26338	Catch Basin	Concrete
SWCBDC26339	Catch Basin	Concrete
SWCBDC26342	Catch Basin	Concrete
SWCBDC26344	Catch Basin	Concrete
SWCBDC26350	Catch Basin	Concrete
SWCBDC26351	Catch Basin	Concrete
SWCBDC26363	Catch Basin	Brick
SWCBDC26364	Catch Basin	Brick
SWCBDC26367	Catch Basin	Brick
SWCBDC26368	Catch Basin	Brick
SWCBDC26375	Catch Basin	Brick
SWCBDC26376	Catch Basin	Brick
SWCBDC26377	Catch Basin	Brick
SWCBDC26378	Catch Basin	Brick
SWCBDC26380	Catch Basin	Concrete
SWCBDC26381	Catch Basin	Concrete
SWCBDC26386	Catch Basin	Concrete
SWCBDC26387	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC26390	Catch Basin	Concrete
SWCBDC26391	Catch Basin	Concrete
SWCBDC26400	Catch Basin	Concrete
SWCBDC26401	Catch Basin	Concrete
SWCBDC26408	Catch Basin	Concrete
SWCBDC26409	Catch Basin	Concrete
SWCBDC26413	Catch Basin	Concrete
SWCBDC26414	Catch Basin	Concrete
SWCBDC26416	Catch Basin	Concrete
SWCBDC26417	Catch Basin	Concrete
SWCBDC26418	Catch Basin	Concrete
SWCBDC26419	Catch Basin	Concrete
SWCBDC26420	Catch Basin	Concrete
SWCBDC26422	Catch Basin	Concrete
SWCBDC26423	Catch Basin	Concrete
SWCBDC26425	Catch Basin	Concrete
SWCBDC26427	Catch Basin	Concrete
SWCBDC26428	Catch Basin	Concrete
SWCBDC26432	Catch Basin	Concrete
SWCBDC26433	Catch Basin	Concrete
SWCBDC26435	Catch Basin	Concrete
SWCBDC26436	Catch Basin	Concrete
SWCBDC26438	Catch Basin	Concrete
SWCBDC26439	Catch Basin	Concrete
SWCBDC26441	Catch Basin	Concrete
SWCBDC26442	Catch Basin	Concrete
SWCBDC26443	Catch Basin	Concrete
SWCBDC26444	Catch Basin	Concrete
SWCBDC26445	Catch Basin	Concrete
SWCBDC26446	Catch Basin	Concrete
SWCBDC26447	Catch Basin	Concrete
SWCBDC26448	Catch Basin	Concrete
SWCBDC26451	Catch Basin	Concrete
SWCBDC26452	Catch Basin	Concrete
SWCBDC26453	Catch Basin	Concrete
SWCBDC26458	Catch Basin	Concrete
SWCBDC26460	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC26462	Catch Basin	Concrete
SWCBDC26463	Catch Basin	Concrete
SWCBDC26464	Catch Basin	Concrete
SWCBDC26465	Catch Basin	Concrete
SWCBDC26466	Catch Basin	Concrete
SWCBDC26467	Catch Basin	Concrete
SWCBDC26468	Catch Basin	Concrete
SWCBDC26470	Catch Basin	Concrete
SWCBDC26471	Catch Basin	Concrete
SWCBDC26472	Catch Basin	Concrete
SWCBDC26473	Catch Basin	Concrete
SWCBDC26474	Catch Basin	Concrete
SWCBDC26475	Catch Basin	Concrete
SWCBDC26477	Catch Basin	Concrete
SWCBDC26478	Catch Basin	Concrete
SWCBDC26482	Catch Basin	Concrete
SWCBDC26483	Catch Basin	Concrete
SWCBDC26484	Catch Basin	Concrete
SWCBDC26486	Catch Basin	Concrete
SWCBDC26487	Catch Basin	Concrete
SWCBDC26488	Catch Basin	Concrete
SWCBDC26489	Catch Basin	Concrete
SWCBDC26495	Catch Basin	Concrete
SWCBDC26496	Catch Basin	Concrete
SWCBDC26497	Catch Basin	Concrete
SWCBDC26498	Catch Basin	Concrete
SWCBDC26499	Catch Basin	Concrete
SWCBDC26500	Catch Basin	Concrete
SWCBDC26504	Catch Basin	Concrete
SWCBDC26505	Catch Basin	Concrete
SWCBDC26515	Catch Basin	Concrete
SWCBDC26516	Catch Basin	Concrete
SWCBDC26518	Catch Basin	Concrete
SWCBDC26519	Catch Basin	Concrete
SWCBDC26526	Catch Basin	Concrete
SWCBDC26527	Catch Basin	Concrete
SWCBDC26528	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC26529	Catch Basin	Concrete
SWCBDC26530	Catch Basin	Concrete
SWCBDC26531	Catch Basin	Concrete
SWCBDC26532	Catch Basin	Concrete
SWCBDC26533	Catch Basin	Concrete
SWCBDC26534	Catch Basin	Concrete
SWCBDC26535	Catch Basin	Concrete
SWCBDC26537	Catch Basin	Concrete
SWCBDC26538	Catch Basin	Concrete
SWCBDC26539	Catch Basin	Concrete
SWCBDC26540	Catch Basin	Concrete
SWCBDC26542	Catch Basin	Concrete
SWCBDC26543	Catch Basin	Concrete
SWCBDC26544	Catch Basin	Concrete
SWCBDC26545	Catch Basin	Concrete
SWCBDC26547	Catch Basin	Brick
SWCBDC26548	Catch Basin	Concrete
SWCBDC26550	Catch Basin	Concrete
SWCBDC26552	Catch Basin	Concrete
SWCBDC26553	Catch Basin	Concrete
SWCBDC26554	Catch Basin	Concrete
SWCBDC26557	Catch Basin	Concrete
SWCBDC26558	Catch Basin	Concrete
SWCBDC26563	Catch Basin	Concrete
SWCBDC26564	Catch Basin	Concrete
SWCBDC26565	Catch Basin	Concrete
SWCBDC26566	Catch Basin	Concrete
SWCBDC26567	Catch Basin	Concrete
SWCBDC26568	Catch Basin	Concrete
SWCBDC26569	Catch Basin	Concrete
SWCBDC26571	Catch Basin	Concrete
SWCBDC26572	Catch Basin	Concrete
SWCBDC26575	Catch Basin	Concrete
SWCBDC26576	Catch Basin	Concrete
SWCBDC26577	Catch Basin	Concrete
SWCBDC26578	Catch Basin	Concrete
SWCBDC26579	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC26580	Catch Basin	Concrete
SWCBDC26581	Catch Basin	Concrete
SWCBDC26584	Catch Basin	Concrete
SWCBDC26587	Catch Basin	Concrete
SWCBDC26589	Catch Basin	Concrete
SWCBDC26597	Catch Basin	Concrete
SWCBDC26603	Catch Basin	Concrete
SWCBDC26604	Catch Basin	Concrete
SWCBDC26605	Catch Basin	Concrete
SWCBDC26606	Catch Basin	Concrete
SWCBDC26607	Catch Basin	Concrete
SWCBDC26614	Catch Basin	Concrete
SWCBDC26615	Catch Basin	Concrete
SWCBDC26616	Catch Basin	Concrete
SWCBDC26617	Catch Basin	Concrete
SWCBDC26618	Catch Basin	Concrete
SWCBDC26619	Catch Basin	Concrete
SWCBDC26624	Catch Basin	Concrete
SWCBDC26625	Catch Basin	Concrete
SWCBDC26626	Catch Basin	Concrete
SWCBDC26627	Catch Basin	Concrete
SWCBDC26628	Catch Basin	Concrete
SWCBDC26631	Catch Basin	Concrete
SWCBDC26632	Catch Basin	Concrete
SWCBDC26633	Catch Basin	Concrete
SWCBDC26634	Catch Basin	Concrete
SWCBDC26635	Catch Basin	Concrete
SWCBDC26636	Catch Basin	Concrete
SWCBDC26639	Catch Basin	Concrete
SWCBDC26640	Catch Basin	Concrete
SWCBDC26648	Catch Basin	Concrete
SWCBDC26649	Catch Basin	Concrete
SWCBDC26650	Catch Basin	Concrete
SWCBDC26652	Catch Basin	Concrete
SWCBDC26653	Catch Basin	Concrete
SWCBDC26655	Catch Basin	Concrete
SWCBDC26656	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC26659	Catch Basin	Concrete
SWCBDC26661	Catch Basin	Concrete
SWCBDC26662	Catch Basin	Concrete
SWCBDC26663	Catch Basin	Concrete
SWCBDC26664	Catch Basin	Concrete
SWCBDC26665	Catch Basin	Concrete
SWCBDC26669	Catch Basin	Concrete
SWCBDC26672	Catch Basin	Concrete
SWCBDC26673	Catch Basin	Concrete
SWCBDC26674	Catch Basin	Concrete
SWCBDC26676	Catch Basin	Concrete
SWCBDC26677	Catch Basin	Concrete
SWCBDC26679	Catch Basin	Concrete
SWCBDC26681	Catch Basin	Concrete
SWCBDC26683	Catch Basin	Concrete
SWCBDC25563	Catch Basin	Concrete
SWCBDC25564	Catch Basin	Concrete
SWCBDC25565	Catch Basin	Concrete
SWCBDC25566	Catch Basin	Concrete
SWCBDC25567	Catch Basin	Concrete
SWCBDC25504	Catch Basin	Concrete
SWCBDC25569	Catch Basin	Concrete
SWCBDC25571	Catch Basin	Concrete
SWCBDC25574	Catch Basin	Concrete
SWCBDC25575	Catch Basin	Concrete
SWCBDC25580	Catch Basin	Concrete
SWCBDC25581	Catch Basin	Concrete
SWCBDC25583	Catch Basin	Concrete
SWCBDC25584	Catch Basin	Concrete
SWCBDC25585	Catch Basin	Concrete
SWCBDC25586	Catch Basin	Concrete
SWCBDC25587	Catch Basin	Concrete
SWCBDC25588	Catch Basin	Concrete
SWCBDC25592	Catch Basin	Concrete
SWCBDC25593	Catch Basin	Concrete
SWCBDC25594	Catch Basin	Concrete
SWCBDC25595	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC25598	Catch Basin	Concrete
SWCBDC25599	Catch Basin	Concrete
SWCBDC25600	Catch Basin	Concrete
SWCBDC25604	Catch Basin	Concrete
SWCBDC25605	Catch Basin	Concrete
SWCBDC25606	Catch Basin	Concrete
SWCBDC25607	Catch Basin	Concrete
SWCBDC25608	Catch Basin	Concrete
SWCBDC25612	Catch Basin	Concrete
SWCBDC25613	Catch Basin	Concrete
SWCBDC25614	Catch Basin	Concrete
SWCBDC25615	Catch Basin	Concrete
SWCBDC25616	Catch Basin	Concrete
SWCBDC25618	Catch Basin	Concrete
SWCBDC25619	Catch Basin	Concrete
SWCBDC25621	Catch Basin	Concrete
SWCBDC25622	Catch Basin	Concrete
SWCBDC25623	Catch Basin	Concrete
SWCBDC25624	Catch Basin	Concrete
SWCBDC25625	Catch Basin	Concrete
SWCBDC25626	Catch Basin	Concrete
SWCBDC25627	Catch Basin	Concrete
SWCBDC25628	Catch Basin	Concrete
SWCBDC25630	Catch Basin	Concrete
SWCBDC25631	Catch Basin	Concrete
SWCBDC25632	Catch Basin	Concrete
SWCBDC25633	Catch Basin	Concrete
SWCBDC25634	Catch Basin	Concrete
SWCBDC25635	Catch Basin	Concrete
SWCBDC25643	Catch Basin	Concrete
SWCBDC25644	Catch Basin	Concrete
SWCBDC25647	Catch Basin	Concrete
SWCBDC25648	Catch Basin	Concrete
SWCBDC25649	Catch Basin	Concrete
SWCBDC25654	Catch Basin	Concrete
SWCBDC25655	Catch Basin	Concrete
SWCBDC25656	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC25659	Catch Basin	Concrete
SWCBDC25660	Catch Basin	Concrete
SWCBDC25661	Catch Basin	Concrete
SWCBDC25662	Catch Basin	Concrete
SWCBDC25663	Catch Basin	Concrete
SWCBDC25664	Catch Basin	Concrete
SWCBDC25667	Catch Basin	Concrete
SWCBDC25668	Catch Basin	Concrete
SWCBDC25669	Catch Basin	Concrete
SWCBDC25673	Catch Basin	Concrete
SWCBDC25674	Catch Basin	Concrete
SWCBDC25675	Catch Basin	Concrete
SWCBDC25676	Catch Basin	Concrete
SWCBDC25677	Catch Basin	Concrete
SWCBDC25679	Catch Basin	Concrete
SWCBDC25680	Catch Basin	Concrete
SWCBDC25681	Catch Basin	Concrete
SWCBDC25684	Catch Basin	Concrete
SWCBDC25686	Catch Basin	Concrete
SWCBDC25687	Catch Basin	Concrete
SWCBDC25688	Catch Basin	Concrete
SWCBDC25689	Catch Basin	Concrete
SWCBDC25690	Catch Basin	Concrete
SWCBDC25691	Catch Basin	Concrete
SWCBDC25692	Catch Basin	Concrete
SWCBDC25698	Catch Basin	Concrete
SWCBDC25699	Catch Basin	Concrete
SWCBDC25703	Catch Basin	Concrete
SWCBDC25704	Catch Basin	Concrete
SWCBDC25705	Catch Basin	Concrete
SWCBDC25706	Catch Basin	Concrete
SWCBDC25707	Catch Basin	Concrete
SWCBDC25708	Catch Basin	Concrete
SWCBDC25709	Catch Basin	Concrete
SWCBDC25710	Catch Basin	Concrete
SWCBDC25712	Catch Basin	Concrete
SWCBDC25713	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC26698	Catch Basin	Concrete
SWCBDC26699	Catch Basin	Concrete
SWCBDC26701	Catch Basin	Concrete
SWCBDC26702	Catch Basin	Concrete
SWCBDC26705	Catch Basin	Concrete
SWCBDC26706	Catch Basin	Concrete
SWCBDC26707	Catch Basin	Concrete
SWCBDC26709	Catch Basin	Concrete
SWCBDC26711	Catch Basin	Concrete
SWCBDC26714	Catch Basin	Concrete
SWCBDC26715	Catch Basin	Concrete
SWCBDC26901	Catch Basin	Concrete
SWCBDC26902	Catch Basin	Concrete
SWCBDC26903	Catch Basin	Concrete
SWCBDC26905	Catch Basin	Concrete
SWCBDC26906	Catch Basin	Concrete
SWCBDC26907	Catch Basin	Concrete
SWCBDC26908	Catch Basin	Concrete
SWCBDC26909	Catch Basin	Concrete
SWCBDC26910	Catch Basin	Concrete
SWCBDC26912	Catch Basin	Concrete
SWCBDC26918	Catch Basin	Concrete
SWCBDC26919	Catch Basin	Concrete
SWCBDC26921	Catch Basin	Concrete
SWCBDC26922	Catch Basin	Concrete
SWCBDC26924	Catch Basin	Concrete
SWCBDC26925	Catch Basin	Concrete
SWCBDC26933	Catch Basin	Brick
SWCBDC26949	Catch Basin	Concrete
SWCBDC26951	Catch Basin	Concrete
SWCBDC26952	Catch Basin	Concrete
SWCBDC26953	Catch Basin	Concrete
SWCBDC26956	Catch Basin	Concrete
SWCBDC27000	Catch Basin	Concrete
SWCBDC27001	Catch Basin	Concrete
SWCBDC27003	Catch Basin	Concrete
SWCBDC27004	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC27012	Catch Basin	Concrete
SWCBDC27013	Catch Basin	Concrete
SWCBDC27014	Catch Basin	Concrete
SWCBDC27015	Catch Basin	Concrete
SWCBDC27016	Catch Basin	Concrete
SWCBDC27017	Catch Basin	Concrete
SWCBDC27018	Catch Basin	Concrete
SWCBDC27019	Catch Basin	Concrete
SWCBDC27024	Catch Basin	Concrete
SWCBDC27025	Catch Basin	Concrete
SWCBDC27026	Catch Basin	Concrete
SWCBDC27028	Catch Basin	Concrete
SWCBDC27038	Catch Basin	Concrete
SWCBDC27040	Catch Basin	Concrete
SWCBDC27041	Catch Basin	Concrete
SWCBDC27042	Catch Basin	Concrete
SWCBDC27045	Catch Basin	Concrete
SWCBDC27046	Catch Basin	Concrete
SWCBDC27047	Catch Basin	Concrete
SWCBDC27049	Catch Basin	Concrete
SWCBDC27050	Catch Basin	Concrete
SWCBDC27051	Catch Basin	Concrete
CCDC9645CB	Catch Basin	Brick
CCDC9646CB	Catch Basin	Brick
SWCBDC27101	Catch Basin	Concrete
SWCBDC27102	Catch Basin	Concrete
SWCBDC27103	Catch Basin	Concrete
SWCBDC27105	Catch Basin	Concrete
SWCBDC27106	Catch Basin	Concrete
SWCBDC27109	Catch Basin	Concrete
SWCBDC27111	Catch Basin	Concrete
SWCBDC27112	Catch Basin	Concrete
SWCBDC27119	Catch Basin	Concrete
SWCBDC27121	Catch Basin	Concrete
SWCBDC27123	Catch Basin	Concrete
SWCBDC27124	Catch Basin	Concrete
SWCBDC27127	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC27128	Catch Basin	Concrete
SWCBDC27129	Catch Basin	Concrete
SWCBDC27132	Catch Basin	Concrete
SWCBDC27133	Catch Basin	Concrete
SWCBDC27140	Catch Basin	Concrete
SWCBDC27141	Catch Basin	Concrete
SWCBDC27144	Catch Basin	Concrete
SWCBDC27145	Catch Basin	Concrete
SWCBDC27146	Catch Basin	Concrete
SWCBDC27147	Catch Basin	Concrete
SWCBDC27148	Catch Basin	Concrete
SWCBDC27149	Catch Basin	Concrete
SWCBDC27150	Catch Basin	Concrete
SWCBDC27152	Catch Basin	Concrete
SWCBDC27154	Catch Basin	Concrete
SWCBDC27155	Catch Basin	Concrete
SWCBDC27156	Catch Basin	Concrete
SWCBDC27158	Catch Basin	Concrete
SWCBDC27161	Catch Basin	Concrete
SWCBDC27162	Catch Basin	Concrete
SWCBDC27163	Catch Basin	Concrete
SWCBDC27169	Catch Basin	Unknown
SWCBDC27175	Catch Basin	Concrete
SWCBDC27178	Catch Basin	Concrete
SWCBDC27179	Catch Basin	Concrete
SWCBDC27187	Catch Basin	Concrete
SWCBDC27189	Catch Basin	Concrete
SWCBDC27190	Catch Basin	Concrete
SWCBDC27191	Catch Basin	Concrete
SWCBDC27195	Catch Basin	Concrete
SWCBDC27201	Catch Basin	Concrete
SWCBDC27204	Catch Basin	Concrete
SWCBDC27238	Catch Basin	Brick
SWCBDC27239	Catch Basin	Brick
SWCBDC27241	Catch Basin	Concrete
SWCBDC27242	Catch Basin	Concrete
SWCBDC22335	Catch Basin	Concrete

