Washington State Department of Ecology

Appendices: A - G

1998 Site Investigation
Bertrand Creek & Meadowdale Areas
Whatcom County, Washington

Study of Drinking Water
From Residential Wells

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List of Appendices

Appendix A

Surface Water Features

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Bertrand Creek Area

The principal study area surface water features include Bertrand and Dakota Creeks and their tributaries. This is part of the Bertrand Creek Watershed which drains to the Nooksack River to the south and southeast.

Information regarding fish habitat is taken from the "Whatcom County Portfolio" unless otherwise specified. The names/numbers given to the tributaries are based on the numbers assigned in the WDF Stream Catalogue.

- Bertrand Creek provides for Coho, Cutthroat and Steelhead rearing and spawning habitat.
- A tributary to Bertrand Creek (DFW 0203on RB at RM 2.0) provides habitat for spawning and rearing of Coho and Cutthroat.
- A tributary to Bertrand Creek (DFW 0205on LB at RM 3.0) provides habitat for rearing of Coho and Cutthroat.
- McClelland Creek, a tributary to Bertrand Creek (DFW 0206 on RB at RM 3.6) provides habitat for rearing of Coho and Cutthroat.
- Dakota Creek and its tributaries provide for spawning and rearing habitat for Coho, Cutthroat and Steelhead.

Meadowdale Area

The principal study area surface water features include Fishtrap and Kamm Creeks and their tributaries. This is part of the watershed which drains to the Nooksack River to the south .

Information regarding fish habitat is taken from the "Whatcom County Portfolio" unless otherwise specified. The names/numbers given to the tributaries are based on the numbers assigned in the WDF Stream Catalogue.

- Fishtrap Creek provides for spawning and rearing habitat for Chinook (per Jeff McGowan, Area Habitat Biologist) and for Chum, Cutthroat, Steelhead and Coho.
- Kamm Creek provides spawning and rearing habitat for Chum, Cutthroat and Coho.
- A tributary to Kamm Creek (DFW 0224 on RB at RM 2.2) has no documented fish spawning per both the Whatcom County Portfolio and the WDF stream catalog.
- Closer to the U.S.-Canadian border, these creeks also supports populations of Salish Sucker and Nooksack Dace (per the State of the Nooksack Report).

Appendix B

Hydrogeology, Soils and Climate of Area

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Hydrogeology, Soils & Climate

a) Climate of Whatcom Co.

From; Soil Survey of Whatcom County Area, Washington, U. S. Dept. of Agriculture, Soil Conservation Service. May, 1992. Pages 2-3. Prepared by the National Climatic Data Center, Asheville, North Carolina.

The climate of the survey area is greatly tempered by winds from the Pacific Ocean. Summers are fairly warm, but hot days are rare. Winters are cool, but snow and freezing temperatures are not common except at the higher elevations. At the lower elevations freezing temperatures generally occur under the influence of dry air masses. During summer, rainfall is extremely light, so crops growing actively during this period need irrigation. Often several weeks pass without precipitation. During the rest of the year, rains are frequent, especially in the late fall and winter.

In most winters one or two storms contain strong and sometimes damaging winds, and in some years the accompanying heavy rains cause serious flooding. Ice-laden northeast winds moving down he valley of the Fraser River are particularly damaging. In some years, either in winter or summer, a large invasion of a continental air mass from the east causes abnormal temperatures. As a result, several consecutive days are well below freezing in winter or a week or longer is sweltering in the summer.

In winter, the average temperature at Blaine, Glacier, Bellingham, and Clearbrook are 39, 34, 39, and 38 degrees F., respectively. The average daily minimum temperature is 33 degrees at Blaine and Bellingham, 28 degrees at Glacier, and 32 degrees at Clearbrook. The lowest temperature on record, which occurred at Glacier, is –12 degrees. In summer, the average temperature is 60 degrees at Blaine and 61 degrees at Glacier, Bellingham, and Clearbrook. The average daily maximum temperature is about 73 degrees at all four locations. The highest recorded temperature, which occurred at Clearbrook, is 102 degrees.

The total amount of precipitation is about 41 inches at Blaine, 67 inches at Glacier, 36 inches at Bellingham, and 46 inches at Clearbrook. Of this, 30 percent usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 4.65 inches at Glacier on December 14, 1959. Thunderstorms occur on about 6 days each year.

The average seasonal snowfall is 12 to 14 inches at Blaine and Bellingham, 48 inches at Glacier, and 19 inches at Clearbrook. During the period of record, the greatest snow depth in the survey area at any one time was 37 inches. On the average, 2 or fewer days at Blaine, Bellingham, and Clearbrook and 7 days at Glacier have at least 1 inch of snow on the ground. The number of such days varies from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 60 percent of the time

possible in summer and 25 percent in winter. The prevailing wind is from the southwest. Average wind speed is highest, 10 miles per hour, in winter"

The following table shows, in inches, average precipitation (precip), potential evapotranspiration (PET), and actual evapotranspiration for a 6-inch waterholding capacity soil (Ea[6]) for the Bellingham, Blaine, and Clearbrook stations.

	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Bellingham													
Precip	4.1	3.3	3.2	2.2	1.8	1.9	1.1	1.1	1.9	3.5	4.5	5.0	33.6
PET	0.5	0.6	1.1	1.9	2.9	3.6	4.2	3.8	2.8	1.7	0.9	0.6	24.6
Ea[6]	0.5	0.6	1.1	1.9	2.6	3.2	2.7	2.0	2.1	1.7	0.9	0.6	19.9
Blaine													
Precip	5.8	4.4	3.8	2.6	2.0	2.0	1.3	1.2	2.2	4.6	5.5	6.3	41.7
PET	0.4	0.5	1.1	1.9	3.1	3.9	4.4	3.8	2.8	1.7	0.8	0.5	24.9
Ea[6]	0.4	0.5	1.1	1.9	3.0	3.4	2.8	1.9	2.3	1.7	0.8	0.5	20.3
Clearbrook													
Precip	5.8	4.6	4.6	3.2	2.6	2.6	1.6	1.5	2.8	5.2	5.8	6.9	47.2
PET	0.2	0.5	1.1	2.0	3.1	3.8	4.4	3.9	2.9	1.7	0.8	0.4	24.8
Ea[6]	0.2	0.5	1.1	2.0	3.1	3.6	3.3	2.4	2.8	1.7	0.8	0.4	21.9

From; Washington Climate for these counties; Clallam, Jefferson, Island, San Juan, Skagit, Snohomish, Whatcom. Cooperative Extension Service, College of Agriculture, Washington State University, p. 63.

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b) Geology

Whatcom County Study Areas A and B, in the Lynden vicinity, are located in the central portion of the Fraser Lowland, a topographic basin north of the Puget Lowland that extends into British Columbia (Crandell, 1965). As reported by Black & Veatch (1986) and others, the Fraser Lowland is characterized by glacially derived landforms and soils. At least four episodes of glacial advances are recognized in this region. During each episode, soils were deposited by direct glacial action and by the action of proglacial meltwater streams. In the Lynden Study Area, only deposits of the youngest of these glacial advances are exposed. As described by Easterbrook, 1971, the exposed Fraser deposits include, from oldest to youngest, glacial deposits of the Vashon Stade, glaciomarine deposits of the Everson Interstade, and glacial deposits of the Sumas Stade. The thickness of unconsolidated glacial deposits, resulting from the Fraser and earlier glacial episodes, ranges from 800 to 1,200 feet in the region (Hall and Othburg, 1974).

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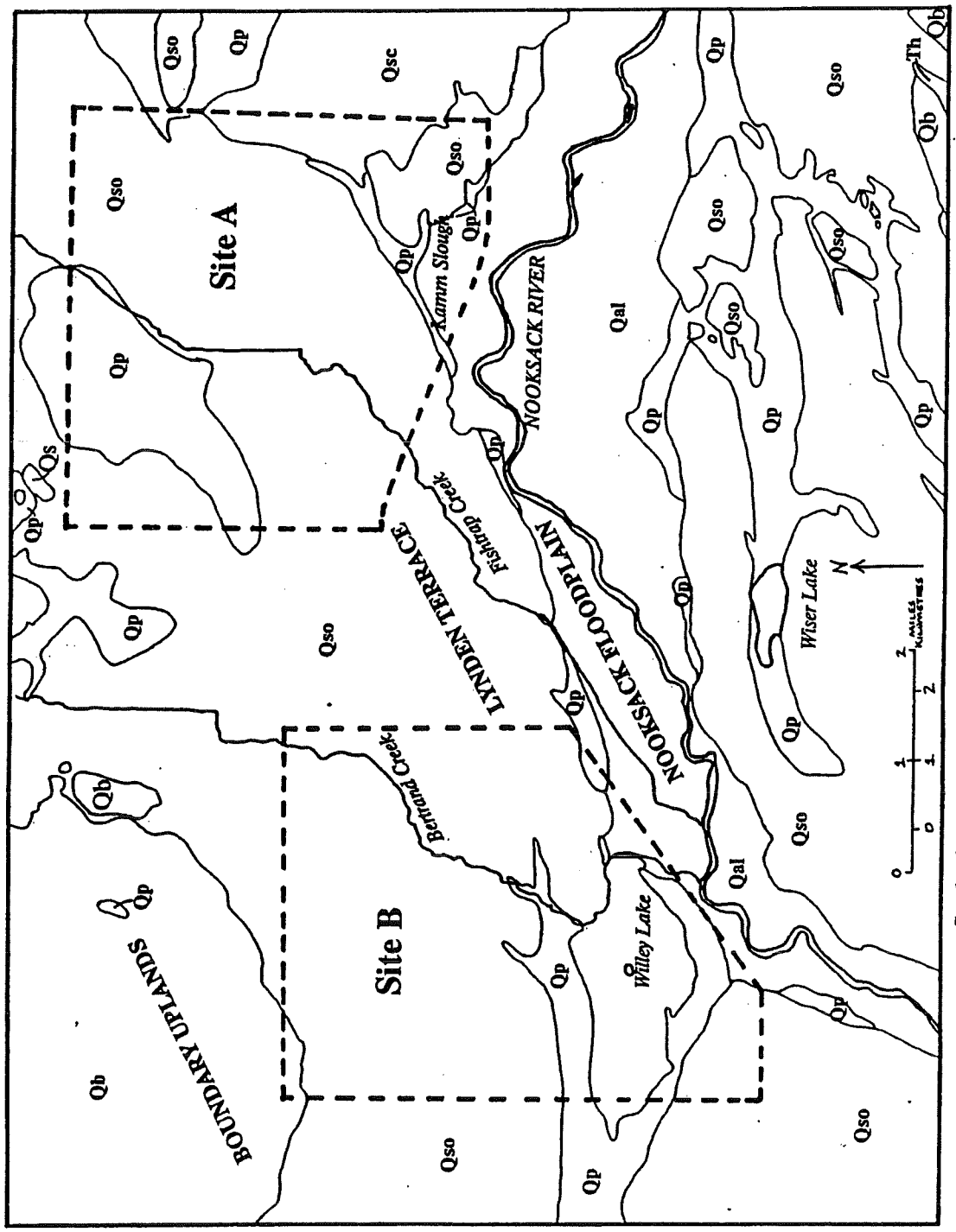

(Map from Creahan, 1988)

Study sites A and B superimposed on geologic map (after Easterbrook, 1976). Qso = Sumas Outwash; Qal = Nooksack River alluvium; Qp = peat deposits; Qb = Bellingham glacio-marine drift.

As summarized by Black & Veatch (1986), ice from the Sumas Stade pushed into the eastern portion of the Fraser Lowland about 11,000 years ago. Meltwater streams associated with that advance built an outwash plain of glacial material southward to Lynden and from about Everson west to Ferndale. The outwash consists of gravel, sandy gravel, sand, silt, and clay. The northern portion closest to the ice terminus consists of coarse gravel and boulders. The outwash is predominantly sand near Lynden where it meets the modern Nooksack alluvium, and is clay and silt at its far western end. Preserved in the outwash are depressions and meltwater channels, many of them containing peat deposits (Creahan, 1988 and Easterbrook, 1969).

Study sites A and B are both located on the Lynden Terrace, which slopes gently toward the south or southwest. The southern margin of the terrace is a Holocene erosional scarp, cut by the Nooksack River into the outwash plain.

The Boundary Uplands to the north of sites A and B consist of glacial till, or glaciomarine drift deposited before the deposition of the outwash that comprises the Lynden Terrace. The northern edge of the outwash laps onto the Boundary Uplands. The till and glaciomarine deposits of the Boundary Uplands are not productive aquifers, however limited productive horizons occur under confined conditions in sandy strata under the Boundary Uplands (Creahan, 1988).

c) Soils

Soil material in the Lynden study area consists predominantly of Lynden-Hale-Tromp soils, as described by the U.S. Department of Agriculture, Soil Conservation Service. They are generally deep to very deep, well-drained to somewhat poorly drained and occur on outwash terraces and moraines in the area. Following are descriptions of these soils.

Lynden sandy loam.

"This very deep, well drained soil is on outwash terraces. It formed in loess and volcanic ash over glacial outwash. The native vegetation is mainly conifers and shrubs.

Typically, the surface layer is dark brown sandy loam 8 inches thick. The subsoil is dark brown sandy loam 10 inches thick. The substratum is variegated sand. The upper 12 inches is dominantly very dark grayish brown, and the lower part to a depth of 60 inches is dominantly dark grayish brown. The depth to sand ranges from 14 to 24 inches. In some areas the surface layer is loam. In other areas the soil has 15 to 25 percent pebbles in the substratum. In some places the lower part of the subsoil, the substratum, or both are weakly cemented, mottled, or both. In other places the combined thickness of the surface layer and subsoil is 24 to 36 inches or 8 to 14 inches.

Permeability is moderately rapid in the upper part of the Lynden soil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches. Runoff is slow, and the hazard of water erosion is slight.

Hale silt loam.

This very deep, somewhat poorly drained soil is on outwash terraces. It formed in an admixture of loess and volcanic ash over glacial outwash. The native vegetation is mainly trees and shrubs.

Typically, when mixed to a depth of 8 inches, the soil is dark brown silt loam. The subsoil is light olive brown, mottled loam 8 inches thick. The substratum, to a depth of 60 inches is mottled sand. It is variegated but is dominantly grayish brown. The depth to sand or loamy sand ranges from 15 to 30 inches. In some areas the surface layer is loam. In other areas the soil has a substratum of sandy loam, gravelly sandy loam, gravelly sand, or very gravelly sand.

Permeability is moderate in the upper part of the Hale soil and very rapid in the substratum. Available water capacity is moderate. Runoff usually is very slow, but the soil may be ponded during the winter. There is no hazard of erosion.

Tromp loam.

This very deep, moderately well drained soil is also on outwash terraces. It formed in a mixture of loess and volcanic ash over glacial outwash. The native vegetation is mainly conifers and shrubs.

Typically, the surface layer is dark brown loam 11 inches thick. The upper 9 inches of the subsoil is dark brown and strong brown loam. The lower 6 inches is weakly cemented, dark yellowish brown, mottled sandy loam. The upper 20 inches of the substratum is weakly cemented, olive brown, mottled sand. The lower part to a depth of 60 inches is grayish brown and dark grayish brown, mottled sand. The depth to sand ranges from 14 inches to 30 inches. In some areas the surface layer is sandy loam or silt loam. In other areas the soil is not cemented, is sandy loam in the upper part of the substratum, has 15 to 35 percent pebbles in the substratum, has loamy glaciomarine or glacial till at a depth of 40 to 60 inches, or is 10 to 14 inches deep to sand.

Permeability is moderate in the upper part of the Tromp soil and very rapid in the substratum. Available water capacity is high. Runoff is very slow, and there is no hazard of erosion.

d) Ground Water

Wells within Sites A and B are supplied by a shallow unconfined aquifer in the Sumas outwash and recent alluvial deposits. Water levels are generally within 6 to 33 feet of the

ground surface. Ground water recharge in the Lynden Terrace and Nooksack Lowland comes primarily from precipitation. The unconfined aquifer is recharged by precipitation percolating through the permeable glacial and alluvial deposits. Approximately 49 inches of precipitation falls in the study area annually (Black & Veatch, 1986).

The regional ground water flow direction is generally from the Uplands in the north toward the Nooksack River in the south. The lowest level of the regional water table is commonly along the major streams, with the water table beneath the Nooksack River flood plain being in general balance with the river into which the ground water escapes by effluent seepage (Liu, 1997). However, irrigation practices in the study area could locally affect the direction and rate of flow. There would be a greater effect on local ground water flow during the irrigation season than during the rainier seasons when natural recharge rates would be high. Agricultural practices in the area also have an impact upon water quality. There is little or no natural geologic protection of the shallow aquifer from infiltration of surface waters therefore, runoff from fields and stockyards can easily enter the shallow ground water system (Black & Veatch, 1986).

In order to better understand the direction and rate of ground water flow across the area, particularly across sites A & B, a study was undertaken in 1987-1988, by Western Washington University, under the auspices of the Washington Department of Ecology (Contract #C0087216). In that study (Creahan, 1988), water levels in over 100 wells in each site were measured in March, 1987, and again in September, 1987. Results, which were presented to Ecology in the form of a report and maps of ground water elevation, showed that:

e) Water Level Elevations

The water table contour maps of Site A for March, 1987 (Figure 5) and September, 1987 (Figure 6) are similar, with only minor differences in water table elevation, configuration of contours, and hydraulic gradient. Most of the area had lower water table elevations in September, as expected, following the drier summer months. Although flow direction is generally southward, there are local variations in direction. The hydraulic gradient is low in areas of low surface relief (the north and southeast portions of the study area). The gradient is shown to steepen considerably toward the erosional scarp at the north end of the Nooksack River floodplain. The only seasonal difference in the hydraulic gradient was observed in the northeast where the gradient was slightly steeper in March than in September.

The Bertrand Creek area (Site B) water table contour maps for March (Figure 7) and September, 1987 (Figure 8) show minor seasonal changes in water table elevation and negligible seasonal change in ground water flow direction. As in Site A, the flow direction is generally southward, but there is more variability in flow direction in Site B than in Site A. The gradient is lowest in the flat northern part of the site and steepens toward stream channels and along the erosional scarp at the southern end of the Lynden Terrace. The upstream-pointed contour lines along Bertrand Creek show clearly that ground water is flowing toward, and discharging to the creek.

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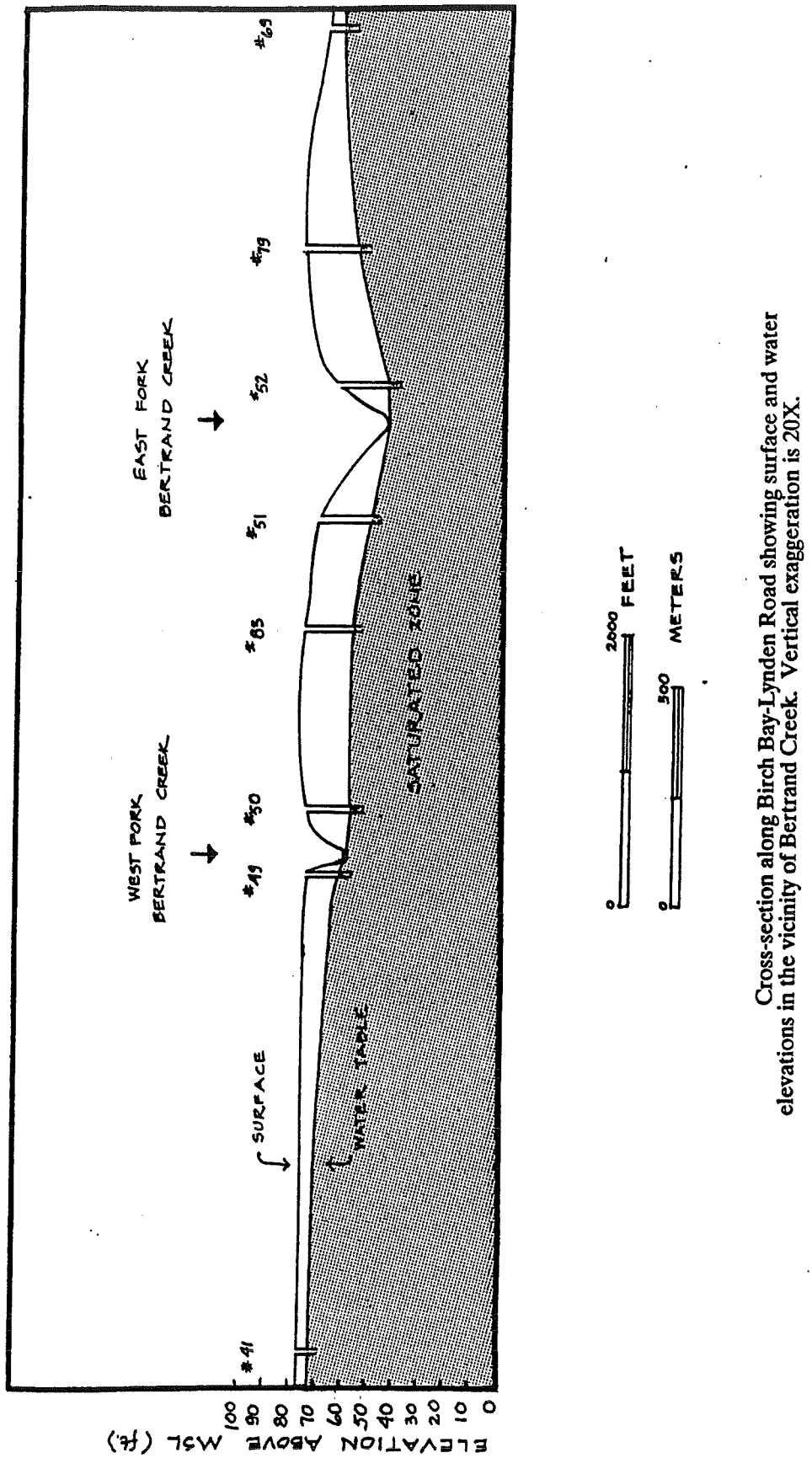

(Map from Creahan, 1988)

Cross-section along Birch Bay-Lynden Road showing surface and water elevations in the vicinity of Bertrand Creek. Vertical exaggeration is 20X.

f) Estimates of Average Linear Velocity

Based upon the ground water gradient, and estimates of the hydraulic conductivity for the predominantly sand and gravel aquifer, the rate of travel of water across both sites was estimated by Creahan. The Darcy-based ground water flow equation $v = K/n\ dh/dl$ was used, where K is the estimated hydraulic conductivity, n is the estimated porosity, and dh/dl is the hydraulic gradient. The Dupuit-Forchheimer assumptions were employed; 1) flowlines were assumed to by horizontal and equipotential lines were assumed to be vertical, and 2) the hydraulic gradient was assumed to be equal to the slope of the water table and to not vary with depth. These assumptions neglect vertical flow components and reduce a two-dimensional system to one dimension.

The values used by Creahan for porosity (n) and hydraulic conductivity (K) were published typical values for sand and gravel. Base upon lithologic descriptions of the unconfined aquifer in available well logs, the values $K = 10^{-3}$ and n = 35% were used. The only variable in the calculations is dh/dl, the ground water gradient as determined from the plot of water level elevations.

The flow velocities calculated in Site A ranged from 0.5 m/day, in the northwest and southeast, to 5 m/day along the Nooksack floodplain. In the Bertrand Creek area, Site B, the average velocities were estimated to range from 0.5 m/day in the north to 2.5 m/day along the southern edge of the Lynden Terrace.

These flow velocities, as estimated by Creahan, describe the rate of travel of an individual particle of water along its tortuous path through the aquifer. An advancing "front" of water would be estimated to travel at rates calculated by multiplying Creahan's rates by the estimated porosity, i.e. 0.35. This implies that an advancing front of water would move approximately 0.2 to 2 m/day across Site A, and from 0.2 to 4 m/day across Site B. Translated to distance moved during an approximately 15 year period, a front of water would have traveled an estimated 1,100 m to 11,000 m across Site A, and 1,100 to 22,000 m across Site B. For practical purposes, these etiolates do not provide meaningful information. It is therefore suggested that aquifer tests be conducted in each of the sites to define the transmissivity, or hydraulic conductivity, and storage coefficient of the aquifer.

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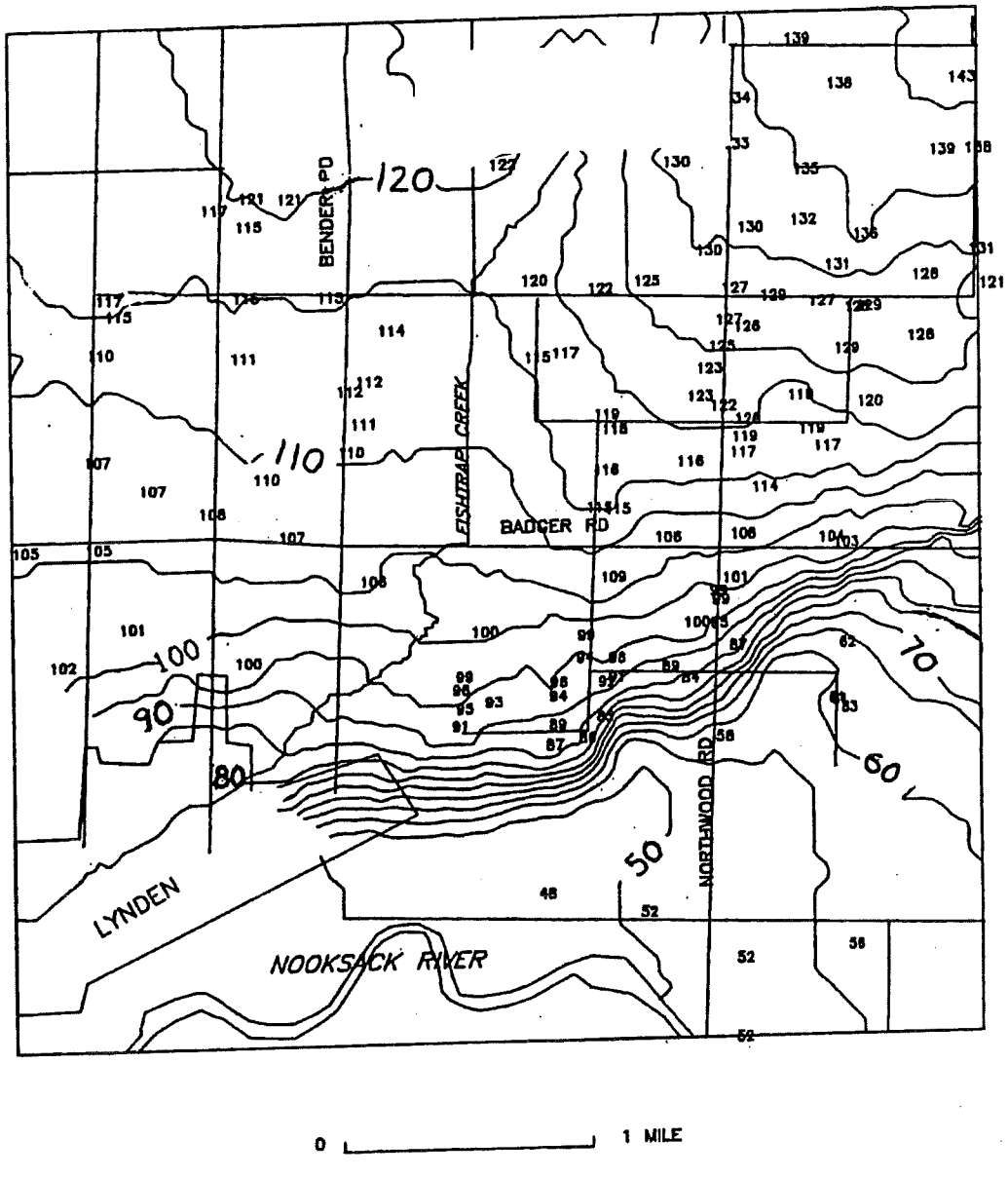

(Map from Creahan, 1988)

Figure 5. Contour map of water table elevations, Lynden area, March 1987. The contour lines are based on the data points and stream elevations. Contour interval is 5 feet. Numbers refer to the water table elevation (feet) at the locations of measured wells.

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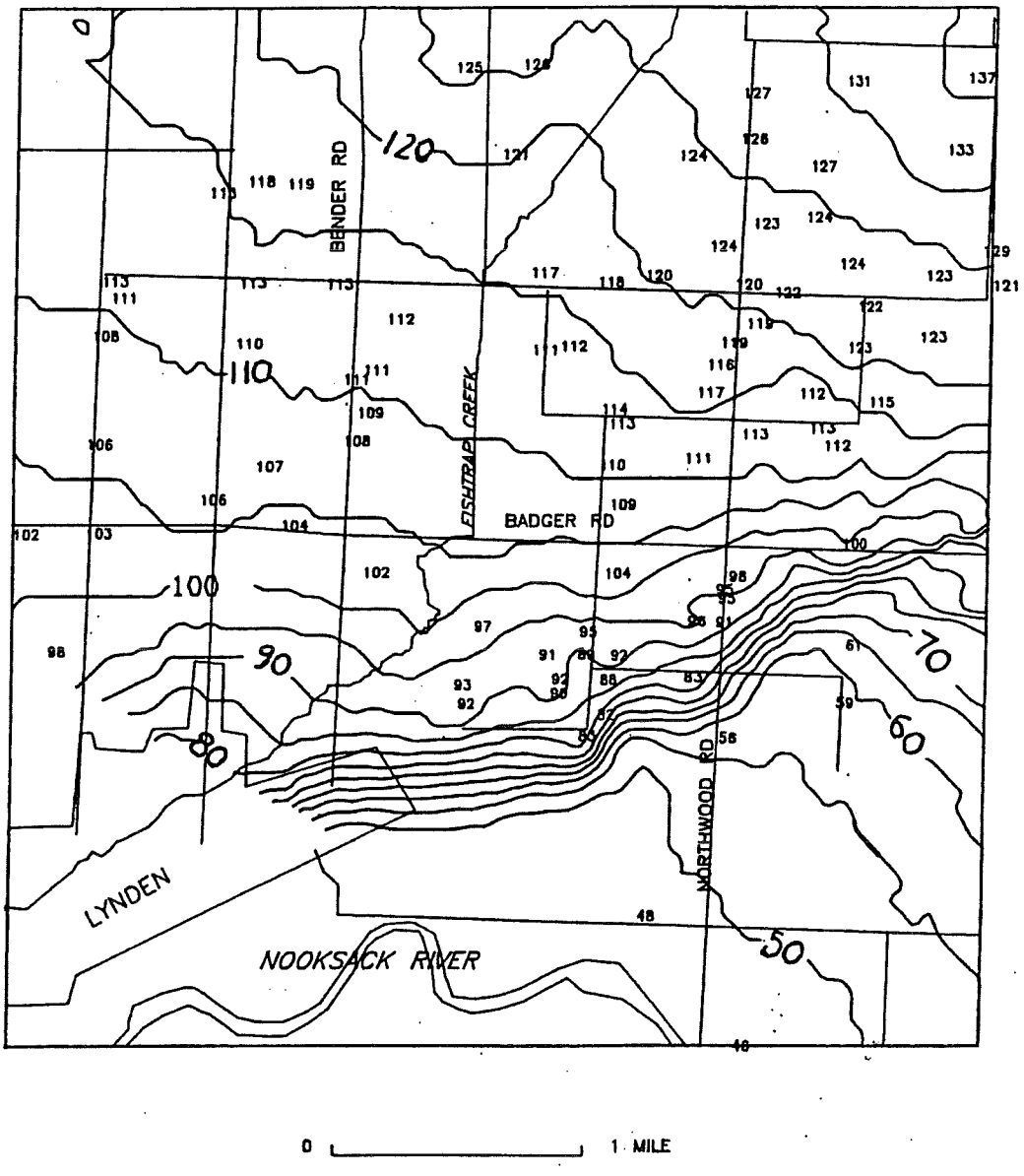
Figure 6. Contour map of water table elevations, Lynden Area, September 1987. The contour lines are based on the data points and stream elevations. Contour interval is 5 feet. Numbers refer to the water table elevation (feet) at the locations of measured wells.



