TECHNICAL ASSISTANCE BULLETINS

Groundwater

A technical assistance series prepared by:

Maine State Planning Office

Maine Department of Environmental Protection

Oxford County Soil and Water Conservation District

Androscoggin Valley Council of Governments

with input from a number of professional and citizen planners.

Inside

TA Bulletin #1

This TA Bulletin is one in a series of documents intended to provide guidance to volunteer board and committee members on specific planning topics. Emphasis is placed on the development review process.

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May 2000

Water that is found beneath the land surface is referred to as groundwater. It is one of Maine's critical natural resources. Half of the state's total population and almost all of its rural population depend upon groundwater for domestic use.

Drinking water, whether supplied from public or private sources, is one of our most important resources.

- Ninety percent of rural residents depend upon groundwater as their primary source of drinking water.
- Over 300 community water systems, supplying over 213,000 residents, use groundwater.
- Over 370 non-transient public systems such as schools and factories use groundwater sources to serve approximately 70,000 people.
- One thousand three hundred (1,300) transient public supplies, such as a restaurant, serve over 200,000 patrons.

Property values and municipal growth depend on the quantity and quality of water available for drinking as well as for commercial and industrial processes.

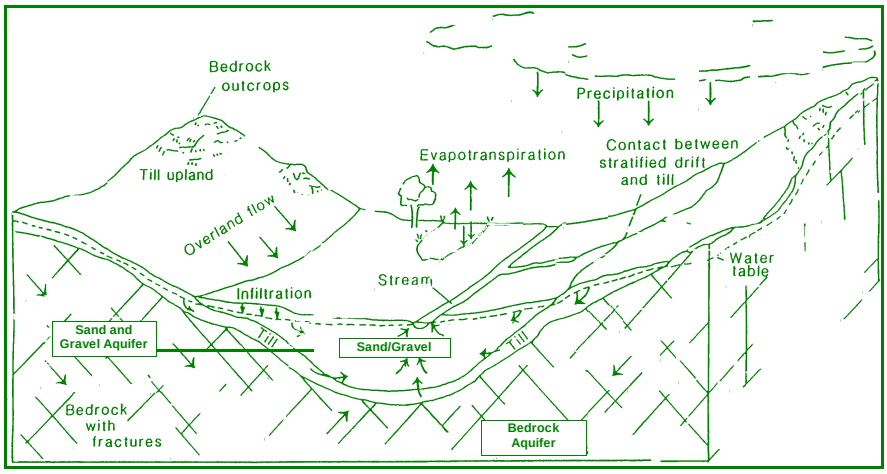
Many municipal water systems use groundwater as their source. Schools and businesses in rural areas also depend on groundwater. Additionally, most of the single-family homes in rural areas rely on groundwater obtained from drilled or dug wells, well points, or springs. Groundwater is one of our most valuable resources, yet it is often taken for granted.

Background Information

Principles of Groundwater

The constant movement of water above, on, and below the earth's surface is known as the hydrologic cycle. Groundwater is part of this continuous sun-driven cycle that includes precipitation of water onto the land, infiltration into the ground, slow flow through the ground to wetlands, streams, lakes and the oceans, and evaporation back into the atmosphere for release as rain and snow.

Hydrologic Cycle Showing Groundwater Aquifers



Adapted from graphic developed by U.S.G.S.

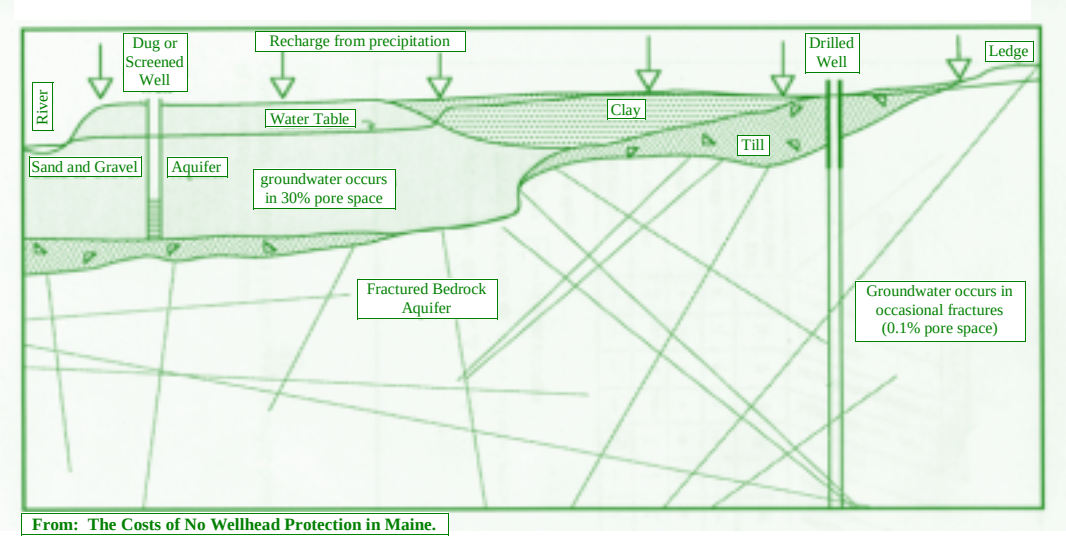
In Maine, "normal" precipitation averages about forty-four (44) inches per year which is equivalent to about one million one hundred ninety-five thousand (1,195,000) gallons of water falling on each acre in a year's time. Most of this large volume of water is lost through runoff, transpiration, and evaporation. The small portion that seeps into the ground and percolates through the soil becomes groundwater. This water is then stored in **aquifers** which are permeable soil or rock materials capable of holding, transmitting, and yielding water to wells and springs. One type of aquifer is a **bedrock aquifer** where groundwater is stored in faults or fractures in the rock or between the grains in sedimentary rocks. Another type of aquifer is a sand and gravel aquifer; it consists of sand and gravel deposits, many of which line our rivers in the foothills and coastal plain. They store groundwater in the pores between the soil particles.

