

Northern Thurston County Ground Water Management Plan Implementation Project

1992-1996

Final Report
April, 1996



Appendix 4: Early Warning and Contaminant Action Levels For Nitrates

Early Warning Levels and Contaminant Action Levels

I. Introduction

Early Warning and Contaminant Action Levels (EWL and CAL) for nitrate are guidelines for interpreting ground water quality data and considering a range of responses. The early warning level is set fairly close to the background level of water quality and is designed to trigger further assessment and a range of less costly and less restrictive responses. The contaminant action level indicates water quality that has been significantly degraded and calls for stronger responses.

The EWL-CAL system does not, by itself, mandate particular actions. It does identify levels at which further ground water protection actions may need to be taken. These further actions, if they are to be made mandatory, will require separate action by the Thurston County Commission, Board of Health, or the city councils. The EWL-CAL system says that if water quality has reached these levels, previous protective actions have been insufficient and the community may need to do more. The existing maximum contaminant levels (MCL) for most substances are derived from federal law and do mandate specific actions.

This system is not a major change in the way agencies in Thurston County that deal with water issues respond to problems. Formalizing the EWL and CAL is a way to get a more consistent set of responses among agencies concerned about ground water.

The proposed EWLs and CALs are a practical way to implement the antidegradation policy contained in state law (RCW 90.48 and Chapter 173-200 WAC). The EWLs And CALs, if approved, would be a recommendation of the Ground Water Policy Advisory Committee (GWPAC). Because this body is only advisory to county and city governments, any EWL and CAL proposal would have to be adopted by the county and city governments before it could take effect.

The Northern Thurston County Ground Water Management Plan recommended a system of EWLs and CALs but did not set specific nitrate levels. The plan was written for Northern Thurston County and the proposed actions were mainly related to managing on-site sewage disposal systems. The present proposal is intended to cover the whole range of nitrate sources and to apply to the whole county.

The EWLs And CALs are designed to serve the following functions:

- To serve as a benchmark of water quality and show how any specific area's water quality compares to Thurston County as a whole.
- To provide simple, objective, and explicit guidance to government agencies and the public

about when certain ground water quality protection actions are necessary, while still allowing a flexible response.

- To help coordinate ground water protection activities and ensure that consistent policies are followed by government agencies within Thurston County.
- To help public agencies and private water system managers make the most effective use of water quality monitoring to protect their large investment in wells and other infrastructure.

II. How the System Will Work

Collect Ground Water Data

The EWL and CAL system is based on the review of ground water quality data. This monitoring data should be adequate to document water quality conditions and trends for contaminants of concern with a reasonable degree of completeness and accuracy. This data can come from several different sources. Public water supplies are required to monitor their wells and the State Department of Health sometimes samples public wells. Thurston County Environmental Health may require that wells be tested or that special studies of water quality be conducted as part of land use permit applications. The regional Ground Water Program conducts special area studies of ground water quality. The water programs of Lacey, Olympia, and Tumwater may conduct studies and the city water utilities take samples to ensure the quality of the water coming from their wells. As the cities, the county, and private water purveyors develop their wellhead protection programs, they will be monitoring to track the quality of the water in their wellhead protection areas.

Interpret the Data

When these ground water quality data are compiled and plotted onto maps, the predominant water quality of different areas becomes apparent. The EWLs and CALs are designed to trigger a response to areas, rather individual wells. If a single well were to exceed the EWL or CAL, that would be treated as a problem with a single well, rather than an indication of a regional problem. For the EWLs and CALs to be useful, the data must be interpreted with sound professional judgement and common sense.

Trends in contaminant levels are critical to determining the significance of water quality data. Stable but elevated levels of nitrate in a built-out developed area may be less cause for concern than increasing nitrates in an area with more pristine ground water. Trends in contaminants other than nitrate are also important.

Respond to the Data

Data that shows that an area has exceeded the EWL or CAL would trigger the development of a response plan that is appropriate for the type of contaminant source detected. This data could have been collected and the problem detected by the regional ground water program, a city or private wellhead program, or another government agency. When a problem is detected, the groups affected by the problem would choose one group to act as the lead agency in managing the problem. This lead agency would coordinate the development of a response plan, often drawing on the resources of other concerned agencies.

