Appendix 1: Definitions

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Appendix 1: Definitions

A

Advanced Wastewater Treatment: Any treatment of sewage that goes beyond the secondary or biological water treatment stage and includes the removal of nutrients such as phosphorus and nitrogen and a high percentage of suspended solids. (See primary, secondary treatment.)

B

Backwater conditions: When the sewer system fills to maximum capacity during large storms, and excess water attempting to enter the collection system is pushed backwards (or against gravity) into connecting branch sewers, sewer laterals, and house fixtures.

Bacteria (Singular: bacterium): Microscopic living organisms that can aid in pollution control by metabolizing organic matter in sewage, oil spills or other pollutants. However, some types of bacteria in soil, water or air can also cause human, animal and plant health problems. Measured in number of bacteria organisms per 100 milliliters of sample (No./ml or #/100 ml).

Best Management Practice (BMP): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources.

Bulkhead: A constructed system blockage that eliminates a sewer system connection.

Bypass sewer: A sewer used to circumvent, or remove flow from a sewer line, typically done to relieve an under capacity sewer or to reroute sewage so that a damaged line can be repaired.

C

Capture: The total volume of flow collected in the combined sewer system during precipitation events on a system-wide, annual average basis (not percent of volume being discharged).

Catch basin: A receptacle at the entrance to a sewer designed to keep out large or obstructive matter.

Clarified effluent: Wastewater that has undergone primary treatment (primary sedimentation/clarification), meaning that rags, grit, dirt, and settable solids have been removed.

Collection system: Pipes used to collect and carry wastewater from individual sources to an interceptor sewer that will carry it to a treatment facility.

Combined sewage: Sewage conveyed in a combined sewer system, consisting of stormwater runoff, sanitary sewage, and industrial wastewater.

Combined Sewer Overflow (CSO): Discharge of a mixture of storm water and domestic waste when the flow capacity of a sewer system is exceeded during rainstorms.

Combined Sewer System (CSS): A sewer system that carries both sewage and storm-water runoff. Normally, its entire flow goes to a waste treatment plant, but during a heavy storm, the volume of water may be so great as to cause overflows of untreated mixtures of storm water and sewage into receiving waters. Storm-water runoff may also carry toxic chemicals from industrial areas or streets into the sewer system.

Consent Decree: A final, binding judicial decree or judgment memorializing a voluntary agreement between parties to a suit in return for withdrawal of a criminal charge or an end to a civil litigation.

Construction staging area: A designated area where vehicles, supplies, and construction equipment are positioned for access and use to a construction site.

D

Dechlorination: A chemical process by which chlorine is removed from wastewater in order to mitigate chlorine's detrimental environmental effects on receiving water bodies.

Design-build: A type of construction contract where a Prime or Main contractor bids or negotiates to provide Design and Construction services for the entire construction project.

Design storm: A storm whose magnitude, rate, and intensity do not exceed the design load for a storm drainage system or flood protection project.

Discharge: Flow of surface water in a stream or canal or the outflow of ground water from a flowing artesian well, ditch, or spring. Can also apply to discharge of liquid effluent from a facility or to chemical emissions into the air through designated venting mechanisms.

Downstream: The opposite of upstream; literally meaning away from the source of a river or stream.

E

Easement: A right of way giving individuals other than the owner permission to use a property for a specific purpose.

Effluent: Wastewater—treated or untreated—that flows out of a treatment plan, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Ejector pump: A pump that conveys wastewater from plumbing fixtures that are situated below the sewerage system into the conveyance system.

Eminent Domain: The power to take private property for public use by a state, municipality, or private person or corporation authorized to exercise functions of public character, following the payment of just compensation to the owner of that property.

F

Flushing apparatus: A system of hoses that ensure a total flush-out of the storage basin after each use.

G

Grinder pump: A waste management device whereby waste from water-using household appliances (toilets, bathtubs, washing machines, etc.) flows through the home's pipes into the grinder pump's holding tank. Once the waste inside the tank reaches a specific level, the pump will turn on, grind the waste into a fine slurry, and pump it to the central sewer system.

H

Helical anchor disk: Consists of one or more helix-shaped bearing plates attached to a central shaft which is installed by rotating into the ground.

Holding Pond: A pond or reservoir, usually made of earth, built to store polluted runoff.

Hydraulic Grade Line (HGL): The surface or profile of water flowing in an open channel or a pipe flowing partially full. If a pipe is under pressure, the hydraulic grade line is the level water would rise to in manhole connected to the pipe.

I

Impervious: Having a solid surface that doesn't allow water to penetrate, forcing it to run off. Examples are asphalt, concrete and brick.

Infiltration: The penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Inflow: Entry of extraneous rainwater into a sewer system from sources other than infiltration, such as basement drains, manholes, storm drains, and street washing.

Influent: Water, wastewater, or other liquid flowing into a reservoir, basin, or treatment plant.

Inlet: See Catch Basins.

Interceptor sewers: Large sewer lines that, in a combined system, control the flow of sewage to the treatment plant. During some storm events, their capacity is exceeded and regulator structures relieve excess flow to receiving waters to prevent flooding basements, businesses and streets.

J

K

L

Level sensor: A device that detects the level of substances that flow, including liquids, slurries, granular materials, and powders.

Long Term Control Plan (LTCP): A document developed by CSO communities to describe existing waterway conditions and various CSO abatement technologies that will be used to control overflows.

LID: Low Impact Development

LID-R: Low Impact Development – Retrofit

M

MOUSE: Computer model developed by the Danish Hydraulic Institute used to model the combined sewer system.

Municipal sewage: Wastes (mostly liquid) originating from a community; may be composed of domestic wastewater and/or industrial discharges.

N

National Pollutant Discharge Elimination System (NPDES): A provision of the Clean Water Act which prohibits discharge of pollutants into water of the United States unless a special permit is issued by EPA, a state, or, where delegated, a tribal government on an Indian reservation.

Non-point source (NPS): Diffused pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by storm water. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.

Nutrient: Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

O

Operation and Maintenance (O&M): Actions taken after construction to ensure that facilities constructed will be properly operated and maintained to achieve normative efficiency levels and prescribed effluent eliminations in an optimum manner.

Orifice system: A restriction used to regulate flow entering or leaving a sewer system facility.

Overflow structure: A structure designed to discharge combined sewage from the sewer system to a receiving water body when it is full.

Overland flow: The tendency of water to flow horizontally across land surfaces when rainfall has exceeded infiltration capacity and depression storage capacity.

P

Peak flows: The maximum flow through the sewer system or through the wastewater treatment plant. This term is typically used to describe daily flows (which have a diurnal peak) and maximum flow experienced by a system (typically during a rain event).

Permeable: Having an absorbent, porous surface that allows water to percolate into the soil, thus filtering out pollutants and recharging the water table. Examples include mulch, gravel, pervious concrete, or pervious/permeable paver.

Permeable/pervious pavers: Specially fabricated paving units designed to replace asphalt and other impermeable paving materials. Interconnected pore spaces within the material channel water into the underlying soil or into a special storage layer which forces slow percolation during periods of heavy rainfall. Permeable pavers are often laid on a bed of sand or gravel to enhance drainage properties.

Point source: A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g., a pipe, ditch, ship, ore pit, factory smokestack.

Ponding level: The depth of standing water in the street.

Potable water: Water that is safe enough to be consumed by humans or used with low risk of immediate or long term harm.

Primary waste treatment: First steps in wastewater treatment; screens and sedimentation tanks are used to remove most materials that float or will settle. Primary treatment removes about 30 percent of carbonaceous biochemical oxygen demand from domestic sewage.

R

Rain gauge: A type of instrument used by meteorologists and hydrologists to gather and measure the amount of liquid precipitation over a set period of time.

Rain leader: A drain designed to collect water from the surface of a roof and discharge it to the ground surface or combined sewer system.

Rated capacity: The design peak flow rate of wastewater a treatment plant has been approved to process over a given period of time (typically measured in million gallons per day, or MGD).

Raw sewage: Untreated wastewater and its contents.

Return period: The likelihood or probability of an event with a specified intensity and duration. The intensity of a storm can be predicted for any return period and storm duration, from charts based on historic data for a location. The term *1 in 10 year storm* describes a rainfall event which is rare and is only likely to occur once every 10 years, so it has a 10 percent likelihood any given year.

Right of way: The right given by one landowner to another to pass over the land, construct a roadway, or use as a pathway, without actually transferring ownership.

Runoff: That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface-water. It can carry pollutants from the air and land into receiving waters.

S

Sanitary sewers: Underground pipes that carry off any domestic or industrial waste, not storm water.

Screen chamber: A collection of screens used to remove large objects such as rags, rocks, and dirt from wastewater in order to protect sensitive equipment.

Secondary treatment: The second step in most publicly owned waste treatment systems in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment.

Sediments: Soil, sand, and minerals washed from land into water, usually after rain. They pile up in reservoirs, rivers and harbors, destroying fish and wildlife habitat, and clouding the water so that sunlight cannot reach aquatic plants. Careless farming, mining, and building activities will expose sediment materials, allowing them to wash off the land after rainfall.

Sewer bypass: Any combination of equipment or structures utilized to circumvent or remove flow from one portion of a sewer line.

Sewer diversion structure: A structure designed to direct sewage from the sewer system to another facility such as storage tank, parallel sewer, or sewage outfall.

Sewer sludge: Sludge produced at a Publicly Owned Treatment Works (POTW), the disposal of which is regulated under the Clean Water Act.

Sewage: The waste and wastewater produced by residential and commercial sources and discharged into sewers.

Sewage outfall: A discharge point for a mixture of storm water and domestic waste when the flow capacity of a combined sewer system is exceeded during rainstorms.

Sewer: A channel or conduit that carries wastewater and storm-water runoff from the source to a treatment plant or receiving stream. “Sanitary” sewers carry household, industrial, and commercial waste. “Storm” sewers carry runoff from rain or snow. “Combined” sewers handle both.

Sewerage: The entire system of sewage collection, treatment, and disposal.

Sewershed: A defined sewer drainage area that is tributary to a single point within the sewage collection system.

Shotcrete: Concrete (or sometimes mortar) conveyed through a hose and pneumatically projected at high velocity onto a surface, as a construction technique.

Sluice gate: A gate designed to move vertically to control the flow of water out of a treatment plant, conveyance system, or a reservoir. Typically an emergency measure designed to provide relief to an overloaded reservoir or sewer system.

Storage: Treatment holding of waste pending treatment or disposal, as in containers, tanks, waste piles, and surface impoundments.

Storm return frequency: The per-year probability of a given storm occurring in a particular year. For example, a storm with a 15-year return interval has a 1/15 chance of occurring in a particular year.

Storm sewer: A system of pipes (separate from sanitary sewers) that carries waste runoff from buildings and land surfaces.

Subshed: A sub-portion of a water- or sewershed.

Surcharge flow: Flow in which the water level is above the crown of the pipe causing pressurized flow in pipe segments. Sewer surcharge refers to the overloading of the sewer beyond its design capacity due to inflow and infiltration of water. A surcharging sewer often results in sewer overflow at manholes

Surface runoff: Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source pollutants in rivers, streams, and lakes.

Surface water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Swirl tank: A facility that provides preliminary treatment for combined sewer overflow through solids removal by directing flow into a circular spinning motion which separates solids down and to the outside of the tank.

T

Tipping bucket gauge: A type of rain gauge that that collects and channels precipitation into a small seesaw-like container. After a pre-set amount of precipitation falls, the lever tips, dumping the collected water and sending an electrical signal.

Treated wastewater: Wastewater that has been subjected to one or more physical, chemical, and biological processes to reduce its potential of being a health hazard.

Treatment: (1) Any method, technique, or process designed to remove solids and/or pollutants from solid waste, waste-streams, effluents, and air emissions. (2) Methods used to change the biological character or composition of any regulated medical waste so as to substantially reduce or eliminate its potential for causing disease.

Treatment plan: A structure built to treat wastewater before discharging it into the environment.

Trunk Sewer: A sewer receiving sewage from many tributaries serving a large territory.

U

Underflow: The flow concentrated with solids leaving the bottom of the Northeast Boundary Swirl Facility before flowing by gravity to the East Side Pumping Station where the flow is conveyed to Blue Plains.

Upstream: In geography, literally meaning towards the source of a river or stream, or against the normal direction of water flow.

Urban heat island: A metropolitan area which is significantly warmer than its surrounding rural areas. The main cause of the urban heat island is modification of the land surface by urban development which uses materials which effectively retain heat.

Urban runoff: Storm water from city streets and adjacent domestic or commercial properties that carries pollutants of various kinds into the sewer systems and receiving waters.

V

W

WASA: District of Columbia Water and Sewer Authority

Waste Water Treatment Plant (WWTP): A facility containing a series of tanks, screens, filters and other processes by which pollutants are removed from water.

Wastewater: The spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

Water pollution: The presence in water of enough harmful or objectionable material to damage the water's quality.

Watershed: A defined drainage area that is tributary to a river, river system, or other body of water.

Weir: (1) A wall or plate placed in an open channel to measure the flow of water. (2) A wall or obstruction used to control flow from settling tanks and clarifiers to ensure a uniform flow rate and avoid short-circuiting.

Wet well: A compartment or tank in which wastewater is collected.

X

Y

Z

Appendix 2: Acronyms and Abbreviations

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Appendix 2: Acronyms and Abbreviations

A

ANC: Advisory Neighborhood Commission

AWWTP: Advanced Wastewater Treatment Plant

B

BBL: Basic Business License

BPWWTP: Blue Plains Wastewater Treatment Plant

BFP: Backflow preventer

C

CCCB: Construction Codes Coordinating Board

CCTV: Closed-circuit television

CFR: Code of Federal Regulation

CIP: Capital Improvement Program

CRS: Community Rating System

CSO: Combined Sewer Overflow

CWA: Clean Water Act – Federal law stipulating actions to be carried out to improve water quality in U.S. waters.

D

DCMR: District of Columbia Municipal Regulations

DETS: WASA's Department of Engineering and Technical Services

DDOT: District of Columbia Division of Transportation

DOH: District of Columbia Department of Health, the environmental regulatory agency for the District

DPW: District of Columbia Department of Public Works

DSS: WASA's Department of Sewer Services

E

EPA: United States Environmental Protection Agency

EL: elevation

F

FIRM: Flood Insurance Rate Map

G

GIS: Geographical Information System

GPD: Gallons per Day

H

HGL: Hydraulic Grade Line

HPO: Historic Preservation Office

HPRB: Historic Preservation Review Board

HSEMA: Homeland Security and Emergency Management Agency

I

in: Inches

ICC: International Code Council

J

K

L

LTCP: Long Term Control Plan

LID: Low Impact Development

LID-R: Low Impact Development - Retrofit

M

MPR: Mandatory Purchase Agreement

mg: Million Gallons – A measure of volume.

mgd: Million Gallons Per Day – A measure of the rate of water flow.

mg/l: Milligrams Per Liter – A measure of concentration.

MHI: Median Household Income

N

NEBTS: Northeast Boundary Trunk Sewer

NEB: Northeast Boundary

NFIP: National Flood Insurance Program

NOAA: National Oceanic Atmospheric Administration

NPDES: National Pollutant Discharge Elimination System

O

P

PS: Pump Station

PRP: Preferred Risk Policy

Q

R

S

SF: Square foot

SSWS: Separate Storm Water System – A system of catch basin, pipes, and other components that carry only surface run off to receiving waters.

SWMP: Storm Water Management Plan

T

TAG: Technical Advisory Group

TBM: Tunnel Boring Machine

TMDL: Total Maximum Daily Loads

U

USACE: United States Army Corps of Engineers

V

W

WSACs: Water and Sewer Availability Certificates

X

Y

Z

Appendix 3: Task Force Charter Documents

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GOVERNMENT OF THE DISTRICT OF COLUMBIA

ADMINISTRATIVE ISSUANCE SYSTEM

Mayor's Order 2012-132
August 21, 2012

SUBJECT: Establishment — Mayor's Task Force on the Prevention of Flooding in the Bloomingdale Area

ORIGINATING AGENCY: Office of the Mayor

By virtue of the authority vested in me as Mayor of the District of Columbia by section 422(11) of the District of Columbia Home Rule Act, approved December 24, 1973, 87 Stat. 790, Pub. L. 93-198, D.C. Official Code § 1-204.22(11) (2012 Supp.), it is hereby **ORDERED** that:

I. **ESTABLISHMENT**

There is hereby established within the executive branch of the government of the District of Columbia the Mayor's Task Force on the Prevention of Flooding in the Bloomingdale Area ("Task Force").

II. **PURPOSE**

The Task Force shall advise the Mayor on the causes of, and potential actions to prevent, flooding in the Bloomingdale area (including both the Bloomingdale and LeDroit Park neighborhoods).

III. **FUNCTIONS**

The Task Force shall:

1. Investigate the causes of flooding in the Bloomingdale area;

2. Investigate potential short-term, medium-term, and long-term actions that may be taken by the District of Columbia Water and Sewer Authority, other District agencies, and residents to reduce the likelihood or severity of flooding and its consequences in the Bloomingdale area and to prevent or reduce the damage caused by such flooding (collectively, "remedial measures");

3. Estimate the costs to implement the remedial measures and the time periods within which the remedial measures may be implemented; and

4. Transmit to the Mayor no later than December 31, 2012, a written report setting forth the findings and recommendations of the Task Force regarding the causes of flooding in the Bloomingdale area and potential remedial measures.

IV. MEMBERSHIP

The Task Force shall be composed of the following fifteen (15) members:

1. The City Administrator, who shall serve as co-chairperson of the Task Force;

2. The General Manager of the District of Columbia Water and Sewer Authority, who shall serve as co-chairperson of the Task Force;

3. The Director of the District Department of Transportation (DDOT);

4. The Director of the Department of the Environment;

5. The Director of the Homeland Security and Emergency Management Agency;

6. The Director of the Department of Consumer and Regulatory Affairs;

7. The Director of the Department of Public Works;

8. The Director of the Department of Health;

9. The Director of the Department of Insurance, Securities, and Banking;

10. The member of the Council of the District of Columbia representing Ward 5;

11. The member of the Council of the District of Columbia representing Ward 1;

12. Two (2) residents of the Bloomingdale neighborhood, one (1) of whom shall be appointed by the Mayor and one (1) of whom shall be appointed by the member of the Council of the District of Columbia representing Ward 5; and

13. Two (2) residents of the LeDroit Park neighborhood, one (1) of whom shall be appointed by the Mayor and one (1) of whom shall be appointed by the member of the Council of the District of Columbia representing Ward 1.

V. **TERMS**

Each member of the Task Force shall serve until the Task Force ceases to exist pursuant to section VIII of this Order, unless earlier removed by the designating or appointing authority.

VI. **COMPENSATION**

The members of the Task Force shall serve without compensation.

VII. **ADMINISTRATION**

1. Meetings of the Task Force shall be held at such times and locations as are designated by the co-chairpersons. Each meeting shall include a period of time for the public to comment on issues being considered by the Task Force.

2. The District of Columbia Water and Sewer Authority, DDOT, Department of the Environment, Department of Consumer and Regulatory Affairs, Department of Public Works, and, at the request of the co-chairpersons, any other agency of the District government, shall provide technical support to the Task Force.

3. The District of Columbia Water and Sewer Authority and DDOT shall provide administrative and clerical support to the Task Force.

VIII. **SUNSET**

The Task Force shall cease to exist as of the date on which it transmits to the Mayor the report required by section III.4 of this Order.

IX. **EFFECTIVE DATE**

This Order shall be effective immediately.

Vincent C. Gray

VINCENT C. GRAY
MAYOR

ATTEST: Cynthia Brock-Smith

CYNTHIA BROCK-SMITH
SECRETARY OF THE DISTRICT OF COLUMBIA

MAYOR'S TASK FORCE ON THE PREVENTION OF FLOODING IN THE BLOOMINGDALE AREA

Committee Designations

(1) **Technical Committee**

1. DC Water *(LEAD)*
2. Department of Public Works
3. Department of the Environment
4. Department of Transportation
5. Resident Representative
6. Office of the City Administrator

(2) **Finance Committee**

1. Office of Budget and Finance *(LEAD)*
2. DC Water
3. Department of Consumer and Regulatory Affairs
4. Department of Transportation
5. Resident Representative
6. Office of the City Administrator

(3) **Emergency Response Committee**

1. Department of Public Works*(LEAD)*
2. Department of Transportation
3. Homeland Security and Emergency Management Agency
4. Department of Health
5. Department of Insurance, Securities and Banking
6. Resident Representative
7. Office of the City Administrator

(4) **Planning and Research Committee**

1. Department of the Environment (LEAD)
2. Department of Transportation
3. DC Water
4. Department of Public Works
5. Homeland Security and Emergency Management Agency
6. Resident Representative
7. Office of the City Administrator

(5) **Legislative and Government Affairs Committee**

1. Office of the City Administrator (LEAD)
2. Councilmember McDuffie
3. Councilmember Graham
4. Homeland Security and Emergency Management Agency
5. Department of Insurance, Securities and Banking
6. Department of Consumer and Regulatory Affairs
7. Resident Representative

MAYOR'S TASK FORCE ON THE PREVENTION OF FLOODING IN THE BLOOMINGDALE AREA

Committee Description/Scope

Technical Committee

- Determine the viability (costs/benefits) of an independent engineering assessment that examines neighborhood conditions, identifies weak and/or damaged arteries susceptible to blockage; and examines the impact of new development
- Define implementation processes and timeline for priority medium-term engineering solutions such as temporary storage of storm water upstream of Bloomingdale/LeDroit Park; installation of stormwater retention features; and connection of additional storm drains
- Develop green technology/green management strategies to help control property damage including expansion of the RiverSmart program
- Investigate options for inflatable or movable flood walls, and other solutions for Rhode Island Avenue
- Assess impact of new construction in adjacent neighborhoods (e.g., NOMA, McMillian, Eckington) on drainage and sewer control in Bloomingdale/LeDroit Park

Finance Committee

- Estimate the costs of various flood prevention options, with an emphasis on short-term and interim solutions – pending planned facility upgrades scheduled for the 2018/2025 period – in coordination with Technical group
- Identify financing and/or subsidy resources to help homeowners with the procurement and installation of equipment or surfacing improvements to prevent flooding
- Examine opportunities to extend flood insurance coverage, including designation as flood protection zone via FEMA and legislative mandates through DC Council
- Develop preliminary program specs (e.g., eligibility, inspection, funding source) for an "emergency relief fund", to help assess the feasibility of short-term assistance to residents
- Identify federal financial assistance options for short and medium-term remedies
- Estimate the costs to implement remedial measures and the implementation timeframe

Storm Response Committee

- Prepare a storm/flood response plan to guide emergency activities and ensure coordination between District agencies, DC Water, and community information services – define control, command, and coordination in operational action plans
- Develop public awareness materials with guidance on citizen storm preparation and emergency preparedness activities, including safety tips and after flood precautions (e.g., food and water hazards, interior and exterior clean-up, and structural damage) to help ease the recovery process
- Improve strategic communication and coordination between DPW, DC Water, DDOT, and HSEMA (including weather alerts, emergency preparedness, traffic control changes)
- Prepare guidelines for treating flood damaged homes that include after flood clean-up, waste removal, and vector control actions
- Develop strategy for voluntary home inspection of environmental and health hazards associated with severe flooding and sewer overflow
- Evaluate the need for mental health services and identify mental health resources

Planning and Research Committee

- Review and summarize experiences and remedial strategies from neighborhoods in other jurisdictions with similar flooding conditions to highlight best practices
- Examine the response capacity of DC Water, DPW, HSEMA, and other key service-providers to identify gaps and recommend improvements, in consideration of common standards, as applicable
- Research "affordable" flood prevention/flood damage repair financial assistance services including grants, matching funds, low interest loans, rebates, and tax benefit solutions
- Identify and package available resources from DC agencies (and other credible organizations) into a flood protection toolkit encompassing property damage reconditioning, food safety, clean-up and sanitation, and health and environmental safety
- Identify pipeline infrastructure improvement plans that offer coordination opportunities with short-term and medium-term flood relief strategies
- Summarize flood prevention, protection, and mitigation best practices with a focus on diminishing impact or severity, ensuring preparedness and readiness within the community, implementing immediate response actions, and supporting community recovery – to help strengthen the District's flood response operations

Legislative and Government Affairs Committee

- Identify gaps in plumbing and building code regulations, and develop recommendations to improve guidance on front/rear entrance and basement renovation (in low-lying areas), strengthen installation and inspection services, enforce compliance with flood hazard rules, and foster greater contractor and homeowner accountability
- Determine the legislation and regulatory changes needed to implement short-term flood prevention strategies or to improve storm response
- Draft specific provisions where appropriate
- Coordinate with other government agencies, where needed
- Examine options for legislative action to authorize "emergency relief funding"

GOVERNMENT OF THE DISTRICT OF COLUMBIA
Executive Office of the Mayor
Office of Communications

PRESS RELEASE

FOR IMMEDIATE RELEASE: Tuesday, August 21, 2012

CONTACTS: Doxie McCoy (EOM) 202.727.9691; doxie.mccoy@dc.gov
Tony Robinson (OCA) 202.724.5541; tony.robinson1@dc.gov

Mayor Vincent C. Gray Establishes Flood Prevention Task Force for Bloomingdale and LeDroit Park

Panel of Residents, Government Officials and D.C. Water Reps to Recommend Solutions

(WASHINGTON, D.C.) – Mayor Vincent C. Gray today announced that he was establishing a flood prevention task force that will study the causes of, and short- and medium-term solutions to, frequent street flooding and sewer backups in the Bloomingdale and LeDroit Park neighborhoods. In early July the area was inundated with flood waters three times, resulting in damage to dozens of homes and businesses.

