King County

Barton, Murray, Magnolia, and North Beach

CSO Facilities

Workshop No. 2

May 30, 2007

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Review of Workshop #1

- Modeling Results and Problem Definition
  - North Beach
  - Barton and Murray
  - Magnolia
- Discussion of Range of Possible Solutions
- Evaluation Criteria

North Beach Potential Solutions

- 3.5 MG storage?
- Increase PS capacity to 10-12 mgd
  - Increase Carkeek wet weather treatment
  - Improve treatment performance?
  - Pump to 8th Avenue Interceptor for conveyance to West Point
  - Forcemain alignment impacts capacity
- Combined storage/pumping

Barton and Murray Potential Solutions

- Increased pumping with no storage
  - Barton 53 mgd
  - Murray 65 mgd
  - Increase flow to Alki?
- Storage alone
  - Barton 0.5 MG
  - Murray 1.3 MG
- Impervious area disconnection
  - Target > 50% to eliminate overflows
- Combinations?

Magnolia Potential Solutions

- 2.6 MG storage
- No basin storage and add capacity to South Magnolia Trunk (15 mgd)
- Increase conveyance to 15 mgd and put storage upstream of Interbay PS.
- Combination

CSO Control Approach Overview

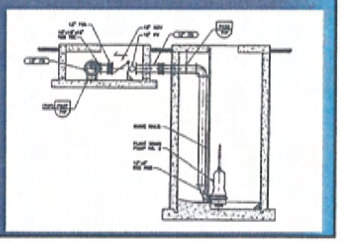
1. Store Peak Flows in Basin
2. Convey Peak Flows, Treat, and Discharge
3. Provide End of Pipe Treatment at CSO
4. Reduce Peak Flows, "Demand Management"
5. Combinations

Approach No. 1 - Storage

- Rectangular, cast-in-place concrete basins
- Below grade, depths up to 30 ft
- Fill by gravity, drain with submersible drainage pumps
- Wash down facilities similar to North Creek
- Carbon odor control

Approach No. 2 – Convey & Treat

- Submersible PS for head < 200 ft
- High Head (Carkeek) PS for head > 200 ft
- All pumps in service for peak hour flow



Approach No. 2 – Convey & Treat

- Limit force main velocity to ± 5 ft/s
- Provide expanded capacity at Carkeek and Alki WWTPs
  - High Rate Clarification (HRC)
  - Ultraviolet Disinfection (UV) or hypo/dechlor
  - New outfalls for hydraulic capacity

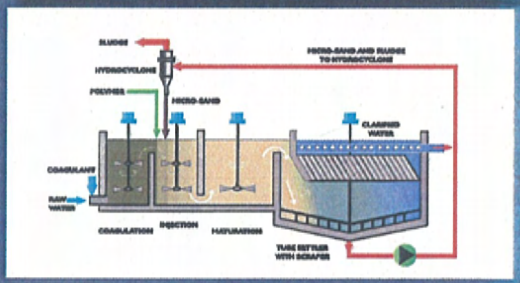
Approach No. 3 – End of Pipe Treatment

- Remote facility installed at CSO location
  - HRC provides primary treatment
  - UV provides disinfection
- Designed for rapid, automated startup
- Mix of below grade tanks and above grade support facilities
  - Electrical
  - Chemical storage

HRC Features

- Physical/chemical process
- Ballast used to promote rapid settling
- Very small footprint
- Effective with UV disinfection

HRC Process Schematic



Approach No. 4 – Peak Flow Reduction

- Targeting roof drain disconnects within 100 ft of storm drain inlets
- Roof areas and connections determined from SPU GIS
- Limited field investigation to verify GIS data

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1A: Storage at NBPS Site

Store peak flows at NBPS site, pump to Carkeek following event

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Store peak flows at NBPS site, pump to Carkeek following event

- Assumptions:
  - Sufficient space is available at NBPS site for 3.5 MG tank
  - Capacity of NBPS allows storage to be drained in 1 day while base flows are pumped
- Key Issues
  - Neighborhood impacts
  - Storage siting

1A: Storage at NBPS Site

Store peak flows at NBPS site, pump to Carkeek following event

- Summary and Initial Conclusions
  - Relatively low cost option for CSO management
  - Low impact on O&M
  - Very unlikely that storage will fit on site, even if entire park is utilized
  - Likely require increased pump station capacity to drain storage following event
  - Does not correct existing NB FM (suspect condition)
  - Results in double pumping peak flows