Structure ID	Type	Material
SWCBDC22336	Catch Basin	Concrete
SWCBDC22349	Catch Basin	Concrete
SWCBDC21861	Catch Basin	Concrete
SWCBDC21862	Catch Basin	Concrete
SWCBDC23101	Catch Basin	Concrete
SWCBDC23102	Catch Basin	Concrete
SWCBDC23104	Catch Basin	Concrete
SWCBDC23110	Catch Basin	Concrete
SWCBDC22838	Catch Basin	Concrete
SWCBDC22839	Catch Basin	Concrete
SWCBDC22840	Catch Basin	Concrete
SWCBDC22841	Catch Basin	Concrete
SWCBDC21864	Catch Basin	Concrete
SWCBDC21865	Catch Basin	Concrete
SWCBDC21867	Catch Basin	Concrete
SWCBDC21868	Catch Basin	Concrete
SWCBDC21869	Catch Basin	Concrete
SWCBDC21873	Catch Basin	Concrete
SWCBDC21874	Catch Basin	Concrete
SWCBDC21876	Catch Basin	Concrete
SWCBDC21877	Catch Basin	Concrete
SWCBDC21878	Catch Basin	Concrete
SWCBDC21880	Catch Basin	Concrete
SWCBDC21882	Catch Basin	Concrete
SWCBDC21883	Catch Basin	Concrete
SWCBDC21884	Catch Basin	Concrete
SWCBDC21885	Catch Basin	Concrete
SWCBDC21886	Catch Basin	Concrete
SWCBDC21887	Catch Basin	Concrete
SWCBDC21888	Catch Basin	Concrete
SWCBDC21890	Catch Basin	Concrete
SWCBDC21891	Catch Basin	Concrete
SWCBDC21892	Catch Basin	Concrete
SWCBDC21896	Catch Basin	Concrete
SWCBDC21897	Catch Basin	Concrete
SWCBDC21898	Catch Basin	Concrete
SWCBDC21899	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBDC21902	Catch Basin	Concrete
SWCBDC30595	Catch Basin	Brick
SWCBDC30565	Catch Basin	Brick
SWCBDC30566	Catch Basin	Brick
SWCBDC30568	Catch Basin	Unknown
SWCBDC30571	Catch Basin	Brick
SWCBDC30587	Catch Basin	Unknown
SWCBDC30589	Catch Basin	Brick
SWCBDC30590	Catch Basin	Brick
SWCBCC30119	Catch Basin	Brick
SWCBCC30121	Catch Basin	Brick
SWCBCC30123	Catch Basin	Concrete
SWCBCC30125	Catch Basin	Concrete
SWCBCC30126	Catch Basin	Concrete
SWCBCC30128	Catch Basin	Concrete
SWCBCC30129	Catch Basin	Concrete
SWCBCC30130	Catch Basin	Concrete
SWCBCC30131	Catch Basin	Concrete
SWCBCC30132	Catch Basin	Concrete
SWCBCC30133	Catch Basin	Concrete
SWCBCC30099	Catch Basin	Concrete
SWCBCC30100	Catch Basin	Concrete
SWCBCC30101	Catch Basin	Concrete
SWCBCC30102	Catch Basin	Concrete
SWCBCC30103	Catch Basin	Concrete
SWCBCC30104	Catch Basin	Concrete
SWCBCC30105	Catch Basin	Concrete
SWCBCC30106	Catch Basin	Concrete
SWCBCC30107	Catch Basin	Concrete
SWCBCC30108	Catch Basin	Concrete
SWCBCC30109	Catch Basin	Concrete
SWCBCC30110	Catch Basin	Concrete
SWCBCC30114	Catch Basin	Concrete
SWCBCC30135	Catch Basin	Concrete
SWCBCC30136	Catch Basin	Concrete
SWCBCC30137	Catch Basin	Concrete
SWCBCC30138	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC30140	Catch Basin	Concrete
SWCBCC30141	Catch Basin	Concrete
SWCBCC30146	Catch Basin	Concrete
SWCBCC30147	Catch Basin	Concrete
SWCBCC30150	Catch Basin	Concrete
SWCBCC30151	Catch Basin	Concrete
SWCBCC30154	Catch Basin	Concrete
SWCBCC30156	Catch Basin	Concrete
SWCBCC30158	Catch Basin	Concrete
SWCBCC30001	Catch Basin	Concrete
SWCBCC30002	Catch Basin	Concrete
SWCBCC30003	Catch Basin	Concrete
SWCBCC30004	Catch Basin	Concrete
SWCBCC30009	Catch Basin	Concrete
SWCBCC30012	Catch Basin	Concrete
SWCBCC30017	Catch Basin	Concrete
SWCBCC30018	Catch Basin	Concrete
SWCBCC30019	Catch Basin	Concrete
SWCBCC30021	Catch Basin	Concrete
SWCBCC30022	Catch Basin	Concrete
SWCBCC30024	Catch Basin	Concrete
SWCBCC30025	Catch Basin	Concrete
SWCBCC30028	Catch Basin	Concrete
SWCBCC30029	Catch Basin	Concrete
SWCBCC30034	Catch Basin	Concrete
SWCBCC30035	Catch Basin	Concrete
SWCBCC30037	Catch Basin	Concrete
SWCBCC30041	Catch Basin	Concrete
SWCBCC30042	Catch Basin	Concrete
SWCBCC30043	Catch Basin	Concrete
SWCBCC30044	Catch Basin	Concrete
SWCBCC30045	Catch Basin	Concrete
SWCBCC30047	Catch Basin	Concrete
SWCBCC30052	Catch Basin	Concrete
SWCBCC30053	Catch Basin	Concrete
SWCBCC30054	Catch Basin	Concrete
SWCBCC30056	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC30057	Catch Basin	Concrete
SWCBCC30058	Catch Basin	Concrete
SWCBCC30059	Catch Basin	Concrete
SWCBCC30060	Catch Basin	Concrete
SWCBCC30061	Catch Basin	Concrete
SWCBCC30062	Catch Basin	Concrete
SWCBCC30063	Catch Basin	Concrete
SWCBCC30064	Catch Basin	Concrete
SWCBCC30065	Catch Basin	Concrete
SWCBCC30066	Catch Basin	Concrete
SWCBCC30068	Catch Basin	Concrete
SWCBCC30069	Catch Basin	Concrete
SWCBCC30072	Catch Basin	Concrete
SWCBCC30073	Catch Basin	Concrete
SWCBCC30081	Catch Basin	Concrete
SWCBCC30082	Catch Basin	Concrete
SWCBCC30083	Catch Basin	Concrete
SWCBCC30088	Catch Basin	Concrete
SWCBCC30089	Catch Basin	Concrete
SWCBCC30090	Catch Basin	Concrete
SWCBCC30091	Catch Basin	Concrete
SWCBCC30093	Catch Basin	Concrete
SWCBCC30094	Catch Basin	Concrete
SWCBCC30095	Catch Basin	Concrete
SWCBCC30096	Catch Basin	Concrete
SWCBCC30098	Catch Basin	Concrete
SWCBCC30139	Catch Basin	Concrete
SWCBCC30159	Catch Basin	Concrete
SWCBCC30161	Catch Basin	Concrete
SWCBCC30162	Catch Basin	Concrete
SWCBCC30164	Catch Basin	Concrete
SWCBCC30166	Catch Basin	Concrete
SWCBCC30167	Catch Basin	Concrete
SWCBCC30168	Catch Basin	Concrete
SWCBCC30169	Catch Basin	Concrete
SWCBCC30170	Catch Basin	Concrete
SWCBCC30178	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC30179	Catch Basin	Concrete
SWCBCC30180	Catch Basin	Concrete
SWCBCC30181	Catch Basin	Concrete
SWCBCC30182	Catch Basin	Concrete
SWCBCC30183	Catch Basin	Concrete
SWCBCC30184	Catch Basin	Concrete
SWCBCC30185	Catch Basin	Concrete
SWCBCC30190	Catch Basin	Concrete
SWCBCC30191	Catch Basin	Brick
SWCBCC30192	Catch Basin	Concrete
SWCBCC30193	Catch Basin	Concrete
SWCBCC30196	Catch Basin	Concrete
SWCBCC30197	Catch Basin	Concrete
SWCBCC30198	Catch Basin	Concrete
SWCBCC30199	Catch Basin	Concrete
SWCBCC30200	Catch Basin	Concrete
SWCBCC30201	Catch Basin	Concrete
SWCBCC30202	Catch Basin	Concrete
SWCBCC30203	Catch Basin	Concrete
SWCBCC30204	Catch Basin	Concrete
SWCBCC30205	Catch Basin	Concrete
SWCBCC30206	Catch Basin	Concrete
SWCBCC30208	Catch Basin	Brick
SWCBCC30209	Catch Basin	Concrete
SWCBCC30210	Catch Basin	Concrete
SWCBCC30211	Catch Basin	Concrete
SWCBCC30213	Catch Basin	Concrete
SWCBCC30214	Catch Basin	Concrete
SWCBCC30219	Catch Basin	Concrete
SWCBCC30220	Catch Basin	Concrete
SWCBCC30221	Catch Basin	Brick
SWCBCC30222	Catch Basin	Concrete
SWCBCC30225	Catch Basin	Concrete
SWCBCC30226	Catch Basin	Concrete
SWCBCC30227	Catch Basin	Concrete
SWCBCC30228	Catch Basin	Concrete
SWCBCC30229	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC30230	Catch Basin	Concrete
SWCBCC30233	Catch Basin	Concrete
SWCBCC30234	Catch Basin	Concrete
SWCBCC30237	Catch Basin	Concrete
SWCBCC30238	Catch Basin	Concrete
SWCBCC30240	Catch Basin	Concrete
SWCBCC30241	Catch Basin	Concrete
SWCBCC30250	Catch Basin	Concrete
SWCBCC30251	Catch Basin	Concrete
SWCBCC30252	Catch Basin	Concrete
SWCBCC30253	Catch Basin	Concrete
SWCBCC30254	Catch Basin	Concrete
SWCBCC30255	Catch Basin	Concrete
SWCBCC30257	Catch Basin	Concrete
SWCBCC30258	Catch Basin	Concrete
SWCBCC30259	Catch Basin	Concrete
SWCBCC30260	Catch Basin	Concrete
SWCBCC30261	Catch Basin	Concrete
SWCBCC30262	Catch Basin	Concrete
SWCBCC30263	Catch Basin	Concrete
SWCBCC30265	Catch Basin	Concrete
SWCBCC30266	Catch Basin	Concrete
SWCBCC30267	Catch Basin	Concrete
SWCBCC30268	Catch Basin	Concrete
SWCBCC30269	Catch Basin	Concrete
SWCBCC30270	Catch Basin	Concrete
SWCBCC30271	Catch Basin	Concrete
SWCBCC30272	Catch Basin	Concrete
SWCBCC30273	Catch Basin	Concrete
SWCBCC30274	Catch Basin	Concrete
SWCBCC30276	Catch Basin	Concrete
SWCBCC30277	Catch Basin	Concrete
SWCBCC30278	Catch Basin	Concrete
SWCBCC30280	Catch Basin	Concrete
SWCBCC30281	Catch Basin	Concrete
SWCBCC30282	Catch Basin	Concrete
SWCBCC30283	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC30284	Catch Basin	Concrete
SWCBCC30285	Catch Basin	Concrete
SWCBCC30286	Catch Basin	Concrete
SWCBCC30288	Catch Basin	Concrete
SWCBCC30289	Catch Basin	Concrete
SWCBCC30290	Catch Basin	Concrete
SWCBCC30291	Catch Basin	Concrete
SWCBCC30297	Catch Basin	Concrete
SWCBCC30298	Catch Basin	Concrete
SWCBCC30299	Catch Basin	Concrete
SWCBCC30300	Catch Basin	Concrete
SWCBCC30301	Catch Basin	Concrete
SWCBCC30302	Catch Basin	Concrete
SWCBCC30303	Catch Basin	Concrete
SWCBCC30305	Catch Basin	Concrete
SWCBCC30307	Catch Basin	Concrete
SWCBCC30311	Catch Basin	Concrete
SWCBCC30312	Catch Basin	Concrete
SWCBCC30313	Catch Basin	Concrete
SWCBCC30314	Catch Basin	Concrete
SWCBCC30315	Catch Basin	Concrete
SWCBCC30316	Catch Basin	Concrete
SWCBCC30317	Catch Basin	Concrete
SWCBCC30318	Catch Basin	Concrete
SWCBCC30321	Catch Basin	Concrete
SWCBCC30325	Catch Basin	Concrete
SWCBCC30326	Catch Basin	Concrete
SWCBCC30329	Catch Basin	Concrete
SWCBCC30330	Catch Basin	Concrete
SWCBCC30336	Catch Basin	Concrete
SWCBCC30337	Catch Basin	Concrete
SWCBCC30338	Catch Basin	Concrete
SWCBCC30339	Catch Basin	Concrete
SWCBCC30340	Catch Basin	Concrete
SWCBCC30342	Catch Basin	Concrete
SWCBCC30343	Catch Basin	Concrete
SWCBCC30348	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC30349	Catch Basin	Concrete
SWCBCC30350	Catch Basin	Concrete
SWCBCC30351	Catch Basin	Concrete
SWCBCC30354	Catch Basin	Concrete
SWCBCC30357	Catch Basin	Concrete
SWCBCC30359	Catch Basin	Concrete
SWCBCC30361	Catch Basin	Concrete
SWCBCC30365	Catch Basin	Concrete
SWCBCC30366	Catch Basin	Concrete
SWCBCC30367	Catch Basin	Concrete
SWCBCC30369	Catch Basin	Concrete
SWCBCC30370	Catch Basin	Concrete
SWCBCC30371	Catch Basin	Concrete
SWCBCC30378	Catch Basin	Concrete
SWCBCC30379	Catch Basin	Concrete
SWCBCC30382	Catch Basin	Concrete
SWCBCC30383	Catch Basin	Concrete
SWCBCC30386	Catch Basin	Concrete
SWCBCC30388	Catch Basin	Concrete
SWCBCC30389	Catch Basin	Concrete
SWCBCC30390	Catch Basin	Concrete
SWCBCC30397	Catch Basin	Concrete
SWCBCC30398	Catch Basin	Concrete
SWCBCC30399	Catch Basin	Concrete
SWCBCC30400	Catch Basin	Concrete
SWCBCC30401	Catch Basin	Concrete
SWCBCC30402	Catch Basin	Concrete
SWCBCC30403	Catch Basin	Concrete
SWCBCC30405	Catch Basin	Concrete
SWCBCC30406	Catch Basin	Concrete
SWCBCC30411	Catch Basin	Concrete
SWCBCC30412	Catch Basin	Concrete
SWCBCC30414	Catch Basin	Concrete
SWCBCC30415	Catch Basin	Concrete
SWCBCC30416	Catch Basin	Concrete
SWCBCC30417	Catch Basin	Concrete
SWCBCC30418	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC30419	Catch Basin	Concrete
SWCBCC30420	Catch Basin	Concrete
SWCBCC30422	Catch Basin	Concrete
SWCBCC30423	Catch Basin	Concrete
SWCBCC30424	Catch Basin	Concrete
SWCBCC30425	Catch Basin	Concrete
SWCBCC30426	Catch Basin	Concrete
SWCBCC30427	Catch Basin	Concrete
SWCBCC30432	Catch Basin	Concrete
SWCBCC30433	Catch Basin	Concrete
SWCBCC30434	Catch Basin	Concrete
SWCBCC30435	Catch Basin	Concrete
SWCBCC30436	Catch Basin	Concrete
SWCBCC30437	Catch Basin	Concrete
SWCBCC30438	Catch Basin	Concrete
SWCBCC30439	Catch Basin	Concrete
SWCBCC30440	Catch Basin	Concrete
SWCBCC30443	Catch Basin	Concrete
SWCBCC30444	Catch Basin	Concrete
SWCBCC30445	Catch Basin	Concrete
SWCBCC30446	Catch Basin	Concrete
SWCBCC30447	Catch Basin	Concrete
SWCBCC30452	Catch Basin	Concrete
SWCBCC30454	Catch Basin	Concrete
SWCBCC30455	Catch Basin	Concrete
SWCBCC30456	Catch Basin	Concrete
SWCBCC30460	Catch Basin	Concrete
SWCBCC30462	Catch Basin	Concrete
SWCBCC30463	Catch Basin	Concrete
SWCBCC30464	Catch Basin	Concrete
SWCBCC30466	Catch Basin	Concrete
SWCBCC30467	Catch Basin	Concrete
SWCBCC30469	Catch Basin	Concrete
SWCBCC30470	Catch Basin	Concrete
SWCBCC30471	Catch Basin	Concrete
SWCBCC30475	Catch Basin	Concrete
SWCBCC30476	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC30477	Catch Basin	Concrete
SWCBCC30479	Catch Basin	Concrete
SWCBCC30485	Catch Basin	Concrete
SWCBCC30486	Catch Basin	Concrete
SWCBCC30491	Catch Basin	Concrete
SWCBCC30492	Catch Basin	Concrete
SWCBCC30499	Catch Basin	Concrete
SWCBCC30501	Catch Basin	Concrete
SWCBCC30503	Catch Basin	Concrete
SWCBCC30504	Catch Basin	Concrete
SWCBCC30505	Catch Basin	Concrete
SWCBCC30506	Catch Basin	Concrete
SWCBCC30507	Catch Basin	Concrete
SWCBCC30508	Catch Basin	Concrete
SWCBCC30509	Catch Basin	Concrete
SWCBCC30510	Catch Basin	Brick
SWCBCC30511	Catch Basin	Brick
SWCBCC30512	Catch Basin	Concrete
SWCBCC30513	Catch Basin	Concrete
SWCBCC30514	Catch Basin	Concrete
SWCBCC30517	Catch Basin	Concrete
SWCBCC30518	Catch Basin	Concrete
SWCBCC30519	Catch Basin	Concrete
SWCBCC30520	Catch Basin	Concrete
SWCBCC30521	Catch Basin	Concrete
SWCBCC30522	Catch Basin	Concrete
SWCBCC30524	Catch Basin	Concrete
SWCBCC30525	Catch Basin	Concrete
SWCBCC30526	Catch Basin	Concrete
SWCBCC30528	Catch Basin	Concrete
SWCBCC30529	Catch Basin	Concrete
SWCBCC30530	Catch Basin	Concrete
SWCBCC30531	Catch Basin	Concrete
SWCBCC30532	Catch Basin	Concrete
SWCBCC30533	Catch Basin	Concrete
SWCBCC30534	Catch Basin	Concrete
SWCBCC30535	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC30537	Catch Basin	Concrete
SWCBCC30538	Catch Basin	Concrete
SWCBCC30539	Catch Basin	Concrete
SWCBCC30540	Catch Basin	Concrete
SWCBCC30541	Catch Basin	Concrete
SWCBCC30542	Catch Basin	Concrete
SWCBCC30543	Catch Basin	Concrete
SWCBCC30544	Catch Basin	Concrete
SWCBCC30548	Catch Basin	Concrete
SWCBCC30550	Catch Basin	Concrete
SWCBCC30551	Catch Basin	Concrete
CCCC0001CB	Catch Basin	Concrete
CCCC0002CB	Catch Basin	Concrete
CCCC0003CB	Catch Basin	Concrete
CCCC0004CB	Catch Basin	Concrete
CCCC0005CB	Catch Basin	Concrete
CCCC0006CB	Catch Basin	Concrete
CCCC0007CB	Catch Basin	Concrete
CCCC0009CB	Catch Basin	Concrete
CCCC0010CB	Catch Basin	Concrete
CCCC0011CB	Catch Basin	Concrete
CCCC0012CB	Catch Basin	Concrete
CCCC0013CB	Catch Basin	Concrete
CCCC0014CB	Catch Basin	Concrete
CCCC0015CB	Catch Basin	Concrete
CCCC0016CB	Catch Basin	Concrete
CCCC0017CB	Catch Basin	Concrete
CCCC0018CB	Catch Basin	Concrete
CCCC0019CB	Catch Basin	Concrete
CCCC0020CB	Catch Basin	Concrete
CCCC0021CB	Catch Basin	Concrete
CCCC0023CB	Catch Basin	Brick
CCCC0025CB	Catch Basin	Concrete
CCCC0026CB	Catch Basin	Concrete
CCCC0027CB	Catch Basin	Concrete
CCCC0035CB	Catch Basin	Unknown
CCCC0037CB	Catch Basin	Unknown

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
CCCC0038CB	Catch Basin	Unknown
CCCC0087CB	Catch Basin	Brick
CCCC0093CB	Catch Basin	Brick
CCCC0107CB	Catch Basin	Brick
CCCC0128CB	Catch Basin	Concrete
CCCC0129CB	Catch Basin	Brick
CCCC0140CB	Catch Basin	Unknown
CCCC0145CB	Catch Basin	Brick
CCCC0158CB	Catch Basin	Brick
CCCC0162CB	Catch Basin	Brick
CCCC0163CB	Catch Basin	Brick
CCCC0166CB	Catch Basin	Concrete
CCCC0169CB	Catch Basin	Concrete
CCCC0171CB	Catch Basin	Concrete
CCCC0172CB	Catch Basin	Concrete
CCCC0174CB	Catch Basin	Brick
CCCC0176CB	Catch Basin	Brick
CCCC0177CB	Catch Basin	Brick
CCCC0179CB	Catch Basin	Unknown
CCCC0181CB	Catch Basin	Brick
CCCC0182CB	Catch Basin	Brick
CCCC0190CB	Catch Basin	Concrete
CCCC0193CB	Catch Basin	Concrete
CCCC0199CB	Catch Basin	Brick
CCCC0200CB	Catch Basin	Brick
CCCC0201CB	Catch Basin	Unknown
CCCC0202CB	Catch Basin	Brick
CCCC0212CB	Catch Basin	Brick
CCCC0213CB	Catch Basin	Brick
CCCC0214CB	Catch Basin	Brick
CCCC0215CB	Catch Basin	Concrete
CCCC0216CB	Catch Basin	Concrete
CCCC0217CB	Catch Basin	Concrete
CCCC0218CB	Catch Basin	Concrete
CCCC0219CB	Catch Basin	Concrete
CCCC0220CB	Catch Basin	Concrete
CCCC0221CB	Catch Basin	Concrete

Structure ID	Type	Material
CCCC0224CB	Catch Basin	Brick
CCCC0225CB	Catch Basin	Unknown
CCCC0747CB	Catch Basin	Unknown
CCCC0748CB	Catch Basin	Unknown
CCCC0749CB	Catch Basin	Brick
CCCC0750CB	Catch Basin	Brick
CCCC0751CB	Catch Basin	Brick
CCCC0752CB	Catch Basin	Brick
CCCC0753CB	Catch Basin	Brick
CCCC0754CB	Catch Basin	Brick
CCCC0756CB	Catch Basin	Brick
CCCC0758CB	Catch Basin	Brick
CCCC0759CB	Catch Basin	Unknown
CCCC0760CB	Catch Basin	Unknown
CCCC0761CB	Catch Basin	Brick
CCCC0762CB	Catch Basin	Brick
CCCC0763CB	Catch Basin	Unknown
CCCC0766CB	Catch Basin	Brick
CCCC0767CB	Catch Basin	Brick
CCCC0772CB	Catch Basin	Brick
CCCC0773CB	Catch Basin	Brick
CCCC0774CB	Catch Basin	Brick
CCCC0775CB	Catch Basin	Concrete
CCCC0776CB	Catch Basin	Concrete
CCCC0777CB	Catch Basin	Brick
CCCC0778CB	Catch Basin	Brick
CCCC0779CB	Catch Basin	Brick
CCCC0781CB	Catch Basin	Concrete
CCCC0783CB	Catch Basin	Concrete
CCCC0784CB	Catch Basin	Concrete
CCCC0785CB	Catch Basin	Concrete
CCCC0786CB	Catch Basin	Concrete
CCCC0787CB	Catch Basin	Concrete
CCCC0788CB	Catch Basin	Concrete
CCCC0789CB	Catch Basin	Concrete
CCCC0790CB	Catch Basin	Concrete
CCCC0791CB	Catch Basin	Concrete

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Structure ID	Type	Material
CCCC0792CB	Catch Basin	Concrete
CCCC0800CB	Catch Basin	Brick
CCCC0802CB	Catch Basin	Brick
CCCC0803CB	Catch Basin	Brick
CCCC0804CB	Catch Basin	Concrete
CCCC0830CB	Catch Basin	Brick
CCCC0831CB	Catch Basin	Brick
CCCC0832CB	Catch Basin	Brick
CCCC0833CB	Catch Basin	Brick
CCCC0834CB	Catch Basin	Brick
CCCC0835CB	Catch Basin	Brick
CCCC0836CB	Catch Basin	Brick
CCCC0837CB	Catch Basin	Brick
CCCC0838CB	Catch Basin	Unknown
CCCC0839CB	Catch Basin	Unknown
CCCC0840CB	Catch Basin	Unknown
CCCC0841CB	Catch Basin	Unknown
CCCC0842CB	Catch Basin	Unknown
CCCC0845CB	Catch Basin	Unknown
CCCC0846CB	Catch Basin	Unknown
CCCC0847CB	Catch Basin	Unknown
CCCC0848CB	Catch Basin	Unknown
CCCC0850CB	Catch Basin	Unknown
CCCC0857CB	Catch Basin	Brick
CCCC0870CB	Catch Basin	Unknown
CCCC0871CB	Catch Basin	Brick
CCCC0916CB	Catch Basin	Unknown
CCCC0917CB	Catch Basin	Unknown
CCCC0918CB	Catch Basin	Unknown
CCCC0923CB	Catch Basin	Unknown
CCCC0929CB	Catch Basin	Unknown
CCCC0930CB	Catch Basin	Unknown
CCCC0931CB	Catch Basin	OTHER
CCCC0932CB	Catch Basin	OTHER
CCCC0933CB	Catch Basin	Brick
CCCC0934CB	Catch Basin	Brick
CCCC0939CB	Catch Basin	Concrete

Structure ID	Type	Material
CCCC0940CB	Catch Basin	Concrete
CCCC0941CB	Catch Basin	Brick
CCCC0942CB	Catch Basin	Brick
CCCC0943CB	Catch Basin	Brick
CCCC0944CB	Catch Basin	Brick
CCCC0947CB	Catch Basin	Brick
CCCC0948CB	Catch Basin	Brick
CCCC0949CB	Catch Basin	Unknown
CCCC0955CB	Catch Basin	Concrete
CCCC0956CB	Catch Basin	Unknown
CCCC0957CB	Catch Basin	Concrete
CCCC0958CB	Catch Basin	Concrete
CCCC0959CB	Catch Basin	Concrete
CCCC0960CB	Catch Basin	Concrete
CCCC0961CB	Catch Basin	Concrete
CCCC0962CB	Catch Basin	Concrete
CCCC0963CB	Catch Basin	Concrete
CCCC0964CB	Catch Basin	Brick
CCCC0965CB	Catch Basin	Brick
CCCC0966CB	Catch Basin	Brick
CCCC0967CB	Catch Basin	Concrete
CCCC0969CB	Catch Basin	Concrete
CCCC0970CB	Catch Basin	Brick
CCCC0971CB	Catch Basin	Brick
CCCC0972CB	Catch Basin	Brick
CCCC0973CB	Catch Basin	Brick
CCCC0974CB	Catch Basin	Brick
CCCC0977CB	Catch Basin	Brick
CCCC0978CB	Catch Basin	Brick
CCCC0979CB	Catch Basin	Unknown
CCCC0982CB	Catch Basin	Unknown
CCCC0984CB	Catch Basin	Unknown
CCCC0985CB	Catch Basin	Unknown
CCCC0986CB	Catch Basin	Brick
CCCC0987CB	Catch Basin	Unknown
CCCC0990CB	Catch Basin	Concrete
CCCC0995CB	Catch Basin	Brick

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Structure ID	Type	Material
CCCC0996CB	Catch Basin	Concrete
CCCC0997CB	Catch Basin	Brick
CCCC0998CB	Catch Basin	Brick
CCCC0999CB	Catch Basin	Brick
CCCC1000CB	Catch Basin	Brick
CCCC1001CB	Catch Basin	Brick
CCCC1003CB	Catch Basin	Brick
CCCC1004CB	Catch Basin	Concrete
CCCC1005CB	Catch Basin	Brick
CCCC1006CB	Catch Basin	Concrete
CCCC1007CB	Catch Basin	Concrete
CCCC1008CB	Catch Basin	Concrete
CCCC1009CB	Catch Basin	Concrete
CCCC1010CB	Catch Basin	Concrete
CCCC1011CB	Catch Basin	Concrete
CCCC1012CB	Catch Basin	Concrete
CCCC1013CB	Catch Basin	Concrete
CCCC1014CB	Catch Basin	Brick
CCCC1019CB	Catch Basin	Unknown
CCCC1034CB	Catch Basin	Brick
CCCC1035CB	Catch Basin	Brick
CCCC1036CB	Catch Basin	Brick
CCCC1037CB	Catch Basin	Concrete
CCCC1038CB	Catch Basin	Concrete
CCCC1039CB	Catch Basin	Concrete
CCCC1040CB	Catch Basin	Concrete
CCCC1041CB	Catch Basin	Concrete
CCCC1043CB	Catch Basin	Concrete
CCCC1044CB	Catch Basin	Brick
CCCC1045CB	Catch Basin	Brick
CCCC1046CB	Catch Basin	Concrete
CCCC1047CB	Catch Basin	Concrete
CCCC1048CB	Catch Basin	Concrete
CCCC1049CB	Catch Basin	Brick
CCCC1050CB	Catch Basin	Brick
CCCC1057CB	Catch Basin	Brick
CCCC1058CB	Catch Basin	Brick

Structure ID	Type	Material
CCCC1059CB	Catch Basin	Unknown
CCCC1060CB	Catch Basin	Brick
CCCC1061CB	Catch Basin	Brick
CCCC1062CB	Catch Basin	Brick
CCCC1064CB	Catch Basin	Concrete
CCCC1073CB	Catch Basin	Concrete
CCCC1303CB	Catch Basin	Unknown
CCCC1306CB	Catch Basin	Unknown
CCCC1331CB	Catch Basin	Brick
CCCC2006CB	Catch Basin	Unknown
CCCC2025CB	Catch Basin	Unknown
CCCC2033CB	Catch Basin	Unknown
CCCC2034CB	Catch Basin	Unknown
CCCC2066CB	Catch Basin	Unknown
CCCC2374CB	Catch Basin	METAL
CCCC2404CB	Catch Basin	Brick
CCCC2441CB	Catch Basin	Brick
CCCC2487CB	Catch Basin	Concrete
CCCC2489CB	Catch Basin	Concrete
CCCC3000CB	Catch Basin	Unknown
CCCC3002CB	Catch Basin	Unknown
CCCC3128CB	Catch Basin	Brick
CCCC3180CB	Catch Basin	Brick
CCCC3200CB	Catch Basin	Unknown
CCCC3278CB	Catch Basin	Brick
CCCC3282CB	Catch Basin	Unknown
CCCC3490CB	Catch Basin	Concrete
CCCC3492CB	Catch Basin	Concrete
CCCC4216CB	Catch Basin	Brick
CCCC4218CB	Catch Basin	Brick
CCCC4537CB	Catch Basin	OTHER
CCCC4542CB	Catch Basin	Unknown
CCCC4613CB	Catch Basin	Unknown
CCCC4661CB	Catch Basin	Brick
CCCC4663CB	Catch Basin	Brick
CCCC4671CB	Catch Basin	Concrete
CCCC4673CB	Catch Basin	Concrete