For example, if a water quality problem were detected in a city's wellhead protection area monitoring wells, the city might become the lead agency. If part of the well's capture zone were within the county, the county might want to provide staff and money toward managing and correcting the problem. Or the city might wish to have the regional ground water program take the lead agency role. While there are a number of ways that roles could be assigned, interjurisdictional cooperation will generally be required.

It is important to note that this system of EWLs and CALs will not mandate any particular actions. By themselves, they are only guidelines to help implement the antidegradation policies found in Washington law. It is expected that changes may be made in some existing plans or ordinances that could make specific actions mandatory upon reaching the EWL or CAL. For example, a sewer or comprehensive plan might be rewritten to require connection of septic systems to sewer in certain areas upon reaching the CAL. Article Four of Thurston County's Sanitary code could be used to formally designate areas that have reached the EWL as "Areas of Special Concern".

II. The Levels

- 1. Background Level, Zero to 1.9 Mg/l.** The background level is the concentration reasonably attributed to natural causes without the influence of human activities. Thurston County's ground water nitrate levels are usually below 1 Mg/l. The USGS found that 71% of the samples they analyzed in northern Thurston County were below 1 Mg/l (Dion and others, 1994). Natural nitrate sources include rainfall, wildlife, and nitrogen fixing plants. Background levels are typically found up-gradient from residential and agricultural uses and down-gradient from forested areas.
- 2. Early Warning Level:** The EWL is set at 2.0 Mg/l (2.0 to-3.9 Mg/l). This level is above background and generally indicates human activities have affected water quality. This level is also not toxic to human use, and the water is fit for all known beneficial uses.

Typical Actions at the Early Warning Level

- Take additional samples (confirm validity) and determine contaminant sources.

- Increase monitoring to define the scope of the problem. This should include sampling additional wells and sampling for other possible chemical contaminants.
 - Make threshold determination about the seriousness of the problem.
 - Choose lead agency to manage problem.
 - Evaluate corrective and preventive actions that are sufficient to prevent further contamination. In some cases, no action may be the best alternative.
 - Make the affected area a high priority for education and enforcement activities.
3. **Contaminant Action Level:** The CAL is set at 4.0 Mg/l or 40% of the Maximum Contaminant Limit, (MCL) of 10 Mg/l (4-9.9 Mg/l). Nitrate below 10.0 Mg/l is still not toxic to humans. This range is significantly above background and some very sensitive beneficial uses may be affected.

Typical Actions at the Contaminant Action Level

- All of the actions listed for the Early Action Level.
 - Develop and implement a response plan for the affected areas. This plan may include some actions listed below as action at the Maximum Contaminant Level.
 - The affected area may be targeted as a priority area for the development of farm plans or other responses under Article 6 of the Sanitary Code.
 - Secure funding for response plan.
 - Set a time line for implementing the response plan and its required monitoring.
4. **Maximum Contaminant Level:** The MCL is set at 10.0 Mg/l. This is the public health drinking water standard. At this level, water purveyors must notify their clients that the water may be harmful to infants, and must devise a strategy to comply with the drinking water standard. There are proven health effects at this level.

Typical Actions at the Maximum Contaminant Level

- The Thurston County Board of Health might prohibit new on-site sewage disposal permits (Building Site Applications) within the affected area until sewers are available.
- The LOTT members and the Health Officer might reprioritize sewer interceptor timing.
- Evaluate the need for alternate water supplies
- These response plans would be prepared by Thurston County Health Department staff or the cities and would be presented as recommendations to the Health Officer, the Thurston County Board of Health, or city councils for action.

III. Assumptions, Cautions and Limitations

For an EWL-CAL system to function there must be a sampling program that collects reliable data over time. Someone must keep and distribute the data, and make maps showing the areas that exceed the EWL or CAL.