Bedrock aquifers typically have very low yields producing only enough water to supply a single household while sand and gravel aquifers often have high yields making them more suitable for use as municipal water supplies.

Groundwater is recharged through the infiltration of precipitation. Surface waters such as streams, lakes, and wetlands may recharge groundwater especially during droughts or near large wells. More often, groundwater flows upward into streams, lakes, and wetlands recharging them. It is this process, referred to as groundwater discharge, which constitutes the base flow of many streams that would otherwise be dry in non-rainy periods. The quality and quantity of our groundwater and surface waters are, therefore, integrally related. The specific recharge-discharge relationship between these resources varies according to the individual site and time of year.

Groundwater recharge rates from precipitation are controlled by the type of soils and land cover in an area. Clay soils are largely impermeable due to their small, unconnected pores. Water infiltration in a clay soil is minimal. At the other end of the scale, soils consisting of sands and gravel have larger, connected pores which transmit and store water easily. The type of land cover also helps determine the amount of infiltration in an area. In general, wooded areas permit relatively greater recharge than open fields, and impermeable surfaces such as paved areas and buildings provide no recharge at all.

Section Showing Bedrock and Sand and Gravel Aquifers



From: The Costs of No Wellhead Protection in Maine.

Potential for Contamination

Although most of Maine's groundwater is of high quality, the growth and dispersion of Maine's population and associated land use activities are threatening the quality of Maine's groundwater resources and, at the same time, creating additional demands for potable groundwater. Once polluted, groundwater supplies are extremely difficult and expensive to clean.

Many materials and substances have the potential to contaminate groundwater, including:

- petroleum products
- bacteria
- fertilizers and nutrients
- toxic chemicals such as solvents and antifreeze
- heavy metals

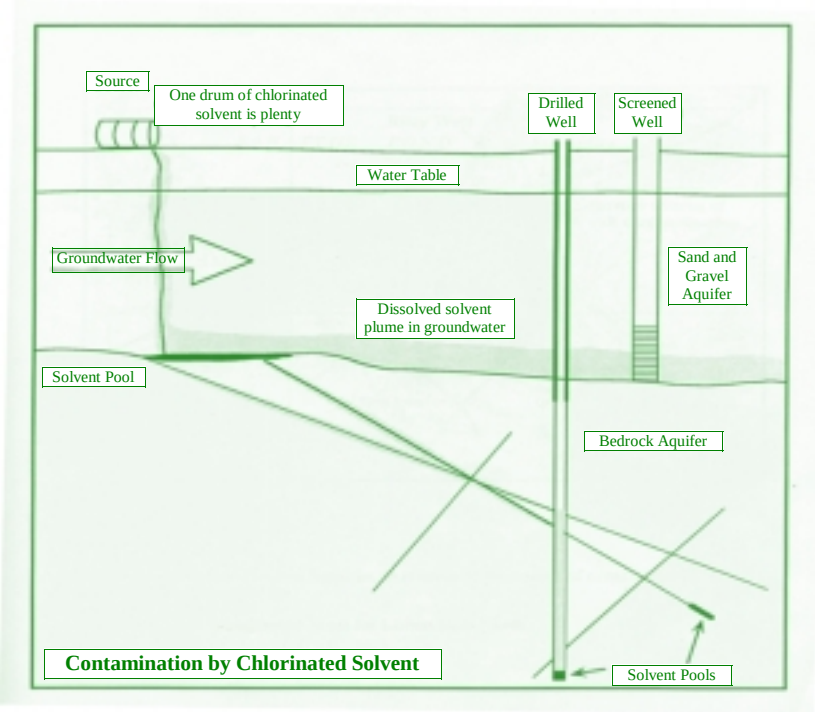
Sources of these types of groundwater contamination include:

- spills and leaks from various commercial or industrial activities
- improper storage of various types of petroleum products and other materials
- illegal dumping of oil, solvents, and other pollutants by residents and businesses
- agricultural operations
- septic systems
- waste dumps and landfills

Several large and pervasive threats such as underground petroleum tanks, sand-salt piles, and dumps have been addressed at the State level over the past several decades, but more remains to be done. Potential threats of a more insidious nature are typically from unplanned spills, leaks, and discharges. A list of business and industrial types that present possible threats appears in the highlighted box on the following page. These businesses pose a threat due to the type of materials that they handle. If facilities are properly designed and materials handled with care, the potential for contamination of the groundwater is reduced.

Contaminants tend to move with groundwater but often form a well-defined slug or "plume." A very small amount of chemical can contaminate an extensive amount of groundwater making it unusable for domestic purposes. Because groundwater moves slowly and because it is "out of sight," oftentimes, incidents of contamination are found and reported only after drinking water has been affected.

Contamination of Bedrock and Sand and Gravel Aquifers



From: The Costs of No Wellhead Protection in Maine (edited).

Potential Sources of Groundwater Contamination

There is very little treatment of most contaminants in the soil. While soils generally treat residential sewage fairly well, they have little to no impact on most chemicals and petroleum products. For example, soils provide no treatment to either salt or gasoline. Once contaminated, groundwater does not readily purify itself, and the slow rate of movement also means that once it is contaminated, it does not readily flush from the area. Over long periods of time, contamination can travel significant distances and contaminate wells and surface water a mile or more away.

Adapted from graphic developed by EPA.