(Map from Creahan, 1988)

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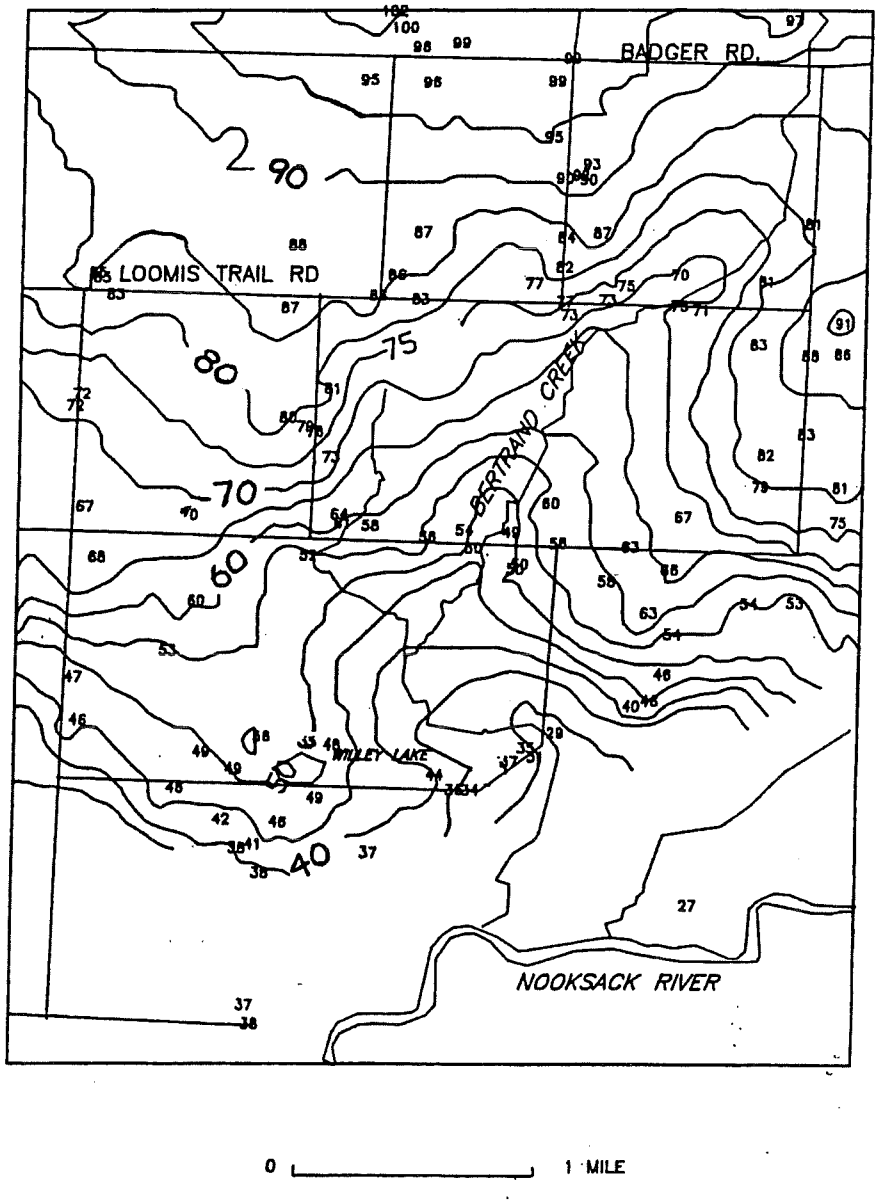
Figure 7. Contour map of water table elevations, Bertrand Creek area, March 1987. The contour lines are based on the data points and stream surface elevations. Contour interval is 5 feet. Numbers refer to the water table elevation (feet) at locations of measured wells. Three wells at the eastern end of Badger Road were not used in the construction of water table contour lines (compare Figure 17; see text).



(Map from Creahan, 1988)

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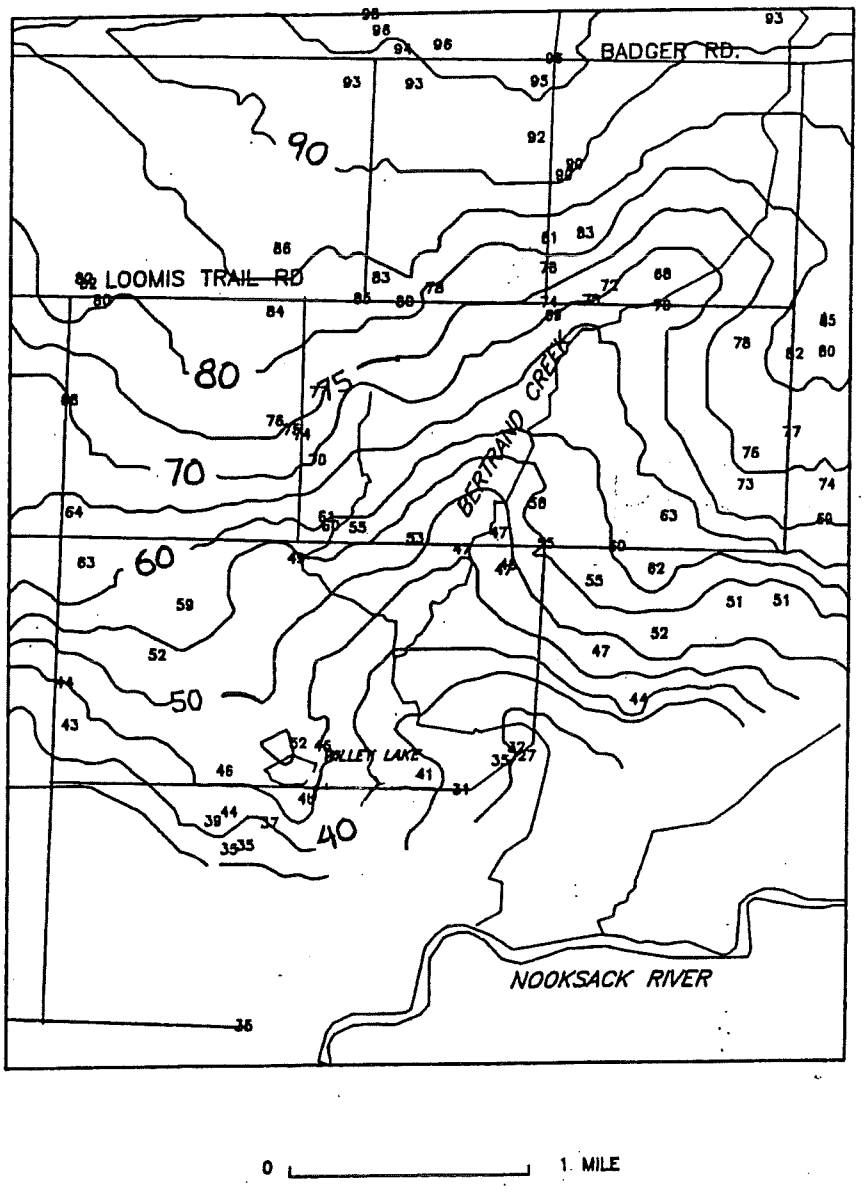
Figure 8. Contour map of water table elevations, Bertrand Creek area, September 1987. The lines are based on the data points and stream surface elevations. Contour interval is 5 feet. Numbers refer to the water table elevation (feet) at locations of measured wells.



(Map from Creahan, 1988)

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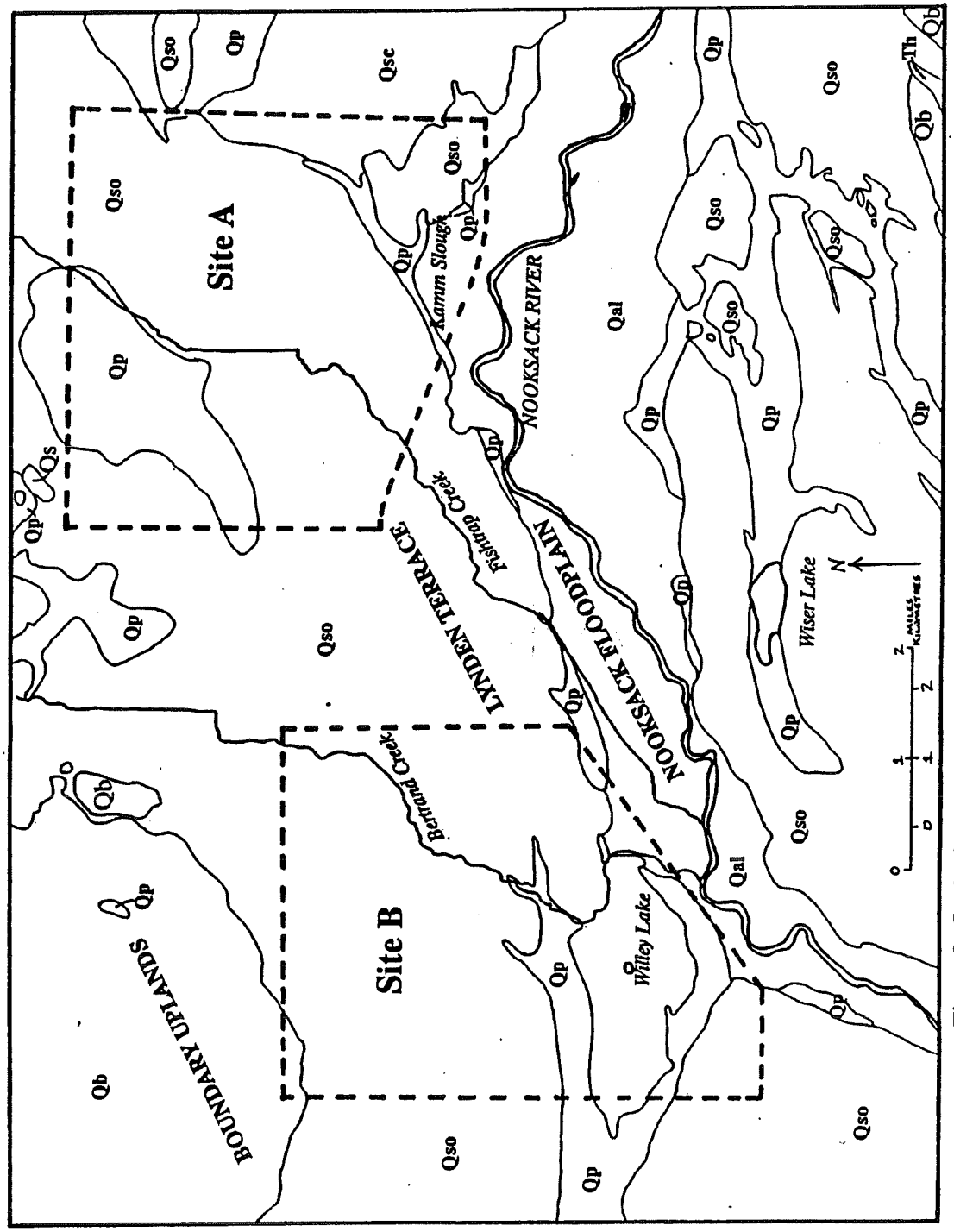

Figure 2. Study sites A and B superimposed on geologic map (after Easterbrook, 1976). Qso = Sumas Outwash; Qal = Nooksack River alluvium; Qp = peat deposits; Qb = Bellingham glacio-marine drift.

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Appendix C

Chronology of key events and/or milestones

1998 Site Investigation
Bertrand Creek & Meadowdale Areas
Whatcom County, Washington

BERTRAND CREEK AND MEADOWDALE SITE CHRONOLOGY

1940s-1980s

- EDB used as a soil and grain fumigant and, until fairly recently, a lead scavenger in gasoline. In Whatcom County, EDB has been used particularly on raspberry, strawberry and seed potato fields.

1980s

- 1,2-Dichloropropane (1,2-DCP, component of soil fumigant ("Telone")) replaced EDB on raspberry, strawberry and potato fields in Whatcom County after the emergency suspension of EDB.

1983

- EPA ordered an emergency suspension of the sale and distribution of EDB for soil fumigation and initiated cancellation of all other major pesticide uses of EDB because it was known to cause cancer in animals by all routes of exposure, and because its use as a pesticide was likely to result in contamination of ground water and drinking water supplies. EDB was classified as a probable human carcinogen and possibly linked to other health issues. Drinking water limit recommended standard set at 0.02 ppb.

1984

- EDB discovered in well in Skagit County.
- Local health departments interviewed farmers re: EDB application.
- The legislature convened a state interagency task force to study problem of EDB. This appears to be Ecology's first involvement. Initial focus is on food.
- EPA's Region 10 office was notified that EDB was detected in a well in Skagit County at 11 parts per billion (ppb); EPA announces standards for EDB in food.
- DSHS issues health advisory on EDB – 0.02 ppb limits in drinking water.
- Washington Dept. of Agriculture provides some data on EDB use statewide, from 1981 to 1983. No other data available, and what was available relied on voluntary, self-reporting by pesticide applicators.
- EPA begins testing wells in Skagit County; turns over investigation to DSHS, which then samples public and private water supplies. DSHS, in conjunction with local health departments, conducted an investigation into EDB contamination of groundwater in western Washington. Out of 96 sites sampled, 14 were found to contain EDB at levels above the health advisory limit of 0.02 ppb. Levels ranged from 0.018 ppb to 5.7 ppb. The highest EDB levels were found in Whatcom County, where 33 samples were taken between June and October 1984.
- DSHS confirmed high levels of EDB at the Enfield Labor Camp well and at the Meadowdale Water Association well. DSHS sent a letter to Whatcom County Health Department officials asking that "...your District not issue any operating permits to any of the affected migrant labor camps for this coming season unless they have indicated that their drinking water will be obtained from an alternate source." (Note: Camps sampled in 1988.)

- News release issued by DSHS, "EDB confirmed in Whatcom Co. Wells."

1985

- DSHS released report, "Results and Implications of the Investigations of EDB in Ground Water in Western Whatcom County." Of 35 wells sampled, EDB contamination was found in five. The Black and Veatch report found 8 wells with EDB from this same data, not including a positive detection in a control sample. DSHS determined that additional investigation of EDB groundwater contamination was beyond the agency's resources. The responsibility for further investigation was handed off to Ecology (whose cleanup program was on the verge of being dismantled due to legislative funding cuts). Ecology declared EDB cleanup sites in Whatcom, Skagit and Thurston counties.

- Ecology contracts for Black & Veatch report, which reviews toxicological literature on EDB.

- Whatcom County's Sites "A" & "B" defined -- hereafter referred to as "Site A" (Meadowdale), a 4-square-mile area east of Lynden; and "Site B" (Bertrand Creek) a 7square-mile area west of Lynden.

1986

- Lynden area wells sampled; draft "Phase 1 Investigation, EDB Sites, Whatcom Co." completed by Black and Veatch. This report did not contain any new sampling. It reviewed the DSHS sampling in 1984 and actually reported more specific and different data than DSHS.

- Ecology began supplying bottled water to EDB affected residents of Whatcom Co.

- Ecology proposed an investigation of possible pesticide contamination of groundwater in Whatcom Co.

- Dr. Richard Mayer from Western Washington University conducted additional sampling of wells in Whatcom County. (Over a four-year period, 107 wells were tested; EDB levels exceeding the health advisory limit were found in 18 wells.)

- Ecology published "Phase I Investigation of EDB Sites in Whatcom County" by consultants Black & Veatch. The study included a health risk assessment, defines and maps the "study areas" – Site A and Site B – and concluded that additional sampling was needed to better understand area hydrogeology and extent of EDB contamination.

- The State of Florida sued Great Lakes Chemical for contaminating water in 19 counties, where the EDB levels ranged from 0.03 ppb to 21.5 ppb in wells serving 305 people. Great Lakes settled for $1.5 million but denied all allegations that the EDB contamination was caused by its negligence.

- Washington's Attorney General sought " injunctive relief to require defendant – Great

Lakes Chemical Company -- to investigate the extent of EDB contamination that has occurred from the use of its EDB products and to repair or remediate the damages caused."

- In December, USGS received approval to conduct pesticide study in WA State.

1987

- The legislature requested study by Ecology of statewide groundwater contamination by pesticides. Ecology sampled the Site B, Bertrand Creek area for this report.

- Great Lakes Chemical offers $40,000 settlement.

- Whatcom County Health Department received a complaint of chemical drum dumping in Bertrand Creek &/or irrigation ponds. This complaint was investigated by Environmental Health Specialist Dave Bader. Bader found old rusted drums within the water course and on several irrigation ponds, as well as considerable amounts of trash (including empty pesticide containers) in the area of the sand pit. Mr. Bader reported at the time that he did not observe any indication of a release having occurred. Investigation yielded no evidence of illegal disposal.

1988

- Dr. Mayer, in conjunction with Ecology, sampled wells in Whatcom County agricultural labor camps. Levels ranged from <0.01 to 0.345 ppb (Mayer, 1988)

- Ecology requested DSHS to do risk assessment of EDB found at Whatcom Co. labor camps.

- DSHS risk assessment in Whatcom Co. labor camps: Long-term risk is present.

- City of Lynden signed contract w/ Ecology for grant funds to construct a pipeline extending the city's water supply to the Meadowdale Water Association.

- Washington State amended its suit against Great Lakes Chemical, to be brought under the state's newly adopted Model Toxics Control Act and sought $3.3 million in cost recovery for addressing four sites in Western Washington.

1988-89

- Ecology's Environmental Investigation and Laboratory Services (EILS) program conducted agricultural pesticides pilot study.

1989

- Whatcom County received Centennial Clean Water funding from Ecology for a comprehensive groundwater study to be performed in conjunction with USGS and the cities of Lynden, Everson, Nooksack and Sumas (LENS).

- Cost estimates for Bertrand Creek area alternative water supply prepared.

- Ecology "Agricultural Chemicals Pilot Study" interim report prepared.

- Great Lakes Chemical motion for summary judgement based on federal pre-emption of state claims was denied.

-

1990

- Ecology released a report requested by the legislature entitled "Agricultural Chemicals Pilot Study." Three areas were considered especially vulnerable to groundwater contamination from agricultural land use - Whatcom, Franklin and Yakima counties. This study also showed a significant problem of contamination from 1,2-DCP. Ecology concluded "the Pilot Study results show that pesticides are migrating to shallow ground water in some areas of the state and that additional sampling and studies are needed to define the extent of the problem."

- USGS began conducting groundwater sampling as part of a cooperative study with Whatcom County.

- Great Lakes Chemical offered $150,000 settlement. Ecology countered with $ 1.3 million; Great Lakes made next offer of $ 237,400 settlement.

1991

- Ecology conducted additional testing. EDB and/or 1,2-DCP above the health advisory level were detected in 16 of the 21 wells.

- State vs. Great Lakes Chemical trial began.

- An anonymous citizen contacted Ecology personnel about improper pesticide handling at the Clark, Enfield and Sheets farms. Information and photographs from 1987 showed miscellaneous pesticide containers floating in Bertrand Creek &/or irrigation ponds. This is likely the same person who had earlier contacted Dave Bader of local health department. The citizen reported that, in 1989, burn barrel residues were brought from throughout the area and were placed into a nearby dry well. The citizen provided a photograph of a truck loaded with at least 6 drums next to an estimated 8-foot square hole several feet deep, with a pile of debris resembling ash and including various cans apparent in the hole. Additionally, the citizen indicated that he/she was aware that various drums were buried in a sand pit near the area, and that numerous drums were also stored on the surface near the pit. In subsequent Ecology investigations, the area containing these farms became known as the "Bertrand Creek" area.

- Ecology began investigating the citizen allegations. An estimated 100 55-gallon drums were found, some labeled "Telone" and or "Telone II". Ecology personnel concluded that the drums were empty, though many of them were bulging. The investigator's report, in referring to the bulging drums, states that, "They are stored in the vicinity of the sand pit

where burial activity has reportedly occurred in the past is a concern." The investigator also reported that "Vegetation in a ravine below this sand pit appeared to be affected." Further investigation of private wells in the Site B area that were known to be contaminated with 1,2-DCP revealed that the wells were downgradient from the farms involved in the allegations. Significantly, no 1,2-DCP was detected in three tested wells that were upgradient from the farms involved in the allegations.

1992

- Ecology and Great Lakes Chemical reach a settlement agreement of $575,000 for cost recovery at four sites: Sites A & B in Whatcom county, one each in Skagit and Thurston. Company is not released from liability for any future sites discovered.

- Ecology requested access from farm owners to investigate citizen complaint. During the next several months, serious complications arose with the investigation. The farms involved refused to allow access to their properties unless Ecology would reveal who the informant was. At this point, the Attorney General's office became involved, as did a law firm (Langabeer, Tull) hired by the farmers involved in the allegations. The investigation was repeatedly delayed as the farmers refused/postponed access to their properties. Around this same time, affidavits by the farm personnel involved in these conversations were submitted to Ecology, denying any knowledge of improper chemical disposal. When Ecology was unable to inspect the farms without search warrants in 1992, the Whatcom County Health Dept., represented by Mr. Bader, did so "as requested by the property owners." Mr. Bader's inspection revealed "no indication of illegal chemical disposal."

1993

- In conjunction with LENS study, Whatcom Health and WSU Cooperative Extension collected 304 samples, with 54 violating nitrate standards.

- LENS study completed.

1993/1994

- Steve Hulsman of state DOH sampled 26 public and private wells in northern Whatcom County, including several in Area A and B.. According to Mr. Hulsman, soil fumigants were detected in the same wells and at similar levels (some above the MCLs) as had been detected in previous sampling activities. Many wells had levels of nitrate exceeding the MCL, with higher values in the winter season. Non-soil fumigant pesticides (primarily herbicides) were detected at levels below respective MCLs in a few wells in the areas. Results reported in 1998.

1995

- The dry well that was a part of the 1991 citizen's complaint was decommissioned. The event was witnessed by Ecology personnel (Rod Thompson).

1996

- Ecology released, "Pesticides in Washington State's Ground Water, A Summary Report,

1988-1995." Report recommended continued monitoring but concludes that pesticide contamination of groundwater represents a low public health risk, based on a report from DOH.

1997

- The USGS requested access to Whatcom County rights-of-ways in order to drill wells as part of its National Water Quality Assessment Program (NAQWA) for Puget Sound Basin. Access to county rights-of-way was granted for the flow path study.

- In early 1997, USGS encountered substantial opposition to its agricultural land use study when Whatcom County raspberry growers became aware that USGS would primarily be sampling groundwater near raspberry fields. Several large growers, along with WSU Coop Extension, urged County Executive Pete Kremen and his public works department to not approve USGS access to County right-of-way for the agricultural land use study. After several meetings among USGS staff, local growers, Cooperative Extension and Kremen, the USGS decided to pursue alternative locations for its well sites. USGS is relying on additional sampling across the border in the Abbotsford, B.C. area where access to farms and monitoring wells is easier to obtain. (Note: sites in Canada were always planned.) Of 19 sampling sites originally proposed for Whatcom County by USGS, only seven were ultimately located in the County. None of these sites required approval by the County. The only right-of-way permits for well installation from the County were for flow path study wells approved in 1997.

- Technical memo by Dave Garland of NWRO noted the continued deterioration of water quality in the Abbotsford-Sumas Aquifer over past five years.

- Bellingham resident Nancy Keene requested that State Department of Health begin a study about whether a disproportionate number of childhood leukemia and lymphoma cases exist in northern Whatcom County and why this might be so.

- Ecology Bellingham Field Office hired Mary O'Herron, a toxic cleanup specialist from the agency's Northwest Regional Office. Whatcom County EDB sites were among several responsibilities transferred to her.

1998

- An intern for a local environmental education group (ReSources) began reviewing Whatcom County and Ecology files related to the historic groundwater contamination in the north county.

- Local interest in leukemia study, raspberry growers' reaction to proposed USGS study, and historic contamination (including Ecology's bottled water program) result in series of local media stories.

- Whatcom County and the USGS entered into a cooperative agreement to sample 20 existing wells for nitrate and volatile organic compounds (including fumigant-related compounds). The cooperative study was not part of the NAWQA study, but results will

be used by the NAWQA study. The wells were sampled in 1998.

- Ecology requests ATSDR provide current assessment of EDB re: dermal and inhalation exposure pathways.

- Ecology developed program to track sampling data and information about the bottled water program and recipients in the Bertrand Creek area. Researched property ownership in county assessor's office; briefed agency management and began internal discussions to determine course of action. Met with representatives from the City of Lynden to discuss options for water supply to the Bertrand Creek area.

- Ecology and Whatcom County Health and Human Services hosted a citizens forum in Lynden. About 240 people attended. DOH officials were on hand to discuss health risks.

- Local residents and environmental groups petitioned ATSDR to investigate the health implications of contaminated groundwater in the area, especially with relation to EDB and 1,2-DCP.

- A related petition by same group to EPA asked that agency to review the 1992 Ecology investigation of alleged improper pesticide disposal at several local farms (originally known as the Enfield/Sheets/Clark sites).

- Ecology completed initial review of historical information from archive boxes, including schema to reflect contents of boxes. WA State Archives at WWU agreed to serve as the repository to make files more easily accessible to Whatcom County citizens.

- Ecology sent letters to households where bottled water had been provided in the past, but where it had been discontinued. Offered to reinitiate delivery. It appears that most of these properties may be rentals and the change in tenants resulted in a disruption of service.

- 45 households receiving bottled water under Ecology contract with Culligan..

- Ecology and contractor, SAIC, developed and carried out Site Investigation/domestic water sampling in two phases in Bertrand Creek and Meadowdale areas. A total of 123 households had their drinking water sampled.

- Results of SAIC sampling indicated that a few wells contain pesticides above MCL, but coliform and high nitrates are shown to be a more common problem. All well owners notified of all sampling results by a series of 3 letters.

- Ecology developed preliminary draft report regarding alternative water sources and treatment options.

- Ecology immediately provided Whatcom Co. Health with results for homes where E.*coli* was found in the tap water. Whatcom Health agreed to be the main contact for all homes

with coliform-contaminated wells and to directly contact residents who had *E.coli* show up in the test results.

- Agency for Toxics Substances and Disease Registry (ATSDR), at the request of Ecology and in response to a citizens' petition, conducted an assessment of health risks associated with EDB contaminated drinking and domestic water. Report published July 31, 1998, citing studies from late 80s and early 90s indicating dermal and inhalation exposure of EDB could pose risks equal to that of ingesting by drinking; recommends site specific exposure study.

- EPA began investigating sites of alleged improper dumping or pesticide handling, sending property access notices to about 35 property owners west of Lynden. Lesa Starkenburg and Mark Lee, two local attorneys, begin representing property owners and raspberry growers. EPA served warrants for access to eleven property owners.

- ATSDR released its report and a summary focus sheet was mailed out to 1,000 area homes; dermal and inhalation pathways were described as "great a health risk as that presented by drinking contaminated water." Numerous residents called Ecology to volunteer their homes for the September (Phase 2) sampling.

- The bottled water contract with Culligan/Home Services Network expired on Sept. 30th; received bids from four bottled water companies. Ecology awarded the contract to lowest bidder, Culligan/Home Services Network.

- Whatcom County natural resource committee members and local resident Nancy Keene were provided with sampling and analysis protocols adopted by Ecology and with a draft Phase 2 sampling plan.

- State DOH and Whatcom County Health Dept. collected samples from 23 individual homes throughout northern Whatcom County (including 3 homes with previous EDB & DCP contamination in Areas A & B). DCP was detected at a level of one half the MCL at a location one mile south of Willey's Lake Rd (the southern border of Area B). DCP was also detected at trace levels at one location in and several locations north of the Meadodale area. EDB was detected at two locations in Area B (on Birch Bay-Lynden Rd.), but at lower levels than were previously detected. Many homes had elevated levels of nitrate (8 were above the MCL) and detections of coliform bacteria.

- Whatcom County Health Dept. issued letter to northern Whatcom County residents warning them of high nitrate levels.

- Because nitrate levels in the area can fluctuate significantly, SState DOH issued a fact sheet to northern Whatcom County residents recommending that they consider using an alternative water supply if nitrates were found above 5 ppm – half of the established drinking water MCL.

- WDOH issued report in November, suggesting that concentrations of EDB and 1,2-DCP at or above the MCL (drinking water standard) present as great a risk for inhalation and dermal pathways as they do for people who are drinking the water.

1999

- Ecology provided background information and conducted internal research in response to questions by Seattle P.I. reporter Heath Foster. Several previous and current Ecology and other government employees were interviewed, along with Ms. Keene and representatives of RE Sources, raspberry growers and others. Articles and subsequent PI editorial material prompted attention by area legislators.

- Ecology contracted with SAIC to prepare "options report" to evaluate water supply alternatives for affected homes in Bertrand Creek and Meadowdale cleanup sites.

- ATSDR Study measured concentration of 1,2-DCP in air following shower use at 2 homes where tap-water concentrations were particularly high. Report also looked at effect of: a) shorter showers, b) less intense showers, c) bathroom exhaust fans, and d) shower-head carbon filters.

- EPA issued a site investigation report regarding its investigation into alleged pesticide/pesticide container mishandling. No evidence of improper disposal of pesticide/pesticide containers was found nor was a contaminant source identified. It appears that the groundwater contamination could have been caused by the agricultural application of pesticides on fields.

- DOH holds an open house to gather community health concerns to be addressed in the upcoming Pubic Health Assessment being prepared in cooperation with ATSDR. Report will look at all exposure pathways and will fulfill citizen petition request.

- Whatcom County Health/WDOH exposure report released.

- Multi-agency meeting in Olympia with area legislators resulted in plan for completing remedial activities and assessing water quality of migrant labor camps. $3.3 million earmarked in local toxics control account for grant to local government partner in the Bertrand Creek remedial activities.

- Ecology and WDOH issue report to the Governor summarizing statewide groundwater contamination resulting from agricultural chemical use or land practices.

- 65 households enrolled in Ecology's bottled water program by 5/99.

- Draft Ecology report re: 1998 site investigation of drinking water contamination in the Meadowdale Study Area (Area A) and the Bertrand Creek Study Area (Area B) sent out for comment.

Still to be completed or anticipated

- USGS NWQA sampling results will be presented in two journal articles, a ground-water report, and a summary report.
- Expect another public meeting in Lynden with analysis of problem as it is today and options for treatment or alternate water supplies.
- Some funding being "earmarked" in Toxics; county is presumably poised for a supplemental budget request.
- A Public Health Assessment to prepared by DOH under a cooperative agreement with ATSDR in fulfillment of a citizen petition to ATSDR.

Appendix D

Chemical Information

1998 Site Investigation
Bertrand Creek & Meadowdale Areas
Whatcom County, Washington

Draft -- Information on chemicals found during Bertrand Creek Study (Phase 1) - Updated 8/26/98

Information re: the uses of chemicals was obtained from a variety of sources

Please note that some of the uses may be historic, rather than current.
Please also note that there may be other uses for the chemicals that are not listed here.

This is a draft document and this list makes no attempt to determine or identify -- via this listing -- the actual source of the chemicals found in the water samples during this study.

A (**) next to a chemical's name indicates that it was detected in one or more of the laboratory blanks at low levels. This may indicate that the chemical was not actually present in the sample collected.

Chemical Name	Some of the chemical's uses
1,2-dibromoethane	Formerly-pesticide. Had been used as fumigant for control of nematodes. Grain fumigant. Additive to leaded gasoline. Used in fire extinguishers, gauge fluids & waterproofing. Used for termite control. Solvent for fats, oils, waxes & celluloid. Used in dyes & pharmaceuti
1,2-dichloropropane	Pesticide. Used for fumigant control of nematodes. Grain fumigant. Used in mfg.of resin , pa coating and leaded gasoline.
1,2-dibromo-3-chloropropane	Used as a soil fumigant and as a nematocide.
chloromethane	Refrigerant. Local anesthetic. Used in mfg. of silicon resins & rubber. Industrial solvent.
acetone (**)	Used in mfg. of explosives, rayon, film, rubber cement & varnishes. Nail polish remover. Cleaning & drying of precision parts. Production of lubricating oils.

Chemical Name	Some of the chemical's uses
2-butanone	Industrial solvent, esp. for vinyl and acrylic resins. Used in dewaxing lubricating oils.
chloroform (**)	Formerly inhalant anesthetic. In food as flavoring & preservative. Used as refrigerant. General solvent for adhesives & pesticides. Insecticidal fumigant on stored grain. Dry cleaning agent. Used in fire extinguishers. Present in chlorinated water.
1,1,1- trichloroethane	Used as aerosol propellant, solvent for cleaning precision instruments, and in various pesticid In household cleaning agents, pesticides, adhesives, etc.. Used as a vapor degreaser and in Formerly used for fumigating strawberries after harvest. Solvent for various insecticides.
carbon tetrachloride	Used for fumigation of grain and as insecticide. Used as degreaser, aerosol, refrigerant & solv Formerly used as fire extinguisher, veterinary anthelmintic, and dry cleaning agent.
benzene	Industrial solvent. Found in gasoline and some paints. Used in mfg. of styrene, phenols & plastics. Used in mfg. of detergents, pesticides and solvents.
bromodichloromethane	Fire retardant. Solvent.
toluene (**)	Used in mfg. of dyes, explosives, perfumes, medicines & detergents. Solvent in paints, lacquers & paint thinners. Gasoline additive.
tetrachloroethene	Formerly used with grain fumigants and protectants. Used as a solvent, dry-cleaning agent, degreaser, fungicide, insecticide, and nematocide. Used in metal cleaning. Used as insulatin fluid and cooling gas in electrical transformers. Found in aerosol laundry products.
dibromochloromethane	Used in mfg.of fire extinguishing agents. Used as an aerosol propellant, refrigerant & pesticid
chlorobenzene	Used in mfg.of insecticides & dyestuffs, rubber, adhesives, paints, polishes, waxes & pharmaceuticals. Solvent for paints. Sometimes used as dry cleaning agent.
styrene	Naturally in cranberries, currants, vinegar, dairy products, whiskey, tea, coffee & roasted pean Used in mfg. Of plastics & paints. Used in lamination process. Used in boat building & repair
1,2,3-trichloropropane	Paint and varnish remover. Solvent for oils, fats, waxes, chlorinated rubber & resins. Degreasing agent.

Chemical Name	Some of the chemical's uses
tetrahydrofuran (**)	Solvent for resins, adhesives, mfg.of lacquers. Solvent used in preparation of food-contact plastics, printing inks, pharmaceuticals and insecticides. Naturally in coffee aroma.
1,1-dichloropropanone	(reference unavailable at this time)
1,3-dichloropropane	Chemical intermediate for cyclopropane (anesthetic). Probably formed as by-product in mfg.of 1,3-dichloropropene (1,3-DCP) and applied along with it during soil fumigation.
1,3,5-trimethylbenzene	Solvent in paint & varnish. UV stabilizer for plastics. Used in mfg.of dyes, plastics, inks, pesticides, and as constituent of some solvent mixtures. Also as motor fuel additive.
1,2,4-trimethylbenzene	Used in mfg.of pharmaceuticals & pseudocumidine. In motor fuels, solvents, resins, dyes and paint thinners.
1,2,2-trichloropropane	(reference unavailable at this time)
1-chloro-1-propene	Chemical intermediate for 1,3-dichloropropane.
ethylbenzene	Used in mfg.of rubber and plastics. Solvent and dilutent. In automobile and aviation fuel. Unrecovered component of gasoline.
n-propylbenzene	Used in textile dying & printing, as solvent for cellulose acetate, and in mfg.of methylstyrene.
tert-butylbenzene	Solvent in production of hydrogen peroxide. Used in organic synthesis. Polymerization solven
n-butylbenzene	(reference unavailable at this time)
napthalene (**)	Used in mfg.of hydronaphalene, dyes, explosives (smokeless powder), wood preservative, fungicides, lacquers, varnishes, insecticide 2842 and lubricants. Moth repellant. In cigarette smoke. Breakdown product of Sevin (agricultural naphthyl carbamate).