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Structure ID	Type	Material
CCCC4678CB	Catch Basin	Brick
CCCC4684CB	Catch Basin	Unknown
CCCC4804CB	Catch Basin	Concrete
CCCC4856CB	Catch Basin	Concrete
CCCC4912CB	Catch Basin	Brick
CCCC4980CB	Catch Basin	Brick
CCCC4982CB	Catch Basin	Brick
CCCC4988CB	Catch Basin	Brick
CCCC7777CB	Catch Basin	Brick
SWCBCC8987	Catch Basin	Brick
SWCBCC9271	Catch Basin	Unknown
SWCBCC9273	Catch Basin	Concrete
SWCBCC9274	Catch Basin	Concrete
SWCBCC9275	Catch Basin	Concrete
SWCBCC9276	Catch Basin	Concrete
SWCBCC9282	Catch Basin	Concrete
SWCBCC9283	Catch Basin	Concrete
SWCBCC9284	Catch Basin	Concrete
SWCBCC9285	Catch Basin	Concrete
SWCBCC9286	Catch Basin	Concrete
SWCBCC9297	Catch Basin	Brick
SWCBCC9298	Catch Basin	Unknown
SWCBCC9313	Catch Basin	OTHER
SWCBCC9314	Catch Basin	Unknown
SWCBCC9316	Catch Basin	Concrete
SWCBCC9091	Catch Basin	Brick
SWCBCC9094	Catch Basin	Brick
SWCBCC9098	Catch Basin	Brick
SWCBCC9099	Catch Basin	Unknown
SWCBCC9109	Catch Basin	Concrete
SWCBCC9110	Catch Basin	Concrete
SWCBCC9111	Catch Basin	Concrete
SWCBCC9112	Catch Basin	Concrete
SWCBCC9113	Catch Basin	Concrete
SWCBCC9114	Catch Basin	Concrete
SWCBCC9115	Catch Basin	Concrete
SWCBCC9118	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC9119	Catch Basin	Concrete
SWCBCC9324	Catch Basin	Concrete
SWCBCC9345	Catch Basin	Brick
SWCBCC9347	Catch Basin	Brick
SWCBMO9358	Catch Basin	Unknown
SWCBCC9363	Catch Basin	Unknown
SWCBDC30627	Catch Basin	Brick
SWCBDC30630	Catch Basin	Brick
SWCBCC30575	Catch Basin	Brick
SWCBCC30576	Catch Basin	Brick
SWCBCC30578	Catch Basin	Brick
SWCBCC30579	Catch Basin	Brick
SWCBCC30581	Catch Basin	Brick
SWCBCC30601	Catch Basin	Concrete
SWCBCC30607	Catch Basin	Concrete
SWCBCC30608	Catch Basin	Concrete
SWCBCC30611	Catch Basin	Concrete
SWCBCC30613	Catch Basin	Concrete
SWCBCC30614	Catch Basin	Concrete
SWCBCC30586	Catch Basin	Brick
SWCBCC30615	Catch Basin	Concrete
SWCBCC30555	Catch Basin	Concrete
SWCBCC30557	Catch Basin	Concrete
SWCBCC30558	Catch Basin	Concrete
SWCBCC30560	Catch Basin	Concrete
SWCBCC30561	Catch Basin	Concrete
CCCC1068CB	Catch Basin	Brick
CCCC1069CB	Catch Basin	Brick
SWCBCC32002	Catch Basin	Concrete
SWCBCC32006	Catch Basin	Concrete
SWCBCC32007	Catch Basin	Concrete
SWCBCC32008	Catch Basin	Concrete
SWCBCC32015	Catch Basin	Concrete
SWCBCC32016	Catch Basin	Concrete
SWCBCC32018	Catch Basin	Concrete
SWCBCC32019	Catch Basin	Concrete
SWCBCC32020	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32021	Catch Basin	Concrete
SWCBCC32022	Catch Basin	Concrete
SWCBCC32026	Catch Basin	Concrete
SWCBCC32027	Catch Basin	Concrete
SWCBCC32030	Catch Basin	Concrete
SWCBCC32031	Catch Basin	Concrete
SWCBCC32033	Catch Basin	Concrete
SWCBCC32034	Catch Basin	Concrete
SWCBCC32035	Catch Basin	Concrete
SWCBCC32037	Catch Basin	Concrete
SWCBCC32038	Catch Basin	Concrete
SWCBCC32039	Catch Basin	Concrete
SWCBCC32040	Catch Basin	Concrete
SWCBCC32041	Catch Basin	Concrete
SWCBCC32042	Catch Basin	Concrete
SWCBCC32044	Catch Basin	Concrete
SWCBCC32045	Catch Basin	Concrete
SWCBCC32046	Catch Basin	Concrete
SWCBCC32047	Catch Basin	Concrete
SWCBCC32048	Catch Basin	Concrete
SWCBCC32049	Catch Basin	Concrete
SWCBCC32051	Catch Basin	Concrete
SWCBCC32052	Catch Basin	Concrete
SWCBCC32058	Catch Basin	Concrete
SWCBCC32059	Catch Basin	Concrete
SWCBCC32065	Catch Basin	Concrete
SWCBCC32066	Catch Basin	Concrete
SWCBCC32067	Catch Basin	Concrete
SWCBCC32068	Catch Basin	Concrete
SWCBCC32069	Catch Basin	Concrete
SWCBCC32070	Catch Basin	Concrete
SWCBCC32071	Catch Basin	Concrete
SWCBCC32081	Catch Basin	Concrete
SWCBCC32082	Catch Basin	Concrete
SWCBCC32083	Catch Basin	Concrete
SWCBCC32084	Catch Basin	Concrete
SWCBCC32085	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32086	Catch Basin	Concrete
SWCBCC32087	Catch Basin	Concrete
SWCBCC32088	Catch Basin	Concrete
SWCBCC32089	Catch Basin	Concrete
SWCBCC32090	Catch Basin	Concrete
SWCBCC32091	Catch Basin	Concrete
SWCBCC32092	Catch Basin	Concrete
SWCBCC32093	Catch Basin	Concrete
SWCBCC32095	Catch Basin	Concrete
SWCBCC32097	Catch Basin	Concrete
SWCBCC32098	Catch Basin	Concrete
SWCBCC32102	Catch Basin	Concrete
SWCBCC32103	Catch Basin	Concrete
SWCBCC32104	Catch Basin	Concrete
SWCBCC32105	Catch Basin	Concrete
SWCBCC32107	Catch Basin	Concrete
SWCBCC32108	Catch Basin	Concrete
SWCBCC32109	Catch Basin	Concrete
SWCBCC32110	Catch Basin	Concrete
SWCBCC32111	Catch Basin	Concrete
SWCBCC32112	Catch Basin	Concrete
SWCBCC32113	Catch Basin	Concrete
SWCBCC32114	Catch Basin	Concrete
SWCBCC32116	Catch Basin	Concrete
SWCBCC32117	Catch Basin	Concrete
SWCBCC32119	Catch Basin	Concrete
SWCBCC32120	Catch Basin	Concrete
SWCBCC32121	Catch Basin	Concrete
SWCBCC32122	Catch Basin	Concrete
SWCBCC32125	Catch Basin	Concrete
SWCBCC32126	Catch Basin	Concrete
SWCBCC32001	Catch Basin	Concrete
SWCBCC32060	Catch Basin	Concrete
SWCBCC32061	Catch Basin	Concrete
SWCBCC32129	Catch Basin	Concrete
SWCBCC32130	Catch Basin	Concrete
SWCBCC32137	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32138	Catch Basin	Concrete
SWCBCC32139	Catch Basin	Concrete
SWCBCC32140	Catch Basin	Concrete
SWCBCC32142	Catch Basin	Concrete
SWCBCC32143	Catch Basin	Concrete
SWCBCC32145	Catch Basin	Concrete
SWCBCC32146	Catch Basin	Concrete
SWCBCC32151	Catch Basin	Concrete
SWCBCC32152	Catch Basin	Concrete
SWCBCC32153	Catch Basin	Concrete
SWCBCC32154	Catch Basin	Concrete
SWCBCC32165	Catch Basin	Concrete
SWCBCC32166	Catch Basin	Concrete
SWCBCC32173	Catch Basin	Concrete
SWCBCC32174	Catch Basin	Concrete
SWCBCC32176	Catch Basin	Concrete
SWCBCC32178	Catch Basin	Concrete
SWCBCC32179	Catch Basin	Concrete
SWCBCC32180	Catch Basin	Concrete
SWCBCC32181	Catch Basin	Concrete
SWCBCC32183	Catch Basin	Concrete
SWCBCC32184	Catch Basin	Concrete
SWCBCC32190	Catch Basin	Concrete
SWCBCC32191	Catch Basin	Concrete
SWCBCC32193	Catch Basin	Concrete
SWCBCC32194	Catch Basin	Concrete
SWCBCC32195	Catch Basin	Concrete
SWCBCC32196	Catch Basin	Concrete
SWCBCC32200	Catch Basin	Concrete
SWCBCC32202	Catch Basin	Concrete
SWCBCC32203	Catch Basin	Concrete
SWCBCC32204	Catch Basin	Concrete
SWCBCC32205	Catch Basin	Concrete
SWCBCC32206	Catch Basin	Concrete
SWCBCC32207	Catch Basin	Concrete
SWCBCC32209	Catch Basin	Concrete
SWCBCC32210	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32212	Catch Basin	Concrete
SWCBCC32214	Catch Basin	Concrete
SWCBCC32215	Catch Basin	Concrete
SWCBCC32219	Catch Basin	Concrete
SWCBCC32220	Catch Basin	Concrete
SWCBCC32222	Catch Basin	Concrete
SWCBCC32223	Catch Basin	Concrete
SWCBCC32226	Catch Basin	Concrete
SWCBCC32227	Catch Basin	Concrete
SWCBCC32228	Catch Basin	Concrete
SWCBCC32229	Catch Basin	Concrete
SWCBCC32230	Catch Basin	Concrete
SWCBCC32231	Catch Basin	Concrete
SWCBCC32232	Catch Basin	Concrete
SWCBCC32233	Catch Basin	Concrete
SWCBCC32235	Catch Basin	Concrete
SWCBCC32237	Catch Basin	Concrete
SWCBCC32242	Catch Basin	Concrete
SWCBCC32243	Catch Basin	Concrete
SWCBCC32247	Catch Basin	Concrete
SWCBCC32248	Catch Basin	Concrete
SWCBCC32250	Catch Basin	Concrete
SWCBCC32251	Catch Basin	Concrete
SWCBCC32253	Catch Basin	Concrete
SWCBCC32254	Catch Basin	Concrete
SWCBCC32255	Catch Basin	Concrete
SWCBCC32256	Catch Basin	Concrete
SWCBCC32257	Catch Basin	Concrete
SWCBCC32258	Catch Basin	Concrete
SWCBCC32259	Catch Basin	Concrete
SWCBCC32263	Catch Basin	Concrete
SWCBCC32264	Catch Basin	Concrete
SWCBCC32267	Catch Basin	Concrete
SWCBCC32268	Catch Basin	Concrete
SWCBCC32269	Catch Basin	Concrete
SWCBCC32271	Catch Basin	Concrete
SWCBCC32272	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32273	Catch Basin	Concrete
SWCBCC32275	Catch Basin	Concrete
SWCBCC32276	Catch Basin	Concrete
SWCBCC32279	Catch Basin	Concrete
SWCBCC32280	Catch Basin	Concrete
SWCBCC32285	Catch Basin	Concrete
SWCBCC32286	Catch Basin	Concrete
SWCBCC32287	Catch Basin	Concrete
SWCBCC32296	Catch Basin	Concrete
SWCBCC32297	Catch Basin	Concrete
SWCBCC32298	Catch Basin	Concrete
SWCBCC32299	Catch Basin	Concrete
SWCBCC32301	Catch Basin	Concrete
SWCBCC32302	Catch Basin	Concrete
SWCBCC32306	Catch Basin	Concrete
SWCBCC32307	Catch Basin	Concrete
SWCBCC32310	Catch Basin	Concrete
SWCBCC32316	Catch Basin	Concrete
SWCBCC32318	Catch Basin	Concrete
SWCBCC32319	Catch Basin	Concrete
SWCBCC32321	Catch Basin	Concrete
SWCBCC32323	Catch Basin	Concrete
SWCBCC32324	Catch Basin	Concrete
SWCBCC32325	Catch Basin	Concrete
SWCBCC32326	Catch Basin	Concrete
SWCBCC32328	Catch Basin	Concrete
SWCBCC32329	Catch Basin	Concrete
SWCBCC32330	Catch Basin	Concrete
SWCBCC32331	Catch Basin	Concrete
SWCBCC32332	Catch Basin	Concrete
SWCBCC32333	Catch Basin	Concrete
SWCBCC32340	Catch Basin	Concrete
SWCBCC32341	Catch Basin	Concrete
SWCBCC32343	Catch Basin	Concrete
SWCBCC32344	Catch Basin	Concrete
SWCBCC32345	Catch Basin	Concrete
SWCBCC32346	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32347	Catch Basin	Concrete
SWCBCC32348	Catch Basin	Concrete
SWCBCC32349	Catch Basin	Concrete
SWCBCC32350	Catch Basin	Concrete
SWCBCC32352	Catch Basin	Concrete
SWCBCC32356	Catch Basin	Concrete
SWCBCC32357	Catch Basin	Concrete
SWCBCC32360	Catch Basin	Concrete
SWCBCC32361	Catch Basin	Concrete
SWCBCC32363	Catch Basin	Concrete
SWCBCC32364	Catch Basin	Concrete
SWCBCC32366	Catch Basin	Concrete
SWCBCC32367	Catch Basin	Concrete
SWCBCC32368	Catch Basin	Concrete
SWCBCC32369	Catch Basin	Concrete
SWCBCC32370	Catch Basin	Concrete
SWCBCC32371	Catch Basin	Concrete
SWCBCC32372	Catch Basin	Concrete
SWCBCC32376	Catch Basin	Concrete
SWCBCC32377	Catch Basin	Concrete
SWCBCC32378	Catch Basin	Concrete
SWCBCC32379	Catch Basin	Concrete
SWCBCC32380	Catch Basin	Concrete
SWCBCC32381	Catch Basin	Concrete
SWCBCC32382	Catch Basin	Concrete
SWCBCC32383	Catch Basin	Concrete
SWCBCC32384	Catch Basin	Concrete
SWCBCC32385	Catch Basin	Concrete
SWCBCC32386	Catch Basin	Concrete
SWCBCC32388	Catch Basin	Concrete
SWCBCC32389	Catch Basin	Concrete
SWCBCC32392	Catch Basin	Concrete
SWCBCC32393	Catch Basin	Concrete
SWCBCC32394	Catch Basin	Concrete
SWCBCC32396	Catch Basin	Concrete
SWCBCC32397	Catch Basin	Concrete
SWCBCC32398	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32399	Catch Basin	Concrete
SWCBCC32400	Catch Basin	Concrete
SWCBCC32401	Catch Basin	Concrete
SWCBCC32402	Catch Basin	Concrete
SWCBCC32403	Catch Basin	Concrete
SWCBCC32404	Catch Basin	Concrete
SWCBCC32405	Catch Basin	Concrete
SWCBCC32406	Catch Basin	Concrete
SWCBCC32408	Catch Basin	Concrete
SWCBCC32413	Catch Basin	Concrete
SWCBCC32414	Catch Basin	Concrete
SWCBCC32415	Catch Basin	Concrete
SWCBCC32416	Catch Basin	Concrete
SWCBCC32419	Catch Basin	Concrete
SWCBCC32420	Catch Basin	Concrete
SWCBCC32421	Catch Basin	Concrete
SWCBCC32422	Catch Basin	Concrete
SWCBCC32425	Catch Basin	Concrete
SWCBCC32426	Catch Basin	Concrete
SWCBCC32431	Catch Basin	Concrete
SWCBCC32432	Catch Basin	Concrete
SWCBCC32433	Catch Basin	Concrete
SWCBCC32434	Catch Basin	Concrete
SWCBCC32435	Catch Basin	Concrete
SWCBCC32437	Catch Basin	Concrete
SWCBCC32438	Catch Basin	Concrete
SWCBCC32439	Catch Basin	Concrete
SWCBCC32440	Catch Basin	Concrete
SWCBCC32441	Catch Basin	Concrete
SWCBCC32442	Catch Basin	Concrete
SWCBCC32444	Catch Basin	Concrete
SWCBCC32445	Catch Basin	Concrete
SWCBCC32446	Catch Basin	Concrete
SWCBCC32447	Catch Basin	Concrete
SWCBCC32449	Catch Basin	Concrete
SWCBCC32450	Catch Basin	Concrete
SWCBCC32451	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32452	Catch Basin	Concrete
SWCBCC32454	Catch Basin	Concrete
SWCBCC32455	Catch Basin	Concrete
SWCBCC32456	Catch Basin	Concrete
SWCBCC32459	Catch Basin	Concrete
SWCBCC32460	Catch Basin	Concrete
SWCBCC32461	Catch Basin	Concrete
SWCBCC32462	Catch Basin	Concrete
SWCBCC32463	Catch Basin	Concrete
SWCBCC32464	Catch Basin	Concrete
SWCBCC32467	Catch Basin	Concrete
SWCBCC32469	Catch Basin	Concrete
SWCBCC32470	Catch Basin	Concrete
SWCBCC32472	Catch Basin	Concrete
SWCBCC32473	Catch Basin	Concrete
SWCBCC32474	Catch Basin	Concrete
SWCBCC32484	Catch Basin	Concrete
SWCBCC32485	Catch Basin	Concrete
SWCBCC32486	Catch Basin	Concrete
SWCBCC32487	Catch Basin	Concrete
SWCBCC32489	Catch Basin	Concrete
SWCBCC32490	Catch Basin	Concrete
SWCBCC32491	Catch Basin	Concrete
SWCBCC32493	Catch Basin	Concrete
SWCBCC32494	Catch Basin	Concrete
SWCBCC32496	Catch Basin	Concrete
SWCBCC32497	Catch Basin	Concrete
SWCBCC32499	Catch Basin	Concrete
SWCBCC32500	Catch Basin	Concrete
SWCBCC32502	Catch Basin	Concrete
SWCBCC32503	Catch Basin	Concrete
SWCBCC32506	Catch Basin	Concrete
SWCBCC32507	Catch Basin	Concrete
SWCBCC32508	Catch Basin	Concrete
SWCBCC32509	Catch Basin	Concrete
SWCBCC32511	Catch Basin	Concrete
SWCBCC32512	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32517	Catch Basin	Concrete
SWCBCC32518	Catch Basin	Concrete
SWCBCC32519	Catch Basin	Concrete
SWCBCC32520	Catch Basin	Concrete
SWCBCC32522	Catch Basin	Concrete
SWCBCC32523	Catch Basin	Concrete
SWCBCC32524	Catch Basin	Concrete
SWCBCC32525	Catch Basin	Concrete
SWCBCC32527	Catch Basin	Concrete
SWCBCC32528	Catch Basin	Concrete
SWCBCC32529	Catch Basin	Concrete
SWCBCC32530	Catch Basin	Concrete
SWCBCC32532	Catch Basin	Concrete
SWCBCC32533	Catch Basin	Concrete
SWCBCC32534	Catch Basin	Concrete
SWCBCC32536	Catch Basin	Concrete
SWCBCC32537	Catch Basin	Concrete
SWCBCC32538	Catch Basin	Concrete
SWCBCC32539	Catch Basin	Concrete
SWCBCC32543	Catch Basin	Concrete
SWCBCC32544	Catch Basin	Concrete
SWCBCC32545	Catch Basin	Concrete
SWCBCC32546	Catch Basin	Concrete
SWCBCC32547	Catch Basin	Concrete
SWCBCC32549	Catch Basin	Concrete
SWCBCC32550	Catch Basin	Concrete
SWCBCC32551	Catch Basin	Concrete
SWCBCC32553	Catch Basin	Concrete
SWCBCC32554	Catch Basin	Concrete
SWCBCC32556	Catch Basin	Concrete
SWCBCC32557	Catch Basin	Concrete
SWCBCC32563	Catch Basin	Concrete
SWCBCC32564	Catch Basin	Concrete
SWCBCC32565	Catch Basin	Concrete
SWCBCC32566	Catch Basin	Concrete
SWCBCC32567	Catch Basin	Concrete
SWCBCC32569	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32570	Catch Basin	Concrete
SWCBCC32571	Catch Basin	Concrete
SWCBCC32572	Catch Basin	Concrete
SWCBCC32573	Catch Basin	Concrete
SWCBCC32574	Catch Basin	Concrete
SWCBCC32575	Catch Basin	Concrete
SWCBCC32576	Catch Basin	Concrete
SWCBCC32578	Catch Basin	Concrete
SWCBCC32579	Catch Basin	Concrete
SWCBCC32580	Catch Basin	Concrete
SWCBCC32581	Catch Basin	Concrete
SWCBCC32582	Catch Basin	Concrete
SWCBCC32583	Catch Basin	Concrete
SWCBCC32584	Catch Basin	Concrete
SWCBCC32585	Catch Basin	Concrete
SWCBCC32586	Catch Basin	Concrete
SWCBCC32598	Catch Basin	Concrete
SWCBCC32599	Catch Basin	Concrete
SWCBCC32600	Catch Basin	Concrete
SWCBCC32601	Catch Basin	Concrete
SWCBCC32602	Catch Basin	Concrete
SWCBCC32603	Catch Basin	Concrete
SWCBCC32604	Catch Basin	Concrete
SWCBCC32605	Catch Basin	Concrete
SWCBCC32612	Catch Basin	Concrete
SWCBCC32617	Catch Basin	Concrete
SWCBCC32618	Catch Basin	Concrete
SWCBCC32620	Catch Basin	Concrete
SWCBCC32961	Catch Basin	Concrete
SWCBCC32962	Catch Basin	Concrete
SWCBCC32963	Catch Basin	Concrete
SWCBCC32966	Catch Basin	Concrete
SWCBCC32967	Catch Basin	Concrete
SWCBCC32973	Catch Basin	Concrete
SWCBCC32974	Catch Basin	Concrete
SWCBCC32975	Catch Basin	Concrete
SWCBCC32976	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32977	Catch Basin	Concrete
SWCBCC32978	Catch Basin	Concrete
SWCBCC32981	Catch Basin	Concrete
SWCBCC32982	Catch Basin	Concrete
SWCBCC32985	Catch Basin	Concrete
SWCBCC32990	Catch Basin	Concrete
SWCBCC32991	Catch Basin	Concrete
SWCBCC32993	Catch Basin	Concrete
SWCBCC32621	Catch Basin	Concrete
SWCBCC32622	Catch Basin	Concrete
SWCBCC32623	Catch Basin	Concrete
SWCBCC32624	Catch Basin	Concrete
SWCBCC32625	Catch Basin	Concrete
SWCBCC32627	Catch Basin	Concrete
SWCBCC32628	Catch Basin	Concrete
SWCBCC32634	Catch Basin	Concrete
SWCBCC32635	Catch Basin	Concrete
SWCBCC32637	Catch Basin	Concrete
SWCBCC32638	Catch Basin	Concrete
SWCBCC32641	Catch Basin	Concrete
SWCBCC32642	Catch Basin	Concrete
SWCBCC32644	Catch Basin	Concrete
SWCBCC32645	Catch Basin	Concrete
SWCBCC32648	Catch Basin	Concrete
SWCBCC32654	Catch Basin	Concrete
SWCBCC32655	Catch Basin	Concrete
SWCBCC32665	Catch Basin	Concrete
SWCBCC32666	Catch Basin	Concrete
SWCBCC32667	Catch Basin	Concrete
SWCBCC32669	Catch Basin	Concrete
SWCBCC32670	Catch Basin	Concrete
SWCBCC32672	Catch Basin	Concrete
SWCBCC32673	Catch Basin	Concrete
SWCBCC32674	Catch Basin	Concrete
SWCBCC32675	Catch Basin	Concrete
SWCBCC32677	Catch Basin	Concrete
SWCBCC32678	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32679	Catch Basin	Concrete
SWCBCC32682	Catch Basin	Concrete
SWCBCC32683	Catch Basin	Concrete
SWCBCC32684	Catch Basin	Concrete
SWCBCC32685	Catch Basin	Concrete
SWCBCC32686	Catch Basin	Concrete
SWCBCC32691	Catch Basin	Concrete
SWCBCC32692	Catch Basin	Concrete
SWCBCC32693	Catch Basin	Concrete
SWCBCC32694	Catch Basin	Concrete
SWCBCC32695	Catch Basin	Concrete
SWCBCC32697	Catch Basin	Concrete
SWCBCC32698	Catch Basin	Concrete
SWCBCC32700	Catch Basin	Concrete
SWCBCC32701	Catch Basin	Concrete
SWCBCC32702	Catch Basin	Concrete
SWCBCC32703	Catch Basin	Concrete
SWCBCC32707	Catch Basin	Concrete
SWCBCC32712	Catch Basin	Concrete
SWCBCC32716	Catch Basin	Concrete
SWCBCC32717	Catch Basin	Concrete
SWCBCC32720	Catch Basin	Concrete
SWCBCC32725	Catch Basin	Concrete
SWCBCC32726	Catch Basin	Concrete
SWCBCC32730	Catch Basin	Concrete
SWCBCC32731	Catch Basin	Concrete
SWCBCC32734	Catch Basin	Concrete
SWCBCC32735	Catch Basin	Concrete
SWCBCC32736	Catch Basin	Concrete
SWCBCC32737	Catch Basin	Concrete
SWCBCC32744	Catch Basin	Concrete
SWCBCC32745	Catch Basin	Concrete
SWCBCC32746	Catch Basin	Concrete
SWCBCC32747	Catch Basin	Concrete
SWCBCC32750	Catch Basin	Concrete
SWCBCC32752	Catch Basin	Concrete
SWCBCC32753	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32755	Catch Basin	Concrete
SWCBCC32758	Catch Basin	Concrete
SWCBCC32759	Catch Basin	Concrete
SWCBCC32761	Catch Basin	Concrete
SWCBCC32762	Catch Basin	Concrete
SWCBCC32765	Catch Basin	Concrete
SWCBCC32766	Catch Basin	Concrete
SWCBCC32767	Catch Basin	Concrete
SWCBCC32768	Catch Basin	Concrete
SWCBCC32769	Catch Basin	Concrete
SWCBCC32771	Catch Basin	Concrete
SWCBCC32772	Catch Basin	Concrete
SWCBCC32779	Catch Basin	Concrete
SWCBCC32780	Catch Basin	Concrete
SWCBCC32785	Catch Basin	Concrete
SWCBCC32789	Catch Basin	Concrete
SWCBCC32791	Catch Basin	Concrete
SWCBCC32795	Catch Basin	Concrete
SWCBCC32796	Catch Basin	Concrete
SWCBCC32797	Catch Basin	Concrete
SWCBCC32798	Catch Basin	Concrete
SWCBCC32800	Catch Basin	Concrete
SWCBCC32803	Catch Basin	Concrete
SWCBCC32805	Catch Basin	Concrete
SWCBCC32809	Catch Basin	Concrete
SWCBCC32811	Catch Basin	Concrete
SWCBCC32812	Catch Basin	Concrete
SWCBCC32813	Catch Basin	Concrete
SWCBCC32820	Catch Basin	Concrete
SWCBCC32821	Catch Basin	Concrete
SWCBCC32827	Catch Basin	Concrete
SWCBCC32828	Catch Basin	Concrete
SWCBCC32832	Catch Basin	Concrete
SWCBCC32833	Catch Basin	Concrete
SWCBCC32835	Catch Basin	Concrete
SWCBCC32836	Catch Basin	Concrete
SWCBCC32837	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC32838	Catch Basin	Concrete
SWCBCC32841	Catch Basin	Concrete
SWCBCC32842	Catch Basin	Concrete
SWCBCC32849	Catch Basin	Concrete
SWCBCC32850	Catch Basin	Concrete
SWCBCC32851	Catch Basin	Concrete
SWCBCC32852	Catch Basin	Concrete
SWCBCC32853	Catch Basin	Concrete
SWCBCC32854	Catch Basin	Concrete
SWCBCC32855	Catch Basin	Concrete
SWCBCC32857	Catch Basin	Concrete
SWCBCC32858	Catch Basin	Concrete
SWCBCC32861	Catch Basin	Concrete
SWCBCC32863	Catch Basin	Concrete
SWCBCC32864	Catch Basin	Concrete
SWCBCC32868	Catch Basin	Concrete
SWCBCC32869	Catch Basin	Concrete
SWCBCC32870	Catch Basin	Concrete
SWCBCC32877	Catch Basin	Concrete
SWCBCC32878	Catch Basin	Concrete
SWCBCC32879	Catch Basin	Concrete
SWCBCC32880	Catch Basin	Concrete
SWCBCC32882	Catch Basin	Concrete
SWCBCC32883	Catch Basin	Concrete
SWCBCC32884	Catch Basin	Concrete
SWCBCC32885	Catch Basin	Concrete
SWCBCC32887	Catch Basin	Concrete
SWCBCC32888	Catch Basin	Concrete
SWCBCC32889	Catch Basin	Concrete
SWCBCC32890	Catch Basin	Concrete
SWCBCC32891	Catch Basin	Concrete
SWCBCC32892	Catch Basin	Concrete
SWCBCC32894	Catch Basin	Concrete
SWCBCC32895	Catch Basin	Concrete
SWCBCC32900	Catch Basin	Concrete
SWCBCC32901	Catch Basin	Concrete
SWCBCC32902	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC32906	Catch Basin	Concrete
SWCBCC32907	Catch Basin	Concrete
SWCBCC32914	Catch Basin	Concrete
SWCBCC32915	Catch Basin	Concrete
SWCBCC32916	Catch Basin	Concrete
SWCBCC32917	Catch Basin	Concrete
SWCBCC32920	Catch Basin	Concrete
SWCBCC32924	Catch Basin	Concrete
SWCBCC32925	Catch Basin	Concrete
SWCBCC32926	Catch Basin	Concrete
SWCBCC32931	Catch Basin	Concrete
SWCBCC32932	Catch Basin	Concrete
SWCBCC32933	Catch Basin	Concrete
SWCBCC32934	Catch Basin	Concrete
SWCBCC32935	Catch Basin	Concrete
SWCBCC32936	Catch Basin	Concrete
SWCBCC32939	Catch Basin	Concrete
SWCBCC32942	Catch Basin	Concrete
SWCBCC32943	Catch Basin	Concrete
SWCBCC32944	Catch Basin	Concrete
SWCBCC32948	Catch Basin	Concrete
SWCBCC32949	Catch Basin	Concrete
SWCBCC32950	Catch Basin	Concrete
SWCBCC32951	Catch Basin	Concrete
SWCBCC32953	Catch Basin	Concrete
SWCBCC33002	Catch Basin	Concrete
SWCBCC33003	Catch Basin	Concrete
SWCBCC33004	Catch Basin	Concrete
SWCBCC33006	Catch Basin	Concrete
SWCBCC33007	Catch Basin	Concrete
SWCBCC33008	Catch Basin	Concrete
SWCBCC33009	Catch Basin	Concrete
SWCBCC33010	Catch Basin	Concrete
SWCBCC33011	Catch Basin	Concrete
SWCBCC33012	Catch Basin	Concrete
SWCBCC33013	Catch Basin	Concrete
SWCBCC33014	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC33018	Catch Basin	Concrete
SWCBCC33019	Catch Basin	Concrete
SWCBCC33020	Catch Basin	Concrete
SWCBCC33021	Catch Basin	Concrete
SWCBCC33022	Catch Basin	Concrete
SWCBCC33023	Catch Basin	Concrete
SWCBCC33025	Catch Basin	Concrete
SWCBCC33026	Catch Basin	Concrete
SWCBCC33029	Catch Basin	Concrete
SWCBCC33030	Catch Basin	Concrete
SWCBCC33031	Catch Basin	Concrete
SWCBCC33032	Catch Basin	Concrete
SWCBCC33033	Catch Basin	Concrete
SWCBCC33034	Catch Basin	Concrete
SWCBCC33037	Catch Basin	Concrete
SWCBCC33038	Catch Basin	Concrete
SWCBCC33039	Catch Basin	Concrete
SWCBCC33040	Catch Basin	Concrete
SWCBCC33041	Catch Basin	Concrete
SWCBCC33042	Catch Basin	Concrete
SWCBCC33044	Catch Basin	Concrete
SWCBCC33046	Catch Basin	Concrete
SWCBCC33047	Catch Basin	Concrete
SWCBCC33049	Catch Basin	Concrete
SWCBCC33050	Catch Basin	Concrete
SWCBCC33051	Catch Basin	Concrete
SWCBCC33052	Catch Basin	Concrete
SWCBCC33056	Catch Basin	Concrete
SWCBCC33057	Catch Basin	Concrete
SWCBCC33058	Catch Basin	Concrete
SWCBCC33059	Catch Basin	Concrete
SWCBCC33068	Catch Basin	Concrete
SWCBCC33069	Catch Basin	Concrete
SWCBCC33073	Catch Basin	Concrete
SWCBCC33074	Catch Basin	Concrete
SWCBCC33076	Catch Basin	Concrete
SWCBCC33077	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC33084	Catch Basin	Concrete
SWCBCC33085	Catch Basin	Concrete
SWCBCC33086	Catch Basin	Concrete
SWCBCC33087	Catch Basin	Concrete
SWCBCC33088	Catch Basin	Concrete
SWCBCC33090	Catch Basin	Concrete
SWCBCC33091	Catch Basin	Concrete
SWCBCC33094	Catch Basin	Concrete
SWCBCC33096	Catch Basin	Concrete
SWCBCC33097	Catch Basin	Concrete
SWCBCC33098	Catch Basin	Concrete
SWCBCC33099	Catch Basin	Concrete
SWCBCC33100	Catch Basin	Concrete
SWCBCC33101	Catch Basin	Concrete
SWCBCC33102	Catch Basin	Concrete
SWCBCC33103	Catch Basin	Concrete
SWCBCC33106	Catch Basin	Concrete
SWCBCC33112	Catch Basin	Concrete
SWCBCC33117	Catch Basin	Concrete
SWCBCC33120	Catch Basin	Concrete
SWCBCC33121	Catch Basin	Concrete
SWCBCC33122	Catch Basin	Concrete
SWCBCC33123	Catch Basin	Concrete
SWCBCC33125	Catch Basin	Brick
SWCBCC33126	Catch Basin	Brick
SWCBCC33128	Catch Basin	Brick
SWCBCC33129	Catch Basin	Unknown
SWCBCC33132	Catch Basin	Brick
SWCBCC33133	Catch Basin	Brick
SWCBCC33137	Catch Basin	Brick
SWCBCC33138	Catch Basin	Brick
SWCBCC33140	Catch Basin	Brick
SWCBCC33141	Catch Basin	Brick
SWCBCC33143	Catch Basin	Brick
SWCBCC33144	Catch Basin	Brick
SWCBCC33146	Catch Basin	Concrete
SWCBCC33147	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC33148	Catch Basin	Concrete
SWCBCC33149	Catch Basin	Concrete
SWCBCC33150	Catch Basin	Concrete
SWCBCC33154	Catch Basin	Concrete
SWCBCC33155	Catch Basin	Concrete
SWCBCC33156	Catch Basin	Concrete
SWCBCC33157	Catch Basin	Concrete
SWCBCC33158	Catch Basin	Concrete
SWCBCC33159	Catch Basin	Concrete
SWCBCC33164	Catch Basin	Concrete
SWCBCC33167	Catch Basin	Concrete
SWCBCC33168	Catch Basin	Concrete
SWCBCC33169	Catch Basin	Concrete
SWCBCC33170	Catch Basin	Concrete
SWCBCC33180	Catch Basin	Concrete
SWCBCC33181	Catch Basin	Concrete
SWCBCC33182	Catch Basin	Concrete
SWCBCC33183	Catch Basin	Concrete
SWCBCC33184	Catch Basin	Concrete
SWCBCC33187	Catch Basin	Concrete
SWCBCC33190	Catch Basin	Concrete
SWCBCC33191	Catch Basin	Concrete
SWCBCC33192	Catch Basin	Concrete
SWCBCC33193	Catch Basin	Concrete
SWCBCC33194	Catch Basin	Concrete
SWCBCC33195	Catch Basin	Concrete
SWCBCC33196	Catch Basin	Concrete
SWCBCC33198	Catch Basin	Concrete
SWCBCC33199	Catch Basin	Concrete
SWCBCC33201	Catch Basin	Concrete
SWCBCC33202	Catch Basin	Concrete
SWCBCC33203	Catch Basin	Concrete
SWCBCC33204	Catch Basin	Concrete
SWCBCC33205	Catch Basin	Concrete
SWCBCC33207	Catch Basin	Concrete
SWCBCC33208	Catch Basin	Concrete
SWCBCC33209	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC33210	Catch Basin	Concrete
SWCBCC33212	Catch Basin	Concrete
SWCBCC33213	Catch Basin	Concrete
SWCBCC33214	Catch Basin	Concrete
SWCBCC33215	Catch Basin	Concrete
SWCBCC33216	Catch Basin	Concrete
SWCBCC33217	Catch Basin	Concrete
SWCBCC33219	Catch Basin	Brick
SWCBDC33223	Catch Basin	Brick
SWCBDC33224	Catch Basin	Brick
SWCBCC33225	Catch Basin	Unknown
SWCBCC33226	Catch Basin	Unknown
SWCBDC33229	Catch Basin	Concrete
SWCBDC33230	Catch Basin	Unknown
SWCBCC33234	Catch Basin	Brick
SWCBCC33235	Catch Basin	Brick
SWCBCC33239	Catch Basin	Brick
SWCBCC33240	Catch Basin	Brick
SWCBDC33243	Catch Basin	Brick
SWCBDC33244	Catch Basin	Brick
SWCBDC33246	Catch Basin	Brick
SWCBDC33247	Catch Basin	Brick
SWCBCC33249	Catch Basin	Brick
SWCBDC33252	Catch Basin	Brick
SWCBDC33253	Catch Basin	Brick
SWCBDC33258	Catch Basin	Brick
SWCBDC33259	Catch Basin	Brick
SWCBDC33262	Catch Basin	Brick
SWCBDC33263	Catch Basin	Brick
SWCBCC33265	Catch Basin	Concrete
SWCBCC33266	Catch Basin	Concrete
SWCBCC33268	Catch Basin	Concrete
SWCBCC33275	Catch Basin	Concrete
SWCBCC33276	Catch Basin	Concrete
SWCBCC33279	Catch Basin	Concrete
SWCBCC33281	Catch Basin	Concrete
SWCBCC33292	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC33293	Catch Basin	Concrete
SWCBCC33295	Catch Basin	Concrete
SWCBCC33297	Catch Basin	Concrete
SWCBCC33298	Catch Basin	Concrete
SWCBCC33299	Catch Basin	Concrete
SWCBCC33303	Catch Basin	Concrete
SWCBCC33320	Catch Basin	Concrete
SWCBCC33323	Catch Basin	Concrete
CCCC0088CB	Catch Basin	Brick
CCCC0089CB	Catch Basin	Brick
CCCC0090CB	Catch Basin	Brick
CCCC0569CB	Catch Basin	Brick
CCCC0570CB	Catch Basin	Brick
CCCC0585CB	Catch Basin	Concrete
CCCC0588CB	Catch Basin	Brick
CCCC0596CB	Catch Basin	Brick
CCCC0597CB	Catch Basin	Brick
CCCC0598CB	Catch Basin	Brick
CCCC0601CB	Catch Basin	Concrete
CCCC0603CB	Catch Basin	Concrete
CCCC0604CB	Catch Basin	Concrete
CCCC0605CB	Catch Basin	Concrete
CCCC0606CB	Catch Basin	Brick
CCCC0607CB	Catch Basin	Brick
CCCC0609CB	Catch Basin	Brick
CCCC0611CB	Catch Basin	Brick
CCCC0612CB	Catch Basin	Brick
CCCC0616CB	Catch Basin	Brick
CCCC0638CB	Catch Basin	Unknown
CCCC0639CB	Catch Basin	Brick
CCCC0654CB	Catch Basin	Brick
CCCC0656CB	Catch Basin	Brick
CCCC0806CB	Catch Basin	Concrete
CCCC0807CB	Catch Basin	Concrete
CCCC0808CB	Catch Basin	Concrete
CCCC0809CB	Catch Basin	Concrete
CCCC0810CB	Catch Basin	Concrete