1B: Storage at Alternate NB Site

Pump to storage site, pump to Carkeek following event

1B: Storage at Alternate NB Site

Pump to storage site, pump to Carkeek following event

- Assumptions:
  - Sufficient space is available at NBPS site for 10 mgd high head PS
  - An alternate location for storage can be found in the NB basin
  - The same pipeline can be used to convey flow to/from storage
  - Capacity of NBPS allows storage to be drained in 1 day while base flows are pumped
- Key Issues
  - Neighborhood impacts
  - Storage siting
  - PS siting and FM siting/alignment

1B: Storage at Alternate NB Site

Pump to storage site, pump to Carkeek following event

- Summary and Initial Conclusions
  - Likely require increased pump station capacity to drain storage following event
  - Does not correct existing NB FM (suspect condition)
  - Results in double pumping peak flows
  - Easier to site storage (relative to Alt. 1A)

1C: Storage at Alternate NB Site

Pump to storage site, transfer to West Point following event

1C: Storage at Alternate NB Site

Pump to storage site, transfer to West Point following event

- Assumptions:
  - Sufficient space is available at NBPS site for 10 mgd high head PS
  - An alternate location for storage can be found in the NB basin
  - Conveyance capacity to West Point allows storage to be drained in 1 day following storm event
- Key Issues
  - Neighborhood impacts
  - PS, storage and FM siting/alignment

1C: Storage at Alternate NB Site

Pump to storage site, transfer to West Point following event

- Summary and Initial Conclusions
  - Easier to site storage (relative to Alt. 1A)
  - Does not correct existing FM (suspect condition)
  - Eliminates double pumping of peak flows

2A: Convey and Treat Peak Flow

Pump to Carkeek through new beachside FM, upgrade Carkeek capacity by 10 mgd

2A: Convey and Treat Peak Flow

Pump to Carkeek through new beachside FM, upgrade Carkeek capacity by 10 mgd

- Assumptions:
  - Sufficient space is available at NBPS site for 10 mgd submersible PS
  - A new 24" FM can be constructed along the beach and through Carkeek Park
  - An additional 10 mgd discharge into Puget Sound will be permitted from the Carkeek WWTP
  - A new outfall and diffuser can be constructed from the Carkeek WWTP
- Key Issues
  - Environmental permitting (beach, Carkeek Park)
  - Neighborhood impact (PS construction)
  - Regulatory permitting (increase Carkeek discharge)

2A: Convey and Treat Peak Flow

Pump to Carkeek through new beachside FM, upgrade Carkeek capacity by 10 mgd

- Summary and Initial Conclusions
  - Involves a smaller, less costly submersible pump station near the NBPS
  - Cost of FM construction along beach and in Carkeek Park eliminates PS savings
    - Opportunity to correct existing 14" FM
  - Capacity expansion at Carkeek possible but difficult to construct
  - Increasing outfall capacity from Carkeek adds to cost

2B: Convey and Treat Peak Flow

Pump to Carkeek through new FM in residential alignment, upgrade Carkeek capacity by 10 mgd

2B: Convey and Treat Peak Flow

Pump to Carkeek through new FM in residential alignment, upgrade Carkeek capacity by 10 mgd

- Assumptions:
  - Sufficient space is available at NBPS site for 10 mgd high head PS
  - A new 24" FM can be constructed through the neighborhoods of North Beach & Blue Ridge
  - An additional 10 mgd discharge into Puget Sound will be permitted from the Carkeek WWTP
  - A new outfall and diffuser can be constructed from the Carkeek WWTP
- Key Issues
  - Environmental permitting (Carkeek Park)
  - Neighborhood impact (PS, FM construction)
  - Regulatory permitting (increase Carkeek discharge)

2B: Convey and Treat Peak Flow

Pump to Carkeek through new FM in residential alignment, upgrade Carkeek capacity by 10 mgd

- Summary and Initial Conclusions
  - Capacity expansion at Carkeek possible but difficult to construct
  - Increasing outfall capacity from Carkeek adds to cost
  - Difficult residential alignment causes neighborhood impacts, high head
  - Does not correct existing FM (suspect condition)

3A: End of Pipe Treatment

Treat and discharge peak flows (10 mgd) at NBPS site

3A: End of Pipe Treatment

Treat and discharge peak flows (10 mgd) at NBPS site

- Assumptions:
  - An additional 10 mgd discharge will be permitted from a remote HRC facility
  - Sufficient space is available at NBPS site for treatment
  - Existing outfall(s) at NB can be used to discharge treated effluent
- Key Issues
  - Neighborhood impact and perception (construction & treatment facility)
  - Regulatory permitting (permit remote HRC discharge)

