MEETING MINUTES

MWH

MEETING DATE:	February 7, 2006
MEETING PLACE:	MWH Office Portland, Oregon
SUBJECT:	Collection System Master Plan Alternative Development Workshop
PREPARED BY:	R. Dale Richwine

ATTENDEES

City of Bend	
Ken Fuller	Michael Magee
Heidi Lansdowne	Paul Rheault
Dave Lee	Stan Smith

Consultant Team	
R. Dale Richwine - MWH	Gordon Merseth - CaMES
Ian Lang - MWH	Claudia Zahorcak – CLZ Consulting
Paul Giguere - MWH	
Steve Hyland -MWH	
Ed Barnhurst – MWH	
Chaithanya Vuppala - MWH	

INTRODUCTION

A workshop was held February 7, 2006 to evaluate the alternatives that were developed during Tasks 1 and 2 of the Collection System Master Planning project for the City. Consultant team members, City staff and outside consultants met for the one day workshop to develop and screen alternatives for evaluation. The intent of this workshop was to ensure that all appropriate alternatives will be considered during planning.

The consultant team consisted of specialists in collection system master planning and design. This team consisted of the following specialists:

- R. Dale Richwine – Project Manager for the collection system master plan. Dale is a member of MWH's Technical Directorate and has completed master plans for cities throughout Oregon and Washington.
- Ian Lang – Ian is on a five-year assignment to the United States from the United Kingdom to provide technology transfer within MWH. A member of MWH's Technical Directorate, Ian is one of the most knowledgeable individual in collection system modeling and master planning in the United States working on projects in Las Vegas, NV; Dallas, TX; Sacramento, CA; Atlanta, GA; and New York City, NY. Ian was a reviewer for MWH Soft for the development of the InfoSWMM software.
- Paul Giguere – Paul is located in the MWH San Diego, CA office. Paul specializes in wet weather modeling with an emphasis in continuous simulation. Paul has worked with Clean Water Services to develop peak wet weather flows for the Durham Pump Station Design and the Rock Creek and Durham AWTPs Facility Plans. Paul was on the team that assisted MWH Soft develop the InfoSWMM software.
- Steve Hyland – Steve is a mechanical engineer and one of the most senior project managers within MWH. Steve has extensive experience in the planning and design of pump stations and treatment plants. He recently completed the design of a new collection system and membrane treatment plant for the City of Los Osos, CA. During this project Steve conducted an extensive evaluation of alternative collection technologies to provide sanitary service to this currently unsewered city.
- Ed Barnhurst – Ed is a civil engineer with over 25-years of experience in the design of gravity collection systems and force mains. He is currently serving as the MWH Design Center Pipeline Design Lead where he is responsible for establishing the design guidelines used for pipeline design within MWH and for the quality review of all pipeline designs performed within the company.
- Gordon Merseth is a Principal Engineer with Crane and Merseth Engineering and Surveying (CaMES) since 1992. Prior to starting his own firm, Gordon was the Group Leader for CH2M HILL's Collection System Design Group in their Portland Office. Gordon has specialized in the planning and design of gravity sewers for over 25-years. Gordon is a subconsultant on this project and developed the alignments for the North and Southeast Interceptors in Task 2.
- Claudia Zahorcak is the Owner and a Principal Engineer of CLZ Consulting. Claudia has over 20-years experience in collection system master planning when she worked with Brown and Caldwell and CH2M HILL. She was one of the lead engineers during the development of the CSO Master Plan for the City of Portland.

This group of specialists in combination with the public works engineering, operations and maintenance staff from the City of Bend developed the alternatives to be evaluated during master planning for the City of Bend.

PLANNING CRITERIA

The planning criteria that will be used to evaluate the capacity of the existing system components and to develop new system components were reviewed with the assembled team of experts. The planning criteria were developed during Tasks 1 and 2 of the project. The

intent of the criteria review was to obtain confirmation of the criteria and do obtain any additional ideas and/or input from the team of experts.

