

# AN OVERVIEW OF MIXING ZONES FOR MONTANA GROUNDWATER POLLUTION CONTROL SYSTEM (MGWPCS)

## WHAT IS A MIXING ZONE?

A 'mixing zone' is a limited area in either surface or ground water where initial dilution happens following a permitted discharge and where certain water quality standards may be exceeded (MCA 75-5-103; ARM 17.30.502; ARM 17.30.1005). Not all facilities will qualify for a mixing zone; in those cases, applicable water quality standards must be met at the point of discharge (i.e. end of pipe). Importantly, mixing zones are not dependent on whether a facility is subject to review under the Montana Nondegradation Policy.

## WHERE WILL THE MIXING ZONE BE LOCATED, AND HOW LARGE WILL IT BE?

Ground water mixing zones can be standard, source specific, or in some cases department modified. The type of mixing zone will in part determine its overall size, and thus, the amount of dilution water available to blend with the discharged wastewater. Other factors that determine the size of a mixing zone include the size & shape of the wastewater discharge structure (outfall), and how the discharge structure is oriented in relation to the groundwater flow direction at the site.

If a facility discharging under a MGWPCS permit meets certain requirements, it may qualify for a standard mixing zone (ARM 17.30.517). Standard mixing zones extend from the discharge outfall to a point 500' downstream in the direction of ground water flow at the site and are 15' deep (Figure 1). The upgradient width of a standard mixing zone is determined by the width of the outfall perpendicular to the groundwater flow direction. The downgradient width is equal to the upgradient width plus a flare equal to the tangent of 5° on each side to account for dispersion (equal to 0.0875 multiplied by twice the length of the mixing zone).

Depending on the nature of the discharge facility and site, a source specific mixing zone (ARM 17.30.518) may be more appropriate than a standard mixing zone. Source specific mixing zones may have any dimensions so long as the applicant can demonstrate that it will not threaten or impair existing beneficial uses (ARM 17.30.506, ARM 17.30.7, MCA 75-5-303). All requests for source specific mixing zones must include information showing that pollutant concentrations will meet applicable nondegradation criteria and human health standards at the end of the proposed mixing zone.

If DEQ determines that a standard or source specific mixing zone is not feasible for a site, it may establish a department modified mixing zone pursuant to ARM 17.30.515. This may be necessary for setback purposes, to avoid intersecting existing drinking water well zones of influence or impacting other sensitive features.

Regardless of type, all applications for a mixing zone must include an analysis that demonstrates the concentration of pollutants will meet applicable water quality standards and nondegradation criteria at the end of the mixing zone.

Whether a given mixing zone must remain on the same property as a proposed outfall depends on several factors, including the type of facility, parcel size, when the parcel was created, and whether the property is subject to review under the Sanitation in Subdivision Act. Contact the Subdivision Review Section within the Engineering Bureau for more information on mixing zone location and setback requirements. In all cases, no mixing zone may intercept the 100' zone of influence around an existing drinking water supply well.

## HOW ARE MIXING ZONES USED IN PERMIT DEVELOPMENT?

Mixing zones are used to estimate the amount of groundwater available for dilution when calculating whether a facility can meet applicable water quality standards and nondegradation requirements, as well as calculating the discharge limits included in a permit. The amount of dilution water available for mixing is determined by the Darcy equation:  $Q=KIA$ , where  $Q$ =volume of dilution water;  $K$ =hydraulic conductivity;  $I$ =hydraulic gradient; and  $A$ =cross section of the aquifer area available for mixing.

If the volume of dilution water within a given mixing zone were not accounted for when calculating discharge limits, facilities would be subject to much more stringent permit limitations, requiring costly treatment infrastructure or in some cases precluding the facility from operating at all.

Mixing zone dimensions & location are also used to determine where monitoring wells will be required for ongoing compliance sampling.

## WHAT INFORMATION MUST BE PROVIDED FOR A MIXING ZONE EVALUATION?

In addition to a site plan of the facility and surrounding area, certain hydrogeologic information about the site must be provided for the Department to evaluate the appropriateness of a requested mixing zone. At a minimum, values for: hydraulic conductivity, hydraulic gradient, groundwater flow direction, background water quality, and the supporting data and analysis methods used to obtain these values must be provided. Additional site specific hydrogeologic data or modelling may be required for certain areas, especially if surface waters are near the site.

To obtain the required hydrogeologic data, it is usually necessary to install monitoring wells into the receiving groundwater at the facility and conduct one or more aquifer tests. Wells located onsite will help to not only characterize the hydrogeology of the site, but also serve as future sampling points for required water quality monitoring once the permit has been issued. Site specific data from existing wells or scientific studies may also be submitted to provide additional information about the receiving aquifer. Most facilities will need to have at least one well hydraulically upgradient of the proposed discharge location and one or more wells at or near the end of the proposed mixing zone.

Questions regarding the extent and availability of necessary hydrogeologic data for the site can be addressed as part of the recommended preapplication meeting with the department.

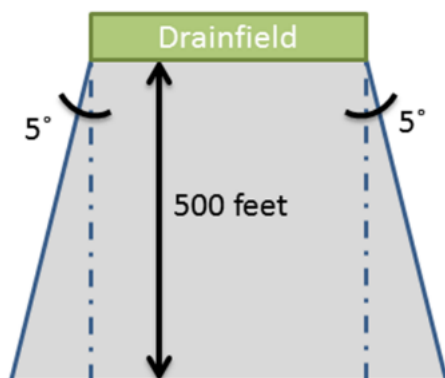


Figure 1: Mixing zone schematic