DC WASA Impervious Area Information System:
Designed to Allocate the Costs of the Mandated CSO Long Term Control Plan

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ASCE - EWRI
Pittsburgh Chapter Meeting
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Presentation Components

- Project Need & Background
- Policies, Procedures, & Legal
- Impervious Surface Area (IA) and Equivalent Resident Units (ERUs)
- Premises and Business Rules
- Rates, Bill Determinants and Computations
- Cool stuff – system, integration, database and tools
Project Need

- USEPA consent decree mandate
- WASA developed the combined sewer overflow (CSO) long term control plan (LTCP) in response
  - The plan incorporated series of projects into a comprehensive program
- The capital costs for implementing the CSO LTCP were substantial
- As a result the Agency needed to find manageable sources of alternate funding to balance the budget
  - Financial program analysis and management options yielded viability in restructuring billing
  - Impervious Area Charge (IAC)
The big picture project review

• Analyzed Costs (Capital, O&M, Debt Load)
• Analyzed Land Use and Land Area for District
• Performed Financial Analysis
  – Bills, Rates, Usage, Payment History
• Performed Industry Trade Study
• Developed Alternatives Plan
• Released RFP for IAIS
• Began Legal Procedures with Stakeholders
• Performed Data Quality Review & then CLEANUP
• Developed Design Parameters, System & Software
LTCP – Projects Overview

- Nine minimum controls at a cost of $140 million have been implemented, reducing CSOs by 40%
- Will reduce CSOs by 96% overall and 98% in Anacostia River
- Plan includes:
  - 3 large storage tunnels
  - Pumping station improvements
  - Targeted sewer separation
  - Consolidation/elimination of outfalls
  - Low impact development projects
Project background

- The program over the next 20-years:
  - $2.2 billion
  - Includes two large diameter bore tunnels under the Potomac River and multiple project build-outs
  - Volumetric sewer charge covers initial CSO implementation in 2009
  - IAC was more equitable way to allocate costs for CSO LTCP implementation over 10 year financial plan
  - IAC allocated based on the amount of surface water runoff from a property

- Reduce wet weather run-off from impervious surfaces including:
  - Rooftops
    - Buildings
    - Garages
  - Pavement
    - Driveways
    - Roads
  - Walkways
    - Sidewalks
    - Patios
    - Fountains
  - Recreation Areas
    - Swimming Pools
    - Tennis Courts
    - Basketball Courts
Based on DC WASA 2009 – 2017 approved 10-year financial plan

- Costs will increase annually from $7.9 million in 2009 to $80+ million in 2017
- Cost includes all capital, operating and debt service costs to implement the CSO program
Our Agenda

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• Project Need & Background
• Policies and Procedures
• Impervious Surface Area (IA) and Equivalent Resident Units (ERUs)
• Premises and Business Rules
• Rates, Bill Determinants and Computations
• The system – tools, SOPs, database and billing
IAC Policies

• WASA has summarized the polices, business rules and operating procedures in the IAC BofD Policies, Operating Guidelines and Procedures Manual

• The manual is designed to provide a convenient reference document and includes:
  – Three (3) Board of Director’s IAC Resolutions/Policies
    • Supported from legislation enacted
  – Seven (7) Operating Guidelines/Business Rules
  – Fourteen (14) Procedures defining the primary processes involved in managing the IAC Program
  – Appendices (impervious area features, glossary of terms and sample bills)
IAC Legal Policies

- WASA developed draft legislation in conjunction with PB and Agency Steering Committee
- The legislation authorized implementation via process:
  - Billing & Payment process via “separate” Authority/Utility
  - City/Municipal
  - Federal/Congressional
- Once legislative approval was received the clock to go-live was 90 days
- Legislative approval process and timeline had to align with Consent Order
- Within 1 year the Agency was required to implement a multi-tier rate to achieve “balance within district for residents”
IAC Procedure Flowcharts (Example)

IAC 01: Manage Premises -- Create New Premise (Pending Premise) – Water/Sewer Availability Application