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Structure ID	Type	Material
CCCC0812CB	Catch Basin	Concrete
CCCC0813CB	Catch Basin	Concrete
CCCC0814CB	Catch Basin	Concrete
CCCC0815CB	Catch Basin	Concrete
CCCC0816CB	Catch Basin	Concrete
CCCC0817CB	Catch Basin	Concrete
CCCC0818CB	Catch Basin	Concrete
CCCC0819CB	Catch Basin	Concrete
CCCC0820CB	Catch Basin	Concrete
CCCC0821CB	Catch Basin	Concrete
CCCC0822CB	Catch Basin	Concrete
CCCC0823CB	Catch Basin	Concrete
CCCC0824CB	Catch Basin	Concrete
CCCC0825CB	Catch Basin	Concrete
CCCC0826CB	Catch Basin	Concrete
CCCC0827CB	Catch Basin	Concrete
CCCC0828CB	Catch Basin	Concrete
CCCC0829CB	Catch Basin	Concrete
CCCC1018CB	Catch Basin	Concrete
CCCC1051CB	Catch Basin	Brick
CCCC1052CB	Catch Basin	Brick
CCCC4066CB	Catch Basin	Brick
CCCC4089CB	Catch Basin	Concrete
CCCC4424CB	Catch Basin	Brick
SWCBCC33351	Catch Basin	Unknown
CCCC4437CB	Catch Basin	Brick
CCCC4448CB	Catch Basin	Brick
CCCC4450CB	Catch Basin	Brick
CCCC4473CB	Catch Basin	Brick
CCCC4475CB	Catch Basin	Brick
CCCC4479CB	Catch Basin	Brick
CCCC4488CB	Catch Basin	Unknown
CCCC4490CB	Catch Basin	Brick
CCCC4500CB	Catch Basin	Unknown
CCCC4513CB	Catch Basin	Concrete
CCCC4519CB	Catch Basin	Brick
CCCC7551CB	Catch Basin	Unknown

Structure ID	Type	Material
SWCBCC8975	Catch Basin	Brick
SWCBCC8983	Catch Basin	Concrete
SWCBCC25216	Catch Basin	Concrete
SWCBCC9342	Catch Basin	Concrete
SWCBCC33332	Catch Basin	Concrete
SWCBCC25217	Catch Basin	Concrete
SWCBCC25218	Catch Basin	Concrete
SWCBCC25220	Catch Basin	Concrete
SWCBCC25221	Catch Basin	Concrete
SWCBCC25223	Catch Basin	Concrete
SWCBCC29900	Catch Basin	Concrete
SWCBCC29901	Catch Basin	Concrete
SWCBCC29902	Catch Basin	Concrete
SWCBCC29903	Catch Basin	Concrete
SWCBCC29904	Catch Basin	Concrete
SWCBCC29905	Catch Basin	Concrete
SWCBCC29906	Catch Basin	Concrete
SWCBCC29907	Catch Basin	Concrete
SWCBCC29908	Catch Basin	Concrete
SWCBCC29909	Catch Basin	Concrete
SWCBCC29910	Catch Basin	Concrete
SWCBCC29911	Catch Basin	Concrete
SWCBCC29917	Catch Basin	Concrete
SWCBCC29918	Catch Basin	Concrete
SWCBCC29919	Catch Basin	Concrete
SWCBCC29920	Catch Basin	Concrete
SWCBCC29921	Catch Basin	Concrete
SWCBCC29922	Catch Basin	Concrete
SWCBCC29923	Catch Basin	Concrete
SWCBCC29924	Catch Basin	Concrete
SWCBCC29928	Catch Basin	Concrete
SWCBCC29934	Catch Basin	Concrete
SWCBCC29935	Catch Basin	Concrete
SWCBCC29942	Catch Basin	Concrete
SWCBCC29943	Catch Basin	Concrete
SWCBCC29944	Catch Basin	Concrete
SWCBCC29945	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC29946	Catch Basin	Concrete
SWCBCC29948	Catch Basin	Concrete
SWCBCC29949	Catch Basin	Concrete
SWCBCC29951	Catch Basin	Concrete
SWCBCC29952	Catch Basin	Concrete
SWCBCC29953	Catch Basin	Concrete
SWCBCC29958	Catch Basin	Concrete
SWCBCC29959	Catch Basin	Concrete
SWCBCC29961	Catch Basin	Concrete
SWCBCC29964	Catch Basin	Concrete
SWCBCC29965	Catch Basin	Concrete
SWCBCC29967	Catch Basin	Concrete
SWCBCC29968	Catch Basin	Concrete
SWCBCC29969	Catch Basin	Concrete
SWCBCC29972	Catch Basin	Concrete
CCCC0905CB	Catch Basin	Brick
CCCC0906CB	Catch Basin	Brick
CCCC4049CB	Catch Basin	Brick
CCCC4035CB	Catch Basin	Brick
CCCC4037CB	Catch Basin	Brick
SWCBCC9052	Catch Basin	Concrete
SWCBCC29602	Catch Basin	Concrete
SWCBCC29603	Catch Basin	Concrete
SWCBCC29604	Catch Basin	Concrete
SWCBCC29605	Catch Basin	Concrete
SWCBCC29609	Catch Basin	Concrete
SWCBCC29610	Catch Basin	Concrete
SWCBCC29611	Catch Basin	Concrete
SWCBCC29612	Catch Basin	Concrete
SWCBCC29617	Catch Basin	Concrete
SWCBCC29618	Catch Basin	Concrete
SWCBCC29619	Catch Basin	Concrete
SWCBCC29620	Catch Basin	Concrete
SWCBCC29621	Catch Basin	Concrete
SWCBCC29623	Catch Basin	Concrete
SWCBCC29624	Catch Basin	Concrete
SWCBCC29625	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC29630	Catch Basin	Concrete
SWCBCC29631	Catch Basin	Concrete
SWCBCC29632	Catch Basin	Concrete
SWCBCC29633	Catch Basin	Concrete
SWCBCC29634	Catch Basin	Concrete
SWCBCC29636	Catch Basin	Concrete
SWCBCC29637	Catch Basin	Concrete
SWCBCC29638	Catch Basin	Concrete
SWCBCC29647	Catch Basin	Concrete
SWCBCC29648	Catch Basin	Concrete
SWCBCC29657	Catch Basin	Concrete
SWCBCC29658	Catch Basin	Concrete
SWCBCC29660	Catch Basin	Concrete
SWCBCC29665	Catch Basin	Concrete
SWCBCC29666	Catch Basin	Concrete
SWCBCC29680	Catch Basin	Concrete
SWCBCC29682	Catch Basin	Brick
SWCBCC29685	Catch Basin	Brick
SWCBCC29687	Catch Basin	Concrete
SWCBCC29688	Catch Basin	Concrete
SWCBCC29689	Catch Basin	Concrete
SWCBCC29691	Catch Basin	Concrete
SWCBCC29693	Catch Basin	Concrete
SWCBCC29694	Catch Basin	Brick
SWCBCC29696	Catch Basin	Concrete
SWCBCC29697	Catch Basin	Concrete
SWCBCC29698	Catch Basin	Concrete
SWCBCC29699	Catch Basin	Concrete
SWCBCC29700	Catch Basin	Concrete
SWCBCC29712	Catch Basin	Concrete
SWCBCC29713	Catch Basin	Concrete
SWCBCC29715	Catch Basin	Concrete
SWCBCC29716	Catch Basin	Concrete
SWCBCC29719	Catch Basin	Concrete
SWCBCC29723	Catch Basin	Concrete
SWCBCC29724	Catch Basin	Concrete
SWCBCC29742	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC29743	Catch Basin	Concrete
SWCBCC29746	Catch Basin	Concrete
SWCBCC29747	Catch Basin	Concrete
SWCBCC29751	Catch Basin	Concrete
SWCBCC29754	Catch Basin	Concrete
SWCBCC29755	Catch Basin	Concrete
SWCBCC29756	Catch Basin	Concrete
SWCBCC29757	Catch Basin	Concrete
SWCBCC29770	Catch Basin	Concrete
SWCBCC29771	Catch Basin	Concrete
SWCBCC29773	Catch Basin	Concrete
SWCBCC29774	Catch Basin	Concrete
SWCBCC29775	Catch Basin	Concrete
SWCBCC29776	Catch Basin	Concrete
SWCBCC29778	Catch Basin	Concrete
SWCBCC29779	Catch Basin	Concrete
SWCBCC29780	Catch Basin	Concrete
SWCBCC29781	Catch Basin	Concrete
SWCBCC29782	Catch Basin	Concrete
SWCBCC29783	Catch Basin	Concrete
SWCBCC29784	Catch Basin	Concrete
SWCBCC29785	Catch Basin	Concrete
SWCBCC29787	Catch Basin	Concrete
SWCBCC29791	Catch Basin	Concrete
SWCBCC29797	Catch Basin	Concrete
SWCBCC29803	Catch Basin	Concrete
SWCBCC29807	Catch Basin	Concrete
SWCBCC29808	Catch Basin	Concrete
SWCBCC29811	Catch Basin	Concrete
SWCBCC29812	Catch Basin	Concrete
SWCBCC29814	Catch Basin	Concrete
SWCBCC29815	Catch Basin	Concrete
SWCBCC29823	Catch Basin	Concrete
SWCBCC29824	Catch Basin	Concrete
SWCBCC29827	Catch Basin	Concrete
SWCBCC29828	Catch Basin	Concrete
SWCBCC29833	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC29834	Catch Basin	Concrete
SWCBCC29837	Catch Basin	Concrete
SWCBCC29838	Catch Basin	Concrete
SWCBCC29841	Catch Basin	Concrete
SWCBCC29842	Catch Basin	Concrete
SWCBCC29845	Catch Basin	Concrete
SWCBCC29846	Catch Basin	Concrete
SWCBCC29847	Catch Basin	Concrete
SWCBCC29852	Catch Basin	Concrete
SWCBCC29862	Catch Basin	Concrete
SWCBCC29863	Catch Basin	Concrete
SWCBCC29865	Catch Basin	Concrete
SWCBCC29867	Catch Basin	Concrete
SWCBCC29868	Catch Basin	Concrete
SWCBCC29869	Catch Basin	Concrete
SWCBCC29872	Catch Basin	Concrete
SWCBCC29874	Catch Basin	Concrete
SWCBCC29973	Catch Basin	Concrete
SWCBCC29974	Catch Basin	Concrete
SWCBCC29975	Catch Basin	Concrete
SWCBCC29979	Catch Basin	Brick
SWCBCC29980	Catch Basin	Brick
SWCBCC29981	Catch Basin	Brick
SWCBCC29983	Catch Basin	Concrete
SWCBCC29987	Catch Basin	Concrete
SWCBCC29989	Catch Basin	Concrete
CCCC0249CB	Catch Basin	Brick
CCCC0250CB	Catch Basin	Brick
CCCC0255CB	Catch Basin	Brick
CCCC0312CB	Catch Basin	Concrete
CCCC0314CB	Catch Basin	Concrete
CCCC0333CB	Catch Basin	Concrete
CCCC0341CB	Catch Basin	Concrete
CCCC0436CB	Catch Basin	Concrete
CCCC0437CB	Catch Basin	Concrete
CCCC0438CB	Catch Basin	Concrete
CCCC0439CB	Catch Basin	Concrete

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Structure ID	Type	Material
CCCC0440CB	Catch Basin	Concrete
CCCC0441CB	Catch Basin	Concrete
CCCC0442CB	Catch Basin	Concrete
CCCC0443CB	Catch Basin	Concrete
CCCC0444CB	Catch Basin	Concrete
CCCC0445CB	Catch Basin	Concrete
CCCC0446CB	Catch Basin	Concrete
CCCC0448CB	Catch Basin	Concrete
CCCC0449CB	Catch Basin	Concrete
CCCC0450CB	Catch Basin	Concrete
CCCC0451CB	Catch Basin	Concrete
CCCC0452CB	Catch Basin	Concrete
CCCC0453CB	Catch Basin	Concrete
CCCC0454CB	Catch Basin	Concrete
CCCC0455CB	Catch Basin	Concrete
CCCC0456CB	Catch Basin	Concrete
CCCC0457CB	Catch Basin	Concrete
CCCC0458CB	Catch Basin	Concrete
CCCC0459CB	Catch Basin	Concrete
CCCC0460CB	Catch Basin	Concrete
CCCC0461CB	Catch Basin	Concrete
CCCC0463CB	Catch Basin	Concrete
CCCC0468CB	Catch Basin	Brick
CCCC0469CB	Catch Basin	Brick
CCCC0470CB	Catch Basin	Brick
CCCC0471CB	Catch Basin	Brick
CCCC1616CB	Catch Basin	Concrete
CCCC0900CB	Catch Basin	Brick
CCCC0901CB	Catch Basin	Brick
CCCC0902CB	Catch Basin	Brick
CCCC0903CB	Catch Basin	Brick
CCCC1066CB	Catch Basin	Brick
CCCC1067CB	Catch Basin	Brick
CCCC1618CB	Catch Basin	Concrete
CCCC1581CB	Catch Basin	Concrete
SWCBCC8933	Catch Basin	Concrete
SWCBCC8938	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24951	Catch Basin	Concrete
SWCBCC29882	Catch Basin	Concrete
CCCC1070CB	Catch Basin	Brick
CCCC1630CB	Catch Basin	Concrete
CCCC1702CB	Catch Basin	Brick
CCCC1704CB	Catch Basin	Brick
CCCC2304CB	Catch Basin	Concrete
SWCBCC24952	Catch Basin	Concrete
SWCBCC24953	Catch Basin	Concrete
SWCBCC9387	Catch Basin	Concrete
SWCBCC9388	Catch Basin	Concrete
CCCC2594CB	Catch Basin	Brick
SWCBCC24959	Catch Basin	Concrete
SWCBCC24960	Catch Basin	Concrete
SWCBCC24961	Catch Basin	Concrete
SWCBCC24962	Catch Basin	Concrete
CCCC2598CB	Catch Basin	Brick
CCCC2599CB	Catch Basin	Brick
CCCC2600CB	Catch Basin	Brick
CCCC2684CB	Catch Basin	Unknown
SWCBCC24963	Catch Basin	Concrete
SWCBCC24964	Catch Basin	Concrete
SWCBCC24966	Catch Basin	Concrete
CCCC2686CB	Catch Basin	Brick
CCCC2697CB	Catch Basin	Brick
CCCC2699CB	Catch Basin	Unknown
CCCC2903CB	Catch Basin	Brick
CCCC2905CB	Catch Basin	Brick
CCCC2907CB	Catch Basin	Unknown
CCCC2909CB	Catch Basin	Brick
SWCBCC24969	Catch Basin	Concrete
SWCBCC25032	Catch Basin	Concrete
SWCBCC25033	Catch Basin	Concrete
SWCBCC25034	Catch Basin	Concrete
SWCBCC29883	Catch Basin	Concrete
CCCC3034CB	Catch Basin	Brick
CCCC3036CB	Catch Basin	Brick