Footprint of Storage at North Beach

Footprint of HRC/UV at North Beach

3A: End of Pipe Treatment

Treat and discharge peak flows (10 mgd) at NBPS site

- Summary and Initial Conclusions
  - Lowest cost relative to all other alternatives
  - Seems to have least impact during construction
  - Fits well on site next to NBPS
  - Difficulty with public perception – treatment facility near park & homes
  - May be difficult to get NPDES permit

Approach to I/I Reduction

Description

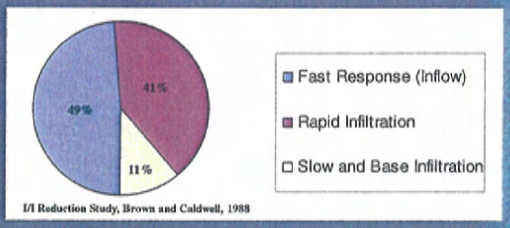
- Manage peak flows through I/I reduction
- Sources
  - Inflow
    - Roof drains
    - Catch basins
    - Other direct connections
  - Infiltration
    - Laterals
    - Side sewers
    - Foundation drains
    - Sewer main
    - Manholes

I/I Reduction Techniques

- Inflow
  - Drain disconnection
  - New storm sewers
- Infiltration
  - Rehabilitation (slip lining)
  - Replacement (dig and replace, pipe bursting)

I/I Quantification

- Estimated I/I flow: 13.5-15.5 mgd
- Flow per source:



I/I Reduction Study, Brown and Caldwell, 1988

Impacts of I/I Component Reduction

I/I Component	System Component	Percent of I/I Flow	Flow (mgd)	Expected Percent Reduction	Predicted I/I Flow (mgd)
Fast Response (Inflow)	Catch basins, roof drains, other direct connections	49%	6.4	10%-15%	5.4 - 5.7
Rapid Infiltration	Laterals, side sewers, foundation drains	40%	5.2	50%-60%	2.1 - 2.6
Slow & Base Infiltration	Manholes, sewer mains	11%	1.4	30%	1.0
Total		100%	13.0		

Impacts of Complete Replacement

- King County pilot studies indicate 70-80% I/I reduction can be achieved, with replacement of:
  - Laterals
  - Side Sewers
  - Manholes
  - Direct Connections
- 75% reduction of 13.5 mgd = 3.4 mgd
- Peak flows can be handled by existing infrastructure

Conclusions: Alternative 4A

Evaluation based on previous reports
- I/I Reduction Study (Brown and Caldwell, 1988)
- Pilot Study (Earth Tech, 2005)

Technically feasible to sufficiently reduce I/I so that no additional facilities are needed (storage, pumping). Cost and timeline uncertain

Conclusions 4A (cont'd.)

- Issues
  - 70-80% reduction is very aggressive strategy
  - Requires flow monitoring (~1 year)
  - Requires coordination with SPU
- Remaining Technical Evaluations
  - Verify modeling results to determine feasibility
  - Identify areas for disconnection or rehabilitation

Approach 5: Combinations

- Previous study identified that storage of <0.2MG will fit on NBPS site
  - This would require about 70% I/I reduction
    - No significant decrease in costs for I/I reduction
  - Storage at NBPS site not reasonable alternative with I/I
- Lowest infrastructure cost alternative is End of Pipe Treatment
  - Consider End of Pipe and I/I Reduction?
    - More costly than End of Pipe Treatment alone
    - Would require coordination with SPU
    - Would require flow monitoring for 1 year

Summary of North Beach Alternatives

Alternative	Cost Rankings	Feasible
1A: On-site storage, pump to Carkeek	1.3	No
1B: Off-site storage, pump to Carkeek	1.7	Yes
1C: Off-site storage, pump to West Point	1.9	Yes
2A: Pump to Carkeek, beach alignment, HRC/UV at Carkeek	2.3	Yes
2B: Pump to Carkeek, neighborhood alignment, HRC/UV at Carkeek	2.2	Yes
3A: Provide HRC/UV at NBPS site	1.0	Yes
4A: Reduce Inflow/Infiltration	2.4+	?
5A: Combination	2.4+	?

