Lower Mill Creek Partial Remedy

Hamilton County Board of County Commissioners Public Hearing

September 26, 2012
Today’s Agenda

- Why we are here today
- Lower Mill Creek Study
- MSD’s Recommendation
- Relevant Criteria
- Next Steps
LMCPR Alternatives

- These alternatives must conform first and foremost with EPA requirements, because the Regulators must approve any alternative. If an alternative does not meet those requirements, the Regulators cannot approve it.

- MSD recognizes that there are related issues associated with each alternative, under the WWIP and otherwise, and will continue to assist the City and County to address them with the Regulators and others.
Why we are here today

County Policy Direction: Supports Green/Sustainable Approaches for WWIP

County Pursued Change to ORC 6117 (June 2008)

Regulators’ Rejection of Conceptual Outline and Requirement for Significant Volume Reduction in Lower Mill Creek (November 25, 2008)

Global Consent Decree

2004 2005 2006 2007 2008 2009

Green Infrastructure Report by County & City

Final Approval Revised WWIP with Lower Mill Creek Study

LEGEND
- Consent Decree Benchmarks
- Lower Mill Creek (LMC) SI
- Lick Run Watershed SI
- Tunnel / Grey Alternative
- Overall Analysis

2004-2009
MSD’s recommendation today is grounded by the policy direction received from the Commission’s July 18th Resolution regarding cost control within WWIP estimates.

The Sustainable Alternative achieves the 2 BG CSO reduction at a cost much closer to the $244M WWIP estimate.

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$537,409,000  $316,069,000
Relevant Criteria

Compliance & Conformance
- Final WWIP
- State & Federal Laws
- USEPA’s Sustainable Guidance
- Document & Integrated Planning Framework Policy
- County Policy Directions

Capital
- O&M
- Life-Cycle
- Funding Sources

Policy

Costs

Risks

Benefits

Level of Certainty
- Flooding
- Maintenance

Ratepayers
- Water Quality
- Flexibility
MSD’s
Recommendation

MSD has provided its official recommendation in the “Lower Mill Creek Partial Remedy MSD’s Recommendation to the Co-Defendants of LMCPR Alternative”.

Lower Mill Creek Partial Remedy

MSD’s Recommendation to the Co-Defendants of LMCPR Alternative

September 25, 2012
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<th>Sub-Basin</th>
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What a Sustainable Solution Accomplishes

*Developing a solution that brings our historical water wealth normally below ground to the surface to create a benefit the community can see.*

- Complies with 2 BG Consent Decree target
- Provides lowest cost solution
- Utilizes stormwater as a resource = sustainable
- Creates new class of green jobs
- Improves water quality
- Offers potential to leverage private side actions
MSD’s Recommendation complies with all applicable policies.

- 2 BG CSO reduction target of the WWIP
- USEPA guidance for development of a LMCPR alternative
- Hamilton County’s July 18th resolution regarding cost control
- State and federal laws regarding stormwater management and flood control
- USEPA integration & sustainable policies
**Costs – How they were developed**

- **Industry Standards**
  - USEPA Protocols & Guidelines
  - American Association of Cost Estimating
  - R.S. Means Building Construction Cost Data
  - Hamilton County & MSD Standards

- **Developed Costing Tool**
  - Tool vetted & accepted by County, City & Regulators
  - Good track record using tool
  - 88 WWIP projects completed under budget

- **Detailed Project Information**
  - Site specific information
  - MSD historical cost comparison
  - Project Engineer’s estimate

- **Coordination**
  - 31 Utility Coordination Meetings
Relevant Criteria = Costs

- **Capital Cost**
  - Grey Alternative: $537,409,000
  - Sustainable Alternative: $316,069,000
  - (2006 dollars)

- **Life Cycle Costs**
  - Grey Alternative: $431,349,000
  - Sustainable Alternative: $250,624,000
  - (2006 dollars)

