General Information

Texas Surface Water Quality Standards (TSWQS) at 30 TAC §307.7(b)(4)(C) and 30 TAC §307.4(f)(1-4) establish temperature criteria as both absolute maxima for classified segments and rise over ambient limitations dependent upon water body types and season. Discharges with a thermal component will be evaluated for compliance with TSWQS temperature criteria using a risk based approach. Thermal discharges are considered those TPDES industrial discharge permit authorizations with the potential to violate temperature criteria. This may include discharges from specific industrial sectors such as Steam Electric Generation and discharges comprised of any of the following heat bearing waste streams: non-contact cooling water, cooling tower blowdown, boiler blowdown, steam condensate, or wet scrubber blowdown. Additional types of industrial wastewater discharges may be subject to evaluation on a case by case basis, as determined necessary, unless specifically exempted by the TSWQS (e.g., discharges to industrial cooling impoundments). The principal permitted parameter of concern in the screening analysis is the daily average temperature. These procedures do not preclude a permittee from applying for a thermal variance under Section 316(a) of the Clean Water Act or seeking a temporary standard under 307.2(g), as appropriate.

Screening Procedure Principles

Screening procedures will be used that progress from simple, conservative approaches to more complex, site-specific approaches as necessary. Attached is a flow chart that supplements these procedures designed to illustrate the decision making and analytical processes that are considered while progressing from simple to complex methodologies (See Attachment 1). Supplemental procedures will be spelled out in the Implementation Procedures for existing/proposed thermal discharges to water bodies listed as impaired on the 303(d) list for elevated temperature and those water bodies known to contain aquatic dependent endangered species. In general, effluent limits will be established to avoid an increase in thermal loading to the impaired waterbody. Consistent with this goal (1) water quality standards will need to be attained in the area affected by the discharge; and (2) the proposed discharge must not increase temperature in any areas that are not meeting temperature criteria as documented on the 303(d) list. These goals may be achieved by employing various permitting strategies that will be dictated by case-specific details. Some examples will be illustrated in the future language placed in the Implementation Procedures document.

Water Body Applicability

Screening of thermal discharges will be undertaken for those releasing wastewater into all water bodies with established temperature criteria. Unclassified waters will be screened for compliance with rise over ambient criteria as described in TAC §307.4(f)(1-4). Classified water bodies listed in TAC §307.10 Appendix A will be screened for compliance with temperature criteria described in 30 TAC §307.7(b)(4)(C) and 30 TAC §307.4(f)(1-4). Intermittent water bodies with minimal aquatic life use will not undergo screening, however, downstream waters with higher aquatic life uses may be screened for potential thermal impacts. In general, the downstream extent of the screening analysis will be limited to one mile below the discharge point unless there is reason to believe the scope of the analysis needs to be extended for reasons such as sensitive nursery habitat or the presence of endangered species located downstream.

Critical Conditions/Mixing Zone

Critical conditions are those combinations of ambient environmental conditions and wastewater inputs that combine to result in a conservative representation of potential pollutant impact. For evaluation of thermal impacts, the basic parameters defining critical conditions consist of effluent flow and temperature, ambient flow (or dilution) and ambient temperature.

Effluent temperatures are a result of plant operating conditions considering the highest anticipated thermal loads that are expected to occur primarily during the summertime (June-August). For temperature screening, effluent temperatures should be evaluated using ambient receiving water body temperatures consistent with a summertime condition. Likewise, dilution potential used in the screening analysis should represent conservative values typical of the summer season. In cases where effluent temperature does not follow ambient temperature patterns, a winter reasonable potential analysis may be performed to verify compliance with temperature criteria.

Analysis of streams and rivers is performed using low ambient flow values: the seven-day, two-year low-flow (7Q2) or summertime 10^{th} percentile flow if the 7Q2 occurs during a different season of the year. If base flow information is not available to estimate the 7Q2, then a value of 0.1 ft^3/s is usually assumed for perennial streams, and a value of 0.0 ft^3/s is used for intermittent streams. For perennial streams, 7Q2 flows may also be estimated using a proportional watershed approach or similar technique. For other water body types, critical dilutions developed using methods employed for the screening of chronic aquatic life criteria may be used. Site-specific critical dilutions derived from model analysis can be used if available. These approaches to critical flow mirrors the techniques used for the reasonable potential analysis for the majority of other regulated pollutants.

In many cases, critical mixing conditions are tied closely to the size and configuration of the allotted regulatory mixing zone. Mixing zones for thermal discharges can be different from those allowed for compliance with other water quality criteria and in general are expected to be larger. For the simplest, most conservative screening analyses, small mixing zones normally associated with chronic toxic criteria can be used. Larger mixing zones and associated critical conditions can be used in the screening process as may be appropriate on a case by case basis.