Outside Agencies (DC OTR, DCGIS)
- DCRA issues Building Permit
- Change in Property Boundary?
  - Yes
  - OTR Processes Site Plan Property Changes Subdivision or Assemblage
  - OTR completes Property Subdivision or Assemblage updates
- DCGIS processes weekly OTR vector property update
  - DCGIS

Eng/Permits DETS
- Water & Sewer Availability Application and Site Plan
  - DETS reviews Application Supplemental Submissions
  - Complete
  - Capacity Available
  - Yes
  - Approved Application and Site Plan
  - JTX Job Opened
  - JTX Job Closed
  - Assignable Existing Premise

IAID Group
- Owner Developer Contractor
  - Submits site plans Building Permit Application
  - Completes Water & Sewer Availability Permit Application
  - Submits Water & Sewer Application and Site Plan to DETS
  - Processes request for additional information and/or funding
  - No - Negotiates Funding Improvements

Customer Call Center (CSR, Meter Shop)
- CIS
  - CIS downloads Daily CIS Import
  - CIS
  - CIS uploads daily premise extract to IAIS

EDMS
- Stores Site Plan Water & Sewer Availability Permit
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Impervious Area Features Subject to IA Charges

- Excludes Federal and municipal public right-of-ways – streets, roads, highways, sidewalks
- Designated impervious features on a property include sq. ft.
  - Building(s) roofprint (house, garage, structure)
  - Parking lots, sidewalks,
  - Private streets and roads,
  - Patios/Hardscapes & Fountains,
  - Swimming pools
  - Tennis courts
- Properties with < 100 SF of impervious surface features are not subject to IA charges
- There are no variations/gradations in imperviousness or credits for low impact development features in computing IA charges during year 1.
Examples of Impervious Surface Area Features subject to IA Charges

Map highlighting impervious surface areas: driveways, private walks, roof tops, and parking lots
### Impervious Area Statistics (as of 12/2008) – FY 2009 and Equivalent Residential Unit

<table>
<thead>
<tr>
<th></th>
<th>SF Res</th>
<th>Non Res</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Premises to be Billed</strong></td>
<td>104,285</td>
<td>27,610</td>
<td>131,895</td>
</tr>
<tr>
<td><strong>Total Billing Impervious Area (sq. ft.)</strong></td>
<td>125,759,654</td>
<td>310,929,129</td>
<td>436,688,783</td>
</tr>
<tr>
<td><strong>Percent of Total Billing Impervious Area (%)</strong></td>
<td>28.8%</td>
<td>71.2%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Percent of Total Water Consumption (%)</strong></td>
<td>21.3%</td>
<td>78.7%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Mean Impervious Area per Billable Premise (sq. ft.)</strong></td>
<td>1,206</td>
<td>11,261</td>
<td>3,269</td>
</tr>
<tr>
<td><strong>Median Impervious Area per Billable Premise (sq. ft.)</strong></td>
<td>981</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The IA computations were used as a basis for establishing the Equivalent Residential Unit (ERUs)
  - Based on the median square feet of impervious area per billable premise
- 1 ERU = 1000 square feet of impervious surface area
- The ERU allows WASA to simplify billing for the 104,000 + residential customers
What are Equivalent Residential Units?

Initially, to simplify impervious area billing, all residential customers will be charged based upon one Equivalent Residential Unit (ERU)

- Multi-tier rate structure will be implement around Fall 2010
- Credit and incentives program is in design/authorization currently

Non residential customers will be billed for actual number of ERUs, truncated to next lowest 100 sq. ft.

Example of Equivalent Unit definition adapted from: The Florida Stormwater Association.

1 ERU = 1,000 square feet of impervious area

Source: Florida Stormwater Association
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Premises – Types and Business Rules

• What is a *premise*?
  – A spatially located *point* that represents Authority water and sewer services on a property and or eligible for impervious area billing.
  – Premise generally defines a customer location

• What is a *property*?
  – A *polygon* that defines the boundaries of a land unit in the District of Columbia.
  – Most property polygons are defined by DC GIS and have ownership information (name, address, etc).