Chemical Name	Some of the chemical's uses
pentane	Used in fuel, solvents, artificial ice and in chemical synthesis. Used in low temperature thermometers. In pesticides. Used in gasoline. Incidental additive in grain fumigants. Additive in automotive, aviation and farm fuels. General lab solvent.
2,5-dihydrofuran	Used for coating automobile bodies. Used in mfg.of resins for varnishes, drying oils and fumaric acid. In agricultural chemicals (maleic hydrazide, Malathion). As a pesticide.
2-methyl-1-pentene	(reference unavailable at this time)
cyclohexane	Used as solvent for lacquers & resins. Used in varnish removers, extraction of essential oils, mfg.of solid fuel for camp stoves, fungicide formulation, and paint removers.
3-heptene	Plant growth retardant.
1-ethyl-3-methyl-benzene	(reference unavailable at this time)
(2-bromocyclopropyl)-benzene	(reference unavailable at this time)
1-methyl-3-(1-methylethyl)-benzene	In many essential oils like cumin, thyme and cheropodium. Used as paint thinner.
1-ethyl-2-4-dimethylbenzene	(reference unavailable at this time)
2,3-dihydro-1-methylindene	(reference unavailable at this time)
1,2,3,5-tetramethylbenzene	(reference unavailable at this time)
1,2,3,4-tetramethylbenzene	(reference unavailable at this time)
m- & p-xylene (for total xylene)	m- principal component of xylene (with o- and p-). Solvent. Used in mfg.of polyesters & resins, aviation fuel, and insecticides. p- component of xylene (with m- and o-). Solvent, Used in pharmaceutical synthesis, synthetic fibers, and insecticides. Frequently used in painting & printing industry.

Chemical Name	Some of the chemical's uses
o-xylene	0- component of xylene (with m- and p-). Used in mfg. Of phthalic anhydride, vitamins, pharmaceuticals, dyes, insecticides, and motor fuels.
	xylene (mixture of o- p- and m-). Solvent in paints, varnishes, degreasers, mastics, pesticides and pharmaceutical preparations. Additive to aviation fuel.
isopropylbenzene	Used in mfg.of chemicals (phenol/acetone/etc.). Solvent & thinner for paints, enamels & lacqu Aviation fuel additive. Small amount in gasoline blending.
ethanethioamide	Solvent in mfg.of leather, textiles, and paper. Stabilizer for motor fuel.
dinoseb	Herbicide for pre-emergence treatment. Plant growth regulator, insecticide, ovicide, desiccant and herbicide.
atrazine	Pre- and post-emergence herbicide. Used to control broadleaf and grassy weeds. Plant growth regulator.
bromacil	Broad-spectrum herbicide for non-selective weed, grass and brush control. Has been used in some anti-depressant medications.
metalaxyl	Fungicide
metalaxyl-des methyl propionate	Probable breakdown product of metalaxyl.
2,6-dichloro-benzamide	Final breakdown product of herbicide dichlorobenil.
prometon	Pre- and post-emergence herbicide which controls annual & perennial broadleaf & grassy wee
simazine	Pre-emergence herbicide for broad leafed and grassy weeds. Used to control vegetation and algae in farm ponds and fish hatcheries.
nitrates	(not a manufactured chemical)

Reference values for detected chemicals (revised 1/99)

MCL = Maximum Contaminant Level = The maximum concentration of a contaminant allowed in drinking water. This value is determined by either the Washington state board of health or the EPA under the federal Safe Drinking Water Act and published in chapter 248-54 WAC or 40 C.F.R. 141. For public water supplies, the MCL is the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. It takes into account feasibility and cost, but is set as close as possible to the level at which no adverse health effects occur.

Action Level = Contaminant levels are high enough to warrant additional periodic sampling, but do not exceed drinking water standards.

MTCA Cleanup Level = If no MCL exists, a possible alternative standard may be the groundwater cleanup standard determined under the Model Toxics Control Act (MTCA). The cleanup level is the concentration of a hazardous substance in groundwater that is determined to be protective of human health and the environment under specified exposure conditions.

ppb = parts per billion = To visualize one part per billion, imagine 1 ounce compared to 31 tons or 1 second compared to 32 years. This measurement is also written as ug/L (micrograms per liter).

ppm = parts per million = To visualize one part per million, imagine 1 seconds compared to to 11.7 days. This measurement is often written at mg/L (milligrams per liter).

Chemical Name	Other names for the chemical	MCL	Trigger Level	MTCA Cleanup Level Method B for groundwater (use Method A if available)	CAS #
1,2-dibromoethane	a) EDB b) ethylenedibromide	0.05 ppb	0.02 ppb	0.01 ppb (Method A) 0.0005 ppb (Method B)	106-93-4
1,2-dichloropropane	a) 1,2-DCP b) propylene dichloride	5 ppb	0.5 ppb	0.643 ppb	78-87-5
1,2-dibromo-3-chloropropane	a) DBCP	0.2 ppb	0.02 ppb	0.0312 ppb	96-12-8
chloromethane	a) methyl chloride b) monochloromethane		0.5 ppb	3.37 ppb	74-87-3
acetone	a) dimethyl formaldehyde b) dimethyl ketone c) pyroacetic aci	No MCL	No Trigger Level	800 ppb	67-64-1
2-butanone	a) methyl ethyl ketone b) MEK	No MCL	No Trigger Level	4800 ppb	78-93-3
chloroform	a) trichloromethane	7 ppb	0.5 ppb	7.17 ppb	67-66-3

Chemical Name	Other names for the chemical	MCL	Trigger Level	MTCA Cleanup Level	CAS #
1,1,1- trichloroethane	a) chloroethene b) methyl chloroform c) methyltrichlorometha	200 ppb	0.5 ppb	200 ppb (Method A) 7200 ppb (Method B)	71-55-6
carbon tetrachloride	a) carbon tet b) perchloromethane c) tetrachloromethane	5 ppb	0.5 ppb	0.337 ppb	56-23-5
benzene		5 ppb	0.5 ppb	5 ppb (Method A) 1.51 ppb (Method B)	71-43-2
bromodichloromethane	a) dichlorobromomethane	(?)0.3 ppb	0.5 ppb	0.706 ppb	75-27-4
toluene		1000 ppb	0.5 ppb	40 ppb (Method A) 1600 ppb (Method B)	108-88-3
tetrachloroethene	a)tetrachloroethylene b) PERC c) perchloroethylene	5 ppb	0.5 ppb	5 ppb (Method A) 0.858 ppb (Method B)	127-18-4
dibromochloromethane	a) chlorodibromomethane b) dibromochloromethane	No MCL	0.5 ppb	0.521 ppb	124-48-1
chlorobenzene	a) benzene monochloride b) monochlorobenzene c) phenyl chloride	100 ppb	0.5 ppb	160 ppb	108-90-7
styrene	a) vinyl benzene b) ethenylbenzene c) phenylethylene	100 ppb	0.5 ppb	1.46 ppb	100-42-5
1,2,3-trichloropropane	a) allyl trichloride b) glycerol trichlorohydrin c) trychlorohydrin	No MCL	0.5 ppb	0.00625 ppb	96-18-4
tetrahydrofuran	a) 1,4-epoxybutane b) butylene oxide c) cyclotetramethylene oxide d) tetramethylene oxide	No MCL	No Trigger Level	Not yet calculated	109-99-9
1,1-dichloropropanone	a) 1,1-dichloro-2- propanone b) 1,1-dichloroacetone c) dichloromethyl methyl ketone	No MCL	No Trigger Level	Not yet calculated	513-88-2
1,3-dichloropropane	a)1,3-DCP b) trimethylene dichloride)	No MCL	0.5 ppb	Not yet calculated	142-28-9
1,3,5-trimethylbenzene	a) mesitylene b) TMB c) trimethylbenzol	No MCL	0.5 ppb	Not yet calculated	108-67-8

Chemical Name	Other names for the chemical	MCL	Trigger Level	MTCA Cleanup Level	CAS #
1,2,4-trimethylbenzene	a) pseudocumene b) psicumene c) pseudocumol	No MCL	0.5 ppb	Not yet calculated	95-63-6
1,2,2-trichloropropane		No MCL	No Trigger Level	Not yet calculated	3175233
1-chloro-1-propene	a) propenyl chloride	No MCL	No Trigger Level	Not yet calculated	590216
ethylbenzene	a) ethylbenzol b) phenylethane	700 ppb	0.5 ppb	30 ppb (Method A) 800 ppb (Method B)	100-41-4
n-propylbenzene	a) 1-phenylpropane b) isocumene	No MCL	0.5 ppb	Not yet calculated	103-65-1
tert-butylbenzene	a) (1,1-dimethyl)benzene b) 2-methyl-2-phenylpropane c) (1,1-dimethylethyl)benzene d) dimethylethylbenzene e) phenyltrimethylmethane f) pseudobutylbenzene g) trimethylphenylmethane	No MCL	0.5 ppb	Not yet calculated	98-06-6
n-butylbenzene	a) 1-butylbenzene b) 1-phenylbutane	No MCL	0.5 ppb	Not yet calculated	104-51-8
napthalene	a) napthene b) napthalin c) napthaline d) moth balls	No MCL	0.5 ppb	320 ppb	91-20-3
pentane	a) amyl hydride b) n-pentane	No MCL	No Trigger Level	Not yet calculated	109660
2,5-dihydrofuran	a) maleic anhydride b) dihydro -2-5-dioxofuran c) 2,5-furandion d) cis-butenedioic anhydride e) toxilic anhydride	No MCL	No Trigger Level	1600 ppb	1708298
2-methyl-1-pentene	a) 4-methyl-4-pentene b) 1-methyl-1-propylethylene c) iso - hexene	No MCL	No Trigger Level	Not yet calculated	763291
cyclohexane	a) hexahydrobenzene b) hexamethylene c) hexanaphthene d) benzenehexahydride	No MCL	No Trigger Level	Not yet calculated	110827
3-heptene		No MCL	No Trigger Level	Not yet calculated	592789
1-ethyl-3-methyl-benzene	a) m-ethyltoluene b) 1-methly-3-ethylbenzene	No MCL	No Trigger Level	Not yet calculated	620144

Chemical Name	Other names for the chemical	MCL	Trigger Level	MTCA Cleanup Level	CAS #
(2-bromocyclopropyl)-benzene		No MCL	No Trigger Level	Not yet calculated	36617024
1-methyl-3-(1-methylethyl)-benzene	a) 1-isopropyl-3-methylbenzene b) m-cymene c) m-cymol d) 3-isopropyltoluene	No MCL	No Trigger Level	Not yet calculated	535773
1-ethyl-2-4-dimethylbenzene		No MCL	No Trigger Level	Not yet calculated	874419
2,3-dihydro-1-methylindene		No MCL	No Trigger Level	Not yet calculated	27133933
1,2,3,5-tetramethylbenzene	a) 1,3,4,5-tetramethylbenzene b) isodurene	No MCL	No Trigger Level	Not yet calculated	527537
1,2,3,4-tetramethylbenzene	a) prehnitene b) prehnitol	No MCL	No Trigger Level	Not yet calculated	488233
m- & p-xylene	m-xylene = a) 1,3-dimethylbenzene b) 3-methyltoluene p-xylene = a) 1,4-dimethlybenzene b) 4-methyltoluene	No MCL	0.05 ppb	16,000 ppb	
(for total xylene)		##### ppb	---	20 ppb (Method A)	1330-20-7
o-xylene	a) 1,2-dimethylbenzene b) 2-methyltoluene	No MCL	0.05 ppb	16,000 ppb	95-47-6
isopropylbenzene	a) cumene	No MCL	0.05 ppb	640 ppb	98-82-8
ethanethioamide		No MCL	No Trigger Level	Not yet calculated	62555
dinoseb		7 ppb	0.4 ppb	16 ppb	88-85-7
atrazine		3 ppb	0.2 ppb	0.398 ppb	1912-24-9
bromacil	a) bromax b) hyvar X c) krovar II d) cynogan e) eerex	No MCL	No Trigger Level	Not yet calculated	314-40-9
metalaxyl	a) apron b) ridomil c) subdue d)metalaxil	No MCL	No Trigger Level	960 ppb	57837-19-1
metalaxyl-des methyl propionate		No MCL	No Trigger Level	Not yet calculated	57837191BD
2,6-dichloro-benzamide		No MCL	No Trigger Level	Not yet calculated	2008-58-4
prometon	a) pramitol 5p b) prometon c) methoxypropazine	No MCL	No Trigger Level	240 ppb	1610-18-0
simazine		4 ppb	0.15 ppb	0.729 ppb	122-34-9

Chemical Name	Other names for the chemical	MCL	Trigger Level	MTCA Cleanup Level	CAS #
carbofuran	a) furaden 4 b) furaden 3G c) brifur d) chrisfuran e) chinfur f) curaterr g) yaltox h)pillarfuran I) kenofuran j) 2,3-dihydro-2,2-dimethylbenzoburan-7-yl methylcarbamate	40 ppb		80 ppb	1563-66-2
pentachlorophenol	a) 2,3,4,5,6-pentachloro-phenol b) PCP (not the drug) c) penchlorol d) pentachlorophenol e0 pentachlorophenate	1 ppb		0.729 ppb	87-86-5
nitrates		10 ppm		Not regulated by MTCA	

Appendix E

SAIC Field Investigation Procedures

1998 Site Investigation
Bertrand Creek & Meadowdale Areas
Whatcom County, Washington

SAIC
FIELD ACTIVITIES REPORT
BERTRAND CREEK DRINKING WATER STUDY
WASHINGTON STATE DEPARTMENT OF ECOLOGY

INTRODUCTION

The Washington State Department of Ecology (Ecology) requested Science Applications International Corporation (SAIC) to perform two rounds of drinking water sampling. The purpose of the sampling was to further assess the current status of groundwater contamination in two areas in Whatcom County, near the City of Lynden. The two areas known as Study Area A and Study Area B or (Bertrand Creek Area) are located northeast and west of Lynden, respectively. The analytes of concern include EDB, 1,2,-DCP,TCP, TCE, Dinoseb, DBCP, nitrates and fecal coliform.

During Phase I and Phase II sampling, a total of 127 water samples were collected, which included four duplicate samples from 123 domestic wells. Phase I and Phase II water sampling was conducted from June 15 to July 1, 1998 and September 21 to October 8, 1998, respectively. SAIC field personnel consisted of Romy Freier-Coppinger, Glenn Haupt, and Lynn Brimmer. The first section of this report describes the field methods used to perform the sampling. The second section describes the daily activities that occurred during and Phase I and Phase II sampling. This includes a discussion of the areas and number of wells sampled on a daily basis.

FIELD METHODS

Global Positioning System

A portable Global Positioning System (GPS) receiver was supplied by Ecology to locate the horizontal position of each wellhead. Prior to use field personnel followed a daily set up procedure supplied by Ecology to ensure proper operation of the GPS unit. The GPS unit was placed at the wellhead and a unique eight-digit filename was created based on the street address of the well to be sampled. Data was collected for approximately eight minutes or longer if the unit was having difficulty receiving satellite data. In some instances, the GPS unit location was adjusted because of overhead interference's (trees, sides and roofs of buildings, etc.). In these cases, the distance and offset direction (bearing) of the GPS unit relative to the wellhead was recorded. Additionally, if the water sample was collected at a location other than the wellhead i.e. (outside water tap, faucet) the distance and offset direction (bearing) from the sample location to the wellhead was recorded. This information was recorded on the groundwater sample data sheet and was supplied to Ecology along with the collected GPS data on a daily basis.

Groundwater Quality Instrumentation

A Horiba U-10 water quality checker was used to take field measurements of pH, electrical conductivity, temperature, and turbidity. This instrument was calibrated daily according to the manufacturer directions
with calibration solution supplied by the manufacturer. A YSI Model 50 B was used to measure dissolved oxygen in the field. This instrument was calibrated to 100 % air saturation according to the manufacturer directions on a daily basis.

Well Locations and Sampling Procedures

Well locations for water sampling were identified by Ecology. Ecology and SAIC field personnel discussed the locations to be sampled prior to the start of fieldwork. More locations were added as work progressed as more residents replied favorably to having their water sampled. A well sampling permission form was filled out by the property owner a supplied to the field personnel. This form provided information on the location of the well, outside water taps and knowledge of water softeners, filters, and other treatment systems. Water sample locations were sketched on the back of the sampling permission form. Additionally, many water sample locations were marked with red flagging. In all cases, field personnel would first attempt access to wellhead and collect a water sample at this location. Samples collected at the wellhead were recorded in the field book. If access to the wellhead was not possible, water samples were collected at the red flagged outside tap or kitchen tap as identified on the water sample permission form. Additionally, water samples were collected upstream of water softeners, filters, and other treatment systems. Samples that could not be collected as stated above were noted in the fieldbook with a reason for the deviation.

Deviations in the above sampling procedures occurred at four sample locations. Samples collected at 1127 Birch Bay-Lynden (lab sample 278515) and 0505 Birch Bay Lynden Roads (lab sample 418521) were sampled through an existing garden hose because there was no access to the tap head or wellhead. The volatile sample 398504 collected at 1121 Willey Lake Road had excessive amounts of air due to tap head problems. A filter system could not be bypassed based on the plumbing design at the wellhead located at 0603 Birch Bay-Lynden; therefore, laboratory sample 398531 collected at this location was filtered.

Water was purged from the well for several minutes to as long as one-half hour at a rate of 5 to 15 gallons per minute depending upon the distance of the sample collection point to the distance of the wellhead. Samples collected at the wellhead were generally purged for a shorter period of time than those samples collected away from the wellhead. Purge water was permitted to drain onto the ground. Groundwater field measurements of pH, electrical conductivity, temperature, turbidity, and dissolved oxygen were recorded at regular intervals during the water purging process. Final groundwater field measurements for each well are provided in the electronic database deliverable. Water sample collection was initiated when field measurements were stabilized to 10 percent of the previous reading and the appropriate volume of water had been purged from the well. Prior to sampling the purge rate was greatly reduced. Volatile organic compound (VOC) samples were collected at a rate of 0.1 gpm to minimize aeration of the sample and to collect a headspace-free sample. Additionally, water samples were collected for nitrate,

nitrite, chloride, hardness, calcium, sodium, potassium, magnesium, EDB, DBCP, and total coliform analyses. Preservatives were added to samples bottles as directed by the laboratory.

Sample Identification and Documentation Procedures

Prior to sample collection, bottles were labeled with the sample time, date, type of preservative (if required), sampler's initials, analysis required, project name, and the unique six-digit laboratory number. Sample tags containing this information were place on each sample bottle. Sample information was also recorded in the field book and on the chain-of-custody (C-O-C) form at the time of sample collection. Additionally, the eight-digit field station identification number, which corresponds to the street address number and street name, was recorded on the C-O-C to cross-reference the laboratory number. Samples collected for coliform analyses were delivered to a different laboratory using their own five-digit laboratory sample bottle number. These samples, however, had the same eight-digit field station identification numbers for cross-references purposes.

Sample Handling and Delivery

Samples were partially packed in the field for delivery to the laboratory. Samples were immediately placed in coolers, and kept cool with a combination of double zip-lock bagged ice and "blue ice" packs. Glass sample bottles were covered with bubble wrap and arranged in the cooler between plastic (poly) bottles to protect against breakage. SAIC field personnel daily relinquished samples and C-O-C documentation to Ecology. Shipment of samples to the laboratory was performed by Ecology. Samples collected for coliform analysis were retained and kept cool overnight by SAIC personnel, then delivered directly to a local laboratory at the start of the next day.

PHASE I SAMPLING

Phase I water sampling was performed the weeks of June 15 to June 18, 1998 and June 29 to July 1, 1998 in Study Area B (Bertrand Creek). No sampling occurred the week of June 22 so that the laboratory would not get overloaded with samples. A total of 52 wells were sampled during Phase I activities.

June 15, 1998- SAIC mobilized equipment to the site and met with Ecology to discuss sample locations and picked up additional sample equipment and sample bottles. Collected five water samples along Birch Bay-Lynden Road. After collecting sample 1191BBL0 and 1199BBL0 which are on adjacent properties it is learned that both sample locations are supplied by one well. It was decided by Ecology that both samples would be submitted for analytical testing. These sample locations share one GPS filename 1191BBL0, which is the horizontal location of the well head. Relinquished samples to Ecology for delivery to Manchester laboratory.

June 16, 1998- Delivered previous day coliform samples to Udder Health (the local laboratory used for coliform analysis). Collected seven water samples along Birch Bay-Lynden Road and one water sample on Bob Hall Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

June 17, 1998- Delivered previous day coliform samples to Udder Health. Collected 11 water samples from 10 wells (included field duplicate sample) along Birch-Bay Lynden Road and Bob Hall Road. Collected field duplicate sample at location 8126BBL0. Relinquished samples to Ecology for delivery to Manchester laboratory.

June 18, 1998- Delivered previous day coliform samples to Udder Health. Collected 10 water samples along Birch Bay Lynden Road and Bob Hall Road. Relinquished samples to Ecology for delivery to Manchester laboratory. Delivered coliform samples to Udder Health.

June 29, 1998- Traveled to Ecology office. Picked up sampling equipment and sample bottles. Collected eight water samples from wells on Birch Bay-Lynden Road, Bob Hall Road, and Loomis Trail Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

June 30, 1998- Delivered previous day coliform samples to Udder Health. Collected nine water samples on Bob Hall Road, Birch Bay-Lynden Road, and Loomis Trail Road. Five of the nine samples were split samples collected at the Enfield wells by Dave Bater (Enfield's consultant). Enfield split samples correspond to following Ecology Field Station Identification/Laboratory Sample Number: 1064BBL0/278509, 8220BH00/278511, 8225BH00/278512, 8239BH00/278513, 8256BH00/278514. Relinquished samples to Ecology for delivery to Manchester laboratory.

July 1, 1998- Delivered previous day coliform samples to Udder Health. Collected a total of three water samples, which includes a field duplicate sample at field station identification 1212LT00. The field duplicate was identified with the same laboratory number 278518 and sample time as the environmental sample collected at this location. Sample bottles for the duplicate sample were labeled as a duplicate on the bottle label. Delivered coliform samples to Udder Health. Relinquish samples to Ecology for delivery to Manchester laboratory.

PHASE II SAMPLING

Phase II water sampling was conducted September 21, 1998 to September 24, 1998 and from October 5, 1998 to October 8, 1998 in remaining Study Area B wells and Study Area A. Samples were not collected the week of October 12 so that the laboratory would not get overloaded with samples. A total of 71 wells were sampled during Phase II activities.

September 21, 1998- Met at Ecology office in Bellingham. Picked up sampling equipment, sample bottles, and updated list of wells to be sampled. Collected six water samples along Willeys Lake Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

September 22, 1998- Delivered previous day coliform samples to Udder Health. Collected ten water samples along Willey Lake Road, Parkwood Way, North Enterprise, and Enterprise Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

September 23, 1998- Delivered previous day coliform samples to Udder Health. Collect ten water samples along Willey Lake Road, Parklynn Way, and North Enterprise Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

September 24, 1998- Delivered previous day coliform samples to Udder Health. Collected ten water samples along Willey Lake Road, Birch Bay-Lynden Road and Rathbone Road. Collected field duplicate at field station location 7999RB00. The environmental sample collected at 0920 at field station 7999RB00 and was identified as laboratory number 398526. The associated field duplicate was labeled with a sample time of 0925 but was identified with the same laboratory number as the environmental sample. Delivered coliform samples to Udder Health. Relinquished samples to Ecology for delivery to Manchester laboratory.

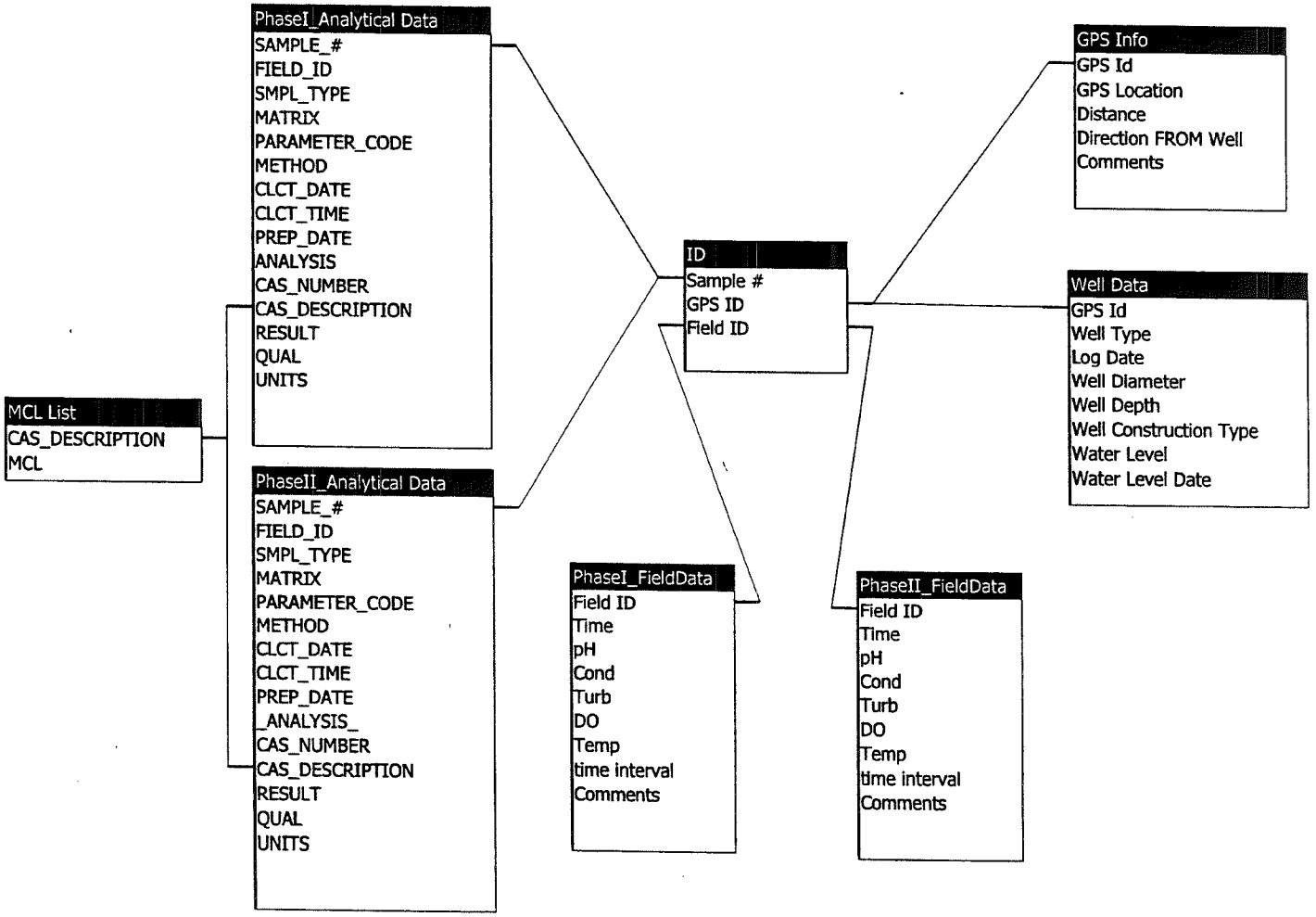
October 5, 1998- Met at Ecology office to pickup sampling supplies and sample bottles. Collected seven water samples along Loomis Trail Road and Weidkamp Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

October 6, 1998- Delivered previous day coliform samples to Udder Health. Collected nine water samples at Study Area A along Kamm Road, Clay Road, East Badger Road, Pangborn Road, Northwood Road and two water samples in Study Area B along Loomis Trail Road and Willey Lake Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

October 7, 1998- Delivered previous day coliform samples to Udder Health. Collected ten water samples from Study Area B along Loomis Trail Road, Parklynn Way, Willey Lake Road, and Birch Bay-Lynden Road. Relinquished samples to Ecology for delivery to Manchester laboratory.

October 8, 1998- Delivered previous day coliform samples to Udder Health. Collected eight water samples (includes one field duplicate sample) along Loomis Trail Road, Weidkamp Road, and Willey Lake Road. Sample number 418534 collected at 1330 is the field duplicate sample associated with environmental sample 418533 collected at 1325 from field station 8539WKR00. Relinquished samples to Ecology for delivery to Manchester laboratory. Delivered coliform samples to Udder Health.

Relationships for BertrandCreek
Thursday, February 18, 1999



Analytical Detections (By Well)

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
0507LT00	98418500	VOA	1,1,1-Trichloroethane	0.1	J	ug/L	200
	98418500	VOA	Chloroform	0.06	J	ug/L	NA
0550WBR0	98418522	VOA	Propane, 1,2,2-trichloro-	0.28	NJ	ug/L	NA
0595LT00	98418501	VOA	Chloroform	0.13	J	ug/L	NA
0603BBL0	98398531	VOA	Chloroform	0.12	J	ug/L	NA
0632LT00	98418517	VOA	Acetone	3.3	J	ug/L	NA
	98418517	VOA	Benzoyl bromide	1.3	NJ	ug/L	NA
	98418517	VOA	Bromobenzene	0.15	J	ug/L	NA
	98418517	VOA	Bromoform	3	J	ug/L	NA
	98418517	VOA	Carbon Disulfide	0.22	J	ug/L	NA
	98418517	VOA	Cyclohexanone, 2-propyl-	0.13	NJ	ug/L	NA
	98418517	VOA	Trichloroethene	0.08	J	ug/L	5
0690LT00	98418502	VOA	1,1-Dichloroethene	0.05	J	ug/L	7
	98418502	VOA	Chloroform	0.06	J	ug/L	NA
0766PLR0	98398521	VOA	Dibromochloromethane	0.05	J	ug/L	NA
0786BBL0	98398529	VOA	1,1-Dichloroethene	0.02	NJ	ug/L	7
0794LT00	98418529	HERBS	Dinoseb	0.06	J	ug/L	7
	98418529	NPEST	Metalaxyl-des methyl propionate	1.1	NJ	ug/L	NA
	98418529	VOA	1,2,3-Trichloropropane	0.77	J	ug/L	NA
0809LT00	98418518	EDB	1,2-Dibromo-3-Chloropropane	0.01	J	ug/L	NA
	98418518	EDB	1,2-Dibromoethane (EDB)	0.01	NJ	ug/L	0.05
	98418518	VOA	1,2,3-Trichloropropane	3	J	ug/L	NA
	98418518	VOA	Bromoform	0.45	J	ug/L	NA
	98418518	VOA	Chloroform	0.15	J	ug/L	NA

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
0809LT00	98418518	VOA	Dibromochloromethane	0.1	J	ug/L	NA
0811BBL0	98398528	VOA	1,1-Dichloroethene	0.13	J	ug/L	7
0827BBL0	98258522	VOA	1,2,4-Trimethylbenzene	0.12	J	ug/L	NA
	98258522	VOA	1,3,5-Trimethylbenzene	0.016	J	ug/L	NA
	98258522	VOA	Tetrahydrofuran	1.2	J	ug/L	NA
0829LT00	98418528	EDB	1,2-Dibromo-3-Chloropropane	0.003	J	ug/L	NA
	98418528	EDB	1,2-Dibromoethane (EDB)	0.004	NJ	ug/L	0.05
	98418528	NPEST	Carbofuran	0.16	J	ug/L	40
	98418528	NPEST	Metalaxyl-des methyl propionate	2.4	NJ	ug/L	NA
	98418528	VOA	1,2-Dichloropropane	15	E	ug/L	5
	98418528	VOA	1,3-Dichloropropane	0.14	J	ug/L	NA
	98418528	VOA	Chloroform	0.13	J	ug/L	NA
0845PWW0	98398510	VOA	1,2,3-Trichloropropane	0.46	J	ug/L	NA
	98398510	VOA	1,3-Dichloropropane	0.1	J	ug/L	NA
	98398510	VOA	Propane, 1,2,2-trichloro-	0.84	NJ	ug/L	NA
0895BBL0	98258518	VOA	1,3-Dichloropropane	0.1	J	ug/L	NA
0904BBL0	98258517	EDB	1,2-Dibromo-3-Chloropropane	0.0099	J	ug/L	NA
	98258517	VOA	Carbon Tetrachloride	0.034	J	ug/L	5
	98258517	VOA	Chlorobenzene	0.051	J	ug/L	NA
0909LT00	98418530	NPEST	Metalaxyl-des methyl propionate	0.06	NJ	ug/L	NA
	98418530	VOA	1,2-Dichloropropane	0.1	J	ug/L	5
0931BBL0	98258519	VOA	1,3-Dichloropropane	0.2	J	ug/L	NA
	98258519	VOA	Chloroform	0.16	J	ug/L	NA
0940WLRO	98398501	VOA	Trichloroethene	0.3	J	ug/L	5
0943BBL0	98258521	VOA	1,2,3-Trichloropropane	0.15	J	ug/L	NA
0947WLR0	98398535	VOA	Bromomethane	0.38	J	ug/L	NA
0950LT00	98418527	NPEST	Atrazine	0.01	J	ug/L	3
	98418527	NPEST	Metalaxyl	0.1	NJ	ug/L	NA

