MWMC Eugene-Springfield WPCF Facility Plan—Peak Flow Management Alternatives

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Project File—Task 2.2 and 2.3

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Executive Summary

As part of the Facility Plan Update for the Metropolitan Wastewater Management Commission (MWMC), alternatives were evaluated for increasing the peak flow treatment capacity at the Eugene-Springfield (E-S) Water Pollution Control Facility (WPCF) from 175 mgd to 277 mgd by 2025. This increase in peak flow capacity is necessary to comply with the Oregon Department of Environmental Quality's (DEQ's) requirement that the wet season flow associated with the 5-year, 24-hour rainfall event be accommodated by MWMC's facilities without resulting in sanitary sewer overflows (SSOs). The alternatives analysis presented in this technical memorandum was conducted at the same time as the collection system modeling update effort (also being conducted as part of this Facility Plan Update). A 300 mgd value for peak flow was assumed for developing and comparing these peak flow management alternatives, even though the modeling effort estimated the peak flow to be 277 mgd in 2025. It was concluded that this safety factor was necessary in light of the uncertainty associated with predicting peak flow levels in 20 years. MWMC is continually collecting pre- and post-data to assess the effectiveness of their infiltration and inflow (I/I) reduction efforts and it is anticipated that the peak flow values will periodically be revised as new information becomes available. The preliminary cost estimates that have been developed for the purpose of comparing alternatives are based on the 300 mgd value and are not anticipated to be significantly impacted if the peak flow is reduced from 300 mgd to 277 mgd.

Modifications to the E-S WPCF will be required to accommodate this peak flow. The modifications would be constructed in phases to ensure continued compliance with effluent permit requirements. The alternatives evaluated in this memorandum use a combination of primary treatment and secondary treatment in conjunction with effluent blending to treat the peak flows. Current effluent blending policy is still evolving; however, for the alternatives presented to be successful, a key underlying assumption was made that some level of effluent blending would continue to be an acceptable approach to treating the peak wet weather flows. This technical memorandum evaluates the following three alternatives for treating peak wet weather flows at the E-S WPCF:

- Alternative 1 – Additional Primary Clarifiers

  Four new primary clarifiers would be constructed and used in conjunction with the existing primary clarifiers to treat the entire 300 mgd peak flow. Primary effluent in excess of 160 mgd would be diverted around the secondary treatment system. The primary and secondary effluents would be disinfected and blended prior to discharge to the river. This alternative essentially continues MWMC's current approach to accommodating peak flows.

- Alternative 2 – High Rate Clarification (HRC)

  A new high rate clarification unit process would be constructed and used in conjunction with the existing primary clarifiers to treat the entire 300 mgd peak flow. A pump station would divert peak flows in excess of 160 mgd from preliminary treatment to the new HRC treatment facility. Primary effluent from the HRC facility would be diverted around the secondary treatment system. The HRC primary and secondary effluents would be disinfected and blended prior to discharge to the river.

- Alternative 3 – Parallel Primary and Secondary Treatment

  During peak flow events a dynamic flow management strategy would be used to optimize the existing primary and secondary treatment capacities. Two new pump stations would be used to divert preliminary treated wastewater directly to secondary treatment and divert primary effluent around secondary treatment. When influent flows exceeded 160 mgd, primary and secondary treatment processes would begin to operate in parallel.

All alternatives were evaluated assuming that the capacity of the existing four primary clarifiers would be enhanced/increased to 160 mgd by adding energy dissipating inlets (EDIs), flocculation feed wells, and density current baffles, and would be operated without a sludge blanket (that is, primary sludge thickened outside the primary clarifier). However, the capacity and performance of the primary clarifiers should be evaluated after the baffling improvements are complete to determine when the new thickening equipment and operational changes will need to be in place to allow the WPCF to continue to meet effluent permit requirements. All alternatives also include an increase in secondary treatment capacity to 160 mgd by enhancing secondary clarifiers and by constructing two additional clarifiers. The evaluation was performed assuming that future permits would not include an increase in allowable total suspended solids (TSS) and carbonaceous 5-day biochemical oxygen demand ($CBOD_5$) effluent mass limits.

Evaluation of the alternatives includes both a relative cost comparison and a non-monetary evaluation. Several improvements will ultimately need to be constructed independent of which peak flow alternative is ultimately implemented because they serve multiple benefits (for example, ammonia removal, dry season mass limits, etc.) and/or they will still be required for all three peak flow management alternatives. These improvements would be constructed in phases, as necessary, to allow the WPCF to continue to meet permit effluent requirements. These improvements include enhancements to the existing primary and secondary clarifiers, additional secondary clarifiers, tertiary filters, headworks facility, an effluent blending structure, and sludge thickening equipment. These improvements, which are common to the alternatives, were not included in the relative cost comparison. Only improvements that were unique to each alternative were included. The results from the relative cost and non-monetary comparisons are summarized in Table 1.

TABLE 1
Cost Comparison of Three Alternatives
MWMC Facility Plan, Eugene-Springfield

Alternative	Capital Cost (millions of 2004 dollars)	Non-Monetary Comparison (based on maximum of 30 points)
Alternative 1 – Additional Primary Clarifiers	$31	20
Alternative 2 – HRC	$25	20
Alternative 3 – Parallel Primary and Secondary Treatment	$11	23

All three alternatives can meet the anticipated effluent requirements for $CBOD_5$ and TSS. Figure 1 illustrates the anticipated weekly TSS loadings for each alternative, as well as the relative costs for each alternative.