- **CSO Reduction Unit Cost**
  - Grey Alternative: $0.24
  - Sustainable Alternative: $0.16
  - (2006 dollars)
All of these risks are discussed in MSD’s Recommendation Report.
Benefits – Best Case for Ratepayers

- **Lowest Cost**
  - 40% lower capital cost
  - 42% lower 25-year life-cycle cost
  - Opportunity for external funding

- **Achieves Multiple Goals**
  - Significant CSO reduction
  - Removes natural waters from sewers
  - More local construction jobs
  - Public Involvement

- **Provides Flexibility**
  - Future Phase 2 plan more nimble
  - Monitoring Program to assess reductions achieved
  - Provides time to address future regulations

- **Rate Equity Opportunity**
  - Costs driven by wet weather problem
  - True cost to provide stormwater service
  - Structure stormwater fees by acreage vs. number of toilets

All of these benefits are discussed in MSD’s Recommendation Report.
Conclusions

- Lowest cost & lowest risk
- Supported & vetted with the Regulators
- Opportunities for external funding partners
- Similar approach used by others
- Increases base flow to tributaries and streams
- Flexibility to adapt to future conditions
- Best solution to achieve relevant criteria
Next Steps - 2012

- Receive Public Comments – August thru October
- Decision by Co-Defendants – October
- Co-Defendants to continue legal discussions with Regulators - October
- Draft LMCPR Report developed by MSD – November
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- Continue Flow Monitoring Program
Questions?
Lower Mill Creek Partial Remedy

Hamilton County Board of County Commissioners Public Hearing

October 3, 2012
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- MSD’s Recommendation
- Next Steps
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Relevant Criteria

Policy & Cost

Benefits

Risks

Level of Certainty
Flooding
Maintenance

Compliance & Conformance
Final WWIP
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Capital O&M
Life-Cycle Funding Sources

Ratepayers
Water Quality
Flexibility
MSD’s Recommendation

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September 25, 2012
### Recommended Alternative

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This image illustrates where surface flooding occurs under 100 year storm conditions.
Future Conditions Flood limits based on Proposed Corridor Grades

This graphic shows flood limit areas resulting after riparian & floodplain grading associated with the VCS.

Impacted properties are identified for acquisition due to potential impact and grading plan.
Existing Conditions Surface Flooding

100-YEAR FLOOD WATER DEPTHS
Proposed Solution Surface Flooding
Proposed Solution Surface Flooding
Existing Conditions

- Existing Combined Sewer
- Existing Combined Sewer (installed prior to 1913)
Existing Conditions

More than 40% of main trunk sewers are surcharged during the 10-year storm
Proposed Separate Stormwater Conveyance

Less than 20% of main trunk sewers are surcharged during the 10-year storm.
Developing a solution that brings our historical water wealth normally below ground to the surface to create a benefit the community can see.

✓ Complies with 2 BG Consent Decree target
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Hamilton County Board of County Commissioners Public Hearing

October 8, 2012
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- MSD’s Recommended Alternative
- MSD’s Strategic Separation Approach
- Model & Local Data
- Confidence in Results
- Regulator Feedback
## Recommended Alternative

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### Phase 1 Highlights

- Kings Run Source Control & Storage
- Bloody Run, Mitchell, Ross Run RTC
- Storage at CSO 488
- West Fork Source Control, Storage & RTC
- Lick Run Source Control & RTC

### Sustainable/Hybrid Real Time Control Facilities (CSOs)

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<th>Details</th>
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<td>Real Time Control Facilities (CSOs)</td>
<td>5, 125, 181, 482, 485/487</td>
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<tr>
<td>West Fork Channel Grate Modifications</td>
<td>YES</td>
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<td>New Storm Sewers (ft)</td>
<td>104,400</td>
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<td>21,500</td>
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<td>Naturalized Channels (ft)</td>
<td>5,500</td>
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<tr>
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<td>8,100</td>
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<tr>
<td>Natural Conveyance/Stream Separation (ft)</td>
<td>20,000</td>
</tr>
<tr>
<td>Non-Tunnel Storage Capacity (mg)</td>
<td>5</td>
</tr>
<tr>
<td>Additional EHRT Capacity (mgd)</td>
<td>20</td>
</tr>
<tr>
<td>Stormwater Detention Basins (acre - ft)</td>
<td>80</td>
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From April 2, 2012 LMCPR Preliminary Findings Report
To New Storm Sewers in Tier 1 Areas:
- Existing Storm Sewers
- Downspouts Connected to Existing Storm
- Hillside Ravines and Inlets
- Stream Inlets
- Roadway Inlets
- Overland Flow (Tier 2 also)