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Barton Basin Significantly Favors Storage

- Peak flows high compared to required storage volume
- Pumping has higher cost and flows must still be dealt with at Murray
- Because of high peak flows – end of pipe treatment much more expensive and difficult to site
- Potential for demand management

Summary of Barton Analysis

Description	*Relative Cost*
• Storage – 0.5 MG at Fauntleroy School	1.0
• Pumping – 25 mgd and increases cost at Murray	2.0
• Demand Management	--
• End of Pipe Treatment	4.0

B1A/M1B: On-Site Storage

Fauntleroy School storage - Lowman Beach Park storage

B1A/M1B: On-Site Storage

Fauntleroy School storage - Lowman Beach Park storage

B1A/M1B: On-Site Storage

Fauntleroy School storage - Lowman Beach Park storage

B1A/M1B: On-Site Storage

Fauntleroy School storage - Lowman Beach Park storage

- Assumptions:
  - Sufficient flow can be intercepted at Fauntleroy School to adequately attenuate peak at Barton PS
  - Flows can be effectively regulated to the Barton Pump Station
- Key Issues:
  - Public acceptance challenges for siting storage facilities

B1A/M1B: On-Site Storage

Fauntleroy School storage - Lowman Beach Park storage

- Summary and Initial Conclusions:
  - Limited options for storage siting within Barton and Murray Basins
  - Upland storage siting presents flow regulator challenges

B1A/M2B: Barton Storage-Murray Conveyance

Fauntleroy School storage – Murray conveyance & treatment

B1A/M2B: Barton Storage-Murray Conveyance

Fauntleroy School storage – Murray conveyance & treatment

- Summary and Initial Conclusions:
  - Limited options for storage siting within Barton Basin
  - Upland storage siting presents flow regulator challenges
  - Constricted conveyance corridor along Beach Drive
  - Highest relative cost of the paired alternatives

B1A/M2B: Barton Storage-Murray Conveyance

Fauntleroy School storage – Murray conveyance & treatment

- Assumptions:
  - Sufficient flow can be intercepted at Fauntleroy School to adequately attenuate peak at Barton PS
  - Flows can be effectively regulated to the Barton Pump Station
  - 8.5 mgd peak flow requirement from Murray Basin
- Key Issues:
  - Permit issues for additional 8.5 mgd discharge at Alki outfall?

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

M4: Murray Demand Management

Murray Impervious Area Disconnection

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

- Summary and Initial Conclusions:
  - Limited options for storage siting within Barton Basin
  - Upland storage siting presents flow regulator challenges
  - Sufficient impervious area available for disconnection

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

- Assumptions:
  - Sufficient flow can be intercepted at Fauntleroy School to adequately attenuate peak at Barton PS
  - Flows can be effectively regulated to the Barton Pump Station

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

- Key Issues:
  - Confirmation of SPU requirements for disconnected areas
  - Confirmation of areas that are currently connected
  - Adequacy of existing storm drainage infrastructure to convey increased peak flows
  - Infiltration capacity of soils in the basin
  - Challenges of routing disconnected flows away from property

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

B1A/M3B: Barton Storage-Murray Demand Management

Fauntleroy School storage – Murray impervious area disconnection

B1A/M4B: Barton Storage-Murray End of Pipe Treatment

Fauntleroy School storage – Treatment at Lowman Beach Park

B1A/M4B: Barton Storage-Murray End of Pipe Treatment

Fauntleroy School storage – Treatment at Lowman Beach Park

- Summary and Initial Conclusions:
  - Limited options for storage siting within Barton Basin
  - Upland storage siting presents flow regulator challenges
  - Lowest relative cost of the paired alternatives

B1A/M4B: Barton Storage-Murray End of Pipe Treatment

Fauntleroy School storage – Treatment at Lowman Beach Park

- Assumptions:
  - 8.5 mgd peak flow requirement from Murray Basin
  - Sufficient flow can be intercepted at Fauntleroy School to adequately attenuate peak at Barton PS
  - Flows can be effectively regulated to the Barton Pump Station
- Key Issues:
  - Public acceptance challenges for siting treatment facility
  - Permit issues for additional 8.5 mgd discharge at Murray outfall?

B4A-M1B: Barton Demand Management

Barton Impervious Area Disconnection

B4A-M1B: Barton Demand Management

Barton Impervious Area Disconnection

- Summary and Initial Conclusions:
  - Questionable whether sufficient impervious area is available
  - Less storm drainage infrastructure in place in basin

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1A: Magnolia Upper Basin Storage

Pump and gravity to storage site, gravity sewer to ex. interceptor

1A: Magnolia Upper Basin Storage

Pump and gravity to storage site, gravity sewer to ex. interceptor

- Assumptions:
  - 30% of basin above storage site.
  - 70% of basin below storage site.
  - New sewer needed to discharge tank to existing interceptor due to local flows downstream.
- Key Issues
  - Neighborhood impacts
  - PS, storage and FM siting/alignment
  - Need to upgrade SPU pump station or build new.