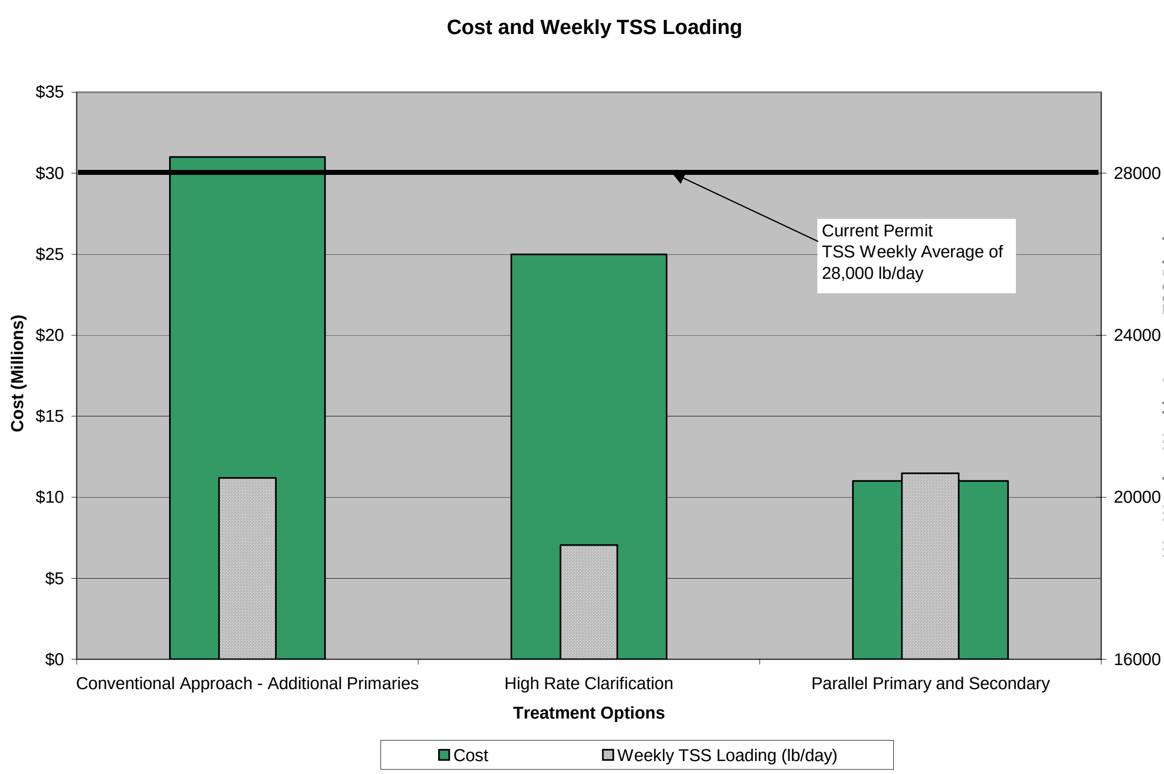

FIGURE 1
Anticipated Weekly TSS Loadings and Relative Costs
MWMC Facility Plan, Eugene-Springfield

Alternative 3 - Parallel Primary and Secondary Treatment is recommended for treating peak wet weather flows. All three alternatives had similar non-cost evaluation results; however, Alternative 3 would be considerably less expensive to construct. The Alternative 3 approach needs to be presented to DEQ before proceeding with any pre-design phase activities.

Introduction

This technical memorandum has been prepared as part of the Metropolitan Wastewater Management Commission (MWMC) Facility Plan Update (MWMC Project No. 80010) and evaluates alternatives for treating peak wet weather flows at the Eugene-Springfield Water Pollution Control Facility (E-S WPCF). The U.S. Environmental Protection Agency (EPA) has mandated that WPCFs eliminate sanitary sewer overflows (SSOs) by the year 2010 and treat peak wet weather flows to secondary treatment standards.

Previous studies have concluded that peak flows could be conveyed by the collection system to the E-S WPCF. Once flows have been conveyed to the E-S WPCF, significant modifications to the facility would be required to convey and treat the peak flow. Collection system modeling results estimated the 2025 projected peak hour flow to the E-S WPCF to be 277 mgd. The alternatives analysis presented herein was conducted at the same time as the collection system modeling update effort (also being conducted as part of this Facility Plan Update). A 300 mgd value for peak flow was assumed for developing and comparing these peak flow management alternatives, even though the modeling effort estimated the peak flow to be 277 mgd in 2025. It was concluded that this safety factor was necessary in light of the uncertainty associated with predicting peak flow levels in 20 years. MWMC is continually collecting pre- and post-data to assess the effectiveness of their infiltration and inflow (I/I) reduction efforts and it is anticipated that the peak flow values will periodically be revised based on the more current data and collection model calibrations and output. The preliminary cost estimates that have been developed for the purpose of comparing alternatives are based on the 300 mgd and are not anticipated to be significantly impacted if the peak flow is reduced from 300 mgd to 277 mgd.

Three alternatives were analyzed using a spreadsheet model developed to simulate the projected peak flows and estimate the resulting effluent biochemical oxygen demand (BOD) and total suspended solids (TSS) concentrations. The spreadsheet model used historical unit process performance data from peak flow events in conjunction with anticipated unit process performance expectations to simulate worst-case average weekly and monthly values for BOD and TSS. Compliance with the monthly average 85 percent removal requirement was also assessed. The results of each model run were compared with current National Pollutant Discharge Elimination System (NPDES) BOD and TSS permit requirements to assess the alternatives ability to meet both current and potential future effluent limits.

Existing Facilities

Preliminary treatment at the E-S WPCF consists of influent pumping, coarse bar screening, and aerated grit removal. The current capacity of these facilities ranges from 175 to 210 mgd limited by the influent screening capacity. Primary treatment is accomplished with traditional primary clarification using the clarifiers for primary sludge thickening. The effective peak flow primary treatment capacity is estimated at 90 mgd with all four primary clarifiers in service, although the facility pushes in excess of 200 mgd through these clarifiers during peak flow events. Secondary treatment facilities consist of eight aeration basins and eight secondary clarifiers. The current peak flow secondary treatment capacity is estimated at 103 mgd and is limited by secondary clarification. Primary effluent flows over 103 mgd are diverted around secondary treatment through a diversion conduit and recombined with the secondary effluent prior to disinfection. Disinfection facilities consist of gaseous chlorine with four chlorine contact basins and gaseous sulfur dioxide for de-chlorination. The peak flow disinfection capacity is estimated at 215 mgd, limited by the chlorinators, although hydraulic restrictions and effluent flow measurement can limit the capacity to 175 mgd.

Preliminary Screening of Alternatives

In order to convey and treat 300 mgd through the E-S WPCF, a number of unit process modifications and expansions are required. Suitable unit process alternatives and technologies to accomplish this were identified in Technical Memorandum No. 2, ***Preliminary Screening of Alternatives***. Further alternatives analysis can be found in Technical Memorandum No. 1, ***Wet Weather Peak Flow Analysis;*** No. 5, ***Pretreatment Expansion Alternatives***; No. 6, ***Primary Clarifier Capacity Analysis and Enhancements***; No. 7***, Secondary Treatment Alternatives***; No. 9, ***Peak Flow Management Alternatives;*** and No. 10, ***Disinfection Alternatives*** memorandums prepared as part of this Facility Plan Update. For this analysis it has been assumed that the plant hydraulics, influent pumping, preliminary treatment, and disinfection unit processes at the facility will be modified or expanded to convey and treat the projected 2025 peak hour flow.

This memorandum focuses on the treatment alternatives required to treat the entire peak flow to secondary treatment standards. To accomplish this goal the alternatives will need to use a combination of primary and secondary treatment technologies. For all alternatives it has been assumed that the existing primary clarifiers have been modified in accordance with the ***Primary Clarifier Capacity Analysis and Enhancements*** memorandum to include the addition of baffling and primary sludge thickening outside of the primary clarifiers. The clarifiers could be stress-tested after the installation of the recommended baffling to determine when the new thickening equipment and operational changes will need to be in place to allow the WPCF to continue to meet effluent permit requirements. With these modifications the peak flow capacity of the existing primary clarifiers is assumed to be 160 mgd. Furthermore, it has been assumed that the secondary treatment capacity has been modified in accordance with the ***Secondary Treatment Alternatives*** memorandum to treat a peak flow of 160 mgd. Thus, an additional 140 mgd (300 mgd less 160 mgd) of alternatively treated flow must be combined with the secondary effluent flow of 160 mgd, and the combined flow must meet the existing NPDES permit requirements and secondary treatment standards.