To Existing Combined Sewers:
- Foundation Drains
- Downspouts Connected to Existing CSS
- Inflow and Infiltration
- Stream Inlets in Tier 2 Areas
- Roadway Inlets in Tier 2 Areas
The Consent Decree requires a wet weather solution that is based on USEPA’s hydraulic and hydrologic modeling software.

How Big (acreage)
How Much (rainfall)
How Many (pipes & outfalls)
How Often (dry weather flow)

Local Data Used for Inputs
Pipe Sizes & Shapes
Invert Elevations
Hydraulic Interconnections
Sediment Depth
Underflow Pipe Diameters
Regulator Function
Topography & Land Use

Local Data to Refine Model’s Assumptions
Pan Evaporation Data
300 Soil Borings – soil & groundwater
Ops Interviews – surcharges, pumps
Weir & Orifice Settings
Runoff Catchment Parameters

Local Data to Confirm Model’s Results
Sanitary Flow Monitoring
Storm Flow Monitoring
Telog Overflow Data
USGS Mill Creek Level Gauges
RTC & Interceptor Level Monitors

Flow to Treatment Plant
Combined Sewer Overflows
Overland Flow to Stream
Local Data to

**INPUT INTO MODEL**

**Local Data Used for Inputs**
- Pipe Sizes & Shapes
- Invert Elevations
- Hydraulic Interconnections
- Sediment Depth
- Underflow Pipe Diameters
- Regulator Function
- Topography & Land Use
Difficult to monitor pipes of this size for sudden, severe storms

Pipe height = 19.5 feet

Revised loss coefficient to account for grating installed

Revised pipe size connected to AMCI

Lick Run Inflow

Invert = 457.22

2’ Side Circular Orifice
Inlet Offset = 10’

Invert = 457.22

2’ pipe – offset 6.28’ into the AMCI

Invert = 446.45
Outlet Offset = 11.37’
Entry Loss Coeff = 3.72

Invert = 449.58

Invert = 446.45

Updated Underflow Structure
Model Updates

- Ponding turned on
- Blind MHs
- Shape/Size Updates

<table>
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<tr>
<th>Conduit</th>
<th>Original Shape</th>
<th>Original Size</th>
<th>New shape</th>
<th>New size</th>
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<td>28605024-28605025</td>
<td>HORIZ_ELLIPSE</td>
<td>17.83' x 20'</td>
<td>CUSTOM</td>
<td>17.8' x 20'</td>
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<td>28605025-28605026</td>
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<td>17.8' x 20'</td>
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<td>28605026-28605029B</td>
<td>RECT_CLOSED</td>
<td>17.83' x 20.5'</td>
<td>CUSTOM</td>
<td>17.8' x 20'</td>
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<tr>
<td>28605029B-29408023</td>
<td>RECT_CLOSED</td>
<td>17.75' x 20.5'</td>
<td>CUSTOM</td>
<td>17.8' x 20.5'</td>
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<tr>
<td>29408023-29408050</td>
<td>CIRCULAR</td>
<td>14.5'</td>
<td>CUSTOM</td>
<td>17.8' x 20.5'</td>
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<td>29408050-29408049</td>
<td>CIRCULAR</td>
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- Added 10,000 sf of area for each node
- 9 sealed manholes adjusted to prevent surcharge
- Created custom shapes for conduits
Local Data to Refine Model’s Assumptions

- Pan Evaporation Data
- 300 Soil Borings
- Ops Interviews – surcharges, pumps
- Weir & Orifice Settings
- Runoff Catchment Parameters

Local Data to

REFINE MODEL ASSUMPTIONS
Lick Run Separation Assumptions Summary

• Pan elevation data based upon local NOAA information added into the model to account for local climatic conditions in lieu of using regional information.