What an Early Warning Level System is Not

An EWL-CAL system is not implied permission to degrade ground water up to some specific point. That would be clearly illegal under Washington State law. The goal of using an EWL-CAL system is still to prevent the degradation of water quality as much as possible. WAC 173-200-030 states that waters of high quality shall not be allowed to be degraded unless an overriding public interest is served and all contaminants are provided with all known, available, and reasonable methods of prevention, control, and treatment. All possible local efforts shall still be directed to achieving this goal. The EWL and CAL system will serve as a way to prioritize and focus additional resources in areas in which water quality has been degraded.

Why Use Nitrate?

Nitrate is not toxic at low levels but does have health effects at higher concentrations. Nitrate is chemically stable, easy to measure, and is often found along with a variety of other contaminants. There is a wealth of national and local nitrate data. This makes it very well suited to be an indicator of the potential presence of other contaminants.

Nitrate is not a perfect and complete indicator of water quality. It is also not the only possible chemical contaminant. Other chemicals can reach ground water and a nitrate EWL-CAL system will not directly detect these other contaminants. However, a large body of published literature shows that elevated levels of nitrate are often associated with increased risk of other contaminants. For example, in agricultural areas, pesticides in ground water are usually accompanied by elevated nitrate levels. In areas served by septic systems, viruses, bacteria, and household hazardous materials in ground water are often accompanied by elevated nitrate levels.

Although nitrate is an important general indicator of ground water quality, some types of water quality contamination do not produce elevated nitrate levels. Examples include chemical spills, leaking underground storage tanks, solid waste disposal, etc. Nitrate levels are not an adequate predictor of the extent of these types of contamination. Land use patterns and existing water quality data, especially from public water supplies, are the best way to guide the extra water quality monitoring needed for these contaminants.

Not all nitrate in ground water comes from septic systems. When investigation shows that septic systems cannot explain the nitrate levels and shows that most of the nitrate comes from agricultural sources, then the procedures outlined in Article VI of the Sanitary Code would

apply. In general, Environmental Health would proceed with follow-up monitoring. This would provide ground water quality feed-back to the Department of Ecology, the Conservation District and the farmer.

The EWL's and CALs should be used with particular care in agricultural areas. Introducing livestock or over-applying manure can happen over a relatively short time. This in turn could cause high levels of nitrate to appear in down-gradient wells or streams. Over-application of manure from a single operation can take place on multiple sites in irregular patterns, which makes the water quality data hard to evaluate. Dealing with agricultural nitrate problems effectively requires close coordination among Environmental Health, Ecology, and the Thurston Conservation District.

Because nitrate is a good predictor of the presence of other contaminants, responding to it and using it to guide other monitoring can increase the effectiveness of ground water monitoring efforts. One of the challenges for a local monitoring program is that Thurston County covers 758 square miles and is underlain by as many as seven aquifers. Each of these aquifers supplies water to wells and has its own chemistry and unique character. Each of these aquifers could potentially be contaminated by one or more of the hundreds of chemicals that have been found within ground water within the United States. The zones of contamination may be small in size but still very significant. The plume of TCE (trichloroethane or trichloroethylene) that contaminated the City of Tumwater's Palermo wellfield is only about 100 feet wide. By using the presence of nitrate as a way to prioritize further sampling, it is possible to target expensive sampling for pesticides and organic chemicals in areas where the sampling is most needed.

It is essential that other water quality indicators are also monitored in order to achieve and maintain a complete picture of the condition of the aquifers. Iron and manganese are important when interpreting ground water quality data. Naturally occurring sub-soil bacteria feeding on dissolved nutrients can convert naturally occurring iron and manganese from solid form to dissolved form. This causes an increase in these metal ions in ground water that is a secondary measure of the response of the aquifer to other contaminants. Approximately one-third of the wells in northern Thurston County exceed the maximum contaminant level for iron or manganese.

Other Factors to Consider

The relationship of the nitrate levels to the EWL and CAL is not the only factor to consider. Other associated circumstances may cause a given set of nitrate levels to have a higher or lower priority.