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
0950LT00	98418527	NPEST	Metalaxyl-des methyl propionate	0.05	NJ	ug/L	NA
	98418527	VOA	1,2-Dichloropropane	0.14	J	ug/L	5
0955BBL0	98258531	VOA	1,3-Dichloropropane	0.13	J	ug/L	NA
0973BBL0	98258524	VOA	1,3-Dichloropropane	0.17	J	ug/L	NA
0999WLR0	98418516	VOA	Chloroform	0.12	J	ug/L	NA
1003BBL0	98258526	VOA	Chloroform	0.045	J	ug/L	NA
1053BBL0	98258527	VOA	Chloroform	0.16	J	ug/L	NA
	98258527	VOA	Tetrachloroethene	0.013	J	ug/L	5
1064BBL0	98278509	VOA	1,2-Dibromoethane (EDB)	0.17	J	ug/L	0.05
	98278509	VOA	Chloroform	0.095	J	ug/L	NA
1073BBL0	98258528	VOA	1,3-Dichloropropane	0.11	J	ug/L	NA
	98258528	VOA	Chloroform	0.046	J	ug/L	NA
1094LT00	98418519	VOA	1,2-Dichloropropane	0.03	NJ	ug/L	5
	98418519	VOA	Propane, 1,2,2-trichloro-	0.14	NJ	ug/L	NA
1107BBL0	98278507	VOA	1,2-Dibromoethane (EDB)	0.2	J	ug/L	0.05
	98278507	VOA	1,3-Dichloropropane	0.026	J	ug/L	NA
	98278507	VOA	Tetrachloroethene	0.11	J	ug/L	5
1110BBL0	98258529	EDB	1,2-Dibromoethane (EDB)	0.23	E	ug/L	0.05
	98258529	VOA	1,2-Dibromoethane (EDB)	0.24	J	ug/L	0.05
	98258529	VOA	1,2-Dichloropropane	0.17	J	ug/L	5
	98258529	VOA	Chloroform	0.02	J	ug/L	NA
1119BBL0	98278517	VOA	1,2-Dibromoethane (EDB)	0.23	J	ug/L	0.05
	98278517	VOA	Chloroform	0.0058	J	ug/L	NA
1121WLRO	98398504	VOA	Bromodichloromethane	0.2	J	ug/L	NA
	98398504	VOA	Cyclopropane, 1,2-dimethyl-, cis-	0.16	NJ	ug/L	NA
	98398504	VOA	Dibromochloromethane	0.04	J	ug/L	NA
1124BBL0	98258530	VOA	Benzene	0.025	J	ug/L	5
	98258530	VOA	Toluene	0.1	J	ug/L	1000

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
1127BBL0	98278515	VOA	1,2-Dibromoethane (EDB)	0.15	J	ug/L	0.05
1147WLRO	98398505	VOA	1,2-Dibromoethane (EDB)	0.14	J	ug/L	0.05
1157BBL0	98258504	EDB	1,2-Dibromoethane (EDB)	0.014	J	ug/L	0.05
1188BBL0	98258503	VOA	1,2-Dibromoethane (EDB)	0.042	J	ug/L	0.05
1191BBL0	98258502	EDB	1,2-Dibromoethane (EDB)	0.0059	J	ug/L	0.05
1199BBL0	98258501	EDB	1,2-Dibromoethane (EDB)	0.0059	J	ug/L	0.05
1212LT00	98278518	VOA	1,3,5-Trimethylbenzene	0.15	J	ug/L	NA
	98278518	VOA	1-Pentene, 2-methyl-	1.7	NJ	ug/L	NA
	98278518	VOA	2,3-Dihydro-1-methylindene	1.7	NJ	ug/L	NA
	98278518	VOA	3-Heptene	0.94	NJ	ug/L	NA
	98278518	VOA	Benzene, (2-bromocyclopropyl)-	0.72	NJ	ug/L	NA
	98278518	VOA	Benzene, 1,2,3,4-tetramethyl-	1.6	NJ	ug/L	NA
	98278518	VOA	Benzene, 1,2,3,5-tetramethyl-	1.1	NJ	ug/L	NA
	98278518	VOA	Benzene, 1-ethyl-2,4-dimethyl-	1.5	NJ	ug/L	NA
	98278518	VOA	Benzene, 1-ethyl-3-methyl-	2.4	NJ	ug/L	NA
	98278518	VOA	Benzene, 1-methyl-3-(1-methylethyl)-	0.85	NJ	ug/L	NA
	98278518	VOA	Chloroform	0.013	J	ug/L	NA
	98278518	VOA	Cyclohexane	1.9	NJ	ug/L	NA
	98278518	VOA	Ethylbenzene	0.15	J	ug/L	700
	98278518	VOA	Furan, 2,5-dihydro-	0.77	NJ	ug/L	NA
	98278518	VOA	Isopropylbenzene (Cumene)	0.2	J	ug/L	NA
	98278518	VOA	n-Butylbenzene	0.15	J	ug/L	NA
	98278518	VOA	n-Propylbenzene	0.099	J	ug/L	NA
	98278518	VOA	Pentane	0.72	NJ	ug/L	NA
	98278518	VOA	Tert-Butylbenzene	0.026	J	ug/L	NA
	98278518	VOA	Toluene	0.08	J	ug/L	1000
1216BBL0	98258500	VOA	1,2-Dibromoethane (EDB)	0.016	J	ug/L	0.05
1227LT00	98278506	VOA	Chloroform	0.073	J	ug/L	NA

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
1231WLR0	98398506	EDB	1,2-Dibromoethane (EDB)	0.07	J	ug/L	0.05
	98398506	VOA	1,2-Dibromoethane (EDB)	0.14	J	ug/L	0.05
1236BBL0	98258508	HERBS	Dinoseb	0.12	J	ug/L	7
	98258508	NPEST	Metalaxyl-des methyl propionate	0.83	NJ	ug/L	NA
1264BBL0	98258509	NPEST	Benzamide, 2,6-dichloro-	0.024	J	ug/L	NA
	98258509	NPEST	Bromacil	0.61	J	ug/L	NA
	98258509	NPEST	Metalaxyl-des methyl propionate	0.49	NJ	ug/L	NA
	98258509	VOA	1,3-Dichloropropane	0.11	J	ug/L	NA
1282BBL0	98258507	EDB	1,2-Dibromoethane (EDB)	0.0062	J	ug/L	0.05
	98258507	HERBS	Dinoseb	0.21	J	ug/L	7
	98258507	NPEST	Atrazine	0.011	J	ug/L	3
	98258507	NPEST	Benzamide, 2,6-dichloro-	0.1	J	ug/L	NA
	98258507	NPEST	Bromacil	0.052	J	ug/L	NA
	98258507	NPEST	Metalaxyl-des methyl propionate	1.7	NJ	ug/L	NA
	98258507	VOA	Chloroform	0.094	J	ug/L	NA
	98258507	VOA	Tetrachloroethene	0.026	J	ug/L	5
1306BBL0	98258506	NPEST	Benzamide, 2,6-dichloro-	0.17	J	ug/L	NA
	98258506	NPEST	Metalaxyl-des methyl propionate	1.9	NJ	ug/L	NA
	98258506	VOA	1,3-Dichloropropane	0.043	J	ug/L	NA
	98258506	VOA	Chloroform	0.12	J	ug/L	NA
1315BBL0	98258505	NPEST	Bromacil	0.024	J	ug/L	NA
	98258505	NPEST	Metalaxyl	0.16	J	ug/L	NA
	98258505	NPEST	Metalaxyl-des methyl propionate	0.19	NJ	ug/L	NA
	98258505	VOA	1,3-Dichloropropane	0.054	J	ug/L	NA
1322BBL0	98258510	NPEST	Benzamide, 2,6-dichloro-	0.17	J	ug/L	NA
	98258510	NPEST	Bromacil	0.077	J	ug/L	NA
	98258510	NPEST	Metalaxyl-des methyl propionate	3.6	NJ	ug/L	NA
	98258510	VOA	1,3-Dichloropropane	0.089	J	ug/L	NA

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
1322BBL0	98258510	VOA	Chloroform	0.17	J	ug/L	NA
1349BBL0	98258515	VOA	Chloroform	0.23	J	ug/L	NA
1353BBL0	98258516	VOA	1,2,3-Trichloropropane	0.12	J	ug/L	NA
	98258516	VOA	Tetrahydrofuran	0.75	J	ug/L	NA
1408WLR0	98398507	VOA	1,1,1-Trichloroethane	0.22	J	ug/L	200
	98398507	VOA	Chloroform	0.05	J	ug/L	NA
1415WLR0	98398508	VOA	Chloroform	0.04	J	ug/L	NA
1523WLR0	98398524	VOA	Chloroform	0.05	J	ug/L	NA
7762NER0	98398516	VOA	Chloroform	0.04	J	ug/L	NA
7777NER0	98398517	VOA	1,1,2-Trichloroethane	0.01	J	ug/L	5
	98398517	VOA	1,2-Dichloropropane	0.14	J	ug/L	5
	98398517	VOA	1,3-Dichloropropane	0.02	J	ug/L	NA
	98398517	VOA	Chloroform	0.04	J	ug/L	NA
	98398517	VOA	Propane, 1,2,2-trichloro-	4.9	NJ	ug/L	NA
7803NER0	98398514	VOA	1,1,2-Trichloroethane	0.03	J	ug/L	5
	98398514	VOA	1,2-Dichloropropane	0.17	J	ug/L	5
	98398514	VOA	1,3-Dichloropropane	0.08	J	ug/L	NA
	98398514	VOA	Propane, 1,2,2-trichloro-	4.7	NJ	ug/L	NA
7999RB00	98398526	VOA	1,1,1-Trichloroethane	0.21	J	ug/L	200
	98398526	VOA	1,2,3-Trichloropropane	0.66	J	ug/L	NA
	98398526	VOA	Chloroform	0.05	J	ug/L	NA
	98398526	VOA	Tetrachloroethene	0.03	J	ug/L	5
8126BH00	98258513	NPEST	Atrazine	0.007	J	ug/L	3
	98258513	NPEST	Benzamide, 2,6-dichloro-	0.17	J	ug/L	NA
	98258513	NPEST	Bromacil	0.061	J	ug/L	NA
	98258513	NPEST	Metalaxyl-des methyl propionate	2.2	NJ	ug/L	NA
	98258513	NPEST	Simazine	0.019	J	ug/L	70
	98258513	VOA	1,3-Dichloropropane	0.028	J	ug/L	NA

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
8126BH01	98258514	VOA	1,3-Dichloropropane	0.02	J	ug/L	NA
8132BH00	98258512	EDB	1,2-Dibromo-3-Chloropropane	0.0086	J	ug/L	NA
	98258512	NPEST	Benzamide, 2,6-dichloro-	0.058	J	ug/L	NA
	98258512	NPEST	Bromacil	0.77	J	ug/L	NA
	98258512	NPEST	Metalaxyl-des methyl propionate	0.62	NJ	ug/L	NA
	98258512	NPEST	Prometon (Pramitol 5p)	0.013	J	ug/L	NA
	98258512	VOA	1,3-Dichloropropane	0.16	J	ug/L	NA
	98258512	VOA	Chloroform	0.22	J	ug/L	NA
8138BH00	98258532	VOA	1,3-Dichloropropane	0.096	J	ug/L	NA
	98258532	VOA	Chloroform	0.18	J	ug/L	NA
8168BH00	98278508	VOA	1,3-Dichloropropane	0.08	J	ug/L	NA
	98278508	VOA	1-Propene, 1-chloro-	0.063	NJ	ug/L	NA
	98278508	VOA	Chloroform	0.15	J	ug/L	NA
8195BH00	98278510	VOA	1,3-Dichloropropane	0.07	J	ug/L	NA
	98278510	VOA	Chloroform	0.13	J	ug/L	NA
8220BH00	98278511	VOA	Acetone	99	E	ug/L	NA
	98278511	VOA	Tetrahydrofuran	112	E	ug/L	NA
8225BH00	98278512	VOA	Chloroform	0.02	J	ug/L	NA
8247BH00	98258533	VOA	Tetrachloroethene	0.024	J	ug/L	5
8351BH00	98278500	VOA	Propane, 1,2,2-trichloro-	0.12	NJ	ug/L	NA
8539WKR0	98418534	EDB	1,2-Dibromoethane (EDB)	0.01	J	ug/L	0.05
	98418533	EDB	1,2-Dibromoethane (EDB)	0.01	J	ug/L	0.05
	98418533	NPEST	Atrazine	0.01	J	ug/L	3
	98418534	NPEST	Atrazine	0.01	J	ug/L	3
	98418533	NPEST	Metalaxyl-des methyl propionate	0.89	NJ	ug/L	NA
	98418534	NPEST	Metalaxyl-des methyl propionate	0.86	NJ	ug/L	NA
	98418533	VOA	1,2,3-Trichloropropane	1.8	J	ug/L	NA
	98418534	VOA	1,2,3-Trichloropropane	2	J	ug/L	NA

FIELD_ID	SAMPLE #	PARAMETER_CODE	CAS_DESCRIPTION	RESULT	QUAL	UNITS	MCL
8539WKR0	98418533	VOA	Chloroform	0.14	J	ug/L	NA
	98418534	VOA	Chloroform	0.14	J	ug/L	NA
8591WKR0	98418532	NPEST	Metalaxyl-des methyl propionate	0.4	NJ	ug/L	NA
	98418532	VOA	1,1-Dichloroethene	0.03	NJ	ug/L	7
	98418532	VOA	Tetrahydrofuran	44	E	ug/L	NA
8691WKR0	98418531	NPEST	Carbofuran	0.03	J	ug/L	40
	98418531	NPEST	Metalaxyl-des methyl propionate	0.25	NJ	ug/L	NA
8751WKR0	98418505	VOA	1,2-Dichloropropane	0.11	J	ug/L	5
	98418505	VOA	Trichloroethene	0.06	J	ug/L	5
8783NWR0	98418508	VOA	Chloroform	0.09	J	ug/L	NA
	98418508	VOA	Propane, 1,2,2-trichloro-	0.06	NJ	ug/L	NA
8895WKR0	98418523	VOA	Chloroform	0.06	J	ug/L	NA
	98418523	VOA	Tetrahydrofuran	0.92	J	ug/L	NA
	98418523	VOA	Trichlorofluoromethane	0.14	J	ug/L	NA

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GPS Filename	Address	Date	Time	Feet from well	Direction	Comment
0929WLR0	929 Willey's Lake Road	9/21/98	1305	At well head		
0940WLR0	940 Willey's Lake Road	9/21/98	1340	At well head		
0950WLR0	950 Willey's Lake Road	9/21/98	1420	94	75	
1063WLR0	1063 Willey's Lake Road	9/21/98	1450	At well head		
1121WLR0	1121 Willey's Lake Road	9/21/98	1550	At well head		
1147WLR0	1147 Willey's Lake Road	9/21/98	1630	At well head		
0809ER00	8092 Enterprise Road	9/22/98	1355	At well head		
0845PWW0	845 Parkwood Way	9/22/98	1125	At well head		
1231WLR0	1231 Willey's Lake Road	9/22/98	845	At well head		
1408WLR0	1408 Willey's Lake Road	9/22/98	930	At well head		
1415WLR0	1415 Willey's Lake Road	9/22/98	955	At well head		
1535WLR0	1535 Willey's Lake Road	9/22/98	1030	At well head		
7778NER0	7778 North Enterprise Ro	9/22/98	1645	80	340	
7898NER0	7898 North Enterprise Ro	9/22/98	1450			Couldn't locate well; gps taken in vicinity indicated on map.
8294NER0	8294 North Enterprise Ro	9/22/98	1300	At well head		
0708PLR0	708 Parklyn Way	9/23/98	1410	At well head		
0750PLR0	750 Parklyn Way	9/23/98	1315	116	4	
0766PLR0	766 Parklyn Way	9/23/98	1340	36	0	
0828PLR0	828 Parklyn Way	9/23/98	1710	40	104	
1080WLR0	1080 Willey's Lake Road	9/23/98	1220	At well head		
1523WLR0	1523 Willey's Lake Road	9/23/98	1420	At well head		
7762NER0	7762 North Enterprise Ro	9/23/98	850	At well head		
7777NER0	7777 North Enterprise Ro	9/23/98	925	10	280	
7803NER0	7803 North Enterprise Ro	9/23/98	935	10	280	
8300NER0	8300 North Enterprise Ro	9/23/98	1050	At well head		
	1454 Willey's Lake Road	9/23/98	1540			Site is heavily wooded; unable to get gps reading.
0509BBL0	509 Birch Bay Lynden	9/24/98	1540	At well head		
0569BBL0	569 Birch Bay Lynden	9/24/98	1510	62	268	
0595BBL0	595 Birch Bay Lynden	9/24/98	1435	120	258	
0603BBL0	603 Birch Bay Lynden	9/24/98	1340	At well head		
0672BBL0	672 Birch Bay Lynden	9/24/98	1300	64	174	
0786BBL0	786 Birch Bay Lynden	9/24/98	1115	129	106	
0811BBL0	811 Birch Bay Lynden	9/24/98	1020	110	320	Estimated distance and direction due to site conditions.
0817BBL0	817 Birch Bay Lynden	9/24/98	940	At well head		
0947WLR0	947 Willey's Lake Road	9/24/98	1630	At well head		
7999RB00	7999 Rathbone Road	9/24/98	900	At well head		
0507LT00	507 Loomis Trail	10/5/98	1200	At well head		

0690LT00	690 Loomis Trail	10/5/98	1400	32	159	
1359LT00	1359 Loomis Trail	10/5/98	1500	At well head		
1696LT00	1696 Loomis Trail	10/5/98	1600	At well head		
8751WKR0	8751 Weidkamp Road	10/5/98	1630	75	15	
8755WKR0	8755 Weidkamp Road	10/5/98	1700	146	74	
0632LT00	632 Loomis Trail	10/6/98	1730	200	196	
0999WLR0	999 Willey's Lake Road	10/6/98	1630	At well head		
1094LT00	1094 Loomis Trail	10/6/98	1005	14	220	
1306KR00	1306 Kamm Road	10/6/98	850	92	166	
1424EBR0	1424 East Badger Road	10/6/98	1230	60	239	
1506PBR0	1506 Pangborn Road	10/6/98	1430	At well head		
1650PNL0	1650 Pine Needle Lane	10/6/98	1550	At well head		
1684EBR0	1684 East Badger Road	10/6/98	1305	At well head		
8783NWR0	8783 Northwood Road	10/6/98	930	74	75	
9056NWR0	9056 Northwood Road	10/6/98	1010	At well head		
9131CR00	9131 Clay Road	10/6/98	1350	At well head		
9239NWR0	9239 Northwood Road	10/6/98	1040	At well head		
0505BBL0	505 Birch Bay Lynden	10/7/98	1100	At well head		
0550WBR0	550 West Badger Road	10/7/98	1320	30	109	
0694BBL0	694 Birch Bay Lynden	10/7/98	1540	At well head		
0782PLW0	782 Parklyn Way	10/7/98	1610	At well head		
0809LT00	809 Loomis Trail	10/7/98	900	At well head		
0950LT00	0950 Loomis Trail	10/7/98	1700	At well head		
1055WLR0	1055 Willey's Lake Road	10/7/98	1445	At well head		
8702WKR0	8702 Weidkamp Road	10/7/98	1030	At well head		
0794LT00	794 Loomis Trail	10/8/98	905	16	220	
0829LT00	829 Loomis Trail	10/8/98	830	At well head		
0909LT00	909 Loomis Trail	10/8/98	950	At well head		
1438WLR0	1438 Willey's Lake Road	10/8/98	1415	140	80	Estimated distance and direction due to site conditions.
8539WKR0	8539 Weidkamp Road	10/8/98	1305	18	82	
8591WKR0	8591 Weidkamp Road	10/8/98	1100	24	82	
8691WKR0	8691 Weidkamp Road	10/8/98	1030	38	95	
0595LT00	595 Loomis Trail	10/5/98	1320	At well head		
8895WKR0	8895 Weidkamp Road	10/7/98	1410	At well head		

1322BBL0	1322 Birch Bay Lynden	9/21/98	1730	At Well head	replaces original zero length file

* The two remaining zero length files from phase I were collected on 9/24/98. Both samples were collected at the wellhead between 1230 and 1330. Both gps locations were on Birch Bay Lynden; however, I gave Mary my note with the gps filenames. Both were taken at the wellhead.

Address	Latitude	Longitude
1227LT00	48.94997	122.54652
8351BH00	48.944435	122.55206
8289BH00	48.942459	122.55295
8293BH00	48.942421	122.55138
8269BH00	48.941795	122.55137
8256BH00	48.941238	122.55000
8247BH00	48.941044	122.55142
8239BH00	48.940586	122.54990
8195BH00	48.938988	122.55130
8168BH00	48.938145	122.55026
8138BH00	48.93726	122.54926
8132BH00	48.93671	122.54913
8126BH00	48.936657	122.55068
0904BBL0	48.936447	122.52837
1188BBL0	48.936218	122.54466
1124BBL0	48.936069	122.54127
1110BBL0	48.935905	122.54019
1216BBL0	48.935783	122.54633
1282BBL0	48.935677	122.54956
0994BBL0	48.9356	122.53346
0827BBL0	48.935207	122.52500
1127BBL0	48.935204	122.54132
1157BBL0	48.935123	122.54281
1107BBL0	48.935104	122.53991
1353BBL0	48.935123	122.55412
0973BBL0	48.934814	122.53275
1191BBL0	48.934849	122.54480
0955BBL0	48.934731	122.53129
0943BBL0	48.93428	122.53111
1073BBL0	48.934113	122.53709
0963BBL0	48.933662	122.53270
1349BBL0	48.932865	122.55267
1212LT00	48.950954	122.54702
1306BBL0	48.935883	122.55134
1309LT00	48.950581	122.55248
8225BH00	48.940323	122.55114
8277BH00	48.942139	122.55556
8281BH00	48.942368	122.55456
8285BH00	48.942669	122.55286
1064BBL0	48.935902	122.53778
1236BBL0	48.935776	122.54779
8220BH00	48.940121	122.55000
1003BBL0	48.935173	122.53394
1053BBL0	48.93681	122.53636
1119BBL0	48.934822	122.54157
1315BBL0	48.934322	122.55232
0895BBL0	48.934582	122.52850
1322BBL0	48.935886	122.55344

Address	Latitude	Longitude
1055WLR0	48.92004	122.53738
1063WLR0	48.920116	122.53898
1080WLR0	48.920891	122.54046
1121WLR0	48.920177	122.54252
1147WLR0	48.919857	122.54455
1231WLR0	48.919712	122.54911
1306KR00	48.957973	122.41627
0845PWW0	48.930809	122.52630
0909LT00	48.949581	122.53089
0929WLR0	48.922272	122.53144
0940WLR0	48.922836	122.53157
0947WLR0	48.921726	122.53234
0950WLR0	48.923119	122.53072
0999WLR0	48.920425	122.53555
0782PLW0	48.929413	122.52248
0786BBL0	48.935177	122.52252
0794LT00	48.950615	122.52416
0809LT00	48.949688	122.52541
0811BBL0	48.93536	122.52492
0817BBL0	48.934853	122.52550
0829LT00	48.949142	122.52712
0603BBL0	48.934284	122.51322
0672BBL0	48.935009	122.51699
0690LT00	48.95013	122.51817
0694BBL0	48.935532	122.51806
0708PLR0	48.925674	122.52134
0750PLR0	48.930016	122.51979
0766PLR0	48.930817	122.52177
8294NER0	48.942368	122.57369
8300NER0	48.942982	122.56842
8539WKR0	48.951729	122.53076
8591WKR0	48.953491	122.53069
8691WKR0	48.957069	122.53093
8702WKR0	48.957474	122.52819
8751WKR0	48.959637	122.53027
1650PNL0	48.933453	122.57211
1684EBR0	48.96418	122.39720
7762NER0	48.922699	122.57375
7777NER0	48.924854	122.57472
7778NER0	48.923584	122.57366
7898NER0	48.930672	122.56358
7999RB00	48.931396	122.53101
1359LT00	48.948856	122.55586
1415WLR0	48.920341	122.55913
1424EBR0	48.96452	122.41262
1438WLR0	48.92083	122.55847
1506PBR0	48.979115	122.40695
1523WLR0	48.919601	122.56400

Address	Latitude	Longitude
1535WLR0	48.920254	122.56644
7803NER0	48.925064	122.57472
8755WKR0	48.959751	122.52924
0632LT00	48.95023	122.51511
1094LT00	48.950146	122.54047
0950LT00	48.950764	122.53384
0505BBL0	48.933262	122.50815
8092ER00	48.935074	122.57349
1696LT00	48.950653	122.57374
8783NWR0	48.959541	122.40740
8895WKR0	48.964447	122.53085
9056NWR0	48.969624	122.40676
9131CR00	48.97271	122.39641
9239NWR0	48.976173	122.40778
1408WLR0	48.920788	122.55909
0828PLR0	48.929615	122.52507
1454WLR0	48.920769	122.55964
0507LT00	48.949566	122.50800
0509BBL0	48.93446	122.50794
0550WBR0	48.965263	122.51018
0569BBL0	48.934315	122.51209
0595BBL0	48.931675	122.51342
0595LT00	48.949669	122.51268
1264BBL0	48.935642	122.54894
0931BBL0	48.935555	122.53048
0932BBL0	48.935074	122.53039

Appendix F

Fact Sheets, Permission Forms, Letters to Residents, Attachments and Translations

1998 Site Investigation
Bertrand Creek & Meadowdale Areas
Whatcom County, Washington

Summer '98 Drinking Water Sampling

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Study Area B – Bertrand Creek Area

Introduction

The Washington State Department of Ecology (Ecology) is planning to conduct two rounds of ground water sampling this summer in the area known as Study Area B, located west of Lynden. The purpose of the sampling is to:

- evaluate the current status of ground water contamination;
- assess the current short-term solution (providing bottled water);
- assist in developing potential long-term solutions.

Sampling in Study Area B area will allow Ecology to get a more timely picture of the ground water status. It will also be useful in updating the list of households who should be receiving bottled water. If EDB-contaminated ground water exists in areas not previously defined in earlier studies, it is important that this be determined in order to include such households in a (potentially) expanded bottled water program. As mentioned earlier, sampling the area is also important in determining the full scope of any long-term solutions.

Ecology may contact you if you live in Study Area B to coordinate a date to sample your ground water. *(Please refer to the map on the back of this page to see if you live in Study Area B.)*

In order to obtain a complete profile of the condition of each household's well water, sampling will include analysis for other potential contaminants in addition to EDB. This will avoid possible problems associated with multiple agencies asking to collect samples at the same addresses.

History

In 1983, the Environmental Protection Agency (EPA) banned the use of EDB (ethylene dibromide) as a soil fumigant. In response, from 1984 through 1986, several state agencies investigated areas where EDB had been used to determine if there was ground water contamination. The investigations revealed that two areas in Whatcom County (near the city of Lynden) had EDB contamination in domestic wells and that as a result, drinking water was contaminated. Study Area B was one of those two areas.

Beginning in 1986, Ecology made bottled water available to those households in Study Area B whose drinking water was known or suspected to be contaminated. Later on (in 1989), Ecology defined the bottled water delivery area to be those households with addresses 8100 to 8400 Bob Hall Road and 900 to 1300 Birch Bay Lynden Road.

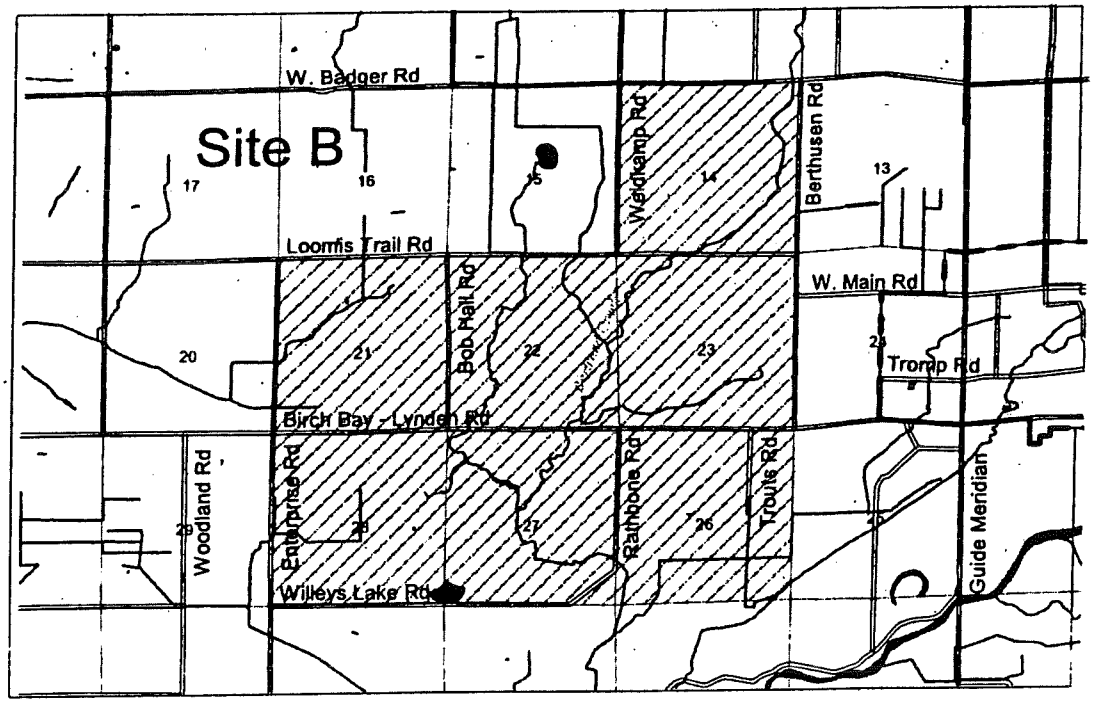
Two Rounds of Sampling will be Conducted

The first round of sampling will be of those households in and directly adjacent to the bottled water delivery area. This area has not been sampled since 1993/94. The second round of sampling will be of a portion of those households who do not reside in the defined bottled water area but do live in Study Area B.

Sampling Schedule (Tentative)

June 1 – 19	Households in bottled water delivery area will be sampled
August 1 – 7	Results will be sent to homeowners
SEPT. 21 – OCT. 9	Remaining households in Study Area B will be sampled
November 16	Results will be sent to homeowners
February 1	Final report containing sampling results is scheduled to be available

Map of Study Area B *(striped section is Area B)*



More Information

For more information regarding sampling or the history of EDB in the area, please contact Mary O'Herron, Washington State Department of Ecology, (360) 738-6246.

Verano '98: Muestreo Del Agua Potable

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Area B de Estudios – Bertrand Creek

Introducción

El Departmento de Ecología del Estado de Washington (Ecology) está planificando a conducir un muestreo de dos etapas de las aguas subterránneas durante el verano en el área B de estudios, ubicado al oeste de la cuidad de Lynden. El propósito de tomar estas muestreas es para::

- Evaluar la condición actual de al contaminación de las aguas subterráneas;
- Evaluar la solución actual de poco plazo (el subministrar agua embotellada);
- Asistir en desarollar las soluciones potenciales de largo plazo.

Muestreos en el Area B de Estudios dará la oportunidad a Ecology para conseguir una vista más al momento de la condición actual de las aguas subterránneas. También será útil en poner al día la lista de las casas residenciales que deben estar recibiendo el agua embotellada. Si hay aguas subterráneas contaminadas con EDB en las áreas no definidas por los estudios anteriores, sería importante determinar tal para incluir tales casas en un programa amplificado (potencialmente) de subministrar agua embotellada. Como se mencionó anteriormente, el muestreo en el área es importante para determinar el rango completo de las soluciones de largo plazo.

Si vive Usted en el Area B de Estudios, es posible que Ecology se pone in contacto consigo para coordinar una fecha para tomar muestras de sus aguas subterránes. *(Favor de referirse al mapa al otro lado de esta página para averiguar si vive Ud. en el Area B de Estudios.)*

Para obtener un perfil completo de la condición de las aguas de los pozos de cada casa, las muestras estarán analizadas para otros contaminantes potenciales más que el EDB. Esta práctica evitará la posibilidad de que varias agencias gobermentales les pedirán a tomar muestras en las mismas casas residenciales.

La Historia

En 1983, la Agencia Federal para la Protección del Medio Ambiente (EPA) prohibió el uso del EDB (dibromuro de etileno) como fumigante del suelo. En constestación, desde 1984 hasta 1986, varias agencias estatales investigaron las áreas donde se usaban el EDB para averiguar si había contaminación en las aguas subterráneas. Las investigaciones revelaron que dos areas del Condado de Whatcom (cerca de la cuidad de Lynden) tenían contaminación del EDB en los pozos domesticose, y como resultado el agua potable era contaminada. El Area B de Estudios fue uno de esos dos áreas.

Comenzando en el año 1986, Ecology ha tenido disponible el agua embotellada para las casas residenciales dentro del Area B de Estudios cuyas agua potable se sabía o se sospechaba que era contaminada. Más adelante (en el año 1989), Ecology estableció el área para recibir el agua embotellada como incluir todas las casas con direcciones desde 8100 hasta el 8400 de Bob Hall Road y también desde 900 hasta el 1300 de Birch Bay Lynden Road.

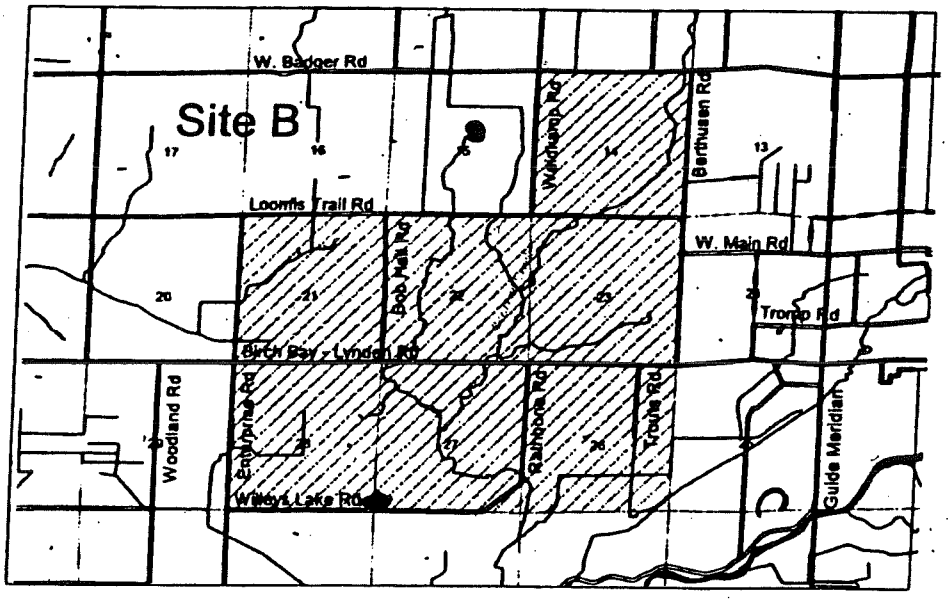
La Muestras Se Tomarán en dos Etapas

La primera etapa del muestreo en las propiedades de las casas residenciales dentro de y justo al lado del área que recibe el agua embotellada. No se ha tomado muestras de esta área desde los años 1993/1994. La segunda etapa del muestreo será en las propriedades de las casas que no se ubican en el área que recibe el agua embotellada pero que *sí* se ubican en el Area B de Estudios.