• 300 soil borings were advanced to confirm soil conditions and the ground water elevation for the Lick Run area in lieu of using regional information.

• Operational staff interviews conducted to gain an accurate understanding of locations of surcharges in the existing system and control settings.

• Weir and orifice control setting and operational logic were adjusted to match actual conditions in lieu of using typical values.

• Runoff catchment parameters were field verified to account for local data unique to each sub-catchment areas in lieu of using regional published information.
Lick Run Percent Stormwater Capture Results
Existing storm sewer (orange) connected to existing combined sewer (pink)
Local Data – Refine Assumptions

Reflects level of detail of field reconnaissance efforts to verify stormwater removal assumptions.

Existing storm sewer (orange) connected to existing combined sewer (pink)
Data to Confirm Model’s Results
Sanitary Flow Monitoring
Storm Flow Monitoring
Telog Overflow Data
USGS Mill Creek Level Gauges
RTC & Interceptor Level Monitors

Local Data to
CONFIRM MODEL RESULTS
Local Data – Flow Monitoring Sites

MSD utilizes flow monitoring data for planning and monitoring efforts throughout the service area.
“The main differences in the levels of verification will be in the number of points at which the model is verified rather than the exactness of the fit.”

Wastewater Planning Users Group (WaPug)
Code of Practice for Hydraulic Modeling of Sewer Systems
REGULATOR FEEDBACK

The Regulators have articulated the approach MSD used to model separation is the accepted method and they have confidence MSD’s CSO model is effectively capturing the sewer separation.

- CSO 5
- AMCI
- WWTP
Lick Run Sanitary and Storm Sewer Flow Monitoring 2011

- Collected data from 11 sites
  - 7 storm sewers
  - 4 sanitary sewers
- Collected during storm events over 10 months
- Data supported the model’s assumptions for the amount of rainfall entering the storm and combined sewers
- Results within 1% of MSD’s stormwater removal assumptions
MSD’s Current Flow Monitoring Plan:

- Takes into account slope, debris, pipe size, velocity
- Underwent refinement and verification through field inspection
- Sites have smaller pipes and slower velocities
- Will monitor flows in the upstream areas of the watershed in pipes no greater than 66-inch diameter and maximum velocities no greater than 12 feet per second
Since modeling is an iterative process, MSD is continuing to collect flow monitoring data and has refined the locations to improve data reliability.
Confidence in Results

The risk associated with limited flow monitoring data at CSO 5 is minimized through the collective wealth of local data and sophistication of the current modeling technology that has been deemed a rational tool by the Regulators.

Confidence in Stormwater Removal Volumes
Existing local data provides good understanding of quantities to be removed

Lick Run Model is Correct
Reasonable assumption due to validation of up and downstream sections

Model Input Fully Vetted
Leading industry experts and Regulators agree with inputs and assumptions

MSD has made Comprehensive Effort
Visual review of every pipe, manhole, parcel drainage pattern for all 87 subcatchments

LMCPR is Based on Results from USEPA Model
Regulators have indicated “NO RED FLAGS”
The Regulators have articulated the approach MSD used to model separation is the accepted method.

The Regulators have confidence MSD’s CSO model is effectively capturing the sewer separation.

The Regulators have stated MSD’s model leaves the infiltration & inflow component of stormwater in the combined sewer system. They said this a conservative approach and can be refined in the future if pipes are lined or more data is collected.

The Regulators said for the alternatives analysis, MSD has a model that can be relied on to predict what will happen to a reasonable degree of accuracy.

Both the Regulators and MSD are comfortable the information produced by the model is adequate for making decisions.