"Residents of the Bloomingdale and LeDroit Park neighborhoods deserve to enjoy a high quality of life and should not have to bear a disproportionately negative impact because of an aging infrastructure," Mayor Gray said. ***"Just as I have done in asking a task force to look at solutions to frequent power outages, I am now asking officials, utility representatives and residents to work together to address the flooding and sewer back up issues that happen all too often in these neighborhoods While D.C. Water has already been working on long-term solutions, this panel will help us bring about short- and medium-term mitigation strategies."***

The task force will be co-chaired by City Administrator Allen Y. Lew and D.C. Water General Manager George Hawkins. The panel will investigate the causes of flooding in the affected areas and work to develop actions that may be taken by D.C. Water, other District agencies and residents to reduce the likelihood or severity of flooding and its consequences.

"As a member of the D.C. Water Board, I am acutely aware of the impact of the floods on the community. The task force will monitor the interim steps taken by D.C. Water to prevent or mitigate the flooding problems in the short term," said Lew. "DC Water has already initiated closed-circuit inspections of sewers and, along with the Department of Public Works, is distributing sandbags for any impacted residents who want them. I look forward to working with the Task Force to examine these issues and to develop possible long-term solutions."

The task force will transmit a written report to the Mayor no later than December 31, 2012. The task force will also estimate the costs to implement the necessary remedial measures and the time periods within which those actions may be implemented.

The task force will include four members drawn from residents of the Bloomingdale and LeDroit Park communities. Mayor Gray has appointed one resident to the panel from each neighborhood, and Ward 5 Councilmember Kenyan McDuffie and Ward 1 Councilmember Jim Graham – whose wards include the affected area – will each appoint one additional representative to the panel.

Other members of the task force include: Councilmembers McDuffie and Graham; District Department of Transportation Director Terry Bellamy; District Department of the Environment Director Christophe Tulou; Department of Public Works Director William Howland; D.C. Homeland Security & Emergency Management Agency Director Chris Geldart; Department of Consumer & Regulatory Affairs Director Nicholas Majett; D.C. Department of Health Director Dr. Saul Levin; and Department of Insurance, Securities & Banking Director William White.

# # #

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Follow Mayor Gray on Twitter at http://www.twitter.com/MayorVinceGray and on Facebook at http://www.facebook.com/MayorGray

Appendix 4: Existing Land Use

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Appendix 4: Existing Land Use

The existing land use map for the NEBT Sewershed served as the basis from which impervious cover within the Bloomingdale and LeDroit Park drainage area was estimated in Section 2.3.1: Land Use. Created by the Office of Planning (OP), and land use categories as they existed in 2005 for the NEBT drainage area are tabulated below.

The Office of Planning compiled this information from a variety of sources. The main data source was "use code" information from the Office of Tax and Revenue (OTR). Use codes are generated through an automated process whereby entire squares (blocks) are assigned to particular land uses when the use codes for the properties on those squares were consistent with one another. For squares with multiple uses (e.g., a mix of residential and commercial properties), operators at OP split the areas manually until the remaining portions had consistent land uses. OP's planners then reviewed this information and made corrections where the available data appeared inaccurate.

Table A4-1: Summary of Existing Land Use within the NEBT Sewershed

Land Use Code	Land Use Description	Area (acres)	Percentage
ALLEYS	Alley	144.59	2.95%
C	Commercial	272.80	5.57%
FP	Federal Public	426.59	8.70%
HDR	High Density Residential	30.09	0.61%
I	Industrial	113.94	2.32%
LAKE	Lake	2.03	0.04%
LDR	Low Density Residential	92.34	1.88%
LMDR	Low-Medium Density Residential	978.60	19.98%
LP	Local Public	146.36	2.99%
MDR	Medium Density Residential	168.65	3.44%
MEDIAN	Median	23.43	0.48%
MU	Mixed Use	4.97	0.10%
O	Open Space	38.09	0.78%
PARKING	Parking	14.45	0.29%
PQP-I	Public, Quasi-Public, Institutional	24.51	0.50%
R	Recreation, Cemetery	195.26	3.98%
RIVER	River	0.42	0.01%
ROADS	Road	713.06	14.56%
S	School	603.80	12.32%
TCU	Transport, Communication, Utilities	265.34	5.41%
TROW	Transportation Right of Way	636.91	12.99%
"blank"	Undetermined	5.02	0.10%
Total Northeast Boundary Drainage Area (acres) = 4901			

Source: Office of Planning

Land use code percentages for existing conditions within the Bloomingdale and LeDroit Park drainage areas are presented in Tables A4-2 and A4-3, and illustrated graphically in Figure A4-1.

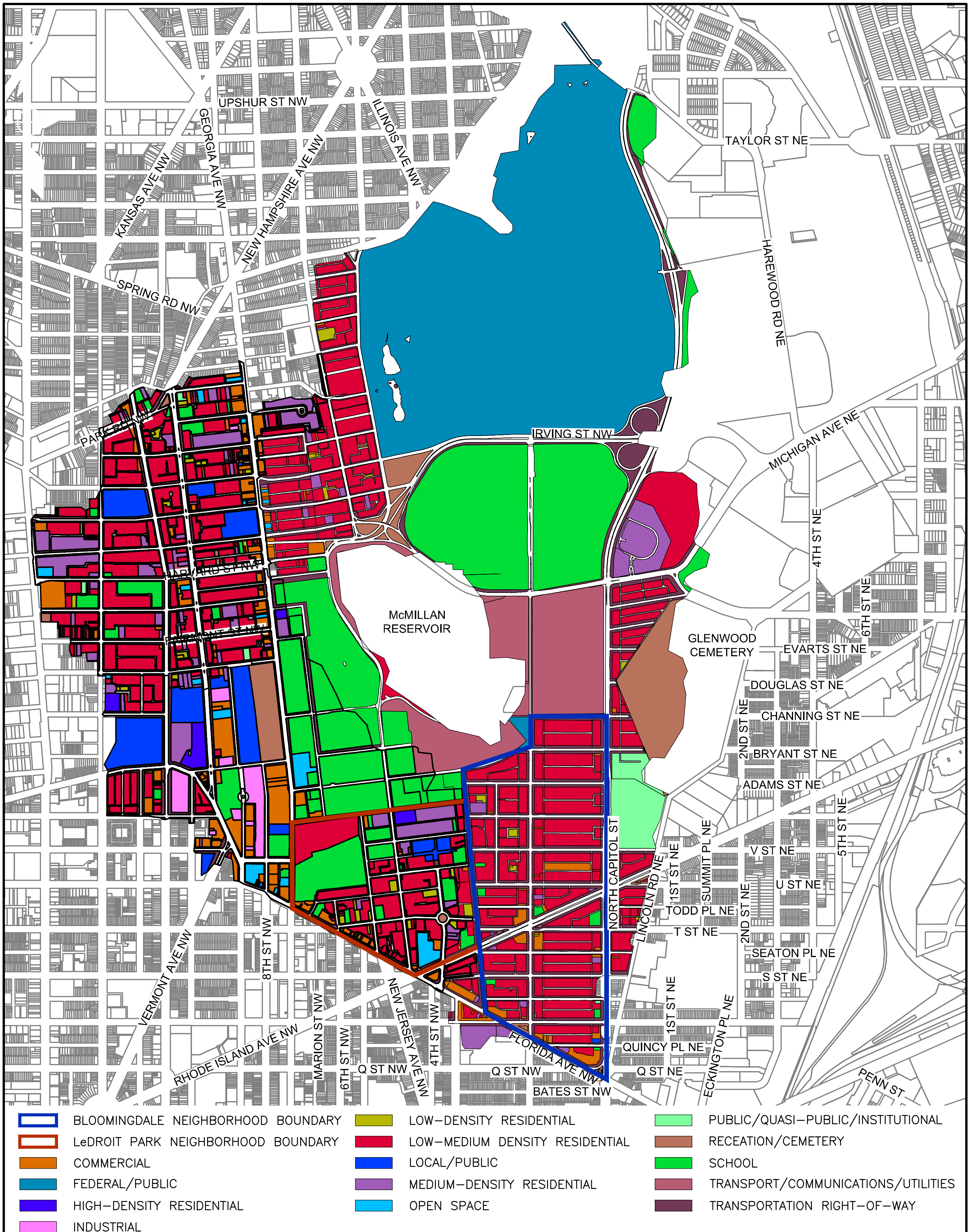
Table A4-2: Summary of Existing Land Use within Bloomingdale Drainage Area

Land Use Code	Land Use Description	Area (acres)	Percentage
ALLEYS	Alley	14.55	2%
C	Commercial	6.06	1%
FP	Federal Public	229.11	32%
HDR	High Density Residential	0.00	0%
I	Industrial	0.00	0%
LAKE	Lake	2.03	0%
LDR	Low Density Residential	1.95	0%
LMDR	Low-Medium Density Residential	132.40	18%
LP	Local Public	0.00	0%
MDR	Medium Density Residential	11.18	2%
MEDIAN	Median	2.47	0%
MU	Mixed Use	0.00	0%
O	Open Space	0.26	0%
PARKING	Parking	0.00	0%
PQP-I	Public, Quasi-Public, Institutional	12.70	2%
R	Recreation, Cemetery	26.48	4%
ROADS	Road	71.68	10%
S	School	107.70	15%
TCU	Transport, Communication, Utilities	53.07	7%
TROW	Transportation Right of Way	52.02	7%
“blank”	Undetermined	0.17	0%
	Total Bloomingdale Drainage Area (acres) =	**723.8**	

Table A4-3: Summary of Existing Land Use within LeDroit Park Drainage Area

Land Use Code	Land Use Description	Area (ac.)	Percentage
ALLEYS	Alley	12.94	3.19%
C	Commercial	28.32	6.99%
FP	Federal Public	0.00	0.00%
HDR	High Density Residential	4.44	1.10%
I	Industrial	7.92	1.95%
LAKE	Lake	0.00	0.00%
LDR	Low Density Residential	3.94	0.97%
LMDR	Low-Medium Density Residential	97.56	24.08%
LP	Local Public	28.35	7.00%

MDR	Medium Density Residential	27.17	6.71%
MEDIAN	Median	0.29	0.07%
MU	Mixed Use	0.07	0.02%
O	Open Space	12.95	3.20%
PARKING	Parking	0.00	0.00%
PQP-I	Public, Quasi-Public, Institutional	0.74	0.18%
R	Recreation, Cemetery	8.08	1.99%
ROADS	Road	65.61	16.20%
S	School	63.21	15.60%
TCU	Transport, Communication, Utilities	1.69	0.42%
TROW	Transportation Right of Way	41.70	10.29%
“blank”	Undetermined	0.17	0.04%
Total LeDroit Park Drainage Area (acres) = 405.1			



MAYOR'S TASK FORCE REPORT
ON THE PREVENTION OF FLOODING
IN BLOOMINGDALE AND LeDROIT PARK

SUMMARY OF EXISTING LAND USE
BLOOMINGDALE & LeDROIT PARK DRAINAGE AREAS

DATE: DECEMBER 2012 | FIGURE A4–1

Appendix 5: Summary of Zone Districts in the District of Columbia

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Appendix 5: Summary of Zone Districts in the District of Columbia

Table A5-1: Summary of Zoning District within Bloomingdale Drainage Area

Zoning District	Description	Area (acres)	Percentage
C-2-A	Permits matter-of-right low density development, including office employment centers, shopping centers, medium-bulk mixed use centers, and housing to a maximum lot occupancy of 60% for residential use and 100% for all other uses, a maximum FAR of 2.5 for residential use and 1.5 FAR for other permitted uses, and a maximum height of fifty (50) feet. Rear yard requirements are fifteen (15) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.	10.30	1.42%
R-3	Permits matter-of-right development of single-family residential uses (including detached, semi-detached, and row dwellings), churches and public schools with a minimum lot width of 20 feet and a minimum lot area of 2,000 square feet for row dwellings, 30 feet and 3,000 square feet for single-family semi-detached dwellings, 40 feet and 4,000 square feet for all other structures and 120 feet and 9,000 square feet for schools, a maximum lot occupancy of 60% for row dwellings, churches and schools, 20% for public recreation and community centers, and 40% for all other structures, and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Rear yard requirement is twenty (20) feet.	54.34	7.51%
R-4	Permits matter-of-right development of single-family residential uses (including detached, semi-detached, row dwellings, and flats), churches and public schools with a minimum lot width of 18 feet, a minimum lot area of 1,800 square feet and a maximum lot occupancy of 60% for row dwellings, churches and flats, a minimum lot width of 30 feet and a minimum lot area of 3,000 square feet for semi-detached structures, a minimum lot width of 40 feet and a minimum lot area of 4,000 square feet and 40% lot occupancy for all other structures (20% lot occupancy for public recreation and community centers); and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Conversions of existing buildings to apartments are permitted for lots with a minimum lot area of 900 square feet per dwelling unit. Rear yard requirement is twenty (20) feet.	200.09	27.64%

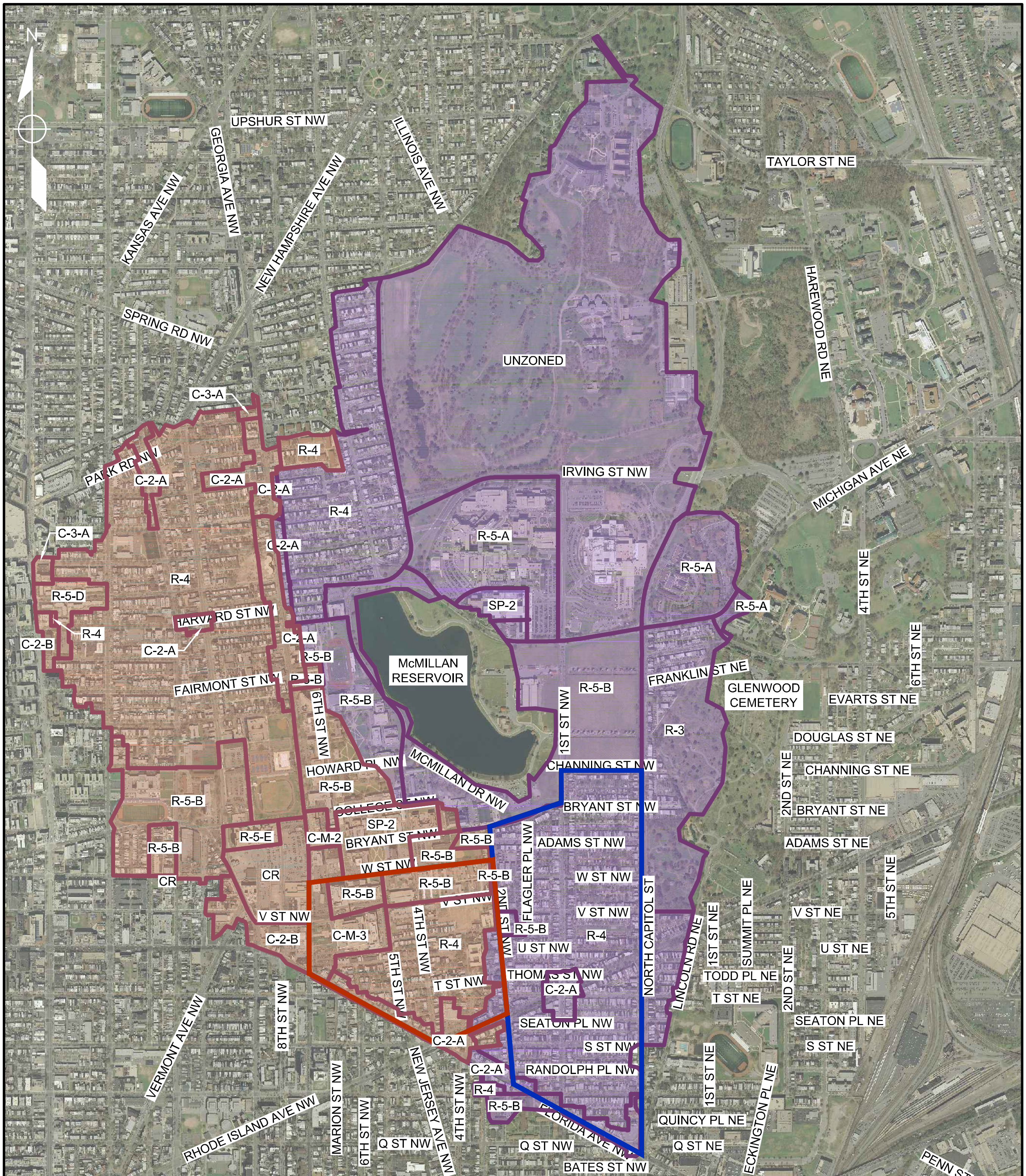
R-5-A	Permits matter-of-right development of single-family residential uses for detached and semi-detached dwellings and, with the approval of the Board of Zoning Adjustment, new residential development of low density residential uses including row houses, flats, and apartments to a maximum lot occupancy of 40%, 60% for churches and public schools, and 20% for public recreation and community centers; a maximum floor area ratio (FAR) of 0.9, and a maximum height of three (3) stories/forty (40) feet (90 feet for schools, 60 feet for churches, and 45 feet for public recreation and community centers). Rear yard requirements are twenty (20) feet, side yard requirements are not less than eight (8) feet. If all other provisions of the zoning regulations are complied with, conversion of existing buildings to flat or apartment use is permitted as a matter-of-right.	72.52	10.02%
R-5-B	Permits matter-of-right moderate development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 60% (20% for public recreation and community centers), a maximum FAR of 1.8, and a maximum height of fifty (50) feet (90 feet for schools and 45 feet for public recreation and community centers). Rear yard requirements are not less than fifteen (15) feet.	94.06	12.99%
SP-2	Permits matter-of-right medium/high density development including all kinds of residential uses, and limited offices for non-profit organizations, trade associations and professionals if approved as a special exception by the Board of Zoning Adjustment. Maximum lot occupancy of 80% for residential use except a hotel, 20% for public recreation and community centers and 40% with special exception approved from the BZA. Maximum FAR is 6.0 for residential and 3.5 for other permitted uses, and a maximum height of ninety (90) feet. Rear yard requirements are not less than twelve (12) feet, one-family detached dwellings and one-family semi-detached dwellings side yard requirements are eight (8) feet.	6.91	0.96%
UNZONED		285.59	39.46%
	Total Bloomingdale Drainage Area (acres) =	**723.8**	

Table A5-2: Summary of Zoning District within LeDroit Park Drainage Area

Zoning District	Description	Area (acres)	Percentage
C-2-A	Permits matter-of-right low density development, including office employment centers, shopping centers, medium-bulk mixed use centers, and housing to a maximum lot occupancy of 60% for residential use and 100% for all other uses, a maximum FAR of 2.5 for residential use and 1.5 FAR for other permitted uses, and a maximum height of fifty (50) feet. Rear yard requirements are fifteen (15) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.	34.01	8%

