Temperature Management Plan

TEMPERATURE MANAGEMENT ASSESSMENT REPORT

FOR

EUGENE/SPRINGFIELD WATER POLLUTION CONTROL FACILITY

REVISED
JANUARY 2004

SUBMITTED TO

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Table of Contents

Figures

1. Introduction

This Temperature Management Assessment Report was prepared in accordance with the Eugene/Springfield Water Pollution Control Facility's (E/S WPCF) National Pollutant Discharge Elimination System (NPDES) Permit 102486 and, by incorporation, its Temperature Management Plan of October 2001. The report summarizes measures that have been taken to identify sources of thermal loading through source and process temperature monitoring, and an assessment of options for reducing thermal loads to the waste stream.

Under the 1996 Oregon Temperature Standard (Oregon Administrative Rule 340-41-0026), the E/S WPCF was required to prepare and implement an approved Temperature Management Plan because:

- discharge from the facility is to a stream that is water quality-limited;
- heat is contributed to the stream above a water quality-limited stream segment;
- reasonable potential exists for the discharge to have a measurable impact outside of the assigned mixing zone; and
- temperature-sensitive endangered fish may be present.

The purpose of the temperature standard is to protect beneficial uses of state waters and to preserve aquatic ecosystems, especially salmonid species. Specifically, the standard prohibits a measurable temperature increase from anthropogenic sources in basins exceeding the numeric criteria unless allowed under a DEQ-approved Temperature Management Plan (TMP).

In December 2003, the Oregon Department of Environmental Quality (DEQ) enacted significant revisions to state water quality standards, including those pertaining to the temperature standard. In brief, OAR 340-41-0028 states that the biological numeric criterion for the Upper Willamette River Basin is 55.4 ˚F from October 15 to May 15 in a basin for which salmon and steelhead spawning is a designated beneficial use, and 64.4 ˚F in summer in a basin for which salmonid fish rearing and migration is a designated beneficial use. Since the Upper Willamette River is water quality limited for temperature, no single NPDES point source may cause the temperature of the river to increase more than 0.5 F˚ above the applicable criteria after mixing with either 25 percent of the stream flow or the permit-specified mixing zone, whichever is more restrictive. These criteria supercede those under which the October 2001 TMP and the December 2003 Temperature Management Assessment Report were prepared. This report reassesses the temperature monitoring data in light of the new temperature standard.

The report includes background information on the E/S WPCF and receiving waters, as well as an assessment of process and in-stream temperature monitoring data, including the regulatory mixing zone. A discussion of source and process management control considerations and their effectiveness is also presented. In addition to alternative end uses for effluent to reduce the volume of wastewater discharged to the Willamette River, several promising engineering methods are listed which may help reduce effluent temperatures. These are part of an on-going Facility Master Plan update and pre-design study being conducted by CH2M-Hill. We anticipate beginning the capital improvements program identified in the Facility Master Plan beginning in fiscal year 2004-2005. Additional capital improvement projects which address long-term temperature management will be assessed more fully within the current NPDES permit cycle. Metropolitan Wastewater Management Commission (MWMC) management staff anticipates submittal of an implementation plan and schedule for long-term capital improvement projects with the 2006 NPDES permit renewal application, as originally proposed in the Temperature Management Plan.

2. Description of E/S WPCF and Receiving Water

a. General Design and Process Information

Plant Name:	Eugene/Springfield Water Pollution Control Facility
Plant Type:	Activated Sludge Treatment Plant
Location:	410 River Avenue Eugene, OR 97404 Lane County
Telephone Number:	(541)682-8600
Treatment System Class: **Collection System Class:**	IV IV
Current NPDES Permit Number: **Current File Number:**	100980 55999

Facility Flow

Design Average Dry Weather Flow: 49 mgd (76 cfs)

Census Information

Population Served (1000s): 210

Liquid Stream Processes

Preliminary/Primary Treatment

- Influent Pumping
- Grit Basins
- Degritted Primary Sludge
- Mechanical Bar Screens
- Primary Clarifiers