Suitable primary treatment technologies identified in the ***Preliminary Screening of Alternatives*** memorandum include the following:

- Add new primary clarifiers to expand capacity
- Use high rate sedimentation to treat a portion of the flow to expand capacity

Each candidate process was given scores of 1 to 5 based on various performance, operations and maintenance (O&M), and implementation criteria. The ideas receiving the highest combined scores were given more consideration for inclusion in alternatives to be evaluated for peak flow management. "Add new primary clarifiers" received the highest score at 43, followed by "add new partial high rate sedimentation" with a score of 41. These candidate processes are incorporated into some of the alternatives outlined in this memorandum to address peak flow management.

Peak Flow Management Alternatives

Alternative 1 – Additional Primary Clarifiers

This alternative proposes the construction of new primary clarifiers to treat flows in excess of 160 mgd. The result would be four additional new primary clarifiers having a capacity of 140 mgd for a total primary clarifier capacity of 300 mgd. Both new and existing primary clarifiers would be operated without a sludge blanket and would include baffling. At the anticipated surface overflow rates (SORs), it was assumed that all the primary clarifiers would remove 50 percent of the TSS and 35 percent of the carbonaceous 5-day biochemical oxygen demand ($CBOD_5$). Primary effluent in excess of 160 mgd would be diverted around the secondary treatment system.

Secondary effluent characteristics were estimated using historical plant data in conjunction with the anticipated modified process performance. It was assumed that the secondary effluent TSS and $CBOD_5$ concentrations would be 15 mg/L and 10 mg/L, respectively. It was also assumed that a new tertiary treatment system would treat 30 mgd of the plant secondary effluent prior to disinfection. Tertiary filters are expected to remove approximately 80 percent of the secondary effluent TSS.

Both primary and secondary effluents would be disinfected in separate flow streams and blended together prior to discharge into the river. Figures 2 and 3 illustrate the process flow schematic and the proposed layout for Alternative 1.

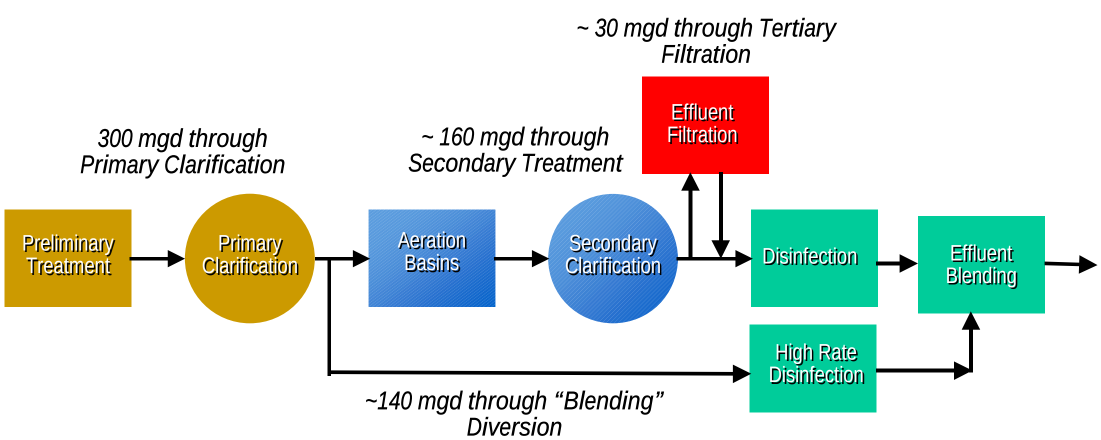

FIGURE 2
Process Flow Schematic for Alternative 1—Additional Primary Clarifiers
MWMC Facility Plan, Eugene-Springfield

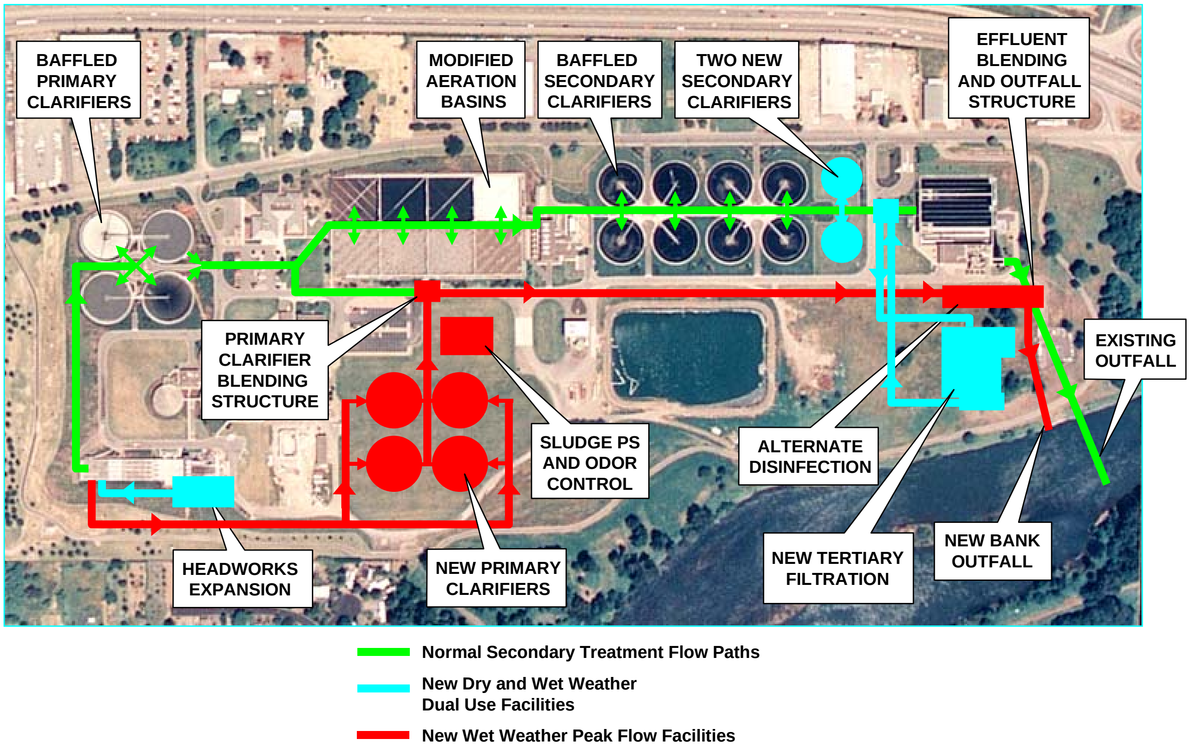

FIGURE 3
Proposed Layout for Alternative 1—Additional Primary Clarifiers
MWMC Facility Plan, Eugene-Springfield

Alternative 2 – High Rate Clarification (HRC)

Alternative 2 uses High Rate Clarification to treat peak flows over 160 mgd, the existing primary clarifier capacity once enhancements are made. One new pump station would be required to divert preliminary treated wastewater to the HRC facility. The result would be the addition of enough HRC to treat 140 mgd of preliminary treated wastewater and produce primary effluent. The total existing and new primary treatment capacity would then be 300 mgd. The existing primary clarifiers would be operated without a sludge blanket and would include baffling. At the anticipated SORs, it was assumed that the existing primary clarifiers would remove 50 percent of the TSS and 35 percent of the $CBOD_5$. It was further assumed that the HRC system would remove 70 percent of the TSS and 40 percent of the $CBOD_5$. Primary effluent from the existing primary clarifiers would continue on to secondary treatment. Primary effluent from the HRC system would continue on to disinfection and effluent blending.