El Horario del Muestreo (Provisional)

1 a 19 de Junio	Se tomarán muestras en el área que recibe el agua embotellada
1 a 7 de Agosto	Los resultados estarán enviados a los dueños de las casas residenciales donde se tomaron las muestras
9/21-10/9	Se tomarán muestras en las demás casas residenciales del Area B de Estudios
11/16	Los resultados estarán enviados a los dueños de las casas residenciales donde se tomaron las muestras
1 de Febrero (1999)	El informe final de los resultados del análisis de las muestras tomadas será disponible al público

El Mapa del Area B de Estudios



Para recibir más información

Para recibir más información relato al sacar muestras o la historia de EDB en el area, favor de ponerse in contact con William Green, El Departamento de Ecología (Ecology), (360) 407-6795 (en español) o Mary O'Herron, Washington State Department of Ecology, (360) 738-6246 (en inglés).

COPY

Summer '98 Drinking Water Sampling -- Permission to Sample
Bertrand Creek Area / Study Area B

Household: _____

Address: _____

The Washington State Department of Ecology (Ecology) and/or its contractors will be collecting samples of domestic well water in the Bertrand Creek Area / Study Area B during the month of June, 1998. Ecology's contractor during this sampling event is SAIC, an environmental consulting firm.

The water samples will be collected from taps on the outside of the house, some time between the hours of 8 a.m. and 6 p.m.. To collect the samples correctly, the contractors will need to let the water run for 20 to 30 minutes.

No one needs to be home during the sampling. The contractors will, however, announce their presence when they arrive.

___ I am willing to have my water sampled by Ecology and/or their contractors

___ I am not willing to have my water sampled by Ecology and/or their contractors

---

___ I would like to receive a copy of the analytical results

___ I would prefer not to receive a copy of the analytical results

---

Is there anything that the contractor should be aware of when coming to collect the samples? (Dogs _____ Gates/ Fences? _____ Other? _____)

Does your household have a water softener? Y N

Does your household have any water filtration device? Y N

If yes, is the filtration device at the kitchen tap? Y N

Name: _____ Date: _____

Muestreo de agua potable en el Verano de 1998 –
Permiso para mostrar en el área de Bertrand Creek: Area B del Estudio

Nombre del Domicilio:_____

Dirección:_____

El Washington State Department of Ecology (Ecology) y/o su contratista tomarán muestras de agua potable durante el mes de junio, 1998 en el área de Bertrand Creek que es el Area B del Estudio. El contratista de Ecology para este trabajo es SAIC, una compañía consultora del medio ambiente.

Las muestras de agua estarán tomadas desde una llave de agua que está ubicada fuera de las casas durante las horas de 0800 hasta las 1800 de la tarde. Para tomar correctamente las muestras, los contratistas necesitarán causar un flujo libre del agua para aproximadamente veinte a treinta minutos.

No es necesario que alguien estén en la casa durante el muestreo. Sin embargo, los contratistas anunciarán sus presencia cuando lleguen a su casa.

Por favor, contesta Ud. a lo siguiente:

___ Estoy dispuesto a permitir el muestreo de agua potable por Ecology o su contratista.

___ No estoy dispuesto a permitir el muestreo de agua por Ecology ni su contratista.

___ Me gustaría recibir una copia de los resultados analíticos.

___ Prefería no recibir una copia de los resultados analíticos.

¿Hay algo importante que Ecology debe informar al contratista cuando visita a su casa para tomar las muestras? Por ejemplo, marca Ud. si hay:

¿Perros? _____ ¿Portones cerrados o cercas exteriores? _____
Otras cosas que prohibirán el muestreo? _____

¿Hay un suavizador de agua en su casa? Sí No

¿Hay cualquier filtro de agua en su casa? Sí No

¿Si hay un filtro, está ubicado en la cocina? Sí No

Nombre: _____ Fecha: _____

NOTA IMPORTANTE: Si Ud. no está en casa cuando visataremos el área, manda esta pagina con la estampilla provista a: Mary O'Herron, Department of Ecology, 1204 Railroad Ave., #200, Bellingham, WA 98225.

Fall '98 Drinking Water Sampling -- Permission to Sample Northern Whatcom County

Name (Please print) : _____ Phone:_____

Address: _____ Zip:_____

A number of different agencies (Ecology, USGS, and WA Dept. of Health) will be collecting samples of domestic well water in northern Whatcom County during the months of September and October, 1998. Whatcom County Health & Human Services will be coordinating this request for volunteers on behalf of all of the agencies involved.

The water samples will be collected from taps on the outside of the house, some time between the hours of 8 a.m. and 6 p.m.. To collect the samples correctly, the person doing the sampling will need to let the water run for 20 to 30 minutes.

No one needs to be home during this proceedure. The samplers will, however, announce their presence when they arrive.

___ I am willing to have my water sampled.

___ I am not willing to have my water sampled.

___ I would like to receive a copy of the analytical results

___ I would prefer not to receive a copy of the analytical results

---

Is there anything that the sampler should be aware of when coming to collect the samples? (Dogs _____ Gates/ Fences? _____ Other? _____)

Does your household have a water softener? Y N

Does your household have any water filtration device? Y N

If yes, is the filtration device at the kitchen tap? Y N

(OVER)

Additional information

Name of landlord: _____

Address of landlord: _____

Does the well serve more than one home? Y N

How many homes does it serve? ____

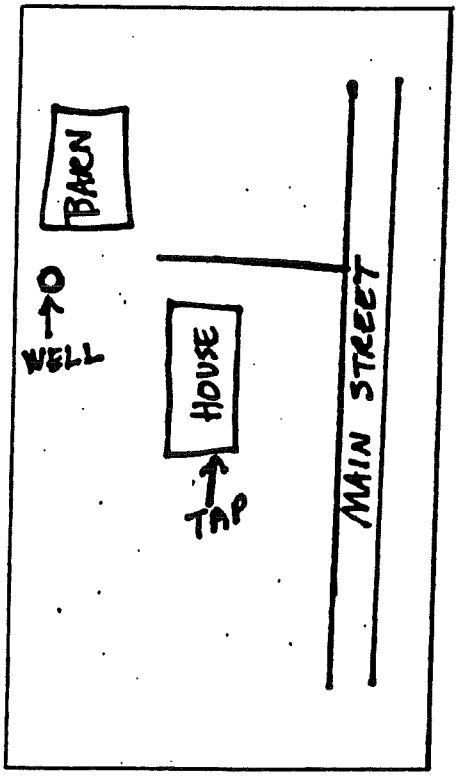
What are the other addresses? _____

_____

Do you have any information about the construction of your well? Y N

Map - Please draw a rough map of your property. Show where the well is located. Also the show location of outside household tap where the water can be collected.

Example Map :



Your Map:

Signature: _____ Date: _____

Muestreo de agua potable en el Verano de 1998 -- Permiso para mostrar en el área de Bertrand Creek: Area B del Estudio

Nombre del Domicilio:_____

Dirección:_____

El Washington State Department of Ecology (Ecology) y/o su contratista tomarán muestras de agua potable durante el mes de junio, 1998 en el área de Bertrand Creek que es el Area B del Estudio. El contratista de Ecology para este trabajo es SAIC, una compañía consultora del medio ambiente.

Las muestras de agua estarán tomadas desde una llave de agua que está ubicada fuera de las casas durante las horas de 0800 hasta las 1800 de la tarde. Para tomar correctamente las muestras, los contratistas necesitarán causar un flujo libre del agua para aproximadamente veinte a treinta minutos.

No es necesario que alguien estén en la casa durante el muestreo. Sin embargo, los contratistas anunciarán sus presencia cuando lleguen a su casa.

Por favor, contesta Ud. a lo siguiente:

___ Estoy dispuesto a permitir el muestreo de agua potable por Ecology o su contratista.

___ No estoy dispuesto a permitir el muestreo de agua por Ecology ni su contratista.

___ Me gustaría recibir una copia de los resultados analíticos.

___ Prefería no recibir una copia de los resultados analíticos.

¿Hay algo importante que Ecology debe informar al contratista cuando visita a su casa para tomar las muestras? Por ejemplo, marca Ud. si hay:

¿Perros? _____ ¿Portones cerrados o cercas exteriores? _____
Otras cosas que prohibirán el muestreo? _____

¿Hay un suavizador de agua en su casa? Sí No

¿Hay cualquier filtro de agua en su casa? Sí No

¿Si hay un filtro, está ubicado en la cocina? Sí No

NOTA IMPORTANTE: Si Ud. no está en casa cuando visataremos el área, manda esta pagina con la estampilla provista a: Mary O'Herron, Department of Ecology, 1204 Railroad Ave., #200, Bellingham, WA 98225.

↓

Información adicional

Nombre del propietario:
_____

Dirección del propietario:
_____

¿El pozo abastece más que una sola casa? Si No

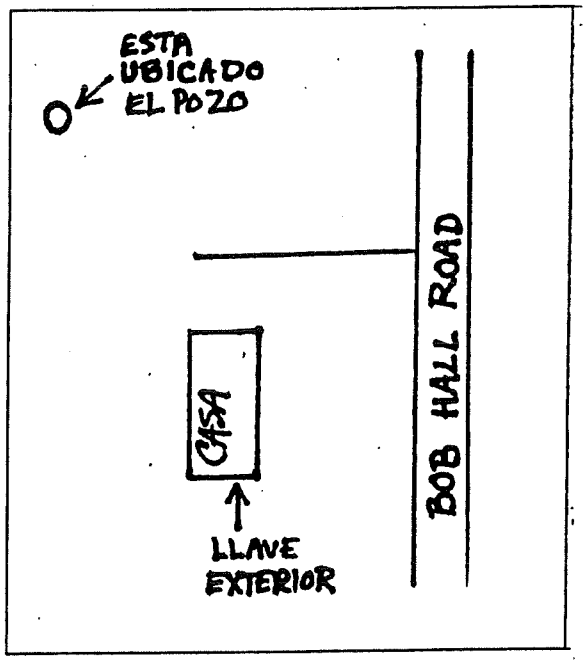
¿Cuántas casas están abastecidas por el pozo? ____

¿Cuáles son las direcciones de las otras casas?
_____
_____

¿Tiene información sobre la construción del su pozo? Si No

Mapa - Favor de dibujar un mapa crudo de la propiedad donde vive. Muestra donde el está ubicado el pozo. También, muestra donde está una llave exterior de donde se puede recoger una muestra del agua potable.

Mapa de ejemplo:



Su mapa:

Firma: _____ Fecha: _____

WHATCOM COUNTY
HEALTH & HUMAN SERVICES
P.O. Box 935
Bellingham, WA 98227-0935

CHARLES R. BENJAMIN
Director

KENNETH B. GASS, M.D.
Interim Health Officer

Si requiera información en español, por favor, llame al numera gratis 1-888-586-9427. Pida hablar con Joanne Prado, o deje su numero de telefono y alguien le vuelve a llamar.

ADMINISTRATION
(360) 676-6720
384-1528

COMMUNICABLE DISEASE REPORTING LINE
(360) 738-2503

CHILDREN WITH SPECIAL HEALTH CARE NEEDS
(360) 738-2522
384-0574

COMMUNICABLE DISEASE IMMUNIZATIONS
(360) 738-2508
384-1336

DEVELOPMENTAL DISABILITIES
(360) 676-6829
398-1310

ENVIRONMENTAL HEALTH
(360) 676-6724
384-1565

MATERNAL/INFANT
(360) 647-2329
380-4017

MENTAL HEALTH
(360) 676-6829
398-1310

STD/AIDS/HIV
(360) 676-4593
384-5848

SUBSTANCE ABUSE
(360) 676-6829
398-1310

TRAVEL CLINIC
(360) 676-4593
384-5848

VITAL RECORDS
(360) 676-6720
384-1528

WIC CLINIC
(360) 738-2505
384-1633

August 28, 1998

Dear North Whatcom County Residents,

As you may be aware, pesticide and nitrate contamination has been identified in some wells in your area. Information about this problem was sent to area residents this spring and summer. Those who are not familiar with the situation should call us at 676-6724 or 384-1565 to receive fact sheets that summarizes the groundwater contamination issue.

While a lot of information exists, we need to test additional wells to insure that we have a complete picture of the problem. **We need your help. We need residents in your area to volunteer their wells for sampling. If your well is selected, the water sampling and analysis will be done at *no charge*.**

A number of different agencies (Ecology, WA Dept of Health, USGS) are planning to sample wells in your area during September and October. Whatcom County Health and Human Services is coordinating this request for volunteers so that together we can better identify the area of contamination, address public health concerns and find a permanent solution to the drinking water problem.

Your well will be considered for testing if you do any of the following before September 14th:

1) Call Whatcom County Health and Human Services at 384-1565 or 676-6724 to let us know you would like to volunteer for well sampling and leave your name, address and phone number.
2) You may also email us at water@co.whatcom.wa.us with the same information, or
3) Complete and return the enclosed Permission to Sample Form to:
   Whatcom County Health and Human Services
   Environmental Health Division
   509 Girard Street
   Bellingham, WA 98225

Our goal is to assure a safe drinking water supply to all residents of Whatcom County. We believe that we can achieve this goal with your help. We appreciate your ongoing participation and input. Please feel free to contact us at any time.

Sincerely,

Kenneth Gass, MD
Health Officer

Charles R. Benjamin
Public Health Director

Whatcom County Health & Human Services
509 Girard Street
Bellingham, WA 98225

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

October 15, 1998

[redacted]

Subject: Summer '98 Drinking Water Sampling – Bertrand Creek Area
Partial results for [redacted] Loomis Trail Road, Lynden, WA

Dear Mr. & Ms. [redacted]

Last week, contractors working for the Washington State Department of Ecology (Ecology) collected water samples at the above address. Most of the analytical results will not be available for a number of weeks. However, one set of analytical results has been forwarded to us by the laboratory and we would like to share that information with you.

A water sample collected at this address was analyzed for the presence of the coliform bacteria. **The laboratory results show that coliform <u>was not present</u> in the domestic well water at the time the sample was collected.** The enclosed laboratory reporting sheet is for the sample collected at this address.

If you have any additional questions, or would like information about our sampling program, please feel free to call me. My number is (360)738-6246.

Sincerely,

Mary K. O'Herron
Environmental Specialist

COPY

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

October 15, 1998

[redacted]

Subject: Summer '98 Drinking Water Sampling – Bertrand Creek Area
Partial results for [redacted] Willeys Lake Rd., Ferndale, WA

Dear Mr. & Ms. [redacted]

Last week, contractors working for the Washington State Department of Ecology (Ecology) collected water samples at the above address. Most of the analytical results will not be available for a number of weeks. However, one set of analytical results has been forwarded to us by the laboratory and we would like to share that information with you.

A water sample collected at this address was analyzed for the presence of the coliform bacteria. **The laboratory results show that coliform was present in the domestic well water at the time the sample was collected.** The enclosed laboratory reporting sheet is for the sample collected at this address.

Although this does not appear to be the e. coli which has frequently been mentioned in the national news, there are potential health issues associated with the presence of the coliform bacteria in domestic drinking water.

The enclosed information sheets (furnished by the Whatcom County Health Department) provide information regarding coliform contamination. They also provide useful suggestions regarding steps that you can take to help remedy the situation. [Please note: If this well also serves the nearby church, decontamination procedures will have to include that plumbing system too.]

In addition, I am enclosing the business card of Sarah Brozusky at the Whatcom County Health Department who may be able to provide you with some additional information and/or help.

If you have any additional questions, or would like information about our sampling program, please feel free to call me. My number is (360)738-6246.

Sincerely,

M.K. O'Herron

Mary K. O'Herron
Environmental Specialist

Cc: Sarah Brozusky, Whatcom County Health Department.

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

Monday, 10 August 1998

[redacted]

Subject: Summer '98 Drinking Water Sampling – Bertrand Creek Area
Partial results for [redacted] Birch Bay-Lynden Road

Dear [redacted]

This is the second in a series of letters designed to keep you updated regarding the results of our '98 Drinking Water Sampling. It includes some of the preliminary results for sampling that occurred at the above location between June 15th and July 1st, 1998.

A full report, interpreting this part (Phase 1) of the study and the sampling tentatively scheduled for September, 1998 (Phase 2), will be available in early 1999. In the meantime, we want to make sure that you are kept informed regarding the status of your well water.

Contractors working for the Washington State Department of Ecology (Ecology) collected water samples at the above address. Some of the analytical results are still not available for distribution. However, we felt that it was important that we forward the results for *ethylene dibromide* (also known as EDB or 1,2-dibromomethane), *1,2-dichloropropane* (also known as 1,2-DCP) and *nitrite-nitrate* to you as quickly as possible. Information concerning additional analytical results will follow in approximately 7 to 10 days.

Under the Federal Drinking Water standards, a*ction level* means that contaminant levels are high enough to warrant additional periodic sampling, but contaminant levels do not exceed drinking water standards. *Maximum contaminant level (MCL)* is the maximum amount of a contaminant allowed in drinking water.

- **The laboratory results show that EDB <u>was</u> present in your domestic drinking water at the time the sample was collected. During this sampling event, the level of EDB was 0.12 parts per billion (ppb). This is above the drinking water standard or Maximum Contaminant Level (MCL) for EDB of 0.05 ppb.**

  A review of the files shows that your well had been tested in the past for the presence of EDB. The results 3/89 (5.79 ppb) and from 3/92 (2.32 ppb) provide a possible basis for comparison.

- **The laboratory results show that 1,2-DCP <u>was not</u> present in your domestic drinking water at the time the sample was collected. The level of 1,2-DCP was reported as not detected at or above 0.25 ppb. This is not above the drinking water standard or**

Maximum Contaminant Level (MCL) for 1,2-DCP of 5.0 ppb. However, it may show that 1,2-DCP is present at very low levels.

A review of the files shows that your well had been tested in the past for the presence of 1,2-DCP. The results from 11/91 (no detection) provide a possible basis for comparison.

- **The laboratory results show that nitrate-nitrite was present in your domestic drinking water at the time the sample was collected. The level of nitrate-nitrite was 10.2 parts per million (ppm). This is above the drinking water standard or Maximum Contaminant Level (MCL) for nitrate-nitrite of 10.0 ppm.**

We do not have information currently available that indicates whether your well water has been tested in the past for nitrates.

Laboratory printouts are enclosed. On some of these printouts, other chemicals (besides nitrates-nitrites, EDB, and 1,2-DCP) may show up as "present." Currently, we are analyzing that data and putting together a packet of information regarding those specific chemicals. It will be sent to you in 7 to 10 days.

The enclosed sheets provide some information regarding nitrates, EDB and 1,2-DCP. If you have any additional questions, or would like information about our sampling program, please feel free to call me. My number is (360)738-6250.

Sincerely,

M. K. O'Herron

Mary K. O'Herron
Environmental Specialist

Cc: Whatcom County Health and Human Services

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

Monday, 10 August 1998

[redacted]

Subject: Summer '98 Drinking Water Sampling – Bertrand Creek Area
Partial results for [redacted] Birch Bay-Lynden Road

Dear [redacted]

This is the second in a series of letters designed to keep you updated regarding the results of our '98 Drinking Water Sampling. It includes some of the preliminary results for sampling that occurred at the above location between June 15th and July 1st, 1998.

A full report, interpreting this part (Phase 1) of the study and the sampling tentatively scheduled for September, 1998 (Phase 2), will be available in early 1999. In the meantime, we want to make sure that you are kept informed regarding the status of your well water.

Contractors working for the Washington State Department of Ecology (Ecology) collected water samples at the above address. Some of the analytical results are still not available for distribution. However, we felt that it was important that we forward the results for *ethylene dibromide* (also known as EDB or 1,2-dibromomethane), *1,2-dichloropropane* (also known as 1,2-DCP) and *nitrite-nitrate* to you as quickly as possible. Information concerning additional analytical results will follow in approximately 7 to 10 days.

Under the Federal Drinking Water standards, a*ction level* means that contaminant levels are high enough to warrant additional periodic sampling, but contaminant levels do not exceed drinking water standards. *Maximum contaminant level (MCL)* is the maximum amount of a contaminant allowed in drinking water.

- **The laboratory results show that EDB <u>was not</u> present in your domestic drinking water at the time the sample was collected. During this sampling event, the level of EDB was reported as not detected at or above 0.02 parts per billion (ppb). This is not above the drinking water standard or Maximum Contaminant Level (MCL) for EDB of 0.05 ppb or above the action level of 0.02 ppb. However, it may show that EDB is present at very low levels.**

  A review of the files shows that your well had not been tested in the past for the presence of EDB.

- **The laboratory results show that 1,2-DCP <u>was</u> present in your domestic drinking water at the time the sample was collected. The level of 1,2-DCP was 1.2 ppb. This is not**

above the drinking water standard or Maximum Contaminant Level (MCL) for 1,2-DCP of 5.0 ppb but it is above the action level for 1,2-DCP of 0.5 ppb.

A review of the files shows that your well had not been tested in the past for the presence of 1,2-DCP.

- **The laboratory results show that nitrate-nitrite was present in your domestic drinking water at the time the sample was collected. The level of nitrate-nitrite was 10.4 parts per million (ppm). This is above the drinking water standard or Maximum Contaminant Level (MCL) for nitrate-nitrite of 10.0 ppm.**

  We do not have information currently available that indicates whether your well water has been tested in the past for nitrates.

Laboratory printouts are enclosed. On some of these printouts, other chemicals (besides nitrates-nitrites, EDB, and 1,2-DCP) may show up as "present." Currently, we are analyzing that data and putting together a packet of information regarding those specific chemicals. It will be sent to you in 7 to 10 days.

The enclosed sheets provide some information regarding nitrates, EDB and 1,2-DCP. If you have any additional questions, or would like information about our sampling program, please feel free to call me. My number is (360)738-6250.

Sincerely,

M. K. O'Herron

Mary K. O'Herron
Environmental Specialist

Cc: Whatcom County Health and Human Services

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

December 26, 1998

[redacted]

Subject: Fall '98 Drinking Water Sampling – Bertrand Creek Area
Partial results for [redacted] Rathbone Road

Dear [redacted]

This is the third in a series of letters designed to keep you updated regarding the results of our '98 Drinking Water Sampling. It includes the last of the preliminary results for sampling that occurred at the above location between September 21st and October 8th, 1998.

A full report, interpreting this part (Phase 1) of the study and the sampling tentatively scheduled for September (Phase 2), will not be available until early 1999. In the meantime, we want to make sure that you are kept informed regarding the status of your well water.

Contractors working for the Washington State Department of Ecology (Ecology) collected drinking water samples at the above address. In our previous letter, we had felt that it was important that we forward the chemical results to you as quickly as possible. With that letter we included information on EDB (ethylene dibromide or 1,2-dibromomethane), 1,2-DCP (1,2-dichloropropane) and nitrite-nitrate. However -- for some households -- we were unable to include information regarding all of the chemicals detected. Instead, we are now sending you information (see enclosed sheets) about the additional chemicals that were detected in the samples collected at this location.

In addition, for the 6 homes where we analyzed the drinking water for additional herbicides and pesticides, we have only now received the data. (Please see the green sheets to determine if your water was tested.)

Not all of the sampling locations had drinking water analyzed for these chemicals because: a) they had only shown up – historically – at a couple of homes and b) the analytical cost for these specific chemicals is quite high. For this reason, during the September 21st – October 8th event, we sampled at (and near) the homes where there was a history of the chemicals having been present.

Of the 6 homes where the drinking water was sampled for these chemicals, herbicides were detected at 2 and pesticides were detected at 6. All of the chemicals detected were found at levels significantly below the drinking water standards (where a standard exists). Their presence, however, may indicate the need for additional samples to be collected at a few additional homes.

COPY

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

10/15/98

[redacted]

Tema: Muestras de agua potable, Verano 1998, Area de Bertrand Creek
Resultados parciales del domicili[redacted] Willeys Lake Rd., Ferndale, WA

Estimado Sr[redacted]

El 6 de Octobre, 1998, contratistas trabajando para Ecology tomaron pruebas de agua potable del domicilio indicado arriba. Los resultados completos no seran disponibles por varias semanas. Sin embargo, hemos recibido parte de los resultados y queremos compartir la informacion con usted.

Una muestra de agua potable fue tomada y analizada para la presencia de bacterias coliformes. Los resultados del laboratorio confirman que coliformo **ESTA** presente en el pozo de su agua potable al tiempo que fue tomada la muestra. La hoja apegada es del laboratorio y contiene los resultados de este domicilio.

Aunque este contaminante no aparece ser la especie "E-Coli", que ha sido mencionado frecuentemente en las nuevas nacionales, si existen temas potenciales con la bacteria coliforme que puede afectar la salud.

Las hojas informativas apegadas (proveidas por Whatcom County Health Department) proveen informacion sobre este tipo de contaminacion. Tambien proveen informacion respecto a medidas que usted puede tomar para mejorarar la situacion.

Estoy disponible por telefono en el numero 509-454-7833 para contestar sus preguntas sobre este tema.

Sinceramente,

M. K. Dickerson for Tony Valero

Antonio Valero
Especialista del Medio Ambiente

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Bellingham Field Office • 1204 Railroad Avenue, Suite 200 • Bellingham, Washington 98225 • (360) 738-6250

10 augusto1998

[redacted]

Asunto: El muestreo del agua potable que se llevará a cabo en el verano del año 1998 del área de Bertrand Creek. Los resultados parciales para [redacted] Birch Bay-Lynden Road

Estimado [redacted]

Esta carta es la segunda de una serie que le mantendrá informado encima los resultados del muestreo del agua potable que se está haciendo durante este año de 1998. Incluido dentro de la carta están algunos de los resultados del muestreo que se hizo en la dirección notada arriba, entre el 15 de junio y el 1 de julio de 1998.

El reporte completo, con las conclusiones de la fase 1 del estudio y el horario tentativo de muestreo para el mes de septiembre (conocido como fase 2), no sería disponible hasta los primeros meses del año 1999. Mientras tanto, queremos estar seguro que le queda bien informado encima la condición del agua potable dentro de su pozo.

Las contratistas que trabajan para el Departamento de Ecología del Estado de Washington (Ecology) sacaron muestras del agua potable en la casa con dirección notada arriba. Algunos de los resultados todavía no están disponible. Sin embargo, reconocemos que es importante que le enviamos tan pronto sea posible los resultados analíticos de las siguientes químicas: dibromuro de etileno (EDB), dicloropropano (DCP) y nitrito-nitrato. La información encima los resultados analíticos adicionales llegarán dentro de los próximos 7 a 10 días.

El nivel de acción significa que los niveles de contaminación son suficientes altos para justificar el saqueo periódico de muestras adicionales, pero esos mismos niveles de contaminación no encimapasan los estandares de agua potable. *El nivel máximo de contaminación (MCL)* es la cantidad máxima de una contaminante que se permite estar dentro del agua potable.

- **Los resultados del laboratorio demuestra que el EDB <u>no fue</u> presente en su agua potable al tiempo que se sacó la muestra.** Durante este evento de muestreo el nivel

de no se detectó a o encima 0.02 porciones por billón (ppb). El estándar máximo (MCL) de agua potable es 0.05 ppb. Esto no está encima del estándar máximo de agua potable ni el Nivel Máximo de Contaminación (MCL) para EDB de 0.05 ppb o encima del nivel de acción de 0.02 ppb. Sin embargo, la muestra significa que el EDB podría estar presente en su agua potable en niveles muy bajos.

Una revisión de los archivos indica que su pozo de agua potable no hat sido examinado en el pasado para la presencia de EDB.

- **Los resultados del laboratorio demuestra que el DCP fue presente en su agua potable al tiempo que se sacó la muestra.** Durante este evento de muestreo el nivel de DCP es 1.2 porciones por billón (ppb). Esto no está encima del estándar máximo de agua potable ni el Nivel Máximo de Contaminación (MCL) para DCP de 5.0 ppb pero está encima del nivel de acción para DCP de 0.5 ppb.

  Una revisión de los archivos indica que su pozo de agua potable no ha sido examinado en el pasado para la presencia de DCP.

- **Los resultados del laboratorio demuestra que los nitritos/nitratos fue presente en su agua potable al tiempo que se sacó la muestra.** Durante este evento de muestreo el nivel de los nitritos/nitratos es 10.4 porciones por millón (ppm). Esto está encima del estándar máximo de agua potable ni el Nivel Máximo de Contaminación (MCL) para nitrato-nitrito de 10.0 ppm.

  No tenemos información disponible en este momento que indica si su pozo de agua potable fue examinado en el pasado para los nitritos/nitratos.

Las hojas analíticas del laboratorio que contienen los resultados analíticos están incluido dentro de esta carta. En algunos de esas hojas hay otras químicas (ademas el dibromuro de etileno, dicloropropano y nitrato) que pueden estar marcadas como "presente". Estamos analizando los datos y estaremos haciendo un folleto de información encima esas químicas específicas. Le enviaremos el folleto dentro de los próximos 7 a 10 días.

Las hojas del laboratorio incluidas en esta carta contienen alguna información encima las químicas de dibromuro de etileno, dicloropropano y nitrato. Si tiene más preguntas, o le gustaría recibir información encima nuestro programa de muestreo, favor de ponerse en contacto conmigo. Mi número telefónico es (360) 738-6246. Si tiene Ud. preguntas especificas y quisieras hablar con nosotros en Español, favor de ponerse en contacto con el Sr. Greg Bohn, de número telefónico (509) 454-4174.

Atentamente,

M. K. O'Herron

Mary K. O'Herron
Especialista del Medioambiente

Cc: Servicio de Salud y Humano del Condado de Whatcom
(Whatcom County Health and Human Services)

The Department of Ecology has decided that -- outside of the existing bottled water delivery area but inside the Bertrand Creek Study Area -- the action levels of .02 ppb for EDB and 0.05 for DCP should trigger availability of bottled water for drinking, cooking and teeth brushing for residents in the Bertrand Creek area. The nitrate-nitrite level does not trigger the availability of bottled water. Please note: All homes within the bottled water delivery area (8100-8400 Bob Hall Road and 900-1300 Birch Bay - Lynden Road) are currently eligible for bottled water no matter what their current contamination levels may be.

Ecology ha decidido que los niveles de acción de 0.02 ppb para EDB y 0.5 ppb para DCP debería iniciar la disponibilidad de agua potable embotellada para los residentes del área de Bertrand Creek (8100-8400 Bob Hall Road y 900-1300 Birch Bay - Lynden Road) para que ellos pueden beber, cocinar y limpiarse los dientes. Ningún nivel de acción ha sido establicido para los niveles de Nitrato-Nitrito.

DATA QUALIFIER CODES

U	-	The analyte was not detected at or above the reported result.
J	-	The analyte was positively identified. The associated numerical result is an estimate.
UJ	-	The analyte was not detected at or above the reported estimated result.
REJ	-	The data are unusable for all purposes.
NAF	-	Not analyzed for.
N	-	For organic analytes there is evidence the analyte is present in this sample.
NJ	-	There is evidence that the analyte is present. The associated numerical result is an estimate.
NC	-	Not Calculated
E	-	This qualifier is used when the concentration of the associated value exceeds the known calibration range.

Fall Drinking Water Study, 1998

Your domestic drinking water **was** tested for the presence of herbicides and/or pesticides.

Of the 6 homes where samples were collected (near the intersection of Loomis Trail Road and Weidcamp Road) 6 had pesticides present and 2 had herbicides present.

The detected chemicals are listed below, along with the drinking water standards (MCLs) and the levels at which the chemicals were detected. If no MCL is available, the Model Toxics Control Act (MTCA) groundwater standard – if calculated – is used as a point of reference.

None of the pesticides or herbicides detected were found at concentrations exceeding the MCL and/or the MTCA groundwater standards.

Chemical Name	MCL	Concentration found
Atrazine	3.0 ppb	0.007J ppb / 0.013J ppb
Carbofuran	40 ppb	0.16J ppb / 0.028J ppb
Dinoseb	7.0 ppb	0.056J ppb
Metalaxyl	No MCL (MTCA std. is 960 ppb)	0.10NJ ppb / 1.6 ppb 0.65 ppb / 0.19 ppb 0.49 ppb / 1.0 ppb
Pentachlorophenol	1.0 ppb	0.083 ppb
Simazine	4.0 ppb	0.052 ppb
Metalaxyl-des methyl propionate (*)	No MCL	0.051NJ ppb / 2.4NJ ppb 1.1NJ ppb / 0.056NJ 0.40NJ ppb / 0.89NJ ppb

(*) = breakdown product of Metalaxyl

Your domestic drinking water was not tested for the presence of herbicides and/or pesticides.

Of the 8 homes where these samples were collected (near the intersection of Bob Hall Road and Birch Bay Lynden Road) 8 had pesticides present and 2 had herbicides present.

The detected chemicals are listed below, along with the drinking water standards (MCLs) and the levels at which the chemicals were detected. If no MCL is available, the Model Toxics Control Act (MTCA) groundwater standard – if calculated -- is used as a point of reference.