Uses Which are a Potential Threat to Groundwater

agricultural chemical storage
airport fire fighter training areas
airport fueling areas
airport maintenance
auto chemical supplies wholesalers
auto repair
auto washes
beauty salons
boat builders, refinishers
body shops
chemical reclamation
chemical bulk storage
concrete, asphalt, tar, coal companies
construction sites/demolition activities
covered salt or sand/salt piles
demolition of uses listed in this table
dry cleaners
feed lots
food processors
fuel oil transfer and storage
furniture strippers
gas stations, service stations
golf courses and golf course maintenance facilities
hazardous or special waste storage or disposal
heat treaters, smelters, annealers, descalers
heating oil storage (consumptive use)
industrial manufacturers
industrial waste disposal
junk, salvage yards (including tire storage)

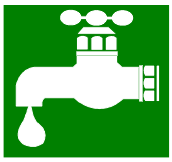
transfer stations and recycling facilities
laundromats
machine shops
manure piles
meat packers, slaughter houses, abattoirs
medical, dental, veterinary offices
metal plating/electroplating
nurseries (horticultural)
oil pipelines
painters, finishers
pesticide, herbicide, wholesalers or retailers
pesticide, herbicide bulk storage
photo processors
printers
railroad yards
research laboratories
residential homes
rust-proofers
open salt or sand/salt piles
sand and gravel mining, other mining
sludge utilization
small engine repair shops
snow dumps
stormwater impoundments
truck terminals
utility corridors
wastewater impoundment areas
wastewater treatment plants
wood preserving operations (commercial)

(from Model Wellhead Protection Ordinance, AVCOG)

Planning Considerations

Planning for Protection

Protection of groundwater resources involves three activities: **Planning, Regulation, and Education.** Planning, accomplished through the Comprehensive Planning Process, identifies the resources and potential threats and determines public policy. Regulation involves ordinances with standards for and methods of review. Education involves informing the public of the importance of groundwater and how it can be protected.



The Comprehensive Plan is an important part of protection. It determines the value of the resources to the community and establishes the goals, policies, and strategies for protecting them. The plan must be specific; the local regulations must have a sound basis in the plan. The plan should also lay out methods to implement an education process. With groundwater, as perhaps no other resource, there is significant potential for contamination from many existing sources. A local education program can help to reduce this potential.

Comprehensive Planning Process

- The first step is to inventory groundwater resources and determine their importance in your community. Of great importance are public drinking water supplies. The area which contributes groundwater to a well is called the Wellhead Area. Federal and State law requires each public water supply to delineate an area around the wellhead and develop a protection plan for it. As a town proceeds with the steps below to develop their groundwater protection policies and strategies, the planners must keep in mind Wellhead Protection Areas as well as areas of possible future public wells. In addition, groundwater may warrant protection even if it is not associated with a wellhead or high yield aquifer. For example, it may provide a base flow for wetlands, streams, lakes, or other water bodies that sustain important wildlife and fisheries habitat.

Wellhead protection may require the development of an overlay zone or zones which prohibit certain types of development and/or in which there are more detailed controls to prevent contamination of the groundwater.

- Map the Sand and Gravel Aquifers. (Maps are available from your Regional Council, the Maine

Geological Survey, and may be on the Maine Office of Geographical Information Systems web page for downloading into GIS software.)

- If the local public water system uses groundwater as its source, the location of the source must be obtained along with the amount extracted and yield of the aquifer, the type of well, and a map of the wellhead area. If an aquifer in the municipality is used as a source of water by a nearby town, district, or other public supply, the same information including the extent of the wellhead area should be obtained.
- Determine the location of any other public or large scale private users of groundwater such as restaurants, schools, and businesses in the municipality or in an adjacent town near the town boundary. Other information to be obtained: the location and type of their sources and if they have ever had any geological work done to determine the yield and recharge rates of the aquifer. Inform them that planning is being done, and solicit their involvement.
- Determine the percent of people on private water supplies and the prevalent types of sources - drilled wells, dug wells, etc.
- Document any known problems with public and private supplies. Since groundwater is hidden and not tested regularly, note anecdotal evidence of problems. It may provide direction for additional study.
- Inventory potential sources of contamination. Major sources of contamination such as salt piles, old landfills (dumps) and industries handling hazardous materials in bulk (greater than two thousand [2,000] gallons) should be mapped. Also, map areas of concentrated business and industrial development. These areas may have small businesses which could unknowingly contaminate groundwater through floor drains, small spills, etc.

- Compare the public and large private groundwater supplies with the existing land uses to determine potential threats to the aquifer and water supplies in town or in neighboring towns since groundwater knows no political boundaries. Potential problem areas include:

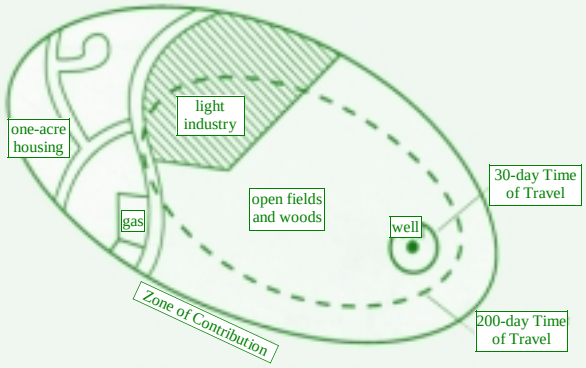
  - a bulk storage facility located within the wellhead protection area of a public water supply well,
  - industrial areas within two thousand five hundred (2,500) feet of public supplies, and
  - gasoline stations located uphill from an area that uses individual drilled wells for water supply.

- Develop policies which will protect groundwater resources, aquifers and, particularly, public and private water supplies. To the extent possible, industrial zones, especially those which would allow industries using bulk quantities of hazardous materials, should not be located in the wellhead protection area of a public water supply. Separation should also be provided between businesses using or storing hazardous materials and concentrated areas of housing which use on-site water supplies.

In cases where there are significant sources of contamination in wellhead protection areas, consider policies which require installation of Best Management Practices at existing facilities.

Some examples of groundwater protection policies and strategies are provided below as a guide. Goals, policies, and strategies should be adapted to the needs of the individual town.