Secondary effluent characteristics were estimated using historical plant data in conjunction with the anticipated modified process performance. It was assumed that the secondary effluent TSS and $CBOD_5$ concentrations would be 15 mg/L and 10 mg/L, respectively. It was also assumed that a new tertiary treatment system would treat 30 mgd of the plant secondary effluent prior to disinfection. Tertiary filters are expected to remove approximately 80 percent of the secondary effluent TSS.

Both HRC and secondary effluents would be disinfected in separate flow streams and blended together prior to discharge into the river. Figures 4 and 5 illustrate the process flow schematic and the proposed layout for Alternative 2.

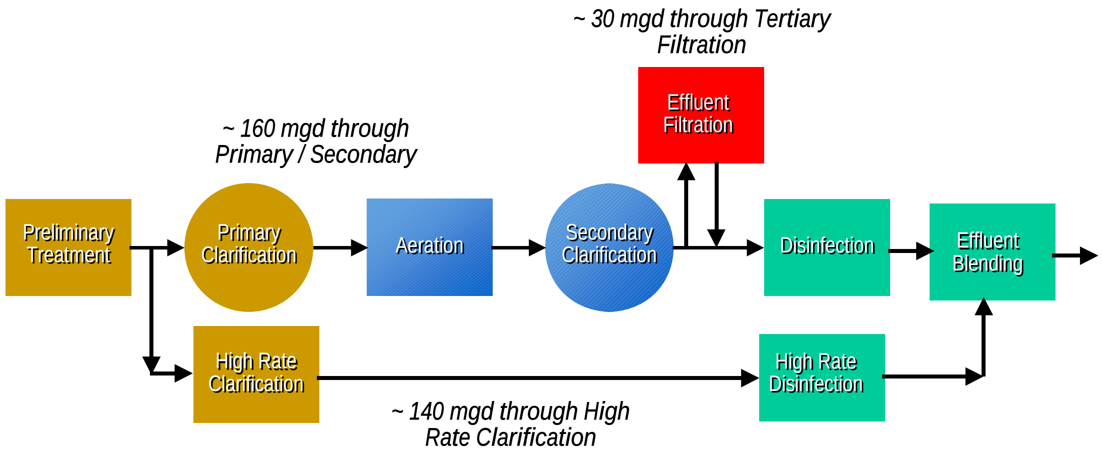

FIGURE 4
Process Flow Schematic Alternative 2—HRC
MWMC Facility Plan, Eugene-Springfield

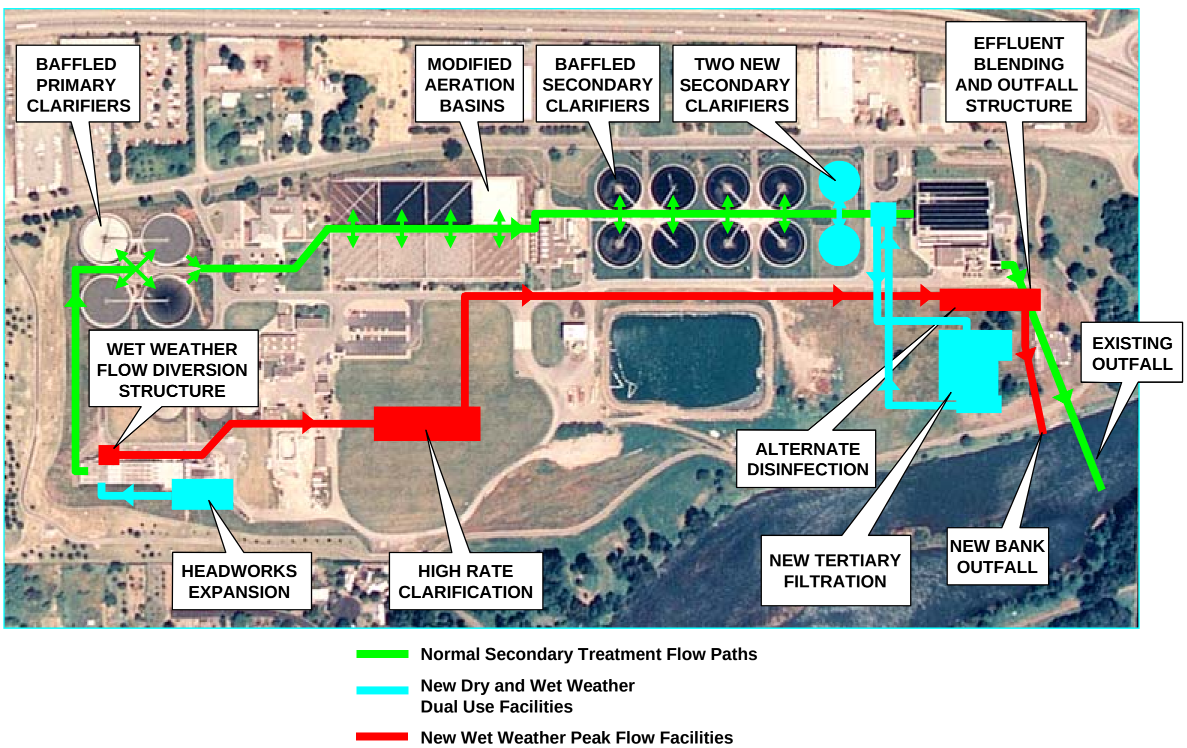

FIGURE 5
Proposed Layout Alternative 2—HRC
MWMC Facility Plan, Eugene-Springfield

Alternative 3 – Parallel Primary and Secondary Treatment

Alternative 3 uses parallel primary and secondary treatment in conjunction with a dynamic flow management strategy to treat the peak wastewater flow. Flow management would occur on two levels: primary flow management, and secondary flow management.

Primary flow management is defined as the management of primary effluent flows. Primary effluent flow, all or a portion thereof, can be either routed to secondary treatment or diverted around secondary treatment. Diversions would be controlled with a new primary effluent diversion pump station. Once total plant flows start to exceed 160 mgd, diversion would begin. Primary influent flows in excess of primary clarifier capacity would be channeled directly to secondary treatment. Once the secondary design capacity is reached, any additional primary clarifier effluent (approximately up to 140 mgd) could be diverted around secondary treatment.