Special Protection Areas

The type of response to a given level of nitrates may be different if it is found along with certain special geological or other conditions. For example, exceeding the EWL in a major wellhead protection area might require a faster and more forceful response than the same level of nitrates

in a sparsely populated rural area. In other words, there are some cases where cost/benefit analysis is appropriate. Geologically sensitive areas and aquifer sensitive areas are also examples of areas that might require a more rigorous response to exceeding the EWL-CAL

Land Use

The presence of certain land use characteristics should supplement nitrate EWLs and CALs when decisions are made about some types of responses. This is based on the assumption that some high risk land uses merit additional scrutiny based on their contamination potential, including:

- Industrial or commercial development using on-site sewage disposal, particularly if using hazardous materials.
- Population Density or Dwelling unit Density using on-site sewage disposal
- Existence of Community systems, and their age.

Ease of Remediating the Problem

A problem located close to existing sewer lines may get corrected more quickly than another problem area with higher nitrate levels that is located in a more remote area.

Additional Policies that May Apply

Other policies, plans, and laws may apply to a specific geographic area which could affect the response actions. Coordination among governmental agencies is essential when implementing responses to EWL-CAL exceedances. A partial list of related policies follows:

Northern Thurston County Ground Water Management Plan recommendations:

Wastewater; WW-1 to WW-11, pages 5-42 to 5-48, and 6-17 and 18

Pesticides and Fertilizers, PF-1 through PF-4 and PF-5A through PF-5E.

General Recommendations

GR-1 Implementation of policies into local jurisdiction policies

GR-2 Ground water education

GR-3 Plan periodically revised with increase in g w knowledge

GR-4 Health Department Staff response to Citizen requests

GR-5 Funding should be established to prevent or respond to ground water contamination

GR-6 Implementation Agencies should coordinate with Ft. Lewis and Nisqually and Squaxin Island tribes on ground water protection.

Sewerage General Plan for the Unincorporated portion of the Urban Growth Area and the Implementing agreement with the north county Cities.

Cities' Sewerage Plans

LOTT Sewage treatment plan

Comprehensive Drinking Water System Plans for the Cities, including their Well-head protection plans.

Comprehensive Land-use Plans

Critical Areas Ordinances (each jurisdiction's)

IV. Implementation Actions

1. Adoption of EWL-CAL Policy

After revision and adoption, any recommendation of the GW Policy Advisory Committee will be forwarded to the jurisdictions for review and action. The intent would be for all cities and towns and the county to adopt compatible policies to implement the EWLs and CALs.

2. Adoption of Implementing Policies.

By mutual agreement, the participating jurisdictions would need to adopt changes in sewerage, land use, and zoning plans to make the EWL and CAL policy effective.

Reference

Dion, N. P., Turney, G. L., and Jones, M. A., 1994, Hydrology and Quality of Ground Water in Northern Thurston County, Washington: USGS WRIR 92-4109, 188pp..

RESOLUTION NO. H-2-96

A resolution relating to the establishment of Early Warning Levels and Contaminant Action Levels for nitrate in ground water.

WHEREAS, the majority of water used by residents of Thurston County is obtained from the ground; and

WHEREAS, it is recognized that drinking water supplies rely on the purity and availability of the ground water; and

WHEREAS, it is recognized that ground water, once contaminated is expensive and difficult to purify; and

WHEREAS, nitrate contamination in ground water is measurable by cost effective laboratory methods; and

WHEREAS, the levels selected are the result of an investigation of current literature and established based on scientific information; and

WHEREAS, the establishment of Early Warning Levels (EWLs) and Contaminant Action Levels (CALs) for nitrate provides a guidance tool to Thurston County for response to ground water contamination; and

WHEREAS, the establishment of EWLs and CALs is a practical means of implementing the anti-degradation policies contained in state law (RCW 90.48 and Chapter 173-200 WAC); and

WHEREAS, the EWLs and CALs provide a more consistent set of responses for ground water protection activities; and

WHEREAS, the Board of Health believes the establishment of EWLs and CALs is in the public interest, providing guidance to government agencies regarding ground water quality protection, with a flexible response strategy based on available resources.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF HEALTH OF THURSTON COUNTY, as follows:

Section 1. The use of EWLs and CALs guidance as described in Section 3 and 4 shall be implemented on a regional basis and activities associated with the established levels will not be applicable to single or small numbers of samples, unless a competent professional trained in the science of geology or hydrogeology has analyzed the data and determined that reasonable justification and resources exist to consider the problem.