None of the pesticides or herbicides detected were found at concentrations exceeding the MCL and/or the MTCA groundwater standards.

Chemical Name	MCL (ppb)	Concentration found
Atrazine	3.0 ppb	0.028 ppb / 0.11J ppb 0.007J ppb
Bromacil	No MCL	0.024J ppb / 0.052J ppb / 0.61J ppb 0.077J ppb / 0.77J ppb 0.061J ppb
Metalaxyl	No MCL (MTCA std. is 960 ppb)	0.16J ppb / 1.5 ppb / 4.9 ppb 0.50 ppb / 0.12 ppb / 4.5 ppb 0.18 ppb / 1.6 ppb
Dinoseb	7.0 ppb	0.12 J ppb / 0.21J ppb
2,6-dichlorobenzamide	No MCL	0.17 ppb / 0.10J ppb / 0.024J ppb 0.17 J ppb / 0.058J ppb / 0.17J ppb
Prometon	No MCL (MTCA std. is 240 ppb)	0.091 ppb / 0.022 ppb / 0.013J ppb
Simazine	4.0 ppb	0.019J ppb
Metalaxyl-des methyl propionate(*)	No MCL	0.19 NJ ppb / 0.83 NJ / 1.9 NJ 1.7 NJ / 0.49 NJ / 3.6 NJ 0.62 NJ / 2.2 NJ

(*) = breakdown product of Metalaxyl

DRAFT - Reference values for detected chemicals - DRAFT (revised 8/24/98)

MCL = Maximum Contaminant Level = The maximum concentration of a contaminant allowed in drinking water. This value is determined by either the Washington state board of health or the EPA under the federal Safe Drinking Water Act and published in chapter 248-54 WAC or 40 C.F.R. 141.
For public water supplies, the MCL is the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. It takes into account feasibility and cost, but is set as close as possible to the level at which adverse health effects occur.

Trigger Level = Contaminant levels are high enough to warrant additional periodic sampling, but do not exceed drinking water standards.

MTCA Cleanup Level = If no MCL exists, a possible alternative standard may be the groundwater cleanup standard determined under the Model Toxics Control Act (MTCA). The cleanup level is the concantration of a hazardous substance in groundwater that is determined to be protective of human health

ppb = parts per billion = To visualize one part per billion, imagine 1 ounce compared to 31 tons or 1 second compared to 32 years.
This measurement is also written as ug/L (micrograms per liter).
ppm = parts per million = To visualize one part per million, imagine 1 seconds compared to to 11.7 days. This measurement is often written at mg/L (milligrams per liter).

Chemical Name	Some other names for the chemical	MCL	Trigger Level	MTCA Cleanup Level Method B for groundwater (use Method A if available)	CAS #
1,2-dibromoethane	a) EDB b) ethylenedibromide	0.0[illegible] ppb	0.02 ppb	0.01 ppb (Method A) 0.0005 ppb (Method B)	106-93-4
1,2-dichloropropane	a) 1,2-DCP b) propylene dichloride	5 ppb	0.05 ppb	0.643 ppb	78-87-5
1,2-dibromo-3-chloropropane	a) DBCP	0.2 ppb	0.02 ppb	0.0312 ppb	96-12-8
chloromethane	a) methyl chloride b) monochloromethane c)		0.5 ppb	3.37 ppb	74-87-3
acetone	a) dimethyl formaldehyde b) dimethyl ketone c) pyroacetic acid	No MCL	No Trigger Level	800 ppb	67-64-1

Draft

See Appendix D for entire Information Sheet

Draft -- Information on chemicals found during Bertrand Creek Study (Phase 1) - Updated 8/26/98

Information re: the uses of chemicals was obtained from a variety of sources

Please note that some of the uses may be historic, rather than current.
Please also note that there may be other uses for the chemicals that are not listed here.

This is a draft document and this list makes no attempt to determine or identify -- via this listing -- the actual source of the chemicals found in the water samples during this study.

A (**) next to a chemical's name indicates that it was detected in one or more of the laboratory blanks at low levels. This may indicate that the chemical was not actually present in the sample collected.

Draft

Chemical Name	Some of the chemical's uses
1,2-dibromoethane	Formerly-pesticide. Had been used as fumigant for control of nematodes. Grain fumigant. Additive to leaded gasoline in fire extinguishers, gauge fluids & waterproofing. Used for termite control. Solvent for gums, oils, waxes & celluloid. Used in dyes & pharmaceuti
1,2-dichloropropane	Pesticide. Used for fumigant control of nematodes. Grain fumigant. Used in mfg.of resin , pa coating & leaded gasoline.
1,2-dibromo-3-chloropropane	Used as a soil fumigant and as a nematocide.
chloromethane	Refrigerant. Local anesthetic. Used in mfg. of silicon resins & rubber. Industrial solvent.
acetone (**)	Used in mfg. of explosives, rayon, film, rubber cement & varnishes. Nail polish remover. Cleaning & drying of precision parts. Production of lubricating oils.

See Appendix D for entire Information Sheet

ENVIRONMENTAL FACT SHEET

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
6 Hazen Drive, Concord, NH 03301

Return to Index

NHDES Technical Bulletin WD-WS-4-1

Interpreting the Presence of Coliform Bacteria

Determining the bacterial quality of drinking water is the single most important water quality test for a private well. Why? Because exposure to disease organisms creates an acute health risk. One glass containing just a few organisms can cause illness. In contrast, a meaningful health risk from chemical contaminants such as arsenic, radon, or benzene, to name only a few, requires a long period of exposure, typically over many years.

The total coliform test is the basis yardstick for determining a well's microbiological quality. This test is performed frequently because of the high risk that disease causing organisms pose to public health. The test is easy to perform, inexpensive, and errs on the side of caution.

The organisms in the total coliform group are normally considered indicator organisms. When present, they indicate that there is a possibility, but not a certainty, that disease organisms may also be present in the water. When absence there is a very low possibility of disease from the water. The dependability of this relationship has been a key element in the program over the decades. Recently however, public health experts have recognized that certain protozoa such as giardiasis and cryptosporidium can be present in surface water even when total coliform testing is negative. Consequently filtration, in addition to disinfection, is now generally required for surface water supplies.

There are a number of subgroups within the overall coliform family as shown at the bottom. The presence of bacteria from each smaller subgroup heightens the concern that disease-causing organisms may be present in the water. These groups and their relative risk implications are discussed below.

Total Coliform. These organisms are very prolific in the soil and their presence does not necessarily imply poor wastewater disposal or other sanitary origin. The presence of only total coliform generally does not imply an imminent health risk but does require an analysis of all facilities and operations to determine how these organisms entered the water system. Public Notice to public water system users is required since a properly constructed and properly maintained wells and piping systems should not have total coliform.

Fecal Coliform. This is a much smaller group within the coliform family. They generally originate in the intestines of mammals. They have a relatively short life span compared to more general coliforms. Their presence could be related to improper disposal of sanitary waste. Immediate Public Notice to public water system users is required in view of the higher perceived risk.

Escherichia Coli. This is a very small specific subgroup within the coliform family. They originate only in the intestines of animals and humans. Their presence indicates a strong likelihood that human or animal wastes are entering the water system. Immediate Public Notice is required in view of the higher perceived risk.

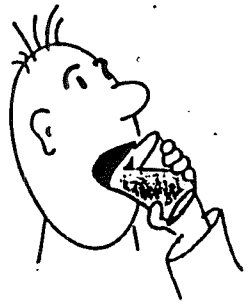
What are coliforms?

Coliform bacteria belong to the family Enterobacteriaceae - which includes aerobic and facultative anaerobic, rodshaped, gram-negative and non-spore forming bacteria. They are found in the intestines of warm-blooded animals and therefore occur in sewage, soils, surface waters and vegetation. To make sure they are not in your water supply, you need to do a fecal coliform count. And the best indicator of fecal coliform activity - and probable contamination from human and animal waste-is Escherichia coli (E. coli).

WHAT HAPPENS IF COLIFORMS ARE FOUND IN MY WATER?

Finding coliform bacteria in the drinking water is a signal that your water system may be contaminated. Further investigation of your water system is necessary to make certain disease causing organisms are not present. To protect you from diseases, your water system manager should:

- Take necessary action to make certain the drinking water is free of disease causing organisms.
- Inform you of any steps you can take to protect your health until the problems are corrected.



ADDITIONAL INFORMATION

IF YOU HAVE ANY QUESTIONS ABOUT COLIFORMS IN YOUR DRINKING WATER, CALL:

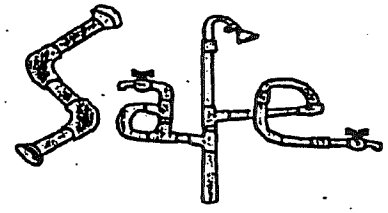
Whatcom County Health & Human Services
509 Girard Street
Bellingham, WA 98225
(360) 676-6724 or 384-1565

Washington State Department of Health

Division of Drinking Water

COLIFORM BACTERIA

&



DRINKING WATER

Information
for
Water System Users

WHY IS MY WATER TESTED FOR COLIFORMS?

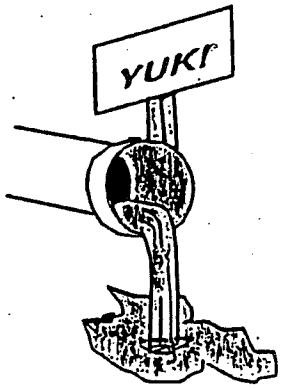
Some diseases are spread through drinking water. Cholera, typhoid, hepatitis, giardiasis, and epidemic dysentery are a few of these waterborne diseases. Disease results when microorganisms (such as protozoa, bacteria, and viruses) infect our bodies in numbers great enough to over-power our natural defenses.

Sanitary procedures and water treatment methods can limit the spread of waterborne diseases. Fortunately, many steps are taken in this country to ensure the public is provided with safe drinking water. One of these methods is to test water for coliform bacteria.

WHAT ARE COLIFORMS AND WHAT DO THEY INDICATE?

Coliforms are a large group of bacteria which commonly live in the digestive tracts of humans and animals. For this reason, coliform bacteria are found in sewage and animal wastes. However, many coliforms are harmless and can be found in other places such as soil. Unfortunately, the tests for coliform bacteria do not indicate their source.

The presence of coliforms in drinking water indicates a possible contamination by sewage or animal wastes. Sewage and animal wastes contain many disease causing organisms in addition to coliforms. For this reason, disease causing organisms may be present whenever coliforms are found in drinking water.



Some of the particular types of coliform bacteria that are often tested for are "fecal coliforms" and *Escherichia coli (E. coli)*. The presence of these organisms can help in the investigation of possible contamination.

WHY NOT TEST DIRECTLY FOR DISEASE CAUSING ORGANISMS?

Many different organisms can cause diseases. Unfortunately, almost as many tests would be needed to check drinking water for all of them. Instead, health officials test water for coliform bacteria to see if disease causing organisms could be present. The advantages of using coliform bacteria are:

- In general, coliforms are longer living and easier to find than disease causing organisms.
- Disease causing organisms are usually more susceptible to some treatment methods than are coliform bacteria.

If coliform bacteria are not present, there is good reason to believe that the water system is free of disease causing organisms.

HATCOM COUNTY HEALTH DEPARTMENT

Community Health Center - 509 Girard Street
P.O. Box 935
Bellingham, Washington 98227-0935
FAX 676-7646

PRIVATE WELL DISINFECTION DIRECTIONS

If your water sample showed bacteriological contamination, you can follow the directions below for disinfecting the well and pipes. The water should be resampled about one week after chlorinating the well.

Note: Do not drink the water if coliform bacteria were found by the laboratory. The coliform bacteria indicate potential risk of illness when consuming the water. The water must be boiled for 10 minutes before drinking or using in food preparation to avoid risk of illness.

DISINFECTION PROCEDURES:

1. Use one gallon of fresh household bleach (5-1/4% chlorine compound).
2. Mix the bleach in 5 to 10 gallons of clear water. Pour half of it directly into the well. If possible, pour the remainder in so that the sides of the casing are washed down.
3. After the bleach is added, turn on some taps in the house until the odor or taste of chlorine can be detected, then turn them off. Do the same for all other taps and faucets. If you have a treatment system for your water, you may need to by-pass the treatment unit so it is not damaged by the chlorine.
4. Allow the chlorine to remain in the well and pipes overnight or for 24 hours if possible. Turn on the outside taps (to avoid over loading the septic system) until the smell of chlorine can no longer be detected. Then do the same with the taps inside the house.
5. After about 1 week of use, or after chlorine is not detected with a test kit, submit another sample to the laboratory for analysis.

WELL CONSTRUCTION FEATURES:

A well constructed as follows will help improve water quality:

1. A tight cover with a screened vent is needed to keep contaminated surface water, debris, and insects from entering the well.
2. The well casing should rise at least 6 inches above the ground surface to protect it from flooding or ponding of water.
3. A water-tight casing with solid joints should be sealed on the outside with bentonite clay or cement to a minimum of 18 feet below the ground. Finding a copy of the driller's well report will help confirm the proper construction of your well. The Health Department has some driller's well reports on file, otherwise contact the driller or previous owners.
4. The well should be located at least 100 feet from any source of contamination such as a septic drainfield, privy, manure storage and spreading, or stream and lake.

10,000/13 2/94
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DIRECCIONES PARA LA DESINFECCION DE POZOS PRIVADOS

Si la muestra de su agua contiene contaminación de bacteria, Ud. puede seguir las siguientes direcciones para desinfeccionar el pozo y la tubería. Se debe de analizar el agua hace una semana despues de que la obra de desinfección.

NOTA: NO beba el agua contaminada con bacteria coliformo. Esta bacteria indica que existe un riesgo potencial de enfermarse al beber el agua. Es necesario herbir el agua por 10 minutos antes de beberlo o utilizarlo en la preparación de comidas para evitar el riesgo de enfermarse.

INSTRUCCIOÓNES PARA DESINFECCION:

1. Utilize un galón de cloro doméstico (5-1/4% concentración de cloro)
2. Mezcle el cloro con 5 a 10 galónes de agua limpia . Vacié la mitad directamente al pozo. Si es posible, vacié el sobrante a modo de que los lados de la tubería del pozo tambien se enjuagen.
3. Tiene que abrir algunas de las llaves de agua dentro de la casa hasta que se detecte el olor de cloro, luego cierre todas las llaves. Si Ud. tiene un sistema de tratamiento de agua (suavizador), quizas sea necesario desviar el sistema de tratamiento para que el cloro no le cause daño al sistema de tratamiento.
4. Permita que el cloro permanezca en el pozo y la tubería, toda la noche o por 24 horas, si es posible. Luego, tiene que abrir las llaves de agua **afuera** de la casa (para evitar sobrecargar el sistema septico) hasta que no detecte el olor de cloro. Luego, haga lo mismo con las llaves de agua dentro de la casa.
5. Despues de aproximadamente una semana de uso o cuando no detecte cloro con un "test kit" (probador), envie otra muestra de agua al laboratorio.

CARACTERÍSTICAS DE CONSTRUCCIÓN DE POZO:

Un pozo construido según las instrucciones de en seguida ayudara mejorar la calidad de agua:

1. Un cubridero apretado con un respiradero con rejas para que no entre agua superficial, insectos u otros desechos al pozo.
2. La tubería del pozo debe ser elevada 6 pulgadas, por lo minimo, arriba del suelo para que sea protejida de un deluvio o charcos de agua.
3. Tubería impermeable con uniónes solidas debe ser sellado por fuera con "bentonite clay" o cemento hasta un minimo de 18 piez bajo el suelo. Para confirmar la construcción de su pozo, obtenga una copia del reporte del pozo del taladrador. El Departamento de Salud tiene algunos de estos reportes archivados, tambien puede hacer contacto con el taladrador o los propietarios anteriores.
4. El pozo debe ser ubicado un minimo de 100 piez de cualquier otra fuente de contaminación tal como un sistema séptico de aguas negras, almacenaje de abono, area en donde se desparrama abono o un lago o un arroyo.

Nitrate in Drinking Water

September 1996

Fact Sheet

Environmental Health Programs
Office of Toxic Substances

Washington State Department of Health

Fertilizers And Septic Systems Can Contaminate Well Water

When nitrogen fertilizers are used to enrich soils, nitrate may be carried by rain, irrigation, and other surface waters through the soil and into ground water aquifers. Natural sources of nitrate are from geological deposits and decomposing vegetation.

Nitrate can more easily impact well water if the well is shallow, poorly constructed, or improperly located. Such conditions could allow entry of contaminated waters from nearby agricultural lands, feedlots, barnyards, or septic systems.

Testing Your Drinking Water

The only way to know if drinking water is contaminated with nitrate is to have it tested. Public water systems are tested routinely. If you own a single family (domestic) well, your county health agency can give you advice about how to obtain a water sample. The fee for a nitrate test is about twenty dollars.

Nitrate May Indicate Other Pollutants in Well Water

Nitrate levels in drinking water can be an indicator of overall water quality. Elevated nitrate levels suggest the possible presence of other contaminants, such as microorganisms or pesticides, that could cause health problems.

Babies at Risk

High levels of nitrate in drinking water can cause a potentially fatal blood disorder in infants called "blue baby syndrome" or methemoglobinemia. Although methemoglobinemia can occur at any age, nitrate contaminated water principally causes this illness in children under six months of age. Infants are at greater risk of methemoglobinemia than older children and adults because they have:

- Lower stomach acidity, which allows certain kinds of bacteria to grow in the stomach and intestines. If a baby is fed formula made from nitrate contaminated water, these bacteria convert nitrate to nitrite. Nitrite then changes the oxygen carrying hemoglobin to methemoglobin, which does not carry oxygen.

- A higher proportion of fetal hemoglobin that is more easily converted to methemoglobin.
- A high liquid diet per body weight which increases the relative dosage of nitrate.
- More incidences of vomiting and diarrhea that lowers stomach acidity.

Although nitrate is found in breast milk, there are no confirmed reports of nitrate poisoning of breast fed infants due to maternal ingestion of nitrate-contaminated water. Poisonings usually occur when contaminated water is used to prepare infant formula and foods. Boiling water for infant formula kills bacteria, but will not destroy nitrates.

Symptoms Can Be Subtle

An infant with mild to moderate methemoglobinemia may be lethargic and have diarrhea and vomiting. This can be misdiagnosed as poor nutritional status or an upset stomach. Though methemoglobinemia is easily diagnosed from a blood test, the illness is often only recognized in acute cyanotic stages, when the infant turns a brownish-blue color (this sign can be missed in dark skinned children) and has trouble breathing.

Switch To Safe Water

If the condition is not life-threatening, no treatment is needed other than a switch to uncontaminated water. The symptoms will improve within two to three days. For severely affected infants, intravenous treatment with methylene blue will convert the methemoglobin back to hemoglobin and bring rapid recovery.

Infants under one year of age should not drink water exceeding the drinking water standard of 10 parts per million (ppm) of nitrate expressed as nitrogen (equivalent to 45 ppm of nitrate expressed as nitrate).

Although no health based standards exist for adult exposures, the following people may be at risk:

- Individuals with reduced gastric acidity.
- Individuals with a hereditary lack of methemoglobin reductase.
- Women who are pregnant.

Bibliography

- Johnson, Carl J. and Kross, Burton C., "Continuing Importance of Nitrate Contamination of Groundwater and Wells in Rural Areas," *American Journal of Industrial Medicine*, 18:449-456, 1990.
- National Research Council, "Nitrate and Nitrite in Drinking Water," *National Academy Press*, Washington D.C., 1995
- Walton, Graham, "Survey of Literature Relating to Infant Methemoglobinemia Due to Nitrate-Contaminated Water," *American Journal of Public Health*, 41:986-996, August 1951.

Need More Information?

- For **public** water systems contact your water utility, **or**
  Washington State Department of Health
  Division of Drinking Water
  1 (800) 521-0323
- For **single family (domestic)** wells contact your county health agency
- Additional copies of this fact sheet can be obtained from:
  Washington State Department of Health
  Office of Toxic Substances
  P.O. Box 47825
  Olympia, Washington 98504-7825
  (360) 753-3519

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FRANK E. JAMES, M.D.
Health Officer

[Revised March 1998]

Ethylene Dibromide (EDB)
Questions and Answers

What is EDB?
EDB is a colorless, heavy organic liquid with a mildly sweet chloroform-like odor.

How is it used?
EDB is mainly used in anti-knock (leaded) gasoline mixtures, particularly in aviation fuel. Other uses include: as a pesticide and fumigant for grains and fruit; as a solvent for resins, gums, and waxes; in water-proofing preparations; and in making dyes and drugs.

Is it still in use?
In Washington State, EDB was registered for use as a soil fumigant for nematodes (root worms) on berries and potatoes. EDB was removed from use as a fumigant in the United States in 1983.

By what other names is it known?
Synonyms and trade names for ethylene dibromide include: EDB, glycol dibromide, Bromofume, Dowfume W 85, Aadibroom, Iscobrome-D, Nefis, Pestmaster, EDB-85, Soilbrom, Soilfume, Kopfume, 1,2 -dibromoethane , and ethylene bromide.

Why is EDB being regulated?
In 1974, Congress passed the Safe Drinking Water Act. This law requires EPA to determine safe levels of chemicals in drinking water which do or may cause health problems.

Who regulates EDB?
The Washington State Department of Agriculture regulated the application of EDB as a pesticide in Whatcom County.

Are there drinking water standards for EDB?
Yes, EPA has set an enforceable standard called a Maximum Contaminant Level (MCL). MCLs are set considering safety and the ability of public water systems to detect and remove contaminants using suitable treatment technologies. The MCL for EDB is .05 parts per billion (ppb or ug/liter).

How much is one part per billion?
To visualize one part per billion, imagine 1 ounce compared to 31 tons or 1 second compared to 32 years.

What treatment methods will remove EDB from contaminated water?
Granular activated charcoal treatment will remove EDB from contaminated water.

Is it harmful to bathe/shower in contaminated water?
There is no direct information on skin exposure to EDB. One study indicated that daily bathing/showering may be a significant route of exposure for other volatile organic compounds.

Can contaminated water be used for cooking?
Cooking appears to reduce EDB levels but the evidence is inconclusive. Contaminated water is not recommended for cooking.

What are the potential health effects of drinking water above the MCL for EDB?
Short-term: damage to the liver, stomach, and adrenal glands along with significant reproductive system toxicity, particularly the testes.
Long-term: damage to the respiratory system, nervous system, liver, heart, and kidneys; cancer.

Will the water hurt animals?
EDB is known to cause reproductive problems in animals, and is an animal carcinogen. It is not known if animals are at the same risk as humans, due to differences in consumption, life-span, weight, and metabolism.

What type of well is most susceptible to contamination?
Shallow wells which do not have a good surface seal, or are drawing from an unprotected aquifer, are the most susceptible.

What is a shallow well?
There is no strict definition of a shallow well. Forty (40) feet has frequently been used as a cut-off point in many groundwater studies.

Are all shallow wells contaminated?
Not all shallow wells are contaminated with EDB. The known areas of contamination are quite limited and tend to be near former application sites.

How long has it been in my well?
The duration of EDB contamination will depend upon when EDB was used. If your well has current detectable EDB levels the well has likely been contaminated at least since EDB was removed from use as a fumigant in 1983.

When was the Health and Human Services Department first aware of the problem?
Contamination of wells in Whatcom County was confirmed in 1984. Notification of well owners and the public was made as soon as contamination was confirmed.

What does the Health and Human Services Department plan to do about it?
There are ongoing studies of groundwater in the area that include EDB. An effort to expand public education for residents using private wells is anticipated.

What else is there in my water that could hurt me?
Shallow, unprotected wells are subject to surface contamination by bacteria, protozoan, viruses, inorganic and organic chemicals (which could include other pesticides). Wells contaminated with EDB may have contamination problems which preceded EDB usage.

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Health Officer

[Revised March 1998]

1,2-Dichloropropane (1,2-DCP) Questions and Answers

What is 1,2-DCP?
1,2-Dichloropropane (1,2-DCP) is a colorless organic liquid with a chloroform-like odor. It evaporates quickly at room temperature.

How is it used?
Uses for 1,2-dichloropropane include: as a pesticide and fumigant; as a cleaning agent; as insecticide for stored grain; for ion exchange resin manufacture; for paper coating; and in making lead-free gasoline.

Is it still in use?
In Washington, 1,2-dichloropropane was used primarily as a soil fumigant for nematodes (root worms) on berries and potatoes. Presently, the greatest use of 1,2-dichloropropane is in chemical manufacturing; it is found in trace amounts in fumigants.

By what other names is it known?
Synonyms and trade names for 1,2-dichloropropane include: 1,2-DCP, propylene dichloride, Nematox, Vidden D, Dowfume EB-5 and dichloro-1,2-propane.

Why is 1,2-dichloropropane being regulated?
In 1974, Congress passed the Safe Drinking Water Act. This law requires EPA to determine safe levels of chemicals in drinking water which do or may cause health problems.

Who regulates 1,2-dichloropropane?
The Washington State Department of Agriculture regulated the application of 1,2-dichloropropane as a pesticide in Whatcom County.

Are there drinking water standards for 1,2-dichloropropane?
Yes, EPA has set an enforceable standard called a Maximum Contaminant Level (MCL). MCLs are set considering safety and the ability of public water systems to detect and remove contaminants using suitable treatment technologies. The MCL for 1,2-dichloropropane has been set at 5 parts per billion (ppb or ug/liter).

How much is one part per billion?
To visualize one part per billion you can imagine 1 ounce compared to 31 tons or 1 second compared to 32 years.

What treatment methods will remove 1,2-dichloropropane from contaminated water?
Granular activated carbon (GAC) absorption, air stripping and boiling will work.

Is it harmful to bathe/shower in contaminated water?
There is no direct information on skin exposure to contaminated bath or shower water.

Can contaminated water be used for cooking?
Boiling should reduce the levels; however, contaminated water is not recommended for cooking.

What are the potential health effects of drinking water above the MCL for 1,2-DCP?
Short-term: dizziness, headaches and nausea; also damage to the liver, kidneys, adrenal glands, bladder, and the gastrointestinal and respiratory tracts.
Long-term: damage to the liver, kidneys, bladder, gastrointestinal tract and respiratory tract; also, cancer. In addition, extended skin contact by humans has caused severe dermatitis.

Will the water hurt animals?
A number of effects have been observed in animal experiments, depending upon the length and level of exposure of animals to 1,2-dichloropropane. These effects include: damage to the liver, kidney, and respiratory systems; irritation to the eyes and throat; liver cancer in mice and breast cancer in female rats; and in extreme cases, death.

What type of well is most susceptible to contamination?
Shallow wells which do not have a good surface seal, or are drawing from an unprotected aquifer, are the most susceptible.

What is a shallow well?
There is no strict definition of a shallow well. Forty (40) feet has frequently been used as a cut-off point in many groundwater studies.

Are all shallow wells contaminated?
Not all shallow wells are contaminated with 1,2-dichloropropane. The known areas of contamination are quite limited and tend to be near former application sites.

How long has it been in my well?
The duration of 1,2-dichloropropane contamination will depend upon when 1,2-dichloropropane was used.

When was the Health and Human Services Department first aware of the problem?
1,2-Dichloropropane was first detected in Whatcom County at least as early as 1989.

What does the Health and Human Services Department plan to do about it?
There are ongoing studies of groundwater in the area that include 1,2-dichloropropane. An effort to expand public education for residents using private wells is anticipated.

What else is there in my water that could hurt me?
Shallow, unprotected wells are subject to surface contamination by bacteria, protozoan, viruses, inorganic and organic chemicals (which could include other pesticides). Wells contaminated with 1,2-dichloropropane may have contamination problems which preceded 1,2-dichloropropane usage.

Testing your well for EDB, DBCP and/or 1,2 Di-Chloropropane

Where do I go to have my water tested?

A Washington State Certified laboratory is the best place to go to have your water tested. A list of State Certified laboratories is attached for your reference. The one lab on the list that tests for these compounds in the immediate area is:

Edge Analytical
1551 Knudson
Burlington, Washington 98223
(360) 757-1400

Edge Analytical has two additional drop off stations at:

Clean Water Services in Lynden
310 Front Street
Lynden, Washington 98263
(360) 354-2121

Udder Health
6401 Old Guide Road
Bellingham, Washington 98226
(360) 398-1360

(Please contact these places on the procedure for dropping off samples)

What should I test for?

If you have no test results on your private well and you live in an agricultural area or in an area where pesticides are commonly used, we recommend testing for the following:

EDB/DBCP
Volatile Organic Chemical (VOC) - will detect 1,2 Di-Chloropropane along with a wide range of additional chemicals.
Nitrate
Coliform Bacteria

If you have satisfactory test results for all of the above and land use has remained the same in your area we recommend you still test for coliform bacteria at least one time each year.

If any tests were unsatisfactory we recommend you consider repeating that specific test.

A VOC test provides a broad base test for many pesticides but will not detect EDB or DBCP. If you have a pesticide or herbicide that you know was used in your area, contact the lab to determine if that parameter can be tested for in your water and how much it will cost. However, the nitrate and coliform bacteria test do provide a good idea of the health of your well without the high cost.

How much will the testing cost?

The price range for testing is $75.00 - $350.00 depending on the laboratory and what compounds you want to be tested.

How do I collect the sample?

The lab will provide you with collection bottles for sampling your water. Follow the directions carefully. Water samples must be collected in a sanitary manner to prevent contamination and assure accurate test results. The sample must be returned to the lab as soon as possible. The sample may be too old for testing if it is not returned in a timely manner.

Where should I sample?

As close to the well head as possible. The sample should be collected before treatment, before the distribution system and before pressure tanks. If you take the sample from the tap, let the water run for a few minutes (about 3) until the temperature is stable. Before collecting the water, be sure to take off any filters, screens, aerators and vacuum breaker from the tap. Remember not to touch the inside the sample container.

When should I sample?

There is no particular time that is better than another to collect the sample. Just remember to take your sample to the lab as soon as possible after collecting to assure accurate results.

How long will the test results take?

The standard turn around time is 14 days, but it may be longer depending on the number of samples there are to process. Please contact the lab for more information on this subject.

If you have any additional questions contact the Whatcom County Health Department at (360) 676-6724 or (360) 384-1565.

Please note:

You may wish to refer to the July 1998 Environmental Health Update North "Whatcom County Groundwater Contamination" for new, updated information concerning EDB and 1,2-DCP.

The Washington State Department of Health mailed this Health Update to you last week. It summarized a report by the Agency for Toxic Substances and Disease Registry (ATSDR). It focused on whether breathing and skin contact to groundwater contaminated with EDB and 1,2-DCP presented a health concern.

Appendix G

Draft Sampling Plan

1998 Site Investigation
Bertrand Creek & Meadowdale Areas
Whatcom County, Washington

PHASE 1
Work Plan Summary

How the SAIC Work Plan & Ecology Statement
Of Work Contain Sampling Plan Information

(please note – references may be paraphrased versions of the original text)

As found in the SAIC Work Plan

A) Who is involved?

Allender, Dagel, Haupt & Freier-Coppinger are mentioned the most often in the organization, sampling, and deliverables area. Best reference : table 4.0 "Key Personnel"

B) Brief description of work to be done

2.1 Field Sampling

Phase 1 includes sampling aprox. 65 domestic wells near Lynden, WA to be analyzed for EDB and a number of other parameters. Samples will be collected in 2 separate sampling events, each event including aprox. half the total number of wells to be sampled. The sampling events will be separated be 1 to 2 weeks.

3.0 Task 3 –collection of samples-phase 2

Phase 2 sampling is expected to encompass aprox. 70 wells. … the phase 2 area is substantially larger than that of Phase 1 making traveling time between wells slightly longer.

C) History of site

NA

D) Details of sampling

2.1.1 Mobilization

- receive sampling information from Ecology (names/addresses) & schedule based on this information
- receive and inventory sample containers, preservatives, and paperwork (labels/chain-of-custody, analysis request forms) from lab

- coordinate w/lab re: sample preservation, labeling & paperwork requirements
- order, receive and calibrate field instruments (pH, conductivity, temp., turbidity, dissolved O2)
- obtain GPS and instruction on use from WDOE
- assemble necessary field sampling equipment
- hold "readiness review" meeting

2.1.2 First half Sampling

- two-person sampling crew/one vehicle/one set field equipment
- expected work day = 10 hours
- obtain samples from private wells ID'd by Ecology
- wells to be sampled during date/time specified by Ecology
- Ecology will arrange date/time window with owner prior to sampling
- Samples collected,, to extent possible, from outdoor tap as near to well head as possible & upstream of any accumulator tank, water softener, filter, or other treatment device
- Plumbing between well head and tap will be purged prior to sampling by allowing water to run onto ground
- If no tap near wellhead upstream of treatment device or existence of device cannot be determined, this will be noted by sampler & well sampled from whatever tap available
- Measure & record pH, electrical conductivity, temp. , turbidity, and dissolved O2 conc. of the water.
- For each sample, prepare appropriate labels & complete necessary analysis request form and chain of custody forms.
- Preserve samples as directed by lab
- Pack samples for transport in coolers & cool w/blue ice or ice in double zip-locked bags.