C-2-B	Permits matter-of-right medium density development, including office, retail, housing, and mixed uses to a maximum lot occupancy of 80% for residential use and 100% for all other uses, a maximum FAR of 3.5 for residential use and 1.5 FAR for other permitted uses, and a maximum height of sixty-five (65) feet. Rear yard requirements are fifteen (15) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.	12.88	3%
C-3-A	Permits matter-of-right medium density development, with a density incentive for residential development within a general pattern of mixed-use development to a maximum lot occupancy of 75% for residential use and 100% for all other uses, a maximum FAR of 4.0 for residential and 2.5 FAR for other permitted uses and a maximum height of sixty-five (65) feet. Rear yard requirements are twelve (12) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.	2.19	1%
C-M-2	Permits development of medium bulk commercial and light manufacturing uses to a maximum FAR of 4.0, and a maximum height of sixty (60) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet.	2.72	1%
C-M-3	Permits development of high bulk commercial and light manufacturing uses to a maximum FAR of 6.0, and a maximum height of ninety (90) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet.	15.49	4%
CR	Permits matter-of-right residential, commercial, recreational and light industrial development to a maximum lot occupancy of 75% for residential use, 20% for public recreation and community center use (up to 40% with Board of Zoning Adjustment approval), and 100% for all other structures, a maximum FAR of 6.0 for all buildings and structures, of which not more than three (3.0) may be used for other than residential purposes, a maximum height of ninety (90) feet for all buildings and structures and forty-five (45) feet for public recreation and community centers. An area equivalent to 10% of the total lot area shall be required at ground level for all new development, and rear yards shall be provided for each residential building or structure.	17.30	4%

R-4	Permits matter-of-right development of single-family residential uses (including detached, semi-detached, row dwellings, and flats), churches and public schools with a minimum lot width of 18 feet, a minimum lot area of 1,800 square feet and a maximum lot occupancy of 60% for row dwellings, churches and flats, a minimum lot width of 30 feet and a minimum lot area of 3,000 square feet for semi-detached structures, a minimum lot width of 40 feet and a minimum lot area of 4,000 square feet and 40% lot occupancy for all other structures (20% lot occupancy for public recreation and community centers); and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Conversions of existing buildings to apartments are permitted for lots with a minimum lot area of 900 square feet per dwelling unit. Rear yard requirement is twenty (20) feet.	208.32	51%
R-5-B	Permits matter-of-right moderate development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 60% (20% for public recreation and community centers), a maximum FAR of 1.8, and a maximum height of fifty (50) feet (90 feet for schools and 45 feet for public recreation and community centers). Rear yard requirements are not less than fifteen (15) feet.	85.22	21%
R-5-D	Permits matter-of-right medium/high density development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 75% (20% for public recreation and community centers), a maximum FAR of 3.5 and a maximum height of ninety (90) feet (45 feet for public recreation and community centers). Rear yard requirements are not less than fifteen (15) feet.	7.65	2%
R-5-E	Permits matter-of-right high density development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 75% (20% for public recreation and community centers), a maximum FAR of 6.0 for apartment houses and hotels, and 5.0 for other structures, and a maximum height of ninety (90) feet (45 feet for public recreation and community centers). Rear yard requirements are not less than twelve (12) feet.	3.74	2%
SP-2	Permits matter-of-right medium/high density development including all kinds of residential uses, and limited offices for non-profit organizations, trade associations and professionals if approved as a special exception by the Board of Zoning Adjustment. Maximum lot occupancy of 80% for residential use except a hotel, 20% for public recreation and community centers and 40% with special exception approved from the BZA. Maximum FAR is 6.0 for residential and 3.5 for other permitted uses, and a maximum height of ninety (90) feet. Rear yard requirements are not less than twelve (12) feet, one-family detached dwellings and one-family semi-detached dwellings side yard requirements are eight (8) feet.	15.61	4%
	Total LeDroit Park Drainage Area (acres) =	**405.127**	



BLOOMINGDALE NEIGHBORHOOD BOUNDARY

LeDROIT PARK NEIGHBORHOOD BOUNDARY

BLOOMINGDALE DRAINAGE AREA

LeDROIT PARK DRAINAGE AREA

dc water is life

DISTRICT DEPARTMENT OF THE ENVIRONMENT

ONE CITY

d.

DISTRICT OF COLUMBIA dpw DEPARTMENT OF PUBLIC WORKS

MAYOR'S TASK FORCE REPORT
ON THE PREVENTION OF FLOODING
IN BLOOMINGDALE AND LeDROIT PARK

SUMMARY OF ZONE DISTRICTS
BLOOMINGDALE & LeDROIT PARK DRAINAGE AREAS

DATE: DECEMBER 2012	FIGURE A5–1

Table A5-3: Summary of Zoning District within Northeast Boundary Drainage Area

Zoning District	Area (ac)	Percentage
C-1	25.26	0.52%
C-2-A	282.65	5.77%
C-2-B	68.64	1.40%
C-2-C	10.38	0.21%
C-3-A	77.91	1.59%
C-3-C	23.93	0.49%
C-M-1	144.39	2.95%
C-M-2	82.83	1.69%
C-M-3	16.08	0.33%
CR	42.27	0.86%
HE-1	12.50	0.26%
HE-2	15.96	0.33%
HE-3	21.56	0.44%
HE-4	11.49	0.23%
M	270.27	5.51%
R-1-B	72.42	1.48%
R-2	55.18	1.13%
R-3	153.43	3.13%
R-4	2167.53	44.23%
R-5-A	405.94	8.28%
R-5-B	407.44	8.31%
R-5-C	5.60	0.11%
R-5-D	32.93	0.67%
R-5-E	8.82	0.18%
SP-2	22.53	0.46%
UNZONED	461.58	9.42%
W-0	1.57	0.03%
Total Northeast Boundary Drainage Area (acres) = 4901		

Insert Figure A5-2: Map of Northeast Boundary Zone Districts

Table A5-4: Detailed Zone District Definitions for the District of Columbia

Districts	Summary
CR	Permits matter-of-right residential, commercial, recreational and light industrial development to a maximum lot occupancy of 75% for residential use, 20% for public recreation and community center use (up to 40% with Board of Zoning Adjustment approval), and 100% for all other structures, a maximum FAR of 6.0 for all buildings and structures, of which not more than three (3.0) may be used for other than residential purposes, a maximum height of ninety (90) feet for all buildings and structures and forty-five (45) feet for public recreation and community centers. An area equivalent to 10% of the total lot area shall be required at ground level for all new development, and rear yards shall be provided for each residential building or structure.
C-1	Permits matter-of-right neighborhood retail and personal service establishments and certain youth residential care homes and community residence facilities to a maximum lot occupancy of 60% for residential use and 100% for all other uses, a maximum FAR of 1.0, and a maximum height of three (3) stories/forty (40) feet. Rear yard requirements are twenty (20) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-2-A	Permits matter-of-right low density development, including office employment centers, shopping centers, medium-bulk mixed use centers, and housing to a maximum lot occupancy of 60% for residential use and 100% for all other uses, a maximum FAR of 2.5 for residential use and 1.5 FAR for other permitted uses, and a maximum height of fifty (50) feet. Rear yard requirements are fifteen (15) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-2-B	Permits matter-of-right medium density development, including office, retail, housing, and mixed uses to a maximum lot occupancy of 80% for residential use and 100% for all other uses, a maximum FAR of 3.5 for residential use and 1.5 FAR for other permitted uses, and a maximum height of sixty-five (65) feet. Rear yard requirements are fifteen (15) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-2-C	Permits matter-of-right higher density development, including office, retail, housing, and mixed uses to a maximum lot occupancy of 80% for residential use and 100% for all other uses, a maximum FAR of 6.0 for residential and 2.0 FAR for other permitted uses, and a maximum height of ninety (90) feet. Rear yard requirements are fifteen (15) feet; one family detached dwellings one family semi-detached dwellings side yard requirements are eight (8) feet.
C-3-A	Permits matter-of-right medium density development, with a density incentive for residential development within a general pattern of mixed-use development to a maximum lot occupancy of 75% for residential use and 100% for all other uses, a maximum FAR of 4.0 for residential and 2.5 FAR for other permitted uses and a maximum height of sixty-five (65) feet. Rear yard requirements are twelve (12) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-3-B	Permits matter-of-right medium density development, including office-retail, housing, and mixed uses. It is intended for uptown locations, where the largest component of development will be office-retail and other nonresidential uses to a maximum lot occupancy of 100%, a maximum FAR of 5.0 for residential and 4.0 FAR for other permitted uses, and a maximum height of six (6) stories/seventy (70) feet. Rear yard requirements are twelve (12) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.

C-3-C	Permits matter-of-right development for major business and employment centers of medium/high density development, including office, retail, housing, and mixed uses to a maximum lot occupancy of 100%, a maximum FAR of 6.5 for residential and for other permitted uses, and a maximum height of ninety (90) feet. Rear yard requirements are twelve (12) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-4	The downtown core comprising the retail and office centers for the District of Columbia and the metropolitan area, and allows office, retail, housing and mixed uses to a maximum lot occupancy of 100%, a maximum FAR of 8.5 (or 10.0 if permitted height is in excess of one hundred-ten (110) feet), a maximum height of 110 feet and 130 on 110-foot adjoining streets. (Maximum height and FAR depend on width of adjoining streets.) Rear yard requirements are not less than twelve (12) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-5	Pennsylvania Avenue Development (PAD) permits retail and office, housing and mixed development in the area on the north side of Pennsylvania Avenue, NW between Tenth Street and 15th Street, NW to a maximum lot occupancy of 100%, a maximum FAR of 10.0 to 12.0, and a maximum height of 130 to 160 feet. (Maximum height and FAR depend upon approval of bonus incentives.) Rear yard requirements are not less than twelve (12) feet; one family detached dwellings and one family semi-detached dwellings side yard requirements are eight (8) feet.
C-M-1	Permits development of low bulk commercial and light manufacturing uses to a maximum FAR of 3.0, and a maximum height of three (3) stories/forty (40) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet.
C-M-2	Permits development of medium bulk commercial and light manufacturing uses to a maximum FAR of 4.0, and a maximum height of sixty (60) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet.
C-M-3	Permits development of high bulk commercial and light manufacturing uses to a maximum FAR of 6.0, and a maximum height of ninety (90) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet.
HE-1	Hill East Subdistrict 1 (19th Street) includes squares with frontage onto 19th Street, between Independence Avenue and Massachusetts Avenue. Allows a maximum lot occupancy of 80%, minimum and maximum building heights of 26 and 50 feet respectively, a maximum of 4 stories, and a maximum floor area ratio (FAR) of 3.0. New buildings, or additions to existing buildings must be reviewed by the Zoning Commission for consistency with established design guidelines.
HE-2	Hill East Subdistrict 2 (20th Street) includes squares with frontage on 20th Street. The maximum lot occupancy is 75%, the minimum and maximum building heights are 40 and 80 feet respectively. The maximum number of stories is 7, and the maximum floor area ratio is 4.8. New buildings, or additions to existing buildings must be reviewed by the Zoning Commission for consistency with established design guidelines.

HE-3	Hill East Subdistrict 3 (Water Street) includes squares with frontage on Water Street. Allows a maximum lot occupancy of 80%, minimum and maximum building heights of 80 and 110 feet respectively, a maximum of 10 stories, and a maximum floor area ratio (FAR) of 7.2. New buildings, or additions to existing buildings must be reviewed by the Zoning Commission for consistency with established design guidelines.
HE-4	Hill East Subdistrict 4 (Corrections) includes squares N and O. The maximum lot occupancy is 75%, the maximum building height is 90 feet. The maximum number of stories is 8, and the maximum floor area ratio is 6.0. New buildings, or additions to existing buildings must be reviewed by the Zoning Commission for consistency with established design guidelines.
M	Permits general industrial uses to a maximum FAR of 6.0, and a maximum height of ninety (90) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet.
R-1-A	Permits matter-of-right development of single-family residential uses for detached dwellings with a minimum lot width of 75 feet for residential, churches, and public recreation and community centers and 120 feet for schools, a minimum lot area of 7,500 square feet for residential, churches, and public recreation and community centers and 15,000 square feet for schools, a maximum lot occupancy of 40% for residential, 60% for church and public school use, and 20% for public recreation and community centers and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Rear yard requirements are twenty-five (25) feet, side yard requirements are eight (8) feet.
R-1-B	Permits matter-of-right development of single-family residential uses for detached dwellings with a minimum lot width of 50 feet for residential, churches, and public recreation and community centers and 120 feet for schools, a minimum lot area of 5,000 square feet for residential, churches, and public recreation and community centers and 15,000 square feet for schools, a maximum lot occupancy of 60% for a church or public school use, 20% for public recreation and community centers, and 40% for all other structures; and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Rear yard requirements are twenty-five (25) feet, side yard requirements are eight (8) feet.
R-2	Permits matter-of-right development of single-family residential uses for detached and semi-detached structures, with a minimum lot width of 40 feet and lot area of 4,000 square feet for detached structures, churches, and public recreation and community centers, 30 feet and 3,000 square feet for semi-detached structures and 120 feet and 9,000 square feet for schools; a maximum lot occupancy of 60% for church and public school use, 20% for public recreation and community centers, and 40% for all other structures, and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Rear yard requirements are twenty (20) feet, side yard requirements are eight (8) feet.
R-3	Permits matter-of-right development of single-family residential uses (including detached, semi-detached, and row dwellings), churches and public schools with a minimum lot width of 20 feet and a minimum lot area of 2,000 square feet for row dwellings, 30 feet and 3,000 square feet for single-family semi-detached dwellings, 40 feet and 4,000 square feet for all other structures and 120 feet and 9,000 square feet for schools, a maximum lot occupancy of 60% for row dwellings, churches and schools, 20% for public recreation and community centers, and 40% for all other structures, and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Rear yard requirement is twenty (20) feet.

R-4	Permits matter-of-right development of single-family residential uses (including detached, semi-detached, row dwellings, and flats), churches and public schools with a minimum lot width of 18 feet, a minimum lot area of 1,800 square feet and a maximum lot occupancy of 60% for row dwellings, churches and flats, a minimum lot width of 30 feet and a minimum lot area of 3,000 square feet for semi-detached structures, a minimum lot width of 40 feet and a minimum lot area of 4,000 square feet and 40% lot occupancy for all other structures (20% lot occupancy for public recreation and community centers); and a maximum height of three (3) stories/forty (40) feet (60 feet for churches and schools and 45 feet for public recreation and community centers). Conversions of existing buildings to apartments are permitted for lots with a minimum lot area of 900 square feet per dwelling unit. Rear yard requirement is twenty (20) feet.
R-5-A	Permits matter-of-right development of single-family residential uses for detached and semi-detached dwellings and, with the approval of the Board of Zoning Adjustment, new residential development of low density residential uses including row houses, flats, and apartments to a maximum lot occupancy of 40%, 60% for churches and public schools, and 20% for public recreation and community centers; a maximum floor area ratio (FAR) of 0.9, and a maximum height of three (3) stories/forty (40) feet (90 feet for schools, 60 feet for churches, and 45 feet for public recreation and community centers). Rear yard requirements are twenty (20) feet, side yard requirements are not less than eight (8) feet. If all other provisions of the zoning regulations are complied with, conversion of existing buildings to flat or apartment use is permitted as a matter-of-right.
R-5-B	Permits matter-of-right moderate development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 60% (20% for public recreation and community centers), a maximum FAR of 1.8, and a maximum height of fifty (50) feet (90 feet for schools and 45 feet for public recreation and community centers). Rear yard requirements are not less than fifteen (15) feet.
R-5-C	Permits matter-of-right medium density development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 75% (20% for public recreation and community centers), a maximum FAR of 3.0 and a maximum height of sixty (60) feet (90 feet for schools and 45 feet for public recreation and community centers). Rear yard requirements are not less than fifteen (15) feet.
R-5-D	Permits matter-of-right medium/high density development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 75% (20% for public recreation and community centers), a maximum FAR of 3.5 and a maximum height of ninety (90) feet (45 feet for public recreation and community centers). Rear yard requirements are not less than fifteen (15) feet.
R-5-E	Permits matter-of-right high density development of general residential uses, including single-family dwellings, flats, and apartment buildings, to a maximum lot occupancy of 75% (20% for public recreation and community centers), a maximum FAR of 6.0 for apartment houses and hotels, and 5.0 for other structures, and a maximum height of ninety (90) feet (45 feet for public recreation and community centers). Rear yard requirements are not less than twelve (12) feet.
SP-1	Permits matter-of-right medium density development including all kinds of residential uses, and limited offices for non-profit organizations, trade associations and professionals if approved as a special exception by the Board of Zoning Adjustment. Maximum lot occupancy is 80% for residential use except a hotel, 20% for public recreation and community centers and 40% with special exception approval from the BZA. Maximum FAR is 4.0 for residential and 2.5 for other permitted uses, and a maximum height of sixty-five (65) feet. Rear yard requirements are not less than twelve (12) feet, one-family detached dwellings and one-family semi-detached dwellings side yard requirements are eight (8) feet.

SP-2	Permits matter-of-right medium/high density development including all kinds of residential uses, and limited offices for non-profit organizations, trade associations and professionals if approved as a special exception by the Board of Zoning Adjustment. Maximum lot occupancy of 80% for residential use except a hotel, 20% for public recreation and community centers and 40% with special exception approved from the BZA. Maximum FAR is 6.0 for residential and 3.5 for other permitted uses, and a maximum height of ninety (90) feet. Rear yard requirements are not less than twelve (12) feet, one-family detached dwellings and one-family semi-detached dwellings side yard requirements are eight (8) feet.
W-0	Permits open space, park and low-density and low-height waterfront-oriented retail and arts uses with a maximum height of 40 feet and a maximum FAR of 0.5 (.75 for a lot that is used exclusively for recreational use, marina, yacht club, or boathouse building or structure), and a maximum lot occupancy of 25% (50% for a lot that is used exclusively for recreational use, marina, yacht club, or boathouse building or structure). Maximum height is forty (40) feet (25 feet for a structure located on, in, or over the water, including a floating home). There is also a 100-foot waterfront setback requirement.
W-1	Permits matter-of-right low density residential, commercial, and certain light industrial development in waterfront areas to a maximum lot occupancy of 80% for residential use, a maximum FAR of 2.5 for residential and 1.0 for other permitted uses and a maximum height of forty-five (45) feet. Rear yard requirements are not less than twelve (12) feet.
W-2	Permits matter-of-right medium density residential, commercial, and certain light industrial development in waterfront areas to a maximum lot occupancy of 75% for residential use and public recreation and community centers, a maximum FAR of 4.0 for residential and 2.0 for other permitted uses and a maximum height of sixty (60) feet. Rear yard requirements are not less than twelve (12) feet.
W-3	Permits matter-of-right high density residential, commercial, and certain light industrial development in waterfront areas to a maximum lot occupancy of 75% for residential use and public recreation and community centers, a maximum FAR of 6.0 for residential and 5.0 for other permitted uses and a maximum height of ninety (90) feet. Rear yard requirements are not less than twelve (12) feet.

Appendix 6: Flood Mitigation Technologies

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Appendix 6: Flood Mitigation Technologies

Removable Barriers

The following removable barrier products are available for personal purchase. Removable barriers keep water out of the basement or street level ground floors of individual buildings. When installed properly, removable barriers effectively protect doorways and entrances from overland flooding during heavy rain events.

PS Doors' Flood Plank - *Model: FP-530* - The Flood Plank provides flood protection in vertical increments of 6". Each plank stacks on top of the previous plank and can typically be placed by a single individual. The Flood Plank is available in various horizontal lengths to fit the opening width, and can be configured in multiple planks to provide continuous protection for extended lengths. The Flood Plank conveniently stacks for storage when not in use.

Zero International's #2070 Flood Barrier Shield -The Flood Barrier Shield is available in heights of 10, 20, 24, 30 and 36 inches (other sizes available upon request). No tools or muscle strength are needed to insert the lightweight aluminum shield into pre-mounted vertical channels attached to either the door frame or adjacent walls.

Green Infrastructure Overview

The purpose of this section is to provide detailed descriptions of various green infrastructure technologies under consideration for the Bloomingdale and LeDroit Park region. Green infrastructure measures span multiple technologies, each of which intercepts stormwater runoff at or near its source.

Bioretention cells

A bioretention cell or rain garden is a depressed area with porous backfill (material used to refill an excavation) under a vegetated surface. These areas encourage filtration and infiltration and often have an underdrain system, especially in clay soils. Bioretention cells provide groundwater recharge, pollutant removal, and runoff detention. Bioretention cells are an effective solution in parking lots or urban areas where green space is limited.

Curb and gutter elimination

Curbs and gutters transport flow as quickly as possible to a stormwater drain without allowing for infiltration or pollutant removal. Eliminating curbs and gutters can increase sheet flow and reduce runoff volumes. Sheet flow, the form runoff takes when it is uniformly dispersed across a surface, can be established and maintained in an area that does not naturally concentrate flow, such as parking lots. Maintaining sheet flow by eliminating curbs and gutters and directing runoff into vegetated swales or bioretention basins helps to prevent erosion and more closely replicate predevelopment hydraulic conditions. A level spreader, which is an outlet designed to convert concentrated runoff to sheet flow and disperse it uniformly across a slope, may also be incorporated to prevent erosion.

Green parking design

Green parking refers to several techniques that, when applied together, reduce the contribution of parking lots to total impervious cover. Green parking lot techniques include: setting maximums for the number of parking spaces created; minimizing the dimensions of parking lot spaces; utilizing alternative pavers in overflow parking areas; using bioretention areas to treat stormwater; encouraging shared parking; and providing economic incentives for structured parking.

Infiltration trenches

Infiltration trenches are rock-filled ditches with no outlets. These trenches collect runoff during a storm event and release it into the soil by infiltration (the process through which stormwater runoff penetrates into soil from the ground surface). Infiltration trenches may be used in conjunction with another stormwater management device, such as a grassed swale, to provide both water quality control and peak flow attenuation. Runoff that contains high levels of sediments or hydrocarbons (for example, oil and grease) that may clog the trench are often pretreated with other techniques such as water quality inlets (series of chambers that promote sedimentation of coarse materials and separation of free oil from stormwater), inlet protection devices, grassed swales, and vegetated filter strips.

Permeable pavement

Permeable pavement is an alternative to asphalt or concrete surfaces that allows stormwater to drain through the porous surface to a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the subsoil. The appearance of the alternative surface is often similar to asphalt or concrete, but it is manufactured without fine materials and instead incorporates void spaces that allow for storage and infiltration. Underdrains may also be used below the stone reservoir if soil conditions are not conducive to complete infiltration of runoff.

Permeable pavers

Permeable pavers promote groundwater recharge. Permeable interlocking concrete pavements (PICP) are concrete block pavers that create voids on the corners of the pavers (pictured to the right). Concrete grid paver (CGP) systems are composed of concrete blocks made porous by eliminating finer particles in the concrete which creates voids inside the blocks; additionally, the blocks are arranged to create voids between blocks. Plastic turf reinforcing grids (PTRG) are plastic grids that add structural support to the topsoil and reduce compaction to maintain permeability. Grass is encouraged to grow in PTRG, so the roots will help improve permeability due to their root channels.