Section 2. Based on current information the background level for nitrate levels in Thurston County ground water shall be established to be between Zero to 1.9 Mg/l. The background level is the concentration reasonably attributed to natural causes without the influence of human activities. Thurston County's ground water nitrate levels are usually below 1 Mg/l. The United States Geologic Survey (USGS) found that 71% of the samples they analyzed in northern Thurston County were below 1 Mg/l (Dion and others, 1994). Natural nitrate sources include rainfall, wildlife, and nitrogen fixing plants. Background levels are typically found up-gradient from residential and agricultural uses and down-gradient from forested areas.

Section 3. The Early Warning Level (EWL) for nitrate shall be 2.0 Mg/l (2.0 to 3.9 Mg/l). This level is above background and generally indicates human activities have affected water quality. This level is not toxic to human use, and the water is fit for all known beneficial uses.

If the nitrate level meets or exceeds the EWL, the Thurston County Regional Ground Water Program will:

- Make a threshold determination about the seriousness of the problem.
- Evaluate corrective and preventative actions that are sufficient to prevent further contamination. In some cases, no action may be the best alternative.

If the nitrate level meets or exceeds the EWL, the local jurisdiction or a designated private party may:

- Choose a lead agency to manage the problem.
- Take additional samples for confirmation of validity and determine contaminant sources
- Increase monitoring to define the scope of the problem. This should include sampling additional wells and sampling for other possible chemical contaminants.
- Make the affected area a high priority for education and enforcement activities.

Section 4. The Contaminant Action Level (CAL) for nitrate shall be 4.0 Mg/l or 40 percent of the Maximum Contaminant Limit, (MCL) of 10Mg/l (4.0 to 9.9 Mg/l). Nitrate below 10.0 Mg/l is still not toxic to humans. This range is significantly above background and some very sensitive beneficial uses may be affected.

If the nitrate level meets or exceeds the CAL, the Thurston County Regional Ground Water Program will:

- Make a threshold determination about the seriousness of the problem.

- Evaluate corrective and preventative actions that are sufficient to prevent further contamination. In some cases, no action may be the best alternative.

If the nitrate level meets or exceeds the CAL, the local jurisdiction or a designated private party may:

- Take any or all of the actions listed for the Early Warning Level.
- Develop and implement a response plan for the affected areas. These response plans would be prepared by Thurston County Health Department staff, or the cities, or a designated private party and would be presented as recommendations to the Health Officer, the Thurston County Board of Health or city councils for action. This plan may include some actions listed below as action at the Maximum Contaminant Level.
- Set a time line for implementing the response plan and any recommended monitoring.
- Pursue methods for funding the response plan.
- Target the affected area as a priority area for the development of farm plans or other responses under Article 6 of the Thurston County Sanitary Code.

Section 5. The Maximum Contaminant Level (MCL) for nitrate shall be set at 10.0 Mg/l. This is the public health drinking water standard. At this level state law requires water purveyors to notify their clients that the water may be harmful to infants, and must devise a strategy to comply with the drinking water standard. There are proven health effects at this level.

If the nitrate level meets or exceeds the MCL, the Thurston County Regional Ground Water Program will:

- Make a threshold determination about the seriousness of the problem.
- Evaluate corrective and preventative actions that are sufficient to prevent further contamination.

If the nitrate level meets or exceeds the MCL, the local jurisdiction or a designated private party may:

- Take any or all of the actions listed for the Early Warning Level or the Contaminant Action Level.
- Request that the Thurston County Board of Health prohibit new on-site sewage disposal permits within the affected area until sewers are available.
- Request that the LOTT members and the Health Officer re-prioritize sewer interceptor timing.
- Evaluate the need for alternate water supplies.

ADOPTED: Sept. 16, 1996

ATTEST:

Patricia A. Swanson
Clerk of the Board of Health

APPROVED AS TO FORM:

BERNARDEAN BROADOUS
PROSECUTING ATTORNEY

By: [Signature]
Jeffrey S. Myers
Deputy Prosecuting Attorney

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