• “One dot in every box”
  – The goal of IAIS is to have one billable premise in every property parcel in DC
  – Water or sewer service only definition of customer is removed
Premises – Types and Business Rules (cont.)

- WASA defines customers into categories for billing purposes. These categories are the following:
  - Federal, Municipal, Commercial, Multifamily, District of Columbia Housing Authority, and Residential

- Impervious Area Information System and the Customer Information System match categories

- The water and sewer rate is the same for all the customer categories ($/CcF), however the Impervious Area Charge is NOT the same
  - Residential IAC = 1 ERU
  - Non-Residential (all other customer categories) are charged the number of equivalent ERUs based on the measured amount of impervious area on the property
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IAC Annual and Monthly Rates

- The annual and monthly ERU rate ($/ERU) will be computed based on the below formulas and the total budget fiscal year CSO LTCP funding requirement for capital, operating expenses and debt service.

- The Impervious Area Charge is determined *annually* and prorated to be paid *monthly* (some exceptions apply).

- The Impervious Area Charge is a component of the sewer bill. The total sewer bill is comprised of a volumetric charge ($ per Ccf) based on metered water consumption and an Impervious Area Charge ($ per ERU) based on impervious area.

\[
\text{Total CSO Revenue Requirement} = \frac{\text{IAC Rate/Year}}{\text{Total Number of ERUs}} = \text{IAC Rate/Year}
\]

\[
\text{IAC Rate/Year} = \frac{\text{IAC Rate/Year}}{12 \text{ Months}} = \text{IAC Rate/Month}
\]
IAC rate increases for meeting program

- Projected Monthly Residential IAC Charge per ERU based on projected CSO LTCP Plan Funding Forecasts
Example of a Customer Bill (Front)

Service Address
1291 Mockingbird Lane SE
Washington, DC 20011-5923

Account Number 0152536
Square/Suffix/Lot XXXX XXXX XXXX
Impervious Surface Square Footage 1,000

Billing Date 11/3/08
Previous Balance $100.00
Payments as of 11/2/08 – Thank You $100.00 CR
Late Fees From Prior Balance $0.00
Outstanding Amount Due $0.00
Total Current Bill $31.00
Total Amount Due - Please Pay by 11/30/08 $31.00

<table>
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<tr>
<th>Meter Number</th>
<th>Prior Read Date</th>
<th>Current Read Date</th>
<th>Number Of Days</th>
<th>Prior Read</th>
<th>Current Read</th>
<th>Usage (CCF)</th>
<th>Usage (Gallons)</th>
<th>Read Type</th>
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<td>1305253</td>
<td>10/01/08</td>
<td>10/02/08</td>
<td>29</td>
<td>25</td>
<td>33</td>
<td>8</td>
<td>5,084</td>
<td>ACT</td>
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</table>

CURRENT CHARGES AND CREDITS
DC Gov't PILOT Fee $8 CCF x $0.30 $3.12
DC Gov't Right of Way Fee $8 CCF x $0.13 $1.04
DC Gov't Stormwater Fee 1 ERU x $1.95 $1.95
SPLASH Contribution – Thank You $0.17

TOTAL CURRENT CHARGES $32.00
ADJUSTMENTS 10% Late Penalty Fee Adj $1.00 CR
TOTAL CURRENT BILL $31.00

Bill Summary

Current Water and Sewer Charges – Residential

Metering Fee $2.01
Water Services 8 CCF x $0.30 $16.40
Water CAP Credit 4 CR CCF x 2.30 $9.20 CR
Sewer Services 8 CCF x $3.31 $26.48
Sewer CAP Credit 4 CR CCF x $3.31 $11.24 CR
Impervious Area Charge 1 ERU x $1.24 $1.24

CURRENT CHARGES AND CREDITS

DC Gov't PILOT Fee 8 CCF x $0.39 $3.12
DC Gov't Right of Way Fee 8 CCF x $0.13 $1.04
DC Gov't Stormwater Fee 1 ERU x $1.95 $1.95
SPLASH Contribution – Thank You $0.17