1A: Magnolia Upper Basin Storage

Pump and gravity to storage site, gravity sewer to ex. interceptor

- Summary and Initial Conclusions
  - May not be feasible due to proposed land use.
  - Only one site available.
  - 70% of flow must be pumped to storage.
  - SPU pump station upgrade may be problematic due to siting and permits.

1B: Magnolia storage at CSO site

Move storage down the hill, gravity sewer to ex. interceptor

1B: Magnolia storage at CSO site

Move storage down the hill, gravity sewer to ex. interceptor

- Assumptions:
  - 77% of basin above storage site
  - 23% of basin below storage site.
  - SPU PS capacity may need increase.
- Key Issues
  - Neighborhood impacts
  - PS, storage and FM siting/alignment
  - Need to upgrade SPU pump station.

1B: Magnolia storage at CSO site

Move storage down the hill, gravity sewer to ex. interceptor

- Summary and Initial Conclusions
  - Site in ravine constrained by topography.
  - Site has to be west of local connections.
  - Less pumping required – all gravity?
  - SPU pump station upgrade may be problematic due to siting and permits.

1C: Magnolia storage near Marina

Pump to storage east of Marina

1C: Magnolia storage near Marina

Pump to storage east of Marina

- Assumptions:
  - Pressure or gravity sewer to new storage.
  - SPU PS may be upgraded or replaced.
- Key Issues
  - PS, storage and MT siting/alignment.
  - MT feasibility due to land and geology.
  - Need to upgrade SPU pump station.

1C: Magnolia storage near Marina

Pump to storage east of Marina

- Summary and Initial Conclusions
  - Geotechnical conditions for microtunneling need investigation.
  - Easements/ROW/property must be acquired from Seattle Parks.
  - SPU pump station upgrade may be problematic due to siting and permits.

2A: Magnolia Convey and Treat

Replacement interceptor to Interbay PS then to West Point

2A: Magnolia Convey and Treat

Replacement interceptor to Interbay PS then to West Point

- Assumptions:
  - Replace existing interceptor to Interbay.
  - Available capacity at Interbay for increased flow of 10.6 mgd.
  - SPU PS may be upgraded or replaced.
- Key Issues
  - Capacity at Interbay
  - MT siting/alignment.
  - MT feasibility due to land and geology.
  - Need to upgrade SPU pump station.

2A: Magnolia Convey and Treat

Replacement interceptor to Interbay PS then to West Point

- Summary and Initial Conclusions
  - Unlikely 10 mgd capacity available at Interbay PS
  - Geotechnical conditions for microtunneling new interceptor need investigation.
  - SPU pump station upgrade may be problematic due to siting and permits.

2B: Magnolia Convey and Treat

Parallel interceptor to Interbay PS then to West Point

2B: Magnolia Convey and Treat

Parallel interceptor to Interbay PS then to West Point

- Assumptions:
  - Parallel ex. Interceptor, 10.7 mgd capacity.
  - Available capacity at Interbay for increased flow of 10.6 mgd.
  - 27% of basin to pumped through SPU PS77 to inlet sewer.
  - SPU PS must be upgraded.
- Key Issues
  - Capacity at Interbay
  - MT siting/alignment.
  - MT feasibility due to land and geology.
  - Need to upgrade SPU pump station.

2B: Magnolia Convey and Treat

Parallel interceptor to Interbay PS then to West Point

- Summary and Initial Conclusions
  - Unlikely 10 mgd capacity available at Interbay PS
  - Geotechnical conditions for microtunneling new interceptor need investigation.
  - SPU pump station upgrade may be problematic due to siting and permits.

3A: Magnolia End of Pipe Treatment

Pump and gravity to treatment

3A: Magnolia End of Pipe Treatment

Pump and gravity to treatment

- Assumptions:
  - Land available
  - Existing infrastructure has adequate capacity for peak flows.
  - SPU PS may need upgrade.
- Key Issues
  - Land must be acquired from Seattle Parks.
  - Neighborhood impacts.
  - Need to upgrade SPU pump station.

3A: Magnolia End of Pipe Treatment

Pump and gravity to treatment

- Summary and Initial Conclusions
  - Geotechnical conditions for treatment plant need investigation.
  - SPU pump station upgrade may be problematic due to siting and permits.