Planning a Wellhead Protection Area



TYPICAL WELLHEAD AREA WITH POSSIBLE LAND USES

From: The Costs of No Wellhead Protection in Maine.

Sample Policies

⇒ Improve and protect the quality and quantity of groundwater resources for current and future use.

⇒ Control activities over significant aquifers such that the cumulative effect of those activities does not reduce water quality below State Primary and Secondary Drinking Water Standards.

⇒ Control activities, including limiting the amount of impervious area, over significant sand and gravel aquifers such that the cumulative effect of those activities does not reduce the quantity of water available for use by existing or potential future uses.

⇒ Protect wellhead areas of the public drinking water supply and for identified potential new well sites.

Sample Strategies

⇒ The Planning Board should inform the water district (department if municipally owned) and other owners of public water supplies when new or expanded uses are proposed within the wellhead area.

⇒ The Planning Board should provide the water district opportunity to review and comment on all development proposals on the significant sand and gravel aquifer(s).

⇒ The Conservation Commission should work with local water districts to develop and implement an education campaign to inform residents and businesses of the importance of groundwater and potential threats to it.

⇒ Groundwater protection standards in town ordinance should require Best Management Practices in all facilities that store, handle, or transport hazardous materials.

⇒ Town ordinances should delineate wellhead protection areas identified by a state certified hydrogeologist. Uses should be severely restricted near the well, and all activity in the area should be governed by the best available management practices.

Review Process

The Review Process starts with the submittal of the required information by the developer. The significance of the issues involving groundwater quantity and quality will depend on the location of the development in the community and the type of development. Reviewers will need to determine the significance of the issue and let that guide them in the level of detail they will use in reviewing the development.

This section of the bulletin provides model ordinance language for submittal requirements; it also provides a discussion of how to apply the requirement and of how to use the information during the review process.

The next section of the bulletin provides model "standards" that the development must meet to obtain approval. The Review Standards section presents several levels of standards. A Basic Standard is presented first, followed by additional standards or more detailed standards. This Review Process section is divided into subsections which correspond to the alternative standards presented in the Review Standards section.

The left column provides a listing of documents (submittals) which municipalities should require in order to adequately review proposals. Each submittal helps the reviewing authority determine whether the standard contained in the ordinance will be met. The reviewing authority has to review and understand the submittals. The background information provided in this bulletin and the discussions of the submittals and the standards will help the authority interpret the submittals. Submittal requirements should be included in local ordinances. The town may also develop a submittal checklist so that it can easily determine if an application is complete.

The right column provides a discussion of the submittal requirements. The discussion points provide information about why the submittals are needed and how they are used in determining compliance with the standard.

Submittals

Discussion

I. Submittals for Basic Standard
For Use in Subdivision, Zoning, and Site Plan Review Ordinances

The following submittals consider the potential impacts of a development on the quantity of groundwater available for both subdivisions and other site development. The submittals also consider the potential impacts on quality from sanitary waste: the waste generated by bathroom and kitchen use.

A. Statement including:

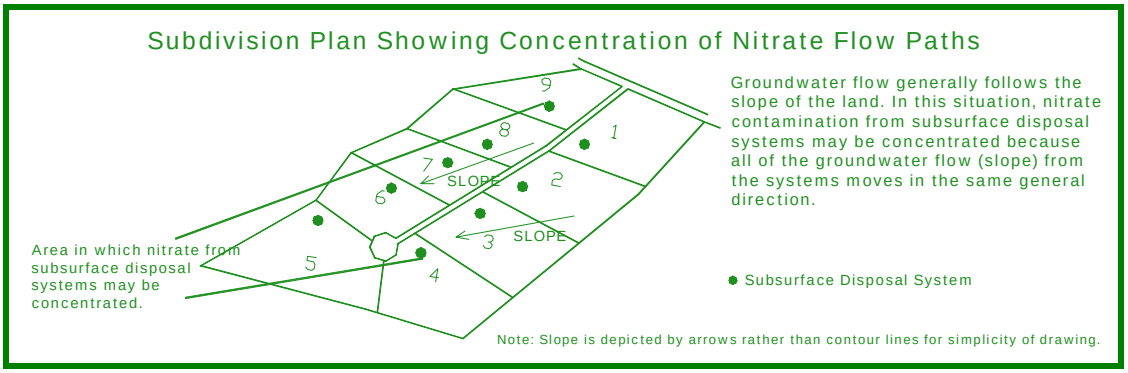
- type of water supply to be used,
- quantity of water to be used by the development upon startup and at build out,
- quantity and nature of sewage or liquid waste to be disposed.

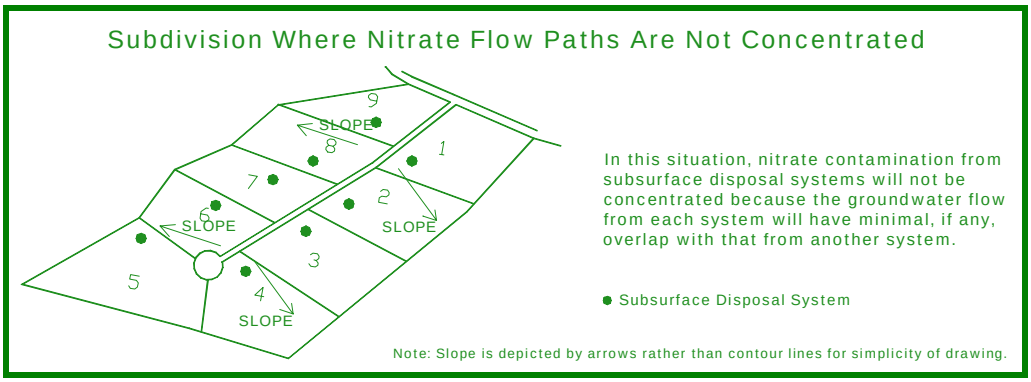
A. The statement can be simple but should reference how the quantities were estimated. The statement can be provided by the developer or site evaluator for developments using or disposing of less than two thousand (2,000) gallons per day. The quantities should be calculated in accordance with the State Plumbing Code or, for industrial uses, with recognized industrial standards.