Peaking Factors

The peaking factors used for the master plan will be based on a combination of the summer weekend diurnal peak. This criterion was developed during Task 1 of the planning effort and during the calibration of the model.

The diurnal and weekend peaking factors were developed for residential and combined residential/commercial areas during the flow monitoring that was performed in Task 1. These peaking factor curves will be applied to each sub-basin based on the zoning of the sub-basin.

The weekend flows in the system are higher than weekday flows. This is due to the transient population using seasonal homes and hotels on weekends to take advantage of the recreational opportunities provided in the area. Weekend peaking factors were developed from the flow monitoring data to provide the additional peak flows that are experienced.

Records at the treatment plant show that the system flows are up to 25% higher during the months of July and August as they are during February and March when the flow monitoring was performed. Therefore, a conservative peaking factor of 25% will be added to all system base flows to provide for the summer season peak.

Considering each of these peaking factors, the peak system flow will occur during the Diurnal Peak on a Saturday in August. Each of these peaking factors will be applied to base the base flows developed for each sub-basin in the model for evaluating system capacity.

Gravity Sewer Capacity

The criteria for determining the capacity of an existing gravity sewer is the depth of flow in the sewer compared to the pipeline diameter. The criterion to be used in this master plan for flows not influenced by rainfall is:

- $\frac{d}{D} = 0.8$

This criteria means that the gravity sewer is at capacity at a depth that is 0.8 times the pipe diameter. This criterion relates to a flow ratio of pipe flow to maximum flow of:

- $\frac{q}{Q} = 0.92$

This means that at a depth of 0.8 d/D, the flow will be at 92% of the pipes maximum flow capacity. The primary criteria to evaluate system capacity will be the 0.8 d/D criteria. If a

downstream pipe segment is at 0.8 d/D, the upstream segments can exceed this criterion due to the bottleneck. Therefore, all segments will also be checked for the q/Q criteria when the d/D criterion is exceeded. It shall be noted that this is to be used as the criteria for the evaluation of existing sewers. The City's design criteria will be used for the design of new sewers.

Design Wet Weather Event

The City of Bend system will require a different wet weather criterion than other Oregon cities located west of the Cascades. The climate is very dry with an average rainfall of 9-inchs per year with peak rainfall occurring in a summer thunderstorm. The water table is 200 to 300-feet below the surface which makes infiltration not an issue for most of the system. There is a flow peak that occurs during rain events. This is due to roof drain connections, leakage into manholes during street flooding and other inflow sources. The system capacity will need to be evaluated with some inflow added to the system. It was recommended that a basis for infow be developed and applied in the model. This flow should be applied to the existing system flow peaks.

Peak rainfall events will occur infrequently in the Bend area. Therefore, a different design criteria needs to be used for wet weather events than the d/D of 0.8 that will be used for dry weather flows. For peak rainfall events the sewer system will be allowed to surcharge, but no overflows are allowed. Therefore, the system will be modeled using the summer weekend diurnal peak with inflow to confirm that there will be no overflows during peak rainfall events.

Pump Station and Force Main Firm Capacity

Pump stations and force mains will be evaluated to ensure that system capacity can be maintained with one pump not in service to provide redundancy. This criterion is a standard of the industry and is required to meet EPA Class 1 redundancy criteria. Therefore for pump stations with two pumps, system peak flow needs to be pumped using only one pump. For a station with more than two pumps, system peak flow needs to be pumped with the largest pump out of service.

Headloss in the force main will increase as flow is increased at a rate of the square of the velocity. Therefore, pumping high velocities will require increased system pressures to pump the required flow. As a general rule of thumb, a velocity of six feet-per-second (fps) is used with the redundant pump not in service and a velocity of 10-fps with all pumps in service. This will be the criteria used to evaluate force main capacity in the master plan.