4A: Magnolia Demand Management

Reduce impervious area to reduce storage by 50%

4A: Magnolia Demand Management

Reduce impervious area to reduce storage by 50%

- Assumptions:
  - 29 ac roofs can be disconnected (50%)
  - 3,000 ft, 8-ft. diameter tunnel storage in lieu of tank.
  - SPU PS must be upgraded for higher head.
- Key Issues
  - Easement must be acquired from Seattle Parks.
  - Neighborhood impacts.
  - Need to upgrade SPU pump station.

4A: Magnolia Demand Management

Reduce impervious area to reduce storage by 50%

- Summary and Initial Conclusions
  - Disconnection of all rooftops would not eliminate storage requirement.
  - Most expensive due to tunnel storage.
  - Demand management in combination with Option 1B may be least expensive option.

Summary of Magnolia Alternatives

Alternative	Cost Rankings	Feasible
1A: Upper Basin Storage	2.0	?
1B: Storage at CSO Control Point	1.5	Yes
1C: Storage near Marina	1.9	Yes
2A: Convey and Treat (New sewer)	1.0	No
2B: Convey and Treat (Parallel sewer)	1.2	No
3A: End of Pipe Treatment	1.3	Yes
4A: Demand Management	2.1+	?

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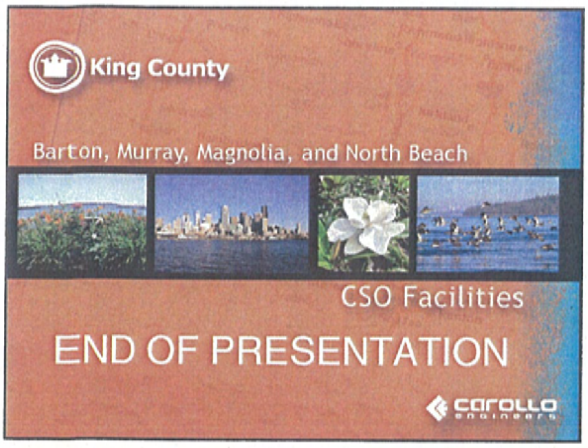
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Wastewater Treatment Division

Planning Confirmation Workshop #2

Comments and Questions from Meeting Participants

North Beach CSO
How did you calculate the force main velocity as 5 ft/sec?
There is a trade-off between upsizing the force main and putting horsepower down below.
1A: Storage at NBPS Site
Would pumping capacity be increased?
King County is experiencing that the Carkeek pumping capacity cannot quite reach 9 MGD, but the pump is being replaced now.
1B: Storage at Alternate NB Site
Are electrical costs included in the life cycle analysis? That could affect comparative long-term cost.
If you have to upsize the pump station, would you have to upgrade the force main?
Where in the basin could storage be located?
1C: Storage at Alternative NB Site
The 8th Ave. Interceptor also has CSOs; have you looked at the potential effects on that facility? Have you looked at capacity needs?
The flow would be split, with some going to Carkeek for treatment and some going to the 8th Ave. Interceptor, correct?
2A: Convey and Treat Peak Flow
Would the High Rate Clarification (HRC) facility treat all Carkeek flow?
How complicated would construction be? How big would the footprint of the HRC facility be?
What is the condition of the existing 33" outfall at Carkeek?
Would each treatment facility and each outfall require a separate permitting process?
A combined permit would probably be allowed. You can view it as consolidating the permits. There has been a precedent for the Henderson/M.L. King CSO Project and other projects combining permits.
Regulatory agencies try to improve effluent quality through the permitting process. This might require multiple FTEs.
We would have to get a commitment from Ecology that only one permit would be required.
Ecology will very much want the County to run the HRC facility first, because it is better treatment, then the existing facility.
If the two outfalls have two different qualities of effluent, I think separate permits will be required.