Soil amendments

Soil amendments increase the soil's infiltration capacity and help reduce runoff from the site. They have the added benefit of changing physical, chemical, and biological characteristics so that the soils become more effective at maintaining water quality. Soil amendments, which include both soil conditioners and fertilizers, increase water retention capabilities and make the soil more suitable for plant growth. The use of soil amendments is conditional on their compatibility with existing vegetation, particularly native plants.

Stormwater planters

Stormwater planters are small landscaped stormwater treatment devices that can be placed above or below ground and can be designed as infiltration or filtering practices. Stormwater planters use soil infiltration and biogeochemical processes to decrease stormwater quantity and improve water quality, similar to rain gardens and green roofs but smaller in size—stormwater planters are typically a few square feet of surface area compared to hundreds or thousands of square feet for rain gardens and green roofs. Types of stormwater planters include contained planters, infiltration planters, and flow-through planters.

Tree box filters

Tree box filters are in-ground containers used to control runoff water quality and provide some detention capacity. Often pre-manufactured, tree box filters contain street trees, vegetation, and soil that help filter runoff before it enters a catch basin or is released from the site. Tree box filters can help meet a variety of stormwater management goals, satisfy regulatory requirements for new development, protect and restore streams, control combined sewer overflows (CSOs), retrofit existing urban areas, and protect reservoir watersheds. The compact size of tree box filters allows volume and water quality control to be tailored to specific site characteristics. Tree box filters provide the added value of aesthetics while making efficient use of available land for stormwater management. Typical landscape plants (for example, shrubs, ornamental grasses, trees and flowers) are an integral part of the bioretention system. Ideally, plants should be selected that can withstand alternating inundation and drought conditions and that do not have invasive root systems, which may reduce the soil's filtering capacity.

Vegetated filter strips

Filter strips are bands of dense vegetation planted downstream of a runoff source. The use of natural or engineered filter strips is limited to gently sloping areas where vegetative cover can be established and channelized flow is not likely to develop. Filter strips are well suited for treating runoff from roads and highways, roof downspouts, very small parking lots, and impervious surfaces. They are also ideal components for the fringe of a stream buffer, or as pretreatment for a structural practice.

Vegetated roofs

Green roofs consist of an impermeable roof membrane overlaid with a lightweight planting mix with a high infiltration rate and vegetated with plants tolerant of heat, drought, and periodic inundations. In addition to reducing runoff volume and frequency and improving runoff water quality, a green roof can reduce the effects of atmospheric pollution, reduce energy costs, and create an attractive environment. They have reduced replacement and maintenance costs and longer life cycles compared to traditional roofs.

Proposed Green Infrastructure Projects for Bloomingdale and LeDroit Park

The following projects have been proposed as feasible, medium-term green infrastructure projects for the Bloomingdale and LeDroit Park region. They comprise the replacement of concrete with permeable pavement in alley ways, construction of curb bump-out rain gardens, and rain gardens in public rights-of-way.

Permeable Pavement (Alley)

Figure 1: Proposed Green Street (Permeable Pavement in Alley) between Adams Street and Bryant Street NW, near North Capitol Street NW

Residential blocks in Bloomingdale and LeDroit Park can be accessed through alleys to the rear of most properties. In replacing existing impervious paving in these alleys with a paving material that allows water to infiltrate to the ground below, stormwater can be absorbed before it contributes to flooding further downhill. By examining the flow of water that moves over the surface of these two neighborhoods, pervious paving can be installed in strategic locations to intercept areas of the highest surface flow rate. The alleys are publicly owned and receive far less traffic than the streets. In placing pervious paving in alleys, the effectiveness and lifetime of the paving is maximized.

Figure 2: Example Urban Permeable Pavement Installation

Curb Bump-out Rain Gardens

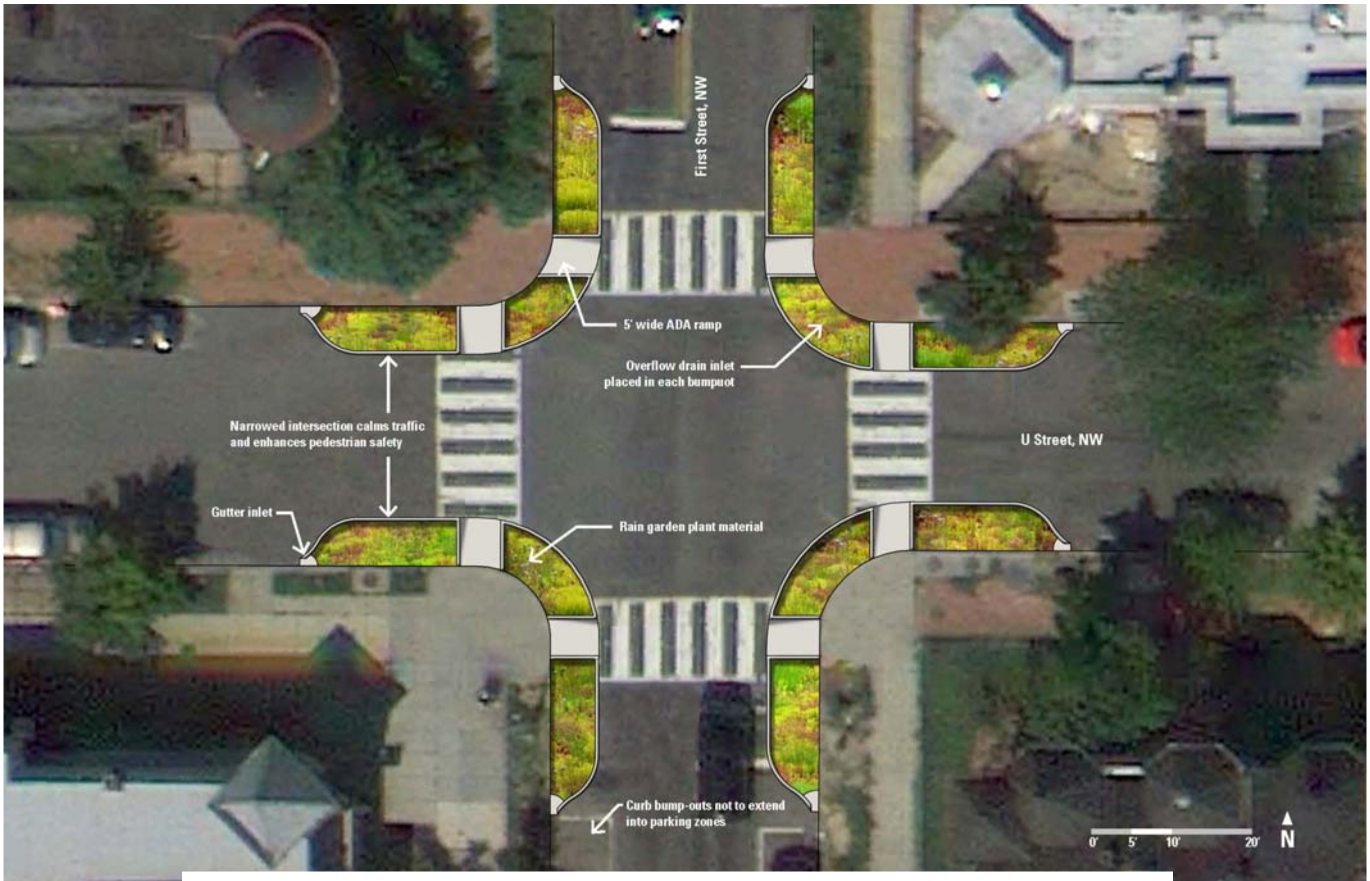

Figure 3: Proposed Curb Bump-out Rain Gardens at U Street and First Street

Rain gardens placed in curb bump-outs intercept water flowing in the gutters and allow it to infiltrate into the ground. Overflow piping allows excess water to be drained after water has collected to a certain level. These bump-outs extend into the street area, using the space at intersections where parking is not permitted. In using this space, the pedestrian experience is enhanced by expanding the curb into the roadway, providing a place in the roadway for the pedestrian to see traffic before crossing. The pedestrian also benefits from the narrowed intersections, as narrow streets have a calming effect on traffic. Implementing these rain gardens would occur within the public right-of-way.

Figure 4: Example Curb Bump-out Rain Garden

Rain Gardens

Figure 5: Proposed Rain Gardens at Anna J. Cooper Circle

Rain gardens in public rights-of-way are proposed as part of the medium term GI solutions. A tremendous opportunity exists in the current open space in the Anna J. Cooper Circle. In preserving the trees and green space within Anna J. Cooper Circle, the vegetated area within the Circle can be reformed and replanted to collect rain water. Doing so would enhance its ability to absorb water before it can reach chronic flooding areas. Any design must be sensitive to the pedestrian traffic that circulates through the Circle, and the seating areas that are often used by residents. Through careful implementation, the Circle's current use as a gathering space can exist side-by-side with vegetated areas that perform beyond their current ability to mitigate stormwater runoff. The traffic circle is publicly owned, in which any direction of water into the Circle could be accommodated within the public right-of-way.

Figure 6: Example Rain Garden Installation

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Appendix 7: Structural/Geotechnical Engineering Evaluation of the McMillan Filter Site

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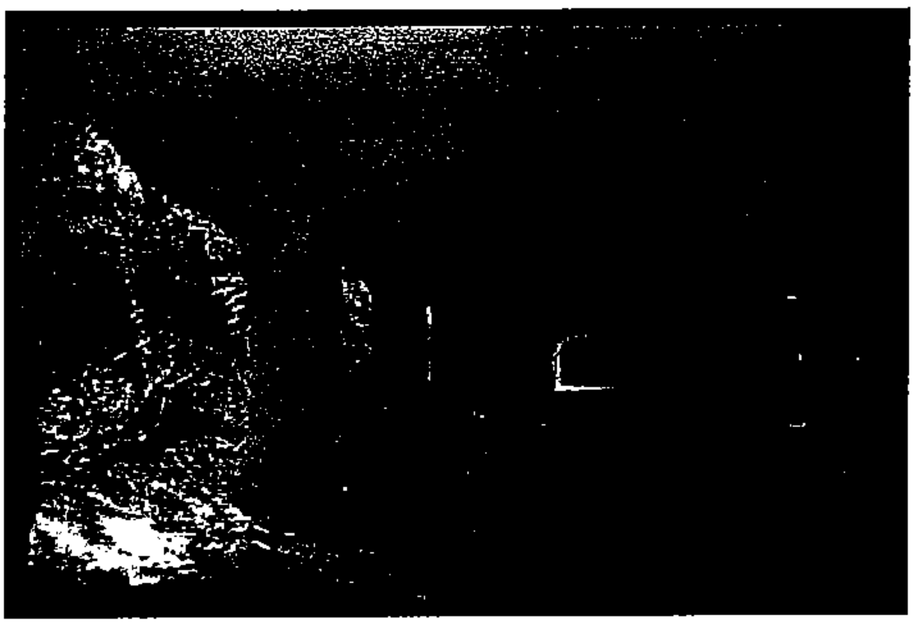
STRUCTURAL/GEOTECHNICAL ENGINEERING EVALUATION of the McMILLAN FILTER SITE

Prepared for the
D.C. DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT



AUGUST 25, 2000

C.C. JOHNSON AND MALHOTRA, PC
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
WASHINGTON, DC

Structural/Geotechnical Engineering Evaluation of the McMillan Filter Site

Table of Contents

Structural/Geotechnical Engineering
Evaluation of the McMillan Filter Site

EXECUTIVE SUMMARY

C.C. Johnson & Malhotra, P.C. along with it sub-consultant E2CR Inc., performed a field survey that evaluated the structural conditions of 20 filters cells at the McMillan Filter Site. Geotechnical data was also obtained.

The purpose of gathering the field data was to determine what would be required to allow the site to be developed as open space, a site for single-story buildings, or a site that could support 4-story buildings.

Once the project team reviewed the field data, it was obvious that the cells varied significantly in their physical condition. Therefore the cells were categorized into three types of cells:

Type I: Significant Deterioration: Potentially dangerous. Cracks of to two inches and larger, joint separation of up to four inches, and collapsed portions of the ceiling. A significant amount of structural damage has occurred since a 1967 survey performed by the Corps of Engineers. The cells within this category are mostly in the south east corner of the site and were constructed on earth fill.

Type II: Moderate Deterioration: Cracks up to one inch and joint separations of up to two inches. Joints were increasingly loose and cracks appear wider and longer than original survey. These defects were generally noted in the vicinity of the exterior walls, and it was only in the vicinity of the exterior walls that significant deterioration was observed to have occurred since the 1967 survey.

Type III: Stable: There are only hairline cracks and less than 1/8 inch joint separations. No significant deterioration has occurred since the 1967 survey. The cells within this category are generally the interior cells

Table 8.1 Summarizes the costs for the various combinations of type of cell and type of development. Development costs range from $440,000 per cell to 2.6 million dollars per cell.

TABLE 8-1
STRUCTURAL/GEOTECHNICAL REQUIREMENTS FOR DEVELOPMENT OF McMILLAN FILTER SITE

DESIGNATION	CELL DESIGNATION		
	TYPE I	TYPE II	TYPE III
CELLS	19,22,23,24,26,27,28,29	10,11,12,13,14,15,20,25	16,17,18,21
DESCRIPTION	Built on fill, active cracking, some failures, additional failures likely	Built in cut areas, active cracking observed around perimeter	Interior cells, built in cut areas, no apparent new cracking has occurred in last 30 years
CONDITION	Unstable, Unsafe	Stable except at edges	Stable
OPEN SPACE			
PRESERVE FILTERS			
Struct. Req'ments	Not Feasible	Reinforced top slab and exterior walls	Reinforced top slab
Geotech. Req'ments	N/A	None	None
Cost Estimate	N/A	$2,020,000 per cell	$1,790,000 per cell
DEMOLISH FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	None	None	None
Cost Estimate	$860,000 per cell	$860,000 per cell	$860,000 per cell
FILL FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	None	None	None
Cost Estimate	$440,000 per cell	$440,000 per cell	$440,000 per cell
SINGLE STORY BUILDING			
PRESERVE FILTERS			
Struct. Req'ments	Not Feasible	Reinforced top slab, columns and exterior walls	Reinforced top slab and columns
Geotech. Req'ments	N/A	Spread footers	Spread Footers
Cost Estimate	N/A	$2,250,000 per cell	$2,020,000 per cell
DEMOLISH FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$1,330,000 per cell	$1,240,000 per cell	$1,240,000 per cell
FILL FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$920,000 per cell	$790,000 per cell	$790,000 per cell
FOUR STORY BUILDING			
PRESERVE FILTERS			
Struct. Req'ments	Not Feasible	Reinforced top slab, columns and exterior walls.	Reinforced top slab and columns
Geotech. Req'ments	N/A	Spread Footers	Spread Footers
Cost Estimate	N/A	$2,560,000 per cell	$2,330,000 per cell
DEMOLISH FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$2,000,000 per cell	$1,370,000 per cell	$1,370,000 per cell
FILL FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$1,610,000 per cell	$920,000 per cell	$920,000 per cell

CHAPTER 2

BACKGROUND

In 1852, the U.S. Congress authorized the U.S. Army Corps of Engineers to develop a drinking water system for Washington, DC. Construction began in 1853 and the first of the system was placed in service in 1864. The early construction was delayed four times due to funding shortages and the Civil War.

The early facilities consisted of a conduit from Great Falls on the Potomac River to a receiving reservoir near Little Falls (now known as the Dalecarlia Reservoir); a distribution reservoir (now known as the Georgetown Reservoir); and a system of cast iron pipe to distribute the water from the Georgetown Reservoir to the City. Most of the original facilities remain in service today.

Many problems were encountered with the original water system. These included: 1) Inadequate pipe sizing from the Georgetown Reservoir to provide sufficient volumes of water. 2) Insufficient water pressure in many parts of the city and 3) The quality of the water was not always good, particularly during periods of heavy rainfall. As a result, the system was expanded to include a tunnel connecting the Georgetown Reservoir to a new reservoir, (now known as the McMillan Reservoir) located on the grounds of Howard University. The tunnel and reservoir were placed in service in 1903. This solved the inadequate water quantity and pressure problems, but it did not improve the quality of the water.

To improve the quality of the water, twenty-nine (29) slow sand filters were constructed adjacent to the reservoir. The construction of the filters began in 1903 and were placed in service in 1905. At the time of completion, the filters were the largest slow sand filtration installation in the country. These filters remained in service until 1986 when a rapid sand filter facility was placed in service.

Twenty of the original 29 filters (or filter cells) were constructed east of First Street, N.W., in the block bounded on the north by Michigan Avenue, the west by North Capitol Street and on the South by Channing Street. When the new rapid sand filters went into service the Corps of Engineers declared the property and facilities east of First Street to be excess. The District of Columbia Government purchased the property at that time. Appendix A shows the overall site location and cell numbering system.

Prior to construction of the filters, the site for the filters was of gently rolling topography. There was a ridgeline running in a northeasterly direction across the site at elevations just over 180. There was also a stream that cut across the southeast corner of the site. The elevation of the stream was as low as 120. The bottom of the filters is at elevation 155; therefore approximately one third of the facility was built upon earth fill, which was as much as 35 feet deep. The other two thirds of the site were built in cut areas as much as 25 feet deep. Figure 2-1 depicts the fill under a portion of the filters.

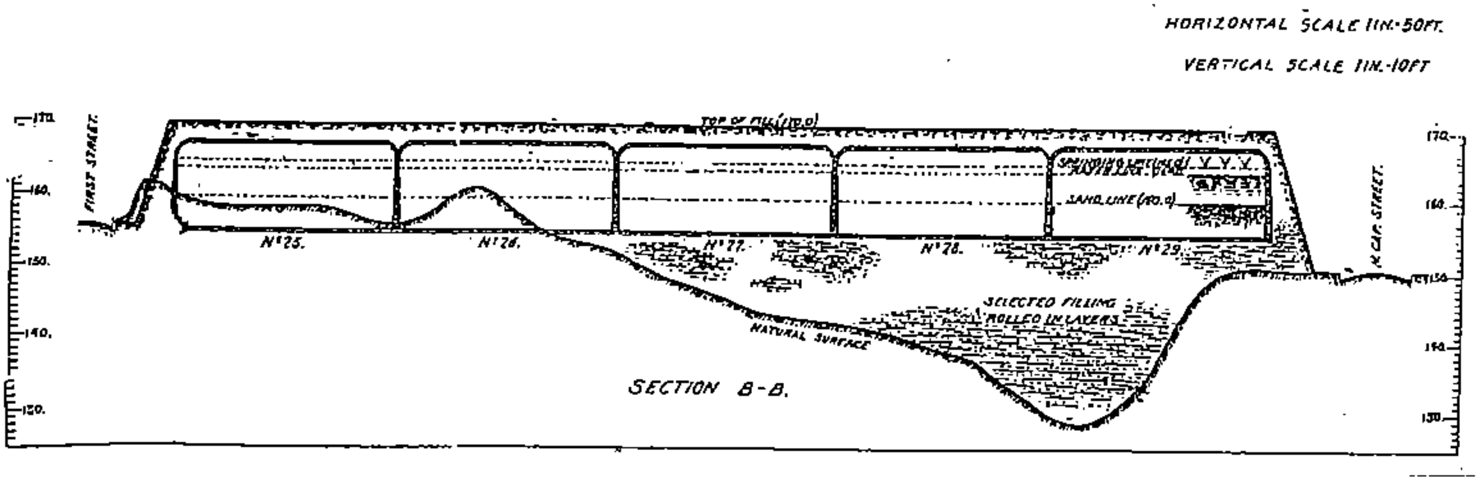


Figure 2-1
. Extract From 1902 Design Drawings

Each filter cell is approximately 150 feet in the east-west direction and 300 feet in the north-south direction. Each cell occupies approximately 45,000 sq. ft. Several cells adjacent to Michigan Avenue, however, do deviate in length and width.

The filter cells are buried concrete vault-like structures constructed entirely of non-reinforced concrete. The structural design consisted of an arch shaped top slab supported on 22 inch square columns spaced 14 feet on center. At the high point of the arches, centered between the columns, were manhole openings. These manholes were for light, ventilation, and for placing clean sand into the filters. The walls of the filter cells were of various configurations varying in widths from three feet to seven feet. Figure 2-2 illustrates the existing cell configuration.

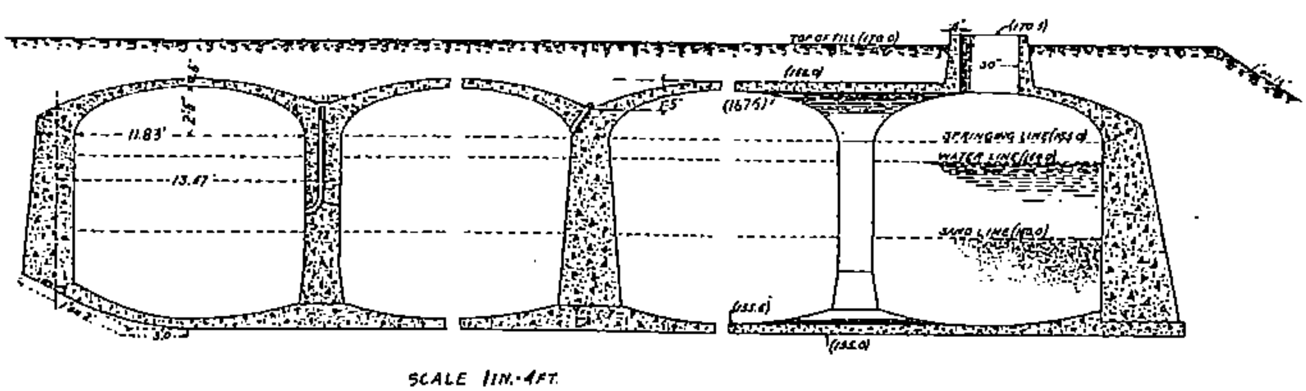


Figure 2-2
Extract From 1902 Design Drawings

The roof of each cell is approximately elevation 168 and is covered with approximately 2 feet of soil; thus making the existing surface grade over the filter cells at elevation 170. The cells have a floor to ceiling height of about 12 feet at the highest point in each cell. The floor slab in each cell is approximately elevation 155 and is 6 inches thick at its thinnest point. The floor is covered with about a foot of gravel overlain by about 3 ½ feet of sand (the elevation of the top of sand is 160).

Two east-west courtyards approximately 100 feet wide traverse the width of the site dividing the site into thirds. The courtyards are paved with 6 inches of concrete and have a surface grade of approximately elevation 163. Concrete and masonry sand bins, sand washers, and regulator houses are present in each courtyard. Numerous underground pipes and conduits also present under each courtyard extending up to 19 feet below grade.

The grades around the site vary from a high along Michigan Avenue of about elevation 180 to a low Channing St. of about elevation 150.