ALTERNATIVE DEVELOPMENT

A brainstorming session was held to develop alternatives to meet the following planning goals:

- Minimize bottle necks in the collection system

- Provide system capacity for future connections to the system
- Provide treatment and discharge of all wastewater generated within the UGB and UAR
- Maximize the use of gravity collection systems while minimizing the use of pump stations

The brainstorming session provided an opportunity for all workshop attendees to suggest alternatives. Each attendee provided an alternative in order until no additional alternatives could be suggested by the group. Following is the list of alternatives developed during the brainstorming session, in order, with a brief explanation of the alternative.

1) **Reduce Per Capita Consumption** – Implement a program of water conservation to reduce the volume of water use resulting in less wastewater being introduced to the sanitary sewer system.
2) **Industrial Recycling** – Implement a program to increase recycling by existing and new industrial users resulting in less wastewater being introduced to the sanitary sewer system.
3) **Replace Existing Trunk Sewer-Plant to Downtown** – The existing trunk sewer system can be replaced with a larger capacity system to meet the long term system needs. Construction cost of replacement may result in lower cost trenching due to the construction in the existing trench instead of the blasting required to construct new systems.
4) **Extend Westside Force Main Beyond Bottlenecks** – Considerable flow is currently generated on the west side of the river and pumped across the river by the Westside Pump Station. System bottlenecks occur downstream of the Westside Pump Station discharge. The discharge point can be moved downstream in the gravity trunk system by extending the force main.
5) **Regional Pump Stations With New Combined Force Main To WWTP** – Develop a system where local sewers flow to regional pump stations. The regional pump stations will then pump the flow to the WWTP through a lower cost force main instead of a larger and deeper gravity sewer. Force mains will be combined when possible.
6) **SE Interceptor** – Construct a new gravity interceptor to provide service to the southeast Bend areas
7) **Parallel Interceptor To Plant On Top Of Existing** – Construct the new interceptor to the treatment plant on top of the existing interceptor to take advantage of the current easement and lower trenching costs.
8) **North Interceptor** – Construct a new gravity interceptor to provide service to Juniper Ridge and the north and northwest Bend areas
9) **SE WWTP** – Construct a new treatment plant in the southeast area of Bend to treat flows generated in that area. Evaluate the use of current public lands at the landfill.
10) **Westside WWTP With Existing Pump Stations** – Construct a new treatment plant on the west side of the river to treat flows from the Westside Pump Station.
11) **Put Sewer In Canal** – Construct the new trunk sewers in the canals to minimize construction cost by reducing the cost of trenching.

12) **Eastside By Pass With Or Without WWTP** – Construct a force main on the east side of Bend. Based on overall system cost, build a new treatment plant on the east side.
13) **Maximize Flows From Existing Areas To N/SE Interceptor** – Construct new interceptors to serve the north and southeast areas of Bend. Divert flows from the existing systems to these new systems to the greatest extent possible.
14) **Central Tunnel** – Construct a tunnel from the downtown core area to the edge of the UGB. Pump from the tunnel to the treatment plant. Divert flows from the Westside pump station and south areas of Bend to the tunnel. Construction of the tunnel will reduce the interruption to traffic and commerce in the downtown core area.
15) **Pipe Burst Existing System** – Utilize pipe bursting to the greatest extent possible to increase the capacity of the existing system.
16) **Reuse Scalping Plants Following Reuse Needs Evaluation** – Develop a reuse plan to minimize the use of potable water requirements in the City. Use scalping plants to provide the reclaimed water for reuse.
17) **Eliminate Pump Stations Through Gravity Trunks Through Regional Pump Stations** – Construct gravity trunks where possible to eliminate local pump stations. The trunks can flow to existing gravity systems or regional pump stations to minimize the total number of pump stations.
18) **Manage Location Of Growth** – Growth can only occur when water, wastewater and transportation system are available. The location of growth can be managed through planned development of the infrastructure.
19) **Inline Storage** – Develop system storage at strategic points in the system to maximize the capacity of the existing system by reducing flow peaking.
20) **Continue With Existing Master Plan** - Continue with the concept of the existing Master Plan using multiple local pump stations.
21) **Westside Pump To Lagoon System** – Construct a new force main from the Westside Pump Station to pump flows to a new lagoon treatment system located on the west side of Bend.
22) **Westside Pump Station Located Away From The Existing Pump Station** – Construct a new pump station to replace the existing Westside Pump Station on a new site.
23) **Eastside Regional Plant To Save The Cost Of Interceptor With A Effluent Forcemain To Existing WWTP** – Construct a new treatment plant on the east side of Bend to minimize the cost of interceptors to the existing treatment plant.
24) **SE Regional Pump Station** – Construct a regional pump station to collect flows generated in southeast Bend. This pump station will transfer flow through a force main to the treatment plant. The force main will be a lower construction cost than a gravity interceptor.
25) **Maximize Onsite Treatment.-Use Of Existing Septic Tanks** – Continue the use of septic tanks for onsite treatment eliminating the need to expand the existing collection system capacity.
26) **Neighborhood/Cluster Treatment Plants** – Develop a system of neighborhood treatment plants to treat wastewater locally. This will minimize/eliminate the need to upgrade the existing collection system capacity.