There may be room for negotiation with the regulators because the additional treatment process and outfall would provide better quality effluent that the existing treatment facility and outfall do.
Is there an alternative where Carkeek would be a totally HRC facility? That would make all the effluent the same quality.
The effluent quality would be higher, but the effluent volume would be higher.
The cost of putting a force main on the beach has not been included. The construction element could be ugly.
Maybe the CSO problem could be solved without upgrading the force main.
The force main is expected to fail by 2020.
You should include the upgrade of the 14" force main in this option. It would make this option look less attractive.
It is not unusual for King County to do a project that solves two problems; part of the project could be designated as CSO control and part of the project as asset management.
2B: Convey and Treat Peak Flow
No comments
3A: End of Pipe Treatment
The impact of the project is on the people generating the sewage, rather than transferring the problem to Carkeek.
Would it be difficult to permit this facility or would it be rolled into the West Point permit?
It would be the same amount of discharge, just not all at West Point.
Right now some of the discharge is not going to West Point. This option would provide better treatment than current conditions.
Permitting the end of pipe treatment facility would probably be an easier argument than some of the other alternatives that have been shown.
This is an advanced primary process, so workload would be affected for King County.
Does this option include underground electrical facilities, etc? Neighbors will not want anything sticking out of the ground.
4A: Approach to I/I Reduction
In analyzing infiltration and inflow, what is the difference between rapid and slow infiltration?
The Earth Tech report did consider social equity.
What is the cost of I/I reduction?
It seems this option is geared toward solving the whole CSO problem. Did you look at doing I/I reduction as part of the solution and then sizing CSO control facilities accordingly?
Because of groundwater issues and slope issues, groundwater is intentionally being put in the sewer system. Removing groundwater from the sewer system could create problems.
In looking at the cost of I/I reduction, abenefit is the construction of a new collection system. That is a benefit for the general ratepayer.
5: Combinations
Do you think it is realistic to assume that storage could be reduced from 3.5 million gallons to 200,000 gallons by doing I/I reduction?
Are you saying that by replacing everything in the basin, you would get a 70% reduction

in I/I?
During the I/I pilot projects, I/I was reduced by 75% in some basins just by doing some laterals, but you have to do a field investigation to find out where the leaks are.
Is there capacity in the stormwater system for stormwater diverted from the sewer system?
The stormwater system is ditch and culvert.
The stormwater system is a mix, it is not uniform.
Is providing stormwater capacity included in the cost?
Comments after Breakout Session on North Beach CSO Alternatives
Why is there no combination of end of pipe treatment and demand management?
Our group rated demand management green because you can do an investigation first and perhaps find something surprising.
There is some interest in tunneling into the hillside for storage. Does that fit into any of the alternatives?
The City of Seattle has CSO reduction projects planned in Ballard and Fremont/Wallingford. King County CSO control options that look at treating at Carkeek or doing I/I reduction would give Seattle more flexibility than would storage options.
There has been no discussion of impacts to the City's CSO system. If the County maintains the current capacity of its system, what are the impacts to the City's CSO basins that discharge into the King County pump?
An upfront decision needs to be made by King County management on whether the County is going to replace the 14" force main regardless of this CSO project. That would affect how we look at the CSO control options. There also needs to be a decision on whether any facilities will be located above ground by the pump station.
Barton and Murray CSO
B1A/M1B: On-Site Storage
How deep would storage be at Lowman Beach Park?
Does the County own the tennis courts?
I would put flow meters out to verify that enough flow would be captured at the school in the Barton basin.
Would a gate close to force flow in or would you do weirs?
Would the Barton storage be off of a City sewer line?
The City's pump station pumps directly into the County's Barton pump station.
Ecology is looking at a TMDL on Fauntleroy Creek right now.
B1A/M2B: Barton Storage – Murray Conveyance
Is conveyance what causes this alternative to have the highest relative cost?
Have you looked at whether there is capacity at the Elliott Bay Interceptor?
This would use the West Seattle Tunnel? Remember, the County wants to squeeze Chelan in there.
B1A/M3B: Barton Storage – Murray Demand Management
No comments
M4: Murray Demand Management
No comments
B1A/M4B: Barton Storage – Murray End of Pipe Treatment
With this option, would the volume be removed from Alki?

Have you assumed costs for additional treatment and outfall capacity?
The outfall capacity is a problem.
There is overflow at the 63rd Ave. pump station when the head is too high to Alki. Although the overflow is chlorinated, it is not dechlorinated.
We need to look at the 140 MGD outfall at Alki – a diffuser has been added.
How big is North Creek storage compared to the size of potential storage at Murray?
The big tree in Lowman Beach Park must be left alone.
There is a generator at Murray now.
A big issue is the other projects that are happening at Murray. Can they all be done at once? Can some be delayed so they can all be done at once?
B4A/M1B: Barton Demand Management
Demand management might work in the Barton basin.
The City has been looking at specific areas in the southern part of Barton that could be disconnected, but that would ultimately tie into the combined system.
Curb cuts can attenuate flows. The City hasn't tested them, but they have been used in combined basins elsewhere in the U.S.
The City has a GIS layer for soils/infiltration. Is infiltration a concern?
Comments after Breakout Session on Barton and Murray CSO Alternatives
What about putting a storage tunnel between Barton and Murray underneath Lincoln Park, with portals on either end?
A storage tunnel would relieve pressure on Alki.
You could leave smaller parks alone.
Magnolia CSO
Since all of the alternatives include upgrading the SPU pump station, why not offload the SPU pipe?
Can King County offload the SPU pipe?
It would be important to know how much flow SPU has in the line.
SPU restored hydrobrake capacity in 2004 or 2005 and gave the County the flows that they were responsible for.
There are opportunities along the SPU pipe to intercept flows; it might be necessary to do multiple storage locations.
The site would have to be south of local connections, not west.
All of these options depend on geotechnical conditions.
Has the expansion of Terminal 91 been considered?
1A: Magnolia Upper Basin Storage
Has tunneling into the hill been considered?
1B: Magnolia Storage at CSO Site
Why would the SPU pump station need to be upgraded?
How close is the King County outfall to the City of Seattle outfall?
Does the City of Seattle have overflows there? I recollect that hydrobrakes were planned.
1C: Magnolia Storage Near Marina
No comments
2A: Magnolia Convey and Treat
Why would the SPU pump station need to be upgraded for this option?
Repumping a pump could be cost effective. You could put in new rotators.