B. If over two thousand (2,000) gallons of water are used or sewage waste is generated, a statement by a State Certified Geologist or Professional Engineer detailing the potential impacts on abutting property owners and considering both quantity and quality. The analysis shall include:

B. The statement should indicate that the development will not adversely impact the quantity or quality of water at the property boundary.

Nitrate is the pollutant contained in sanitary (domestic) sewage which has the greatest migration potential. For developments which use a single or tightly clustered subsurface disposal system(s) for over two thousand (2,000) gpd, a nitrate analysis is appropriate. It may also be appropriate where eight (8) or more residential housing units are placed on lots having densities of less than one (1) house per two (2) acres. The appropriateness will depend on the lot layout, the topography, and the soil conditions. For example, an analysis may not be necessary if the disposal areas are located in different drainage sheds (waste flows towards different property boundaries). Sandy soils permit the migration of nitrate more readily than clay and glacial till soils.





Submittals

- a nitrate analysis where appropriate, and

- a hydrologic analysis of the potential impacts on the quantity of water available to abutters where appropriate.

C. A map of the sand and gravel aquifers within two thousand (2,000) feet of the site with existing and proposed water supply wells, subsurface sewage disposal areas, buildings, and other relevant structures delineated and labeled.

Discussion

The analysis should clearly state the concentration of nitrate expected at the property boundary and that allowed in drinking water by the Maine Department of Human Services.

The need for a detailed analysis of quantity will depend on the geology and the flow rate. Usually, quantity will not be an issue until use on the development site reaches ten thousand (10,000) gallons per day for bedrock wells and well points and fifty thousand (50,000) gallons per day for wells in sand and gravel aquifers.

C. A map will be helpful in determining the potential for the development to contaminate mapped sand and gravel aquifers. The map may be a copy of one produced by the Maine Geological Survey or by an independent, professional geologist. The further that the development is from the site, the less detailed the delineation of disposal areas and buildings needs to be.

II. Submittals for Basic Standard Addition for Use in Zoning and Site Plan Review Ordinances

(In addition to those required in Section I)

The submittals are to be used for site review whether part of a zoning ordinance or as a stand alone site plan review ordinance. The submittals are in addition to those found in Section I. The submittals ensure that the reviewing authority is aware of any hazardous materials or wastes that will be used or generated on the site. The reviewing authority can then require the use management practices that will protect groundwater from accidental spills and leaks. The fire department will also find the information helpful for emergency response.

Submittals	Discussion
D. A list of all petroleum products, hazardous materials, and hazardous wastes which are regulated by federal or state government agencies and which will be handled on site, whether used, stored, transported, or transferred. The list will contain the name of the agency which regulates the hazardous materials, the volume of each handled, a statement on how it will be used, and a brief synopsis of how it is regulated.	**D.** The reviewing authority needs to understand what hazardous materials will be handled on site, how they will be used and handled, and how they are regulated by federal and state agencies.
E. If other than domestic sewage is to be disposed on site or if fertilizers or pesticides are to be applied, a statement by a State Certified Geologist or Professional Engineer detailing the potential impacts on groundwater quality and that of abutting property.	**E.** The need for a detailed analysis of quality will depend on the type of activities which will occur. Usually, subsurface sewage disposal can only be used for domestic sewage, and Best Management Practices should be used to prevent the contamination of groundwater from hazardous material storage and use. Therefore, in most cases, this analysis is not necessary. However, it may be appropriate to conduct an analysis where chemicals (pesticides or herbicides) are to be applied to the ground such as with power line clearing and agricultural and silvicultural operations to which the ordinance is applicable.

III. Submittals for More Detailed Standard For Use in Subdivision, Zoning, and Site Plan Review Ordinances

The submittals for this section of the more detailed standard are the same as for the Basic Standard that has been previously presented. These submittals consider the potential impacts of a development on the quantity of groundwater available for both subdivisions and other site development. The submittals also consider the potential impacts on quality from sanitary waste: the waste generated by bathroom and kitchen use. Refer to Section I for the listing and discussion.

IV. Submittals for More Detailed Standard Addition for Use in Zoning and Site Plan Review Ordinances

(In addition to those required in Section III)

The submittals provide for a more detailed review of commercial or industrial proposals using the site review procedures whether part of a zoning ordinance or as a stand alone site plan review ordinance. The submittals are in addition to those of Section I (also III) and II. The submittals ensure that the reviewing authority is aware of any hazardous materials or wastes that will be used or generated on the site and requires the applicant to make provisions for containing spills and leaks and for responding to emergency releases. The reviewing authority can require the use of any additional management practices that will protect groundwater. The fire department will also find the information helpful for emergency response.

F. A plan detailing the activities involved in the handling of the petroleum products, hazardous materials, and hazardous wastes including methods to update the plan and to train employees.	**F.** The reviewers should understand how the hazardous materials are to be handled and used so that they may assess the potential for spills and leaks and ensure that the developer has considered groundwater protection in the planning and design of the development. The plan should include procedures which will be used during the handling of hazardous materials so that the potential for spills is reduced. Liquid waste should be characterized, and a plan for handling it should be included. Industrial waste, chemicals, solvents, and petroleum products cannot be discharged to a septic system. The plan should include methods to keep current employees trained and to train new employees. This plan may be combined with the SPCC required in the following submittal.