27) **Localized Step Systems** – Use step systems for local collection systems to minimize construction costs.
28) **Second Pathway To WWTP With Interconnection To Existing WWTP Interceptor** – Construct a second interceptor to the treatment plant with an interconnection to the existing interceptor for transfer of flows between interceptors.
29) **Mandatory Purple Pipe System For New Development** – Develop a mandatory program for all new development to use reclaimed water. Local membrane package plants can be used to provide the reclaimed water. This will result in lower system flows.
30) **Seasonal Scalping Plants For Reduction Of Summer Peak** – Construct scalping plants in strategic areas to minimize the summer peak resulting in additional system capacity.
31) **Golf Course With Treatment Facility In SE** – Develop a new golf course in cooperation with a new treatment plant in southeast Bend.
32) **Redeveloping Murphy Road WWTP, Use Existing Reuse Line And Existing Infiltration Basins** – Construct a new treatment plant at the Murphy Road site. Use the existing reuse line and infiltration basins for transport and discharge of the treated effluent.
33) **Reuse Water To Canals-Year Round** – Construct membrane treatment plants and discharge Level IV reuse water to the canals.
34) **Expand Deschutes Brewery WWTP As Public/Private Partnership** - Develop a partnering agreement with the Deschutes Brewery to treat sanitary wastewater.
35) **Maximize Existing Capacity Through Operation And Maintenance** -
36) **Northwest Treatment Plant** – Construct a new treatment plant northwest of Bend to treat wastewater generated on the west side of the river. Flows from the Westside Pump Station will be pumped to this new treatment plant.
37) **Reuse On Median On Highway 97 Bypass** – Construct a reclaimed water treatment system to provide reuse water to provide irrigation on the Highway 97 median.
38) **City Managed Horticulture Business—Reuse For Parks and Development** – Develop a City owned and managed horticulture business for growing plants for use on City parks. Use reclaimed water for nursery irrigation.
39) **Reuse For Reforestation In NW Sector** – Develop a reclaimed water program for providing irrigation water for the reforestation of the northwest sector of Bend.
40) **Peak Flow Shaving Tanks- Temporary Storage on Daily Basis**. -
41) **Local Vacuum Systems** – Use vacuum systems on a local basis to minimize construction cost and system inflow.
42) **Coordinate With Transportation Planning For Right Of Ways** – Coordinate the development of new interceptors with the transportation planning to minimize the requirement for easements.
43) **Localized Area Pump Stations** – Use localized area pump stations to minimize the construction of gravity systems.
44) **Upsize Of Existing System At A Local Level** – Provide increased system capacity at the local level.
45) **Coordinate Property / Assessment Acquisition** – Coordinate the acquisition of property for easements with other projects.
46) **Inflow Control** – Develop a program to minimize system inflow.