TOTAL CURRENT CHARGES $32.00
ADJUSTMENTS 10% Late Penalty Fee Adj $1.00 CR
TOTAL CURRENT BILL $31.00

Current Water and Sewer Charges – Commercial

Metering Fee $3.92
Water Services 80 CCF x $0.30 $18.00
Sewer Services 80 CCF x $3.51 $280.80
Impervious Area Charge 15.8 ERU x $1.24 $19.59

CURRENT CHARGES AND CREDITS

DC Gov't PILOT Fee 80 CCF x $0.39 $31.20
DC Gov't Right of Way Fee 80 CCF x $0.13 $10.40
DC Gov't Stormwater Fee 15.8 ERU x $1.95 $31.28
SPLASH Contribution – Thank You $0.81

TOTAL CURRENT CHARGES $546.00
ADJUSTMENTS
TOTAL CURRENT BILL $546.00

IMPORTANT

This is a draft mock bill for discussion only.

Historical Usage

<table>
<thead>
<tr>
<th>Month</th>
<th>Usage</th>
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<tbody>
<tr>
<td>Jan</td>
<td>14</td>
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<tr>
<td>Feb</td>
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<tr>
<td>Mar</td>
<td>10</td>
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<td>Apr</td>
<td>8</td>
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<tr>
<td>May</td>
<td>6</td>
</tr>
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<td>Jun</td>
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<td>2</td>
</tr>
<tr>
<td>Aug</td>
<td>0</td>
</tr>
<tr>
<td>Sep</td>
<td>1</td>
</tr>
<tr>
<td>Oct</td>
<td>2</td>
</tr>
<tr>
<td>Nov</td>
<td>4</td>
</tr>
<tr>
<td>Dec</td>
<td>6</td>
</tr>
</tbody>
</table>

This graph shows the historical usage for the past year.
Impervious Area Charge description for billing:

The impervious area charge is based on the surface area on your property that prevents water from going into the ground as it normally would under natural conditions. This type of surface, called an impervious surface, also causes water to run off your property into the combined sewers and sanitary sewers at an increased rate of flow relative to the flow under natural conditions. The fee is designed so that property parcel owners pay their fair share of the costs associated with a long term combined sewer overflow control plan. The fee is structured using the term equivalent residential unit, or ERU, which equals 1,000 square feet of impervious surface. Residential property owners are assessed the cost of one ERU and non-residential properties may pay multiple ERU’s based on the amount of impervious surface on their property.
Example Bill Determinant File

- Non-Residential
- Ortho-imagery
- IA Features
- Scale
- Service Address
- Premise number
- SSL
- Sq. Ft. of IA
- ERU
- Other Premises on lot
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Cool Stuff – System Background

• Systems Engineering Process – VEE Method
• Software Engineering
  – Iterative Prototype Method
• Tools
  – Developed in VB.NET
  – ESRI ArcGIS thick-client extensions
  – Modular design/deploy
  – Process controls & tool customization
    • JTX & PLTS
• Modules
  – Manage Premise
  – Manage IA
  – Exceptions Processing
  – Search/Report
  – Automation and Data Management
• Oracle 10GR2 Database
• Integration with
  – Citrix XenApp
  – CIS & DCGIS
Project Implementation 101

- Data source identification
  - OCTO/DCGIS
  - DC Agency search
  - Architecture of the Capitol
- Data evaluation and assessment
- Data cleanup and process automation
- Concept of Operations
- Functional Requirements
- Use Case and Storyboard for application modules
- SOPs and Business Process
- Database design
- Software engineering
- Testing
- Implementation
The method to design & implement

Phase 1 - Planning/Requirements

Region Architecture

Detail Planning

Source:
HAVA Systems Engineering
DOE Systems Development
The Systems & Components

- Components
  - ESRI ArcGIS
  - ESRI Job Tracking Extension (JTX)
    - Required for all jobs within the IAIS
    - Establishes and tracks all processes and modifications
    - Heavily modified toolset to integrate all modular tools with JTX framework
  - ESRI PLTS extension
    - Required for data analysis and information management
    - Tracks information and supports process controls
    - Supports automation process and QA of revisions
- Separate Customer Information System (CIS)
- Separate Agency supplying base data (DCGIS)
How the integration works