Secondary Treatment

- Activated Sludge
- Secondary Clarifiers

Solids Handling

- Facultative Lagoons

Disinfection

- Chlorine Contact

Outfall

- Submerged with Diffuser
- Stream bank during High Flow

b. Receiving Water and Outfall Information

Basin: Willamette
Sub-basin: Upper Willamette

Receiving Stream: Willamette River

Hydro Code: 22 = -WILL 178 D

Outfall Location & Description:

Effluent is released to the Willamette River via a multi-port diffuser extending from the north bank. The diffuser consists of a 96-inch outfall pipe and eight 30-inch evenly spaced risers. Each riser is end-capped and has three downstream-directed ports. Each port has a total area of about 775 square-inches. The ports diffuse effluent at the river bottom.

Coordinates: 44° 05' 40" Latitude
123° 06' 33" Longitude

A map of the facility location is presented in Figure 1.

c. Applicable Receiving Water Criteria

A Total Maximum Daily Load (TMDL) has not been completed for the Upper Willamette River. Completion of the temperature TMDL is anticipated in March, 2004. In the absence of site-specific temperature criteria, the following criterion is applicable under OAR 340-41-0028 and Section 303(d) under the Clean Water Act:

Fish Activity	Applicable Standard	Time Period
In a basin for which salmon and steelhead spawning is a designated beneficial use.	55.4 ˚F OAR 340-041-0028(4)(a)	October 15 – May 15
In a basin for which salmonid fish rearing and migration is a designated beneficial use.	64.4 °F OAR 340-041-0028(4)(c)	Summer

3. Temperature Monitoring

In order to determine the magnitude of the temperature change on the receiving water (Willamette River), the E/S wastewater staff collected in-stream temperature data at locations upstream and downstream of the diffuser outfall, and of WPCF effluent. In addition, probes were deployed throughout the plant to evaluate the relative temperature change over each treatment stage. Monitoring locations included the influent waste stream, preliminary treatment, primary clarification, activated sludge return, aeration, and secondary clarification. These data were used to assess waste stream thermal loads due to treatment processes, and to aid E/S wastewater management staff in assessing options for process temperature management. The sections below discuss results of the in-stream and plant temperature monitoring programs.

Protocol for temperature data collection and processing will follow those specified in the DEQ Procedural Guidance for Water Temperature Monitoring, Rev. May 6, 1997. Only data that met the quality control standards specified in the guidance document were used for comparison to the numeric temperature criteria. Discussion of effluent temperature effects will be limited to the summer criterion at this time; ongoing monitoring data are being collected to assess plant effluent and river temperatures during the salmon and steelhead spawning period from October 15 through May 15. Measurable increase allowance at the regulatory mixing zone is currently defined as 0.5 F˚ above the applicable water quality criterion, in this case the summer criterion for a water quality limited water body, of 64.4 ˚F (OAR 340-041-0028(12)(b)(A)).

a. In-Stream Temperature Monitoring

The sites selected for in-stream temperature monitoring are identified in Figure 2. Criteria for site selection generally followed those described in the DEQ guidance document with simultaneous efforts to minimize the effects of confounding variables from anthropogenic activities. Onset probes were deployed at the monitoring locations to collect hourly temperature measurements. These data were subsequently processed to reduce sporadic temperature spikes caused by sensitivity of the probes.

To resolve fully temperature differences between the downstream and upstream locations with respect to the E/S WPCF outfall, analysis of temperature data was done by comparing synchronized values, charting their trends, and measuring these against the temperature criterion. These comparisons were used to isolate and identify plant-operating conditions that may contribute to exceedance of the temperature standard downstream of the plant outfall. In addition, analysis of temperature data includes the regulatory methodology of computing seven-day running averages to determine compliance with the temperature standard. While the mathematical relationship above uses standardized parameters by which all permittees are evaluated, the following paragraphs take a closer look at the data to determine temperature increases at the RMZ under actual river and effluent flow conditions.