47) **New River Discharge --West Side Pump Station** – Construct a new treatment plant at the Westside Pump Station site with a discharge of high-quality effluent to the Deschutes River.
48) **Utilize Development Based Storage** – Incorporate storage at the local level to increase system capacity by lowering system peaking. Local storage can be constructed as part of new developments.
49) **Juniper Ridge Purple Pipe System** – Develop a reclaimed water program in Juniper Ridge.
50) **Portable Membrane Plants For Short-Term Area Use** - Expansion of the system will take time and considerable monies. Package membrane scalping plants can be used to provide temporary service for development until the ultimate collection system can be constructed. The plants can then be moved to serve a new area.
51) **Develop Equity Based Connection Fees To Reflect Cost Of Service** – Perform a rate study to develop equity based connection fee that will reflect the true cost of service.
52) **Modified Parallel System for Delineations (Next Block)** – Use parallel systems to relieve sewer system capacity limitations. These systems can be paralleled on the block next to the existing system.
53) **Alternative 52 With Storage** – Incorporate the modifications specified in Alternative 52, but also add local storage to minimize system size by reducing peak flows.

ALTERNATIVE SCORING

Each of the alternatives developed during the brainstorming session were then scored. To score the alternatives, each of the workshop attendees was given five votes. The rules were that they could use each of the five votes as they like. For instance, they could place one vote on each of five alternatives or multiple votes could be placed on a single alternative, if desired. The results of the voting for the 53 alternatives are summarized on ***Table 1***.

Table 1
Alternative Voting Summary

Alternative Number	Alternative Descriptions	Score
1	Reduce per capita consumption	1
2	Industrial Recycling	-
3	Replace existing trunk sewer - Plant to Downtown (Lower cost trenching)	3
4	Extend Westside Force main beyond Bottle necks	2
5	Regional Pump stations with new combined Force main to WWTP	6
6	SE Interceptor	5
7	Parallel Interceptor to plant on top of existing	1
8	North Interceptor	7
9	SE WWTP	-
10	West side WWTP with existing Pump stations	6
11	Put Sewer in Canals - (Pipe Canals)	2
12	Eastside by Pass With or Without WWTP	1
13	Maximize Flows from existing areas to N/SE Interceptor	2

Table 1 (cont)
Alternative Voting Summary

Alternative Number	Alternative Descriptions	Score
14	Central Tunnel	-
15	Pipe burst existing system	1
16	Reuse Scalping Plants following reuse needs evaluation	1
17	Eliminate Pump stations through gravity trunks through regional pump stations	6
18	Manage location of growth	-
19	Inline Storage	1
20	Continue existing master plan	-
21	Westside Pump to lagoon system	-
22	Westside Pump station located away from the existing pump station	-
23	Eastside regional Plant to save the cost of Interceptor with a effluent Forcemain to existing WWTP	1
24	SE regional Pump station	2
25	Maximize onsite treatment.-Use of existing septic tanks	1
26	Neighborhood/Cluster treatment Plants	Same as 25
27	Localized Step systems	-
28	Second Pathway to WWTP with interconnection to existing WWTP	-
29	Mandatory Purple pipe system for new development	1
30	Seasonal Scalping Plants for reduction of summer peak	-
31	Golf Course With treatment facility in SE	-
32	Redeveloping Murphy road WWTP, Use existing reuse line and existing infiltration basins	5
33	Reuse water to canals-year round	3
34	Expand Deschutes Brewery WWTP as Public/Private partnership destination resorts	1
35	Maximize existing capacity through Operation and Maintenance	-
36	Northwest treatment Plant	2
37	Reuse on median of Bypass(97)	-
38	City managed horticulture business—Reuse for parks and development	1
39	Reuse for reforestation in NW sector	1
40	Peak flow shaving tanks- temporary storage on daily basis	-
41	Local vacuum systems	-
42	Coordinate with transportation planning for right of ways	-
43	Localized area pump stations	-
44	Upsize of existing system at a local level	-
45	Co-ordinate property / assessment acquisition	-
46	Inflow Control	-
47	New River discharge --West Side Pump station	3
48	Utilize development based storage	-
49	Juniper ridge purple pipe system	-
50	Portable membrane plants for short-term area use	1
51	Develop equity based connection fees to reflect cost of service	-
52	Modified parallel system for delineations(next block)	-
53	Option 52 with storage	-