- Determine location of each well head w/GPS
- If GPS reading not possible at well head, location of a nearby point will be recorded and the aprox. offset (distance and direction) to the well head estimated and recorded.
- Samples w/short holding time will be delivered daily to a local lab
- Samples w/longer holding times will be shipped daily to WDOE's Manchester Lab
- Ecology will prearrange for well sampling, including getting owner's permission for sampling. This will be provided to SAIC prior to sampling.
- Wells that are inaccessible will not be sampled (to avoid cost of repeated attempts).
- Well casings need not be purged prior to sampling. Plumbing between well head and tap will be purged.
- Ecology will provide for all analysis except pH, conductivity, temp., turbidity, and dissolved O2. SAIC will take these measurements in the field. Short-holding time samples will go to a local lab. Other samples will go to WDOE lab.
- All containers, preservatives, coolers, labels provided by WDOE
- Ecology will provide for overnight shipping to WDOE lab
- Ecology will provide GPS receiver, accessories, & software

E) <u>After the sampling</u>

2.2 Phase 1 deliverables

- write up brief text describing sample collection methods & activities performed
- photocopy work plan, field notes, lab reports, and other assoc. documentation
- laboratory data to be provided to SAIC electronically
- formal analytical data validation will be provided by Ecology or one of its labs
- physical information (aquifer, screen depth, well collar elevation) will be provided to SAIC by Ecology
- develop electronic relational database containing
  -physical well information

-results of lab chemical analysis for each well
-MCLs for all chemical detected
-A summary table of concentrations of detected chemicals

- prepare draft versions of deliverables for Ecology review
- prepare final versions of deliverables incorporating Ecology's comments
- prepare 2 copies of all paper deliverables and also an electronic version.
- Maps mentioned in Ecology statement of Work are not to be prepared by SAIC

F) QA/QC and chain-of-custody related items

2.1.1 Mobilization .

- receive and inventory sample containers, preservatives, and paperwork (labels/chain-of-custody, analysis request forms) from lab
- coordinate w/lab re: sample preservation, labeling & paperwork requirements
- order, receive and calibrate field instruments (pH, conductivity, temp., turbidity, dissolved O2)
- obtain GPS and instruction on use from WDOE

2.1.2 First half Sampling

- Samples collected,, to extent possible, from outdoor tap as near to well head as possible & upstream of any accumulator tank, water softener, filter, or other treatment device
- Plumbing between well head and tap will be purged prior to sampling by allowing water to run onto ground
- If no tap near wellhead upstream of treatment device or existence of device cannot be determined, this will be noted by sampler & well sampled from whatever tap available
- Measure & record pH, electrical conductivity, temp. , turbidity, and dissolved O2 conc. of the water.
- For each sample, prepare appropriate labels & complete necessary analysis request form and chain of custody forms.

- Preserve samples as directed by lab
- Pack samples for transport in coolers & cool w/blue ice or ice in double zip-locked bags.
- Determine location of each well head w/GPS
- If GPS reading not possible at well head, location of a nearby point will be recorded and the aprox. offset (distance and direction) to the well head estimated and recorded.
- Samples w/short holding time will be delivered daily to a local lab
- Samples w/longer holding times will be shipped daily to WDOE's Manchester Lab
- Well casings need not be purged prior to sampling. Plumbing between well head and tap will be purged.
- Ecology will provide for all analysis except pH, conductivity, temp., turbidity, and dissolved O2. SAIC will take these measurements in the field. Short-holding time samples will go to a local lab. Other samples will go to WDOE lab.
- Ecology will provide for overnight shipping to WDOE lab

2.2 Phase 1 deliverables

- laboratory data to be provided to SAIC electronically
- formal analytical data validation will be provided by Ecology or one of its labs
- physical information (aquifer, screen depth, well collar elevation) will be provided to SAIC by Ecology

As found in the Ecology Statement of Work

A) Who is involved?

Ecology Staff

Mary O'Herron	Ecology Project Manager (360) 738-6246
Jan Swanberg	Ecology Contracts Officer (360) 407-7213

B) Brief discussion of work to be done

Introduction

The Washington State Department of Ecology (Ecology) is requesting contractor assistance to conduct two rounds of drinking water sampling in Whatcom County. The sampling is to take place in two phases.

Task 2 Collection of Samples – Phase I

Phase I includes sampling groundwater in the area that currently receives bottled drinking water, plus several additional households to the east, west, and north. Currently, the bottled-water delivery area includes about 52 households with individual wells and several small Water Associations, all within about 1 square mile.

Task 3 Collection of Samples – Phase II

Phase II includes sampling drinking water in Study Area B, excluding the area sampled during Phase I. The sampling and analytical methods would remain the same as for Phase I.

If it is determined that any households within Study Area A were never connected to the municipal water system, Phase II sampling may be expanded to include those additional households.

Project Objectives

The specific objectives of the work to be performed are two-fold.

The first is to determine the chemical quality of groundwater in, and adjacent to, the current bottled water delivery area in Study Area B. As noted above, the delivery area was delineated in 1989. A number of subsequent studies have either not focused on the issue of EDB contamination or have included too few samples to allow for a thorough assessment of the extent of EDB contamination. The last study to address the issue of EDB groundwater contamination took place in 1993/94. Because over four years have passed since that study was conducted, and because drinking water from many households in and near the bottled water delivery area have never been sampled, a more timely picture of the groundwater status is needed. The current extent of EDB contamination in groundwater is important information in defining a new, updated delivery area. This will insure that all households that should be in the bottled water delivery area are then offered the opportunity to participate.

The second is to determine the chemical quality of groundwater from domestic drinking water wells throughout Study Area B. Once the area historically known to have EDB-contaminated groundwater has been reassessed (see objective one), the current status of groundwater beyond the previously defined delivery area should be evaluated. Sampling beyond the bottled water delivery area, aside from the sampling of Class A Water Systems, has not occurred since (for a very few households) 1990. Many domestic wells were last sampled in 1986 and/or 1988. A number of wells were never sampled at all. If EDB-contaminated groundwater exists in areas not previously defined through earlier studies, it is important that this be determined in order to include such households in a (potentially) expanded bottled water program. It would also be important in order to determine the full scope of any long-term solutions being evaluated.

Because of Ecology's wish to coordinate the sampling of Study Area B domestic well water with studies to be conducted by other agencies throughout Whatcom County, the sampling events will include analysis for other potential contaminants in addition to EDB. This will provide not only a more complete profile of the condition of each household's well water, but will also avoid potential problems associated with multiple agencies asking to collect samples at the same addresses.

C) History of site

Background

The EPA removed the nematocide EDB (ethylene dibromide) from use as a soil fumigant in 1983. At that time, it was believed to be a possible carcinogen in animals. From 1984 through 1986, several State agencies investigated EDB application areas to determine if groundwater (and thus, drinking water) contamination had taken place. Four areas were found to have EDB contamination in domestic wells. Two of those areas were in Whatcom County, near the city of Lynden.

An area to the northeast of Lynden (known as Study Area A) and areas in two other counties were provided with access to municipal water supplies. The area to the west of Lynden (known as Study Area B) was deemed to be too sparsely populated to make installation of a municipal water line a financially feasible option. Instead, beginning in 1986, Ecology made bottled water available to households in Study Area B with known or suspected EDB-contaminated drinking water. In 1989, Ecology defined the bottled water delivery area to include households with addresses from 8100 to 8400 Bob Hall Road and from 900 to 1300 Birch Bay Lynden Road.

Several groundwater and drinking water studies have taken place over the years. They have been conducted by a number of different individuals and agencies. The most recent study of EDB contamination in domestic drinking water was conducted by the WA Dept. of Health in 1993/94. Other groundwater studies

have also occurred in the area. Together, the many investigations have revealed that this area of Whatcom County has very shallow groundwater and that analytes of concern include EDB, 1,2-DCP, TCP, TCE, Dinoseb, DBCP, nitrates and fecal coliform.

Currently, Ecology is involved in assessing the current status of groundwater contamination in the area. The work under this contract will assist Ecology in the assessment of current, short-term solutions to the problem of EDB-contaminated drinking water. It will also assist Ecology in coordinating their actions with those of other agencies to develop potential long-term solutions to the issue of contaminated drinking water in this part of Whatcom County.

D) Details of Sampling

Task 1 Work Plan and Budget Development

- The contractor will develop draft and final work plans to conduct the work described in this scope of work.
- The contractor will also prepare a budget for completing the project. This task includes an initial meeting with Ecology to discuss the scope of work.
- The contractor will provide a draft work plan and budget for Ecology's review within 5 days after the initial meeting.
- The contractor will provide a final work plan and budget within 5days of receiving Ecology's comments on the draft work plan and budget.
- The contractor should evaluate the work plan and budget in consideration of two possible plans of action -- with and [BFO1]without the contractor performing the notification and appointment-making portion of the sampling events.[DLS2]
- They will also include in their scope of work the necessary actions needed to promote a high percentage of household participation.

Task 2 Collection of Samples – Phase I

- Ecology will provide names and addresses for the households. (Note: The water in the Association wells will not be tested by the contractor. The Health Department will be dealing with those wells.) The total number of wells to be sampled – with 100% participation – would be approximately 65.
- See Attachment D (?) for list of analytes.

- Some parameters may be measured in the field.

- Approximately 6 households will be chosen for the collection of additional analytical samples.

- Samples [BFO3]will [BFO4]be collected in two stages (of aprox. one half of the households in each stage), with at least 1 week -- but no more than 2 weeks -- between collection dates.

- The contractor will:
  - collect analytical and QA samples
  - label containers
  - pack the containers for transport
  - transport the samples to Ecology's Manchester Laboratory for analysis.

- Samples will be transported to the Manchester Lab, or to Ecology's designated drop-off location,[BFO5] on a daily basis.

Task 3 Collection of Samples – Phase II

- Phase II includes sampling drinking water in Study Area B, excluding the area sampled during Phase I. The sampling and analytical methods would remain the same as for Phase I.

- Choice of sampling locations would depend on:
  - existing evidence of contaminated groundwater
  - households that have volunteered to participate in the sampling program
  - groundwater flow patterns in relation to known areas of contamination.

- The extent of Phase II sampling may be modified by:
  - Phase I analytical results
  - analytical data obtained from private well-testing
  - analytical date obtained from Water Association well-testing
  - any additional groundwater information obtained prior to the initiation of the Phase II sampling event.

- If it is determined that any households within Study Area A were never connected to the municipal water system, Phase II sampling may be expanded to include those additional households.

- The number of households will be approximately 70. These would be spread out over the entire (7 square mile) Study Area B.

- See Attachment D (?) for list of analytes.

- Some parameters may be measured in the field

- approximately 6 to 8 households will be chosen for the collection of additional analytical samples.

- Samples [BFO6]will [BFO7]be collected in two stages (of aprox. one half of the households in each stage), with at least 1 week -- but no more than 2 weeks -- between collection dates.

- The contractor will:
  - collect analytical and QA samples
  - label containers
  - pack the containers for transport
  - transport the samples to Ecology's Manchester Laboratory for analysis.

- Samples will be transported to the Manchester Lab, or to Ecology's designated drop-off location,[BFO8] on a daily basis.

E) After the Sampling

Task 2 Deliverables:

- A full report will not be prepared by the contractor.

- On receipt of the analytical results from the Manchester Laboratory, the contractor will prepare draft and final versions of the following:
  1) data (QA/QC'd) in table form and as lab sheets (2 copies)
  2) text describing sampling preparations and actions at the site (2 copies)
  3) copies of the work plan, field notes, and other associated documentation (2 copies)
  4) a map illustrating the locations of all sampling events (2 copies)
  5) a map illustrating the location of all MCL exceedences over the area sampled (2 copies)
  6) GPS locations for all sampling events (2 copies)
  7) electronic copies of all tables and documents, and maps. (See Attachment E for details.)

Task 3 Deliverables:

- A full report will not be prepared by the contractor.

- On receipt of the analytical results from the Manchester Laboratory, the contractor will prepare draft and final versions of the following:
  1) data (QA/QC'd) in table form and as lab sheets (2 copies)

2) text describing sampling preparations and actions at the site (2 copies)
3) copies of the work plan, field notes, and other associated documentation (2 copies)
4) a map illustrating the locations of all sampling events (2 copies)
5) a map illustrating the location of all MCL exceedances over the area sampled (2 copies)
6) GPS locations for all sampling events (2 copies)
7) electronic copies of all tables and documents, and maps ((See Attachment E for details.)

F) QA/QC & Chain-of-custody related items

Task 2 Collection of Samples – Phase I

- The contractor will:
  - collect analytical and QA samples
  - label containers
  - pack the containers for transport
  - transport the samples to Ecology's Manchester Laboratory for analysis.

- Samples will be transported to the Manchester Lab, or to Ecology's designated drop-off location,[BFO9] on a daily basis.

Task 3 Collection of Samples – Phase II

- The contractor will:
  - collect analytical and QA samples
  - label containers
  - pack the containers for transport
  - transport the samples to Ecology's Manchester Laboratory for analysis.

- Samples will be transported to the Manchester Lab, or to Ecology's designated drop-off location,[BFO10] on a daily basis.

Task 2 Deliverables:

- On receipt of the analytical results from the Manchester Laboratory, the contractor will prepare draft and final versions of the following:
  1) data (QA/QC'd) in table form and as lab sheets (2 copies)
  2) text describing sampling preparations and actions at the site (2 copies)
  3) copies of the work plan, field notes, and other associated documentation (2 copies)
  4) a map illustrating the locations of all sampling events (2 copies)

5) a map illustrating the location of all MCL exceedences over the area sampled (2 copies)
6) GPS locations for all sampling events (2 copies)
7) electronic copies of all tables and documents, and maps. (See Attachment E for details.)

Task 3 Deliverables:

- A full report will not be prepared by the contractor.

- On receipt of the analytical results from the Manchester Laboratory, the contractor will prepare draft and final versions of the following:
  1) data (QA/QC'd) in table form and as lab sheets (2 copies)
  2) text describing sampling preparations and actions at the site (2 copies)
  3) copies of the work plan, field notes, and other associated documentation (2 copies)
  4) a map illustrating the locations of all sampling events (2 copies)
  5) a map illustrating the location of all MCL exceedances over the area sampled (2 copies)
  6) GPS locations for all sampling events (2 copies)
  7) electronic copies of all tables and documents, and maps ((See Attachment E for details.)

Draft 9/17; format revisions 9/27

Sampling Plan: Phase 2 - 1998 sampling in Study Areas A & B near Lynden WA

CONTENTS

Introduction:

The historical name for the site under consideration has been the "Whatcom EDB Site". That site has been comprised of two sub-sites – Study Area A (also known as the Meadow View Study Area) and Study Area B (also known as the Bertrand Creek Study Area). The two sub-sites are near the City of Lynden in Whatcom County. Study Area A is northeast of the city and Study Area B lies to the west of the city. (See Map ___.) Both areas were found to have groundwater contaminated with ethylene dibromide (EDB).

EDB was a soil fumigant that was taken off the market by the EPA as a possible carcinogen. Four areas in the state were determined in approximately 1985 to have problems with EDB-contaminated drinking water. Whatcom County had two of these sites.

At that time, the Meadow View Water Association well (which served much of Study Area A) was found to be contaminated. To resolve this problem, the water association was connected to the City of Lynden water system.

A water line was not extended to serve the residents in Study Area B because it was cost prohibitive. The population was considered to be too sparse to make it economically feasible. Instead, bottled water was made available to households where EDB was known or suspected to be present in the drinking water from their domestic wells.

Currently, groundwater conditions in the area have once again come to the forefront. As a number of years have passed since the drinking water was last fully evaluated and as the information that has been collected over the intervening years indicates that EDB contamination still remains, it has been determined that a more thorough evaluation of the drinking water should be conducted.

This study is being conducted in order to determine the current drinking water status within Study Area B, with some limited follow-up sampling in Study Area A. Phase 1 of the study – which looked at homes in and adjacent to the historic bottled water delivery area -- has already been completed. Phase 2 will expand upon the information collected during Phase 1, the data provided by other agencies currently studying groundwater/drinking water in the area, and the historic data available regarding groundwater/drinking water conditions in the area.

Objective:

This study shall attempt to evaluate, through the collection and analysis of domestic drinking water samples:

- The current concentrations of EDB in areas historically known to have EDB-contaminated domestic drinking water.
- The extent of the EDB contamination (whether it has spread or not).
- The presence of other contaminants in the domestic drinking water.

This study shall be conducted in cooperation with other government agencies studying groundwater and drinking water in the area. Data collected by other agencies will be utilized to supplement the study results and to achieve a more thorough picture of water issues throughout much of northern Whatcom County.

A portion of the study (Phase 1) has already been completed. This, in combination with historic data and information currently becoming available from other agencies, indicate several areas where additional data is needed.

> This study will focus on Study Area B where the majority of residents are served by private, residential drinking water wells. This is where the bottled water program has been in place for many years and where the residential population may run the greatest chance of exposure to EDB and other chemicals via the drinking water. Phase 1 of the study focused on that portion of Area B where bottled water had been historically provided. Preliminary analysis of the data indicates that the concentrations of EDB may be decreasing, although is not yet certain if that is due to degradation or migration. Homes downgradient of the bottled water delivery area have not been sampled and the impact of the upgradient problem on their drinking water has not been determined.

Phase 1 of the Study indicates that other chemicals, including the soil fumigant 1,2-dichloropropane (or 1,2-DCP) are also present in the drinking water samples. The extent and degree of this contamination is unknown.

Data from other agencies, and that from samples collected by individual homeowners, indicate that groundwater contamination problems exist in the area near the intersection of Loomis Trail Rd. and Weidcamp Rd. The degree and extent of this contamination problem has not yet been determined.

Study Area A will be evaluated to determine if there are residences that are not being served by the Mountain View Water Association (or other group water sources) but are, instead, relying on individual domestic wells. If such homes are determined to exist, a representative sampling of homes in that area will also have their drinking water tested. There is no data regarding these homes in the files.

Schedule:

The Phase 2 sampling will take place during the last week full of September (9/21-9/24) and the first full week of October (10/5-10/8). One non-sampling week will fall between the two sampling weeks at the request of WDOE's Manchester Lab. Per the lab, this schedule will allow them to accommodate the large number of samples with the best guarantee that samples will be analyzed within their holding time. No samples will be collected on Fridays because of the lab's schedule.

The laboratory results should be available in 3 stages.

- Approx. 1 week from date of sampling for coliform data.
- Approx. 6 weeks from last sampling date for nitrates, EDB, and 1,2-DCP data.
- Approx. 8 weeks from last sampling date for other chemical data, including pesticide and herbicide data.

During Phase I of the study, information was provided to residents approximately 1 week post-sampling for letter #1 (coliform results), 5 weeks after the last day of sampling for letter #2 (nitrates, EDB, and 1,2-DCP results) and 7 weeks after the last day of sampling for letter #3 (herbicides, pesticides, and information re: other detected chemicals). It is anticipated that Phase II data will be distributed on about the same schedule. However, aside from the coliform data, all dates are estimates and will depend on the speed with which the laboratory can analyze the samples, process the data, and forward the analyses to the site manager.

Residents of the home where the sample was taken, other households that use the same well, and any non-resident property owners (landlords) will all be sent information concerning the analytical results for their drinking water as soon as it is received and processed.

At the same time, this information will be shared with Whatcom Co. Health and Human Services in order that they might be prepared to handle any question they might receive from the public. (This is especially important in the case of coliform data, which is within the sphere of the Health Dept.)

No other agency will have this data available to them until the residents and/or owners have received it. At that time, the raw data will be made available to other agencies currently conducting studies in the area.

See Work Plan for additional deliverables and their scheduled due-dates.

It is anticipated that a final report documenting and interpreting these results will be completed (tentatively) in February of 1999.

Personnel involved:

Mary O'Herron – Site Manager, WDOE (360) 738-6246
Mark Daigle – Project Manager, SAIC (425) 482-3318
Romy Freier-Coppinger – Field sampler/environmental engineer, SAIC (425) 485-3322
Glen Haupt – Field Sampler/_____, SAIC (425)_____
Joan Pelley, Public Involvement, WDOE (360) 738-6247

SAIC is an environmental consulting firm. They are under contract to Ecology. Ecology assembled a draft work plan for which SAIC then bid. Ecology modified the work plan in order to minimize the consulting costs and presented an edited work plan. SAIC submitted a second bid and this was accepted. (See attached Work Plan.)

The Work Plan was composed in consultation with Ecology management and input from Ecology's Manchester Lab, WDOE-EILS, Whatcom Co. Health and Human Services, EPA, WDOH, and USGS.

History: pre-1998

Ethylene dibromide (EDB) was a chemical that the EPA ordered withdrawn from the market in 1983. Its main use had been as a fumigant for nematodes in soil where strawberries, raspberries and seed potatoes were to be grown. EPA's actions based on evidence that EDB was a carcinogen in animals and a possible carcinogen in humans.

A number of agencies – including Ecology, WSDAgriculture, and WDOH – looked throughout the state to see where EDB had been used and especially where it might have

gotten into the drinking water. They found one area in Thurston Co., one in Skagit Co., and two in Whatcom Co.. The two areas in Whatcom Co. were referred to as Study Area A (the Meadowview Area) and Study Area B (the Bertrand Creek Area).

In 1992, Ecology signed a settlement agreement with Great Lakes Chemical (the former manufacturer of EDB). The agreement spelled out the limits of the areas covered by the settlement, including the two in Whatcom County which are referred to here as Study Area A (aprox. 4 square miles, northeast of Lynden) and Study Area B (aprox. 7 square miles, west of Lynden). (See attached Maps A and B.)

By the time of the settlement, much of Study Area A (along with the areas in Thurston and Skagit Counties) was hooked up to a municipal water system. Study Area B was considered to be too sparsely populated and too far from the city to make a municipal water line economically feasible. Instead, residents in a subsection of Study Area B where EDB-contaminated groundwater was known or suspected to occur were offered the option of having bottled water delivered to their homes at no charge.

The exact location of the bottled water delivery area is not specified in the Great Lakes Chemical settlement. Instead, it first appears in the files in a 1989 memo to Michael Gallagher, WSDOE. The memo proposes the addresses from 8100 to 8400 Bob Hall Road and 900 to 1300 Birch Bay–Lynden Road as being eligible for the bottled water program.

A series of sampling events took place in Study Area B between 1984 and 1994. Almost all of them looked for EDB in the groundwater or in tap water. Some studies looked for additional chemicals, some did not. Some homes were sampled many times, some only once, and some were never sampled at all. Some of the studies were focused specifically on Study Area B and some only sampled a few homes in this area as part of larger projects. For this reason, the historical data regarding the presence of chemicals in the groundwater is something of a patchwork, concentrating mostly on homes along Birch-Bay-Lynden and Bob Hall Roads, but also including information from other locations throughout and beyond Study Area B.

Data appears to be most reliable for EDB-contamination. Some data collected between 1986 and 1990 (aprox. 37 sampling events at one home) indicates that there does not appear to be a significant fluctuation in concentration from season to season.

Studies between 1984 and 1994 also indicated the presence in tap water and/or in groundwater of a number of additional contaminants including: 1,2-DCP, nitrates, dinoseb, TCE, methylene chloride (a possible lab contaminant), DBCP, benzene, xylene, simazine, carbofuran, and 1,2,3-TCP. Not all chemicals were found in all samples and concentrations varied from >MCL to barely detectable.

The most commonly encountered chemical was 1,2-DCP. This chemical was used as a constituent of the soil fumigant Telone. It is currently in use as a very small percentage (<1%) of the soil fumigant Telone II.

History - 1998 and beyond:

Recently, interest in the quality of groundwater in this area has again come into focus. Several State and Federal agencies either have been or will be conducting studies of the groundwater, drinking water, and/or soil. Data from these other agencies (both final & preliminary), the historical analytical data, results from samples taken by local residents and chemicals identified in petitions to ATSDR and EPA will all be coupled with the analytical results from Ecology's Phase I sampling to determine the nature of the Phase II sampling.

This information includes:

1) Preliminary USGS data (1997) shows the presence of 1,2-DCP in groundwater east of the Loomis Trail/Weidkamp Roads intersection and along Birch Bay – Lynden Road. (See Map C.)
2) A draft (1998) Sumas-Blaine Aquifer report shows moderately high to high nitrate and chloride levels in the area. (See attached Maps D, E, and F.)
3) Very preliminary groundwater results were obtained – verbally – relating to the ongoing 1998 EPA investigation of several sites in section 22 (in the middle of Study Area B). Conformational laboratory data will not be available for several months, but field analysis confirms the historical EDB data along Birch Bay-Lynden Roads. Field analytical data also showed high concentrations of 1,2-DCP near the Bob Hall/Birch Bay-Lynden intersection and also along Loomis Trail Rd. (See attached Map G.)
4) A number of homeowners in the area have sampled their own wells. One on Loomis Trail Rd. found 1,2-DCP and 1,2,3-TCP. One on Weidkamp found EDB, 1,2,3-TCP and 1,2-DCP. (See Map H.)
5) WDOH sampled drinking water at several homes in the area (1993/94). One home on Loomis Trail Rd., east of the Loomis Trail/Weidkamp intersection, showed a number of contaminants present. These included EDB, 1,2-DCP, dinoseb, DBCP, benzene, xylene, simazine, 1,2,3-TCP and carbofuran.
6) Two petitions have been submitted (one to ATSDR and one to EPA) naming EDB, 1,2-DCP, 1,3-DCP, atrazine, simazine and carbofuran as chemicals of concern.

In addition to this relatively current information from other sources, Ecology conducted Phase I of the Summer 1998 Study in June and July. Phase I sampling took place in that part of Study Area B where EDB contamination had historically been known to (or suspected to) exist, i.e., the bottled water delivery area. Additional homes were sampled for aprox. ¼ mile to the north, east and west of the delivery area in order to determine if the area of concern had been adequately defined. No homes with domestic wells were available to the immediate south. Tap water was collected from all homes where the resident and/or owner was willing to participate in the study. A total of 52 wells, serving 58 homes, 1 grocery, and 1 church were sampled. (Five households declined to participate.) (See Maps I through __)

In Phase I of the study:

EDB was found at levels >.02 ppb in nine locations along Birch Bay-Lynden Road, east of the Bob Hall intersection. This was the same general area where it had been detected in the past. Six of those samples showed concentrations >MCL (.05ppb). Many additional homes to the east, north and west of these homes had no EDB detected in their wells. This suggests that the area of concern may not have expanded or migrated from what had been determined in the past.

1,2-DCP was detected at levels >.25 ppb in 19 locations along Birch Bay-Lynden Road and five along the southernmost part of Bob Hall Road. Four of those samples showed concentrations >MCL (5.0 ppb). As 1,2-DCP data had been somewhat spotty in the past, this was the first thorough assessment of its presence in the water. As it was detected at levels >MCL at the homes to the eastern and western limits of the Phase I testing, additional testing would be helpful to determine the extent of contamination along Birch Bay-Lynden Road.

A number of other drinking water problems were detected. 51 of the 52 wells had nitrates present, 21 above the MCL. 33 of the 52 wells have coliform bacteria present, 3 with *e.coli* detected. In addition, a long menu of other chemicals was detected in one or more of the homes. (See Appendix __.)

Phase 2 - Factors influencing sampling:

1) Ecology's 1998 Phase I sampling indicates that 1,2-DCP may be at concentrations >MCL along Birch Bay-Lynden Road, especially to the east of the area sampled during Phase I. Historical data on 1,2-DCP had been spotty and may not have been representative of its actual distribution.
2) Ecology's 1998 Phase I sampling indicates that EDB was present in areas where it had historically been detected, but at much lower concentrations than previously seen.
3) EPA's preliminary data indicates that 1,2-DCP concentrations may be high in groundwater to the west of the Bob Hall/Birch Bay-Lynden intersection and along Loomis Trail Rd., near the Weidcamp intersection.
4) Information from WDOH (Hulsman) samples in 1993/94 indicates the presence of EDB, 1,2-DCP, dinoseb, DBCP, benzene, xylene, simazine, carbofuran, and 1,2,3-TCP east of the Weidcamp/Loomis Trail intersection.
5) Information from individual homeowners indicates 1,2,3-TCP and 1,2-DCP in wells near the Weidcamp/Loomis Trail intersection.
6) USGS preliminary data indicates the presence of 1,2-DCP east of the Weidcamp/Loomis Trail intersection.
7) EPA and USGS are also sampling in the area. Every effort will be made not to duplicate work that other agencies are doing. However, in earlier meetings all agencies agreed to sample for a "core menu" of analytes. This will allow some incorporation of their data into Ecology's final profile of the area.

8) All sampling locations are voluntary. If a resident and/or property owner chooses not to participate in the study Ecology does not plan to seek authority to sample against a property owner's wishes.
9) Some volunteers for Phase II of the study may not have their tap water tested. If the number of volunteers exceeds the available sampling budget, some may have to be omitted from the study. Lowest priority homes will be eliminated first, e.g., if a number of homes in a given area have volunteered and there is no evidence of historical groundwater contamination in the area. Ecology has allocated funds to sample at approximately 70 homes. If there are more than 70 volunteer locations, the project manager will determine which wells will not be sampled. Areas where contamination is already known or suspected will have the highest priority. All other areas will be sampled as thoroughly & randomly as the pool of volunteer homes allows.
10) Volunteers will be solicited by:
    - Previous contact. Some residents have already contacted Ecology or Health to volunteer for the study.
    - Mass-mailing. Whatcom Co. Health and Human Services has mailed a letter and permission form to all rural residents in northern Whatcom County. The responses will provide a pool of volunteers for USGS, Ecology and WDOH studies.
    - Door-to-door. In areas where there are few volunteers, or where we have historic knowledge of contamination problems, Ecology employees will go to homes to talk to the residents or to leave information packets taped to their door. If the number of volunteers is low, this effort to solicit additional sampling locations may proceed through Oct.2nd.
    - Only one household tap will be sampled per well.
    - Only domestic wells will be sampled. (No residences served by water systems will be sampled at this time.)
11) The exact addresses of sampling locations will evolve as long as volunteers continue to submit Permission Forms. This will allow the most thorough coverage possible of the areas of greatest concern. Please see Map __ for the most current information regarding volunteer well locations.

Phase 2 - Chemicals to be tested for:

- Nitrate/Nitrite EPA Method 353.2
- Chloride EPA Method 300.0
- EDB EPA Method 504
  -- target analytes incl. EDB and DBCP
- VOAs EPA Method 524.2
  -- target analytes incl. benzene; 1,2-DCP; 1,3-DCP; xylene; 1,23-TCP

(for approx. 8 households only)

- Pesticides/Herbicides SW 8085 (+ carbofuran)
  - target analytes incl. atrazine, simazine, dinoseb, and carbofuran
- Hardness EPA Method 130.2
- Coliform (total) Std. Method 9223 (40 CFR Part 141 & 143)

Phase 2 - QA/QC at the lab:

1. Nitrate/Nitrite and Chlorides
Duplicates/calibration standards/blanks/spiked samples/laboratory control sample

2. EDB
Target analytes incl. EDB and DBCP
Blanks/duplicates/surrogates/matrix spikes/

3. VOAs
Target analytes incl. benzene; 1,2-DCP; 1,3-DCP; xylene; 1,23-TCP
Blanks/duplicates/surrogates/matrix spikes

4. Pesticides/Herbicides
Target analytes incl. atrazine, simazine, dinoseb, and carbofuran
Nitrogen-containing pesticide analysis: surrogate sample/blank/duplicate
Acid herbicide analysis: calibration validation/blanks/surrogate/duplicate/matrix spike

5. Coliform
Field duplicates

Phase 2 - Methodology in the field:

Samples will be collected by Ecology's SAIC contractors. They will:

1) Call and make an appointment with the owner/resident at homes where it has been requested. They will then make an appointment with the owner/resident for a mutually agreeable time to conduct the sampling.
2) Arrive at the home unannounced if the owner/resident has not asked for a call prior to the sampling.
3) Knock on the door to announce their presence to the residents.
4) Label the bottles and tags with site location designation (e.g., 8745BH = the tap sampled at 8745 Bob Hall Rd.), date and time. Also, if available, sample numbers provided by Manchester Lab.

5) Enter information onto Sample Log form.
6) Take a GPS reading re: location of the well. If the GPS reading is not taken directly above the well head, they will document their position in relation to the well (per instructions from Kim Homan, GIS Analyst, WDOE) in order for a correction to be made at a later date.
7) Collect sample from outside household tap closest to the kitchen tap and, preferably, closest to the well. In some cases, there may be only one exterior tap or the resident may prefer that the samplers use a specific exterior tap. The samplers will need to adapt to accommodate to these conditions and note the information in their sampling log.
8) If it is determined that the tap to be sampled does not represent the household drinking water (i.e., it is served by another well or pump) the sampler shall attempt to obtain a representative drinking water sample. If none is available, they will contact the Site Manager to determine if any sample should be collected at that location.
9) In cases where there is no outside tap that is served by the same well and/or pump as the interior taps, a sample may need to be taken from an inside faucet. In that case, the kitchen faucet is preferred. The samplers will need to call the residents in advance and arrange for a time when the sample can be collected. Any filter or diffuser attached to the faucet must be removed prior to the sample being collected.
10) Turn the outside tap on high and let the water run for 20 minutes in order to flush the lines. If possible, direct the water away from the house.
11) Take field readings during purging process of pH, conductivity, temperature, dissolves oxygen, and turbidity.
12) Turn the outside tap down to a very low flow (after disconnecting any hoses or other attachments) to avoid aerating the water.
13) Fill containers. Fill coliform sample container last to allow the maximum amount of water to have flushed the system. (Note: EDB and VOA containers must be filled to the top with no air space or bubbles present.)
14) For a pre-selected 8 locations, collect additional pesticide/herbicide samples. These locations will be determined by the Site Manager.
15) Place containers into ice chest with ice.
16) Complete entries into Sample Log form. (See attached example.)
17) Reconnect any hoses or other attachments to the tap.

Phase 2 - QA/QC in the field:

Samples will be collected by Ecology's SAIC consultants and will be placed into coolers in the van. If the van is left without supervision, the van will be locked. The samples will remain in the locked van or in the locked room of the sampler until they – and the coolers -- are surrendered to an Ecology employee within 24 hours of the time of collection. The only exception to this will be the coliform samples. SAIC will deliver those samples directly to the lab (Udder Health) either the evening of the date they were collected or the following morning. During this entire time the samples will be kept on ice or in a cold refrigerator.

On surrendering the samples, the SAIC representative will sign the sampling sheet and have the person receiving the samples also sign the sheet (to document chain-of-custody).