The Regulators said they are not aware of any on-going discussions regarding changes at the state level for MS4 permits.
Lower Mill Creek Partial Remedy

QUESTIONS?
Lower Mill Creek Partial Remedy

Hamilton County Board of County Commissioners
Public Hearing

October 10, 2012
Today’s Agenda

- MSD’s Recommended Alternative
- Valley Conveyance System Components
- Regulator Feedback
## Recommended Alternative

<table>
<thead>
<tr>
<th>Sub-Basin</th>
<th>MG CSO Reduction</th>
<th>Capital Cost (2006$)</th>
<th>Cost/Gallon</th>
<th>No. of CSOs</th>
<th>CSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lick Run</td>
<td>726</td>
<td>$200,492,000</td>
<td>$0.28</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Wooden Shoe</td>
<td>156</td>
<td>$27,534,000</td>
<td>$0.17</td>
<td>2</td>
<td>217,483</td>
</tr>
<tr>
<td>West Fork</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bloody Run</td>
<td>93</td>
<td>$10,651,000</td>
<td>$0.04</td>
<td>1</td>
<td>181</td>
</tr>
<tr>
<td>CSO 488 Storage</td>
<td>47</td>
<td>$3,421,000</td>
<td>$0.23</td>
<td>1</td>
<td>488</td>
</tr>
<tr>
<td>4 RTCs</td>
<td>737</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>5,125,482,485</td>
</tr>
<tr>
<td>Total</td>
<td>1,759</td>
<td>$242,098,000</td>
<td></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Sustainable Alternative

From April 2, 2012 LMCPR Preliminary Findings Report

<table>
<thead>
<tr>
<th>Phase 1 Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Kings Run Source Control &amp; Storage</td>
</tr>
<tr>
<td>- Bloody Run, Mitchell, Ross Run RTC</td>
</tr>
<tr>
<td>- Storage at CSO 488</td>
</tr>
<tr>
<td>- West Fork Source Control, Storage &amp; RTC</td>
</tr>
<tr>
<td>- Lick Run Source Control &amp; RTC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Time Control Facilities (CSOs)</td>
<td>5,125, 181, 482, 485/487</td>
</tr>
<tr>
<td>West Fork Channel Grate Modifications</td>
<td>YES</td>
</tr>
<tr>
<td>New Storm Sewers (ft)</td>
<td>104,400</td>
</tr>
<tr>
<td>Relocated Combined Sewers (ft)</td>
<td>21,500</td>
</tr>
<tr>
<td>Naturalized Channels (ft)</td>
<td>5,500</td>
</tr>
<tr>
<td>Valley Conveyance System (ft)</td>
<td>8,100</td>
</tr>
<tr>
<td>Natural Conveyance/Stream Separation (ft)</td>
<td>20,000</td>
</tr>
<tr>
<td>Non-Tunnel Storage Capacity (mg)</td>
<td>5</td>
</tr>
<tr>
<td>Additional EHRT Capacity (mgd)</td>
<td>20</td>
</tr>
<tr>
<td>Stormwater Detention Basins (acre - ft)</td>
<td>80</td>
</tr>
</tbody>
</table>
Utility Coordination

Costs included in Base Project is AFTER coordination efforts.

- CDOT (projects sequencing/phasing plan)
- Hamilton County Planning (public engagement coordination)
- Duke Energy ($400,000 avoided cost for 6,000 feet gas mains)
- Time Warner Cable (no utility impact)
- Cincinnati Bell (no utility impact)
- Greater Cincinnati Water Works (construction coordination for water main, hydrants, and valve vault improvements)
**Valley Conveyance System**

- **Conveyance Components**
  - $45 million
  - 67%
  - *waterways, earthwork, utilities, culvert box, plantings, irrigation*

- **Transportation Components**
  - $12 million
  - 18%
  - *bridges & replaced Intersections*

- **Multi-Purpose Components**
  - $8 million
  - 12%
  - *Open spaces, Access & Maintenance Paths, Safety*

- **Replaced Infrastructure**
  - $2 million
  - 3%
  - *community park, sidewalks*