Secondary flow management is defined as the management of preliminary treated waste-water. Preliminary treated wastewater (all or a portion) can be routed to primary treatment or diverted around primary treatment and routed directly to the aeration basins. Diversions would be controlled with a new preliminary effluent diversion pump station. Preliminary treated wastewater in excess of 137 mgd would be diverted directly to the secondary treatment system up to the modified secondary treatment capacity of 160 mgd. Although it is anticipated that the modified primary clarifiers will treat up to 160 mgd of capacity, 137 mgd is the flow rate through the existing primary clarifiers at which point it is anticipated that the TSS removal efficiency will begin to decline. Thus, this flow rate provided a conservative estimate, the rate of which was used to trigger the diversion of preliminary treated effluent directly to the secondary treatment system. Preliminary treated effluent up to 160 mgd may be diverted around primary treatment directly to the aeration basins.

Under this flow management strategy, the influent to the secondary treatment system when the total plant influent exceeded 160 mgd would consist of a combination of preliminary treated wastewater and primary effluent. Only under the peak hour flow scenario would the secondary influent consist of 100 percent preliminary treated effluent, and only then for very short periods of time. In addition, the hydraulic detention time in the aeration basins far exceeds the amount the time that any sustained diversion might occur over the course of a day. For these reasons the secondary effluent characteristics were estimated using historical plant data in conjunction with the anticipated modified process performance. It was assumed that the secondary effluent TSS and $CBOD_5$ concentrations would be 15 mg/L and 10 mg/L, respectively, the same as for the other alternatives. It was also assumed that a new tertiary treatment system would treat 30 mgd of the plant secondary effluent prior to disinfection. Tertiary filters are expected to remove approximately 80 percent of the secondary effluent TSS.

As total plant flows increase from 160 mgd to 300 mgd, the quantity of preliminary treated effluent diverted around primary clarification increases and the quantity of primary effluent diverted around secondary treatment increases. At this point the primary and secondary treatment systems can be modeled as parallel treatment processes. The diverted primary effluent and secondary treated effluent would be disinfected in separate flow streams and blended together prior to discharge into the river. The assumptions and estimated flow stream characteristics were used in conjunction with the flow management strategy outlined in Table 2 to predict the combined effluent conditions for a maximum week and a monthly flow. Figures 6 and 7 illustrate the process flow schematic and the proposed layout for Alternative 3.

TABLE 2
Parallel Primary and Secondary Treatment Flow Strategy
MWMC Facility Plan, Eugene-Springfield

Plant Influent Flow (mgd)	Total Flow Through Secondary Treatment	Preliminary Treated Effluent to Secondary Treatment	Primary Treated Effluent to Secondary Treatment	Primary Treated Effluent Diverted Around Secondary Treatment
0-137	0 increasing to 137	0	0 increasing to 137	0
137-160	137 increasing to 160	0 increasing to 23	137	0
160-297	‘160	23 increasing to 160	137 decreasing to 0	0 increasing to 137
297-300	160	160	0	137 increasing to 140

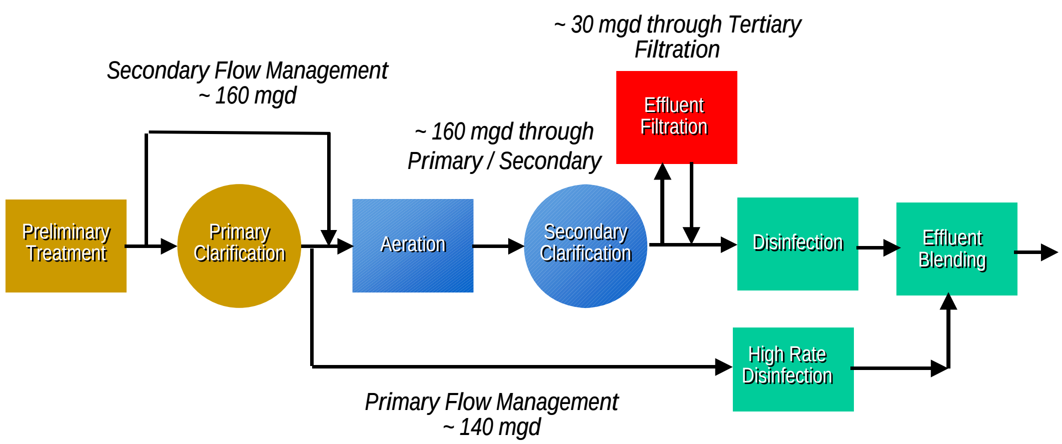

FIGURE 6
Process Flow Diagram Alternative 3—Parallel Primary and Secondary
MWMC Facility Plan, Eugene-Springfield

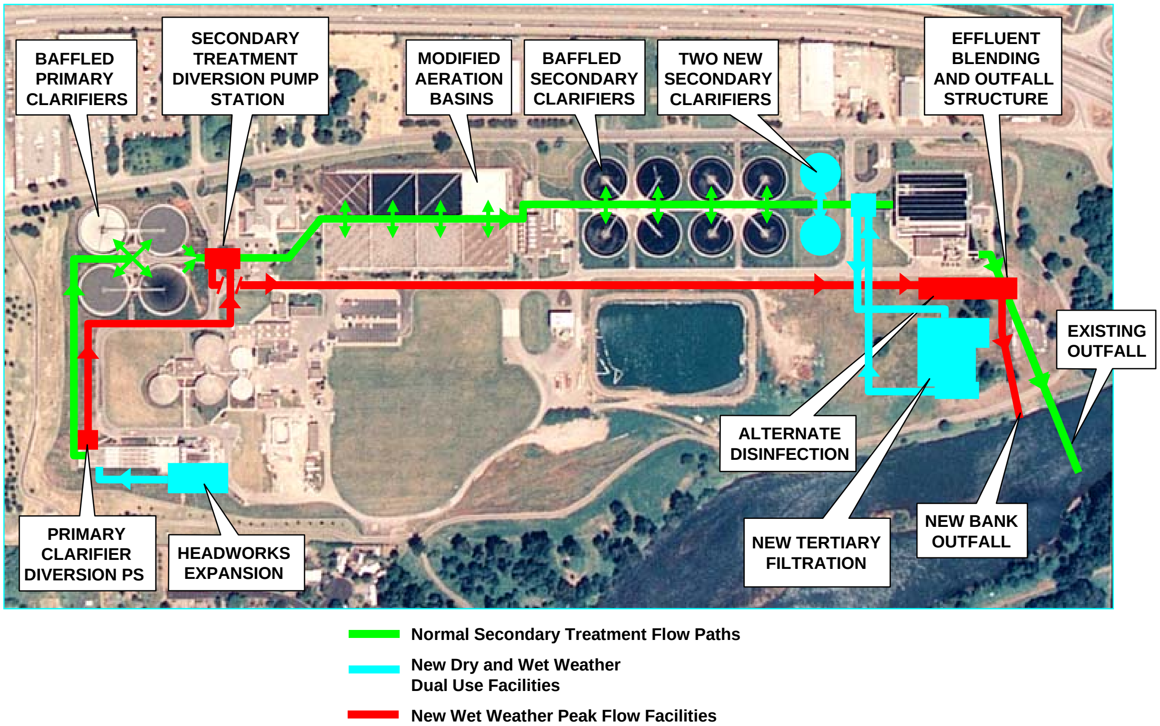

FIGURE 7
Proposed Layout Alternative 3—Parallel Primary and Secondary Treatment
MWMC Facility Plan, Eugene-Springfield