For renewal applications, the wastewater flow used in the screening analysis is the highest average value reported for the previous 2 years or the existing permitted average flow(s) as reflected in the current permit. For new or amendment applications, the wastewater flow used is the proposed average flow(s).

Ambient summer temperature is used in the analysis. Consistent with the summertime value used for dissolved oxygen modeling, the temperature will normally be assumed to be 30.5°C. This value was derived from statistical analysis of summer temperatures collected throughout the State. Alternative critical temperatures can be used if justifiable based on analysis of measured temperatures from areas not affected by thermal discharges. These data may include those collected in surrogate water bodies of similar character. The appropriate statistic for development of an alternative summer temperature is the average of the monthly average temperatures for the three hottest months plus the average of the standard deviations for these months. If ambient temperature derived from these procedures are above the established temperature criterion, procedures analogous to those employed in 303(d) listed water bodies will be used.

Screening Methods

The general screening methods described below progress from simple to more involved and complex as warranted. Three general methods in this progression are discussed below, but other defensible approaches in keeping with the spirit of the goals of the screening process may also be used.

Simple Heat Balance

For water bodies receiving small thermal loads or that have high thermal load assimilative capacity, simple, conservative heat balance calculations can sometimes be used to perform a reasonable potential analysis. For select cases, the need for a temperature limit or development of a conservative permit limit can readily be derived using this technique. This approach discounts the presence of thermal dissipation processes in the water body and uses critical dilutions consistent with the small mixing zones normally employed for toxic pollutants. The equation below can be used to perform this analysis:

$$WLA_t = \left[T_{crit} - T_{amb}\left(1 - E_f\right)\right] / E_f$$

WLA_t = effluent temp that will not cause temp criterion to be exceeded at the edge of the MZ

E_f = effluent fraction at the edge of the mixing zone

T_{crit} = temperature criterion (maximum or T_{amb}+ rise)

T_{amb} = ambient temperature

Simplified, Uncalibrated Numerical Modeling

Simplified numerical modeling using conservative input assumptions may be appropriate for those discharges where a simple heat balance does not yield reasonable results. These models could include more sophisticated and realistic mixing and heat dissipation processes, and encompass a larger portion of the receiving water body. The primary use of this level of screening is for those discharges with a higher potential to negatively affect receiving water temperatures. Models in this class would typically be steady state and able to be used without the need for extensive amounts of site-specific data. Examples of models of this type include CORMIX, QUAL2k, or QUAL-TX. Other models may also be used. Judicious use of these models is required to ensure the model application is appropriate for the water body under investigation.

Apart from discharge flow and temperature, the model inputs for this approach may include:

• water body hydraulic characterization

• outfall design information

• heat balance related parameters

• knowledge of other nearby discharges

• critical conditions

• mixing zone dimensions.

Highly Site-Specific Analysis

For the largest thermal discharges, highly site-specific analyses will likely be warranted. Some examples of the types of considerations that may be employed in these cases could include:

• Collection of site-specific temperature and heat dissipation data for use in numerical model calibration.

• Installation and analysis of a high rate effluent diffuser.

• Site-specific temperature mixing zone or specification of an industrial cooling area in combination with numerical modeling.