Total: $67 million
Transportation Components

- Connectivity Bridges
- Intersection Replacements
- Pedestrian Safety

Transportation

$12 million

18% of VCS Cost

3.8% Base Project Cost
## Transportation Components

### Existing Roadways

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridges</td>
<td>$5.6 million</td>
<td>8 crossings of urban waterway between Queen City &amp; Westwood Avenues</td>
</tr>
<tr>
<td>Intersection Reconnections</td>
<td>$5.2 million</td>
<td>Elimination of Beekman Avenue between Queen City and Westwood, pavement markings, traffic signals</td>
</tr>
<tr>
<td>Streetscape &amp; Safety</td>
<td>$1.9 million</td>
<td>Highly visible crosswalks, signals, signage, trash receptacles, street trees &amp; lights</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$12.7 million</strong></td>
<td></td>
</tr>
</tbody>
</table>
- 8 crossings to maintain north-south connectivity
- Cost in base project = $5.6 million
Transportation Related Components

- One-way traffic remains with 3 wider lanes
- Pedestrian safety improvements (sidewalks, crosswalks & lighting)
- Vetted with CDOTE
- Average right-of-way: 58 feet
- Traffic Volume: 23,000 vehicles per day
- One-way traffic remains with 3 wider lanes
- Pedestrian safety improvements (sidewalks, crosswalks & lighting)
- Vetted with CDOTE
- Average Right-of-Way: 60 feet
- Traffic Volume: 16,000 vehicles per day
Multi-Purpose Features

- Stormwater Management
- Maintenance
- Safety
- Public Education
- Community Integration

Multi-Purpose

$8 million

12% of VCS Cost

2.5% Base Project Cost
Multi-Purpose Features

- Stormwater Management = $4.3 million
  - open spaces, roadside planters
- Maintenance Components (irrigation, access)= $2.1 million
- Safety (lighting, railings, crosswalks) = $1 million
- Public Education (interpretive signage) = $230,000
- Community Integration = $620,000
  - bike racks, benches, paver plazas, off-street parking

Open Spaces for Flood Control

Typical Stormwater Planters
Safety & Maintenance

Multi-Purpose Features

Narrow Channel Zone

- Retaining Wall: to protect existing infrastructure and Westwood Avenue
- Safety Railing: along top of retaining wall
- Urban Waterway System: stormwater conveyance/CSO reduction/water quality
- Lighting: for public safety
- Multi-Purpose Access Path: maintenance access and easement for large diameter combined sewer

Looking south towards Westwood Avenue
Multi-Purpose Features

- **Community Integration**
  - Stormwater Management = $4.3 million
    - open spaces, retaining wall, roadside planters
  - Maintenance (irrigation, access) = $2.1 million
  - Safety (lighting, railings, crosswalks) = $1 million
  - Public Education (interpretive signage) = $230,000
  - **Community Integration** = $620,000
    - bike racks, benches, paver plazas, off-street parking

---

“Make Lick Run beautiful and exciting and bring it into a very urban setting, where many people can enjoy it.” - Citizen employed in South Fairmount
Relocated Infrastructure

- Existing Sidewalks
- South Fairmount Community Recreation Park Features

- Replaced Infrastructure:
  - $2 million
  - 3% VCS Cost
  - 0.6% Base Project Cost
Impacted by Project

Currently exist and disturbed by construction of project
- Sidewalks, parking lot
- Basketball courts
- Playground
- Picnic shelter/pavilion
- Cost in base project = $2 million
Understand these costs are included due to the unique nature of this CSO project.

Acknowledged the look of features is different than traditional projects in order to fit into a public setting, but it accomplishes the same functionality.

Agreed features needed for safety or to fit into neighborhood are appropriate costs.

Noted, in general if a feature meets test of necessary and reasonable, then it is viewed as a project cost.

Agreed the features included for safety, maintenance access, water quality, and restoration of impacted areas would be placed into the category of “necessary and reasonable.”
Lower Mill Creek Partial Remedy

QUESTIONS?