The Onset Stowaways were deployed without data collection synchronization. In order to facilitate temperature comparison of upstream and downstream temperature measurements, dates were converted to serial numeric values and the temperature data processed by applying a smoothing algorithm to compute the local weighted average at arbitrary time increments of 1/10th the serial numeric date value. Temperature data from the pair of upstream thermistors were averaged; those from the downstream location were combined to obtain a mostly continuous data set. A data gap, occurring between the 17th and 19th of June, was filled by interpolation using temperature data nearest the gap. This will generally appear as a featureless section of trend in the charts.

Willamette River temperatures often exceeded the 64.4-˚F criterion established for salmonid rearing and migration upstream and downstream of the plant outfall during the period monitored (see Figure 3). This warmest period begins in June and extends into October; the maximum river temperature recorded at the downstream monitoring site (see Figure 2) was 68.30 ˚F, which occurred on July 21 at about 2100 hrs. Diel fluctuation of river temperature is as high as 6 F˚ in June, July, and August as represented by the data subset in the lower chart of Figure 3. In general, late afternoon through early morning river temperatures are warmer than those of late morning through early afternoon, as labeled data points in the lower chart illustrate. *Most importantly, the lower figure shows that downstream temperatures are lower than those measured upstream, which was true for the entire monitoring period.* This aspect is further discussed later.

b. Process Temperature Monitoring

Temperature monitoring of the WPCF waste stream followed the collection and processing protocol referenced for in-stream monitoring where applicable. Process monitoring locations are shown in the plant schematics presented in Figure 4. Initial monitoring efforts during the summer of 2002, consisting of simultaneous deployment of three probes proved to have limited value in assessing thermal load contributions from the plant. WPCF process temperature monitoring was subsequently reconfigured so that all major treatment stages were monitored simultaneously.

Process temperatures were collected from April 30 through November 3, 2003, using Onset thermistors set to record and store temperature measurements at hourly increments. Processing of the temperature data was identical to that for the river data. Smoothed data sets for each waste stream monitoring station are shown in Figure 5; the lower chart is a subset of the data set showing details. Several temperature probes were lost during monitoring though replacement thermistors were deployed as soon as the loss was discovered. Calculation of relative temperature differences for a specific treatment stage could not be done at the data gaps; however, these were filled using interpolation of temperature data nearest the gap. A period during May 18 and 19 has been excluded from the analysis because of anomalous data at the pre-primary clarification monitoring station where the probe seems to have been exposed during much of this period. Featureless sections of the trends are indicative of data loss, either from loss of the temperature thermistor or censoring.

Temperature change across the entire treatment works is estimated in two ways; 1) as the difference between the pretreatment and effluent monitoring locations, and 2) the sum of temperature changes observed across each treatment stage; (see shaded cells in table). Comparison of descriptive statistics for both calculation methods shows relatively good comparison, suggesting the maximum temperature difference across the plant is about 3.6 to 3.9 F˚, and averages about 1.1 to 1.4 F˚. Temperature

Change in Temperature (F˚) Across Treatment Stage
Monitoring Period: 4/30 – 11/3/03

Statistic	Process Treatment Stage: Pretreatment	Primary Clarification	Aeration Basins	Secondary Clarification	Primary Clarification to Effluent	Sum of Temperature Changes
Mean	0.272	0.430	0.976	-0.279	1.13	1.40
Median	0.196	0.425	0.963	-0.275	1.18	1.48
Maximum	2.66	2.68	2.47	1.33	3.64	3.91

differences are shown in Figure 6. The lower chart is a subset of the data showing detailed relative temperature changes across each treatment process stage. Primary clarification and aeration of the waste stream account for 26% and 58% respectively of the total process thermal loading.

Maximum seven-day averages of the process stage temperature data are presented in Figure 7. In addition, thermal load is charted on the right y-axis as billion Btu/day. The maximum seven-day average plant effluent thermal load occurred on August 20-21 at 1.19 billion Btu/day, well below the facility's permit-specified thermal load limit of 3.1 billion Btu/day.