Permit Compliance Assessment

The three alternatives were analyzed using a dynamic spreadsheet model developed to simulate the projected peak flows and estimate the resulting effluent BOD and TSS concentrations. Historical unit process performance data from peak flow events and anticipated unit process performance expectations were used in conjunction with previously outlined alternative assumptions to simulate worst-case average weekly and monthly values for BOD and TSS. Where specific E-S WPCF data were not available, either performance data from other similar facilities were used, or best professional judgement was applied to obtain values. The results of each model run were compared with the current NPDES BOD and TSS permit requirements to assess the alternative's ability to meet both current and potential future effluent limits. The E-S WPCFs existing wet weather permit requirements for BOD_5 and TSS are summarized in Table 3.

TABLE 3
Existing Permit Conditions
MWMC Facility Plan, Eugene-Springfield

Parameter	Average Effluent Concentrations Monthly & Weekly	Monthly Average (lbs/day)	Weekly Average (lbs/day)	Daily Maximum (lbs)
$CBOD_5$	25 mg/L & 40 mg/L	16,000	24,000	32,000
TSS	30 mg/L & 45 mg/L	19,000	28,000	38,000

$CBOD_5$ = Carbonaceous Biochemical Oxygen Demand
TSS = Total Suspended Solids

The current NPDES permit suspends the daily effluent mass limits for both BOD and TSS if the flow exceeds twice the average dry weather design flow. Historically this has been the case for peak wet weather flows and it has been assumed that the daily effluent mass limitations would not apply to the alternatives under consideration. All alternatives have been evaluated for compliance against the current average monthly and weekly mass limits, as well as the monthly average 85 percent removal requirement.

Flow

The 2025 projected maximum week wet weather flow of 165 mgd was used as the basis for comparison of the treatment alternatives. Historical flow data from January of 1992 through September of 2003 were reviewed to identify the seven consecutive days that yielded the highest average flow. The maximum historical average week flow of 136 mgd occurred during December 5 through December 11, 1996. A flow ratio factor of 165/136 mgd, or 1.2, was then applied to the historical daily flows to predict projected daily flows that would be associated with the 165 mgd average week. The historical and projected daily and maximum week flows are summarized in Table 4.

TABLE 4
Peak Week Actual and Projected Average Daily Flows
MWMC Facility Plan, Eugene-Springfield

Day	Date	Historical Average Daily Flow	Projected Average Daily Flow
1	12-5-96	144	174
2	12-6-96	125	151
3	12-7-96	129	156
4	12-8-96	170	206
5	12-9-96	139	168
6	12-10-96	134	162
7	12-11-96	111	135
Weekly Average Flow		136	165

For this set of weekly historical data the annual peak hourly flow did not occur during the peak week. The historical record does show occurrences where the peak hour flow does occur during the peak week. To be conservative and to ensure that the weekly average TSS discharge would not exceed the existing permit limit of 28,000 lbs/day, the maximum day of the projected average daily flows shown in Table 4 was replaced with an estimated average daily flow that would contain the projected 2025 peak hour flow of 300 mgd. This was accomplished by applying the peak hourly flow of 300 mgd to a normalized 2025 projected hydrograph developed from collection system modeling. The corresponding peak day flow is approximately 260 mgd. Table 5 illustrates the plant hourly hydrograph and the projected hourly flows resulting from this analysis.

Projected 2025 maximum month flows were used in conjunction with the peak week flows previously described to predict the effluent quality from the plant during maximum month. Table 6 summarizes the flows used to predict maximum month effluent conditions.

TSS and $CBOD_5$

Influent TSS concentrations of 56 mg/L and 137 mg/L were assumed for the maximum week and maximum month conditions, respectively. The maximum week TSS concentration is based on the weekly average TSS concentration obtained from the week of December 5 through December 11, 1996. The maximum month TSS concentration is based on the average wet season TSS concentration obtained from January 1992 through September of 2003. Influent $CBOD_5$ concentrations of 34 mg/L and 86 mg/L were assumed for the maximum week and maximum month conditions, respectively. The maximum week $CBOD_5$ concentration is based on the weekly average $CBOD_5$ concentration obtained from the week of December 5 through December 11, 1996. The maximum month $CBOD_5$ concentration is based on the average wet season TSS concentrations from January 1992 through September of 2003, respectively.

TABLE 5
Hourly Plant Hydrograph and Projected Hourly Flows for 300 mgd Peak Flow
MWMC Facility Plan, Eugene-Springfield

Hour	Projected Hourly Flows for a 300 mgd peak Hour Flow (mgd)
1	217
2	220
3	205
4	222
5	246
6	262
7	271
8	273
9	269
10	266
11	283
12	297

TABLE 5
Hourly Plant Hydrograph and Projected Hourly Flows for 300 mgd Peak Flow
MWMC Facility Plan, Eugene-Springfield

Hour	Projected Hourly Flows for a 300 mgd peak Hour Flow (mgd)
13	300
14	297
15	288
16	284
17	279
18	273
19	263
20	258
21	254
22	243
23	235
24	241

TABLE 6
Maximum Month Evaluation Flows
MWMC Facility Plan, Eugene-Springfield

Days	Flows for Maximum Month Evaluation	Basis
1 –7	Peak Week Flows (See Table 7, except day 4 is 260 mgd)	Historical Data and projected flows
8-30	111 mgd	Historical Data and projected flows

Design Loads

The resulting flow and loads used to evaluate each alternative are summarized in Table 7.

TABLE 7
Design Conditions
MWMC Facility Plan, Eugene-Springfield

Day	Projected Average Daily Flow (mgd)	TSS Loading (mg/L)	$CBOD_5$ Loading (mg/L)
1	174	56	34
2	151	56	34
3	156	56	34
4	260 (with 300 mgd peak hour)	56	34
5	168	56	34
6	162	56	34

TABLE 7
Design Conditions
MWMC Facility Plan, Eugene-Springfield

Day	Projected Average Daily Flow (mgd)	TSS Loading (mg/L)	$CBOD_5$ Loading (mg/L)
7	135	56	34
8-30	111	137	86

Permit Compliance Results

Table 8 summarizes the results of the spreadsheet model evaluation. All three alternatives will meet current permit loading requirements with the flow and loading assumptions listed in Table 7.