Submittals	Discussion
G. A Spill Prevention, Control and Countermeasures (SPCC) plan.	**G.** The SPCC plan provides guidance on preventing spills and leaks and on controlling and cleaning them up. The plan should be specific to the establishment. It should contain information on: • how spills can be prevented, • how to contain and clean up spills, • hazardous materials and equipment available to contain and clean up spills, • a training schedule, • a list of emergency phone numbers specifying where they will be posted, • procedures to train the fire department and other emergency response personnel (reviewing procedures with the fire chief at least annually is a good idea), and • an inspection schedule for all areas.
H. Drawings or sketches of the building layout with the handling, storage, use, and transfer areas clearly marked. A plan for the floor drains, storm drains, and sewage piping including any pretreatment facilities should be included.	**H.** The drawings can be a simple sketch plan of the building with notes as to the areas and activities occurring in the areas. A condition of approval should be to have an as-built plan of the building and site provided to the Planning Board and the Fire Chief. The as-built should have all areas and activities clearly marked, also.
I. A report by a Professional Engineer registered in the State of Maine or other competent professional which addresses the design methodology – why the facility was designed the way it was and how groundwater protection was considered. The report should include information and drawings as needed on:	**I.** The report should identify the areas where hazardous materials are to be stored, handled, and used.
1. Containment facilities to be constructed into the building.	1. The report should contain information on how spills and leaks will be controlled by the structural features of the site, and buildings and drawings should be provided of containment structures to ensure that they are adequate and easy to maintain.
2. A description of any portable containment facilities or equipment to be used.	2. Portable containment devices should be used around areas where hazardous materials are transferred from their original containers to smaller ones for use or where small quantities of wastes are poured into larger containers for temporary storage.
3. Steps taken to reduce the use of hazardous materials.	3. The report should note any steps taken to reduce the use of hazardous materials such as replacing petroleum based solvents with aqueous degreasers.
4. Steps taken to control and reduce the amount of waste produced.	4. The report should note the steps taken to reduce the amount of hazardous waste produced such as use of computerized paint mixing to eliminate trial and error color matching.

Review Standards

This section presents review standards which should be included in subdivision, zoning, and site plan review ordinances. The standards should be applied to new development, expansions, and changes in use. Standards are presented in the left column and a discussion of the standard appears in the right column.

Several alternatives having varying amounts of detail are included. First is a basic standard which addresses the impacts of a development on the quantity of groundwater available for both subdivisions and other site development. It also addresses potential impacts on quality from sanitary waste. Section II is an addition to the Basic Standard for use in reviewing uses which may use or generate hazardous materials or wastes. Section III is a more detailed standard for use in subdivision, zoning, and site plan review ordinances. It addresses the same issues as the Basic Standard (I) but provides a stricter limit on potential groundwater impacts. Section IV is a more detailed standard to address commercial and industrial development using a zoning or site plan review ordinance. It requires the applicant to undertake more detailed planning for emergency releases of hazardous materials.

In order to provide additional protection to significant sand and gravel aquifers or to protect public water supplies, especially municipal supplies, towns may adopt an aquifer protection overlay zone or a wellhead protection zone around a municipal well. These overlay zones may regulate types of land uses in addition to the types of management practices which this standard addresses. The standards below are intended to be used town-wide. For protection of aquifers around public water supplies (wellheads), additional references should be consulted.

The discussion notes if the standard is primarily for subdivision or site plan review. Standards most relevant to residential use should be included in the subdivision ordinance while standards relevant to commercial and industrial use should be included in site plan review.

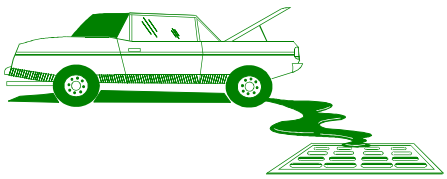
Standard

Discussion

I. Basic Standard
For Use in Subdivision, Zoning, and Site Plan Review Ordinances

The Basic Standard can be used in subdivision ordinances and in site plan review. It provides a minimum level of protection of the groundwater resource. It is best used by towns which have a low growth and where most proposed residential subdivisions are small (less than ten [10] lots) and have relatively large lots (over sixty thousand [60,000] sq. ft.). The standard is primarily aimed at nitrate contamination from domestic sewage. It also addresses quantity issues in a fundamental manner.

A. The proposed use must not adversely impact either the quality or quantity of groundwater available to abutting properties or to public water supplies. Applicants whose projects involve on-site water supply or sewage disposal systems with a capacity of two thousand (2,000) gallons per day (gpd) or greater must demonstrate that the groundwater at the property line will comply, following development, with the Primary and Secondary Standards for Drinking Water as established by the Maine Department of Human Services.



A. Nitrate is the pollutant in domestic sewage that travels the furthest with the least amount of treatment in the soil. The nitrate concentration at the property boundary must be determined by a nitrate transport model developed for the site by a State Certified Geologist or Professional Engineer. Flows should be based on the sewage disposal rates used in the Maine Subsurface Wastewater Disposal Rules (State Plumbing Code), a recognized national industrial standard, or other documented experience. Discharges of other than normal household sanitary waste requires a waste discharge license from the Maine Department of Environmental Protection. Generally, metals, chemicals, and industrial wastes cannot be discharged to groundwater or disposed in subsurface systems. Therefore, even though the standard references the Drinking Water rules, concentrations of anything other than nitrate should not increase.

The standard also addresses groundwater quantity. Evaluating impacts on quantity can be simple in most settings. See discussion of submittals for this standard in the Review Process section.

Two thousand (2,000) gpd is the equivalent of approximately eight (8) single family units (assume three

Standard	Discussion
	[3] bedroom units). Large businesses, institutions, and uses such as restaurants may exceed two thousand (2,000) gpd. There are very few locations in Maine where single family residences using on-site wells would impact the quantity of water available to the development or abutting property. However, when more than two thousand (2,000) gpd is to be pumped from a single source well, additional information is warranted. If drilled wells in bedrock are to be used, then information from a well driller familiar with the area may be all that is needed for flows up to ten thousand (10,000) gpd. Above that, the evaluation by a geologist is recommended.