In July 2000, CCJM performed a Phase I Environmental Site Assessment of the McMillan Filter Site, in conformance with the scope and limitations of American Society for Testing and Materials (ASTM) Practice E-1527-94. The assessment revealed no evidence of recognized environmental conditions in connection with the McMillan Filter Site. A copy of the Environmental Assessment is included in Appendix D.

CHAPTER 3

FIELD SURVEY

The field condition survey consisted of a detailed visual inspection of each of the 20 filter cells. The condition survey was performed between June 26 and July 11, 2000. Engineers from CC Johnson & Malhotra, P.C. walked through each of 20 the filter cells to inspect the condition of concrete columns, walls, and ceiling. The results of the survey are presented in the following three sections – an overview of the survey process, a general description of what was observed, and a detail summary of the condition of each cell.

Overview

CCJM utilized as a base map, a 1967 the Corps of Engineers condition survey of all of the filters. Individual drawings of each filter cell map the location and size of all cracks and other defects. CCJM utilized that condition survey as a base line for the field survey to identify where new cracks developed, the change in existing cracks, areas of collapse, joint separations, and any new structural deficiencies. Drawings showing the results of the field survey are included in Appendix A.

General Observations

Most structural deficiencies were observed in the arched ceiling in the form of cracks, sagging ceilings, and joint separations. The damage to the ceiling ranges from hairline cracks to the collapse of large areas.

Perimeter walls and partition walls (common wall between two cells) have only minor hairline to 1/8" cracks and the construction joints appear to be in good condition. Several of the perimeter walls had tree or plant roots penetrating the cracks and in some cases, light through the cracks could be seen.

Most concrete columns or piers appear to be in good shape. A notable exception is in cell No. 27 where columns near the entrance ramp are so severely displaced that steel collars and rods were used to confine them. The ceiling continues to crack and the joint separations are wider.

An 8' x 8' area (test pit # 2 – see Appendix B) on top of filter cell No. 23 was excavated to inspect the condition of the top of the ceiling slab. There is a 1/8" wide crack indicated on the plan of condition survey. (This crack is presently a ¼" wide crack). After excavation, it was revealed that this crack is continuous through the depth of the ceiling slab and is also ¼" wide on the topside of ceiling slab.

The topside of the ceiling appears to be curved as shown on plan and the two adjacent ceiling slabs butt together at the crown of the curve. The topside of ceiling slab appears to be in good shape except for the crack, probably caused by the long term loading of the two feet of fill.

Another 8'x8' area (test pit #1, see Chapter 5) on top of filter cell No. 18 revealed a similar condition of top face of ceiling slab.

Specific: Observations for Each Cell

Based on the results of the field survey each of the twenty cells was placed into one of three categories as defined below:

Type I: Significant Deterioration: Potentially dangerous. Cracks of up to two inches and larger, joint separations of up to four inches, and collapsed portions of the ceiling. A significant amount of structural damage has occurred since the 1967 survey. The cells within this category are mostly in the south east corner of the site and were constructed on earth fill.

Type II: Moderate Deterioration: Cracks up to one inch and joint separations of up to two inches. Joints were increasingly loose and cracks appear wider and longer than original survey. These defects were generally noted in the vicinity of the exterior walls, and it was only in the vicinity of the exterior walls that significant deterioration was observed to have occurred since the 1967 survey.

Type III: Stable: There are only hairline cracks and less than 1/8 inch joint separations. No significant deterioration has occurred since the 1967 survey. The cells within this category are generally the interior cells.

A drawing of the site depicting the locations of these cell categories is included in Appendix A.

Following are detailed descriptions the field inspection observations for cells 24, 23 and 19. These three cells, all Type 1, show the biggest change of conditions since the 1967 survey. Table 3.1, which follows the discussion of these 3 cells, summarizes the findings for 20 cells. Detail drawings that map the defects in each of the cells are in Appendix A.

Cell No. 24

Ceiling

This is the only cell where the ceiling has collapsed. According to Corps of Engineer records, the collapsed area was measured to be approximately 106 square feet on January 5, 1969. Since that time, the collapsed area has increased to about 900 square feet. *Note: In the discussion on the photos, lines are referenced by number and letter. The designations are on the diagrams in Appendix A.*

Photo 24-1: Early collapse in 1969 expanded from 106 SF to about 900 SF.

An additional 60 feet south of the above ceiling has collapsed, which adds another 500 feet of collapsed ceiling. No documentation was provided to CCJM as to when the additional failures took place.

Photo. 24-2: Second collapsed ceiling in Cell No. 24

The collapse of both ceilings have similar patterns. Structural cracks develop at about 1.5 feet to 2 feet from the face of the column, the cold joint between different concrete pours separate, and settle differentially. The strength of an arched ceiling is compromised and the crown collapses.

At locations near the ceiling collapse, dangerously wide cracks and joint separation were observed. The arched ceiling is no longer a smooth curve and further collapse appears imminent. Presently there is as much as four inches of differential settlement at the joints, and 2-3" wide cracks at locations near the existing collapsed areas.

Photo 24-3: Sagging ceiling that is out of alignment at the edge row next to North Capital Street.

Early retrofitting with steel plate and bolts did not prevent further sagging of the separated joints nor widening of structural cracks.

Photo 24-4: Earlier structural repair did not stop the cracks from expanding.

At the east side of the entrance ramp, the joint settlement on the ceiling increased from two inches to three inches.

Photo 24-5: Even with steel strap, cracks extend and joint separation continues.

A crack near line 1 and A widened from ¼" to ½" and settled even with the strap in place to restrain it.

Photo 24-6: Crack development continues even though the strap is in place.

A crack near column 5 and M widened from ¼" to ½" even with the strap in place to limit further widening.

Photo 24-7: Crack development continues even though the strap is in place.

At the manhole near line 1 and B, a ½" joint separation documented in 1969 increased to 3" although the steel strap was placed in the 1960's to slow widening of the crack. With further crack development and joint separation, this piece of ceiling is likely to fall.

Photo 24-8: A piece of ceiling surrounded by cracks and separated joint. The circular opening is a manhole.

Concrete has fallen out of a crack near line 2, 4 and 7. A few new cracks appear at line A and 10, 7/9 and C, and 2/3 and H. In general, where the ceiling slab was repaired in 1960's, there is increased settlement and wider cracks.

Column (Pier)

No cracks are observed on the column although at several locations near the entrance ramp the cold joint between the top of column, and the base the of arched ceiling are slightly separated.

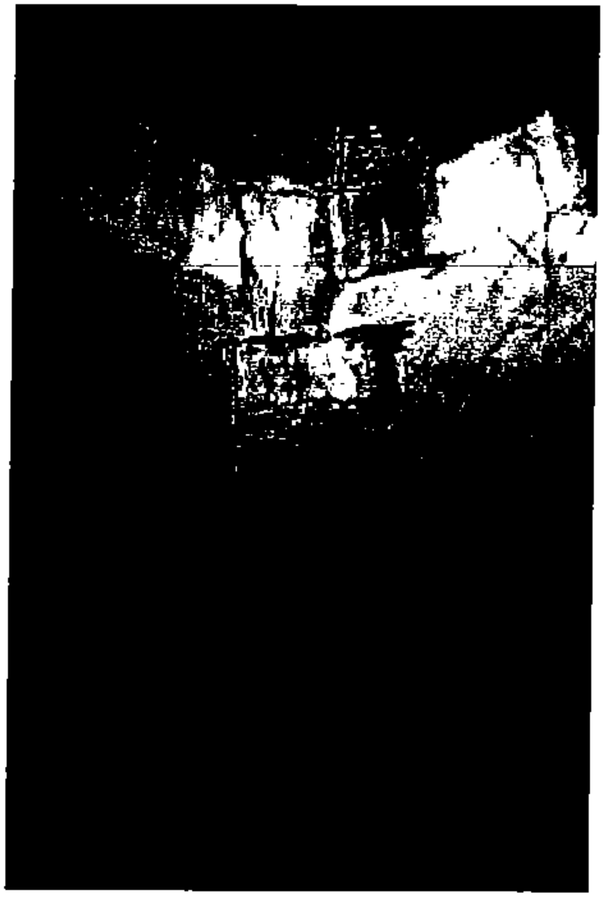
Walls

The South wall shows four new hairline cracks between line 6 and 8. The West wall shows a new hairline crack near line L. One crack is observed on the North wall at line 8.

Cell No. 19

Ceiling

Cell No. 19 is an edge cell next to North Capital Street. It is North of cell No. 24. It shows major cracks and joint separations on the ceiling besides cell No. 24 where the collapse occurred. At the manhole between line Q/R and 10, the ceiling slab has separated from the bottom of the manhole wall for 3" – 4" and is only restrained by a row of steel straps. A ½" wide compound crack developed along the settled joint.



Photo, 19-1 and 19-2: Ceiling shows 3"- 4" settlement and compound cracks parallel to the joint.

Not far above the sagging ceiling, there are a few 1" – 2" wide cracks in the ceiling. These were recorded in 1967 as a ¼" wide single crack. They are now much wider and compounded into multiple cracks next to each other. The slabs are strapped together with steel plates. Since the ceiling slab at the crown is about 6" thick, further settlement of the ceiling may crumble the ceiling slab-causing collapse without any advance warning.

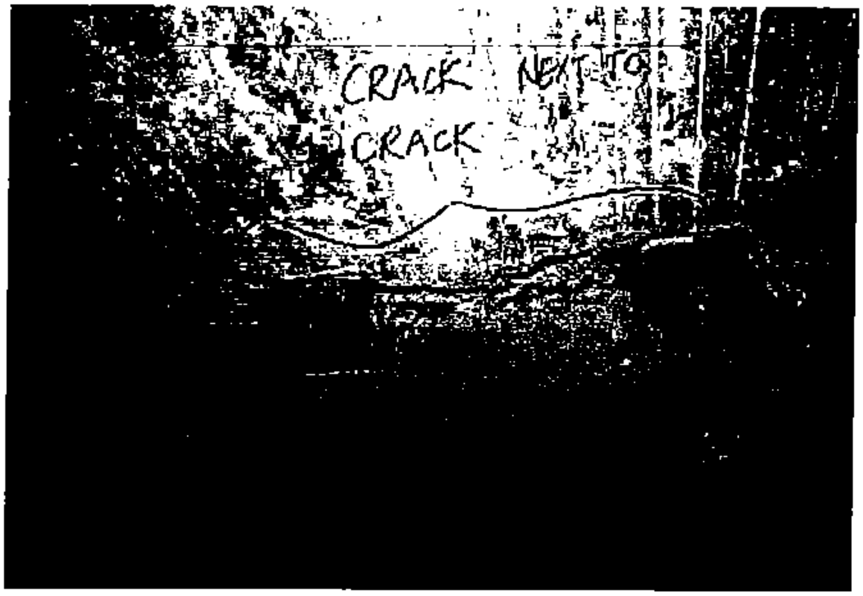


Photo 19-3: Wide cracks at ceiling near line 10.

Concrete has started to fall out at a crack near line K and 10. In general, where the ceiling slab was repaired in the 60's, there is development of increased settlement and wider cracks.

Column (Pier)

No cracks were observed on columns although at several locations the cold joint between top of the column the base of the arched ceiling shows signs of separation. This is obvious at the entrance along line 4 and 5.

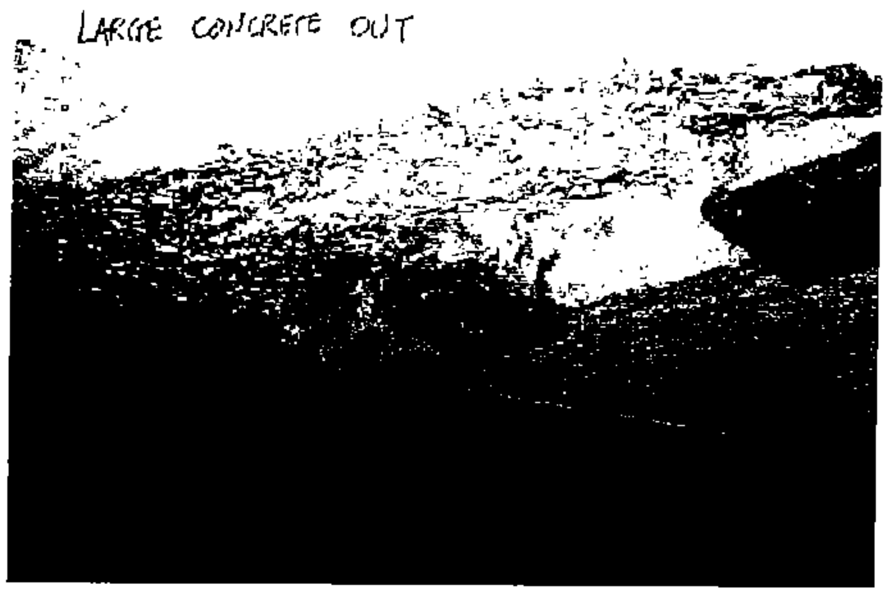
Walls

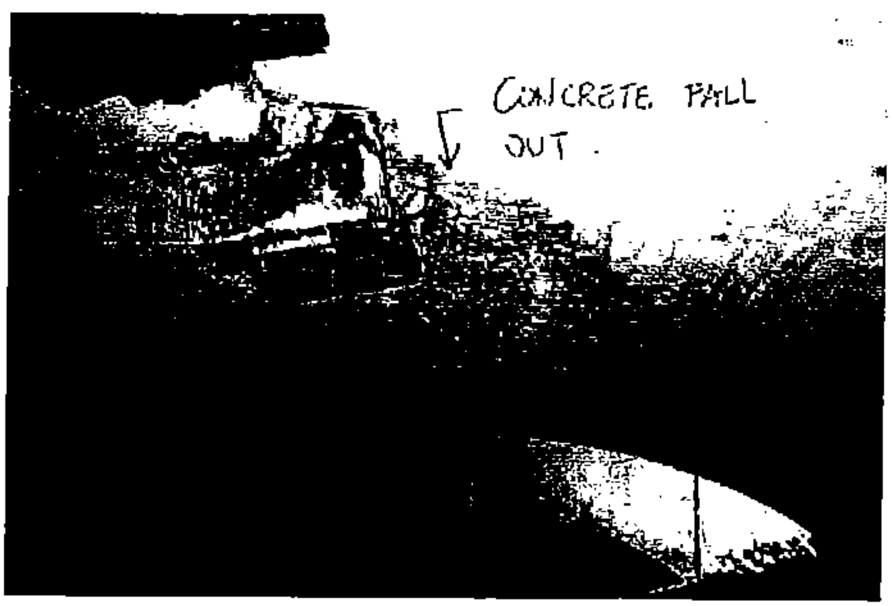
A new horizontal crack has appeared on the South wall and the East wall. A few vertical cracks show on the South wall.

Cell No. 23

Ceiling

A large piece of concrete (7' x 2'- 6") with thickness ranging from 0-6" has fallen out near line A and 6. This appears to have happened after the steel plates were placed to prevent its fall.





Photos 23-1 &2. 7'x2'-6"x up to 6" deep concrete loss.

Photo 23-3 shows further joint settlement and crack development from the 1967 survey, near a manhole along line 1 and P.

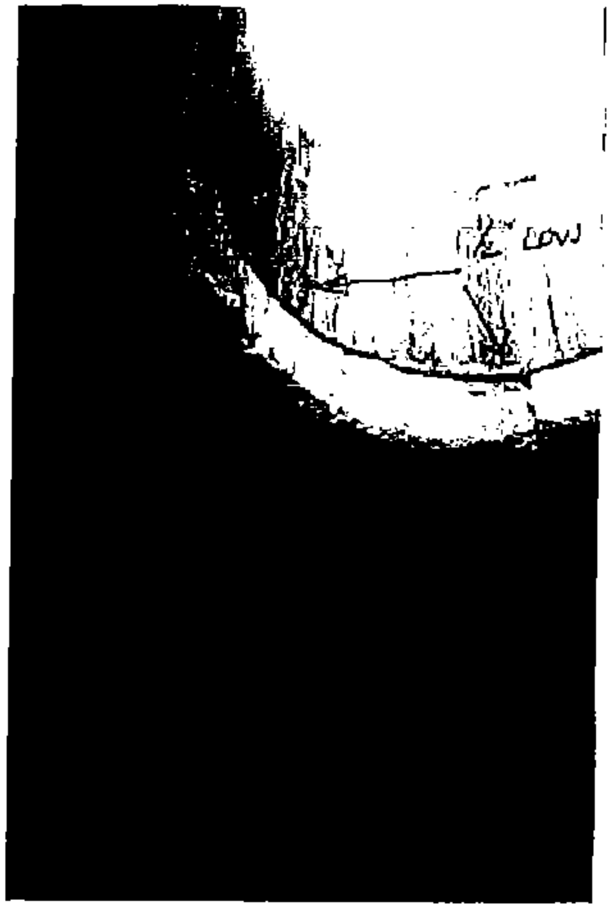


Photo 23-3: Further settlement at the crack and joint around manhole.

In general, where the ceiling slab was repaired in the 1960's, there is more settlement and wider cracks.

Column (Pier)

No cracks are observed on columns although at several locations the cold joint between top of the column and the base of arched ceiling show signs of separation. This is obvious at the entrance along line 4 and 5.

Walls

Three vertical cracks were found on the South wall between line 8 and 10.

Other photos below show some of the structural deficiencies in cells 17, 22, 26, 28.

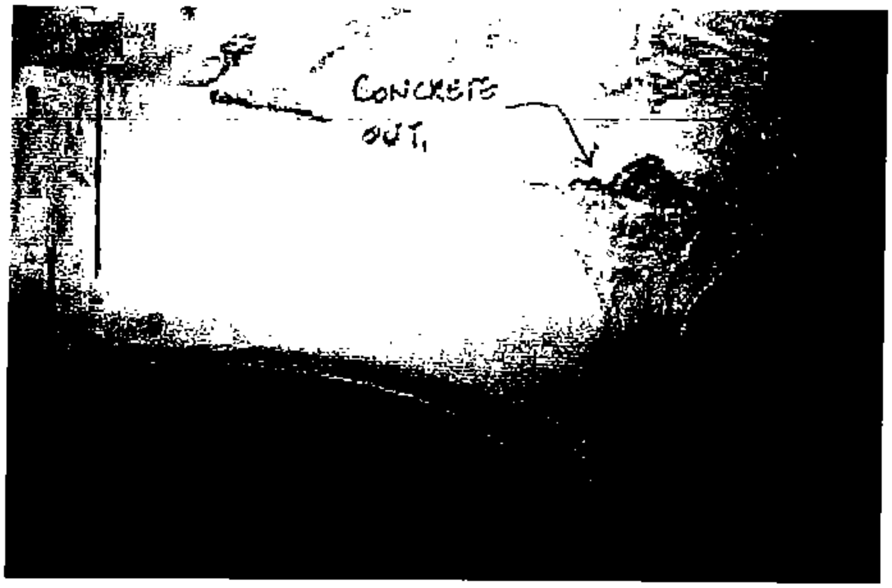
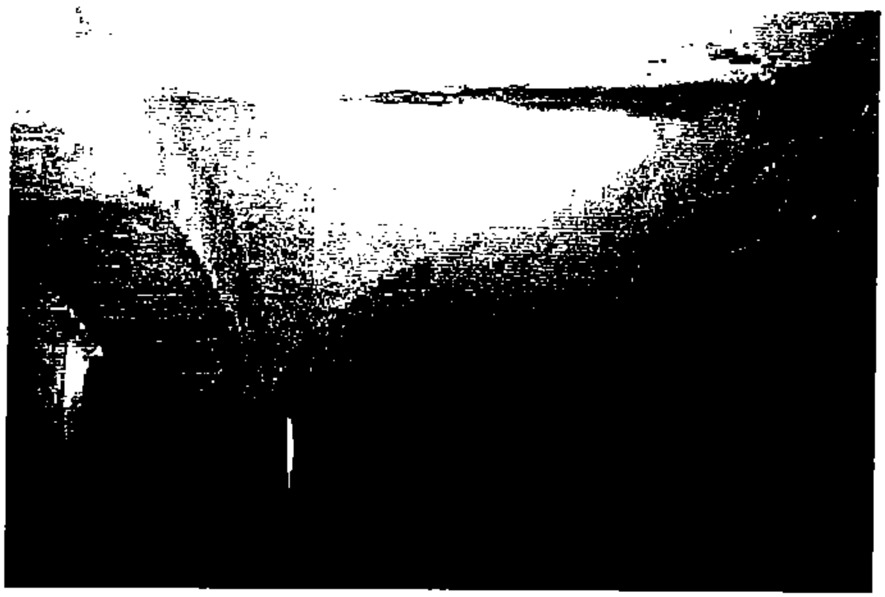
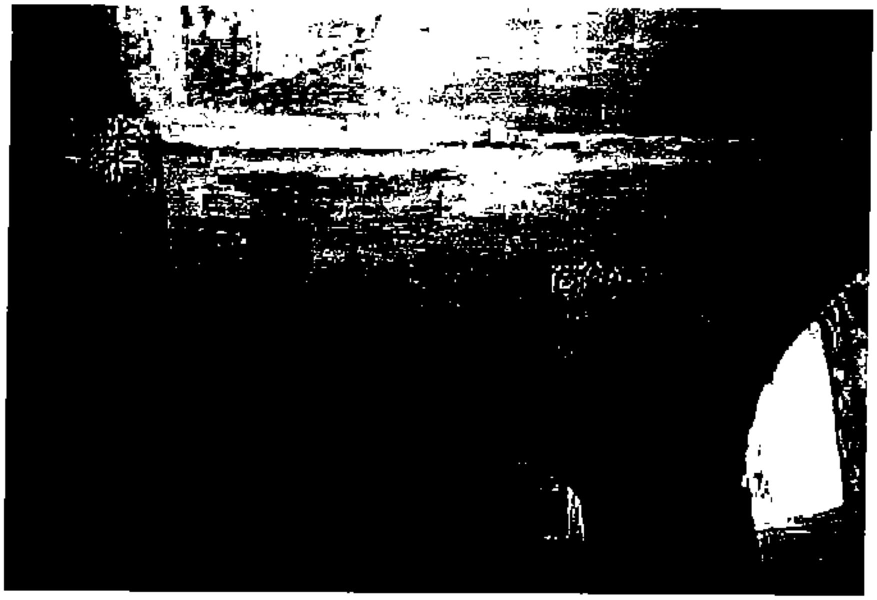


Photo 22-1: A piece of concrete fell from the cracked ceiling near column D5.





Photos 22-2 and 3: Ceiling slab rotated and dropped out of its original place at the butt joint.