TABLE 8
Evaluation Performance Results
MWMC Facility Plan, Eugene-Springfield

Parameter	Alternative 1 – Additional Primary Clarifiers	Alternative 2 – High Rate Clarification	Alternative 3 – Parallel Primary and Secondary
Maximum Week TSS Permit Limit	28,000 lb/day	28,000 lb/day	28,000 lb/day
Predicted Maximum Week TSS Discharge	20,477 lb/day	18,820 lb/day	20,555 lb/day
Maximum Week $CBOD_5$ Permit Limit	24,000 lb/day	24,000 lb/day	24,000 lb/day
Predicted Maximum Week $CBOD_5$ Discharge	14,160 lb/day	13,908 lb/day	14,160 lb/day
Maximum Month TSS and $CBOD_5$ Removal Requirements	85 percent	85 percent	85 percent
Predicted Maximum Month TSS Removal Efficiency	87.7 percent	88.0 percent	87.6 percent
Predicted Maximum Month $CBOD_5$ Removal Efficiency	86.5 percent	86.6 percent	86.5 percent

Alternatives Cost and Non-monetary Comparison

Relative Cost Comparison

Each alternative included similar structures and equipment. For the economic comparison, only those facilities that are unique to each alternative were included in the analysis. Table 9 illustrates the process units that were considered as part of the economic comparison.

TABLE 9
Basis for Relative Cost Comparison
MWMC Facility Plan, Eugene-Springfield

Items Included in Cost Comparison	Alternative 1 – Additional Primary Clarifiers	Alternative 2 – HRC	Alternative 3 – Parallel Primary and Secondary
Number of Pump Stations	0	1	2
Number of New Sludge Pump Stations	1	0	0
Number of New Primary Clarifiers	4	0	0
High Rate Clarification Equipment	0	1	0

The size and cost of the diversion pump stations are based on the following assumptions:

- Five pumps with a flow of 35 mgd per pump @ 35 feet total dynamic head (TDH)
- Two variable frequency drives (VFDs)
- Two sluice gates per pump station
- Structure size 30 feet long x 20 feet wide x 25 feet deep.

The size of the HRC structure was based on a surface loading rate of 35 gpm/sf and on previous HRC facility designs. The following additional assumptions were part of the HRC economic analysis:

- Cost for equipment of $0.06 per gallon of average flow treated
- A design flow of 100 mgd with an ability to peak to 140 mgd
- Two sluice gates

The size and cost of the primary clarifiers was based on the following assumptions:

- Four new 135-foot-diameter primary clarifiers to match the existing at a surface overflow rate of 3000 gpd/sf
- Odor control covers and treatment equipment to be provided for new primary clarifiers, as are planned for the existing primary clarifiers
- Gravity flow of primary effluent to disinfection
- One new primary sludge pump station to provide thin sludge pumping for thickening outside the primary clarifier. This pump station would have multiple pumps in a single building.

The relative costs for each alternative are summarized in Table 10. All alternative costs are relative to Alternative 3, which is the lowest-cost alternative.

TABLE 10
Capital Cost Comparison of Alternatives
MWMC Facility Plan, Eugene-Springfield

Treatment Alternative	Approximate Cost for Unique Facilities for Each Structure	Cost Factor (See Note 1)
Alternative 1 – Additional Primaries	$31,000,000	2.8
Alternative 2 – HRC	$25,000,000	2.3
Alternative 3 – Parallel Primary and Secondary	$11,000,000	1.0

Notes: Cost is normalized to Alternative 3.
Attachment 1 provides background information for the costs presented in Table 10.

Non-Monetary Comparison

The purpose of a non-monetary comparison between the two alternatives is to evaluate issues other than cost that may influence the selection of one alternative over the other. Issues include constructibility, O&M, performance, siting, etc. Table 11 summarizes the preliminary results of the non-monetary comparison.

TABLE 11
Non-Monetary Comparison of Alternatives
MWMC Facility Plan, Eugene-Springfield

Issue	Alternative 1 – Additional Primaries	Alternative 2 – HRC	Alternative 3 – Parallel Primary and Secondary
Siting	1	3	5
Constructibility	4	4	3
Effluent Performance	5	5	5
Effect on Performance of Downstream Equipment	4	3	3
Operational Flexibility -	2	4	3
Maintenance	4	1	4
Total Score (30 possible points)	20	20	23

1 = Negative/Difficult
5 = Beneficial

Alternatives Evaluation

Figures 8 and 9 combine the capital cost comparison and permit compliance assessment (Figure 8 shows TSS; Figure 9 shows $CBOD_5$) results for each alternative. These figures illustrate that the predicted effluent loadings are comparable for each alternative even though the construction costs vary considerably. All three alternatives would be able to meet the current and future effluent requirements provided the mass limits remain constant.