II. Basic Standard
Addition for Use in Zoning and Site Plan Review Ordinances
(In addition to those required in Section I)

This standard is for use in Site Plan Review. It should be used in addition to the Basic Standard (I). It is best suited to towns which have slow growth and small scale commercial and industrial development (i.e., fewer than five [5] employees on lots of less than two [2] acres). This standard applies to non-residential development and provides varying degrees of protection depending on the type and quantity of materials used and how they are handled.

B. The transportation, handling, storage, use, and disposal of petroleum products and all materials and wastes identified by the standards of a federal or state agency as hazardous must be done in accordance with the standards of these agencies. (NOTE: Agencies include the U.S. Environmental Protection Agency, the Maine Department of Environmental Protection, the U.S. Department of Transportation, and the State of Maine Fire Marshall.)	**B.** In small businesses such as a local auto body shop, only the disposal of the hazardous materials (solvents and paint) is regulated by federal and state agencies. Storage of the product in order to protect groundwater is not. Businesses that require regulation in order to protect groundwater may be as small as a one- (1) person auto body shop or printer. Some commercial businesses also use hazardous materials. The table found on Page 4, Uses Which are a Potential Threat to Groundwater, is a list of uses which poses a potential threat to groundwater. Most liquid chemicals have the potential to contaminate groundwater, and many are considered hazardous. See Definitions at the end of the bulletin.

III. Detailed Standard
For Use in Subdivision, Zoning, and Site Plan Review Ordinances

The standard provides an added degree of protection beyond the Basic Standard. It should be used to replace the Basic Standard for Subdivision and Site Plan Review (I) for those municipalities seeking additional protection. For Site Plan Review, it should be used in conjunction with the addition in Section IV. It is best suited to towns experiencing significant growth and having relatively large subdivisions (greater than ten [10] lots) brought before them.

A. The use will not increase the contaminant concentration in the groundwater at the property line of the development to more than eighty (80) percent of the State's Primary and Secondary Drinking Water Standards.	**A.** See discussion of the Basic Standard (I). For small projects, the opinion of a State Certified Geologist or Professional Engineer may be adequate to determine that there will be no impact on the quality of groundwater beyond the property boundary.
B. Projects which propose on-site water supply or sewage disposal systems with a capacity of two thousand (2,000) gallons per day (gpd) or greater must demonstrate that the groundwater at the property line will comply with A.	**B.** For larger projects, the nitrate concentration at the property boundary must be determined by developing a nitrate transport model (see discussion of Basic Standard [I]).

Standard	Discussion
C. The use will not decrease the quantity of groundwater available on nearby properties below the quantity needed to support existing uses, potential expansions of existing uses, or allowable uses.	**C.** See discussion of the Basic Standard (I). This standard considers the availability of groundwater on adjacent properties in more detail than the Basic Standard. It considers potential future uses of adjacent properties as well as current uses.

IV. Detailed Standard
Addition for Use in Zoning and Site Plan Review Ordinances
(In addition to those required in Section III)

The Basic Standard for Site Plan Review is used, but is supplemented by additional standards requiring the use of Best Management Practices. The standard is primarily concerned with commercial and industrial operations from the local body shop to large manufacturing facilities. It is suited to towns which desire an added degree of groundwater protection from hazardous materials used at business operations. It is best suited to towns experiencing significant growth in the business sector. It should be used in conjunction with the Basic Standard (I) or the Detailed Standard (III) in order to account for possible nitrate loading and quantity concerns. Use of this standard will provide for enforcement at the local level and allow some oversight on housekeeping practices which are an important method of preventing groundwater contamination from accidental spills and leaks. It provides an extra degree of review and security for the town.

D. The handling, storage, use, and disposal of petroleum products and all materials and wastes identified by the standards of a federal or state agency as hazardous must be done in accordance with the standards of these agencies. (NOTE: Agencies include the U.S. Environmental Protection Agency, the Maine Department of Environmental Protection, the U.S. Department of Transportation, and the State of Maine Fire Marshall.)	**D**. See discussion for Basic Standard (II).
E. The proposed use must employ Best Management Practices to prevent the pollution of groundwater with petroleum products and hazardous materials or wastes identified by the federal or state agencies. The following Best Management Practices, or their equivalent, shall be used:	**E.** Best Management Practices are methods which are used to ensure that hazardous materials are properly handled and do not result in contamination of the air, surface water, or groundwater. There may be several practices which can be used to obtain this desired goal. The application often depends on the specific situation. For example, it may be best to eliminate floor drains, but when working with highly flammable chemicals, the State Fire Marshall's Office may require them. Therefore, secondary containment of the piping and tanks used to hold the floor drain inflow is needed. An alarm on the tank to indicate that it is half full would also be a desirable management practice.
1. A plan noting the potential environmental hazards and detailing the proper handling, transportation, storage, use, recycling, and/or disposal shall be maintained and updated as needed. Employees shall be familiar with the plan.	1. The plan provides the reviewers with knowledge that the business has considered all aspects of handling hazardous materials and that employees will be aware of the potential hazards and procedures.
2. A Spill Prevention, Containment, and Countermeasures (SPCC) Plan must be available and understood by all owners, managers, and employees.	2. The SPCC provides reviewers with information on how spills will be prevented and handled if they occur. All employees need to be aware of the procedures. The plan required in #1 may be incorporated into the SPCC.
3. All floor areas in buildings where transferring, handling, using, recycling, or storage of	3. A solid, impervious surface eliminates the potential for spills and leaks to soak into the