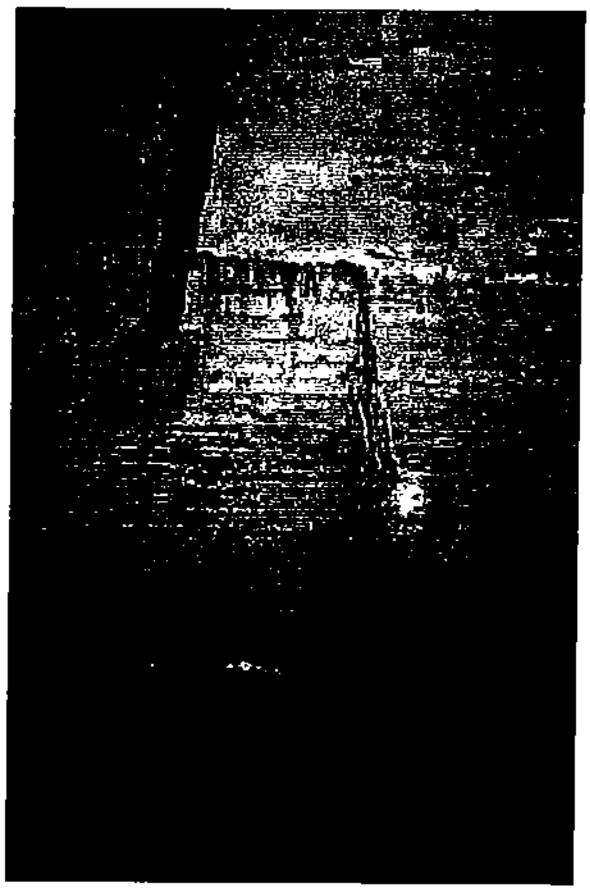


Photo 26-1: Root growth out of the structural cracks.

Photo 28-1

Photo 28-2

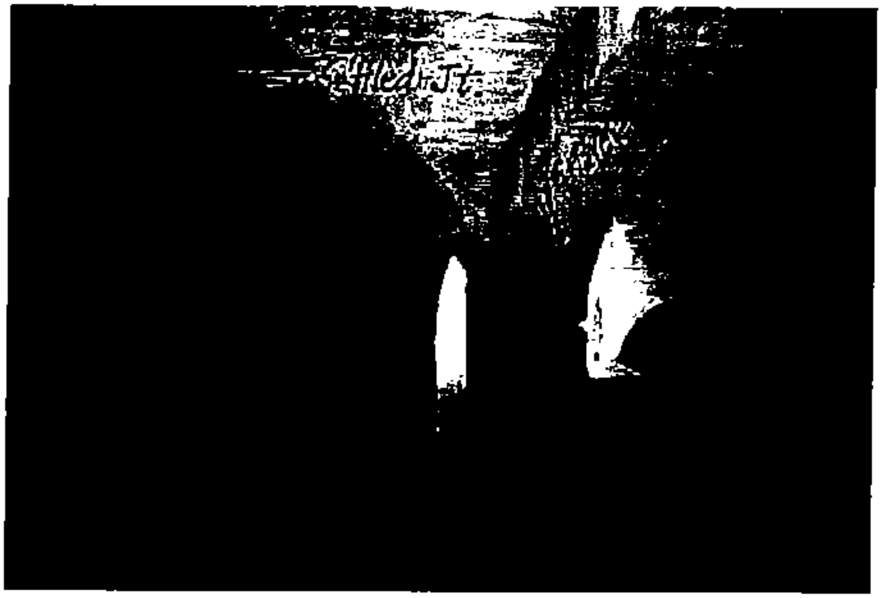


Photo 28-3

Photos 28-1,2 &3: Joint settled differentially.

Table 3-1: Summary of Field Inspection

Cell No.	Soils Below Base Slab	Description of Observation	Special Notes	Category of Damage
10	Firm Material	Refer To Plan CS-2. 1. A few new hairline cracks on the ceiling and walls. 2. Further settlement of the ceiling near column C5 and a piece of concrete fell out at this location. 3. Active water migration along north wall and ceiling nearby.	Water migrating into the filter was collected and sent to the Corps of Engineers for testing for chloride and fluoride to determine if the water comes from water main leakage or surface runoff. Results are .24 mg/l fluoride which is above local background levels and below target levels for distribution system.	**TYPE II**
11	Firm Material	Refer To Plan CS-3. 1. A few new hairline cracks on the ceiling and north wall. 2. Further settlement of the ceiling at joint near column A7 and a piece of concrete fell out at this location. Bottom of column A5 shows red brick surface.	There is no documentation as to why or when red brick on column 5 was used in the filter construction. This is not typical.	**TYPE II**
12	Firm Material	Refer To Plan CS-4. 1. A few new hairline cracks on the ceiling at the entrance. 2. One new hairline crack on North wall.		**TYPE II**

Cell No.	Soils Below Base Slab	Description of Observation	Special Notes	Category of Damage
13	Firm Material	Refer To CS-5 1. A few new hair line cracks on the ceiling and North wall. 2. New settlement of up to ½" near column A5 and A6. 3. Hair line crack at C10 widens to 1/8" and a small piece of concrete is falling off at the crown under manhole wall.		**TYPE II**
14	Firm Material	Refer To CS-6 1. New hairline cracks on the North and south walls. 2. New hairline cracks near column X1. 3. New settlement at manholes near C1 and F1.		**TYPE II**
15	Firm Material	Refer To Plan CS-7 1. Northeast corner appears to have widened cracks and more joint settlement at several locations. 2. Widened cracks at the ceiling above the entrance ramp. New hairline cracks on the ceiling and North and South walls.		**TYPE II**

Cell No.	Soils Below Base Slab	Description of Observation	Special Notes	Category of Damage
16	Firm Material	Refer To Plan CS-8 1. Two new hairline cracks on the ceiling at C6 and A1. 2. Minor joint settlement near A4. 3. A few new hair line cracks on the North and South walls.		**TYPE III**
17	Firm Material	Refer To Plan CS-9 1. Six new hairline cracks on West side of north wall. 2.		**TYPE III**
18	Firm Material	Refer To Plan CS-10 1. Along East side of line A, lower joint separation, new and wider cracks. 2. Crack on top of column B5. 3. A small piece of concrete fell off a crack near column E2.	Test pit No. 1 at column D4 over a nearby 1/8" wide crack: 1/8" wide crack was sprayed with water on the topside. Water was observed below thereby indicating full-dept crack.	**TYPE III**
19	Partially on fill	Refer To Plan CS-11 1. Condition similar to cell No. 24 at the Southeast corner. Cracks widened and joint separation worsened. 2. Joint separation of 1" found near line A.	SE corner appear to be in pre-collapse condition. Unsafe to walk under or above it.	**TYPE I**

Cell No.	Soils Below Base Slab	Description of Observation	Special Notes	Category of Damage
20	Firm Material	Refer To Plan CS-12 1. Numerous new cracks on ceiling between line B and H. 2. New cracks on top of column at A6. 3. New cracks on North and South walls.		**TYPE II**
21	Firm Material	Refer To Plan CS-13 1. At column I7, a hairline crack developed into a 1" wide crack.		**TYPE III**
22	On Fill in south east corner	Refer to Plan CS-14 1. Column cracks on top at the ramp entrance. 2. Red brick found in column B5. 3. Joint settled out of plan at the crown for up to 2 ½". 4. A piece of concrete fell off ceiling near column D5.		**TYPE I**
23	Mainly on top of fill	Refer to Plan CS-15 1. As shown in photos 23-1 thru 23-3..		**TYPE I**
24	Mainly on top of fill	Refer to Plan CS-16 1. As shown in photos 24-1 thru 24-8.		**TYPE I**

Cell No.	Soils Below Base Slab	Description of Observation	Special Notes	Category of Damage
25	Partially on top of fill at south east corner	Refer to Plan CS-17. Refer to photo numbers 1. Joint settle for up to 2" along line S between 2 and 3. 2. New cracks found. 3. Root growth out of crack on East wall near line A. 4. Crack found on top of column U2.	This is an edge cell subject to damage caused by the end wall displacement along the edge. It appears the edge cell shows more new crack development than the interior cell.	**TYPE II**
26	Mainly on top of fill	Refer to Plan CS-18 1. Concrete fell out at two joints at the crown, near U6 and A5. 2. Earlier cracks repaired with straps in 60's appear to have expanded and widened. 3.		**TYPE I**
27	Entirely on top of fill material	Refer to Plan CS-19 1. At the entrance, vertical cracks on the columns and arch ceiling bottom is severe. Steel collar and tie rod to retrofit these columns and ceiling corroded and lost more than 50% of its size. 2. Severe vertical cracks in column A5, B6, C6 and D6. 3. Earlier cracks repaired with straps in 60's appear expand and widened.	Early repair to the cracked column and arched ceiling fell apart.	**TYPE I**

Cell No.	Soils Below Base Slab	Description of Observation	Special Notes	Category of Damage
28	Entirely on top of fill material	Refer to Plan CS-20 1. Earlier cracks repaired with straps in 60's appear to have expanded and widened.		**TYPE I**
29	Entirely on top of fill material	Refer to Plan CS-21 1. Earlier cracks repaired with straps in 60's appear to have expanded, widened and sagged. **2.** Horiz. cracks on top of column B5, C5.		**TYPE I**

CHAPTER 4

GEOTECHNICAL INVESTIGATION AND RECOMMENDATIONS

PURPOSE AND SCOPE

The purpose of the investigation was to evaluate the subsurface conditions, on a preliminary basis. The information obtained may be used by a potential developer to determine the complexities involved in developing and/or preserving the site. The investigation was not a design phase investigation. Consequently, the scope of the investigation was rather limited and consisted of the following:

- Collect and review the available information.
- Conduct a site reconnaissance and visually inspect the condition of the structure.
- Drill 12 borings to determine the subsurface conditions.
- Evaluate the data.
- Prepare a report of our findings.

DATA REVIEWED

The following reports were made available to us and were reviewed:

- Architectural / Engineering Feasibility Study of McMillan Reservoir Site; Existing Conditions Report; Oct. 3, 1988.
- Architectural & Archaeological Survey – Eastern Portion, McMillan Water Treatment Plant – June 1990
- Conditional Survey Drawings – February 1968 through July 1968
- Contract Drawings – 1905

Review of the old topographical data indicates that a stream traversed the southeast portion of the site, in a northeast to southwest direction. The elevation at the site had varied from about El. 120 at the south central portion to El. 180 in the northwest portion. Since the cell floor is at about El. 155, it is apparent that the site was developed by cutting the north west portion and filling the south east portion. The thickness of the fill could be up to 35 feet, with the thickest section being in the south central part.

FIELD RECONNAISSANCE

Field reconnaissance was conducted on several occasions in June and July 2000. We observed the following:

- Portions of the arches have collapsed at several locations, especially near the southeast portion of the site and along the perimeter of the site.
- There are several "sink holes" at the surface, especially in the southeast portion of the site.
- Some arches appear to have experienced some movement, since there are steel plates and bolts across the cracks in the arches.

- Some concrete columns also appear to have experienced some movements.
- The conditions of the arches and the columns appear to vary considerably from incipient failure to fairly sound.
- The cell floor is covered by about 4 feet of sand.

The sand storage bin and regulator house structures appear to be in sound condition. Noticeable cracks or settlements were not visible in these structures.

FIELD INVESTIGATION

The field investigation was conducted in July 2000. A total of twelve test borings (E-1 through E-12) were drilled to depths of 15-feet to 60-feet at locations shown on Figure 1 and listed on Table 1 in Appendix B. Borings E-1 through E-6 were drilled in the Court area (at El. 164±) and borings E-7 through E-12 were drilled from top of the roof (El. 170±) through the manholes and by coring the concrete floor slab underneath. Borings E-1 through E-6 were drilled by a truck mounted drill rig and borings E-7 through E-12 were drilled by a skid mounted special light weight drill rig. The holes were advanced using hollow stem augers. Standard penetration tests were conducted and split spoon samples were obtained in every boring, at depth intervals of 2.5-feet to 5-feet. Representative portions of each sample were placed in an airtight glass jar and were appropriately marked. Bulk (bag) samples were obtained off the auger flights in some borings. Two undisturbed Shelby tube samples of cohesive soils were also obtained. The depths of the boring varied from 15-feet to 60-feet. The groundwater level was monitored in each boring during drilling and at completion of drilling. Temporary 2-inch PVC pipes were installed in seven borings to measure the long-term water levels. After the water levels were obtained, all borings were backfilled with grout. The edited log of the borings are included in Appendix B.

LABORATORY TESTING

All samples were visually inspected in the laboratory by a Geologist/Geotechnical Engineer, to corroborate and/or modify the field classifications. Selected samples were tested for their natural water content, gradation (sieve analysis), Atterberg Limits, and unconfined compressive strength. A total of 77 natural moisture, 6 Atterberg limits, 6 sieve analysis, 4 percent fines, 2 natural densities and 2 unconfined compression tests were conducted. All tests were conducted in accordance with ASTM procedures. The results of the laboratory tests are summarized in Table-2 in Appendix B.

SITE GEOLOGY

Regional Geological Maps indicate that the site is located in the Atlantic Coastal Plain Physiographic Region where the near surface soils are an alluvial formation consisting of interbedded layers of silt, sand, clay and gravel.

SUBSURFACE CONDITIONS

The subsurface stratigraphy below the cell floor generally consists of the following two major strata:

Stratum-I: This stratum consists of fill, which is composed of brown, orange to reddish brown clayey sand and sandy clay with varying amounts of gravel. The fill is basically free of organics and was encountered predominantly in the southeastern portion of the site, as shown on Figure 2 in Appendix B. The depth of fill varied from 3-ft. to 35-ft. below the cell floor. Table 1 and Figure 2 in Appendix B show the thickness of the fill below the existing grade of the roof (El. 170±), not the cell floor. Standard Penetration Resistance in the fill varies considerably from 3 blows/ft. to 50 blows/inch. It is believed that the fill is an uncontrolled/unengineered fill.

The pressure and thickness of the fill observed in the borings is corroborated by the old topographic data and by the borings drilled in 1998 by others. The B borings were taken in 1988 by Schnable Engineering Associates. Boring B-14 indicates the presence of about 35-ft. of fill below the cell floor (El. 155±). The topographic map indicates that the elevation near Boring B-14 was about El. 120. Thus, the fill should be, and is, about 35-ft. It should be noted that the quality and nature of the fill is highly variable. In Boring B-14, the N value is in excess of 20 blows/ft. in the upper 20-ft.; in E-7 it is in excess of 50 blows/ft., whereas in Boring B-12 and E-11, the N value is 8 to 10 blows/ft. below the cell floor.

Figure 2 in Appendix B shows the surface contours prior to the construction of the cells. It appears that a stream traversed through the southeast portion of the filtration plant, and the grade at the stream was about El. 120 to El. 130. The western portion of the site was at about El. 180. The cell floor slab is at about El. 155. This would indicate that cell No. 28 would have about 30-ft. of fill, and cells 15, 20 and 25 have about 26-ft. of cut. Based on the topographic map, it appears that the thickness of the fill/cut in the cells was as follows:

Cell Number	Pre-Construction Elev.	Floor Slab Elev.	Fill / Cut
15	180	155	26' cut
16	180	155	25' cut
17	180	155	25' cut
18	120 – 180	155	15' – 25' cut
19	150 – 170	155	5' fill – 15' cut
20	180	155	25' cut
21	175 – 180	155	20' – 25' cut
22	155 – 175	155	0 – 20' cut
23	130 – 155	155	0 – 25' fill
24	130 – 155	155	0 – 25' fill
25	180	155	25' cut
26	145 – 180	155	10' fill – 25' cut
27	120 – 155	155	0 - 35' fill
28	120 – 125	155	30 – 35' fill
29	130 – 145	155	10' – 25' fill

Borings drilled by Schnabel Engineering Associates in 1988 indicate the following:

Boring	Location	Bottom of Fill Elev.	Original Grade
B-9	Cell 24	142	140+
B-11	Cell 22	148	145+
B-12	Cell 24	136	130+
B-14	Cell 27	119	120
B-15	Cell 29	140	140

Figures 3, 4 and 5 shows the thickness of the fill below the floor slab.

Stratum-II: This stratum consists predominantly of brown, orange to reddish brown clayey to silty sand with interbedded layers of sandy to silty clay. Standard penetration resistance varies considerably, from about 3 blows/ft. to 50 blows/4 inches, and generally increases with depth.

The soils in the stratum are highly variable and include gravel, Sand, Silty Sand, Clayey Sand and Clay. The liquid limit of the cohesive portion is generally between 35 to 40; the plasticity index is generally between 14 to 24; the natural water content is generally between 17% to 22%.

Groundwater was encountered in several borings and measured to be generally between El. 135 to El.140, as shown in Table 1 in Appendix B.

The generalized subsurface profiles are shown on Figures 3 through 5 in Appendix B.

EVALUATION AND ANALYSIS

The available data was evaluated with respect to the proposed development and is discussed below.

Site Development

If the site is to be developed as a mix use development, we envision the following issues and possible solutions.

Foundations

The soil fill above the arches is not considered to be suitable for supporting the one to 4 story structures, especially since the integrity of the arches in some areas, is highly questionable (see Chapter 6). Structures could be safely founded at the site, using one or more of the following options:

Option A: Demolish the sand filters and place the new structures at El. 155 (existing floor slab of the cells).

Option B: Demolish the sand filters; raise the elevation using structural fill; and construct the new structures on the structural fill.

Option C: Fill the cells and use the filled cells to support the new structures.

Option D: Preserve the cells.

Each option is discussed below.

Option A: In this option, the existing cells would be demolished, either entirely or selectively. The new structures would be founded on the virgin soil below the existing floor slab. The soils below the slab are anticipated to vary significantly, from uncompacted fill to soft/loose virgin soils to medium dense sand, as discussed under Subsurface Conditions. Where the floor slab is underlain by fill or soft soils, and if the fill or the soft soil is less than about 10-ft. thick, then the fill or the soft soil could be undercut and replaced with compacted fill. In that case, all the structures could be founded on shallow spread footings, bearing either on the existing virgin soil, or on the new compacted fill. On a preliminary basis, an allowable bearing capacity of 3 ksf on the fill and 4 ksf on the floor slab could be used to design the footings. Since the soils below the floor slab are generally sands and clays of the Terrace or Potomac formations, and have standard penetration resistance varying from 5 blows/foot to over 50 blows/foot, some localized undercutting and backfilling should be anticipated below the slab.

If the thickness of the existing fill is more than 10-ft. then deep foundations would be needed. This condition is anticipated to occur in cells 23, 24, 27, 28 and 29 i.e. the southeast portion of the site. The length of the deep foundations would depend upon their type, method of installation and load carrying capacity. Additional and deeper borings need to be drilled in the southeast portion to determine the lengths of the deep foundations.

In our opinion, 14-inch thick diameter auger cast pile could be used as one of the deep foundation systems to support the structure columns. Allowable design capacities of 40 kips could be used, tentatively, per 14-inch diameter cast pile with tip elevations varying from El. 130 to El. 100. The individual pile capacity and the top elevation depend on the depth of fill and the consistency of the soil.

Option B: This option is similar to Option A. The existing cells could be demolished either entirely or selectively. The existing fill under the floor slab, and the soft soils under the floor slab, would need to be undercut and backfilled. As discussed under Option A, the southeast portion would still require a deep foundation system. The grade of the entire area could then be raised to the desired level using structural fill. The structures could be founded on the compacted structural fill using an allowable bearing capacity of 3 ksf.

Option C: This option is based on filling the cells.

Fill the cells with clean sand, using hydraulic filling method. The sand could be placed in a sand/water slurry, and pumped into the filter cells, from various openings at the surface. The sand fill would be in a medium dense condition, and would prevent the collapse of the arches. This approach would require a large volume of water. However, the water could be recycled.

Fill the cells using "flowable fill", such as fly ash, sand and cement mixture. The flowable fill would fill the cells, provide support for the arch, and prevent surficial subsidence.

Option D: Selectively Preserve the Cells

Strategically locate the surficial structures over those portions of the sand filters that have a "low risk" of structural failure, and place the footings of the structures over the existing columns that are structurally sound, see Chapter 6 for locations of low, moderate and high risk areas.

Provide additional columns in the cells to support the arches, if necessary.

Construct a new structural slab on top of the arches, and support the new slab on either the existing columns or new columns.

Sports Fields

If sports fields are planned in the southeast portion, they could develop "sink holes", since the existing arches could collapse. The option cited for "Foundations" above, also apply to sports fields. In addition, the risk of "sink holes" developing could be reduced by removing the upper 2+ feet of soil cover, and replacing it with geotextile reinforced fill.

Groundwater

The borings indicate that the groundwater is at or below El. 135. The existing floor slab of the cells is at about El. 155. Therefore, groundwater is at a depth of about 19+ feet below the floor slab. Since the excavation or removal of soft soils will not extend below El. 145, groundwater is not anticipated to have any impact on the construction of the new facilities.

Suitability of Existing Soil as Fill

The existing soil inside the cells, above the concrete, is generally a sand and gravel. There is some debris on the surface of the sand. If the debris is removed, the sand and gravel is considered to be suitable for use as fill, from construction considerations.

Perimeter Wall

The perimeter wall appears to be in poor structural condition and will need to be repaired or replaced in certain areas. If a new wall is planned, it could be founded on shallow spread footings at about El. 155, except in the southeast portion, where it would need to be founded on deep foundations. An alternative would be to use a soil nail wall, auger cast pile wall, or steel sheet pile wall.

CHAPTER 6

STRUCTURAL ANALYSIS

A structural analysis was performed on the existing non-reinforced concrete arched ceiling structures that comprise the underground filters at the McMillan Filter Site. The goal of the analysis was to determine what, if anything could be constructed on top of the filters depending on their condition (Type I, Type II and Type III). The loads that would be imposed on the filter cells were assumed to be open space, one-story buildings such as supermarkets, and four-story office buildings.

Since the loads imposed by all three of the proposed types of development probably exceed the original design loads of 1902, any change in the use of these structures will be subject to current load requirements as indicated in Chapter 34 of the BOCA Building Code, which is the governing building code.

Cost estimates were performed to determine an estimated unit price per cell for preparing the site for each of the three forms of development.

Existing Structure

The original 1902 design documents reveal that the filters were constructed totally of non-reinforced concrete. There are 20 cells, each of which is about one acre in size. This nearly century old structure has the following features of structural significance:

1. The finished grade of the site is elevation 170 and there are two feet of earth fill on top of the ceiling slab at the crown. The curved ceiling slab collects the surface water that percolates through the two feet of overburden and directs it into two-inch drains that run through the center of the columns and discharge onto the filter bed.