Is the assumption for available capacity at Interbay a good one?
2B: Magnolia Convey and Treat
Why was convey and treat rejected?
3A: Magnolia End of Pipe Treatment
There is a school bus turnaround.
Does the footprint for the treatment facility include odor control, etc?
Staging could be a problem because of the tight space.
Dilution at the outfall needs to be considered; the water is shallow.
4A: Magnolia Demand Management
King County has one meter for flow coming from the top of the basin. There is another meter but it has not been calibrated.
Maybe a small area should be targeted for intensive demand management activities, and something else could be done in another area.
Is there capacity in the stormwater infrastructure that would allow for demand management activities?
Comments after Breakout Session on Magnolia CSO Alternatives
Why was O&M flagged red for the end of pipe treatment alternative?
Another treatment plant increases O&M work, especially if treatment facilities are built in other CSO basins.
Next Steps
Will life cycle costs be available at the next workshop?
King County CSO staff and O&M staff need to meet to discuss what to expect in terms of costs for each of the CSO control options. There is currently a great deal of uncertainty.
I believe O&M hours per facility are tracked. We could look at how many hours are spent at facilities after a storm.
The County could make an educated guess about travel time, and discuss whether an O&M team would be responsible for a particular group of facilities, or if O&M staff are traveling to facilities all over the place.
The City of Seattle is creating modeling tools for demand management methods such as roof disconnects and green roofs, which should be completed within the year. The City would probably be willing to share those tools with the County.
The County and the City would need to work out a relationship.
Does the City have CSOs that need to be controlled in any of these four Puget Sound Beach CSO basins?
Yes, although West Seattle is pretty close to being controlled, and the City thinks Magnolia is controlled. North Beach is a sanitary area according to the City. By definition, there are no CSOs.
Does the City have SSOs?
The City does not have SSOs, but some are borderline. The City is approximately 12-14 months of analysis away from knowing for sure.
For the City, making sure there is capacity for its flows is important.

Workshop Attendees

King County Wastewater Treatment Division	**King County Wastewater Treatment Division**
Dave Dittmar, *Capital Projects* Alton Gaskill, *Permitting, Compliance and Property Acquisition* Betsy Cooper, *Permitting, Compliance and Property Acquisition* Jennifer Kauffman, *Community Relations* Martha Tuttle, *Community Relations* Darrell Myers, *Construction Management* Sekhar Palepu, *Operations & Maintenance* Karl Zimmer, *Operations & Maintenance* Rob LaRock, *Operations & Maintenance*	Ron Kohler, *Capital Projects* Bob Swarner, *GIS* Kevin Schock, *Engineering* Karen Huber, *CSO Program Planning* John Phillips, *CSO Program Planning* Kenneth Eldridge, *Operations & Maintenance* Mary Beth Gilbrough, *Engineering* Steve Davidson, *Operations & Maintenance* Steve Witkowski, *Operations & Maintenance*
Seattle Public Utilities Drainage and Wastewater Division Jason Sharpley, *CSO Program Manager* Andrew Lee, *Manager, Control Structures* Ben Marre	**Consultants** Bob Eimstad, *Carollo Engineers* Brian Matson, *Carollo Engineers* Jeff Lykken, *Tetra Tech/KCM* Tim Kuhns, *Tetra Tech/KCM* Allen de Steiguer, *Carollo Engineers* Cara Wilson, *Carollo Engineers* Bob Wheeler, *Triangle Associates* Ellen Blair, *Triangle Associates* Lloyd Skinner, *ESA Adolfson* Lisa Adolfson, *ESA Adolfson*