Standard	Discussion
materials is conducted shall be constructed of a solid, impervious surface.	ground. Spills and leaks are less readily detected on dirt floors, and they are more difficult to contain and clean up.
4. Areas where hazardous materials are stored or transferred shall not have floor drains, or, if outside, storm drains.	4. Floor drains can be direct routes to groundwater, and storm drains can create paths to groundwater and surface waters.
5. When feasible, there shall be no floor drains in areas where hazardous materials are used. If proven necessary by the applicant, floor drains shall be connected to a public sewer or to a water tight holding tank. Piping to the holding tank shall have secondary containment, and the holding tank shall have an audible and visible alarm which shall be activated when the tank is full to seventy-five (75) percent of capacity.	5. Floor drains should be discouraged, but they are sometimes necessary. An example is a facility that brings in vehicles for repair during inclement weather conditions. Rain and snowmelt from vehicles may wash oil and grease from the floor into drains. However, if a floor drain is not used, the water may flow out the door and can contaminate the yard area. It is best to connect floor drains to public sewers. If a holding tank is used, the piping should have secondary containment and the holding tank should have an alarm to indicate that it needs to be pumped.
6. When floor drains are connected to a public sewer, adequate pretreatment, including the use of oil/water separators, shall be provided.	6. The local sewer department or district should be consulted to determine pre-treatment needs.
7. Floor drains shall not be connected to subsurface disposal systems.	7. Subsurface sewage disposal systems are designed to accept only domestic sewage. Floor drain wastes which may contain oil and grease or strong detergents can cause systems to fail.
8. Sink and bathroom drains to subsurface disposal systems shall be located so as to prevent the discharge of hazardous materials to the system.	8. Sewer drains connected to subsurface disposal systems should be located such that they cannot be easily used for the disposal of process wastes and hazardous materials. For example, sinks should be in separate rooms and not in shop areas.
9. Spill containment materials shall be available in the immediate vicinity of all storage, use, and transfer operations. They shall be clearly marked.	9. Spill containment materials are needed immediately when hazardous materials are spilled or leaks detected. They need to be readily available and clearly marked.
10. Outside storage of hazardous materials, except in bulk storage tanks complying with state requirements, is not permitted.	10. Hazardous materials should not be stored outside except in bulk storage tanks which have containment and roofs to prevent precipitation from building up in the containment area. Exposure to weather can damage containers, and leaks and spills are more difficult to detect and clean up.
11. All hazardous materials must be stored in water tight containers which are clearly marked as to their content. Secondary containment equal to one hundred twenty-five (125) percent of the amount of material in the storage container(s) shall be provided.	11. Hazardous materials should be stored in leak proof containers, and there should be containment in the event that a container is ruptured or other catastrophic failure occurs.

Standard	Discussion
12. Adequate containment shall be provided around all areas where hazardous materials are transferred from one container to another.	12. Small containment systems can be used to contain small spills and drips from the transfer of hazardous materials in relatively small quantities on a routine basis. An example would be the transfer of waste oil from a vehicle into a fifty-five- (55) gallon drum at an automobile repair facility.
13. Where bulk storage is used, containment equal to one hundred twenty-five (125) percent of the largest bulk storage vessel shall be provided.	13. Containment is needed in case of a catastrophic spill or leak. This sometimes occurs during material transfer or because someone leaves a valve open.
14. Fluids shall be drained from all equipment being stored outside for a period of over three (3) months and from all junk stored on site for over twenty-four (24) hours.	14. Fluids, including oil, gasoline, and hydraulic fluid, can leak from equipment and other junk. Since junk parts and equipment will need the fluid drained before transport and processing, it is best to drain it shortly after it arrives on site.
15. Refueling operations and non-emergency equipment maintenance shall not be accomplished in gravel pits.	15. Refueling operations (transfer of a petroleum product) and equipment maintenance can lead to sizeable spills of fuel, oil, and hydraulic fluid. Most gravel pits are located on sand and gravel aquifers which are particularly susceptible to petroleum product contamination.
16. Routine maintenance operations should be conducted inside structures and on impermeable surfaces.	16. Routine or non-emergency maintenance operations can be the source of leaks and spills of petroleum products and solvents. Having such operations outside allows rain and snow to wash away leaks before they are cleaned up. Also, cleaning up permeable surfaces such as gravel is difficult.

V. Additional Standard, Residential

This standard can be used as an addition to any of the previous standards or as a stand alone requirement in a Building Code. It can be used in subdivision ordinances where it would be applicable to future home construction or in site plan review procedures (zoning or site plan review ordinances) where it would be applicable to any building construction being reviewed. For subdivision, the standard would become a condition for construction of new homes.

F. Heating oil tanks shall be located in the basement which shall have an impermeable floor or, if located on the exterior, on an impermeable pad. An exterior installation shall be located such that it can be easily inspected.	**F.** This criteria may be used to ensure that the storage of home heating oil will not contaminate groundwater. It has been common practice in some areas to locate oil tanks under stairs in mobile home parks. This should be discouraged since leaks are difficult to detect.

Definitions

The following are explanations of the terms used. They are presented to provide a context for this bulletin and should not be used as definitions in an ordinance.

Base Flow - the part of stream discharge derived from groundwater seeping into the stream. The base flow keeps many streams flowing when precipitation is minimal.
Bedrock – commonly referred to as ledge, the parent rock material underlying the loose soil at the surface of the earth.
Discharge - the volume of water moving through an aquifer past a specific point in a given period of time.
Evaporation - the process by which water passes from the liquid to the vapor state in the atmosphere.
Fault - fractures or cracks in bedrock. Drilled wells produce water by penetrating faults which are filled with groundwater.
Head – the pressure created from up-gradient groundwater. The pressure is created as water tries to seek its own level.
Infiltration - the downward flow of water from the land surface into and through the upper soil layers.
Public Drinking Water Systems – Public drinking water systems are those serving twenty-five (25) or more people; they may be publicly or privately owned. They are divided into Community Systems such as a town water district; non-transient, non-community systems such as schools and large businesses; and transient systems such as restaurants and hotels.
Recharge - the process of infiltration and migration by which groundwater is replenished.
Transpiration - the process by which plants give off water vapor through their leaves.
Yield – the amount of water which a well can produce at a sustainable rate. It is measured over a given period of time such as a minute or day.

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