2. The ceiling slab has curved top and bottom faces that are supported on 22 inch square concrete columns that are spaced at 14 feet on center in each direction. The thickness of the ceiling slab varies from six inches at the crown to 15 inches at the supports atop the columns.

3. The slab-on-grade base slab varies from 14 inches to six inches in depth with a curved top and flat bottom. It was designed to hold approximately four feet of sand and one foot of gravel in addition to water. The clearance between the top of the base slab to the ceiling at the crown is about 12 feet.

4. The perimeter walls are tapered retaining walls that are either buried completely or partially buried in the ground. The perimeter walls vary in thickness from two feet to seven feet. The partition walls that separate the cells are also tapered walls with a varying thickness of 24 to 34 inches.

5. The connection between the ceiling slab and the columns is a shear key. The columns are rooted into the base slab without a shear key.

6. The concrete ceiling slab appears to have been poured in either 14 feet by 42 feet segments that are supported on three columns, or 14 feet by 14 feet segments supported on one column. Along the edge near the perimeter wall, the segments appear to be 14 feet by 7 feet and 42 feet by 7 feet. Each segment butts each other at the crown and is vertically supported at the columns and walls.

Analysis Approach:

The Finite Element Method (FEM) method of analysis was utilized on a three-dimensional (3D) model of the arched ceiling structures to determine:

1. What additional surface loading can the existing non-reinforced structure support in addition to its own weight and the soil fill on top; and

2. The amount and method of reinforcing of the top slab required to support the three types of development.

After the model analysis, column and footing design calculations were performed to determine the amount of subsurface work, such as retrofitting columns, that would be needed to meet development requirements.

The model analysis only considered the Type II and Type III cells. The Type I cells that were built on fill continue to experience active differential settlement under the foundations. This ongoing settlement is the cause for the continuing structural deterioration of these cells. To prevent further damage to these cells, stabilizing the below grade fill would be required. This option would be prohibitively expensive. Also, most of Type I cells are already damaged beyond reasonable repair and cannot be salvaged even if the below grade fills were somehow stabilized. CCJM recommends that the Type I cells either be demolished or filled (Figures 6-1, 6-2 and 6-3).

In the 3D model analysis, both prismatic and non-prismatic plate elements were used to mimic the dome ceiling. Three models were implemented for the ceiling structure:

1. A 42 feet by 28 feet segment of curved ceiling supported on three columns that are spaced at 14 feet apart;

2. A 7 feet by 42 feet segment of curved ceiling supported on the perimeter wall and adjacent ceiling at the crown;

3. A 7 feet by 7 feet segment of curved ceiling supported on the perimeter wall and adjacent ceiling at crown.

Two loading scenarios for the ceiling were analyzed:

1. Weight of two feet of soil and 640 pounds per square foot (psf) live load.

2. Weight of two feet of soil and HS-20-44 truck load per AASHTO code (32,000 lbs. per axle).

In the 3D model the only vertical supports (Z) were assumed to be at the columns, and the only horizontal supports (either X or Y) were assumed to be at the butt joints occurring at the crowns.

Analysis Results and Structural Recommendations

The results of the model analysis show that in an ideal situation, the domed ceilings have sufficient capacity to carry the assumed gravity load. Under current code requirements, however, the non-reinforced concrete ceilings are unsafe for public access because of their nearly zero ductility. Since the columns and domed ceilings are constructed of non-reinforced concrete, they have little capacity to resist tension loads caused either by unbalanced vertical loads or horizontal forces caused by a possible superstructure above the ground. It also performs poorly under dynamic loads caused by vehicular traffic.

To add ductility to the non-reinforced concrete ceilings so that they could support open space development or the ground floor of a building, a reinforced concrete cast-in-place slab overlaid on top of the existing ceiling will be required. A reinforced slab one-foot thick at the crown and about 30 inches at the column is adequate to support a surface live load of 640 psf and its own weight and/or an H-20 load (Figures 6-4 and 6-5).

In Type II and III cells, the columns are in relatively good condition and most of them can support the new slab without reinforcing. However, some of the columns are cracked and will require reinforcing. For the Type II cells, CCJM estimates that ten percent of the columns (20 columns) will require reinforcing. For the Type III cells it is estimated that five percent or ten columns per cell will require reinforcing.

In the Type II cells, in addition to the above described construction requirements, the exterior wall will have to be reinforced. This can be accomplished by constructing a continuous two-foot thick reinforced concrete mat directly on, and doweled into the exterior face of the walls (Figures 6-4 and 6-5).

The construction of future buildings on top of the Type II and Type III cells, with new slab and reinforced columns as described above, would be possible if the new building column spacing is in multiples of 14 feet, and if the new columns are centered over the existing columns. The existing columns can be retrofitted and converted into reinforced columns by wrapping them with six inches of reinforced concrete. The base slab can be reinforced with a square footing at each retrofitted column. The perimeter wall can be retrofitted in a similar manner to support new columns (Figure 6-5). In this report, a frame 28 feet by 42 feet was used to determine the design for retrofitting of the columns and footings. Based on a 3000 psf bearing capacity a 13'-6" square by two feet high footing above the base slab is required for a four-story building and an 8 feet square by one foot high footing for a single story building. The new footings would be tied into the existing base slab with drill and bond dowels at 18-inch spacing. Similarly, the new column wrap will be connected to the existing columns with drill and bond dowels.

In the case where the Type II and Type III cells are filled with sand, the spread footers can be placed directly on the concrete arches, or on the fill within the cells as long as the footing is below the frost line as described in the BOCA Building Code. Where the Type II and Type III cells are demolished, the bottom slab can be broken up and the footers placed thereon. Or, if required by the site development, the slabs can be fully or partially removed and the spread footers can be founded on the soil at any elevation below the bottom slab.

For building construction in the Type I cell areas, pile foundations are recommended for both one story commercial buildings and four story of office buildings (Figure 6-2 and 6-3). These piles would be driven after the cells are demolished to the base slabs or after the cells are filled with sand.

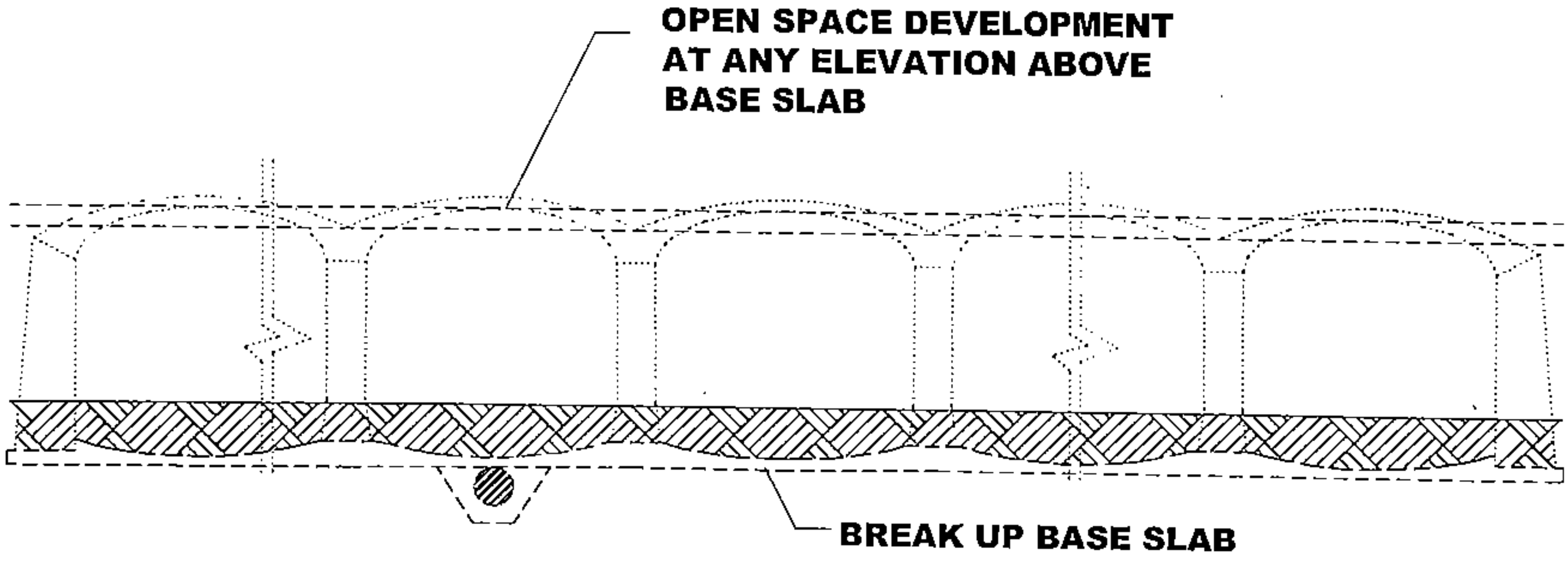


FIG. 6-1: DEMOLISH CELLS DOWN TO BASE SLAB OPEN SPACE DEVELOPMENT

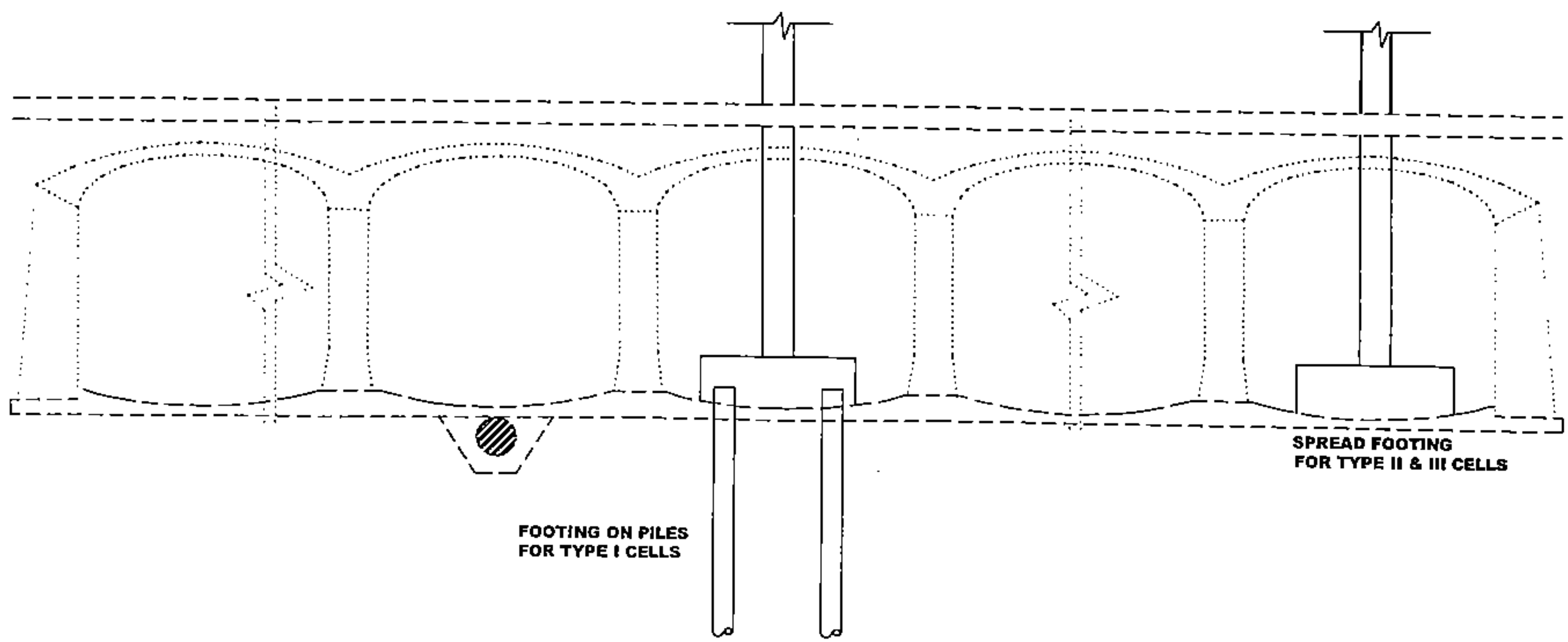


FIG. 6-2: DEMOLISH CELLS DOWN TO BASE SLAB
BUILDING CONSTRUCTION DEVELOPMENT

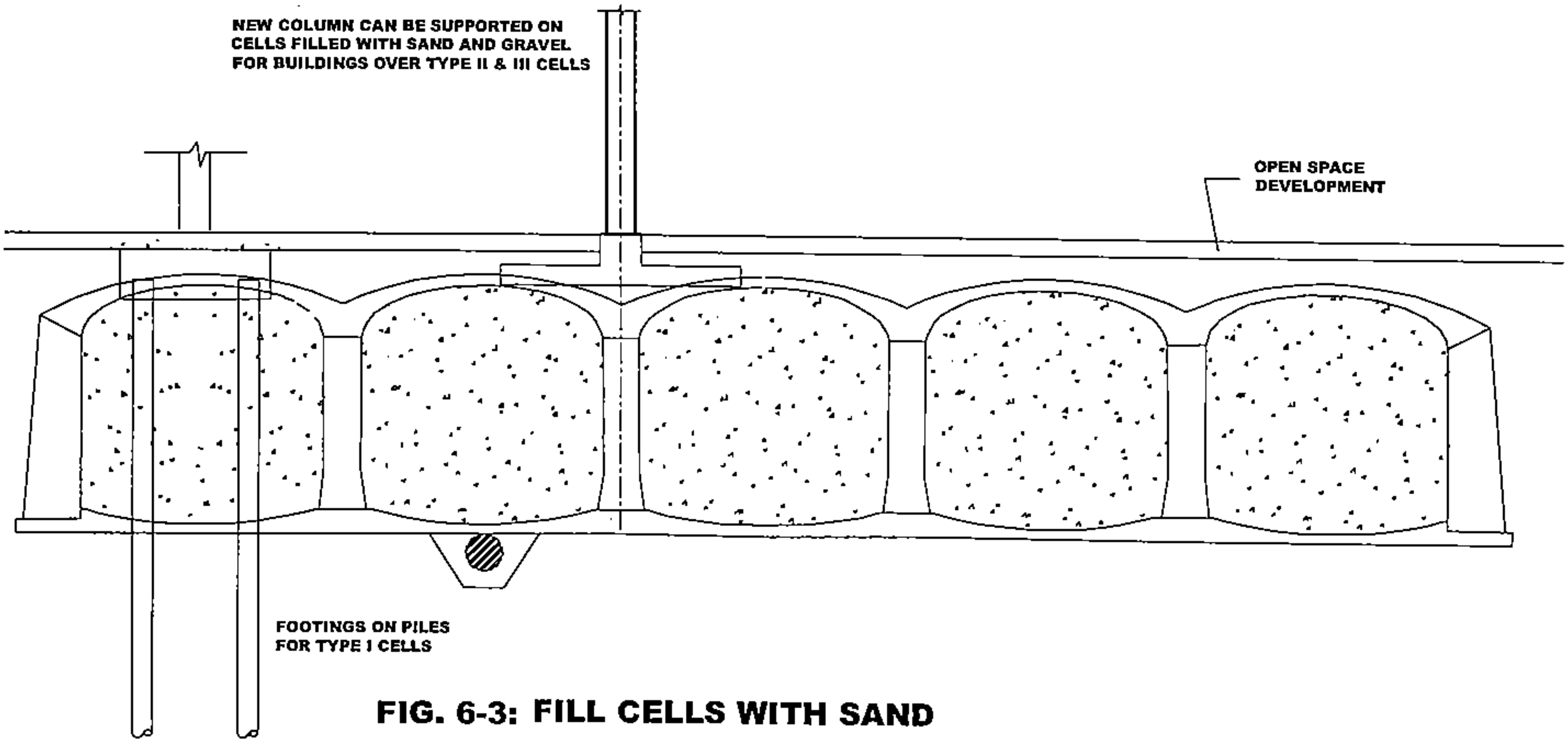


FIG. 6-3: FILL CELLS WITH SAND

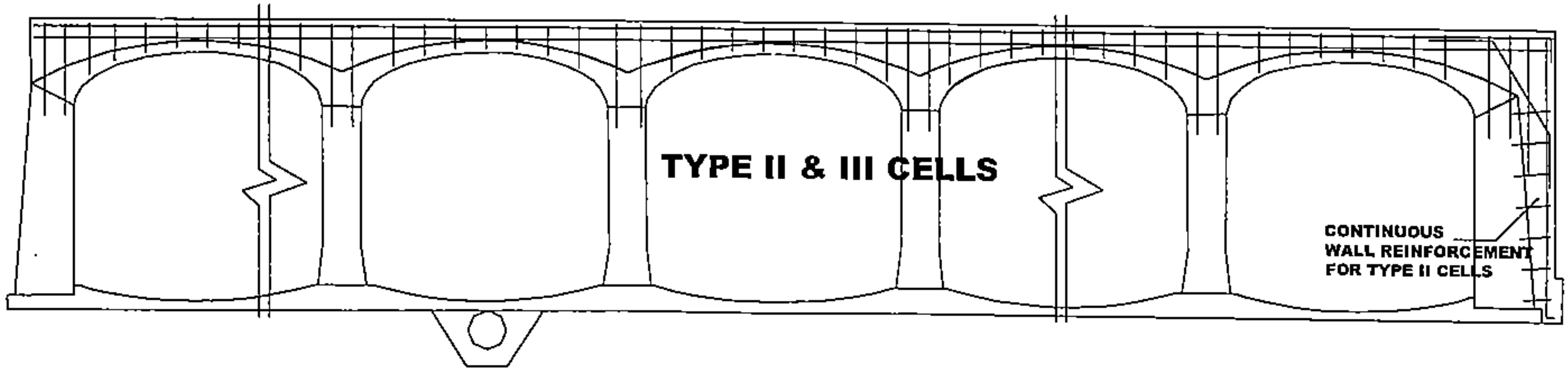


**FIG. 6-4: PRESERVE CELLS
OPEN SPACE DEVELOPMENT**

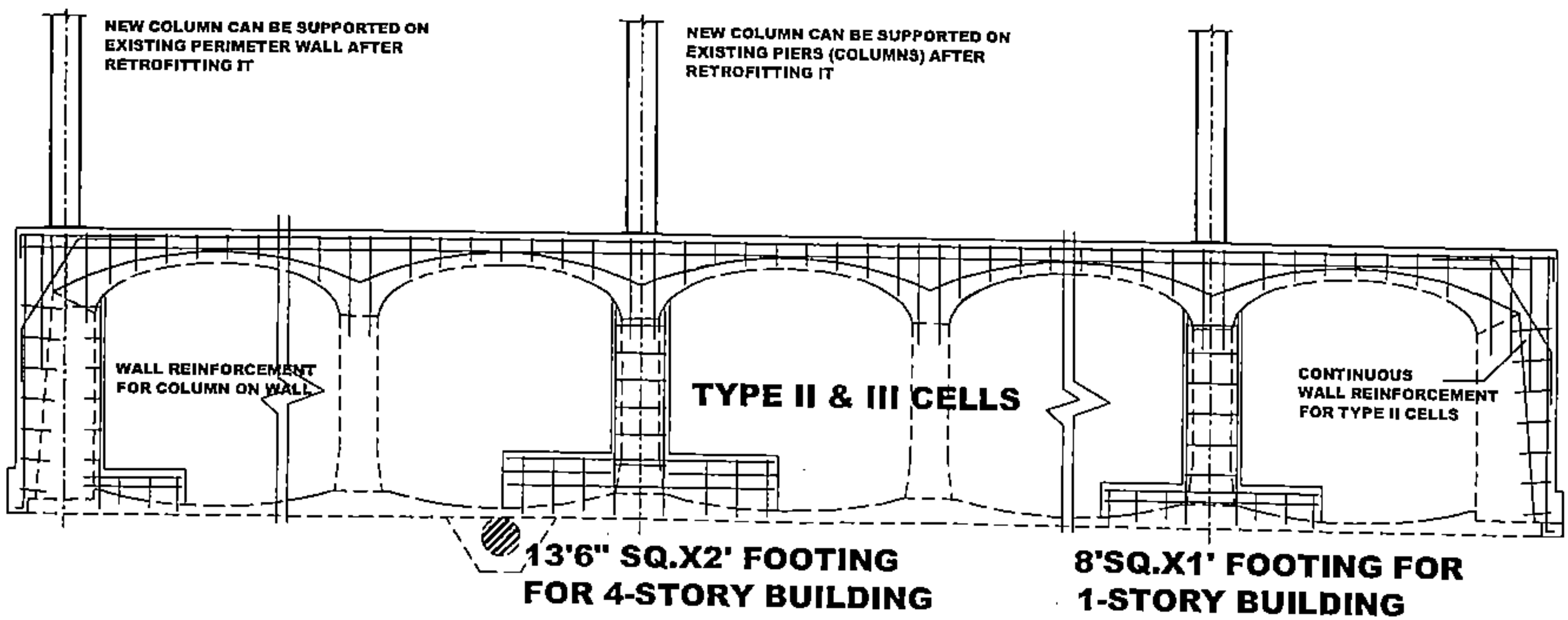


FIG. 6-5: PRESERVE CELLS BUILDING CONSTRUCTION DEVELOPMENT

CHAPTER 7

CONSTRUCTIBILITY

Due to the age of the facility, the structural limitations of non-reinforced concrete, and the apparent relatively light surface loads considered in the original design, certain precautions should be consideration prior to construction on this site.

No traffic, pedestrian or vehicular, should be allowed within the Type I cell area. These cells should be either demolished or filled prior to any form of traffic, let alone any form of construction.

Light weight vehicles may travel over the surface of the Type II and Type III cells. In fact, equipment movement across the structures will be required in order to perform some of the construction activities required under the various options. The equipment may be steel tracked if operated on at least one foot of overburden, to protect the concrete. The equipment should be rubber tired or rubber tracked if it is to operate close to or on the concrete. In general the equipment should weigh less than 16,000 pounds, including any load and operator. Many different kinds of small construction equipment have recently become available. However prior to any construction activities, the contractor should be required to demonstrate by calculations that the stresses, moments and shears that will be created by his proposed equipment will be less than a specified uniformly distributed load. This load may vary depending on the condition of the structure, but may be as much as 100 psf to 150 psf. A uniform load is suggested as a criteria because it is impossible to predict wheel base and load distribution for the great variety of equipment that is available, but the effects of these different types can all be compared to a uniform load criteria. The contractor's analysis should also consider the effects of dynamic loading. Limiting the speed of travel may mitigate these effects.