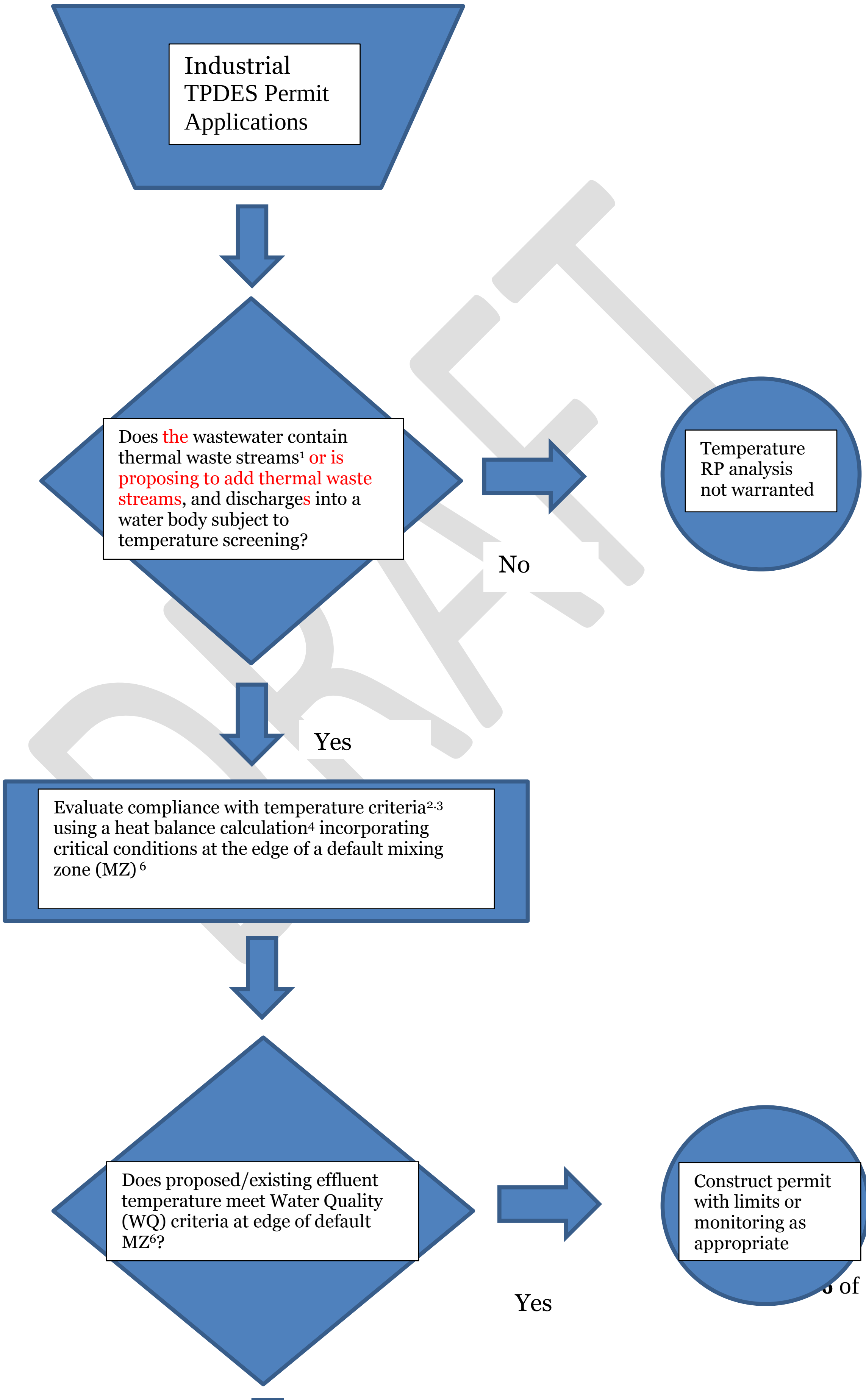
Description of all the possible alternatives are not listed here as the data needs and heat mitigation strategies will be dictated by the unique circumstances associated with these discharges.

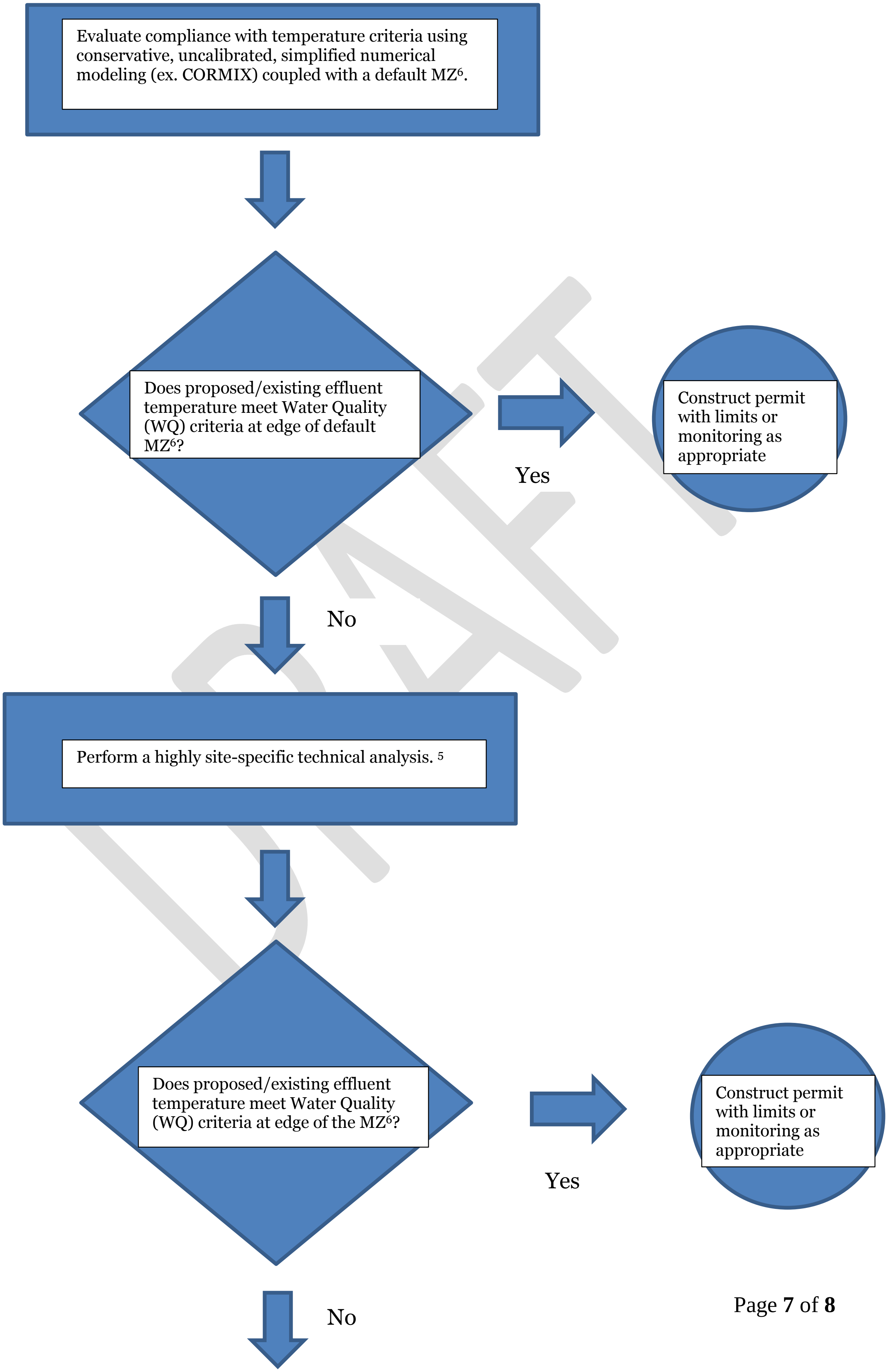
Water Bodies with Temperature Impairment