The non-coliform samples will then remain in Ecology custody -- and on ice -- until: a) surrendered to UPS for overnight delivery to Ecology's Manchester Lab or b) delivery by Ecology staff to the Manchester Lab.

During each week of Phase II sampling, SAIC consultants will collect one full set of duplicate samples. One of those two duplicate sets will be from a residence where herbicide/pesticide samples are collected. Both will be from locations where there is reason to suspect some chemical contamination in the groundwater, either due to historical data for that site or for a nearby site. (Note: During Phase I, samples were collected from two locations that drew water from the same well. There was no significant difference between the two results and no indication that this QA/QC experiment need be duplicated during Phase II.)

VERBAL INSTRUCTIONS GIVEN TO SAIC RE: SAMPLING METHODS

Phase 1 - Methodology in the field:

Ecology's SAIC contractors will be provided by the project manager with a list of homes to be sampled, along with any special instructions.

Contractors will also be provided with the Permission Forms which the resident had signed. This form will include a site map indicating which tap to use and where the well is located (if known). It will also indicate any other factors (i.e. dogs) that the contractor should be aware of.

Contractors will:

- Call and make an appointment with the owner/resident at homes where it has been requested. They will then make an appointment with the owner/resident for a mutually agreeable time to conduct the sampling.
- Arrive at the home unannounced if the owner/resident has not asked for a call prior to the sampling.
- Knock on the door to announce their presence to the residents.
- Label the bottles and tags with site location designation (e.g., 8745BH = the tap sampled at 8745 Bob Hall Rd.), date and time. Also, if available, sample numbers provided by Manchester Lab.
- Enter information onto Sample Log form (see attached form).
- Take a GPS reading re: location of the well. If the GPS reading is not taken directly above the well head, they will document their position in relation to the well (per instructions from Kim Homan, GIS Analyst, WDOE) in order for a correction to be made at a later date.
- Collect sample from outside household tap closest to the kitchen tap and, preferably, closest to the well. In some cases, there may be only one exterior tap or the resident may prefer that the samplers use a specific exterior tap. The samplers will need to adapt to accommodate to these conditions and note the information in their sampling log.
- If it is determined that the tap to be sampled does not represent the household drinking water (i.e., it is served by another well or pump) the sampler shall attempt to obtain a representative drinking water sample. If none is available, they will contact the Site Manager to determine if any sample should be collected at that location.
- In cases where there is no outside tap that is served by the same well and/or pump as the interior taps, a sample may need to be taken from an inside faucet. In that case, the kitchen faucet is preferred. The samplers will need to call the residents in advance and arrange for a time when the sample can be collected. Any filter or diffuser attached to the faucet must be removed prior to the sample being collected.
- Turn the outside tap on high and let the water run for aprox. 20 minutes in order to flush the lines. If possible, direct the water away from the house.

- Take field readings during purging process of pH, conductivity, temperature, dissolved oxygen, and turbidity.
- Turn the outside tap down to a very low flow (after disconnecting any hoses or other attachments) to avoid aerating the water.
- Fill containers. Fill coliform sample container last to allow the maximum amount of water to have flushed the system. (Note: EDB and VOA containers must be filled to the top with no air space or bubbles present.)
- Add preservative to sample containers as specified by Manchester Lab
- For a pre-selected 8 locations, collect additional pesticide/herbicide samples. These locations will be determined by the Site Manager.
- Collect one full set of duplicate samples each week. One of those two duplicate sets will be from a residence where herbicide/pesticide samples are collected. The second duplicate will be from a non-pesticide/herbicide home. (Both duplicate sampling locations will be selected by the contractor in an area chosen by the project manager.) These samples will be assigned the same sample number and site designation, with the word "duplicate" indicated on the tag and in the sampling log.
- Collect samples from one site (specified by the project manager) where two locations draw water from the same well. These samples will each be assigned a separate sample number and site designation.
- Place containers into ice chest with ice.
- Complete entries into Sample Log form. (See attached example.)
- Reconnect any hoses or other attachments to the tap.

Samples will be collected by Ecology's SAIC consultants and will be placed into coolers in the van. If the van is left without supervision, the van will be locked. The samples will remain in the locked van or in the locked room of the sampler until they – and the coolers -- are surrendered to an Ecology employee within 24 hours of the time of collection. The only exception to this will be the coliform samples. SAIC will deliver those samples directly to the lab (Udder Health) either the evening of the date they were collected or the following morning. During this entire time the samples will be kept on ice or in a cold refrigerator.

On surrendering the samples, the SAIC representative will sign the sampling sheet and have the person receiving the samples also sign the sheet (to document chain-of-custody).

The non-coliform samples will then remain in Ecology custody -- and on ice -- until: a) surrendered to UPS for overnight delivery to Ecology's Manchester Lab or b) delivery by Ecology staff to the Manchester Lab.

During each week of Phase 1 sampling, SAIC consultants will collect one full set of duplicate samples. One of those two duplicate sets will be from a residence where herbicide/pesticide samples are collected. Both will be from locations where there is reason to suspect some chemical contamination in the groundwater, either due to historical data for that site or for a nearby site. Please note: These samples will be

assigned the same sample number and site designation, with the word "duplicate" indicated on the tag and in the sampling log.

One site will be specified by the project manager where samples will be collected from two locations that draw water from the same well. This pair of samples will serve to determine if the decision to – at other locations -- sample only one home per well was valid.

Big brown glass bottles with narrow necks (Note: leave no head space)	EDB
Brown plastic bottles	Chloride
Clear plastic w/clear, wide cap ("contains acid")	Nutrients
125-ml white w/narrow blue or white cap ("hardness" or "contains acid")	Hardness
1-liter plastic bottle w/square shoulders ("metals")	If samples turbid or not clear- Calcium, Potassium, Soduim
Vials in foam holders (Note: collect 3 per location)	VOA's
Glass gallon bottles	Pesticides
Dropper bottles	Acid for VOA pH
Small, squat glass bottles with wide, white lids	Coliform

Attachment D

Chemical properties of concern

List of analytes (Phase I, all households/Phase II, to be determined):

EDB	(ethylene dibromide/1,2-dibromoethane)
1,2-DCP	(1,2-dichloropropane)
1,3-DCP	(1,3-dichloropropene)
TCP	(trichloropropane)
1,2,2-TCP	(1,2,3-trichloropropane)
1,2,3-TCP	(1,2,3-trichloropropane)
TCE	(trichloroethene)
DBCP	(1,2-dibromo-3-chloropropane)

Nitrates
Fecal coliform
Dissolved oxygen
PH

Possible analytes (Phase I, all households/Phase II, to be determined):

Temperature
Conductivity
Total hardness
Turbidity
Total disolved solids
Cations/Anions

List of additional analytes (Phase I, aprox. 6-8 households/Phase II, to be determined):

Dinoseb
Triazine
Atrazine
Simozine
(?MITC – methylisothiocyanite)
(?Methyl bromide)
(?fenamiphos – nemacur)
(?metalaxyl – ridomil)

Attachment E

Requirements for electronic data submissions

Electronic copies of all tables and documents, and maps will be presented in an electronic relational database of all data, including well locations in state plane coordinates or other appropriate coordinate system [from GPS work]].

The database should include:
A) a table on well information, if available (Well Identification, location coordinates, other pertinent information such as owner, address, aquifer drawn from, top and bottom depths of screen, collar elevation, etc.)
B) a table on regulatory standards (CAS number, chemical name, relevant standards) and analytical results (Lab ID, Sample ID, Well Number, sample date, analysis date, CAS number, chemical name (optional – can get chemical name from table of regulatory standards), result, units, flag, comments, etc.)

Note: ALL RESULTS ARE TO BE IN THE SAME UNITS; AND ALL CHEMICAL STANDARDS ARE TO BE IN THE SAME UNITS AS THE RESULTS. CAS NUMBERS ARE TO BE ENTERED UNIFORMLY BETWEEN THE REGULATORY STANDARDS AND THE ANALYTICAL RESULTS TABLE.

Relational integrity should be assured (No CAS number in the results table which is not in the standards table; only one occurrence of the CAS number in the standards table (i.e., CAS number is the primary key in the standards table). No well in the results table not in the well information table, and well identification is the primary key in the well information table.

Ecology uses Microsoft Access, and the data base should be importable by it. The database is to be suitable for comparing results to standards as a ratio calculated in a query and suitable for extracting selected data and exporting it to Excel or Surfer for preparation of graphics. The contractor is expected to work with Ecology to design a useful relational database in which to store data in a readily retrievable form.

Ecology anticipates that the results table will be provided in electronic format by the Manchester Laboratory and the other tables will be designed around what the laboratory routinely provides.

Chemical properties of concern

List of analytes (Phase I, all households/Phase II, to be determined):

Name	Alternative names	MCL
EDB	ethylene dibromide/1,2-dibromoethane	0.05 ppb
1,2-DCP	1,2-dichloropropane	5.0 ppb
1,3-DCP	1,3-dichloropropylene/1,3-dichloropropene	
TCE	Tetrachloroethene/Tetrachloroethylene	5.0 ppb
1,2,2-TCP	1,2,2-trichloropropane	
1,2,3-TCP	1,2,3-trichloropropane	
DBCP	1,2-dibromo-3-chloropropane	0.2 ppb
Nitrates	NO2 + NO3	10.0 ppb
Coliform		
Temperature		
Conductivity		
Total hardness		
Turbidity		
Cations/Anions		

List of additional analytes (Phase I, aprox. 6-8 households/Phase II, to be determined):

Dinoseb	7.0 ppb
Atrazine	
Simozine	

Analytical Methods for Bertrand Creek Sampling Event – 1998

Nitrate/Nitrite	EPA Method	353.2			
Chloride	EPA Method	300.0			
EDB	EPA Method	504			
VOAs	EPA Method	524.2	or	SW	8260
Pesticides/Herbicides	SW	8085			
Hardness	EPA Method	130.2			
Coliform (total)	Std. Method	9223	(40 CFR Part 141 & 143)		

APPENDIX B

ECOLOGY CONTRACT C9800045
WORK ASSIGNMENT SAI 01
BERTRAND CREEK DRINKING WATER STUDY

SAIC
DRAFT WORK PLAN

1.0 TASK 1 – WORK PLAN AND BUDGET DEVELOPMENT

This work element includes effort to review the Ecology statement of work, identify any questions or issues, hold a scoping meeting with Ecology staff, pursue follow-up questions to further define the scope of work, and prepare draft and final work plans and budgets. We estimate that this work element will require the following:

- *C.Allender: 10 hours*
- *M.Dagel: 30 hours*
- *L.Wynands: 4 hours*

2.0 TASK 2 – COLLECTION OF SAMPLES – PHASE I

As described in Ecology's statement of work, this task encompasses two technical activities: sampling private wells and preparing deliverables. These are discussed below in Sections 2.1 and 2.2, respectively. In addition, this task includes the effort needed for administrative project management. This effort includes the preparation of monthly progress reports and periodic communication with Ecology project management and contracts staff. We estimate that administrative project management for this task will require the following:

- *C.Allender: 4 hours*
- *M.Dagel: 8 hours*
- *L.Wynands: 4 hours*

2.1 FIELD SAMPLING

As described in the Ecology statement of work, Phase I includes sampling approximately 65 domestic wells near Lynden, Washington to be analyzed for EDB and a number of other parameters. Samples will be collected in two separate sampling events, each event including approximately half the total number of wells to be sampled. The sampling events will be separated by one to two weeks.

The field sampling activities of Phase I encompass the following three work elements:

- Mobilization for Phase I sampling
- First half of the Phase I sampling
- Second half of the Phase I sampling

2.1.1 Mobilization for Phase I

This work element includes the effort necessary prepare for both halves of the Phase I field sampling and includes the following activities:

- Receiving sampling information from Ecology (e.g., names and addresses of wells to be sampled and dates and times that the owners have authorized for such sampling) and planning the optimum sampling order and schedule based on this information.
- Receiving and inventorying sampling containers, preservatives, and paperwork (e.g., labels, chain of custody, and analysis request forms) from the analytical laboratories.
- Coordinating with the analytical laboratories regarding sample preservation, labeling and other paperwork requirements, and delivery logistics.
- Ordering, receiving, and testing field instruments (e.g., pH, conductivity, temperature, turbidity, and dissolved oxygen meters).
- Obtaining and being instructed in the use of an Ecology GPS receiver (requires one SAIC sampler to travel to and from Bellingham, Washington and receive three to four hours' training).
- Assembling all other necessary field sampling equipment and supplies.
- Holding a "readiness review" meeting with field sampling crew, the SAIC project manager and, if desired, the Ecology project manager.

We estimate that this work element will require the following:

- *M.Dagel* *12 hours*
- *G.Haupt:* *24 hours*
- *R.Freier-Coppinger* *32 hours*

2.1.2 First Half Phase I Sampling

This work element includes the effort to sample the first half of the Phase I wells (i.e., about 33). We anticipate that the sampling will be done with a two-person sampling crew using one vehicle and one set of field equipment. The crew will work 10-hours per day to minimize recurring fixed expenses (e.g., lodging and equipment rental). The crew will stay in the Bellingham, Washington area on weeknights during the sampling effort to minimize travel time and mileage expenses. It is estimated that the first half of Phase I sampling will take five working days.

The crew will obtain water samples from the private wells identified by Ecology. The wells will be sampled during the date/time windows that Ecology will have arranged with the well owners prior to the start of field work. To the extent possible, samples will be collected from an accessible, outdoor tap, as near as possible to the well head, and upstream from any accumulator tank, water softener, filter, or other treatment system. The plumbing between the well head and

the sample tap will be purged for several minutes prior to sampling by allowing the water to run onto the ground. If there is no tap near the wellhead upstream of any water treatment device, or if the presence of a water treatment device cannot be determined, this will be noted and the well will be sampled from whatever tap is accessible.

The crew will measure and record the pH, electrical conductivity, temperature, turbidity, and dissolved oxygen concentration of the water. For each sample, the crew will prepare appropriate sample labels and will complete the necessary analysis request forms and chain of custody forms. Samples will be preserved as directed by the analytical laboratories. Samples will be packed for transport in coolers with an absorbent material (e.g., vermiculite) and cooled with either gelled "blue ice" packs or with ice cubes in double zip-lock plastic bags.

The horizontal location of each well will be determined using an Ecology-supplied portable GPS receiver. If a GPS reading cannot be obtained at the well itself (e.g., because of overhead obstructions) then the location of a nearby point will be determined and the approximate offset (distance and direction) to the well will be estimated and recorded.

It is anticipated that samples for the short-holding time analyses will be delivered daily to an analytical laboratory in Bellingham and that the rest of the samples will be shipped daily to Ecology's Manchester laboratory.

The following assumptions were made for our cost estimate of this work element; these assumptions are reflected in the budget estimate:

- Ecology will pre-arrange with residents for their wells to be sampled. Ecology will obtain the owner's permission for SAIC to sample each will within a specific date and time window. This information will be given to SAIC prior to sampling.

- Wells where an owner is unavailable during the pre-arranged date/time window will not be sampled (i.e., there are no costs in the budget associated with repeated attempts to sample a well where the owner has broken an appointment.)

- Well casings will not need to be purged prior to sample collection (i.e., it is assumed that all wells are in active use). It is assumed, however, that the plumbing between the wellhead and the sample tap *will* have to be purged.

- Ecology will provide for all chemical analyses except for pH, electrical conductivity, temperature, turbidity, and dissolved oxygen, which SAIC will measure in the field. Short-holding time parameters (e.g., fecal coliform and nitrates) will be performed by a commercial laboratory in the Bellingham area. The other analyses will be performed by Ecology's Manchester laboratory.

- All sample containers, preservatives, coolers, and labels will be provided by Ecology.

- Ecology will provide for overnight sample shipment (via UPS) from the study area to the Manchester laboratory.

- Ecology will provide the appropriate GPS receiver and any necessary accessories, software, etc., for determining the locations of sampled wells.

We estimate that this work element will require the following:

- *M.Dagel: 5 hours*
- *G.Haupt: 50 hours*
- *R.Freier-Coppinger: 50 hours*
- *8 nights Lodging in Bellingham (2 people x 4 nights)*
- *10 days Meals & Incidentals in Bellingham (2 people x 5 days)*
- *9 days of Van Rental and field water quality instruments (5 field days + 2 days shipping & mobilization + 2 days return shipping & demobilization)*

2.1.3 Second Half Phase I Sampling

This work element includes the SAIC effort to sample the second half of the Phase I wells. The description of this work, costs, and cost assumptions are the same as those for the first half of the Phase I sampling, described in Section 2.1.2 above.

We estimate that this work element will require the following:

- *M.Dagel: 5 hours*
- *G.Haupt: 50 hours*
- *R.Freier-Coppinger: 50 hours*
- *8 nights Lodging in Bellingham (2 people x 4 nights)*
- *10 days Meals & Incidentals in Bellingham (2 people x 5 days)*
- *9 days of Van Rental and field water quality instruments (5 field days + 2 days shipping & mobilization + 2 days return shipping & demobilization)*

2.2 PHASE I DELIVERABLES

This work element includes the SAIC effort to provide deliverables for Phase I. Based on the Ecology statement of work and on subsequent discussions with Ecology staff, it is our understanding that the Phase I deliverables are to consist of the following four items:

1. A brief text write-up describing the sample collection methods and activities performed.

2. Photocopies of this work plan and of field notes, laboratory reports, and other associated documentation.

3. An electronic relational database containing the following three categories of information:

   - Physical well information (well identification and GPS coordinates plus any other information that Ecology may supply, such as owner, depth, elevation, etc.).

   - Results of laboratory chemical analyses for each well.

   - MCLs of detected chemicals.

4. A table summarizing the concentrations of detected chemicals at each well.

Draft versions of the deliverables will be prepared for Ecology review. Following the review, final versions will be prepared incorporating Ecology comments. Two copies of all paper deliverables (items 1, 2, and 4) will be submitted to Ecology. The text write-up, the database, and the table (items 1, 3, and 4) will also be submitted to Ecology electronically. Based on clarifications from Ecology staff, the maps mentioned in the Ecology statement of work will be not be prepared by SAIC. As noted in the Ecology statement of work, the deliverables described above are not intended to comprise a full report.

The following additional assumptions were made regarding this work element; these assumptions are reflected in the budget estimate:

- Laboratory data will be supplied to SAIC electronically such that manual entering and checking of chemical data will not be required.
- Formal analytical data validation will be provided by Ecology or one of its labs.
- Physical well information mentioned in Appendix D of the Ecology statement of work (such as aquifer, screen depths, well collar elevation) will be provided to SAIC by Ecology for inclusion in the database.

We estimate that this work element will require the following:

- *C.Allender* *2 hours*
- *M.Dagel* *15 hours*
- *G.Haupt:* *15 hours*
- *R.Freier-Coppinger:* *48 hours*
- *S.Dumas:* *14 hours*

3.0 TASK 3 – COLLECTION OF SAMPLES – PHASE II

As described in Ecology's statement of work, this task encompasses the same activities as described for Task 2—sampling private wells, preparing deliverables, and administrative project management. Because of this, the work element descriptions, cost assumptions, and costs are exactly the same as described in Section 2 with the following exception:

- Per the Ecology statement of work, the Phase II sampling area is expected to encompass approximately 70 wells (compared to 65 wells for Phase I). In addition, the Phase II area is substantially larger than that of Phase I making travel time between wells slightly longer.

Because of this, one extra day of field sampling has been budgeted for each half of Phase II sampling (i.e., each half of Phase II sampling is estimated to take six working days).

4.0 KEY PERSONNEL

We propose the following key technical personnel for this work assignment:

Key Personnel	Project Role	Assignments
Chip Allender	SAIC Program Manager	• Project scoping • Review of work plan, cost estimate, monthly reports, and deliverables • Communication with Ecology program staff.
Mark Dagel	SAIC Work Assignment Manager; Senior Hydrogeologist	• Preparation of work plan, cost estimate, and monthly reports • Communication with Ecology project manager • Technical oversight and coordination of all work assignment activities • Budget management • Preparation of deliverables
Glenn Haupt	Project Hydrogeologist	• Mobilization for field sampling • Field sample collection • Assist with preparation of deliverables
Romy Freier-Coppinger	Project Environmental Engineer	• Mobilization for field sampling • Field sample collection • Primary author of written deliverables and electronic database

5.0 SCHEDULE

We propose the following schedule for this work assignment:

Activity	Due Date
Submit Final Work Plan and Budget	5 working days after receipt of Ecology comments on Draft submittal
Training in Bellingham for SAIC field staff on the use of Ecology's GPS receiver	3 working days after notice to proceed
Begin sampling	6 working days after notice to proceed
Submit Draft Phase I Sampling Data/ Documentation (2 photocopies and 1 electronic copy)	30 calendar days after receipt of all validated data
Submit Final Phase I Sampling Data/ Documentation (2 photocopies and 1 electronic copy)	5 working days after receipt of Ecology comments from draft submittal
Submit Draft Phase II Sampling Data/ Documentation (2 photocopies and 1 electronic copy)	30 calendar days after receipt of all validated data
Submit Final Phase II Sampling Data/ Documentation (2 photocopies and 1 electronic copy)	5 working days after receipt of Ecology comments from draft submittal

APPENDIX B

Bertrand Creek Drinking Water Study
Phase I and II

Scope of Work

Introduction

The Washington State Department of Ecology (Ecology) is requesting contractor assistance to conduct two rounds of drinking water sampling in Whatcom County. The sampling is to take place in two phases.

Background

The EPA removed the nematocide EDB (ethylene dibromide) from use as a soil fumigant in 1983. At that time, it was believed to be a possible carcinogen in animals. From 1984 through 1986, several State agencies investigated EDB application areas to determine if groundwater (and thus, drinking water) contamination had taken place. Four areas were found to have EDB contamination in domestic wells. Two of those areas were in Whatcom County, near the city of Lynden.

An area to the northeast of Lynden (known as Study Area A) and areas in two other counties were provided with access to municipal water supplies. The area to the west of Lynden (known as Study Area B) was deemed to be too sparsely populated to make installation of a municipal water line a financially feasible option. Instead, beginning in 1986, Ecology made bottled water available to households in Study Area B with known or suspected EDB-contaminated drinking water. In 1989, Ecology defined the bottled water delivery area to include households with addresses from 8100 to 8400 Bob Hall Road and from 900 to 1300 Birch Bay Lynden Road.

Several groundwater and drinking water studies have taken place over the years. They have been conducted by a number of different individuals and agencies. The most recent study of EDB contamination in domestic drinking water was conducted by the Washington State Department of Health in 1993/94. Other groundwater studies have also occurred in the area. Together, the many investigations have revealed that this area of Whatcom County has very shallow groundwater and that analytes of concern include EDB, 1,2-DCP, TCP, TCE, Dinoseb, DBCP, nitrates and fecal coliform.

At this time Ecology is involved in assessing the current status of groundwater contamination in the area. The information gathered under this work assignment will assist Ecology in the assessment of current, short-term solutions to the problem of EDB-contaminated drinking water. It will also assist Ecology in coordinating their actions with those of other agencies to develop potential long-term solutions to the issue of contaminated drinking water in this part of Whatcom County.

Project Objectives

The specific objectives of the work to be performed are two-fold.

The first is to determine the chemical quality of groundwater in, and adjacent to, the current bottled water delivery area in Study Area B. As noted above, the delivery area was delineated in 1989. A number of subsequent studies have either not focused on the issue of EDB contamination or have included too few samples to allow for a thorough assessment of the extent of EDB contamination. The last study to address the issue of EDB groundwater contamination took place in 1993/94. Because over four years have passed since that study was conducted, and because drinking water from many households in and near the bottled water delivery area have never been sampled, a more timely picture of the groundwater status is needed. The current extent of EDB contamination in groundwater is important information in defining a new, updated delivery area. This will insure that all households that should be in the bottled water delivery area are then offered the opportunity to participate.

The second objective is to determine the chemical quality of groundwater from domestic drinking water wells throughout Study Area B. Once the area historically known to have EDB-contaminated groundwater has been reassessed (see objective one), the current status of groundwater beyond the previously defined delivery area should be evaluated. Sampling beyond the bottled water delivery area, aside from the sampling of Class A Water Systems, has not occurred since (for a very few households) 1990. Many domestic wells were last sampled in 1986 and/or 1988. A number of wells were never sampled at all. If EDB-contaminated groundwater exists in areas not previously defined through earlier studies, it is important that this be determined in order to include such households in a (potentially) expanded bottled water program. It would also be important in order to determine the full scope of any long-term solutions being evaluated.

Ecology wishes to coordinate the sampling of Study Area B domestic well water with studies to be conducted by other agencies throughout Whatcom County. Therefore, the sampling events will include analysis for other potential contaminants in addition to EDB. This will provide not only a more complete profile of the condition of each household's well water, but will also avoid potential problems associated with multiple agencies asking to collect samples at the same addresses.

Proposed Scope of Work

Task 1 Work Plan and Budget Development

The contractor will develop a draft and final work plan to conduct the work described in this scope of work. The contractor will also prepare a budget for completing the project. This task includes an initial meeting with Ecology to discuss the scope of work. The contractor will provide a draft work plan and budget for Ecology's review within 5 days after the initial meeting. The contractor will provide a final work plan and budget within 5 days of receiving Ecology's comments on the draft work plan and budget.

The contractor should prepare the workplan and budget in consideration of two possible plans of action – with and without the contractor performing the notification and appointment-making portion of the sampling events. They will also include in their scope of work the necessary actions needed to promote a high percentage of household participation.

Task 2 Collection of Samples – Phase I

Phase I includes sampling groundwater in the area that currently receives bottled drinking water, plus several additional households to the east, west, and north. Currently, the bottled-water delivery area includes about 52 households with individual wells and several small Water Associations, all within about 1 square mile. Ecology will provide names and addresses for the households. (Note: the contractor will not test the water in the Association wells. The Health Department will be dealing with those wells.)

The total number of wells to be sampled for all analytes – with 100% participation – would be approximately 65. (See APPENDIX C for list of analytes). In addition, approximately 6 households will be chosen for the collection of additional analytical samples.

Samples will be collected in two stages (approximately one-half of the households in each stage), with at least one week - but no more than two weeks – between collection dates.

If possible, all samples will be collected from the kitchen tap. Some parameters may be measured in the field. For samples requiring laboratory analysis, the contractor will collect analytical and QA samples, label containers and pack the containers for transport. Samples will be transported to the Manchester Lab, or to Ecology's designated drop-off location at NWRO, on a daily basis.

Task 2 Deliverables:

On receipt of the analytical results from the Manchester Laboratory, the contractor will prepare draft and final versions of the following:

1) data (QA/QC'd) in table form and as lab sheets (2 copies)
2) text describing sampling preparations and actions at the site (2 copies)
3) copies of work plan, field notes, and other associated documentation (2 copies)
4) a map illustrating the locations of all sampling events (2 copies)
5) a map illustrating location of all MCL exceedances over the area sampled (2 copies)
6) GPS locations for all sampling events (2 copies)
7) electronic copies of all tables, documents and maps (see APPENDIX D for details)

(Note: the contractor will not prepare a full report.)

Task 3 Collection of Samples – Phase II

Phase II includes sampling groundwater in Study Area B, excluding the area sampled during Phase I. The sampling and analytical methods will remain the same as for Phase I. Choice of sampling locations will depend on several factors, including: existing evidence of contaminated groundwater, households that have volunteered to participate in the sampling program, and groundwater flow patterns in relation to known areas of contamination. Phase II sampling will be conducted after results from Phase I can be analyzed and interpreted. Ecology may modify the extent of Phase II sampling based on: Phase I analytical results, analytical data obtained from private well-testing, analytical date obtained from Water Association well-testing, and any additional groundwater information obtained prior to the initiation of the Phase II sampling event. If it is determined that any households within Study Area A were never connected to the municipal water system, Phase II sampling may be expanded to include those additional households.

The number of wells to be sampled for all analytes will be approximately 70. These would be spread out over the entire (7 square mile) Study Area B. (See APPENDIX C for list of analytes). In addition, approximately 6 to 8 households will be chosen for the collection of additional analytical samples.

Samples will be collected in two stages (approximately one-half of the households in each stage), with at least one week – but no more than two weeks – between sample collection dates.

If possible, all samples will be collected at the kitchen tap. Some parameters may be measured in the field. For samples requiring laboratory analysis, the contractor will collect analytical and QA samples, label containers and pack the containers for transport. Samples will be transported to Ecology's Manchester, or to Ecology's designated drop-off location at NWRO, on a daily basis.

Task 3 Deliverables:

On receipt of the analytical results from the Manchester Laboratory, the contractor will prepare draft and final versions of the following:

7. data (QA/QC'd) in table form and as lab sheets (2 copies)
8) text describing sampling preparations and actions at the site (2 copies)
9) copies of the work plan, field notes, and other associated documentation (2 copies)
10) a map illustrating the locations of all sampling events (2 copies)
11) a map illustrating location of all MCL exceedances over the area sampled (2 copies)
12) GPS locations for all sampling events (2 copies)
13) electronic copies of all tables, documents and maps (see APPENDIX D for details)

(Note: the contractor will not prepare a full report)

Schedule of Deliverables

Task	Deliverable	Due Date
Task 1	Draft Work Plan & Budget	5 working days after initial meeting
	Final Work Plan & Budget	5 working days after receiving Ecology comments on Draft
Task 2	Draft sampling documentation and Map	(TBD*) working days after receipt of Laboratory data
	Final sampling documentation and Map	5 working days after receiving Ecology Comments on Draft
Task 3	Draft sampling documentation and Map	(TBD)* working days after receipt of Laboratory data
	Final sampling documentation and Map	5 working days after receiving Ecology Comments on Draft

Ecology Staff

Mary O'Herron Ecology Project Manager (360) 738-6246
Jan Swanberg Ecology Contracts Officer (360) 407-7213

- TBD – schedule to be discussed and agreed on at the initial meeting between Ecology and the contractor

APPENDIX C

Bertrand Creek Drinking Water Study
Phase I and II

Chemical Properties of Concern

List of analytes (Phase I, all households/Phase II, to be determined):

EDB	(ethylene dibromide/1,2-dibromoethane)
1,2 - DCP	(1,2-dichloropropane)
1,3 – DCP	(1,3–dichloropropane)
TCP	(trichloroprane)
1,2,2 - TCP	(1,2,3-trichloropane)
1,2,3 - TCP	(1,2,3-trichloropane)
TCE	(trichloroethene)
DBCP	(1,2-dibromo-3-chloropropane)
Nitrates	(N02 + N03)
Fecal coliform	
Dissolved oxygen	
PH	

Possible analytes (Phase I, all households/Phase II, to be determined):

Temperature
Conductivity
Total hardness
Turbidity
Total dissolved solids
Cations/Anions

List of additional analytes (Phase I, approximately 6-8 households/Phase II to be determined):

Dinosch
Triazine
Atrazine
Simozine
(?MITC-methylisothiocyanite)
(?Methyl bromide)
(?Fenamiphos-nemacur)
(?Metalaxyl-ridomil)

APPENDIX D

Bertrand Creek Drinking Water Study
Phase I and II

Requirements for Electronic Data Submissions

Electronic copies of all tables, documents and maps will be presented in an electronic relational database of all data, including well locations in state plane coordinates or other appropriate coordinate system (from GPS work).

The database should include:

A. Table on well information, if available (well identification, location coordinates, other pertinent information such as owner, address, aquifer drawn from, top and bottom depths of screen, collar elevations, etc.)

B. Table on regulatory standards (CAS number, chemical name, relevant standards) and analytical results (lab ID, sample ID, well number, sample date, analysis date, CAS number, chemical name (optional – can get chemical name from table of regulatory standards), result, units, flag, comments, etc.).

Note: All results are to be in the same units and all chemical standards are to be in the same units as the results. CAS numbers are to be entered uniformly between the regulatory standards and the analytical results table.

Relational integrity should be assured (No CAS number in the results table that is not in the standards table; only one occurrence of the CAS number in the standards table (e.g. CAS number is the primary key in the standards table). No well in the results table not in the well information table, and well identification is the primary key in the well information table.

Ecology uses Microsoft Access, and the database should be importable by it. The database is to be suitable for comparing results to standards as a ratio calculated in a query and suitable for extracting selected data and exporting it to Excel or Surfer for preparation of graphics. The contractor is expected to work with Ecology to design a useful relational database in which to store data in a readily retrievable form.

Ecology anticipates that the Manchester Laboratory will provide the results table in electronic format and the other tables will be designed around what the laboratory routinely provides.

APPENDIX A

Work Assignment No. SAI 01

Bertrand Creek Drinking Water Study

Statement of Work

The purpose of this work assignment is to authorize the Contractor to develop a draft and final work plan to conduct two rounds of drinking water sampling in Whatcom County. The Scope of Work is included in this work assignment as APPENDIX B.

Task 1 – Workplan and Budget Development

The Contractor will develop a draft and final work plan that identifies, for each task, proposed staffing; anticipated hours needed to complete each task; hourly rates for each staff member; a breakdown of other direct costs (e.g. travel, goods & services, etc.); fees and overhead, deliverables and schedule. A breakdown of Task 1 must also be included.

The Contractor will attend an initial meeting, to be held at Ecology's Northwest Regional Office, for the purpose of discussing the scope of work. Ecology and Contractor project managers will agree on and schedule the meeting date. The proposed Contractor project manager should attend the meeting.

The draft work plan will be submitted to Mary O'Herron, Ecology's Project Manager and Jan Swanberg, Ecology's Contract Officer within 5 working days after the initial meeting. The Contractor will provide a final work plan within 5 working days of receiving Ecology's comments.

The following is the authorized budget for Work Assignment SAI01:

Direct Labor	
Overhead	
Other Direct Costs	
Fee (33% DL)	
Total	

This work assignment is a cost-plus-fixed fee agreement. The maximum amount payable for this work assignment is $1,568. The Contractor shall not exceed the maximum amount without prior written approval from the Contracts Officer.