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Structure ID	Type	Material
CCCC3039CB	Catch Basin	Unknown
CCCC3041CB	Catch Basin	Unknown
CCCC3447CB	Catch Basin	Brick
CCCC3453CB	Catch Basin	Brick
SWCBCC25035	Catch Basin	Concrete
CCCC3463CB	Catch Basin	Unknown
CCCC3465CB	Catch Basin	Unknown
CCCC3468CB	Catch Basin	Unknown
CCCC3470CB	Catch Basin	Unknown
CCCC3476CB	Catch Basin	Unknown
CCCC3478CB	Catch Basin	Unknown
CCCC3484CB	Catch Basin	Brick
SWCBCC25038	Catch Basin	Concrete
SWCBCC25039	Catch Basin	Concrete
SWCBCC25040	Catch Basin	Concrete
SWCBCC25043	Catch Basin	Concrete
SWCBCC25044	Catch Basin	Concrete
CCCC4000CB	Catch Basin	Brick
SWCBCC8960	Catch Basin	Concrete
SWCBCC8961	Catch Basin	Concrete
SWCBCC8965	Catch Basin	Concrete
SWCBCC25050	Catch Basin	Concrete
SWCBCC25030	Catch Basin	Concrete
SWCBCC25031	Catch Basin	Concrete
SWCBCC9066	Catch Basin	Brick
SWCBCC29885	Catch Basin	Concrete
SWCBCC29886	Catch Basin	Concrete
SWCBCC29887	Catch Basin	Concrete
SWCBCC29888	Catch Basin	Concrete
SWCBCC29890	Catch Basin	Concrete
SWCBCC29891	Catch Basin	Concrete
SWCBCC29892	Catch Basin	Concrete
SWCBCC29893	Catch Basin	Concrete
SWCBCC29895	Catch Basin	Concrete
SWCBCC29896	Catch Basin	Concrete
SWCBCC24688	Catch Basin	Concrete
SWCBCC24689	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24690	Catch Basin	Concrete
SWCBCC24691	Catch Basin	Concrete
SWCBCC24692	Catch Basin	Concrete
SWCBCC24693	Catch Basin	Concrete
SWCBCC24696	Catch Basin	Concrete
SWCBCC24697	Catch Basin	Concrete
SWCBCC24700	Catch Basin	Concrete
SWCBCC24701	Catch Basin	Concrete
SWCBCC24704	Catch Basin	Concrete
SWCBCC24706	Catch Basin	Concrete
SWCBCC24707	Catch Basin	Concrete
SWCBCC24708	Catch Basin	Concrete
SWCBCC24716	Catch Basin	Concrete
SWCBCC24717	Catch Basin	Concrete
SWCBCC24718	Catch Basin	Concrete
SWCBCC24719	Catch Basin	Concrete
SWCBCC24722	Catch Basin	Concrete
SWCBCC24723	Catch Basin	Concrete
SWCBCC24727	Catch Basin	Concrete
SWCBCC24728	Catch Basin	Concrete
SWCBCC24733	Catch Basin	Concrete
SWCBCC24734	Catch Basin	Concrete
SWCBCC24735	Catch Basin	Concrete
SWCBCC24736	Catch Basin	Concrete
SWCBCC24737	Catch Basin	Concrete
SWCBCC24738	Catch Basin	Concrete
SWCBCC24739	Catch Basin	Concrete
SWCBCC24740	Catch Basin	Concrete
SWCBCC24741	Catch Basin	Concrete
SWCBCC24742	Catch Basin	Concrete
SWCBCC24743	Catch Basin	Concrete
SWCBCC24744	Catch Basin	Concrete
SWCBCC24745	Catch Basin	Concrete
SWCBCC24746	Catch Basin	Concrete
SWCBCC24747	Catch Basin	Concrete
SWCBCC24748	Catch Basin	Concrete
SWCBCC24753	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24754	Catch Basin	Concrete
SWCBCC24756	Catch Basin	Concrete
SWCBCC24757	Catch Basin	Concrete
SWCBCC24759	Catch Basin	Concrete
SWCBCC24760	Catch Basin	Concrete
SWCBCC24761	Catch Basin	Concrete
SWCBCC24762	Catch Basin	Concrete
SWCBCC24765	Catch Basin	Concrete
SWCBCC24766	Catch Basin	Concrete
SWCBCC24771	Catch Basin	Concrete
SWCBCC24772	Catch Basin	Concrete
SWCBCC24775	Catch Basin	Concrete
SWCBCC24776	Catch Basin	Concrete
SWCBCC24779	Catch Basin	Concrete
SWCBCC24780	Catch Basin	Concrete
SWCBCC24781	Catch Basin	Concrete
CCCC0464CB	Catch Basin	Brick
CCCC2314CB	Catch Basin	Brick
SWCBCC26851	Catch Basin	Concrete
SWCBCC26852	Catch Basin	Concrete
SWCBCC26838	Catch Basin	Unknown
SWCBCC26839	Catch Basin	Concrete
SWCBCC26842	Catch Basin	Concrete
SWCBCC26843	Catch Basin	Unknown
SWCBCC26844	Catch Basin	Concrete
SWCBCC26845	Catch Basin	Unknown
SWCBCC24810	Catch Basin	Concrete
SWCBCC24811	Catch Basin	Concrete
SWCBCC24814	Catch Basin	Concrete
SWCBCC24815	Catch Basin	Concrete
SWCBCC24817	Catch Basin	Concrete
SWCBCC24818	Catch Basin	Concrete
SWCBCC24821	Catch Basin	Concrete
SWCBCC24822	Catch Basin	Concrete
SWCBCC24824	Catch Basin	Concrete
SWCBCC24825	Catch Basin	Concrete
SWCBCC24827	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC26848	Catch Basin	Concrete
SWCBCC24828	Catch Basin	Concrete
SWCBCC24830	Catch Basin	Concrete
SWCBCC24831	Catch Basin	Concrete
SWCBCC24834	Catch Basin	Concrete
SWCBCC24835	Catch Basin	Concrete
SWCBCC24840	Catch Basin	Concrete
SWCBCC24841	Catch Basin	Concrete
SWCBCC24843	Catch Basin	Concrete
SWCBCC24844	Catch Basin	Concrete
SWCBCC26849	Catch Basin	Unknown
SWCBCC26818	Catch Basin	Concrete
SWCBCC26819	Catch Basin	Unknown
SWCBCC24849	Catch Basin	Concrete
SWCBCC24850	Catch Basin	Concrete
SWCBCC24851	Catch Basin	Concrete
SWCBCC24852	Catch Basin	Concrete
SWCBCC24853	Catch Basin	Concrete
SWCBCC24854	Catch Basin	Concrete
SWCBCC24867	Catch Basin	Concrete
SWCBCC24868	Catch Basin	Concrete
SWCBCC24869	Catch Basin	Concrete
SWCBCC24870	Catch Basin	Concrete
SWCBCC24871	Catch Basin	Concrete
SWCBCC24872	Catch Basin	Concrete
SWCBCC24873	Catch Basin	Concrete
SWCBCC24874	Catch Basin	Concrete
SWCBCC24875	Catch Basin	Concrete
SWCBCC24876	Catch Basin	Concrete
SWCBCC24880	Catch Basin	Concrete
SWCBCC24881	Catch Basin	Concrete
SWCBCC24882	Catch Basin	Concrete
SWCBCC24883	Catch Basin	Concrete
SWCBCC24884	Catch Basin	Concrete
SWCBCC24885	Catch Basin	Concrete
SWCBCC24886	Catch Basin	Concrete
SWCBCC24887	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24888	Catch Basin	Concrete
SWCBCC24889	Catch Basin	Concrete
SWCBCC24890	Catch Basin	Concrete
SWCBCC24891	Catch Basin	Concrete
SWCBCC24892	Catch Basin	Concrete
SWCBCC24893	Catch Basin	Concrete
SWCBCC24894	Catch Basin	Concrete
SWCBCC24895	Catch Basin	Concrete
SWCBCC24896	Catch Basin	Concrete
SWCBCC24897	Catch Basin	Concrete
SWCBCC24898	Catch Basin	Concrete
SWCBCC24899	Catch Basin	Concrete
SWCBCC24900	Catch Basin	Concrete
SWCBCC24901	Catch Basin	Concrete
SWCBCC24903	Catch Basin	Concrete
SWCBCC24904	Catch Basin	Concrete
SWCBCC24909	Catch Basin	Concrete
SWCBCC24910	Catch Basin	Concrete
SWCBCC24911	Catch Basin	Concrete
SWCBCC24913	Catch Basin	Concrete
SWCBCC24916	Catch Basin	Concrete
SWCBCC24917	Catch Basin	Concrete
SWCBCC24918	Catch Basin	Concrete
SWCBCC24919	Catch Basin	Concrete
SWCBCC24921	Catch Basin	Concrete
SWCBCC24922	Catch Basin	Concrete
SWCBCC24926	Catch Basin	Concrete
SWCBCC24927	Catch Basin	Concrete
SWCBCC24928	Catch Basin	Concrete
SWCBCC24929	Catch Basin	Concrete
SWCBCC24930	Catch Basin	Concrete
SWCBCC24931	Catch Basin	Concrete
SWCBCC24932	Catch Basin	Concrete
SWCBCC24935	Catch Basin	Concrete
SWCBCC24936	Catch Basin	Concrete
SWCBCC24937	Catch Basin	Concrete
SWCBCC24938	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24939	Catch Basin	Concrete
SWCBCC24940	Catch Basin	Concrete
SWCBCC24970	Catch Basin	Concrete
SWCBCC24971	Catch Basin	Concrete
SWCBCC24973	Catch Basin	Concrete
SWCBCC24974	Catch Basin	Concrete
SWCBCC24975	Catch Basin	Concrete
SWCBCC24977	Catch Basin	Concrete
SWCBCC24980	Catch Basin	Concrete
SWCBCC24981	Catch Basin	Concrete
SWCBCC24983	Catch Basin	Concrete
SWCBCC24984	Catch Basin	Concrete
SWCBCC24985	Catch Basin	Concrete
SWCBCC24986	Catch Basin	Concrete
SWCBCC24987	Catch Basin	Concrete
SWCBCC24988	Catch Basin	Concrete
SWCBCC24989	Catch Basin	Concrete
SWCBCC24990	Catch Basin	Concrete
SWCBCC25002	Catch Basin	Concrete
SWCBCC25003	Catch Basin	Concrete
SWCBCC25005	Catch Basin	Concrete
SWCBCC25006	Catch Basin	Concrete
SWCBCC25011	Catch Basin	Concrete
SWCBCC25012	Catch Basin	Concrete
SWCBCC25013	Catch Basin	Concrete
SWCBCC25014	Catch Basin	Concrete
SWCBCC25015	Catch Basin	Concrete
SWCBCC25019	Catch Basin	Concrete
SWCBCC25020	Catch Basin	Concrete
SWCBCC25021	Catch Basin	Concrete
SWCBCC25022	Catch Basin	Concrete
SWCBCC25023	Catch Basin	Concrete
SWCBCC25024	Catch Basin	Concrete
SWCBCC25025	Catch Basin	Concrete
SWCBCC25055	Catch Basin	Concrete
SWCBCC25060	Catch Basin	Concrete
SWCBCC25249	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC25061	Catch Basin	Concrete
SWCBCC25062	Catch Basin	Concrete
SWCBCC25063	Catch Basin	Concrete
SWCBCC25065	Catch Basin	Concrete
SWCBCC25066	Catch Basin	Concrete
SWCBCC25067	Catch Basin	Concrete
SWCBCC25068	Catch Basin	Concrete
SWCBCC25091	Catch Basin	Concrete
SWCBCC25092	Catch Basin	Concrete
SWCBCC25093	Catch Basin	Concrete
SWCBCC25094	Catch Basin	Concrete
SWCBCC25100	Catch Basin	Concrete
SWCBCC25101	Catch Basin	Concrete
SWCBCC25102	Catch Basin	Concrete
SWCBCC25103	Catch Basin	Concrete
SWCBCC25113	Catch Basin	Concrete
SWCBCC25114	Catch Basin	Concrete
SWCBCC25124	Catch Basin	Concrete
SWCBCC25125	Catch Basin	Concrete
SWCBCC25127	Catch Basin	Concrete
SWCBCC25128	Catch Basin	Concrete
SWCBCC25131	Catch Basin	Concrete
SWCBCC25132	Catch Basin	Concrete
SWCBCC25133	Catch Basin	Concrete
SWCBCC25134	Catch Basin	Concrete
SWCBCC25135	Catch Basin	Concrete
SWCBCC25136	Catch Basin	Concrete
SWCBCC25139	Catch Basin	Concrete
SWCBCC25140	Catch Basin	Concrete
SWCBCC25142	Catch Basin	Concrete
SWCBCC25143	Catch Basin	Concrete
SWCBCC25146	Catch Basin	Brick
SWCBCC25147	Catch Basin	Brick
SWCBCC25151	Catch Basin	Concrete
SWCBCC25153	Catch Basin	Concrete
SWCBCC25155	Catch Basin	Concrete
SWCBCC25156	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC25158	Catch Basin	Concrete
SWCBCC25159	Catch Basin	Concrete
SWCBCC25167	Catch Basin	Concrete
SWCBCC25168	Catch Basin	Concrete
SWCBCC25171	Catch Basin	Concrete
SWCBCC25172	Catch Basin	Concrete
SWCBCC25192	Catch Basin	Concrete
SWCBCC25193	Catch Basin	Concrete
SWCBCC25195	Catch Basin	Concrete
SWCBCC25196	Catch Basin	Concrete
SWCBCC24636	Catch Basin	Concrete
SWCBCC24637	Catch Basin	Concrete
SWCBCC24638	Catch Basin	Concrete
SWCBCC24639	Catch Basin	Concrete
SWCBCC24640	Catch Basin	Concrete
SWCBCC24641	Catch Basin	Concrete
SWCBCC24642	Catch Basin	Concrete
SWCBCC24644	Catch Basin	Concrete
SWCBCC24645	Catch Basin	Concrete
SWCBCC24646	Catch Basin	Concrete
SWCBCC24647	Catch Basin	Concrete
SWCBCC24649	Catch Basin	Concrete
SWCBCC24650	Catch Basin	Concrete
SWCBCC24651	Catch Basin	Concrete
SWCBCC24652	Catch Basin	Concrete
SWCBCC24662	Catch Basin	Concrete
SWCBCC24663	Catch Basin	Concrete
SWCBCC24664	Catch Basin	Concrete
SWCBCC24665	Catch Basin	Concrete
SWCBCC24666	Catch Basin	Concrete
SWCBCC24667	Catch Basin	Concrete
SWCBCC24668	Catch Basin	Concrete
SWCBCC24669	Catch Basin	Concrete
SWCBCC24677	Catch Basin	Concrete
SWCBCC24678	Catch Basin	Concrete
SWCBCC24679	Catch Basin	Concrete
SWCBCC24681	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24682	Catch Basin	Concrete
SWCBCC24683	Catch Basin	Concrete
SWCBCC24684	Catch Basin	Concrete
SWCBCC23254	Catch Basin	Concrete
SWCBCC23255	Catch Basin	Concrete
SWCBCC23256	Catch Basin	Concrete
SWCBCC23257	Catch Basin	Concrete
SWCBCC23258	Catch Basin	Concrete
SWCBCC23259	Catch Basin	Concrete
SWCBCC23260	Catch Basin	Concrete
SWCBCC23261	Catch Basin	Concrete
SWCBCC23262	Catch Basin	Concrete
SWCBCC23263	Catch Basin	Concrete
SWCBCC23272	Catch Basin	Concrete
SWCBCC23273	Catch Basin	Concrete
SWCBCC23274	Catch Basin	Concrete
SWCBCC23275	Catch Basin	Concrete
SWCBCC23276	Catch Basin	Concrete
SWCBCC23277	Catch Basin	Concrete
SWCBCC23278	Catch Basin	Concrete
SWCBCC23285	Catch Basin	Concrete
SWCBCC23287	Catch Basin	Concrete
SWCBCC23288	Catch Basin	Concrete
SWCBCC23289	Catch Basin	Concrete
SWCBCC23290	Catch Basin	Concrete
SWCBCC23291	Catch Basin	Concrete
SWCBCC23292	Catch Basin	Concrete
SWCBCC23293	Catch Basin	Concrete
SWCBCC23294	Catch Basin	Concrete
SWCBCC23296	Catch Basin	Concrete
SWCBCC23297	Catch Basin	Concrete
SWCBCC23299	Catch Basin	Concrete
SWCBCC23300	Catch Basin	Concrete
SWCBCC23302	Catch Basin	Concrete
SWCBCC23303	Catch Basin	Concrete
SWCBCC23304	Catch Basin	Concrete
SWCBCC23305	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC23307	Catch Basin	Concrete
SWCBCC23312	Catch Basin	Concrete
SWCBCC23313	Catch Basin	Concrete
SWCBCC23315	Catch Basin	Concrete
SWCBCC23316	Catch Basin	Concrete
SWCBCC23318	Catch Basin	Concrete
SWCBCC23253	Catch Basin	Concrete
SWCBCC23319	Catch Basin	Concrete
SWCBCC23320	Catch Basin	Concrete
SWCBCC23321	Catch Basin	Concrete
SWCBCC23322	Catch Basin	Concrete
SWCBCC23323	Catch Basin	Concrete
SWCBCC23325	Catch Basin	Concrete
SWCBCC23327	Catch Basin	Concrete
SWCBCC23329	Catch Basin	Concrete
SWCBCC23330	Catch Basin	Concrete
SWCBCC23332	Catch Basin	Concrete
SWCBCC23334	Catch Basin	Concrete
SWCBCC23336	Catch Basin	Concrete
SWCBCC23337	Catch Basin	Concrete
SWCBCC23338	Catch Basin	Concrete
SWCBCC23342	Catch Basin	Concrete
SWCBCC23344	Catch Basin	Concrete
SWCBCC23345	Catch Basin	Concrete
SWCBCC23346	Catch Basin	Concrete
SWCBCC23351	Catch Basin	Concrete
SWCBCC23352	Catch Basin	Concrete
SWCBCC23353	Catch Basin	Concrete
SWCBCC23354	Catch Basin	Concrete
SWCBCC23355	Catch Basin	Concrete
SWCBCC23356	Catch Basin	Concrete
SWCBCC23357	Catch Basin	Concrete
SWCBCC23359	Catch Basin	Concrete
SWCBCC23360	Catch Basin	Concrete
SWCBCC23366	Catch Basin	Concrete
SWCBCC23367	Catch Basin	Concrete
SWCBCC23368	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC23369	Catch Basin	Concrete
SWCBCC23370	Catch Basin	Concrete
SWCBCC23376	Catch Basin	Concrete
SWCBCC23377	Catch Basin	Concrete
SWCBCC23378	Catch Basin	Concrete
SWCBCC23379	Catch Basin	Concrete
SWCBCC23380	Catch Basin	Concrete
SWCBCC23381	Catch Basin	Concrete
SWCBCC23383	Catch Basin	Concrete
SWCBCC23385	Catch Basin	Concrete
SWCBCC23386	Catch Basin	Concrete
SWCBCC23387	Catch Basin	Concrete
CCCC0258CB	Catch Basin	Concrete
SWCBCC23408	Catch Basin	Concrete
SWCBCC23409	Catch Basin	Concrete
SWCBCC23410	Catch Basin	Concrete
SWCBCC25250	Catch Basin	Concrete
CCCC0259CB	Catch Basin	Concrete
SWCBCC23413	Catch Basin	Concrete
SWCBCC23416	Catch Basin	Concrete
SWCBCC23417	Catch Basin	Concrete
SWCBCC23420	Catch Basin	Concrete
SWCBCC23421	Catch Basin	Concrete
SWCBCC23425	Catch Basin	Concrete
SWCBCC23426	Catch Basin	Concrete
SWCBCC23430	Catch Basin	Concrete
SWCBCC23431	Catch Basin	Concrete
SWCBCC23441	Catch Basin	Concrete
SWCBCC23442	Catch Basin	Concrete
SWCBCC23444	Catch Basin	Concrete
SWCBCC23446	Catch Basin	Concrete
SWCBCC23447	Catch Basin	Concrete
SWCBCC23451	Catch Basin	Concrete
SWCBCC23452	Catch Basin	Concrete
SWCBCC23453	Catch Basin	Concrete
SWCBCC23461	Catch Basin	Concrete
SWCBCC23462	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC23463	Catch Basin	Concrete
SWCBCC23464	Catch Basin	Concrete
SWCBCC23465	Catch Basin	Concrete
SWCBCC23469	Catch Basin	Concrete
SWCBCC23475	Catch Basin	Concrete
CCCC0260CB	Catch Basin	Concrete
SWCBCC23476	Catch Basin	Concrete
SWCBCC23477	Catch Basin	Concrete
SWCBCC23479	Catch Basin	Concrete
SWCBCC23481	Catch Basin	Concrete
SWCBCC23484	Catch Basin	Concrete
SWCBCC23485	Catch Basin	Concrete
SWCBCC23490	Catch Basin	Concrete
SWCBCC23491	Catch Basin	Concrete
SWCBCC23492	Catch Basin	Concrete
SWCBCC23494	Catch Basin	Concrete
SWCBCC23495	Catch Basin	Concrete
SWCBCC23501	Catch Basin	Concrete
SWCBCC23502	Catch Basin	Concrete
SWCBCC23503	Catch Basin	Concrete
SWCBCC23508	Catch Basin	Concrete
SWCBCC23509	Catch Basin	Concrete
SWCBCC23510	Catch Basin	Concrete
SWCBCC23511	Catch Basin	Concrete
SWCBCC23512	Catch Basin	Concrete
SWCBCC23513	Catch Basin	Concrete
SWCBCC23514	Catch Basin	Concrete
SWCBCC23515	Catch Basin	Concrete
SWCBCC23516	Catch Basin	Concrete
SWCBCC23517	Catch Basin	Concrete
SWCBCC23521	Catch Basin	Concrete
SWCBCC23528	Catch Basin	Concrete
SWCBCC23529	Catch Basin	Concrete
SWCBCC23531	Catch Basin	Concrete
SWCBCC23532	Catch Basin	Concrete
SWCBCC23534	Catch Basin	Concrete
SWCBCC23535	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC23536	Catch Basin	Concrete
SWCBCC23537	Catch Basin	Concrete
SWCBCC23538	Catch Basin	Concrete
SWCBCC23539	Catch Basin	Concrete
SWCBCC23546	Catch Basin	Concrete
SWCBCC23547	Catch Basin	Concrete
SWCBCC23548	Catch Basin	Concrete
SWCBCC23549	Catch Basin	Concrete
SWCBCC23550	Catch Basin	Concrete
SWCBCC23552	Catch Basin	Concrete
SWCBCC23555	Catch Basin	Concrete
SWCBCC23556	Catch Basin	Concrete
SWCBCC23557	Catch Basin	Concrete
SWCBCC23558	Catch Basin	Concrete
SWCBCC23559	Catch Basin	Concrete
SWCBCC23560	Catch Basin	Concrete
SWCBCC23561	Catch Basin	Concrete
SWCBCC23562	Catch Basin	Concrete
SWCBCC23563	Catch Basin	Concrete
SWCBCC23564	Catch Basin	Concrete
SWCBCC23567	Catch Basin	Concrete
SWCBCC23568	Catch Basin	Concrete
SWCBCC23574	Catch Basin	Concrete
SWCBCC23578	Catch Basin	Concrete
SWCBCC23583	Catch Basin	Concrete
SWCBCC23584	Catch Basin	Concrete
SWCBCC23590	Catch Basin	Concrete
SWCBCC23591	Catch Basin	Concrete
SWCBCC23593	Catch Basin	Concrete
SWCBCC23594	Catch Basin	Concrete
SWCBCC23595	Catch Basin	Concrete
SWCBCC23596	Catch Basin	Concrete
SWCBCC23601	Catch Basin	Concrete
SWCBCC23602	Catch Basin	Concrete
SWCBCC23606	Catch Basin	Concrete
SWCBCC23608	Catch Basin	Concrete
SWCBCC23621	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC23622	Catch Basin	Concrete
SWCBCC23623	Catch Basin	Concrete
SWCBCC23624	Catch Basin	Concrete
SWCBCC23625	Catch Basin	Concrete
SWCBCC23626	Catch Basin	Concrete
SWCBCC23632	Catch Basin	Concrete
SWCBCC23633	Catch Basin	Concrete
SWCBCC23635	Catch Basin	Concrete
SWCBCC23636	Catch Basin	Concrete
SWCBCC23637	Catch Basin	Concrete
SWCBCC23638	Catch Basin	Concrete
SWCBCC23639	Catch Basin	Concrete
SWCBCC23640	Catch Basin	Concrete
SWCBCC23642	Catch Basin	Concrete
SWCBCC23643	Catch Basin	Concrete
SWCBCC23650	Catch Basin	Concrete
SWCBCC23654	Catch Basin	Concrete
SWCBCC23655	Catch Basin	Concrete
CCCC0261CB	Catch Basin	Concrete
SWCBCC23660	Catch Basin	Concrete
SWCBCC23661	Catch Basin	Concrete
SWCBCC23662	Catch Basin	Concrete
SWCBCC23663	Catch Basin	Concrete
SWCBCC23665	Catch Basin	Concrete
SWCBCC23666	Catch Basin	Concrete
SWCBCC23667	Catch Basin	Concrete
SWCBCC23668	Catch Basin	Concrete
SWCBCC23669	Catch Basin	Concrete
SWCBCC23675	Catch Basin	Concrete
SWCBCC23676	Catch Basin	Concrete
SWCBCC23682	Catch Basin	Concrete
SWCBCC23683	Catch Basin	Concrete
SWCBCC23685	Catch Basin	Concrete
SWCBCC23690	Catch Basin	Concrete
SWCBCC23691	Catch Basin	Concrete
SWCBCC23692	Catch Basin	Concrete
SWCBCC23693	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC23694	Catch Basin	Concrete
SWCBCC23695	Catch Basin	Concrete
SWCBCC23696	Catch Basin	Concrete
SWCBCC23697	Catch Basin	Concrete
SWCBCC23698	Catch Basin	Concrete
SWCBCC23701	Catch Basin	Concrete
SWCBCC23702	Catch Basin	Concrete
SWCBCC23703	Catch Basin	Concrete
SWCBCC23704	Catch Basin	Concrete
SWCBCC23705	Catch Basin	Concrete
SWCBCC23706	Catch Basin	Concrete
SWCBCC23707	Catch Basin	Concrete
SWCBCC23711	Catch Basin	Concrete
SWCBCC23713	Catch Basin	Concrete
SWCBCC23715	Catch Basin	Concrete
SWCBCC23718	Catch Basin	Concrete
SWCBCC23719	Catch Basin	Concrete
SWCBCC23720	Catch Basin	Concrete
SWCBCC23721	Catch Basin	Concrete
SWCBCC23724	Catch Basin	Concrete
SWCBCC23725	Catch Basin	Concrete
SWCBCC23726	Catch Basin	Concrete
SWCBCC23734	Catch Basin	Concrete
SWCBCC23735	Catch Basin	Concrete
SWCBCC23736	Catch Basin	Concrete
SWCBCC23737	Catch Basin	Concrete
SWCBCC23738	Catch Basin	Concrete
SWCBCC23739	Catch Basin	Concrete
SWCBCC23741	Catch Basin	Concrete
SWCBCC23742	Catch Basin	Concrete
SWCBCC23744	Catch Basin	Concrete
SWCBCC23745	Catch Basin	Concrete
SWCBCC23747	Catch Basin	Concrete
SWCBCC23748	Catch Basin	Concrete
SWCBCC23764	Catch Basin	Concrete
SWCBCC23765	Catch Basin	Concrete
SWCBCC23766	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC23767	Catch Basin	Concrete
SWCBCC23768	Catch Basin	Concrete
SWCBCC23771	Catch Basin	Concrete
SWCBCC23772	Catch Basin	Concrete
SWCBCC23773	Catch Basin	Concrete
SWCBCC23776	Catch Basin	Concrete
SWCBCC23777	Catch Basin	Concrete
SWCBCC23778	Catch Basin	Concrete
SWCBCC23779	Catch Basin	Concrete
SWCBCC23781	Catch Basin	Concrete
SWCBCC23785	Catch Basin	Concrete
SWCBCC23786	Catch Basin	Concrete
SWCBCC23787	Catch Basin	Concrete
SWCBCC23790	Catch Basin	Concrete
SWCBCC23791	Catch Basin	Concrete
SWCBCC23793	Catch Basin	Concrete
SWCBCC23794	Catch Basin	Concrete
SWCBCC23795	Catch Basin	Concrete
SWCBCC23796	Catch Basin	Concrete
SWCBCC23797	Catch Basin	Concrete
SWCBCC23798	Catch Basin	Concrete
SWCBCC23800	Catch Basin	Concrete
SWCBCC23801	Catch Basin	Concrete
SWCBCC23813	Catch Basin	Concrete
SWCBCC23814	Catch Basin	Concrete
SWCBCC23816	Catch Basin	Concrete
SWCBCC23817	Catch Basin	Concrete
SWCBCC23819	Catch Basin	Concrete
SWCBCC23820	Catch Basin	Concrete
SWCBCC23822	Catch Basin	Concrete
SWCBCC23823	Catch Basin	Concrete
SWCBCC23824	Catch Basin	Concrete
SWCBCC23826	Catch Basin	Concrete
SWCBCC23827	Catch Basin	Concrete
SWCBCC23829	Catch Basin	Concrete
SWCBCC23831	Catch Basin	Concrete
SWCBCC23832	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC23839	Catch Basin	Concrete
SWCBCC23840	Catch Basin	Concrete
SWCBCC23846	Catch Basin	Concrete
SWCBCC23847	Catch Basin	Concrete
SWCBCC23853	Catch Basin	Concrete
SWCBCC23854	Catch Basin	Concrete
SWCBCC23858	Catch Basin	Concrete
SWCBCC23859	Catch Basin	Concrete
SWCBCC23861	Catch Basin	Concrete
SWCBCC23862	Catch Basin	Concrete
SWCBCC23863	Catch Basin	Concrete
SWCBCC23864	Catch Basin	Concrete
SWCBCC23865	Catch Basin	Concrete
SWCBCC23866	Catch Basin	Concrete
SWCBCC23874	Catch Basin	Concrete
SWCBCC23875	Catch Basin	Concrete
SWCBCC23877	Catch Basin	Concrete
SWCBCC23878	Catch Basin	Concrete
SWCBCC23879	Catch Basin	Concrete
SWCBCC23880	Catch Basin	Concrete
SWCBCC23889	Catch Basin	Concrete
SWCBCC23890	Catch Basin	Concrete
SWCBCC23891	Catch Basin	Concrete
SWCBCC23894	Catch Basin	Concrete
SWCBCC23895	Catch Basin	Concrete
SWCBCC23898	Catch Basin	Concrete
SWCBCC23899	Catch Basin	Concrete
SWCBCC23902	Catch Basin	Concrete
SWCBCC23903	Catch Basin	Concrete
SWCBCC23905	Catch Basin	Concrete
SWCBCC23909	Catch Basin	Concrete
SWCBCC23916	Catch Basin	Concrete
SWCBCC23917	Catch Basin	Concrete
SWCBCC23921	Catch Basin	Concrete
SWCBCC23922	Catch Basin	Concrete
SWCBCC23923	Catch Basin	Concrete
SWCBCC23924	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC23925	Catch Basin	Concrete
SWCBCC23926	Catch Basin	Concrete
SWCBCC23927	Catch Basin	Concrete
SWCBCC23928	Catch Basin	Concrete
SWCBCC23929	Catch Basin	Concrete
SWCBCC23936	Catch Basin	Concrete
SWCBCC23937	Catch Basin	Concrete
SWCBCC23939	Catch Basin	Concrete
SWCBCC23940	Catch Basin	Concrete
SWCBCC23941	Catch Basin	Concrete
SWCBCC23942	Catch Basin	Concrete
SWCBCC23945	Catch Basin	Concrete
SWCBCC23950	Catch Basin	Concrete
SWCBCC23951	Catch Basin	Concrete
SWCBCC23952	Catch Basin	Concrete
SWCBCC23953	Catch Basin	Concrete
SWCBCC24400	Catch Basin	Concrete
SWCBCC24401	Catch Basin	Concrete
SWCBCC24402	Catch Basin	Concrete
SWCBCC24407	Catch Basin	Concrete
SWCBCC24408	Catch Basin	Concrete
SWCBCC24409	Catch Basin	Concrete
SWCBCC24410	Catch Basin	Concrete
SWCBCC24411	Catch Basin	Concrete
SWCBCC24412	Catch Basin	Concrete
SWCBCC24413	Catch Basin	Concrete
SWCBCC24414	Catch Basin	Concrete
SWCBCC24415	Catch Basin	Concrete
SWCBCC24416	Catch Basin	Concrete
SWCBCC24417	Catch Basin	Concrete
SWCBCC24418	Catch Basin	Concrete
SWCBCC24419	Catch Basin	Concrete
SWCBCC24420	Catch Basin	Concrete
SWCBCC24421	Catch Basin	Concrete
SWCBCC24422	Catch Basin	Concrete
SWCBCC24423	Catch Basin	Concrete
SWCBCC24424	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24425	Catch Basin	Concrete
SWCBCC24426	Catch Basin	Concrete
SWCBCC24427	Catch Basin	Concrete
SWCBCC24428	Catch Basin	Concrete
SWCBCC24429	Catch Basin	Concrete
SWCBCC24430	Catch Basin	Concrete
SWCBCC24431	Catch Basin	Concrete
SWCBCC24432	Catch Basin	Concrete
SWCBCC24433	Catch Basin	Concrete
SWCBCC24434	Catch Basin	Concrete
SWCBCC24435	Catch Basin	Concrete
SWCBCC24436	Catch Basin	Concrete
SWCBCC24437	Catch Basin	Concrete
SWCBCC24439	Catch Basin	Concrete
SWCBCC24440	Catch Basin	Concrete
SWCBCC24441	Catch Basin	Concrete
SWCBCC24442	Catch Basin	Concrete
SWCBCC24443	Catch Basin	Concrete
SWCBCC24444	Catch Basin	Concrete
SWCBCC24446	Catch Basin	Concrete
SWCBCC24447	Catch Basin	Concrete
SWCBCC24448	Catch Basin	Concrete
SWCBCC24449	Catch Basin	Concrete
SWCBCC24450	Catch Basin	Concrete
SWCBCC24451	Catch Basin	Concrete
SWCBCC24455	Catch Basin	Concrete
SWCBCC24456	Catch Basin	Concrete
SWCBCC24457	Catch Basin	Concrete
SWCBCC24458	Catch Basin	Concrete
SWCBCC23958	Catch Basin	Concrete
SWCBCC23959	Catch Basin	Concrete
SWCBCC23960	Catch Basin	Concrete
SWCBCC23961	Catch Basin	Concrete
SWCBCC23962	Catch Basin	Concrete
SWCBCC23963	Catch Basin	Concrete
SWCBCC23964	Catch Basin	Concrete
SWCBCC23965	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC23966	Catch Basin	Concrete
SWCBCC23967	Catch Basin	Concrete
SWCBCC23971	Catch Basin	Concrete
SWCBCC23972	Catch Basin	Concrete
SWCBCC23984	Catch Basin	Concrete
SWCBCC23985	Catch Basin	Concrete
SWCBCC23988	Catch Basin	Concrete
SWCBCC23989	Catch Basin	Concrete
SWCBCC23991	Catch Basin	Concrete
SWCBCC23992	Catch Basin	Concrete
SWCBCC23994	Catch Basin	Concrete
SWCBCC23995	Catch Basin	Concrete
SWCBCC23997	Catch Basin	Concrete
SWCBCC23998	Catch Basin	Concrete
SWCBCC24001	Catch Basin	Concrete
SWCBCC24002	Catch Basin	Concrete
SWCBCC24003	Catch Basin	Concrete
SWCBCC24005	Catch Basin	Concrete
SWCBCC24006	Catch Basin	Concrete
SWCBCC24008	Catch Basin	Concrete
SWCBCC24009	Catch Basin	Concrete
SWCBCC24012	Catch Basin	Concrete
SWCBCC24013	Catch Basin	Concrete
SWCBCC24014	Catch Basin	Concrete
SWCBCC24015	Catch Basin	Concrete
SWCBCC24016	Catch Basin	Concrete
SWCBCC24017	Catch Basin	Concrete
SWCBCC24018	Catch Basin	Concrete
SWCBCC24019	Catch Basin	Concrete
SWCBCC24024	Catch Basin	Concrete
SWCBCC24025	Catch Basin	Concrete
SWCBCC24026	Catch Basin	Concrete
SWCBCC24027	Catch Basin	Concrete
SWCBCC24028	Catch Basin	Concrete
SWCBCC24030	Catch Basin	Concrete
SWCBCC24032	Catch Basin	Concrete
SWCBCC24033	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24035	Catch Basin	Concrete
SWCBCC24038	Catch Basin	Concrete
SWCBCC24039	Catch Basin	Concrete
SWCBCC24040	Catch Basin	Concrete
SWCBCC24041	Catch Basin	Concrete
SWCBCC24076	Catch Basin	Concrete
SWCBCC24077	Catch Basin	Concrete
SWCBCC24079	Catch Basin	Brick
SWCBCC24080	Catch Basin	Concrete
SWCBCC24084	Catch Basin	Concrete
SWCBCC24105	Catch Basin	Concrete
SWCBCC24106	Catch Basin	Concrete
SWCBCC24111	Catch Basin	Concrete
SWCBCC24112	Catch Basin	Concrete
SWCBCC24113	Catch Basin	Concrete
SWCBCC24114	Catch Basin	Concrete
SWCBCC24115	Catch Basin	Concrete
SWCBCC24121	Catch Basin	Concrete
SWCBCC24122	Catch Basin	Concrete
SWCBCC24123	Catch Basin	Concrete
SWCBCC24133	Catch Basin	Concrete
SWCBCC24134	Catch Basin	Concrete
SWCBCC24135	Catch Basin	Concrete
SWCBCC24136	Catch Basin	Concrete
SWCBCC24137	Catch Basin	Concrete
SWCBCC24138	Catch Basin	Concrete
SWCBCC24140	Catch Basin	Concrete
SWCBCC24141	Catch Basin	Concrete
SWCBCC24142	Catch Basin	Concrete
SWCBCC24143	Catch Basin	Concrete
SWCBCC24145	Catch Basin	Concrete
SWCBCC24146	Catch Basin	Concrete
SWCBCC24147	Catch Basin	Concrete
SWCBCC24148	Catch Basin	Concrete
SWCBCC24149	Catch Basin	Concrete
SWCBCC24150	Catch Basin	Concrete
SWCBCC24151	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24152	Catch Basin	Concrete
SWCBCC24153	Catch Basin	Concrete
SWCBCC24154	Catch Basin	Concrete
SWCBCC24155	Catch Basin	Concrete
SWCBCC24156	Catch Basin	Concrete
SWCBCC24160	Catch Basin	Concrete
SWCBCC24161	Catch Basin	Concrete
SWCBCC24163	Catch Basin	Concrete
SWCBCC24164	Catch Basin	Concrete
SWCBCC24165	Catch Basin	Concrete
SWCBCC24166	Catch Basin	Concrete
SWCBCC24173	Catch Basin	Concrete
SWCBCC24174	Catch Basin	Concrete
SWCBCC24175	Catch Basin	Concrete
SWCBCC24178	Catch Basin	Concrete
SWCBCC24179	Catch Basin	Concrete
SWCBCC24180	Catch Basin	Concrete
SWCBCC24181	Catch Basin	Concrete
SWCBCC24183	Catch Basin	Concrete
SWCBCC24184	Catch Basin	Concrete
SWCBCC24185	Catch Basin	Concrete
SWCBCC24186	Catch Basin	Concrete
SWCBCC24187	Catch Basin	Concrete
SWCBCC24188	Catch Basin	Concrete
SWCBCC24189	Catch Basin	Concrete
SWCBCC24190	Catch Basin	Concrete
SWCBCC24191	Catch Basin	Concrete
SWCBCC24192	Catch Basin	Concrete
SWCBCC24193	Catch Basin	Concrete
SWCBCC24194	Catch Basin	Concrete
SWCBCC24195	Catch Basin	Concrete
SWCBCC24196	Catch Basin	Concrete
SWCBCC24197	Catch Basin	Concrete
SWCBCC24199	Catch Basin	Concrete
SWCBCC24200	Catch Basin	Concrete
SWCBCC24204	Catch Basin	Concrete
SWCBCC24205	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24206	Catch Basin	Concrete
SWCBCC24207	Catch Basin	Concrete
SWCBCC24210	Catch Basin	Concrete
SWCBCC24211	Catch Basin	Concrete
SWCBCC24212	Catch Basin	Concrete
SWCBCC24213	Catch Basin	Concrete
SWCBCC24226	Catch Basin	Concrete
SWCBCC24227	Catch Basin	Concrete
SWCBCC24228	Catch Basin	Concrete
SWCBCC24229	Catch Basin	Concrete
SWCBCC24230	Catch Basin	Concrete
SWCBCC24231	Catch Basin	Concrete
SWCBCC24234	Catch Basin	Concrete
SWCBCC24236	Catch Basin	Concrete
SWCBCC24237	Catch Basin	Concrete
SWCBCC24238	Catch Basin	Concrete
SWCBCC24239	Catch Basin	Concrete
SWCBCC24240	Catch Basin	Concrete
SWCBCC24241	Catch Basin	Concrete
SWCBCC24242	Catch Basin	Concrete
SWCBCC24243	Catch Basin	Concrete
SWCBCC24244	Catch Basin	Concrete
SWCBCC24249	Catch Basin	Concrete
SWCBCC24251	Catch Basin	Concrete
SWCBCC24252	Catch Basin	Concrete
SWCBCC24253	Catch Basin	Concrete
SWCBCC24254	Catch Basin	Concrete
SWCBCC24255	Catch Basin	Concrete
SWCBCC24262	Catch Basin	Concrete
SWCBCC24263	Catch Basin	Concrete
SWCBCC24264	Catch Basin	Concrete
SWCBCC24265	Catch Basin	Concrete
SWCBCC24267	Catch Basin	Concrete
SWCBCC24268	Catch Basin	Concrete
SWCBCC24269	Catch Basin	Concrete
SWCBCC24270	Catch Basin	Concrete
SWCBCC24272	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24273	Catch Basin	Concrete
SWCBCC24274	Catch Basin	Concrete
SWCBCC24277	Catch Basin	Concrete
SWCBCC24278	Catch Basin	Concrete
SWCBCC24280	Catch Basin	Concrete
SWCBCC24281	Catch Basin	Concrete
SWCBCC24283	Catch Basin	Concrete
SWCBCC24284	Catch Basin	Concrete
SWCBCC24288	Catch Basin	Concrete
SWCBCC24289	Catch Basin	Concrete
SWCBCC24290	Catch Basin	Concrete
SWCBCC24291	Catch Basin	Concrete
SWCBCC24292	Catch Basin	Concrete
SWCBCC24296	Catch Basin	Concrete
SWCBCC24297	Catch Basin	Concrete
SWCBCC24298	Catch Basin	Concrete
SWCBCC24300	Catch Basin	Concrete
SWCBCC24301	Catch Basin	Concrete
SWCBCC24302	Catch Basin	Concrete
SWCBCC24303	Catch Basin	Concrete
SWCBCC24304	Catch Basin	Concrete
SWCBCC24307	Catch Basin	Concrete
SWCBCC24308	Catch Basin	Concrete
SWCBCC24309	Catch Basin	Concrete
SWCBCC24310	Catch Basin	Concrete
SWCBCC24311	Catch Basin	Concrete
SWCBCC24312	Catch Basin	Concrete
SWCBCC24313	Catch Basin	Concrete
SWCBCC24315	Catch Basin	Concrete
SWCBCC24316	Catch Basin	Concrete
SWCBCC24317	Catch Basin	Concrete
SWCBCC24318	Catch Basin	Concrete
SWCBCC24320	Catch Basin	Concrete
SWCBCC24321	Catch Basin	Concrete
SWCBCC24323	Catch Basin	Concrete
SWCBCC24324	Catch Basin	Concrete
SWCBCC24325	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24326	Catch Basin	Concrete
SWCBCC24327	Catch Basin	Concrete
SWCBCC24331	Catch Basin	Concrete
SWCBCC24332	Catch Basin	Concrete
SWCBCC24334	Catch Basin	Concrete
SWCBCC24335	Catch Basin	Concrete
SWCBCC24343	Catch Basin	Concrete
SWCBCC24344	Catch Basin	Concrete
SWCBCC24345	Catch Basin	Concrete
SWCBCC24346	Catch Basin	Concrete
SWCBCC24353	Catch Basin	Concrete
SWCBCC24354	Catch Basin	Concrete
SWCBCC24359	Catch Basin	Concrete
SWCBCC24362	Catch Basin	Concrete
SWCBCC24363	Catch Basin	Concrete
SWCBCC24364	Catch Basin	Concrete
SWCBCC24368	Catch Basin	Concrete
SWCBCC24369	Catch Basin	Concrete
SWCBCC24370	Catch Basin	Concrete
SWCBCC24371	Catch Basin	Concrete
SWCBCC24372	Catch Basin	Concrete
SWCBCC24373	Catch Basin	Concrete
SWCBCC24374	Catch Basin	Concrete
SWCBCC24377	Catch Basin	Concrete
SWCBCC24378	Catch Basin	Concrete
SWCBCC24379	Catch Basin	Concrete
SWCBCC24380	Catch Basin	Concrete
SWCBCC24381	Catch Basin	Concrete
SWCBCC24382	Catch Basin	Concrete
SWCBCC24383	Catch Basin	Concrete
SWCBCC24384	Catch Basin	Concrete
SWCBCC24385	Catch Basin	Concrete
SWCBCC24386	Catch Basin	Concrete
SWCBCC24387	Catch Basin	Concrete
SWCBCC24389	Catch Basin	Concrete
SWCBCC24390	Catch Basin	Concrete
SWCBCC24391	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24392	Catch Basin	Concrete
SWCBCC24393	Catch Basin	Concrete
SWCBCC24394	Catch Basin	Concrete
SWCBCC24395	Catch Basin	Concrete
SWCBCC24396	Catch Basin	Concrete
SWCBCC24397	Catch Basin	Concrete
SWCBCC24459	Catch Basin	Concrete
SWCBCC24460	Catch Basin	Concrete
SWCBCC24461	Catch Basin	Concrete
SWCBCC24462	Catch Basin	Concrete
SWCBCC24463	Catch Basin	Concrete
SWCBCC24464	Catch Basin	Concrete
SWCBCC24465	Catch Basin	Concrete
SWCBCC24466	Catch Basin	Concrete
SWCBCC24467	Catch Basin	Concrete
SWCBCC24468	Catch Basin	Concrete
SWCBCC24469	Catch Basin	Concrete
SWCBCC24471	Catch Basin	Concrete
SWCBCC24472	Catch Basin	Concrete
SWCBCC24475	Catch Basin	Concrete
SWCBCC24476	Catch Basin	Concrete
SWCBCC24482	Catch Basin	Concrete
SWCBCC24487	Catch Basin	Concrete
SWCBCC24488	Catch Basin	Concrete
SWCBCC24491	Catch Basin	Concrete
SWCBCC24493	Catch Basin	Concrete
SWCBCC24494	Catch Basin	Concrete
SWCBCC24495	Catch Basin	Concrete
SWCBCC24496	Catch Basin	Concrete
SWCBCC24497	Catch Basin	Concrete
SWCBCC24498	Catch Basin	Concrete
SWCBCC24499	Catch Basin	Concrete
SWCBCC24500	Catch Basin	Concrete
SWCBCC24501	Catch Basin	Concrete
SWCBCC24502	Catch Basin	Concrete
SWCBCC24503	Catch Basin	Concrete
SWCBCC24504	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBCC24505	Catch Basin	Concrete
SWCBCC24506	Catch Basin	Concrete
SWCBCC24507	Catch Basin	Concrete
SWCBCC24508	Catch Basin	Concrete
SWCBCC24509	Catch Basin	Concrete
SWCBCC24514	Catch Basin	Concrete
SWCBCC24515	Catch Basin	Concrete
SWCBCC24516	Catch Basin	Concrete
SWCBCC24517	Catch Basin	Concrete
SWCBCC24518	Catch Basin	Concrete
SWCBCC24519	Catch Basin	Concrete
SWCBCC24520	Catch Basin	Concrete
SWCBCC24522	Catch Basin	Concrete
SWCBCC24524	Catch Basin	Concrete
SWCBCC24527	Catch Basin	Concrete
SWCBCC24528	Catch Basin	Concrete
SWCBCC24530	Catch Basin	Concrete
SWCBCC24531	Catch Basin	Concrete
SWCBCC24532	Catch Basin	Concrete
SWCBCC24535	Catch Basin	Concrete
SWCBCC24536	Catch Basin	Concrete
SWCBCC24538	Catch Basin	Concrete
SWCBCC24539	Catch Basin	Concrete
SWCBCC24540	Catch Basin	Concrete
SWCBCC24541	Catch Basin	Concrete
SWCBCC24543	Catch Basin	Concrete
SWCBCC24544	Catch Basin	Concrete
SWCBCC24545	Catch Basin	Concrete
SWCBCC24546	Catch Basin	Concrete
SWCBCC24547	Catch Basin	Concrete
SWCBCC24548	Catch Basin	Concrete
SWCBCC24550	Catch Basin	Concrete
SWCBCC24552	Catch Basin	Concrete
SWCBCC24554	Catch Basin	Concrete
SWCBCC24555	Catch Basin	Concrete
SWCBCC24556	Catch Basin	Concrete
SWCBCC24557	Catch Basin	Concrete