Periodic updates:
- Property parcels & ownership
- MAR

DCGIS

Error reporting as needed

IAIS

Daily premise exception reporting

CIS

Daily premise extracts
Manage Premise - JTX process control

Step 1
Prepare
Check Version
Create Version
Edit Data
QC Data
IAB Transaction Export
Clean Up
Notify

Step 2

Step 3

Create Job(s)

Job Type: Daily - IACF Export Exceptions
Job Properties
Assignment
- Group
- User
- Unassigned

Start Date: 03/16/2009
Due Date: 03/19/2009
Data Workspace:
ParentVersion: IADB.IABBASE
Priority: High
Parent Job:
Job Description: Review Exceptions reported by CIS on the IACF Export process
Job Owner: Administrator User
Job Name:

Creating 1 job(s).
Tools – Manage Premise

Premise
Create

Premise
Update
Tools - Manage Premise (Create)

- Make sure IAIS ‘Manage Premise’ toolbar is available
- Start Editing session
Tools – Manage Premise (Create Sample)

- Click the ‘Premise Create’ tool from the toolbar.
- Click a location to insert or create a new Premise. (Ex: A lot that does not have an existing premise.)
- The ‘Premise Attribute’ dialogue box “pops-up” for data entry.
JTX Closeout Steps for IAIS tools

Reconcile

Post

Note: Resolve conflicts ‘In favor of the Edit Version’
IA Manage Tools – JTX process control

Step 1
- Prepare
- Check Version
- Create Version
- Edit Data
- QC Data
- IAB Transaction Export
- Clean Up
- Notify

Step 2
- More Edits?

Step 3
- Setup IA Charges
- Manage Premise
- M&D Job
- Premise Creation
- Revise Property Impervious Area

Job Type:
- Setup IA Charges
- Test Job
- Weekly - MAR Update
- Weekly - Property Update

Job Properties
- Assignment
  - Group
  - User
  - Unassigned

Start Date: 03/21/2009
Due Date: 03/26/2009
Data Workspace:
Parent Version: IADB.IAEBASE
Priority: Low
Parent Job:
Job Description: Setup IA Charges for Premises
Job Owner: Administrator User
Job Name: [Prefix/Suffix]

Creating 1 job(s)

OK Cancel
Tools – Manage Premise

- **IA update source**
- **Target layer for edits**
- **Break Direct Assign Charges For IA**
- **Break IA Existing Relationship/Bill**
The ‘Building Assignment (% Mass)’ tool assigns buildings to the target IA feature class. The tool assigns buildings that fall inside of a selected parcel by a pre-designated percentage.

For example, if the percentage is 80%, if the building is 80% inside of the parcel, it will be assigned to the target IA feature class.
To split a building follow the following steps in ArcMap:

1. Select the building you would like to split
2. Activate snapping using ArcMap’s standard editing tools
3. Select the ‘Building Split’ tool
4. Click once just outside of the start location for the cut
5. Click once just outside of the end location for the cut
Direct Assign IA Charges - Sample

Single Parcel:
• Multiple Active Accounts & Premises
• Multiple Premise Types (RES & MF)
• Multiple IA Features
• Multiple Billing Classes
JTX Closeout Steps for tools

Reconcile

Post

Note: Resolve conflicts ‘In favor of the Edit Version’
The wrap-up

• Water utilities and agencies are facing:
  – Revised regulatory compliance
  – Potential fines and substantial program implementations
  – Budget short-falls/water and infrastructure losses
  – Substantial capital, O&M investments requirements

• Technology implementations like IAIS work:
  – Supports regulator compliance, core business needs, and supports financial program
  – Meets or exceeds program objectives
  – Implemented complex system on tight-schedule
  – Requires good design and implementation practice
Questions

• For reaching the guy without business cards and a new company logo:
  – Brian Reed
  – Email: reedb@pbworld.com
  – Phone: 410-385-4175