4. Effect of Outfall on Receiving Water

a. Description of RMZ

The E/S wastewater staff retained a consultant to perform a mixing zone study, the results of which were submitted to the Oregon DEQ for review on 13 June 1995, and subsequently approved by the Department on 29 July 1996. The dye-trace study consisted of injecting a fluorescent dye in the effluent stream and measuring dye concentrations along surface transects and vertical profiles at various locations in the receiving water. Parameters derived from results of the dye study were subsequently used to calibrate site-specific mixing models with the objective of predicting dilution during critical flow conditions. Two of three models correlated well with results of the dye study including CORMIX 1 and CORMIX 2. The third model, UDKDHEN, was eliminated from further consideration because of unsatisfactory dilution prediction performance.

Dilution in the mixing zone is predicted using the following parameters for critical conditions:

Parameter	Value
River Flow (7Q10), cfs (cms)	1346 (38.1)
WPCF design average dry weather flow, mgd (cfs; cms)	49.0 (75.9; 2.147)
Distance to edge of Regulatory Mixing Zone, ft (m)	200 (61)
Dilution at edge of Regulatory Mixing Zone	12:1
Distance to edge of Zone of Initial Dilution, ft (m)	20 (6.1)
Dilution at edge of Zone of Initial Dilution	4.5:1

The facility's NPDES permit defines the mixing zone as that portion of the receiving stream from 20 feet upstream from the diffuser to 200 feet downstream of the diffuser. In addition, the Zone of Immediate Dilution (ZID) includes that portion of the Willamette River within 50 feet downstream of the diffuser.

b. Temperature at the RMZ

Water temperature at the edge of the Regulatory Mixing Zone (RMZ) is computed as follows:

$$T_{RMZ} = \frac{Maximum\ Effluent\ Temperature\ (°F) + (Dilution\ Factor \times Temperature\ Criterion)}{1 + Dilution\ Factor}$$

The parameters for the monitoring period from May through October 2003 are defined as follows:

Maximum Effluent Temperature:	73.17 ˚F (5 September 2003 at 1730 hrs.)
Dilution Factor (7Q10):	12 (derived from lowest 10-year, 7-day average river flow; Mixing Zone Study, June 1995)
Summer Temperature Criterion:	64.4 ˚F (as defined for Upper Willamette River Basin)
T_{RMZ}:	Temperature at Regulatory Mixing Zone.

Inserting these worst-case conditions into the equation above, the calculated temperature at the regulatory mixing zone (RMZ) is

$$T_{RMZ} = \frac{73.17 + (12 \times 64)}{1 + 12}$$

$$T_{RMZ} = 64.70\ ˚F,$$

suggesting that the temperature at the RMZ is 0.2 F˚ *less than* the 64.9 ˚F summer criterion for water quality limited water bodies that do not have a completed TMDL.

The upper chart in Figure 8 shows the trend for calculated temperatures at the RMZ (Trmz) and a thick red line defining the 64.4-˚F criterion. Actual temperature and flow data for the Willamette River and plant effluent were used to calculate the mass-balanced RMZ temperatures. The dilution factor in the calculations uses a mixing ratio of river flow to effluent flow of 12:1, as derived in the 1995, E/S WPCF Mixing Zone Study. As with the downstream monitoring site above the Beltline Bridge, calculated temperatures at the RMZ exceeded the 64.4-˚F criterion beginning in June and extending into October; the maximum RMZ temperature was calculated at 68.55 ˚F at about 2100 hrs.

In the lower chart of Figure 8, temperature differences between the RMZ and upstream monitoring site (Trmz - Tuo) are shown. The thick blue line defines the 0.5-F˚ measurable increase above background criterion. Temperature differences are mostly clustered between 0.02 and 0.15 F˚. The 0.5-F˚ criterion was not exceeded over the entire monitoring period.