Structure ID	Type	Material
SWCBCC24558	Catch Basin	Concrete
SWCBCC24561	Catch Basin	Concrete
SWCBCC24562	Catch Basin	Concrete
SWCBCC24563	Catch Basin	Concrete
SWCBCC24564	Catch Basin	Concrete
SWCBCC24565	Catch Basin	Concrete
SWCBCC24567	Catch Basin	Concrete
SWCBCC24573	Catch Basin	Concrete
SWCBCC24574	Catch Basin	Concrete
SWCBCC24575	Catch Basin	Concrete
SWCBCC24576	Catch Basin	Concrete
SWCBCC24577	Catch Basin	Concrete
SWCBCC24578	Catch Basin	Concrete
SWCBCC24579	Catch Basin	Concrete
SWCBCC24583	Catch Basin	Concrete
SWCBCC24584	Catch Basin	Concrete
SWCBCC24587	Catch Basin	Concrete
SWCBCC24588	Catch Basin	Concrete
SWCBCC24590	Catch Basin	Concrete
SWCBCC24591	Catch Basin	Concrete
SWCBCC24592	Catch Basin	Concrete
SWCBCC24596	Catch Basin	Concrete
SWCBCC24597	Catch Basin	Concrete
SWCBCC24598	Catch Basin	Concrete
SWCBCC24599	Catch Basin	Concrete
SWCBCC24605	Catch Basin	Concrete
SWCBCC24606	Catch Basin	Concrete
SWCBCC24607	Catch Basin	Concrete
SWCBCC24608	Catch Basin	Concrete
SWCBCC24610	Catch Basin	Concrete
SWCBCC24611	Catch Basin	Concrete
SWCBCC24616	Catch Basin	Concrete
SWCBCC24617	Catch Basin	Concrete
SWCBCC24618	Catch Basin	Concrete
SWCBCC24619	Catch Basin	Concrete
SWCBCC24620	Catch Basin	Concrete
SWCBCC24621	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC24622	Catch Basin	Concrete
SWCBCC24623	Catch Basin	Concrete
SWCBCC24635	Catch Basin	Concrete
CCCC0262CB	Catch Basin	Concrete
CCCC0263CB	Catch Basin	Concrete
CCCC0280CB	Catch Basin	Concrete
CCCC0281CB	Catch Basin	Concrete
CCCC0282CB	Catch Basin	Concrete
CCCC0284CB	Catch Basin	Concrete
CCCC0285CB	Catch Basin	Concrete
CCCC0288CB	Catch Basin	Concrete
CCCC0289CB	Catch Basin	Concrete
CCCC0291CB	Catch Basin	Concrete
CCCC0294CB	Catch Basin	Concrete
CCCC0297CB	Catch Basin	Concrete
CCCC0298CB	Catch Basin	Concrete
CCCC0299CB	Catch Basin	Concrete
CCCC0300CB	Catch Basin	Concrete
CCCC0301CB	Catch Basin	Concrete
CCCC0304CB	Catch Basin	Concrete
CCCC0307CB	Catch Basin	Concrete
CCCC0354CB	Catch Basin	Brick
CCCC0357CB	Catch Basin	Concrete
CCCC0358CB	Catch Basin	Concrete
CCCC0359CB	Catch Basin	Concrete
CCCC1156CB	Catch Basin	Brick
CCCC1294CB	Catch Basin	Brick
CCCC1296CB	Catch Basin	Brick
CCCC1298CB	Catch Basin	Brick
CCCC3858CB	Catch Basin	Concrete
CCCC3881CB	Catch Basin	Unknown
CCCC3883CB	Catch Basin	Brick
CCCC0560CB	Catch Basin	Concrete
CCCC0694CB	Catch Basin	Brick
CCCC0695CB	Catch Basin	Brick
CCCC0696CB	Catch Basin	Brick
CCCC0701CB	Catch Basin	Brick