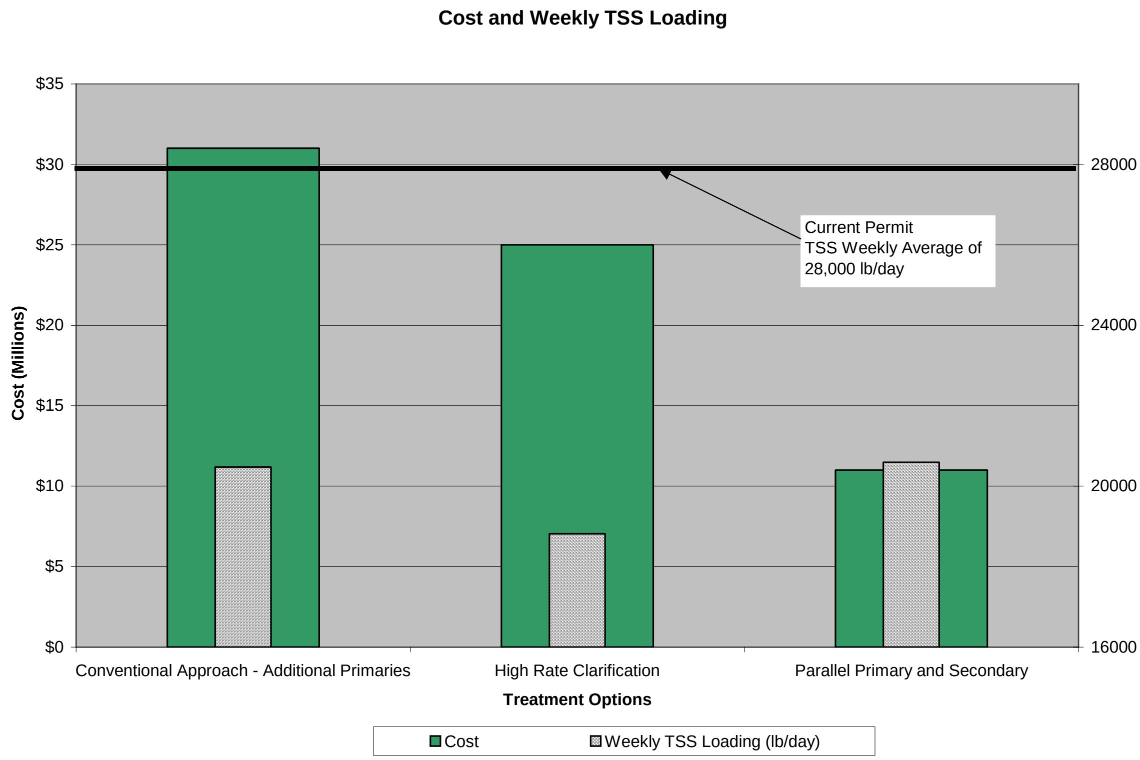

FIGURE 8
Cost and Weekly TSS Loading
MWMC Facility Plan, Eugene-Springfield

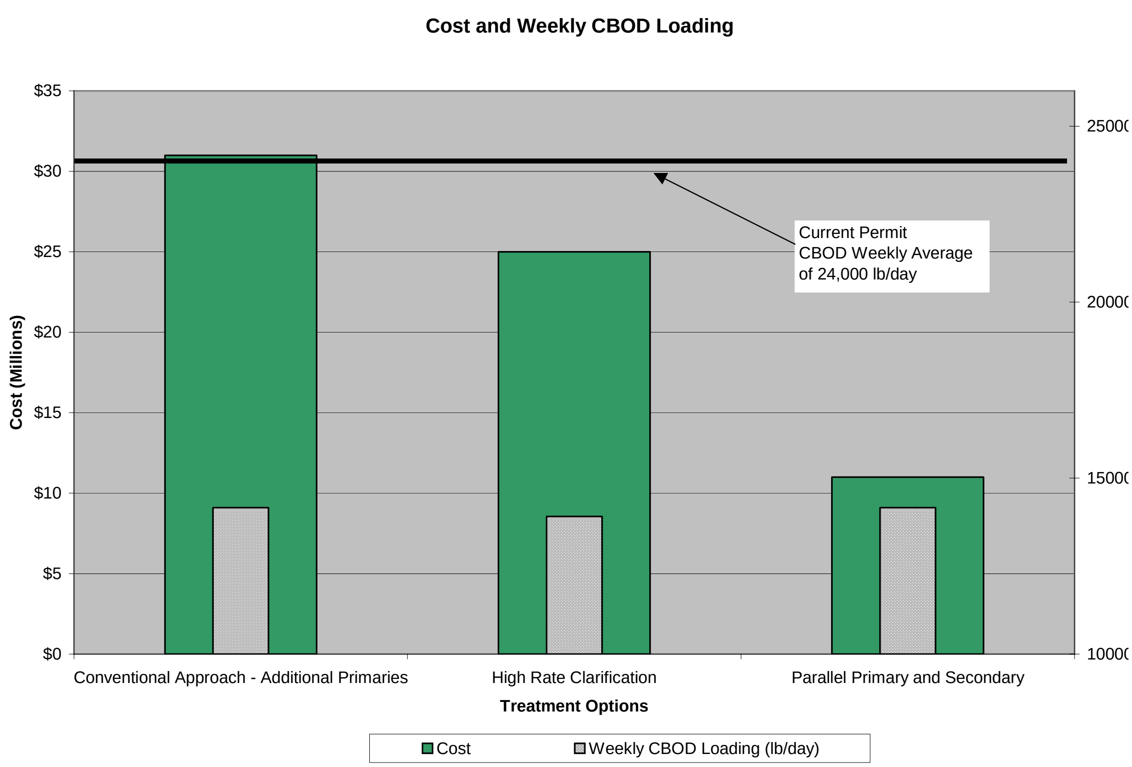

FIGURE 9
Cost and Weekly $CBOD_5$ Loading
MWMC Facility Plan, Eugene-Springfield

Alternative 1, the construction of new primary clarifiers, would result in the highest capital investment and require the most site space. This is significant because the only available site space that could be used for these unit processes is reserved for future build-out secondary treatment capacity. Additionally, if these clarifiers were constructed they would be located a long distance from the existing primary clarifiers, further complicating primary sludge handling and odor control facilities. This alternative does have the benefit of providing the most redundant primary treatment capacity, because a total of eight primary clarifiers would be available.

Alternative 2 offers the greatest operational flexibility because it would allow the HRC to function as primary clarifiers and would allow the existing primaries to be taken off line if necessary. High rate clarification can function in multiple modes, either to treat base dry season flows or to treat peak wet weather flows. The HRC system would require more extensive O&M than either Alternative 1 or Alternative 3 because the monthly exercising of the system would be significantly more involved. This system would also experience higher operational costs because of chemical requirements and electrical costs associated with the system.

The hydraulic control strategy associated with Alternative 3, Parallel Primary and Secondary, would be more complicated to operate than the other two alternatives. This because of the complexity necessary for proper flow splitting and balancing using two pump stations. Additionally, Alternative 3 might present a greater challenge from a regulatory standpoint because state and federal blending policies are still evolving.

Conclusions and Recommendations

Alternative 3, Parallel Primary Secondary, is recommended for treating peak wet weather flows. The three alternatives had similar non-cost evaluation results; however, Alternative 3 would be considerably less expensive to construct. The Alternative 3 approach needs to be presented to the Oregon Department of Environmental Quality (DEQ) before proceeding with the pre-design phase.

Attachment 1
Peak Flow Management Alternative - Cost Background Information

Peak Flow Management Alternatives - Cost Background Information

Costing Approach

Three potential alternatives were identified to treat peak weather flows. Table 1 summarizes the major costs associated with each of the three alternatives and the major differences between the alternatives.

TABLE 1
Cost Comparison Among Three Alternatives
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	Parallel Primary and Secondary	**High Rate Clarification**	**Additional Primary Clarifiers**
Clarifier Structure and New Mechanical Equipment	N/A	N/A	$6,500,000
Odor Control	N/A	N/A	$3,173,976
Sludge Pump Station	N/A	N/A	$2,490,819
Pipe Costs	$1,891,800	$1,878,281	$2,180,309
Pipe Size A (feet)	*7.5*	*7.5*	*4*
Pipe A Quantity (feet)	*1981'*	*2946*	*5333*
Pipe Size B (feet)	*8*	*N/A*	*7.5*
Pipe B Quantity (feet)	*1213*	*N/A*	*2,053*
HRC Structure and Pump Station	N/A	$8,128,278	N/A
Liquid Pump Stations	$2,045,556	N/A	N/A
Subtotal	$3,937,356	$11,029,336	$14,345,104
Retrofit Allowance	$1,000,000	$1,000,000	$1,000,000
Landscape / Visual Screening	$650,000	$650,000	$650,000
Subtotal	**$5,587,356**	**$12,679,336**	**$15,995,104**
General Conditions Percentage	25%	25%	25%
General Conditions	$1,396,839	$3,169,834	$3,998,776
Construction Subtotal	**$6,984,194**	**$15,849,170**	**$19,993,880**
Assumed Construction Contingency Percentage	25%	25%	25%
Construction Total	$8,730,243.06	$19,811,462.50	$24,992,350.00
Assumed Engineering, Legal and Administration Per	25%	25%	25%
Total Cost	**$10,912,804**	**$24,764,328**	**$31,240,438**