Maximum seven-day running averages of river temperature data collected above the Beltline Bridge are presented in Figure 9. In the upper chart river temperatures are plotted in red and the thick red horizontal line defines the 64.4-˚F criterion. Beginning in late June through mid September, and for a short period in early October, Willamette River temperatures downstream of the plant outfall exceeded 64.4 ˚F. The highest 7-day average during this period was recorded on June 23 at 67.7 ˚F.

The trend plotted in the lower chart of Figure 9 represents temperature differences between the downstream thermistor and the pair located upstream at the Owosso Bridge. The average of differences falls between trends for the two thermistors. Trends for downstream to upstream differences for both thermistors show greater variability during periods of cooler river temperatures (see the months of May through June and October). Relatively stable conditions are observed beginning in July and extending through September. The variability may be indicative of differences in thermistor sensitivity to cooler water. Most importantly, this chart shows that temperature differences of monitoring locations downstream and upstream of the plant outfall did not exceed the 0.5-F˚ criterion. Rather, *downstream temperatures were lower than those measured upstream of the E/S WPCF outfall over the entire monitoring period.*

In Figure 10, the blue trend line represents maximum seven-day running averages of river temperatures at the RMZ. Actual temperature and flow data for the river and plant effluent were used to calculate the mass-balanced RMZ temperatures. As with the RMZ calculations in Figure 8, a mixing ratio of Willamette River flow to effluent flow of 12:1 was used to calculate the RMZ temperatures. River temperatures at the RMZ are significantly lower than those measured at the monitoring site located several hundred feet farther downstream above the Beltline Bridge.

Maximum seven-day running average temperature differences between the RMZ and the average of upstream thermistors, is plotted in the lower chart of Figure 10. No exceedance of the 0.5-F˚ criterion occurs over the monitoring period, though marked deviation from previous trends does begin in early November. Two factors have been identified as possible causes for the deviation; the first is related to thermistor drift observed during field calibration checks at both upstream and downstream locations at the end of the monitoring period, though the magnitude of this effect is relatively small. The second factor contributing to the thermal deviation appears to be related to a cooling lag of plant effluent compared to river temperatures. River temperatures decreased 10 F˚ over a period of two days in early November while plant effluent temperatures decreased 1 F˚ over the same period. E/S WPCF staff plan to continue monitoring river temperatures to characterize this phenomenon.

Though the temperature relationship between the upstream and downstream monitoring locations seems inverted in the lower chart of Figure 3 – we would expect that the downstream temperature should be higher than that measured upstream – this phenomenon also was observed the previous year. Several mechanisms are described below which have potential to cause downstream temperatures to be cooler than those observed upstream.

Diel temperature change is one mechanism with potential to effect the observed temperature inversion. For example, it is conceivable that peak daytime river temperatures could coincide with low plant effluent temperatures such that the magnitude of the thermal effect is diminished substantially. Though the data sets did not exactly follow this scenario, it was found that effluent temperatures peaked about five hours before peak river temperatures. However, since plant effluent temperatures are never less than upstream ambient temperatures this mechanism probably does not entirely account for the temperature inversion.

The second mechanism with potential to effect the temperature inversion is incomplete mixing within the mixing zone. Note that the downstream monitoring location is about 890 feet downstream of the outfall diffuser or 690 feet downstream of the RMZ (Figure 2). A thermal gradient may exist in deeper sections of the river channel whereby warmer plant effluent rides above cooler river water. This mechanism seems reasonable given the island upstream of the diffuser dividing the river into two channels with unequal flow. It also presumes a cooler portion of the river is undetected by the Owosso Bridge thermistor, and continues relatively unmixed to the Beltline Bridge thermistor. This mechanism works in theory, however, riffles on both sides of the river upstream of the dividing island enhance mixing of the river and likely eliminate thermal gradients that may be present upstream of the riffles. As the two segments of river rejoin, a new thermal gradient might be created, but it does not entirely explain the cooler downstream temperatures. It also seems implausible for the thermal gradient to persist over the entire monitoring period.