If the option to demolish a cell is chosen, the bottom slab does not need to be demolished and removed, unless the site development is to occur at elevations lower than 155. However, since the ground water table is approximately twenty feet below the slab, the slab will form an impervious barrier to the downward migration of ground water. It is advisable, particularly with open space development, to break up the existing slab to prevent underground ponding. Currently the existing filter underdrain system prevents underground ponding of the ground water.

If the option to fill a cell is chosen, the fill material (sand, fly ash or other material) should be pumped in hydraulically through the manholes. The pumps should be located on the courts or surrounding streets. The existing under drain system can be used to drain off the excess water, except that some drain reconstruction may be required as discussed below in the existing utilities paragraph. As an option to drain reconstruction, the excess water from the filling operation could be pumped from the regulator houses into the onsite sewer which discharges into the combined sewer in North Capitol Street.

If a cell is to remain in place, traffic over the cell must be restricted as discussed above, until the new reinforced concrete top slab is in place.

The placement of concrete should be by concrete pumps. The travel of the concrete trucks and pumps should be restricted to the courts and surrounding streets.

Excavation of the overburden from over the tops of the filters will be required prior to constructing the new concrete top slab. This excavation may be done using light equipment as previously discussed. Light weight backhoes, front-end loaders, and even dozers are available, including some equipment that combines these functions, such as backhoes with dozer blades. If the weight limitations of the structures are met, these smaller types of excavation equipment may be used effectively. The difficulty arises in efficiently moving the large volumes of excavated material off of the filters, the travel distance will be as much as 300 feet. Fully loaded dump trucks will obviously exceed structural limitations. Dump trucks may be utilized if a system of timber platforms resting on cribbing at column locations is installed. A contractor should be required to submit shoring calculations for this method. Other means of transporting the material off of the filters are available such as conveyors and vacuuming equipment.

After the reinforced concrete top slabs are placed, full H-20 traffic can occur anywhere over the cells.

Any filter cell that is preserved could likely be utilized for a stormwater management facility. The filter cells could provide both detention storage as well as filtration. Modifications to the filter underdrain system would be required to carry the flow from the filters to the combined sewer in North Capitol Street.

A cursory review of records provided by the Corps of Engineers indicates that the two influent (settled) water lines (one in each court) and the two effluent (filtered) water were plugged shut by the Corps in 1989 and 1990, west of First Street. The storm sewer system in both courts collects surface water from catch basins, the drainage from the sand bins, and originally the wastewater from the sand washers. This system appears to still be functional, and is transporting these waters to the combined sewer in North Capitol Street.

The filter drain system for filters 20 through 29 (in Court 3) appears to still be functioning. This system appears to carry any and all surface waters that seep into these filters, across First Street and the Corps' Filter Plant, and discharges them into a combined sewer adjacent to the existing Reservoir. The Corps' records show that the filter drain for filters 10 through 19 was plugged in Court Two, just west of First Street, in August of 1989. This being the case, these filters cannot discharge to the sewer similar to filters 20 through 29. Since the filters are dry even though there is evidence of infiltration of surface rainwater, as well as a significant amount of seepage from an unknown source in filter 10, they must drain somewhere. Additional investigations into the existing drain system will be required if any of these filters are preserved as a part of the future site development.

Also within the courts are numerous other utilities, all of which appear to be abandoned. These include a significant amount of small pipe associated with the former sand washing operations, and several electrical ductbanks.

As mentioned above, seepage of water was observed in Filter 10 during periods of dry weather. A sample of this water was provided to the Corps of Engineers' lab. The analysis was not conclusive as to whether the water is ground water or from a leaking watermain. Since the water table is approximately 20 feet below the filter bottoms, the DC Water and Sewer Authority was notified to further investigate this matter.

CHAPTER 8

ALTERNATIVE SUMMARY

The field survey described in Chapter 3 categorized the twenty filter cells as Type I, Type II or Type III based on each cell's physical condition. Chapters 4 and 5 examined the geotechnical conditions above and below the filters. Chapter 6 examined the existing conditions and evaluated what renovations would be required to construct open space, a one-story building or a four-story building on each filter. Chapter 7 identified construction issues that could impact construction costs. Chapter 8 summarizes the information from these previous chapters and develops the cost to implement the alternatives. The costs were computed on a unit basis (per cell) and are summarize in Table 8-1. Copies of the cost estimate summaries are in Appendix E.

The assumptions used in the cost estimates are as follows:

- Open space development occurs at elevation 169 or one foot lower than the current grade over the filters.
- The elevation of the top of the floor slab for building construction is 169.
- Under the options of preserving the cells, the required new concrete slab over the cells is suitable for the floor slab for building construction.
- The cost of an on grade floor slab is included in the cost for building construction options over cells that are demolished or filled.
- Backfilling over the cells (over the bottom slab under the options for cell demolition) will be to elevation 168 for building construction, and 169 for open space construction.
- Under all options, new buildings will have columns spaced at 28 feet by 42 feet; under the options to preserve the cells, the new columns will be centered over the existing filter cell columns.
- The existing sand in the filters will remain under all the options.

The following are detailed descriptions of the alternatives presented in Table 8-1:

Cell Demolition: Under the option of demolishing the cells, there is approximately 1,900 cubic yards of concrete to be demolished and hauled off. The hauling would also include the approximate 4,600 cubic yards of overburden on each filter. The bottom slab would be broken up and left in place. Each filter would then be backfilled to elevation 169 making it suitable for open space development. The estimated cost for this subsurface work for open space development is $860,000 per cell. If the open space development occurred at elevation 160, the top of the sand, the cost would be $480,000.

To construct a new building, the superstructure would be supported on new columns and spread footers in the Type II and Type III cell areas. In the Type I area, the new building would have to be supported on pile foundations. The additional subsurface cost, over that for open space development, for constructing a one story building over a demolished Type II of Type III cell is $80,000 per cell for the columns and footers and $300,000 for the on grade floor slab. The resulting total cost is $1,240,000 per cell. The additional cost for the foundations and slab for a four-story building is $140,000 per cell resulting in a total of $1,370,000 per cell.

In the Type I area, the additional cost for a one-story building is approximately $170,000 for the pile foundations and $300,000 for the floor slab, or a total cost of $1,330,000 per cell. The additional pile foundation and slab cost for a four-story building is approximately $1,140,000 or an approximate total cost of $2,000,000 for a four-story building, per cell.

Filling the Cells: Under the option of filling the cells, there is approximately 9,000 cubic yards of void space above the existing sand that would be filled with a suitable material. The two feet of overburden would need to be replaced with one foot of compacted backfill material. Open space development could then occur. The estimated cost for this subsurface work for open space development is $440,000 per cell.

Building construction in the Type II and Type III cell areas would require new columns, spread footers, and an on grade floor slab placed on the filter tops after the filters are filled. The additional cost per cell to construct a one-story building over one of these cells is $350,000 or $790,000 total per cell for a one-story building. The additional cost for footings and slab for a four-story building would be $140,000 per cell, or a total cost of $920,000 per cell.

In the Type I area, any building constructed would have to be supported on a pile foundation. The piles would be driven after the cells are filled and the new backfill is in place. The additional cost for the pile foundations and floor slab would be $490,000 for a one-story building and $1,170,000 for a four-story building. Therefore, in the Type I cell area the total cost per cell for a one story building would be $920,000, and $1,610,000 for a four-story building.

Preserving the Cells: For the Type II and Type III cells an additional option of preserving the cells and developing over top of them is available. Under this option, the overburden would first have to be meticulously removed as described in Chapter 7. The cost of this excavation and disposal of the overburden is estimated to be $320,000 per cell. Each cell would then have a reinforced concrete slab constructed over it; the slab would be doweled into the existing ceiling, columns and walls. It is estimated that for Type III cells, five percent of the existing columns (ten columns) will be cracked and need reinforcing to support the new slab. The cost of this subsurface work for open space development over a Type III cell is $1,790,000.

In addition to the above described work for a Type III cell, a Type II cell will require reinforcing of the exterior walls. The length of exterior wall varies from cell to cell. We have assumed an average value of 350 feet per cell. It is also estimated that a total of ten percent of the existing columns (20 columns) will require reinforcing to support the new slab. The cost to modify a Type II cell to support open space development will be approximately $230,000 more per cell than for Type III, or a total of $2,020,000.

To construct a building over a preserved Type II or Type III cell, as described in the two preceding paragraphs, existing columns will selectively have to be reinforced and spread footers constructed at each of these columns on the filter bottom slab. We assumed the spacing of the columns to be reinforced would be 28 feet by 42 feet. The additional subsurface cost for a single story building is $230,000 per cell, and the additional subsurface cost for a four-story building is $540,000 per cell. On a Type II cell, the total subsurface cost for a single story building is

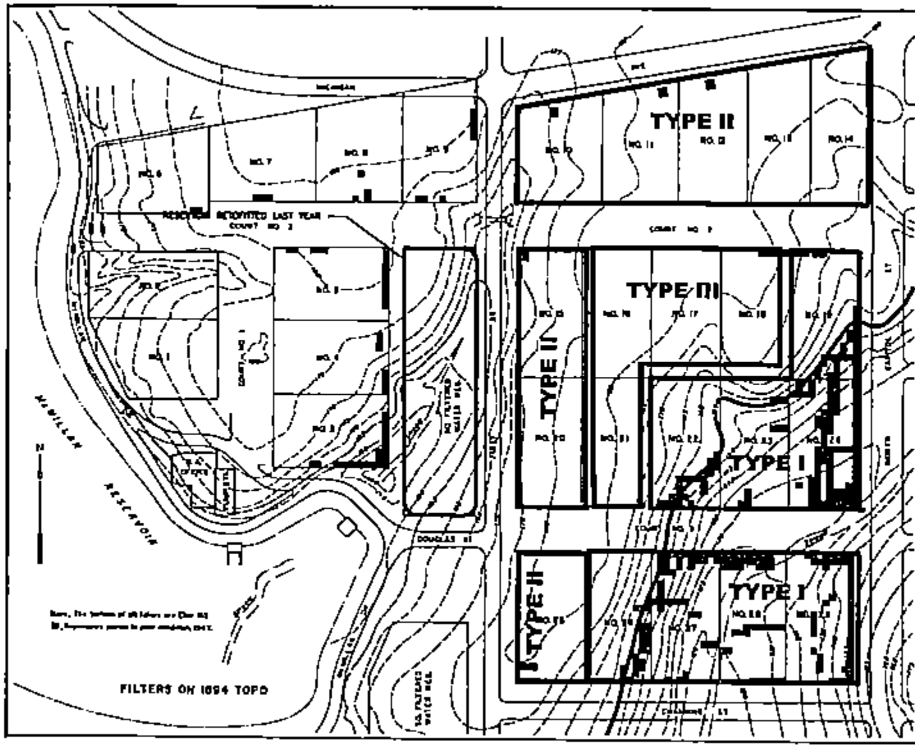
$2,250,000 and $2,560,000 for a four-story building. On a Type III cell, the total subsurface cost for a single story building will be $2,020,000, and $2,330,000 for a four-story building.

Numerous additional options and alternatives can be readily identified, such as developing at elevations other than at the assumed elevation of 169. By presenting the findings on a per cell basis, as well as presenting some of the costing considerations used, a planner can reasonably extrapolate cost estimates for most additional alternatives.

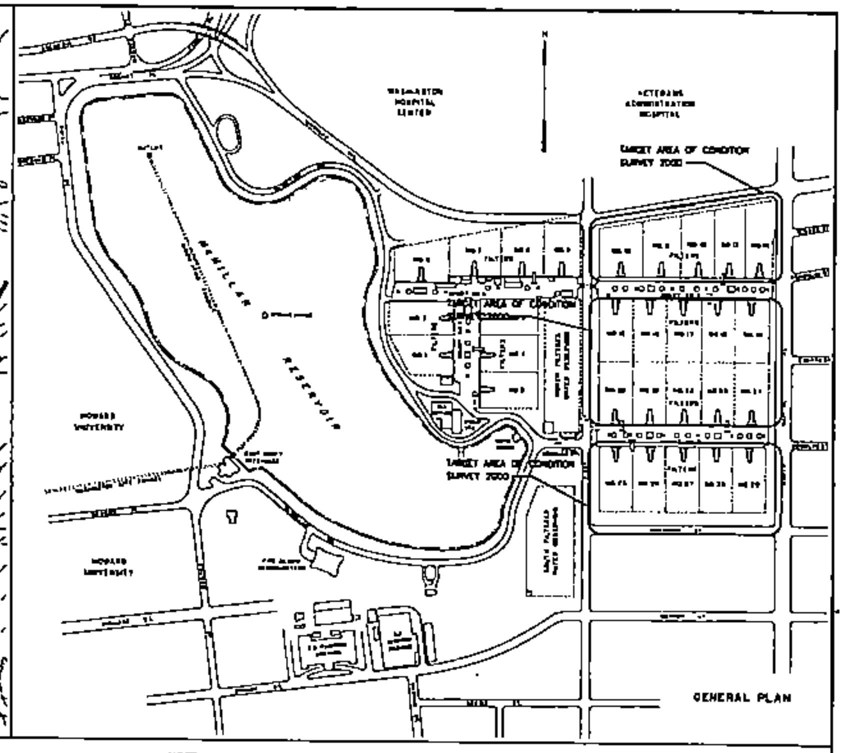
TABLE 8-1
STRUCTURAL/GEOTECHNICAL REQUIREMENTS FOR DEVELOPMENT OF McMILLAN FILTER SITE

DESIGNATION	CELL DESIGNATION TYPE I	TYPE II	TYPE III
CELLS	19,22,23,24,26,27,28,29	10,11,12,13,14,15,20,25	16,17,18,21
DESCRIPTION	Built on fill, active cracking, some failures, additional failures likely	Built in cut areas, active cracking observed around perimeter	Interior cells, built in cut areas, no apparent new cracking has occurred in last 30 years
CONDITION	Unstable, Unsafe	Stable except at edges	Stable
OPEN SPACE			
PRESERVE FILTERS			
Struct. Req'ments	Not Feasible	Reinforced top slab and exterior walls	Reinforced top slab
Geotech. Req'ments	N/A	None	None
Cost Estimate	N/A	$2,020,000 per cell	$1,790,000 per cell
DEMOLISH FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	None	None	None
Cost Estimate	$860,000 per cell	$860,000 per cell	$860,000 per cell
FILL FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	None	None	None
Cost Estimate	$440,000 per cell	$440,000 per cell	$440,000 per cell
SINGLE STORY BUILDING			
PRESERVE FILTERS			
Struct. Req'ments	Not Feasible	Reinforced top slab, columns and exterior walls	Reinforced top slab and columns
Geotech. Req'ments	N/A	Spread footers	Spread Footers
Cost Estimate	N/A	$2,250,000 per cell	$2,020,000 per cell
DEMOLISH FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$1,330,000 per cell	$1,240,000 per cell	$1,240,000 per cell
FILL FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$920,000 per cell	$790,000 per cell	$790,000 per cell
FOUR STORY BUILDING			
PRESERVE FILTERS			
Struct. Req'ments	Not Feasible	Reinforced top slab, columns and exterior walls.	Reinforced top slab and columns
Geotech. Req'ments	N/A	Spread Footers	Spread Footers
Cost Estimate	N/A	$2,560,000 per cell	$2,330,000 per cell
DEMOLISH FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$2,000,000 per cell	$1,370,000 per cell	$1,370,000 per cell
FILL FILTERS			
Struct. Req'ments	None	None	None
Geotech. Req'ments	Pile Foundation	Spread Footers	Spread Footers
Cost Estimate	$1,610,000 per cell	$920,000 per cell	$920,000 per cell

APPENDIX - A



NOTES
Condition survey of Filters No.1 thru 29 made in 1967.
Condition survey of Filter No.10 thru NO.29 made in 2000.



NOTE:
CONDITION SURVEY 2000 EXCLUDES SAND TOWER AND MASONRY PUMP HOUSES IN TWO SERVICE COURTS

CONDITION OF FILTER CELLS CAN BE CATEGORIZED INTO THREE TYPES:

TYPE I: CELLS BUILT ON BACKFILL (FILL BELOW ELEVATION 155) STRUCTURALLY UNSAFE CONDITION. FOOTING HAS BEEN SAGGING. COLLAPSE HAD BEEN CONTINUOUS SINCE 1969. AREA OF COLLAPSE DEVELOPED FROM 100 SQUARE FOOT AT ONE PLACE IN 1969 TO A TOTAL OF 1,400 SF AT TWO LOCATIONS. MORE COLLAPSE IS EXPECTED

TYPE II: EDGE CELLS BUILT ON ORIGINAL GRADE. CELLS HAVE MODERATE DAMAGE AND IT HAS BEEN CONTINUOUS FOR THE PAST 31 YEARS.

TYPE III: INTERIOR CELLS BUILT ON ORIGINAL GRADE. MINOR DAMAGE IS OBSERVED THE DAMAGE APPEAR TO BE STABLE OR HAS ONLY MINOR EXPANSION DURING THE PAST 31 YEARS

CCJM

DISTRICT OF COLUMBIA
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

CONDITION SURVEY
GENERAL PLAN

C3.1

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Appendix 8: Cost Estimates

Appendix 8: Cost Estimates

Storage at McMillan Sand Filtration Site:

The following table is a summary of the estimate of probable costs for storage at the McMillan Sand Filtration Site, as described in Section 5.2.2. Stormwater would be routed to existing underground basins at McMillan via two separate sewer lines: a 72” trunk sewer along First Street NW, and a 60” trunk sewer along North Capitol Street. Costs reflect measures to rehabilitate and reinforce the existing underground basins for storage. Sewer diversion structures and interconnector pipes would also be constructed to carry out this option, and are reflected in the costs accordingly.

Description	Estimated Cost ($)
Stormwater Diversion from North Capitol Street (to northeast corner basin)	3,550,000
Stormwater Diversion from First Street NW (to middle-west basin)	3,850,000
Construction Subtotal	7,400,000
General Conditions (10%)	740,000
Construction Contingency (25%)	1,850,000
Estimated Construction Cost	9,990,000
Project Costs - Eng., PM, Legal, etc. (20%)	1,998,000
Total Estimated Project Cost	**11,998,000**

McMillan Storage and Flagler Place Pump Station:

The following tables are a summary of the estimate of probably costs for two implementation alternatives for storage at McMillan in conjunction with a Flagler Place Pump Station as described in Section 5.2.3. This option would entail stormwater and combined sewage storage at McMillan, and would divert approximately 100 MGD from the Flagler Place Trunk Sewer during peak flow. The first strategy would achieve this option through a pipe jacked force main; the second would use an open cut force main. A third strategy, which would employ a temporary bypass pump station, was not estimated due to project infeasibility.

Strategy 1 - Pipe Jacked Force Main for CSO Diversion

Description	Estimated Cost ($)
Stormwater Diversion from North Capitol Street (to northeast corner basin)	3,550,000
Stormwater Diversion from First Street NW (to middle-west basin)	3,850,000
Flagler Pump Station and CSO Diversion	13,458,000
Construction Subtotal	20,858,000
General Conditions (10%)	2,086,000
Construction Contingency (25%)	5,215,000
Estimated Construction Cost	28,159,000
Project Costs - Eng., PM, Legal, etc. (20%)	5,632,000
Total Estimated Project Cost	**33,791,000**

Strategy 2 - Open Cut Force Main for CSO Diversion

Description	Estimated Cost ($)
Stormwater Diversion from North Capitol Street (to northeast corner basin)	3,550,000
Stormwater Diversion from First Street NW (to middle-west basin)	3,850,000
Flagler Pump Station and CSO Diversion	10,485,000
Construction Subtotal	17,885,000
General Conditions (10%)	1,789,000
Construction Contingency (25%)	4,471,000
Estimated Construction Cost	24,145,000
Project Costs - Eng., PM, Legal, etc. (20%)	4,829,000
Total Estimated Project Cost	**28,974,000**

McMillan Storage and First Street Tunnel

The following table is a summary of the estimate of probably costs for storage at McMillan in conjunction with a First Street Tunnel as described in Section 5.2.4. This option would entail stormwater and storage at McMillan, and would divert stormwater and combined sewage to a new tunnel under First Street. The tunnel would be dewatered using a small temporary pump station. This option consists of accelerating construction on an already planned for portion of the DCCR tunnel system.

Description	Estimated Cost ($)
Subtotal - Storage at McMillan Site (from above estimate)	**11,998,000**
McMillan Site Demolition and Preparation	2,161,929
McMillan Shaft Construction	12,334,871
Excavate/Support First Street Tunnel	31,877,328
Adams Street Diversion and Shaft	11,782,163
First Street Diversion	5,000,000
V Street Diversion and Shaft	11,161,222
Rhode Island Avenue Dewatering Shaft	1,311,958
Final Design, Engineering During Construction, Geotechnical Instrumentation, Allowances	14,875,000
Indirect Costs	41,673,518
Subtotal - First Street Tunnel	**132,177,989**
Total Estimated Project Cost	**144,175,989**

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Appendix 9: District Of Columbia
Soil And Water Conservation District
Summary Of Mission, Purpose, And Charter

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DISTRICT OF COLUMBIA SOIL AND WATER CONSERVATION DISTRICT SUMMARY OF MISSION, PURPOSE, AND CHARTER

Mission:

The mission of the District of Columbia Soil and Water Conservation District (DC SWCD) is to identify and coordinate available technical, financial, and educational resources for the purposes of sponsoring projects and providing guidance for activities that conserve the soil, water and related natural resources of the District of Columbia. The DC SWCD accomplishes this in partnership with the Citizens Advisory Committee, the United States Department of Agriculture – Natural Resources Conservation Service (USDA – NRCS) and the District Department of the Environment (DDOE).

Purpose

The DC Soil and Water Conservation District was established by the District to provide resources to activities relating to the conservation of renewable natural resources. A Citizens Advisory Committee (CAC) was established and included members from every ward in the city.

The CAC promoted the Storm Drain Marker Program to science teachers, environmental educators and community leaders. This allowed students and citizens to get involved in identifying/marking storm drains to help raise awareness about the impact of storm water and help prevent non-point source pollution from entering our waterways. Also, the CAC helps conserves the green space in the city.

DC Law 4-143

"There is established a Citizen Advisory Committee to the Soil and Water Conservation District. The Mayor shall select, for a term of 2 years, 1 advisory neighborhood commissioner from each of the 8 wards of the District of Columbia, to serve on the Citizen Advisory Committee. The function of the Citizen Advisory Committee shall be to ensure communication between the Soil and Water Conservation District and the residents of the District of Columbia affected by the operation of the Soil and Water Conservation District. The members shall keep the Citizen Advisory Committee informed of its work. The Citizen Advisory Committee shall submit recommendations to the members and shall meet with the members at least semiannually. (Sept. 14, 1982, D.C. Law 4-143, 7, 29 DCR 3118)."

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