Structure ID	Type	Material
CCCC0707CB	Catch Basin	Brick
SWCBCC25227	Catch Basin	Concrete
SWCBCC25228	Catch Basin	Concrete
SWCBCC25234	Catch Basin	Concrete
SWCBCC25235	Catch Basin	Concrete
SWCBCC25244	Catch Basin	Concrete
SWCBCC25243	Catch Basin	Concrete
CCCC0719CB	Catch Basin	Brick
CCCC0720CB	Catch Basin	Brick
CCCC0730CB	Catch Basin	Concrete
CCCC0732CB	Catch Basin	Brick
CCCC1108CB	Catch Basin	Brick
CCCC1109CB	Catch Basin	Brick
CCCC1110CB	Catch Basin	Brick
CCCC1111CB	Catch Basin	Brick
CCCC1116CB	Catch Basin	Brick
CCCC1117CB	Catch Basin	Brick
CCCC1120CB	Catch Basin	Unknown
CCCC1121CB	Catch Basin	Unknown
CCCC1123CB	Catch Basin	Brick
CCCC1126CB	Catch Basin	Brick
CCCC1127CB	Catch Basin	Brick
CCCC1131CB	Catch Basin	Brick
CCCC1552CB	Catch Basin	Brick
SWCBCC25255	Catch Basin	Concrete
SWCBCC25256	Catch Basin	Concrete
SWCBCC25257	Catch Basin	Concrete
SWCBCC25259	Catch Basin	Concrete
SWCBCC8892	Catch Basin	Concrete
SWCBCC8896	Catch Basin	Concrete
SWCBCC8906	Catch Basin	Concrete
SWCBCC8907	Catch Basin	Concrete
SWCBCC8948	Catch Basin	Brick
CCCC3586CB	Catch Basin	Concrete
CCCC3588CB	Catch Basin	Concrete
CCCC3590CB	Catch Basin	Concrete
CCCC3592CB	Catch Basin	Concrete

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Structure ID	Type	Material
CCCC3602CB	Catch Basin	Concrete
CCCC3604CB	Catch Basin	Brick
CCCC3612CB	Catch Basin	Concrete
CCCC3614CB	Catch Basin	Concrete
CCCC3616CB	Catch Basin	Concrete
CCCC3618CB	Catch Basin	Concrete
CCCC3620CB	Catch Basin	Concrete
CCCC3622CB	Catch Basin	Concrete
CCCC3626CB	Catch Basin	Concrete
CCCC3628CB	Catch Basin	Concrete
CCCC3647CB	Catch Basin	Brick
CCCC3716CB	Catch Basin	Concrete
CCCC3718CB	Catch Basin	Concrete
CCCC3722CB	Catch Basin	Concrete
CCCC3724CB	Catch Basin	Concrete
CCCC3726CB	Catch Basin	Concrete
CCCC3728CB	Catch Basin	Concrete
CCCC3730CB	Catch Basin	Concrete
CCCC3734CB	Catch Basin	Concrete
CCCC3736CB	Catch Basin	Concrete
CCCC3738CB	Catch Basin	Concrete
CCCC3740CB	Catch Basin	Concrete
SWCBCC9020	Catch Basin	Brick
SWCBCC9146	Catch Basin	Concrete
SWCBCC9147	Catch Basin	Concrete
SWCBCC9149	Catch Basin	Concrete
CCCC0364CB	Catch Basin	Concrete
CCCC0365CB	Catch Basin	Concrete
CCCC0366CB	Catch Basin	Concrete
CCCC0371CB	Catch Basin	Concrete
CCCC0372CB	Catch Basin	Concrete
CCCC0373CB	Catch Basin	Concrete
CCCC0374CB	Catch Basin	Concrete
CCCC0375CB	Catch Basin	Concrete
CCCC0376CB	Catch Basin	Concrete
CCCC0377CB	Catch Basin	Concrete
CCCC0378CB	Catch Basin	Concrete

Structure ID	Type	Material
CCCC0379CB	Catch Basin	Concrete
CCCC0380CB	Catch Basin	Concrete
CCCC0381CB	Catch Basin	Concrete
CCCC0382CB	Catch Basin	Brick
CCCC0383CB	Catch Basin	Brick
CCCC0384CB	Catch Basin	Brick
CCCC0385CB	Catch Basin	Brick
CCCC0386CB	Catch Basin	Brick
CCCC0387CB	Catch Basin	Concrete
CCCC0388CB	Catch Basin	Concrete
CCCC0389CB	Catch Basin	Concrete
CCCC0390CB	Catch Basin	Concrete
CCCC0391CB	Catch Basin	Concrete
CCCC0392CB	Catch Basin	Unknown
CCCC0393CB	Catch Basin	Brick
CCCC0395CB	Catch Basin	Brick
CCCC0396CB	Catch Basin	Brick
CCCC0397CB	Catch Basin	Concrete
CCCC0398CB	Catch Basin	Brick
CCCC0399CB	Catch Basin	Brick
CCCC0400CB	Catch Basin	Brick
CCCC0403CB	Catch Basin	Brick
CCCC0405CB	Catch Basin	Unknown
CCCC0407CB	Catch Basin	Brick
CCCC0409CB	Catch Basin	Brick
CCCC0414CB	Catch Basin	Brick
CCCC0415CB	Catch Basin	Brick
CCCC0417CB	Catch Basin	Unknown
CCCC0418CB	Catch Basin	Brick
CCCC0419CB	Catch Basin	Brick
CCCC0420CB	Catch Basin	Brick
CCCC0421CB	Catch Basin	Brick
CCCC0424CB	Catch Basin	Unknown
CCCC0425CB	Catch Basin	Brick
CCCC0427CB	Catch Basin	Brick
CCCC0428CB	Catch Basin	Brick
CCCC0429CB	Catch Basin	Brick

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Structure ID	Type	Material
CCCC0430CB	Catch Basin	Brick
CCCC0431CB	Catch Basin	Brick
CCCC0432CB	Catch Basin	Brick
CCCC0480CB	Catch Basin	Concrete
CCCC0481CB	Catch Basin	Concrete
CCCC0482CB	Catch Basin	Concrete
CCCC0484CB	Catch Basin	Concrete
CCCC0485CB	Catch Basin	Concrete
CCCC0486CB	Catch Basin	Concrete
CCCC0487CB	Catch Basin	Concrete
CCCC0488CB	Catch Basin	Concrete
CCCC0489CB	Catch Basin	Concrete
CCCC0490CB	Catch Basin	Concrete
CCCC0491CB	Catch Basin	Concrete
CCCC0493CB	Catch Basin	Concrete
CCCC0494CB	Catch Basin	Concrete
CCCC0506CB	Catch Basin	Concrete
CCCC0266CB	Catch Basin	Concrete
CCCC0267CB	Catch Basin	Concrete
CCCC0268CB	Catch Basin	Concrete
CCCC0269CB	Catch Basin	Concrete
CCCC0270CB	Catch Basin	Concrete
CCCC0272CB	Catch Basin	Concrete
CCCC0274CB	Catch Basin	Concrete
CCCC0275CB	Catch Basin	Concrete
CCCC0277CB	Catch Basin	Concrete
CCCC0278CB	Catch Basin	Concrete
CCCC0279CB	Catch Basin	Concrete
CCCC0507CB	Catch Basin	Concrete
CCCC0508CB	Catch Basin	Concrete
CCCC0520CB	Catch Basin	Brick
CCCC0521CB	Catch Basin	Brick
CCCC0523CB	Catch Basin	Brick
CCCC0524CB	Catch Basin	Brick
CCCC0531CB	Catch Basin	Brick
CCCC0532CB	Catch Basin	Brick
CCCC0533CB	Catch Basin	Brick

Structure ID	Type	Material
CCCC0534CB	Catch Basin	Unknown
CCCC0535CB	Catch Basin	Brick
CCCC0538CB	Catch Basin	Brick
CCCC0539CB	Catch Basin	Brick
CCCC0540CB	Catch Basin	Brick
CCCC0541CB	Catch Basin	Brick
CCCC0542CB	Catch Basin	Concrete
CCCC0543CB	Catch Basin	Concrete
SWCBCC9150	Catch Basin	Concrete
SWCBCC9152	Catch Basin	Concrete
SWCBCC9153	Catch Basin	Concrete
SWCBCC9158	Catch Basin	Concrete
SWCBCC9159	Catch Basin	Concrete
SWCBCC9160	Catch Basin	Concrete
SWCBCC9161	Catch Basin	Concrete
SWCBCC9162	Catch Basin	Concrete
SWCBCC9164	Catch Basin	Concrete
SWCBCC9165	Catch Basin	Concrete
SWCBCC9167	Catch Basin	Concrete
SWCBCC9168	Catch Basin	Concrete
SWCBCC9169	Catch Basin	Concrete
SWCBCC9170	Catch Basin	Concrete
SWCBCC9175	Catch Basin	Concrete
SWCBCC9176	Catch Basin	Concrete
SWCBCC9184	Catch Basin	Concrete
SWCBCC9185	Catch Basin	Concrete
SWCBCC9186	Catch Basin	Concrete
SWCBCC9187	Catch Basin	Concrete
SWCBCC9188	Catch Basin	Concrete
SWCBCC9189	Catch Basin	Concrete
SWCBCC9190	Catch Basin	Concrete
SWCBCC9191	Catch Basin	Concrete
SWCBCC9192	Catch Basin	Concrete
SWCBCC9195	Catch Basin	Concrete
SWCBCC9196	Catch Basin	Concrete
SWCBCC9199	Catch Basin	Concrete
SWCBCC9200	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBCC9201	Catch Basin	Concrete
SWCBCC9202	Catch Basin	Concrete
SWCBCC9211	Catch Basin	Concrete
SWCBCC9212	Catch Basin	Concrete
SWCBCC9213	Catch Basin	Concrete
SWCBCC9214	Catch Basin	Concrete
SWCBCC9215	Catch Basin	Concrete
SWCBCC9216	Catch Basin	Concrete
SWCBCC9224	Catch Basin	Concrete
SWCBCC9225	Catch Basin	Concrete
SWCBCC9226	Catch Basin	Concrete
SWCBCC9227	Catch Basin	Concrete
SWCBCC9228	Catch Basin	Concrete
SWCBCC9240	Catch Basin	Concrete
SWCBCC9242	Catch Basin	Concrete
SWCBCC9244	Catch Basin	Concrete
SWCBCC9263	Catch Basin	Brick
SWCBSC32125	Catch Basin	Brick
SWCBSC32128	Catch Basin	Unknown
SWCBSC32132	Catch Basin	Brick
SWCBSC32133	Catch Basin	Unknown
SWCBSC32134	Catch Basin	Brick
SWCBSC32135	Catch Basin	Brick
SWCBSC32138	Catch Basin	Brick
SWCBSC32139	Catch Basin	Brick
SWCBSC32148	Catch Basin	Brick
SWCBSC32149	Catch Basin	Brick
SWCBSC32155	Catch Basin	Concrete
SWCBSC32173	Catch Basin	Brick
SWCBSC32174	Catch Basin	Brick
SWCBSC32179	Catch Basin	Brick
SWCBSC32180	Catch Basin	Brick
SWCBSC32183	Catch Basin	Brick
SWCBSC32184	Catch Basin	Brick
SWCBSC32190	Catch Basin	Brick
SWCBSC32191	Catch Basin	Brick
SWCBSC32194	Catch Basin	Unknown

Structure ID	Type	Material
SWCBSC32195	Catch Basin	Brick
SWCBSC32199	Catch Basin	Brick
SWCBSC32204	Catch Basin	Brick
SWCBSC32205	Catch Basin	Brick
SWCBSC32206	Catch Basin	Brick
SWCBSC32211	Catch Basin	Brick
SWCBSC32215	Catch Basin	Brick
SWCBSC32218	Catch Basin	Brick
SWCBSC32219	Catch Basin	Brick
SWCBSC32222	Catch Basin	Brick
SWCBSC32223	Catch Basin	Brick
SWCBSC32470	Catch Basin	Concrete
SWCBSC32471	Catch Basin	Concrete
SWCBSC32004	Catch Basin	Brick
SWCBSC32005	Catch Basin	Concrete
SWCBSC32007	Catch Basin	Concrete
SWCBSC32008	Catch Basin	Concrete
SWCBSC32009	Catch Basin	Brick
SWCBSC32012	Catch Basin	Concrete
SWCBSC32013	Catch Basin	Unknown
SWCBSC32016	Catch Basin	Concrete
SWCBSC32018	Catch Basin	Brick
SWCBSC32024	Catch Basin	Concrete
SWCBSC32025	Catch Basin	Concrete
SWCBSC32027	Catch Basin	Concrete
SWCBSC32028	Catch Basin	Concrete
SWCBSC32032	Catch Basin	Brick
SWCBSC32036	Catch Basin	Brick
SWCBSC32038	Catch Basin	Concrete
SWCBSC32039	Catch Basin	Concrete
SWCBSC32040	Catch Basin	Concrete
SWCBSC32056	Catch Basin	Unknown
SWCBSC32060	Catch Basin	Unknown
SWCBSC32061	Catch Basin	Brick
SWCBSC32062	Catch Basin	Unknown
SWCBSC32064	Catch Basin	Brick
SWCBSC32065	Catch Basin	Brick

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Structure ID	Type	Material
SWCBSC32067	Catch Basin	Brick
SWCBSC32069	Catch Basin	Brick
SWCBSC32070	Catch Basin	Unknown
SWCBSC32071	Catch Basin	Brick
SWCBSC32073	Catch Basin	Brick
SWCBSC32077	Catch Basin	Brick
SWCBSC32078	Catch Basin	Brick
SWCBSC32081	Catch Basin	Concrete
SWCBSC32085	Catch Basin	Concrete
SWCBSC32086	Catch Basin	Concrete
SWCBSC32087	Catch Basin	Concrete
SWCBSC32090	Catch Basin	Concrete
SWCBSC32094	Catch Basin	Concrete
SWCBSC32096	Catch Basin	Concrete
SWCBSC32098	Catch Basin	Concrete
SWCBSC32101	Catch Basin	Concrete
SWCBSC32102	Catch Basin	Concrete
SWCBSC32104	Catch Basin	Concrete
SWCBSC32105	Catch Basin	Concrete
SWCBSC32108	Catch Basin	Concrete
SWCBSC32110	Catch Basin	Concrete
SWCBSC32111	Catch Basin	Brick
SWCBSC32115	Catch Basin	Brick
SWCBSC32116	Catch Basin	Brick
SWCBSC32117	Catch Basin	Brick
SWCBSC32119	Catch Basin	Brick
SWCBSC32228	Catch Basin	Concrete
SWCBSC32229	Catch Basin	Concrete
SWCBSC32233	Catch Basin	Unknown
SWCBSC32234	Catch Basin	Unknown
SWCBSC32235	Catch Basin	Brick
SWCBSC32236	Catch Basin	Brick
SWCBSC32240	Catch Basin	Brick
SWCBSC32241	Catch Basin	Unknown
SWCBSC32244	Catch Basin	Brick
SWCBSC32245	Catch Basin	Brick
SWCBSC32249	Catch Basin	Brick

Structure ID	Type	Material
SWCBSC32250	Catch Basin	Unknown
SWCBSC32253	Catch Basin	Brick
SWCBSC32257	Catch Basin	Brick
SWCBSC32258	Catch Basin	Unknown
SWCBSC32264	Catch Basin	Brick
SWCBSC32269	Catch Basin	Brick
SWCBSC32274	Catch Basin	Brick
SWCBSC32277	Catch Basin	Brick
SWCBSC32279	Catch Basin	Unknown
SWCBSC32283	Catch Basin	Brick
SWCBSC32287	Catch Basin	Brick
SWCBSC32288	Catch Basin	Brick
SWCBSC32291	Catch Basin	Concrete
SWCBSC32294	Catch Basin	Brick
SWCBSC32296	Catch Basin	Brick
SWCBSC32297	Catch Basin	Brick
SWCBSC32298	Catch Basin	Unknown
SWCBSC32300	Catch Basin	Unknown
SWCBSC32301	Catch Basin	Brick
SWCBSC32303	Catch Basin	Brick
SWCBSC32304	Catch Basin	Brick
SWCBSC32306	Catch Basin	Brick
SWCBSC32307	Catch Basin	Brick
SWCBSC32309	Catch Basin	Brick
SWCBSC32310	Catch Basin	Brick
SWCBSC32315	Catch Basin	Brick
SWCBSC32316	Catch Basin	Concrete
SWCBSC32319	Catch Basin	Concrete
SWCBSC32320	Catch Basin	Concrete
SWCBSC32324	Catch Basin	Concrete
SWCBSC32325	Catch Basin	Concrete
SWCBSC32328	Catch Basin	Concrete
SWCBSC32329	Catch Basin	Concrete
SWCBSC32332	Catch Basin	Concrete
SWCBSC32334	Catch Basin	Concrete
SWCBSC32335	Catch Basin	Concrete
SWCBSC32338	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBSC32340	Catch Basin	Concrete
SWCBSC32342	Catch Basin	Brick
SWCBSC32343	Catch Basin	Brick
SWCBSC32346	Catch Basin	Concrete
SWCBSC32347	Catch Basin	Concrete
SWCBSC32350	Catch Basin	Concrete
SWCBSC32351	Catch Basin	Concrete
SWCBSC32355	Catch Basin	Brick
SWCBSC32357	Catch Basin	Brick
SWCBSC32366	Catch Basin	Brick
SWCBSC32367	Catch Basin	Brick
SWCBSC32369	Catch Basin	Brick
SWCBSC32371	Catch Basin	Brick
SWCBSC32375	Catch Basin	Brick
SWCBSC32378	Catch Basin	Brick
SWCBSC32379	Catch Basin	Brick
SWCBSC32396	Catch Basin	Brick
SWCBSC32397	Catch Basin	Brick
SWCBSC32398	Catch Basin	Concrete
SWCBSC32399	Catch Basin	Concrete
SWCBSC32400	Catch Basin	Concrete
SWCBSC32401	Catch Basin	Concrete
SWCBSC32402	Catch Basin	Brick
SWCBSC32403	Catch Basin	Concrete
SWCBSC32407	Catch Basin	Concrete
SWCBSC32408	Catch Basin	Brick
SWCBSC32414	Catch Basin	Concrete
SWCBSC32415	Catch Basin	Brick
SWCBSC32430	Catch Basin	Concrete
SWCBSC32432	Catch Basin	Brick
SWCBSC32435	Catch Basin	Brick
SWCBSC32436	Catch Basin	Brick
SWCBSC32449	Catch Basin	Unknown
SWCBSC32460	Catch Basin	Unknown
SWCBSC32473	Catch Basin	Unknown
SWCBSC32475	Catch Basin	Brick
SWCBSC32476	Catch Basin	Brick

Structure ID	Type	Material
SWCBSC32480	Catch Basin	Brick
SWCBSC32481	Catch Basin	Concrete
SWCBUC30800	Catch Basin	Concrete
SWCBUC30801	Catch Basin	Concrete
SWCBUC30802	Catch Basin	Concrete
SWCBUC30803	Catch Basin	Concrete
SWCBUC30806	Catch Basin	Concrete
SWCBUC30807	Catch Basin	Concrete
SWCBUC30808	Catch Basin	Concrete
SWCBUC30813	Catch Basin	Concrete
SWCBUC30814	Catch Basin	Concrete
SWCBUC30957	Catch Basin	Brick
SWCBUC30960	Catch Basin	Brick
SWCBUC30835	Catch Basin	Brick
SWCBUC30836	Catch Basin	Concrete
SWCBUC30838	Catch Basin	Concrete
SWCBUC30839	Catch Basin	Concrete
SWCBUC30842	Catch Basin	Concrete
SWCBUC30843	Catch Basin	Concrete
SWCBUC30919	Catch Basin	Brick
SWCBUC30921	Catch Basin	Brick
SWCBUC30922	Catch Basin	Brick
SWCBUC30925	Catch Basin	Brick
SWCBUC30927	Catch Basin	Brick
SWCBUC30928	Catch Basin	Brick
SWCBUC30929	Catch Basin	Concrete
SWCBUC30930	Catch Basin	Concrete
SWCBUC30933	Catch Basin	Concrete
SWCBUC30934	Catch Basin	Concrete
SWCBUC30935	Catch Basin	Concrete
SWCBUC30936	Catch Basin	Concrete
SWCBUC30937	Catch Basin	Concrete
SWCBUC30939	Catch Basin	Concrete
SWCBUC30940	Catch Basin	Concrete
SWCBUC30941	Catch Basin	Concrete
SWCBUC30943	Catch Basin	Concrete
SWCBUC30944	Catch Basin	Concrete

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Structure ID	Type	Material
SWCBUC30950	Catch Basin	Concrete
SWCBUC30951	Catch Basin	Concrete
SWCBUC30952	Catch Basin	Concrete
SWCBUC30953	Catch Basin	Concrete
SWCBUC30815	Catch Basin	Concrete
SWCBUC30819	Catch Basin	Concrete
SWCBUC30820	Catch Basin	Concrete
SWCBUC30821	Catch Basin	Concrete
SWCBUC30822	Catch Basin	Concrete
SWCBUC30823	Catch Basin	Concrete
SWCBUC30828	Catch Basin	Unknown
SWCBUC30829	Catch Basin	Concrete
SWCBUC30830	Catch Basin	Concrete
SWCBUC30831	Catch Basin	Concrete
SWCBUC30832	Catch Basin	Concrete
SWCBUC32003	Catch Basin	Unknown
SWCBUC30908	Catch Basin	Brick
SWCBUC30909	Catch Basin	Brick
SWCBUC30915	Catch Basin	Brick
SWCBUC30917	Catch Basin	Brick
SWCBUC30844	Catch Basin	Concrete
SWCBUC30847	Catch Basin	Concrete
SWCBUC30849	Catch Basin	Concrete
SWCBUC30851	Catch Basin	Brick
SWCBUC30852	Catch Basin	Concrete
SWCBUC30861	Catch Basin	Concrete
SWCBUC30864	Catch Basin	Brick
SWCBUC30866	Catch Basin	Brick
SWCBUC30868	Catch Basin	Concrete
SWCBUC30869	Catch Basin	Brick
SWCBUC30871	Catch Basin	Brick
SWCBUC30872	Catch Basin	Brick
SWCBUC30875	Catch Basin	Brick
SWCBUC30876	Catch Basin	Brick
SWCBUC30879	Catch Basin	Brick
SWCBUC30880	Catch Basin	Brick
SWCBUC30882	Catch Basin	Brick

Structure ID	Type	Material
SWCBUC30887	Catch Basin	Brick
SWCBUC30889	Catch Basin	Brick
SWCBUC30893	Catch Basin	Brick
SWCBUC30896	Catch Basin	Brick
SWCBUC30899	Catch Basin	Brick
SWCBUC30900	Catch Basin	Brick
SWCBUC30903	Catch Basin	Brick
SWCBUC30904	Catch Basin	Brick
SWCBUC30740	Catch Basin	Brick
SWCBUC30743	Catch Basin	Brick
SWCBUC30744	Catch Basin	Brick
SWCBUC30745	Catch Basin	Brick
SWCBUC30748	Catch Basin	Unknown
SWCBUC30749	Catch Basin	Brick
SWCBUC30750	Catch Basin	Brick
SWCBUC30753	Catch Basin	Unknown
SWCBUC30758	Catch Basin	Concrete
SWCBUC30761	Catch Basin	Concrete
SWCBUC30762	Catch Basin	Concrete
SWCBUC30766	Catch Basin	Concrete
SWCBUC30767	Catch Basin	Concrete
SWCBUC30769	Catch Basin	Concrete
SWCBUC30773	Catch Basin	Brick
SWCBUC30774	Catch Basin	Brick
SWCBUC30776	Catch Basin	Brick
SWCBUC32045	Catch Basin	Brick
SWCBUC32046	Catch Basin	Concrete
SWCBUC32048	Catch Basin	Concrete
SWCBUC30778	Catch Basin	Brick
SWCBUC30779	Catch Basin	Brick
SWCBUC30781	Catch Basin	Brick
SWCBUC30782	Catch Basin	Brick
SWCBUC30785	Catch Basin	Concrete
SWCBUC30786	Catch Basin	Concrete
SWCBUC30788	Catch Basin	Concrete
SWCBUC30792	Catch Basin	Concrete
SWCBUC30793	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBUC30965	Catch Basin	Brick
SWCBUC30966	Catch Basin	Brick
SWCBUC30968	Catch Basin	Brick
SWCBUC30969	Catch Basin	Brick
SWCBUC30972	Catch Basin	Brick
SWCBUC30973	Catch Basin	Brick
SWCBUC30978	Catch Basin	Concrete
SWCBUC30979	Catch Basin	Concrete
SWCBUC30980	Catch Basin	Concrete
SWCBUC30981	Catch Basin	Concrete
SWCBUC30983	Catch Basin	Concrete
SWCBUC30984	Catch Basin	Concrete
SWCBUC30985	Catch Basin	Concrete
SWCBUC30986	Catch Basin	Concrete
SWCBUC30992	Catch Basin	Concrete
SWCBUC30994	Catch Basin	Concrete
SWCBUC30996	Catch Basin	Concrete
SWCBUC30997	Catch Basin	Concrete
SWCBUC30998	Catch Basin	Concrete
SWCBUC31002	Catch Basin	Concrete
SWCBUC31005	Catch Basin	Concrete
SWCBUC31006	Catch Basin	Concrete
SWCBUC31007	Catch Basin	Concrete
SWCBUC31009	Catch Basin	Concrete
SWCBUC31013	Catch Basin	Concrete
SWCBUC31014	Catch Basin	Concrete
SWCBUC31016	Catch Basin	Concrete
SWCBUC31017	Catch Basin	Concrete
SWCBUC31018	Catch Basin	Concrete
SWCBUC31019	Catch Basin	Brick
SWCBUC31021	Catch Basin	Concrete
SWCBUC31022	Catch Basin	Concrete
SWCBUC31023	Catch Basin	Concrete
SWCBUC31024	Catch Basin	Concrete
SWCBUC31025	Catch Basin	Concrete
SWCBUC31026	Catch Basin	Concrete
SWCBUC31027	Catch Basin	Concrete