Ground water recharge within the stream reach between the Owosso Bridge and the downstream monitoring location may effect the observed temperature inversion, though this is somewhat speculative since evidence is not presently available supporting this theory. Note, however, that borehole logs for ground-water monitoring wells at the E/S WPCF site indicate extensive saturated gravel deposits are within this area to depths greater than 25 feet, thus ground water recharge is a plausible mechanism. During low river flows, downstream temperatures could be moderated by influx of cool ground water, which may also cause localized thermal gradients. Thus, low river flow, diel temperature change, ground water influx, and localized thermal gradients may all be factors effecting the temperature inversion observed over the course of the entire monitoring period. Temperature change due to ground water influx is probably masked during times of high river flow. Supporting evidence may become available when DEQ makes available FLIR (forward-looking infrared radiometry) information obtained under their TMDL research project for the Upper Willamette River.

5. Source and Process Management Control Options

Sources of thermal loading to the headworks of the WPCF include permitted Significant Industrial Users (SIUs), commercial and residential users, and thermal loading due to wastewater treatment. Nearly all water uses effect a temperature increase of water entering the waste stream, though quantifying the contribution of the temperature increase by each class of user is an extremely complex exercise.

The following sections assess thermal loads attributable to SIUs and those caused by wastewater treatment. It is presumed that commercial and residential users, and to a lesser extent solar radiation, contribute the remainder of the thermal load.

a. Assessment of Significant Thermal Load Sources

An assessment of thermal load contributions by SIUs was done utilizing temperature data collected for permitted facilities by Industrial Pretreatment staff at the E/S WPCF. This data was collected from all SIUs in the Eugene/Springfield area in the routine monitoring of their pollutant discharges in 2001, 2002 and 2003. When combined with their average daily flow, it is possible to estimate the impact these SIUs have on temperature.

Analysis of the SIU temperature data suggests that the largest industrial users do not have a significant impact on influent temperature. When all SIU flows are combined, they contribute 1.8 mgd, or roughly 6% of recent average dry weather flow volume (29 mgd). Their weighted average temperature (per sampling) is 73.4 ˚F, which is less than the weighted average influent temperature of 75.6 ˚F for the influent temperature monitoring period extending from late April through early November 2003. Mitigation of effluent temperature through reduction in SIU discharge temperature would not yield significant thermal load reductions to the Willamette River.

b. Description of Process Management Options to Reduce Thermal Loading

An assessment of process management practices and the temperature data collected over each wastewater treatment stage suggests little, if anything, can be done to mitigate effluent temperatures without compromising effluent quality and perhaps violation of NPDES permit limits. The treatment process is essentially driven by influent flow rates and residence times at each treatment stage. For example, aeration causes the greatest thermal load to the waste stream at 2.5 F˚. Heating occurs when atmospheric air is compressed by blowers used to force air through the wastewater to provide an oxygen source enhancing microbiological oxidation of organic matter. If aeration were reduced or otherwise changed such that insufficient oxygen were available for microbial decomposition of the organic matter, the effluent quality would likely violate multiple effluent quality limitations specified in the facility's NPDES permit.

c. Potential Effectiveness of Source and Process Management Controls

E/S WPCF management staff has reviewed existing source and process management control procedures and did not identify any practical control measures to reduce effluent temperatures.

6. Status of Oregon Temperature Standard and Implications for E/S WPCF

At the time of report preparation, applicable water quality standards for temperature were OAR 340-41-0028 and Section 303(d) under the Clean Water Act. However, the revised Oregon water quality temperature standard is currently under review by the U.S. EPA. Since these rules have a direct effect on threatened and endangered species, the EPA must consult with the U.S. Fish and Wildlife Service and NOAA Fisheries under the Endangered Species Act before they can be approved. Due to a court order, EPA approval is anticipated on or before March 2, 2004. Additionally, the Oregon DEQ is in process of establishing a total maximum daily load (TMDL) for the upper Willamette River because of its 303(d) listing. The document should become available for public comment in early 2004. These rules, when formally adopted, will significantly change the temperature criteria by which NPDES point sources such as the E/S WPCF are regulated.