More comprehensive approaches to setting effluent limits may be necessary when water bodies receiving the discharge are included on the § 303(d) List for elevated temperature. Specific examples of these approaches will be illustrated in the Implementation Procedures document. When evaluating discharges to water bodies with existing temperature TMDLs, effluent limits are based on the TMDL model, or report as applicable. Reviews of TPDES applications received before TMDL development may be conducted with the screening level methodologies discussed previously.

For applications that are proposing a new or increased thermal load into the watershed of water bodies on the § 303(d) list for elevated temperature, the potential of the additional loading to negatively affect the listed portion of the water body is assessed. If the new or increased loadings will cause or further contribute to the elevated temperature conditions, effluent limits to preclude further impairment may be specified or the additional loading request may be denied. In some cases, (i.e. direct discharges into impaired waters) the decision making process is relatively straightforward as additional discharge of elevated temperature waste water would be disallowed. In other cases where distance separates the point of discharge and the impaired area, analyses will typically be employed to see if temperature attenuation prior to the effluent entering the listed waterbody and/or modified temperature limits are sufficient to preclude a negative impact on the listed portion of the water body.

Attachment 1




Evaluate compliance with temperature criteria using conservative, uncalibrated, simplified numerical modeling (ex. CORMIX) coupled with a default MZ[6].
Does proposed/existing effluent temperature meet Water Quality (WQ) criteria at edge of default MZ[6]?
Yes
Construct permit with limits or monitoring as appropriate
No
Perform a highly site-specific technical analysis. [5]
Does proposed/existing effluent temperature meet Water Quality (WQ) criteria at edge of the MZ[6]?
Yes
Construct permit with limits or monitoring as appropriate
No

Consider performing a 316(a) analysis and/or seek a temporary WQ Standard or variance to the WQ Standards, if justified

1 Non-contact cooling water, cooling tower blowdown, boiler blowdown, steam condensate, and wet scrubber blowdown

2 Only rise over ambient temperature criteria TAC §307.4(f)(1-4) apply to unclassified waters. Classified water bodies listed in TAC §307.10 Appendix A will be screened for compliance with temperature criteria described in 30 TAC §307.7(b)(4)(C) and 30 TAC §307.4(f)(1-4)

3 Intermittent water bodies with a minimal aquatic life use assigned are not subject to temperature screening. However, downstream waters with higher aquatic life uses may need to be screened for potential thermal impacts.

4 $WLA_t = \left[T_{crit} - T_{amb}\left(1-E_f\right)\right] / E_f$

WLA_t = effluent temp that will not cause temp criterion to be exceeded at the edge of the MZ

E_f = effluent fraction at the edge of the mixing zone

T_{crit} = temperature criterion (maximum or T_{amb} + rise)

T_{amb} = ambient temperature

5 These analyses may include, but are not limited to, any combination of the following considerations:

- Site-specific temperature mixing zone or specification of an industrial cooling area in combination with numerical modeling.
- Installation and analysis of a high rate effluent diffuser.
- Collection of site-specific temperature data for use in numerical model calibration.

6 A presumptive default MZ for simplified analyses is the aquatic life MZ delineated in RG-194 for toxic constituents. However, the thermal MZ may be expanded for more detailed analyses and be different from the MZ used for toxics in those cases.