Structure ID	Type	Material
SWCBUC31031	Catch Basin	Concrete
SWCBUC31036	Catch Basin	Concrete
SWCBUC31037	Catch Basin	Concrete
SWCBUC31039	Catch Basin	Concrete
SWCBUC31040	Catch Basin	Concrete
SWCBUC31049	Catch Basin	Concrete
SWCBUC31050	Catch Basin	Concrete
SWCBUC31052	Catch Basin	Concrete
SWCBUC31053	Catch Basin	Concrete
SWCBUC31056	Catch Basin	Concrete
SWCBUC31057	Catch Basin	Concrete
SWCBUC31059	Catch Basin	Concrete
SWCBUC31060	Catch Basin	Concrete
SWCBUC31065	Catch Basin	Concrete
SWCBUC31067	Catch Basin	Concrete
SWCBUC31069	Catch Basin	Concrete
SWCBUC31073	Catch Basin	Concrete
SWCBUC31074	Catch Basin	Concrete
SWCBUC31075	Catch Basin	Concrete
SWCBUC31076	Catch Basin	Concrete
SWCBUC31079	Catch Basin	Concrete
SWCBUC31080	Catch Basin	Concrete
SWCBUC31081	Catch Basin	Concrete
SWCBUC31085	Catch Basin	Concrete
SWCBUC31087	Catch Basin	Concrete
SWCBUC31089	Catch Basin	Concrete
SWCBUC31090	Catch Basin	Concrete
SWCBUC31096	Catch Basin	Concrete
SWCBUC31099	Catch Basin	Concrete
SWCBUC31100	Catch Basin	Concrete
SWCBUC31101	Catch Basin	Concrete
SWCBUC31105	Catch Basin	Concrete
SWCBUC31106	Catch Basin	Concrete
SWCBUC31109	Catch Basin	Concrete
SWCBUC31112	Catch Basin	Concrete
SWCBUC31113	Catch Basin	Concrete
SWCBUC31115	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBUC31116	Catch Basin	Concrete
SWCBUC31118	Catch Basin	Concrete
SWCBUC31119	Catch Basin	Concrete
SWCBUC31126	Catch Basin	Concrete
SWCBUC31127	Catch Basin	Concrete
SWCBUC31133	Catch Basin	Concrete
SWCBUC31139	Catch Basin	Concrete
SWCBUC31140	Catch Basin	Concrete
SWCBUC31145	Catch Basin	Concrete
SWCBUC31148	Catch Basin	Concrete
SWCBUC31149	Catch Basin	Concrete
SWCBUC31156	Catch Basin	Brick
SWCBUC31168	Catch Basin	Concrete
SWCBUC31177	Catch Basin	Brick
SWCBUC31178	Catch Basin	Unknown
SWCBUC31186	Catch Basin	Unknown
SWCBUC31194	Catch Basin	Brick
SWCBUC31196	Catch Basin	Unknown
SWCBUC31200	Catch Basin	Brick
SWCBUC31201	Catch Basin	Brick
SWCBWC31207	Catch Basin	Concrete
SWCBUC31213	Catch Basin	Concrete
SWCBUC31214	Catch Basin	Concrete
SWCBUC31219	Catch Basin	Concrete
SWCBUC31222	Catch Basin	Concrete
SWCBUC31224	Catch Basin	Concrete
SWCBUC31229	Catch Basin	Concrete
SWCBUC31233	Catch Basin	Brick
SWCBUC31234	Catch Basin	Brick
SWCBUC31237	Catch Basin	Concrete
SWCBUC32050	Catch Basin	Brick
SWCBUC32051	Catch Basin	Brick
SWCBUC32052	Catch Basin	Concrete
SWCBUC31238	Catch Basin	Concrete
SWCBUC31241	Catch Basin	Concrete
SWCBUC31242	Catch Basin	Concrete
SWCBUC31248	Catch Basin	Concrete

Structure ID	Type	Material
SWCBUC31249	Catch Basin	Concrete
SWCBUC31252	Catch Basin	Concrete
SWCBUC31253	Catch Basin	Brick
SWCBUC31263	Catch Basin	Brick
SWCBUC31264	Catch Basin	Concrete
SWCBUC31268	Catch Basin	Concrete
SWCBUC31269	Catch Basin	Concrete
SWCBUC31271	Catch Basin	Concrete
SWCBUC31272	Catch Basin	Concrete
SWCBUC31274	Catch Basin	Concrete
SWCBUC31275	Catch Basin	Concrete
SWCBUC31278	Catch Basin	Concrete
SWCBUC31279	Catch Basin	Concrete
SWCBUC31280	Catch Basin	Concrete
SWCBUC31281	Catch Basin	Concrete
SWCBUC31283	Catch Basin	Concrete
SWCBUC31284	Catch Basin	Concrete
SWCBUC31287	Catch Basin	Concrete
SWCBUC31288	Catch Basin	Concrete
SWCBUC31291	Catch Basin	Concrete
SWCBUC31292	Catch Basin	Concrete
SWCBUC31295	Catch Basin	Concrete
SWCBUC31296	Catch Basin	Concrete
SWCBUC31298	Catch Basin	Concrete
SWCBUC31299	Catch Basin	Concrete
SWCBUC31302	Catch Basin	Concrete
SWCBUC31303	Catch Basin	Concrete
SWCBUC31304	Catch Basin	Concrete
SWCBUC31312	Catch Basin	Concrete
SWCBUC31316	Catch Basin	Concrete
SWCBUC31317	Catch Basin	Concrete
SWCBUC31320	Catch Basin	Concrete
SWCBUC31325	Catch Basin	Concrete
SWCBUC31326	Catch Basin	Concrete
SWCBUC31331	Catch Basin	Brick
SWCBUC31332	Catch Basin	Brick
SWCBUC31333	Catch Basin	Brick

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBUC31334	Catch Basin	Brick
SWCBUC31335	Catch Basin	Brick
SWCBUC31337	Catch Basin	Unknown
SWCBUC31338	Catch Basin	Brick
SWCBUC31342	Catch Basin	Brick
SWCBUC31343	Catch Basin	Brick
SWCBUC31344	Catch Basin	Brick
SWCBUC31355	Catch Basin	Brick
SWCBUC31356	Catch Basin	Concrete
SWCBUC31358	Catch Basin	Brick
SWCBUC31359	Catch Basin	Brick
SWCBUC31361	Catch Basin	Concrete
SWCBUC31362	Catch Basin	Concrete
SWCBUC31367	Catch Basin	Concrete
SWCBUC31368	Catch Basin	Concrete
SWCBUC31370	Catch Basin	Concrete
SWCBUC31371	Catch Basin	Concrete
SWCBUC31374	Catch Basin	Concrete
SWCBUC31375	Catch Basin	Concrete
SWCBUC31378	Catch Basin	Brick
SWCBUC31379	Catch Basin	Brick
SWCBUC31380	Catch Basin	Brick
SWCBUC31381	Catch Basin	Brick
SWCBUC31385	Catch Basin	Brick
SWCBUC31388	Catch Basin	Concrete
SWCBUC31389	Catch Basin	Brick
SWCBUC31392	Catch Basin	Brick
SWCBUC31393	Catch Basin	Brick
SWCBUC31395	Catch Basin	Brick
SWCBUC31396	Catch Basin	Brick
SWCBUC31397	Catch Basin	Brick
SWCBUC31399	Catch Basin	Brick
SWCBUC31400	Catch Basin	Brick
SWCBUC31402	Catch Basin	Brick
SWCBUC31404	Catch Basin	Brick
SWCBUC31405	Catch Basin	Brick
SWCBUC31406	Catch Basin	Brick

Structure ID	Type	Material
SWCBUC31407	Catch Basin	Concrete
SWCBUC31409	Catch Basin	Brick
SWCBUC31411	Catch Basin	Brick
SWCBUC31412	Catch Basin	Brick
SWCBUC31413	Catch Basin	Concrete
SWCBUC31414	Catch Basin	Concrete
SWCBUC31415	Catch Basin	Concrete
SWCBUC31419	Catch Basin	Concrete
SWCBUC31420	Catch Basin	Brick
SWCBUC31422	Catch Basin	Unknown
SWCBUC31423	Catch Basin	Concrete
SWCBUC31424	Catch Basin	Brick
SWCBUC31425	Catch Basin	Concrete
SWCBUC31426	Catch Basin	Brick
SWCBUC31428	Catch Basin	Brick
SWCBUC31429	Catch Basin	Concrete
SWCBUC31431	Catch Basin	Unknown
SWCBUC31432	Catch Basin	Concrete
SWCBUC31433	Catch Basin	Concrete
SWCBUC31435	Catch Basin	Concrete
SWCBUC31436	Catch Basin	Concrete
SWCBUC31438	Catch Basin	Brick
SWCBUC31439	Catch Basin	Brick
SWCBUC31440	Catch Basin	Brick
SWCBUC31441	Catch Basin	Brick
SWCBUC31443	Catch Basin	Brick
SWCBUC31450	Catch Basin	Concrete
SWCBUC31451	Catch Basin	Concrete
SWCBUC31453	Catch Basin	Concrete
SWCBUC31454	Catch Basin	Concrete
SWCBUC31457	Catch Basin	Concrete
SWCBUC31458	Catch Basin	Concrete
SWCBUC31460	Catch Basin	Concrete
SWCBUC31461	Catch Basin	Concrete
SWCBUC31474	Catch Basin	Concrete
SWCBUC31475	Catch Basin	Concrete
SWCBUC31476	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBUC31477	Catch Basin	Concrete
SWCBUC31478	Catch Basin	Concrete
SWCBUC31481	Catch Basin	Concrete
SWCBUC31482	Catch Basin	Concrete
SWCBUC31483	Catch Basin	Brick
SWCBUC31484	Catch Basin	Brick
SWCBUC31486	Catch Basin	Brick
SWCBUC31487	Catch Basin	Brick
SWCBUC31500	Catch Basin	Concrete
SWCBUC31501	Catch Basin	Concrete
SWCBUC31503	Catch Basin	Brick
SWCBUC31504	Catch Basin	Brick
SWCBUC31507	Catch Basin	Brick
SWCBUC31508	Catch Basin	Brick
SWCBUC31510	Catch Basin	Brick
SWCBUC31511	Catch Basin	Brick
SWCBUC31521	Catch Basin	Concrete
SWCBUC31524	Catch Basin	Concrete
SWCBUC31525	Catch Basin	Concrete
SWCBUC31526	Catch Basin	Concrete
SWCBUC31527	Catch Basin	Concrete
SWCBUC31530	Catch Basin	Concrete
SWCBUC31531	Catch Basin	Concrete
SWCBUC31532	Catch Basin	Concrete
SWCBUC31534	Catch Basin	Concrete
SWCBUC31536	Catch Basin	Concrete
SWCBUC31537	Catch Basin	Concrete
SWCBUC31545	Catch Basin	Concrete
SWCBUC31546	Catch Basin	Concrete
SWCBUC31548	Catch Basin	Concrete
SWCBUC31550	Catch Basin	Concrete
SWCBUC31551	Catch Basin	Concrete
SWCBUC31557	Catch Basin	Concrete
SWCBUC31559	Catch Basin	Concrete
SWCBUC31560	Catch Basin	Concrete
SWCBUC31564	Catch Basin	Concrete
SWCBUC31573	Catch Basin	Concrete

Structure ID	Type	Material
SWCBUC31574	Catch Basin	Concrete
SWCBUC31576	Catch Basin	Concrete
SWCBUC31577	Catch Basin	Concrete
SWCBUC31578	Catch Basin	Concrete
SWCBUC31579	Catch Basin	Concrete
SWCBUC31586	Catch Basin	Concrete
SWCBUC31588	Catch Basin	Concrete
SWCBUC31592	Catch Basin	Concrete
SWCBUC31593	Catch Basin	Concrete
SWCBUC31604	Catch Basin	Concrete
SWCBUC31605	Catch Basin	Brick
SWCBUC31609	Catch Basin	Concrete
SWCBUC31611	Catch Basin	Brick
SWCBUC31613	Catch Basin	Concrete
SWCBUC31617	Catch Basin	Concrete
SWCBUC31619	Catch Basin	Concrete
SWCBUC31620	Catch Basin	Concrete
SWCBUC31628	Catch Basin	Concrete
SWCBUC31629	Catch Basin	Brick
SWCBUC31630	Catch Basin	Brick
SWCBUC31631	Catch Basin	Brick
SWCBUC31635	Catch Basin	Concrete
SWCBUC31636	Catch Basin	Concrete
SWCBUC31637	Catch Basin	Concrete
SWCBUC31638	Catch Basin	Concrete
SWCBUC31640	Catch Basin	Concrete
SWCBUC31641	Catch Basin	Concrete
SWCBUC31643	Catch Basin	Concrete
SWCBUC31644	Catch Basin	Concrete
SWCBUC31645	Catch Basin	Concrete
SWCBUC31648	Catch Basin	Concrete
SWCBUC31652	Catch Basin	Brick
SWCBUC31653	Catch Basin	Brick
SWCBUC31654	Catch Basin	Brick
SWCBUC31661	Catch Basin	Concrete
SWCBUC31662	Catch Basin	Concrete
SWCBUC31664	Catch Basin	Brick

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBUC31665	Catch Basin	Brick
SWCBUC31670	Catch Basin	Brick
SWCBUC31671	Catch Basin	Brick
SWCBUC31674	Catch Basin	Brick
SWCBUC31675	Catch Basin	Brick
SWCBUC31679	Catch Basin	Concrete
SWCBUC31680	Catch Basin	Concrete
SWCBUC31681	Catch Basin	OTHER
SWCBUC31684	Catch Basin	Brick
SWCBUC31685	Catch Basin	Brick
SWCBUC31687	Catch Basin	Concrete
SWCBUC31688	Catch Basin	Brick
SWCBUC31695	Catch Basin	Concrete
SWCBUC31703	Catch Basin	Brick
SWCBUC31705	Catch Basin	Concrete
SWCBUC31708	Catch Basin	Concrete
SWCBUC31712	Catch Basin	Concrete
SWCBUC31713	Catch Basin	Concrete
SWCBUC31714	Catch Basin	Concrete
SWCBUC31718	Catch Basin	Concrete
SWCBUC31719	Catch Basin	Concrete
SWCBUC31720	Catch Basin	Concrete
SWCBUC31725	Catch Basin	Concrete
SWCBUC31729	Catch Basin	Concrete
SWCBUC31730	Catch Basin	Concrete
SWCBUC31732	Catch Basin	Concrete
SWCBUC31736	Catch Basin	Concrete
SWCBUC31738	Catch Basin	Concrete
SWCBUC31739	Catch Basin	Concrete
SWCBUC31740	Catch Basin	Concrete
SWCBUC31741	Catch Basin	Concrete
SWCBUC31745	Catch Basin	Concrete
SWCBUC31746	Catch Basin	Brick
SWCBUC31748	Catch Basin	Concrete
SWCBUC31749	Catch Basin	Brick
SWCBUC31753	Catch Basin	Brick
SWCBUC31756	Catch Basin	Brick

Structure ID	Type	Material
SWCBUC31757	Catch Basin	Brick
SWCBUC31762	Catch Basin	Concrete
SWCBUC31763	Catch Basin	Concrete
SWCBUC31764	Catch Basin	Brick
SWCBUC31765	Catch Basin	Brick
SWCBUC31766	Catch Basin	Brick
SWCBUC31770	Catch Basin	Concrete
SWCBUC31771	Catch Basin	Concrete
SWCBUC31772	Catch Basin	Concrete
SWCBUC31773	Catch Basin	Concrete
SWCBUC31774	Catch Basin	Concrete
SWCBUC31775	Catch Basin	Concrete
SWCBUC31776	Catch Basin	Concrete
SWCBUC31777	Catch Basin	Concrete
SWCBUC31778	Catch Basin	Concrete
SWCBUC31779	Catch Basin	Concrete
SWCBUC31780	Catch Basin	Concrete
SWCBUC31781	Catch Basin	Concrete
SWCBUC31783	Catch Basin	Concrete
SWCBUC31784	Catch Basin	Concrete
SWCBUC31785	Catch Basin	Concrete
SWCBUC31786	Catch Basin	Concrete
SWCBUC31800	Catch Basin	Concrete
SWCBUC31801	Catch Basin	Brick
SWCBUC31802	Catch Basin	Brick
SWCBUC31807	Catch Basin	Concrete
SWCBUC31808	Catch Basin	Concrete
SWCBUC31827	Catch Basin	Brick
SWCBUC31829	Catch Basin	Brick
SWCBUC31830	Catch Basin	Brick
SWCBUC31831	Catch Basin	Concrete
SWCBUC31837	Catch Basin	Concrete
SWCBUC31855	Catch Basin	Concrete
SWCBUC31857	Catch Basin	Brick
SWCBUC31863	Catch Basin	Brick
SWCBUC31864	Catch Basin	Brick
SWCBUC31865	Catch Basin	Brick

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	Type	Material
SWCBUC31866	Catch Basin	Brick
SWCBUC31868	Catch Basin	Concrete
SWCBUC31872	Catch Basin	Concrete
SWCBUC31874	Catch Basin	Brick
SWCBUC31875	Catch Basin	Brick
SWCBUC31877	Catch Basin	Brick
SWCBUC31879	Catch Basin	Concrete
SWCBUC31880	Catch Basin	Concrete
SWCBUC31889	Catch Basin	Brick
SWCBUC31890	Catch Basin	Brick
SWCBUC31893	Catch Basin	Unknown
SWCBUC31897	Catch Basin	Concrete
SWCBUC31898	Catch Basin	Unknown
SWCBUC31901	Catch Basin	Unknown
SWCBUC31902	Catch Basin	Unknown
SWCBUC31906	Catch Basin	Concrete
SWCBUC31907	Catch Basin	Concrete
SWCBUC31908	Catch Basin	Concrete
SWCBUC31910	Catch Basin	Concrete
SWCBUC31911	Catch Basin	Concrete
SWCBUC31912	Catch Basin	Concrete
SWCBUC31913	Catch Basin	Concrete
SWCBUC31915	Catch Basin	Concrete
SWCBUC31917	Catch Basin	Concrete
SWCBUC31919	Catch Basin	Brick
SWCBUC31923	Catch Basin	Concrete
SWCBUC31925	Catch Basin	Unknown
SWCBUC31929	Catch Basin	Concrete
SWCBUC31930	Catch Basin	Brick
SWCBUC31932	Catch Basin	Concrete
SWCBUC30652	Catch Basin	Concrete
SWCBUC30653	Catch Basin	Concrete
SWCBUC30654	Catch Basin	Concrete
SWCBUC30655	Catch Basin	Concrete
SWCBUC30657	Catch Basin	Concrete
SWCBUC30658	Catch Basin	Concrete
SWCBUC30659	Catch Basin	Concrete

Structure ID	Type	Material
SWCBUC30660	Catch Basin	Concrete
SWCBUC30661	Catch Basin	Concrete
SWCBUC30662	Catch Basin	Concrete
SWCBUC30663	Catch Basin	Unknown
SWCBUC30664	Catch Basin	Concrete
SWCBUC30665	Catch Basin	Concrete
SWCBUC30666	Catch Basin	Concrete
SWCBUC30667	Catch Basin	Concrete
SWCBUC30668	Catch Basin	Concrete
SWCBUC30673	Catch Basin	Concrete
SWCBUC30675	Catch Basin	Concrete
SWCBUC30679	Catch Basin	Concrete
SWCBUC30680	Catch Basin	Concrete
SWCBUC30683	Catch Basin	Concrete
SWCBUC30684	Catch Basin	Concrete
SWCBUC30685	Catch Basin	Concrete
SWCBUC30686	Catch Basin	Concrete
SWCBUC30693	Catch Basin	Concrete
SWCBUC30694	Catch Basin	Concrete
SWCBUC30696	Catch Basin	Concrete
SWCBUC30697	Catch Basin	Concrete
SWCBUC30698	Catch Basin	Concrete
SWCBUC30699	Catch Basin	Concrete
SWCBUC30700	Catch Basin	Concrete
SWCBUC30703	Catch Basin	Concrete
SWCBUC30705	Catch Basin	Concrete
SWCBUC30706	Catch Basin	Concrete
SWCBUC30711	Catch Basin	Concrete
SWCBUC30712	Catch Basin	Brick
SWCBUC30717	Catch Basin	Concrete
SWCBUC30718	Catch Basin	Concrete
SWCBUC30723	Catch Basin	Concrete
SWCBUC30724	Catch Basin	Concrete
SWCBUC30727	Catch Basin	Concrete
SWCBUC30728	Catch Basin	Concrete
SWCBUC30729	Catch Basin	Concrete
SWCBUC30730	Catch Basin	Concrete

Appendix C – Stormwater Inventory (Tabular Format)

Structure ID	**Type**	**Material**
SWCBUC30739	Catch Basin	Unknown
SWCBUC29306	Catch Basin	Concrete
SWCBUC29307	Catch Basin	Concrete
SWCBUC29311	Catch Basin	Concrete
SWCBUC29312	Catch Basin	Concrete
SWCBUC29339	Catch Basin	Concrete
SWCBUC29343	Catch Basin	Concrete

Total: 9,628 structures

Appendix B - Stormwater Inventory Map

Appendix A – Definitions

Annual Report means the document submitted by the permittee on an annual basis summarizing the SWMP activities conducted during the previous reporting period, in accordance with Part 4.1 of this permit.

Best Management Practice or **BMP** means both structural devices to store or treat storm water runoff and non-structural programs or practices which are designed to prevent or reduce the pollution of the waters of the State of Georgia.

Construction Activity means the disturbance of soils associated with clearing, grading, excavating, filling of land, or other similar activities which may result in soil erosion.

Construction General Permits or **CGPs** means the Georgia NPDES Permit for Stormwater Discharges Associated with Construction Activity Nos. GAR100001, GAR100002 and GAR100003, which identify the Manual for Erosion and Sediment Control in Georgia (Green Book) and stream buffer requirements.

CWA means the Federal Clean Water Act (formerly known as the Federal Water Pollution Control Act or the Federal Water Pollution Control Act Amendments of 1972), as amended.

Director means the Director of the Environmental Protection Division of the Department of Natural Resources, State of Georgia.

EPA or **USEPA** means the United States Environmental Protection Agency.

EPD means the Environmental Protection Division of the Department of Natural Resources, State of Georgia.

Highly Visible Pollutant Source or **HVPS** means a land use or activity that produces higher than normally found levels of pollutants in stormwater runoff. These facilities may include, but are not limited to, gasoline stations, auto repair shops, commercial car washes, home improvement stores, nurseries, kennels, veterinarian offices, etc. These facilities may also include industries that are not required to be covered under the IGP.

Illicit Connection means any man-made conveyance connecting a non-stormwater discharge directly to an MS4.

Illicit Discharge means any direct or indirect non-stormwater discharge to the separate storm sewer system, including but not limited to, sewage, process wastewater, and washwater. The discharge may be continuous or intermittent in occurrence.

Industrial Activity means the activities related to manufacturing, processing, or raw materials storage areas of an industrial plant.

Industrial Facility means a facility that is eligible to be permitted under the IGP because it has an industrial activity listed in Appendix B.

Industrial Storm Water General Permit or **IGP** means the Georgia NPDES Permit(s) for Storm Water Discharges Associated with Industrial Activity.

Maximum Extent Practicable or **MEP** means the technology-based discharge standards and controls necessary for the reduction of pollutants discharged from an MS4. These standards and controls may consist of a combination of BMPs, control techniques, system design and engineering methods, and such other provisions for the reduction of pollutants discharged from a MS4 as described in the SWMP.

Municipal Separate Storm Sewer System or an **MS4** means a conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels or storm drains, owned or operated by a municipality or other public body, designed or used for collecting or conveying storm water runoff and is not a combined sewer or part of a Publicly Owned Treatment Works.

National Pollutant Discharge Elimination System or **NPDES** means the program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits under the CWA.

Operator means the entity that has the primary day-to-day operational control of the activities necessary to ensure compliance with the SWMP requirements and the MS4 permit conditions.

Outfall means the most downstream point (i.e., final discharge point) on an MS4 where it discharges to the waters of the State.

Owner means the legal title holder to the real property on which is located the facility or site where an SWMP activity takes place.

Point Source means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged into the waters of the State of Georgia. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water.

POTW means Publicly Owned Treatment Works.

State Act means the Georgia Water Quality Control Act, as amended.

State Rules or **Rules** means the Georgia Rules and Regulations for Water Quality Control.

Storm Water means storm water runoff, snowmelt runoff, and surface runoff and drainage.

SWMP or **Program** means the Storm Water Management Program required to be developed and implemented under the terms and conditions of this permit and refers to a comprehensive program to manage the quality of storm water discharged from a MS4.

Waters of the State means any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, wetlands, and all other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the State which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.