This report assessed E/S WPCF effluent temperature and its effects on the Willamette River within the regulatory mixing zone (RMZ) under existing Oregon water quality standards and interim thermal load limitations as specified in our NPDES permit. Management staff at the E/S WPCF believes the temperature effects of the effluent from the facility are insignificant because:

- Temperature-monitoring results for the period of April to November 2003 show that river temperatures downstream of the outfall are less than those measured upstream (Figure 3). These results are consistent with those reported to the DEQ for river temperature monitoring done in 2002.
- Under conditions of 7Q10 river flow and maximum measured effluent temperature, the calculated temperature increase of the Willamette River downstream of the E/S WPCF outfall at the edge of the mixing zone is 0.3 F˚, less than the 0.5 F˚ human use allowance specified under OAR 340-41-0028(12)(b)(A).
- Daily RMZ calculated temperatures (Figure 8) using upstream temperature and plant effluent data, and a mixing ratio of Willamette River flow to effluent flow of 12:1, indicate no exceedance of the 0.5 F˚ human use allowance over the monitoring period. Similarly, no exceedance was observed for maximum seven-day average temperatures (Figure 10).

In addition, management staff anticipates that the E/S WPCF will not be a significant thermal load source under the biologically based numeric criteria of 55.4 ˚F (13 ˚C) for salmon and steelhead spawning from October 15 through May 15, and a human use allowance temperature increase of 0.5 F˚ (0.3 C˚). We will continue to collect temperature data from the same monitoring locations to assess wintertime effects of plant effluent temperatures downstream of the outfall and as calculated at the RMZ. Data from this expanded wintertime study will be analyzed and the results reported to DEQ in a separate report sometime in the spring of 2004.

The MWMC and E/S WPCF management staff believes it prudent to await EPA approval of the new Oregon water quality temperature standard, implementation of a TMDL for the Upper Willamette River Basin, and possibly the results of wintertime temperature monitoring, to ascertain whether long-term temperature management strategies are necessary. Nonetheless, the MWMC and E/S WPCF management staff decided to integrate temperature mitigation as a factor in pre-design of facility improvements during update of the Facility Master Plan. If it becomes evident that control is necessary to mitigate temperature effects of plant effluent at the RMZ following consideration of regulatory and monitoring aspects described above, management staff will proceed with long-term temperature management and assessment activities as specified in our Temperature Management Plan (TMP).

The following section briefly outlines the approach and some of the potential options currently being considered to mitigate temperature effects of plant effluent on the Willamette River.

7. Capital Improvements and Other Options

The Temperature Management Plan requires that MWMC identify long-term CIP alternatives that will be evaluated for effectiveness at temperature reduction. Only the projects that prove to be cost effective and to have a net environmental benefit will be pursued.

a. Pre-Design Study and Facility Plan

In March 2003, MWMC contracted with the engineering firm CH2M Hill to conduct a Facility Master Plan Update and pre-design study for Plant Improvements. The project also includes work to review the existing infrastructure, and present a list of potential capital projects that would improve plant efficiency, reduce costs, improve treatment and/or reduce effluent temperature.

CH2M Hill has provided a matrix of capital improvement projects for further evaluation in the Facility Master Plan Update to address various capacity constraints or process impairments at the WPCF. Of the projects identified, several have potential to mitigate effluent temperature impacts to the Willamette River. The initial list of projects included:

- Biological Treatment
  - Incorporate Membrane Bioreactor into Existing Aeration Basin
- Tertiary Systems
  - Granular Media
  - Fabric/Fuzzy Filters
  - Membrane Systems
- Outfall Diffusion
  - Side Shore Diffuser

The cost effectiveness and viability of these alternatives will be based on their overall effectiveness, efficiency and comparative life cycle costs in meeting multiple needs within the wastewater treatment train.

b. Other Capital Improvement Options

Other possible long-term future temperature reduction options include the list provided below. Many of these options are either costly or create offsetting negative environmental impacts (such as the energy requirements of chillers) and will, therefore, not prove to be reasonable viable temperature reduction strategies.