As shown on ***Table 1***, not all of the alternatives received votes. Many of the alternatives received multiple votes. It can therefore be deduced that the alternatives that received the most votes were the most favorable and should be investigated further. The alternatives that received votes in order of ranking are summarized in ***Table 2***.

Table 2
Alternative Vote Ranking

Alternative Number	Alternative Descriptions	Score
8	North Interceptor	7
5	Regional pump stations with new combined Force main to WWTP	6
10	Westside WWTP with existing pump stations	6
17	Eliminate Pump stations through gravity trunks through regional pump stations	6
6	SE Interceptor	5
32	Redeveloping Murphy road WWTP, Use existing reuse line and existing infiltration basins	5
3	Replace existing trunk sewer - Plant to Downtown (Lower cost trenching)	3
33	Reuse water to canals year round	3
47	New River discharge -- West Side Pump station	3
4	Extend Westside Force main beyond Bottle necks	2
11	Put Sewer in Canal - (Pipe Canals)	2
13	Maximize Flows from existing areas to N/SE Interceptor	2
24	SE regional Pump station	2
36	Northwest treatment Plant	2
1	Reduce per capita consumption	1
7	Parallel Interceptor to plant on top of existing	1
12	Eastside by Pass With or Without WWTP	1
15	Pipe burst existing system	1
16	Reuse Scalping Plants following reuse needs evaluation	1
19	Inline Storage	1
23	Eastside regional Plant to save the cost of Interceptor with a effluent Forcemain to existing WWTP	1
25	Maximize onsite treatment.0Use of existing septic tanks	1
29	Mandatory Purple pipe system for new development	1
34	Expand Deschutes Brewery WWTP as Public/Private partnership destination resorts	1
38	City managed horticulture business — Reuse for parks and development	1
39	Reuse for reforestation in NW sector	1
50	Portable membrane plants for short-term area - use	1

Following the scoring of alternatives, the preferred alternatives that received the highest number of votes were evaluated. These alternatives were then summarized into a list of "Grouped Ideas". The grouped ideas were:

- North Interceptor
- Regional Pump stations /Force main WWTP
- Westside WWTP [variety of discharge options]
- Eastside WWTP [Landfill or Murphy Road sites]
- Regional Pump station strategy with storage
- SE Interceptor
- Maximum use of existing trenches for interceptor
- Use Canal Corridor to the greatest extent possible
- Extend Westside Force Main beyond bottlenecks
- Localized Treatment-Short term and Long term [Optional canal discharge]
- Develop neighborhood treatment systems
- Water Conservation/Purple pipe/Industrial reduced discharge

The recommendation of the workshop attendees was to take each of these "Grouped Strategies" forward into master planning. Each of these alternatives needs to be evaluated based on feasibility and economics during master planning.

RECOMMENDED ACTION ITEMS

In addition to the recommended "Grouped Ideas" to be developed in the Master Plan, a list of add ional recommendations were developed during the workshop. These recommendations are:

1) Need financial Barometer for CIP growth
2) Sensitivity Analysis on Population density: 4.7 vs. 5.3
3) Master Plan must be in a form that can be used by City Staff.
4) Strategic Plan vs. Tactical Plan (Alternative Scenarios)
5) Define the Wet Weather Event
6) Need initial projects that will lead to a long-term plan.
7) Look at different alternatives early in the project.
8) Run the model with unsewered only coming in.
9) Add Unsewered to Population Projection.
10) Documentation needs to discuss the "Cost-effective Plan" and justify it.