- Collection System Cooling
- Cooling Towers
- Chilling Plant
- Side Shore Diffuser

c. Current Projects

The current MWMC CIP has been reviewed to identify projects that can or will assist in meeting temperature management objectives. Two projects with potential to mitigate effluent temperature impacts were identified, the Outfall Diffuser Expansion and the Reclaimed Water Pipeline/Poplar Plantation.

E/S WPCF and CH2M Hill staff preliminarily reviewed the feasibility and effectiveness of a Shoreline Diffuser to meet the expanded outfall needs. Staff concluded that there is need for significant expansion of outfall capacity (approximately 140 mgd) during peak wet weather events. The Shoreline Diffuser did not meet the capacity requirement and was subsequently eliminated from the long-term option list.

The Reclaimed Water Pipeline and Poplar Plantation project is under construction, linking the E/S WPCF to the Biosolids Management Facility (BMF). Initially, the reclaimed water from this project will be used for irrigation and process water for BMF equipment. Excess capacity exists, so as private sector interest is generated, reclaimed water can be provided for some types of irrigation. If higher rates of chlorination for disinfection are provided, reclaimed water can be made available for industrial applications. This current endeavor holds promise as a pilot to demonstrate the many benefits of reclaimed water reuse, including, potentially, mitigation of temperature impacts on the Willamette River by reducing the volume of treated wastewater discharged from the Eugene/Springfield Regional Water Pollution Control Facility.

d. Other Options

MWMC is in the early stages of exploring water quality effluent trading. Opportunities may exist, over the long term, to perform riparian area restoration and shading and/or hyporheic flow augmentation to cool sections of the watershed in exchange for a relaxed temperature standard at the E/S WPCF outfall.

Over the past two hundred years, much of the shade canopy that existed along stream banks has been removed through anthropogenic activities. This shade canopy had long provided insulation against solar gain, particularly on smaller channels. Restoring this riparian shade canopy in the smaller, shallower channels can provide significant positive temperature impacts over the entire watershed.

The Hyporheic Zone – gravel deposits adjacent to and along the bottom of the river channel – play a significant role in reducing water temperature. Water flowing through this porous rocky zone may cool several degrees, so MWMC and E/S WPCF management staff is exploring opportunities to discharge some effluent into hyporheic zones to take advantage of this unique hydrological process. Also under consideration is the restoration of abandoned side channels and historically functional gravel areas as riverine features that could be reestablished to take advantage of the hyporheic properties they possess.

These options and others may provide long-term opportunities to affect positively temperatures in the watershed. Restoration options to mitigate historical anthropogenic practices are preferred over those requiring increased infrastructure and consumption of natural resources and will be promoted by the E/S WPCF.

8. Summary of Management Control, Capital Improvement, and Other Options

a. Source and Process Management Control Implementation Plan/Schedule

As has been described, there are no significant industrial or commercial dischargers to the wastewater treatment system that have a measurable effect on influent temperature. Reducing their existing maximum allowable discharge temperature would have little or no effect on the temperature of plant effluent. Additional temperature monitoring of interceptors and smaller collectors feeding into the headworks could yield some benefit in identifying illegal, high temperature discharges into the wastewater system; however, such an effort may not be warranted given the consistent temperature ranges across the system and at the interceptors currently monitored.

No plant practices have been determined to cause a measurable increase in effluent temperature beyond those caused by necessary biological treatment activities. Staff will continue to monitor new process technology and techniques as they are introduced.

b. CIP Plan/Schedule

The CIP Plan and Schedule will be developed at a later date incorporating changes identified by CH2M Hill, as part of the Long-Term Temperature Management Assessment and Implementation as described in the TMP.